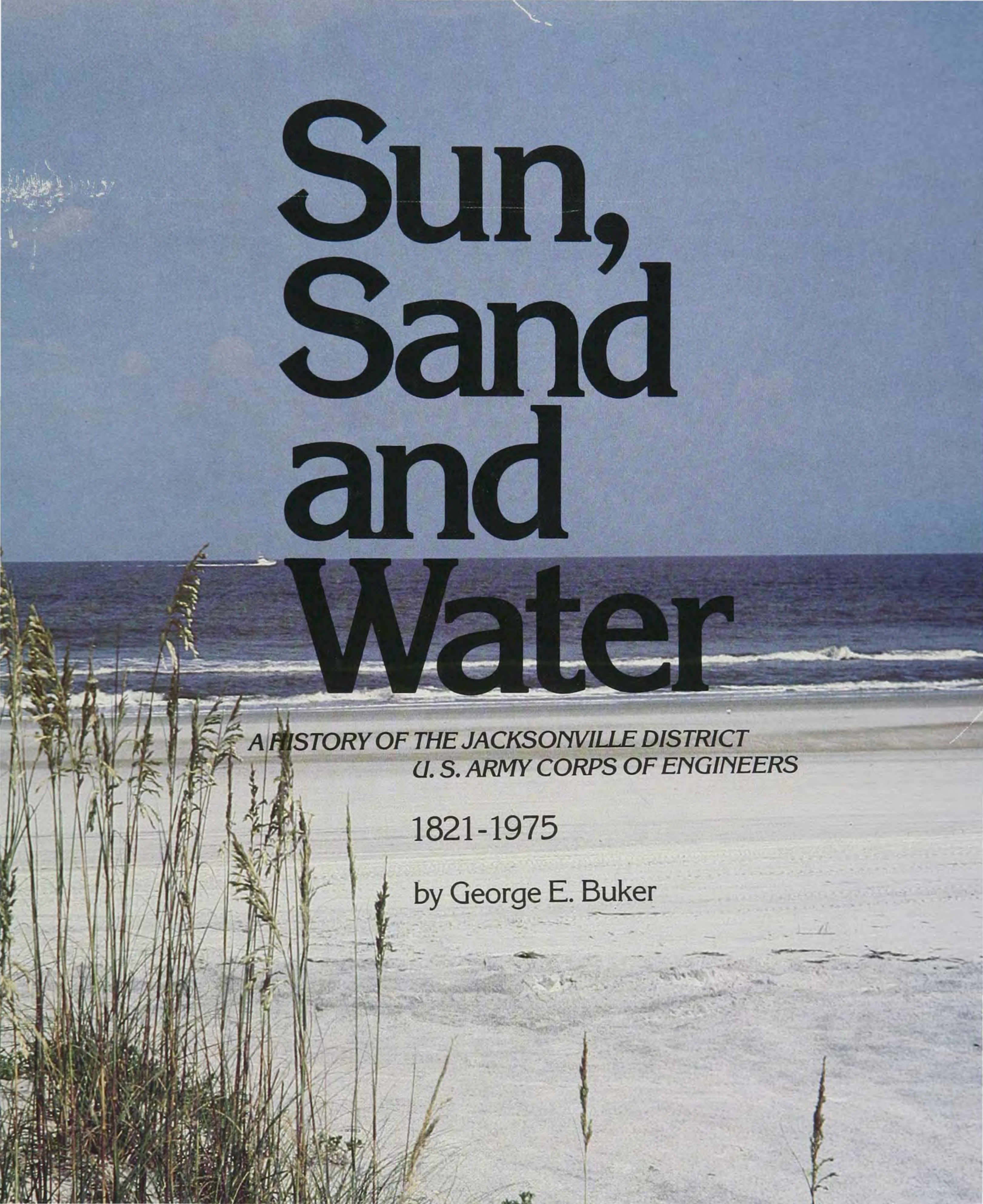

Sun, Sand and Water

A HISTORY OF THE JACKSONVILLE DISTRICT
U. S. ARMY CORPS OF ENGINEERS

1821-1975

by George E. Buker

Report Documentation Page

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Lt. Horatio Gouverneur Wright
1852 – 1854


BVT Maj.Gen.Quincy Adams Gillmore
1869 – 1884


Capt. William Trent Rossell
1884 – 1886


Capt. William Murray Black
1886 – 1891


Col. Dan Christie Kingman
1906 – 1906


LTC Lansins Hoskins Beach
1907 – 1908


Capt. George Redfield Spalding
1908 – 1911


Major John Rodolph Slattery
1911 – 1913


LCT William Baker Ladue
1913 – 1917


Col. Spencer Cosby
1920 – 1920

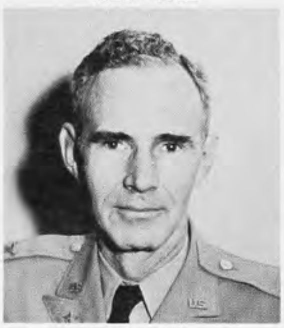

Maj. William C. Lemen
1920 – 1922


LTC Gilbert Albin Youngberg
1922 – 1926


LTC Mark Brooke
1926 – 1928


LTC. Laurence Verner Frazier
1928 – 1932


Col. W. C. Weeks
1940 – 1941


Col. Alvin G. Viney
1941 – 1942


LTC Herbert C. Gee
1942 – 1943


Col. David W. Griffiths
1943 – 1944


Col. A. B. Jones
1944 – 1946


Col. Juliam V. Sollohub
1960 – 1962


Col. H. R. Parfitt
1962 – 1965


Col. R. P. Tabb
1965 – 1968


Col. John F. McElhenny
1968 – 1970


Capt. Frederic Vaughan Abbott
1895 – 1895

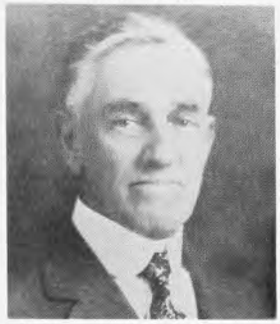

Capt. Henry Jervey
1899 — 1900


Capt. Charles Hedges McKinstry
1899 – 1901


Capt. Herbert Deakyne
1901 – 1903


Major James Franklin Bell
1917 – 1917


Mr. John Warren Sackett
1917 – 1918


Mr. Jaquelin Marshall Braxton
1918 – 1919


Col. Glen Edgar Edgerton
1919 – 1919


Col. William Jones Barden
1919 – 1920


LTC Beverly C. Dunn
1932 – 1935


Capt. Peter A. Feringa
1935 – 1935

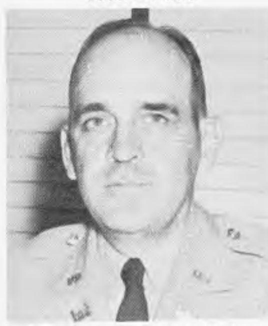

Col. Earl North
1935 – 1938


Col. Lewis H. Watkins
1938 – 1940


LTC Tatnall D. Simkins
1940 – 1940


Col. Willis E. Teale
1947 – 1949


Col. Richard W. Pearson
1949 – 1952


Col. Herman W. Schull, Jr.
1952 – 1955


Col. Elmer E. Kirkpatrick
1955 – 1957


Col. Paul D. Troxler
1957 – 1960


Col. A. S. Fullerton
1970 – 1972


Col. Emmett C. Lee, Jr.
1972 – 1975


Col. Donald A. Wisdom
1975 – 1978


Col. James W. R. Adams
1978 – present

Sun, Sand and Water

A HISTORY OF THE JACKSONVILLE DISTRICT
U. S. ARMY CORPS OF ENGINEERS

1821-1975

by George E. Buker

Acknowledgment

Many people have assisted me during the preparation of this book, for which I am most thankful. I would like to express my special thanks to Jerry DiChiara, chairman of the district's Historical Committee and to Doris Wilson of the Records Management Office for their aid. Without Doris' knowledge of the history of the Jacksonville District and her ability to locate elusive records, this work would have suffered.

Foreword

This is your opportunity to discover how the U.S. Army Corps of Engineers, Jacksonville District, came to be. These pages detail the fascinating history of the Corps of Engineers in Florida and Puerto Rico tracing significant contributions to the growth of each.

More importantly it lets you capture the spirit of the men and women of the Corps who built this district and established the high standards for professional competence, personal service and human warmth which we sustain today. Here is their story and ours in a single volume. I invite you, your family and friends to enjoy and share its many treasures.

JAMES W. R. ADAMS
Colonel, Corps of Engineers
District Engineer

Biographical Sketch

George E. Buker, born in Maine, left college to enter the Naval Aviation Cadet program at the beginning of World War II. He was commissioned a naval aviator and remained on active duty until his retirement as a commander in 1963. He returned to college where he earned his B.A., magna cum laude, in history from Jacksonville University in 1964. He was awarded his PhD from the University of Florida in 1969.

Presently chairman of the Division of Social Sciences at Jacksonville University, he has written numerous articles and reviews for *American Neptune, Florida Historical Quarterly,* and *North Carolina Historical Review.* Dr. Buker's book *Swamp Sailors* was published by the University Presses of Florida.

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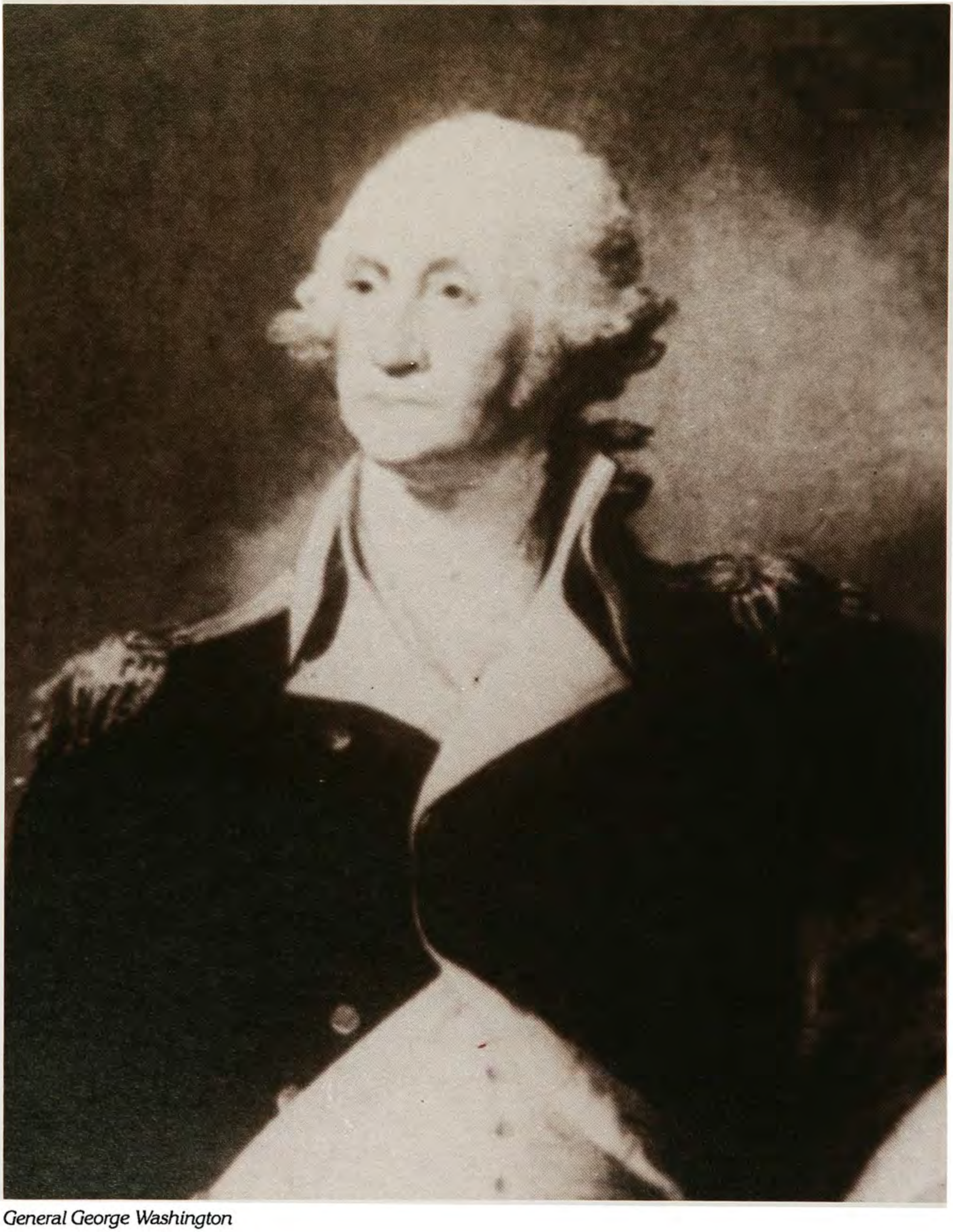


General George Washington

CHAPTER 1

Early History

THE POSITION OF CHIEF ENGINEER for the newly created Grand Army was enacted by the Continental Congress on 16 June 1775 in order to provide military engineering for the nascent movement toward independence. The position was created as a reaction by Congress to the worsening situation between the colonists and the mother country.

Less than a month later, General George Washington, who had recently arrived in Cambridge, Massachusetts, to assume command over the Continental forces, appointed Colonel Richard Gridley to the post of Chief of Engineers. In all probability, Gridley was offered this position because he was serving in that same capacity for the local militia under a commission from the Massachusetts Provisional Congress.

Richard Gridley had an excellent background for his engineering duties. He had served in the Provincial units of the British Army where he had drawn up the plans for the fortification of Lake George in the New York colony. He had also participated in the construction of Fort William for the same colony. In 1746, Gridley had worked on his hometown defenses in Boston for the British and had served on expeditions against the French at Louisburg in 1745, Crown Point in 1755, and Quebec in 1759.

As chief engineer for the Massachusetts militia, he oversaw the creation of the breastworks on Breed's Hill. He took his place in the line at Bunker Hill where he was wounded. Gridley, 64 years old when he was injured, accepted Washington's appointment as Chief Engineer of the Continental forces although he retired from further active combat operations; however, he continued to act as the engineer general of the Eastern Department until 1780.[1]

After the British evacuation of Boston, General Washington sent Lieutenant Colonel Rufus Putnam to New York to take charge of the military fortifications in the New York-Long Island area. Putnam, although not designated an engineer officer, drew up and supervised plans for Fort Lee and Fort Washington. He also placed obstructions in the Hudson River to further impede the British. Upon the recommendation of General Washington, who was impressed with Putnam's ability, Congress appointed Putnam Chief of Engineers on 5 August 1776. At the same time, Putnam was promoted to the rank of colonel.

Up to this time, only officers were assigned to the engineers, but Rufus Putnam saw the need for troops, as well. He drew up plans for the creation of a corps of engineers to include both officers and enlisted men. He presented his proposed organization to General Washington who forwarded it to the Continental Congress on 5 October 1776. When Congress refused to act upon Putnam's plan, Putnam resigned as Chief Engineer to take command of a Massachusetts infantry regiment. The position of Chief Engineer remained vacant for several months after Putnam's departure.[2]

The early engineers were engaged strictly in military work; there was a war to be fought. The erection of fortifications was paramount, but it soon became apparent that more was needed. Surveys of the terrain and military roads used to move troops and supplies to threatened areas, were equally important. The Continental Congress reacted by creating the positions of geographer and surveyor of roads on 25 July 1777, thus dividing the engineering duties into two corps. That same year, in an effort to overcome a shortage of trained personnel, the first rudimentary engineering school was established at Valley Forge.

Benjamin Franklin, while Ambassador to France, took a hand in solving the shortage of engineers by secretly persuading King Louis XV to release some of his military engineers for service in Washington's army. Franklin's tremendous popularity among the French people, including the King, was once more demonstrated when Louis XV officially dispatched four of his officers and allowed others to volunteer to serve in America. Notable among the group of French officers to cross the Atlantic was Lieutenant Louis Le Begue du Portail of the renowned Royal Corps of Genie. In recognition of the importance of his work, Congress promoted du Portail to brigadier general in November 1777.

The soundness of Rufus Putnam's proposal for enlisted engineers became more evident as General du Portail's military works progressed. Congress then created three companies for the Engineer Department, stipulating that commissioned officers "be skilled in the necessary branches of mathematics," and that noncommissioned officers "write a good hand."[3] Unfortunately, the resolution was so poorly worded concerning matters of pay, rank, and precedence with other branches of the Continental Army, that considerable confusion existed among members of the Engineer Department as to their proper place in the military hierarchy. Congress had to correct this vagueness.

On 11 March 1779, Congress formally established the Corps when it resolved: "That the engineers in the service of the United States shall be formed in a Corps and styled the 'Corps of Engineers,' . . . ."[4] Two months later, it appointed General du Portail commandant of the Corps of Engineers. After much trial and error, the Continental Congress seemed to have created a proper organization to handle the duties of the military engineer.

After General Charles Cornwallis surrendered at Yorktown in 1781, combat operations in the United States ceased, although it was 1783 before the peace treaty with Great Britain officially ended the American war for independence. Shortly after the Treaty of Paris was signed, Congress, as part of its military cutback program, dissolved the Continental Army's Corps of Engineers. The immediate need for military construction was over; the Corps was declared dispensable.

Between 1783 and 1789, the newly created United States of America turned to the immediate task of forming a viable government. There appeared to be no need for the military engineer. But, in 1789, the French Revolution broke out and all of Europe was in flames. When the French and the English renewed their age-old struggle, the United States had a treaty of friendship and aid with France. The possibility of Americans having to fight again was a valid assumption. Secretary of War Henry Knox wrote a letter to President Washington, calling for a small corps of artillery and engineers. There the matter stood while war clouds rolled back and forth across Europe.

Four years later, when President Washington turned to Congress for the funds and authority to fortify the nation's coast, there were no engineers in the military establishment. As an immediate measure, on 20 March 1794, Washington divided the coast into a number of districts, making a series of temporary appointments to provide each district with an engineer.

By 9 May 1794, Congress was ready with an act creating a Corps of Artillerists and Engineers. The Corps had an authorized strength of 992 men and a legal life of 3 years. A year later, Congress extended the life of the Corps of Artillerists and Engineers indefinitely. At its peak, in 1799, the Corps consisted of two full regiments; but, in spring of 1800, the numbers were reduced once more by Act of Congress.

Two years later, the Military Academy at West Point was established and Johnathan Williams was appointed its first superintendent. (West Point was the first engineering school in the United States; Rensselaer Polytechnical School was not founded until 1824, and its first graduates were not sent forth until the 1830's.) Williams was a merchant, jurist, and respected scientist who had worked on some of the nation's fortifications. He was not a professional military man. Under William's guidance, West Point became the preeminent engineering and scientific school in America. The Military Academy represented the concept of the citizen-soldier, trained by the military to pursue both civil and military functions. From its inception until 1866, West Point drew its superintendents from among the officers of the Corps of Engineers; thereafter, the command was opened to all branches of the Army.[5]

West Point classroom.

The same Congressional Act of 16 March 1802 which established the Military Academy, discontinued the Corps of Artillerists and Engineers and created two separate organizations; the Corps of Engineers and the Regiment of Artillery.

In addition to establishing a separate Corps of Engineers charged with educating all of the Regular Army officers, President Thomas Jefferson sent his engineer officers throughout the nation to survey, explore, erect fortifications, and build military roads. These tasks were considered both military and civil because it was necessary for the country to know its territory before the land could be protected, settled, and developed.

By 30 April 1824, the need of the civil sector for trained engineers was so great, and the source of these technicians so restricted to the Corps of Engineers, that Congress established for the Corps

Explorers surveying.

the mission of performing civil functions for the nation at large. That mission, many times modified, has continued. Today, in Florida, the Jacksonville District is still engaged in carrying out this charge.

Florida, first touched by Juan Ponce de León in 1513, was the last territory on the Atlantic coast to become a part of the United States. Following several centuries under Spanish control, the peninsula was terra incognito to the Americans when it was ceded to the nation in 1821.

Early Spanish explorers hurriedly tramped over *Las Floridas* chasing Indian myths, seeking the fountain of youth, the Seven Cities of Cíbola, and wealthy native empires to conquer. Ponce de León was followed by the Pánfilo de Narváez-Alvar Núñez Cabeza de Vaca expedition of 1528 and the Hernando de Soto undertaking of 1539. The conquistadors found two elements in Florida; hostile Indians and inhospitable swamps. Spain turned its back upon the peninsula until the French expressed an interest in the land.

At first, the French Huguenots were intent upon founding colonies to escape religious persecution at home. Then, temptation to attack the wealth-ladened Spanish ships, sailing slowly up the Florida coast in the gulf stream toward the higher latitudes where the prevailing westerly winds could carry them back to Spain, proved too much for the Frenchman to ignore. First, Jean Ribault visited Florida and, then, René de Laudonnière attempted to establish a settlement and fort on the St. Johns River in 1564. When Philip II learned of Fort Caroline, he sent Admiral Pedro Menéndez de Avilés the following year to drive off the Huguenots and to build a military outpost to protect outgoing Spanish ships. Pedro Menéndez carried out both missions by virtually wiping out all Frenchmen in Florida and founding St. Augustine, the first permanent European settlement in present-day United States.

In the seventeenth century, it was the English who put pressure on Spain. After the founding of Jamestown in 1607, the English settlers gradually moved southward. Georgia became a no-man's land between the two European rivals and their Indian allies. By the time Spain lost Florida to Great Britain in 1763, there were few of the indigenous Amerindians left on the peninsula. White man's war and disease had decimated the ranks of the Calusa, Timucua, and Apalachees. When the Spanish departed for Cuba, the few surviving Indian allies went with them. The English moved into a nearly deserted peninsula.

The English were not the only newcomers to Florida. The land, nearly desolate of humans, had an appeal to various bands of Indians from the Creek Confederation. Throughout the eighteenth century, they drifted south from their tribal lands in Alabama and Georgia. These Indians became known as Seminoles, meaning "wild people," or "out-settlers," because of their separation from the Creeks.[6] During the English period in Florida, 1763-83, there was comparative harmony between the two races. The British were neither numerous nor aggressive.

Great Britain created two colonies, East and West Florida, out of the newly acquired land. When the American Revolution broke out, both Floridas cast their lot with the mother country. During the war, Spain became an ally of the United States at the urging of France, but primarily to recapture her lost territory of Florida. The Spanish succeeded and in 1783 East and West Florida returned to the flag of Spain. Once again, European settlers were uprooted as the English left and the Spaniards returned.

By this time, Florida was not a necessary military outpost in Spain's colonial organization. The Amerindian empires had been looted of their precious metals and the treasure ships no longer sailed from the Spanish Main along the Gulf Stream to the Iberian peninsula. It had been a matter of national pride for Spain to retake Florida, but once this had been accomplished, there was little incentive for white settlements. The result was that most Spaniards in Florida lived in the two small villages of St. Augustine and Pensacola in the extreme eastern and western portions of the territory. Spanish control over middle Florida was therefore minimal, and the peninsula became a haven for the Seminole Indians and the runaway slaves from Georgia, Alabama, and the Carolinas.

Americans living continguous to Spanish Florida were greatly disturbed by the lawless conditions along the frontier region separating the two countries. Cattle rustling was a way of life on both sides of the border. American slaveowners were convinced the Seminoles were encouraging and even carrying off slaves to the safety of their villages under the Spanish flag. The Seminoles and runaway slaves owned cattle and lived a relatively free existence away from white man's control, which was not the proper life to flaunt before the American plantation system. As a further affront, Spain stationed black troops in Florida, an example fraught with danger for the institution of slavery.[7]

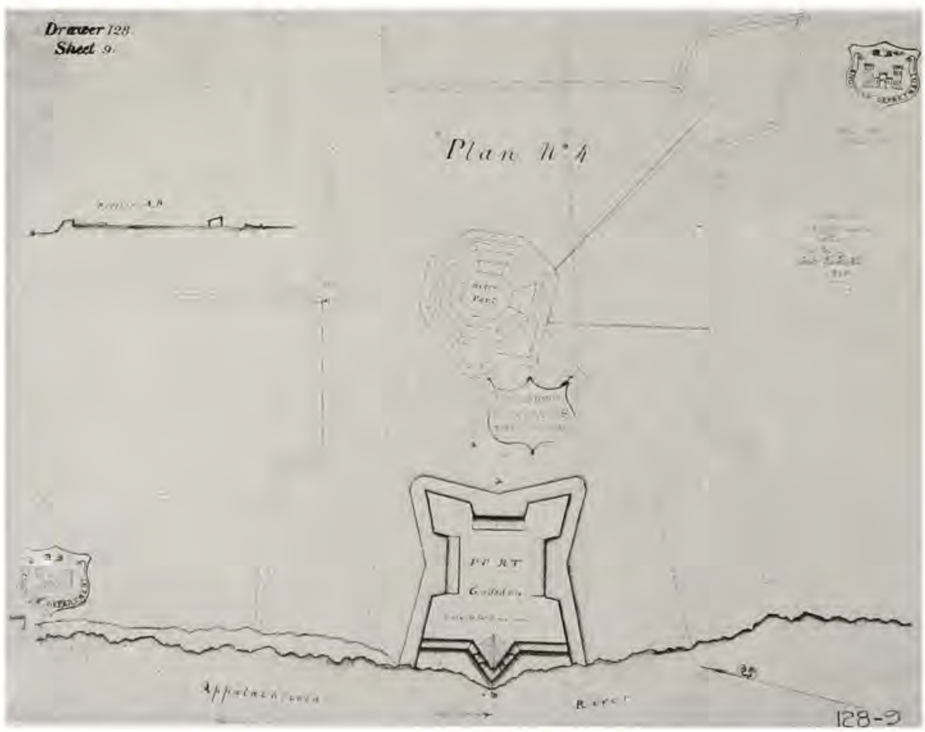
The international situation in 1812, with Americans and British at war again, provided further sanctions to violent acts on both sides of the line. The Governor of Florida encouraged the Seminoles to attack Georgia. American troops retaliated by marching into Spanish territory. Meanwhile, the English began taking advantage of the situation by recruiting Indian allies in Spanish Florida to be used against the United States. Regardless of the provocative actions of England and Spain, the Americans looked to the Seminoles as the primary cause of their border problems.

The end of the War of 1812 did not stop the border strife. British merchants continued to operate in Spanish Florida, encouraging the Seminoles and former slaves to harry and harass nearby Americans. These frontier depredations, local in nature, took on the aspect of a national problem when southern planters considered the future acquisition of Florida a necessary policy for the expansion of the plantation system and the protection of the institution of slavery. The rest of the nation was beginning to accept as inevitable the eventual expansion of the United States from Canada to the Gulf of Mexico and from coast to coast.[8]

Two Seminole chiefs captured with Alexander Arbuthnot, at St. Marks, when Gen. Andrew Jackson used the ruse of flying the English flag. April, 1818. Courtesy State Photographic Archives, F.S.U.

Under such assumptions, the situation deteriorated to the point where General Andrew Jackson, at the head of an army, was sent by President Monroe into Spanish Florida to punish the Seminoles. The action became known as the First Seminole War, 1817-18. General Jackson exceeded his orders calling upon him to respect all posts flying the Bourbon flag. Indian villages were burned; the Spanish settlements of Pensacola and St. Marks were occupied; and two British subjects were captured, tried, and executed. The South was jubilant, Spain and Britain outraged, and the Seminoles impressed.

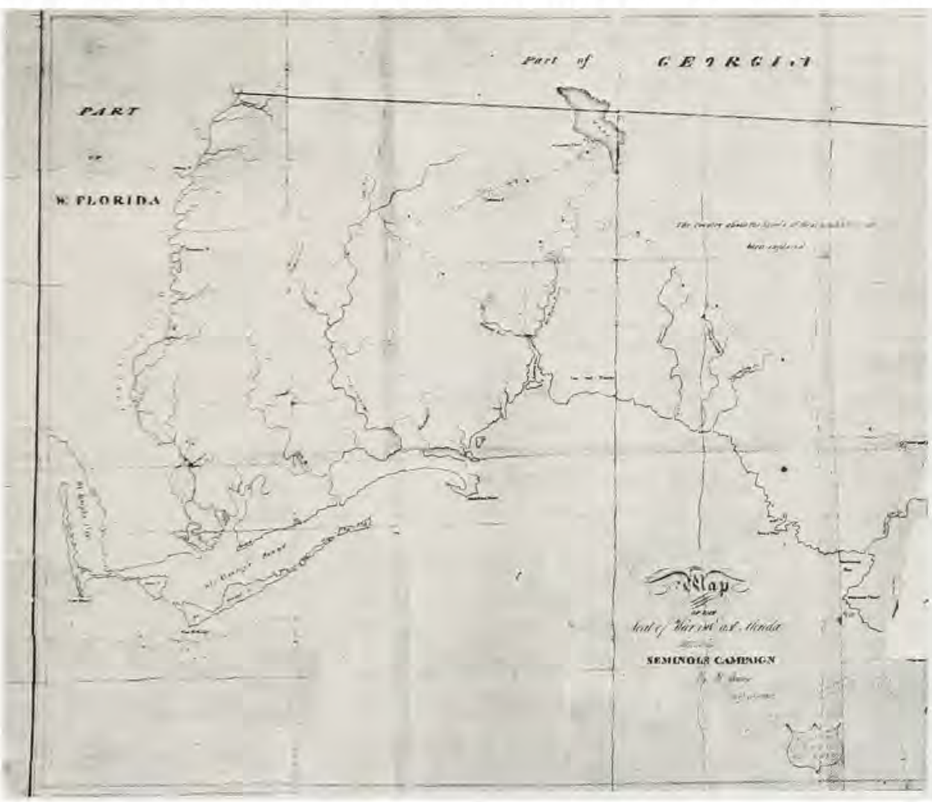
Lieutenant James Gadsden, an engineer accompanying Jackson, was ordered to build a fort on the east bank of the Apalachicola River in Spanish West Florida. Jackson was so pleased with his engineer's results that he named it Fort Gadsden. At the end of this border skirmish, Secretary of War, John C. Calhoun advised General Edmund P. Gaines that the President intended to return Jackson's conquests to Spain, but he added that "Fort Gadsden... appears to be a very commanding position, and ought not to be evacuated. Should you think so, you will retain it, and garrison it with a sufficient force." Apparently, the fort remained in American hands, because when the exchange of Florida did take place, Andrew Jackson, as Territorial Governor of Florida, ordered Major Alexander C.W. Fanning, who was commanding at Fort Gadsden, to take possession of St. Marks.[9]



Plan of Fort Gadsden, 1818
Courtesy National Archives.

President Monroe promptly returned Jackson's other conquests to Spain, but the Spanish crown was well aware of its inability to restrain the dynamic, aggressive Americans. The following year, the Adams-Onís Treaty ceded Florida to the United States, although the formal transfer did not take place until July 1821.

Thus was the territory of Florida obtained by the United States. But, even before the Adams-Onís Treaty took place, Captain Hugh Young, Corps of Topographical Engineers, who had accompanied General Jackson during the First Seminole War, submitted a detailed report to the War Department entitled "A Topographical Memoir on East and West Florida with Itineraries."[10] Young described minutely and distinctly the theater of General Jackson's operation which were bounded by the Georgia border in the north, the Gulf of Mexico in the south, the Sahwanne [Suwannee] or St. Juan River in the east, and the Apalachicola River in the west. In addition to topography, Young provided one of the earliest accounts of the Seminole Indians, their tribes, customs, and manners. He also included a brief description of the Spanish and Negro settlements, and some pertinent remarks on the status of trade and commerce. He admitted that his material was collected on the march during an active campaign; however, he was able to draw valuable information from a resident who had lived for some time in Florida. Young



Captain Young's Map Courtesy National Archives.

wrote: "It is hoped that the information derived from these sources will prove both interesting and useful – this memoir containing the only correct account which has been given to a section of country now rising rapidly into political importance."[11]

There is no doubt about Young's belief in the inevitable expansion of his country. Throughout his report, he was looking ahead to the time when the United States would control Florida. When he wrote of the influence of the House of Forbes & Co. (Formerly Panton Leslie & Co.) in Spanish Florida, he noted that it had accumulated large tracts of land. At the time, this good, fertile farmland was selling for about $2 an acre, but he said that "this tract of country will be of incalculable value to the proprietors should the United States retain the Floridas."[12]

Young described Pensacola as a town with an "inconsiderable" trade, but, he added, "should the Americans retain the Floridas it must greatly increase when the lower part of the Alibama [sic] territory is settled and the fine land in that quarter is cultivated."[13] He believed that the port of Pensacola could be the entrepôt for the rich hinterland.

Even on an active military campaign Young thought as an engineer. He recorded that good roads for carriages would have to be built by digging ditches on each side and placing the dirt on the road to build up the crown in the areas where there were no stones or gravel. He also recommended the construction of causeways along the low banks of streams, and he warned that the logs used should be "well secured by bands, as the weight of the earth would not be sufficient to keep them down when covered by water."[14] All of this information indicated his acceptance of a long-term control over Florida by the United States.

One of the most revealing portions of Young's memoir is his justification for the United States taking the land from the Seminoles. He noted that in the history of the southern Indians, derived from "their own traditions – this important truth is manifest – that their title to territory rests only on forcible occupancy and the dispossession of other tribes not partially or entirely extinct."[15] Because all the Seminoles were emigrants from other lands, Young claimed that they acquired their territory by extermination, not by "any species of purchase – either imposed on the weaker nation or fairly made by the offer of an equivalent."[16]

"What different viewpoint does this fact place on our Indian relations?" he asked. "It entirely does away [with] those shadowy excuses for Indian perfidy and outrage which ignorant writers have so plausibly urged."[17] Of course, Young did not recommend that the United States resort to the same methods used by the Seminoles to obtain the land, but he did suggest that the nation be free "to adopt such a line of policy towards them as shall be based on our own views of beneficial result."[18] Young's memoir was more than a topographical report of a theater of operations; it was an expression by an Army engineer of the American expansionism which resulted in the acquisition of Florida.

It was a long time after Florida became a part of the United States before the creation of the Jacksonville District could take place. Prior to the Civil War, the Corps of Engineers was not organized along district and divisional lines. Engineers were assigned, either individually or in groups, to specific projects. When the task was finished either by completion or the exhaustion of funds, the officers concerned were reassigned. Often, if the task took a long time, the original engineer would be succeeded by other officers.

After the war, permanent offices were established, consisting of a small staff of civilian engineers, clerks, and others, working under the direction of an officer in charge. Generally, this was the case in the larger coastal and river cities or at the headquarters for a major project. Gradually, lesser jobs in the local area were given to that office. All of this development led to the creation of divisions and districts. Today, the divisions cover broad geographic regions; the districts are confined to river basin areas for their civil works activities.

Captain Hugh Young and Lieutenant James Gadsden were among the first engineers in Florida. Both were attached to General Jackson's forces during the invasion of Spanish Florida in 1818. Young's tenure in Florida was confined to the short period of occupation under Jackson. Gadsden returned to the peninsula after it had become a territory of the United States.

During the 1820's, Gadsden performed numerous engineering services for the Corps in Florida in a civilian capacity. In keeping with contemporary custom, Gadsden's assignments were directed to him as an individual. His orders gave no indication that would lead one to assume that the Chief Engineer had organizational designs, similar to district functions, in mind when he instructed Gadsden.

It must be remembered that the Corps of Engineers first became a major force in internal improvements through an Act of Congress on 30 April 1824. The Board of Engineers for Internal Improvement was established under the direction of General Simon Bernard to carry out these new responsibilities. From 1824 to 1829 there was a tremendous increase in improvement projects. There was some indication that regional decentralization was contemplated when Engineer Orders No. 9, of 1 August 1828, designated Captain William H. Chase commanding engineer of the Gulf of Mexico. Chase was charged with constructing defensive fortifications at Pensacola and harbor improvements at Pascagoula, Mississippi.[19]

The Board of Engineers for Internal Improvements ceased existence in 1831. In November of that year, Chief of Engineers, Colonel Charles Gratiot expanded Chase's supervision to include the river works of Lieutenant George W. Long on the Apalachicola and Mr. Jesse H. Willis on the St. Marks. By this time, Captain Chase had charge of fortifications on Santa Rosa Island and Foster's Bank on Pensacola Harbor. He was also inspecting and performing general supervision on several rivers and harbors in Florida, Alabama, and Mississippi.[20]

This arrangement of a commanding engineer obviously lasted several years, as Lieutenant Long was still reporting to Chase in January 1835. By that time, Long was responsible for projects on the Apalachicola, St. Marks, and Ocklocknee Rivers. Whatever reasons Colonel Gratiot had initially for this organization are not known, and there is no indication that such a structure was kept beyond 1835.

Actually, there was little opportunity to create regional groupings of river and harbor projects while responsibility for these tasks was being passed from corps to corps. Back in June 1831, the Topographical Engineers had been separated from the Engineer Department to be formed into a distinct bureau of the War Department.[21] The Corps of Engineers continued to control the river and harbor projects for a few years after the division. Then, in August 1838, the system was revised by Secretary of War Joel Poinsett. Poinsett reasoned that the newly created Corps of Engineers should handle military tasks. During 1839, he transferred 56 river and harbor projects to the topographical engineers.[22] The changing engineering functions meant very little in Florida during these years because the Second Seminole War occupied the energies of the topographical engineers.

There was little internal improvement during the period from 1838 to 1852. No general river and harbor bills were passed by Congress from 1838 to 1843. A few individual acts for appropriations were granted and some unexpended balances were available, but that was all until 1844. The next two years recorded increased activity centered about the harbors on the Great Lakes. Then, just as there appeared to be a revival of other projects, the Mexican War occurred, bringing river and harbor works to a standstill.[23] It was 1852 before new activity began.

Despite a dearth of money for internal improvements, there was a plethora of funds for constructing fortifications. Captain George Dutton arrived in Key West in 1845 to begin construction of Fort Taylor. A year later, Lieutenant Horatio G. Wright reached Garden Key in the Dry Tortugas to erect Fort Jefferson. The engineering offices established by both Dutton and Wright were designed to carry out their primary task of military fortification work.

River and harbor improvements were resumed when Congress appropriated some $2 million for over 100 projects in 1852. Most of the allocations were small amounts intended for surveys to prepare plans for future works. In Florida, a grant was given to survey the St. Johns River.

There were no general river and harbor bills passed after 1852 until near the end of the Civil War, but there were several large projects funded by individual congressional acts. The mounting tensions brought on by the country's sectionalism over the institution of slavery caused the legislators to be wary of providing funds and projects to rival regions. By 1860, almost all civilian activities had been stopped and they remained idle throughout the war.[24] During the conflict, military matters were the concern of the day. The only tasks performed in Florida were for the furtherance of the Union cause.

In the midst of the war, the Topographical Corps was merged with the Corps of Engineers. The military engineers were once again under one corps.

In retrospect, it is easy to see that the pent-up demand for internal improvements would swell to a flood tide after being dammed up for nearly a decade and a half. The first year of peace saw more works undertaken, with larger appropriations, than in any prewar year. The period from 1866 to 1880 was one of expansion. The startling growth peaked about 1881, but there were annual increases of funds from 1881 to 1901, even during the Spanish-American War.[25] These years provided the climate for organizational changes to match the growth of appropriations and projects.

The regional concept of engineering works may be discerned through the various headings used in the annual reports of river and harbor projects in the 1870's and 1880's. Immediately after the war, such projects were assigned individually to engineering officers and noted as such in the annual report. For example, the report for 1869 listed the Florida project under the heading of "Survey of the Mouth of the St. Johns River, Florida." Major General Quincy Adams Gillmore was listed as being in charge of the project. The wording was changed the following year to "Atlantic Harbors and Rivers South of the Cape Fear." The heading was again changed in 1873 to "Improvements of Rivers and Harbors on the Coast of South Carolina, Georgia, and the Atlantic Coast of Florida."[26] This terminology remained consistent throughout the annual reports for over a decade. During this period, Gillmore was the officer in charge, with his headquarters in New York City.

It is difficult to assess Gillmore's position with respect to the issue of district engineer during this decade and a half. His area of operations corresponded more to the present day division than to district status. Gillmore was also the officer in charge of projects on the east coast of Florida only. Key West and the west coast projects, both part of the present Jacksonville District, were under the direction of another engineer.

Captain Andrew N. Damrell might well hold the honor of being the precursor of a district engineer in Florida. On 7 April 1873, he became the officer in charge of the "Improvement of the Harbor of Mobile — . . . Removal of Bar at the Entrance of the Harbor of Cedar Keys, Florida." Throughout the following decade, Captain Damrell's description varied in the annual reports as more Florida projects were assigned to his control. By 1884, his description of Florida works listed "Pensacola Harbor, . . . Key West Harbor, . . . Appalachicola [sic] River, . . . Suwanee [sic] River, . . . Caloosahatchee River, . . . Peas [sic] Creek, . . . Manatee River, Fla. . . ."[27]

Regardless of what view one takes with respect to Gillmore and Damrell, the annual report of 1885 introduced a major change in the organization of the river and harbor groupings. It was the harbinger of the divisional and district structure presently in use. Colonel Gillmore's area of concern was reduced and it was so indicated in the report under the title of "Improvement of Rivers and Harbors on the Coast of South Carolina and Georgia and part of the Atlantic Coast of Florida." This was followed by a numerical listing of his projects. Items 13 and 14 set the southern boundary for his responsibility at the "Entrance to Cumberland Sound, Georgia and Florida," and the "Inside passage between Fernandina and the St. Johns River, Florida."[28]

Captain William T. Rossell relieved Colonel Gillmore of his southernmost region. Rossell's duties read, "Improvement of Rivers and Harbors in the State of Florida."[29] In the same paragraph listing Rossell as the officer in charge, there was a new term stating that Lieutenant Colonel David C. Houston was Rossell's supervising engineer. In another part of the report, Houston's duties were enumerated, including his position as "supervising engineer of the districts embracing works in charge of . . . Russell [Rossell]."[30] This was the first mention of a supervising engineer and of districts. Therefore, Captain William T. Rossell was the first district engineer in Florida, and, unlike Gillmore, Rossell's station was Jacksonville.

Florida was in the vanguard of the movement during the 1880's which saw the conception and development of the present-day organization of divisions and districts. Colonel David Houston was appointed supervising engineer of districts under the charge of Major Andrew N. Damrell, and Captains Thomas Turtle, Richard L. Hoxie, and William T. Rossell.[31] These officers were in command of fortifications and river and harbor projects from the St. Johns west to Mobile, Alabama. They were also the Corps of Engineers inchoate division. There were two supervising engineers listed in the 1888 annual report; Colonel William P. Craighill, for the districts from Virginia to Florida, and Colonel George H. Mendell, for the west coast from San Diego, California, to the State of Washington.[32] It is evident that this regional and district organization proved satisfactory, for under new regulations approved by the Secretary of War on 4 February 1889, the country was divided into five divisions. For the first time, Colonel Craighill was called the division engineer for the Southeast Division.[33]

Today, the establishment or disestablishment of a district would be carried out by a general order, but in 1884 when the concept of a district was first utilized, special orders to the officers concerned were used. Thus, in order to observe the creation of the Florida District, it is necessary to consult the special orders issued to Captain Rossell. He was instructed to go to Jacksonville, Florida, to relieve Colonel Gillmore, Major Andrew N. Damrell, and Captain Thomas Turtle of such river and harbor works and fortifications under their supervision, as the Chief of Engineers shall designate.[34] Rossell's district ultimately covered all of Florida from the St. Johns River to, and including, Apalachicola Bay.

Lieutenant William M. Black relieved Captain Rossell in April 1886. The following April, Apalachicola River was removed from Captain Black's control to be placed under Captain Richard L. Hoxie. His district, entitled "Improvement of Certain Rivers in the States of Florida, Georgia, and Alabama," is today part of the Mobile District.[35] This shift in territory was reflected in the title of Black's district from 1887's "Improvement of Rivers and Harbors in the State of Florida," to 1888's "Improvement of Certain Rivers and Harbors in the State of Florida."[36]

It was during Captain Black's tenure that the district headquarters was moved from Jacksonville to St. Augustine. It has been a long-held belief in the Jacksonville District that the move was made because of an epidemic of yellow fever. However, Black received orders dated 22 December 1887 to move to St. Augustine. He had completed his transfer by 14 January 1888, several months before the yellow fever epidemic in Jacksonville in July 1888.[37] The epidemic obviously had no bearing upon the district's change of location.

Moving the district headquarters to St. Augustine and creating the Southeast Division seemed to be the beginning of a period of trial and error with respect to the size of the Florida District. In 1898, First Lieutenant Charles H. McKinstry was ordered to relieve Lieutenant Colonel William H. H. Benyaurd of his duties at Key West.[38] Florida was now divided into two districts. The Key West District consisted of the fortifications at Fort Taylor, as well as the harbor and entrance improvement projects for the island. Key West did not remain separate long. A year later, Captain McKinstry was ordered to St. Augustine to assume control over Lieutenant Colonel Benyaurd's district in Florida.[39]

When McKinstry relieved Benyaurd, it did not unite the engineering projects in the state. A month before, Captain Henry Jervey had been ordered to establish a district in Tampa to supervise the west coast projects. The river and harbor works on the gulf coast remained independent of the St. Augustine office, until Captain Francis Shunk assumed responsibility for St. Augustine on 24 September 1902, and for Tampa on 21 January 1903.[40] The peninsula was once again under one district. On 25 May 1903, Captain Shunk was instructed to move his headquarters from St. Augustine back to Jacksonville where it has remained to this day.[41]

Prior to the 1908 annual report, the Corps designated its river and harbor projects under cumbersome geographic and special works titles. Northern New England was an example of a simple geographic description: "Improvement of Rivers and Harbors in

The Masonic Temple building on Main Street at Monroe Street, where Jacksonville District offices were located from 1911 until 1929. Courtesy of Jacksonville Journal.

Maine and New Hampshire." More complex, using the names of the rivers concerned, was the region covered under "Improvements of Falls of the Ohio River, of White River, Indiana, of Wabash River, Indiana and Illinois, and of certain Rivers in Kentucky." Florida's title was "Improvement of Certain Rivers and Harbors in Florida."[42]

All of this changed in 1908 when the various regions became designated by the headquarters' city within the district. Northern New England became the "Improvement of Rivers and Harbors in the Portland, Maine, District"; the Falls of the Ohio River became the "Improvement of Rivers and Harbors in the Louisville, Kentucky, District"; and Florida became the "Improvement of Rivers and Harbors in the Jacksonville, Florida, District."[43] As a result of this new terminology, Lieutenant Colonel Lansing H. Beach had the distinction of being the first district engineer of the Jacksonville District.

On 3 September 1935, when President Roosevelt set aside the first construction money for a ship canal across Florida, the Chief of Engineers was ready with a reorganization to create the Ocala, Florida, District, under Lieutenant Colonel Brehon B. Somervell, to serve the canal area. After Congress refused a year later to allocate funds for the canal, the Ocala District was absorbed by the Jacksonville District.[44]

With the outbreak of conflict in Europe in 1939, the United States began gearing up its defenses. The first activity to feel the change was construction. The burden of building, added to the other tremendous supply problems dumped upon the Quartermaster Corps, was overwhelming. The Corps of Engineers, with a nationwide engineering organization of trained specialists in construction, found its work dwindling as the nation shifted from peacetime civil river and harbor projects to wartime military tasks. The answer was to utilize this pool of talent-in-being immediately. In November 1940, all Air Corps construction was shifted to the Corps of Engineers, relieving the quartermasters of a sizable job and freeing them to perform their supply functions. This was only the beginning. A year later, on 1 December 1941, the House of Representatives passed, and the President signed into law, the transfer of all military construction and maintenance work of the Army from the Quartermaster Corps to the Corps of Engineers.[45]

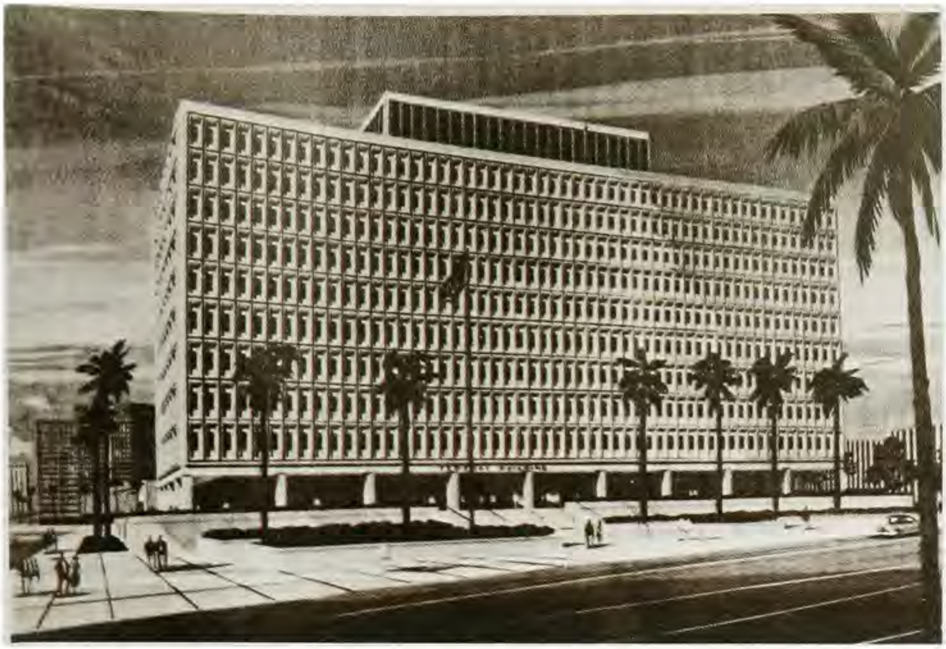
The effect of this law was significant. Lieutenant General Brehon B. Somervell wrote that the consolidation of military construction represented "the greatest change of activities of the Corps in its entire history."[46] This massive transfer of engineering projects in all stages of work, from planning to near-completion, was effected on 16 December 1941, 9 days after Pearl Harbor. Lieutenant General Eugene Reybold noted that this consolidation of construction activities "had become the first unified command in World War II."[47]

District staff.

The Jacksonville District became deeply involved in its new wartime duties. The 1941 staff, which consisted of about 30 persons, zoomed to 300 employees by early 1942 as the district turned its energies to military construction.

Five years after the war, when the Chief Engineer abolished the Panama District on 30 June 1950, its civil works activities were assigned to the Jacksonville District.[48] This addition was reflected in the annual report by the statement: "It [Jacksonville District] also includes Puerto Rico, the Virgin Islands of the United States, and other nearby islands." The specific navigation projects listed were:

The old Corps of Engineers building on Riverside Avenue at Rosselle Street in Jacksonville, headquarters for the district from 1944 until 1967.
Courtesy Jacksonville Journal.



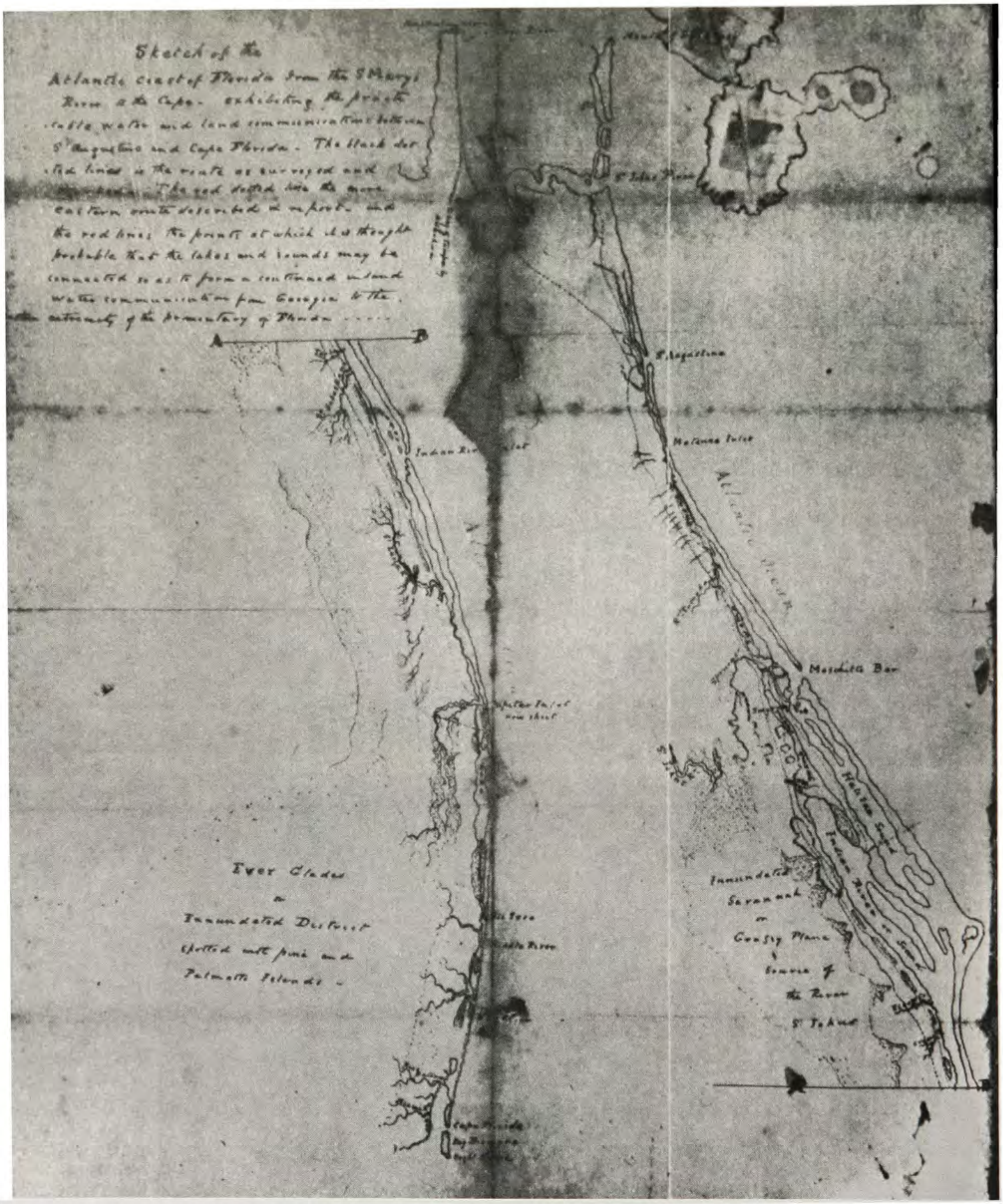
The Federal Building in Jacksonville, where district headquarters have occupied the top three floors since 1967. Courtesy General Services Administration.

Arecibo Harbor, San Juan Harbor, and Mayaguez Harbor, all in Puerto Rico. Later, the South Atlantic Division transferred the military construction and maintenance functions of the Panama District to Jacksonville.[49]

The district received more overseas territory when Kindley Air Force Base, Bermuda, was placed under its responsibility on 1 November 1958. This addition was not just a military construction assignment. Harbor improvement dredging operations were also conducted.[50]

The tide of acquisitions turned in 1963 when the Cape Canaveral space construction works were withdrawn from the Jacksonville District by the creation of the independent Canaveral District. Changes in district functions occurred 30 June 1970 when, in a consolidation program within the Corps, Jacksonville turned over all of its military responsibilities to the Mobile District.[51] At the same time, the Bermuda area was transferred to the Navy. The canaveral District was disestablished in June 1971, and the Jacksonville District reached its present status.

Today, the Jacksonville District labors in civil areas. Yet, the earlier days of military tasks, the harbor defenses in the Spanish-American War, the massive fortifications in the 1840's and 1850's, and the Indian wars against the Seminoles, are all part of the warp and woof of the history of the Jacksonville District Corps of Engineers.



Gadsden's map of Florida's east coast, 1825. Courtesy Carter Territorial Papers 23:304.

CHAPTER 2

The Territory of Florida

WHEN PRESIDENT THOMAS JEFFERSON received the Louisiana Territory from Napoleon in 1803, he immediately sent out survey teams to study the land so that it might be protected, settled, and developed. In his Annual Message to Congress in 1806, he clearly expressed his belief that the nation must develop its roads, rivers, and canals to promote national economic harmony.[1] The transfer of Florida to the United States in 1821 placed upon the Corps of Engineers these same tasks. The first requirement was for a basic knowledge of the terrain and its inhabitants.

Some prospective settlers perferred to wait for first-hand reports on Florida before embarking upon an enterprise which would cut them off from the life they knew. Still others, with no intention of moving, were eager to read about the newly gained territory and to bask in the glory of the dynamic expanding country of which they were citizens. The result was a spate of books on Florida. It was unfortunate that Captain Young's earlier informative memoir was buried somewhere in the War Department away from the eyes of an interested public.

In the first two years after the transfer, books about Florida were published in New York, Philadelphia, and Charleston. Their lengthy descriptive nineteenth century titles provide the essence of their contents: James Grant Forbes, *Sketches, Historical and Topographical of the Floridas;* William Darby, *A Memoir on the Geography and Natural and Civil History of Florida;* and William H. Simmons, *Notices of East Florida with an Account of the Seminole Nation of Indians.* Before the decade was over, John Lee Williams and Charles Vignoles added their works to the list of books on Florida. All of these authors wrote in the same vein as Young, yet not one of these men mention or appear to have profited from the earlier memoir.[2]

Captain John LeConte, Corps of Engineers, had been sent by the Government to find the headwaters of the St. Johns River. He had traced the river's channel about 50 miles beyond Lake George to a lake in the midst of a vast savanna. LeConte had heard rumors of Lake Mayaco in the middle of the peninsula, but he discounted these reports after his own limited observation.

The interior of the peninsula was terra incognita in 1821, and William Simmons, the third author to write of Florida, attempted to pierce its darkness. He gathered all the sources of information he could find to amplify and enlarge upon his own knowledge of the territory. Although the work of Captain Young was omitted, Simmons acknowledged the information gathered by Captain LeConte.

The English surveyor, Charles Vignoles, in his travels along the southern coastline of Florida, had met many Indians and Negroes who claimed they had crossed this great wasteland mentioned by LeConte. They said that, during their journey, there was not one spot elevated enough to set up a dry campsite.

Simmons, commenting on LeConte's and Vignoles' reports, said that "below the St. John's, the peninsula consists of an immense basin, which, probably, forms the chief supply of the latter stream, and gives origin to most of the rivers to the south."[3] He concluded that it would be a small matter to connect the St. Johns with the Indian River on the east, with the Caloosahatchee, which flows into the Gulf of Mexico, on the west, and with Lake Mayaco in the center of the peninsula, thus opening island navigation throughout the territory. Simmons made his projection even though he knew Captain LeConte doubted the existence of Lake Mayaco.

What was needed to open Florida, more than the speculations of an author, was the services of a trained engineer, and James Gadsden was just such an individual. Gadsden, born in Charleston, South Carolina, in 1788, joined the Army soon after he graduated from Yale in 1806. During the War of 1812, he became a lieutenant in the Corps of Engineers. After the war, he aided Andrew Jackson in surveying the military defenses of the southwest coast and gulf coast, and he was with Jackson during the First Seminole War.

His friendship with Jackson helped Gadsden's military career, and, in late 1820, he was promoted to Colonel. For 8 months after August 1821, he served as Adjutant General of the Army. When the

James Gadsden. Courtesy Ladies Hermitage Association.

Senate refused to ratify his appointment, he was miffed. He immediately resigned his commission and moved to Florida to start life anew.

Gadsden remained in the territory for the next 16 years, maintaining continual communication with the Chief of Engineers in Washington, proposing engineering undertakings,supervising assigned projects, or recommending competent individuals in Florida to act for the Corps. James Gadsden is better known in American history texts for his Mexican activities and for the Gadsden Purchase than he is for his role in Florida. This is unfortunate, because his services to the Corps of Engineers and the State of Florida are equally deserving of historical notice.[4]

In April 1823, President James Monroe appointed Gadsden commissioner to move the Seminoles onto a reservation in the center of the peninsula, away from the northern portion of the teritory, which was considered suitable land for American settlers. Gadsden represented the United States at the Treaty of Moultrie Creek where the Seminoles ceded 28 million acres to the white man, keeping only 4 million acres for themselves. In addition to moving the Indians south, the reservation was set up inland, away from either the Atlantic or gulf coasts. The Americans were afraid that the red men would receive communications, and possibly supplies, from their Spanish friends in Cuba. Whether such a move was really necessary is immaterial; the fear of the day was that, if Spain became hostile, she would have ready allies in the Seminoles, and there was not need to make things easy for a potential enemy.

As a further means of defense, the following year Congress approved and authorized the President to construct a military road from St. Augustine to the southeastern tip of the peninsula at Cape Florida. Again, the task was assigned to James Gadsden. The commanding officer at St. Augustine was to provide an officer and as many men as Gadsden desired. The quartermaster of the post was instructed to furnish the necessary equipment.

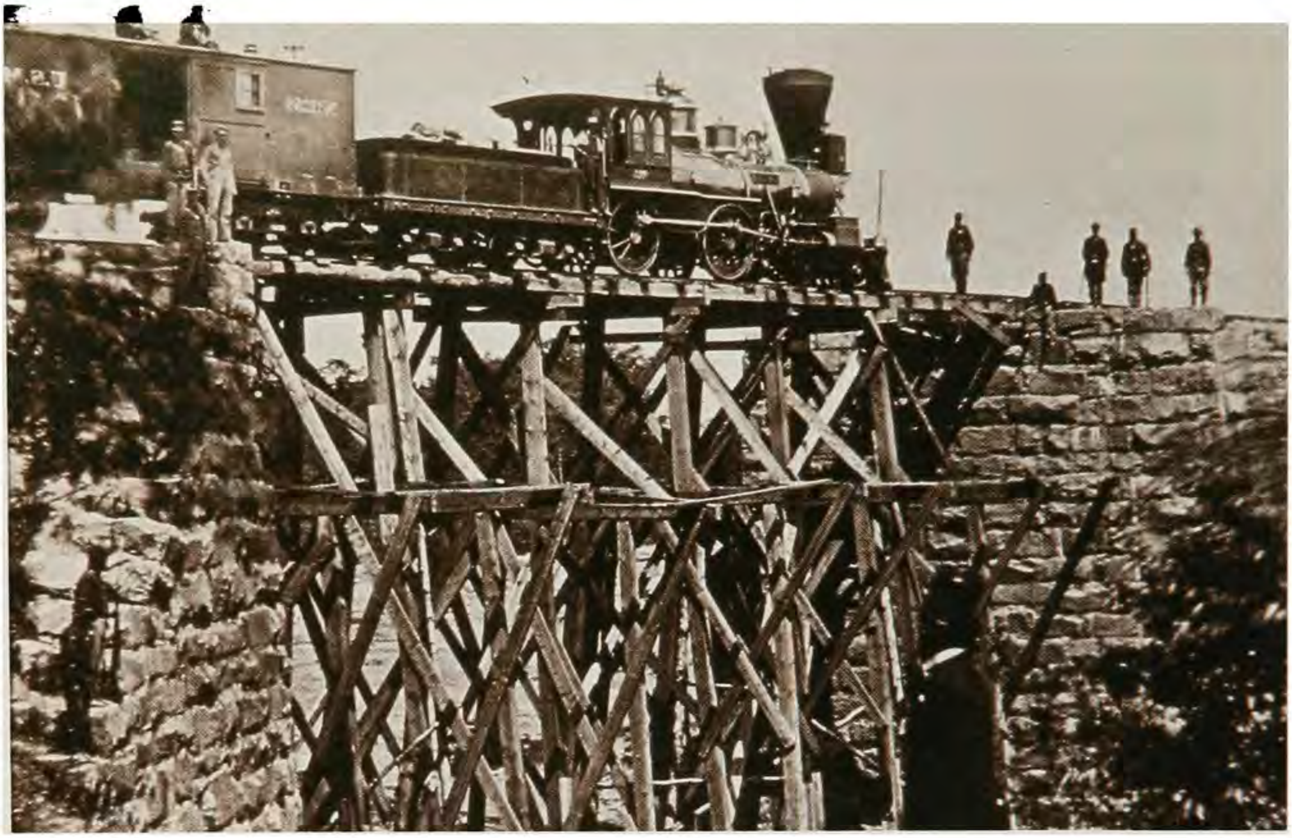
Gadsden's party set out in the fall, under instructions from Washington, to mark or blaze trees at a close enough interval so that troops later ordered to open the road could do so without the aid of guides. Gadsden hacked his way south as far as the St. Lucie River before he was forced to turn back because sickness and two deaths had struck his group. When he reported his failure in December 1824, he stated that St. Lucie was the farthest point south he expected would ever be populated. He believed that the land beyond St. Lucie had absolutely no military value, nor was there any need to worry about an enemy landing below that point and moving northward. As far as Gadsden was concerned, St. Lucie was the end of the line.[5]

Gadsden took a second expedition south in 1825 which reached Cape Florida. However, the successful trip did not change his views, except to shorten his proposal for the military road to New Smyrna. South of that settlement, Gadsden believed, the terrain was so rough that the construction of a military road would be only to the benefit of an invading army. If the enemy had to cut its way through the vegetation, ford the streams, and carry its baggage, Gadsden was positive it would present little threat to the United States.[6]

While Gadsden was surveying along the east coast, Captain Isaac Clark, Jr. was in command of a detachment doing the same task on the west coast. Clark had been ordered to lay out a road from the Suwannee River south to Cape Sable. He got as far as Charlotte Harbor before giving up. The captain found the route almost impassable, reporting that the whole countryside was inundated and crisscrossed with "innumerable streams and bayous." Although he did find several establishments in Charlotte Harbor which supported about 50 Spaniards and Indians who fished for the Havana market, he concluded: "A road through that country would be, at this time, of little value in a military point of view,...."[7]

It was over a decade before white men became acquainted with the interior portion of the southern extremity of Florida, the Everglades. Even the land in the upper-center of the peninsula was unknown wilderness. Lieutenant Charles Despinville of the 4th Artillery stationed at Savannah was assigned in 1827 to Joshua A. Coffee, the commissioner for running the Indian boundary in Florida. While in the field, Despinville became separated from the survey party. The commissioner tried for 3 days to find the lieutenant. Neither the Indians with the survey group nor those encamped nearby would aid in the search, even though Coffee offered a $10 reward. As time passed, Coffee became more desperate. He kept raising the reward. On the third day, when it reached $100, 90 warriors turned out to search. The second day of this massive hunt brought results; two braves returned the lost officer. Mr. Coffee submitted a claim to Washington for an extra $100 to cover the cost of his reward.[8]

The territory of Florida was not the only part of the United States to need the technical engineering services that the Corps of Engineers could provide. The whole nation was bursting with projects to develop communications systems, open transportation routes (both roads and canals), and tame rivers – in a few words – to promote progress! The hue and cry from all parts of the country was for government participation in these sectional projects; the local resources were not enough to carry the cost nor supply the technical talent. Congress reacted in April 1824 to the demand of its constituents by passing a Rivers and Harbor Act and a Canals and Road Act which put the Corps of Engineers into the midst of the nation's expanding civil programs. Henceforth, the Corps performed civil and military tasks with equal facility. The civil features of West Point's education were so unique and desirable that many young men accepted appointments to the Military Academy not to become Army officers, but to become civil engineers.



Railroad timber trestle.

Among the first projects of a national character to be undertaken by the Corps were the improvement of navigation upon the Mississippi River, the construction of the Chesapeake and Ohio Canal, and the continuation of the Cumberland Road. Later, with the advent of railroads, the Corps surveyed many of the routes linking the nation together by iron rails. It has been said that "West Point produced more railroad presidents than generals."[9]

Strangely enough, this act was not only the historical benchmark upon which to note the shift of the Corps to civil functions, but it records the end of the French influence upon the Corps of Engineers. The reason France had played such an important role in the development of the Corps is apparent. When the colonies first engaged Great Britain in the struggle for independence, France was the one major power sympathetic to the colonial cause. In addition, France was the preeminent land military power in Europe, having the foremost engineers in the field of fortifications schooled in the doctrines of Marshal Vauban.

From the beginning, French engineering officers were instrumental in shaping the American Corps. Among the officers sent over to aid General Washington, after the pleading of Benjamin Franklin, were: Lieutenant Colonel Louis de Portail, who became commandant of the Corps of Engineers; Major Pierre Charles L'Enfant, who later laid out the site of Washington, D.C.; Major Stephen Rochefontaine, who served as commandant of the Corps of Artillerists and Engineers, and who designed many of the seacoast fortifications.[10]

Long after the Revolutionary War, the idea persisted in American circles that the French trained engineers were outstanding in their field. Thus, in 1816, when Congress and the Administration were casting about for a foreign engineer to plan and construct an up-to-date system of fortifications, the French General Simon Bernard was chosen. General Lafayette and the American Minister to France, Albert Gallatin, had highly recommended Bernard to President Madison.

General Bernard, after graduating from the Ecole Polytechnique, entered the Engineers as a lieutenant in 1797. During 1810-12, he designed and built the fortifications at Antwerp. In 1813, as a colonel, he became the aide-de-camp to Napoleon. He remained with the Emperor to the end of Napoleon's career.

Simon Bernard was given the pay and courtesy title of brigadier general when he was assigned to the Corps as an assistant engineer. He sat as a member of the Board of Engineers for Fortifications. With the passage of the Civil Functions Act, Bernard became a member of the Board of Internal Improvements, which supervised an extensive program to develop the interior communications system of the nation by roads and canals. When Louis Phillipe became King of France after the July Revolution of 1830, General Bernard resigned his position so that he might return to his homeland.[11]

By the time Bernard left the United States, the civil functions of the Corps of Engineers were in full swing, and the greater need was for civil engineers. The bent for civil engineers in America lessened the influence and the desire for French trained military engineers. Of course, military fortifications were needed still, but, by the 1830's, the Vauban school of military design was understood well enough by the American engineers that such construction could be kept under their own control.[12]

A year and a half after Congress had acted in 1824, the *Niles' Register,* in a plea to increase the Corps of Engineers, eloquently stated the nation's case. "It is true, there are some distinguished private engineers in our country, but they are either insufficiently known, or too limited in their numbers for their talents and services to be made available in the greater part of the contemplated projects. . . ."[13]

Now that the way was clear for the civil projects so badly needed to develop Florida, there was a flurry of tasks performed by the Corps to bring progress to the territory. One of the first, though unsuccessful, endeavors was the survey for a canal across the peninsula to link waterborne traffic from the Gulf of Mexico with that of the Atlantic coast, bypassing the lengthy, treacherous reefs and shoals of the Florida Keys. The Florida canal survey demonstrates vividly the wilderness, the communications difficulties, and the lack of basic knowledge of the Florida territory in 1826.

On 3 March 1826, Congress passed an act authorizing the survey of a route for a canal across Florida linking the Atlantic to the Gulf of Mexico. Almost two weeks later, Chief of Engineers, General Alexander Macomb instructed General Simon Bernard of the Board of Internal Improvements to draw up plans for a survey brigade of topographical engineers to carry out the wishes of Congress. Three days later, Bernard issued his instructions to Major Paul Hyacinte Perrault, topographical engineer stationed in New York City, who was to lead the survey party.

Bernard's instructions outlined a lengthy detailed proposal for surveying two routes. The first would ascend the St. Johns River to its tributary, Black Creek, and continue along the south fork of the creek to reach the summit ground. The descent would traverse Alligator Creek, Sampson's Creek, Santa Fe River, and the Suwannee River. The second route would ascend the St. Marys River to its source, then continue to the fork formed on the Suwannee by the Alapaha and the Withlacoochee Rivers. From this point the line would drop in the Bay of St. Marks. The proposed canal route would continue along the gulf coast westward through Ocklockonee Bay to Apalachicola Bay. In spite of the fact that his letter was dated 18 March 1826, General Bernard wanted the two routes surveyed before the heat of summer set in. Other surveys were to be made afterwards along the Atlantic coast from St. Mary's Harbor to the mouth of St. Johns River, and along the coast of the Gulf of Mexico from Pensacola to Vassasousa Bay.[14]

In the meantime, General Macomb issued his orders creating the eight-officer brigade. Lieutenant Searle, another topographical engineer, was serving under Perrault when ordered to this duty. Lieutenant William H. Swift, 1st Artillery, had to travel up from Philadelphia to join the brigade. Lieutenants Constant M. Eakin, 2nd Artillery, and Joseph R. Smith, 2nd Infantry, were stationed in New York when they received their orders to report to Major Perrault. Two lieutenants from the 3rd Artillery in South Carolina, Benjamin Huger and Abbott H. Brisbane, took passage from Charleston to

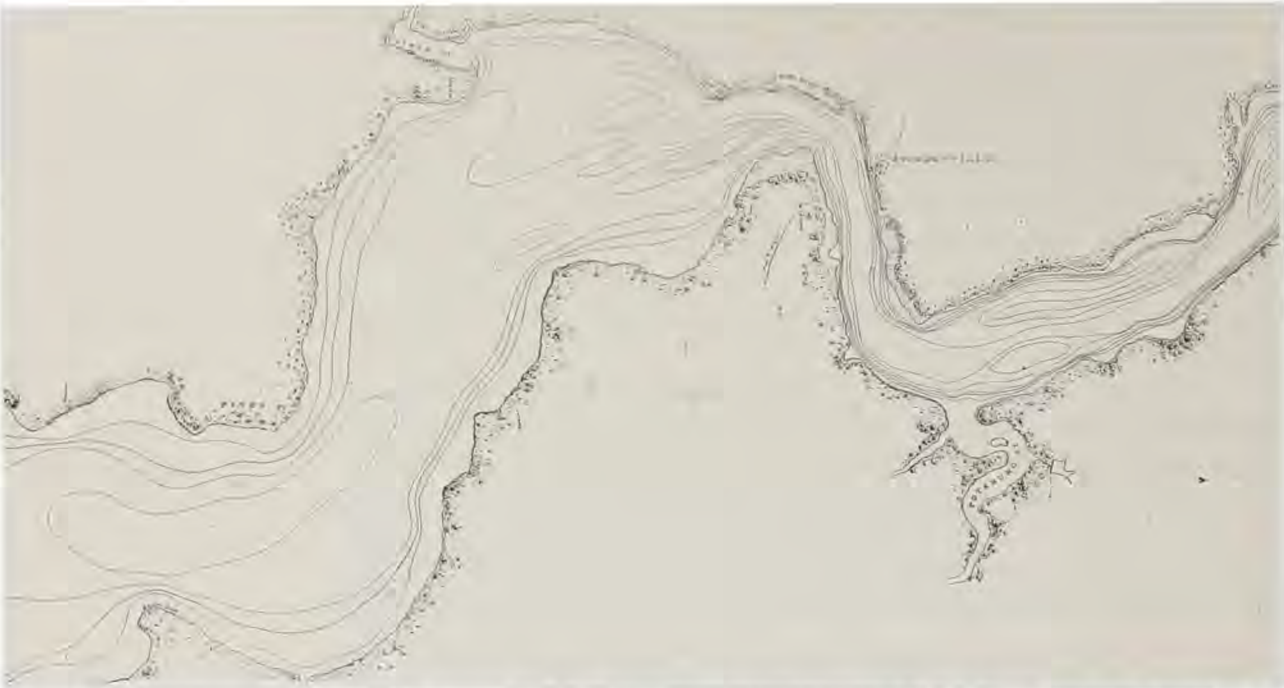
St. Augustine to await the New York contingent. Huger and Brisbane were met in St. Augustine by another member of the group, Lieutenant Augustus Canfield, who was stationed there with the 4th Artillery.

Perrault was instructed further to procure additional instruments for his officers in New York, rent one or more vessels for his project, "observing in all your arrangements the strictest economy consistent with a proper and faithful execution of your duties," and to prepare an estimate of the funds necessary for this undertaking.[15]

Evidently, either this assignment was not to Perrault's liking or the preparations were more time consuming than General Macomb in Washington felt was necessary. In any case, the major was still in New York in mid-May when he wrote to the Chief Engineer the reasons for his delay. Macomb's answer was blunt and direct. "I regret exceedingly to find from it [Perrault's letter] the difficulties which have retarded your expedition to Florida." However, the Chief Engineer stressed in strong terms that Major Perrault and his brigade were to leave New York immediately, "by the first opportunity . . . to Charleston, Savannah, St. Mary or St. Augustine or any other point which may enable you to reach the scene of your intended operations in Florida." The general went on to say that if the sickly season of summer found him inland, he could return to the healthy places on the coast. While waiting for the fever season to pass, Perrault was to survey the coasts and harbors. He could not return north until his task had been completed.[16] General Macomb's letter brought results. Major Perrault left New York at the end of May 1826.

By July, the brigade had arrived at St. Augustine. Major Perrault divided his group into two parties; the gulf coast detachment consisted of Lieutenants Swift, Canfield, Smith and Walter Gwyn (a replacement for Lieutenant Eakin who had fallen ill); the Atlantic coast group was made up of Major Perrault, Lieutenants Searles, Huger, Brisbane, and a civilian, Mr. T. Gibbs. (Gadsden had highly recommended Gibbs to Perrault, stating that he had served as a surveyor on one of Gadsden's earlier projects and could be useful in the local area.)

At the beginning of the next year, Major Perrault reported to the Chief of Engineers that the west coast demi-brigade had informed him that the entrance to the Suwannee River was not satisfactory. Even at high tide the water was no more than 6 or 7 feet deep. Just as soon as he could communicate with that group, he would instruct them to look at Tampa Bay.



Map Of Jacksonville, 1826, by Lieutenant Colonel Perrault, Courtesy of the Corps of Engineers.

Perrault also informed Washington that Lieutenants Canfield and Smith had been delayed over a month on the west coast because of Indian troubles in the area they were assigned to survey. Most problems between the white and red men were blown out of proportion by many Floridians who were continually seeking the means by which to expel the Seminoles from their midst.

Governor William P. DuVal wrote of the Indian murders in a particularly strong and colorful language. "The Indians have committed a most wanton unprevoked and cruel murder in this Country - . . . Serious Danger is apprehended . . . the discontented Creeks & the Mickasuky tribe of the Seminole Indians have determined to destroy our Settlements." In another letter he said, "The Indians Committed a Murder of the most Shocking Character on the West Side of the Oscilla River. — One white man, four children & one Negro were the victims and the house burnt to ashes . . . . This Outrage is the forerunner of some Desperate Movement of these restless beings of both nations."[17] The Governor immediately dispatched letters to Colonel Duncan L. Clinch and Colonel George M. Brooke, both of whom commanded garrisons within the territory, requisitioning officers to lead troops to strike before it was too late. He then wrote to the Secretary of War for Federal aid.

Colonel Clinch was assigned to look into the matter. Two months later, he informed his commanding general that he could find no hostile intention on the part of either band of Indians. He said, "The outrages and murders recently committed in Georgia and Florida, were the Acts of a few desperate Outlaws, three of whom it is believed, have already atoned for their crimes, and efforts are making to have the others taken and brought to justice."[18]

In light of the latter information, it would appear that the Governor was crying wolf in an effort to have the Seminoles removed from Florida. To fan such fears as the Governor suggested was dangerous on the frontier. Such were the conditions under which Major Perrault and his brigade worked.

In the spring of 1827, General Simon Bernard visited Florida to personally examine the terrain over which Lieutenant Colonel Perrault (he had been promoted while in the territory) and his brigade had worked. General Bernard's itinerary was exhausting. Starting on 15 April, he examined the coast from the St. Johns River to the St. Marys. He then traveled up the St. Marys River on the route to Apalachicola Bay. He returned to the east coast via the Suwannee River. The general was back in St. Augustine by 13 May, preparing to cross the peninsula on the route from the St. Johns River to Tampa Bay. He arrived in Tampa on the 23rd of the month. Here, he took passage on the revenue cutter *Alabama* to examine the coast from Tampa to New Orleans.[19]

When General Bernard returned to Washington, he called upon President John Q. Adams to report his findings. Bernard believed that a ship canal across Florida was impracticable. The most that could be done would be to construct a canal 6 feet deep for steamboats and the final result did not justify the expense and effort. He did recommend a canal between Mobile and Pensacola. Later, Bernard also recommended the practicality of a canal from St. Marys to the St. Johns as part of the contemplated inland waterway along the Atlantic coast.[20]

In 1828, the first project for constructing an intracoastal waterway was adopted by Congress in the River and Harbor Act of 23 May. Appropriations were made for enlarging the water system between Mobile Bay and the Mississippi Sound on the gulf coast, and from the Cumberland Sound to the St. Johns on the Atlantic coast. The Florida undertaking lasted from 1828 to 1838, and was revived from 1874 to 1880. A later design to improve the mouth of the St. Johns River so changed the local transportation conditions, that the Cumberland Sound – St. Johns River scheme was terminated in December 1880. Work on the waterway has been programmed several times in the twentieth century. The first Florida project was given to James Gadsden.

Gadsden parceled the work out to local contractors. A year later, he wrote to the Chief Engineer, Colonel Charles Gratiot, to tell him that the canal cut near the Amelia narrows was completed; however, his contract with Zephariah Kingsley had been delayed.

Kingsley most certainly qualified for a position among the more colorful characters to work for the Corps of Engineers. He was a native of Scotland whose family migrated to Charleston, South Carolina, when he was an infant. Little else is known about him until he appeared in Florida in 1803. After the slave trade of the United States was banned in 1807, Kingsley became a slave smuggler operating out of Spanish Florida. On one of his trips to Africa, he married Princess Anna Madgegine Jai of Senegal in an elaborate tribal rite. He brought his new bride to Florida and installed her on his plantation, placing her in charge of all his slaves. Kingsley never did take a white wife, but he lived with several of his slaves and made provisions for them and their children in his will. Just before his death in 1843, he sent Princess Anna and his children by her to his plantation in Haiti.[21]

Gadsden's problem was with an agent of Kingsley's who was hesitant about carrying out some instructions Gadsden had issued during the time Kingsley was called north. Rather than continue in Kingsley's absence, the agent suspended all work. The agent's actions may have been prudent. Zephariah Kingsley was a strange man who defied convention, and his agent decided not to test his employer.[22]

This episode with Kingsley caused Gadsden to be late submitting some of his reports to Washington. The Chief Engineer, as a gentle hint, sent copies of two sections of Acts of Congress containing instructions for disbursing officers to James Gadsden. This elicited the following reply: "I regret that you should have deemed so delicate a hint of my supposed public obligations at all necessary —". Gadsden went on to say that the penalties listed had no fear for him. "I never was & never will be a public defaulter. . . ."[23]

By July 1830, Gadsden stated that navigation between the St. Marys and the St. Johns was open. Coasting schooners drawing not more than 5 or 6 feet could pass the Amelia Cut at the north or the Sisters Cut at the south at an early stage of the flood, reaching the Talbot dividings at a favorable stage of half or full tide. Such timing would keep vessels from being impeded by the obstruction. This was Gadsden's final report. On 21 July 1831, he was appointed assistant engineer to succeed General Bernard, who had resigned to return to France.[24]

The work continued on the waterway. Lieutenant Joseph K. F. Mansfield, Corps of Engineers, submitted a letter of progress 6 years later, in 1836, stating that he had arranged for the construction of a dredge boat and mud flats, which were employed to clear out oyster beds at the Sisters and other obstructions at Amelia dividings. Lieutenant James S. Williams, in the steamer *Essayons*, moved mud flats from place to place along the route under Mansfield's instructions.[25]

Not all the work of the Corps was directed to improving transportation systems that would encourage settlement. Even in the early nineteenth century there was concern with historical preservation. The Castillo de San Marcos, renamed Fort Marion by the Americans, was constructed by the Spanish between 1672 and 1695. It is the oldest masonry fort in the United States today. The Castillo was in good repair, serving as a garrison for Spanish troops at the time of cession. Extending from the fort to the barracks of St. Francis was a sea wall of stone designed to preserve both the town and the fort from the ravages of the sea. Shortly after the Americans moved into St. Augustine, some unthinking governmental offical removed a portion of the wall, using the stones to construct a wharf leading to the barracks. This destruction of part of the sea wall had grave consequences; the foundation began eroding away from under the Castillo.

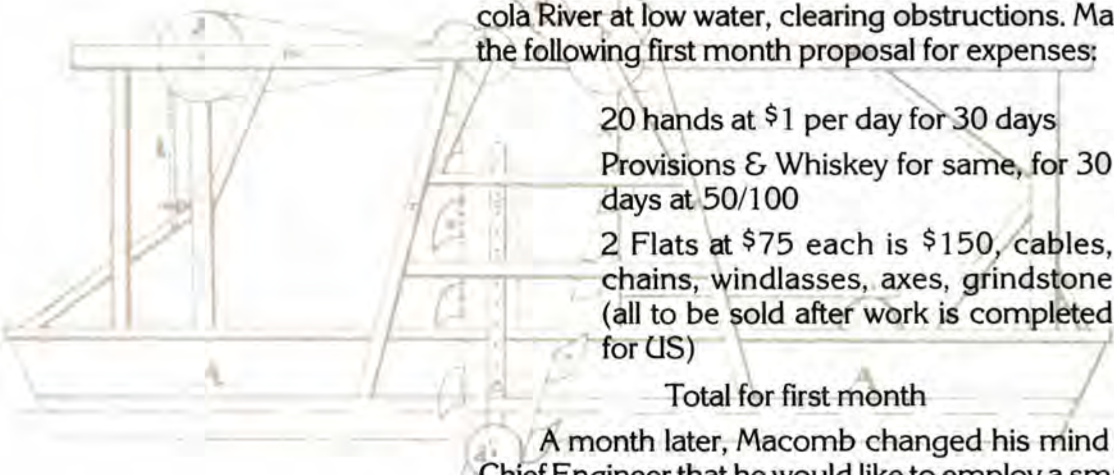
In the fall of 1834, St. Augustine was subjected to severe northeast gales accompanied by high water. The pounding of the sea led to a rapid deterioration beneath the castle. The storm brought fears for the safety of this magnificent edifice to many of the citizens. The town fathers approached the resident engineer, First Lieutenant Francis L. Dancy, with a plea for aid. Dancy wrote to General Charles Gratiot, stating that "should the government cause a few thousand dollars to be judiciously expended on it, it would remain for ages a monument, and not an unworthy one, of the Spanish Nation, by whom it was erected, and a memento of events more memorable in the history of our country."[26] Funds were forthcoming and the Castillo was saved.

Over on the west coast along the Apalachicola, St. Marks, and Ocklockonee Rivers, the Corps of Engineers also had navigational designs. Today, these rivers are in the Mobile District; however, during the early years when district boundaries were forming, they were under Jacksonville's control. In addition, their navigational improvements demonstrate the frontier working conditions under which the Corps had to contend throughout the territorial days. As on the east coast, the tasks were performed by both engineer officers and civilians.

The first appropriation was made to clear the Apalachicola River. David B. Macomb, a civilian, was given the contract. Macomb decided to use two flats, about 50 or 60 feet long, joined parallel, with Spanish Windlasses placed on them. This equipment was constructed at the junction of the Flint and Chattahoochee

Rivers where it could be launched to proceed down the Apalachicola River at low water, clearing obstructions. Macomb submitted the following first month proposal for expenses:

20 hands at $1 per day for 30 days	$600.00
Provisions & Whiskey for same, for 30 days at 50/100	300.00
2 Flats at $75 each is $150, cables, chains, windlasses, axes, grindstone (all to be sold after work is completed for US)	300.00
Total for first month	$1,200.00[27]



Drawing of John Grant's mud machine, 1826, Courtesy National Archives.

A month later, Macomb changed his mind and wrote to the Chief Engineer that he would like to employ a small steamer. Such a vessel would be more expeditious and less expensive to operate. While he was in New Orleans, he had found that a good second-hand steamer of 20 or 25 horsepower could be had for between $1,500 and $2,000, plus all cables and hawsers. With the steamer, he would need only 10 hands instead of 20 with the flats. As the final point to his argument, he noted this procedure had been tried on the Altamaha River in Georgia, and it had been successfully used by Captain John Jenkins of the steamboat *Fanny* on the Apalachicola.[28]

Colonel Gratiot turned down Macomb's suggestion. The sum appropriated for clearing the Apalachicola was not large enough to cover such expenses. Gratiot also believed that the steamboat enterprise would be "deemed a hazardous experiment."[29] Macomb was instructed to continue the project, using the two flats.

At the time Macomb was given the contract for the Apalachicola River, he was also assigned to survey the harbor and river at St. Marks. In discussing the obstructions to St. Marks. Macomb singled out the Devil's Elbow as a particularly challenging barrier to navigation. He recommended the employment of the newer, improved Mud Machines then being used to scoop up soft mud only, but he was convinced that they could be used on oyster bars. He proposed to send a working party out ahead of the Mud Machine, either on flats or in sculls. These hands would be provided with iron crowbars sharpened on one end and flattened on the other. Using these crowbars and sledge hammers, he believed four men could detach enough oysters in a day to provide all the loosened material the Mud Machine could raise in the same period of time.[30]

Not only did Macomb have rather grandiose ideas on how to execute his schemes, but he had a haphazard way of submitting his expenses. Colonel Gratiot had to ask Macomb to send more detailed estimates of expenses on more than one occasion.

The Chief Engineer, who began casting about for some competent person to replace David Macomb, thought of James Gadsden. Colonel Gratiot wrote Gadsden in April 1829 asking him to take over the St. Marks project. Gadsden declined. In August, Gratiot wrote again, this time sweetening the offer by telling Gadsden he would have to be an overseer only; he would not be expected to work in the field. He also suggested that "perhaps the dredging machine which has been used in deepening the Channel at Mobile might be procured on very low terms if there is no further use for it."[31] Gadsden still refused to accept the assignment.

Finally, in February 1830, Macomb was notified that his services were terminated because of his failure to settle his accounts. Gabriel J. Floyd was given the Apalachicola contract; Jesse H. Willis, the collector at St. Marks, was assigned the St. Marks job.[32]

Gabriel Floyd lasted one year. Joseph White, Florida Territorial Delegate to Congress, recommended the replacement of Floyd because he was not a trained engineer. White also submitted to the Chief Engineer several letters critical of Floyd written by other Floridians.

Floyd, informed of these proceedings, wrote to the Chief Engineer asking to be kept on his appointment. When this had no effect, he wrote to the President claiming that White had done this to him solely on account of his "adverse vote in the election of [the] Delegate."[33] Regardless of this counter charge, Second Lieutenant George W. Long, 4th Artillery, who was on engineering duty at Fort Jackson, New Orleans, was sent to replace Gabriel Floyd as agent at Apalachicola on 29 March 1831.

In November 1831, First Lieutenant Long (who had been promoted that September) and Mr. Willis were placed under Captain William H. Chase, Corps of Engineers. Chase was in charge of constructing Fort Pickens at Pensacola with the designation of Commanding Engineer of the Gulf of Mexico.[34]

First Lieutenant Long's new duties were to be long and busy. He remained in Florida until he resigned his commission in December 1835. Long's tenure with the Corps in Florida in many respects epitomizes the experiences of engineers of that day. His tasks were varied, he had to improvise, and he was drawn into the private sector because of his engineering skills.

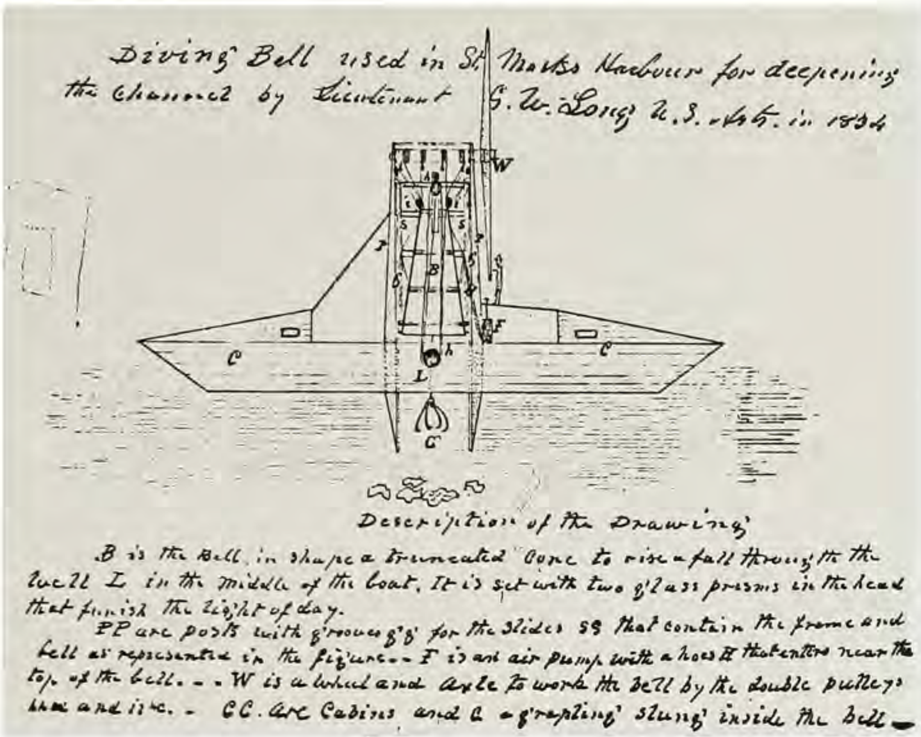
The first task Long undertook was to continue the excavating which had been commenced by Gabriel Floyd. He kept his crew on the job from July through late August until heavy rains caused the river to rise and effectively stopped all such work. Long then shifted to constructing a snag-boat and a house boat. The snag-boat consisted of two flats, parallel to each other and fastened together with about 8 feet separation between the two. A wheel and axle, worked by a capstan, was installed to produce a power of about 40 tons.[35] With this rig, First Lieutenant Long was able to remove many snags previously immovable. It was a most successful start.

At the beginning of 1832, First Lieutenant Long was also given control over the St. Marks River. Devil's Elbow presented the same problem to Long that it had to Macomb and Willis. There was a stratum of rotten limestone only 7 feet below the water at high tide. On this rock were oyster beds.

Long determined that the only solution was to blast the rock in the bed of the channel. He devised a method by fastening chisels to long poles. His crew on the surface would then chisel holes in the rock 8 to 10 feet below them. When a hole of sufficient depth had been created, Long placed canisters (4 inches in diameter and 10 inches in length) filled with powder, in the opening. At one end of the canister, he attached a 1-inch diameter tube, long enough so that when the canister was placed in the hole, the other end of the tube would be above water. This rig was then lowered into the hole and the area above the canister was rammed home with pounded stone. When this was finished, a hot ball was dropped down the tube to explode the powder in the canister.[36] Long reported that his method was successful, and each blast broke up stone for 10 to 12 feet around the drilling. In most cases, the blasted stone was fine enough for the dredging machine to take up nearly all the loosened material.

Long eventually realized that the dredging buckets were not able to take up all the broken stones from the blasting and that something else was needed. He constructed a diving bell. He was hampered by sickness among his crew, and some difficulty hiring others, but, by the fall of 1834, the bell was ready.

Long's diving bell consisted of a truncated cone with two glass prisms set in the top to provide light. The bell was set in a well amidships in the boat and attached by pulleys to the well frame. Inside the bell, Long placed a grapling sling to hoist rocks and other obstructions to the surface. The diving rig could lower two men and their equipment to a depth of 9 feet in 30 seconds, through the efforts of four workers manning the wheel and axle on deck. When the bell reached bottom, the four topside laborers would ply the air pump, providing oxygen to the workers and keeping the air pressure in the bell high enough to stop water from seeping in through the open bottom. When the workers had



Lt. Long's Diving Bell. Courtesy National Archives.

readied their load, the wheel and axle was employed, which raised the diving rig high enough in the ship's well for a platform to be slid under the bell to remove the stone in the grapple. Then the whole performance would be repeated.[37]

Long reported that his bell was a powerful engine with which to tear up rock from the river bed. Rocks up to 2 tons had been lifted with greater ease than if they had been taken from a dry quarry because of the buoyancy of the bell, combined with the power derived from wheel, axle, and pulleys. He strongly urged the Chief of Engineers to give serious consideration to employing his bell on other river tasks.[38]

Long went on to say that he had been informed that the Chipola River was to be improved. He was well acquainted with that river. There was a section of 3 or 4 miles through a cypress swamp containing large trees in the water. He recommended that the trees by felled at low water, cut close to the surface, then his diving bell could be sunk over the stumps and "a ready means will be had to accomplish the work of cutting the stumps out of the way—."[39]

The major difficulty Long encountered while working on the Apalachicola was with his laborers. In September 1833, a crew of Negroes rebelled against their overseer, attacked and nearly killed the man. The entire group then deserted the job and fled to the sanctuary of the wilderness, undoubtedly to join the blacks living in

Print of Apalachicola in 1837, Courtesy State Photographic Archives, F.S.U.

comparative freedom among the Seminoles. The next gang hired by Long was white, but they quit when sickness struck many of them on the job. In addition to desertion and sickness, Long had to contend with the higher wages offered in town. Long was partly the cause of his own problems. As he improved the harbor and river, more commerce was drawn to the area to compete with him for laborers.[40]

In mid-January 1835, First Lieutenant Long made an extensive report of his undertakings to Captain Chase. The river of Apalachicola had been cleared of logs and rafts of driftwood which had lodged along the banks and at sharp bends in the channel. Heavy timber along the banks were removed to prevent them from falling into the channel. A new and straight channel, created from St. George Sound to the town of Apalachicola, had been cut. By the end of 1834, a full-rigged ship had passed up to the town. On the St. Marks, Devil's Elbow had been cut and other work completed. The river and swamp were now open for scow navigation about 14 miles above the natural bridge near Colonel Gadsden's plantation, which was 2 miles south of the St. Augustine road. The Ocklocknee River had been cleared for navigation for about 130 miles before the appropriated funds ran out.[41]

In addition to the many tasks First Lieutenant Long had to perform for the Corps, he found time to become interested in private civil schemes. He was engaged as an engineer by the Tallahassee Railroad Company, which had been formed in 1834 to promote a railroad from Tallahassee to St. Marks. In justifying his acceptance of this work, he wrote the Chief Engineer that this project was of first importance to the territory, and that the expense of getting an engineer from the north would be prohibitive for the promoters.[42]

The Tallahassee-St. Marks Railroad brought forth these comments from Comte de Castelnau when he visited middle Florida in 1837-38: "Certainly [it is] the very worst that has yet been built in the entire world." Yet, he went on to say that it was a very useful road for "it would be almost impossible to take a heavy load of cotton across the sand that covers the country to the south, into which horses sink at every step." He reported that the train consisted of two mules pulling carts along the tracks and it took about 7 hours to cover the 23-mile route. Several times the company had tried to put a locomotive on the tracks, but the roadbed construction was so poor that the company gave up on the plan.

Was it really the world's worst railroad? The Comte's concluding remarks demonstrate otherwise. The Frenchman expressed

Tallahassee Railroad Co. depot in Tallahassee, 1838. Construction was started on Florida's first railroad (incorporated Feb. 10, 1834) in 1834 and completed in 1836, from Tallahassee to Port Leon (22 miles). Courtesy State Photographic Archives, F.S.U.

his awe over the achievements of these new Americans: "Instead of being astonished over bad construction of this railroad, one is inclined on the other hand to admire the bold thought that inspried a project of such a sort in a country inhabited by hostile savages, and through almost impenetrable forests, which so few years ago were not even explored by whites."[43]

Thus, the Corps of Engineers carried out projects in the territory of Florida which were instrumental in bringing settlers and commerce to the frontier. These particular tasks were more civil than military; yet, as will be noted, there were military needs to be performed in Florida which the Corps did not shirk from undertaking.

CHAPTER 3

The Military Frontier

IN THE FIRST HALF of the nineteenth century, the Corps of Engineers prepared defenses and fought in three Indian wars in Florida. The relatively minor engagements of the First Seminole War have been recorded in an earlier chapter. The two remaining frontier conflicts (the Second Seminole War, 1835-42 and the Third Seminole War, 1856-57) called upon the services of the Corps of Topographical Engineers. Between the Second Seminole War and the Civil War, the Corps of Engineers was busy erecting fortifications around the perimeter of the state to bolster the defenses of the nation's sea frontier.

In both men and material, the Second Seminole War was the longest, most costly Indian war fought by the United States. It was brought about as a direct result of Congress' "Indian Removal Act," passed in 1830. Under the act, most American Indians east of the Mississippi River were to be moved west of the river to curb frontier conflicts between the white and red men.

Prior to the Indian Removal Act, the United States Army had set up frontier outposts in Florida. In 1823, just 2 years after Florida became an American territory, James Gadsden was sent to Tampa Bay to select the site for a post. Fort Brooke was named for Colonel George M. Brooke, the commander of the troops who had responsibility for the actual construction. Soon there were several such military camps scattered throughout the territory, including Fort King.

These posts were designed to protect the military from the Indians, who employed unsophisticated weapons. The frontier forts were generally temporary, rude log structures for quartering troops. They might be more properly considered cantonments rather than forts. (Colonel Brooke was pleased with his log buildings which were 200 feet long and 12 feet from floor to loft.) There was little need for an engineer officer to raise such structures; most frontier posts were built by the troops themselves. Engineer officers were necessary to create the fortifications needed to confront an enemy equipped with large guns, cannon, and seige weapons. They could not be wasted on frontier Indians.

When the United States took the final steps to remove the Seminoles from their homeland, the Indians reacted violently to the threat. In a series of widely separated attacks, the red men struck at the whites in actions displaying the coordination of prior planning. On the morning of 28 December 1835, a band of warriors ambushed Major Francis L. Dade's column of two companies of regulars enroute from Fort Brooke to Fort King. Of the 108 men in his command, only three survived the attack. That afternoon, Indian Agent Wiley Thompson and First Lieutenant Constantine Smith were shot and killed just outside the agency at Fort King. Three days later, the Seminoles caught an Army column crossing the Withlacoochee River and bested the Americans. The war, which was never formally declared, began.

The Second Seminole War deteriorated into a primitive conflict of chase and ambush. By 1839, three-fourths of the Seminoles had turned themselves in or had been captured and sent west. The rest were driven back to the Everglades where, during the final 4 years, small units of Americans (soldiers, sailors, and marines) thrashed about in that trackless wasteland searching out the elusive red man. In twentieth century terms, it was guerilla warfare, employing the search-and-destroy tactics similar to the Vietnam War in the Mekong Delta.

The Florida war was unique. There were no land fortifications to be breached; there were no harbors to be defended; there were no population centers to be fortified against siege weapons; in short, there were no projects peculiar to the Corps of Engineers undertaken for waging this conflict. The result was that individual engineers took part in the conflict, but not specifically as engineers. However, there was a vital need for topographical engineers.

Topographical engineers had had a checkered career in the American military organization. The Continental Congress had authorized the appointment of a geographer on 25 July 1777. In 1781 Congress called for two geographers, one for the main army and one for the army in the south. After the war, the army was disbanded and the geographer continued as the surveyor of public lands. There were no more topographical officers in the Army until after the commencement of the War of 1812. Then Congress created topographical officers in 1813; they were mustered out in 1815 when the war ended. The next year the Topographical Corps became part of the general staff. In 1818, the Topographical Corps was placed under the Corps of Engineers where it remained until 1838. In 1838, it became an independent Corps and was assigned the functions of surveying roads, canals, lakes, rivers, and harbors. It was finally merged with the Corps of Engineers in 1863. Thus, during part of the Second Seminole War, the Topographical Corps was in existence supplying officers to map the unknown terrain of Florida.[1]

Very early in the war, General Abraham Eustis sent scouting detachments ahead of his main column. One such party consisted of Colonel James Gadsden, Captain Augustus Canfield (both from the Corps of Engineers), Captain John T. Sprague, and Lieutenant Joseph E. Johnston, with 17 men, who were sent "in a miserable little steamer" to explore the St. Johns River as far as Lake Monroe.[2] When the Topographical Corps became a separate unit in 1838, both Canfield and Johnston became topographical engineers. These officers undoubtedly prepared field maps for General Eustis.

Lieutenant Joseph E. Johnston's case was unusual. A year after that scouting mission, Johnston resigned his Army commission on 31 May 1837. Later, while waiting for a reappointment, he volunteered to serve in Florida as a civilian. In the fall of that year, he was attached to a unit commanded by Lieutenant Levin M. Powell of the United States Navy.

Powell had earlier suggested to the Secretary of War that a specially formed amphibious force, composed of both soldiers and sailors, might be able to penetrate the watery refuge of the Seminoles who were hiding in the Everglades. Secretary of War Joel L. Poinsett accepted the Navy Lieutenant's suggestion and preparations were made for the unit to enter the Everglades in December 1837. Powell's command consisted of three naval officers, 100 sailors, Lieutenant Henry W. Fowler with Company I, 1st Artillery, and Joseph E. Johnston, who was the group's civilian topographical engineer.

Early in January, the group had a sharp engagement with Indians at the headwaters of Jupiter River. Lieutenant Fowler was wounded during the fight while the Americans were attempting to retreat to their boats. Johnston took command of the soldiers, rallying the waverers and directing the rearguard so successfully that the unit was saved from almost certain destruction. Lieutenant

Powell was high in his praise of Johnston. In June 1838, Johnston accepted a commission as first lieutenant in the Topographical Engineers, and for his actions with Lieutenant Powell he was brevetted to captain.[3]

In 1839, General Zachery Taylor, the commanding general in the field in Florida, wrote to the Adjutant General in Washington about the assistance he had received from his topographical engineers. A military map of the theater of operations, drawn up by Captain John McKay and First Lieutenant Jacob E. Blake, was cited by the general for the wealth of information it contained. "It will be observed that fifty-three new posts have been established, eight hundred and forty-eight miles of wagon road, and three thousand six hundred and forty-three feet of causeway and bridges opened and constructed," wrote the general.[4] A year later, the map was printed and widely distributed to the public.

In the same letter General Taylor said: "The officers of the topographical engineers (Captains [John] MacKay and [Walter B.] Guion, Lieutenants [Jacob E.] Blake, [John W.] Gunnison, and [Robert M.] McLane), one of whom accompanied each column, have done all I could expect from them. Their maps and charts will show the labor they have performed."[5] It is apparent that the topographical engineers were busy during the Indian War. Most, if not all, of the 848 miles of wagon roads and the 3,643 feet of causeway and bridges built for General Taylor, must have come under the supervision of these topographical engineers.

The Second Seminole War ended as unofficially as it had begun; by the simple expedience of not assigning troops to south Florida. It was estimated that there were about 300 Seminoles still hiding in the Everglades in August 1842. The Indians were left alone, and they had little contact with the whites.

As time passed, however, some Floridians chaffed because nothing was being done about these Indians. One of the arguments used was that the existence of red men living in the Everglades kept white settlers from moving into the region around Lake Okeechobee. Governor Thomas Brown of Florida complained that "the most interesting and valuable part of our state . . . is cut off from any benefit to the citizens and sealed to the knowledge of the world, to be used as a hunting ground for a few roving savages."[6]

Commissioner of Indian Affairs, Luke Lea, sent Indian Agent Luther Blake to Florida to attempt to peacefully persuade the Seminoles to go west. Blake was to receive $10,000 for his expenses, with the provision that, if he could move the Indians, he would be paid another $10,000 plus $800 per warrior and $450 per woman or child. Out of these funds Blake had to pay all expenses, including gifts, bribes, and travel costs to move the Indians. Blake succeeded in shipping 36 Seminoles west. With the failure of his mission in 1852, Blake angrily commented that if the Government would shut off the supply of powder to the Indians, and harass the red men by running surveys through their lands, they might be inclined to move.[7]

The surveyor general of Florida, John Westcott, proposed this same policy in his report of 1853, declaring "a gradual and easy approach by survey, and settlements from the present surveyed lands, would . . . soon accomplish peacefully and economically the object so most desired."[8] It is difficult to accurately pinpoint whether the invasion by surveyors was the brainchild of Blake or Westcott.

Captain John C. Casey, the Indian agent who succeeded Blake, presented the plan which was executed. It was similar to the suggestions of Blake and Westcott, but the timing was more complex. First, Casey proposed to send surveyors out to study the land between the Kissimmee, Lake Okeechobee, and Fort Myers. Then he wanted roads opened in that region. Casey insisted that during this period there must be many units moving about and scouting on the roads, in boats, and in the swamp.

Meanwhile, all trade with the Seminoles must stop, especially that of gun powder. After 18 months of this form of blockade, Casey reasoned that the Indians would be low on powder. That was the time, he suggested, to send surveyors into the heart of their land – the Big Cypress Swamp. This would probably lead to a violent reaction on the part of the red man, but so what? With little or no powder, the conflict should be short and one-sided.[9]

Secretary of War Jefferson Davis accepted Casey's plan. (It's possible that Davis had his own reasons for accepting the plan. He was known to favor expanding the control of the United States into the West Indies to secure more slave-holding states for the country and, if so, south Florida, well settled with slave owners, would have been a good jumping-off place.) For whatever reasons, the plan was approved and, by the end of the year, reconnaissance groups were sent out into Indian territory.

Lieutenant George L. Hartsuff, 2nd Artillery, was appointed a topographical engineer on 22 January 1855 and was assigned to lead a survey party in the vicinity of Big Cypress Swamp in the Everglades. Colonel Harvey Brown requested that Hartsuff gather detailed information which would be used by later groups sent out to cut roads and build forts in the region. The lieutenant was instructed to note the value of the land and its capability of supporting a civilized population.

Hartsuff made his report in June stating that: "On my arrival at Fort Deynaud after an absence in the swamp of more than three months, my field duties as Topographical Engineer ended. The map accompanying this I have made full and complete as possible with the limited means in my power."[10] His final observation was that the land was worthless except to the Seminoles.

During the first half of 1855, Lieutenant Hartsuff had selected the site for the Fort Simon Drum blockhouse; blazed a trail northward to Fort Deynaud; traveled east to Waxy Hadjo's campsite where Fort Shackelford was erected; and had rediscovered Fort Keais, one of the abandoned and lost Second Seminole War forts. Hartsuff carried out Captain Casey's plan to perfection. He made the Army visible to the Seminoles in the Big Cypress Swamp.

There were others penetrating the heartland of the Seminoles. Captain Samuel K. Dawson led his group into the swamp twice, first in March 1855 during the dry season, and again in June after the rains. On the first expedition, Dawson's men hauled their boats through mudholes more often than they rode in them. When they reached the Everglades they found the tremendous expanse of sawgrass standing dry – there was no visible water.[11] Lieutenant Henry Benson skirted Lake Okeechobee on his reconnaissance patrol in 1855. That same year, Lieutenants Thomas J. Haines and Thomas M. Vincent of the 2nd Artillery trekked from Harney's River to the Caloosahatchee.[12]

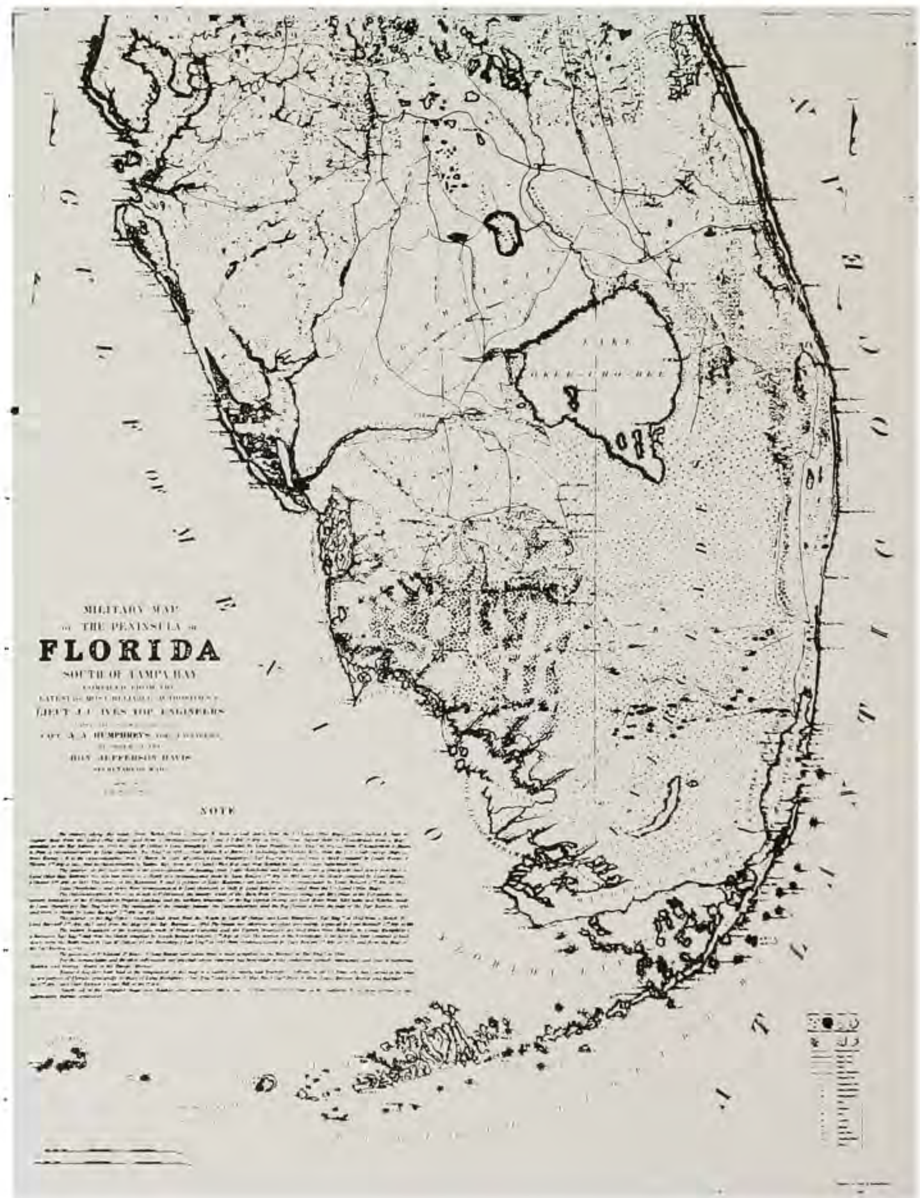
Billy Bowlegs, one of the remaining Seminole chiefs left in Florida, watched these incursions of the Army with anxiety. He was well aware of the power and numbers of the white man. In September 1852, he had been taken to Washington, D.C., to confer with the Great White Father about the necessity of the Indians migrating west. Old Billy had traveled by horseback, coach, steamboat, and train, visiting Tampa, Palatka, and Savannah enroute to the Capital. Yet, upon his return to Florida, he discreetly moved into the interior of Big Cypress Swamp where he attempted to avoid the white man. By 1855 the many survey parties crisscrossing the Everglades made this impossible for Billy.[13]

The Third Seminole War, a minor affair in military annals, was made bizarre by the antics of Jacob E. Michler. A Florida volunteer, Michler organized a boat company of fellow volunteers for the express purpose of capturing Seminoles alive for the Government reward. Finally, Colonel Elias Rector brought a group of western Seminoles back to Florida to try once more to convince their kinsmen to migrate to Oklahoma. Billy Bowlegs capitulated at last. His terms were: $6,500 as his personal enrichment, $1,000 each for his four subchiefs, $500 for each warrior, and $100 for each

Billy Bowlegs, Courtesy State Photographic Archives, F.S.U.

woman and child. Of the 164 emigrating Indians loaded aboard the steamer *Grey Cloud* at Fort Myers, 123 went voluntarily and 41 were captives. A final remnant of about 100 Seminoles remained in the depths of the Florida swamps.[14]

The most succinct summation of the role of the topographical engineers in the Everglades may be found in the note of acknowledgment on the military map of southern Florida published in 1856. The compiler, topographical engineer Lieutenant Joseph C. Ives, mentioned the earlier works of Captain John McClellan, Lieutenants Andrew A. Humphreys, William B. Franklin, and John



Ives' military map of south Florida, 1856. Courtesy National Archives.

W. Gunnison of the Topographical Engineers, and Lieutenant George Hartsuff, while working for the Topographical Corps in 1855.[15]

Although the engineering functions were divided between the two corps so that the topographical engineers did most of the surveying, there was still much work for the Corps of Engineers, now concerned almost exclusively with military fortifications. The international situation seemed to Americans to demand strong defenses. The 1830's and 1840's were turbulent years in the life of the country. The Indian War in Florida did not hold center stage in the national news.

In 1836, the Texans were struggling for their independence from Mexico. After the Lone Star Republic was established, there were Texans interested in joining the United States, but, when President Jackson refused this overture, some of them began to court England. Whether this was done sincerely or just to prod the United States, it nevertheless posed the threat of having England encircle the country.

Then the Pastry War *(Guerra de los Pasteles)* broke out in 1838 between Mexico and France. The French Minister asked for his papers on 20 April 1838. Before the month was out the French fleet arrived in the Gulf of Mexico to blockade the Mexicans. A small number of French troops landed and remained in the country for 2 weeks.[16] It was a minor international incident, but it demonstrated to the Americans the ease with which foreign navies could sail into the Gulf of Mexico where the southern states and the Mississippi River lay unprotected.

James K. Polk was elected to the Presidency in the fall of 1844. His term of office, 1845-49, is considered one of the more active periods in the expression of American manifest destiny. During Polk's tenure, the nation confronted Great Britain over the Oregon question, and engaged Mexico in a war which added present-day New Mexico, Arizona, Nevada, Utah, and California to the United States. The nation was expanding westward, and the Corps of Engineers had to create the fortifications necessary to protect the southern flank. On the Florida peninsula, this resulted in Fort Clinch on Amelia Island in the northeast, and Forts Jefferson and Taylor in the south. On the western panhandle Fort Pickens in Pensacola Bay was already standing guard. During the first months of 1849, Polk's last year in office, a board of engineers, with Captain Robert E. Lee as recorder, examined the general system of defense along the Florida coast.[17]

In the fall of 1844 Captain John G. Barnard, Corps of Engineers, was sent to the Florida Keys to survey sites for the proposed

Fort Taylor, as sketched by a member of the garrison and published in Harper's Weekly on March 2, 1861. At that time the fort was completely surrounded by water and reached by a draw bridge. Between 1898 and 1905, the top two tiers of the fort were torn down and an estimated 200 pre-civil war cannon are believed buried in the first floor casements, placed there during the remodeling. Courtesy Florida State Photographic Archives.

defenses. He recommended Key West and Tortugas. A board of engineer officers, after viewing his sites in January 1845, approved the selections.

Captain George Dutton, Corps of Engineers, was the first officer in charge of construction of Fort Taylor at Key West. He labored for 8 years. When Captain Jeremiah M. Scarritt relieved Dutton, the walls had risen well above the first tier of casemates. This was quite an accomplishment because the plans called for a fort shaped in the form of a trapezoid to be built offshore. The three seaward walls, or curtains, were to be 225 feet in length. The land face, or gorge, contained the living quarters and was 495 feet long. The sally port was protected by a large sand-covered concrete coverface. Between the sally port and the coverface was a 30-foot moat and drawbridge.

The foundation of the castle was laid on bedrock 11 feet below the water, requiring Dutton to construct breakwaters and cofferdams before he could assemble the grillage of cypress ties and girders. Dutton then placed huge granite blocks from New England in the grillage. He built the ashlar 16 feet above normal high tide. Like the iceberg, most of Dutton's efforts were below the surface.

The captain's engineering problems were minor compared to his procurement and labor vexations. The granite blocks came by schooner from quarries in Maine and Vermont. Occasionally, with such a long lead time, Dutton found himself waiting for supplies of granite. He finally went north in 1848 to look for an additional source, which he found in New London, Connecticut.

Bricks were another item often in short supply. Dutton's prime contractors were in Mobile and Pensacola and he used New York and New Orleans as secondary suppliers. When Captain Scarritt arrived to assume command, Dutton was in the midst of one of his periodic shortages. He had no bricks for the masons to turn the arches in the first tier.

Most of his artisans and mechanics were recent immigrants from Ireland and Germany. Captain Dutton employed a New York agency to keep recruiting these newly arrived craftsmen, none of whom were acclimated to the climate at Key West. Of course, New York was not the only entrepôt for laborers. In 1856, Major John Sanders signed an agreement with Baker and Stetson of Philadelphia to transport 100 passengers for the Corps to Key West. The steamship *Henry B. Beach* was to have berthing spaces, erected between decks forward of the engine room, for 70 laborers after the regular ship's stateroom lodgings were exhausted. The shipping agents stipulated that extra tables would be built, and a "privy placed on the side of the ship for the accommodations of the forward passengers."[18]

William Land of Key West agreed to board Captain Dutton's workmen at the following rates: mechanics at $14 per month, laborers at $12 per month, and slaves or black laborers at $7 per month. Dutton had to furnish fixtures for all quarters and provide fuel.[19]

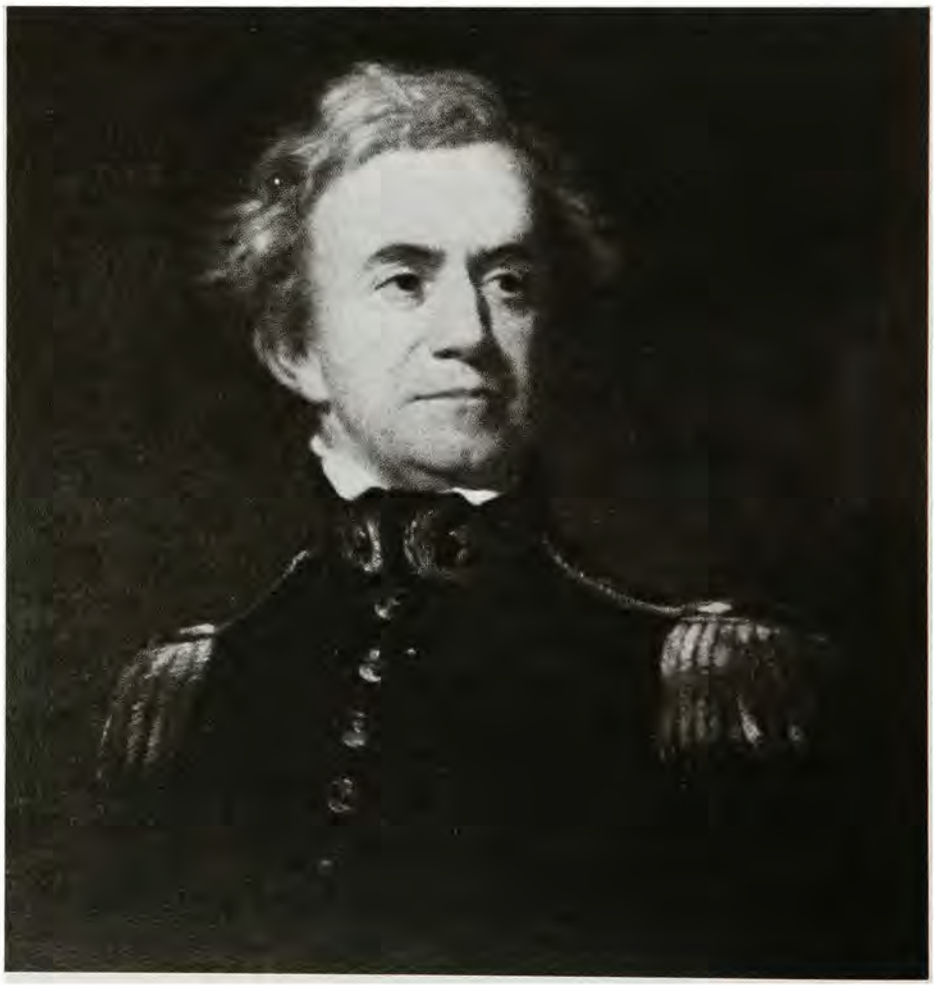
Most of the backbreaking tasks were accomplished by local slaves, rented to the Government by their owners, and by a few free blacks. In 1845 John Saville, a free black living in Key West, appointed Benjamin Sawyer, a Key West merchant, his guardian for 1 year so that he might be employed on the works at Fort Taylor.[20] Two years later, L. D. Rogers of Key West gave written permission for his slave Hector to work for the Corps of Engineers as a carpenter.[21] These are just two examples of some of the business forms used when employing laborers.

Stephen R. Mallory, who became Secretary of the Navy in the Confederate States of America, was quite involved in supplying slaves for the Fort Taylor project. In 1848 he complained to Captain Dutton that one of the white men working for the Corps had physically assaulted his slave Mat, while Mat was on the job. The assailant was not in a position of authority over Mat, and Mallory accepted Mat's account of the affair because, "I have owned him about fifteen years and have never had occasion to lay my hand upon him."[22] Three years later, Mallory transferred 14 slaves to Fernando J. Moreno who was to act as their agent in dealings with the Corps. Mallory had given the blacks to his wife Angela, and

Moreno was trustee for Angela's property.[23] On 12 March 1858, Fernando Moreno was still dealing with the Corps of Engineers for slave laborers for Fort Taylor.[24]

In the summer of 1854 yellow fever struck the construction camp. Fifteen men died, including Captain Scarritt. Lieutenant Horatio G. Wright, who had charge of Fort Jefferson on Tortugas, almost 70 miles westward, was temporarily assigned to handle both projects.

For the next 4 years there was a parade of officers overseeing the construction of Fort Taylor. Major William H. Chase held the post only until he could find a way to be ordered elsewhere. Major William D. Fraser lasted about 7 months before contracting yellow fever and dying. Captain Daniel P. Woodbury, who like Wright had charge of Fort Jefferson, was given temporary command over both structures. Finally, late in 1857, General Joseph G. Totten, Chief Engineer, found Lieutenant Edward B. Hunt, who had the ambition and desire to do a good job.



Maj. Gen. Joseph G. Totton, Chief of Engineers from 1838 through 1864, during the construction of Fort Taylor, Fort Jefferson, and Fort Clinch. Courtesy U. S. Military Academy.

Lieutenant Hunt sought near and far for good laborers, but his search for slave labor away from Key West brought a complaint from Florida Senator Stephen R. Mallory. The senator objected to the Lieutenant hiring slaves from the mainland and voiced his objection to the Secretary of War. Actually at fault were the slave owners of Key West, including the senator, who were preying upon the local labor shortage to raise their rates above what Lieutenant Hunt was willing to pay. But, the senator's influence soon was felt and Hunt was told to give preference to the local labor market.

Two years under Hunt brought exceptional results in the erection of Fort Taylor. The second tier of the seaward curtains was completed, the soldier's quarters roofed, the parapet in place around the fort, and many lesser works finished. While it was far from complete, enough had been done to garrison Fort Taylor if an emergency arose, and war clouds were gathering over the United States.[25]

Although both the sites of Fort Taylor and Fort Jefferson were selected by Captain Bernard in 1844, a later time schedule for construction was set for Fort Jefferson on Tortugas. Chief Engineer Totten selected Lieutenant Montgomery C. Meigs to draw up the plans for Fort Jefferson, which was to be a major military edifice among the nation's defensive fortifications. It was to be a six-sided, three-tiered, fort, mounting 250 guns and housing a wartime complement of 1,500 men.

Fort Jefferson, the largest masonry fort ever built in the United States, as sketched by a member of the garrison in 1860. This drawing appeared in Harper's Weekly on February 23, 1861. Courtesy National Archives.

All of this brick and masonry was to be placed upon Garden Key, a large oval key 300 yards long, rising 3 feet above sea level, with a stagnant pool in the center of sand and coral. Garden Key lay isolated almost 70 miles west of Key West in the Gulf of Mexico.

Second Lieutenant Horatio Governeur Wright arrived on Garden Key in December 1846 with his fellow Yankee, George Phillips, master mason, to assume the duties of engineer for Fort Jefferson. This imposing task may have been given to the young, untried officer because the Mexican War was underway and the more senior officers opted for the chance for fame and glory on the battlefield. Wright remained on Tortugas, overseeing the construction of the submarine foundations, until 1856.

Wright's problems were rather like those encountered at Key West, but more extreme because of his isolation. Many shippers were reluctant to bring bricks to Garden Key because they would have a return trip empty of cargo for several hundred miles to the next port. The northern mechanics were apprehensive enough about going to Fort Taylor, but at least the town of Key West was there. Fort Jefferson offered simply a construction camp and the job, with none of the niceties of life.

Lieutenant Wright complained continually about the gulf fisherman who called on the key frequently to bring liquor for the workers. Not that he particularly objected to their local trade, but they had often recently touched Havana or other Caribbean fever ports first, and Wright's unacclimated northern workers were more susceptible to tropical diseases.

Lieutenant Wright had an additional problem which was exclusively his. When he began construction he could not find the expected bedrock. He wondered where the Washington engineers found the elusive rock. Maybe he was building on sand!

By 1851 he noticed many cracks appearing in the foundations, and duly reported this to Washington. General Joseph Totten received Wright's reports and made adjustments on the plans for the foundation, but there was no undue alarm expressed. The Chief Engineer sent detailed instructions on the proper mixture to be used in making the cement. The general also requested that a subsidence table be constructed to ascertain if Garden Key could support the weight of the piers and scarp of Fort Jefferson.[26]

Although Wright's table showed a settling tendency, the lieutenant continued his work. He constructed cofferdams, rigged windmills, and built steam-powered pumps to keep the water out while the mortar was dumped, wheelbarrow load at a time, into forms upon which the massive foundations, 14 feet wide and 2 feet thick, were constructed.

On 5 September 1853 Lieutenant Wright reported the continued subsidence of his table. General Totten sent a lengthy reply describing how to convert the pier foundation to a grillage base.[27]

When Wright's job was completed, Captain Daniel Phineas Woodbury relieved him to erect the walls of the fort. This new stage of construction called for the erection of 50-foot walls, which included hundreds of gunrooms with numerous brick arches. Captain Woodbury was an authority on the arch. He had published an engineering treatise, *Sustaining Walls,* in 1845, which had a second edition in 1854. When he arrived on Garden Key, his second manuscript, *Elements of Stability in the Well-Proportioned Arch,* was at the publishers.[28]

Captain Woodbury was succeeded in 1860 by Captain Montgomery Meigs, who had originally laid out the plans for Fort Jefferson. In the fall of 1860, Meigs, while stationed in Washington, D.C., had disagreements with several contractors over their contracts. Secretary of War John B. Floyd, more vulnerable to pressures of this nature than the captain, banished Meigs to Tortugas. When Floyd resigned shortly thereafter, Meigs was recalled from exile to return to his work on the aqueduct at Washington. Meigs served during most of the Civil War as the Quartermaster-General of the Army where he amassed an enviable record.[29]

The war may have disrupted the building program of Fort Jefferson, but it did not retard the subsidence. By 20 July 1863, headquarters ordered extensive experimental boring and piledriving to be undertaken on nearby Bird Key to locate once and for all, the elusive bedrock.

The task was begun 24 February 1864 by First Lieutenant A. H. Holgate. His completion report of 3 May 1864 must have been an eye-opener. "There is no solid rock within thirty feet of the surface of the island, and in all probability there is none within reach of the longest pile we could procure." Holgate found that the top layer of sand, down about 18 feet, was firmer than the lower stratum. He noted that the water channels which criss-crossed the Tortugas shoal, or bank, varied in depth from 40 to 80 feet and he concluded that "it may not be unreasonable to suppose, therefore, that we must penetrate at least to this depth before reaching anything like solid rock." The lieutenant continued: "The patches of rock visible at the waters edge on East Key, Loggerhead and elsewhere, and which formerly gave support to an underlying rock are pretty well proved to be a mere concretion – sand, shells and coral hardened by the action of the waves." Fort Jefferson was a castle in the sand.[30]

Fort Clinch after being captured, then abandoned by Confederate forces at the start of the Civil War. The drawing was done by a Mr. Such and was published in Harper's Weekly.
Courtesy Florida State Photographic Archives.

Fort Clinch, at the northeast corner of Florida, was also constructed at this time. The Government acquired the property in 1842, but construction did not begin until 1847. It was another fort built along the Vauban lines, but much smaller than Taylor and Jefferson. By 1852, most of the seawall and the channel bastion facing north had been built, and the northeast and northwest ramparts started. Neither labor nor supplies seem to have been the problem they were with the southern forts. At first, the large, oversized southern brick, so much in demand for all these forts, was supplied from Savannah, Georgia, carried by barge down the inland waterway. In 1859, Samuel A. Swann, whose brick kilns were only 30 miles from the fort, became the principal supplier. (In 1859-60 Swann also shipped his bricks to Key West.) Yet, at the time the Confederate forces occupied Fort Clinch in April 1861, it was far from being completed.[31]

Both the Corps of Engineers and the Topographical Corps served on the Florida frontier during the early decades after the peninsula's transfer from Spain to the United States. Both corps labored to provide security for American settlers on this new land. The Indian frontier was eliminated, the foreign threat did not materialize, but, in 1861, the engineers' tasks in Florida were disrupted by the nation's internal problem over unity or disunity.

CHAPTER 4

War and Defense

THE REMAINING DECADES of the nineteenth century were bracketed by the Civil War from 1861 to 1865, and the Spanish-American War of 1898. These two conflicts brought dramatic changes to the engineer's concept of military defense. The former war saw the demise of brick and mortar harbor fortifications employing smooth-bore guns, while the latter introduced high-powered rifled guns and electrical mine fields to defend the nation's ports. Both the old and new military installations were to be found in Florida.

When the Civil War broke out, there were four Federal forts in the south still in Union hands; Sumter in South Carolina, and Pickens, Jefferson, and Taylor, all in Florida. Fort Sumter, where the opening shot of the war took place, fell after substantial bombardment. Pickens resisted several assaults and remained under Northern control throughout the war. Neither Jefferson nor Taylor were threatened. All three Florida forts remained in the hands of the Federal Government.

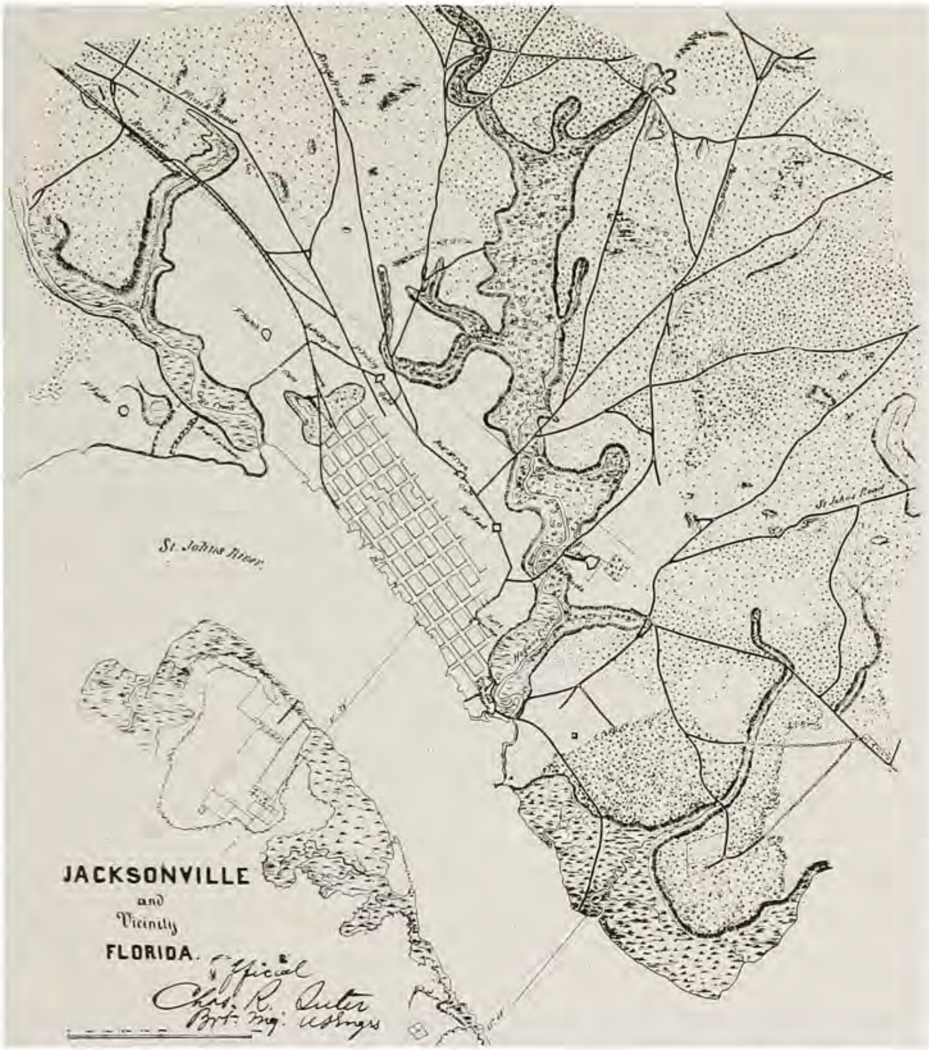
Similar to the Second Seminole War, the Civil War in Florida did not provide the Corps of Engineers with an opportunity to undertake engineering projects of any note as a part of the war effort. Yet, once again, engineer officers served during the war in various military capacities. The actual fighting in Florida was minor. Only the engagement at Olustee can be properly called a battle. Still, actions in Florida were part of the overall conduct of the war. A brief overview will suffice to place the proper perspective upon Florida's role in the conflict.

Even before the Florida legislature signed the Ordinance of Secession on 10 January 1861, Governor Madison S. Perry had ordered the State militia forces to take the Federal arsenal near Chattahoochee and Fort Marion at St. Augustine. When Captain John M. Brannon, commanding the Key West barracks, learned of the takeover of Fort Marion, he discretely moved his troops from the barracks, across the island to Fort Taylor. On the day Florida signed the Ordinance of Secession, Lieutenant Adam J. Slemmer, Corps of Engineers, shifted his force from Barrancas barracks on the Pensacola mainland to Fort Pickens on Santa Rosa Island. The defenseless Captain Meigs, on Garden Key with no soldiers, watched apprehensively as a big steamer hove to off Fort Jefferson on 19 January 1861. He was relieved when 66 artillerymen from Boston offloaded to secure the fort for the Union. Fort Clinch was the only Florida fort to fall into Confederate hands.

The situation remained static in Florida throughout 1861. Early the following year, the South suffered serious losses in Kentucky and Tennessee. Most of the Florida soliders were shipped north to stem the Union advance. There were few troops left to protect the state. General James H. Trapier, CSA, had requested permission to withdraw his forces on Amelia and Cumberland Islands. He was in the process of doing so when a Union fleet of 26 ships approached Fernandina to disembark troops to occupy Fort Clinch. The commanding general was Horatio G. Wright, whose volunteer service had led to a rapid advancement in rank.

Six days later, Wright sent his soliders to take St. Augustine and Jacksonville. Both Fernandina and St. Augustine stayed in Northern hands for the remainder of the war. The city of Jacksonville was occupied and evacuated three times before the fourth and permanent takeover by Federal troops under the command of General Quincy Adams Gillmore on 7 February 1864. (General Gillmore was another engineer who had transferred to the volunteers and had received rapid promotion.) Most of the war in Florida consisted of minor skirmishes between the blockading force and Florida's militia, while the northeast, northwest, and southern portion of the state were occupied territory.

General Gillmore's taking of Jacksonville during the final year of the war is indicative of the chores performed by the engineers in occupied Florida. His engineers consisted of a detachment of less than company size of the 1st Battalion, 1st New York Volunteer Engineers. Their principal tasks were to strengthen entrenchments around occupied posts, repair docks, and construct communications systems. In June 1864 the engineers were improving ammunition magazines and building a dock on the south bank of the St. Johns River. The following month they were repairing the railroad and telegraph line to the town of Baldwin, some 20 miles



Military map of Jacksonville, 1865. Courtesy National Archives.

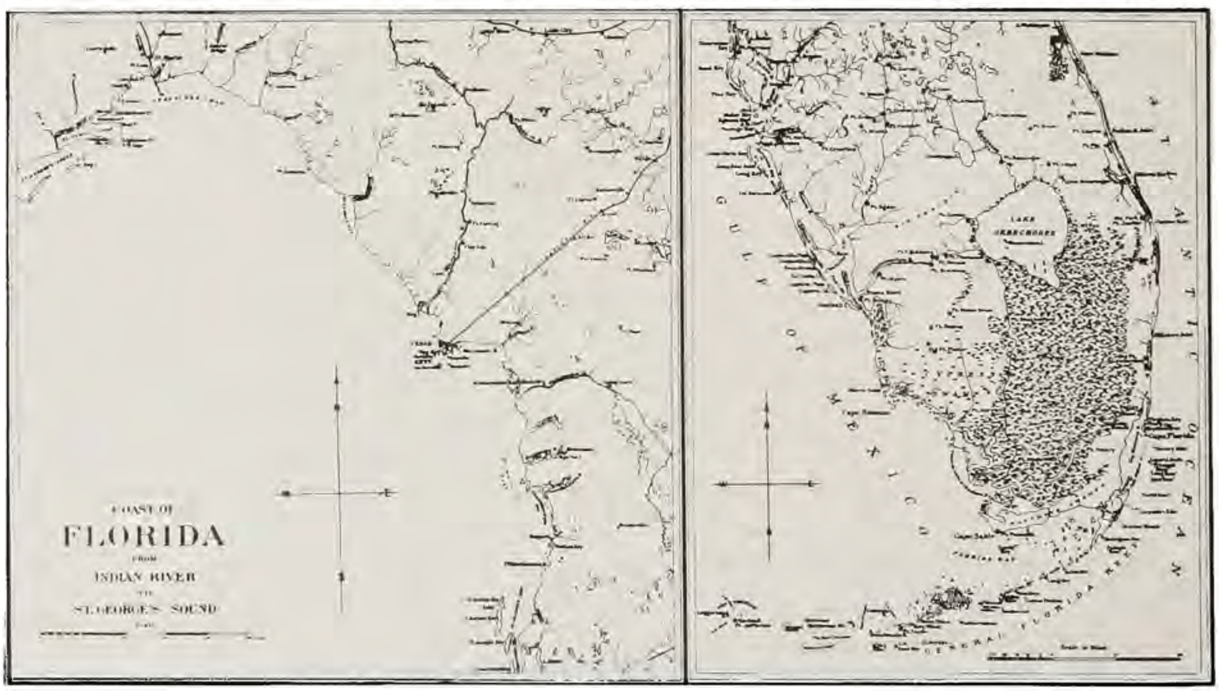
to the west. In September, fatigue parties deepened the ditches around Jacksonville to 12-foot depths and erected palisades in them. Their labor also included clearing away the timber near the works to provide clear fields for observation.

The engineers repaired the docks at Magnolia, south of Jacksonville, during the month of July, in anticipation of an advance post being established there. Troops occupied Magnolia in August while the engineers were busy building a temporary fort. September was spent placing entrenchments around the Magnolia post. Then, on 4 November, Magnolia was evacuated and the fort destroyed.

In March 1865, the engineers erected a large blockhouse on the St. Augustine Road, 13 miles from Jacksonville, for the safety and security of couriers traveling between the two towns. Major Charles R. Suter's terse report on the Florida engineers recorded the end of the Civil War: "May 1865. But little work done this month, mainly repairing and finishing. Work suspended at the end of the month on account of the cessation of hostilities."[1]

In south Florida it was a different story. General Daniel P. Woodbury had been stationed in Washington, D.C., when the war started. He participated in the Battle of Bull Run and, later, at Fredericksburg, he directed the building of the pontoon bridges over the Rappahannock for the Army. In March 1863 he was assigned command of the District of Key West and Tortugas. There General Woodbury sat out the war, remote from all the action. Also at Key West was the command headquarters of Admiral Theodorus Bailey's East Gulf Blockading Squadron. In such an isolated, restricted location, the two commanders kept each other informed about the war in Florida. Most of the information was one-way from Bailey to Woodbury because it was the Navy blockaders who had contact with Floridians in the Confederacy.

In December 1863, Admiral Bailey sent Enoch Daniels, a refugee, to General Woodbury with a plan to recruit those loyal Floridians in the country between Tampa Bay and Charlotte Harbor. Daniels believed there were about 200 to 800 people out there in the wilderness of Florida's last frontier who would serve in the Federal Army. General Woodbury, who decided this was his chance to promote action in his district, and to add a contribution to the war effort, accepted Daniels' plan. Admiral Bailey offered the services of his ships to Woodbury for the undertaking. Eventually, the



Department of Key West and Tortugas area. Courtesy National Archives.

group recruited by Daniels became the United States Second Florida Cavalry (Union), made up of Florida men loyal to the North.

The Navy blockaders also had established contact with disaffected bands of Floridians hiding out in the swamps on the west coast of Florida around the Fenholloway River. The Sailors were providing these groups with arms and necessary supplies. On several occasions the blockaders joined forces with the Floridians to strike at railroad bridges, disrupting Confederate communications.[2]

General Woodbury decided to recruit these men for his Second Florida Cavalry. In March 1864, he sent four of his refugee soldiers to the USS *Tahoma* which was on blockade duty off the coast and in communication with the disaffected bands. A week later Woodbury visited the *Tahoma.* The Naval officers took the general and his party ashore to talk with the Floridians. Woodbury spent 2 days at the refugees' camp in Confederate Florida, laying the groundwork for these men to enlist in the Union forces. Woodbury was successful, and the following month, many of these men shipped over for his refugee unit.[3]

The Second Florida Cavalry operated along the west coast of the state, engaging in many minor skirmishes, all of which added to the burden of defense for the Confederacy. Unfortunately for General Woodbury, shortly after his refugee unit was formed, he contracted yellow fever and died at Key West on 15 August 1864.[4] His command was taken over by another engineer, Brigadier General John Newton.

The last major skirmish executed in Florida was the work of General Newton and Rear Admiral C. R. Stribling (who had become commander of the East Gulf Blockading Squadron). It was a joint operation, involving 16 ships and about a thousand troops. The soliders were to land near St. Marks' lighthouse and move inland to Newport. The Navy was to steam up the St. Marks River to disembark 600 sailors at Old Port Leon to protect the Army's left flank. The ultimate objective was the capital at Tallahassee, but, between the planning and the execution, many things went wrong. Fog delayed troop landings after the advanced parties had been sent ashore. The Navy vessels grounded before reaching their objective, and the Florida forces waiting for the Union troops at Natural Bridge were able to stop General Newton's advance. Thus, in the last days of the war, Floridians celebrated the victory of the Battle of Natural Bridge, but, before a month had passed, General Robert E. Lee surrendered and the Civil War ended.[5]

Early photograph of Fort Taylor taken shortly after the Civil War. Courtesy Florida State Photographic Archives.

Throughout the war, the Corps of Engineers worked sporadically at the task of constructing Forts Taylor and Jefferson. Shortly after the war, on 3 November 1866, Captain Walter McFarland, engineer in charge of Fort Taylor, was instructed to suspend all construction work. The order to cease was an acceptance of the fact that, with the advent of the rifled gun, brick and mortar defense had passed into history. The bench mark of the end of such forts took place when General Quincy Adams Gillmore's rifled guns pounded Fort Pulaski in Georgia to rubble. At that time, the general remarked that his new guns had the same impact upon military fortifications of stone or brick as the battle between the *Monitor* and *Merrimac* had upon naval architecture.[6]

Fort Jefferson enjoyed a longer active life than Fort Taylor. Early in the war, slave labor gave way to prisoner of war labor. In September 1861, the first of the prisoners arrived. In 1864, President Lincoln commuted the death penalty for desertion to life in prison on Tortugas. This added more prisoners to the Fort Jefferson labor force.

One of the more famous prisoners was Dr. Samuel A. Mudd, the doctor who innocently treated John Booth after he had assassinated President Lincoln. Dr. Mudd served his time on Tortugas from 24 July 1865 until he was pardoned by President Johnson on 11 March 1869. Most of the prisoners worked under the charge of the Corps of Engineers. There is some question as to the prisoners' work habits. Dr. Mudd said that when he was assigned to clean old brick he "worked hard all day, and came very near finishing one brick."[7]

By 1867, the number of prisoners at Fort Jefferson was less than fifty. Four companies of the 5th Artillery were all that was left. The hurricane of 1874 was the final blow; the troops were withdrawn. The fort's commandant wrote, "There is not the slightest probability in my opinion of this fortification being completed within the next fifty years."[8] Yet, the engineer force continued to clean up after the havoc created by the hurricane.

The end of Fort Jefferson, as a mighty brick and mortar fort important in the military world of static defense, came at the hands of the man who had created it. Old George Phillips, the master mason who had come ashore on a sandy key 37 years before with Lieutenant Horatio Wright to commence work, returned to Fort Jefferson in 1883 to pack up the last of the still usable engineering equipment.

But, the problem of determining the proper defense against the improved weaponry remained. In the same year that George Phillips closed Fort Jefferson, President Chester A. Arthur initiated a modest but widespread military reform throughout the nation's armed services. In his annual message, President Arthur outlined what became the first stirrings of this reform.[9]

The nation's military leaders were seeking answers to the changing technology. General Emory Upton had completed his seminal manuscript "The Military Policy of the United States" in 1880. Although it was not formally published until 1904, it was widely circulated among the military planners. Captain Alfred Thayer Mahan, USN, published his most influential book, *The Influence of Sea Power Upon History, 1660-1783,* in 1890. Bracketed by these two stellar military and naval critiques, based upon the study of history, was the report of the Endicott Board, which the Cleveland administration had set up as a continuation of the military reforms of the Arthur presidency.

In 1886, the Endicott Board called for sweeping changes to defend the nation's shores: hundreds of batteries of both heavy and light ordnance to be installed; searchlights set up to illuminate harbors; an elaborate plan for mining restricted waterways ordered; and the building of torpedo boats to defeat the enemy's attempt to clear out mine fields. Of course, the Board realized that it was neither feasible nor practicable to completely defend the whole coast, but it did list 11 crucial ports and bays, none of them in Florida.[10]

On 29 March 1887, the Corps was instructed to prepare plans for the defense of the 11 ports and bays. By 30 June 1894, the task had been completed and new locations were added to the list, including Key West. These military projects settled upon artillery and mines for protection, under the maxim that: "Heavy batteries and submarine mines are correlative terms of a good defense from shore."[11] It was believed that only powerful guns could hold off an armored ship's deliberate and otherwise impervious attempt to remove the mines. On the other hand, the mine fields would prevent the enemy from running past the defensive batteries to lay waste to the unprotected port.

Key West had Fort Taylor guarding its harbor, but the greater ranges of modern guns made it necessary to build defensive batteries at additional sites because the yesteryear fort provided too small a base for the new weapons. Two other sites were obtained to add to harbor protection. Bids were invited for the construction of gun emplacements for four 10-inch and two 7-inch guns on disappearing carriages, and eight 12-inch mortars. The $400,000 contract was to be completed by 1 January 1898, but, due to delays, the time was extended to 7 September 1898.[12]

At the same time, work began on 26 February 1897 on the mine casemate. The main room was 15 by 18 feet with its arch spanning the shortest dimension. The protective cover over this room was to be 19 feet at its thinnest point, and at least 25 feet thick on the exposed side. Under this configuration, the casement walls had to support 6 tons per square foot under the arch.

Because the mine casemate site consisted of light coral sand overlying coral rock, the engineers conducted an experiment to determine if the soil could support this weight. A mast with a cross-section of a square foot was erected, upon which 7 tons (12 granite blocks weighing between 1,000 and 1,200 pounds) were placed upon horizontal frames spiked to the mast. At the start, the structure was on unprepared soil, a foot below the natural surface. The mast settled 1 to 3 inches as each stone was placed on the frames. After the last weight was in place, the mast was 2.3 feet below its starting place, and 2 days later, the structure was still settling. Obviously, the site could not support the mine casemate in its natural state.

At first it was determined to excavate to bedrock, but once below water level, the engineers ran into trouble because the only pump available was a small, inadequate hand pump. Rather than delay construction, Lieutenant Robert P. Johnson decided to build upon a wooden grillage. The 30-foot timbers extended 3½ feet beyond the casemate side walls. The walls were founded directly upon the grillage, and when the work was finished there was no perceptible settlement.[13]

Lieutenant Colonel William H. H. Benyaurd, district engineer in Jacksonville, reported on Florida's old style military defenses in 1897, saying that Fort Marion was of little value. The two forts in the Keys were not garrisoned. Fort Taylor had an ordnance sergeant and a fort keeper. Fort Jefferson was under the Marine Hospital Service as a quarantine station. The woodwork was decayed in both installations. In conclusion, Colonel Benyaurd said, "Large sums could be expended on both advantageously."[14]

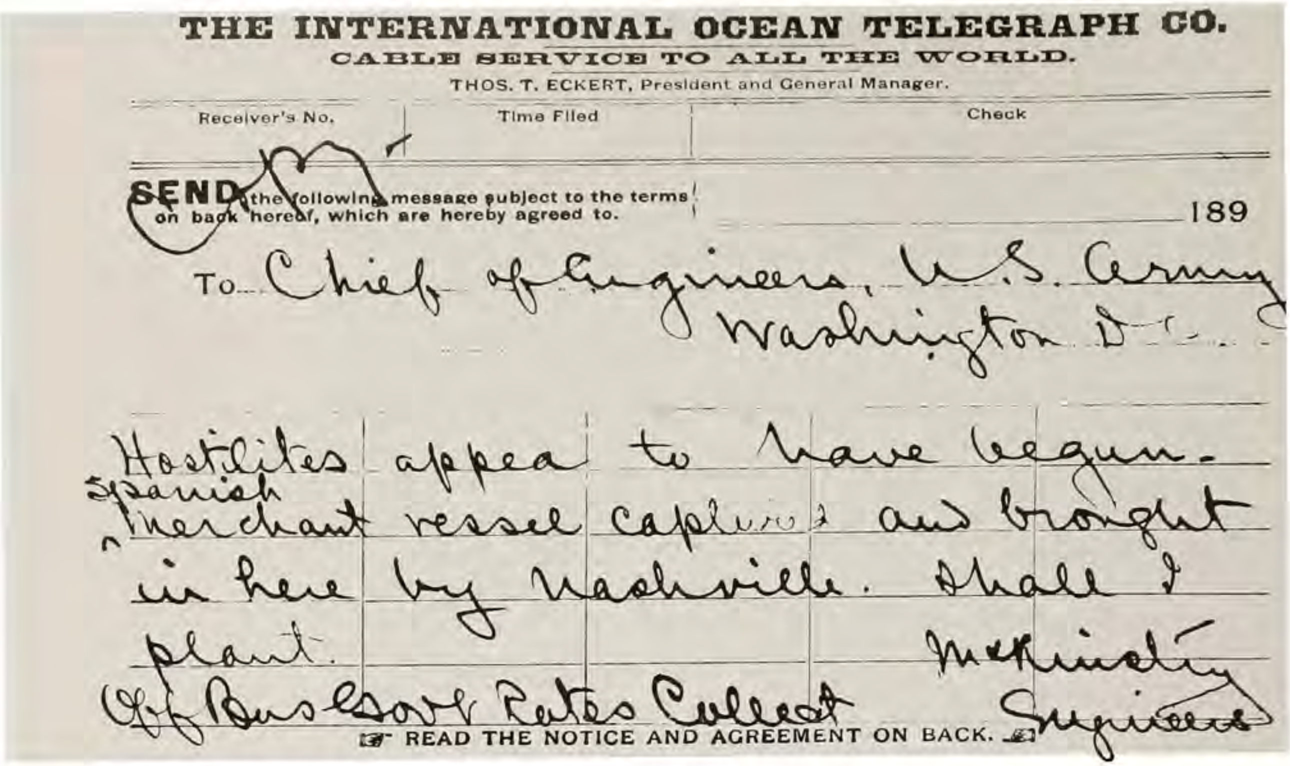
Some money was forthcoming from Congress for defense, and with these funds Fort Taylor was cut down to one tier to lower its profile and to strengthen its structure so that it might accommodate the new 12-inch disappearing guns. The south curtain was filled in with concrete. Into the concrete were dumped the old columbiads, howitzers, and parrott rifles of the 1860's. The offensive weapons of another age were now strength supports for the new-age defense.

Just as the physical objects of war were changing roles, so too the tenor of American military thought was in a state of transition at the time of the Spanish-American War. This conflict projected the United States onto the world stage as a major power. The war itself was a brief, minor affair more noted in American circles for the inadequacies it pointed up in the military organization. The Quartermaster Corps, which had charge of all Army procurement, as well as the construction of camps and posts, was subject to the most criticism. The Corps of Engineers had military responsibility for building forts and gun emplacements at home, and laying out entrenchments, military roads, and bridges in the field. Of all the branches of the Army, the Corps of Engineers was least criticized for its role in the Spanish-American War.

Captain Charles H. McKinstry assumed command of the new Key West District 1 February 1898, just 2 weeks before the sinking of the United States battleship *Maine* in Havana Harbor. When the USS *Nashville* brought a captured Spanish merchantman into Key West, McKinstry wired the Chief Engineer for permission to plant his defensive mine fields, to protect the nation's southernmost harbor from possible Spanish attack.

McKinstry soon discovered that his mines were defective, but he continued using them because "There was reason to apprehend that an attack on the place if made at all would be made at once. . . . It was therefore determined to proceed with the planting, relying on 'moral [sic] effect to prevent an attack, and on judgement firing if an attack should be made."[15]

All along the seaboard, the citizenry was alarmed at the prospect of war, fearing a naval attack. Insistent demands were sent to Washington for protection. Nowhere were the demands more insistent than in Florida. Before the war ended, the mouth of the St. Johns River, St. Augustine, Miami, and Tampa Bay, as well as Key West, had temporary batteries constructed or under construction, and mines were planted in the St. Johns, Miami, and Key West waters.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SEND the following message subject to the terms on back hereof, which are hereby agreed to. 189

To Chief of Engineers, U.S. Army
Washington D.C.

Hostilites appear to have begun. Spanish merchant vessel captured and brought in here by Nashville. Shall I plant.

McKinstry
Engineer

Off Bus Govt Rates Collect

READ THE NOTICE AND AGREEMENT ON BACK.

Copy of actual telegram sent by Capt. Charles H. McKinstry, engineer in charge of Fort Taylor at Key West, requesting permission to mine the harbor at Key West. Courtesy Corps of Engineers

The War Department sent telegraphic orders on 2 April 1898 for the district to prepare temporary batteries to defend Miami and, 2 days later, to do the same for Jacksonville. Colonel Benyaurd complained that the temporary batteries and the weapons planned for them could do no more than offer "moral encouragement."[16]

Batteries were constructed at the mouth of the St. Johns River. In the fever of wartime excitement, the privately owned land was immediately surrendered to the Government. Construction began on 11 April, and by mid-May, when the ordnance arrived, the site was ready. These weapons were 5-inch breech loading rifles and 7-inch breech loading siege howitzers. In January 1899, two 8-inch breech loading rifles were mounted, but by then the war was over. Work stopped before the magazines had received their concrete covers or their sand embankments.[17]

Miami's defenses did not progress as rapidly. Its sites were on coral rock. There was no earth available. Finally, the engineers had to contract with the Florida East Coast Railroad to borrow one of its dredges to bring up sand from Biscayne Bay. The sand was dumped into forms made of wood, certainly not a strong or permanent installation. Work stopped in October 1898, and the battery abandoned long before it was completed.[18]

Tampa presented the greatest problem because it was the major staging area for the Cuban invasion. The wharfs, miles from the town, served by a single track railroad, added immeasurably to the confusion. Money became plentiful for defense, but the engineers were competing with the other branches of the Army for the limited railroad space, warehouse construction, laborers, and all of the other requirements needed to wage a war or defend a state. On 19 April 1898, Colonel Benyaurd was ordered to give all of his tasks to subordinates, move to Tampa, and take personal charge of the situation there.

Tampa was a boom town. The local labor market had been drawn off for other works. Benyaurd had to recruit men from Jacksonville, Mobile, and New Orleans. In spite of ample funds, outside labor, and much pressure from the Chief Engineer, Benyaurd reported that no work on the construction of the batteries had been made by the end of 1898 because needed material had not arrived, due to the congestion of the railroad facilities at Tampa. The concentration of troops and Army supplies destined for the embarkation of the expedition to Cuba, swamped the limited storage and transportation systems in the area. The colonel complained that "it was in some cases impossible to get material for two weeks after its arrival in Tampa."[19] Local military defensive needs were submerged beneath the avalanche of preparations for the overseas endeavor.

The work of the Corps of Engineers in Florida during the Spanish-American War was psychological, but the action of bringing guns to hurriedly constructed sites had a calming effect upon the civilians. For example, in Jacksonville, when the *Florida Times Union and Citizen* reported the arrival of the gun carriages and guns at the railway station, the news drew a number of people to the depot to view "the mighty machine(s)"[20]

The Spanish-American War brought many inadequacies of the American Army to public notice. Secretary of War, Russell Alger left office under intense national criticism. In 1899, President McKinley prevailed upon Elihu Root to become Secretary of War. Root was a New York corporation lawyer, not a military man, but he soon became well versed in the military institution he had been assigned to direct. He discovered it was creaky and moss-grown in organization, thinking, and training. There was a need for reform, and Elihu Root took the lead. Under his guidance, a whole series of enactments changed the Army: the creation of "the Army War College; a Chief of Staff and the general staff system; the replacement of the Militia Act of 1792 with the Dick Act of 1903, recognizing the National Guard as the 'organized militia' and bringing it into a more effective relationship with the Regular Army; improved promotion and training systems; and an Army-Navy Joint Board, ancestor of the Joint Chiefs of Staff."[21]

Fort Jefferson long after it had been abandoned by the Army, but years before it was restored as a National Monument. Courtesy National Archives.

But, for the engineers in Florida, the Spanish-American War was the last time they would be engaged in direct military combat operations of either offense or defense within the state. The United States had emerged as a world power and its international relations were now conducted overseas. The Jacksonville District, in the twentieth century, would be primarily concerned with peaceful, domestic civil functions.

CHAPTER 5

To The Sea

FINDING THE SHIFTING CHANNEL through the bar at the mouth of the St. Johns River was at times as difficult as passing through the eye of a needle. The many St. Johns River improvement projects to allow navigation from Jacksonville to the ocean, were among the more complex and time-consuming undertakings of the Corps of Engineers in Florida. It was because of these two attributes that, when the district office concept developed within the Corps, it was located in Jacksonville.

The first man to seriously study the problem of the moving channel of the St. Johns was Dr. Abel Seymour Baldwin. Typical of that day, his profession resulted in his traveling up and down the valley of the St. Johns River by boat as well as by horseback. Dr. Baldwin became acquainted with the people living along the river. He also became familiar with the treacherousness of the St. Johns bar, which restricted access to the valley to small coastal vessels, thus limiting the growth of the town of Jacksonville and the region. Dr. Baldwin became fascinated by this problem of the shifting channel. Why didn't the river bed remain in one place?

From 1850 to 1852, Dr. Baldwin studied the mouth of the St. Johns River. He held long conversations with people who knew the river from years of working on and living by the St. Johns. From all of this study, he concluded that the Fort George Inlet was the culprit. Normally, the sediment, carried down a river by the current, fans out and settles when the river flows into the ocean where its current is diffused in the larger body of water. This is part of the creation of shoal waters about the mouth of a river. However, the main current from the river, continuing its force longer, has the effect of cutting through the shoal grounds, creating the channel of the river bed.

From his observations Dr. Baldwin determined that the opening of Fort George Inlet, no more than a mile or two north of the St. Johns, under certain circumstances of tide and current had an injurious effect upon the main channel. During each tide there was an interchange of waters between the river and the inlet, brought about because of the different time of the flood and ebb tides in each outlet. Fort George Inlet flooded anywhere from one and a half to three hours before the ebb current of the St. Johns River stopped flowing over the bar. During this period, a large volume of water passing out the river's mouth was pulled northward into the inlet. Thus, a series of swash channels over the north shoal was formed which diminished the amount, velocity and force of the waters flowing out the St. J ohns River's main channel.[1]

Local wind conditions also contributed to the uniqueness of the St. Johns bar. Prevalent northeasterly winds pushed the river waters back up the St. Johns, causing a decrease in the volume and velocity of the waters in the main channel. The result was that the sand thrown up by the ocean waves met a reduced ebb flow and it was deposited in large amounts in the channel, further shallowing the depth of the bar. The reverse was true from prolonged westerly winds. The ebb current was increased by the wind push, causing a greater depth of water over the bar.[2]

Still another factor was the littoral current. The average storm flow (littoral current) of the Atlantic Ocean along the Florida coast was in a southern direction, and the sand from the littoral current washed southward along the coast until it came in contact with river or inlet currents moving eastward. When this occurred, the sand was deposited on the upflow side of the intersection of the littoral and the river current, building a sand bar on the north side of the outflow. The river current, seeking the path of least resistance, swung southward, closely followed by an ever-building curved sand bar. In cases where the inlet flow was weak, the littoral current would seal shut the exit to the ocean. On the other hand, strong river currents would bend southward 3 or 4 thousand feet from the original track.[3]

The St. Johns channel, over time, would swing gradually south until conditions were such that the river current would punch another channel through the shoals in a more easterly direction. The southern channel would fill up with sediment again. At times, the St. Johns would have two main cuts to the ocean; at other times, it had only a northern or a southern deep water exit. Is it any wonder that throughout the years the sinuous channel challenged the coastal captains calling upon the port of Jacksonville?

All of these phenomena added to the risks a merchantman encountered using the St. Johns River. Smaller ships, which were safe enough in draft, often were too light to be seaworthy in the Atlantic, especially during the fall hurricane season; large ocean vessels might stand off the bar for days or weeks waiting to enter the river. Once over the bar, the route to Jacksonville was relatively easy. With added cargo, the ship might have to wait once again for enough water to exit the St. Johns. Jacksonville, as a seaport, was a poor competitor for Fernandina and Savannah, even though it drew upon the tremendous resources of the St. Johns valley.

The early solution to the shifting channel, and the one promoted by the people on Amelia Island, was to use the deep water harbor of Fernandina. Small coastal steamers could steam from Jacksonville to Fernandina, by either the protected intracoastal waterway or the outer oceanway, where the goods could be transferred to the large vessels for destination any place bordering the world's seas. This was not acceptable, however, to the citizens of Jacksonville, who dreamed of opening the St. Johns River so that their own city might engage in world trade.

Dr. Abel Baldwin presented his answer to the shifting channel of the St. Johns River to his fellow citizens in 1852: Close up the Fort George Inlet. Dr. Baldwin reasoned that the waters of Fort George River would then be added to those of the St. Johns. Two effects would result; the elimination of the cross-current over the shoal ground, and the strengthening of the main flow of the St. Johns River, which would aid in the creation and deepening of the cut across the shoal grounds. The logic of his observations resulted in the town voting to send Baldwin to Washington, D.C., to present his proposal before Congress to seek Federal aid.

At first, everything went as planned. Florida representatives in the House presented the doctor's views to Congress, and they received permission to have Dr. Baldwin explain his project to the engineers of the Topographical Bureau. The bureau accepted and approved the doctor's plan with a recommendation to Congress to appropriate money so that it might carry out the plan. Congress provided the funds in two separate bills of $10,000 each.

Unfortunately for Dr. Baldwin, Congress failed to pass a bill for fortifications that session; therefore, the funds appropriated in the Lighthouse Bill and River and Harbor Bill were divided between the Corps of Engineers and the Topographical Corps. This resulted in works on the Atlantic being assigned to the Corps of Engineers, while the Topographical Corps received projects on the Great Lakes and western rivers. Dr. Baldwin had to start over again with the Corps of Engineers.

In his dealings with the Corps of Engineers, Dr. Baldwin relates: "I at once called upon the chief of the Military Bureau, General Totten, and offered to give him a history and exposition of my plan, but his time was too much occupied in assigning the work in various localities to the charge of separate engineers to listen to me. I was requested to leave any statement in writing, or confer with the engineer in whose charge the work would be placed."[4] The doctor left Washington to await the results of his efforts.

The next winter, Lieutenant Horatio Wright arrived in Jacksonville with a party from the Coast Survey to study plans for the improvement of the St. Johns channel. This was the beginning of a running feud between Dr. Baldwin and the Corps which was to last over a quarter of a century. When Lieutenant Wright informed the doctor that the original funds from Congress were paying for the survey, Dr. Baldwin immediately objected. According to his interpretation, Congress had accepted his proposal and the monies were appropriated to close Fort George Inlet. The protest was to no avail.

When Lieutenant Wright recommended the construction of a single pier on the north bank of the outer channel, Dr. Baldwin was convinced that the Corps of Engineers was out to destroy his scheme. He knew the cost of a pier was above the limit Congress could reasonably expect to finance. Further, the doctor was sure that a pier would not change his original premise. It would project the channel farther out to sea, but when the pier ended, the same influences from Fort George would be there to act as always. He believed Lieutenant Wright was wrong!

Lieutenant Wright was more generous in his comments about Dr. Baldwin than the doctor was with him. "His [Baldwin's] project is certainly a very ingenious one, the means required for its accomplishment very small, and his confidence in its success most sanguine. I am only sorry I cannot agree with him." Wright went on to speak of his recommendation of breakwaters both on the north and south shoals, but he stressed the northern one as being most necessary.[5]

Ultimately, the support of the local population for Dr. Baldwin and the extreme differences in the solutions proposed by the doctor and lieutenant, led the Chief Engineer to refer the problem to a special commission, consisting of a Navy captain, a captain and two lieutenants from the Corps of Engineers, and a civilian. Lieutenant Wright and Doctor Baldwin were both on the commission. The result was two statements: a majority report subscribed to by the Government officers, and a minority statement signed by Dr. Baldwin. Lieutenant Wright was right!

The formal hearing did not end Dr. Baldwin's fight with the Corps. In 1857, he obtained another examination of the mouth and bar of the St. Johns, this time under the direction of Lieutenant Stephen D. Trenchard, USN, who was serving with the Coast Survey service. Dr. Baldwin was delighted with the results. A comparison of the 1853 and 1857 charts showed great changes in the underwater topography which convinced the doctor that his assumptions had been justified.[6] But, once again, Dr. Baldwin's goal was thwarted, this time by the outbreak of a major conflict – the Civil War.

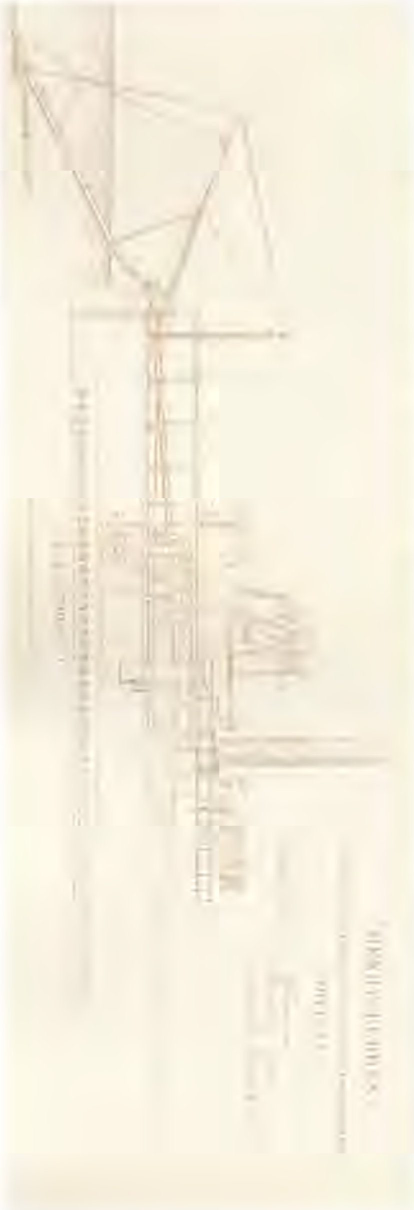
After the war, Dr. Baldwin became a member of the Jacksonville Board of Trade, which was formed in 1867. The following year he headed the board's Bar Improvements Committee and, in that capacity, he was back in Washington seeking funds from Congress.[7] His plea resulted in General Gillmore ordering several more surveys during 1868 and 1869. The results were no different than earlier reports submitted by the Corps in rejecting Baldwin's views.

Colonel William Ludlow, in charge of the latest investigations of the St. Johns, wrote the doctor that Gillmore had discussed with him the many plans proposed for improving the St. Johns Bar. Gillmore had considered straightening the river channel above the bar to increase the scouring action; constructing piers for the same reason; Dr. Baldwin's plan of closing Fort George Inlet; and, finally, raking or dredging of the bar itself. This last plan was most agreeable to Gillmore.[8]

After more thought, General Gillmore submitted his plan to the Chief of Engineers, suggesting the channel be deepened, "by repeated dredgings or rakings during the strongest stage of the ebb current, promising, as it does, at least a fair measure of success at compartively small cost." Along with his letter, Gillmore forwarded a communication from Charles H. Campbell of New York, who had been engaged in towing on the St. Johns bar, offering to dredge and keep the depth at 15 feet for $10,000 per year. Brigadier General A. A. Humphreys endorsed Gillmore's letter, approving the operation after stressing that it was a "purely experimental" program which could not be a permanent solution.[9]

Dr. Baldwin would have worn a smug smile of satisfaction if he had read Gillmore's follow-up report on the dredging operations. The contract, which had been issued on 19 October 1870 "for dredging, raking or otherwise," was cancelled on 22 May 1871 because of lack of success.[10] In fact, the failure was so complete that Gillmore made no payment on the contract.

General Gillmore was at the end of his resources. He had no confidence in the practicality of jetties, he did not accept Dr. Baldwin's proposal, and his own scheme of raking or dredging had



failed. He was running out of ideas while Dr. Baldwin was still exerting pressure on the Corps to do something. It was at this time that his assistant, Colonel Ludlow, provided him with a new and revolutionary answer – a hydraulic hopper dredge.

Back on 20 October 1870, Gillmore had written to Ludlow in Charleston, S.C., to examined that harbor. Colonel Ludlow's reply on 20 April 1871 was quite detailed. The colonel had gone back over the records, quoting from an engineer's report of 11 October 1839, and from a letter written by Captain George W. Cullum to the Commissioners of the State of South Carolina on 10 November 1857. That last letter discussed the improvement to the harbor through the use of a hydraulic hopper dredge, the *General Moultrie.*[11] Gillmore read Captain Cullum's reports and decided to do the same.

After studying the available information, Gillmore recommended chartering a steamer to be equipped with a centrifugal pump, two suction hoses, and a bin to hold the sand brought up from the bottom until the steamer could take the dredged material away from the channel to dump it.

During the early years of the 1870's, the *Henry Burden,* an old sidewheeler, converted, according to Gillmore's plan, into a hopper dredge, might be seen at the mouth of the river chasing the elusive channel, bringing up the sand and muck, filling the ship's bin, and steaming out to sea to dump its load.*

The *Henry Burden* was built to carry passengers. She was 132 feet long, 24½ feet on the beam, and drew 5½ feet. She could carry 100 tons on a 7-foot draught. The *Burden* was a strongly built ship, but her deep draft and small carrying capacity hindered her work as a dredge. Still, the *Henry Burden* was the best vessel available for charter. The engineers attached two 6-inch suction pipes to the pump and ran them off each quarter. This arrangement allowed the engineers to work both sides of the *Burden* simultaneously. It also lessened the handling tasks.

Gillmore made the suction pipe flexible by including a section composed of a 6-inch rubber hose covering a spiral spring. The suction pipe was designed to ride on the bottom regardless of the pitching of the *Burden.* The dredge end of the pipe was weighted

*The world's first hydraulic hopper dredge was invented by Nathaniel H. Lebby of Charleston, S.C., in 1855. Lebby presented his plan to the Charleston Chamber of Commerce who asked Captain George W. Cullum, Corps of Engineers, for his opinion. When he answered that Lebby's invention was sound, James M. Eason and Thomas D. Eason of Charleston built the *General Moultrie* from Lebby's plans for the Chamber of Commerce. The *Moultrie* was destroyed during the Civil War. The next hydraulic hopper dredge in the United States was Gillmore's *Henry Burden,* the first one to be operated by the Corps. The *Burden* was chartered until purchased by the Corps on 20 August 1873. She was modified by replacing her two 6-inch pipes with one 9-inch suction pipe over the stern in 1875.[12]

down with a 200-pound iron frame. Below this, at the mouth of the pipe, metal teeth were attached to stir up the sand and muck. The entire pipe length was 50 feet.

As General Gillmore described the *Henry Burden's* operations, the steamer would travel outside the bar with its suction pipes raised. Then, it would turn, lower the pipes, and steam in slowly to the bar. As soon as it reached the outer edge of the bar, the pumps would be turned on, the speed reduced to barely maintain steerageway, and the *Burden* would cross the bar sucking up sand and water. Once over the bar, the pumps would be stopped, the pipes raised, and the dredge turned to begin its outwardbound run. The process of lowering the suction pipes, reducing speed, and dredging the bar would be repeated on the outgoing track. These two runs would be sufficient to fill the *Burden's* storage bins. During the outer turnaround, the side gates to the bins were opened, the pipes raised off bottom, the pump run of full speed drawing in clear water, and the storage areas flushed out. It took the *Henry Burden* 6 minutes to turn at the completion of each run.[13] Very little time was lost during the dredging operations.

During 1871-72, Gillmore's *Henry Burden* removed almost 48,000 cubic yards, cutting a channel 15 feet deep at high tide. But, the storms which lashed the mouth of the St. Johns during the winter of 1873-74 deposited more sand than the *Henry Burden* could handle. Each time the channel was dredged, another storm would fill it up. Gillmore became discouraged. He wrote: "The natural and proper port for the shipment of all freight arriving in east Florida, is Fernandina, and the inside passage should be enlarged. . . . I doubt the wisdom of expending any more money upon the bar at the mouth of the St. Johns River."[14] When the appropriations ran out, the *Henry Burden* was retired from service on the St. Johns and the water over the bar was soon a mere 6 feet.

The problem with the St. Johns River bar was a hindrance to the economic growth of the whole region. Not only did the shallow bar keep out or delay deep draft vessels from using the port of Jacksonville, but the sinuous channel caused groundings and shipwrecks which drew scavengers, undesirable elements of society, to the river's mouth. From 1850 to 1868, excluding the war years, there were five sailing ships and two steamers lost while attempting to cross the bar.[15] In addition to those seven major disasters, there were innumerable minor mishaps due to piloting errors.

Two ships, the brigs *Neva* and *John,* both had their cargos rifled by crewmen of ships inside the bar and by the local residents living near the bar, when they grounded after missing the channel. The result of these and similar events was an increase in insurance

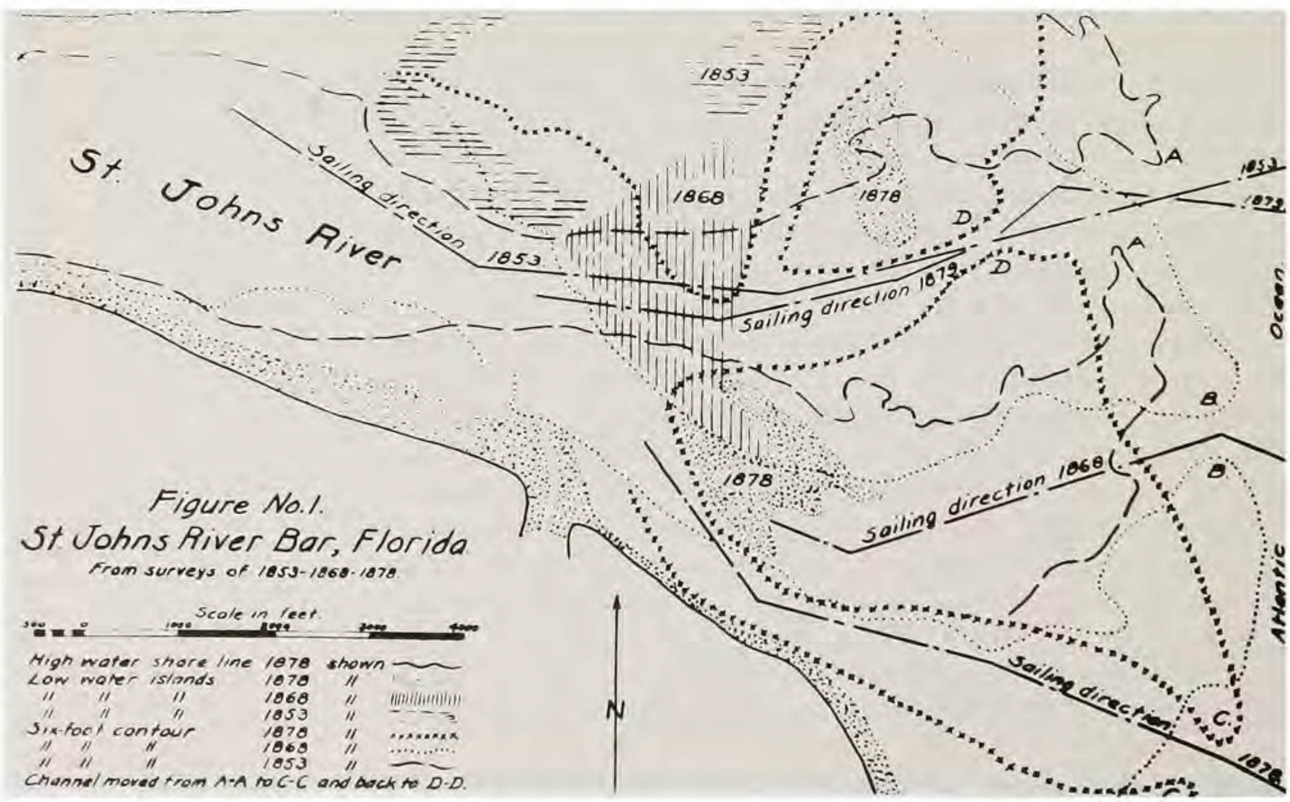
General Quincy Adams Gillmore's Henry Burden.
Courtesy Corps of Engineers.

rates stated by the New York Board of Underwriters. The Jacksonville Board of Trade wrote to explain that things had changed along the mouth of the St. Johns, that the undesirable elements had moved to be replaced by "owners of the soil, honest, and industrious."[16]

Having to stand off waiting for deep water was a more frequent occurrence and was equally as harmful to trade. Conditions worsened after the *Henry Burden* had been removed from the St Johns River. At one time in 1874, 22 ships were locked inside the bar waiting for deep enough waters to leave port. One of those ships had been waiting more than 6 weeks.[17] Almost a decade later, in January 1883, more than a dozen ships were waiting to escape Jacksonville. Most of them were three-masted schooners carrying yellow pine to the north. The *Ridgewood,* with Captain Somers Hand, left Jacksonville on 20 December 1882. On 8 January 1883, she was still waiting at Mayport for high water. Captain Hand grumbled that he had traveled 20 miles in 19 days.[18] The business community of Jacksonville suffered, but not in silence.

Back in 1878, Dr. Baldwin had prevailed upon influential Jacksonville citizens to raise money to bring Captain James B. Eads, an authority on hydraulic engineering, to make a definitive study of the local situation. Eads, who had gained fame for his daring jetty work

The shifting channel of the St. Johns River, 1853-1879. Courtesy Corps of Engineers.

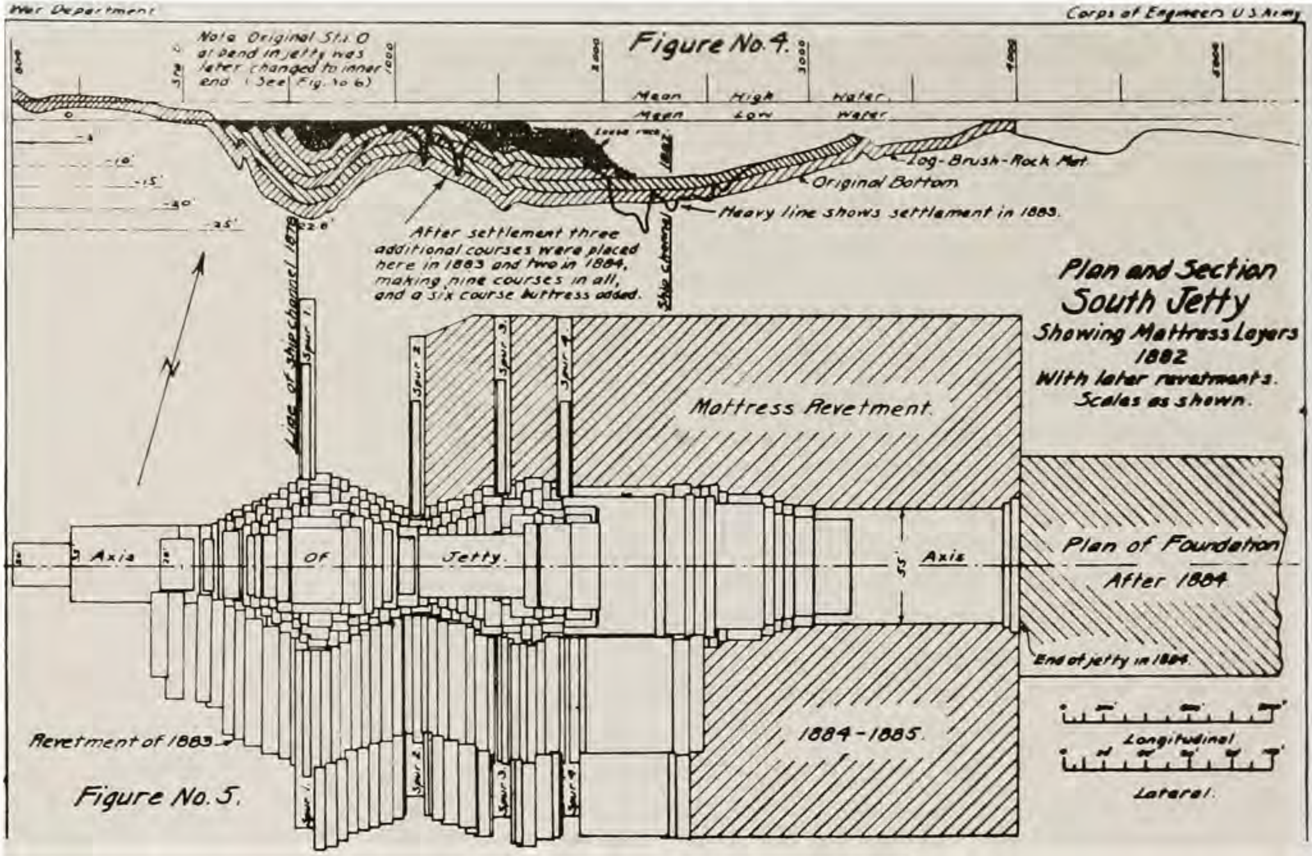


on the mouth of the Mississippi, came to Jacksonville, studied the bar, and presented his proposal to the townsmen. He said two converging jetties should be built which would create a stable 20-foot deep channel out to sea. The price was high, an estimated $1.7 million. Still, Captain Eads felt it was a small cost to open Jacksonville up to the world, and influential Jacksonvillians agreed. Congress was besieged with pleas from the city.[19]

General Gillmore, in New York City, felt the pressure. He sent Assistant Engineer George Daubeney to the St. Johns for yet another survey. Daubeney came up with a plan similar to the one Eads had suggested. Gillmore, accepting his engineer's proposal, drew up plans for permanently fixing and deepening the treacherous, elusive channel. Gillmore favored a low or submerged jetty rather than the high one proposed by Eads. Of the two jetties, the northern one was to be the longest, 9,400 feet, while the southern would be 6,800 feet in length. Gillmore felt that if all of the river's waters were trapped and channeled through the jetties, the force of the current would be too great, and would result in excessive scouring of the bed. He designed the jetties so that from the shore out they would be submerged, with the last 2,000 feet being built up to one-half tide level. This design, with the early sections being submerged, would allow the waters rushing out during ebb flow to spill over the jetties, reducing both the velocity and volume of water contained to scour the cut. Gillmore assumed this method would result in a channel of 15 feet at mean low water. Congress adopted his plan on 30 June 1879 with an appropriation of $125,000 being funded in 1880.[20]

When work started on the jetties, Lieutenant Walter L. Fisk was assigned as officer in charge of the St. Johns River project. On 10 November 1880, he opened an office at Fort George. This office was the beginning of a resident engineer in the Jacksonville area, and, while not yet the Jacksonville District, the needs of Florida were better served from this time on.

Army engineer office at Mayport during St. John's River jetty construction in 1900.



Plan of south jetty, 1882. Courtesy Corps of Engineers.

In 1880 the first contract was awarded to Lara, Ross, and Company of Wilmington, North Carolina. Roderick G. Ross arrived on the construction site in November to begin a long career of working for the Corps in Florida, especially on the St. Johns River. Ross set about creating the foundation. "We started the preliminary work on the south jetty 14 December 1880. As a foundation for the stone, a mattress was made of logs 9 inches in diameter at the smaller end, placed close together, spiked, and fastened with binders. On top of this raft a layer of loose brush, one foot in thickness, was placed and fastened down with poles and wire. The width of each mattress varied from 25 to 150 feet, according to the depth of water."[21] These rafts were towed out to sea and sunk in place.

In March 1881 another contract was let to J. H. Durkee, a Jacksonville firm, to work on the foundations. Midway through the year, the southern jetty had its initial layer and the first rafts of the northern pier were being placed.[22]

As the foundations were being built, the St. Johns was in a cycle of two channels. Ships were using the southern route and passing over the foundation. A 300-foot gap in the southern jetty was left open for shipping until the northern channel had stabilized and the scouring action had taken effect to deepen the northern cut. It seemed that Gillmore's plan was working well.

Still, there were continual problems cropping up to vex Lieutenant Fisk and his successors. Mr. Ross related: "A very annoying circumstance arose about 1885, when an individual stopped our work by an injunction, claiming that he had a patent on the log mattress that we were using. Fortunately, sometime previously I had thought out a design of mattress, composed of fascines of brush and other small growth, that might answer the purpose just as well as the logs, and save a great deal in the cost. The opportunity to test it out was now at hand, and shortly afterward we laid the first fascine mattress foundations. It proved a perfect success, and from that time the Government used the design in all foundations thereafter, and the plan is now in universal use wherever jetties are built on sand or mud base."[23]

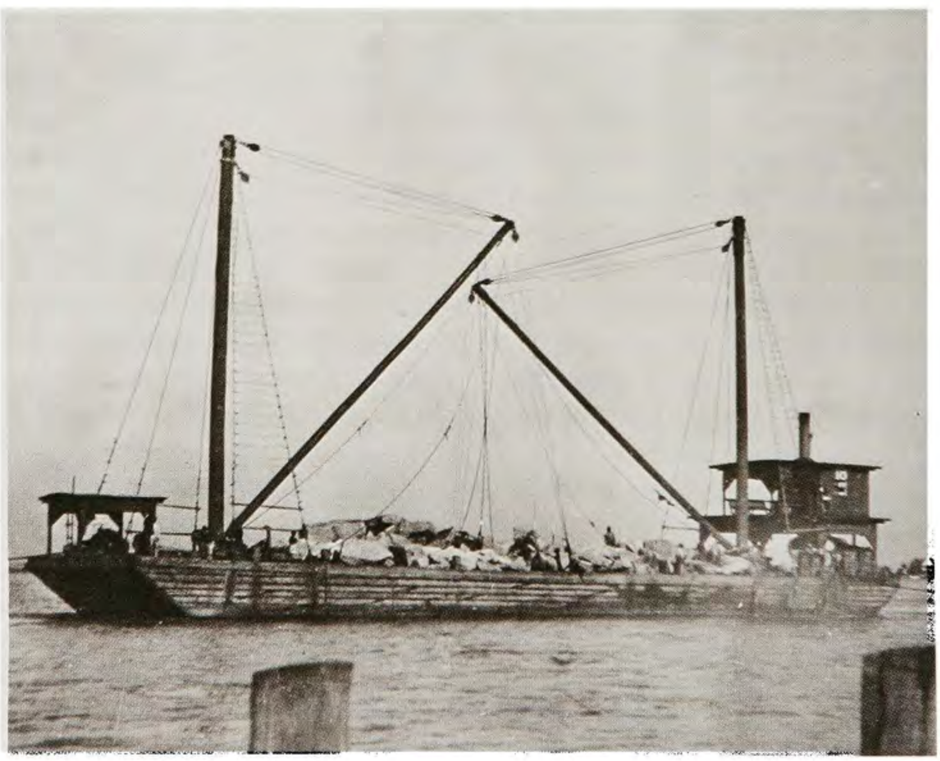
One unexpected result of the south jetty was to route some water around the south or outer side with enough velocity to scour the sand from under the foundations. Lieutenant Fisk had to construct several spur jetties perpendicular to the south pier to correct this fault. Then, very serious erosion took place on the south jetty because, at times during the ebb flow, the river water was so much higher than the Atlantic waters that the river flowed over the jetty with enough velocity to carry away part of the bottom sand next to the foundation. Fisk solved this by raising the jetty height.

Captain James C. Post. Lieutenant Fisk's successor, was confronted with a new problem. The extra weight added to the jetty caused appreciable settling of the foundations. In some places the structure dropped 15 feet. In one night a section sank 6 feet.[24] And, so it seemed to go for the resident engineers.

The early rock hauled in for the jetties consisted of huge blocks of granite shipped from New York in seagoing barges. Sometimes these carriers would arrive during storms, which called for the utmost in seamanship and engineering skills to properly dump the stone in its proper place. Florida limestone was not as heavy as the New York product, but, when some of it was used it was found to be superior. The marine life had an affinity for the local stone, growing rapidly over the structure, cementing the blocks together naturally. Eventually, only local limestone was used in the jetty.[25]

Mr. Ross recalled another innovation during the jetty work: "At this stage of construction, Captain W. M. Black, engineer in charge of the work at that time, devised a plan of two ridges of stone with a space between, built up to the level of low water. The space between the ridges was then filled in with oyster shell and a layer of stone placed on top. The shell made a solid hearting when covered over with stone; being mixed with Florida limestone, they both found their natural element in the ocean where shellfish had something to

Workmen unload small pieces of stone onto jetty in 1900 (top). Another load of stone arrives for the jetties (bottom).



cling to, thus cementing the whole into a solid breakwater below the low water level. The oyster shell hearting was used only where the water was deep and still. This kind of construction has proven satisfactory."[26]

Concrete blocks of 6 to 10 tons were also used in place of rock. In 1887, when the coast was lashed by a particularly severe gale, Lieutenant William M. Black found that some of the 10-ton blocks had been moved a mile or so out to sea. Of course, this was an unusual storm, but it certainly demonstrated the energy in nature, and if man intended to compete, he would have to work on a similar scale. In the contract written in 1891, District Engineer Black insisted that the stone topping must consist of a minimum of 1-ton stone with 50 percent of the stones used being over 4 tons in weight. When the work was completed, marine life had cemented the jetties together so that there was, in effect, two huge single obstructions jutting out to sea from the mouth of the St. Johns River.[27]

To add to the construction problems, Congress was erratic in appropriating money for the project. The original plan called for $1.7 million, and in 1884 the Jacksonville interests had petitioned for $.6 million. Both sums were on a grand scale compared to actual allotments.

1880	Congress granted	$125,000
1881	Congress granted	$100,000
1882	Congress granted	$150,000
1884	Congress granted	$150,000
1886	Congress granted	$150,000

The result of this piecemeal funding was to have the engineers operate from hand-to-mouth. Often, while waiting for more money, the scouring actions would do so much damage that a major portion of the next appropriation would be spent repairing damage. By the time the corrections were effective, the project's funds would be low again.

Colonel Gillmore wrote in 1883 that: "The work of improving the mouth of the St. Johns River has been for sometime past, and is still, in a critical condition. Ample means should be furnished to proceed with the work, and to protect it thoroughly."[28] Two years later Captain Rossell stated: "During the progress of the work, from its commencement on 14 December 1880, up to the present time it has been idle, through lack of money, for more than a year. The damage caused by these delays has materially increased the cost of the work,"[29] Again, in 1887, Captain Black complained of the dangers of inadequate funding.[30]

The project gradually took shape. Almost 4,500,000 cubic yards had been scoured out of the channel at a cost of 21 cents per cubic yard. This cost was about half as much as the dredging operations, and it had the added feature of being permanent.[31] Yet, when the Board of Engineers reviewed the jetty work, it found that Gillmore's submerged piers were not able to produce a 15-foot channel as desired. The Board revised his original decision and moved that the jetties be raised to normal high tide from the shore outward.[32]

The story of opening Jacksonville to the sea does not end with the success of the jetty system. Similar to the engineering problems with the foundations, one bit of progress pointed to another area in need of improvement. The Jacksonville leaders realized that pinning down and deepening the elusive St. Johns River channel over the shoal ground of the Atlantic was not enough. The river, from the mouth to the city, must be reworked. These same men considered this a financial task they must undertake themselves. In 1891, the people passed a bond issue, the first for Duval County, for port improvements. The county raised $300,000, which was made available to the Federal Government to remove shoals and dredge the river bed up to the city of Jacksonville. The Corps of Engineers carried out the task using the local funding.[33] By 1895, there was 15 feet over the bar and an 18-foot channel up to the city. Jacksonville had become a seaport 25 miles upriver from the Atlantic Ocean.

A seaport, no matter where it is located, must keep up with its rivals and maritime technology. Hardly had the harbor improvements been established when the Jacksonville Board of Trade called for deeper water. Congress set aside $350,000 in 1902 for the construction of a 24-foot channel. The two jetties, the southern 2½ miles long, and the northern 3 miles long, jutting out into the Atlantic only 1,600 feet apart at the outer end, had done their job. Now it was the dredge which must provide the action.

Two new and powerful dredges were needed. They were appropriately named the *St. Johns* and the *Jacksonville*. The contract for the *St. Johns* was awarded on 13 June 1902. Captain J. C. Sanford of the Corps was in charge of the oceangoing hopper dredge from design through construction. Sanford completed the *St. Johns* by March 1905. The *Jacksonville* was a stationary hydraulic dredge. It took the *St. Johns* and the *Jacksonville*, working together, only 4 years to bring a 24-foot channel to the city.[34]

The effect the jetties had upstream soon demanded notice. The current flow had increased due to the bar project and the river dredging. The river banks in some places became undercut and vast amounts of earth fell into the river bed. St. Johns Bluff and

Dames Point were especially hard hit. St. Johns Bluff was set back several hundred feet within a period of 10 years. This latest problem called for building retaining walls and throwing up riprap (a sustaining wall of stones put together without any formal order, as in deep water or on embankments to prevent erosion) at various places along the river bank. Chaining the St. Johns bar spread construction upriver.[35]

The whole concept of opening Jacksonville to the sea became a growing notion which called for greater efforts to improve the port. By 1909, the Board of Trade wanted a 30-foot channel. Ships were growing in size; the 24-foot depth was not enough. According to business sources of the time, foreign ships could load comfortably to 27 feet. Therefore, many lines stopped off at nearby deep water ports to discharge part of their cargo to lighten the ship for a visit to Jacksonville. It seemed as if the region was always a bit behind in its efforts to be a first-class port.

In 1910, work began on a 30-foot depth. Several dredges were employed. The dredging was not without its mishaps. The *St. Johns* was destroyed in an accident on the jetties on 5 August 1912. The stationary hydraulic dredge *Jacksonville* proved inadequate for the task, so it was traded for another dredge, the *Major J. C. Mallory* in 1914. A privately owned dredge, the *Atlantic,* owned by the Standard American Dredging Company of Oakland, California, sank in 32 feet of water on 31 August 1916. It was later raised, but not employed on the St. Johns River. The *Key West,* a hopper dredge, brought up to work the final portion of the 24-foot channel, remained and turned to on the new project. When the task was completed in 1918, the *Key West* was still on the job. All the dredging work was accompanied by restraining walls or riprap.

Even routine maintenance had its occasional hazards. On 17 September 1928, the pipeline dredge *Welatka* was working along the north jetty, dredging and dumping the material around the jetty,

Fishing off the south jetty at the St. Johns River in about 1925; Note remains of old wreck at right of jetty. Courtesy DeGroot.

when a northeaster blew in, lashing the beaches and the *Welatka.* The storm continued for several days and the floating pipeline received damage to three or four of its pipeline sections. The following spring, while working on the Fulton Cut, the *Welatka* collided with an inbound steamship *Sidney M. Hauptman.* The *Hauptman* was found to be at fault.

In the 1930's, it was still an oft-told story of deepening the channel to keep up with world trade. The dredge *Norfolk* teamed up with the drill barge *Quincy* to develop the St. Johns River. Towards the completion of work, a *Jacksonville Journal* reporter visited the team. As his boat neared the Quincy a muffled explosion was felt. Associate Superintendent H. H. Williams, guiding the group, directed the visitor's attention to a spot a hundred yards away. Suddenly the surface water boiled, then jumped several feet into the air, the result of an underwater charge just exploded as the guest's boat approached the dynamiting barge.[36] It was an impressive welcome.

During a 9-month period the *Quincy* had been attacking a solid rock formation in the river's bed. Night and day the *Quincy's* crew drilled, placed charges, and detonated. A total of 180 tons of dynamite were used on the St. Johns. This blasting work was a far cry from Lieutenant Long's dropping hot shot down a tube on the St. Marks River a century earlier.

Jacksonville Harbor came into its own during World War II. The Main Street Bridge had been completed just before the war, ending the ferry service across the river. But, the withdrawal of the ferry boats was little noticed with all of the other activities taking place. Shipyards on both sides of the river expanded to meet wartime demands. From Main Street to Commodore Point was a hive of activity. Liberty ships and small vessels were built in Jacksonville and extensive repairs were made to ships already in service.

The Jacksonville District was kept busy doing maintenance dredging for all of this activity on the river. Periodically, there were calls from the U. S. Maritime Commission for emergency dredging when larger warships or merchant vessels were brought into port. In addition to these routine tasks, the district completed new studies on the channel which called for construction of a cutoff from Fulton to Dames Point. This would eliminate 1.9 miles of travel, but, more importantly, it would bypass some rather difficult bends in the St. Johns channel. This proposal was adopted in 1945 by Act of Congress.

The Fulton Cutoff had the benefit of the modern technology of the Corps. Unlike the earlier years on the St. Johns, when, as jetties were being built, one improvement led to another major disturbance, the Fulton Cutoff was first studied on a scale model by the

The Fulton Cutoff and Blount Island. Courtesy Corps of Engineers.

U. S. Waterways Experiment Station of Vicksburg, Mississippi. Most of the problems were ironed out before actual construction. Work began on 10 July 1950 when the dredges *Barlow* and *Philadelphia* bit into the muck. More than 15 million cubic yards were removed. By 3 August 1951 the cutoff dredging had been completed. The dike along the southside was in place by 24 October 1951, the 34-foot channel from Mayport to Fulton was finished by December 1951, and the final blasting to clean up was over by January 1952. Jacksonville had a shorter, deeper exit to the sea.

The Fulton Cutoff created a large island in the St. Johns River, first known as Goat Island, then, later, named Blount Island. It became a major industrial site for the city, offering excellent waterfront facilities for oceangoing vessels. By this time, the Jacksonville Port Authority was the city's agency responsible for harbor improvement. The Port Authority traces its lineage through the Jacksonville Chamber of Commerce back to the early Board of Trade, of which Dr. Baldwin was one of the prime movers.

When Ribault Bay became the Mayport Naval Station, the Jacksonville District assisted the Navy in dredging out the carrier basin. Also, the bar channel had to be deepened to 42 feet to accommodate the giant aircraft carriers.

Looking West up the St. Johns River; jetties are at bottom, Mayport Naval Station at lower left.
Courtesy Corps of Engineers.

Three hopper dredges enter St. Johns River together.
Courtesy Corps of Engineers.

Giant pieces of granite unloaded onto north jetty during maintenance under contract on May 11, 1961.
Courtesy Florida Publishing Company.

The mammoth aircraft carriers were but precursors of the monstrous commercial vessels being built for world trade. The River and Harbor Act of 27 October 1965 called for a 38-foot depth from the Atlantic to mile twenty, which is just beyond the Jacksonville Port Authority's Tallyrand Avenue docks. Everything proceeded according to plan until the contractors ran into limestone rock off St. Johns Bluff. When blasting began, there was an uproar from the residents on shore and from local fishermen. These two groups went to court to stop the use of explosives. Residents feared damage to their private wells; fishermen feared destruction of marine life and their economic well-being.

The district instructed its contractors to use smaller amounts of explosives in order to quiet the demands of the citizens, but this was not the answer. On 13 July 1972, Judge Charles E. Scott, U. S. District Court, issued a preliminary injunction order to the Jacksonville District to cease all blasting because the district had failed to comply with the Environmental Impact Statement, as required by the National Environmental Policy Act.

In answer to Judge Scott, the district issued a report on 15 August 1972 stating that the explosions brought only temporary distruption to aquatic life; within a reasonably short time the area

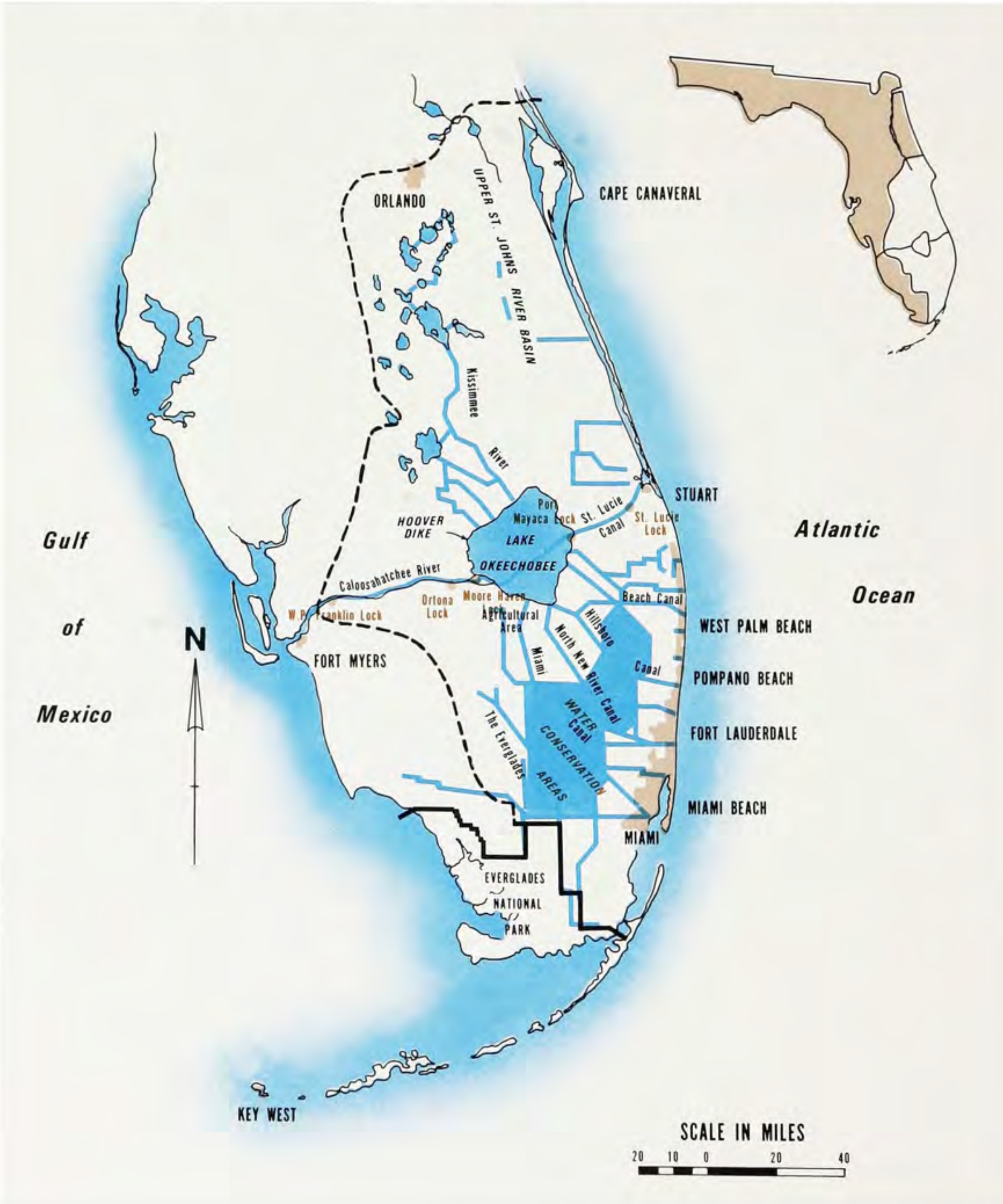
Drag arm of hopper dredge in raised position after working on St. Johns River bottom. Courtesy Jacksonville Journal.

would be repopulated. The engineers reported there was no danger to private wells from the channel blasting. This report, however, in no way mitgated the judge's order.

On 23 March 1973, the Jacksonville District filed a Supplemental Environmental Impact Statement with the court and requested that the preliminary injunction be dissolved. Judge Scott concurred and set aside his previous ruling 3 April 1973.[37] The court proceedings and the judge's injunction delayed, but did not stop, the deepening project. By 1975, the 38-foot channel had been completed to mile seventeen. It should reach mile twenty by 1976.

Jacksonville's desire to reach the sea to engage in the ocean trade of the world has had great influence upon the Corps of Engineers in Florida. These projects seem to be never-ending tasks as oceangoing commerce continues to use larger and larger carriers. Because the taming of the St. Johns River channel and bar was such a complex, long-term affair, the Corps established a resident engineer office to supervise the river projects. This office became the Jacksonville District. Had any other region of Florida had a similar program at an earlier time, that region might have been the site of the peninsula's district office. Jacksonville's call "to the sea" was the reason for the creation of the Jacksonville District.

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL PROJECT



CHAPTER 6

Grassy Water

THE CENTRAL AND SOUTHERN FLORIDA PROJECT is the largest civil undertaking of the Jacksonville District. The region encompasses most of the 18 southern counties covering some 16,000 square miles. Lake Okeechobee is the heart of this project, but the area extends northward up the Kissimmee River and includes the upper St. Johns River Basin, westward following the Caloosahatchee River, an important artery to the Gulf of Mexico, and southward along the Everglades, that river of saw grass, oozing in a broad arc from the shores of Lake Okeechobee to Florida Bay and the Gulf of Mexico. (The English surveyor, Charles Vignoles, named the saw grass area south of Lake Okeechobee the "Everglades" in his *Observations upon the Floridas* published in 1823.)

Initially, the promoters of south Florida felt it was just a simple matter of dredging a few canals from Lake Okeechobee to the Atlantic or Gulf of Mexico to drain off excessive waters, leaving an immensely rich, fertile muckland for man to turn into a tropical cornucopia. The tremendously delicate, centuries-old ecological balance which had been developed in nature was not understood, considered, or known by those early pioneers who envisioned tapping this agricultural El Dorado.

In south Florida, after the area was drained, the soil subsided, causing new problems, and, as the fresh water supply was depleted, saltwater intrusion began. By June 1974, the National Government had spent \$206 million, while state and local interests added another \$38 million. Yet, it was estimated that to complete the project it would take an additional \$497 million in Federal funds and \$117 million in local matching monies.[1] With hindsight, it is now clear that there was no simple solution. Still, it would be an anachronism to fault the early pioneers for errors only recently learned.

By the time the Jacksonville District became involved in south Florida many irreversible decisions had been made. The district has had the unenviable task of correcting past mistakes and studying for future effects, while carrying out present day engineering projects in its battle to restore balance to the water problems of this region.

Water is one of man's most precious commodities, essential to all of life. Fortunately, it is renewable through the hydrologic cycle and imperishable; there is the same amount of water on the earth today as in the beginning of time. The problem is that it is not always available at a particular place in the correct amount. A paucity of water creates deserts; a plethora of water creates swamps.

On 30 December 1842, David Levy, Florida's Territorial Delegate to Congress, requested the Secretary of War provide the House with all the information at his disposal concerning the practicability of draining the Everglades. The Secretary of War submitted a report from the Topographical Engineers that "there was no information in the department on the matter of Everglades drainage, . . . and all that has come to my knowledge is speculation, supposition, reasoning from supposed facts, verbally communicated by officers and others who have been in that region."[2]

Although the Chief of the Topographical Corps had very little scientific information for the House of Representatives, there were many Army and Navy officers who had become acquainted personally with the Everglades. Official and unofficial reports were to be found in print in the nation's papers, keeping the stay-at-homes abreast of the Indian war in Florida and the terrain of south Florida.

Lieutenant Levin Powell, USN, made an official report to his commanding officer of his first penetration of the Everglades during the Second Seminole War and, before a month was out, it was published in the *Army and Navy Chronicle.* Colonel Zachary Taylor's famous Christmas Day battle on the shores of Lake Okeechobee in 1837 also was reported in the *Army and Navy Chronicle.*[3]

On 19 December 1840, Colonel William S. Harney's group encamped on a small island within sight of Indian Key, at the completion of the first crossing of the glades. News of his expedition spread rapidly. On the last day of the month, Judge William Marvin of Key West sent a letter to the editor of the Tallahassee *Floridian* describing the results of Harney's work. Still later, on 16 January 1841, the *Niles' National Register* in Washington, D. C., retold the story quoting from the *Savannah Republican* and the Tallahassee *Floridian.* Just 8 days after Marvin's letter, the St. Augustine *News* published the anonymous diary of one of the participants of that trek and the following week the Washington paper carried the St. Augustine diary story. The reading public certainly was aware of the activity going on in south Florida.

After Texas gained its independence from Mexico in 1836, it encouraged settlers from the southern states to its wide open plains. The Far West also was calling. In the spring of 1843, a caravan of over a thousand pioneers jammed the Oregon Trail. It was apparent to Florida's publicists that something must be done to divert some of these land seekers to south Florida, and one way to do that was to publicize the wealth and fertility of a drained Everglades.

No sooner had the territory become the State of Florida in 1845, than the legislature asked Congress to support a program of reclamation. A resolution on 10 December 1845 called upon the Federal Government to send competent engineers to investigate and to survey the Everglades to counteract the prevailing opinion that the watery, southern peninsula was valueless.

Senator James D. Westcott, Jr., carried Florida's message to Washington where he enlisted the aid of Secretary of the Treasury, Robert J. Walker. On 18 June 1847, Walker appointed Buckingham Smith to gather "authentic information in relation to what are generally called the 'Everglades' on the peninsula of Florida."[4]

The Buckingham Smith report included a vast amount of information gathered by the very men who had trekked through the glades during the Florida War. Smith went beyond the role of compiler; he actually entered the Everglades to see for himself the conditions in south Florida. His conclusions were published as Senate Document No. 242 of the 30th Congress in 1848. On the whole, it was a favorable report, as indicated by his quote of Colonel Harney who predicted that the population would jump to "a hundred thousand souls or more" within 5 years of any drainage.[5]

Senator Westcott immediately introduced a bill to grant to Florida all lands south of the established survey, on condition that drainage projects, financed by the sale of public lands at $1.25 per acre, be commenced by 1851. It seemed assured of passage until Florida's other senator, David L. Yulee, opposed the measure. Yulee, far more realistic, knew that the state was too poor to finance such a measure. He pressed for passage of another act whereby the state of Arkansas was to be granted swamp and overflowed lands unfit for cultivation. He believed that Florida could be included in a similar transfer of its swamp and overflowed lands. Yulee was correct; two years later, when the Swamp Land Act was passed, Florida acquired the Everglades, and the state benefited from the omission in this act of any specific date for the beginning of drainage.

There were several early attempts at drainage of a local nature to open inlets to the sea, but these were not designed to reclaim submerged lands. During the Second Seminole War, old Fort Jupiter was built on the southern shore of Jupiter River, 3 miles inland from the bar at the mouth of the inlet. It stood on the western point of the junction of Jupiter River and Jones Creek. Later, this post was moved to the eastern side of the creek and river. Periodically, Jupiter Inlet would silt up, closing water traffic to the fort. When this occurred, the water inside the bar would become fresh, causing "a rapid growth of vegetable matter, which, decaying, taints the atmosphere and engenders disease.", according to Lieutenant Joseph C. Ives, Topographical Engineers.[6]

Between 1840 and 1844, the inlet was closed. In 1844, Captain William Davis, the mail carrier between Fort Capron and Cape Florida, decided to dig a channel to open the inlet to the sea. Employing a party of four men, he managed to excavate a ditch which, by nightfall, carried about 4 inches of water to the Atlantic. The river was exceptionally high, having been fed by a freshet from the Everglades. A strong north wind aided in piling up the waters. During the night, the men were awakened by a flood of water rushing at them. They had to run for their lives, abandoning their camp equipage. When the sun rose the next day, a channel almost a quarter of a mile wide, secured by the rushing waters, greeted their view.

Jupiter Inlet remained open until 1847 before it closed once more from natural causes. It opened of its own accord in 1853 for a short time, then sealed itself up. In 1855 Major Joseph A. Haskin, First Artillery, commanding at Fort Jupter, tried to clear a channel to the sea, Unfortunately, his labors were in vain. It had been a particularly dry year, and although he dug a ditch, there was not enough flow of water to scour a satisfactory channel. Lieutenant Ives of the Topographical Corps concluded that' "A small amount of labor expended under favorable circumstances would, in all probability, effectually open this inlet, and render the harbor one of the best upon the eastern coast. At times it has admitted vessels drawing eight feet, and the entrance is protected from north winds by a ledge of rocks."[7]

The driving force for reclamation, however, was the result of the state's vast land holdings. Long before Florida became a part of the United States, Congress enacted the Ordinance of 1785 which established the pattern for the sale of public lands. Upon entering statehood in 1845, Florida was entitled to land benefits similar to those granted earlier to her sister states. Florida also profited from the Congressional Act of 1841, which granted each state an additional 500,000 acres of public land for internal improvement, to be sold for $1.25 per acre. Finally, the Swamp Land Act of 1850 gave to the state about 20 million acres, with the largest portion being lands of south Florida around Lake Okeechobee and the Everglades.

It can readily be observed that the new state had much potential wealth, all of it tied up in land. In 1855 the Internal Improvement Fund was established to handle these public lands. Its task was to manage the state's domain and to apply the proceeds from the sales to internal improvements.

In 1866, William H. Gleason entered into the first drainage project agreement with the trustees on lands near the Everglades. Almost a decade later, Gleason submitted a claim for 3,840 acres. His action was based upon a small ditch, dug from Lake Worth to the Atlantic Ocean, which he alleged lowered the lake, thereby draining six sections of land. His work is now the Lake Worth Inlet and his labors changed the lake from a fresh-water body to a salt-water extension of the Atlantic Ocean. At the time of his claim, the trustees, who were in receivership, refused to accept his allegations. After a long court battle, the trustees were able to cancel his request for lands in 1879.[8]

Four individuals approached the trustees in February 1869 with an ambitious plan to reclaim land along the Caloosahatchee River, Lake Okeechobee, and Kissimmee River. Half of the lands drained would be turned over to the promoters, who were to commence the following year and to complete their project within 7 years. Nothing ever came of this agreement, but it established the pattern for later grants.

The Corps of Engineers became involved in south Florida when Congress passed an act to survey the Caloosahatchee River. At that time, the west coast of Florida was under the control of Captain Andrew N. Damrell, with headquarters at Mobile, Alabama. Damrell sent Assistant Engineer, J. L. Meigs, with a survey party to Fort Myers in March 1879 to carry out the congressional instructions.

Fort Myers had a population of about 150 persons and a business district consisting of four stores supplying goods and medicines necessary for the sparse population of the Caloosahatchee valley. Contact with the outside world was maintained by several schooners plying between Fort Myers, Cedar Key, and Key West. The citizens of Fort Myers were interested in the survey being conducted, and they expressed the hope that better drainage could be effected to render the valley safe and secure from its frequent floods. The previous year had been particularly difficult. The rains had been so heavy that the valley was submerged from 6 February to 1 December 1878. Many of the settlers living on the rich, hummock lands bordering the river, had been driven off by high waters. These hardy pioneers were eager to volunteer their services to aid the engineers.

Meigs and his two surveyors left Fort Myers in a 2-ton sloop, drawing 2 feet of water. The sloop was loaded with provisions, instruments, and camp equipage, and was manned by three boatman. On the third day, they reached Lake Flirt where progress was hindered by "floating masses of water-lilies, wild lettuce, and 'careless weeds', which were removed by grass-hooks and grapnels." It took 2 days to cross Lake Flirt's 5½-mile length. Two more days' labor was expended before the party reached Sugar Berry Hummock, located about 3½ miles west of Lake Hicpochee. Between Hicpochee and Okeechobee was a vast saw grass marsh.[9]

From Sugar Berry Hummock things appeared hopeless. Although only 3 or 4 miles from Lake Hicpochee, the lake could not be seen even from a height of 32 feet. Because the saw grass was too dense to penetrate, Meigs sent two members of his party north to Fish-Eating Creek with instructions to get canoes from the Seminoles living there. They were to paddle down the creek to Lake Okeechobee, where they were to fire the saw grass in order that the prevailing northeast wind could carry the flames toward the surveyors' camp. In this way, a wide swath might be created, allowing them to traverse the burnt stubble to Lake Okeechobee where they could commence running the line of levels toward the gulf.

When the men reached Fish-Eating Creek and found the stream nearly dry, they retraced their tracks back to the base camp. For the next 2 days, Meigs and his men explored eastward from Sugar Berry Hummock. They followed the many prongs of water running to the east, but, in every instance, the waterways grew shallower as they meandered eastward, until, finally, the canoes could be pushed no farther.

While the engineers were attempting to enter Lake Okeechobee via the Caloosahatchee River and Lake Hicpochee, a group of citizens from Fort Myers moved up and encamped on the savanna south of Lake Hicpochee, close by the saw grass marsh. They began burning to reach the lake. From Meigs' observations, their fires seemed to have opened a space between the two lakes. He decided to join forces with them.

On 14 March the combined parties attempted to push a skiff across the burnt stubble toward Lake Okeechobee. "After a day of exhausting toil, struggling through water and mire, for the most part 2 feet deep, they arrived late in the afternoon within one-fourth mile of the western shore of Lake Okeechobee, but their progress was arrested by vast beds of waterlilies, careless and frog weeds, and wild lettuce, filling the entire space between them and the lake, across which they were unable, by their united strength, to force the boat."[10] They had to give up and return to camp.

Meigs decided that the waters of Lake Hicpochee were at the same level as Okeechobee because there was no perceptible current; therefore, he started his line of levels from the south shore of Hicpochee.

Meigs' line of levels followed the drovers' trail from Hicpochee to Fort Thompson, then to the old military road, which ran close to the dividing ridge south of the Caloosahatchee valley, on to Fort Myers. "The results of the leveling are," according to Meigs, "interesting as showing the elevation of Lake Okeechobee above tide water of the Gulf of Mexico, and as, perhaps, the beginning of engineering operations that will one day protect the Kissimmee and Caloosahatchee Valleys from disastrous floods, and reclaim the very valuable Okeechobee Margin."[11]

At the conclusion of his report, Meigs noted that during periods of drought, the marsh became dry and it was possible to ride a horse in the river channel from Fort Thompson to Sugar Berry Hummock. This would be the time to construct a river canal at least 40 feet wide and 6 feet deep, and a similar canal to connect Hicpochee to Okeechobee. He estimated the cost to be $148,978 to provide passage for vessels 40 feet long with 8-foot beams, from the Gulf of Mexico to Lake Okeechobee.

The assistant engineer realized that neither the sparse population nor the small trade of the region, warranted such an expenditure but he stated that "the principal advantage, however, to be expected from this improvement would arise from the partial drainage of the wide margin of saw-grass marsh bordering the shore of the Upper Caloosahatchee and the Lower Kissimmee, and surrounding Lakes Hicpochee and Okeechobee. The soil of these marshes is a rich black loam, 5 or 6 feet in depth and deemed by experts admirably adapted to the growth of sugar cane."[12]

The Meigs report may have been the tocsin of the drainage mania which soon swept over the Okeechobee region. The 1880's were the haydays of the Robber Barons, when the moves and machinations of the financial wizards were adulated by the masses. Florida participated in this era of the nation's history as three tycoons battled and maneuvered for position within the state. Two of these men were railroad magnates; Henry Flagler building down the east coast and Henry Plant constructing along the west coast. The third, in the southern swamp lands, was Hamilton Disston, the drainage king.

Hamilton Disston became president of Disston & Sons upon his father's death in 1878. He was a millionaire who became interested in land development in south Florida. In February 1881, Disston entered into an agreement with the trustees of Florida's Internal

Improvement Fund, whereby he would undertake a drainage project in south Florida in return for half the lands cleared. When he became aware that Florida could not give title to these lands (the Internal Improvement Fund was in receivership, with its hands tied by a court order forbidding the trustees to make any but cash sales), he offered to purchase outright 4 million acres for $1 million. This would give the Fund the cash necessary to come out of receivership and to honor its former agreement upon his drainage scheme.

The Disston interests wasted little time bringing on the dredges. Dredge No. 1 arrived from New Orleans in late 1881. As it moved up the Caloosahatchee, it removed the snags and logs along the way. When No. 1 got to Fort Thompson, it began dredging through the falls. Reedy Canal was evacuated, opening up Lake Flirt, then on the Lake Bonnet, Lake Hicpochee, and Three Mile Canal from Hicpochee to Okeechobee. Disston Dredge No. 2 was brought to Lake Tohopekaliga by railroad to work the northern area, heading south. Southport Canal ran 4 miles connecting Tohopekaliga and Cypress Lakes in 1882. This was followed by the Hatcheneha Canal joining Lake Cypress to Lake Hatcheneha. The Kissimmee Canal connected Hatcheneha with Lake Kissimmee. By 1883, the series of Disston canals had joined Lake Tohopekaliga to the Gulf of Mexico via Lake Okeechobee.[13]

Disston's project caught the public fancy. The *New Orleans Times-Democrat* (later the *Times-Picayune*) financed a group of explorers who sailed down the Kissimmee River, across Lake Okeechobee, through the canal (still in the process of being built) to Lake Hicpochee, then down the Caloosahatchee to the Gulf of Mexico. The 498-mile journey took 14 days, commencing 29 November 1882. A second *Times-Democrat* expedition left Punto Rassa in October 1883, travelling eastward to Lake Okeechobee, then south to Shark River for egress to the gulf.[14] The newspaper coverage of these events generated great public interest in the south Florida reclamation project.

During Disston's first year of dredging, General Quincy Gillmore sent three surveying parties into south Florida to investigate the feasibility of a steamboat route from the St. Johns River to Charlotte Harbor. The surveyors reported upon the Disston activity and the many rumored projects of other entrepreneurs in the region. Based upon their comments, General Gillmore recommended that the Government await the development of private enterprise before doing anything further with the steamboat route.[15]

Three years after Disston started, his engineers were claiming that the Kissimmee River lakes had been lowered 2 to 8 feet and that Lake Okeechobee had dropped a foot and a half. Local residents were thankful that their fears of floods were ended. The southern settlers sent many testaments concerning the benefits wrought by Disston engineers to the trustees in Tallahassee.[16]

Former engineer for the Central and Southern Florida Flood Control District, Larmar Johnson, writing in 1974, pointed out that "the limited rainfall records of the period indicate that 1881 to 1884 was a dry cycle." He did not understand how the pioneers living in that region, so close to nature, could have been hoodwinked by Disston's agents. Johnson felt that the Disston engineers soon realized that their work was not the primary cause of the drop in water, as evidenced by their renewed attempts to enlarge the original canals which had been dug so hurriedly in the first years of the project. Nevertheless, the trustees of the Internal Improvement Fund agreed with Disston that over 2 million acres had been reclaimed. Accordingly, they deeded land to the Disston Company.[17]

A private survey, more serious than the *Times-Democrat*'s, was the Ingraham Expedition of 1892, designed to cross the Big Cypress Swamp and the Everglades from the Gulf coast to Miami. Ostensibly, it was to investigate the possibility of a railroad from Tampa to Miami. The expedition left Fort Myers on 16 March and finally, after undreamed of hardships, emerged in Miami 7 April 1892.[18]

During this same period of the early 1880's, the Corps of Engineers had been operating along the Caloosahatchee River, deepening the canal for navigation purposes. District Engineer, Captain William M. Black's annual report of 1887, reflected the changing attitude of the people of the Caloosahatchee valley. Citizens were now voicing fears that Disston's Atlantic and Gulf Coast Canal and Okeechobee Land Company's drainage ditches were carrying too much water from Lake Okeechobee down their river, flooding their cultivated lands. The valley people were alarmed over the navigation work of the Corps in deepening the channel. They believed that it might add to the drainage flow. They requested that the United States discontinue improvements to the Caloosahatchee until it was certain that this would not increase the danger of flooding.[19]

However, before this attitude of the pioneers had a chance to turn against drainage, the Disston project ceased. Disston's empire was dealt two crippling blows in the 1890's; first the financial depression of 1893 occurred, and second, his untimely death in 1896. Disston heirs were not interested in his south Florida plans and the drainage program withered.

When Napoleon Bonaparte Broward ran for governor in 1904, one of his most potent campaign oratory themes was directed toward draining the Everglades. He argued that all that was needed was to "knock a hole in the wall of coral and let a body of water obey a natural law and seek the level of the sea." At emotional times during his oratory, he would proclaim in a loud voice: "Water will run down hill!"[20]

True to his word, Broward no sooner attained the governership than he set about to construct canals to carry off the swamp waters of south Florida. He prevailed upon the trustees to build two dipper dredges, the *Okeechobee* and *Everglades,* to commence work. Both vessels were in operation a year later in 1906. The Governor traveled to Fort Lauderdale in July to watch the *Everglades* move out of New River toward the northwest, cutting a canal as it went. "There was no definite technical survey to follow, and an engineering party, laying out stakes, preceded the dredge."[21] In Broward's rush to expedite his reclamation project, there was no thought to providing an engineering study upon which to base the drainage program. In fact, it was 1910 before the first qualified drainage engineer was employed. Broward's plan was just as he had stated it time after time during his campaign: "Water will run down hill!"

In 1907, the State legislature created the Everglades Drainage District, with specific boundaries which included Lake Okeechobee. This body had the power to tax the land within the district 5 cents per acre. Immediately, the large landowners challenged the legality of this act, on the ground that property close by the proposed canal would benefit more from the tax money than would lands far removed from the lake.[22]

Seminoles on the South Fork of the Miami River, 1904.
Courtesy State Photographic Archives, F.S.U.

In 1910, under Governor Albert W. Gilcrest's administration, the State of Florida and the large landowners reached a compromise which ended their long-standing court battles. The owners agreed to pay up their back taxes; the State's Drainage Commission promised to spend the money for dredging 200 miles of canals. The 10 years from 1917 to 1927 were the most active in reclamation. During this period, more than half the excavation of the Everglades took place. Of course, this does not include later Federal projects concerned with flood control programs. In all, 433 miles of canal, 54 miles of levee, and 14 canal locks were completed by 1927. Population figures were up, land values quadrupled, acreage under cultivation tripled, railroads and highways pushed out to the shores of Lake Okeechobee, and it appeared as if the visions of the dreamers were a reality.[23]

Yet, even visions may have flaws when examined closely. Both the farmer and the boat operator had an interest in the waters of Lake Okeechobee. The farmer saw high water in the lake as threat; the boat operator was more concerned when the lake was at a low stage. In those early days of reclamation by private and state interests, the men in power leaned toward the farmer's position. As the lands surrounding Okeechobee subsided, the level of the lake was regulated downward to balance the agricultural interests. When the lake outlets began to seriously lower Okeechobee's level, the Corps of Engineers entered the debate to protect the interests of the navigating sector on public domain.[24]

Generally, Lake Okeechobee overflowed its banks when its waters rose 20 feet above mean sea level. In 1912, when the trustees of the Internal Improvement Fund applied for a permit from the War Department to connect its four main Everglades canals to Lake Okeechobee, the Corps of Engineers stipulated that the lake waters should not be allowed to drop below 14.56 feet above mean sea level. It was 1917 before the lake level dropped to that depth, and then it was the result of a prolonged drought, rather than drainage conditions which caused the drop.[25]

The opposite situation occurred on 18 September 1926 when a hurricane came ashore at Miami, crossing the bay and roaring inland over Lake Okeechobee. Miami was left in a shambles with over 100 of its citizens dead. The wind, rain, and lake waters of Okeechobee merged into a massive force which pounded against the earthen dike of the lake's southwestern shore. Three miles of levees crumbled, sending floodwaters raging from Clewiston to Moore Haven. Peak waters, 10 to 12 feet high, swept over Clewiston. In the storm's wake, almost 400 persons had died in Okeechobeeland.[26]

Schooner 'Kessie C. Price' ashore in Bayfront Park, 1926.
Courtesy State Photographic Archives, F.S.U.

The people of Florida began to realize that drainage was not the panacea to south Florida's problems. They had spent $14 million for a series of canals built for transportation and drainage; the highly vaunted works provided neither. During times of high waters, the ditches could not carry off the excess; during low periods, they drained precious water which should not have been moved.[27]

A year after the hurricane, the Jacksonville District held public hearings at Pahokee and Moore Haven to gather local views about the situation. Meanwhile, Governor Martin asked the Secretary of War to use his office to convince Congress that it should provide Federal aid for flood control of the Okeechobee area. Before any actions resulted from these endeavors, a second hurricane swept the region.[28]

The 1928 storm was much worse than the earlier disturbance. When this second tropical storm passed over the lake, the muck dikes gave way, sending flood waters over the flatlands. More than 2,000 persons drowned as winds, estimated at 160 miles per hour, drove the waters before it. There was no doubt that local agencies could not cope with the problem.

Miami, South Bayshore Drive, September 24, 1926.
Courtesy State Photographic Archives, F.S.U.

Coffins beside the road between Belle Glade and Pahokee, hurricane of 1928.
Courtesy State Photographic Archives, F.S.U.

At the time, President-Elect Hoover was aboard a warship returning from a trip to Brazil. After stopping off at Miami to personally view the destruction and damage, Hoover called upon Congress to authorize the Corps of Engineers to come to the aid of the state. Congress requested information on south Florida, which the Jacksonville District presented to that body in January 1929. By December, legislation had been introduced calling for Federal cooperation in the Lake Okeechobee project.

Strangely enough, the legislative act which passed the Congress and was signed by President Hoover in July 1930, was a navigation act. The first bill had been sent to the House Flood Control Committee, but it was withdrawn by its backers because of some congressional fears that it would extend the Corps' flood control program beyond the Mississippi and Sacramento Rivers. The bill then went to the Rivers and Harbors Committee of the House before finally being turned over to the Committee of Commerce in the Senate. (It was 1936 before the Corps of Engineers was assigned authority by Congress over all national flood control projects.)

As a navigation act, the district recommended that the Caloosahatchee River and the St. Lucie Canal be enlarged and connected by a channel, to be dug along the east and south sides of the lake, to provide a cross-state waterway. Very conveniently, the dredged material from this new canal would be placed along the lakeshore, creating the much needed levee. The engineers also recommended that the state undertake the building of a levee on the north shore.[29]

By the time the Jacksonville District became fully involved in the reclamation of south Florida, it was no longer a simple matter of allowing water to run down hill. Even more difficult was the fact that the district had to build upon a previously constructed base which had not been blessed with very extensive engineering surveys or studies. The Jacksonville District was faced with correcting past mistakes while it provided contemporary construction, and, at the same time, planned for the future.

During the first 2 years, the district engineers spent a major portion of their time conducting surveys of that region. Meanwhile, necessary work began as soon as possible and levees between Clewiston and Moore Haven were erected in January 1932. Construction started in August on 12 miles of levee along the eastern shore, and the next year saw a levee rise along the 20-mile stretch from Moore Haven to Fish-Eating Creek.

The nation was in the early years of the New Deal's attempt to provide employment and this benefited the south Florida program. Construction increased in 1934 under impetus from President

Franklin D. Roosevelt's Public Works Administration, which spent $4.1 million on the project in fiscal year 1935. To this amount, the Corps and state funds brought the total to over $5.8 million. Through 1937, the district's major source of construction funds came from unemployment relief money from Washington, but, in fiscal year 1938, funds for the project were cut back. The engineers were back to their more meager allocations. By this time, however, the task was 80 percent complete.[30]

The district constructed hurricane gates, as well as channels and levees. Hurricane gates are openings in the levees to allow passage of water and vessels through the encircling retainer walls. When a hurricane approaches, the gates are closed to contain the high waters generated by wind-tide, and to protect the surrounding countryside from inundation. As the project grew in physical size, maintenance, rather than construction, costs, became the greater expense. By 1940, maintenance costs ran $1.7 million, compared to $.6 allocated for new work.

The early 1940's were years of drought. When saltwater seeped into several municipal systems in 1945, conditions became critical. Fortunately, heavy rains fell during the spring and summer months of 1946 and 1947, which eased the situation before irreparable damage resulted. Hurricanes passed over Lake Okeechobee in September and October of 1947, bringing much needed water to the lake. This sudden change in condition made it necessary for the district to shift to its flood control system, and for the next 6 months, the task was to control the rate of discharge from Okeechobee. The lake reached a peak of 18.73 feet above mean sea level in October. Had the district not been able to regulate the outflow from the lake, the equivalent of 26.89 feet would have been reached by December. Such levels could have caused a flood disaster comparable to those of the 1920's.[31]

The saltwater intrustion at the beginning of the decade was a warning of a new area of concern. It was clear that that something must be done so that south Florida would not be at the mercy of such natural phenomenon again. The flood control plan must do more than drain excess waters from Lake Okeechobee. It must contain fresh water in volume sufficient to keep out the intruding seawater from the underground water table.

The Jacksonville District developed a plan for a network of canals, locks, dikes, and levees, designed to draw off flood waters rapidly, to eliminate overdrainage, and to conserve water for later use during dry periods. This new program was all inclusive as it sought to protect farms already developed, add lands which were suitable for agriculture, set aside terrain which should remain in the natural state, protect wildlife, and improve navigation throughout the region. The execution of this project was to be in two phases.

The first phase of the Central and Southern Florida Project, authorized by the Flood Control Act of 30 June 1948, called for works designed to protect the productive agricultural lands south of Okeechobee and the highly developed urban region of the lower east coast from floods. Basic to this project, was the construction of a protective levee from the Tamiami Trail north to the West Palm Beach Canal to guard the urban coast; an encircling levee and canal surrounding the developed portion of the Everglades agricultural area to safeguard rural interests; the building of four pumping stations at Lake Okeechobee; the enlargement of existing lake levees; and many lesser works expanding canals and placing spillways in key locations. The second phase covered the remaining tasks of the comprehensive plan. Much of these secondary works were directed toward the conservation region set up for water impoundment.

The state moved to adapt its agencies to conform to this new plan when the legislature created the Central and Southern Florida Flood Control District to replace the old Everglades Drainage District and the Okeechobee Flood Control District in 1949. Five members, appointed by the Governor, were to control the district, acting on behalf of local interests. It was their responsibility to see that Federal conditions were met, such as providing rights-of-way, relocating roads, bridges, and public utilities.

Despite early flood control achievements, this 1947 flood scene in Kissimmee was not uncommon until after the Central and Southern Florida Flood Control Project was under way. Courtesy Corps of Engineers.

Broward County ranch under water during floods of 1948, the year that the flood control project was adopted. Courtesy Corps of Engineers.

Once the vast extent of the south Florida water problem was grasped, continguous areas were brought into the original scheme. In 1954 Congress added the upper St. Johns and the Kissimmee River Basins to the Central and Southern Florida Flood Control District. Four years later, 64 square miles, located in Hendry County west of the agricultural and conservation areas, were included. In 1960, the Nicodemus Slough in Glades County brought another 39 square miles into the project. An area in south Dade County was added in 1962 and southwest Dade County in 1965, and the flood control umbrella covered Martin County in 1968.[32]

Long before the project was completed, it received a severe test, when, in March 1960, heavy rains fell over the Kissimmee and Istokpoga river basins, setting records for water levels and discharges. Later in the year, the state was drenched by three tropical storms. In July, Hurricane Brenda moved in from the Gulf of Mexico to dump a large amount of rain, followed by Donna in August, and Florence in September. Rainfall during these latter 2 months was more than four times the normal amount. More water flowed into Lake Okeechobee than could be discharged, and it remained that way until mid November. Yet, the early flood control work proved its worth and minimized destruction around Lake Okeechobee. Although the work was only 27 percent completed, it was enough to limit high water damage to minor events along the north shore.

The wet years of 1960 and 1961 were followed by some of the driest years on record. Evaporation alone exceeded the rainfall by 27 inches on the lake. The water conservation aspects of the program were put into action. More than 400,000 acres of farmland were irrigated by water drawn from Okeechobee. Large sections of the Everglades literally began to dry up, threatening the very existence of alligators, birds, and certain fishes.

The three water conservation areas provided for in the comprehensive plan could have prevented the near disaster brought on by this dry spell, if they had been completed and placed in operation on schedule. Originally, the 1,350 square miles of storage area had been programmed to be completed by 1960, but lack of funds and the rapid growth and development of south Florida, with its increased demands upon the district's schedule, delayed completion of the storage regions. Only Conservation Area No. 1 in Palm Beach County had been finished, but not in time.

The drought of the early 1960's clearly demonstrated the delicate balance of south Florida's water problem. Sending too much water to the sea during periods of flood stage meant a shortage of water when the next dry spell arrived. The impoundment regions were vital to overall success. In 1965-66, when the drought was broken, the water levels in Lake Okeechobee and the two smaller conservation areas rose to minimum heights. June 1966 provided a dramatic turnabout. Hurricane Alma dropped over 6 inches of water on south Florida in a 2-day period, and, almost immediately, the withholding regions exceeded the desired levels of water. The rains continued. Soon the water threatened the wildlife within the conservation area; deer and other animals could not forage for food.

The United States Fish and Wildlife Service joined the Florida Game and Fresh Water Fish Commission in aproaching the district engineers for aid. The Jacksonville District responded by pumping excess waters from the impoundment regions to the east coast,

Raising of Hoover Dike at Lake Okeechobee, February 1964. Courtesy Corps of Engineers.

Hoover Dike holds back flood waters in September 1966. Courtesy Corps of Engineers.

while water from the agricultural areas was sent north to Lake Okeechobee. A swath was cut through the saw grass of the northern Everglades National Park to increase the natural drainage flow toward the gulf. Finally, traffic was stopped on the levee roadways so that the deer might use this higher ground; because of these measures, the herd of Everglades deer survived.

During this period of feast or famine for south Florida's water supply, the Jacksonville District was conducting a long-range study of the complex problem. When the plan was submitted to Congress in 1967, the solution consisted of refining many works which had been done in the past, such as improving canals by deepening navigational channels, and building more pumping stations, secondary canals, and levees. In addition, the district suggested that the height of the levees around Lake Okeechobee be increased so that they could contain waters of 21 feet above mean sea level.

At the present time, the project has "917 miles of levees, 950 miles of canals, 30 pumping stations, 192 floodway control and diversion structures, 57 railroad bridge relocations, and 2 highway bridge relocations," and the job is 39 percent complete.[33]

The Jacksonville District's 1975 annual report reads like an oft-told tale: "Fiscal year 1975 started as a severe drought was ending in south Florida. Heavy rains began in the last week of June 1975 and continued through August, causing a complete turn about in the hydrologic conditions in the lower half of the state. The south Florida area went from a condition of drought to that of an over abun-

Fishing off St. Lucie Lock on St. Lucie canal section of Okeechobee waterway, 1966. Courtesy Corps of Engineers.

dance of water in a six-week period. Lake Okeechobee rose from an elevation of 11.1 feet on June 23 to 15.4 feet on 7 August, and remained above schedule for three months despite regulatory discharges to Caloosahatchee River and St. Lucie Canal."[34]

Through the efforts of the Jacksonville District, the disasters associated with the natural phenomena of drought and flood have been controlled to an encouraging extent. Hopefully, as the project nears completion, even more benefits will accrue.

Man has literally changed the face of the earth in south Florida. The river of saw grass, oozing southward from Lake Okeechobee to Florida Bay, which sluggishly lapped at the pine barrens a few short miles west of Fort Dallas, is gone, replaced by the sprawling metropolis of Greater Miami. A trip from Miami to Lake Okeechobee passes through fertile agricultural lands. The trail is a modern highway, undreamed of by the early explorers who poled, pushed, and pulled their shallow canoes through the trackless wastes of saw grass.

Yesterday's men of vision, who could only see that "water will run down hill," brought ecological disasters to south Florida; the Jacksonville District Engineers, studying the multitudinous facets of nature's balance, are gradually redressing the equation so that many may live and raise agricultural produce in the region called Pa-hay-okee (Grassy Water) by the Indians.

INTRACOASTAL WATERWAYS

CHAPTER 7

The Intracoastal Waterways

FLORIDA'S INTRACOASTAL WATERWAYS did not come into existence from one single project. The dredged canals and natural waterways which gird the state from Jacksonville, south to Miami, with a cross-state route utilizing the St. Lucie Canal, Lake Okeechobee, and the Caloosahatchee River to Fort Myers, then up the gulf coast to Anclote River, are the result of many separately scheduled projects.

By the very nature of the peninsula's terrain, the early settlers made extensive use of the existing waterways. When James Gadsden surveyed the east coast for the purpose of laying out a military road south to Cape Florida, he discounted the feasibility of a road through that desolate countryside, but he did strongly urge that a canal be bult at the Haulover to join Mosquito Lagoon with Indian River. He made this recommendation in December 1824, at the end of his first expedition. His report the following year, after his successful trek, included a map which delineated the Haulover.[1] However, the territory was settled too poorly for the Government to undertake any improvement project that far south.

Two years later, the citizens of St. Augustine, Matanzas, and Tomoka petitioned Congress to alter Gadsden's plan. He had determined that New Smyrna should be the southernmost terminus of the military road down the coast. Settlers of these three communities felt that the population south of Tomoka was not great enough to sustain the road. The Floridians requested that the road run from the Georgia line to Tomoka, but that the funds for continuing the road south be used to construct a canal, linking the Matanzas with the Halifax River. Such a cut, about 8 miles long, would provide a more satisfactory communication link along the coast from St. Augustine to New Smyrna.[2] However, Washington took no action upon this petition.

Congress did appropriate funds to dredge the waters between the Cumberland Sound, Georgia, and the St. Johns River in May 1828. Gadsden had charge of this initial project until July 1830, when he submitted his final report stating that the undertaking had been successfully completed. The Amelia, Kingsley, and Sisters cuts had been made and "navigation between St. Marys and St. Johns rivers, may now be considered open at high tide for any of the coasting schooners drawing not more than 5½ to 6 feet."[3]

Gadsden's work was not enough. Congress allocated further funding to improve the water passage to the St. Johns River. Lieutenant Joseph K. F. Mansfield surveyed the project in June 1835 before recommending the construction of a dredge boat and mud flats to be used to deepen the channel at Amelia Dividings, the dividings west of Talbot Island, and the Sisters Dividings. Mansfield constructed his equipment in time for work to begin in December 1835. This deepening of the land navigation route continued until October 1836. Still later, Lieutenant John Williams Gunnison labored on this waterway. Gunnison's Cut connected Sawpit Creek with Sisters Creek and Fort George River.[4] By 1839 this work seemed to be all that was necessary at the time.

Undoubtedly, the work on the inland waterway to the St. Johns River was expedited during the years 1836 and 1839 as a direct result of the Second Seminole War which broke out in December 1835. In the early years of the Florida War, settlers in the northeast corner of the territory flocked to the nearest town for safety as the Indians raided outlaying plantations. In July 1836, the steamer *Essayons* was detached from dredging work to steam up the St. Johns River to rescue settlers who had been burned out by a marauding war party operating south of Mandarin.[5]

When General Zachary Taylor assumed command of the Army in Florida in May 1838, he announced that his first project was to drive the Seminoles south of a line drawn from St. Augustine to Garey's Ferry on Black Creek, a tributary of the St. Johns River, just south of Jacksonville. Taylor felt this would remove the redmen from "every portion of Florida worth protecting."[6] Garey's Ferry served as the headquarters for his army in 1839. Later, a chain of forts was established on the river, as well as down the inland coastal waterway. During this period, the Army shipped quantities of supplies up the St. Johns and south along the Mosquito Lagoon – Indian River route to support these military establishments.

On the coast, the lagoon and river were separated by a portage known as the Haulover. It was also the site of Fort Ann, built during the war. At times, the Army kept 800 to 1000 troops stationed on this narrow spit of land just to carry military supplies from Mosquito

Lagoon to Indian River, to be forwarded on to forces operating farther south on the peninsula.

Navy Lieutenant Levin M. Powell's group of sailors and soldiers, with the civilian Joseph E. Johnston acting as the topographical engineer for this amphibious detachment, departed St. Augustine in schooners for Mosquito Inlet. Here they offloaded to break out their small craft for the sail up the lagoon to the Haulover. Powell spent the month of December 1837 drilling his conglomerate forces into a cohesive unit while he moved his boats and supplies across to Indian River. For many units, the interruption at the portage was a needless consumption of time. In Powell's case, the delay was beneficial; it provided the opportunity for the two services to learn to work together.

Among the troops forced to delay at the Haulover were three companies of the 1st Artillery. With these soldiers was Army surgeon Jacob Rhett Motte who wrote of Powell's men drilling: "When drawn up in line they presented a curious blending of black and white, like the keys of a piano forte; many of the sailors being coloured men. There was also an odd alternation of tarpaulin hats and peajackets, with forage caps and soldiers trip roundabouts; soldiers and sailors, white men and black, being all thrown into the ranks indiscriminately, a beautiful specimen of mosaic, thus modifying sailor's ardour with soldier's discipline."[7]

A year after hostilities ceased, Quartermaster General Thomas S. Jesup stated in his annual report of October 1843 that: "The difficulties which I experienced when directing the operations against the Seminoles in the campaign of 1837-8 in supplying the division of the Army operating south of the Haulover, on the Atlantic side of the Peninsula of Florida, enable me to speak with positive certainty as to the necessity of improving the inland commmunications from Saint Augustine to Key Biscayne."[8] But, despite Jesup's pleading, no action was forthcoming on the Haulover Canal, probably because the Indian War had ended and the civil traffic was not significant.

Shortly after the cession of combat, Colonel William J. Worth, commanding in Florida, sent First Lieutenant Jacob Edmund Blake, topographical engineer, to the Haulover to make a survey. Blake considered this protgage to be a waste of manpower when a canal could join so easily these two waters, eliminating the work of offloading, loading, and offloading of supplies over such a short obstacle.[9]

Blake found that the distance between the two waters was only 725 yards with the highest point of land being 8½ feet above the level of the water. He recommended that the cut be made. To remove the possibility of the canal filling up, he suggested that 8-inch square, 12-foot long piles be driven into the ground, spaced 12 feet apart. Two-inch planks should be rivetted to these piles to strengthen the sides. To insure that the pressure of the sand and water at the sides of the canal did not force up the sand from the bottom, he contemplated covering the bottom with 2-inch planks. Blake thought this would "render the whole free from all liability to fill up & [make] the canal at all times passable."[10]

After Colonel Worth accepted Blake's plan, he proposed to the Chief of the Topographical Corps that his troops, garrisoned in winter quarters, perform the labor while the Topographical Corps provide the funding for the tools and equipment necessary to build the canal. Colonel John J. Abert replied from Washington that he did not have the money to grant to this enterprise.[11] Two months later, Quartermaster General Jesup wrote to the Secretary of War concerning the importance of water passage at the Haulover. He quoted from his earlier annual report of October 1843, but, again, to no avail.

A decade later, when the Army was preparing to carry out Captain John C. Casey's suggestion to provoke the Seminoles to move or fight, Lieutenant Horatio G. Wright was assigned to examine and later to supervise the construction of a shallow canal across the Haulover. Wright's canal, 8 feet wide at the bottom, 12 feet wide at the water's surface, and 2 feet deep, was completed just before the Third Seminole War. It was no coincidence that the Haulover Canal was designed for the small boat operation used by the Army in its earlier Indian struggles along the Florida coast.[12]

The Haulover Canal was not maintained by the engineers after the Third Seminole War; nor did the population along that shore increase enough to provide much private traffic. During the years of the Civil War, coastal navigation dried up due to the Union blockade. By 1869, when J. Francis Le Baron traveled down the coast, he found the canal filled in to such an extent that he passed through in a small boat with great difficulty.[13]

In 1878 Le Baron again made use of the canal. By this time, private interests had cleaned out the cut so that it would admit boats with a beam of 11 feet, drawing 1½ feet of water. On both occasions, Le Baron had been making collections of natural history for Harvard University.

Three years later, Le Baron was an assistant engineer working for the Corps. Lieutenant Colonel Gillmore sent him to survey the Haulover in the fall of 1881. Le Baron chartered the *Belle,* a 3-ton sloop on the Indian River, to carry his party from Titusville to the canal, 9 miles northeast of the town. While he was at the Haulover, a northeaster struck which caused the waters in Mosquito Lagoon to rise 20 inches higher than the Indian River. The result was a current of 2.8 miles per hour flowing west through the cut, making it almost impossible for Le Baron's sloop to stem the current. This flow condition to the west was not normal. The reverse generally was true, because the Indian River had a greater surface, a smaller outlet to the sea, and a longer reach from the ocean to its headwaters; the river was often higher than the lagoon. When Le Baron used the canal in 1878, the river had been 2 to 3 feet above the lagoon, and had remained that way for several months. The current under those conditions had tested severely many of the vessels trying to move against it.[14]

Federal construction of the intracoastal waterway was delayed after Le Baron's survey when private enterprise moved in. The Florida Coast Line Canal & Transportation Company, organized 7 May 1881, was granted a State charter in August 1881 to construct a continuous waterway from the St. Johns River to Miami. Four years later, the state granted the company the right to continue from Miami to Key West, but no work was ever done on this latter portion and the amendment became inoperative.

The original project was based upon a 5-foot deep, 50-foot wide channel. The state was to grant 3,840 acres of land for each mile of canal built. Beginning in 1883, construction continued almost unceasingly until 1912, when the last section of the canal was finished and the final grant of property was deeded by the state. Total land awarded to the company was 1,030,128 acres for 268 miles of canal. Yet, seldom during this period, were conditions of the State charter met by the Florida Coast Line Canal & Transportation Company. Once a section of canal had been examined and accepted by the state, maintenance became minimal. Jacksonville District Engineer, Colonel Gilbert A. Youngberg noted in 1926 that the canal's "dimensions have never been successfully maintained, and, except by taking advantage of tides and high waters, navigation with vessels of more than 4-foot draft is practically impossible."[15]

But long before Colonel Youngberg's remarks, the Corps of Engineers had been called upon to help correct a trying situation for the Florida citizens living along the Indian River. This reach of waterway running 128 miles from Titusville to Jupiter Inlet was their only highway of commerce and transportation, and it was apparent that the canal company was not providing a satisfactory outlet. The citizen's pleas to Congress were heard and District Engineer, Captain William H. Black was instructed to examine the Indian River.

Captain Black found conditions poor due to the shallowness of certain sections of the waterway. He noted that the area served by the Indian River was "unsurpassed in the State for the cultivation of vegetables and semitropical fruits,"[16] and that the region should be served by the district. The area was cut off from the state's railroad system except for Titusville in the north. South of Titusville for 200 miles, the people relied upon steamers. The limitations of channel depth forced the ship owners to employ light-draft, stern-wheel steamers. Black cited the *St. Lucie* as an example of the trend towards long, broad-beamed, shallow-draft vessels trying to utilize the company's canal, saying: "Vessels of this character have slight hold on the water and are difficult to manage in the brisk winds which prevail throughout the year in this river, so close to the ocean. The width of the canal company's cut, 50 feet, is insufficient and the boats are continually delayed by grounding on the banks."[17]

Black pinpointed the section of the river which needed help. The area from Goat Creek to Jupiter Inlet had low water, numerous shoals and bars, and was hemmed in by mangroves. Inasmuch as the company had intimated to Captain Black that it had no intention of collecting tolls on that reach if the Corps of Engineers assumed responsibility for the canal, the captain recommended that, after the company had surrendered its rights and privileges granted by the state, the Government undertake to clear a continuous channel 5 feet deep at low water, widen the waterway to at least 75 feet, and to cut back the mangroves. The district engineer noted in conclusion that work by the Corps would enhance the value of all the land along the river, including the company's, which caused him to believe that the company would be prompt in relinquishing its claims to that section of the waterway.[18] Nevertheless, 3 years passed before all the legal procedures had been accomplished and the Corps of Engineers could begin work on the Indian River.

On the morning of 4 July 1894, the hydraulic dredge boat *Suwanee* steamed out of Tampa Bay headed around the peninsula for Indian River. Sixteen days later, the shallow-draft, square-bowed scow pulled into Fort Pierce. The *Suwanee* was 100 feet long with a 24-foot beam. Much of her top deck machinery had been removed, to be shipped by railroad to Fort Pierce, so as to lighten her load for the trip around Florida. Therefore, another 8 days were spent in port replacing her machinery before the actual work of dredging could begin.

The *Suwanee* was suited to her task except for being underpowered. She was a combination dredge and snag boat, put together in an inexpensive manner as an experiment in creating a general purpose vessel for the varied minor works performed on smaller rivers. Her suction dredges discharged the raised slurry

'St. Lucie,' operated by Menge Brothers on Indian River and in vicinity of Punta Rassa. Courtesy State Photographic Archives, F.S.U.

Unidentified government dredge on the Apalachicola River, 1895. Courtesy State Photographic Archives, F.S.U.

upon the banks through pipes swung perpendicular to her sides, while the *Suwanee's* derrick provided the lifting power to raise rocks and snags from the river bed.

She began her Indian River work on the lower end of Long Cut, located about 13 miles above Fort Pierce. Long Cut was 7,470 feet in length, filled in considerably from its original dimensions. The *Suwanee* worked from 28 July until 15 December removing 36,718 cubic yards from the channel.

It was 3 miles upriver to the next work area, High Bank Canal. When the canal company cut through this place, it had used a dipper dredge, placing the spoils on each side of the cut. As the steamers plied back and forth, their washes had eroded much of the banks, causing the spoils to tumble back into the channel. From 20 December to 19 January, the *Suwanee* removed 10,944 cubic yards from the 1,435 foot reach. Next, the *Suwanee* moved downstream to Curved Canal, about midway between Long Cut and High Bank Canal. In 13 days of work, 7,700 cubic yards were removed.

After this job, the *Suwanee* spent 18 days on the ways at Eau Gallie having her bottom scraped of the shellfish and marine vegetation which had accumulated below the waterline. With the appropriated funds almost exhausted, the *Suwanee* spent 3 days working on the Conch Bar, 3 miles above Jupiter Inlet, before it was time to return to the west coast of Florida. All of this was just the beginning of the district's work on the Indian River.[19]

The canal company was never successful in its waterways operations. At the same time it was dredging down the coast of Florida, Henry W. Flagler was pushing his Florida East Coast Railway south, parallel to the canal. The railroad proved to be a formidable competitor. By 1923, the canal company was thrown into receivership. The new owners' tenure coincided with the south Florida land boom and in 1925 the company turned a profit. But, with the collapse of the boom, economic conditions were reversed. The new company went into receivership and the canal itself fell into disrepair.[20]

In the meantime, Charles F. Burgman of Daytona Beach led a movement demanding that the Federal Government take over operations of the waterways. Under Burgman's impetus the State legislature created the Florida Inland Navigation District in 1927 (composed of the 11 counties through which the canal ran) to issue bonds to acquire the right-of-way from the canal company, in preparation for turning the private waterways over to the Federal Government.[21]

Long before these events had occurred, the Jacksonville District had been involved in studying the intracoastal waterway. In 1911, Congress had instructed the Corps to make a preliminary investigation of sites for an inland route which would become part of the larger project of a protected waterway from Boston to the Rio Grande. The district looked at four choices: down the east coast where the canal company had dredged; follow the St. Johns River, Dunns Creek, and Crescent Lake before constructing a canal to the coast just north of Titusville; up the St. Johns through Lake Harney, then create a cut to a point north of Titusville; or continue beyond Lake Harney through Lake Shad and Salt Lake before building a shorter canal to Indian River north of Titusville. While the last route was recommended by the district, Washington decided to delay actual construction. It was 1920 before Congress again ordered the Corps to look into the intracoastal waterways. The River and Harbor Act of 21 January 1927 finally adopted the project, utilizing the existing private canal, and it was 11 December 1929 before the Corps of Engineers actually took possession of the waterway. The project called for a canal 8 feet deep and 75 feet wide.

Lieutenant Colonel Laurence V. Frazier was the district engineer when the Corps assumed control over the east coast waterway. His operation to clean up the channel was complex, massive, and efficient. As equipment became available to the colonel, he put it to work on the project. The United States snagboat *D–1* moved into Pablo Creek from the St. Johns River and headed south, clearing obstructions from the creek. By the end of the year, it had removed 46,810 snags, logs, and other impediments to navigation. A month later, the U. S. pipe-line dredge *Congoree* followed in the wake of the *D–1* removing fill from the channel.

The Army Engineer dredge, Congoree, 1936.

The Army Engineer dredge, Pullen, 1936.

Frazier sent the leased pipe-line dredge *Simons* up from St. Augustine to work its way north to meet the *D–1* and *Congoree.* Ahead of the *Simons* the leased derrick boat *Joeb* raised snags. At the year's end, the *Simons* had removed 113,611 cubic yards of material. The leased pipe-line dredge *Northwood* was added to the operations at the end of April 1930, moving into the waterway from Matanzas Inlet to dredge south. At the other end of the line, Lieutenant Colonel Frazier had leased the pipe-line dredge *Hester,* cleaning up the north end of Lake Worth while the *Venetia,* another leased pipe-line dredge, entered the Hillsboro Inlet to work north.

During the first year of operation, Frazier leased 10 pipe-line dredges and one derrick boat. Overall, seven pipe-line dredges and two derrick boats were in the waterway in full swing at the end of the year. The Jacksonville District Engineer also made arrangements for the dredge *Pullen* from the Norfolk District and the snag boat *Fayetteville* from the Wilmington, North Carolina, District to join his fleet. To handle the daily operations of this force, Colonel Frazier established field offices at West Palm Beach and at Daytona Beach.[22] When the project was completed, the waterways from Jacksonville to Miami had an 8-foot deep, 100-foot wide channel, except in a few localities where bridges reduced this width to 60 feet.

The Florida Coast Line Canal and Transportation Company's bridge over the canal in Palm Valley had been removed by the district engineers. It was replaced by a temporary pontoon bridge. Three years later, a new steel and concrete double-leaf bascule bridge was completed. This is the only bridge in Florida which is operated and maintained by the Corps of Engineers.

Palm Valley bridge over Intracoastal Waterway at Palm Valley is the only bridge still operated by the Corps of Engineers.
Courtesy Corps of Engineers.

Work on the east coast section of the Intracoastal Waterway was in progress during the depression years of the 1930's. The project received funds for emergency relief from the Public Works Administration during the years 1932-35. More than 500 jobs were provided through the addition of this relief money.

In 1938, an act was passed to increase the channel from Fernandina Harbor to St. Johns River to 12 feet deep and from 90 to 150 feet wide. This work was completed in 1941, just before the United States entered World War II. Shortly after the country's entry into the war, German submarines were prowling the Atlantic coast, sinking merchant ships in appalling numbers. It became apparent that the Intracoastal Waterway provided a safe channel for waterborne traffic along the east coast. Additional wooden barges were built. They were used to carry bulk freight at substantial savings in precious metal, fuel, and rubber which the nation needed for its war effort.[23]

After the war, the east coast waterways were deepened and widened to improve the transportation network. Today, the main channel from Jacksonville to Miami is 125 feet wide. It is 12 feet deep to Fort Pierce and 10 feet deep from Fort Pierce to Miami. There is a short reach of channel, 75 feet wide and 7 feet deep, running south of Miami for 63 miles, which was built between 1935 and 1939. The 1945 act to enlarge the waterways included this

Intracoastal Waterway passes tiny island in Baker's Haulover inlet at Bal Harbor north of Miami.
Courtesy Corps of Engineers.

southernmost section, but no work was done on it. An economic study in 1963 concluded that there was no justification for improving that section.

The Okeechobee Waterway was an outgrowth of the drainage and flood control development of Lake Okeechobee. Yet, it was also the fulfillment of Floridian dreams for an all-water route across the peninsula. The waterway utilizes the St. Lucie River, the St. Lucie Canal, Lake Okeechobee, and the Caloosahatchee River, linking the East Coast Intracoastal Waterways with the Gulf Coast Intracoastal Waterway.

Although the earlier Everglades Drainage District built canals in its area, these waterways were for the purpose of drainage, not navigation. When a permit was sought from the War Department to connect its four main Everglades canals to Lake Okeechobee, the Corps of Engineers, thinking of waterborne commerce, insisted that for the sake of navigation the lake waters should not be allowed to go below 14.5 feet above mean sea level.[24]

In 1927, after the hurricane of 1926, the state called upon the Corps of Engineers to widen and deepend the St. Lucie and Caloosahatchee waterways in order to increase their runoff capabilities. Lieutenant Colonel Mark Brooke, Jacksonville District Engineers, studied the situation before recommending that his district improve the Caloosahatchee and St. Lucie's drainage, from the Everglades Drainage District boundaries to the Gulf of Mexico and the East Coast Intracoastal Waterway, by straightening and dredging channels 80 feet wide and 6 feet deep. But, he qualified this by stressing that the state must construct and maintain similar channels from the western to the eastern boundary of the Everglades Drainage District and must include the necessary dams and locks for this undertaking. This plan would creat a cross-Florida waterway.[25]

Before much could be done on Brooke's recommendation, the hurricane of 1928 struck the lake with even more fury than the 1926 blow. The new district engineer, Lieutenant Colonel Frazier, presented additional measures to provide for the safety of the inhabitants of this region. The levees were to be raised higher and made more sturdy. A new belt-line canal should be dug around the south shore of the lake. The dredged material would be available for the southshore levee. This was a departure from the previous canals in Lake Okeechobee which had gone through the center of the lake from east to west. The belt-line canal would be longer, but it would also provide the necessary levee to protect cultivated lands south of the lake.[26]

Two years later, 53 miles of levee line and right-of-way had been surveyed along the southshore. Foundation tests had been made for the construction of hurricane gates at Moore Haven, Clewiston, Miami Canal, and Hillsboro Canal. Ninety miles of floodway and navigation channel in the Caloosahatchee River had been surveyed and the district's pipe-line dredges *Sarasota* and *Congoree* were raising muck along the proposed channel.[27]

By 1937, with the benefit of WPA funds, the project was 92 percent completed. A boat-a-cade left Fort Myers on 22 March, headed east, to officially open the Okeechobee Waterway. The group reached Stuart on the St. Lucie River the next day. Florida's east and west coasts were joined at last.

The completed project consisted of four locks (St. Lucie, Moore Haven, Ortona, and W. P. Franklin) along its 155-mile length. The main 8-foot channel varies from 80 to 100 feet in width. The secondary south channel from Clewiston to Belle Glade is shallower; 6 feet in depth. The Okeechobee Waterway serves both commercial barges and recreational boats. It has averaged 472,000 tons and 14,000 passengers per year from 1963 through 1973.[28]

As the Okeechobee Waterway developed, extending the east coast protected water route across the Florida peninsula to the gulf coast, west coast interests quickened to the idea of creating an extension along their coast. Congress responded to the pleadings of this group by authorizing the Jacksonville District to examine the feasibility of such a project, and in April 1939, Colonel Lewis H. Watkins submitted his evaluations. He sized up the situation as two different reaches of coastline. From the mouth of the Caloosahatchee River, north to the Anclote River, there were a series of protected inside water passages similar to those on the east coast. Continuing north from the Anclote to St. Marks River, however, there was a dearth of barrier reefs, leaving the shoreline open and exposed to the Gulf of Mexico.

The first section covered a distance of about 148 miles. All along this reach, the Gulf Stream flowed near the shore, bringing deep water close in. The result was that the open water was too rough for the safe use of small boats and barges, except in calm weather. Fortunately, the coastline was protected by barrier reefs and offshore islands. The colonel noted further that the southern reach was effectively bounded north and south by the deep-sea ports of Tampa Bay and Charlotte Harbor, both with depths of 30 feet, which would enhance the coast barge commerce. In addition, there were existing harbors for such traffic at the Caloosahatchee River, Caseys Pass (Venice Inlet), Manatee River, and Anclote River. Watkins recommended the proposed project as feasible.

The northern portion from Anclote to St. Marks River had a different geographic setting. While there was an absence of barrier reefs or offshore islands, the landslope into the gulf was gradual, about a 1-foot drop per mile to deep water. Over such a long, shallow bottom, the waves of the gulf were dissipated long before reaching shore. Under these circumstances, it was practicable and safe for small boats and barges to utilize the minus-12-foot contour when travelling this reach, under all but the most stormy weather brought in from the southwest or west. For this section, Colonel Watkins recommended only that the minus-12-foot contour from Anclote to St. Marks be adequately marked for navigation.[29]

World War II interrupted the colonel's plans for constructing such a waterway. It was not until the final months of the war that the River and Harbor Act of 2 March 1945 was passed, authorizing the building of the Florida section of the Gulf Intracoastal Waterway. The initial project plans specified a channel 9 feet deep and 100 feet wide from the Caloosahatchee to the Anclote River, including a land cut approximately 4.2 miles long, parallel to the shore just west of the city of Venice. As usual, the act included the provision that local interests must furnish the necessary land for the project.

The State legislature created a special taxing district in 1947 (the West Coast Navigation District) for the purpose of complying with the requirement for procuring land. The district included the six counties through which the project would pass: Lee, Charlotte, Sarasota, Manatee, Hillsborough, and Pinellas.

Boaters traveling south on the gulf coast Intracoastal Waterway will pass through the winding waterway through Indian Rocks Beach (top) in Pinnelas County, then under the Welch Causeway (center) in Boca Ciega Bay near Madeira Beach, and through a man-made link in the canal under the U.S. Highway 41 bridge (bottom) in Venice. Courtesy Corps of Engineers.

For several years after the passage of the act, the Jacksonville District was caught up in planning the new work and maintaining some of the channels already in existence. During this time there was a dramatic growth of population in Venice westward towards the gulf shores. As early as 1948, certain local groups opposed the original site of the waterway because it would deprive developers of desirable land along the gulf shore. There were several alternate proposals suggested, each with its own group of backers. Finally, in 1951, there was a consensus for a route known as C-1 which was put forth by the community.

Alternate Route C-1 departs from the original proposal at Roberts Bay just north of Venice. It trends landward toward the Seaboard Airline Railroad, which it parallels south around Venice, and then trends back to the coast, rejoining the original track north of Lemon Bay. This route is 5 miles long and moves inland a mile and half over the first track.[30]

It was June 1960 before dredging finally began on the waterway. The first section to be worked started at the Caloosahatchee and ran north between Sanibel Island and Pine Island up to Boca Grande. The following year, the reach from Tampa Bay through Clearwater Harbor to Anclote River was developed. In 1962, the dredging headed south from Tampa Bay through Sarasota Bay towards Venice. Two years later, the engineers began the northward trek from Boca Grande to Venice. The last segment to be constructed was Alternate C-1 Route, which was begun April 1965 and completed January 1967.

The Intracoastal Waterway serves a different purpose than the great inland water system of the Missouri-Mississippi or the Ohio Rivers. These latter networks have long distance commerce at the heart of their existence. From the beginning, the Intracoastal Waterway has been used by the short-haul operator. This has been partly because the east coast is served by several large bays reaching well inland; but, more importantly, is the fact that from Portland, Maine, to Jacksonville, Florida, there are many excellent deepwater seaports in contact with world trade. Therefore, the intracoastal system has been used only to reach the nearest seaport for trans-shipment to ocean going vessels.

By the time the Florida peninsula was sufficiently populated to warrant an intracoastal system, railroads and highway trucking competitors provided a stiff challenge to the waterways. Even the wartime expansion of barge traffic during World War II was not felt in Florida as much as it should have been because of the shallowness of most of the channels south of Jacksonville. Nevertheless, the value of protecting intracoastal waterways is a lesson that should not be lost upon the nation.

For the future, there are two users of the waterways: recreational boaters and barge carriers. As the threat of reduction of fossil fuel grows, the value of barge transportation as an energy saving measure becomes more real and striking.

CHAPTER 8

Building Harbors

COMMERCE, vital to the well-being of any society, was especially necessary to Florida because the natural products of the soil had to be brought to distant markets rapidly. In the latter quarter of the nineteenth century, the railroad was beginning to penetrate the peninsula, but railroads running to nowhere were poor risks for investment. Ideally, the rails should terminate at a deepwater port which would complement and extend overseas the interior transportation network. Even before the railroads actually arrived, Floridians were looking to the future, requesting Federal aid to develop useful ports along Florida's coast.

Assistant Engineer, Gustave Jaenicke arrived in Tampa on 13 July 1871 to survey the region for the development of harbor facilities on the west coast. Captain Andrew N. Damrell instructed Jaenicke to make a detailed report of his week's work every Saturday night, to be forwarded to him at Mobile, Alabama, whenever the mail system would allow. Jaenicke was given $1,938.40 for expenditures, which was to include the cost of the draughtsman's plotting after he had returned to Mobile. Damrell told him: "Your pay will be at first $150 per month; if satisfaction is given it will be increased to $200."[1] Jaenicke left Mobile aboard the Lighthouse tug *General Poe* for Apalachicola. There, he hired his surveying party, chartered a sloop, and set sail for Tampa Bay.

Tampa was a city of about 1,000 people, whose only contact with the outside world was through small, coastal vessels plying the ports of the Gulf of Mexico. Yet, in spite of its isolated location, Tampa supported 18 stores, a newspaper-printing shop, blacksmith, tinsmith, harness-maker, and two carpenters. According to Jaenicke, there was not much money in circulation and most busi-

TAMPA HARBOR

ness was on a credit basis. Yet, he expressed the conviction that, regardless of its isolation or lack of money, the town had considerable trade which would improve if the proposed harbor work were undertaken and the railroad came into the community.[2]

The main purpose of Jaenicke's visit was to examined the bay. Tampa Bay, between 6 and 9 miles wide, runs northeasterly into Florida peninsula 24 miles before it branches out Y-shape into two inner bays. Hillsborough Bay is the easternmost and Old Tampa Bay is the westernmost prong of the upper reaches of Tampa Bay. The Hillsborough River empties into its namesake at the head of the bay.

In the midst of Jaenicke's survey, a mid-August northwest gale set in while his party was working on the bay. By noon, it had become a hurricane force storm, blowing down trees, fences, and breaking boats from their anchorage. The surveying crew rode out the storm safely, but all of the beacons, tripods, signals, and many of the range poles had vanished. Jaenicke began again. He had no more than repositioned his equipment before another storm lashed the area, creating more damage. His expenditures were mounting rapidly from nature's destruction; still, he completed his work and submitted his recommendation on time.

Tampa Bay was not Jaenicke's problem. There was adequate water in the bay to meet shipping needs. Jaenicke was concerned with Hillsborough Bay because he was trying to improve the city's communications with the rest of the world. When he finished his work, he presented three estimates: a straight channel 200 feet wide from the 12-foot contour in Tampa Bay up Hillsborough Bay to the river and the city, at a cost of half a million dollars; dredge the existing sinuous shipping channel from its 5-foot depth to 12 feet, for $50 thousand more than his first estimate; or, by cutting the width to 100 feet, deepen the present channel for a quarter of a million dollars. Jaenicke thought the project was worthwhile.

Captain Damrell's superior in Mobile, Colonel J. H. Simpson, studied Jaenicke's survey and recommendations carefully before reaching a quite different conclusion. Simpson believed there was not enough business to warrant spending the large amount of money necessary to make Tampa accessible to the sea. It would cost far less (about $180,000) to build a short line railroad the 9 miles from Tampa to Passage Point than to dredge the channel. If the city truly desired to reach the sea, he recommended that it build a railroad and use Passage Point as Tampa's port.[3] With this negative recommendation, no action was taken on the Tampa project.

By the end of the decade, local interests once more prevailed upon Congress. Assistant Engineer J. L. Meigs had to spend the months of April and May 1879 examining Tampa, with its inner bays. He noted that the mail steamer from Cedar Key had no difficulty steaming up Tampa Bay, but once it rounded the interbay peninsula into Hillsborough Bay, the going became hazardous. The channel was tortuous, while the depth varied from 5 to 8 feet. Navigating from the entrance of Hillsborough Bay to the mouth of the river where the town's wharves were located, called for careful piloting as well as proper use of the tides. Meigs suggested either a straight channel 9 feet deep or dredging to the same depth, following the natural channel. The city's merchants favored the short, direct approach, but the engineer felt that the most economical permanent solution would be to enlarge the existing route.[4]

The following year, the Federal project for creating a 9-foot deep, 150-foot wide channel through Hillsborough Bay to the river, was passed by the River and Harbor Act of 14 June 1880. As had happened on other programs, the money appropriated each year was not enough to keep the engineers fully employed. The result was that funds from a new allotment were often used to repair the ravages wrought during periods of no work.[5] It will be recalled that the St. Johns Bar project was suffering similar financial ailments at this same time.

Meanwhile, Henry Bradley Plant brought his railroad system into Tampa. On 16 June 1883, the first construction crew arrived in the city to begin grading operations for the railroad which was coming across the state from Kissimmee. Three months later, the first two locomotives where shipped into Tampa aboard a three-masted schooner. By the spring of 1884, regularly scheduled runs between Tampa and Sanford were being made on the 115 miles of track in 4½ hours. A year and half later, Plant's railroad ran from Jacksonville to Tampa. On Florida's west coast, Plant linked his railroad up with the Plant Steamship Line sailing from Tampa to Key West and Havana.[6]

The port situation irked Henry Plant. While the original harbor improvement was still in process, his prized steamers, SS *Mascotte* and SS *Olivette,* had to anchor a mile or so off Tampa's waterfront to load and offload by lighter. In 1887, Captain William Black, while surveying the work at Tampa, reported that it would take extensive diking to make permanent changes in Hillsborough Bay. He recommended that the engineers concentrate on Old Tampa Bay.

With the dawn of a new year, 1888, Plant made his move, undoubtedly influenced by Black's findings. He hired all available town labor to build a bridge over the Hillsborough River and then to lay railroad tracks to Passage Point. Port Tampa, 9 miles from the city, became the deep water port with just over 15 feet depth offshore.[7]

Captain Black's recommendations and Henry Plant's actions had repercussions on the harbor work. Another survey in 1888 determined that the Hillsborough project should be modified to remain at the then dredged depth of 8 feet, while attention should be paid to improving Port Tampa on Old Tampa Bay. The River and Harbor Act of 11 August 1888, accepting the earlier recommendations, called for dredging a 20-foot channel to Port Tampa to bring deep water to Plant's South Florida Railway terminal.[8] By 1893, as a result of these various modifications, the channel to Port Tampa had been completed to the 20-foot level; work had ceased in Hillsborough Bay, leaving a channel 100 feet wide and 7 feet deep; and the Hillsborough River stood at a 9-foot depth. Thus, the terminal facilities along the river's edge of the city of Tampa exceeded the bay entrance channel's ability to provide traffic.[9]

No real action was taken to relieve Hillsborough Bay's problem before the Spanish-American War occurred in April 1898. Tampa was selected as the major port for embarkation because of its proximity to Cuba. The terrible limitations of a port 9 miles from the city, served by a single-track railroad line, need not be repeated. Conditions were abominable, but, at least they highlighted the necessity of improving the port facilities of Tampa's Hillsborough Bay, as well as Port Tampa. Both areas were subject to new legislation under the River and Harbor Act of 3 March 1899, which called for widening the channel and deepening it to 27 feet at Port Tampa, while improving Hillsborough Bay to 12 feet.[10]

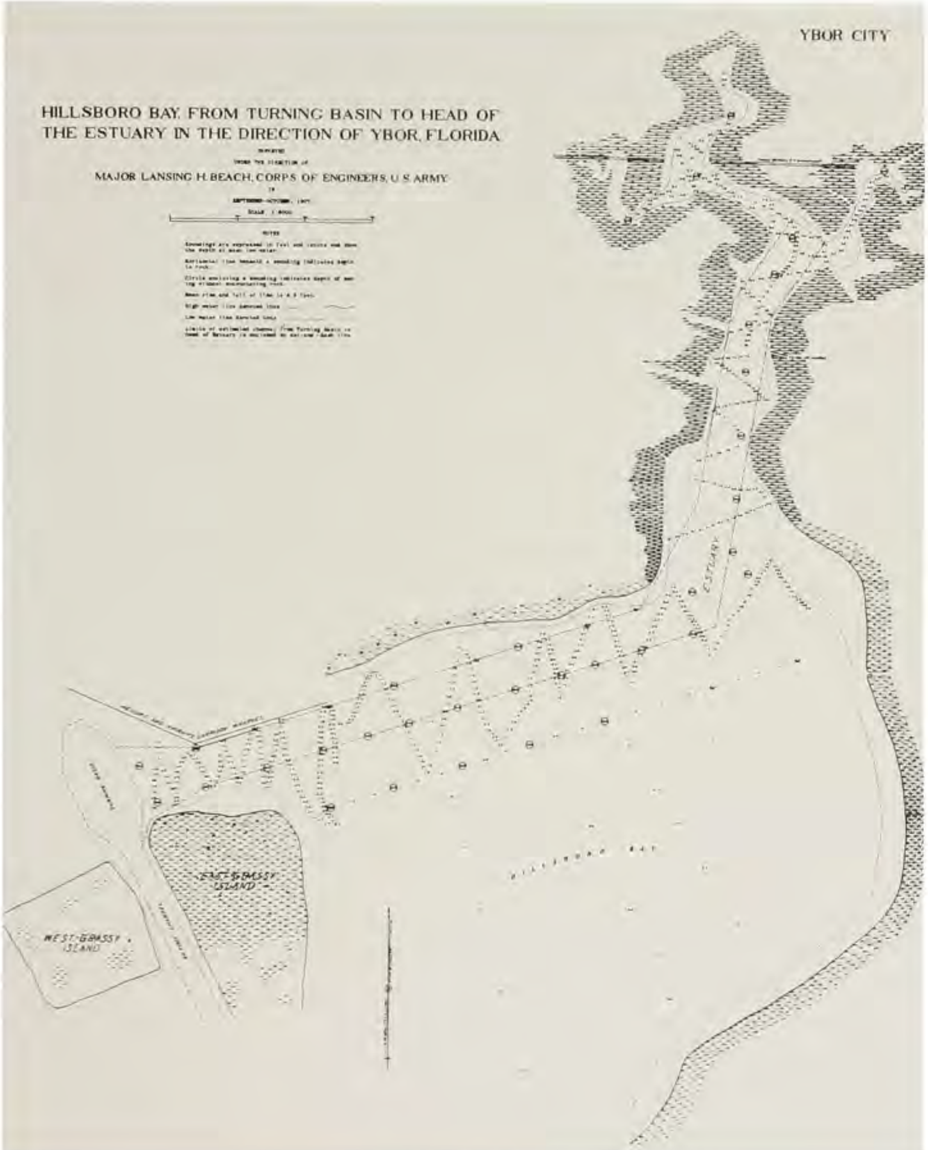
The development of the two inner bays became more than just an engineering problem of the most economical method of serving the city of Tampa. The improvement of each one became part of the economic struggle between the railroads and other business interests. Captain Herbert Deakyne reported the situation to the Chief of Engineers in 1902 when he informed him that the single railroad line controlled the docks of Port Tampa, and that the only way to move goods from the wharves to Tampa was over South Florida's tracks. Deakyne went on to say: "It is stated that the rate for moving certain kinds of merchandise from a ship at Port Tampa to Tampa is about equal to the rate on the same merchandise from New York to Tampa direct by water."[11] A year later Colonel Charles J. Allen, senior member of a board of engineers studying the Tampa situation reported: "It was clearly shown at the public hearings . . . that, owing to excessive wharf and freight charges, it is practically impossible for the shippers of Tampa to do business through Port Tampa."[12] Therefore, these merchants depended entirely on the Hillsborough channel for their economic well-being.

The River and Harbor Act of 3 March 1905 modified the depth of the channel in Old Tampa Bay from 27 to 26 feet, and increased the Hillsborough channel to 20 feet. Meanwhile, the Atlantic Coast Line Railroad, which had acquired the South Florida Railway, had dredged several 27-foot cuts from the main Old Tampa Bay channel to serve its terminals at Port Tampa.

Two years later, District Engineer, Major Francis R. Shunk reported that the 20-foot channel from Tampa Bay through Hillsborough Bay to a turning basin just before the mouth of the river, was almost complete. Bedrock in the Hillsborough River limited its channel to 10 feet. He also pointed out that the Tampa Terminal Company had plans to develop a rail terminal and wharves on East Grassy Island (now known as Seddon Island) which runs along the eastern side of the Hillsborough channel. Shunk added that "this company is really the Seaboard Air Line Railroad under another name."[13] He was sure that the railroad would need to make full use of its new port facilities just for its own business.

Jacksonville District Engineer, Captain George R. Spalding summarized the Tampa port situation at the end of 1909 when he said that the Government dredging of the 20-foot channel in Hillsborough Bay benefited just two railroads. The Seaboard Air Line Railway owned Seddon Island, which could be reached only via its own railroad bridge; and the Tampa Northern Railroad owned all of Hookers Point, which was connected to the city exclusively through its rail line. Further, in 1907, the Tampa Northern dredged a spur cut from the Government's main channel, 2,600 feet to service its Hookers Point terminal.

Spaulding pointed out that if nothing were done, all of the steamer lines to Tampa would be forced to use either of these two railroad's facilities. The fact that all three wharves (one at Port Tampa and two in Hillsborough) could be reached only on the tracks of the railroads concerned, meant that there was no possibility for competing wagon services between the wharves and the city. However, the firm of Hendry & Knight, well aware of the situation, dredged eastward from the turning basin into the waterway, separating the city from Seddon Island so that it could build wharves on the north or Tampa side. Hendry & Knight succeeded in clearing a 20-foot passage for 2,200 feet and constructed its own wharves along this reach. Its wharfage and warehouse rates were reasonable. Soon, several steamship lines, including the Mallory Line, Southern Steamship Company, and Penn Line were leasing the facilities. There was no unoccupied space available by 1909, yet, the demand for additional waterfront docking was increasing as the city's commerce expanded.



Hillsboro Bay, from turning basin to Ybor City.
Courtesy Corps of engineers.

Captain Spalding estimated that at least 12 thousand more feet of docking facilities were needed. It was a question of where the wharves could be built. An extension of the Hendry & Knight channel eastward would provide somewhere on the order of 2,000 feet. The low-lying bedrock in the Hillsborough River eliminated any river work. The only additional area available was the estuary just east of the Hendry & Knight channel which ran north towards Ybor City, a subdivision of Tampa. That was the region selected by Spalding as the next expansion of Tampa's harbor.

The Jacksonville District engineer was deeply concerned that his proposal should benefit the public. Therefore, he offered some rather unusual suggestions. He felt that the Ybor Estuary should be dredged to a width of 300 feet, with harbor lines established for the protection of the public interests. Spalding recognized that the dredged materials would offer reclamation benefits to low-lying lands which would probably be obtained by the wealthier landowners. He recommended that the work should be undertaken by the Government without imposing any requirements upon the riparian owners. Further, if the work were let by contract, the bidders could make private arrangements for the estuary spoils, which should reduce the cost of the work to the Government.[14]

Colonel Dan C. Kingman, Southeastern Division Engineer, was the first in the chain of command to review Spalding's comments. He agreed with the district engineer that it was necessary to increase Tampa's facilities. He noted that the proposal would create a deep water channel where a shallow marsh land existed. This would cause land, practically worthless, to zoom in value to something like $1.2 million through no effort on the part of the owners. Kingman thought the landowners should shoulder some of the burden of expense for such a project. He went on to include the municipal government; its powers to tax would greatly benefit from such a proposal. In the interest of the general public, Colonel Kingman felt that all should share the cost, with the Federal Government providing between 25 and 50 percent of the expenses.[15]

The Chief of Engineers, General W. L. Marshall's, recommendation was the one finally accepted by Congress. He suggested that the city should construct wharves of at least 1,400 feet along Ybor channel which should be open to all at reasonable rates and regulations. The municipality should control property along the waterfront for a depth of 700 feet on both sides of the channel, so that free access could be had to the slips by the general public. Further, until the Secretary of War was assured that the city of Tampa would meet these conditions, the Corps of Engineers was not to expend any funds beyond those required for the new turning basin at the eastern end of the Hendry & Knight channel.[16] These restrictions were contained in the River and Harbor Act of 25 June 1910.

This 1910 act established a depth of 24 feet for the Hillsborough channel. It had the Corps of Engineers assume responsibility for the Hendry & Knight channel and for the outer 50 feet of the Tampa Northern Railroad cut. These two acquired channels, deepened to 24 feet, were to be extended to a junction at the mouth of the Ybor Estuary. The Hendry & Knight Cut became known as Garrison Channel; the Tampa Northern Cut became the Sparkman Channel. Upon completion of all of this work, Seddon Island would have three channels completely surrounding it.

Ship runs aground in Tampa harbor in 1970. Courtesy Corps of Engineers.

Tampa harbor, Florida's busiest in total tonnage. Courtesy Corps of Engineers.

The city submitted satisfactory evidence of its purchase of waterfront property, for a depth of 700 feet from the water's edge along Ybor Estuary, to the Secretary of War 18 April 1911. When the development plan for the estuary was approved 8 August 1913, the project was activated, creating the present day facilities.[17]

The River and Harbor Act of 22 September 1922 combined the inner bay projects into one unit, known as Tampa Harbor, with a standard depth of 27 feet throughout Tampa Bay. By 1928 this goal had been met.

Until 1930, dredging had been confined to the inner bays. Now Tampa Bay needed to be improved to provide safe passage from the gulf to the city. Egmont Channel was dredged to a depth of 29 feet by 1932, and, later, Mullet Key Channel was deepened. Throughout the 1930's, channels were continually widened or deepened, but the basic design of Tampa's waterfront facilities remained the same. The last new project was begun in 1962 when the district assumed maintenance for the Port Sutton Channel and turning basin on the easternmost reaches of Hillsborough Bay.

By 1975, most channels were authorized to be dredged to depths from 40 to 46 feet with the two interior (Seddon and Garrison) channels 30 feet deep. The Hillsborough River remained at 9 feet. The overall project was 19 percent completed during fiscal year 1975. These waterways serve Tampa's 78 commercial piers and wharves. Metroport (the municipal terminals on Ybor Channel) has a slip 778 feet long, 250 feet wide, with wharves on both sides. The Tampa Port Authority has installed an 800-head cattle-loading wharf east of Sparkman Channel. Due to the Corps of Engineers, the conditions of waterfront monopoly are a thing of the past, and, today, 10 of the privately owned terminals are now open to the public.[18]

Besides the St. Johns River and Tampa Bay harbor constructions, the Corps of Engineers played a major role in developing the port of Miami. There had been a sprinkling of settlers along the southern coast of the peninsula in the 1830's, but the initial Indian raids during the Second Seminole War drove most of these people from the mainland to the more populated Keys to the south. However, after Navy Lieutenant Powell established Fort Dallas on the Miami River in 1838, there had been a few settlers clustered about this protected position, waiting for peace to come so that they could return to their homesteads. Fort Dallas was one of the principal staging points for the soldiers and sailors moving into the Everglades, pursuing Indians during the Florida War. Because the area had very poor communications with the rest of the state, there was little growth or development around the shores of Biscayne Bay during the nineteenth century. All of this changed when Henry M. Flagler brought his Florida East Coast Railroad south to Miami. Even before his railroad arrived, he requested congressional aid for developing Biscayne Bay.

District Engineer Major Thomas H. Handbury's preliminary examination of Biscayne Bay in February 1895, reported that the bay was 26 miles long with an average width of 6 miles. Half of the bay had a low water depth of 6 feet or less. The remaining portion ran to less than 10 feet, with occasional holes with soundings of 13 feet. The mean tide rose and fell a foot. The west shore was coral rock, rising at times to 10 feet above water level and running back to the Everglades about 6 miles inland from the coast. Among the several short streams flowing from the glades into the bay, the most significant was the Miami River. Four miles upstream from the mouth of the Miami River there was a quarter-mile rapids, with a fall of 4 feet, marking the boundary of the Everglades.

The east side of the bay was bounded by coral reefs along its entire length. Most of the reefs were above high water, with the soil upon them supporting a thick growth of mangrove, saw palmetto, and similar vegetation. The rest of the reefs were covered with sand, which was exposed only at low tide. Throughout this chain of coral were openings or cuts, connecting the bay with the ocean beyond. Three miles to seaward, another reef ran parallel to the first which was awash during high tide. Between these two strips of coral lay Hawk Channel, permitting an inside passage with 12 feet of water from Cape Florida to Key West. Unfortunately for sailors, there are numerous rock formations scattered throughout Hawk Channel.

Following this overview of the region, Major Handbury described in detail the three principal cuts permitting access to the ocean. The northernmost was Norris Cut, separating Miami Beach from Virginia Key. This channel, almost opposite the mouth of the Miami River, was the most direct route for exit from the Miami settlement.

Bear Cut was a mile and a half south of Norris Cut, dividing Virginia Key from Key Biscayne. Bear Cut was twice as wide as Norris, yet it also had 4 feet on the bar. However, Handbury was told that Bear Cut had 4 feet of sand over the coral at its bar, making it possible to dredge an 8-foot channel without using explosives.

The southernmost opening was Cape Florida, traversing the lower end of Key Biscayne. Actually, there were three narrow channels exiting the bay across the low sand flats which covered the coral reef. Two of these outlets carried 10 and 12 feet of water. The difficulty was that vessels using Hawk Channel had to make a twisting, tortuous course over the shoal flats before reaching the exit channels. This route could be dredged to a depth of 11 feet, but the exposed position on the shoal buffeted by drifting sands and prevailing storms, could not be maintained except under constant care. It was concluded that Bear Cut offered the best approach to Biscayne Bay and Miami.

Major Handbury commented that, unless extensive blasting was done, Biscayne Bay would not be a port of call for the normal Gulf of Mexico-New York trade, because those seagoing ships drew far too much water to use Miami's port. However, he did expect that improvements in the bay would create a situation where light draft vessels would engage in trade between the Caribbean Islands and south Florida. In a prophetic vein, he stated that "as soon as better facilities are provided for reaching the locality there is no doubt but it will become the most popular of our winter resorts and the headquarters for pleasure cruisers from this country among the adjacent islands."[19]

At the time of the survey, the produce of the region was carried south to Key West in shallow draft sailboats where it was transshipped by steamer to New York. There was mail service tri-weekly from Lemon City on Biscayne Bay to Lantana on the southern edge of Lake Worth. The mail was carried by two mules hauling a hack. It took two days to travel the 60 miles. But, the major noted that, in a few weeks, the Florida East Coast Canal Company would have its canal open from Lake Worth to the head of Biscayne Bay. Major Handbury was optimistic that this area was beginning to develop and that it held great promise for the future.[20]

A year after Handbury's report, Flagler's railroad reached Miami. Henry Flagler had grandiose plans for his Florida empire. He brought his railroad right up to the banks of the Miami River, and where the tracks ended, he built a wharf about half a mile upstream from the mouth of the river. Then he commenced dredging in Biscayne Bay.

In August 1896, Henry Flagler fired off a letter to the Secretary of War, listing his accomplishments and requesting aid for his Biscayne Bay project. Beginning in February 1896, his company had dredged a 9-foot low water route to the Cape Florida channel. His excavations included a 90-foot wide cut, with the spoils being deposited on the channel banks, except near the mouth of the Miami River, where he used lighters to carry the material out to an unused portion of the bay. Writing in August of that year, Flagler said that in 2 weeks he could bring the *City of Richmond*, a 233-foot-long, 50-foot-beamed steamer, drawing 7½ feet of water, up to his railroad dock. He concluded saying, "We would like more water... and believe that from 12 to 15 feet can be obtained at moderate cost, and that the work already done can be much improved and protected."[21]

Lieutenant Colonel William H. H. Benyaurd was the district engineer when the second survey of Biscayne Bay was made in April 1896. Benyaurd concurred with Handbury that it would be impossible to go beyond 12 feet in depth anyplace in the bay without extensive use of explosives. For simple dredging down to coral rock, however, Colonel Benyaurd recommended that the Cape Florida Cut be used, because it was the only route which could be dredged to near 12 feet. If a harbor deeper than 12 feet were to be developed, Benyaurd felt that Norris Cut would be the most practical exit.[22]

When Assistant Engineer James H. Bacon began the third survey, 15 August 1899, he pushed his crew in a race against time. Yellow fever had broken out in Miami and he knew that it was only a matter of days before the city would be quarantined. Bacon was right; the quarantine suspended all work on 30 September and it remained that way until 17 January 1900. He finished his survey a month later.[23]

By 1900, Miami had 2,500 inhabitants, supported by a rather large hinterland population which had followed the railroad building south, establishing settlements all along the fertile land and now opened to northern markets. Flagler's arrival in Miami had done everything that Major Handbury had predicted. Winter vegetables which used to go to Key West for transshipment were now sent directly to New York by rail. Flagler built a large hotel at Miami and another at Nassau, and he joined the two by a tourist-carrying steamship line. It was soon apparent that the original wharf on the Miami River was too restrictive, so he built another on Biscayne Bay and extended his tracks to it. Because of this growth, a board of engineers was set up to examine the feasibility of creating an 18-foot harbor at Miami.[24]

Of the three natural cuts in Biscayne Bay, the Board felt that Norris Cut was the most practical. Yet, as they studied all of the factors noted by James Bacon, it became apparent that a better route would be to cut through Miami Beach, about a mile north of Norris Cut. Here, the 18-foot contour line bent in closest to shore, offering the shortest distance to deep water. Because this cut would interfere less with the littoral current, the length of the jetties needed to keep the channel free from the shifting sand would be shorter. The Board made its decision to strike out directly for the sea, cutting into the southern portion of Miami Beach.[25]

The result of all these surveys was the River and Harbor Act of 13 June 1902, which stipulated that the Corps of Engineers would create an entrance to Biscayne Bay and build a refuge basin near the entrance on the bay side of the cut. All of this was contingent upon the Florida East Coast Railway Company constructing, at its expense, a turning basin 1,600 feet long and 500 feet wide adjacent to the wharves, and digging a channel 85 to 100 feet wide across the bay to connect the two basins.

On 15 October 1902, the railway company agreed to the terms. Between March 1903 and January 1906, the company built its basin, 1,000 feet long and 500 feet wide, with a depth of 10 feet off the wharves. It also dredged a channel 12 to 14 feet deep across the bay. What the company did not do was remove the coral rock below the sand. Still, the Florida East Coast Railway Company spent over $200,000 on its portion of the harbor work.

The engineers began work on the cut in March 1904, after the railway company had completed its channel across the bay. The district's work became known as Government Cut, and the newly created island (formerly the southern tip of Miami Beach) became Fisher Island. Initially, crews were digging up rock across land, while others were laying rock for the jetty reaching out into the ocean on the north side of Government Cut. This pier, jutting out 1,400 feet from shore, was raised 5 feet above sea level, but one breakwater was not enough to keep the sand from eddying into the cut. Three years later, the engineers decided to construct a south jetty to provide more scouring action. Before the south pier was half completed, the drift of sand into Government Cut was checked, and, soon thereafter, the scouring action began which kept the channel clear to the coral rock. The task was finished in 1911 with a depth of 19 feet at the bay end and 20 feet at the ocean side.

A year earlier, the Chief of Engineers had noted that the original plan by the Board of Engineers called for a 300-foot wide channel; however, funds had been allocated for only 100 feet. He warned that the present depth of the channel meant little if the width restrictions were so stringent that only the small draft vessels would dare to use Government Cut. His comments were heard, and, 2 years later, the River and Harbor Act of 25 July 1912 modified the existing project to provide for an outlet from the bay 300 feet wide.

Meanwhile, the Florida East Coast Railway Company had stopped its work almost as soon as its dredging operations ran into the more expensive task of blasting rock. The district engineers were in the precarious position of being authorized to dredge an 18- and 20-foot refuge basin and entrance channel, while the remainder of the harbor work stood at 12 to 14 feet. Obviously, all of this effort would be to no avail unless the private portion of the work was completed. After repeated attempts to get the railway company to continue its work, the district filed suit in Federal court to enforce performance on the original contract. When the case was heard in July 1914, it was decided against the Government.

The situation was ominous for the business interests of Miami. Where would they be if the district placed the harbor work on its inactive list? Port growth would be stifled. The voters of Miami ap-

Ships waiting off Government Cut to enter Miami harbor, 1925. Courtesy State Photographic Archives, F.S.U.

'Prins Valdemar' overturned in Miami harbor January 10, 1926. Courtesy State Photographic Archives, F.S.U.

proved a bond issue to build the terminal facilities required by the previous river and harbor acts. With the money, the city agreed to construct wharves on the bay, create a turning basin in front of the municipal pier, and dredge a channel 18 feet deep and 100 feet wide across the bay to connect with the Government's work. When the Secretary of War accepted Miami's proposal, the Jacksonville District began its new phase of harbor work in Biscayne Bay.

The district and the city turned to improving the port. Government engineers extended the north and south jetties another 405 feet by 1922, and 20-foot dredging was completed the following year, at the same time both sides of Government Cut were revetted. Meanwhile, the city carried out its share of the work. In addition, a channel 13 feet deep and 80 feet wide had been dug to connect the Florida East Coast Railway Company's basin with the new municipal turning basin. Miami's port was open for business.[26]

But, even the most optimistic booster of the city's waterfront could not have forseen the frantic land boom which burst upon south Florida in the early years of the Roaring Twenties. Thousands of people flocked to Miami for some of the action. One grandiose scheme followed another, with whole cities being placed on blueprints to be carved out of swampland. Contrary to popular conception, the Florida land boom was not all paper and pipedreams. For a while, it was a builder's paradise.

Construction material poured into south Florida from everywhere. Lumber, nails, roofing, plumbing fixtures, window frames; everything necessary to turn dreams into reality. The railroads began routing more and more freight cars onto southern tracks to meet the demand. Soon, even the refrigerated produce cars returned from the north carrying building materials. Eventually, the railroads had to place a freight embargo on south Florida because they could not keep up with the pace.

Sailing vessels of all kinds were employed to cater to the boom. Biscayne Bay became the port of barks and barkentines, as well as steamers. The parade of ships through Government Cut became a steady stream with harbor tugs plying back and forth, ceaselessly escorting sailing ships into and out of Biscayne Bay. Then, on 10 January 1926, the four-masted barkentine *Prins Valdemar* was towed into Government Cut on its way to becoming a floating hotel off Miami's shore. Suddenly, a gust of wind caught the *Prins Valdemar* broadside; she lurched, snapped her tow lines, slued across the channel, turned turtle, and sank. Government Cut was blocked to all traffic.

The settling of the *Valdemar* ground Miami's construction boom to a halt. Dredging around the hulk was attempted, but the close proximity of coral rock stopped that operation. Blasting could have been employed, but it would have been too dangerous in such a restricted area with the heavy concentration of ships held in port by the disaster. Finally, salvage crews took over, before freeing the *Prins Valdemar* from her unwelcomed resting place.

Many of the vessels arriving after the incident dropped anchor at sea to offload their cargo onto lighters to be carried ashore; a very costly, time-consuming procedure. Those ships not yet committed to Miami's port were sent elsewhere; the ships in port sat gathering barnacles and marine growth, and losing business. The *Valdemar* effectively ended Miami's building boom.[27]

The *Valdemar* was the first of three disasters to visit Biscayne Bay. The hurricane in September of that year swept in from the Atlantic, bringing destruction and death to south Florida. A section of the north jetty, as well as huge portions of the revetment along Government Cut, crumbled before the onslaught of the sea. But, the Jacksonville District returned to the task, and by the end of the fiscal year, the project was 61 percent completed. The hurricane of 1928 was not as destructive to the port projects. The full brunt of its fury was reserved for the Lake Okeechobee area, inland. Still, it was 1933 before all the earlier projects in Biscayne were completed.

As the nation slowly recovered from the Depression, a new interest developed at Miami's port – cruise ships carrying tourists to the Caribbean and Bahama islands. Hardly had this trade begun before World War II stopped such luxury traffic. During the war years, while Tampa and Jacksonville boomed with defense shipping, Miami languished. It had no war-related industry to sustain it. With the coming peace, the traffic in Biscayne Bay picked up again.

Post war shipping brought with it larger vessels and more problems. Miami's bar pilots complained of the constant hazards they faced in bringing these ships into port. The first bone of contention was the 500-foot bar channel. Although the bend approaching the channel was 850 feet wide, the course change was about 45 degrees, which necessitated bringing large ships around to their new headings in shallow waters. The pilots had to line up with the jetty entrance, without the benefit of range lights to help align the ship properly. Usually, ships approached this turn under crosswind and crosscurrent conditions, and the limited water under the keel made the vessels respond sluggishly. There had been a number of groundings or near grounds to emphasize the dangers.

The second hazard occurred just as the ships entered the jetty channel. Once again, the normal southward flowing current and crosswinds pushed against the vessel as it approached the protected channel. When the bow entered the 300-foot channel, the

Miami port terminals in 1962 (bottom of picture); Government Cut channel leads to ocean; huge spoil area at right is Dodge Island. Courtesy Corps of Engineers.

cross forces acting on it would cease, while the stern would still be under the influence of the southern push. The result was a twisting of the ship's head to the north, toward the jetty. Frequently, the pilots had to resort to emergency full speed to gain control of the vessel in order to bring the ship's head back to channel alignment. Placing a large vessel under emergency full speed in the narrow confines of the jetty channel was a nervewracking experience which most pilots considered beyond the call of duty. They wanted the engineers to do something about these phenomena.

Piloting dangers were not over, however, even after the ship was under control in the jetty channel. Upon leaving Government Cut to enter the bay proper, the vessel was again exposed to crosscurrent at ebb tide from Meloy Channel. This current had the effect of pushing the vessel onto the south side of the channel where, once again, a pilot often had to rely on increased speed to gain control to keep his ship tracking correctly.[28] The situation needed attention before shipping interests left Miami for better ports.

District Engineer, Colonel Paul D. Troxler listened to the pilots' views before he presented his recommendations. The Chief of Engineers accepted Troxler's report asking Congress to widen the ship channel and to enlarge the turning basin. The River and Harbor Act of 14 July 1960 was the result of Troxler's plan, and his project was completed in October 1964.

MIAMI HARBOR

Meanwhile, the local interests in Miami were divided on plans for improving the city's terminal facilities. The existing wharves were located on the mainland coast just north of the downtown area, reached by a 30-foot channel. Just to the north of Miami was a new rival harbor at Port Everglades, with a 35-foot channel depth and a much shorter reach to the deep waters of the Atlantic. Everyone concerned knew that something must be done to improve Miami's facilities, but the question was: Where should the new facilities be located?

During World War II, under the impetus of national defense, the Corps of Engineers had developed a plan whereby Miami's port would be relocated on Virginia Key. This would have put terminal structures just inside Government Cut, eliminating much cross-bay travel for ships. A major feature of this move was the placement of an airport on the same key, which would increase the versatility of the project. Nothing was ever done about this proposal, but it provided a guide to the solution of relocating Miami's port in the 1950's, except that the later plan called for the port facilities to be built on Dodge Island.

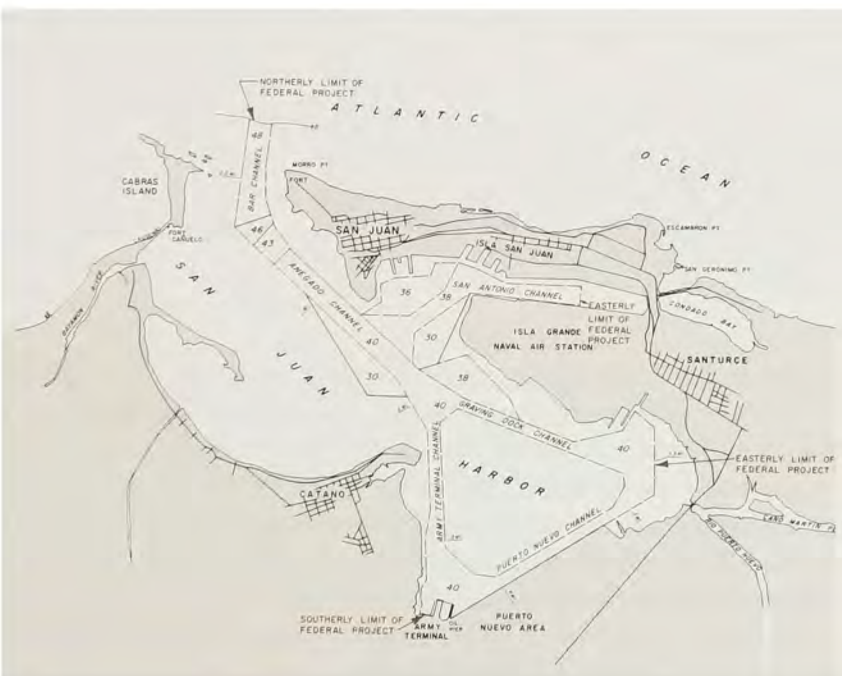
This man-made island, created by the disposition of dredge spoils north of and adjacent to the ship channel, stood in Biscayne Bay just off the city. Opposition to Dodge Island was primarily based upon the aesthetic injury a shipping terminal in the bay would have upon the harbor appearances. Eventually, the proponents won and Dodge Island became the port terminal. Construction was carefully planned so that the structure did not meet the fate predicted by the opponents of the plan.

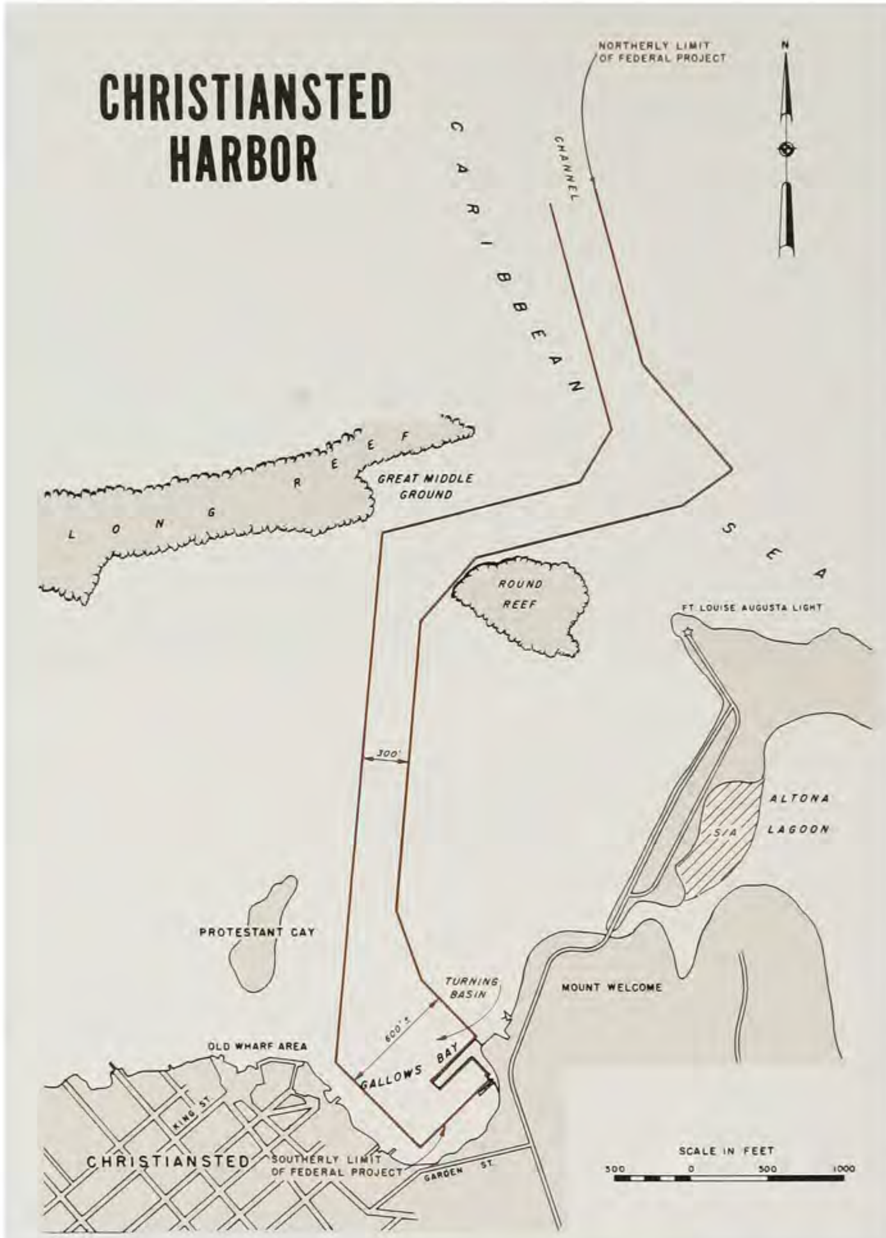
During 1975, the Miami harbor project to deepen the approach channel to 38 feet and to provide 36 feet within the bay, was 80 percent completed. There are 82 piers and wharves included among the harbor terminals scattered around the bay at Dodge Island, Fisher Island, Miami Beach, MacArthur Causeway, the mainland, and on the Miami River. In addition, there are numerous recreational marinas housing a large concentration of pleasure yachts gathered in Biscayne Bay.[29]

The district's harbor works moved 1,100 miles east of Miami when Puerto Rico and the Virgin Islands became part of the Jacksonville district in 1951. San Juan, Puerto Rico, was the principal harbor of the island group. Before the American occupation, the Spanish had dredged a 25-foot channel 400 feet wide into the bay, past the ancient El Morro Fortress, to an anchorage basin on the south side of San Juan Island. The Spanish engineers built bulkheads and an 18-foot deep berthing area at the water's edge.

Dodge Island in 1972, now one of the world's busiest cruise ports (note liners docked at top of photo), replaced Miami's old downtown seaport.
Courtesy Corps of Engineers.

SAN JUAN HARBOR





The first project by the United States engineers, completed in 1911, deepened the channel entrance to 30 feet and widened it to 500-600 feet. The anchorage basins were dredged to 24 and 50 feet under the same authorization. During World War II, the Army Terminal Channel and basin were constructed with military funds. When the Jacksonville District assumed responsibility for the harbor all that was necessary was routine maintenance. The district's dredge *Hyde* removed 836,606 cubic yards, bin measurement, from the Army Terminal Channel and turning basin in the spring of 1951.[30]

District Engineer, Colonel Elmer K. Kirkpatrick recommended modifying the San Juan Harbor project in November 1955, so that the ocean entrance channel would have a 45-foot depth, the Army Terminal Basin 36 feet, and a new channel to be cut from the Army Terminal Basin to the eastern end of Graving Dock Channel. At the juncture of these latter channels, Kirkpatrick requested an additional anchorage be constructed about 3,200 feet long, 1,550 feet wide, and 36 feet deep. His program was authorized on 3 July 1958.[31]

Four years later, the general and detail design work had been completed and dredging commenced. During 1963, four dredges were at work in San Juan harbor; *Gahagan No. 18, Jamaica Bay, Allan Judith,* and *Crest.* These four vessels removed 7,340,253 cubic yards in 1963. The following year, the dredge *Cartagena* was added to the project, and 98 percent of the work was completed. The project was finished 10 May 1965.[32]

Farther east at Christiansted Harbor, St. Croix, Virgin Islands, a project had been authorized, a year before the Jacksonville District became responsible for the island, to provide an approach channel 25 feet deep and 300 feet wide from the Caribbean Sea to the turning basin just offshore. However, funds were not provided and the project languished. An economic restudy in 1957 reported that there was no justification for a 25-foot approach depth, and in 1961 the plan was modified to 16 feet. It was 1962 before the dredge *Trident* was employed on Christiansted Harbor, and the task was completed 5 April 1963.[33]

Seaports are gateways to world commerce. The Jacksonville District's harbor building activities opened these gateways for the people of its region, and brought economic well-being to remote, isolated communities. Of all of the tasks performed by the Jacksonville District, this endeavor touched the lives of all inhabitants more directly than any other.

CHAPTER 9

Ship Canal – Barge Canal

THE LONG AWAITED MOMENT arrived on 19 September 1935. President Franklin Delano Roosevelt pressed a telegraph key in his Hyde Park, New York, home, detonating an explosive charge in Florida, and officially opening construction on the Cross-Florida Ship Canal. The event was received with mixed emotions by Floridians. Generally, those living along the proposed route in the northern part of the state were jubilant; but, south Floridians were worried that the venture might turn their land into a desert by damaging their water supply.[1]

Of all the engineering projects undertaken in Florida, none has had a longer, more turbulent, or emotional history than the Cross-Florida Canal. Time after time, Congress, at the pleading of local interests, had the Corps of Engineers conduct surveys for a feasible water course across the peninsula. In all, 28 routes were examined.

Even before the territory traded hands from Spain to the United States, James Gadsden wrote to John C. Calhoun recommending an investigation of a route from the St. Marys River in Georgia to the Suwannee River in Spanish Florida.[2]

Immediately after the exchange of the territory, Americans began to think and write of a waterway connecting the Atlantic with the Gulf of Mexico. All three authors (mentioned in Chapter Two) writing about Florida in 1821 and 1822, presented proposals for water transportation across the peninsula. James Grant Forbes suggested a canal from the St. Lucie River to Lake Mayaca. William Darby's book contained a letter from a supporter for a canal project to his friend in Charleston, South Carolina, proposing that the St. Johns River be united with either Tampa Bay or Apalachicola Bay. William H. Simmons wrote of the desirability of connecting the St.

Johns River with Indian River, Lake Mayaca, and the Caloosahatchee River. The principal reason for this engineering feat was to eliminate the sea journey around the peninsula, through the most dangerous stretch of rocks, reefs, and shoals of all the coasts of North and South America.[3]

In December 1824, Florida's Legislative Council sent a memorial to Congress to consider the construction of a canal across the territory, from the Suwannee River to the St. Johns—or any other place which may be more eligible. The council stressed three advantages which would be listed over and over in pleas directed to Congress during the next century: First, such a project would develop the land; second, commerce between the Atlantic coastal and western states could be increased; and, third, the system would enhance troop and supply movements during wartime.[4]

This action was just the beginning of the campaign for a canal. Two months later, Florida's first territorial delegate to Congress, Richard Keith Call, wrote to the chairman of the Committee on Roads and Canals to bring to his attention the advantages of an inland waterway between the Mississippi and the Atlantic. Call thought the Florida route should run from St. Marks to the Suwannee River via a 60-mile canal, then from the Suwannee to the St. Johns River through a 20-mile cut, dug between the two. According to Call, the whole thing should be completed with an expenditure of a half million dollars.[5]

On 28 November 1825, Joseph White, who had replaced Call as the territorial delegate, wrote to the Secretary of War on the subject. He listed not only the advantages to the southern states, but the Federal Government's gain from the sale of public land. The Secretary of War replied that there was considerable interest in such a scheme, but that there was neither the means nor the personnel available for such an undertaking.[6]

Florida's Legislative Council was not content with writing memorials. On 8 December 1825, it appointed a three-man committee to investigate the possibility of such a waterway.[7] The members were: James Gadsden, an engineer with close connections with the Corps of Engineers; William H. Simmons, who had expressed his views positively toward some route; and his friend, Edward R. Gibson. It was hoped that these three men would make the canal a reality.

The first thing Gadsden and Gibson did was petition Congress for aid. They felt that the Corps of Engineers should undertake a study to determine the most direct route and to compute the cost of such a venture. Gadsden and Gibson went further. They suggested that, if for some reason the project would not be assumed by the

Federal Government, then Washington should at least invest some proportional amount in conjunction with a private joint stock company.[8] Of course, the company would have access to the information gathered by the engineers.

Two days after appointing Gadsden, et al, to investigate the possibilities of a canal, the Florida Legislative Council wrote to Congress once again on the subject. The memorial asked for a canal wide and deep enough to accommodate Mississippi River steamboats so that these vessels could extend their travels to Savannah or Charleston.[9]

Floridians were not the only Americans interested in the water connection. Congressman Daniel Webster submitted a resolution asking for an examination of the peninsula to determine the feasibility of a project so beneficial to the nation as a whole.[10]

This barrage of requests bore fruit. On 3 March 1826, Congress passed an act providing for a survey for a canal across Florida. The Board of Internal Improvements drew up the plans which Major Paul H. Perrault executed when he commanded the survey brigade discussed in Chapter Two.

Joseph White and James Gadsden were political enemies, even if they were on the same side with respect to the Florida canal. White complained to the Secretary of War in the spring of 1827 that he had been informed that one of Perrault's officers had been electioneering in a St. Augustine tavern for James Gadsden. Among other things, the officer was supposed to have said that the canal would never be completed unless Gadsden was elected as Florida's delegate to Congress. "Such gross improprieties, which bring into disrepute the government, and its officers, will I am sure ... meet your decided disaprobation," White told the Secretary.[11] Whether this letter helped or not, the final outcome was White's election by two to one over Gadsden.

Early in 1827, General Simon Bernard and Captain William Tell Poussin visited Florida for a whirlwind tour of the two routes examined by Perrault. They considered the St. Johns and the St. Marys Rivers. Both routes were to link up with St. Marks on the Gulf of Mexico. It was the treacherousness of the St. Johns Bar which precluded the construction of a ship canal. Between the current, winds, and shallow bar, sea-going vessels were not certain of gaining entrance, and an inaccessible harbor in wartime could prove disasterous. But, if all goods in transit had to be transshipped by boat or barge anyway, then, they felt that the St. Johns River provided the best waterway for a barge canal because it would only be 25 miles long, as opposed to 45 for the St. Marys route.[12] However, based upon his personal investigation, plus the data from the survey brigade, Bernard was able to report to President John Quincy Adams that a ship canal was not practicable, and, while a 6-foot deep cut for steamers could be accomplished, he did not think the project desirable.[13]

The brigade's work was completed piecemeal. On 20 October 1826, Lieutenant Canfield was the first to submit his surveys of the Suwannee, St. Marks, and Santa Rosa Sound. Seven months later, Lieutenant Brisbane's reconnaissance of the St. Johns River was finished. Lieutenant Huger's line, from St. Marys River to the Suwannee and from St. Marys to Black Creek, was completed by 9 November 1827. Major Perrault's final summary was turned over to the Chief Engineer on 1 February 1828 and it included all of his officers' earlier reports. The Chief Engineer passed this on to General Bernard so that the Board of Internal Improvements could issue its conclusions. A year passed before Bernard presented the complete undertaking to Congress to be published as Senate Document 102, 20th Congress and House Document 147, 20th Congress; the beginning of a long line of congressional documents upon this subject.

Floridians backing the canal project were impatient with this delay. Long before Bernard presented his findings, Delegate White wrote to the Secretary of War to complain of the slowness of the Board. He reminded the Secretary that it had been two and half years since Congress first ordered the survey, and that, until Congress received a report, there was no possibility of proceeding. If the maps and report were not available to Congress soon, that body would adjourn and another year would pass before any action could take place. The Chief Engineer replied on 14 July 1828 that the narrative and maps were "in a state of forwardness." The following December, White proposed to the Chief Engineer that the maps be engraved immediately, but he was informed that there were no funds left for this task.[14]

Bernard's findings indicated doubt that there was a large enough water supply along the high ridge to sustain a canal. Because this matter had to be cleared up before proceeding further, Congress set aside $10,000 to complete the previous work.

It was October 1830 before Major Poussin was assigned to head the new survey team. Lieutenant Frederick Searle, who had served under Perrault, was ordered to report immediately to Major Poussin. As soon as the two officers left Washington, Joseph White wrote to the Tallahassee *Floridian and Advocate* to inform his constituents that a new survey was being made to determine the question of the sufficiency of water at the summit level. The third member, Lieutenant W. H. Harford, 4th Infantry, surveying The Falls of the Ohio, was ordered to go to Florida as soon as possible after completing his Ohio work.

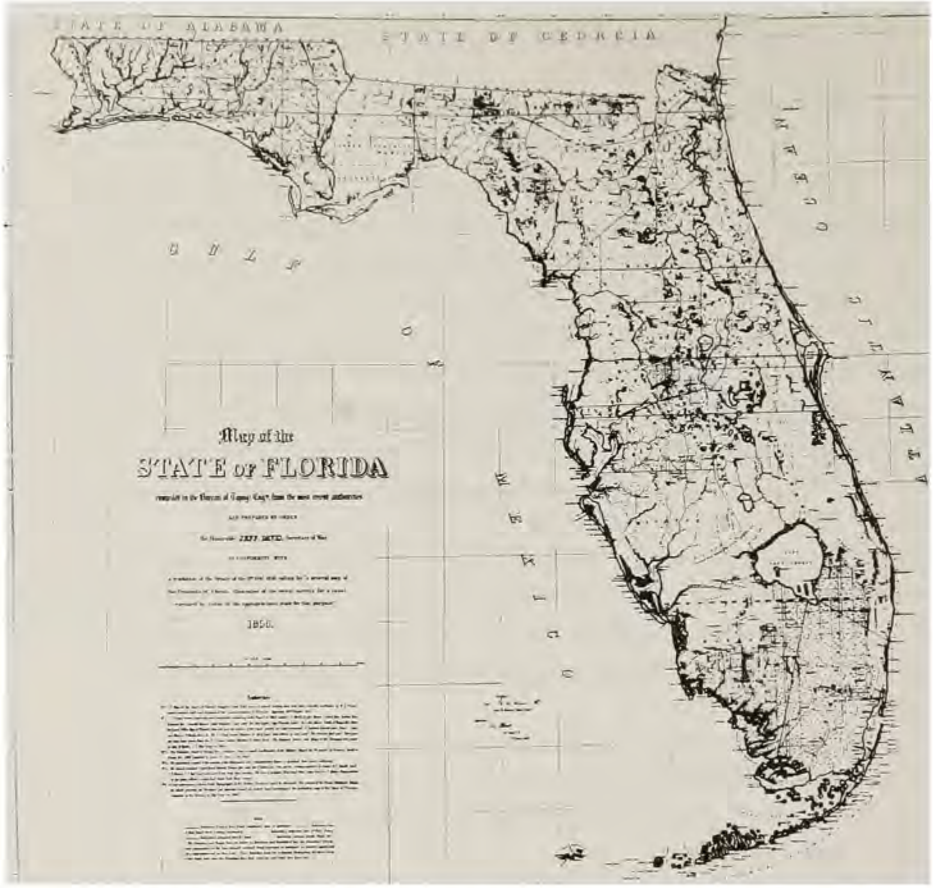
Major Poussin concentrated first upon running the survey lines. In July 1831, he left Florida on furlough to visit his home in France, and Lieutenant John Pickell replaced him in charge of operations.[15] Pickell spent much of his efforts trying to determine if a canal would lose water through filtration, or gain water by the process of infiltration and perculation. He sank a series of wooden shafts 7 feet square, 20 or more feet into the ground. These shafts were drained, then observed as they filled with water. From his experiments, which were reported to the Chief Engineer, he concluded that a canal cut might gain water through the infiltration properties of the terrain, but the money ran out before enough shafts were sunk to be certain.[16]

With nothing decided by this latest survey, Congress put aside the ship canal project. Two years later, the Florida Legislative Council reconciled itself to the fact that the Government probably would not provide a ship canal across Florida. The council petitioned Congress to consider constructing a railroad from Jacksonville via Tallahassee to St. Marks.[17]

Even James Gadsden recognized the futility of the ship canal. As he put it: "Had the Report of the Engineers been favorable as to its practicability, an intercourse across the Peninsula of Florida might long since have been secured."[18] In 1838, he sent a memorial to Congress, seeking to incorporate the Florida Peninsula Railroad and Steamboat Co., to create a link across the territory.

It was 1852 before Congress again took up the question of Florida's ship canal. This time, the terminal points were to be the headwaters of the St. Johns River and Tampa Bay. Lieutenant Martin Luther Smith, topographical engineer, was the officer in charge. Martin Smith followed the line from the St. Johns River to Tampa Bay, while Lieutenant W. F. Smith made a reconnaissance of Charlotte Harbor and Peace Creek. W. F. Smith soon abandoned his survey when he realized that these waters were too shoal.

Martin Smith used data obtained from Lieutenant Pickell's earlier work in 1831 to expedite his own task. Based upon Pickell's report, Smith believed that there was no reason to worry about the water loss from infiltration. His concern was with the approaches to the ship canal on both the east and west coasts of Florida. Smith ended his investigation inconclusively, stating that there were four likely places to cut through the peninsula. Because he had funds and instructions to survey only two of the lines, he felt there was no possibility of reaching a conclusion until the other two routes had been fully explored. For the survey made by his group, Lieutenant Smith noted that the routes were too circuitous, and the depths of



Map of Florida showing surveys for a canal, 1856. Courtesy Corps of Engineers.

water on the St. Johns River and the western harbors too shallow, to entertain such an important ship canal.[19] Once again, the Corps of Engineers did not find a satisfactory solution to the problem of creating a waterway across the peninsula.

Local interests certainly were not placated by Lieutenant Smith's findings; they had had enough preliminary surveys. What was desired was a means of shipping goods between the gulf and the Atlantic. By this time, however, the national situation concerning the issue of slavery was becoming more divergent. In those last few years before the Civil War, there was little hope that Congress would entertain a project so completely beneficial to Southern interests. The proponents of a ship canal had to wait for a more opportune time.

The sectional conflict was not brought to a close until the settlement of the contested Presidential election between Rutherford B. Hayes and Samuel J. Tilden in 1877. This was the end of reconstruction and the beginning of home rule in the South, and, with it, local interest renewed demands for a ship canal.

Lieutenant Colonel Gillmore was instructed by the River and Harbor Act of 18 June 1878 to survey *"the peninsula of Florida* *with a view to the construction of a ship-canal from the St. Marys River to the Gulf of Mexico."*[20] Gillmore had his engineers in the field by November of that year. The primary purpose was to establish, if at all possible, the capacity of Okefenokee Swamp to supply the water necessary to feed the long summit reach of the proposed canal. To answer this question his engineers spent 5 months in the field. Transit and level lines were run from Fernandina and Jacksonville to Lake City. These lines were the base lines for all other observations.

Next, U. S. Civil Assistant Engineer, S. L. Tremont had his men push inland to the swamp itself. They ran lines all around the border of the Okefenokee. This was followed by offset lines into, and some across, the watery lands. Side trips were made to surrounding lands to examine the many lakes and ponds which could become part of a feeder system to support a canal. Then, the engineers moved down the Suwannee River to the gulf, locating and recording several good lines for the proposed project. From April to December 1879, the field work was recorded, examined, and mapped.[21]

Tremont's final report delineated his canal route. The eastern terminus would be Camp Pinckney, 29 miles above the town of St. Marys on the St. Marys River. The cut would pass through the Okefenokee Swamp on a heading of 248°, then cross the Suwannee River near Blount's Ferry to Ellaville, a reach of 77 miles. Here, the canal would turn to a heading of 260° 15′ for the remaining 64 miles to St. Marks. The total distance from St. Marys to St. Marks was 170 miles, 60 of which would be along the summit level. The engineer calculated it would take 11 locks (350 feet long, 80 feet wide, and 24 feet deep), five on the eastern end and six on the western end, to lift and lower the ships utilizing this waterway.

In his conclusion, Tremont said, "I believe I have shown conclusively that the Okefenokee swamp, with its contiguous water sheds, is capable of supplying all the water that may be required to operate a ship canal to its full capacity during the entire year."[22]

Lieutenant Colonel Gillmore, as was his custom on all major projects, went back to the records of previous surveys to add to his engineer's field reports. He noted that the loss of water by filtration had never been satisfactorily calculated. Gillmore pointed out that the 1826 survey had not come to grips with that particular problem; that the Board of Internal Improvement had suggested another examination, which had resulted in Lieutenant Pickell's expedition. The Board, and later, Lieutenant Martin Smith, accepted Pickell's conclusions that filtration would not be a problem. As Gillmore viewed the results, the weakness of Pickell's work was twofold; first, the head under which his infiltration experiments took place had not been considered, and second, his shafts had been constructed and observed during the rainy season. In fact, it had been exceptionally rainy for 3 months, with 28¾ inches falling during his observations. Gillmore concluded that there was no evidence to support a contention that the dry season would have the same factors acting to hold or increase canal waters.[23] Once again, the Corps of Engineers returned a negative verdict.

But, the forces interested in the canal would not take no for an answer; they managed another attempt in the River and Harbor Act of 14 June 1880, the same year that Gillmore released his first negative findings. This time, Colonel Gillmore was to survey for a steamboat route from the St. Johns River through Tohopekaliga Lake and on to Charlotte Harbor or Peace Creek. Assistant Engineer, George Daubeney led this team until he was relieved by Assistant Engineer, W. G. Williamson. Daubeney moved into the field in January 1881 to run a number of lines with the transit and level, and many with compass and level, to locate and determine the surface altitude of the numerous lakes along the route. He divided his team into three groups, leading one himself, assigning J. Francis Le Baron the western route, and John Gartland the eastern survey.

Assistant Engineer J. Francis Le Baron submitted a 92-page preliminary report of his work from the headwaters of the St. Johns River to Charlotte Harbor. He left from Orlando on 16 March 1881 on his reconnaissance for a ship canal and arrived at Fort Myers 4 months later on 12 July. His letter is a fascinating account by an intelligent, articulate man. For example, Le Baron wrote that from the mouth of Little Charley Apopka to tide water, the sand bars contained many fossils. "In several places we found portions of the skeletons of the fossil elephant (Elephas Columbi) in one case nearly entire... I collected several barrels of these fossil remains intending to forward them to the Smithsonian Institution at Washington, but half of them were lost at the mouth of Peace Creek by the swamping of one of our boats, by which accident two of my men nearly lost their lives."[24]

John Francis LeBaron, C.E. Courtesy Ernest LeBaron.

[Le Baron, who had discovered river pebble phosphate, sent samples to Professor S. F. Baird of the Smithsonian Institution for analyses. The professor wanted Le Baron to make a complete geological survey of the region; however, General Gillmore refused to allow his assistant engineer to make such an undertaking. Le Baron took leave of absence during 1882-83 in an effort to obtain financial backing for his discovery. He urged prospective backers to "buy or bond the entire Peace River Valley," but he did not receive financial support. The development of Florida's phosphate industry had to await other individuals in the mid-1880's.][25]

With regard to the purpose of his survey, Le Baron felt that there was much work left to be done before any positive recommendations could be made. "From this rather uncertain data, I am inclined to believe that a small canal *without locks* can be easily and economically constructed at a probable cost of less than two million dollars, on the general route indicated."[26] John W. Sackett, who accompanied Le Baron, prepared the expedition's maps.

John Gartland recorded some of his hardships: "I experienced great difficulty as well as delay in discovering the section lines, the blazed trees denoting merely the direction the line had taken, while the posts set by the Land Office to mark corners had all disappeared... It was only by a reference to the deeds of settlers residing near the survey that I was enabled to locate position of line with reference to the State survey."[27]

Gartland reached a different conclusion than Le Baron with regard to the necessity of employing locks. He noted the different levels of various lakes in his region, and felt a series of cuts would soon drain the higher waters off. "The difference in level between where it [Bowlegs Creek] emerges from Lake Buffum to where it enters Peace Creek, being 65.125 feet. It is therefore evident that any improvement of those streams for the purpose of steam navigation, is impracticable without the use of locks."[28]

A year later, Colonel Gillmore issued his findings. Again, he discussed reports of earlier expeditions. The J. L. Meigs report of 1879 was especially singled out for its information. Gillmore concluded that the route could not be employed without the construction of locks. Such a canal would have a cost "plainly unwarranted by the amount of traffic and the extent of population that would for many years to come be accommodated by it."[29] This was the fifth major survey made by the Corps of Engineers in almost 60 years. There seemed to be no prospect for a waterway across the state.

Some Florida proponents of a canal attempted to turn to private enterprise. The Atlantic and Gulf Transit Canal Company was chartered in 1878, with capitalization of $30 million to build and operate a canal across the state.[30] Nothing concrete came of this venture. Several private surveys were undertaken, but the task was too large and costly to be considered without tremendous governmental aid. Realistically, this was a project for the National Government.

In 1909, when Congress authorized the sixth survey, the project was a barge canal. This endeavor did no better than the previous examinations; the recommendation was unfavorable. The canal backers met the same results in 1924 when the report was reviewed and its negative findings confirmed.[31]

Although the setbacks were numerous, the backers of the project continued to plead their case. In 1921, the State legislature created the Florida State Canal Commission, dedicated to the building of a waterway. Six years later, it was successful in having another survey ordered by the River and Harbor Act of 1927. This last investigation reaffirmed the previous findings.

In the next decade, the situation was drastically changed by the Great Depression. The economic debacle, with its tremendous increase in unemployment, provided the proponents of the canal with yet another lever – the project would put thousands of people back to work. In light of the new economic conditions, a Special Board of Engineer Officers was convened to review the project. In all, the Board studied 28 routes, seven of them in great detail. Number 13-B seemed to be the most practical. Thirteen-B ran from the Atlantic Ocean up the St. Johns River to Palatka, followed the Oklawaha River, crossed the divide, then ran down the Withlacoochee River to the Gulf of Mexico, about 95 miles north of Tampa Bay.

Throughout the long history of the cross-Florida canal idea, there had been little organized opposition to the project. Now that the plan seemed near realization, its major competitors rose up. They asked the Special Board of Engineer Officers for a hearing, which was granted in Jacksonville on 10 February 1933. Representatives of the Atlantic Coast Line Railroad, the Florida East Coast Line Railway, the Seaboard Airline Railway, and the Southern Railway presented their objections to the canal, demonstrating, from their observations, that the endeavor was not economically sound. "More important, however, they introduced the theory that excavation of the ship canal would endanger the underground water supply of central and south Florida... [This testimony] concerning possible damage to the underground water marked the first time this idea was put forth."[32]

It was the Board's opinion that Route 13-B was feasible for either a barge or a ship canal. It recommended that the waterway should be a lock-type canal so that it would not interfere with, or damage, the natural underground water system. But, in spite of these positive factors, the Board did not recommend the construction of either a ship or a barge canal be undertaken by the Government.

Local canal interests were not to be denied again. Pressure was brought to bear so that this rejection would not be accepted by Congress until the proponents had an opportunity to present more data justifying the project.[33] Meanwhile, Floridians joined with Texans and other gulf coast interests to form the National Gulf-Atlantic Ship Canal Association, with former Army Chief-of-Staff, General Charles P. Summerall as president. He applied to the Reconstruction Finance Corporation for funds, but was not successful in obtaining any money. The RFC rejection was followed, in rapid order, by similar refusals on the part of the Public Works Administration and the Department of Commerce when these agencies were approached for funds.[34] Next, General Summerall persuaded President Roosevelt to appoint another board to study the matter. The Interdepartmental Board of Review, created by the President in April 1934, finally recommended a 30-foot sea-level ship canal to the President.[35]

It was evident that Franklin Roosevelt had made up his mind as to the value of the canal's construction to relieve some of the unemployment problems of the nation. On 30 August 1935, at a news conference, the President mentioned that he would probably spend $4 or $5 million as a relief measure on the canal. Four days later, a natural disaster gave Roosevelt his springboard to the construction of Florida's ship canal. A hurricane swept over south Florida and dashed the cruise ship *Dixie* onto French Reef in the Florida Keys. Franklin Roosevelt, a master of political timing, announced the very next day that he was allocating $5 million in relief money for a canal which "would forever make it unnecessary for seagoers to risk their lives in circumnavigation Florida's long, hurricane–blistered thumb."[36] At long last, the trans-Florida waterway was funded; although the source of the money did not come from the normal congressional appropriation. This initial allocation of $5 million was nowhere near the amount needed to complete this project, but it was a start.

Scores of mule teams and hired labor clear the route of the ship canal; October 11, 1935. Courtesy Corps of Engineers.

Construction workers line up for chow at Camp Roosevelt near Ocala on September 13, 1935.
Courtesy Corps of Engineers.

The Chief of Engineers had been standing by for the President's order. On 3 September 1935, he created the Ocala, Florida, District to supervise the territory through which the canal would traverse. The immediate need, when funds became available, was for the new district to erect a construction camp to house the workers. Over 4,000 acres of right-of-way were cleared by the newly employed workers during the first year of operation. Excavations took place, with the engineers moving about 13 million cubic yards of earth. South of Ocala, massive bridge foundations rose from dry land in anticipation of the canal, which would eventually flow beneath the vehicular overpass.[37]

But, the opponents of the canal had not been idle. They mustered forces to fight the construction. Two influential political foes of the canal were Secretary of the Interior, Harold Ickes, and Senator Arthur H. Vandenberg of Michigan. Both were deeply concerned that the canal would introduce salt water into Florida's underground water supply. Ickes worked within the Administration, while Vandenberg pressed his views in the Senate. Downstate, Floridians organized the Central and South Florida Water Conservation Committee to carry the fight throughout the state. Large newspaper ads carried blaring headlines: "What Will We Do Without Water."[38]

President Roosevelt became disturbed by this opposition. He was fearful that the Republicans, led by Senator Vandenberg, might make political gains at his expense by a fight on the floor of Congress. On 17 December 1935, Roosevelt told reporters that he

Administration building for Army Engineers goes up at Camp Roosevelt in September 1935 prior to start of construction of Florida ship canal. Courtesy Corps of Engineers.

would not use any more relief money for the Florida project.[39] Instead, the President planned to ask Congress for the money. This was obviously a sound move on Roosevelt's part. It allowed him to divorce himself from the project while putting the burden of proceeding upon Congress. The appropriation went down in defeat in the Senate by a vote of 39 to 34.

The Ocala, Florida, Engineer District was discontinued 1 September 1936, and the Jacksonville District had to secure work on the canal after 1 year of operation.[40] The project was 3 percent completed. The remains of this first building attempt included several sections of excavated canals, four massive bridge piers south of Ocala, jutting skyward with no roadway built above them and no water below, and Camp Roosevelt. Camp Roosevelt was turned over to the WPA, then transferred to the University of Florida to serve as an extension campus. In 1937, the Camp Roosevelt campus had over 4,000 students enrolled in the piney woods of central Florida.

Even as the district engineers were closing project activities, the numerous proponents for the canal were working for its reinstitution. The Chief of Engineers appointed a new board of officers to review all previous reports. This Board presented a favorable report to the public on 16 April 1936. It suggested a 33-foot deep, 250-foot wide canal be built to benefit the nation as a whole.

A year later, Chief of Engineers, Major General Edward M. Markham reported to the Secretary of War his justification of the project: "The following matters have weight in the balance; the great development in the Gulf States in recent years is certain to continue for many years to come." Then the general shifted to a newer, contemporary reason: "It appears likely, that for a period of years it may be advisable to finance public works with the dual purpose of constructing useful facilities and of employing those who otherwise would require relief."[41] The economic situation in the 1930's was an important factor counted upon to gain adherents to the proposal.

In Florida, Henry Holland Buckman, secretary and engineering counsel to the National Gulf-Atlantic Ship Canal Association, produced his "Documentary History of the Florida Canal, 1927-1936," which placed great emphasis upon the fact that the recent legislation provided for a ship canal, as opposed to the earlier barge canal projects. According to Buckman, the difference between the two canal uses was significant. Using the argument that a ship canal was a more viable and valuable contribution to the nation's transportation system over the earlier, limited barge canal, he made it appear that the many earlier rejections of a waterway across Florida were now invalidated. "Until recent years, the project assumed the form of a barge canal. Until the growth of ocean shipping into and out of the Gulf of Mexico increased to a point which appeared to justify the cost of a ship canal, such surveys and discussions were limited to a waterway of the barge-canal type because of the smaller dimensions of a barge canal and other engineering considerations."[42] It is difficult to understand how Buckman could make this point when so many of the nineteenth century surveys were for construction of a ship canal. Still, in the heat of battle, his distinction may have been of tactical value.

Workers are about ready to pour concrete as work on ship canal progresses in late 1935. Courtesy Corps of Engineers.

After the relief funds were exhausted, the Corps of Engineers sought $12 million from Congress to continue its work. On the floor of the Senate, Arthur Vandenberg led the fight to withhold such funds. When he was successful, the canal was doomed; the project was set aside for the time being.

World War II changed the situation, and interest in a cross-Florida waterway was revived. Now it was a military project, especially after German U-boats stalked the east coast shipping lanes in wolf packs. Early in 1942, Congress asked the Corps of Engineers to review the project in the light of the latest military actions. The engineers suggested a 12-foot deep, 150-foot wide, waterway along the 13-B route. "The value of the barge canal in time of war... is sufficient to warrant its construction," concluded the Corps' report.[43] The comments were well placed; during the war about 165 ships were sunk in and around Florida.

On 16 July 1942, when the Senate debated a bill for both a pipe line and a barge canal across Florida, Senators Claude Pepper and Arthur Vandenberg squared off to renew their argument. Arthur Vandenberg objected to the barge canal being funded under the guise "to promote the national defense and to promptly facilitate and protect the transport of materials and supplies," when it had been stated that it could not "be completed until the fall of 1945 at the earliest."[44] This time, Florida's Senator Pepper was victorious. Seven days later, the President signed a new law, authorizing a barge canal. Unfortunately for the proponents, the bill carried no appropriations. In some respects, the result was a tie, but the stalemate worked to the disadvantage of the promoters of the waterway.

There was never disagreement as to the military advantages of the canal. The Chief of Engineers told a House subcommittee in 1946 that: "If this canal had been finished during the war time it would have paid for itself several times over."[45]

The opponents stuck to their position, without qualms of giving aid to the enemy, because the engineers had stated that the construction time would be at least 3½ years – leading to the possibility that the war would be over before the canal was completed. Further, building this waterway would add to the manpower and material shortage already in existence in wartime America.[46] To their way of thinking, opposition to the canal was not disrupting the war effort.

As soon as the war ended, the Chief of Engineers proposed early construction of the waterway, with a request for $20 million. It was not approved by the House committee, nor did it reach the floor of Congress for a vote. By 1949, the annual report listed the project under the Intracoastal Waterway section, rather than as a separate project. In 1954, it was placed in the "deferred for restudy" category. Two years later, Congress approved an economic restudy and granted $11,000 for this purpose. It was the first investigation of the canal's economic impact to be undertaken in over a decade. On 23 July 1958, the Corps reported that the project was economically justified, for the first time![47]

Although efforts to get Congress to appropriate construction funds in 1960 failed, the proponents for the canal were encouraged by John F. Kennedy's remarks in favor of the project during his Presidential campaign. Florida's congressional delegation later pressed President Kennedy to take action to bring about the building of the trans-Florida waterway. In June 1963, the President submitted a budget amendment to Congress to provide $1 million to begin construction. It passed, but, in the interim, President Kennedy was assassinated. President Lyndon B. Johnson participated in opening ceremonies where he pressed the button to explode the dynamite charge, initiating construction of the barge canal.[48]

This latest project specified a five-lock canal, 12 feet deep, with a minimum bottom width of 150 feet. The entire length was 184.4 miles from the Intracoastal Waterway at the St. Johns River, to Port Inglis on the west coast. There was a brief planning period for the remainder of 1963 before actual construction began 24 February 1964.[49]

*President Johnson accepts gift from nearby Rodeheaver Boys Ranch as he stands in the rain before setting off the charge to start construction on the Cross-Florida Barge Canal; February 27, 1964.
Courtesy Corps of Engineers.*

Once the task was approved and funded, it did not take the Jacksonville District engineers long to start moving earth. A section of canal, running from Palatka to the St. Johns Lock, was begun 24 February and completed by 4 August 1964. Another section, from the St. Johns Lock to Rodman Pool, was under construction during 1964. On the western end, there was more work as a dredge began excavating a canal from the Gulf of Mexico toward Inglis Lock. The dredge labored from November 1964 almost to the end of January 1965, before giving way to dragline operations. In addition to the digging, there was bridge construction as the overpass for U. S. Highway 19 began. The first lock work started in December 1964 at the site of the eastern St. Johns Lock; 4 months later, work began on the Inglis Lock.[50] It seemed as if the district wanted to make up for all the lost time.

By 1969, the project had created three new lakes; the Rodman Reservoir became Lake Ocklawaha; Eureka Reservoir was changed to Eureka Lake; and Inglis Reservoir became Lake Rousseau. In the early months of 1969, the engineers held the levels of Lake Ocklawaha to 14-16 feet while the final clearing of trees and limbs took place. Then, during June and July, the discharge outlets were regulated to allow the lake to fill to its operational level of 20 feet mean sea level.

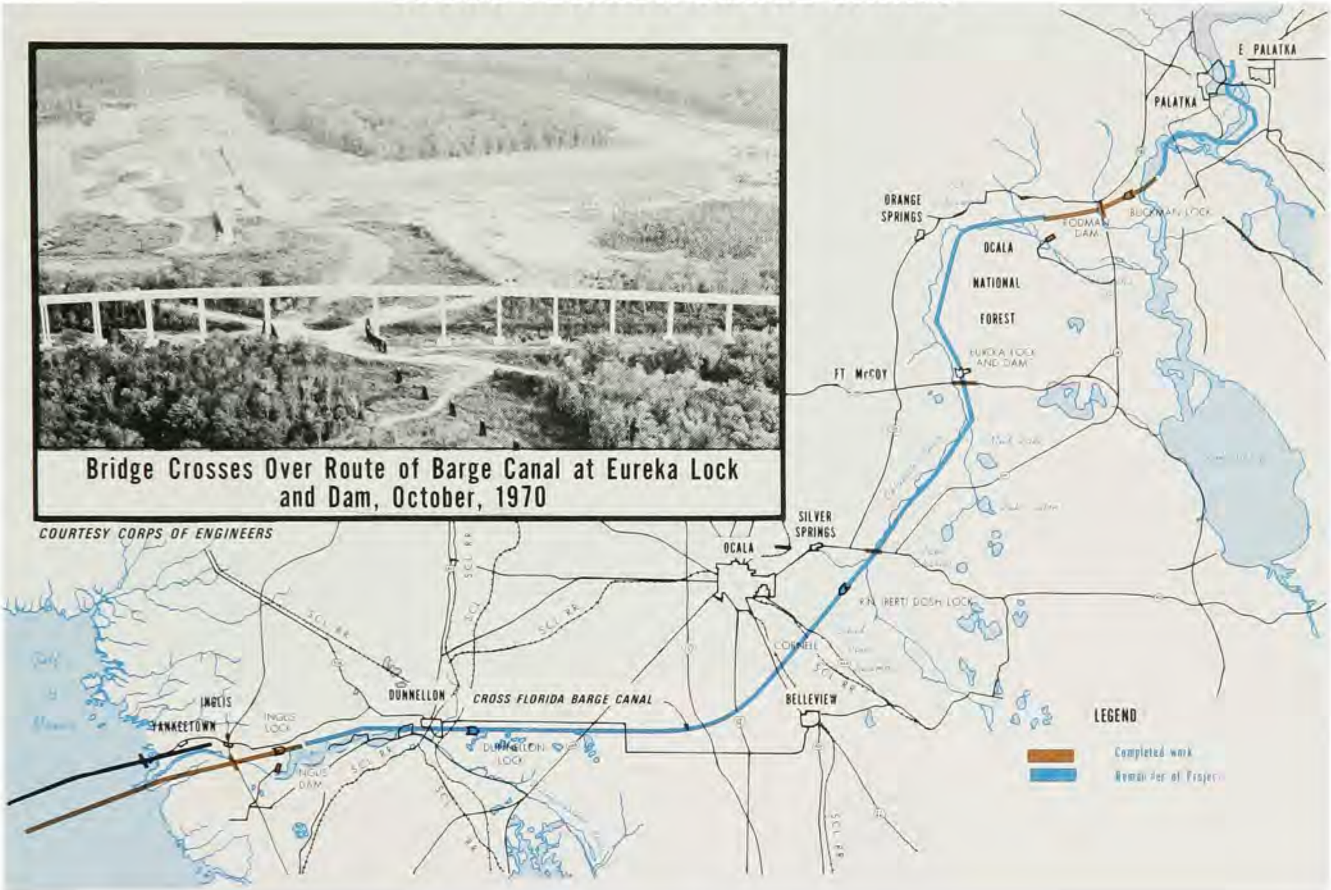
The Jacksonville District maintained responsibility for regulating Lake Ocklawaha. During the period from July 1969 to June 1970, when rainfall was above average, the engineers estimated that the increase in water amounted to 2,181,000 acre-feet. Of this total net increase, 19,000 acre-feet were needed to bring the lake level to 20 feet; 22,000 acre-feet were employed for lockages for Buckman Lock (formerly the St. Johns Lock); and 2,140,000 acre-feet were directed through Rodman Spillway.[51]

Among the construction tasks performed by the Jacksonville District were such unlikely items as boat ramps and campsites. The days when engineering projects were just for economic gain were over. Today, the engineers play a major role in providing recreational service and facilities wherever possible. The United States has reached the stage of development whereby its society is highly industrialized and urbanized, and it demands activities for satisfying the emotional and aesthetic needs of its people. The nation's wilderness areas belong to the people as a whole; therefore, in answer to the public's need for recreational areas, the Corps included this factor in the planning of its projects. Hand in hand with the desire for leisure time activities, is the growing awareness that our environment must be preserved and set aside for future generations. Lieutenant General Frederick J. Clarke, Chief of Engineers, observed the

Buckman Lock formerly St. Johns Lock, looking west towards St. Johns River, was officially opened on December 14, 1968. Courtesy Corps of Engineers.

Inglis Lock near western terminus of Cross-Florida barge canal, looking west towards Gulf of Mexico, 1970. Courtesy Corps of Engineers.

CROSS FLORIDA BARGE CANAL



Bridge Crosses Over Route of Barge Canal at Eureka Lock and Dam, October, 1970

public change in attitude in 1971 when he said: "Our efforts in the Civil Works Program are changing somewhat in emphasis to reflect the public's growing desire that the development of our natural resources for economic benefits no longer be the sole criteria for our work. Rather, people seem willing to forego, or to pay more for their immediate needs so that the quality of their environment may be preserved and enhanced for the future. In that light, environmental values are now being given full consideration along with economic, technical, and social and other factors when we study alternate means of meeting human demands. We are attempting to keep resource options open for future generations as far as it is possible to do so."[52]

There were other groups, with the same goals, who felt that the Cross-Florida Barge Canal was not compatible with the desire to preserve the natural state. The Florida Defenders of the Environ-

Recreation was an important byproduct of Cross-Florida barge canal; Lake Ocklawaha (Rodman Reservoir) attracted thousands of fishermen, campers, boaters and picnickers, below.
Courtesy Corps of Engineers.

ment called on President Richard M. Nixon to halt construction on the project. They, and others, put great pressure upon the President. Nixon finally ordered construction stopped on 19 January 1971, on the basis that the canal "could endanger the unique wildlife of the area and destroy this region of unusual and unique beauty."[53] Work was suspended immediately. In March 1971, three of the four major contracts were ordered completed, either for safety or environmental reasons. When all work had been properly secured, the project stood at 28 percent completed.

For over 100 years, the Corps of Engineers surveyed for a cross-Florida waterway without being able to justify crating such a project. The first successful funding of the plan was by Presidential decree as a step to relieve unemployment in the 1930's. The first time the engineers found the canal economically justified was 1958, and, by the time construction began, opposition centered upon the environmental dangers of such an undertaking. Immediately after construction on the canal was halted, new environmental impact studies were begun by the Jacksonville District at Congress' direction. Meanwhile, the Cross-Florida Barge Canal remains suspended in limbo once again.

CHAPTER 10

Twentieth Century Military Activities

THE SPANISH-AMERICAN WAR in 1898 ended military activities of the nineteenth century; the new century had a different task for the Corps of Engineers in Florida. In the earlier period, Florida had been the locale for actual fighting; in the twentieth century, conflicts moved to overseas theaters. World War I did not directly affect the Jacksonville District. The United States' participation in the struggle was confined to a 19-month period. The Secretary of War established the Cantonment Division within the Quartermaster Corps as the agency responsible for training camp construction. None of these camps were located in Florida.

When war clouds rolled over Europe in 1939, the United States began to take stock of its military posture. The country needed to rebuild its army. In the initial phase of creating a large, modern army, the tasks included the erection of training facilities, the gathering of war materials, and the stockpiling of supplies to support any desired troop movements. All of these jobs, functions of the Quartermaster Corps, placed an overwhelming burden upon that organization. In the streamlining reorganization which took place during 1940-41, various functions were taken from the Quartermaster Corps and given to the Corps of Engineers, such as the Air Corps construction in November 1940, and all military construction and cantonment maintenance work for the Army on 1 December 1941. Lieutenant General Brehon B. Somervell, one of the leaders in the plan to consolidate construction work under the Corps of Engineers, issued his assessment of the merger in September 1941, warning that: "Under no circumstances should the less important, slow moving, civil works be permitted to dominate the reorganization for vital, fast moving and extensive requirements" for the defense effort.[1]

The Jacksonville District responded to Somervell's remarks wholeheartedly as the district's civilian population shot up from 30 to 300 emplyees, almost overnight. On 27 May 1941, construction at the Orlando Air Base was transferred to the Jacksonville District. Area Engineer, Captain John P. Larson took over the task of building an air base to house 281 officers and 2,030 enlisted men. The reservation contained 748 acres, of which 60 acres held the cantonment area. Larson's job included more than building the temporary living quarters for the officers and men at this base. He had to provide everything for the establishment; the roads, streets, runways, taxiways, and shop spaces necessary to support active air base operations. The water distribution, sanitation, and electrical systems could handle a fair sized town.

By September 1942, Orlando Air Base had facilities for 1976 officers and 1,529 enlisted men. Its closed warehouse space held 52,883 square feet. The paved area for aircraft operations included 20,250 lineal feet of perimeter taxiways, 8,300 lineal feet of dispersal taxiways, and 40 concrete hardstand zones 75 feet in diameter, in addition to the runways. Although this specialized construction was in contrast to the river and harbor dredging, which had been the district's usual work, it was handled competently and professionally.

The Orlando Air Base was the center of a cluster of military reservations within a radius of 30 miles, all of them supported the Orlando air activities. For example, the ordnance reservation of 584 acres, located east of the city near the air field, housed the munitions used by the Air Corps. The South Street Cantonment held 1,000 enlisted men in a 33.5 acre tract. The Coast Artillery Searchlight troop cantonments were grouped about Orlando Air Base to utilize the aircraft for its own training. At first, it may seem incongruous to have Coast Artillery reservations in the center of the Florida peninsula, but they were located near air activities to provide more efficient training facilities. The cantonments were:

a) Winter Garden, 12 air miles northwest of Orlando, 16.5 acres, 32 officers and 720 enlisted men,

b) Apopka, 12 air miles northwest of Orlando, 9 acres, 16 officers and 240 enlisted men,

c) Mount Dora, 25 miles northwest of Orlando, 12 acres, 240 enlisted men,

d) Eustis, 15.5 miles northwest of Orlando, 15.5 acres, 120 enlisted men, and

e) Umatilla, 30 miles northwest of Orlando, 9.5 acres, 240 enlisted men.[2]

In all, the Jacksonville District constructed facilities at eight separate reservations around Orlando in this one complex.

Orlando was not the only Air Corps establishment in Florida. The state, enjoying excellent flying weather, drew many air installations to the peninsula, both Army and Navy. MacDill Air Base at Tampa was another base taken over from the Quartermaster Corps and constructed by the district. During 1941-42, four short connecting runways were built, including perimeter taxiways and two large parking aprons. In 1943, a larger instrument runway was built along with its parallel taxiway system.[3]

It is sometimes difficult, in retrospect, to grasp the sense of urgency which underlay most activities during the hectic period just prior to and during World War II. Time has a way of masking emotions more completely than actions. Everyone concerned with developing the nation's preparedness felt that their task was crucial, that their demands were reasonable, and that their solution was the only answer to a critical problem. It was the obligation of the district engineer to build well, rapidly, and as economically as possible. Thus, when the commander at MacDill Air Base requested "Coolite" glass be installed in his hangars to lower heat and glare, District Engineer Colonel William C. Weeks solved the problem with $50 worth of blue paint, sprayed over plain window glass, for a substantial savings over the $3,000 cost of Coolite originally requested.[4]

Just a little over 7 miles north of MacDill Field was Drew Field. This airport had formerly been Tampa's municipal airport, with one hangar and a sod field. Originally, the Air Corps planned to use this base as an auxiliary field to house 150 enlisted men in a tent camp. By the time the Jacksonville District assumed responsibility for Drew Field, the planners had transformed it into an installation housing 421 officers, 9,615 enlisted men, and a hospital. So many

Inside hangar no. 3, Macdill Field. Courtesy National Archives.

items were in short supply, such as copper, brass, pipe fittings, and kitchen equipment, that the completion of Drew Field was delayed for several months.

When the third job assignment was completed in 1943, Drew had 1,324 buildings accommodating 987 officers and 26,069 enlisted men. Included in the above totals were living structures for 96 nurses, 6 Woman's Army Auxiliary Corps officers, and 150 Woman Auxiliaries. The hospital held 734 beds. The air field had three concrete runways, two over and one just under 5,000 feet.[5] The Jacksonville District moved into aviation construction rapidly in the 1940's.

Another example of air base construction was Morrison Field at West Palm Beach. Similar to Drew, Morrison had been a municipal air strip built in the mid-1930's. It was leased by the Government for 20 years at $1 per year, payable at the end of each fiscal year. Military construction began in November 1940 under the Quartermaster Corps, but very little building took place before Morrison was transferred to the Jacksonville District in December 1940.

As was usual with air bases, auxiliary installations grew up around the field proper. A radio beacon and transmitter station occupied 20 acres, less than 3 miles from Morrison Field. This property was acquired by governmental condemnation on 6 June 1941. A magazine area of 633 acres was obtained under the same procedure of condemnation.

Initially, Morrison was programmed as a training base for nine squadrons, one air base group, and supplemental troops. Living accommodations were set for 365 officers and 3,206 enlisted men, but, long before this construction took place, the Army Air Corps revised its manning compliment down to 207 officers and 1,897 enlisted men. However, the district planned the cantonment layout

Looking north down road "4" from top of parachute building, Morrison Field. Courtesy National Archives.

of water and sewer systems so that if the Air Corps returned to its first estimate, there would be no need to disrupt the completed construction in order to accommodate the increased numbers.[6] In the hectic days of early mobilization, it was necessary for the district to think ahead of the latest directive received.

The largest and most controversial military task in Florida during World War II was Camp Blanding, near Starke, 30 miles southwest of Jacksonville. Its history has all the ingredients which epitomize the rapid war time construction: the site had been selected at an earlier time for a different purpose; the principal contractor, Starrett Brothers & Eken, a successful northern company that built the Empire State Building in New York City, was on unfamiliar ground building in the swamp and pineland of Florida; northern labor unions moved south with Starrett Brothers & Eken to jostle with independent southern labor, creating additional tensions; and the installation dwarfed the rural town of Starke. Throughout all of this was the pressure of time – to build facilities to store and use the materials – to build quarters before the troops arrive. It was a pressure-laden situation from the start.

The site was initially selected in 1939 by the Florida National Guard to replace Camp Foster, the former guard camp near Jacksonville which had been transferred to the Navy. Brigadier General Vivian B. Collins, Florida National Guard, selected a 27,000 acre site in Clay County on Kingsley Lake. It was an excellent site for a country plantation type retreat for hunting and fishing. When the plans were drawn up, the layout was modest. The state estimated about $700,000 would be necessary to create a summer camp for Florida guardsmen. The Fourth Corps Area Commander, Lieutenant General Stanley D. Embick, was as impressed as General Collins with Camp Blanding, and soon the camp was placed on the Protective Mobilization Plan list.

When the national defense program accelerated in the spring of 1940, rumors began circulating that Blanding would be more than just a guardsmen's summer camp. In mid-year, the War Department plans were released indicating that Blanding would house the 31st Division from Florida, Alabama, Louisiana, and Mississippi for a year's training cycle. The Quartermaster Corps had to move fast to create a major training base out of virgin terrain. Then it was announced that the 43rd Division from Maine, Vermont, Connecticut, and Rhode Island was scheduled to move in 50,000 troops by the next spring. An installation of this size caused construction estimates to soar to $27.5 million, and the labor population to create this camp rose to 21,000.

By this time, the Quartermaster construction men were writing about the swamp conditions at Blanding. The description of the site shifted from one of gently rolling country plantation to a swamp and quagmire base. General Embick was undismayed by these construction reports and the plans continued as before.[7]

Starrett Brothers & Eken met new problems with innovative solutions. There was a need for 7,000 carpenters at the very start of construction. The local area could not produce anywhere near that number. The contractor stationed experienced carpenters side by side with novices, on the theory that the beginner could learn from and be guided by the experienced man on the job. Starrett Brothers also shifted to prefabrication to aid construction. They set up plans for building sections which were precut at the sawmill and lumber yard. After the company had organized this system, a standard messhall could be cut to size in the lumber yard in 10 minutes, and erected in the field on its foundation in 25 minutes.[8]

Camp Blanding, with all of its troubles, was taken over by the Jacksonville District and completed with a minimum of dislocation. Secretary of War, Henry L. Stimson, reporting to the Truman Committee on the shift of construction from the Quartermaster Corps to the Corps of Engineers said: "The construction projects which have been allocated to the Engineer Corps have been actively and efficiently prosecuted and are generally meeting the requirements of their schedule completion dates.[9]

Housing for the laborers at and near Camp Blanding was almost non-existent. A daily train run was established between Jacksonville and Starke to carry over 1,000 workers to Starke in the morning and return them to Jacksonville in the evening. Trucks carried the men the 9 miles from Starke to Camp Blanding along a vehicle-jammed, two-lane country road.

L. B. McLeod, of the Orlando construction company bearing his name, summed up the attitude of the day when he told the Truman Committee of the intensity of working conditions: "You must increase, you have got to build more – putting the pressure on us – I spent day and night. I worked harder the first 3 months than I ever worked in my life, trying to find equipment somewhere in the country available. As a result, we rented equipment of every description that we could from 16 other owners than ourselves . . . We went in there to do a job, to do it in a hurry and put this defense program over with every ounce that we could put forth."[10]

At the end of two frantic years of work, Camp Blanding was completed, or was as near completion as any large military installation could be. Albert R. Swartz wrote to the Jacksonville District Reporting Section a brief, detailed report of the overall construction

Construction workers, Camp Blanding, December, 1940–January, 1941. Courtesy State Photographic Archives, F.S.U.

Barracks, Camp Blanding, December 1940–January, 1941. F.S.A. collection.

effort. The reservation enclosed 180,000 acres, housed 55,000 personnel, and contained 9,104 buildings. The camp had a 2,051 bed hospital with the buildings connected by 8 miles of corridors. Among the specialized areas of the camp was an artillery range able to handle all types of fire from a minimum of 8 miles from gun to impact zone. This range included a moveable track target, operating over a half-mile course, controlled electrically. There were nine control towers connected to the range, and, closer to the impact zone, two concrete observations dugouts. The 4 by 5 mile rifle range was modeled upon that of Fort Benning, which was considered to be the most advanced of all rifle training ranges. There were also anti-aircraft, mortar, and grenade ranges on the reservation.

Blanding's utility system included 125 miles of paved roads, over 1 million square yards of motor parking areas, 81 miles of water lines, 256 miles of electrical wiring, and 26.5 miles of railroad track. Total construction cost had grown from $27 million to $60 million, In sum, Swartz wrote: "It was a good job and we are all proud to have had a part in it."[11]

After the war, the Jacksonville Chamber of Commerce went on record to have Camp Blanding continue in an active status. It pointed out that the many facilities already in place should be considered a positive factor in the retention of the camp. The Post War Utilizations Studies conducted by the Corps of Engineers determined otherwise. This study, after pointing out the many desirable features, decided that Camp Blanding was not satisfactory because the housing was predominately hutment construction, and the railroad facilities were too light for continued use on an active installation.[12]

In contrast to the major military reservation at Camp Blanding, there were many smaller camps built during the war with no thought of permanency. Camp Murphy at Hobe Sound was one such base. This station was a joint training school for Signal Corps and Coast Artillery personnel learning to maintain radio detection equipment. The reservation held 11,200 acres accommodating 504 officers and almost 5,000 enlisted men. Camp Murphy was one of the many varied installations built by the Jacksonville District during World War II.

This war saw the innovation of the Government in leasing hotels and other facilities to support its growing military training program. Under Secretary of War Robert P. Patterson, returning by ship to the United States after a visit to Puerto Rico early in the war, noted that Miami Beach was blacked out. Realizing the tremendous task of cantonment construction and the equally desirable need to save time, money, and material, he thought of the unique idea of leasing luxury hotels. Patterson broached his idea to War Department officials upon his return to Washington. Major General Walter R. Weaver accepted the idea, and, after he became head of the Army Air Corps Technical Training Command, he decided to utilize hotels in Miami Beach for his operation. In answer to initial criticism, General Weaver replied; "The best hotel room is none too good for the American solider."[13]

At the peak of the tourist season, the Corps of Engineers received the directive putting it in the hotel leasing business. Morris A. Spooner, later chief of the real estate division for the Jacksonville District, was assigned to this detail at its inception. The timetable for this, as for other related defense operations, was brief. By the end of January 1942, the Army Air Corps asked representatives of the Miami Beach hotels to report on its facilities. Early in February, the Dade County Defense Council and Hotel Men's Association met with the Corps of Engineers to draw up plans. By 20 February 1942, the first of 400 enlisted men arrived in Miami, followed in the next few days by 500 officer candidates.

In the fall of 1942, more than 200 additional hotels in Miami had been taken up by this program. The Army then expanded the program to other resort areas to do the same thing. Atlantic City, New Jersey, leased 47 hotels; Daytona Beach, 48; and St. Petersburg, 58, before the year was out. The procedure was fairly standard. Upon completion of negotiations, the hotel owners would evict the guests, take down the draperies, and remove the rugs and objects of art as the servicemen moved in. The WAAC's utilized Daytona Beach, the Breakers at Palm Beach became a general hospital, and an Army Air Corps radar school was located in a leased club at Boca Raton. At the peak, around October 1942, 348 hotels in Miami Beach held 78,000 servicemen.[14]

By the summer of 1943, the great need for training facilities began to slacken. Trained troops were being shipped overseas, and the permanent cantonments were completed and able to handle more of the training population. The pressing necessity was over. Most of the Government leasing contracts included a 30-day cancellation clause. On 19 June 1943, the War Department released information that 109 of the 340 hotel leases at Miami Beach would be terminated at once. More hotels were closed in November, followed by another group in January 1944. It had been a unique plan which had succeeded admirably.

The success of this program can be measured in many ways. In dollars, the cost savings were impressive. The rental bill was about \$12.5 million, with an average cost of \$170 per man. Camp Polk had been constructed at a cost of \$1,263 per man, averaged out at

$253 per man over a 5 year period. Far more important than the money saved, was the time and materials freed for the war effort. It was conservatively estimated that the training program would have been retarded by 6 months if the Army had had to first build its facilities. The utilization of existing structures saved a tremendous amount of materials which could be better used elsewhere. One historian noted: "Equally unusual in any history of war financing was the finding of the Senate committee that the facilities in Miami had been leased too cheaply for the good of their owners."[15] The hotel venture was a stroke of American inventiveness carried out successfully by the Real Estate Division of the Jacksonville District.

Military construction by the district continued after World War II until 1970, but most of it was routine maintenance. Geographically, the Korean War was around the world from Florida, and the magnitidue of its mobilization was so much less as to be unnoticed within the district. However, the Korean conflict was the first combat use of jet aircraft by the now independent Air Force, and, indirectly, this had a slight impact upon military construction. During 1951-52, most of the concrete pavement at MacDill Air Force Base was strengthened with an asphaltic concrete overlay to support the heavier, faster jets. Shortly after the war, the district used Homestead Air Force Base to develop suitable materials to counteract the effect of jet fuel spillage upon aprons and other aircraft work areas. A tar-

Officers quarters, Macdill Air Force Base, 1968. Courtesy Corps of Engineers.

rubber compound had been tested earlier in the cold climate of northern New England, and Homestead became the hot weather station used to complete the experiment.[16]

Among the major peacetime military construction projects were the many contracts to build Capehart housing for military families in Puerto Rico and the Panama Canal Zone. Paul B. Schultz inspected the $5.4 million contract for living units being erected on the west coast of the Canal Zone. In January 1960, he reported that the 134 units of Area One were 93 percent finished, Area Two's 100 domiciles 67 percent completed, and Area Three's 96 units 9 percent completed.

Capehart housing was basically the same in Puerto Rico and the Canal Zone, but the different climatic characteristics necessitated some building changes. For example, the outside stairways on the four-family buildings in Puerto Rico were not satisfactory in the Canal Zone because of the excessive rainfall in that region. The long rainy season, with over 120 inches annual rainfall, meant adding electric clothes dryers to the unit design. The parking area for Fort Davis had to be placed continguous to the housing to accommodate family living under these wet conditions. The soil laboratory reported swelling tendencies of 3 to 4 percent, which caused the district to abandon terrazzo flooring at Fort Clayton in the Canal Zone. In spite of these differences, the division's building program kept pace with the initial construction schedule.[17]

In addition to military housing, the Jacksonville District performed the usual construction and maintenance for the Army and Air Force. The erection of a crypto room at Fort Buchanan, Puerto Rico, in 1964, called for a work space surrounded by 8-inch masonry walls, with a reinforced concrete floor, and all reinforcing bars grounded to the crypto room ground (a ground bar embedded in the wall encircling the room about 6 inches above the floor). The standard commercial metal-clad door was set in a 16-gauge frame.[18]

District engineers in Puero Rico were involved in several projects at Ramey Air Force Base, improving apron lighting and building a new jet fuel storage farm, when the 2 July 1964 issue of the *San Juan Star* carried a headline, "Navy Public Works Office to Handle Caribbean Jobs." That same morning, the area engineer in San Juan sent a dispatch message to the district engineer quoting extensively from the newspaper report. Subsequently, in July 1964, the district turned over its Caribbean military construction to the Navy.[19]

The Jacksonville District participated directly in the Vietnam conflict through the employment of one of its dredges, the *Hyde*, in

A veteran of the Vietnam War, the hopper dredge, Hyde returns to duty in the Jacksonville district. Courtesy Corps of Engineers.

Southeast Asian waters. The *Hyde* departed Jacksonville on 20 January 1967 for a tour of Vietnam. She crossed the Atlantic, Mediterranean, Suez Canal, and Indian Ocean on her voyage to combat.

The ship's master, Captain Russell J. Bartell, was working his vessel in Cua Harbor on 9 May 1967, when she hit two magnetic mines. The first one blew a 6- by 8-foot hole in the starboard bow of the dredge. Captain Bartell immediately ordered the hoppers emptied while he turned the ship's head away from the channel to beach her before she blocked thé harbor entrance. By the time the *Hyde* hit the second mine, her draft was lighter and the damage to the ship less serious; however, several crewmen were injured in the latter blast. In two days, repairs had been made to the *Hyde*, allowing her to get back on the job.[20]

The *Hyde* returned to Jacksonville via the Pacific Ocean and the Panama Canal – the first Corps of Engineers hopper dredge to circumnavigate the world. The homeport welcoming included a special commendation for Captain Bartell and Navy awards for the entire crew.[21]

Willie J. Williams, civilian cook on the *Hyde* and one of the three men injured in the mine explosion, transferred to the *Davison,* the *Hyde's* replacement, and he remained in the war zone. On 16 January 1969, Williams was fatally injured in another mine explosion while he was riding a launch back to the *Davison.* On 14 July 1969, District Engineer, Colonel John F. McElhenny presented Williams' widow his Purple Heart and Vietnam Civilian Service medal posthumously.[22]

In June 1970 the Jacksonville District turned its military construction projects over to the Mobile District. This change in tasks placed the district in the same status it had prior to 1940. However, if the need arose, the Jacksonville District has demonstrated that it is capable of moving into a pressure ladened situation and producing the desired results in military construction.

CHAPTER 11

Cape Canaveral

CAPE CANAVERAL IS LOCATED on the east coast of Florida almost midway between Jacksonville and Miami along the Intracoastal Waterway. The Florida coast trends generally south-southeast, but, about 50 miles north of the cape, the shore begins to veer to the east. This change in direction projects a long, curved coastline out into the Atlantic Ocean. At the cape there is a sudden reversal as the beach turns westward. This is followed by a long arc, trending first southwest, then south and finally, south-southeast, rejoining the general alignment of the peninsula's shoreline some 30 miles south of the cape. A shoal extends southeasterly from the cape farther into the Atlantic for 7 to 8 miles, with water depths varying from 3 to 16 feet. The shoal and the recurving south shoreline of the cape enclose the area of deeper water, known as the Canaveral Bight, wherein water depths of 20 to 40 feet are found.

The northwest tip of the bight, which is approximately 3 miles west-southwest from the cape, is known as Canaveral Harbor. Knowing of the protection offered by the Canaveral Bight, mariners have sought shelter at Canaveral Harbor from storms at sea for many years. The anchorage provides a relatively safe haven from the most common storms approaching from the north and east; only the occasional tempest from the southeast threatens a ship anchored at Canaveral Harbor.[1]

As early as 1889, local interests were advocating the construction of a deep water harbor along the shore of the Canaveral Bight. But, the area, sparsely settled, did not command the backing necessary for such a project. When J. Francis Le Baron traveled through the region in 1869, he reported that there were only a dozen settlers within a radius of 20 miles of the haulover, which was about 35 miles north of Canaveral Harbor. In 1882 he found there were about the same number within a radius of 2 miles of the canal.[2] Although the population had increased, it was still a thinly settled locale. Undoubtedly, the backers of the Florida Coast Line Canal and Transportation Company were in favor of the project as one way to economically enhance the intracoastal waterway they were constructing from the St. Johns River to Miami. However, Canaveral Harbor had to wait for a more auspicious time for its port.

During the Florida land boom of the 1920's, development schemes cropped up throughout the state. The Port Canaveral Terminal Company of Orlando was issued a permit from the War Department to construct a harbor, with port facilities on the bight, at the peak of the speculative period. Most venture financing, including that of the Port Canaveral Terminal Company, dried up with the economic debacle which swept the state and nation following the financial crash of 1929. In the end, the company tried unsuccessfully to have the Federal Government take over its project.[3]

Nevertheless, the company's efforts had produced action within the legislature. In 1929, the state created the Canaveral Harbor District as a taxing agency in Brevard County to actively develop finances for the construction of port facilities. In preparing preliminary plans for development, the district provided for an independent economic survey to determine the feasibility of its program. It also offered encouragement to private industry willing to take on the task of port improvement.

The Atlantic Peninsula Corporation of Titusville was the next private company to become interested in constructing an outlet to the sea at Canaveral. It worked very closely with the state agency in furtherance of plans to improve the port. It received its permit from the War Department in July 1933, authorizing it to build a pier, breakwater, seawall, and to dredge a channel out to deep water.[4] As with the Port Canaveral Terminal Company, the Atlantic Peninsula Corporation was unsuccessful in raising the necessary funds before its permit expired at the end of December 1939. Still, the company did not give up; it had an application before the Reconstruction Finance Coprporation for a loan of $3.4 million in 1941. The Atlantic Peninsula Corporation estimated that the total project would cost about $5.5 million. The company stated that if it received the loan it would have the cash and other assets with which to complete the job. It owned over 8.5 thousand acres along U.S. 1, and it had contracts for the purchase of an additional 2.2 thousand acres.[5]

In 1939, the State legislature abolished the Canaveral Harbor District when it created the Canaveral Port District in its stead. The Canaveral Port District and the Atlantic Peninsula Corporation were prime movers in placing plans for a port at Canaveral before Congress and the Corps of Engineers. Their plans for the new port were more complex than the earlier projects. It was no longer just a channel from deep water to a dockside terminal on the shores of Canaveral Bight. Now, the plan envisioned a dredged cut through the barrier beach to Banana River. On the river there would be a turning basin with terminal facilities, and the seaward approaches to the cut would be protected by jetties. A tributary canal was requested to link up the seaport facilities with the intracoastal canal to the west. This canal would cut through Merritt Island, which separated Indian River from Banana River.[6]

District Engineer, Colonel Lewis H. Watkins held a public hearing at Cocoa on 13 February 1939 to discuss this project. There were about 300 persons at the meeting representing many civic organizations and municipalities from the eastern and central sections of Florida. The Canaveral Harbor District, in existence at the time, submitted its economic survey prepared by the New York consulting engineering firm of R. S. MacElwee. On behalf of the Atlantic Peninsula Corporation, C. C. Kirkpatrick, traffic analyst, presented data substantiating the harbor district's survey. Colonel W. C. Weeks was the district engineer when the district finally submitted its evaluation of the project in 1941. Concluding that the project was not feasible at the time, Weeks recommended that no action be taken by the Federal Government.

Division Engineer, Colonel Jarvis J. Bain reversed Weeks' decision. He thought that Weeks had overestimated construction costs and had underestimated the freight tonnage to be generated by such an enterprise. Bain recommended an entrance canal, guarded by two jetties, through the barrier land from the 27-foot contour line in the Atlantic to a 27-foot turning basin in the Banana River. The basin would be enclosed by a dike, with a lock constructed through it leading to an 8-foot deep barge canal running west to the Intracoastal Waterway.[7] Of course, the local interests had to obtain the right-of-way, spoil disposal areas, etc., and had to demonstrate that public facilities would be created in furtherance of the project before the Corps of Engineers would begin construction. Complying with these stipulations required time on the part of the local organizations.

The State created a governing body known as the Canaveral Port Authority to oversee the non-Federal aspects of the program. Five million dollars in revenue certificates and bonds were authorized to carry out local responsibilities. On 22 February 1947, the Canaveral Port Authority informed the district engineer, Colonel Willis E. Teale, that plans and specifications for the proposed port had

Canaveral harbor, view west, December 1961. Courtesy Corps of Engineers.

been contracted for at that time. Two years later, the authority formally resolved to assume full responsibility for local cooperatiton. The Assistant Secretary of the Army accepted this resolution on 21 November 1949, clearing the way for the project to commence. The planning consumed over 6 months before the distict moved its dredges onto the scene. On 26 June 1950, contract dredges began cutting into the ocean bottom from the 27-foot contour line, and into the 8-foot barge canal.[8] By this time, the Canaveral program was not the usual civil works project.

A year earlier, President Harry S. Truman had signed a bill to create a long-range testing and proving area for the country's infant missile and space program. In the ensuing months, it was decided that the facility would be housed at Patrick Air Force Base, Cape Canaveral. In early 1950, the Jacksonville District was designated to be the construction agent for the facility. In May, a month before its dredging operations began, the district started work on the first launch pad. The dredging and launch pad assignments were so close in time, location, and ultimate use as to be considered one. For clarity's sake, the two tasks will be discussed separately.

During the first full year of dredging, three contract units moved almost 6 million cubic yards, working simultaneously on the turning basin and the barge and ship canals. The spoils were used to construct the dike around the basin and the causeway being built from Merritt Island to the turning basin.

The pilot cut, which penetrated the barrier beach on 2 October 1951, brought an unstable condition at the entrance channel and adjacent beach areas. Almost immediately a sand spit formed, extending about 150 feet into the channel from the south shore of the cut. The U.S. hopper dredge *Hyde* worked on the entrance channel the first 3 months of 1952, but the lack of progress halted its operations until conditions could be stabilized. From that time on, seaward dredging efforts were employed only to maintain the channel. During fiscal year 1953, the entrance channel was dredged four times to keep the waterway open.

Emergency construction was initiated on a south groin in June 1953, in an effort to halt the shoaling of the channel. It consisted of an 813-foot shoreward section with a 445-foot revetment. This groin work was underway before the seaward extension of the south jetty had been made. Both tasks were under construction from June to November 1953. Between December 1953 and June 1954, the north jetty was built. it was 1,150 feet long with a 300-foot revetment attached. Gradually, conditions improved as the north jetty took shape; by early September 1954, the work was complete.

At the end of fiscal year 1958, port construction work had been completed, except for the lock connecting the turning basin with the Intracoastal Waterway. This task was deferred for further study.

By this time, the military services utilizing the missile complex at Canaveral needed greater depth at the entrance channel and in the turning basin. Service funds were transferred to the district to dredge a 33-foot basin with a 36-foot outer channel. Later, in 1961, as the military required additional depths, the outer channel was deepened to 37 feet, the entrance to 36 feet, and the turning basin to 35 feet. At the same time, the barge canal lock was authorized and constructed with enlarged dimensions of 125 feet wide, 600 feet long, and 12 feet deep.[9]

Man-made Port Canaveral, built under Corps of Engineer contracts and supervision in 1950-52, has since undergone frequent modifications in depth and facilities. This 1967 view shows missile tracking ships in right center and Navy's Observation Island *test ship at left center. Courtesy Corps of Engineers.*

Meanwhile, local interests had constructed terminal facilities within the area. South of the barge canal, to the west of the turning basin, the shrimp and commercial fishing craft utilize a 1,500-foot bulkhead with 12 feet of water at dockside. Charter boats use the two finger piers located at the west end of the bulkhead. The Canaveral Port Authority operates the 1,060-foot wharf on the south side of the turning basin. On the south shore of the ship channel stretch 1,200 feet of oil docking facilities, including pipelines to storage tanks. Bulk construction materials are handled on the east end of the barge canal.

The port at Canaveral was but one side of the work of the Corps of Engineers at the cape. In May 1950, the Jacksonville District had the urgent task of building the first launch pad for a scheduled Bumper 8 launch, planned to blast off in 2 months. Bumper 8 was a two-stage launch, designed to test the possibility of firing one rocket from another. The launch consisted of a German V-II, carrying a WAC Corporal missile as the second stage. District Engineer, Colonel Richard W. Pearson, selected two men from the Clewiston office and one from the Miami Beach Resident Office to establish an Area Office at Canaveral. The three engineers pitched in to help their contractor pour concrete before they attempted to set up their office at Patrick Air Force Base. They had the satisfaction of being ready for the launch on 24 July 1950, just 45 days after the ground had been leveled. It was an auspicious start.

Primitive as this first launch pad was, it was more than just a slab of concrete laying on the ground. Under the pad were walkthrough tunnels to carry the necessary circuitry and high pressure air lines to the missile. Five hundred feet away from the missile pad, the engineers built the blockhouse for technicians and launch officials. By later standards, it was a crude structure, heavily sandbagged for the safety of its occupants. Between the pad and the blockhouse, power cables lay on the earth's surface, connecting the two pioneer structures of the nascent space center. The road over which the launch hardware was carried was so new as to be of questionable stability. The missile moved on a "don't stop or you'll bog down" procedure.[10] The first two launches were carried out during a 5-day period.

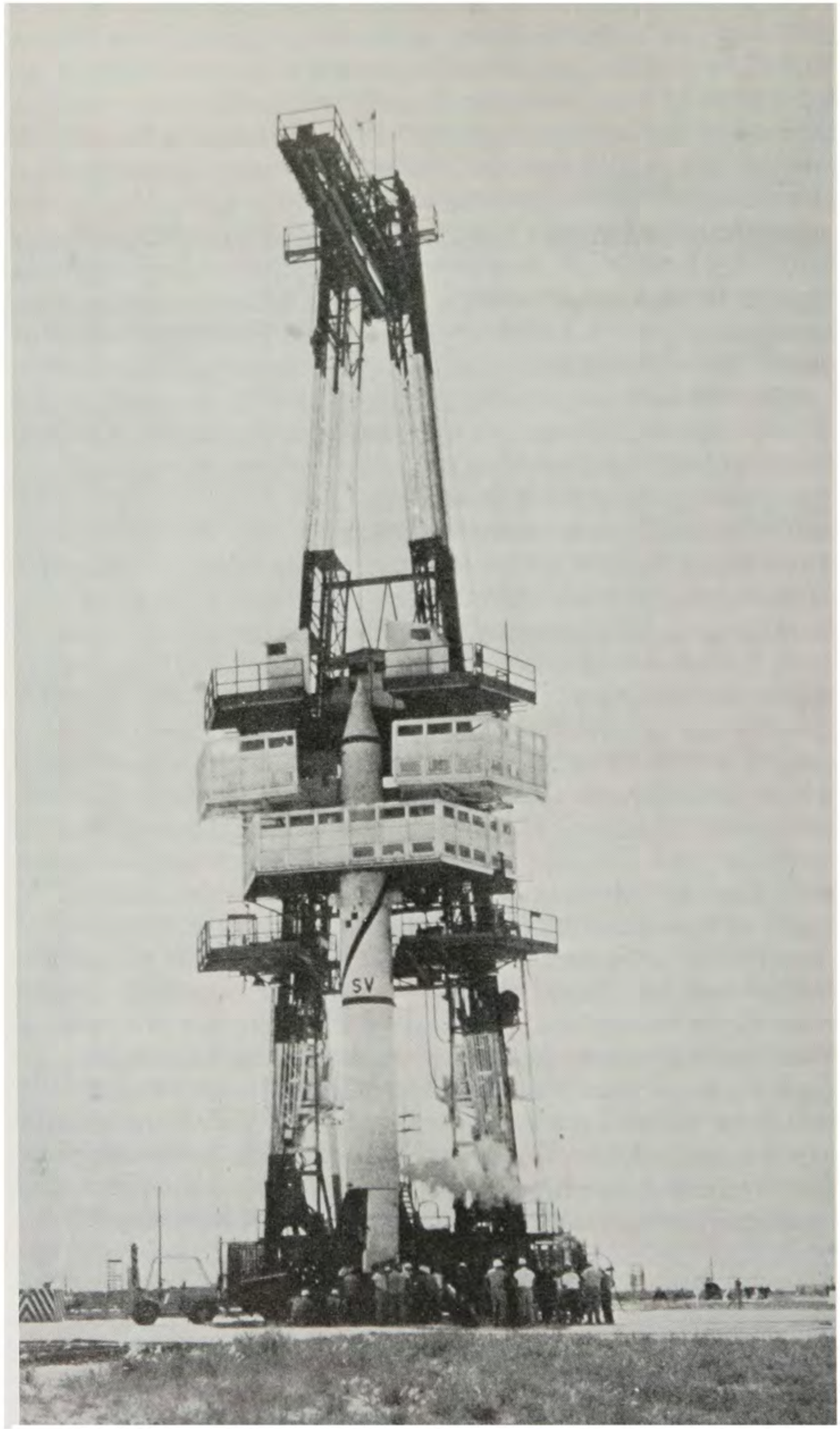
The Bumper 8 launch construction set the stage for later tasks which were performed under the same conditions of immediacy. Soon, the Jacksonville District had contractors working on seven technical buildings at the cape. While new structures were rising above ground, a launch area water system was being placed underground, and around all this activitiy, the engineers were running security fences and patrol roads to enclose the space center.

Nearby, Patrick Air Force Base was being renovated. The base had originally been the Naval Air Station, Banana River, during World War II. In the post-war years, it had deteriorated rapidly after being phased out of operational use. When the Air Force acquired the installation, the district had the task of renewing the base. In the first 6 months of its existence, the Patrick Area Office expended almost $1.7 million in construction contracts.

In 1951, the district began building a skid-strip which was a 7,000-foot long, 300-foot wide landing strip, designed for the recovery of SNARK, a winged missile. This was a time of transition in the air age from the pre-ballistic weapons to the ballistic. The SNARK was one of the last of the winged missiles to be phased out as strategic plans shifted to the ballistic carriers of nuclear weapons. The SNARK had a 6,000 mile range at cruising speeds of 600 miles per hour. Its landing gear consisted of skids; therefore, the ski-strip was surfaced with compacted limerock fill. During the test phase of the SNARK operations, some of the missiles were flown downrange, then returned to land, which saved considerable funds through recovering and reusing the missile.[11] In 1955, the skid-strip was lengthened to 10,000 feet with a 1,000-foot overrun at each end. Later, the whole area was hard-topped with asphalt concrete to attain its present status as an all-weather airfield.

Missile science developed rapidly during the 1950's and 1960's, and the district's knowledge of space structures advanced with the hardware. After the Bumpers came the LARK, first launched in October 1950. The engineers constructed the original scaffolding to service this missile on the pad. By present day standards, this early service tower resembled a painter's scaffold. The LARK's blockhouse was an army tank pressed into service.

REDSTONE's service tower was the forerunner of the now famed gantries so familiar to viewers of launchings of the nation's manned space vehicles. It was designed to provide access to all levels of the missile while it stood in an upright launch position. The service tower was constructed on an A-frame mast which rose 140 feet above the pad. On the mast were cantilevered work platforms which could encircle the missile, allowing access to all stations on the vehicle. Elevators brought technicians up and down the mast to the desired level, from the ground to the 15-ton hammerhead crane at the top, or to any intermediate level. The structural steel base which supported the mast was mounted on railway tracks. This massive, self-propelled unit was designed to move to the missile or back away from it. The Noble Company of Oakland, California, built the REDSTONE service tower and transported it to the cape in 14 railway cars. Seven of the company's men re-assembled the tower



Redstone service tower was first (1953) of long and imposing row of missile gantries confronting the Atlantic at Cape Canaveral/Kennedy. Redstone booster itself put first American in space (Cmdr. Alan Shepard, 1961). Courtesy Corps of Engineers.

at the launch site within 5 days after delivery. The service tower was available almost immediately thereafter for REDSTONE's maiden flight.[12]

The shift to ballistic missiles demanded new construction designs for the launching complex. These new vehicles generated tremendous forces thrust down upon the pad. The engineers had to design structures to carry off the high heat and flame produced during ignition and launch. Then, too, this new technology required complex communication systems between the vehicle and the control area. The engineers had to design and construct the physical systems to carry the myriad parts of the overall launch to their proper places.

Yet, the problems were not as divergent as one might expect. The missiles being developed were similar to their predecessors; thus, the various component parts of the launch resembled those which had gone before. There was the missile assembly and checkout building, the transportation system to the launch area, the launch pad, the service tower, and the blockhouse. Although each new missile made different demands upon these stations, the similarities narrowed the variations to matters of degree.

The Jacksonville engineers built 21 missile assembly buildings, which resembled hangars, before the Saturn, Apollo, and Titan III vehicles were introduced. It was in these buildings that the component parts of the missiles were gathered to be assembled. Unlike aircraft hangars, the missile assembly buildings were honeycombed with covered trenches, below the ground floor, which carried the myriad power circuits, testing devices, compressed oxygen, and other gasses necessary to launch a missile.

Overhead, the buildings all housed cranes for lifting and moving the huge sections of the missile as it was assembled. The cranes were unlike ordinary industrial cranes. Because the interior space of the missile assembly building had to be free from all encumbrances, the crane bridges were of an underslung design, moving on rails suspended from roof trusses. Each bridge covered half the main bay, but interlocked with another bridge on the other half. This arrangement allowed the crane to cover the whole bay.[13] Learning from the earlier structures, the Jacksonville District built the last 16 missile assembly buildings utilizing a basic design, which allowed the standard frame to be fabricated, even as the special design features were being planned for the specific missile series programmed to undergo tests.

From a construction point of view, the most individual and complex portion of the missile assembly building was the emplacement of utilities supporting each missile series. The missile determined, with great exactitude, where and what services were

Corps of Engineers built 21 missile assembly buildings at Cape. The last 16 of which had standardized steel framework with exterior appearance of aircraft hangar.
Courtesy of Corps of Engineers.

necessary. The piping problem was tremendous. Lines carrying liquid oxygen, kerosene, gaseous nitrogen, or compressed air, had to be routed through the covered trenches beneath the main floor, to terminal facilities at the precise station to be connected to the missile being assembled. Each element demanded something different in its piping system. The boiling point of liquid oxygen is -297 degrees. Some of the inert gasses were stored in tanks, carried in pipes built to withstand pressures of 6,000 pounds per square inch. Is it any wonder that this portion of the missile assembly building presented engineering challenges?

Solid fuel missiles, such as the Minuteman and Polaris, simplified the piping system, but these missiles required launching from a silo. The launch device is an underground firing barrel or silo, buried 90 feet in the ground. This was a radical departure from the previous launchings. The Minuteman silo is 267 feet in diameter, with 6-foot thick reinforced concrete walls surrounding the vehicle. Equipment rooms had to be placed underground and connected to the silo by reinforced concrete cableways.[14]

Blockhouses also followed a pattern. Typically, they were igloo-shaped structures, located about 750 feet from the pad it services. Within the blockhouses could be found similar control consoles and instrumentation. The engineers, learning from each new series of missiles, provided the variations necessary for the latest vehicle.

To construct a blockhouse, the engineers dug a large excavation, then filled it with sand. Reinforced concrete was used for the floor and walls. Actually, two floors and walls were made, with the space between cushioned with sand. Thus, the blockhouses were floating on sand to absorb the tremendous shock which could result from an on-pad, or immediately after launch, explosion.

During the era of the intermediate range ballistic missiles, the igloo had base walls of 2-foot reinforced concrete. The dome of the structure was much more solid, beginning with a 5½-foot thickness at the base, and increasing to 8 feet at the crown. Three layers of 4-inch armored glass provided viewing ports. The degree of protection provided varied with the potential explosive force of the missile. Atlas complexes numbers 11 through 14, had inside walls 10½-foot thickness, then 7 feet of sand held in place by a gunite-concrete shell.[15] The Atlas blockhouse was a far cry from the early sand-bagged army tank.

To track the missiles after launch, the district engineers have built everything from periscope mounts to complex buildings housing radio and radio installations necessary to monitor all aspects of space flight. To interconnect all of these various forms of communication data, the district engineers have laid about 400 miles of underground ducting, just within the 9 square miles on the cape proper. To include Merritt Island, Titan III, and Apollo Saturn complexes, would add greatly to the total mileage.

In addition to the space structures at the cape, the Corps spent over $8 million on conventional military base construction at Patrick Air Force Base. The old World War II buildings were renovated or replaced. One new and unconventional building was the technical laboratory built at Patrick. This massive structure, with 455,000 square feet of floor space, is a dominating structure on the base. It is here that the data are collected, collated, and displayed to the scientists and technicians working on America's newest frontier — space.[16]

Commensurate with the growth of the space program, was the growth of the Jacksonville District personnel attached to the Patrick Area Office. The first three engineers arrived at the cape in May 1950 where they immediately went to work on the Bumper 8 launch pad. It was September before they had a chance to move into their offices at Patrick Air Force Base. From that meager beginning, the Patrick Area Office grew as it designed and constructed the launch and support systems of the Thor, Redstone, Vanguard, Pershing, Jupiter, Atlas, Polaris, Minuteman, Titan, and Saturn I missiles. All of these programs called for new designs to be met under exacting timetables.

By January 1963, the National Aeronautics and Space Administration (NASA) was ready for the Apollo, and the Air Force was ready for its Titan III programs. The Chief of Engineers decided that these projects demanded closer administrative and support organization than could be provided from a distant district office, even one as close as Jacksonville. A new district engineer office was established at Canaveral on 1 May 1963, under the command of Colonel G. A. Finley.

A quota from the Personnel Office of the Jacksonville District was detached for duty with the new Canaveral District. The engineering division continued to work on Canaveral projects from the Jacksonville District right up to moving day on 8 July 1963. One hundred and fifty other employees from the Jacksonville District were sent to staff the Canaveral District.[17]

The outstanding work of the Corps of Engineers at Canaveral after 1 May 1963 properly belongs to the history of the Canaveral District, but the Canaveral port work remained with the Jacksonville District. When the space program began to wind down in the 1970's, the need for a special district diminished. In February 1970, the Jacksonville District once again assumed responsibility for personnel services for the cape. Six months later, these services were transferred to the Mobile District. General Order No. 7, of 22 March 1971, directed that the Canaveral District be deactivated. Formal ceremonies closing the district were held 30 June 1971. That same day, the Florida Area Office, under the Mobile District, was activiated. Presently, Mobile's Florida Area Office supervises military construction at Homestead, MacDill, and Patrick Air Force Bases, as well as the NASA engineering needs of the space construction program at Cape Canaveral and the John F. Kennedy Space Center.[18]

The nation and the world look skyward to America's space exploits, but this glamorous chapter in man's history rests upon the solid foundation of engineering and construction tasks performed and supervised by the Jacksonville District. The Corps of Engineers has served the nation in Florida from the Seminole frontier to the space frontier.

CHAPTER 12

Interoceanic Canal Study

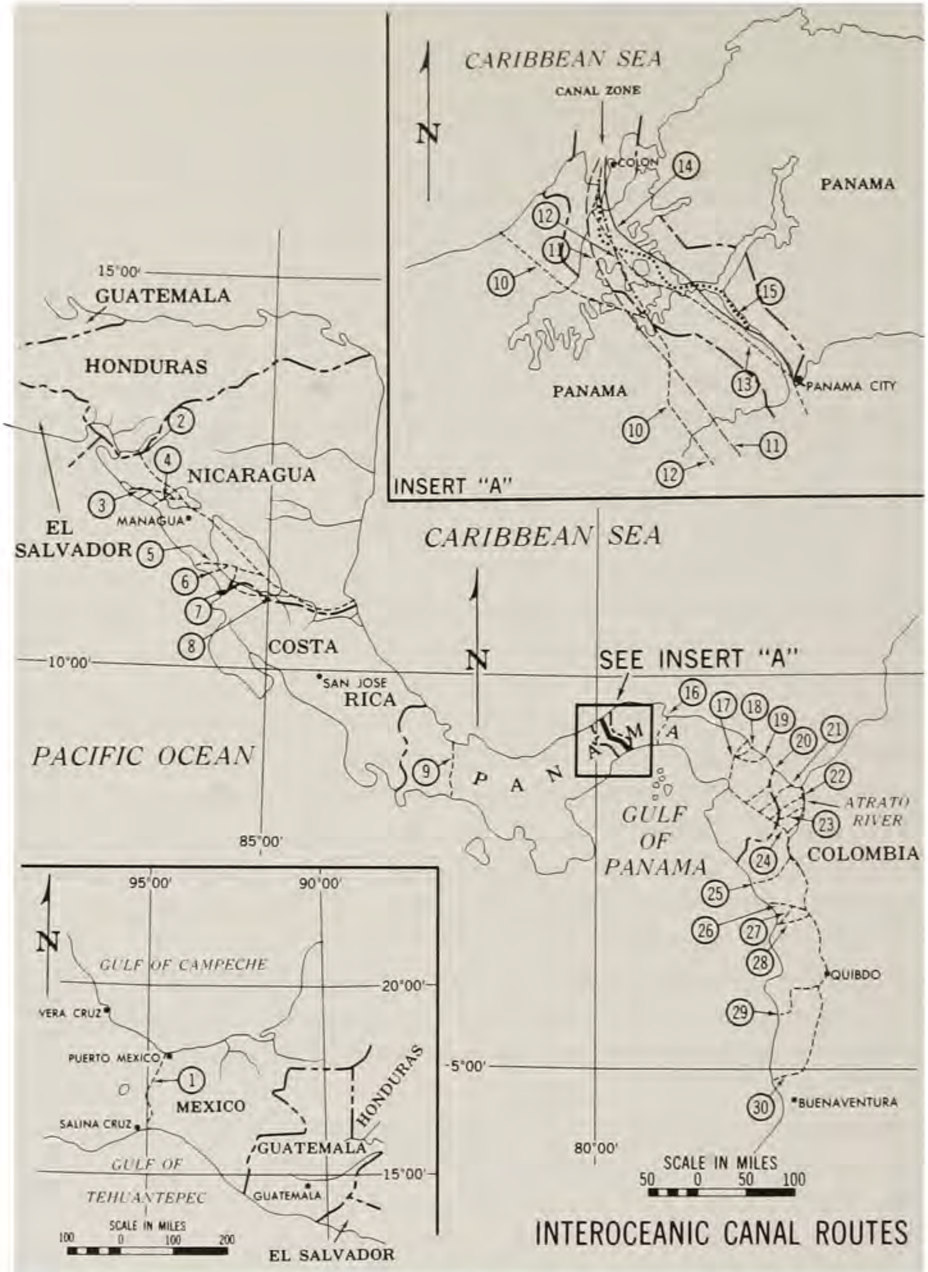
ON 22 SEPTEMBER 1964, Congress authorized President Lyndon B. Johnson to appoint a commission of five men to make a complete study of the feasibility of a sea-level canal across Central America. The Atlantic-Pacific Interoceanic Canal Study Commission was empowered to conduct on-site surveys for selecting the most suitable route, to determine the type of construction to be employed (conventional or nuclear excavation), and to estimate the cost of the proposed project. It was authorized to utilize the facilities of any agency of the executive branch of government, and to expend up to $24 million in the process.[1]

Almost a year later, the Commission requested that the Chief of Engineers be its engineering agent. He, in turn, delegated to the Jacksonville District Engineer the responsibility of collecting data in the field, and of conducting the engineering studies. The district engineer entrusted this task to Mr. Edward W. Eden, Jr. However, nuclear aspects did not come under the district engineer's control. The Atomic Energy Commission supervised the nuclear operations and safety while the U.S. Army Engineer Nuclear Cratering Group had charge of the nuclear excavation design.

District Engineer, Colonel R. P. Tabb established his Interoceanic Canal Studies Field Office in the Canal Zone on 22 July 1965. His field director, Colonel Alex Sutton, Corps of Engineers, supervised the on-site data collection and was the United States' representative on the Joint Canal Study Commissions created in both Panama and Colombia. He served in this capacity until his office was abolished on 31 July 1969.

There were so many supporting organizations involved in this project that the Commission created the Canal Studies Coordinating Committee, composed of the Atomic Energy Commission, the

Interoceanic canal routes.
Courtesy Corps of Engineers.



U.S. Army Nuclear Cratering Group, the Panama Canal Company, and the Jacksonville District, with the district engineer serving as chairman. The diversity of the Canal Studies Coordinating Committee is reflected in its support organizations: The Ecuadorian Institute of Anthropology and Geography, the Hydrodynamics Laboratory of the Massachusetts Institute of Technology, the Institute of Ecology of the University of Georgia, the Institute of Marine Sciences of the University of Miami, the National Academy of Sciences, the National Geographic Society, Oak Ridge National Laboratory, the Puerto

Rico Nuclear Center, the Smithsonian Institution, the Stevens Institute of Technology, the United States Coast and Geodetic Survey, the United States Naval Ship Research and Development Center, the University of Florida, the University of Michigan, and the Waterways Experiment Station of the Corps of Engineers.[2]

The United States has been interested in an interoceanic canal since the mid-nineteenth century. Since the Panama Canal was opened to traffic on 15 August 1914, many studies have been conducted by the Government to plan for the time when the canal would reach its maximum ship transit capacity. The 1947 report of the Governor of the Panama Canal listed 30 possible routes, from the Isthmus of Tehauntepec in Mexico to the northwestern region of Colombia, as potential locations for alternative crossings. The Atlantic-Pacific Interoceanic Canal Study Commission used the 1947 route numbers for its own investigation.

Initially, the Commission contemplated investigating the following proposals:

— Route 8 was a sea-level canal along the Nicaragua-Costa Rica border to be built primarily by nuclear procedures.

— Route 14 was the present lock canal converted to a sea-level canal using conventional excavation.

— Route 17 was a sea-level canal crossing the Darien Isthmus to be constructed by nuclear methods.

— Route 25 was a sea-level cut traversing the Atrato-Truando region of northwestern Colombia to be built by a combination of conventional dredging across the Atrato Flood Plains and a nuclear excavation across the Choco Highlands to the Pacific.

It was determined that only Routes 17 and 25 would be subjected to an in-depth field study, and that existing records were adequate for the other proposals. The Commission later requested a review and update of cost estimates for improving the present Panama Canal while maintaining the lock system of transit (Route 15), and for building a new lock canal (Route 5) in Nicaragua. Some months later, in 1966, it was determined that a new sea-level canal, near the Panama Canal yet distant enough so as not to interfere with present canal operations, was preferable to Route 14 (the conversion of the Panama Canal to a sea-level waterway). This led to the addition of Route 10 as a sea-level canal to be constructed by conventional methods south of Routes 14 and 15.

Eventually, eight routes in four different geographic regions of the American Isthmus were chosen to be studied: two traversing Nicaragua and Costa Rica; three clustered about the present Panama Canal; one crossing the Darien Isthmus; and the final two near the Panama-Colombian border along the Atrato-Truando river valleys. (Route 23 actually traverses parts of both the Darien and the Panama-Colombian border zones.)

Routes 5 and 8 are within the Nicaragua-Costa Rica zone. Lake Nicaragua is the dominant feature of this region's terrain. The lake's surface elevation is 105 feet above sea level. This body of water is 100 miles long, 45 miles wide, and has water depths of over 200 feet in some locations. The lake is drained by the San Juan River, flowing 80 miles eastward to the Atlantic. The total distance between the two oceans varies from 125 to 170 miles, depending upon the exact cut. The Continental Divide runs between Lake Nicaragua and the Pacific Ocean with the lowest elevation being 150 feet (the divide's

Nicaragua-Costa Rica border area. Courtesy Corps of Engineers.

lowest point in Central America). There are a number of active volcanoes in this locale. Tropical moist forests, having both evergreen and deciduous trees, cover much of the area. Temperatures seldom rise above 95/ F. or fall below 70/ F. Rainfall averages 250 inches per year on the Atlantic coast, decreasing to 60 inches annually on the Pacific side. Population density is as varied as the rainfall, but in an inverse proportion with the eastern jungles, holding five persons per square mile. The Pacific slopes and the shores of Lake Nicaragua and Lake Managua average 25 persons per square mile.

The district engineer survey teams plotting the canal alignment east of Lake Nicaragua worked through the underdeveloped, sparsely inhabited, thick jungle. Even on the more densely settled western portion of the proposed routes, the population centers of both Nicaragua and Costa Rica were over 100 miles from the planned canal.

The east coast jumping-off place was the small town of San Juan del Norte at the mouth of the San Juan River, where cargo ships could not approach closer than 3 miles to shore. Supplies for the surveyors had to be brought off in lighters. Much of the surface travel inland was performed in native dugouts powered by outboard motors. Even this method was painfully slow because of the snags and blowdowns which closed the jungle streams. The survey lines were cleared by native labor whenever possible. Work camps, often supplied by Air Force helicopters, were set up along the way.

In the next region, the Panamanian Isthmus is both low and narrow. Routes 14 and 15 (this is the present Panama Canal, modified by improving the present locks, Route 15, or converted to a sea level route, Route 14) cross the Continental Divide where its altitude is 300 feet above sea level. Route 10, to the south, would traverse a slightly higher elevation. This region is serviced by the two urban centers of Colon (population 85,000) on the Atlantic and Panama City (population 415,000) on the Pacific coast. The two terminals are linked by a railroad and a two-lane highway, as well as the present canal.

Route 10 provided the most primitive conditions for survey teams in this region. Most of the ground cover consists of tropical moist forests with multi-storied canopies. In the southern portion of the zone, small savannas are scattered about throughout the jungle. The area has a rainy season from mid-April to mid-December. Annual rainfall varies from 130 inches on the Atlantic side to 70 inches on the Pacific.

Of course, the surveyors were not continually hacking their way through Panama jungles. The rolling hills on the Pacific slope have

Canal Zone and vicinity. Courtesy Corps of Engineers.

been cleared of tropical growth and put under agricultural development. The same is true of the Atlantic coast where farms and grazing lands have been established. But, the major portion of work was through tropical moist jungles, inhabited by primitive Indians who used slash-and-burn methods of cultivation.

The Darien Isthmus is a remote, unknown area where Route 17 would join the two oceans. Its isolation made it an ideal prospect for nuclear excavation. An earlier Isthmian Canal Commission study in 1899-1901 had made expeditions which provided some topographical and geological data. Later, in 1946-47, other geological reconnaissance had been employed. In recent years, aerial photography had covered the Darien Isthmus. All of this data lent credence to a proposed canal, but much more on-site information was needed. Between 1966 and 1969, the Jacksonville District conducted extensive field surveys as it studied all aspects of the locale.

The country of Panama has four major types of forest, and all four are to be found along the Darien crossing. The Caribbean coastline has a narrow strip of sand beach along Caledonia Bay. Almost immediately, the tropical moist forest, with its tall deciduous trees shading the lower evergreens and palms, cover the terrain. Ten miles inland is the Continental Divide where the lowest suitable crossing for nuclear excavation is Sasardi Pass, at an elevation of 1,000 feet. Here, the vegetation is premontane wet forest. Thereafter, Route 17 runs south-southwest toward the Gulf of San Miguel.

Panama-Colombia border area. Courtesy Corps of Engineers.

The river valley flood plains on the Pacific side of the divide support hardwood forests, with the cativo tree predominating. Bordering the Gulf of San Miguel are mangrove forests, thriving in the wet marshlands.

La Palma is the capital of Darien Province. It is a small coastal town of 1,500 people, situated in the upper reaches of the Gulf of San Miguel where the Sabana and Chucunaque Rivers empty into the gulf. The district engineers used Army LCM's to carry supplies up the rivers to the survey camps inland.

The primitive Choco Indians live on the Pacific slope of the divide. The Chocos rarely gather in groups larger than the extended family. Over on the Atlantic side, the Cuna Indians live in scattered isolation along the river valleys. This same tribe also inhabits the San Blas Islands offshore. The coastal and island living Cunas have been thoroughly studied by anthropologists and visited by Caribbean cruise ships. However, the interior Cunas have maintained their hostility to white men since the arrival of the Spanish Conquistadores in the early years of the sixteenth century. It is expected that the Cuna Indians might resist efforts to move them if nuclear excavation were employed.

The Darien region had to undergo intensive investigation by the district engineers before any conclusions could be made concerning Route 17. A 57-mile baseline survey was made which included more than 200 miles of cross section surveys. During the rainy season (8 months of the year) the centerline survey road was passable only in tracked vehicles. In some places along the route, primitive temporary camps were set up, consisting of canvas shelters stretched horizontally among the trees in small clearings. From such rude camps, data collecting parties would investigate the surrounding locale.

Twenty exploratory holes were drilled to check the subsurface properties. These tests totaled 12,000 feet of core drilling, and more than 450 samples were sent to laboratories to test for paleontologic, petrographic, chemical, and physical characteristics. Ten seismographic stations were set up in Panama and Colombia between June 1967 and March 1969 to study ground motion.

Rainfall records from five stream, two sediment, and two tidal gages provided hydrologic records for the engineers from November 1966 to October 1968. Weather stations were established at each end of Route 17 in July 1966. From that date until December 1967, surface and upper air observations were made to record Darien's meteorologic phenomena. In addition, atmospheric conditions of the stratosphere (up to 200,000 feet) were measured by instrumented rockets launched almost daily from Battery McKenzie, Panama Canal Zone. All of this information was crucial to understanding the region.

The Interoceanic Canal Studies Field Office was interested in more than the basic physical properties of climate and land along the proposed route. The indigenuous cultures were studied for knowledge of the social and agricultural organizations of the Indians to be affected by a canal. Such information was a vital element in the engineering decision about to be made. Marine and terrestrial plant and animal life were studied to assess their relation to the Indian's food chain. To protect the lives of the many construction personnel necessary to create the project when a favorable decision is reached, insect and animal specimens were collected along the way. Animal blood samples were analyzed to determine the types of potential human illnesses residing in nature's living reservoirs of diseases. All of this data was painstakingly gathered from 1966 to 1969.

The Atrato-Truando region of northwestern Colombia is probably even less known than the Darien Isthmus. Route 25 in the Atrato-Truando area is, in many ways, a mirror image of Route 17. The Atlantic terminal would be located in the Gulf of Uraba. The canal alignment would follow the Atrato valley through marsh-type soil. The flood plain is covered with impenetrable thickets of tall grasses, cane-like palms, and bush-type plants. As the route leaves the marshes, the rolling uplands of the Choco Highlands are encountered, consisting of multi-storied hardwoods. In this region the Continental Divide shifts to the Pacific side lying within 20 miles of the coasts. The divide is covered with dense, low evergreens, mixed with epiphytes and woody vines. Passes range in altitude from 900 to 1,000 feet. The proposed canal would terminate at the mouth of the Curiche River, which empties into Humbolt Bay. It is the Pacific coast which has the sandy beach in this zone. The rainfall ranges from 80 inches at the Gulf of Uraba to 200 inches on the Pacific side.

The Jacksonville engineers had to make the same extensive investigation of the Atrato-Truando region as that made in the Darien Isthmus. A base camp was established on Curiche Beach for the Pacific operations. It was supplied by Army LCM's and the beach was used as an airstrip by small aircraft. From here, a 78-mile baseline ran from the Pacific coast across the Choco Highlands to the Atrato River. In all, 160 miles of cross sections were surveyed. Using aerial mapping, 540 square miles of the surface were plotted.

Along the Atrato River the marshlands provided very little solid, dry ground for base camp operations. Therefore, the district had to employ barges to be used as a floating base camp.

Many of the sites for subsurface geologic surveys were hacked out of the jungles by teams flown in and supplied by Air Force helicopters. Twenty-two borings were made with an aggregate of 9,000 subterranean feet explored. In addition to the 300 samples forwarded to laboratories, downhole geophysical methods and borehole photography were employed to study underground formations.

Eighteen rainfall gages, eight stream gages, and a tidal gage on the Pacific side were placed in operation, and records were kept from July 1967 to December 1968. After that date, six combination stream and rain gages were used until May 1969.

Weather stations were built at each end of the route. The Alto-Curiche weather station was built on a hilltop area cut out of the jungle, near the Pacific base camp. Over on the Atlantic, the Loma Teguerre weather station was built on one of the few high points in the surrounding marshlands. These installations gathered data from July 1967 to June 1969. The medico-ecological, bioenvironmental, ground motion and stratospheric data gathered for the Darien Isthmus were also relevant to the Atrato-Truando area.

In 1969, Colombia suggested that the three interested nations (Colombia, Panama, and the United States) examine Route 23. Basically, this canal would follow Route 25 up the Atrato River only to the Cacarica River confluence, turn north-west, cross the Continental Divide, utilize the Tuira and Chucunaque River valleys to La Palma, and terminate in the Gulf of San Miguel. The Atlantic-Pacific Interoceanic Canal Study Commission informed Colombia that its investigations were nearly complete, and that it lacked the finances or resources to perform an in-depth field study, but, based upon the available data, the Commission would include an analysis of Route 23 in its report.[3]

Based upon the Jacksonville District Engineer's Study of Engineering Feasibility, and all the other resources at its disposal, the Commission submitted a letter to the President on 1 December 1970, presenting its conclusions that: a sea-level canal created by-conventional means was feasible; Route 10 was the most suitable location for such a canal; and the construction costs would be $2.88 billion in 1970 dollars. The Commission continued: "As a first step, we urge that the United States negotiate with Panama a treaty that provides for a unified canal system, comprising both the existing canal and a sea-level canal on Route 10, to be operated and defended under the effective control of the United States with participation by Panama." If this were done, the Commission recommended construction begin "no later than 15 years in advance of the probable date when traffic through the present canal will reach its transit capacity."[4]

CHAPTER 13

Water Hyacinths

IN ALL HISTORICAL PROCESSES there is a problem of continuity and change. Seldom is there a complete break with the past, particularly so with institutional history. Often, times change so gradually as to be imperceptible to those living through the process. The district's struggles to contain the spread of the noxious weed called the water hyacinth, is an excellent example of the growth and development of the services rendered by the Corps during the last decades of the nineteenth century and throughout the twentieth. The project arose as a result of the direct appeal of private commercial interests requesting governmental aid against a natural phenomenon which was disrupting river communications along the St. Johns River. By the third quarter of the twentieth century, the struggle had led the district into a new frontier – the science of biological engineering – to serve not a limited group of shippers, but all of the people.

The water hyacinth is a beautiful, free-floating, freshwater plant. Its dark green leaves rise above the water's surface from its bulb-like base, while in the center of the plant towers a spike of lavender flowers, presenting an attractive appearance. The plant's beauty is undoubtedly the reason for the water hyacinth's rapid spread throughout the southeastern states. When the flower fades, after 24 to 48 hours of bloom, the stalk bends in the middle, thrusting the flower spike with its seed pods under water. Upon the completion of the ripening process, the seeds are released to settle on the bottom or to become entangled in the roots of the plant, for beneath the water's surface lurks a bushy mass of fibrous roots, from 6 to 24 inches in length, extending away from the leaf bulb. The seed retains its powers of germination for seven or more years under water. Throughout the year, two crops of plants will mature during the warm growing months, while a third crop will be in readiness to develop with the warmth of the following spring. But, the hyacinth's more common means of reproduction comes from stolons growing out from the parent plant an appropriate distance before sprouting a new, independent plant, which will continue the process in a frightfully rapid manner. Ninety-five percent of the hyacinths evolve by this means, as opposed to 5 percent by seed. These intertwined plants, floating on the water's surface, create dense mats of vegetation capable of doubling in area each month of the growing season.[1] In regions such as Florida, where the immigrant water hyacinth is free from its natural enemies, its growth is checked only when it floats into salt water or it is killed by freezing temperatures. Regardless of how severe the freeze may be on the floating plants, some of the seeds on the river bottom survive to start the cycle anew with the advent of the next growing season.

In the 1890's, several mild winters allowed the water hyacinth mats to become truly formidable along the St. Johns River. Acres of the prolific plants were driven by the wind up the tributaries of the St. Johns to lodge tightly from bank to bank, stopping all boat traffic on these side streams. In some reaches of the St. Johns, where bends in the river or man-made obstructions jut out into the water, the floating hyacinth became trapped and the tide and wind-driven mats accumulated, adding to the size of the plant-jam until sections of the river were blockaded.

In the main channel, the larger steamers struggled to push their way through the massed hyacinths; lesser vessels had to await the clearing of the plant. Not only was it difficult for ships to move through the floating mats, but the vegetation covered floating logs, snags, and other water obstructions, creating additional hazards. Water hyacinths became a formidable foe to river traffic on the St. Johns River.

Where did this plant come from? How and when did it get into the St. Johns River? There are many stories told about the hyacinth's introduction to Florida waters. Major Thomas H. Handbury was the first engineer in Florida to write of the water hyacinth. He stated that, prior to 1893, the plant had not been numerous enough to cause concern in the waters of the St. Johns. Beginning in that year, the water hyacinth increased rapidly, forming immense islands floating about on the river at the whim of wind and current. A prolonged southeast wind drove large quantities of hyacinths against the railroad bridge at Palatka, providing the first hazard to river traffic. Handbury heard that the plant came from Colombia, South America, but this was hearsay; he actually had no idea how it had been introduced into the state.[2]

On 3 June 1896, 2 months after Handbury wrote the above, Major James B. Quinn received an appropriation of $1,000 to rid the Tickfau River in Louisiana of the pest. At that time, water hyacinths were confined to the southern waters of Louisiana and the St. Johns River in Florida.

The following year, Lieutenant Colonel W. H. H. Benyaurd, stationed in St. Augustine, and Major Quinn, were appointed a two-officer board to investigate the hyacinth menace. They were interested in the origins of this plant as a function of their duties, and they recorded all the information they could gather. Assistant Engineer John Warren Sackett (who later became one of two civilians to hold the position of Jacksonville District Engineer) told the Board that the water hyacinth was "a native of Venezuela and [it] was introduced into this country as an ornamental plant many years ago." The Board also recorded that: "It has been stated and very generally believed that the plant was introduced from Europe some seven or eight years ago and planted in a small pond near Palatka. Here it flourished to such an extent that . . . the plants were taken from the pond and thrown . . . into the river." It then offered yet another story: "Other opinions have been given that years ago the hyacinth was known on the lower St. Johns. It is further stated that the extensive marsh between Lake Harney and the source of the river is, and has been for years, the hiding place and nursery of the plant."[3]

The basis for the Palatka tale was derived from a newspaper article read by Colonel Benyaurd while he was in New York City in 1896. The 20 September issue of the *Sun* carried a lengthy article and photograph concerning the hyacinth infestation of the St. Johns River. Benyaurd clipped the item and sent it to Chief Engineer, Brigadier General William P. Craighill.[4]

The *Sun* reporter had interviewed Mr. J. E. Lucas, owner of several steamboats, operating on the St. Johns, who said: "I know the man who brought the first plant to Florida, . . . and he thought that he did the State a favor. I have it from his own lips, and I've known him since long before that time, for I used to carry him up the river in a launch year after year to his orange grove. He was Mr. Fuller, father of W. F. Fuller of Brooklyn, owner of Edgewater Grove, . . . seven miles above Palatka . . . I understand that he brought them from Europe."[5]

In discussing the situation in Louisiana, the Board noted: "No definite statement has been made as to the length of time that the streams in Louisiana have been affected. It may be stated, however, that one of the members of the Board, when in charge of certain river and harbor improvements in the State some twenty years ago, had the plant and its peculiarities described, and it is believed that it was then flourishing in the Atchafalaya, this was long before the year stated as to its first appearance in Florida."[6] (The board member was Colonel Benyaurd who had been stationed in Louisiana from 1877 to 1879.)[7]

A South Atlantic Division report, issued in November 1948, stated that the first authenticated appearance of the water hyacinth in the United States occurred during the Cotton States Exposition in New Orleans, in 1884. It then continued with the story of Fuller's pond near Palatka, without mentioning Fuller or his Edgewater property by name.[8] The Department of Agriculture's research into water hyacinth in 1963, concluded that the plant was native to South America, possibly originating in Uruguay.[9]

Besides the rapid natural propagation of the plants, Assistant Engineer Sackett said that, in the early years of the plant's existence in the St. Johns, cattlemen hauled boatloads of hyacinths up reaches of the river, scattering the weed along the banks because they considered it to be a new source of feed for their herds. Thus, this prolific water plant received aid from Florida cattlemen in extending its habitat throughout the extensive waterways of the St. Johns River and into nearby ponds and streams.

Water hyacinths became a problem on the St. Johns in the summer of 1894. Clusters of mats had been drifting about in the river for several years, but that summer was unusual. The Florida East Coast Railway's bridge, crossing just below Palatka, had been built with planking extending from one piling to the next, just above

Lake Monroe, Sanford, Florida

the water's level. The only clear opening was the draw in the center. Between wind and current, the plants began gathering at the bridge. This halted their journey north down the river to the sea and destruction. The growing plant became formidable. Not only did it impede water traffic, but, when the wind blew the tangled growth against the town docks at Palatka, the steamers had to spend hours fighting their way from the dock to midchannel against the relentless pressure of the living green mass.

The bridge was being rebuilt in the summer and fall of 1894 with the same low clearance as the earlier bridge. The citizens of Palatka became alarmed; they called upon one of the town's leading citizens to remedy the situation. President E. S. Crill of the East Florida Savings and Trust Company, wrote to Florida Representative C. M. Cooper in Washington for aid. If the structure were raised above the water to provide sufficient clearance, the plants could float downriver to the Atlantic and extinction. If no changes were made on the bridge, then the inhabitants of the St. Johns River valley could look forward to annual occurrences of plant blockades. President Crill told his representative that "no one can realize how fast this plant multiplies and spreads; and when I say acres, I mean acres and hundreds of acres."[10] Crill's communication made the rounds from Representative Cooper to the Secretary of War to the Corps of Engineers, to Major Thomas Handbury in St. Augustine, and back to the Chief of Engineers, between 9 February and 10 April 1895. The major said that he would talk with the railroad officials about the bridge, in the hopes that they would voluntarily provide some relief.

Bridge at Palatka, showing three small steamers attempting to make their way through a mass of Hyacinths. Courtesy U.S. Senate.

The following year, the citizens of Palatka presented a petition for relief to the Secretary of War. Mr. J. E. Lucas did more – he photographed the plight of three of his steamers battling their way through the hyacinth jam off the Palatka wharf. Armed with visual evidence, Lucas traveled north to see Secretary Daniel S. Lamont in person. His success may be determined by his photograph appearing in House *Document* 91, 55th Congress, 3d Session, in 1898.[11]

Meanwhile, Colonel Benyaurd, who had replaced Major Handbury, brought to the attention of the Chief of Engineers the fact that Palatka's new railroad bridge plans, which had been submitted to the Secretary of War, did not contain the horizontal braces which were being used in the actual construction. The Chief Engineer informed the Secretary of War of this infraction, noting that the bracing had been installed prior to the submission of the company's plans, yet, the drawings did not represent the true bridge design. The Chief Engineer added that he doubted if the Secretary could compel the owners to make the necessary alterations. When notified of the situation, Florida East Coast Railway's president, Henry Flagler, stated that the trestles needed repairs periodically, and, as the occasion arose, the company would try to do something about raising the horizontal bracing so as to allow clearance for the plants to pass under the structure.

The railway bridge at Palatka was only one aspect of the growing problem of water hyacinths. What was needed was a method of eliminating the plants. Assistant Engineer Sackett, who had been assigned the task of handling the green menace, decided to experiment with methods of destruction, for as he put it: "Such a condition of affairs has never been the subject of discussion from an engineering standpoint before."[12] Sackett recommended building a stern paddle-wheel steamer, with either a double bow or outriggers forward, so that, as the vessel pushed its way forward through the mass of plants, it would gather them at the bow where they could be picked up on a carrier and fed into a set of rollers which would squeeze the water from the plant. (Water hyacinths are 94 percent water so the wringing process would greatly reduce their bulk.) The pulp could then be transferred to barges to be disposed of. Sackett reflected that experiments should be conducted on the pulp to determine if the crushing killed the plant. If it did, there would be no need for barges to carry it away – just dump the pulp back into the river.

In October 1897, the assistant engineer established his experimental station at St. Francis on the St. Johns River. Here, he conducted further tests on crushing the plant between the two rollers, which seemed to offer the best hope. The process removed over 60 percent of the water. Tests made by Sackett on the crushed pulp did indeed prove his speculation to be accurate; crushing effectively killed the weed. But, it was a very slow and laborious process. Sackett left John E. Harris in charge of this phase of work at St. Francis while he went upstream to experiment with gathering and towing the weed to areas for destruction.

For this new project, Sackett had a net built of three-sixteenths of an inch cotton line, with one lead and one cork border. The complete rig was 200 yards long. He discovered that the tow boat could encircle a mass of the hyacinth by proceeding slowly, and, if the wind and current were favorable, he could move the plants about. However, too great a speed, adverse wind, or the wrong current would put a heavy strain on the net. When this happened, the plants crowd up to the net, sink the cork line, and tumble free. It was not a very practical solution.

Next, the district tried chemicals. Muriatic acid, sulphuric acid, and carbolic acid were used in varying strengths with negative results. While the tops of the plants suffered from the acids, the bulbs and roots were not damaged, and soon they had put forth growth as high as that which had recently been destroyed. The engineers tried jets of steam, at 70 pounds of pressure, with similar results. When kerosene was sprayed on the weed there was no reaction at all – the plants continued to grow.

Sackett and the Board discarded the idea of employing some animal or parasitic growth against the water hyacinth in view of earlier disasters caused by the introduction of rabbits into Australia and the Australian lady bug into California.[13]

In February 1899, John Sackett visited Louisiana to check on the progress of Assistant Engineer P. H. Thomson, who was engaged in the same work in that state. Thomson had tried a saturation solution of salt mixed with quick lime. It was fatal to water hyacinth, but the cost was prohibitive.

Sackett returned to Florida to recommend to the Board that two sternwheel light-draft steamers be built, fitted to gather hyacinths from the bow to feed to crushing rollers. His plan was accepted and funded. The vessel's design was carried out, but, because the frost during the winter of 1899-1900 destroyed much of the hyacinth on the St. Johns River, it was decided to hold up construction to await the results from the steamer being built in Louisiana. The next year, Sackett again visited Louisiana where it was determined that the steamer, while effective in killing the weeds, could not keep pace with the vigorous growth of the hyacinths.

Meanwhile, the Harvesta Chemical Compounding Company of New Orleans had developed a chemical spray which seemed to promise success. District Engineer, Captain Thomas H. Rees directed Charles Sperry, who had charge of dredging at Orange Mills Flats on the St. Johns River, to undertake experiments for the district. Sperry selected a cove on the west side of St. Johns at Bridgeport, about 11 miles below Palatka, as his site. Most of the month of August 1900 was spent using the chemical and noting its effect. The plants died within 7 days of spraying.

During the process of dying, the plants shriveled, reducing their size so that the dead hyacinths were easy to tear apart from the living mass. As the cost of this process was less than one-third of a cent per square yard, Sperry felt that, with proper equipment, 30,000 to 50,000 square yards could be sprayed per day. The chemical seemed to offer the only hope of controlling the pest during its vigorous growth period.

Sperry also recorded that during his testing a cow had waded through a sprayed section, eaten of the leaves and stalks, and appeared no worse from the experience. Everything about the chemical indicated that it was the solution the district needed to fight water hyacinth.

Two years later, under Captain Francis R. Shunk, the district purchased the steamer *Le Reve*, formally a houseboat rented out under charter for parties along the St. Johns, to be fitted out for spraying. Shunk installed spraying apparatus, but, because there was not enough room on the *Le Reve* for storage tanks, he had a lighter fitted out with two 8,000-gallon cypress tanks. The two vessels made a team assault upon the green menace. From November 1902 through May 1903, the pair worked Black Creek, Rice Creek, Palatka, Deep Creek, Lake Jessup, and Blue Springs. Throughout this time, the *Le Reve* sprayed 242,500 gallons on the weeds.

On three different occasions during the spraying period, work was suspended because of complaints by cattlemen that their cattle were dying after eating the vegetation which had been sprayed. (The active ingredient was arsenic with a large percent of saltpeter.) Shunk required the Harvesta Chemical Compounding Company to conduct further tests to determine the validity of these charges.

Captain Shunk reported that "as a result of these investigations it appears that the compound is certainly injurious to cattle and probably caused some, but not all, of the deaths reported.!"[14] The company concluded that the saltpeter was the noxious ingredient and that the saltpeter contained a large portion of common salt as an impurity. It was the common salt which made the spray so attractive to the cattle. The company substituted bicarbonate of sodium, which gave better results in killing the hyacinths and it did not seem to lure cattle to the sprayed weed.

Captain Shunk continued to spray until January 1904 when funds ran out and the *Le Reve* was laid up at Jacksonville. From November 1902, a total of 1,178,602 gallons had been used to destroy 14,144,018 square yards of the plant. This program had relieved hyacinth congestion and had promoted river traffic. The captain noted that after the shift to bicarbonate of sodium, there were considerably fewer complaints from the cattlemen and he was confident that in none of the complaints had it "been clearly shown that the injury could be traced to the compound."[15] In reality, it may have been that the cattlemen shifted their grievances from the district to Washington, for the River and Harbors Act of 3 March 1905 singled out Florida as the only state where "no chemical process injurious to cattle which may feed upon the water hyacinth shall be used."[16] Spraying in Florida came to an end, although other southern states were free to use chemicals.

In 1896, when water hyacinths were first brought to the attention of the Corps of Engineers as a menace in Florida, John Sackett wrote: "The subject is a novel one."[17] Almost a decade later Captain Shunk could well have replied "Amen!" to Sackett's remarks. In November 1905, Headquarters in Washington authorized him to hire cattle to probe further into the problems connected with spraying. Shunk set up his operation at Riveria, 2 miles below Palatka on the east bank of the St. Johns.

The crudeness of his experiments, and his frustrations as an engineer turned experimenter, are best expressed in his final report. He tried numerous mixtures which he sprayed on the plants to keep the cattle from eating the hyacinths. Captain Shunk tried aloes, a very bitter substance, but the cattle ate the plants without pause. Next he used whale oil soap. The animals didn't notice the solution, nor did they stop eating. Finally, he applied a mixture of badly decomposed eggs, dissolved in water. That horrid spread turned away the cattle. Even after a heavy drenching rain the animals refused to touch the plants. At the end of 8 days it was still effective, but a storm carried away the sprayed plants before Shunk could determine how long it would remain effective.

Just as victory seemed near, Captain Shunk failed. When he added to his solution the compounds of arsenic and copper to kill the hyacinths, the killing compounds eliminated the putrefactive organisms of his mixture. Within a few days the cattle were eating as before. Shunk decided that the only answer was to return to the mechanical method.[18]

The district was not concentrating exclusively upon spraying to eliminate the water hyacinths. In March 1900, the district engineer became aware of a patented invention of Joseph Allan of Macon, Florida. Allan's machine consisted of a horizontal shaft, projected forward over the bow of a boat, to which were attached a number of 2½-foot long knife blades. The apparatus was suspended 1½ to 2 feet above the water, revolving at 350 rpm; it literally tore the plants to shreds.[19]

Allan's device seemed reasonable and communications between the district and the inventor ensued. The district was able to allot $500 of an unexpended balance for Allan's project after he became financially unable to build a working model of his machine.

John Sackett conducted the testing of Allan's cutter. At the conclusion of the experiment, Sackett felt it was the most successful mechanical method yet employed, although it was far inferior to the spraying procedure.

For 4 decades after 1905, mechanical methods were employed in the battle against water hyacinths. The most basic procedure was to send parties along the banks with rakes and forks to throw the weed onto the bank to dry out and die. In navigational channels, boats were used to break up the mats so that detached clumps could drift out to sea and to extinction.

One of the more effective machines developed and improved by the district was the sawboat, designed by Charles R. Short of Clermont, Florida. In many respects it was an improvement on Joseph Allan's invention. The sawboat mounted a series of cotton gin saws on a horizontal axle, which was mounted out over the bow with two outboard rigs extended out from the stern on both sides. The forward axle contained 12-inch diameter saws, spaced five-eighths of an inch apart. Four 18-inch diameter saws were mounted, one on each end of the axle and two in the middle. The outer saws cut the

Corps of Engineer's saw boat chops up Hyacinths near Palatka in March 1940. Courtesy Corps of Engineers.

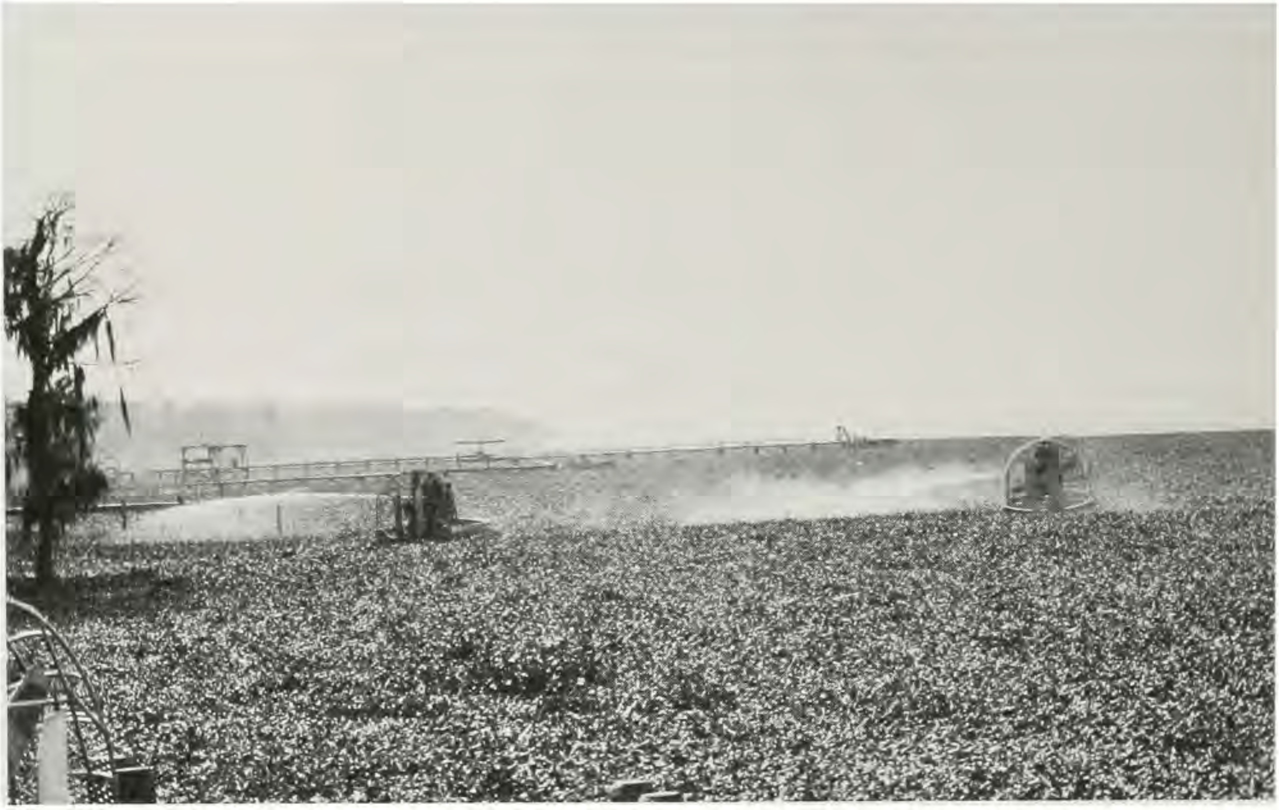
shredded area away from the mat, while the two inner ones opened the center for the hull of the boat. In all, the three axles, with saws spinning at 1,000 rpm, would cut a 10-foot swath through the hyacinth. Behind the sawboat would be a channel of shredded leaves and rhizomes, which would decompose and sink in about 2 weeks. Generally, the area cut would be passed over four different times to macerate the debris; if the rhizomes were not materially damaged there was the possibility of regeneration. During an 8-hour day, a sawboat could cut about 8 acres. The cost varied between $3.50 and $35 an acre, depending on plant size and ease of access of the boat.

The sawboat's propulsion depended upon the same cotton gin saws revolving in the water. In clear areas it could achieve speeds of 4 or 5 mph, but this speed was reduced considerably among the hyacinths. The sawboat was limited to rather open reaches of water carrying at least 18-inches depth because there was no reverse to the propulsion system.

To keep a creek from emptying its plants into the main stream, the district sometimes built booms to hold back the hyacinths. In some places, elaborate booms were designed to open when the tide was running out, to hurry the plants on to the sea; when the tide shifted, the booms closed to check hyacinth drift upriver.

Water hyacinths spread southward into Lake Okeechobee. During the reclamation era, when drainage canals were connected to the lake, the ubiquitous weed followed the man-made waterways to the coast. South Florida has ideal growing conditions for water hyacinth and the plant prospered. The infestation of the canals began with their link-up to Lake Okeechobee about 1918. By the mid-twenties, it was necessary to employ a clamshell dredge with a

Conveyor system pulls Hyacinths into shredder on Lake Okeechobee, March 1973 when Corps of Engineers conducted crash spraying program. Courtesy Corps of Engineers.



"Operation Clean Sweep" cleared the St. Johns of almost all hyacinths in March 1973 when the Corps of Engineers conducted a crash spraying program.

special bucket to clear some of the more serious blockages of vegetation in south Florida canals. Constant water travel helped keep the mats from becoming too well entrenched in the waterways, but, in the 1930's, when roads were built into the Everglades, the canals were given up in default. In 1939 and 1940, the Corps aided the Everglades Drainage District, clearing the plant out of the West Palm Beach, Hillsboro, Upper New River, and Miami canals.

It was 1941 before the weed-killing properties of 2,4-D (2,4-dichlorophenozyl acetic acid) were first recognized. Five years later, the United States Department of Agriculture, the Jacksonville District engineers, and the Everglades Experiment Station of the University of Florida began testing 2,4-D, and soon spraying was back in favor.[20]

Charles F. Zeiger, chief of aquatic plant control for the district, organized Operation Clean Sweep in the spring of 1973. This program was designed to spray the hyacinth, from Palatka to Jacksonville, early in the growing season to take advantage of the reduction of the plant due to the winter freeze which had burned so much of the weed along the St. Johns River. Eight two-man crews set out from Palatka, moving northward. In many places, the mats along the shore were 500 feet wide. In the fifth week high winds and heavy rains swept the area, slowing the spraying operations. The winds were helpful, though, because they dispersed the sprayed mats along the river. The rains also flushed out many of the river's tributaries, bringing more hyacinths into range of the spraying crews. In spite of the weather setbacks, the project was completed in 50 days with over 3,000 acres sprayed.[21]

Meanwhile, experimentation continued with other methods of weed removal. One under investigation was biological control, which began in 1959. Earlier success with the Argentine flea beetle to combat alligator weed, led to the introduction of the Argentine mottled water hyacinth weevil (neochetina eichhorniae). Adult insects were brought into the country, quarantined briefly in California, then transferred to the quarantine laboratory at Fort Lauderdale. Water hyacinth leaves and stems were used for feeding the adult weevils who soon placed eggs in the plants. The eggs were carefully removed, washed in a 0.5 percent hypochlorite solution to eliminate any fungus spores which might have been accidently transmitted from the adult weevil, and the cleaned eggs replaced in new plants. These eggs were then moved into the field to be placed among the healthy hyacinths.

The eggs were released on 23 August 1972 at Collier Estates in Fort Lauderdale. It requires 7 to 10 days for emergence of the larva. Three months in the larva stage is followed by 2 weeks in the pupal stage in an underwater cocoon. The final cycle is the emergence of the adult weevil. The new adult begins feeding on the plant immediately, producing many feeding spots on the hyacinths. In southern Florida, the weevil, which normally lives about 1 year, should be able to produce overlapping generations. It will take several years before the impact of the hyacinth weevil can be determined in the field. It is not the final answer, but it is expected to keep the weed down to more manageable levels. Undoubtedly, all three methods – mechanical, chemical, and biological – will continue to be employed.[22]

Puerto Rico's aquatic weed problem is limited to water hyacinth, but the island faces a different set of circumstances. There is very little fresh water navigation within the island; most commercial and private boaters use the ocean. The dangers presented by the weed include the clogging of the hydroelectric plants, the aqueducts, and sewerage pumping stations. The green menace also blocks irrigation systems when it fills the canals and ditches. In the past, Puerto Rico has relied heavily upon 2,4-D spraying in the reservoirs supplying water to hydroelectric plants. There has also been some experimentation with water snails which feed upon the hyacinths. Similar to the mainland, Puerto Rico will have to use all three methods to control the plant.[23]

Through the years, the consequence of hyacinth and other noxious weed infestations, have grown from the simple impedence of steamboat navigation to multifarious disruptions of flood control and drainage, irrigation, fish and wildlife preserves, and recreational facilities. Many agencies are concerned with aquatic plant control, including the Department of Health, Education and Welfare, and state governmental organizations.

The Jacksonville District's battle with hyacinths, ranging from its early chemical assault to open the river for shippers, to a mechanical attack to protect the cattleman's interest, to today's sophisticated biological probes, demonstrate the district's increasing sensitivity to environmental damage. The clients for the district's services in controlling aquatic plant growth have been expanded from the private interests of shippers to the welfare of the general public.

CHAPTER 14

For The Commonweal

IN RECENT DECADES, there has been a subtle shift in the district's projects from those works requested by private vested interests to broader undertakings for the benefit of the commonweal. Several court decisions rendered for the Jacksonville District help demonstrate the changing philosophy.

In the *United States* v. *Standard Oil Company*, 384 U.S. 224 (1966), the question before the Supreme Court was whether the statutory expression "refuse matter of any kind" included discharges of commercially valuable matter. Standard Oil (Kentucky) had spilled 100-octane aviation gasoline into the St. Johns River and it had been charged under Section 13 of the Rivers and Harbors Act. The District Court dismissed the charge, believing that valuable matter did not constitute refuse. Mr. Justice Douglas delivered the Supreme Court opinion that the statutory word "refuse" did incude valuable matter and reversed the District Court's ruling.[1]

In another case, *Zabel* v. *Tabb*, 430 F.2d 199 (1970), two landowners wanted to dredge and fill their land riparian to Boca Ciega Bay on the gulf side of Pinellas Peninsula, north of the entrance to Tampa Bay. The Pinellas County Water and Navigation Control Authority refused to issue a permit. The Florida Supreme Court reversed the lower court and ordered the Authority to issue the permit.

When the owners applied for a Federal permit, Colonel R. P. Tabb, District Engineer, recommended that the request be refused. He conceded that the permit would not affect navigation, but, because it was not in the best interest of the public, it should not be granted. His decision was upheld by the division engineer, the Chief of Engineers, and the Secretary of the Army.

The owners brought suit, claiming that the Secretary of the Army had no authority to withhold a permit, except if the contemplated action hindered navigation. The District Court agreed and ordered the Secretary of the Army to issue a permit. The final decision, issued by the United States Court of Appeals, reversed the ruling and declared that the Secretary can refuse, basing his decision on conservation grounds only.[2]

Almost a century and a half after Congress put the Corps into civil engineering, it passed the Water Pollution Control Act Amendments of 1972, giving the Corps of Engineers the final say over the nation's wetlands. Undoubtedly, some of the earlier court cases for the commonweal convinced Congress that this was the Federal agency with the know-how and ability to watch over and protect the country's water resources, in spite of the objections of many of the environmentalists. The Jacksonville District has performed a number of projects more encompassing in scope than the traditional venture for private commercial interests.

Beach erosion, a natural process which has been in operation since time immemorial, was one such area of concern. Man has increased erosion by his efforts, either accidentally or purposefully, to improve upon nature. But, only recently, has the eroded shoreline been systematically studied for the purpose of conserving the state's beaches.

The Florida peninsula is part of a larger geographic unit known as the Floridian Plateau, which separates the deep waters of the Gulf of Mexico from similar waters in the Atlantic Ocean. The east coast of Florida consists of a relatively straight beach composed of a series of sandy barrier islands between the mainland and the sea. Interspersed along the barriers are inlets carrying the peninsula's waters to the Atlantic. Much of Florida's sandy beach originated in Georgia and the Carolinas. It was brought to the Atlantic Ocean by rivers of that region, such as the Savannah and Altamaha. Shore current and wave action gradually moved the silica sand southward. This process took place over geological, not historical, time. It has been estimated that the littoral drift of sand along the coast is quite slow – about a foot per year – unless it is interfered with by inlets or other disrupting devices.

There is evidence that this natural erosion is accelerating. Several reasons are given for the increase. As the limestone, coquina, and coral reefs offshore wear away, the beach behind them is exposed to erosion from attacks by greater wave actions. Another explanation offered is that, during the last 1,500 to 2,000 years, there has been a general rise in the sea level. The higher water level subjects formerly dry zones of the shoreline to erosion. Some scientists believe that the increased water level along the east coast may be due to the deceleration of the Gulf Stream. The earth's rotation causes the stream's water to be higher on the left side, nearest the shore, than on the right side. The deceleration of the river in the Atlantic allows more of its high water to escape from the flow along the left bank to flood the Florida coast. But, all of these answers look to the long-term changes of climate or geography.[3]

On a shorter time base, District Engineer, Captain W. M. Black and his assistant, Second Lieutenant D. D. Gaillard, rank among the pioneers who concerned themselves with the movement of sand along the coast. Their report in 1887 occurred long before the terms "ecology" and "beach erosion control" entered into the engineer's working vocabulary. Gaillard's task was to examine St. Augustine for a deep-sea channel on the outer bar, but his survey delved deeply into the phenomenon of the movement of sand along the shore. Gaillard and Black's final reports became the basis for later studies by others concerned with erosion control.[4]

Gaillard worked on the site from 23 May to 26 July 1887. He was aided by Assistant Engineers F. W. Bruce and J. H. Bacon, and he completed his work in Jacksonville in mid-November. During his survey, Gaillard noted that, although a strong current flowed directly along the sand bank, there was no erosive effect, but, whenever there was wave action breaking against the shore, the sand would wear away rapidly. He also noted that the ebb flow influenced sand movement more strongly than the flood tide.

After his field work was completed, Gaillard studied earlier maps to gain perspective concerning St. Augustine's past condition and the long-term changes. He began with a facsimile of an early map of St. Augustine showing Francis Drake's assault in 1586. The outline of the coast was too imprecise to be of value, but the map was important because it indicated that the channel ran close aboard Anastasia Island. Next, a facsimile of Herman Moll's map, made in London sometime in the seventeenth century, depicted the channel in basically the same position as in 1887. A facsimile of Thomas Silver's map, made in 1740 during Oglethorpe's siege of St. Augustine, had the channel in the same position as in 1882. Other maps used by Gaillard were: The Spanish engineers' map of 1791; Lieutenant Colonel Perrault's two maps, one in 1826 and the other in 1829; and the United States Coast Survey maps of 1862 and 1882.

Gaillard made a comparative chart of the shorelines and sailing lines from the 1791, 1826, and 1887 surveys. This chart showed a continual erosion of both the north and south beaches. He concluded that "the wear of the north beach is doubtless due to storms, while that of the south beach, north of Bird Island, is largely due to the ebb tide flowing against it."[5]

Coastal surveys from 1859 to 1963 indicate that Duval County's shoreline had advanced north of the St. Johns River, while recessing to the south. At the beginning of this period, the south end of Little Talbot Island was near the juncture of Fort George River and Simpson Creek. Just south of the island was a sand bar which was inundated at high water. In less than a hundred years, the sand accretion has extended Little Talbot Island almost 9,000 feet to the south.[6] Much of this build-up of sand must be attributed to the obstruction of the natural southern littoral drift by the river current of the St. Johns as it empties into the Atlantic. Part of this stoppage is natural, but the St. Johns' jetties certainly have increased the effectiveness of this barrier.

Local interests have long maintained that the St. Johns River jetty work has intensified the erosion problem south of the river's mouth. Yet, data from 1823 on seems inconclusive. From 1823 to 1879, all indications are that the shoreline receded. (Construction of the jetties began in 1880.) From 1879 to 1900 there was an accretion of sand to the beach. Then, the beach receded again until 1923. An analysis from 1923 to 1963 recorded an average recession of 79 feet for the first 6 to 7 miles south of the jetties, followed by an advance of 56 feet for the remaining 3 or 4 miles left in Duval County. During a very brief period, from 1958 to 1963, the engineers gathered data from 14 profile points on the beach south of the jetties, confirming this trend.[7]

Waves are the most apparent instigators of both accretion and recession of beaches, yet few understand how waves are generated. When the wind blows over a surface there is friction at the interface of the two. When the surface is pliable water, the friction creates turbulence which results in an up and down movement seen as a wave. The up and down energy moves in the direction of the wind, but the water remains relatively stationary except for a limited circular motion. This phenomenon may be be explained as being similar to holding a rope secured at one end, while moving the other extremity up and down vigorously. Waves of energy move along the rope toward the secured end, but the rope does not leave the shaker's hand. Or, if one should observe a free-floating cork in calm waters when something is dropped into the water to create waves, one will notice that the cork bobs up and down but does not move forward with the passage of the wave.

Wave size is determined by wind velocity, wind duration, and the fetch or distance the wave has traveled. Waves moving over deep water encounter no obstructions. As they approach a sandy beach the situation changes. When the water depth equals the wave length (the distance from one trough to the next) the wave begins to change shape, becoming more elliptical until, in shallow water, it tumbles or breaks. The breaking wave has little or no support beneath its crest, causing the water to drop vertically. That portion of water rushing forward up the beach is called the swash; the water flowing back to the sea, down the slope of the beach, is the backwash. The impact of the falling crest dislodges particles from the bottom, putting them in suspension. The swash, having more force behind it than the backwash, carries the sand up on the beach to remain when the water runs back down the slope. Thus, the swash can be the beach building portion of the wave. However, this is so only if the wave approaches the shore perpendicular. If the waves strike at an oblique angle, the swash's energy is not directly up the beach, but is glancing so that part of the suspended sand, and more, may be carried back to the sea in the refraction. Under this condition, the swash erodes rather than builds the shoreline.[8]

This refraction is more commonly called littoral drift. Most of the time, the east coast of Florida is subjected to a southerly drift; although, during times of southeast winds, the drift will reverse to run northward. Between 9 June and 9 July 1936, an investigation of ocean currents and sand movements off Miami Beach revealed a northward littoral drift. Lieutenant Colonel E. J. Dent, senior member of the Beach Erosion Board, noted that this direction was contrary to earlier information available to the Board, and to the physical evidence revealed by the sand accumulation on the north side of jetties and protective works in the area.[9]

Jacksonville Beach during northeast storm, 13th and 14th Avenue North, December 1962. Courtesy Corps of Engineers.

Natural protection of the shoreline is provided by offshore reefs and shallow water, both of which will dissipate wave energy before it attacks the beach. Onshore safeguards for beaches include sand dunes and berm. The latter term is applied to the narrow strip of beach between the dune and the water. Actually, it is a two-step process; normally, the berm provides replacement sand for that taken by the littoral drift, while the dune replenishes the berm.

Hurricanes and severe storms wrack havoc upon beaches because they create wave actions which, especially during high tides, smash against nature's final defense, the sand dune. The force of wind-driven waves hammer the shoreline, washing away large areas at an unbelievable rate. A century's work of building a sandy beach by ordinary wave motion may be swept away after 5 to 10 hours of battering under hurricane conditions. Tides, waves, littoral drift, and inlet currents all are prime movers of sand beaches. In the larger view of the Florida coast, these actions probably cause little loss of beach material. What these forces do is rearrange the state's shoreline, its sandy beaches. The total land area may remain relatively stable, but the location of the transitory beaches shift.[10]

In the primeval condition, there is no concern over moving beaches, but, when man moves in to occupy the shoreline, the shifting sands become a problem; no one wants to see the white beach before his domicile disappear. Much of the recent erosion was manmade when dunes were leveled to erect structures at the very land-edge of the beach. Still further damage occurred by the removal of the vegetation, especially sea oats, whose roots act as anchors to the dunes. With the destruction of nature's stabilizing factors, man resorted to artificial devices to retard erosion through the construction of seawalls, bulkheads, and groins. It is no coincidence that the state's erosion areas occur along the highly developed Palm Beach-Miami, Clearwater-Sarasota, and Duval County shores. Between 1958 and 1970, the Jacksonville District had 14 beach erosion control projects authorized, which included 80 miles of shoreline.

Not all the remedies applied for erosion have been completely successful. Beach groins designed to retard littoral drift have had the adverse effect of increasing leeside erosion. Vertical seawalls have had their drawbacks, also; although they may protect property behind the bulkhead, high water and wave energy striking upright walls are deflected downward, eroding the sand at the base of the structure. Eventually, such walls are left hanging over gapping holes.

Artificial beach nourishment is the latest attack upon erosion. The district now has sand pumping stations planned for Canaveral Harbor and trestle-mounted, sand-transfer plant, if needed, for Hillsboro Inlet in Broward County.[11] Some fill material will be available

Beach building, Dade County project, September 1977. Courtesy Corps of Engineers.

through routine harbor maintenance, but this source is limited because many dredged areas are already so deep that the bottom material is no longer sand. Therefore, offshore borrow areas are being investigated. The Fort Pierce beach erosion control project used this latter method during sand replenishment in 1971.[12] The Virginia Key and Key Biscayne projects called for the construction of groins and the use of an offshore borrow area to renew the beaches. That project was 47 percent completed by 1975.[13] Similar work is being planned for Pinellas County on the west coast.

Revetments have been used by the engineers in their all-out attack upon erosion. During the Florida land boom of the 1920's, extensive bulkheads were built along the east coast as far north as Mayport. Duval County suffered a severe northeast storm in 1925 which destroyed many of these walls. They were rebuilt only to be demolished a second time in a 1932 storm. With Federal aid, Atlantic Beach, Neptune Beach, and Jacksonville Beach constructed concrete seawalls as replacements. Many concrete bulkheads were damaged in the hurricane of 1944; others were destroyed in the intense northeast storm of 1947. Until 1962, these battered walls were replaced by similar concrete structures. After the storm of 1962, emergency granite revetments were constructed in place of concrete seawalls. These structures were more effective in dissipating wave energy without creating extensive erosion problems. Further, 320,000 cubic yards of sand fill was used to replenish Neptune and Jacksonville beaches. At the same time, the Mayport Naval Station was given a protective beach from dredged fill removed from the carrier basin. The damage wrought by Hurricane Dora in September 1964 resulted in an additional 25,750 linear feet of granite revetment along all three beaches.[14]

The Dade County beach erosion control project of the Jacksonville District, is one of the largest single works of this nature undertaken by the Corps. It has a twofold task; to provide for beach erosion control, and for hurricane protection to the Dade County shoreline from Government Cut at Miami Harbor, north to the Bakers Haulover Inlet at the upper reaches of Biscayne Bay. Miami Beach is highly developed, serving as the tourist center for south Florida, and it is one of the most densely built luxury resort areas in the world. The shoreline is protected by an almost continuous seawall, with abutting groins, along the row of contiguous hotels. Erosion has removed over half the fronting beaches so that many of the walls are under direct wave attack during normal tides.[15]

The district's plan for the Dade County project provides for the creation of a dune and a protective recreational beach, to be artificially filled, from Government Cut to Bakers Haulover Inlet. The dune will be 11.5 feet high with a 20-foot wide crown. Side slopes of 1 on 5 will be provided down to the 9-foot elevation where a level berm, 50 feet wide, will be built. The slope from the berm to the existing bottom will be shaped by wave action. It is estimated that this will result in a slope of 1 on 20 to mean low water and then 1 on 40 from that point to the existing bottom. The project will require 14,500,000 cubic yards.[16] As of 1975, the project was still in its preconstruction planning stage. Thus, in recent years the Jacksonville District has been in the forefront, employing new techniques to arrest beach erosion.

Another undertaking for the benefit of the commonweal is flood control. As has previously been discussed in the chapter on

Beach erosion, Dade County. Courtesy Corps of Engineers.

the Central and South Florida Flood Control project, the early efforts at flood control were the result of the Corps being asked to rectify private and state efforts at land reclamation in the Everglades. The more recent flood control projects grew out of this first effort, but later projects have been initiated from a broad base to protect the commonweal through proper techniques of water management.

The Four River Basins project encompasses a 6,000-square-mile area in central and southwest Florida. The heart of this region is the Green Swamp, a vast wilderness of swamps, lakes, streams, marshlands, and prairies. By Florida's standards, the Green Swamp is located at a high elevation – about 200 feet above mean sea level. Four major rivers originate in the swamp: Withlacoochee, Oklawaha, Hillsborough, and Peace. When heavy rainfalls occur, the whole region is quickly inundated because the streams are inefficient at draining off excess water.

Until this locale had a population boom, the periodic flooding did little damage. Earlier settlers developed the better, higher ground first. But, with additional people, the lowlands were brought into use. Flooding became a serious problem as the population density increased.At first, the solution seemed to be to construct drainage ditches to draw off water to the next lower zone. All this did was concentrate the flow peaks which accentuated downstream inundation.

The urban sprawl around Tampa added to the problem by withdrawing holding areas for excess water. There is no way residential and industrial areas with roofs, pavements, and parking lots can hold rainfall. As the development of the urban regions increased, so did the runoff. In fact, the man-made cover actually kept the water from entering the underground water table. The result was twofold; flooding during the rainy months, and droughts during dry months, all because of a decrease in the natural storage capacity of the region. As more subdivisions were built along desirable shorelines of lakes, rivers, and the bay, the problem of flood and drought increased dramatically. The urban sprawl was matched by an agricultural development in the rural areas which removed more lands from the water storage role. Finally, the Flood Control Act of 2 October 1962 was enacted to prevent a recurrence of the serious flooding of the past, and to create a storage system for the excess water.

The result of this act was the Four River Basins project. The Jacksonville District's solution was to design a water management control around the construction of eight reservoirs, and to improve the capacity of several lakes to hold water. The Green Swamp will contain three storage reservoirs; the Hillsboro River will have four, and the Withlacoochee River will have one. These storage centers

will be connected by many miles of channels, protected by levees and other water control structures. Lake Apopka will have a levee along its north shore while other devices are planned for Peace River, Lake Tarpon, Anclote River, and Pithlachascotee River.

Another undertaking in the Four River Basins is a canal to divert the waters of the Hillsborough River, which runs through the center of Tampa, around the outskirts of the city. The urban development along the Hillsborough has taken away that river's capability to flood without inflicting damage along its banks. Therefore, excess waters must be drawn off before reaching the city.[17]

Although the Four River Basins project was authorized in 1962, it was 1966 before the first construction began. By 1975, the task

Flooded residential areas, such as this neighborhood in Tampa, were an almost annual occurence prior to the Four River Basins Project.

was 21 percent completed. Emphasis has been placed upon building the Tampa Bypass Canal, which is designed to bring flood relief to this highly urbanized region.

In the extreme eastern end of the Jacksonville District, there is another flood control project being constructed on the Portugues and Bucana Rivers in Puerto Rico. These two rivers drain 54 miles on the south side of the island. The drainage area varies from 4,000-foot elevation down to sea level in the short distance of 14 miles from peak to sea. Ponce, the second largest city in Puerto Rico, is located on the coastal plain of this region. The topography and rainfall pattern is such that there is an extremely high water runoff rate which produces flooding with very little warning. As was the case with Tampa, as Ponce grew in population, the urban spread encompassed more land which was subject to damage by the periodic floods rushing down from the mountains.

In contrast to the Florida rivers which flow through flat land, the Portugues and Bucana Rivers drop more than 750 feet per mile near their source. Even on the coastal plain the fall is 25 feet per mile. Overall, the two drainage basins average a descent of 300 feet per mile from source to sea. The present project is the first flood control program scheduled for the island of Puerto Rico. It is similar to the Four River Basins project in that it was brought about by urban development.

District Engineer, Colonel A. S. Fullerton recommended constructing a dam on each river to provide reservoirs to impound excess rainfall. Such stored water would then be available for both agricultural and urban use when needed. Also, similar to the Tampa condition, Fullerton recommended a diversion canal be built to draw off the excess waters of the Portugues River which flows through Ponce. The canal would carry water over to the Bucana River for exit to the sea. The project would also include improving the coastal basin channels of both rivers to increase their effectiveness in moving water to the ocean. Construction for this project commended in 1975.[18]

The beach erosion and flood control projects were underway in the 1960's during the same time the ecology movement was sweeping the country. It was at this time that many people began to realize the function of swamps, marshlands, and estuaries. These wetlands are nature's way of slowing down rainfall runoffs; they perform a natural process of purifying the surface waters; they are the basic source of nutrient for the ecological food chain from sea nursery estuaries to commercial fishing in ocean waters; and they are being withdrawn for other less productive uses at a rate of 200,000 acres per year.

Drainage, either for agriculture or real estate, had removed 51 million of the 127 million wetland acres estimated to be available to the nation.[19] Environmentalists were concerned because, although there were many agencies involved in land use at the local and Federal level, no single department was in overall charge of preserving the ecologically vital wetlands. When concerned citizens became politically articulate, Congress addressed itself to the question, and it settled upon the Corps of Engineers as the coordinating agency under Section 404 of the Water Pollution Control Act Amendments of 1972.

The environmentalists charged that the Corps would do nothing. Anxious to right a congressional wrong, the Natural Resources Defense Council and the National Wildlife Federation took the engineers to court where a Federal judge issued his ruling in the spring of 1975. "The Corps," said the judge, "was to assume authority over *all* the waters of the United States – coasts and adjacent wetlands, rivers and small streams, marshes and freshwater swamps, even the Great Lakes."[20] Congress and the Federal judicial system put the engineers into environmental protection in a big way.

Colonel Donald Wisdom, district engineer, made a landmark decision shortly after the Corps had been assigned its new role. A decade earlier, the Deltona Company had purchased Marco Island on the southwest coast of Florida, below Naples, with plans to turn the area into a bustling self-contained waterfront community of 34,000 people. In 1964, the company dug its first canal, after a waiting time of only 9 days for its dredge permit from the district. Deltona intended to lay out its channels so that all lots would front on the water, a venture well received by the buying public. The second permit was received in 1969, after a considerable wait. In 1974, the company was back to the district for a third permit to dredge and fill another 2,200 acres of wetlands. By this time the sides were sharply drawn between the environmentalists and Deltona. The difference was that the Corps of Engineers was now concerned with all waters in the country, not just navigable waters.

Colonel Wisdom had the task of deciding whether to grant the request. The Jacksonville District Office was flooded with written arguments from both sides. Deltona produced enough documents to fill a 6-foot long bookshelf. The environmentalists presented an impact statement of more than a thousand pages. Both sides had experts speak on their behalf. The whole proceding was emotionally argued before the district engineer.

Colonel Wisdom examines some wet lands.
Courtesy George Silk.

When Colonel Wisdom announced his decision in the spring of 1976, it surprised many. He recommended that the company be permitted to develop an additional 1,100 acres, which included 113 acres of wetlands. However, the colonel stated that dredge permits would not be issued for the remaining 1,908 acres, including 2,039 acres of mangrove wetland, because it "would not be in the general public interest."[21] A momentous decision, determined under the guidelines of the congressional charge of 1972. The Chief of Engineers, General John Morris, in Washington, upheld Colonel Wisdom's ruling.

Of course, this is not the end of the episode. The Deltona Company has filed a lawsuit against the Corps, on the grounds that the Federal Government had changed the rules in the midst of its development program, and the company should not have to suffer for such an act.

It is significant that Colonel Wisdom's decision was based upon the welfare of the commonweal, not upon the well-being of an economic segment of society. It was not just the 2,000 odd acres on Marco Island at issue, it was the millions of acres still in their primeval state which were being considered. In an interview, the colonel succinctly summed up the new direction of the Corps of Engineers when he said: "We just used to think about the two 'e's - engineering and economics. Now we've added a third – environment."[22]

CHAPTER 15

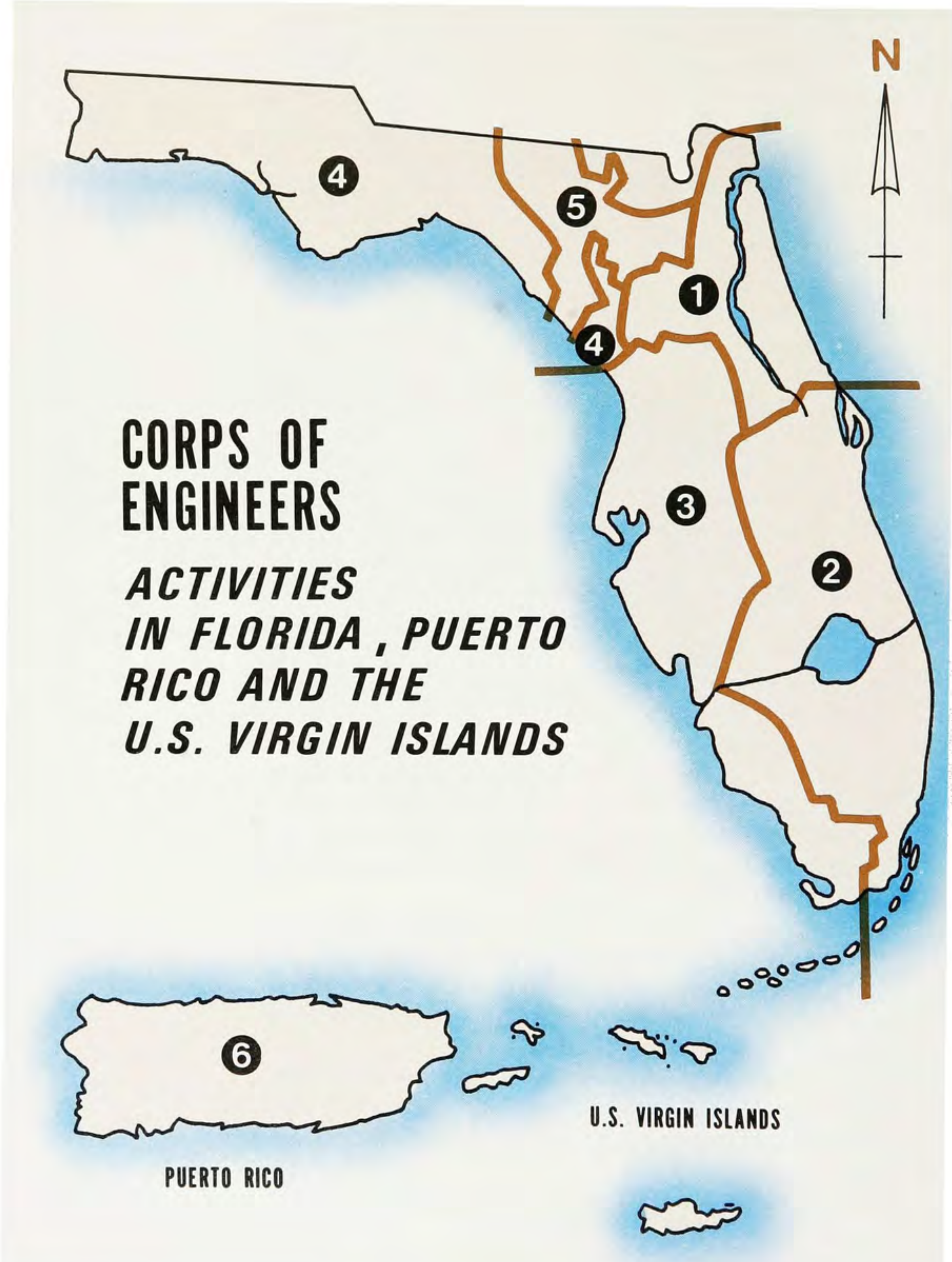
Conclusion

TODAY, THE JACKSONVILLE DISTRICT CORPS OF ENGINEERS is one of the subgroups within the South Atlantic Division based in Atlanta, Georgia. The district covers all of the Florida peninsula, juts into southern Georgia along the lower portion of the Suwannee River basin, and reaches 1,150 miles southeast of Jacksonville to include Puerto Rico and the American Virgin Islands. The Florida panhandle, from the St. Marks River basin west, is in the Mobile (Alabama) District. Districts are confined to natural watersheds for their civil works activities, while divisions cover broad geographic regions containing major river basins. Military construction is a separate activity from the civil works groupings. Therefore, not all districts of the Corps of Engineers are responsible for military tasks within their particular district, and such construction in Florida is now under the control of the Mobile District.

Very broadly, the major functions of the Jacksonville District consist of navigation improvement projects, flood control, and beach erosion control. Among the newer tasks, promising to be both exciting and vital to the future, are water pollution control, urban studies programs, and environmental projects.[1]

It will serve a useful purpose to divide the district into its natural regions and briefly point out a few engineering works in each. Geographically, the state of Florida may be segmented into five areas for easy reference:

1. Lower St. Johns River and North Coastal area,
2. Central and Southern Florida area,
3. Southwest Florida area,
4. Suwannee River Basin, and
5. Northwest Florida area (most of this region is in the Mobile District).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❶ LOWER ST. JOHNS AND NORTH COASTAL AREA

The Lower St. Johns and North Coastal area includes that portion of the St. Johns river basin from Lake Harney to the sea. The St. Johns originates in the swampy region west of Fort Pierce, about 300 miles from its mouth at Mayport. Lake Harney is slightly more than mid-way, 164 miles upstream. The principal tributary of the St. Johns is the spring-fed Oklawaha River, which lies to the west.

Like the rest of the peninsula, the St. Johns river valley is a relatively level expanse of terrain. The river's fall from origin to the Atlantic is only 25 feet; therefore, the river has a perennial tide to Lake George, 106 miles upriver, and, under certain circumstances, tidal affects have been noted as far as Lake Monroe, 161 miles from the sea. It is almost a misnomer to use the term "valley" when discussing the St. Johns river basin. Between the river and the coast there is less than a 50-foot summit dividing the drainage flow; eastward into the lagoons formed by the coastal barrier islands, and westward into the St. Johns. The western drainage divide is a little higher, with elevations ranging from 75 to 200 feet; only the upper Oklawaha river basin is above 300 feet along its divide.

If one were to enter the Jacksonville District in the northeast and travel around the district clockwise, the first project encountered would be the Intracoastal Waterways from Fernandina south to the St. Johns River. Work on this particular system was started in 1828, although the present 12-foot channel was constructed under the River and Harbor Act of 1938, over 100 years later, and completed in 1941. This waterway serves commercial and recreational vessels along its 22-mile length. One may follow the Atlantic Intracoastal Waterway to St. Lucie, where it joins a cross-Florida waterway, or keep sailing south to Miami and Key West.

The navigational improvements of the St. Johns River are next. The engineers constructed two long jetties out into the Atlantic to direct the river's channel and to open Jacksonville up to the sea. On the coast, immediately inside the jetties, is the Mayport Naval Station which contains a large carrier basin that is homeport for some of the Navy's most advanced aircraft carriers. Dredging operations for this basin were performed under the district's direction.

Going upriver, one will observe the modern seaport city of Jacksonville, 25 miles inland from the Atlantic Ocean. The city and the engineers have been concerned with the river's navigation since 1852. Today, a channel has been dredged to a depth of 38 feet from the sea to the city, 13 feet to Palatka, 12 feet to Sanford, and 5 feet to Lake Harney. All of these endeavors were designed to open the St. Johns to waterborne traffic.

The city of Jacksonville is the urban concentration in this first region. It is here that the district is embarking upon programs for flood control, water pollution control, urban studies, and environmental protection. Flooding is a serious problem for metropolitan Jacksonville because of the inadequate drainage facilities and the expansion of its population into the more flood-prone lands. In addition, the increase of people and industry draw heavily upon the ground-water supplies, while the sewage disposal systems contribute greatly to the strain on environmental control.

Farther upriver, at Palatka, the Cross-Florida Barge Canal strikes out to the west. Work was halted on the canal in January 1971 when President Nixon became concerned about the possible environmental dangers allegedly associated with its construction.

New economic and environmental studies are now underway to determine the feasibility of the project. Meanwhile, the 30 percent of the barge canal completed, remains suspended in limbo while the engineers wait for the final determination.

The Central and Southern Florida area runs south of Cape Canaveral-Orlando, down the center and east coast of the peninsula, to include the northern portion of the Florida Keys. This region is geographically dominated by Lake Okeechobee, which embraces the drainage area flowing east of the summit ridge along the

peninsula. Notwithstanding the various directions which the flow of water takes in this region, it should be treated as one drainage basin. The waters of the Upper St. Johns River move northward. The Kissimmee River flows south to Lake Okeechobee. Yet, the summit land dividing the Upper St. Johns and Kissimmee Rivers is so low that, under various wind and weather conditions, the waters of the area may drain to the north or south.

Lake Okeechobee is a large, shallow, fresh water lake in the center of this geographical setting. It acts as the drainage basin for the waters moving south. In its natural state its boundaries are indefinite. Its waters ooze southward to feed the Everglades and southeasterly towards the coast. Lake Okeechobee, which means "big waters" among the Seminoles, is, next to Lake Michigan, the largest fresh water lake wholly within the United States. It was first explored by the Corps during the Second Seminole War (1835-42). Because of the topography of this region, the two extremes of flood and drought are natural disasters of the area.

Along the southeast coast of the peninsula there is a narrow coastal ridge of pine barrens. It is this land which supports the urban population running southward, in what is today Palm Beach, Broward, and Dade Counties. Here, the same urban problems are present: large population, very serious water-resources utilization, and sewage disposal. Except for the new urban development at Orlando in the north and the coastal population in the south, most of this second region is rich agricultural land, much of it devoted to beef cattle.

Travelling down the Atlantic Intracoastal Waterways one would first see, upon entering this second region, the massive space complex at Cape Canaveral. The Jacksonville District engineers were the ones to initiate construction of this jumping-off place to the moon. In the summer of 1950 an area engineer office was set up at the cape. Thirteen years later, Cape Canaveral was separated from Jacksonville to become an independent district. In 1970 the Canaveral District was deactivated, and its functions were taken over by the Mobile District.

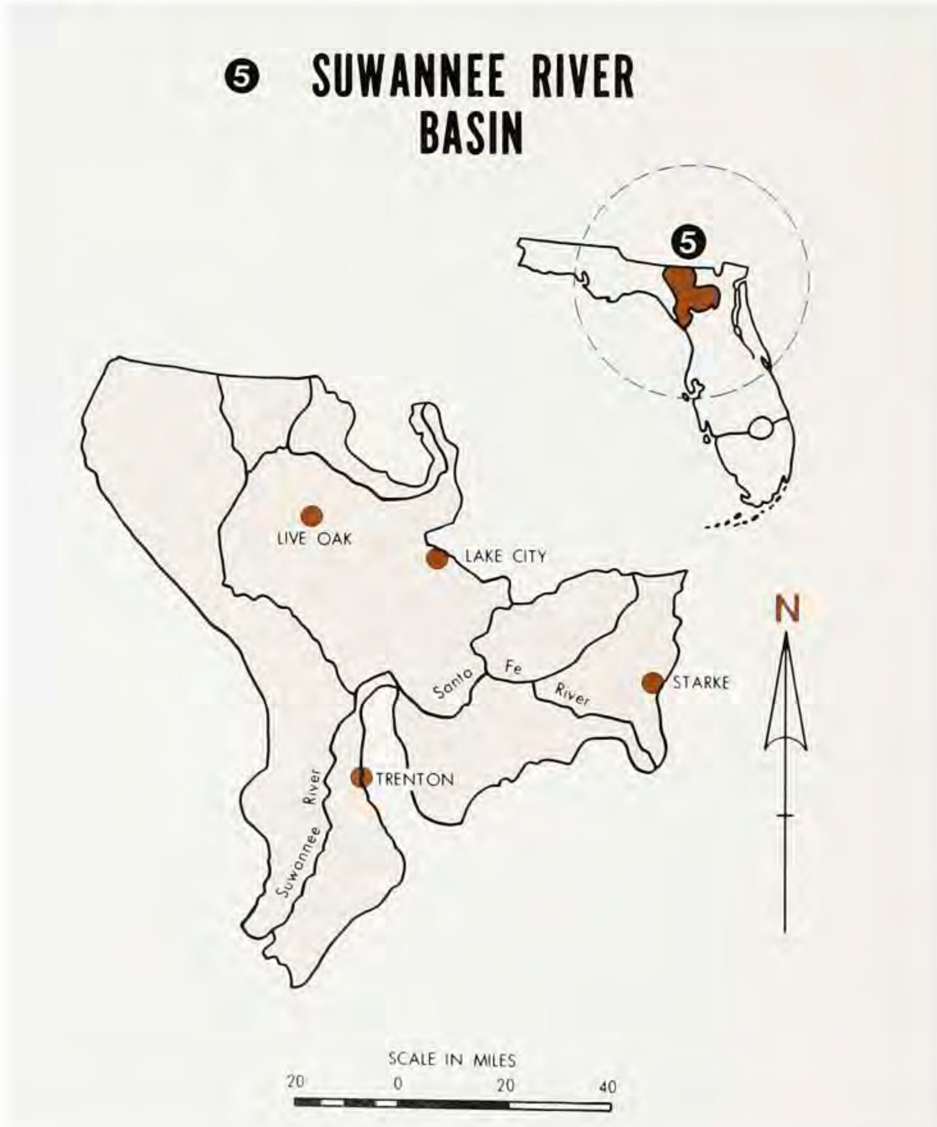
Farther south, one encounters the Okeechobee Waterway from the Atlantic to the Gulf of Mexico via the St. Lucie Canal, Lake Okeechobee, and the Caloosahatchee River. This project was authorized in June 1934 and completed in 1962. The 155-mile waterway, with its four locks, has averaged over 14,000 passengers per year since 1963.

Continuing south, one can visit the harbors of Port Everglades and Miami to watch the cruise ships come and go. Since the Corps dredged out these ports, a new industry, catering to the seagoing tourist, has sprung up in south Florida. The spectacular sight of the graceful passenger vessels, steaming close by the high-rise buildings on the shore, is striking.

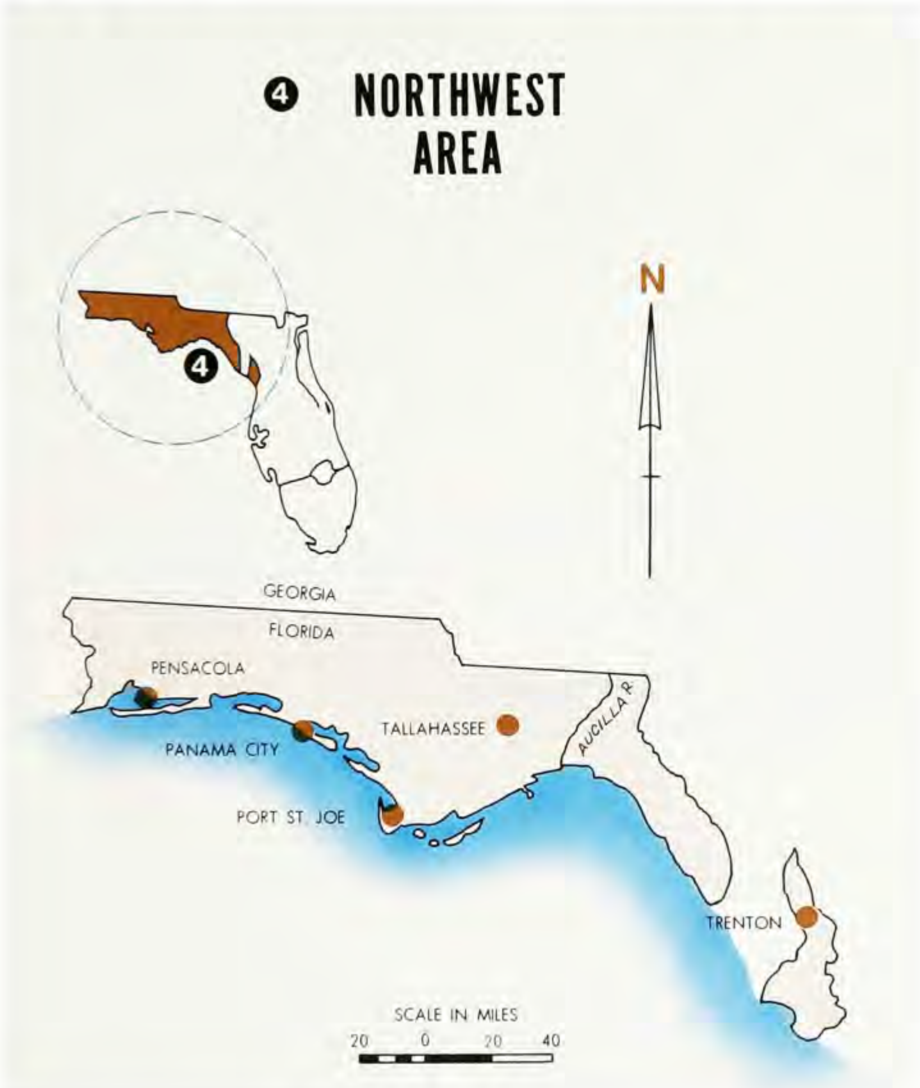
The most impressive work of the Jacksonville District in this region is the Central and Southern Florida Flood Control project. This is a comprehensive flood protection and water conservation program, embracing about 16,000 square miles, and touching 18 counties. The project has two phases. Phase One calls for a protective levee from the Homestead area, north to Lake Okeechobee, close by the St. Lucie Canal. Phase Two concentrates on the western portion, and although it, too, is of a flood control nature, it is more

involved with shifting the area's water to the needed place; that is, bringing water to or withholding water from the Everglades, as the conditions warrant. In addition, there are extensive floodway channels north of Lake Okeechobee to regulate flooding in the upper St. Johns River and the Kissimmee River basins.

The Southwest Florida area covers from the Florida Keys northward along the gulf coast to the Withlacoochee river basin. It includes the Everglades National Park, the two gulf coast bays at Charlotte Harbor and Tampa Bay, and the Green Swamp, an area of about 850 square miles of swamps and lakes feeding the Hillsborough, Withlacoochee, Oklawaha, and Peace rivers.

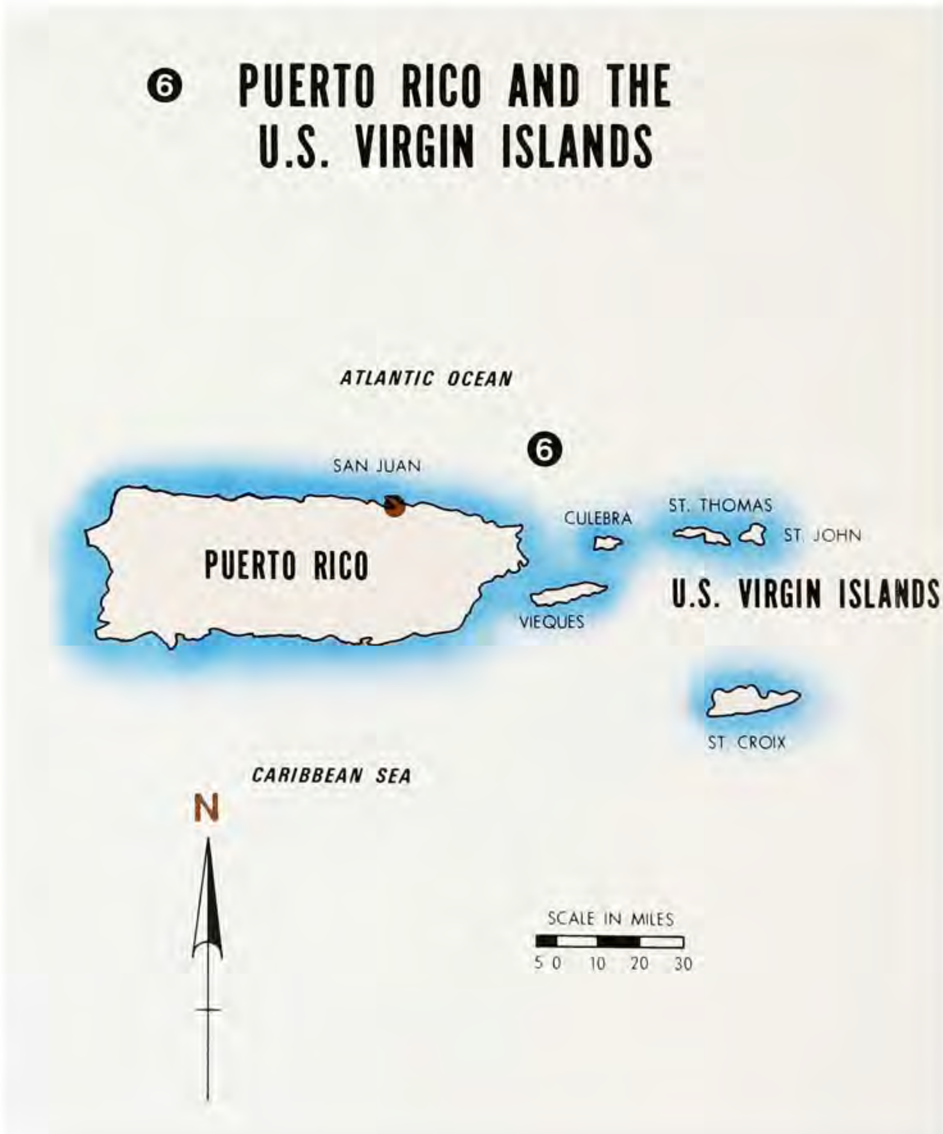


Continuing one's travels around the district, one may utilize the Intracoastal Waterway from Caloosahatchee to the Anclote River, just north of Tampa Bay. However, Tampa Harbor, about midpoint on the peninsula on the gulf coast, serving the second largest metropolitan center of the state, ought to be mentioned. At the present time, the channel dredged by the engineers is from 34 to 36 feet in depth. In 1970, authorization was granted to deepen the channel to 44 and 46 feet, while widening it from its present 400 to 500 feet to the newly proposed 500 to 700 feet. Work has not yet begun on this project. Already, Tampa Harbor is the largest port in Florida, and it is eighth in the nation with respect to tonnage passing through its facilities.



The major flood control project in this region is the Four River Basins. The four rivers are the principal outlets for Green Swamp. The Hillsborough River runs southwesterly 54 miles to Hillsborough Bay at Tampa. The Oklawaha River rushes northerly 75 miles to join the St. Johns River. The Withlacoochee River meanders northwesterly 160 miles to exit into the Gulf of Mexico at Yankeetown. The Peace River flows southerly to Charlotte Harbor 120 miles from its origin. The project plans to make stream improvements, to build canals, and to construct reservoirs in order to harness these waters and prevent such disastrous floodings as have occurred in the past.

The next two regions, the Suwannee River basin and the eastern portion of the Northwest area, are inactive at the present time. The Intracoastal Gulf Waterway, from Tampa Bay north to St. Marks,



has been suspended. An economic study has indicated that, without the Cross-Florida Barge Canal, there would be no justification for the Intracoastal Gulf Waterway. The channel through Derrick Island Gap, created to connect the Suwannee River with the gulf for safer navigation, is also considered nonessential, although it is 25 percent completed.

In the Antilles, the historic harbor of old San Juan is maintained by the Jacksonville District. On the south side of the island a new flood control project is planned for the Portugues and Bucana river basins. This latter task will relieve Ponce, the second largest city of Puerto Rico, from the perils of periodic flooding.

A more detailed study of the Jacksonville District's undertakings shows that the district is undergoing a shift in emphasis. Urban studies are in the incubation stage, although the population growth in metropolitan areas is a harbinger of its future importance. Water pollution control, beach erosion control, and environmental protection are in early stages of development, and all three will become increasingly more important.[2] Today, it is flood control. Yesterday, it was navigational projects. The day before that, in the mid-nineteenth century, it was coastal fortification. In the earliest days of the Corps of Engineers in Florida, it was surveys and map making. Regardless of the emphasis, the Jacksonville District and its predecessors have functioned to serve the nation and its citizens.

APPENDIX A

EARLY ENGINEERS WHO PLAYED A SIGNIFICANT ENGINEERING ROLE IN FLORIDA

James Gadsden	Horatio G. Wright	Quincy A. Gillmore
1822-1830 1831-1839	1846-1856	1869-1884

FORMATION OF DISTRICT AND LIST OF DISTRICT ENGINEERS

MAJ. ANDREW N. DAMRELL

Improving:
Apalachicola Bay
Apalachicola River
Suwanee River
Withlacoochee River
Manatee river
Caloosahatchie river
Pease Creek
Cedar Keys Harbor
Tampa Bay Harbor
Key West Harbor

Examination or Survey:
Anclote Harbor
Wekeiva River
Charlotte Harbor

20 August 1884

CAPT. THOMAS TURTLE

Forts:
Fort Jefferson
Fort Taylor

15 August 1884

LTCOL. QUINCY A. GILLMORE

Improving:
Bar St. Johns River
Upper St. Johns River
Volusia Bar

Examination or Survey:
St. Augustine Harbor
Mosquito Inlet
Canal from St. Johns River through Mosquito Lagoon and Indian River to Jupiter Inlet and Lake Worth

30 August 1884

Lt. William Trent Rossell
First District Engineer

26 April 1886
Lt. William Murray Black

20 November 1891
Maj. J. C. Mallery

20 June 1893
Lt. Albert M. D'Armit

15 May 1894
Maj. Thomas H. Handbury

15 July 1895
Lt. Albert M. D'Armit

17 August 1895
Capt. Frederic Vaughn Abbot

21 October 1895
Maj. Thomas H. Handbury

4 January 1896
Lt. James J. Meyler

8 January 1896
Lt.Col. William H. H. Benyaurd

KEY WEST
1 February 1898
Capt. Charles Hedges McKinstry

31 May 1899

31 May 1899
Capt. Charles Hedges McKinstry

TAMPA
1 April 1899
Capt. Henry Jervey

18 January 1900
Capt. Thomas Henry Rees

24 May 1900
Capt. Thomas Henry Rees

24 September 1900
Capt. Charles H. McKinstry

27 March 1901
Capt. Thomas H. Rees

10 August 1901
Lt. Edmund M. Rhett

11 September 1901
Capt. Herbert Deakyne

24 September 1902
Capt. Francis R. Shunk

10 August 1901
Lt. Edmund M. Rhett

11 September 1901
Capt. Herbert Deakyne

16 February 1903
Capt. Francis R. Shunk

18 August 1905
Col. James B. Quinn

21 October 1905
Capt. Francis R. Shunk

8 August 1906
LtCol Dan Christie Kingman

10 October 1906
Maj. Francis R. Shunk

26 August 1907
LtCol. Lansing Hoskins Beach
First Jacksonville District Engineer

31 July 1908
Capt. George Redfield Spalding

20 July 1911
Capt. John Rodolph Slattery

22 December 1913
Maj. William Baker Ladue

30 April 1917
Maj. James Franklin Bell

31 August 1917
Col. John Millis

30 September 1917
John Warren Sackett

4 July 1918
Col. John Millis

28 July 1918
Jaquelin Marshall Braxton

18 February 1919
Col. Glenn Edgar Edgerton

16 July 1919
Col. William Jones Barden

31 August 1920
Col. Spencer Cosby

18 December 1920
Maj. William C. Lemen

22 August 1922
LtCol. Gilbert Albin Youngberg

24 March 1926
LtCol. Mark Brooke

2 August 1928
LtCol. Laurence Verner Frazier

30 June 1932
Maj. Beverly C. Dunn

30 May 1935
Capt. Peter A. Feringa

3 September 1935
LtCol. Earl North

OCALA, FLORIDA, DISTRICT
3 September 1935
LtCol. Brehon Somervell

1 September 1936

14 July 1938
Col. Lewis H. Watkins

23 October 1940
LtCol. Tatnall D. Simkins

5 December 1940
Col. W. C. Weeks

1 October 1941
LtCol. Alvin G. Viney

16 December 1942
LtCol. Herbert C. Gee

3 March 1943
Col. David W. Griffiths

9 January 1944
LtCol. L. E. Reed

11 February 1944
Col. Albert B. Jones

14 November 1946
Maj. Blase Nemeth

10 January 1947
Col. Willis E. Teale

17 July 1947
Col. Richard W. Pearson

15 February 1952
Col. Herman W. Schull, Jr.

8 May 1955
Col. Elmer E. Kirkpatrick

18 June 1957
Col. Paul D. Troxler

31 July 1960
Col. Julian V. Sollohub

22 December 1962
Col. Harold R. Parfitt

CANAVERAL DISTRICT
1 May 1963
Col. G. A. Finley

1 September 1964
Col. W. L. Starnes

May 1966
Col. N. A. Lord

27 January 1969
Col. G.H. Newman

1 November 1970
LtCol. Vito D. Stipa

30 June 1971

3 June 1965
Col. R.P. Tabb

17 May 1968
Col. John F. McElhenny

1 January 1970
Col. Avery S. Fullerton

February 1972
Col. Emmett C. Lee, Jr.

8 July 1975
Col. Donald A. Wisdom

Appendix B

The growth of civil works projects within the Jacksonville District can best be realized by comparing the projects listed in the first Jacksonville District annual report for 1908 with the 1975 compliation.

1908

1. St. Johns River, Florida
2. St. Johns River, Florida, opposite the city of Jacksonville.
3. St. Johns River at Orange Mills flats, Florida
4. Volusia bar, Florida
5. Oklawaha River, Florida.
6. Indian River, Florida
7. Biscayne Bay, Florida
8. Harbor at Key West, Florida, and entrance thereto.
9. Kissimmee River, Florida
10. Orange River, Charlotte Harbor, and Caloosahatchee River, Florida
11. Sarasota Bay, Florida
12. Manatee River, Florida
13. Tampa Bay, Florida
14. Hillsboro Bay, Florida
15. Crystal, Anclote, and Suwannee Rivers, Florida
16. Withlacoochee River, Florida
17. Removing the water hyacinth from Florida waters

1975
Navigation

1. Aquatic Plant Control
2. Arecibo Harbor, P. R.
3. AIWW Norfolk to St. Johns River
4. Canaveral Harbor, Fla.
5. Charlotte Harbor, Fla.
6. Cross Florida Barge Canal.
7. Fernandina Harbor, Fla.
8. Fort Myers Beach, Fla.
9. Fort Pierce Harbor, Fla.
10. Intracoastal Waterway, Caloosahatchee River to Anclote River, Fla.
11. Intracoastal Waterway, Jacksonville to Miami, Fla.
12. Jacksonville Harbor, Fla.
13. Mayaguez Harbor, P. R.
14. Miami Harbor, Fla.
15. New Pass, Sarasota, Fla.
16. Okeechobee Waterway, Fla.
17. Oklawaha River, Fla.
18. Palm Beach Harbor, Fla.
19. Ponce de Leon Inlet, Fla.
20. Ponce Harbor, P. R.
21. Removing the Water Hyacinth from Navigable Waters in the State of Florida.
22. St. Augustine Harbor, Fla.
23. St. Lucie Inlet, Fla.
24. San Juan Harbor, P. R.
25. Tampa Harbor, Fla.
26. Navigation Projects on which Reconnaissance and Condition Surveys only were Conducted during Fiscal Year.
27. Other Authorized Navigation Projects
28. Navigation Work under Special Authorization.

(1975 Continued)
Beach Erosion Control

29. Brevard County, Fla.
30. Broward County, Fla., Beach Erosion Control and Hillsboro Inlet, Fla., Navigation Project.
31. Dade County, Fla.
32. Duval County, Fla.
33. Palm Beach County, Fla., from Martin County line to Lake Worth Inlet and from South Lake Worth Inlet to Broward County line.
34. Pinellas County, Fla.
35. Virginia Key and Key Biscayne, Fla.
36. Other Authorized Beach Erosion Control Projects.
37. Beach Erosion Control Activities Under Special Authorization.

Flood Control

38. Central and Southern Florida.
39. Four River Basins, Fla.
40. Portugues and Bucana Rivers, P. R.
41. Inspection of Completed Flood Control Projects.
42. Other Authorized Flood Control Projects.
43. Flood Control Work under Special Authorization.

GENERAL INVESTIGATIONS

44. Surveys.
45. Collection and Study of Basic Data.

KEY TO ABBREVIATIONS IN NOTES

AR	Annual Report of the Chief of Engineers
ASP:MA	*American State Papers: Military Affairs*
ASP:MS	*American State Papers: Miscellaneous Series*
DAB	*Dictionary of American Biography*
Ex. Doc.	Executive Document
FHQ	*Florida Historical Quarterly*
FRC	Federal Record Center
GO	General Order
H. Doc.	House Document
Ltrs	Letters
Niles'	*Niles' (Weekly or National) Register*
SAD	South Atlantic Division Corps of Engineers
S. Doc.	Senate Document
SO	Special Order
TP:FT	Carter. *Territorial Papers: Florida Territory*
Truman Committee	Senate, Special Committee Investigating the National Defense Program, 77th Cong., 1st. sess., Hearings.
USA, C of E	United States Army, Corps of Engineers

Notes

CHAPTER 1 / EARLY HISTORY

1. USA, C of E, *History and Traditions,* p. 2.
2. Ibid.
3. Ibid., p. 4.
4. Ibid.
5. Ibid., pp 9-11; Huntington, *The Soldier and The State,* pp. 198-99.
6. Most sources state that Seminole means runaway, but according to Simmons the term translates to wild people or outsettlers and it was given to them when they detached themselves from the Creek Confederation, Simmons, *Notices,* p. 54.
7. *Niles',* 3:154, 311-12; 4:159.
8. A sampling of American opinion concerning the acquisition of Florida may be obtained from the following diverse sources, Lipscomb, *Writings of Thomas Jefferson,* 10:408; Mayo, *Henry Clay,* p. 365; *Annals of Congress,* 12 Cong., 1 sess., I, 657; *Niles',* 16:225.
9. Boyd, "Events at Prospect Bluff," p. 92; Calhoun to Gaines, ASP:MA, 1:696; Jackson to Sec. of State, ASP:MS, 2:897.
10. Young, "Memoir,"; *FHQ,* 13:16-50, 82-104, 129-64; 55:321-46.
11. Ibid., 13:17.
12. Ibid., p. 100.
13. Ibid., pp. 161-62.
14. Ibid., pp. 132-33.
15. Ibid., p. 97.
16. Ibid.
17. Ibid., pp. 97-98.
18. Ibid., p. 98.
19. *Niles',* 34:387.
20. Carter, TP:FT, 24:582; 25:95.
21. Humphreys, "Historical Papers," p. 42.
22. Hill, *Roads, Rails & Waterways,* p. 182.
23. Holt, *The Office of the Chief of Engineers,* p. 9; Hill, pp. 181-87.
24. Holt, pp. 10-11.
25. Ibid., pp. 11-15.
26. AR, 1869, p. 47: AR, 1870, p. 63; AR, 1873, 1:68.
27. AR, 1873, 1:66; AR, 1884, 1:iv.
28. AR, 1885, 1:177.
29. Ibid.
30. Ibid., 1:177, 383; Ibid., 2:1245.
31. Ibid., 1:177, 382, 388, 392, 394, 395.
32. AR, 1888, 1:143, 321, 328, 329, 331, 332, 334, 335, 337, 338.
33. AR, 1889, 1:16, 165.
34. SO, 179, AGO, par. 9, 1 Aug. 1884; SO, 96, Headquarters, C of E, par. 3, 5 Aug. 1884.
35. AR, 1887, 2:1264.
36. AR, 1888, 1:43.
37. Davis, *History of Jacksonville,* pp. 180-86; Fairlie, "The Yellow Fever Epidemic," pp. 95-108; SO, 295, AGO, par. 6, 22 Dec. 1887.

38. SO, 15, AGO, par. 14, 19 Jan. 1898.
39. SO, 79, AGO, par. 55, 5 Apr. 1899.
40. SO, 213, AGO, par. 35, 10 Sep. 1902; SO, 17, AGO, par. 25, 21 Jan. 1903.
41. SO, 102, AGO, par. 23, 1 May 1903.
42. AR, 1907, 1:21, 328, 570.
43. AR, 1908, 1:26, 347, 612.
44. GO, 10, 3 Sep. 1935; G, 5, 12 Aug. 1936; AR, 1936, 1:594.
45. Fine, *The Corps of Engineers,* pp. 267, 440, 471-72.
46. Ibid., p. 472.
47. Ibid., p. 476.
48. GO, 2, 17 Feb. 1950.
49. AR, 1951, 1:Part 1, p. 575; SAD, Organization Order, 1-51, 1 Jan. 1951.
50. GO, 26, 29 Sep. 1958.
51. GO, 5, 8 Mar. 1963; SAD, General Plan for reassignment of military responsibilities of Jacksonville District to Mobile District, 6 Mar. 1970.

CHAPTER 2 / THE TERRITORY OF FLORIDA

1. Hull, *The Origin and Development,* p. 10.
2. Young, "Memoirs," 13:17.
3. Simmons, *Notices,* pp. 24-26.
4. DAB, 7:83-84.
5. Carter, TP:FT, 23:40, 126.
6. Ibid. p. 301.
7. Ex. Doc. 1/14/1, p. 13.
8. Carter, 23:860.
9. Huntington, *The Soldier and the State,* p. 199.
10. Pick, "Corps of Engineers," p. 2.
11. DAB, 2:223; Hill, *Roads, Rails & Waterways,* p. 6.
12. "By 1700 the arts of both fortification and siege craft had been reduced to certain geometric principles by Marshall Sebastien Vauban, a distinguished soldier and engineer in the service of Louis XIV of France. Vauban's fortresses were star-shaped, with walls partially sunk in the earth and covered with earthen ramparts on which cannon could be mounted; projections or bastions with mutually supporting fields of fire jutted forth from the main walls; a ditch was dug around the whole and a second smaller wall erected in front of it, with earth also sloped against it to absorb the shock of cannon ball," Matloff, *Military History,* p. 25.
13. *Niles',* 29:121-22.
14. Carter, 23:476-77.
15. Ibid., 23:484-85.
16. Ibid., 23:541-42.
17. Ibid., 23:684-85.
18. Ibid., 23:758.
19. Ibid., 23:755-56, 816, 835-37, 846-47, 854-55.
20. Ibid., 24:77-80; H. Doc. 61/23/1, pp. 61-65.
21. Smiley, *Florida,* pp. 41-44, Snodgrass, "Fort George Island," p. 82-84.
22. Carter, 24:279, 312.
23. Ibid., 24:312.
24. Ibid., 24:426.

25. Ibid., 25:337.
26. ASP:MA, 5:461-62.
27. Carter, 24:31, 44.
28. Ibid., 24:59-62.
29. Ibid., 24:75-76.
30. Ibid., 24:70-74.
31. Ibid., 24:75-76, 186, 214, 261.
32. Ibid., 24:367-68.
33. Ibid., 24:517-18.
34. Ibid., 24:582; *Niles'*, 34:387.
35. Carter, 24:551.
36. Ibid., 24:754.
37. Long to Gratiot, 1 Dec. 1834, L 398 (1834), RG 77, National Archives.
38. Carter, 25:114.
39. Ibid.
40. Ibid., 24:879, 904.
41. Ibid., 25:95-97.
42. Ibid., 25:30, 95-97.
43. Castelnau, "Essay," pp. 215-16.

CHAPTER 3 / THE MILITARY FRONTIER

1. Snyder, *The District*, p. 2; USA, C of E, *History and Traditions*, pp. 36-38.
2. Sprague, *The Origin ... Florida War*, p. 148.
3. Buker, *Swamp Sailors*, pp. 60-63.
4. Sprague, pp. 225-27.
5. Ibid.
6. Hanna, *Lake Okeechobee*, p. 58.
7. Ibid., pp. 59-60.
8. Ibid., pp. 60-61.
9. Ibid., p. 62.
10. Seley, "Lieutenant Hartsuff," pp. 6-8.
11. Douglas, *The Everglades*, pp. 263-64.
12. Ives, Note on his "Military Map of the Peninsula."
13. Douglas, pp. 260-61; Hanna, pp. 60-61.
14. Hartley, *Osceola*, p. 261; Douglas, pp. 265-66.
15. Ives, "Map."
16. Callcott, *Santa Anna*, p. 155.
17. DeRussy, "Report on the Board of Engineers, ..." 14 Mar. 1849, B4562, RG 77, National Archives.
18. Letter agreement between Major John Sanders, USA, and Baker & Stetson, 3 Nov. 1858, Ft. Taylor, Key West, Fl., 1845-1908, Item 1226, RG 77, FRC, East Point, Ga.
19. Lane to Dutton, 19 Jan. 1847, ibid.
20. Agreement dated 31 Dec. 1845, ibid.
21. L. D. Rogers letter dated 1 Jul. 1847, ibid.
22. Mallory to Dutton, 16 Feb. 1848, ibid.
23. Mallory contract dated 14 Nov. 1851, ibid.
24. Contract dated 12 Mar. 1858, ibid.

25. Williams, "Stronghold of the Straits," pp. 3-24.
26. Totten to Wright, 10 A pr. 1851, ltrs sent to Engineer Officers, vol. 18, pp. 370-73, RG 77, National Archives.
27. Totten to Wright, 29 Sep. 1853, ltrs sent to Engineer Officers, vol. 20, pp. 522-23, RG 77, National Archives.
28. Manucy, "The Gibraltar of the Gulf of Mexico," pp. 303-31; DAB, 20:485.
29. Ibid., 12:507.
30. Holgate to Capt. W. McFarland, 3 May 1964, Records of United States Army Continental Commands, 1821-1920, Fort Jefferson, Florida, ltrs sent by the Engineer Officer, 1862-1880, pp. 251-54, RG 393, National Archives.
31. Shepard, "The Construction of Fort Clinch," A1, A8, A9, 24.

CHAPTER 4 / WAR AND DEFENSE

1. Suter, "Report ... Department of the South," pp. 2, 19-20, Letters Received, 1838-66, S 9662, RG 77, FRC, East Point, Ga.
2. Scott, *War of the Rebellion,* I, 35: p-2, p. 14.
3. Rush, *Official Records,* I, 17:649-52; USS *Tahoma* ship's log, 22, 23, 24, 25 March 1864, RG 24, National Archives.
4. Hanna, *Lake Okeechobee,* pp. 76-80; DAB, 20:485.
5. Boyd, "Battle of Natural Bridge," pp. 102-06.
6. Williams, "Stronghold of the Straits," p. 23.
7. Mudd, *The Life of Dr. Samuel A. Mudd,* p. 124.
8. Manucy, 'The Gibraltar of the Gulf of Mexico," p. 325; Phillips to Humphreys, 9 Nov. 1875, Item 1226, RG 77, FRC, East Point, Ga.
9. Richardson, *Messages of the Presidents,* 10:4767-69.
10. Millis, *American Military Thought,* pp. 198-200.
11. AR, 1895, 1:4.
12. AR, 1897, 1:17-18; AR, 1898, 1:27.
13. AR, 1897, 1:705.
14. Ibid., 1:17.
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16. Schellings, "The Advent of the Spanish-American War," p. 314.
17. AR, 1898, 1:716-17; AR, 1899, 1:889.
18. AR, 1898, 1:717.
19. AR, 1898, 1:718.
20. *Florida Times Union and Citizen,* 2, 5, 13, 22 April 1898.
21. Millis, p. 240.

CHAPTER 5 / TO THE SEA

1. Baldwin, "St. Johns Bar," pp. 321-27.
2. AR, 1872, 1:663.
3. Fineren, "Conditions Adverse," p. 19.
4. Baldwin, p. 328.
5. AR, 1878, 1:581-86.
6. Baldwin, p. 330.

7. Martin, *The City Makers,* p. 148.
8. Baldwin, p. 333.
9. AR, 1869, pp. 269-72.
10. AR, 1872, 1:666.
11. AR, 1871, 2:578-85.
12. Engineers Report Capt. Geo. W. Cullum to W. G. DeSaussure ... Charleston, S. C., Nov. 20th, 1857, is contained in Bache, "Report on the Harbor of Charleston," pp. 56-61; Trenholm, "Report of the Commissioners," p. 4; AR, 1857, 2:221-23; AR, 1872, 2:666-72; AR, 1874, 2:11-13; AR, 1875, 2:37-41; Black, *Hopper Dredging,* 27-28.
13. AR, 1872, 2:662-72.
14. AR, 1874, 2:11.
15. Jacksonville Board of Trade, "Minute Book," p. 11.
16. Ibid., p. 51.
17. Martin, p. 148.
18. Ibid., p. 150.
19. Ibid., p. 149.
20. Rawls, "Ninety-Six Years of Engineering," p. 63.
21. Davis, *History of Jacksonville,* p. 387.
22. Rawls, p. 54.
23. Davis, p. 388.
24. Rawls, pp. 54-55.
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26. Davis, p. 388.
27. Rawls, pp. 57-58.
28. AR, 1883, 1:946.
29. AR, 1885, 2:1249.
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31. Rawls, p. 57.
32. Fineren, "Historical and Financial," p. 10.
33. Martin, p. 151; Rawls, p. 57.
34. Ibid., p. 58.
35. Davis, p. 389.
36. *Jacksonville Journal,* 28 June 1937.
37. Rowland, Matt C., et al., vs. U. S. USDC, M D of Florida, Civil Action No. 72-485-Civ -J-S, USA, C of E, Jacksonville District.

CHAPTER 6 / GRASSY WATER

1. USA, C of E, *Water Resources Development,* pp. 34-35.
2. Dovell, "The Everglades," pp. 29-30.
3. Powell to Crabb, 8 Dec. 1836, printed in *Army and Navy Chronicle,* 4:75, 298-99; Buker, "Lt. Powell," pp. 265-66.
4. Hanna, *Lake Okeechobee,* p. 54.
5. S. Doc. 242/30/1, exhibit 4; S. Doc. 89/62/1, pp. 56-67.
6. Ives, "Memoir," p. 11.
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10. Ibid., p. 865.

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13. Dodson, "Cruise of the Minnehaha," pp. 389, 395.
14. Hanna, pp. 108-10.
15. AR, 1882, 2:1218.
16. Johnson, L., p. 75.
17. Ibid.
18. Hanna, pp. 112-17.
19. AR, 1887, 2:1236.
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21. Ibid., p. 243.
22. Hanna, p. 130.
23. Johnson, L. p. 83.
24. Ibid., p. 198.
25. Ibid.
26. Hanna, p. 255.
27. Douglas, *The Everglades,* p. 341.
28. Johnson, L., p. 150.
29. Ibid.
30. AR, 1934 through 1938 *passim;* Bussard, "History of the Jacksonville District," Part II, ch. 6, pp. 12-14.
31. Ibid., pp. 14-15; AR, 1948, 1:831-32.
32. USA, C of E, *Water Resources Development,* p. 34.
33. AR, 1975, 2:9-20, 9-21, 9-22.
34. Ibid., 2:9-21.

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2. Ibid., 23:945-47.
3. Ibid., 24:51, fn. 48, 426.
4. Ibid., 25:337; 26:5, AR, 1915, 2:1823.
5. *Niles',* 50:361-62; Simmons, *Notices,* p. xxxv; Blakey, *Parade of Memories,* p. 42.
6. Mahon, *History of the Second Seminole War,* p. 247.
7. Motte, *Journey into Wilderness,* p. 168; Buker, *Swamp Sailors,* pp. 59-60.
8. Carter, 26:832.
9. Ibid., 26:804.
10. Ibid., 26:806.
11. Ibid., 26:780-81.
12. AR, 1882, 2:1233.
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14. Ibid., 2:1233-42.
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17. Ibid.
18. Ibid.
19. AR, 1895, 2:1541-46.
20. *Florida Intercoastal Waterway,* n.p.
21. Ibid.
22. AR, 1930, 1:769-70.

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24. Johnson, L., *Beyond the Fourth Generation*, p. 198.
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26. S. Doc. 115/71/2, pp. 30-31, 38.
27. AR, 1932, 1:709.
28. USA, C of E, *Water Resources Development*, p. 20.
29. H. Doc. 371/76/1, pp. 6-7.
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CHAPTER 8 / BUILDING HARBORS

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3. Ibid., p. 647.
4. AR, 1879, 1:870-71.
5. AR, 1885, 2:1262-64.
6. Harner, *Florida's Promoters*, p. 23.
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15. Ibid., p. 15.
16. Ibid., pp. 1-3.
17. AR, 1920, 1:807-12.
18. AR, 1975, 2:9-15, 9-16.
19. AR, 1895, 2:1566-69.
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21. AR, 1897, 2:1595-96.
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31. H. Doc. 38/85/1, p. 24; AR, 1962, 2:520.
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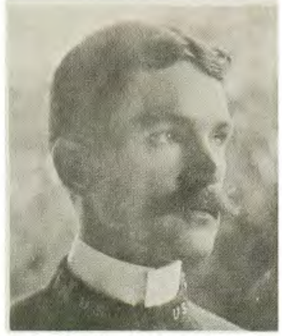
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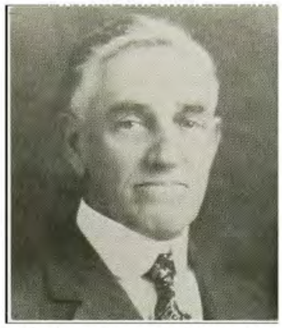
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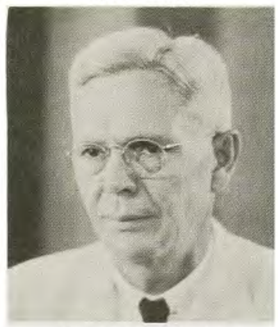
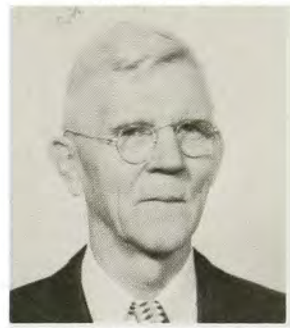
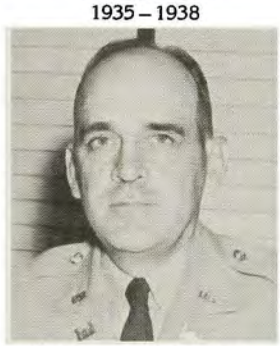
Col. Earl North
1935 – 1938


Col. Lewis H. Watkins
1938 – 1940


LTC Tatnall D. Simkins
1940 – 1940


Col. Willis E. Teale
1947 – 1949


Col. Richard W. Pearson
1949 – 1952


Col. Herman W. Schull, Jr.
1952 – 1955


Col. Elmer E. Kirkpatrick
1955 – 1957


Col. Paul D. Troxler
1957 – 1960


Col. A. S. Fullerton
1970 – 1972


Col. Emmett C. Lee, Jr.
1972 – 1975


Col. Donald A. Wisdom
1975 – 1978


Col. James W. R. Adams
1978 – present