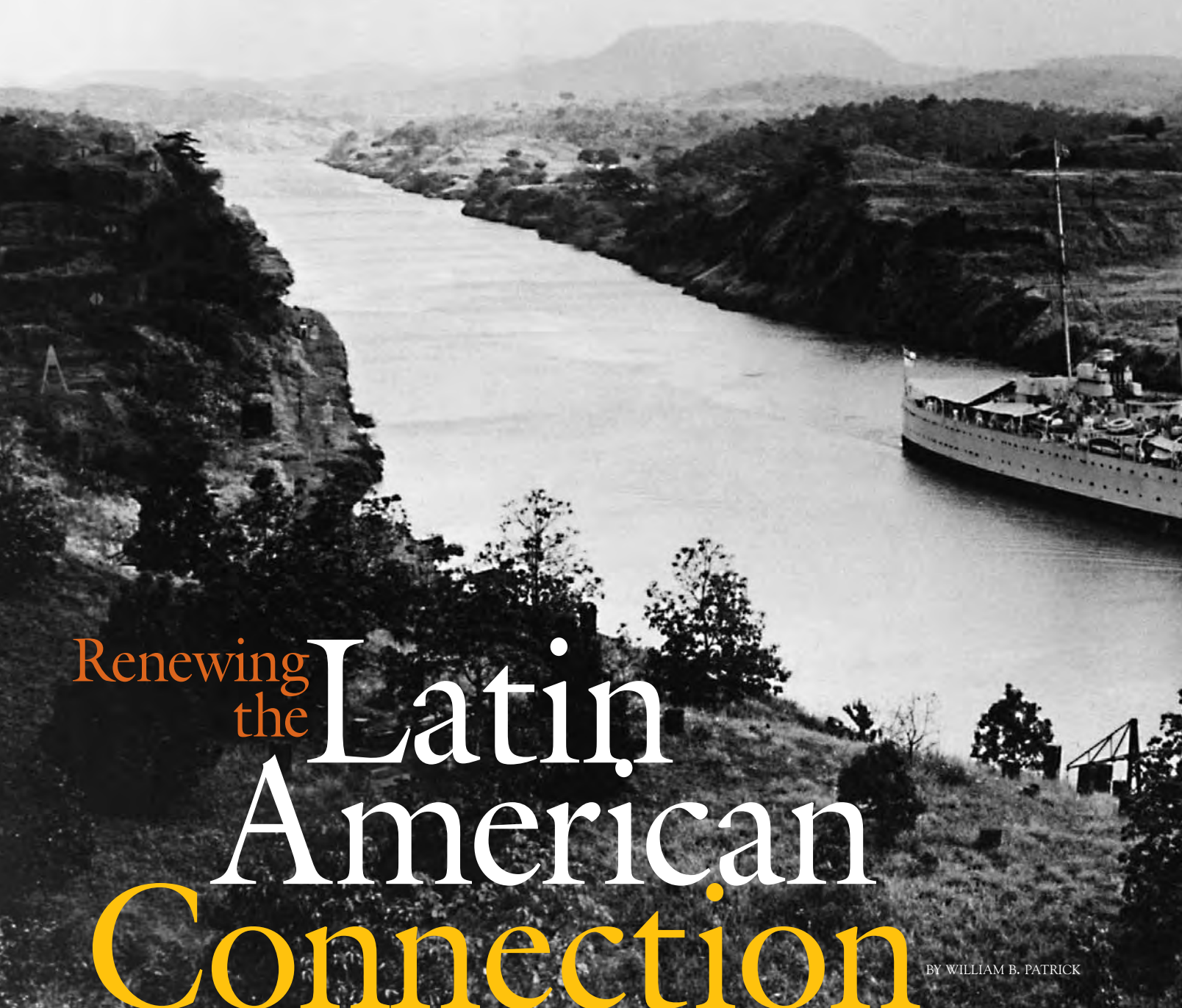
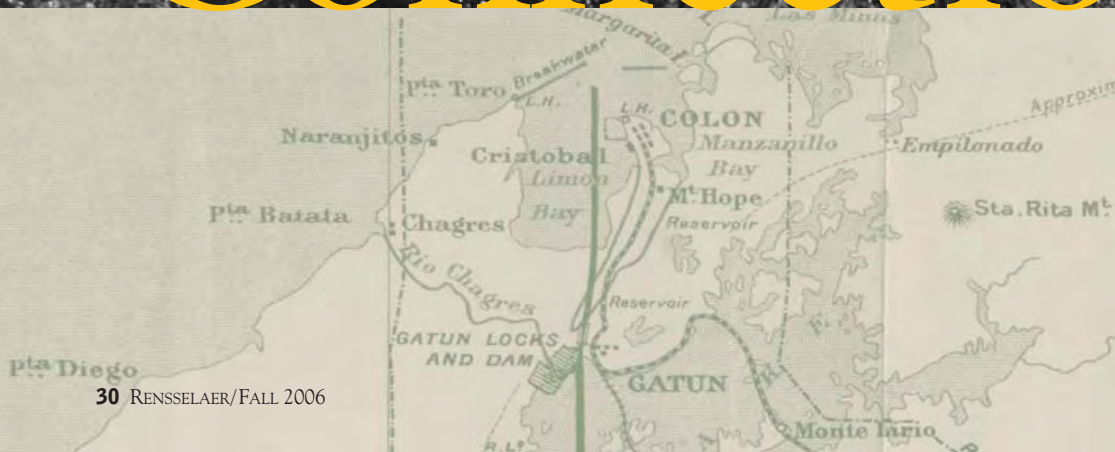


IN THE 19TH CENTURY, TALENTED ENGINEERING STUDENTS
TO RENSSELAER. TODAY, THEIR SPIRIT LIVES ON IN EFFORTS TO BRING MO

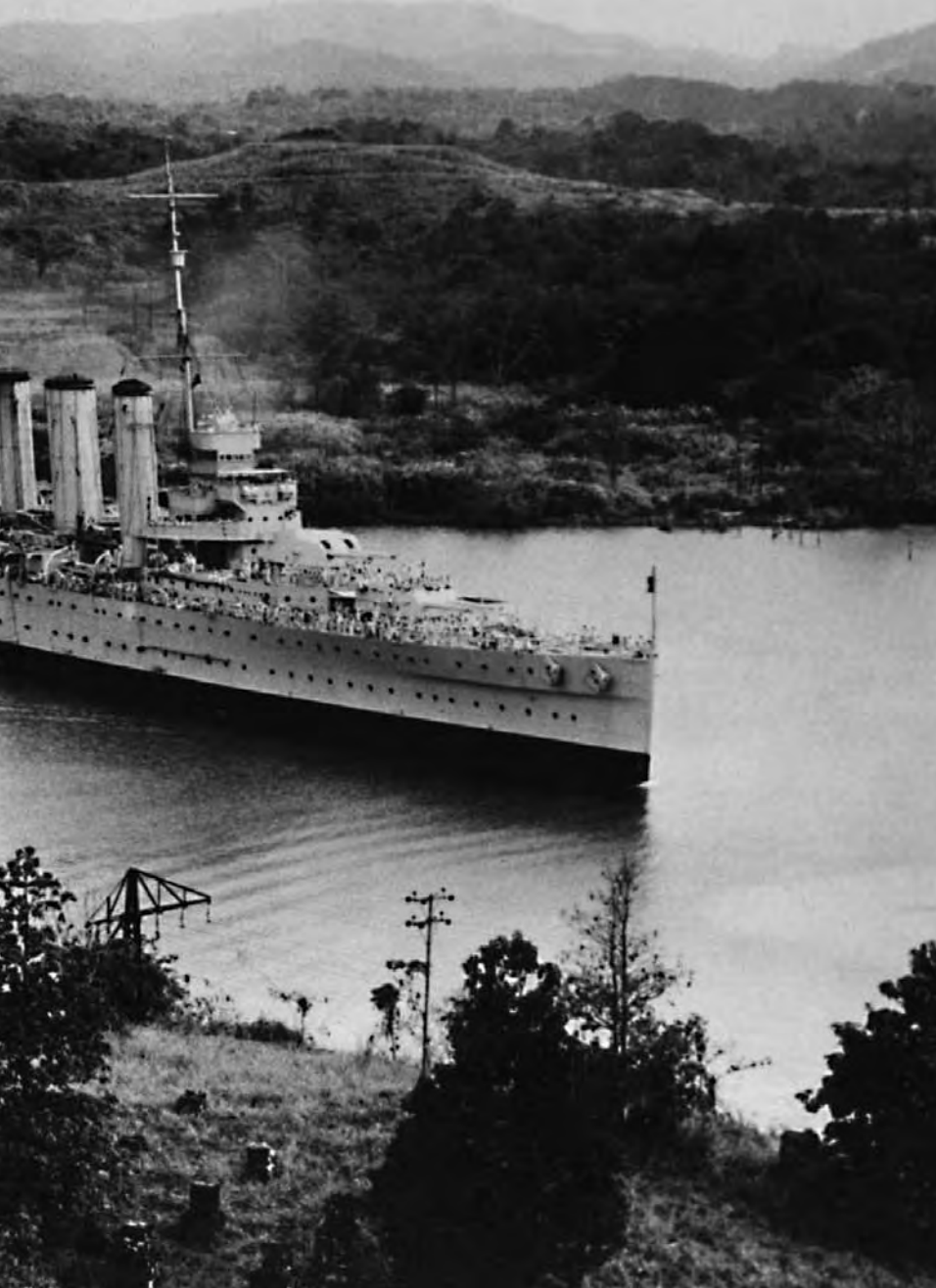


Renewing the Latin American Connection

BY WILLIAM B. PATRICK



FROM LATIN AMERICA TRAVELED THE LONG ROAD RE LATIN AMERICAN STUDENTS TO THE INSTITUTE.



Aniceto Garcia Menocal, Class of 1862



Victor Marrero, graduate student

Graduate student Victor Marrero recently traveled to Caracas, Venezuela, to help renew a Rensselaer tradition that dates back to the mid-19th century. Marrero has joined forces with Napoleon Ferrer '55, president of the Venezuelan Chapter of the Rensselaer Alumni Association, to attract more Latin American students to the Troy campus. In late September, Marrero visited Caracas to meet with Ferrer and other chapter members to discuss how to interest talented students in Rensselaer. While Marrero applauds the Institute's initiative to increase diversity by reaching out to more minority and international students, he believes there is opportunity to tap the talent of young Latin Americans even more.

Marrero, a student in the Ph.D. program in mechanical engineering and president of the Rensselaer chapter of Phi Iota Alpha, the Latin American fraternity, grew up poor in Puerto Rico, but his family's sacrifices allowed him to attend private school and earn his bachelor's and master's degrees in mechanical engineering from universities in Puerto Rico. As an American citizen he was eligible for federal funding and scholarships that have enabled him to study for the last year and a half at Rensselaer.

"I think coming from poverty and being able to accomplish your education gives you the big picture of what the necessities are," Marrero says. "A lot of people in America don't understand what sacrifice is, like having to be the best so you can get out of a country. That takes a lot of discipline. So when you get opportunities, you will then have the perspective to go back and help others."

BORN IN LATIN AMERICA, SONS OF RENSSELAER

Marrero's efforts are building on a rich history of a Latin American connection at Rensselaer that reaches back more than 160 years. This history was documented in a recent exhibit at Folsom Library, "Exporting Engineers: RPI Alumni in Latin America, 1850-1890," which highlighted the crucial roles played by these Institute graduates in building the essential infrastructures of Latin America.

Cuban-born Aniceto Garcia Menocal is a prime example. Born in 1836, the son of a wealthy planter in Cuba, he graduated from Rensselaer in 1862 with a degree in civil engineering and immediately returned to Cuba to become an assistant engineer. Within three years, he was appointed chief engineer in charge of construction at the waterworks of Havana. In 1870, New York City's Department of Public Works enticed Menocal to leave Havana, but he only stayed with the department for two years. At age 36 he found himself looking for a more meaningful challenge—that came his way when the U.S. Navy commissioned him as a chief engineer and offered him a major project in 1872: planning a canal to connect the Atlantic and Pacific oceans.

The idea of a canal in Central America certainly wasn't new in 1872. As early as 1513, the conquistador Vasco Nunez de Balboa had hacked his way through the jungles and crossed the Culebra Range, mountains that rise more than 1,000 feet above sea level, to stand in the surf of the Pacific and claim the Isthmus of Panama for King Ferdinand of Spain. The first canal plan was submitted to the king 16 years later, but the forbidding geography and the poisonous nature of the land prevented any practical progress for 300 years.

Spurred by the needs of thousands of travelers and commercial possibilities following the California Gold Rush of 1848, American entrepreneurs formed the Panama Railroad Company in 1849 and built a railroad that spanned the isthmus over the next six years. That allowed passengers to travel from one ocean to the other in about three hours, and it created the means to cart away the actual mountains of rock and dirt that digging for a canal would create. The French, confident after completing the Suez Canal, were the first to dig in Panama, but their plan to build another sea-level canal became a disaster that cost the lives of more than 20,000 men and \$100 million. Menocal believed he had a better way.

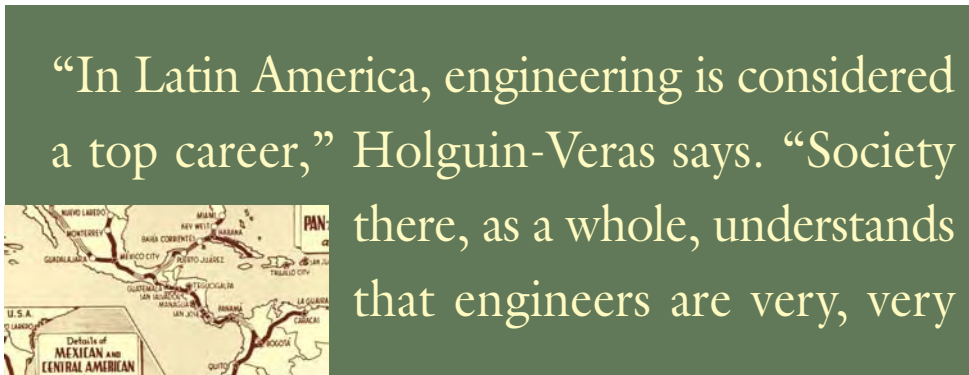
Menocal mapped the two most plausible

routes for an interoceanic canal—initially working through the narrowest part of Nicaragua, which included Lake Managua, and then surveying the route through the Isthmus of Panama that paralleled the existing railroad. He favored the route through Nicaragua, arguing that it possessed lower mountain passes and existing, usable lakes, and that a canal placed there would lie closer to American ports than one built across Panama.

Menocal was able to persuade Ulysses S. Grant to organize first the Provisional Interoceanic Canal Society in 1880. Menocal recommended from the start that a lock system in Panama, rather than a one-level, sea-level

civil engineering degree from Rensselaer in 1897 and debated whether he should return home or look for engineering work in Cuba. At that point, Cuba was still a colony of Spain, and Manuel Coroalles had little idea that he would play such a major role in its future.

Thirty years of war in Cuba (1868-1898) had demolished the infrastructure of that country. When former general Gerardo Machado took office as president in 1925, he ran his campaign with the promise of "roads, waters, and schools" for Cuba and as president set about modernizing the country. Machado wanted to showcase an extensive public works program to appease the public and appointed Coroalles as chief



canal, was the only possible way to surmount the Culebra Range.

A sea-level canal, as the French tried to construct it, would necessitate a cut 300 feet deep and nine miles long at minimum, and that cut alone would require removal of at least 150 million cubic yards of earth. Menocal proposed that they dam the Chagres River in the east and the Rio Grande River in the west to form two inland lakes on both sides of the Culebra Range. Then locks could be built to raise the water level in these lakes and let the water literally lift the ships over the mountains and back down to the ocean on the other side. Few in power were listening, however, and Menocal returned to Washington, D.C., and moved on to his new duties as a consulting engineer with the Navy's Bureau of Yards and Docks. Thirty-one years later, on June 21, 1906, two years before Menocal's death, the United States Senate finally approved construction of a lock canal in Panama.

ENGINEERING MODERN CUBA

In 1875, the same year that Menocal was surveying for the canal, Manuel Coroalles was born in Panama. Coroalles graduated with a

engineer of public works for the Cuban government.

Coroalles found himself in a tricky situation: working for a leader who had quickly grown into a dictator, yet one who had ambitious plans to transform the infrastructure of the struggling country. Nevertheless, Cuba was a major tourist destination for Americans then (increasing from 33,000 visitors in 1914 to 90,000 in 1928), and successful tourism required modern roads, bridges, and transportation systems. Coroalles could not resist taking on the largest road-building project in history at that time. In New York City, he gave an interview to *The New York Times* and described the project. "Our new Cuban Central Highway, for which contracts amounting to \$78,000,000 have just been given out, will be 700 miles long and, beginning at Pinar del Rio, will run to Havana and thence as straight as good engineering permits all the way to Santiago," he told the newspaper.

The road would have a Portland cement concrete foundation for its entire length, but the surface would consist of bituminous concrete or granite in some places and of asphalt in others. In towns, the road would be 26 feet

wide; in the country it would be only 20 feet. And besides the central highway, which would run approximately across the middle of the island, they would also be building branch roads north and south to connect with all seaports and important towns. "This road program is part of President Machado's effort to open up Cuba more extensively to tourists," Coroalles told *The Times*.

The project was completed by the spring of 1931 with a final price tag of \$100 million. President Machado hosted engineers from the American Road Builders Association and provided them with a tour of the entire highway, which also included 2,300 bridges, trestles,

That's kind of a result of engineers building the infrastructure that we know. But in Latin America, there are still a lot of needs."

Holguin-Veras earned a B.S. in civil engineering in his hometown of Santo Domingo in the Dominican Republic and then traveled to Caracas to get his M.S. in transportation from the Universidad Central de Venezuela. He completed his Ph.D. in transportation at the University of Texas at Austin and has taught and done research in the United States since 1996.

"But guess what," he warns. "The infrastructure in *this* country is beginning to crumble. It's 50 or 60 years old. All major roads need

prospective engineering students in Venezuela. But Marrero wonders how Latin American students can afford a private university education in the United States. The young men who came from Cuba and Panama and other Latin American countries in the 19th century had wealthy families and, often, political backing to support their studies at institutions like Rensselaer. "There are fewer Latin American students now because there is little help for them," Marrero says. "There is no help for them in their own countries and no help in the United States. They aren't American citizens, so they don't qualify for federal funding."


From 1850 to 1950, developing countries sent their elite sons to topnotch schools like Rensselaer so they could go back home after graduation and use their educations to build essential infrastructures—railroads, bridges, waterworks, highways, dams, canals, and manufacturing operations. But engineering is far more specialized today, and many students want to study nanotechnology or aeronautical engineering or other advanced technologies that their own countries may not have the facilities or resources to utilize.

Marrero is a case in point. "The opportunities in Puerto Rico aren't good. A lot of companies are leaving Puerto Rico, because tax incentives are being taken away. And there are no research opportunities on the island, so a person like me, who has finished a Ph.D., the only chance I have in Puerto Rico is teaching. That's what I want eventually, but I don't see myself going there."


What Marrero envisions is staying here in the United States and working as a research scientist and eventually joining academia so he can help other students from Latin America come here and get a better education.

"A position where I could combine my deep interest in both research and teaching seems particularly appealing," Marrero says. "I wish to become the type of professor who makes an immediate impact on the lives, and more importantly, the future of his students. In addition, I have found that of the small population of Hispanic engineers, very few have a Ph.D."

"There is a need to strengthen the participation of Hispanics in pursuing graduate degrees, and so I feel obliged to pursue a Ph.D. and hope to inspire others to do the same."



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underpasses, and overpasses. A reporter from the *New York Herald Tribune* who accompanied the American engineers wrote that the highway had been visited by experts from all over Latin America and even from Russia "and will, it is believed, exert an influence for the building of good roads throughout the southern continent."

In 1950, the Rensselaer Alumni Association awarded Manuel Coroalles the Albert Fox Demers Medal, noting that Coroalles became one of Cuba's best-known citizens, was elected a member of the American Society of Civil Engineers, and "consistently fostered in many ways the prestige and welfare of both the Institute and its alumni."

BUILDING A ROAD TO RENSSELAER

Jose Holguin-Veras, professor of civil and environmental engineering, is not surprised that Aniceto Garcia Menocal and Manuel Coroalles were celebrated for their accomplishments. "In Latin America, engineering is considered a top career," Holguin-Veras says. "Society there, as a whole, understands that engineers are very, very important. Somehow, in the U.S., they are being taken for granted.

to be put back into a state of good repair. Major investment is needed, and we don't see it. We don't need to get to the point where we're crashing through the bridges. We basically need to invest, massively, in the major infrastructure before we get to that point."

He points to the 2005 Infrastructure Report Card for the United States from the Web site of the American Society of Civil Engineers, which assesses the current state of America's bridges, dams, waterways, roads, schools, railways, aviation, etc. Of the 15 categories rated, solid waste got the highest grade: a C+. Ten of the 15 categories were awarded Ds.

"Civil engineering has a future in this country, that's obvious," Holguin-Veras says. "Somebody will have to do something, sooner or later. That's a good reason for students and engineers from other countries to come here. The U.S. system is not producing as many engineers as are needed by the economy, and there will be an increasing gap between our needs and the supply of new engineers. That's beginning to happen, and we don't even know how badly we need them. Engineers will certainly be coming here from other countries."

It's a message Victor Marrero can bring to