Island life
Engineering connections

St Helena, discovered in 1502 and one of the most geographically isolated islands in the world, is upgrading its ports infrastructure, from air to sea. Nicholas McIlarmid spoke to the lead engineer, the contractor and the equipment supplier about building something in the middle of nowhere.
CONSTRUCTION VEHICLES AND EQUIPMENT

LEFT The Basil Read ship, NP Glory 4, pictured in Cape Town shortly before making its historic first voyage to St Helena, laden with equipment and materials for building the island’s airport

RIGHT James Bay, St. Helena

Located approximately 1,950 km from the south-west coast of Africa and 2,900 km from South America, the only access to the island has been by sea on the British mail ship, the RMS St Helena. Landing infrastructure on the island has also been limited, with no breakwater or mooring facilities at Jamestown on the seafront. Cargo is transported ashore using towed barges and passengers are ferried to and from the ship by small launches.

WorleyParsons, one of the world’s largest engineering, procurement and construction management businesses, is approaching the end of its task as lead design engineer on the iconic St Helena Airport project — an undertaking that has provided an exceptional showcase of many of its design engineering skills.

Building horizons
The construction of a modern airport and the establishment of a permanent wharf herald a new era for the island by providing employment, creating opportunities for the local “Saints” to learn new skills, stimulating the expansion of support industries and boosting the island’s economic growth with the increased tourism that will follow.

“The St Helena Airport project incorporates many unique and unusual features that have required advanced engineering ingenuity and thorough planning,” says Graham Isaac, technical director special projects at WorleyParsons. “The remoteness of the island, its size, material supply logistics, unique geology, topography and climate, endemic biodiversity with sensitive environmental heritage, ethnic diversity and history called for real innovation in the design of specific aspects of the project infrastructure. The design also necessitated careful consideration to ensure ease of constructability and programming of design delivery, calling for close integration between the members of the design and construction teams.”

Working alongside main contractor Basil Read, WorleyParsons’ scope of work has covered a full spectrum of infrastructure design aspects for the airport project, notably, land-side engineering, air-side design and the airport buildings, including a bulk fuel storage facility for 6 million litres of Jet A-1, diesel and gasoline fuels, and a winding 14.5 km access road rising over 300 m in the first 5 km.

A precious habitat
Apart from the varying geographical features of the island, the airport site presented a unique challenge in terms of the setting and history of St Helena. There were protected slave burial sites and archaeological finds to contend with, apart from the site being close to the breeding area of the wirebird, indigenous to St Helena. The site is also in close proximity to some 40 species of invertebrates that can only be found on the island.

Environmental protection is being guided by Basil Read’s Environmental Management Plan and the independent Landscape and Ecology Mitigation Programme (LEMP), a four-year initiative that will focus on habitat restoration and landscaping.

Filling the gorge
One of the biggest project challenges has been filling the Dry Gut gorge with 8 million m³ of blasted rock to a height of over 100 m, with a width of 750 m, to create an embankment that will form part of the runway. Fill material is sourced from the site area as the landscape and hills are levelled. When completed, the 2 km-long concrete-surfaced runway will provide an effective 1,550 m available landing distance.

Isaac says the predictions of Dry Gut’s potential settlement and the construction method are among the biggest risks on the project. The rock-fill has been designed for stringent final-level tolerances (6 mm in 3 m straight edge) in supporting the concrete runway pavement. The strength and settlement characteristics of the rock-fill determine the side slopes and service performance of the embankment, drawing on WorleyParsons’ extensive international experience in design principles from rock-fill dams. Settlement monitoring instrumentation has been designed and installed at strategic stages in the fill matrix to enable assessments of settlement during construction.

Safe landing
On the aviation side, the WorleyParsons team had to take the remoteness of the island into account when engineering an innovative airport design capable of ensuring that aircraft would be able to land safely, with sufficient fuel to return to the originating airport.

The terrain on the island made positioning of the airport runway difficult, particularly when remaining in the bounds of cost and environmental impact.

“WorleyParsons RSA’s response to the exacting requirements of this unique project underpinned this project,” Isaac concludes. “For the bulk fuel facility, for instance, we drew on our world-renowned, in-house hydrocarbons design expertise and, in terms of the design of the 14.5 km access road, bulk earthworks, concrete runway, structural components of the terminal buildings and

The ship was the first ever to unload directly onto St Helena Island
related services, we drew on our core inhouse skills in the built environment."

Environmental protection is being guided by Basil Read’s Environmental Management Plan, which covers flora, fauna and heritage issues. In addition to these environmental considerations, Basil Read is fully supportive of the LEMP, which is required as a result of the airport construction and supporting infrastructure activities. LEMP will carry on after all construction activities have ceased and will provide alternative habitats and landscape treatments to reduce and offset the permanent direct loss of habitat and the direct and indirect impacts on the landscape that might have arisen from construction works.

Fitting out the island
The supply of heavy equipment, for both the airport and wharf, was undertaken by Babcock.

The project director, Basil Read’s Jimmy Johnston, says with 60% of the airport now complete, the equipment supplied by Babcock – primarily Volvo heavy construction vehicles – has performed reliably, with good fuel efficiency and high productivity. Once the airport and wharf have been completed, this heavy construction equipment, previously unobtainable on the island as a result of the challenging shipping logistics, will be available for future infrastructure development.

**Shipping the yellow metal**
Babcock has supplied the necessary construction equipment in batches, beginning with shipments on the RMS St Helena, which included a Volvo EW140C wheeled excavator, a BL61 backhoe loader and a DD24 2.5 tonne double drum vibration compactor. Since August 2012, Basil Read’s flat-deck shallow-draft cargo ship, the NP Glory 4, has brought the balance of the equipment to the island. Other shipments have included a high-discharge 2 tonne Winget site dumper and a hydraulically operated, heavy-duty Winget concrete mixer. Later shipments brought a Volvo G940B grader, as well as four colossal 70 tonne Volvo EC700 C-Series crawler excavators and one Volvo MC115C skid steer loader. World-renowned Volvo articulated dumpers were also aboard, including an A30E and brand-new A40F articulated dump trucks with 30 to 40 tonne payloads. This equipment was necessary to perform more rigorous and heavy-duty site work, as well as the necessary bulk excavation and rock-fill in the most cost-efficient manner. Adding to the growing Babcock/Volvo fleet on the island are an EC480 excavator, an EC380 excavator and four SD200DX compaction rollers, among other machines.

**30 000 tonnes of cargo**
The project began with the construction of a temporary landing facility at Rupert’s Bay to accommodate the NP Glory 4, which, in July 2012, was the first ever ship to unload cargo directly onto St Helena Island. Since then, the volume of material shipped to the island underscores the scale of the operation. Around 30 000 tonnes of cargo has been moved so far, including 500 tonnes of sand from Namibia, more than 120 items of construction equipment, 900 containers and 1 200 tonnes of reinforcing steel. By the end of the project, more than 20 million litres of diesel fuel, 5 000 tonnes of explosives, 27 000 tonnes of cement and pulverised fuel ash, and 20 000 tonnes of miscellaneous cargo have been moved.

**Building the building to build**
To enable the transport of equipment and material from Rupert’s Bay to Prosperous Plain, where the airport site is situated, Basil Read has built a 1.4 km-long haul road
CONSTRUCTION VEHICLES AND EQUIPMENT

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Fill material being sourced from the site area that rises more than 500 m in the first 5 km – quite an engineering challenge in itself.

Volvo equipment is being heavily deployed on the construction of the airport runway, which involves filling the Dry Gut gorge, thereby creating an embankment that will form part of the runway. As at February 2014, the Dry Gut fill was 65% complete with more than 5 million m³ of material placed through a 24-hour operational cycle. Fill material is sourced from the site area as the landscape and hills are levelled. The Dry Gut fill, taking 24 months to complete, should be completed by September 2014.

Work has also commenced on the 1 950 m-long concrete runway, a taxiway and apron. This is due for completion in May 2015. Construction of the terminal building, combined air traffic control and fire department, is progressing well and is on schedule. Installation of aerodrome ground lighting, navigational aids and air traffic control equipment will begin in August 2014 and will completed and tested by mid-2015.

Construction includes a bulk fuel installation for 6 million litres of diesel, petrol and aviation fuel in Rupert’s Valley and an airport fuel facility at the airport site.

The airport will be connected to the island’s electrical, communications and roads infrastructure. All construction work and certification will be completed and ready for the first flight in early 2016.