Field work to build a new Federal Aviation Administration Self-Sustained Outlet radio communications facility on Alaska's Kuiu Island was completed in nine days. Crew remained onsite in camp with full life support. PHOTOS COURTESY AHTNA ENVIRONMENTAL

Construction at Cloud Level

Building a Radio Communications Facility in Alaska

To build a new radio communications facility on a "high site" in Alaska's Tebenkof Bay Wilderness Area, an innovative design approach avoided the need to cast foundations onsite under difficult conditions and helped reduce the field schedule by at least 60 percent.

By Karina Quintans, M.SAME

The Federal Aviation Administration (FAA) maintains hundreds of facilities designed to ensure the safety of aircraft in flight. These include Self-Sustained Outlet (SSO) radio communications facilities, which in Alaska, are often located on remote, unadorned mountain ridges referred to as "high sites."

In summer 2014, Ahtna Environmental, under subcontract to Parsons Infrastructure & Technology Group, supported the highly complex construction of an FAA SSO atop a 3,400-ft high mountain ridge on Kuiu Island, which is located in the Tebenkof Bay Wilderness Area of The Tongass National Forest in southeast Alaska.

The project scope of work included:

- Removal of the existing building and aluminum helicopter pad.
- Site preparation including the clearing of vegetation or small boulders, and minor site grading and/or leveling.
- Excavation and installation of four concrete disc foundations to support the equipment building; four concrete disc foundations for the guy wire anchors; eight concrete disc foundations to support the solar panel array; and nine concrete disc foundations to support the helicopter pad.

The only piece of hydraulic equipment mobilized to the site was a mini-excavator.

- Installation of prefabricated nominal 6-ft/3-in by 8-ft by 16-in equipment building including deck, railing and stairs; trenching and installation of a 4/0 grounding loop (earth electrode system); assistance during the installation, leveling and plumbing of a solar panel array; and fabrication and assembly of a new helicopter pad.
- Installation of conduits, conduit bodies, connections and cribbing from the equipment building to the solar panel array.

THE NEED FOR PLANNING

Teamwork was essential to project success. The combined experience and technical knowledge of FAA, Parsons and Ahtna was crucial during planning, given the complex conditions associated with high sites. The difficult weather conditions (near zero visibility at times due to heavy fog, winds over 80-mph, rain and snow) and lack of infrastructure (roads, airstrips, landing pads, room and board, electricity, running water, fueling stations, or supply centers) were matched only by the threat of wildlife attacks at a location known to have the highest concentration of black bears in the world.

In addition, detailed logistics planning was required to transport 68,000-lbs of materials, supplies and equipment from Anchorage. It was critical to ensure upfront procurement of all the needed supplies, since procuring any items after the fact, even just a box of nails, could cost at least an extra $2,000 to transport to the high site via helicopter. Given these complexities, a shared awareness across the team was vital.

In Anchorage, everything was weighed, labeled and packaged, then loaded onto two, 28-ft trailers. The trailers traveled to Haines, where the shipment was transferred to a public barge service, which moved the items approximately 300-mi to Petersburg. Four field staff flew to Petersburg to inspect the shipment before loading it onto a chartered 36-ft by 110-ft flat deck barge.

After the chartered barge was fully loaded, a landing craft towed the barge to Camden Bay, approximately 4-mi north of the project site. This trip took about eight hours. The barge was double-anchored in a protected area of the Bay and maintained as a staging area for the duration of the project. Leaving the barge anchored ensured availability for demobilization of demolition debris, equipment and camp. The barge also provided emergency quarters and communications should the need arise and to fuel the two helicopters that were performing slinging operations.

In total, mobilization from Anchorage to the top of the mountain ridge took seven days, traveling more than 1,200-mi combined over land and sea.

REACHING THE MOUNTAINTOP

Loading the shipment on to the last barge was a highly planned sequence to ensure safety and efficiency during helicopter slinging from the barge to the mountaintop.

All items were sorted so that each sling load weighed no more than approximately 80 percent of the helicopter load capacity of 2,800-lbs to ensure safe and efficient slinging operations. The goal was to complete the transfer of 68,000-lbs via helicopter lifts in a single eight-hour day to maintain the project schedule. Each sling load was arranged so everything needed at each of the three major work areas (foundation, helipad, and solar array building) was placed adjacent to the work area to avoid the need to reposition anything after slung onsite, since all work would be performed without any heavy equipment

When possible, materials and supplies were packaged in fish totes, which are weatherproof containers. All loads were, at minimum, double-cinch-strapped. Various combinations of straps, wire chokers, and nets were used to sling supplies and equipment to the project site.

Transportation from the barge to the mountaintop was completed through a total of 53 helicopters slings and in accordance with the eight-hour schedule.

PREPARED FOR CHALLENGES

The nine-person field team (comprised of FAA, Parsons and Ahtna personnel) was housed onsite and came prepared for any inclement weather to avoid demobilization and impact to cost and schedule. Four weatherproof and insulated 12-ft by 10-ft tents were placed on a wooden floor and securely anchored with the appropriate high wind anchoring devices. The camp also was equipped with first aid kits, fire extinguishers and a trauma pack. A subcontracted dedicated cook provided three meals a day. Packed lunches minimized work stoppages at the construction site. Both the camp and construction site were supported by generators.

Satellite phones acted as back up communications to existing cellular service. Air-to-ground and ground-to-air radios were used so that the ground personnel would have full-time contact with the helicopter pilot during slinging operations.

INNOVATIVE FOUNDATION DESIGN

An innovative value engineering design alternative for the structural foundations was used to condense the field schedule by 60 percent and reduce overall project costs. A typical foundation design would have required pouring concrete into 18-in diameter by 4-ft tall columns. Instead, 124 precast foundations measuring 18-ft by 6-in in size, resembling disks, were designed and produced in Anchorage.

This original design, developed by Ahtna, had multiple benefits, including minimizing risk in the foundation quality, since site conditions were not always favorable for pouring concrete, and avoiding the need to transport bags of concrete and additional heavy equipment to the site. The project was performed using only one piece of hydraulic equipment: a mini-excavator 2012 Boxer DX 532 dx with backhoe attachment, with a walk behind skid steer with detachable excavator arm. With bucket removal, the total weight of the unit was 2,400-lb. The excavator attachment weighed 900-lbs. By using a series of disks, the construction crew was able to establish a building foundation within the varying terrain and soil conditions, which dictated the depth of the foundation excavation.

Excavation to prepare the site for placing a series of concrete disks that formed the structure's foundation was primarily performed by hand due to the uneven terrain.

CONSTRUCTION EXECUTION

The work area was approximately 180-ft by 50-ft in size, with varying elevations (as much as 30-ft of change in elevation across the site). The team laid out the site per the plans with the exception of the new helipad, which was established in a different location due to grade variations. Excavation followed primarily by hand due to the uneven terrain and risk of overturning the excavator. A total of 16 holes were excavated between 1-ft and 3-ft deep down to bedrock. Rock anchors were installed using epoxy to resist the uplift and overturning forces caused by extreme mountain top weather.

After the epoxy cured overnight, the team placed the precast concrete foundations, manually moving each disk one on top of the other within the excavation until reaching soil elevation, without the need for heavy equipment.

Once the precast foundations reached grade, the team drilled just off center to create a secondary pin to stabilize the disks, to avoid spin or shifting. The pin was filled with Pro-Poxy 400, which is stronger than the concrete itself. Each series of disks then was glued together with additional Pro-Poxy 400 and the joints were mortared.

The team then erected the solar array, which required working at heights to erect a 16-ft high by 24-ft wide aluminum structure. The solar array frame is designed to withstand extreme winter weather conditions, such as ice and winds in excess of 130-mph.

During the installation of the solar array, it was important to check aviation weather forecasts to find a weather window that would allow the helicopter to safely sling the equipment building onto the project site. The equipment building is an 8-ft by 6-ft by 16-ft fiberglass structure. It was challenging to rig and fly because of limited attachment points. The volume of the enclosed building also made slinging awkward.

Once completed, the building was secured to the foundations, and a complete counterpoise grounding system was installed around the equipment building and solar array frame. After grounding was completed and tested, the team constructed the 20-ft by 20-ft helicopter pad.

After work on the new site was concluded, the team then flew 3-mi to the old site and completed demolition and decommissioning of the former SSO structure.

PROJECT MANAGEMENT EXCELLENCE

Before any excavation and construction took place in the clouds above Kuiu Island, a team pre-construction site visit supported what would become the detailed planning needed to safely execute and complete the project on time. The site visit allowed the team to have an in-depth understanding of the terrain, soils and other factors that could affect project success. Together, the team also developed a schedule that incorporated contingencies for delays from weather since helicopter operations are highly susceptible to adverse conditions. Executing construction work on a mountain ridge accessed only by helicopter also required additional training for the site crew to ensure their health and safety under any conditions. This included Wilderness First Aid and Delayed Care First Aid and CPR Training; Tower Certification – Climbing and Rescue Training; Mountain Climbing and Repelling Training ; and even Hunter Education Training given the high concentration of black bears in the area.

As a testimony to the dedicated team effort, the project was completed on time, on budget, and with no safety incidents. And the design has now become the standard that FAA uses on all similar SSO sites. TME

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