POWER TO KEEP THE ROAD OPEN

Alaska DOT maintains network of powerhouses to support crews and equipment to maintain vital highway

By Mike Brezonick

As part of the development of the Trans-Alaska Pipeline in the mid-1970s, a pioneer road was built by oil company contractors to allow the movement of material and equipment for the pipeline's construction. Over time, that road was improved and expanded and eventually became Dalton Highway 11. Running nearly 500 miles, it serves as the lone artery between Fairbanks in the south and Prudhoe Bay in the north.

As such, it's a vital thoroughfare, even though much of the area through which the road is laid remains virtual wilderness. The road must be passable year round, however, and making sure it remains that way is a full-time job for the Alaska Dept. of Transportation (ADOT).

To do that, a series of seven road camps were established, with colorful names such as Deadhorse, Coldfoot, Chandalar and Jim River. The road camps, all but one of which are north of the Arctic Circle, are completely self-contained, incorporating water and sewer plants, heavy equipment and truck shops, camp maintenance shops and crew housing.

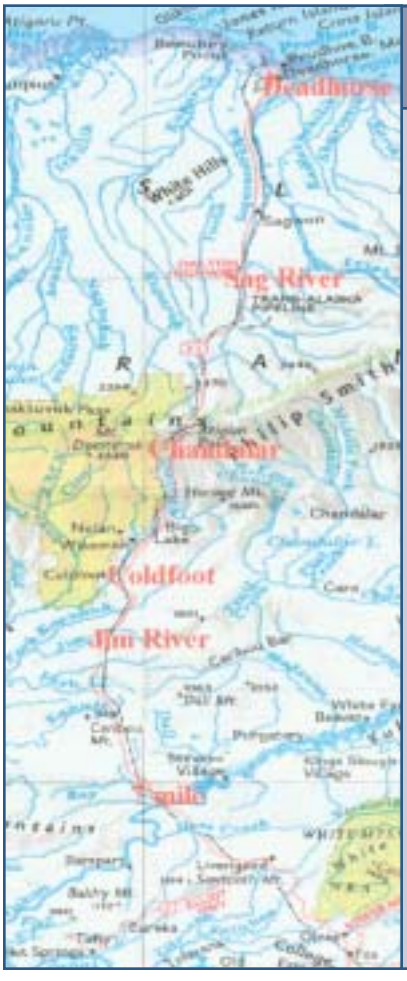
Each camp operates a fleet of graders, dozers, backhoes, Class 8 tractors with end, belly and side dumps, one-way plows, sanders and lowboys. Highway crews of four to seven men work six 11-hour days and one 9-hour day for a 75-hour week, followed by a week off when they are supplanted by a second crew. There is also a staff of four roving operators and four maintenance technicians. Aside from the rovers, each crew is assigned to a specific camp and the camps operate year-round.

As part of its system to keep the vital Dalton Highway open year-round, the Alaska DOT has established a series of road camps, each of which includes its own powerhouse and generator set system. The powerhouses, such as this one from 7-Mile road camp, have different exteriors, but inside the layouts are similar, with most camps using twin Cummins gensets rated 130 kW.

Needless to say, as most of the camps are surrounded by miles of wild land, they are well off any utility grid. Instead, each of the camps include a dedicated powerhouse that encompasses two engine generator sets. In 1993, shortly after being hired, one of the rovers on the maintenance side, Ernie Searing, was assigned to review each of the camps' facilities and develop a uniform spec. "My boss, Dan Moody, who was the Dalton Highway Camp maintenance chief, said here's your truck, survey all the camp powerhouses," Searing noted. "Come back in a week and tell me what we need."

During his survey, Searing said he saw "every color and size" of gen-set "just about all worn out and none really installed right even to the powerhouse layouts.

"All the camps had about the same load demand, so the master plan was all the gen-sets and all the powerhouses would be set up the same. As this is a 24-hour operation, year-round and the entire camp is dependent on electricity, we went pretty much first class with the idea of long-term operation and lifetime on units. "



The Dalton Highway Gen-Set Lineup

7 Mile Camp	2 Cummins L10 gen-sets rated 130 kW 1 John Deere emergency gen-set rated 85 kW
Jim River Camp	2 Cummins L10 gen-sets rated 130 kW
Coldfoot Camp	1 Caterpillar 3304DI gen-set rated 115 kW 1 Caterpillar 3306 emergency gen-set rated 185 kW 1 Cummins 4BT3.9 emergency gen-set rated 35 kW 1 Cummins L10 gen-set rated 130 kW (for drop-in replacement when an in-service unit is overhauled)
Chandalar Camp	2 Cummins L10 gen-sets rated 130 kW
Sag River Camp	2 Cummins L10 gen-sets rated 130 kW 1 John Deere emergency gen-set rated 100 kW
Deadhorse Camp	1 Cummins NT855GC gen-set rated 150 kW
Point Barrow Camp	1 Cummins 5.9 L gen-set rated 100 kW 1 Ford 2.3 L gen-set rated 20 kW

Ultimately, the project was spec'd out, put up for bid and Cummins Northwest in Anchorage got the job. Over the course of the next four years, four new powerhouses were built, two were remodeled and updated and eight new gen-sets were installed.

In addition to the permanently installed gen-sets, Dalton Highway also has three portable emergency gen-sets. Two are John Deere 100 kW units fully self-contained and mounted in vans, while the third is a skid-mounted Caterpillar 3306 gen-set rated 185 kW. "We can haul an emergency unit to the site and hook-up is less than five minutes, Searing noted.

The new gen-sets consisted of Cummins L10 diesels that include Fleetguard two-stage air filters connected to the engine turbos through Dynaflex Products 4 in. aluminum tubing. On the other end, Dynaflex also supplied the 5 in. stainless tubing, fittings, clamps, ells, stack extensions and exhaust mufflers Other engine accessories included Engineered Products restriction indicator; Nelson crankcase emissions absorbers; Dwyer Instruments manometers; and Isspro pyrometers and thermocouples.

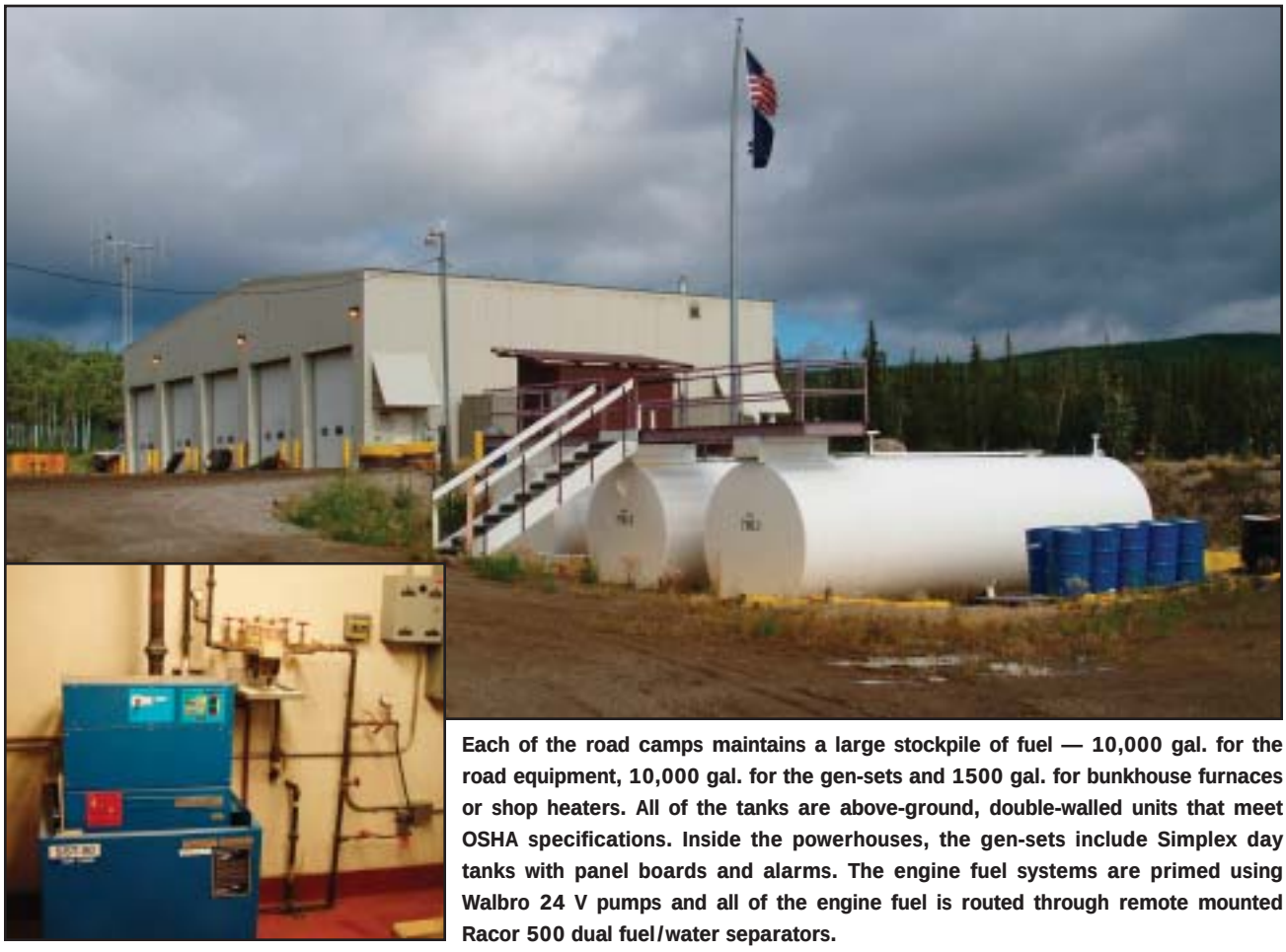
Engine instrumentation includes coolant temperature, fuel pressure and oil pressure gauges packaged in a panel by FWMurphy that is mounted to the engine on Lord shock mounts. Other instrumentation includes an ENM hourmeter and an Engineering Concepts Unlimited (ECU) ECU88N control module that incorporates a manual start/stop switch, hi-lo speed switch and auto shutdown LED indicators.

The engines drive six-pole Kato 6P2-1325 alternators rated 130 kW, 165 kVA, 277/480V, three-phase, 60 Hz, with bolt on bus bars in the junction box. Operating speed is 1200 rpm. Voltage control is through Basler Electric APR63-5 voltage regulators with remote voltage adjustment, remote field switching and red LED indicator when energized. Crompton Instruments provided electric meters, transducers and transformers.

The switchgear, 400 Amp TPDT, main circuit breakers and enclosures, motor starters, waste heat exchanger circulation pump motor controllers, powerhouse panel boards and main distribution panels were supplied by Square-D and thermostats and other sensors were from Honeywell.

Not surprisingly, considering the climate — winter temperatures can exceed -70°F — thermal management is a major challenge. "Preferred powerhouse construction is up on pilings, leaving the ground below frozen," said Searing. "If it's on the ground, then some mechanical method of keeping ground frozen must be used. Permafrost ice heave and melt will kill your project.

"Wintertime prevailing winds must be considered in terms of which way to point the exhaust pipe. Air intakes and



Each of the road camps maintains a large stockpile of fuel — 10,000 gal. for the road equipment, 10,000 gal. for the gen-sets and 1500 gal. for bunkhouse furnaces or shop heaters. All of the tanks are above-ground, double-walled units that meet OSHA specifications. Inside the powerhouses, the gen-sets include Simplex day tanks with panel boards and alarms. The engine fuel systems are primed using Walbro 24 V pumps and all of the engine fuel is routed through remote mounted Racor 500 dual fuel/water separators.

exhaust must have snow hoods and wind blast protection if facing into the wind. Even with 6 in. insulated walls, floor and roofs, when it is -40° and lower, you have to keep checking on air systems to maintain inside room temperatures."

The engine cooling system incorporates remote-mounted L & M Mesabi radiators with fan and 3 hp electric motor. The fan operation is controlled by a Square-D motor controller that receives information from a Square-D thermostat in the cooling circuit.

Searing said that the radiators are mounted high, with the intake and exhaust air kept separate from the ambient air in the powerhouse because "it's just too cold in winter." Room air is regulated by a thermostatically controlled exhaust fan and fresh air is directed into the room through a passive cold air trap, entering directly below a paddle fan to mix with room warm air before it settles to floor. The engine intake air filter is also remote mounted on a wall, with inside and outside air sources that can be mixed by butterfly valves. During the short summer, air can be drawn from either the inside or out, and in winter, the outside air is mixed with warm inside air to maintain minimum turbo inlet air temperature.

The exhaust mufflers are also mounted within the powerhouse, with a minimum outlet outside the structure. Grundfos pumps are used to direct shop heating glycol through Young Touchstone shell and tube heat exchangers to pick up engine water jacket waste heat before the jacket water goes to the engine radiators and waste heat is used for shop heating.

The engine is started by twin Optima 800U dry or gel cell 24 V batteries that are charged by La Marche A46 battery chargers. The entire gen-set is close coupled on a heavy steel skid frame that incorporates four Caldyn spring mounts. The skid is set on 6 in. x 6 in. full-length timbers. A full-length drip pan is positioned between the timbers which raises the bottom of the pan approximately 16 in. above the floor. According to Searing, this keeps the sump temperatures up and makes servicing easier.

Because many of the gen-sets are in near constant operation, oil filtration and cleanliness is also a significant issue. The original engine oil filters were ultimately replaced by T.F. Hudgins Spinner II 96SE centrifugal oil filters. "Up to about four years ago, we were running our sets 250 hours to oil change and service," Searing said. "With two gen-sets in each camp, we'd alternate 10 days on then the other unit 10 days on, with each accumulating equal hours.

"We then went to one unit on and the other standby. The standby unit would run when the main was serviced, then we'd go back onto the main. Thus, when it came time to overhaul one unit, the other would still have good life. This

Chr #1 engine, V. regulator, and gen control boxs

Engine instrumentation includes an ENM hourmeter and an Engineering Concepts Unlimited (ECU) ECU88N control module that incorporates a manual start/stop switch, hi-lo speed switch and auto shutdown LED indicators.

switch occurred at the 15,000 to 17,000 hour mark.

"Also at this time I was able to get out of using the state's bulk purchased lube oil and got Chevron Delo 400-30 for all the gen-sets. The state oil was so poor in detergent characteristics that I was getting early wear on valve bridge pads and the black sludge throughout the engine. Since getting the Delo, we have had clean engines.

"This year, the standby units are still below the 20,000-hour mark and mains are 40,000 to 45,000 hours. With centrifuges now on six units and the oil analysis showing excellent results, we have eliminated lube oil filters. A cleanable strainer takes its place and thus far eliminated oil changes. Make-up oil is all that is used. To date I do not know at what hour we will have to change oil. The most we've run so far is 2600 hours and TBN and all other parameters were well within Cummins oil specs. This is enough savings to pay out the costs of the Spinners and the oil analysis in less than a year."

Each of the road camps maintains a large stockpile of fuel – 10,000 gal. for the road equipment, 10,000 gal. for the gen-sets and 1500 gal. for bunkhouse furnaces or shop heaters. All of the tanks are above-ground, double-walled units that meet OSHA specifications. "Oil spills up here are a disaster," Searing said. "It will soak through frozen tundra and that is harder than concrete to dig into. Recovery and monitoring will really put a hole in your year's budget."

Fuel is trucked in from Fairbanks and while the crews make every effort to keep the roads open, sometimes nature wins. To ensure there is enough to run the camps, all of the tanks are topped off in late fall and new fuel orders are made well in advance. Fuel is monitored through Morrison Brothers clock-style gauges and the gen-sets include Simplex day tanks with panel boards and alarms. The engine fuel systems are primed using Walbro 24 V pumps and all of the engine fuel is routed through remote-mounted Racor 500 dual-fuel/water separators.

Day-to-day maintenance includes logging a range of conditions, including fluid levels, temperatures and electrical output. "The equipment operators over 50 percent of the time check the powerplants," Searing noted. "We do have manpower limits here. They do a good job."

What no doubt helps is the similarity between all of the camps' power installations. "All powerhouses are different outside, but inside, the gen-sets, piping, controls, etc., are identical. We teach a person to check, start/stop a unit in one place and he can do the same in any other powerhouse. This goes clear down to the identification numbers on the electrical wiring, it's all the same schematic."

The more involved maintenance, overhaul and repair work is done by Searing and one other technician in training. This includes coolant system tests and flushes, turbo and water pump rebuilds, etc. "When I started 11 years ago, the powerhouses were in bad to awful shape — noisy, dirty, oily, unreliable, due mainly to old age," Searing noted. "It seemed that as the plants deteriorated, the operators did likewise. They couldn't keep up with it. Correct design and good components gave good results. We've had no breakdowns, no one out of power. The plants are kept clean and I get calls when they hear, see or smell something that they think is not right." ★