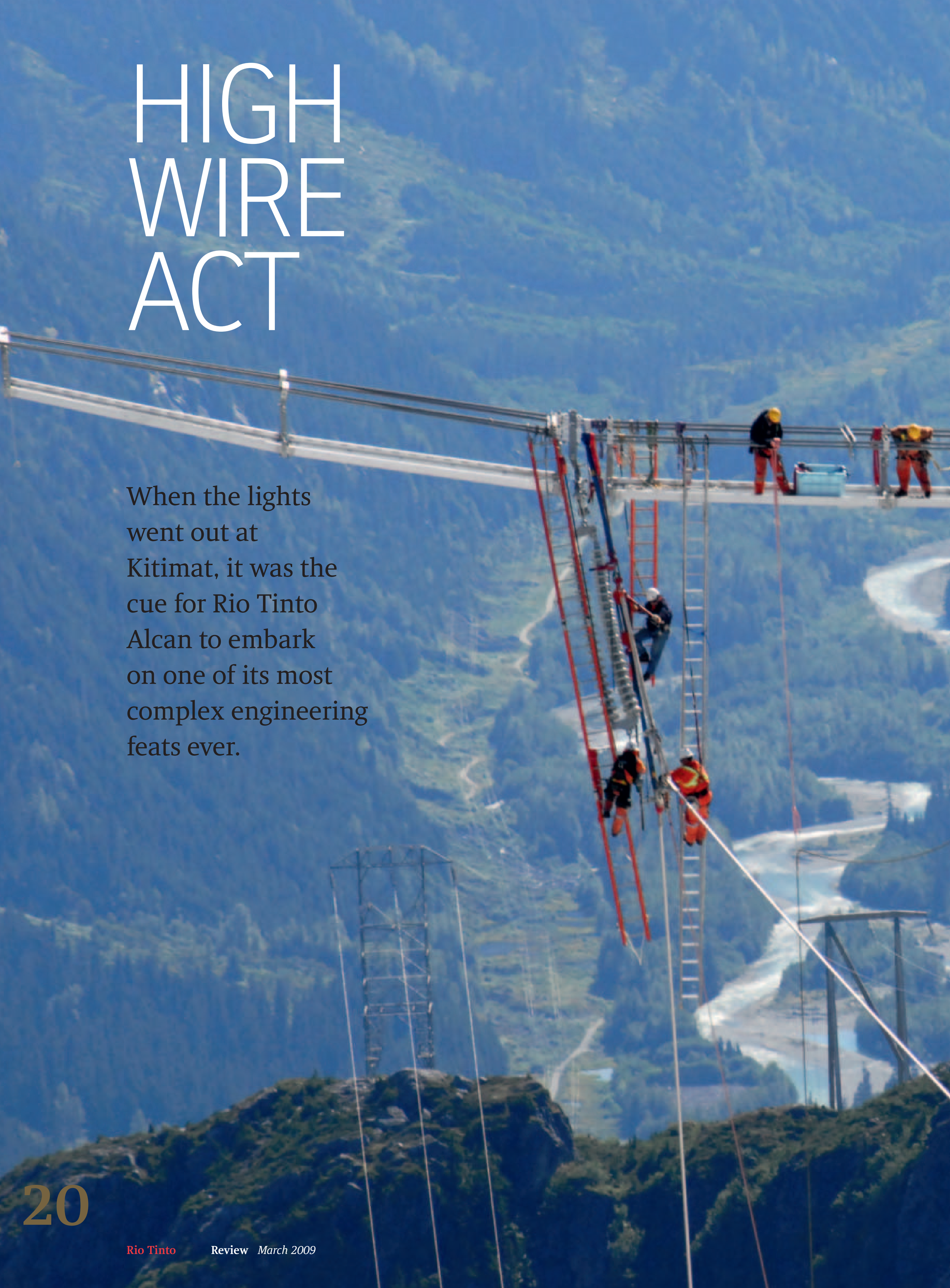


HIGH WIRE ACT

When the lights went out at Kitimat, it was the cue for Rio Tinto Alcan to embark on one of its most complex engineering feats ever.

Words and pictures by Dwight Magee, Corporate Affairs adviser for Rio Tinto Alcan BC Operations at Kitimat, British Columbia.

At 10.41 on the evening of March 28, 2007, at Rio Tinto Alcan's aluminium smelter at Kitimat in British Columbia, Canada, the lights went out. At that instant, no one knew why, for certain, but seasoned power control room operators had their immediate suspicions: in a word, avalanche. They turned out to be spot on.

The electrical power that feeds the smelter is generated at a remote power station located in Kemano, some 80km away. The transmission line from Kemano begins from more or less sea level but then climbs up over the rugged mountains through the Kildala Pass. The transmission line crests the top of the pass at over 1,500 metres. Annual snowfall of over 8m is the norm and in 2007, around this time, record amounts of snow were being recorded in the region.

It was two days before flying weather allowed members of the line crew to carry out a visual inspection of the transmission line from helicopter. From the air, they saw that the word from the control room had been right. A massive avalanche had started at the top of Kildala Pass and raced down the mountain destroying the transmission tower numbered 113R. As the tower went, so did one of the two 300 kV transmission lines from Kemano. The avalanche was so massive in size and force that the transmission tower itself had simply disappeared. The avalanche was thought to have run over 4km in distance and estimates placed its peak depth at 17m.

But the damage was done. The team from Operations now had to figure out how to get the power from Kemano back on line and, more importantly, find a permanent avalanche proof solution. The daunting concept that evolved led to the construction of one of the largest catenary systems in the world.

In the summer of 2007 workers were able to erect a temporary tower where the old one existed. This tower, although temporary, had to be strong enough to last through a potentially unpredictable winter. Spring was late arriving and the unusually cool weather hindered a rapid melt of the record snow fall from the previous winter. Construction crews hoping to begin work found the going slow – and time was of the essence.

Each day that the circuit was out of commission meant that Rio Tinto Alcan had to buy electricity to maintain full operations at the aluminum smelter. Despite the odds, crews had the temporary tower in place and returned full power to the smelter on August 22, finishing the work planned for the year.

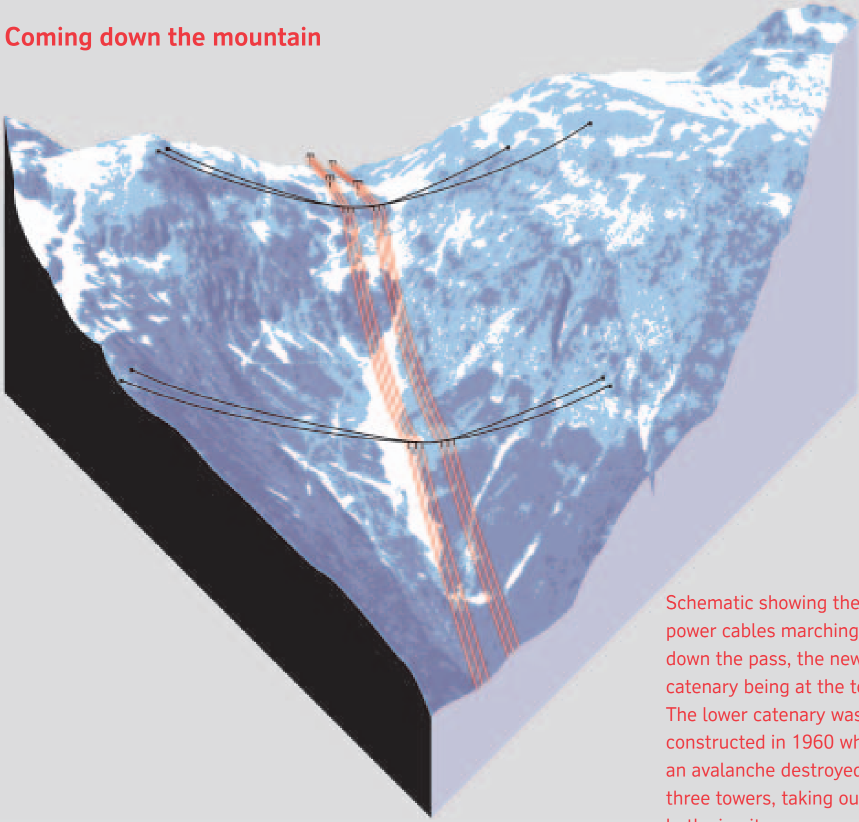
During the time that work was progressing on the construction of the temporary tower engineering, work also began on the permanent solution. A massive length of support cables (the catenary) would stretch 1,100m in a single span between the two mountain peaks of the pass at a height of 1,500m above sea level, supporting the power cables, which march down the pass, at the centre.

The 28 cables making up the two strands of the catenary would be suspended 150m above the valley floor, keeping the transmission line well out of

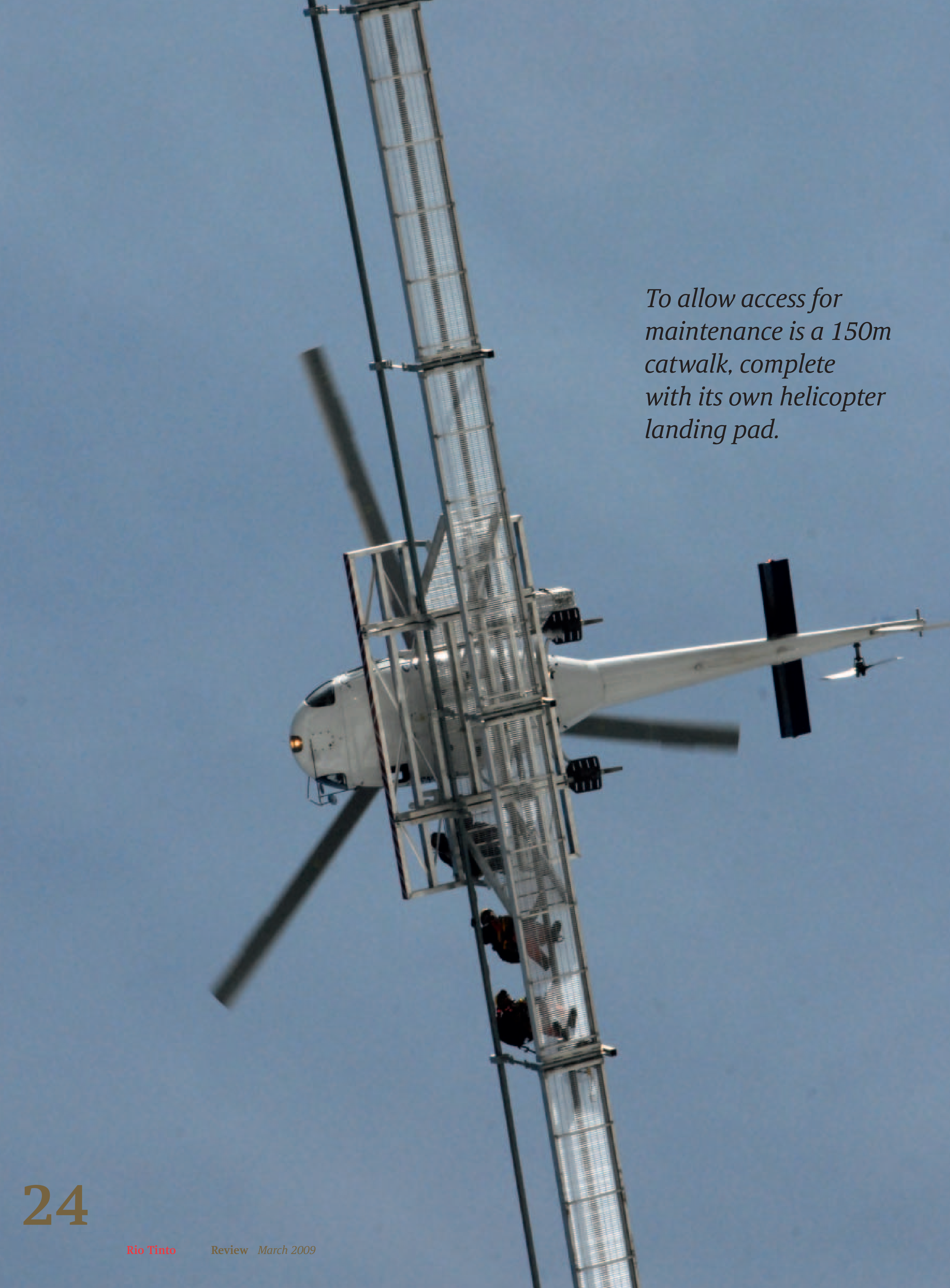
The daunting solution that evolved led to the construction of one of the largest catenary systems in the world.

Below left, heavy winter snowfall, the norm in the rugged Kildala Pass. Below, crews installing one of the 28 individual cables that make up the catenary system. Right, in suspense – crews ready to connect the first conductor onto the new catenary. It took a complete day to raise and connect each conductor.

Coming down the mountain



Schematic showing the power cables marching down the pass, the new catenary being at the top. The lower catenary was constructed in 1960 when an avalanche destroyed three towers, taking out both circuits.



To allow access for maintenance is a 150m catwalk, complete with its own helicopter landing pad.

Left, at the centre of the catenary, above the maintenance catwalk, is a tiny helicopter pad providing access for men and materials. Below, top, a catenary anchor point on the side of the mountain. Each of the four anchor bases is protected within its own avalanche shed. Centre: steady as she goes – all heavy equipment and materials had to be lifted in by helicopter. Bottom: constructive blast. The easiest way to join power line conductors together is with the aid of explosives.
Right, photofinish: members of the construction team pose for a celebratory picture.

harm's way from any conceivable future avalanche risks.

The location of this catenary required special engineering indeed. At the centre of the span, where the cables intersect with the transmission line, would be six insulators and each would weigh ten tonnes, excluding the actual cable it carried. Immediately above, to allow access for maintenance, would be a 150m catwalk, complete with – unbelievably – its own helicopter landing pad.

The first phase of the project consisted of building the four cable anchor points to the side of the mountain. Rock blasting crews and equipment arrived at their work locations daily by helicopter. The anchor area had to be cleared and six holes bored 6m deep into the side of the mountain for each of the four anchor bolts. Wet concrete was flown in continuously from Kitimat to build the actual cement anchors into the side of the mountain. When the bases were completed anchor plates and runners were installed onto each of the four bases.

Work next began on pulling the 28 cables 1,000m across the valley. With the cables in place, workers then had to bind each of the seven sets of cables together to form two massive cables across the valley.

Next came the the installation of the catwalk in the middle of the suspension. To accomplish this, linemen worked from carts that ran along the length of the cable. Helicopters were used to ferry the 26 catwalk panels into place while workers anchored them to the catwalk. Once the catwalk was put into place the final task was installing the new helicopter landing pad on top of the structure.

Raising the conductors from the ground required the use of a cable sling attached from a winch on a tractor over to a ground pulley, up to a pulley on the catenary and back down to the actual conductor. Once the cable was connected the winch was used to lift the conductor, weighing ten tonnes, up to the catenary itself – a process that took over an hour each time. During this lifting process the potential stress on the catenary itself was at its greatest: no one was allowed on the catenary until the conductor was lifted into mounting position with the insulators already attached below the catenary.

On September 13, just 115 days after the project began, there was much to celebrate. The final conductor had been raised that day and the project had been completed ahead of plan, but, most importantly, the entire project had been completed entirely free of accidents or injuries.

No future avalanche in this section of the Kildala Pass will put out the lights at Kitimat.