

## Leading the Rescue of the Miners in Chile

Disaster struck on August 5, 2010. Thirty-three miners, drilling 700 meters (2,300 feet) below the surface, were entombed by a massive cave-in. They had been working in a medium-sized copper and gold mine beneath the moonlike wilderness of the Atacama Desert near the city of Copiapó, Republic of Chile (Chile), some 800 kilometers (500 miles) north of the country's capital, Santiago.

Chilean Mining Minister Laurence Golborne had arrived in Quito, Ecuador, at 9 p.m. that same day with Chilean President Sebastián Piñera on a state visit. At 11 p.m., Golborne's smart phone came to life with a message whose brevity spoke urgency: "Mine cave-in, Copiapó; 33 victims." Golborne informed the president the next morning and flew on commercial air flights to Lima, Peru, and then to Santiago. He then took a Chilean Air Force (FACH) flight to Copiapó, and, from there, he was driven some 45 kilometers to the mine, finally arriving at 3:30 a.m. on August 7.

Piñera, a business-friendly Chilean president inaugurated on March 11, 2010, had recruited Golborne, an engineer, entrepreneur, and corporate executive, to serve as Chile's minister of mines. Golborne had served as chief executive of Cencosud S.A., a large retail firm, and under his leadership, the company had increased annual sales ten-fold, entered the Brazilian, Colombian, and Peruvian markets, and opened two new business lines, including financial

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Much of the information provided in this case is from interviews that the authors conducted with René Aguilar, head of safety, El Teniente mine, Codelco, and deputy chief at the rescue site, December 22, 2010; Cristián Barra, cabinet chief, Ministry of the Interior of the Republic of Chile, January 5, 2010; Laurence Golborne, minister of mines, Republic of Chile, November 1, 2010, with Luz Granier, chief of staff, minister of mines; André Sougarret, manager, El Teniente mine, Codelco, and chief engineer at the rescue site, January 5, 2010. Unless otherwise noted, direct quotes are from these personal interviews. Maria Luisa Melero of the School of Business Administration, Pontifical Catholic University of Chile, served as principal researcher for this case, and Debora Bilger contributed with translations. The account also draws on extensive coverage of the events in Chilean and world media.

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services. With plenty of business experience but no background in mining and just four months in government office, Golborne took charge of one of the most widely watched disaster recovery efforts in world history. When the 33 miners were finally hauled to the surface 69 days later, rescue workers displayed a sign stating: “Misión Cumplida Chile” (Mission Accomplished Chile) to an estimated 1 billion television viewers who witnessed their emergence from inside the mine.

Two separate management efforts had come together to achieve a crowning moment in disaster recovery, just as, in April 1970, the National Aeronautics and Space Administration’s (NASA’s) efforts successfully returned the damaged spacecraft, Apollo 13, to Earth after the near fatal explosion of an oxygen tank. The three astronauts aboard Apollo 13, led by Commander James Lovell, had fought feverishly to preserve the few resources left on board after the explosion. Separately, the ground crew in Houston, led by Flight Director Eugene Kranz, had worked to ensure that the astronauts had the resources required for re-entry into the Earth’s atmosphere. Together, the flight crew and the ground crew produced one of the golden moments in American space flight history—the safe return of the Apollo 13 astronauts.<sup>1</sup>

The 33 miners, led by Crew Foreman Luis Urzúa, had similarly organized themselves into a small society to ration food, preserve morale, and otherwise protect their scarce resources. The surface team, numbering hundreds and led by Golborne, had organized themselves into a SWAT force, racing against time to extract the miners before their resources gave out. The inner circle comprised Golborne and three key lieutenants: André Sougarret, who oversaw the engineering team at the site; René Aguilar, Golborne’s deputy; and Cristián Barra, cabinet chief for the Interior Ministry, who managed relations with the relatives and the government. Together, they and their team achieved success as the 33 miners emerged one by one on October 13 from a new shaft that the rescue crew had created in record time. What follows is an account of that rescue crew’s efforts, Golborne’s decisions, and the critical leadership decisions that he and his inner circle had taken while 33 miners waited and much of the world watched.

Among the many critical decisions Golborne faced was whether to personally take charge of the rescue and whether to bring the Chilean president to the site of the disaster. He also had many other questions to consider. With no background in mining and new to his ministry, how could he build credibility with the miners, families, and drillers, all acutely stressed? Should he take part in the technical decisions on how best to quickly and safely reach, and then extract, the miners by drilling? What information and forecasts—some encouraging, others distressing—should he share with the miners, their families, and the media? When contributing players disagreed over life and death matters, should he play neutral referee or final decider? How should he guide private and public expectations? Who should he draw into his top team? As the person at the scene, how should he best optimize the chances for a complete and safe rescue of all 33 stranded miners? Their personal lives, and more than a few professional lives, were very much on the line in the days that followed. Golborne’s leadership, and that of his inner circle, were tested like never before and as few others ever would be.

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<sup>1</sup> Jeffrey Kluger and James Lovell, *Lost Moon: The Perilous Voyage of Apollo 13* (Massachusetts: Houghton Mifflin, 1994).

## MINING IN CHILE

With the long tradition of mining in Chile—the Atacama Desert region alone hosted 884 mines—and, as the country built a vast infrastructure to exploit its rich mineral resources during the last century, it emerged as the world’s largest producer of copper.

Yet, Chile’s great extractive success came with a high human price. An average of 34 people per year had died over the past decade in mining accidents in Chile, reaching a high of 43 deaths in 2008. Serious accidents in large mines were rare, particularly in those owned by the state copper mining company, National Copper Corporation of Chile (Codelco), or by multinational companies, such as Anglo American, BHP Billiton, and Xstrata plc. However, smaller mines, such as those near Copiapó, had generally adopted lower safety standards and experienced more personnel disasters.

The 33 miners were entrapped near Copiapó in the San José mine of San Esteban Mining Company (SEMC), a firm with a poor safety record. The San José mine had been in operation for close to 100 years, and it had a history of both physical instability and inadequate safety standards. From 2004 to 2010, SEMC had paid fines on 42 occasions for breaching safety regulations in its various mines, and the San José mine had been closed for 12 months between 2007 and 2008 after the relatives of a miner killed in the San José shafts had sued the company. Over a 12-year period, 8 workers had died on the San José property.<sup>2</sup>

### THURSDAY, AUGUST 5, IN THE MINE

Two groups of miners were at work in the San José complex at 2 p.m. on August 5. One group was stationed near its entry and exited the mine without incident when the catastrophic cave-in occurred deep in the mine. The second group was far lower at the moment of collapse. They were working in a long, sloping, and winding tunnel 700 meters below the surface and some 5 kilometers from the mine entry. Miners reference their vertical location by meters above sea level, and the second group was at about 100 meters above sea level—termed “level 100.”

The miners located lowest in the mine reported later that everything began to shake and then a major portion of their tunnel collapsed. A rescue team of geologists estimated the rock fall to be 135 meters in height, 100 meters in length, and 30 meters in width, and it had come down somewhere between level 200 and level 300. A thick cloud of dust spread out from the collapse, virtually blinding many of the miners for six hours. One of them, Richard Villarroel, a mechanic who had been with the mine for 2 years, later reported, “The mountain and the roof of the tunnel and everything shook. The gallery began to break up, and we couldn’t see anything [more than] 1 or 2 meters [away].”<sup>3</sup>

At first, the trapped group of 33 hunkered down in a constricted area of just 50 square meters. Urzúa, immediately appreciating the gravity of the situation and the near impossibility of a quick rescue, gathered his crew in a secure area—a shelter termed the “refuge”—and organized the

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<sup>2</sup> Sam Jones, Guardian.co.uk., “Trapped Chilean miners sing national anthem in footage from inside mine,” August 27, 2010.

<sup>3</sup> Cable News Network, “Chilean miners waited for death,” November 18, 2010.

men and scarce resources for long-term survival. He assigned some of the miners to assess the situation and others to help orchestrate their survival.

Urzúa gave his men the bad news. He estimated that they had only a slim chance of rescue and that it was far more likely that they would not survive. “Even if the truth hurts,” he later recalled, “you have to say it.” He, and many of the other miners, resigned themselves to their likely fate but nonetheless battled for life. “We had a boss who every day said we must stay strong,” remembered Villarroel in referencing Urzúa, but he also recalled of his own mindset: “If they find us, they find us ... and if not, not.”<sup>4</sup>

In the first hours, panic prevailed. Several of the younger and less experienced miners threw themselves on the ground in despair. “I realized several comrades were in a bad way ...,” said Urzúa. He determined that a democratic approach to all major decisions would be vital for keeping the group together and taking the right actions. “There was only one key,” he said. “We took a vote on everything. As long as we had 17—well, that was the majority. Every situation was analyzed. What was possible to do? What can we not do? How should we distribute the food?” Most of the group’s decisions in the days ahead became unanimous, but the essential step, he said, “[was a commitment to] democratic decisions.”<sup>5</sup>

Miner Mario Sepulveda later recalled: “All 33 trapped miners, practicing a one man, one vote democracy, worked together to maintain the mine, look for escape routes, and keep up morale. [We] knew that if society broke down, we would all be doomed. Each day a different person took a bad turn. Every time that happened, we worked as a team to try to keep the morale up.”<sup>6</sup>

The trapped miners initially tried to escape through a ventilation shaft system, but they discovered that the ladders, though required by safety codes, were missing. The company had been required to install them as a condition for restarting operations after the shutdown between 2007 and 2008 but had simply not done so.

The miners opened access to 2 kilometers of galleries, good for exercising. They created water supplies by digging underground water sources with backhoes and by draining the radiators of nearby vehicles. They preserved their meager food supply—intended to last just two or three days—by painfully stretching it out for two weeks. Each received 2 small spoonfuls of tuna, a sip of milk, a morsel of a peach, and a biscuit every 48 hours. By the end, they had an average weight loss of 8 kilograms (18 pounds) apiece.<sup>7</sup>

The miners drew upon truck batteries to power their hard hat head lamps. Nobody was left alone, and everybody was assigned a task. In the weeks that followed, they functioned much like a family, with a mix of affection, dependence, and frustration. Collectively, reinforced conviction proved vital. “As a group, we had to keep faith. We had to keep hope. We had to all believe that we would survive,” offered Florencio Avalos. Franklin Lobos, a former professional footballer, thought that he and his fellow miners had acted like a great sports team. “We pulled together

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<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> BBC News, “Trapped Chile miners give video tour of confinement,” August 27, 2010.

<sup>7</sup> Alonso Soto, Reuters, “Chile to dig escape shaft, prep miners for long haul,” August 24, 2010.

when things got rough,” he said, “when there was nothing, when we needed to drink water and there wasn’t any to drink. We pulled together when there was no food, when you just had to eat a teaspoon of tuna because there was nothing else. That really bonded us.”<sup>8</sup>

## **THURSDAY, AUGUST 5, ON THE SURFACE**

The cave-in sent a deafening roar and cloud of dust out of the mine’s surface entrance. Once the dust settled, the mine superintendent dispatched a team down the mine, and they soon discovered an impenetrable rock wall. Still unsure of the dimensions of the cave-in, the mine superintendent called the regional secretary of mining for the government at 6 p.m., informing him of the accident. Regional authorities, police, owners, friends, and relatives descended on the San José mine.

The regional secretary of mining alerted the undersecretary of mining in Santiago, Pablo Wagner, who in turn sent a message to Golborne in Ecuador. To signal the government’s concern about mining safety, Golborne had recently installed a procedure by which mine operators were required to notify national authorities immediately after an accident. He learned of the gravity of the disaster within hours of its occurrence.

For Golborne, the stop in Quito was the first stage of a trip scheduled to visit Bogota, Colombia, next for the inauguration of José Manuel Santos as the new president of Colombia. Golborne called Wagner back and instructed him to go immediately to the mine. Given the late hour, Golborne decided to talk with the Chilean president the next day, August 6.

## **FRIDAY, AUGUST 6**

Wagner flew with Chilean Labor Minister Camila Merino to Copiapó on August 6, and they reached the San José mine at 11 a.m. The mine superintendent had taken charge of the rescue efforts, assembling a volunteer rescue team with experts drawn of necessity from other mines in the region since the San José mine did not have its own rescue squad.

The rescue team entered the mine and found that the tunnel was blocked 4 kilometers down, at level 355. They could not determine whether the tunnel had also been blocked further down and whether the tunnel with the miners at level 100 had caved in as well. The rescue team decided to descend one of the ventilation shafts that vertically cut the tunnel every 30 meters to 70 meters, but, on reaching level 240, they were again blocked.

Early on the morning of August 6, Golborne informed President Piñera of the accident. A product of the private sector himself, he had earned a Ph.D. in economics from Harvard University and served for a few years on the faculty of the Pontifical Catholic University of Chile. He then entered the private sector as a bank manager, moved to Citigroup Inc. where he served as country manager for Chile, and then launched a credit card venture. He built an enormous personal fortune by finding risk and making the most of it. For example, he had turned Chile’s Lan Airlines S.A. into the region’s premier carrier. In the appraisal of one Chilean

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<sup>8</sup> Fiona Govan and Aislinn Laing, “Miners came to blows, but swore to keep details secret,” *The Daily Telegraph*, October 16, 2010.

journalist, “Piñera thrives in environments where risk and opportunities exist.” And now he approved Golborne’s return to Chile, a place of political risk but also one with an opportunity to save 33 lives.

The logistics of Golborne’s return to Chile were challenging. He travelled on a commercial flight to Lima and then took another one to Santiago. Upon arrival, his chief of staff, Luz Granier, an economist and close advisor, questioned Golborne’s intention in visiting the mine. “Ministers do not show up at accidents right away,” she warned. She had researched prior accidents and reported that a mining minister had never gone to the site of one. Golborne was mindful of her warnings. “Luz Granier was right,” he said. “We, in the government, took charge of the problem due to our lack of political experience.” He foresaw significant downside risks: “Two things could have happened: If the miners were all dead from the first minute, and they were found dead a few days later, [the public would have known that] the government was there and gave the needed support. But, if they had survived and later they were discovered dead, it would have been a political disaster.”

Once the national government came on-site, Golborne knew that the mining disaster would become the government’s disaster if he did not manage the situation extremely well. “We were not part of the problem,” he recalled. “But, we appeared as the responsible party, not only from the political perspective but also from a legal standpoint.” Moreover, the mine was located in a region whose people had delivered less political support than others to President Piñera in the recent presidential election, and as a result, Golborne recalled, “We looked like intruders who came here with no political affiliation.” Yet, he felt he could not have done otherwise. “Mining is my subject in the government,” he said. “Although I do not come from the mining world and was questioning myself [on] what I could do in the mine—how I could help in the rescue given the magnitude of the problem—I understood I had to be there.”

In going there, Golborne needed to draw on his management experience and, in that, he was confident. As he explained to a person involved in the rescue, “When I accepted the government’s invitation [to become Chile’s minister of mines], I had a talk with my family and said, ‘This is a quiet ministry where I can contribute with my management skills.’” But, now, with a mining crisis at hand, he cautioned, “I am not knowledgeable in mining. I have visited two mines before this. I do not have technical knowledge, [but] what I do know is how to manage challenging projects, lead people, build teams, and provide the necessary resources.” He later reiterated this to the rescue team: “You can ask for whatever you need. You do the technical job, and I’ll support you with whatever is necessary.”

## **SATURDAY, AUGUST 7**

When Golborne reached the San José mine at 3:30 a.m. on August 7, he passed relatives near the entrance who had gathered by bonfires to warm themselves in the cold desert night while awaiting word on the rescue’s progress. As he drove by, he could see some people in prayer, despite the darkness. “I will always remember one of the relatives at the entrance barrier,” he recalled, “a guy covering himself with a blue blanket on top of his head, unshaven, with a hopeless look on his face.”

Upon entering the San José mine offices, Golborne was briefed on the efforts already underway. He recalled: “I get into the office—a room filled with rescuers—and I am met by the rescue supervisor from another nearby mine, Pucobre, who had unofficially taken charge of the rescue. He showed me a blueprint of the mine and told me that the next morning at 8 a.m. a rescue team would attack, lowering themselves through the ventilation shaft, trying to open a way to level 100. They were pinning their hopes on the possibility that the trapped miners had reached a shelter where oxygen, water, and food had been stored.”

Golborne then moved to meet with a group of relatives, informing them that a new rescue effort would start at 8 a.m. “It was 4:30 a.m., dark, and cold,” he recalled. “I told them that they would be informed every two hours on what was happening and that we would always tell them the news, straight.” Several hours later, he called President Piñera in Bogota on a satellite phone, and the president abruptly departed for Chile. The growing complexity of the evolving situation was becoming all too evident to Golborne.

Later, Golborne joined in a meeting organized by the Intendente de Atacama, the highest government authority in the region, with police, the local representative of Chile’s National Emergency Office, rescue team leaders, one of the owners of the mine, Alejandro Bohn, the top Chilean Army officer in the region, the Policia de Investigaciones de Chile (Investigations Police of Chile), and others. The discussion was marked with confusion, including uncertainty over basic facts such as the number of miners trapped, with the counts ranging from 33 to 37. Golborne decided on the spot to take control of the meeting and, in effect, the entire rescue effort.

Golborne instructed Prefecto Miranda, the top police officer at the site, to come back in the afternoon with the confirmed number and identities of the trapped miners. “Take the list of the mine employees,” he said, “and go to the relatives outside and check for every missing man person by person. By this afternoon, I expect you to tell me how many miners are down there.” In the evening, he confirmed that the number of trapped miners was 33, comprising 32 Chileans and 1 Bolivian.

In the meantime, the rescue team had grown to 100 volunteers, 40 of whom entered one of the ventilation shafts at 9 a.m. that morning with Pedro Riveros, Pablo Ramirez, and their advance team leading the way. But, on the surface of the mine, new hazards came to Golborne’s attention. In a meeting with Bohn, the mine superintendent, the rescue supervisor from Pucobre, and other technical people, he learned that the mine remained a dangerous place to be inside. “The problem was that the mine was showing more instability,” he said. “[And] the hill was moving again. The guy from Pucobre wanted to call back the rescuers. There were different opinions about what to do, as others were arguing that it was not a risk for the rescuers.”

Though responsible for the rescue process and accountable for its outcome, Golborne knew that, in technical decisions, he had to tread carefully. If he became too deeply involved in the technical decisions, outsiders could have later said, “What do you know?” And, then, if the next steps failed or put rescuers at risk, he knew some would have said, “Why did you get in the middle if you knew nothing?”

Golborne decided on the spot not to try to make the final decision but rather to shape the dialogue so that the rescue leaders could decide. “As a minister,” he said, “I could not make a decision. I did what I normally do ... let the experts talk, until the Pucobre guy retracted his objection to reentering the mine. The rescue effort was not stopped.” And, a fresh idea surfaced in the meeting in case the rescue party failed to reach the miners; the plan was to drill boreholes 13 centimeters (5 inches) in diameter deep into the mine to try to locate the miners. Golborne adhered to this decision-making style in the days that followed. He explained: “With my style, I started asking questions. Why are you putting in this winch? What alternatives are there?”

With optimism about a rescue spreading, Golborne faced a whole new set of issues ranging from family morale to miner health. “That day,” he said, “we organized ourselves: the intendente would take care of the families, Bohn would lead the technical team, and an MD from one of the nearby mines would be in charge of the health of the miners. We expected the trapped miners to be freed during the day, if they were alive. Our main worry was that some of them could be hurt.”

But those hopes were dashed at 3 p.m. on August 7 when Riveros and Ramirez, the two lead rescuers, came back to the surface with the news that a fresh cave-in had blocked the ventilation shaft. The duct had collapsed under their feet at level 250, and now there was no way to reach the miners. Riveros reported to Golborne that the rescue had failed. “They must be dead,” Riveros said. “[And] if they are not dead, they will die.”

In a state of shock, but remembering his pledge of transparency, Golborne went out to meet with the miners’ relatives. With a megaphone in his hand, he recalled, “I started telling them the bad news, but then I saw, in front of me, two of the daughters of Franklin Lobos, the ex-footballer who was in the mine; they silently started crying—teardrops on their faces with a profound sadness. I broke down. I could not continue speaking.” But, one of the relatives shouted, “Minister, you cannot break down. You have to give us strength!”

“This was a turning point for me,” Golborne said.

President Piñera, returning to Santiago from Colombia with First Lady of Chile Cecilia Morel, knew his aircraft would be flying over the region with the San José mine. Cristián Barra, who had known the president for many years, observed: “[He] commits himself with soul and heart.” And now, rather than passing over Copiapó, they made an unscheduled stop at its airport.

The president landed in Copiapó at 10 p.m. that evening. He immediately decided to go to the mine, against the advice of his political advisors who felt he had to keep a distance from the rescue operation. “It was a big political risk that the president involved himself directly in the rescue,” one advisor recalled. “If things went well, it would be great, but, the downside—if things went bad—was enormous. When the previous president, Michelle Bachelet, went to the site of a landslide, things turned bad because the people were shouting and complaining loudly to her ... and the TV cameras were there.” In the wake of earlier mining calamities, the sitting president of Chile had never visited a disaster site. Even Golborne cautioned against the president’s visit. “I always thought the president had to stay away,” he said, “monitoring from a



distance—not directly involved. If there had been a problem, this would have had a direct cost for the president.”

President Piñera decided to go to the mine nonetheless. He later explained: “When I returned from Colombia, my staff was telling me, ‘Don’t get close to the San José mine because it is going to end in a tragedy.’ I told them, ‘Even if there is one probability in one million of finding them alive, I shall do whatever is necessary to rescue them because it is my duty as president of Chile, and I believe that, with God’s help, with the help of many, with technology, and an unshakeable faith, we will achieve a miracle.’”<sup>9</sup>

As the president was leaving the airplane, Barra recalled him stating: “We are not going to rest until we find them and bring them out.” The president and his wife met immediately with the miners’ relatives and received an update on the day’s events. “When I was informed that the company that owned the mine was not capable to do the search operation,” the president said, “I made a simple decision: it was the government or nobody. I met with the relatives and told them, ‘We are going to search for them as if they were our children.’”<sup>10</sup> He and Golborne then took formal oversight of the rescue, as the Minister of the Interior Rodrigo Hinzpeter issued an emergency decree giving the national government control of the mine.

President Piñera’s meeting with the relatives proved turbulent. Since so many relatives had gathered, Golborne had asked them to appoint a group to represent them, and, as expected, they selected the toughest among them. Many of the group came from a mining tradition and knew much about the technical issues confronting the rescue. They complained about the failed efforts and lack of support from the government. They did not want SEMC’s management to be in charge. Having heard a radio interview with a local geologist, Miguel Fort, who had pressed for the drilling of exploratory boreholes, the relatives lobbied for Fort to join the rescue team. President Piñera agreed on the spot to include Fort on the rescue team to represent the families, and he declared that his government would take full charge. With President Piñera then departing for Santiago, Golborne remained the final authority on the scene.

## **SUNDAY, AUGUST 8**

With the boreholes as a possibility, Golborne called Granier in Santiago at 1 a.m. on August 8, and asked her to locate the right drilling equipment as soon as possible. He provided her with a couple of leads from people in the mine and then, exhausted, Golborne turned in while Granier made calls through the night.

The next morning, Golborne heard a rumor that Nelson Contador, a respected mining engineer and expert in geomechanics who had joined the rescue team on his own accord, was upset because nobody was paying attention to him, and therefore, he was leaving the scene. It was an early taste of the egos and conflicts that Golborne had to manage in the days that followed. Golborne found Contador and, averting his defection from the cause, brought him into the inner circle to discuss rescue strategies.

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<sup>9</sup> “Empresarios colombianos no deben temerle a la competencia: Piñera,” *El Tiempo*, November 27, 2010.

<sup>10</sup> *Ibid.*

Golborne also came to conclude that one well-respected mining expert should be fully in charge of the technical aspects of the rescue effort. As he recalled, with reference to Codelco, the enormous, state-owned copper mining company:

When the second disaster—[the collapse of the ventilation shafts]—happened that Saturday, we started thinking about the drilling. I realized that, in the technical issues, we did not have the needed leadership. I could not provide that leadership; although I am an engineer, I do not have any technical knowledge about mining. The problem was complicated by the number of people and parties involved—mostly subcontractors. There were too many voices, and nobody at the site seemed to have the leverage to cut the cake. The obvious choice had to be a manager from Codelco with strong mining experience. The Codelco managers had the leverage with the subcontractors because of Codelco’s size and multiple contracts with them.

Golborne talked several times that day with Codelco Chairman Gerardo Jofre; he also consulted with Hinzpeter who, in turn, talked with President Piñera. They decided to ask Codelco, Chile’s largest corporation, to take charge of the technical aspects of the rescue.

In the meantime, Golborne met with the families every two hours; he learned of increasing demands from the relatives for better living conditions in the harsh desert climate. A tent city had sprung up, some relatives were sleeping in cars, rescuers and reporters were streaming in, and sanitary conditions were deteriorating. President Piñera had promised that the government would provide some comforts; although Golborne was not responsible for human settlements, he decided to take charge of the nascent village as well, leading to the creation of Campamento Esperanza (Camp Hope).

At Golborne’s instigation, the regional government created a more private area for the families so they could avoid the constant queries from the large and inquisitive press corps. The camp included 33 tents—1 for each of the miners’ families—a communal kitchen, a canteen area, sanitary facilities, security, and cell phone service. Bulletin boards sprouted and shuttle bus service started, along with a schoolhouse and children’s play zones. Volunteers came to help feed the families, clowns came to entertain the children, and still others provided emotional and spiritual support. The camp became a small city, with police and soldiers providing security, some even patrolling its perimeters on horseback.

Families erected memorials, lit candles, and prayed. They placed 33 flags on a nearby hill to represent the miners and put shrines, photos, icons, and statues of the Virgin Mary across Camp Hope. María Segovia, the elder sister of the trapped miner Dario Segovia, became known as the *alcaldesa* (mayoress) for her organizational skills and directness. “We’re not going to abandon this camp until we go out with the last miner left,” she declared.”<sup>11</sup>

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<sup>11</sup> Vanessa Buschschluter, BBC News, “High heels and hairdos: Chile countdown begins,” October 11, 2010.

## MONDAY, AUGUST 9

Granier's phone calls on behalf of Golborne had worked. At 8 a.m. on August 8, the first drilling equipment left by truck from the La Escondida mine in Antofagasta, some 600 kilometers from Copiapó, and it was put to work early on August 9. Golborne's rescue group was ready for the equipment upon its arrival, but the drilling had its own set of technical and social challenges. He recalled:

We had already discussed the drilling. The problem was that these boreholes are typically drilled vertically. But, inside the mine, there was a *caserón* (big cavern) and a winding gallery. If the tip of the drilling equipment hit an empty space, the *caserón* or tunnel, mechanically, it does not continue working. With the mine's blueprints, we were [already] doing studies on how to target the drills so as to avoid hitting the cavern or one of the tunnels. That meant drilling the holes at an angle.

[At the same time,] the pressure from the relatives was tough. They were very upset, and they were filming the meetings with me on their cellular phones. They did not believe what we were telling them. We had to calm them down. So, we decided to start the first drill right away, although it was probably going nowhere. There was no technical analysis of how to target the drill at that time.

The stranded miners later reported that they heard the drilling start—the first sure sign that a rescue attempt in the mine was underway.

With competing demands from families and reporters—all targeted at Golborne and his team—Golborne decided that progress reports would go to the families first and then to the media. “It was a difficult call,” he said. “We had put up a big tent to meet with the relatives. I get there, and the place was full of journalists. I said that I would talk to the families first and that the press had to leave. I was firm. When they left, I talked to the relatives. That was the first time, and it was standard procedure later—first the families, then the press.”

President Piñera returned to the mine with Nelson Pizarro, a highly respected mining expert, and Sougarret, the engineer appointed by Codelco to head the technical aspects of the rescue. The President met with the families and introduced Pizarro and Sougarret to them.

“You have to take charge,” said Golborne to Sougarret. He knew that Sougarret had a quiet personality but strong character, and he had, fortunately, brought with him Aguilar, the head of safety from one of Codelco's mines. Aguilar was a psychologist viewed as open-minded and a good communicator. He proved invaluable in managing the team's relations with both the miners' relatives and the rescue team's many subcontractors.

All worked under the enormous stress of the moment, and keeping in mind the ultimate goal helped some stay focused despite profound anxieties about the outcome. Aguilar recalled:

There was a lot of sorrow with the relatives. I had to manage myself. I felt anguish every night, as we did not know whether the men were alive. Every night, when leaving the mine, I had to walk through the camp. I would see the banners saying: 'Daddy, we are waiting for you' and 'Son, we are here.' Some who came to work in the rescue could not stand the pressure and left. If you are not conscious of why you have to stand the pressure, it is difficult. We had a mission: to rescue the men.

## **TUESDAY, AUGUST 10**

The next day, Sougarret took charge of the technical side of the rescue by creating two teams. One team, headed by Sougarret, explored opening a hole in the rock to reach the ventilation shaft at level 220 that might have provided access to the miners. A second team managed the borehole drilling operation. It was headed by another Codelco engineer, Oscar Castro. At this point, Golborne had removed Bohn from the rescue effort. Other conflicts within the rescue team emerged. Fort, the geologist representing the families on the rescue management team, frequently adopted an adversarial stance, arguing against Sougarret's proposed actions in meeting after meeting.

In pursuing the two solution strategy, Golborne knew that the likelihood of either succeeding was not large. He described the options and their uncertainties:

I was enthusiastic about Sougarret's idea of making a hole in the rock, looking again for the shaft. The Codelco people were reinforcing the tunnel and were doing marvels.

On the other hand, the drilling alternative was at full speed. We knew, however, that the probabilities of success with this alternative were low. Consider that we were trying to hit the shelter, a target which was 10x5x5 meters from 700 meters distance, with a borehole 5 inches wide. It is like hitting a house with a 700-meters long stick. A few degrees in deviation would make us miss the target by a lot.

You have to consider that, when drilling contracts are made, a 7 percent deviation is acceptable; over 7 percent, there is a fine. Well, 7 percent in this case was not good enough. A deviation of 7 percent on 700 meters is 49 meters. We were targeting a 10x5x5 [meters] target.

For that reason, I insisted that we set up some drills to target the workshop; although it was a small space, it was much larger—20x30x50 meters—5 times larger. I remember having insisted a lot about it. Finally, the technical experts agreed.

We ended up having 10 different boreholes being drilled, pointing down at different angles. As the drilling progressed, all kinds of mishaps were happening.

Tips broke down, drills lost direction, etc.; so, the work had to be stopped, repairs done, and then work would restart.

On the premise that transparency needed to be consistent to be credible, every time a drilling problem emerged, Golborne made a point to candidly inform the relatives and the press. He later explained: “The decision of transparency was a conscious decision made early on. There were too many people—we could not hide anything. If we did, we would lose their confidence. Therefore, transparency with decisions was calculated, but it was worth it—it was pragmatism. It was impossible not to be transparent. If we were trying to hide something, we would be caught.”

Managing up and managing out were, of necessity, part of Golborne’s mandate as well. President Piñera had called the ambassadors of Chile to South Africa, Australia, Canada, Peru, South Africa, and the U.S. requesting technical assistance. Their response was immediate, with an avalanche of proposals. Golborne designated Fidel Baez, another Codelco engineer, to a technical evaluation team for vetting the proposals and pressed him to evaluate them more quickly than seemed possible.

The first outcome of this search and evaluation process was the identification of a promising technology called diamond core drilling. Available in Australia, this technology uses an annular diamond-impregnated drill bit attached to the end of hollow drill rods to cut a cylindrical core of solid rock. Holes within the bit allow water to be delivered to the cutting face for lubrication, cooling, and removal of cuttings. But, the diamond core drilling parts did not arrive until August 14, and they proved disappointing in practice, taking far longer to cut through the hard rock in the mine than had been anticipated.

## **WEDNESDAY, AUGUST 11**

On August 11, Golborne returned to Santiago for a meeting with the president amidst a political atmosphere that had turned gloomy. Prominent senators and political operators in the Alianza por Chile (Alliance for Chile), the coalition of political parties that supported President Piñera, asked him to lower the government’s profile in the operation. They wanted the Codelco people to take charge and Golborne to return to Santiago.

The argument was simple, if not persuasive: If a top government official was in charge of the operation and the rescue failed or the miners had died, popular support for the government would plummet. “Piñera is gambling his presidency on this accident,” said Patricio Navia, a professor of Latin American studies at New York University. “Of course he has to get them out. It would be impossible for him to govern if the rescue operation fails.”<sup>12</sup>

To worsen the situation, in a nationally televised interview Golborne said that the probabilities of finding the miners alive “are low,” making for newspaper headlines across the country the next morning. In explaining his choice of words, Golborne later offered, “I knew it would hurt my public image, but I had to lower expectations.”

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<sup>12</sup> CBS News, “Chile Controls Message on Miner Rescue Timeline,” September 2, 2010.

That same day, President Piñera fired the head of the National Service of Geology and Mining (Sernageomin) and vowed a major overhaul of its oversight of mine safety.

## THURSDAY, AUGUST 12

Golborne returned to the mine and descended with Sougarret to level 355. There, Golborne became convinced that there were, at the very least, some survivors. He explained: “When the accident occurred, we knew there was food for 48 hours. Although that is a problem, people can survive without food for a long time. We also knew that water was available in an industrial tank.”

But the big question was the quality and supply of air. In coal mine accidents, for example, the air fills with toxic gases. Not so in the case of copper mines, though dust can be a modest hazard. The technical experts in this case were confident that airflow was not a major problem because the San José mine was full of holes. But, those could have, in turn, presented a major problem at the moment of collapse because the resulting intense blasts of air could have blown out rocks that might have maimed or killed the miners. But, Golborne explained his heartening inference from what he witnessed when he arrived at level 355: “When we reached the 355 level with Sougarret, workers were reinforcing the shaft. I placed my hand on top of it and felt air flowing. I asked Sougarret about the air blast, and he told me: ‘There was no air blast because if there had been one, nothing would be standing’ ... I remember thinking that the guys are alive. Not all. Those that were not crushed are alive.”

In the days that followed, the borehole drilling continued, though not without frequent setbacks. The drillers found that they were off course, that their drills stopped when they reached a cavity, and that they had to replace the drill bits from their continuous wear and tear. Barra and Golborne made sure that the relatives and press were always aware of the repeated course corrections and equipment repairs. Each meeting gave rise to new suggestions and endless speculations; some were useful, others were fanciful, but all required his attention. Golborne recalled:

Frequently, in the meetings with the relatives at Camp Hope, they would come with other people, the miners’ unions representatives, *pirquineros* (men who roam the desert looking for rocks with copper mineral) ... all kinds of people pressing for alternative solutions or requests to enter the mine.

The relatives, influenced by Miguel Fort, wanted us to dig a tunnel. I would send them to talk with Manuel Montecinos, a rugged mining supervisor from Codelco and an expert in tunneling. He is a tough, seasoned miner. He would meet with them and ask them to look for a place to dig at sea level. The closest place was 20 kilometers away. It could not be done!

Another character whom I liked a lot was Jose Vega. His son was trapped in the mine. We did not allow any relatives to work inside the mine during the rescue. The first day, he did not tell anybody that he had a family member trapped in the mine and managed to slip in. In the meetings, he was respected because he was an

old miner and his son was there. He is a good reasoning man. He would show up with blueprints and ideas to propose. I listened to him and sent him to talk with Montecinos.

The pirquineros would come to us and ask to be let into the mine. They would say: 'We know the craft. Let us get in ... we will find a fissure; we will slip in on our bellies.' One night, they brought a clairvoyant woman, a psychic who told me she could see corpses and that 16 miners were alive, although some were injured and shrieking for help, their legs crushed. All of this at 11 o'clock at night when everybody was tired, and we were in a pitch-black and cold night.

In another meeting, a guy came up with the idea of letting free a thousand mice in the mine with panic buttons attached to their bodies. 'Rats have their ways to move underground, and we will know whether the miners are alive,' he told me. The only problem he had not solved was how to power the panic buttons and then attach them to the rats. I had to listen to them. Patience was key.

Every night, after the last communiqué and things calmed down, I would go to the camp to sit with the families and listen to them. Every night I would go and say good night, whatever the time it was, and tell them things that I had not told them during the day.

At one point, the de facto leader of the relatives had become too adversarial, and Barra worked to bring forward more affirmative leadership. "We started having serious problems," he recalled, "[with] the relative's leader. I started looking for positive leaders. We could not have a guy who found everything wrong—that we were doing everything badly when we were breaking our backs to save their relatives. So, we started looking for positive leaders and some very valuable people emerged." These people helped unify the families and created an affirmative relationship with the rescuers.

## **THURSDAY, AUGUST 19**

On August 19, two setbacks happened almost simultaneously. First, the deepest drill reached the level of the mine where authorities presumed the miners were, but it did not hit the workshop or encounter any signs of the miners. This was a devastating moment. At almost the same time, Sougarret's alternative plan of reopening access through a hole in the rock to reach the miners through a ventilation shaft also failed. Adding further to the gloom, at level 220, the rock's pressure was cracking the walls, opening fissures wider still. Sougarret determined it was too dangerous to continue working in the mine and decided to shut it down, allowing no one in at that time. Golborne recalled:

I asked that we meet and have the meeting filmed. The fissures were discussed, and several of the mining experts said it was too dangerous to work there. One of them said it would be murder to let people work there. I asked that, in the meeting minutes, it was explicitly said that it would be homicide to let people work in there. At the noon meeting with the families, I told them the bad news. It was

dramatic. Two failures had happened. The mine was closed, and we missed the workshop with the first drill. We had to keep on drilling.

In the afternoon, Golborne travelled to Santiago to be with one of his sons for a birthday party the next day; he left Wagner in charge. That evening, Wagner and Sougarret had a near mutiny on their hands. Frustration ran high. The relatives demanded to enter the mine, claiming that the Codelco people were too uninformed. Fort continued to insist on carving a tunnel, now estimating that it would require just 30 days to reach the miners. Wagner lost his patience, and the meeting ended with recriminations. Appalled by what he saw of the televised rebellion, Golborne rushed back to San José.

## **SATURDAY, AUGUST 21**

Two more drilling machines were approaching the targets on August 21. Although the boreholes had deviated some from their designated path, the engineers were confident that they were close to hitting the right place.

## **SUNDAY, AUGUST 22**

At 1 a.m. on August 22, engineers expected one of two borehole drilling machines to reach the right depth within three hours, but the drill head had to be replaced. Now, with an anticipated delay of 12 hours, Golborne went to sleep.

At 6 a.m., a drill reached a depth of 688 meters, and rescue workers heard faint tapping on the drill. Golborne recalled:

The supervisor in charge woke me up with the news: ‘We broke! We broke it!’ I dressed in a hurry and showed up at the mine at 6:30 a.m. Everybody was very anxious. We put a stethoscope to the iron rod in the hole, trying to hear sounds from the depth of the mine. We could hear weak noises coming from the underground. Later, we learned that the miners had been hitting the iron rod with a big hammer.

We could have hit anywhere, but we had a reasonable expectation that we had reached a gallery. At 7 a.m., I sent an SMS message to the president and called him at 8 o’clock. I told him: ‘We broke in. We do not know whether anybody is alive, but if we have any news, I’ll let you know.’

At the moment they reached the gallery, Granier recalled: “I talked with Laurence at 8:15 a.m. He told me, ‘I hear sounds, but ten more people are hearing the sounds too.’” One of the borehole drills had finally broke into the miners’ subterranean dungeon—17 days after they had been trapped. Later, it was learned that the first borehole hit a gallery some 5 meters from the refuge, but the second had successfully reached the refuge, though only by a few horizontal centimeters.



That same morning, President Piñera's father-in-law, who had been terminally ill, passed away. President Piñera sought to travel to the San José mine anyway, but Golborne recalled warning him:

I told the president that he should wait until a video camera was lowered down the borehole to see if there was anybody alive. I was terrified that the camera might show only corpses or, even worse, injured miners.

With the camera down there, there were two scenarios: [First], nobody showed up because they were all dead or because they could not reach the camera because the gallery was blocked. But the second scenario was even worse—miners dying, crushed legs, bleeding, and us not being able to pull them out. The medical issues were there again.

I was asking the doctors there, 'Are we prepared for this? What are we going to do if there are people dying?' That is why I was concerned with President Piñera's presence at the mine. How would we respond to these scenarios if there were problems? In the scenario where everybody was okay, which was what finally happened, that was marvelous. But the pressures from the relatives when a person is dying—when that person has a name and surname.

President Piñera decided on the spot to travel to the mine nonetheless. "We have to learn to be visible in the good times," he told Barra, "and the bad ones."

As soon as the rescuers made first contact with the miners, word instantly spread among their waiting families, and they were seen on live television cheering, crying, and hugging. Then, an official from the Interior Ministry appeared and told them that it was not official yet and that they would have to wait for final confirmation. However, when the breakthrough drill head was pulled back to the surface, it carried a defining message scrawled in red, capital letters: "Estamos Bien En El Refugio, los 33" (We are fine in the shelter, the 33).

Several hours later, Chile's president held up the note before an assemblage of television cameras.

"Today, all of Chile is crying with excitement and joy," declared President Piñera. A member of the rescue team, Aguilar, recalled, "It was the happiest day in my life. More than happy. Total jubilation!" Golborne, the rescue's mastermind, recalled: "I call that day the epiphany. It was a magical moment, something extraordinary, fantastic."

Soon after the breakthrough, the rescuers lowered a video camera down the narrow borehole. Golborne worried about how to deal with a complex medical emergency that the camera might have revealed. But the live images, broadcast around the world, revealed a group of miners in far better condition than had been feared.

## MONDAY, AUGUST 23

The next day, rescuers reached the miners with two more boreholes, creating three umbilical cords to the trapped men. Thereafter, they worked the lifelines continuously, dropping and retrieving thin, metal cylinders dubbed “carrier pigeons.” Requiring an hour for descent, the cylinders were, at first, filled with rehydration tablets and high-energy glucose gels to help the miners restore their digestive systems. Soon, they included food, water, clothing, and letters. Later, an electric line, fiber optic cable, and even a water pipe were sent down the boreholes.

## RETRIEVAL PLANS A, B, AND C

Amidst the jubilation, Golborne’s attention shifted to the immediate challenge of retrieving the miners. And, fortunately, a plan—in fact, a range of alternative plans—for the potential extraction had already been under development under his direction.

To prepare for the possibility of a rescue, Golborne and his team had reviewed a host of equipment needs and strategies for reaching the miners. They grouped them into distinct approaches, labeled Plan A through Plan J. The plans were informed based on the drilling information acquired from the initial boreholes. Three schemes emerged as favorites, each with different equipment:

- Plan A: Drill straight down at an angle of 90 degrees.
- Plan B: Drill at an angle of 82 degrees.
- Plan C: Drill at an angle of 85 degrees.

By August 19, three days before direct contact was made, Golborne’s staff had already scoped out Plan A, which entailed drilling a shaft directly down to the miners. Approved by President Piñera on August 20, a 3-ton (6,000-pound) drill was rushed from a Codelco mine some 400 kilometers to the south, arriving in San José on August 22. Stabilizing gear had been flown in from Canada that allowed the drill to make a vertical hole to the miners with zero deviation. On the morning of August 23—the day after the famous note emerged—rescuers began drilling a preliminary test hole.

Plan B had come from one of the drilling subcontractors. It entailed widening the boreholes. First from 13 to 32 centimeters and then to 69 centimeters with the same equipment already in place. This made it the lowest cost option. Though he was not technically trained in drilling technologies, Golborne was ready to delve into the technical merits of the proposals:

I got involved because the fellow in charge from Codelco was not listening [to the proposal for Plan B]. He was not a drilling specialist. They talked with me, and I insisted that the plan should be evaluated. I talked a lot with the drilling people, in particular with Felipe Mathews, owner of Geotacama and a geotechnical subcontractor. I would stay talking with [him and others] into the long hours of the night. These guys have not received the merit they deserve. Finally, Plan B was approved, although some thought it was crazy.

The third plan, Plan C, entailed bringing in a petroleum drilling rig and required clearing a large area to operate. It was the most expensive of the three plans, but it was the fastest. When Golborne checked with President Piñera, the president later reported that he had sanctioned all three despite the increased costs to hedge against any one failing. “Minister Laurence Golborne,” said the president, “informed me that there were three technological options for the rescue and asked me to define which one we would use. I told him the three of them because technologies may fail, but we cannot fail.”<sup>13</sup>

## POLITICS

On September 1, President Piñera reported: “There is no chance the miners would be freed by Chile’s Independence Day celebrations,” which begin on September 18. He offered a much more distant date for anchoring public expectations. “The government,” he offered, “is doing all it can, so we can celebrate Christmas and New Year’s with them.”<sup>14</sup>

The December and January dates did not square with the drilling experts’ private estimates, but the public declaration was useful groundwork if they later fell short of their own expectations—both on the surface and in the mine. Chilean Health Minister Jaime Mañalich reported that the miners reacted calmly after learning of the holiday deadline.

The rescuers’ own flowcharts displayed four months for completing the operation, and public officials at all levels vigorously rejected any suggestions of earlier timelines. Yet, when privately discussing their projections, some of the rescuers said, euphemistically, they were, “exploring other options.”

Others more openly disagreed, anticipating quicker success. Larry Grayson, a professor of mining engineering at Pennsylvania State University, said it could take just 25 to 30 days to reach the miners. Gustavo Lagos, a professor at the Pontifical Catholic University of Chile’s Center for Mining, estimated the job could be done in two months if all went well, though four months if it all bogged down. Eduardo Hurtado, a geologist on the team that had drilled the first borehole to make contact with the miners, said, “If there are no major mechanical problems, this can be done in two months, three at the most.”<sup>15</sup>

A central tenet of President Piñera’s campaign for the presidency the prior year had been to bring greater efficiency to government—he had come from an executive position in the private sector. If he publicly announced that the extraction would take two months, but, in fact, the process required four months, his image as a manager would have suffered a blow.

Constanza Cea, a top adviser to President Piñera, claimed that there were no political motives behind the government’s rescue estimates. “We haven’t promised any particular date, in consideration of the effect that this could have on the miners and their families,” she said. “There has been no manipulation of dates.”<sup>16</sup>

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<sup>13</sup> El Tiempo, loc. cit.

<sup>14</sup> CBS News, loc. cit.

<sup>15</sup> Ibid.

<sup>16</sup> Ibid.

President Piñera's handling of the rescue timeline was in step with his governing style: manage expectations, stay in front of the issues—and the cameras—and control the message. He may have learned from U.S. President Barack Obama's mistake of expressing optimistic timelines for capping the spewing oil well in the Gulf of Mexico, only to see them repeatedly unmet.<sup>17</sup>

Despite the distant avowed retrieval date, President Piñera's handling of the mining catastrophe played well with the Chilean public. His approval rating was 46 percent in July, but it soared to 65 percent after the miners were discovered alive. The rise in public support came despite criticism that his government had been too lax in regulating mine safety. He fired five top mining regulators and created an investigating commission on August 5.

## SUPPORTING THE MINERS

Golborne's challenges were transformed by the breakthrough—from locating the miners to supporting them until they could be extracted. Their physical and psychological well-being was most important, and the creation of an escape route was secondary.

The fortitude and unity of the trapped men played a vital role. Under the leadership of Urzúa, they split themselves up into 3 groups of 11 men each, operating on morning, afternoon, and night shifts that mimicked, as best as possible, a miner's daily life. Each group slept, worked, and relaxed separately, but they gathered regularly for shared meals, video conferences, meetings, and prayer sessions. They luxuriated in the heated water piped down from the surface for washing and showering. They each received 3 liters (101 ounces) of drinking water and 1.5 liters of energy drinks daily.

A key task for each shift was the round-the-clock operation of the *palomas*, the thin, 3 meter supply capsules that were threaded up and down the boreholes day and night carrying items from the most mundane to the more inventive, along with a daily flow of letters between the miners and their families and friends.

The government had asked NASA and Chile's submarine fleet for tips on surviving in extreme and confined conditions. Initially, the surface crew sent miners limited rations. However, as days passed, the culinary offerings improved. The men were provided with some variety in their 2,200 calories per day diet which was also supplemented by vitamin pills. On a typical day, breakfast included bread, ham, and cheese, with hot coffee and tea coming in a thermos. A mid-morning snack included fresh fruit, and lunch followed with turkey and vegetables. Dinner typically brought pasta and desert. Beer and wine had been vetoed by doctors above, though they did approve low-tar cigarettes.

The miners jogged, skipped with ropes, and stretched with elastic bands for muscle tone. One of the miners, Edison Pena, ran some 10 kilometers a day. They all wore electronic monitors that routinely sent information on their heart rate and metabolism to the surface. Military camp beds had been disassembled and sent down in the *palomas*; projectors, televisions, and telephones were also sent down. The miners watched popular films including *The Curious Case of Benjamin Button* and *The Mask* and TV dramas such as "CSI: Crime Scene Investigation" and "House."

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<sup>17</sup> Ibid.

One miner, Yonni Barrios, had completed a short medical training course to care for his ill grandmother, and he became the de facto medical officer in the mine, much like Roberto Canessa, who had been a 19-year-old medical student at the time of the air crash of his rugby team in the Andes in 1972—an event described in a book and film entitled *Alive*. In survival mode for more than two months, Canessa became his team’s medical officer.<sup>18</sup> With video conference and written instructions from physicians at the surface, Barrio was soon taking blood samples and administering drugs for every medical condition from high blood pressure and diabetes to skin infections and mouth sores. Based on a character on a well-known American television show, he came to be known as ‘Dr. House.’

“In this very abnormal situation, the goal is to make life as normal as possible,” explained Alejandro Pino, the regional director of the Chilean Safety Association (ACHS) who oversaw the operation to keep the men supplied. “The idea is to make it feel [like] they are working a very long shift [and] not that they’re trapped.”<sup>19</sup>

Through it all, Golborne drew on his management experience to make the most of his mining responsibilities. He ran management meetings from 9 a.m. to 9:45 a.m. every morning. He told the assembled technical experts, “We want you to do your work—tell us what you need, but say it in time because we are not going to tolerate stoppages in the processes because a material, a piece of equipment, or a truck that you did not ask for, but needed, was not there.”

## MANAGING THE SURFACE

With the discovery of the miners and their anticipated rescue, the San José mine became a mecca. Media personalities, public officials, elected politicians, and self-styled experts came by the scores, and Golborne designated Aguilar the task of hosting the visitors. He recalled:

The challenge I had was to control myself when people, who were reputed experts and did not have anything to do with the rescue, showed up. Maybe they were well-intentioned, but they had little to contribute to the rescue effort. However, we soon realized that this rescue was much more for our country than pulling the miners out; it dealt, too, with Chile’s image in the world. Those hours of television time in all of the world’s news programs were the best advertising the country could have had. So, I had to have patience.

Assuming that the drilling opened an escape path, Golborne’s team was already hard at work in creating a capsule that could bring the miners to the surface up the shaft. The planning became meticulous, down to the precise fit of the miners in the rescue capsule.

NASA had come up with a number of design parameters. Clint Cragg, principal engineer of the NASA Engineering and Safety Center, assembled a team of engineers drawn from almost every center in the agency. “We hammered out a 12 to 13 page list of requirements for the capsule and sent that to the Chilean minister of health,” he reported. His team proposed some 75 design

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<sup>18</sup> Piers Paul Read, *Alive: The Story of the Andes Survivors* (New York: Avon, 1975).

<sup>19</sup> Philip Sherwell, “Trapped Chile miners emerge to fame, movie contracts – and angry wives,” *The Daily Telegraph*, October 9, 2010.

features, including that the capsule have ease of entry, an oxygen supply, and minimum friction as it traveled up the shaft.<sup>20</sup> The Chilean Navy incorporated most of the ideas to produce the three rescue capsules—each dubbed “the Fénix” (the Phoenix).

## THE FINAL RESCUE

President Piñera announced on October 4 that they hoped to have the men out of the mine within 11 days: “We are very close to rescuing them, and I hope to be able to rescue them before leaving for Europe.” He was scheduled to leave on October 15.

Three days later, on October 7, Golborne reported that rescue workers had drilled through 535 meters of solid rock and had just a little more than 91 meters of rock to go to reach the trapped miners with the enlarged shaft. To reduce the risk of the escape capsule jamming, he also announced that the rescue team was planning to insert 100 meters of steel sheathing along the inside of the upper-end of the escape tunnel, although that also entailed risks. This decision had come at the end of an agonizing dialogue on the risks involved. Golborne recalled:

The technical discussions started in the late days of September. André Sougarret wanted to encase the whole shaft. I called a technical meeting with all [of] the drilling experts and the geomechanical engineers. The decision related to how much it would take to encase the whole shaft. Every hour counted! Some were saying, ‘The shaft may collapse.’ I asked them: ‘If the shaft collapses, with or without casing, we are damned. Why are we doing the casing?’ I tend to make questions. I am not an expert, but I question things.

Then, someone said: ‘We need the casing for prevention against falling rocks.’ I said, ‘But the Phoenix capsule has a layette on top to catch falling rocks. The shaft will not be blocked, [and] if a rock falls, it will be a small rock.’ From what I remembered from my mechanical engineering classes, the rock would not [affect] the winch bringing up the capsule.

Golborne and his staff decided to lower a camera down the shaft to assess the danger of falling rocks. With the study data, he called a second meeting about how far down the shaft casing should extend. He said, “We had eight geologists there. Each one had a different answer. One said 100 meters, another said nothing, and the Codelco geologists wanted the full shaft to be encased.”

One problem with the casing was the sheer weight of its material. The sheathing for the entire 700 meters of the shaft would have weighed between 150 tons and 200 tons. The crane that they had on-site could have only lowered up to 100 meters of casing at one time. Encasing the full length would have required importing a heavier crane which would have taken days. Finally, Golborne was able to build a consensus around sheathing only the top 100 meters. He recalled:

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<sup>20</sup> Kathy Barnstorff, National Aeronautics and Space Administration, “NASA Engineer Helps Chilean Miners,” October 13, 2010.

I was trying to speed things up—moving the meeting to what I wanted. I was being supported by the geologists who thought encasing was not necessary. But, I could not overrule Sougarret. If we had a problem, everybody would say: ‘It was the minister’s decision,’ but, I am not an expert. It was a very long meeting to come to a difficult decision. Finally, Sougarret decided wisely to encase 100 meters.

On October 9, after 33 days of drilling under Plan B, Golborne announced that the new rescue shaft had finally reached the miners at 8:05 a.m. At the moment when the rescue shaft under Plan B had reached the miners at 700 meters below the surface, the shaft under Plan A had reached only 598 meters, and the shaft under Plan C had reached just 372 meters. Golborne reported that they still needed to reinforce a section of the shaft, but soon after that, they would be ready to lift the miners one by one to the surface. Both workers and relatives cheered and waved Chilean flags.

Golborne’s wrenching challenges were not quite finished. The Codelco managers wanted to replace the winch that was currently being used to lower and raise the capsule with one that was created by an Australian company based on a better technology. It required two additional days to put the new winch in place, and Golborne did not think it was worth the wait, but he acquiesced to the Codelco team. “In my opinion,” he confided, “the change of winching equipment was a waste of time.”

The rescue team had to ensure that rock fall in the shaft would not jam the capsule, and they had to run the capsule and winch through a final set of tests. This process required an additional 48 hours, which was extremely frustrating for Golborne. However, he understood that it was essential for reducing risk and assuring success.

The cost of the rescue operation had been enormous, totaling more than US\$18 million and the bulk of it was provided by the Interior Ministry from an emergency fund. Many private companies donated their equipment and services. For example, the mining company, Compañía Minera Doña Inés de Collahuasi, loaned a drilling rig at no cost; an Irish expert on drilling distance and direction volunteered as a free consultant; and an American company that handled the drilling equipment for Plan B donated its gear. The contributed time and equipment may have contributed another US\$12 million to the price of the rescue.

**Direct Costs of the Rescue Operations<sup>21</sup>**

<b>Organization</b>	<b>Activity</b>	<b>US\$ Millions</b>
CODELCO	Drilling, winching, earth works, excavating, and trucking	7.4
	Plan A	3.0
	Plan B	1.1
	Plan C	3.5
FACH	Helicopters	0.5
ENAP	Fuel	1.0
Intendencia	Camp Hope	1.0
ASMAR	Phoenix rescue capsules	0.7
<b>Total</b>		<b>18.2</b>

**EXTRACTION**

Golborne commenced the extraction effort at 7 p.m. on October 12. The rescue team dubbed it “Operación San Lorenzo” (Operation St. Lawrence) after the statue at a church in Copiapó of the miners’ patron saint.

The rescuers first lowered down one of their own, Manuel Gonzalez, an experienced employee of Codelco; during his 18-minute descent, the waiting families and rescuers sang the Canción Nacional (Chile’s national anthem). The original plan was for the capsule to return to the surface empty after delivering Gonzalez in order to bring down a second rescuer. But, the rescuers decided on the spot to send the first miner up with the returning capsule.

Though the rescuers had played down the risks of ascent, they asked that the first four miners brought up the shaft be those who were most fit. After the first four miners, the others were carried up based on their condition; the least healthy were brought up first. Six hours earlier, the miners were asked to switch to a purely liquid diet, wear a waistband in order to maintain a stable blood pressure, and ingest aspirin to avoid blood clotting. They wore moisture resistant coveralls and carried sunglasses.

The miners were brought to the surface one by one, and as they came to the surface, each faced a moment in the spotlight. The Bolivian, Carlos Mamani, stepped out of the Phoenix on the surface, pointed to his own t-shirt with the emblem of a Chilean flag on it, and shouted, “Thank you, Chile!” Although Bolivia and Chile had long been territorial rivals and they did not have diplomatic relations, Bolivian President Evo Morales came to San José to join with President Piñera in the celebration.

<sup>21</sup> Empresa Nacional del Petróleo (ENAP, National Petroleum Company) is a government-owned, but independently managed, company for fuel, oil, and natural gas; Intendencia is the regional government for the Atacama Province; and Astilleros y Maestranzas de la Armada (ASMAR) is a Chilean Navy shipbuilding organization. “Último balance oficial de rescate duplica monte de la demanda del CDE a dueños de mina San José,” *El Mercurio*, November 26, 2010.



At 8:55 p.m. on October 13, Urzúa, the last of the miners, reached the surface, capping off a flawless extraction. His disciplined leadership was later credited, along with the leadership displayed by others, for organizing and sustaining the 33 miners throughout their ordeal. After greeting his son, he stood with President Piñera and declared, “I’ve delivered to you this shift of workers, as we agreed I would.” The president replied, “I gladly receive your shift because you completed your duty, leaving last, like a good captain.” President Piñera added, “You are not the same after this, and Chile won’t be the same either.”

After the last miner had ascended, a group of rescuers held up a sign stating: “Misión Cumplida Chile” that was seen live by millions of television viewers worldwide.

In reflecting on the team that had directed the rescue, Barra offered, “We met—the four of us. Each one said what he would do.” And, in the weeks ahead, he, Aguilar, Golborne, and Sougarret followed through. Barra recalled that no one had sought the spotlight more than others and that each had executed his responsibilities in collaboration with the others. He concluded, “Everybody had something to give ... [We had to do] the best [we could] and at high speed and that depended on the transparency, the unity, the professional expertise, [and] the sense of urgency.”

“There was no super leader who had all the answers—not Golborne, not Barra, not Rene, nor me,” recalled Sougarret. “I liked the honesty with which we were working—you could feel it. With Barra, Laurence, and Rene, I could feel we were playing with our cards open on the table.”

After the last rescuer was out of the mine, President Piñera covered the top of the rescue shaft with a metal lid. Golborne, largely unknown before the crisis, became one of the most widely known political officials in Chile.

Not long after the disaster, the SEMC, owner of the San José mine, filed for bankruptcy, putting the survivors out of work. Under Chilean law, however, the miners were first in line to receive the proceeds from the sale of its assets, ahead of the government which had sued the company to recover its US\$18 million expenditure on the rescue.

## **APPENDIX: AUTHOR BIOGRAPHIES**

### **Rodrigo Jordán**

Jordán, an adjunct professor of leadership and innovation at the School of Business Administration at the Pontifical Catholic University of Chile and a partner at Vertical S.A., a firm that provided outdoor education in leadership and team building, was the leader of the first South American expeditions to climb Mt. Everest, K2, and Lhotse and authored *Liderazgo Real (Real Leadership)*.

### **Matko Koljatic**

Koljatic, a professor of strategic management and former dean of the School of Business Administration at the Pontifical Catholic University of Chile, editor of *Revista de Economía y Administración UC*, and a member of the management board of several Chilean companies served as country manager for Johnson & Johnson.

### **Michael Useem**

Useem, a professor of management and director of the Center for Leadership and Change Management at the Wharton School, University of Pennsylvania, authored several articles and books on leadership, governance, and decision making, including *The Leadership Moment*, *Investor Capitalism*, and *The Go Point*.