

# **CHILEAN MINERS RESCUE ORAL HISTORY PROJECT**

## **EDITED ORAL HISTORY TRANSCRIPT**

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INTERVIEWED BY REBECCA WRIGHT  
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WRIGHT: Today is April 25, 2011. This oral history is being conducted with Dr. Al Holland in Houston, Texas, for the NASA Headquarters History Office. This interview is part of a series to capture knowledge about NASA's participation in the recent historic rescue of thirty-three Chilean miners. Interviewer is Rebecca Wright, assisted by Sandra Johnson.

Thank you again for taking time from your schedule to visit with us.

HOLLAND: It's absolutely my pleasure.

WRIGHT: Explain to us how NASA first got involved with this effort, and then how you became involved.

HOLLAND: Well, NASA was invited in by the Chilean Government via the U.S. State Department. The U.S. State Department contacted NASA Headquarters and it trickled down, but there was a lot of activity prior to that time at the lower levels within NASA Headquarters [Washington, DC] and lower levels within NASA Johnson Space Center. There was a lot of interaction between people who were Chilean by birth that were within the NASA system, and people such as ourselves, who had had some prior confinement intervention experience. So there was some back and forth informal stuff before we were actually invited in.

I got pulled into the dialogue at the working level before being officially invited in and made some suggestions about interventions. We had a telecon [telephone conference] from JSC with the Minister of Health who was down at the mining site in Chile, the San José mine about an hour north of Copiapó, Chile in the Atacama Desert. It's a high desert there. J. D. [James] Polk was involved and Mike [J. Michael] Duncan was involved—it was before he moved to Headquarters. We sat around and talked with the Chilean team, a small team of ourselves and a nutritionist at JSC, and made some suggestions about how they might go about doing some interventions.

Then we were formally asked by the Chilean government to go down. There were four of us. Mike Duncan is the leader of the band, Clint [Clinton H.] Cragg is the engineer from [NASA] Langley [Research Center, Hampton, Virginia], J. D. Polk, prime medical individual, and myself as the psychology representative. We did a lot of preparation work within our own disciplines before we went down. I met with my group at JSC, which is the Behavioral Health and Performance Group, including Walt [Walter] Sipes, Gary Beven, Steve [Stephen T.] Vanderark, Kim [Kimberly A.] Seaton, and several people that were involved at that time, and we discussed some ideas we could provide the miners.

I collected their ideas, which is essentially what we do for long-duration space flight, always have done for long-duration space flights so there weren't any new surprises there. Also got inputs at a later date from a variety of other external researchers in behavioral health and long-duration confinements, such as Jack [H.] Stuster over in [Claremont Graduate University, Claremont] California. Also we got some input from the JPRA, Joint Personnel Recovery Agency, which is a branch of the military, and some other individuals in the special operations community within the U.S. Army about repatriating individuals that have, in their world, been

held hostage or have been behind enemy lines, and bringing them back and how you best reintegrate them. I was collecting this information over a long period of time. It didn't happen all before we went, but over a long period of time, and would be feeding that information to the Chileans through my primary contact, who was Dr. Alberto Iturra [Benavides], a psychologist on site down there once we arrived.

WRIGHT: Did you meet him through e-mail or the telephone?

HOLLAND: There was another psychiatrist who was representing the behavioral discipline in the telecon before we went down, and then apparently he was relieved of duty and replaced by Iturra, whom I met for the first time and communicated with the first time down there. There were a good bunch of folks down there.

WRIGHT: The preliminary work that you did while you were still here, those recommendations and suggestions—did you feel like that information was getting to where the people needed to have it? You had such a block of translators and interpreters, communication issues, which I know you have dealt with in the past with your experiences with international space relations. I'm curious if you felt that what you were sending down was getting to the people to help to the miners.

HOLLAND: During the telecon that we had before we went down, the actual communications, the logistics, the quality of the communication, was very poor. It was scratchy, you couldn't hear well. There was a group around the phone down there and there was a group around the phone

up here, and it was very difficult to exchange information. We didn't have an interpreter at that time, so we were trying to work in English and they were trying to work in English, and it was difficult. I was able to, I think, get through in terms of circadian rhythms and some advice on circadian rhythms.

We put together a fairly lengthy written collection of recommendations for them before we went down there. We sent it to them through NASA Headquarters and the State Department, back down to Chile and to the Minister of Health, and it never made it to the specialists at the mine, because we verified at the mine that they hadn't seen any of the recommendations. So there was a little bit of a frustration on my part regarding how long it took to get organized and get down there. We knew that time was of the essence. And to us waiting in Houston, the official permissions and official written requests seemed to grind on forever. There's a lot of diplomacy that needs to occur at the higher levels, but at the working level, you know what to do, you're ready to go do it, and it's just matter of getting all the other stars lined up so you have tickets and you have permission and you have interpreter and everyone's support. That was a little bit frustrating to me.

WRIGHT: August 31<sup>st</sup> you arrived there. Tell us about your arrival and the week that was there and what difference it was in communication from what you had done.

HOLLAND: Before we arrived, we had been given some information about the situation through the telecon and through other people at Headquarters and people who had relatives or knew people down there—the situation was a lot more critical from what we heard early on than from what we saw when we arrived. What we heard, most of it was true. There was very high heat

down in the mine, very high humidity down in the mine. There were thirty-three people, thirty-two Chileans and one Bolivian, trapped in the mine. We knew that they had no training for this. We knew they had been down there seventeen days before communications between topside and the miners had been established. We were told there was only a 528-square-foot refuge that had been built into the mine for just such events that these thirty-three men were trapped in. As you know, 528 square feet is very, very small, and they had no food and very little potable water. So the thinking was that under those conditions it was going to be very bad. Just from a psychological point of view, I thought this was going to be real trouble because we knew of people who have had fistfights and have left blood on the walls during long-duration confinement simulations. To put that many people in that small an area, I thought it could be a real bloodbath if we didn't intervene quickly.

We got down there, and all those things were true except for the 528 square feet. They also had about a mile and a half of rough tunneling in addition to the small refuge that they could go out in. Although it wasn't safe, it was volume. In my business, in the behavioral business, environment drives a whole lot of what I do in my specialty area. The humidity, the heat, the volume, the number of people in that volume, how long are you going to be in the volume, communication—those in large part determine a person's psychological capabilities and the stress load. So to find out they had more volume, the social density—they weren't all crammed into a small area—was a huge load off my mind. That was a relief because I knew then they would be in better condition and there was more hope.

Before we arrived down there we had heard from the Minister of Health that it would be December probably before they could be reached by another drilling team and extracted, and so we were looking at four or five months in confinement. It's on the order of what we do, but the

conditions were much more difficult than what our astronauts typically deal with. There was no selection of individuals like we do, there was no training of individuals, there was no support system in place for the families, there was no support system in place for them when they're gone—all these things that we do for our astronauts and other people do for their astronauts. They didn't have all those things, but they did have volume, so I felt that things were more workable.

We arrived down there in Santiago [Chile], and had a very warm greeting and a lot of support from the Santiago [U.S.] Embassy. We had translation support, had briefings about the situation and about how Chile was working with the situation as it currently stood. We also got a briefing about where we would be going, our itinerary. We would be going to Codelco [Corporación Nacional del Cobre de Chile (National Copper Corporation of Chile)], which was the government mining company, and getting a briefing from them; we'd be going to the Minister of Mines, hearing from him; the Minister of Health, hearing from him—a variety of people who could give us the lay of the land quickly. Because we're operational people, we were very much itching to stay below the bureaucratic radar as much as possible, below the diplomatic stuff, and to get to the mine site as quickly as possible, to the people who were actually intervening directly with the miners. But there is that part you have to do, and in the long run it was helpful.

Not only the Santiago Embassy personnel, but also there was an individual from the Chilean Space Agency [Agencia Chilena del Espacio], Juan Fernando [Acuña] Arenas [Executive Secretary] and some of his individuals, and we were helped out in every way. We certainly knew that it was a different situation, a much higher-level situation than what we're used to, because we didn't have to go get our bags after arriving at Santiago [International]

Airport at two, three in the morning. That was a first and a last for us, but we knew that “we weren’t in Kansas anymore.”

We had very good initial briefings down there. I’m sure Mike Duncan can give you a much more thorough look and explanation of that, but we did receive a lot of helpful information and graphs, etc., from Codelco, also from the Minister of Mining and Minister of Health. The Minister of Health was the person who had been designated by the President [Sebastián Piñera] to be over all of the health issues, which included the medical and the psychological issues, and the Minister of Mining, of course, was over the mining aspect of the rescue. We had input into both of those areas. We had, of course, most of our input into the health, but also we had input into the escape, the design of the escape pod, particularly Clint and his team.

Behind each of us there was a team. We were very aware when we went down there that we were consultants. We were there to consult to the Chilean government and the individuals who were doing the actual work there. They were doing an outstanding job. We were there to give our ideas to them; we weren’t there to take over anything from them, and we consciously made an effort not to be perceived that way.

WRIGHT: How were you perceived? Of course the people that you were working with directly recognized the expertise of NASA, but in the landscape of driving up to the mine site, did you feel like people knew that NASA had arrived and there was an awareness of what you could do?

HOLLAND: Actually, when we came out of the airport there was a handful of photographers, and this was before dawn. We thought, “Wow, for them to get up before dawn, they know we’re here.” Mike had to make a statement, so we realized at that time that it was a very different

working environment. The presence of the media, particularly the frenzy of attention that was going on at that time, can affect your work. We're all very work oriented, so we moved that over to Mike's corner a little bit and let him do that while we went off and did things with our counterparts.

However, the reception was very warm. They were all very supportive. Not just the Chilean government individuals, but the people at the mine site. The press, everyone was glad we were there. They felt, I think, at that time that they were open to any help from anyone. They were quite focused on getting these people out alive, and so that was really helpful to us. A good reception. I think we were perceived as being helpful when we met with families.

We had to spend a day in Santiago getting briefings, and there was a press conference, and then we were able to go down to the mine the next morning. We went down in a little van with our interpreter and an embassy staffer and the Chilean Space Agency individual, hopped out and met our contacts and immediately went to work. They have a very small shed down there that was our work spot. It was a little bit smaller than this room, and it's made of metal.

As you're going down there, you leave the palm trees and the vegetation of Copiapó, which is a small, small town with an old Spanish square in the middle with the church and the government building, and you head north for an hour. It becomes very high desert, very barren. You could see a few flowers here and there, but it was basically rock and hills. You're going along the coast. You don't see the water, but it's there.

As you get up there, the roads become gravel, a little bit more treacherous and windy, and when you get back up into the mine site it's all gravel, all rock. Everyone was wearing boots and that kind of gear. They had some individuals from the military camping out there, had tents and



a variety of metal sheds and portable buildings and trucks. They had a portable kitchen that had been set up. It was very much a portable camp.

As you're coming in, we began seeing monuments or remembrances that people had left along the roadside for the miners, that they were thinking about them, that they were pulling for them, "Strength to the Miners," "Hope for the Miners." Particularly certain individuals' families would put up small religious remembrances along the road for the miners. As we got in, there was a large group of tents which had been put up. They were makeshift, mostly plastic with a little bit of maybe some canvas that families had put up and were camping out there. Lots and lots of families were there. And I mean full families, everyone that was related to the individual was there for that individual, times thirty-three. They had over two thousand family members that were camping there.

The Chilean government had supplied a tent for the families to eat in, and facilities for the families that were separate from the people who were actually drilling and tending to the medical and that sort of thing. There was an inner perimeter for the drillers and the rescuers and the medical people, and then there was a second perimeter which was for the families. When we arrived the families were mixed with the press, so the press was milling around through the family areas and collecting stories to find out what their perceptions were. Then by the time we left, a perimeter had been established, which provided a third concentric circle for the press, which turned out to be a good idea because as this thing went down it became just a huge press event.

We trundled in there in our van and hopped out and started meeting with our counterparts. The Minister of Health, who is a very nice person, very sharp person, supportive, was there to provide us with a briefing and had his mine-site people provide us with a briefing of

what's been happening there. As in every organization, what you learn from the site is typically different from what you learn at headquarters. The quality of information is so much better. Given our background that we'd gotten in Santiago, we put some specifics and some real-time information there at that briefing. I was really encouraged because the Minister of Health, I noticed, had on boots, and I heard that he was out there just about every day. While I was there, I saw that he was there just about every day, most of the days, and the boots were scuffed and he was sitting on a table. I thought these were all very good signs for an operational person. This is probably not a bureaucrat. That was encouraging, and that was the sense we got from the whole team, that regardless of whether they were a governor of that region—and she [Ximena Matas Quilodrán] was there—or the Minister of Health or a physician or driller or whatever, they were all in the same pot, and that was a good way to work.

That's our arrival there. Then I went off with my counterpart and he showed me around, and Clint went off with his counterparts and saw some of the drilling that was going on, and I went and spoke with the miners very briefly with my counterpart, Albert Iturra.

WRIGHT: You mentioned he had replaced another person. Had he been on the job for a while, or was he new, arriving with you?

HOLLAND: He was from a small town which was nearby the mine, and he had worked with miners before. In my opinion, he was very familiar with the culture of the miners and the families, and that was critical because you can't come in as an outside person—outside to the nation, outside to the culture, outside to the region, outside to the work—and make those intimate connections you need to make rapidly to do something. He had established himself

there in terms of those things. So he was the one who was doing the real work; I was just his sidekick, giving our input to him and to the Minister of Health. I watched him speak with the miners, and he was the guy. He was very good at that.

That afternoon we also got together as a group so that the four of us, plus our counterparts, the Minister of Health, the Governor and some of the other drilling people were all together, jammed into that little work area. We did that once a day, we'd have a debrief where everybody would exchange information. We would work in there during the day as well, putting our recommendations into specific form in writing and preparing for the daily debrief. We would then debrief the Minister of Health and his officials and the local officials.

Every day at 6 p.m. there would also be a meeting with the families, and this was something that the Chileans had set up previously. The Minister of Health went down there and talked to the families, as well as the head of the drilling, André Sougarret [Larroquette]. Iturra was there and all the key people were there, and we were there and met with the families. It was in a big, open-air tent, so it was cold on cold days and hot on those hot days, but the family and the toddlers and the uncles and the cousins and everybody was in this tent—not all two thousand, maybe a hundred—and the families would receive an update.

This was a really important connection and an important outreach that the Chileans were doing with the families. The reason we were able to intervene at all, the reason we were relevant in any way was because of our long-duration space-flight experience and lessons we had learned throughout the [Shuttle-]Mir Program and throughout the ISS [International Space Station] Program—in medical as well as behavioral, as well as engineering. So my approach was to mobilize all those lessons we had learned from those different environments. The Mir Space Station was a very different space station than the International Space Station is today. As I said

at the beginning, environments greatly drive a person's health and well-being—behavioral health and behavioral well-being as well—and influence a person's readiness to do their job and their emotional, mental wellness.

The mine was most like Mir, so it was something that I was quite familiar with. It was more like Mir than it was International Space Station. The way we worked in the behavioral area—I'll just show you with my hand. The environment demands this level of coping and this level of ability [indicates by holding hand flat approximately one foot above the table] in order to deal with the environmental challenges, whatever it might be—whether it's high heat, whether it's great social density, whether you're nose to nose with the next person, whether you're alone, whether you're in a foreign country—the environment demands this amount of coping from individuals. Then you put individuals into that environment.

The individuals might not be well trained, then they're down here at this level [below]. They have capabilities and coping abilities, but they're not sufficient to the task so they will struggle greatly. There will be a lot of health issues, there will be a lot of social problems, there will be conflict, there can be suicides. There can be lots of things that can happen if the capabilities of the individuals are lower than the demands being made on them by the environment that they're in.

You can have individuals who are highly trained that are way up here [above], and these individuals have good coping strategies. They've been selected in a systematic way for this environment, they've been trained in a systematic way directed toward this specific environment. They're being supported by an infrastructure, their families are being supported. There's a whole system of care on these individuals to bring their coping strategies up at least equal to the environment, and if you can push it up higher, even better. Currently, with ISS we have

individuals that are quite capable of dealing with their environment. They're up here [high], and the environmental demands—because ISS is such a nice platform right now and everything's new and lots of volume, things work, multiple modes of communication—is fairly low, and so we have very well-trained people. The miners, however, had a very high-demand environment that they had been put in, extremely high-demand environment, and they were here [far below] in terms of their coping capabilities.

What you want to do in any situation, whether you're talking about a polar station or you're talking about space or you're talking about a mine or you're talking about someone leaving home for the first time to go to school, you want to bring their coping skills up and you want to bring the environmental demands down. You want to equalize these two, you can move both of these hands. Environmental demands can be made less by changing the environment, or they can be made worse by something you do. The individual, depending on how they're selected, how they're trained, the information they have, their expectations, the support they get, you can bring them up as well. In a large sense, that's what I knew we had to do. We had to bring the two closer in line. The idea is you just get them as close as possible. You just get them as close as you can.

I also knew there was a systems approach needed, that you can't just focus on the miners. You have to realize that individuals live in social systems, and one way to change an individual's health, well-being, behavior and performance is to intervene in the other systems or the other people that influence that individual. In this case, there were three key groups: there were the families of the miners, the miners themselves, and the topside personnel. You have these three key groups, and they're interlocking, they affect one another. I knew this because the parallel is in space flight or anywhere else, in the military, you have the families, you have the individual

who's been deployed, and then you have the people who are supporting him. What you want to do is you want to intervene in these three groups, not just focus on the clinical aspects of one group, if you want a change in the relative coping skills and the environmental demands that's going to last over a long period of time.

I knew that we had to last at least five months, maybe to the first of the year. We had to get through that point. So if you want something that's going to last beyond your personal presence, and going to last over a period of time, you need something that will endure. The way to do that is to change these three groups, their coping mechanisms and the way they behave.

One of the first things that I saw when I got down there was that everybody was still in sprint mode. They were very emotionally charged; they were desperate to get these men out of there. They didn't see any way they could get them out of there quickly. They felt that there was no infrastructure in place to support the people. The Chileans, although they knew mining extensively, didn't have any long-duration confinement experience, so they had no experience base in the areas that we were bringing forward. It's a matter of informing people and just pouring out everything that you know is relevant to this as quickly as possible in a way that would affect the three groups.

The sprint thinking needed to be changed to long-duration thinking. That's one of the first things you have to do anytime you're in a situation like this, is to change the expectations of the individuals that are, in this case in a mine, to thinking long term, that, "Okay, I'm not going to get out of here anytime soon. I'm going to be here a long time, I've got to adapt." You're trying to affect adaptation on everyone's part, on the three groups' part. You want to change their expectations, so you want them to start thinking, in this case, that it'll be Christmas before

these people are extracted, because that was about what they were estimating it would take. It would take that long to drill down there to them.

But the press, the country, the government, the topside personnel, the miners, the families were all acting as if, “We’ve got to get these people out. How can we get them out tomorrow? We’ve just got to do this.” The families were there in great numbers, camped, leaving whatever they do at home undone, and the topside personnel weren’t taking breaks and weren’t rotating out, so they were burning themselves out. The miners themselves were desperate to get out and seeking ways to get out which weren’t effective, weren’t working, and they were thinking in short-term, survival mode.

The key was to shift. First of all, the first thing to do was to shift everyone over to marathon thinking. I used the metaphor of a marathon run versus a sprint run as a way to talk to all the groups about this. I talked to the Minister of Health about that, made that specific, “We have to shift everyone over to marathon,” so that when he went out to the Latin press and was making statements he would use that word, and he did. He used that word, “We’re looking at a marathon here.” People picked up that metaphor, which was extremely helpful in spreading it about so that everyone started sitting back in their chair a little bit and thinking, “Okay, this is going to be a long haul.”

In the family meetings at 6 [pm], I got up and I talked to the families—because they’re frequently overlooked—about the mission they were in and the things that they needed to do which would be helpful for the miners, and tried to change the way they thought of it and looked at it into a marathon or a long-term process. They needed to get back. They needed to take care of the taxes, they needed to make sure kids got to school. They needed to feed the dog and repair the roof and to take care of all that. So they did. By the time we left, there were maybe four or

five hundred family members there. A lot of them had moved back to home, which was a good thing, really good thing. It pulls the emergency-room [ER] feeling off of everyone, and that's what you want to do. "We're not in the ER here. We're in the long-term care ward, and we're going to be here for five months. So everybody just take a breath." That was good, we did that effectively.

WRIGHT: Did you get that message across—you were there such a short time—did you make an impact on them?

HOLLAND: Yes, I think so. The Chileans across the board were very open to our suggestions. They were glad we were there, because they didn't have any experience base [for supporting people in long duration confinement] at all. We had some base, and I knew from the moment I heard about it [the mine entrapment] that that was something we could actually contribute to. In general, it's rare to have your work transfer so directly to a completely different situation or application. I was just exceedingly fortunate in that what I had learned from space, space simulations, submarines, polar science stations and such, and the work I had done in the past, was so cleanly transferable to the mine situation. You know what you've always done, but this fit. And I knew that we could just move our expertise over to them, which we did, and they were open to anything. So it was a very rapid impact; it was easy to impact rapidly.

It was also a very short command chain. The President appointed the Ministers of Health and Mining, and their psychologists and mining experts reported directly to them. We were right there talking to the Minister of Health, so if anything needed to be done he could call the



President of Chile or he could make the decision himself and it got done. It was a dream as far as an intervention goes.

WRIGHT: Saved lots of time.

HOLLAND: Yes, it was really different than your usual day-to-day work setting where there's a lot of bureaucracy in a large government organization. It wasn't that. It was a field intervention, which moves very rapidly, so they were set up for that and they were open to that, and that's why it was rapid and effective.

WRIGHT: Do you believe the rapport that the Minister of Health and the President had created with the families helped them accept your suggestions as well?

HOLLAND: Absolutely, absolutely. Chileans, across the board on that whole mining rescue, they did an excellent job. They did an excellent job, they really carried the water. We probably didn't even need to show up and they would have found their way to this, because they were very, very good. They really were, they were excellent. They intuitively—because it isn't rocket science, it's just a matter of having experience doing something—they intuitively were putting the pieces together. They had set up a school for the children that were there. They were trying to normalize the environment for the families, like we tried to normalize the mine environment for the miners and tried to normalize the environment for the topside personnel in terms of their work schedules and when they eat and the fact that they do eat. That was the idea, to normalize, to go for the marathon, and they did that.

We covered a great deal of topics in my area, because it's a very broad area. When they have nothing, what do you do from a programmatic, systematic point of view, as well as from an individual miner point of view? We went through the individual miners' folders and got information about them. There were, in some cases, some preexisting medical issues and preexisting psychiatric issues, and some social issues which weren't helpful to adaptation and to coming out well. And we talked to the families and we talked to people working with the families. Social workers started working with the families in setting up social programs for the families and a way for families to come in and talk. The psychologist, I was encouraging him to stay, just move around between all these three groups, not just the miners, and he was very effective with everybody.

We talked about a broad array of things. Even if you set aside the medical, just in behavioral there's some broad things. We talked about the basics of confinement and how you manage people in confinement. There's a time course to that, how to manage their expectations about rescue and the way they view each other; teams in confinement as well as individuals in confinement, leadership of confined teams. We talked about circadian rhythms and how to entrain the miners in a regular day-night cycle so that they would have some normality.

The goal in my mind was to, along with shifting them to marathon thinking, to transform the group underground from a group that's standing there at the hole ready to come out, to a community. So they had regular community activities, they had a daily schedule, which wasn't filled, but it had certain things that happened every day at a regular time. There were regular light-dark cycles, which would help them track the days above and help them track time and fall into a regular routine. We talked about lots of ways to do that. They had religious ceremonies at 1:00; they would have mealtimes at certain times.

They were still trying to work three shifts a day in terms of clearing debris out, because they had to have a stake in their own extraction, in their own survival. You don't want people just to sit there. You want them busy and working to help themselves, and so that was part of the deal. We had to set up three shifts and how they moved between light and dark. The mine was dark, so we had to set up a light part where people eat, where people commune and do their business, and over here a sleep area which is completely dark and is cooler, if there's a way we can cool this section. We went through these different areas of the mine and how people would move through those areas to keep their circadian rhythm.

We talked extensively about circadian rhythms, different types of light and different light frequencies that are better for setting circadian rhythms, and exercise. Regular exercise at a certain time was scheduled to help set circadian rhythms, because we didn't want people drifting. When you have drifting sleep cycles and drifting circadian cycles, the polar experience has shown that that can be very negative on the whole team as well as the individual. You start free-running, they call it, and you can have difficulties as far as having a community.

Circadians was one, and another was training, how to train. We needed to retrofit the miners and the families and the topside people with information so that they had basic information about how to get along, what to expect. I actually took one of my in-flight training packages—I took several—but one of them we just translated directly into Spanish, that was on extraction, coming out. We just took the whole thing and they passed it on to the miners, directly down, just in Spanish. Iturra would do the training and would talk them through it.

They had a paloma system [Spanish for dove]. They had initially one drill hole—it was a bore hole, and the bore holes were four inches wide. A long torpedo-looking thing, which was no more than four inches wide and had removable caps on each end, was lowered down and

would carry things down to them, once they had established the bore hole, and would bring it back. It took them, of course, almost three weeks to establish contact with them in the initial bore hole. They expanded that single bore hole to three bore holes once they had located them. That was twenty-three hundred feet below, and so it'd take a long time, but anything you could fit into a four-inch cylinder you could send down to them, and they could send messages back. Initially that's how they were communicating; just sending messages back up in the paloma.

So we took advantage of that and wanted to expand on that. The call went out from the Chileans for cots, because the men were sleeping on rock at that time. But the cots had to fit, couldn't be any larger than four inches wide. There is a lot of creativity out there, and one of the Chilean companies was able to come up with design and quickly fabricate cots that would fit in a paloma, which I thought was really cool.

WRIGHT: That's remarkable.

HOLLAND: Yes. They would lower those down, and they would set them up down there. So in that way, just through the paloma system, cots were provided, meals were provided—because a Styrofoam cup will fit into a four-inch bore hole, you can stack them—so food was provided. With the additional bore holes they were able to send down an electrical cable and an audio-video cable, and air and water, fresh, potable water. Using those three bore holes, they were able to provide cabling down there, as well as a couple of paloma routes.

Eventually they were able to provide audio-video communications. They were able to put little cameras in there and a screen that would fold up that looks like your whiteboard but it would fold out to a large screen, and it was made of fabric, and so they could actually project

training against the wall. They could project what was viewed topside on the wall down under. What you want to do is to keep them all in the same rhythm, topside and the people below and families, so everybody's on the same schedule. That was one of the ways we did that and one of the ways we provided training. "We," I'm talking the big "we." The Chileans did it.

We did provide training in what to expect when you get out, how to live there, how to think about your own situation, how to think about your compatriots, how to give them some slack and not react, how to manage your relations with your family. They've got their own issues and their own concerns and their own fears.

Just a wide variety of information. Information was the big thing, inform these three groups. Topside people, they started taking off, and they set up a system so that they rotated personnel so people would go home for a couple days and sleep, because they weren't sleeping. And throughout, everybody, cooks and everybody, that was involved started that, so you started going into a long run. That was good. There were just a large number of topics that we trained and talked to them about. I'd probably have to go back and read them all to remind myself.

WRIGHT: What did you offer in terms of relaxation and stress relief for them while they were dealing with their entrapment?

HOLLAND: Well, exercise is one big thing, one really big thing, but changing the environment as much as possible. Making the environment a light-dark environment, making it a community environment, exercise on a regular basis. Also they moved their camp, lower actually, into a cooler, less humid part of the mine. There were things they were able to do there, put up big curtains to make a sleep area, huge top-to-bottom heavy curtains.

On the programmatic thing, as far as individuals go, Iturra kept up and needed to keep up regular comm [communication], and he'd do that each day with each person. We wanted to see everybody in the videos that they took down there. We wanted to make sure we saw everybody, just to know how they're doing. There were things like that that we did. At an individual level, it was Iturra who was handling each individual's situation with his family, an individual's stress, fears. That was done in a clinical manner, one-on-one between Iturra and that miner. There were some social workers topside that helped Iturra with the families, and my job was to give these caregivers and the managers and the miners everything I knew, just give them what we knew.

WRIGHT: And how were you able to help Iturra with all the burdens that he had?

HOLLAND: Well, make sure that he got home. Part of the problem was that he was a single point of failure. In the system, he was one person that if he went down, the system, the behavioral aspect, would go down. So my lobby was that he really needed a second person to relieve him. People that are in a situation where they know the individuals that are trapped and they're trying to rescue them, they don't want to leave. We've seen it in our own organization, and we see it in all other organizations. They will remain in danger, their health will degrade. That's okay on a short-term basis, but on a long-term basis you can't do that because a person actually *will* degrade, the caregiver will degrade. So that was one of my recommendations to the Minister and to Iturra, that they bring in a second person so that they can rotate off, and they, in fact, did that.

WRIGHT: Your trip was short, but your involvement didn't stop because you left.

HOLLAND: Very short, it was like a week. I was in constant contact with Iturra until even after they came out, which was seventy days downstream.

WRIGHT: And did you see continued improvement, or were there times you felt they were slipping?

HOLLAND: No. There's generally a timeline with people that are confined like that, and you expect their mood to go up and down day to day as things go and as they become despairing or as they become hopeful. But there's also a larger timeline over a period of four or five months that you can expect. You can expect that not just events influence people's mood, but this timeline does. As they approach the time where they expect to come out, their mood begins to improve. If something occurs where they can't come out on time—boom—their mood goes.

So there are things that you expect. One of the things that I expected, given our experience with other environments, was that just past the halfway point there would be a slump in morale. This is something we see in all deployed personnel, that they'll have a certain level of mood that will vary, but just after halfway, in the third quarter of the expected time that they'll be confined, that's when they have the most morale drop and the most difficulties within teams, and between team members. I thought that October was going to be the most difficult time if we were going to be getting them out in December, so we were building toward that. As I gave Iturra information, I did appropriate to that timeline. So it wasn't that we saw constant improvement; I saw management and maintenance, which was good, which was adequate for the time they were in.

As we approached this third quarter—because we had opened up communications with topside and with families, had regular private family conferences like we do on ISS, even called them that, PFCs—the miners are more susceptible to information from the larger media, and they realized the media frenzy that was going on. And media personnel, through a family member, would contact them and make an offer for a big financial opportunity or a movie or a book or something like that and want an interview. There was a lot of that going on, too, as time moved on, because everyone figured out how to do that. They were open to outside influences, so they were also open to the possibility that they were going to be getting out early, which is fine.

I wanted to make sure that they took them with a grain of salt, because a family member reads in the paper that some mine group has an idea and they could get them out in a week and a half, and they communicate that to the miner, then the miner has false expectations about what's really possible and can then get crossways with topside or have difficulties within himself. So there's a lot of choreography involved in managing those down to those expectations of the individual. But it was a good thing that the sooner they could get them out, the better, so we wanted that.

Plan B was moving along well. It was the American team that came down from Pennsylvania and Colorado and was hammering away. They had some ups and downs and did some great creative problem-solving along the way. As they got closer to that seventy-day mark, the miners knew that they weren't going to be in there until Christmas anymore, and so everyone's expectations, *everyone's* expectations, backed up away from Christmas and that timeline wasn't appropriate anymore. We were looking at a much shorter confinement, which was a good thing. It's much easier to manage.



As actual progress began, morale began to improve. We did things like make sure they all got fresh shirts. And if they're the same shirt, you can put logos on them, and you've got a mission going, and pretty soon you've developed a team and you've got the community. You actually leverage all those opportunities to solidify the team and solidify the individual within that team seamlessly, because you want those people out with minimum damage. They did all those things very well, the Chileans were very good at leveraging that. There might have been an excess here or there, but the bottom line is that everybody got out, and they got out with the minimal expected damage, which was pretty good. Most of them came out in pretty good shape, although there was still damage because some of the people understandably had a traumatic response to the experience. There were some preexisting psychiatric conditions, and any preexisting problems in the family or relationships hadn't gone away. They were still there when they came out, and so some people adapted better than others to extraction.

One good thing I think we did was to influence how they came out. We influenced the fact that they didn't just come out of the hole and go home; part of the planning way back here was that when they came out, they needed to have at least two days away from the press. That recommendation came from a lot of the military input that I got. I was talking to those guys in the Joint Personnel Recovery Agency and the U.S. military about recovering personnel that had been in traumatic situations and what to look for, PTSD [post-traumatic stress disorder] and other anxiety reactions, particularly in light of the fact that the media frenzy was there and people were clamoring to get interviews and to give them book offers and money and that sort of thing.

I wanted to make sure we keep the families intact as long as possible through this extraction period and keep the individuals fairly calm and even-keeled during this time. One of

the suggestions I made was that there be a two-day quarantine. They would come out, they would go to a field hospital right there. There'd be a field tent, a triage tent basically, to see what condition they were in medically and behaviorally, psychologically. They would get a chance to hug their family member, wave to the press, and then go in there. It would be a medical thing. They'd be kept there, then they'd be helicoptered out from that field hospital to the hospital in Copiapó, where they would stay for two days. During those two days there would be a gradual increase in exposure of the miner to the family, starting with the spouse or significant other, and moving out to important people within the immediate family, but keeping the rest of them at bay initially, gradually increasing the family exposure, as well as protecting them from the media exposure until after those two days.

The Chileans did that, and they did that very well. I'm surprised they were able to do that, considering the pressures that were on them. But they did that for medical checkups as well as for adjustment reasons, and I think that was really important they did that because afterwards we see that these people were under a lot of duress because of their fame. They were coming from nothing and no stature and no fame out into this thing which—I don't know how many millions and millions of people watched the extraction, but it was a big deal. Some have adapted better than others, and some families have stayed together better than others. A lot of that is personality-based, whether you're pretty centered when you go into something or when something like that befalls you, because certainly they didn't expect it.

WRIGHT: Where were you when the miners were able to make it to the surface?

HOLLAND: I was at home. I had an easy job; I could watch it on TV. I would have liked to have been there for the whole thing, but no one could afford that.

WRIGHT: You mentioned that you were in contact with Iturro during the time. How did you accomplish that?

HOLLAND: Daily e-mails in Spanish. Headquarters graciously provided a service, and still does, for this project. They will take my e-mails and translate them into Spanish, and then I'll send those down there. I usually attach the English as well underneath it, just in case there's a difference in the translation. But that was very helpful.

There's been talk of going back for a debrief, where we can actually go back and we could talk to our counterparts. I asked for two days of just nothing planned, no press stuff, no dinners, just sitting and talking about their thoughts about what happened as we go through it, because they'll see things a little differently, and they were right there. They were the people that were in the middle of it, and they lived through the whole thing, so I'd really like to capture any lessons learned from them about that situation, as well as about our participation in that, that we could then tailor what we do and change the way we think about our intervention.

WRIGHT: Just on what you know, what do you feel like you've learned from this event that you might be able to use?

HOLLAND: Well, it validated—for space flight, we had gone back to polar stations, to undersea science stations, to deployed military teams and some offshore platforms, teams in remote

locations and confined locations, in order to design our program for Mir, including old Russian spaceflight, what we had learned. We had gone back to that point and collected all these similar situations and said, “Okay, now we’re going to put together this Frankenstein-looking thing of what we think might be a good program based on our estimate of what we have to do in our environment that we’re tailoring it for.” Because remember, environments drive behavior, so it changes your interventions. We designed that for Mir and learned through Mir, and then ISS.

To see the space stuff be applied almost in total, except for the selection part, to a very different environment again, and work, was validating to me that we did the right thing initially. To go to these environments, learn from them, put together the Mir program, the ISS Program, and then it becomes another one of these confined operational settings that can be used to inform the next example, which in this case happened to be a mine. It could be a submarine somewhere or anything next time, they’ll all respond similarly. Not exactly the same, but there’s some core principles and core techniques that apply to all of these confined, long-duration confined environments. And then you have to get in there and throw the curveball to tailor it to that particular situation.

WRIGHT: During this journey to help them, you were also cast in the limelight every now and then. I saw your name on National Public Radio [NPR] or *Larry King Live* [television talk show]. Tell us about those experiences of being on the media spotlight, and what was the message you wanted to give during those interviews?

HOLLAND: I didn’t care for it, I didn’t care for it. The NPR radio thing was a lot easier for me because it was very brief to do, very short, and you can go back and change what you have said.

The live TV stuff I didn't care for at all. I realize that people want to know and need to know, and it's good for NASA for people to hear about NASA's involvement. I understood that and was doing it in that spirit, and hopefully we conveyed what we did in fairly neutral—and hopefully we conveyed to them that the Chileans were really pulling on the oars. It wasn't us; it was really the Chileans that were doing the work. We were there just to advise them, and they could discard or take our advice, and they did an excellent job.

Hopefully that was the message that came across, but I didn't care for it. In fact, the night they were coming up [out of the mine], I bailed out on lots of those types of interviews as they were being hauled out in order to just go home and watch it. I really wanted to watch it and see what happened, and when you're on the other end you can't see what's going on.

And then after that, I was—I guess even a little bit now—a little bit depleted about giving those kinds of interviews, and didn't. And I have opted out of other NASA interviews on other topics just because I was tired of the media interaction. They were good, there was nobody bad, it just doesn't fit me personally as well as other people perhaps.

WRIGHT: Could be that long-term training of not sharing so much information?

HOLLAND: It could be it too. That's very much attention, very much attention.

WRIGHT: When you were sharing some of the different areas that you gave recommendations to, did you also include how best to prepare the men getting into that tight-fitting canister to rise to the surface?

HOLLAND: Yes, we talked about that when we were down there, we talked about extraction. Although, interestingly, the Chileans weren't thinking about that at the point we were down there. They were still in the short-term, how do we rescue these people? I think that's one contribution that the NASA team made, and primarily Clint and J. D., was to push them into thinking about this period of time. We did talk about the two days, so I think that we did give some input. From the behavioral point of view, most of the input about that particular thing was given in terms of the cage design, gave input about the need for comm, the need for some way to keep track of time. I wanted some sort of "time from" [starting the ascent] so that they would have an expectation of when they would be arriving topside. It's all about expectations.

In terms of the extraction, it was not a direct drilling. It was about 80 degrees, and so it was somewhat of an arc. Here's the topside here, and you had a curve [demonstrating]. The drill curved down and then went vertical. The concern was that as the capsule's coming up, once it went into the curve there was much more friction on the sides of the walls and that it might hang up or you could lose a cable or something like that. But worse, they were really concerned about it being stuck, and then you're unable to get anyone else out, much less that individual.

So part of the plan was to encase that curved part with drilling pipe so that you didn't have rock, you weren't bumping along on a rock surface. It was jagged, it had been drilled and you don't know, any rock could hang it up. Even so, you have rockfall potentials down through there and the potential to hang it up. That also drove things like the little wheels on the side and some other things that Clint will tell you about.

From a behavioral point of view, calm, understanding how much time had gone by, that there would be a releasable base [to the capsule]—and top, we didn't get the top, but the releasable base we got—so the person could potentially get themselves back down to the mine.

Two-way audio-video. We needed the medical, wanted to know what their pulse rate was, etc. And some sort of light there, in addition to their helmets, that they could see what was going on. There were other things. Everyone was coming together, and J. D. will tell you about the recommendations for how to sit, rather than stand, because when you stand you can pass out, your legs lock. Primarily for us, from a behavioral point of view, it was to minimize the possibility of a panic attack or to deal with it most effectively should it occur. There was a lot of talk about medications prior, and a lot of ideas that were discarded, such as that one.

If it had been a different situation by the time they were ready to extract, if it had been a situation of desperation where they were fighting to get on the capsule or if things had gone really badly within the mine and there was killings or other things, then you'd have a different design. Your extraction procedures would be different and how you do it. It all works together, so the more you normalize and communitize and keep your leaders and your delegations and all the little groups doing their things, then the more normal [it becomes]; "It's just another day and we're getting out, and if we don't get out today, we'll get out tomorrow." It's that faith and that expectation that "If this doesn't work, the next thing will.", that's in the back of your mind, rather than "If I don't get out now, I'm never getting out." You want to shape all that so by the time you get to extraction, they're fairly calm.

WRIGHT: The fact that they sent a rescue worker down, I think it's Manuel González [Pavez], first, do you think that helped boost the confidence that they were coming out?

HOLLAND: Oh, yes. Absolutely, yes. That was a good thing. And there was a lot of talk about who would be last to come out, and it had to be the leader, Luís Urzúa [Iribarre]. It had to be

him. It's like the last person off the boat. And he was such a good leader that he wanted that. There was a lot of talk about who would be last out and who'd be first out, so they looked at the people that they had there, and assuming the leader would be last, your first person you want to be very resilient and a good problem-solver, because you don't know what you're going to encounter. You could get hung up. Well, how are you going to get out? Do you want someone down there who is in the capsule that isn't your strongest miner, someone who isn't young or who has some sort of medical disorder or who tends to be psychologically marginal? No, you don't.

At least in the first few people that come out, you want somebody who cannot only solve problems but can report once you get up there, for example: "Well, when you get to the 1400-foot level, there's a jagged thing that comes out here and it makes the thing go left." Then that word gets back down to the people down there and say, "When you get to 1400 feet, you're going to hit a bump [demonstrates] here that's going to push you off that way," so that the people who are less adaptable when that happens to them, they've expected it. "Okay, everything's still okay. I'm still going up." The idea is to get that kind of positive information feeding on itself. So, yes, it was a good idea.

WRIGHT: How pivotal was his leadership down with the miners?

HOLLAND: Very, very. Urzúa, the leader, he was really good. He was an older, experienced miner, and he did a really good job in the first seventeen days when they had no contact with topside, which is the most difficult, in keeping the group together. He was able to designate a religious leader, he was able to designate a medical person, who was someone who had a little



bit of EMT [emergency medical technician]-type training. He was able to break up into three groups and to keep people working and moving around. They dug for potable water and they found some. I think out of the three places they dug, the third one gave them some water, which wasn't high quality but it was survivable water. They made attempts to get out. They burned tires under old ventilation shafts to let the topside know that they were alive, because no one knew they were alive. In fact, they initially predicted less than a five percent chance that they were alive because of the type of collapse they had.

They did a lot of things to take control of their own destiny and to be a part of their own extraction, which is, from my point of view, an extremely healthy attitude. If you don't have it, you want to create that. They were already doing that, so we could build on that. He had already delegated and kept people together pretty well. You probably read there was some stuff going on, but basically they did well. And they did that under starvation circumstances, which is extremely difficult to do.

WRIGHT: What about the influence or the impact of the fact that the government had responded to their rescue with a commitment that they were going to get them out?

HOLLAND: Yes, that was big. That was really big, because it was a private mine, and initially the private mine owners tried to launch a rescue mission. Within three days, I think, they tried to go down. There were some ventilation shafts, and they were very poor, and they had rockfalls when they tried to go down the ventilation shafts to rescue them, so those were blocked as well. Before there was a borehole they [the miners] could hear the drill coming down, drilling a borehole. In fact, one of them said, "The worst day we had was when we heard the drill pass

about four feet in the rock behind us and miss us and go on down, and then go back out,” and they figured, “If they don’t find us, they’re going to think that we’re dead.”

The private mine just threw their hands up and they said, “We can’t solve this problem,” so the government took control and brought in their people. And I think the fact that they were so committed was a huge thing all the way through. The government of Chile did an excellent job from the top down, because the top people were on site and they were making good decisions. That combination was evident to the miners, to the topside people, to the press, to the families, that “We’ve got the attention of the head guys,” and that makes a *huge* difference.

WRIGHT: How do you feel that your involvement and the involvement of your team members from NASA is part of the overall agency mission, and why was it important that NASA agreed to walk in and help do what they did?

HOLLAND: I think NASA did it just for humanitarian reasons. There was nothing coming back to us at all. I was not under the impression that I was going to learn a lot that would help in space flight because of our missions right now. I think it was expected that we were going to go down there and just offer whatever knowledge we could, and I think that was the motivation. Before we ever even left, looking at the e-mails zipping back and forth at the work level and even without outside researchers, “Hey, have you thought about this? Have you thought about that?” It was all humanitarian, as far as I could tell.

WRIGHT: Sometimes it’s just a good thing to know that, isn’t it?

HOLLAND: Yes, that's a good thing.

WRIGHT: So where are you now? I know you mentioned about hopefully having a debriefing. Are you still in touch with the miners?

HOLLAND: Not with the miners, with Iturra, yes. We actually wanted to get down off the radar as fast as possible, because it really is a Chilean success story. It's not our success story. We really wanted them to have the stage, so we pulled way back and our interactions have been with our counterparts. That's been very gratifying, fulfilling to us. I think that as far as a debrief goes, it would be extremely helpful professionally to understand better a lot of the things that maybe could not be discussed at the time.

WRIGHT: I think I read that J. D. Polk mentioned that you went down there as consultants but came back as friends.

HOLLAND: Yes, that's a good way to put it. That's very true.

WRIGHT: Do you have any more thoughts about all the people that you met and the whole experience, how it has impacted you?

HOLLAND: Well, I've had to go find my bags every time I travel now, but it was a very good experience. When we were down there, the technical people would provide us with meals at

their house, and it was very, very nice. Our counterparts were there, and I got to meet their kids and that sort of thing, so it really was a very close relationship.

I think all the NASA people shared the same desire to—we were all operational people and we're kind of pragmatic people, and we really didn't want to be in the limelight, and I think that combination helped our relations with the Chileans. They were similar people, they were similar people. You don't see their names in the press, and they did a great job. The interpreters were really good also.

WRIGHT: What about within the agency and some of the outside people? You said even outside the agency people were sending you ideas and suggestions.

HOLLAND: Yes, thank you for reminding me. Chuck [Charles A.] Czeisler and Steve [Steven W.] Lockley were the head of the circadian and sleep laboratories at Harvard [University, Cambridge, Massachusetts], and have been involved with us way back into the early Shuttle days doing sleep shifting and circadian shifting. I've known them, so when this situation came up I called Chuck and I said, "I'm going to need to use you guys as circadian experts in this thing." Because I'm not a circadian expert; but I can interpret it [what you say] into practicality. Chuck and Steve were really big in providing all of the information on frequencies and timing. There's a certain amount of minimum exposure you need to light in order to actually shift the circadian rhythm.

Then there was also a good contributor from Satellite Beach, Florida. It was Lighting [Science] Group [Corporation], Max [Fred Maxik]. That is a private company that had worked with Steve and Chuck on some research projects. Max offered to provide the lighting gratis—

which costs about \$10,000, I believe, it was a good chunk of change—that would fit down in a paloma and had the right blue frequencies that were required. There was a lot of conversation electronically and on the phone between myself and Chuck Czeisler and Steve Lockley and the Lighting [Science] Group in Florida that were fabricating the lights.

Then the Florida group shipped them down to the Chilean miners, and they got hung up in Chilean customs. Despite all of the best efforts, the State Department could not get them out of Chilean customs. Even the Minister of Health couldn't get them from Chilean customs for about two weeks. In the meantime, regular lights were being used, and those lights I think made it to the mine, but it made it to the mine toward the last—I'm not sure if they were ever in place. These are questions that I'd like to get follow-up on.

There were some great contributions by people such as that. The special operations community in the U.S Army was very helpful. I know some of those folks and had been talking to them on the phone from the mine site, and continued to do so afterwards. They were extremely helpful. And not looking for anything out of it either, with information about repatriation. And like I say, Jack Stuster was helpful. We had other people just send us a note, people we didn't know, and just say, "Have you thought about doing that?" Those people were very helpful, people that were giving it a shot.

WRIGHT: Again, a reminder that the whole world was watching and concerned.

HOLLAND: Yes, I thought that was pretty cool. Everybody was wanting to help out, and I think that's great. It's just amazing that I happened to have that opportunity to actually go down there

and to participate in that. That was really remarkable. Things happen, good and bad, and that was a good thing.

WRIGHT: It's good you had information to bring. Anything else you can think of you want to add or any final thoughts about maybe surmounting challenges you thought you weren't going to be able to?

HOLLAND: I think one thing that was important to them was the religious aspect, and it's highly ingrained in Latin American culture, as well as in the mining culture, and that was a very helpful thing. I think everyone involved there drew a lot of solace and a lot of strength from their religious background or religious beliefs. Of course it's important to keep that going, and so we built on that, and they had lots of opportunities. They had tiny little Bibles sent down in the palomas, and they celebrated Mass. They had some Protestants, so they had Protestant services. It was just amazing, once you get the audio-video comm established, what you can do. They even put together lots of programs and things, which was very effective.

I remember feeling that things were going to be okay when they had gotten their first solid food and had it for about a day or two, and then one of the miners one day sent back up a pudding cup and wanted something different for dessert. I knew we were okay, we had turned a corner. There were little indications like that that we had turned a corner with the miners and with the families.

We had some really good interaction with the families and speaking with them, and I think one of the things you want to do is talk to them in their language and you want to get inside of their view of the world. The way you speak with them I think is really important. I think we

were successful in doing that, so we were able to capture their trust, which we greatly appreciated.

WRIGHT: Did you speak with each of the families [individually]?

HOLLAND: As a whole, just as a whole. We didn't have time to do that on an individual basis. I spoke to some of them individually but not all of them.

WRIGHT: Speaking of communication, I think I read that you don't want to over-communicate too much. Could you explain that for us before you leave?

HOLLAND: Yes. In a situation like that, it's like food. You don't want to overfeed somebody or underfeed them, right? You want a certain balance in most things, including communication. If they're getting too little communication, obviously there are unmet emotional needs. They need to understand that things are okay at home, home needs to understand how they look today, and all that worry is dissipated by comm, particularly video comm if you can get it. It's more powerful than audio, and you want that. Our model in the space industry is that every weekend I'll have a PFC or a private family conference, which is audio-video. They also have an IP [Internet Protocol] phone up there, which is a one-way phone line that they can call any number on Earth that they wish, which is a super thing, very popular.

But in this situation, with untrained people and with the media chumming the waters out here, you really can get too much communication. They could have too much interaction with their families back home or with people topside so that an individual that's in a remote setting,

particularly one that's difficult, will actually tend to have a foot in each world, and that's not always healthy. It's healthiest to have both feet where you are and you're attending to what you need to attend to right there, and then managing yourself and managing your team.

That's a lot of work, and you want to be reassured that someone's taking care of things back home, but you don't, yourself, need to be involved in all the details. You don't want to have to be doing someone's homework for them, advising them how to do their math or the taxes. You can talk about those things in the context of general conversation over a period of twenty or thirty minutes, but you don't want to actually be doing those things. That's where the family has to pick up the slack, and they have to make changes to survive without you. If you get too much communication a person can have their attention split excessively so that they don't pay attention to what's going on down here, and they emotionally get pulled into a lot of issues up there that they can't control from down under. So there needs to be a balance in communication, you can't just open it wide open to everybody.

JOHNSON: I have a question. I was wondering about the follow-up once they came to the surface and if you had any input as far as helping to establish what was going to happen after they got above, other than those first few days where you kept the press away, but as far as long-term difficulties that these miners might have and if they're still being followed by a psychologist.

HOLLAND: Yes, I did have input into that, because one of the big overlooked times was what happens afterwards. We always tell our people that the mission's not over at wheel stop. It's not over when you land. Your mission goes on for several months after you come home because you have to get yourself back. You have to rehabilitate yourself physically, you have to recharge



your batteries emotionally, you have to get back in touch with the family. Little kids, young kids, have to get back in touch with you and have to get to know you again. People have changed roles and you have to sort of get used to who's doing what again. There's a lot of adjustment that goes on with coming back from a deployment. You'll see active programs in the military and in NASA and other places to remind people of how to do that.

Part of that was not just the first couple of days that was kind of special, but the longer thing. That was part of the training that I provided them, how do you readapt to coming out. That's everything from the family to getting back to work and adapting to the press, pressure, demands on your time, what happens when you're tired, what happens when other family members are worn out because they've been through stressful things. You try to get everybody on the same page. The families also got the same training the miners got on that, it was an identical training.

We advised the Chilean government that the miners be followed for at least six months, actively, by the government. The government agreed they would do six months of follow-up, after which time individuals would have to be referred to their own psychologist or social worker. The government did, in fact, follow up with them for six months after their extraction, and that was for obvious reasons, not just re-adaptation, which is huge in their situation with all the attention, but also watching for anxiety reactions and PTSD and psychiatric disturbances that might occur post extraction. Marriages need work and it all needs work. Everybody has to adapt. Everybody had to adapt—the families, the miners, everybody. Getting them through that period, they did the six months, but I don't think they did anything after that.

WRIGHT: Anything else you think you can add? We can let you venture back into all those other things you have to do.

HOLLAND: [Recollection 1: The first day that we arrived at the mine site, Iturra took me around to orient me to the site and introduce me to the various groups and people who were working there. Iturra had a great car, and it often ran. It looked like it had been a good friend to him for many years. It was very comfortable although it looked like it was hanging on to life by a thread. Iturra and I, with the interpreter in the back seat, piled into the car and crunched and bounced our way across the rocky roads and around the site. We stopped near a small metal shack, about 6 feet by 8, with a dusty, wooden floor. It housed what was then the only comm line between the miners and the topside folks. It was an old desktop telephone. Iturra picked it up and began speaking with one of the miners and bringing him up on news. Other people—mining specialists, telecomm technicians, support personnel—gradually began to arrive at the shack until eventually it was packed shoulder to shoulder. The phone was passed around, the speaker phone was engaged, and a lively group conversation began. Many supportive words were spoken, and toward the end the topside people broke out into the chant: “Chi! Chi! Chi le! le! le! Los mineros de Chile!” Over and over. The miners picked it up and began chanting it from underground, then people outside of the shack picked it up and began chanting. When we piled out of the building, I noticed tears in the eyes of a number of people outside.

[Recollection 2: The physical setting of the Atacama Desert was extraordinarily beautiful. It was very dry and rocky, like the Moon or Mars, but had a stark, quiet beauty. The sunsets there were excellent and the night skies were clear of course. One night our group was in our van

returning from the mine site back in to Copiapo to sleep. Everyone was tired and lost in their thoughts. The day—like all of the days there—had been insanely busy, and the mine site was very intense with emotion as everyone was focused doing all they could to get the miners out. As the van picked its way along the dirt roads, someone noticed a couple of planets were out, so we decided to stop on the side of the road to look at them. We piled out of the van into the desert and were not at all ready for what we saw. The black sky was absolutely packed with stars, everywhere you looked. And the Milky Way stretched in a great arc from a set of silhouetted hills behind us all the way across the sky to the hills in front of us. It was like standing under a brilliant bowl. The desert, the night and the stars were completely silent, very cool and went on forever. Brilliant, ageless and still. I was absolutely struck by the contrast of this with the feverish, human intensity at the mine site. It was a startling and powerful experience.

WRIGHT: Thanks, Al.

HOLLAND: Yes, sure. Thanks for your time.

[End of interview]