
Lechuguilla Cave Expedition Report

Far West Expedition - March 23 - March 30, 2019

submitted by: Derek Bristol and Dan Austin - April 16, 2019

Summary

This report summarizes the results of a nine-person expedition to the western branch of Lechuguilla Cave. The expedition was planned and co-led by Derek Bristol and Dan Austin. All objectives were in the Far West portion of the cave with most of the focus on survey objectives in Zion, Oasis, Oz, Keel Hall/Long Haul, Mirage Room and Sanctuary. The results of the expedition included 5,948.7 feet of total survey; 5,719.8 feet of new survey, 122.9 feet of redundant and 106.0 feet of resurvey. The expedition added 1.08 miles to the length of Lechuguilla Cave, which now stands at 148.86 miles.

Expedition Goals and Accomplishments

The primary goal for this year's expedition was to return to Zion, which had several leads on the new edge of the cave system. Many of these leads were technical climbs so lead climbing gear was brought with the hope that one or more of these would keep the team busy all week. When we arrived in Zion we realized that the critical hand-drill was missing from the climbing kit, and the very first climb attempted (at station IGF17) was not possible without a bolt. We



Kevin at the Lechuguilla Cave entrance (photo by Dan Austin)

We adapted though and focused on climbs that could be done without bolts and that were likely to have natural anchors at the top. Horizontal and easier climbing leads in Zion kept teams busy for the entire week and a significant extension into large passage going south from Zion was explored and surveyed. Work continued in other areas including the boneyard complex under Long Haul, and mop-up leads near the Mirage Room, Sanctuary and Oz. The complex maze of passages under Oasis

continued to yield as many new leads as those that were marked off the list. Work objectives, including flagging of trails in Zion and replacement of the main rope in Kansas Twister, were completed. The team was very productive with over a mile of new, high-quality survey. Each original goal from the expedition proposal is in italics. A summary of the results follows.

PRIMARY GOALS:

1. *Survey horizontal leads, and complete climbs in Zion (IGF).* **Partially Completed**

Most of the leads on the original list were completed, though several went to a handful of climbing leads that will be included on a future proposal. Unfortunately, when the climbing team arrived in Zion they realized that the hand drill was missing from the climbing gear kit. This limited the type and complexity of technical climbs that could be done. The team only did routes that they felt confident could be done with clean gear (e.g. cams, nuts, naturals), and that were likely to have good natural anchors at the top. There were enough such climbs to keep the team busy for the week, but the good climbing lead at IGF17 was not done because a bolt was required.

2. *Survey horizontal leads in the boneyard under Oasis (EY).* **Partially Completed**

Teams spent four days surveying in the boneyard complex beneath Oasis and left a large number of additional leads for a future expedition. The area is well decorated and is a combination of breakyard and boneyard that is likely an extension of the Paris, Texas complex to the north.

3. *Survey remaining leads in Wild Wild West and Outpost Room (EYWH, EYWM, EYXF, EYWB, EYWD, EYWF).* **Not Completed**

Time did not allow a trip to Wild Wild West. Leads in Zion and Oasis went well enough that these areas remained the priority.

4. *Survey horizontal leads in Sanctuary (EMG, EMGX, EMGH, EMH).* **Partially Completed**

One team visited leads in the EMG survey off of the Art Gallery (near Sanctuary) on the final day of the expedition. There is more work to be completed in and around Sanctuary.



80-foot columns in Zion (photo by Dan Austin)

5. *Climb and survey leads in Oz (EKT, OC, OY, OZ). **Partially Completed***

Two visits were made to Oz. Some work was completed by replacing the main 230-foot Kansas Twister rope, and three technical climbs were completed.

6. *Climb and survey leads in Red Lakes and Red Tides (IG). **Partially Completed***

A few of the leads in Red Tides were completed, but a handful still remain. The horizontal leads and climbs that were conducted in this area all ended.

7. *Survey remaining leads under Long Haul, and Keel Hall (IBN, IBA, IBB, IBGA, IBS). **Partially Completed***

The IBS survey under the NW end of Long Haul was visited by one team and fully surveyed, including a connection to Velvet Underground. A vast network of breakdown and boneyard passage under Northern Exposure, Keel Hall and Long Haul is now all interconnected and will be drafted as a single offset lower level.

8. *Survey leads in Mirage Room (IN, IH, IM, IMA). **Partially Completed***

One team visited leads above and around the Mirage Room. Several of the high level leads go up slippery and exposed fissures and do not look promising, yet a few of these leads remain to be explored and surveyed. A competent climbing team may be needed to finish off the last of these safely.

9. *Climb and survey a lead in Hudson Bay (RCC7). **Not Completed***

This area wasn't visited due to a lack of time, and the accidental omission of a hand-drill.

SECONDARY GOALS:

1. *Survey alternate leads in I35 quadrangle (see alternate lead list in Table 2). **Not Completed***

Time and the quality of primary leads meant that these leads were not visited.

2. *Survey alternate leads in H36 and I36 quadrangles. **Not Completed***

These leads were not visited. Better working maps will be needed to visit these leads with efficiency. The cartography is being updated and these will be incorporated into a future expedition proposal.

3. *Resurvey and/or resketch areas in the upper level of I36 quadrangle. **Not Completed***

These leads were not visited. Better working maps will be needed to visit these leads with efficiency. The cartography is being updated and these will be incorporated into a future expedition proposal

Team

Team members included Derek Bristol (CO, co-expedition leader, sketcher, climber), Dan Austin (SD, co-expedition leader, sketcher), Garrett Jorgensen (NM, sketcher), Kevin Manley (CO, sketcher, climber), Aria Mildice (NM, sketcher), Hazel Barton (OH, sketcher), Adam Weaver (SD), Chris Pelczarski (SD), and Pete Johnson (CO, climber). All of the team members had previous experience in Lechuguilla Cave. It was the first Lech camping expedition for Chris. Everyone on the expedition was safe, careful, conservation-minded and focused on the goals. The expedition results reflect the excellent teamwork and cohesiveness of the members. For his first week-long camp, Chris did extremely well and should be welcomed back to Lechuguilla Cave in the future. His strength and previous experience on numerous camps in Jewel Cave reflected in his performance.



The 2019 Far West Expedition team in Deep Seas Camp (photo by Dan Austin)

Detailed Daily Reports

Note: Trip leaders are underlined.

March 23rd, 2019 (Entering the Cave)

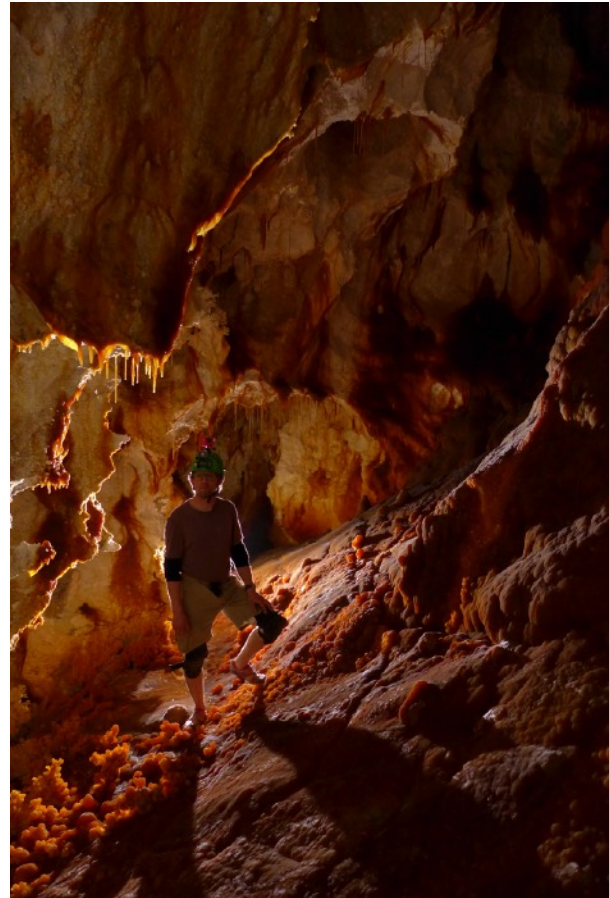
The team split into three groups of 3 for the trip to camp. Aria, Chris and Garrett went down the pre-rigged entrance drop and entered the airlock at 4:10 pm. They added a second maillon to one of the new rebelay bolts on Boulder Falls to reduce rubbing of the rope against the wall. Dan, Adam and Kevin passed through the airlock at 5:20 pm. Derek, Hazel and Pete entered the airlock at 5:40 pm. All teams made the trip to camp in under 3 hours without incident. All seven of the team's Disto-X2 devices were calibrated in camp with delta values below 0.5. The actual delta values are found in a table below. Water was gathered from Lake Louise and the team was in bed by 10 pm.

March 24th, 2019 (Red Tides, Zion)

All teams left Deep Seas Camp at around 9:00 am and headed to the Red Tides / Zion area via the Western Borehole, staggering departure times slightly to avoid a bottleneck at the changing area to Red Lakes and the climb at Rising Tides. All teams reconvened at the bottom of Space Shot in Zion, and then split up to their respective survey areas.

Dan Austin, Chris Pelczarski and Garrett Jorgensen traveled to the far end of Zion at IGF32 heading into marginal cave going south, east, and northeast. After passing through some very delicate areas, they eventually popped out into larger passage trending south / southeast. Several transitions between sediment areas and flowstone necessitated frequent changes of clothes from clean to dirty; thus the name “Unnecessary Changes.” Airflow in this area indicates more passage to be discovered. The team left a few leads to come back to on the next day, including a 150-foot wall of popcorn that would need rope to ascend. A tie-in was made to IGF32. 593.0 feet was surveyed in 21 shots from IGK1-21. The team returned to camp at 9:30 pm.

Hazel Barton, Aria Mildice and Pete Johnson went to check leads that were in the room below Zion at IGF58-IGF63. They worked their way over to the room, only to discover there was no rope rigged for them to descend. Instead, they back-tracked to the passage above Angel’s Landing where they ran a shot each into two leads that ended. Last, they checked a climbing lead above Rising Tides which led to a small ledge they called the Mutton Buster. From here they were able to squeeze into a small room and shoot a shot before they ran out of time. They left a few leads to push out of this room for the next day. Tie-ins were made to IGF5 and IG19V. 107.3 feet of new survey was added in 4 shots from IGF5A-B and IGN1-2. The team returned to camp at 9:20 pm.



Chris with chenille flowstone (photo by Dan Austin)

Derek Bristol, Kevin Manley and Adam Weaver worked on climbing objectives in Zion. While checking gear at IGF17, they realized they were missing a drill in the bolt kit. They tried climbing the lead at IGF17 anyway. The first 20 feet were free climbed with natural protection, but it wasn’t safe to go further, so it was down-climbed and the gear was removed. The team then went to the climb near the bottom of Zion. This was free-climbed to a wide ledge that went back 15 feet with no leads, which was surveyed. Last, they scouted the short climb at IG19W, but ran out of time. A tie-in was made at IGF34, and 83.3 feet was surveyed in two shots from IGF34A-B. The team returned to camp at 9:00 pm.

March 25th, 2019 (Red Tides, Zion)

Aria Mildice, Pete Johnson and Adam Weaver left camp at 9:00 am and traveled to Rising Tides via the Western Borehole. They proceeded to the Mutton Buster and completed the survey of the room discovered on the previous day. Following this, they continued to Zion with the objective of surveying leads in the room under Angel’s Landing. After rigging a rope, they spent some time

identifying the leads at the bottom. Aria had a close call fall on the way down when a punky handhold she was using broke. She fell 10 feet, landing on her feet unharmed. Following the incident, they proceeded to survey leads from IGF45-47 and completed all of them. In order to stay clean, they decided to leave a bad corrosion residue lead at the back of the fissure for later in the week. Last, they went to the short climb lead at IGF60. Pete boosted Adam up the climb, which ended in one shot in a hammer lead that didn't look good. Tie-ins were made at IGN2, IGF45, 46, 47 and IGF60.



Kevin crosses the upper Red Lake that accesses Red Tides (photo by Dan Austin)

270.2 feet was surveyed in 15 shots using IGN3-17. The team returned to camp at 8:23 pm.

Dan Austin, Kevin Manley and Hazel Barton left camp at 9:30 am and traveled back to Unnecessary Changes at the far end of Zion. Their primary objectives were leads left at IGK9 and IGK15. Both of these leads ended in fairly exposed, easy climbs. The climb at IGK32 looked the best, requiring a scramble up a 45-foot flowstone cascade. Last, the team checked a crawl at IGK3, but it immediately connected back to Zion through a too-tight fissure. Tie-ins were made at IGK15, IGK9 and IGK3. 119.9 feet was surveyed in 12 shots from IGK22-34. The team took a little extra time heading back to camp, and took photos along the way. They arrived at 9:30 pm.

Derek Bristol, Garrett Jorgensen and Chris Pelczarski left camp at 9:00 am and traveled to Rising Tides via the Western Borehole and Red Lakes. They returned to a climb near IG19V that plots out on the map very close to the far side of Boomtown. Derek led the 20-foot climb with Chris belaying using only clean gear and found that the top of the flowstone drop ended in a plug. The static rope was run through a sling attached to a small stalagmite and the pitch was down-climbed / rappelled, and the rope pulled. The sling was left behind and was necessary to reduce rope drag for the pull-down. The team then proceeded to the popcorn covered wall discovered the previous day near IGK7. After scouting, Chris opted to lead the climb up the wall, later named the "Niche Wall" using a series of slings over popcorn knobs for protection. It took two pitches to reach a sloping area with a good natural bridge anchor for rigging the rope for teams to return to later. A rebelay was set along the climb by wrapping a double-length white spectra runner around a popcorn knob. The loop in the static rope was kept short just in case this anchor fails. It was originally tied off with a locking

carabiner, but this was later replaced with a SS maillon. Without the hand drill it wasn't possible to place bolts, but if this rope is used in the future for travel then it will need to be improved to reduce abrasion against the many popcorn knobs. Both climbs were surveyed using IG19W and IGK7 as tie-ins and setting stations IG19X and IGK7A-B. use for a total of 141.6 feet of new survey in 3 shots. The team returned to camp by 9:00 pm.

March 26th, 2019 (Zion, Oasis)

Dan Austin, Garrett Jorgensen and Chris Pelczarski left camp at 8:30 am and traveled to the Zion area without incident. Their primary objective was to investigate a horizontal lead discovered at the top of the popcorn climb above IGK7A. The lead went east for a few stations before doubling back over the top of the climb. At IGK7F, the floor ended. The team could see into stooping, formation-filled passage across the pit, 30 feet away, but it would require a traverse across the top of the pit using bolts.

Directly above IGK7F is a 30-foot dome that also requires bolts. After finishing the horizontal leads in this area, the team checked a lead at the bottom of the climb that went two shots and connected to the climb discovered the day before at IGK24. Last, the team surveyed into the pit south of IGF30 in the main Zion room. The pit immediately opened into walking-sized passages coated with thick gypsum and flowers. However, this area ended with no leads after only a few shots. 598.45 feet was surveyed in 15 shots. Tie-ins were made at IGK7A and IGK30. IGK7C-G;AA-AB, and IGK35-42 were used. The only two leads left were the traverse and dome climb at IGK7F. The team returned to camp at 9:00 pm.



Hazel climbs the rope at Rising Tides (photo by Dan Austin)

Derek Bristol, Adam Weaver and Pete Johnson left camp at 9:00 am and traveled to Zion via the Western Borehole. After retrieving the rope rigged in the lower part of the room and the climbing rack at IGK7, they climbed partway up Space Shot to the first balcony and rappelled the static rope south to a ledge below. Another rappel was made from here to a ledge to reach a hole in the ceiling of Zion. The static line was rigged and re-ascended before releasing the tail. The team descended the Space Shot Rope and ascended the new fixed rope to the balcony above. This area was surveyed using IGF70-86, and all leads ended. 498.9 feet was surveyed, and one tie-in made to IGF17. The team pulled the rope and traveled back to camp without incident, arriving at 8:40 pm.

Aria Mildice, Hazel Barton and Kevin Manley left camp at 9:20 am and traveled to the Oasis area via the Western Borehole to push leads in the lower level breakdown. It took them some time to find EY106, the station above the route down. Once they found EY129, they were able to find their first lead which



Aria in Red Tides (photo by Dan Austin)

turned out to be a passage along a wall created by flowstone. They surveyed back up into the Oasis passage, and immediately back down again to a pit which appeared unclimbable without SRT gear. They left this as a lead and headed back to the lead marked at EY121. Here they surveyed a well-decorated loop, tying in to EY124. One hole down went in a number of directions, and the team found a connection to EY140. Another hole down was found, but the team ran out of time to survey it, and left it as a lead. They surveyed 210.4 feet of new passage and 38.6 feet of redundant survey in 20 shots, from EY177-197. Tie-ins were EY129, RFB1, EY121, EY124, EY189, and EY140. The team returned to camp at 9:20 pm, arriving after only 1 hour of travel.

March 27th, 2019 (Oz, Oasis, Zion)

Derek Bristol, Aria Mildice and Hazel Barton departed camp at 9:40 am and traveled to Oz via the Western Borehole. Along the way they stopped at Emerald City to photograph the green minerals. At Kansas Twister, Derek climbed to the first ledge where he rigged the new 230-foot, 11 mm rope, and derigged the old one. The old rope was cut into two sections – 90 feet and 120 feet in length, with the

bad section in the middle taken back to camp and later out of the cave. After the rope had been taken care of, the team continued on to a climbing lead at EKT87. Derek climbed this flowstone climb with Hazel belaying. They rigged the 90-foot segment of rope to a natural bridge, and the lead was surveyed using OD1-5. Another climbing lead was scouted on the way back to camp. 226.3 feet was surveyed from the tie-in station at EKT87. The team returned to camp at 9:50 pm.

Dan Austin, Kevin Manley and Chris Pelczarski left camp at 11:00 am and traveled to the Oasis area, where they mopped up leads in the lower level breakdown. The primary lead was a pit that Hazel's team had found the day before that was thought to be unclimbable without SRT. The team had no trouble negotiating the climb without gear, and proceeded to survey 175.94 feet with several connections back up into the main Oasis passage. EY198-207 was surveyed from the tie-in at EY182. They took time to get a few photos on their way back to camp, and arrived at 8:30 pm.

Garrett Jorgensen, Pete Johnson and Adam Weaver left Deep Seas Camp at 9:15 am and traveled back to Zion to investigate a lead at IGF21. They surveyed down a deep fissure which terminated at a pit at IGK47. After rigging the pit, they rappelled 45 feet into a 16-foot-wide, 60-foot-long room with several leads. Most of these ended after just a few shots. Strong air could be felt throughout the area, but no clear direction was discernible. They also noted an abundance of popcorn and aragonite throughout the survey. They left one easy dig lead at IGK65, and two upper-level leads that would require easy free-climbing to access. Finally, they mopped up a few remaining leads near the top of the rope, and then surveyed out into Zion from the bottom of the fissure at IGF22. Tie-in stations were IGF21 and IGF22, and the team surveyed 696.4 feet using IGK43-78. The team returned to camp at 8:30 pm.



Garrett above a pool in Hidden Canyon (photo by Dan Austin)

March 28th, 2019 (Zion, Oasis, Oz)

Dan Austin, Aria Mildice and Kevin Manley left camp at 9:30 am and returned to the pit at IGK47 discovered the day before in an attempt to try and cross to the passage on the opposite side.

After discovering the belay line was too short, Kevin decided that it was safe to cross without one, and made it to the far side without incident. He rigged the rope as a J-hang, and the rest of the team followed. The passage on the far side split into two directions, with the south-trending branch ending after only a few shots. The northeast trending branch went into small corrosion-residue coated breakdown, and the team left some very small, unpromising leads between breakdown blocks. They also left a climb lead to what appears to be solid cave above IGK87. This will require aid across a steep, crumbly slope to access. Back at the J-hang, the team noticed that at the same level to the west there appeared to be more passage continuing, but would either require a technical traverse from IGK79, or a climb from the opposite side of the pit below. It was difficult to see what would be the best route due to a natural bridge spanning the pit halfway across. However,

much airflow in this area had the team excited that this was where it was going, and perhaps this lead has the best potential for a continuation of the Zion area. The team surveyed 238.29 feet in 13 stations from IGK79-92, with a tie-in at IGK47. The team returned to camp at 8:30 pm.



Garrett looking up to a lead in the ceiling of Zion (photo by Dan Austin)

Hazel Barton, Adam Weaver and Pete Johnson left camp at 9:40 am and made their way to the lower level breakdown leads under the Oasis passage. After locating EY124, they began surveying down a pit that had been left a few days prior. The cave split at the bottom of the pit, and each branch connected into existing passage at EY143, EY152 and EY161. At EY157, the team surveyed into another room which eventually connected back into the main Oasis passage. Some further connecting passages were surveyed before the team decided to call it a day. 452.33 feet was surveyed from EY208-243, EY223A and 226A. Tie-ins were at EY197 and R-EY3A. The team returned to camp at 8:45 pm.

Derek Bristol, Garrett Jorgensen and Chris Pelczarski left camp at 9:00 am and returned to the Oz area. At the Kansas Twister, Derek improved the rigging at the natural bridge before continuing up into Oz and the flowstone climb lead above OD1. Derek led the climb with Chris belaying, and set a natural anchor to two stalagmites. The passage was surveyed and a possible climbing traverse was identified, so the 120-foot, 11 mm rope was left rigged. The leads above OD5 were surveyed to completion, and the 90-foot rope was pulled. Derek led another climb above OA2 to a corrosion residue and rock-flour fissure which was surveyed. The rope was left rigged with leads remaining. 300.7 feet was surveyed in 8 stations from OD6-13. Tie-ins at OD1, OD3, and OA2 were used. The team returned to camp at 8:40 pm.



Adam admiring frostwork near the Mirage Room (photo by Dan Austin)

March 29th, 2019 (Mirage Room, Oasis, Long Haul, Sanctuary)

Dan Austin, Adam Weaver and Garrett Jorgensen departed camp at 9:30 am and headed to the Mirage Room via the Western Borehole. Their first objectives were leads from IH1-10. After some quick recon, they determined the route to these leads was too dangerous to continue along without rope since it traversed along a slippery corrosion-residue slope that ended in a ledge high above the Mirage Room. They opted to check leads near IFB22D instead, working their way towards Spah Harbor. It turns out there was no lead there at all, and instead they surveyed a couple of cut-arounds before returning back to the Mirage Room and surveying some loose ends. After unsuccessfully trying to locate leads

in the breakdown beneath the room, they opted to return to the lower level of Oasis to finish off the day. 337.45 feet of new cave was surveyed, and 14.95 feet of redundant survey added. Tie-ins were at IFB16, IFC7, IFF1 and EY239. Designations used were IFB16A-B, IFC7A-F, IFF1A-B, and EY244-256. The team returned to camp at 8:00 pm.

Derek Bristol, Chris Pelczarski and Hazel Barton left camp at 9:55 am and traveled to Long Haul via the Western Borehole. They spent the day surveying in breakdown under Long Haul, and noted that there seems to be an endless amount of work to be done here, with survey frequently



Adam in raft cones above Lake Louise (photo by Dan Austin)

connecting back into the main room. On a high note for the day, the team connected into the Velvet Underground from this area. They surveyed several leads near IBS30, and left no new leads. They ended their day after connecting in at IBG6. 288.2 feet of new cave was surveyed in 22 shots from IBS36-58. 17.3 feet of redundant survey was also added. The tie-in station was IBS33. The team returned to camp at 8:00 pm.

Aria Mildice, Kevin Manley and Pete Johnson left camp at 10:00 am and traveled down the Western Borehole to the Sanctuary turn-off. Kevin had been there two years prior, but there was still significant route-finding involved, and it took the team 2 hours to reach their leads from camp. Once arriving, they finished all leads along the EMG16 survey, and started to check a lead along the north wall between the Art Gallery and the Menagerie, but decided they wouldn't have enough time. 225.05 feet of new survey, 86.0 feet of resurvey, and 9.06 feet of redundant survey was accomplished utilizing designations EMG71-87 and EMG85A. Tie-ins were at EMG16M, N and I, and at EMG15 and 15A. The team headed back to camp, arriving at 7:40 pm.

March 30, 2019 (Exiting the Cave)

The teams left camp in separate groups of three with Garrett, Adam and Pete leaving first around 9:30 am followed by Dan, Kevin and Chris, and finally Derek, Hazel and Aria. All teams were able to exit in under four hours without incident. It was noted that there's approximately 30 feet of excess rope at the bottom of Boulder Falls. This was tied-off short, but the tail could be cut off if desired.

Conservation

- Trips were taken to Zion on every project day during the expedition. There are numerous shoe and clean clothing changing areas along this route, and some are challenging to negotiate. Some tracking of FMD between Rising Tides and Angels Landing is occurring, and a restoration trip is recommended once the remaining leads have been completed. A poll of team members suggests that everyone who has had the good fortune of being involved in the exploration would be willing to return to conduct restoration. The lower portions of Red Lakes had already seen some impact and would also benefit from restoration. These areas have not been getting worse. The Red Tides and Zion clean areas still look pristine.
- Clean gear was used to carry out technical climbs in the Cloud Ten area of Oz. Additional climbs remain here, but tarps may be necessary to capture sediment that may be knocked down if these leads are explored.
- A solid orange flagged trail was marked from the top of the hill in Zion down to near the dirty shoe changing area near IGF28. Additional flagging would be useful, especially in the lower part of the room to contain the trail through the dirty zone.
- Bright lights were used to thoroughly sweep the Deep Seas camp and latrine area for micro-trash and other contaminants before departing.

Rigging

The lower rope in Kansas Twister was replaced with a new 230-foot piece. A footloop was added to the lower rebelay to make it easier to cross during descent. A maillon was added to this same rebelay to provide a more convenient and redundant place to clip a cowstail when crossing.

There is a wear spot developing on the Cornflakes climb rope (the first rope beyond Lake Louise). The rigging point was adjusted to move this spot up a little higher such that it no longer contacts the wall. There is not a core shot, just abrasion to the sheath. It will probably need to be replaced soon. This rope gets a lot of traffic and rides against an abrasive wall. It would be possible to add a deviation near the top of it to mitigate some of the wear.

The old Kansas Twister 230-foot rope was cut into 3 pieces. A 20-foot section in the middle has two core shots and was removed from the cave. The other two pieces (90 and 120-foot pieces) were used to rig two climbs done in Oz near Cloud Ten. Both climbs have potential additional climbing leads, though these are dirty climbs above flowstone. It was decided to leave both rigged for now since they may be used to access high level leads in the area.

100 and 150-foot x 9 mm ropes that were brought into the cave were left rigged in Zion on climbs with going leads. They are rigged in such a way that the ropes could not be de-rigged and returned to camp.

The tables below are an inventory of new ropes and hardware.

Rope Log (March, 2019)

Rope Location	Nearest Survey Station	Rope Length (ft)	Rope Diameter (mm)	Date Rope was New	Condition	Comments
Deep Seas Camp	EC41	45	11	?	Good	Rope was in camp and not used
Deep Seas Camp	EC41	35	11	?	Good	Rope was in camp and not used
Deep Seas Camp	EC41	75	11	?	Good	Rope was in camp and not used
Deep Seas Camp	EC41	75	11	?	CR coated, but good	Rope was in camp and not used
Zion	IGK7D	150	9	2019	Excellent	Brought into cave 3/2019 and used to rig the Niche Wall in Zion. Rigged to a large natural bridge and rebelayed to a large popcorn cluster with a double-length white runner and single 7mm maillon.
Zion	IGK47	100	9	2018	Excellent	Brought into cave 3/2019 and used to rig pit in side passage off of Zion. Main anchor is bombproof natural bridge. Rigged in a J-hang over 45-foot pit to two large boulders on other side of pit.
Oz	OD1	120	11	2013	Good	Rigged to a pair of stalagmites at top of flowstone climb. This section was cut from the Kansas Twister rope #2 (230 feet), originally placed in 2012/2013.
Oz	OA2	90	11	2013	Good	Rigged to a large (4') breakdown block cemented to the floor. This section was cut from the Kansas Twister rope #2 (230 feet), originally placed in 2012/2013. About 20 feet of the KT#2 rope, in the middle, had bad spots that were cut out and removed from the cave.
Oz	EKT10	230	11	2017	Excellent	Replacement for Kansas Twister #2 rope. Rigged to 2 SS bolts at top, 1 SS rebelay bolt, and 2 more rebelay bolts on natural bridge. Protected by 3 rope pads.

Hardware Log (March, 2019)

Hardware Location	Type	Size	Quantity
Deep Seas Camp	Powers Wedge SS Bolt	3/8 x 3 inch	6
Deep Seas Camp	Fixe Double-Wedge SS Bolt	3/8 x 2 inch	3
Deep Seas Camp	Powers Wedge SS Bolt	3/8 x 2 inch	12
Deep Seas Camp	SS Bolt Hanger	10 mm	12
Deep Seas Camp	Maillon Rapide SS	7 mm - long	7
Deep Seas Camp	Maillon Rapide SS	7 mm - standard	2
Deep Seas Camp	Rope Pad (red vinyl)	small	1
Deep Seas Camp	Cord for Rope Pad	3 mm	1

Disto-X2 Calibration Data (March, 2019)

Disto-X2 Serial #	Owner	Calibration Date	Calibration Delta
2442	Kevin Manley	March 23, 2019	0.3091
2652	Chris Pelczarski	March 23, 2019	0.2219
2685	Hazel Barton	March 23, 2019	0.3087
2833	Pete Johnson	March 23, 2019	0.3319
3219	Derek Bristol	March 23, 2019	0.3215
3706	Derek Bristol	March 23, 2019	0.3047
4229	Hazel Barton	March 23, 2019	0.3154

Safety

One team member took a fall when a handhold broke when accessing leads near IGF45 in a lower level of Zion. The fall was approximately 10 feet and they landed on their feet and were uninjured. This was a lucky outcome given the length of fall and the potential for an uneven landing area. Team members exited the cave in the same condition they entered.

Leads

The tables below are a compilation of leads that were completed (either through field checking or survey), or are newly discovered.

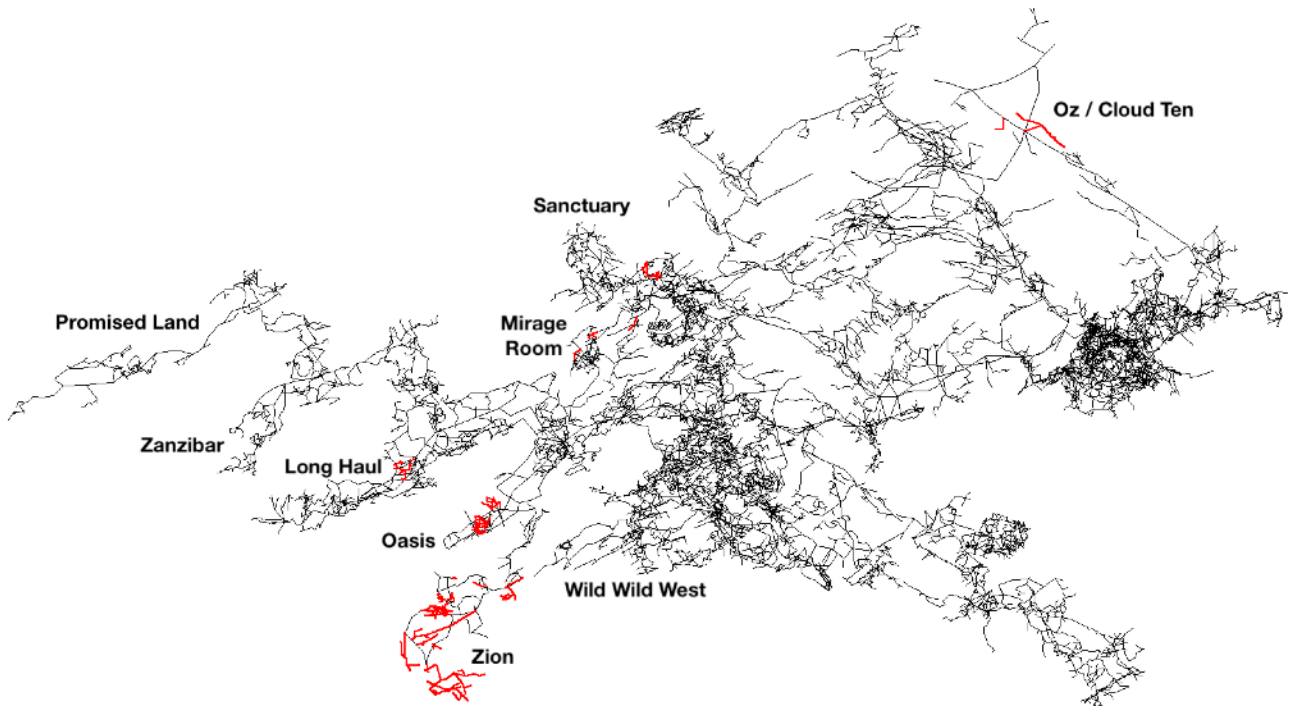
Completed Leads (March, 2019 Lechuguilla Cave Expedition)						
Section	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
H36/H37 - Oz	Oz	EKT87	70	NE, up	5Wx5H	surveyed with OD1-11
H36/H37 - Oz	Oz	OA2	60	S, up	5Wx5H	surveyed with OD12-13
I35 - Keel Hall	Red Tides	IGF5	10	W	2Wx6H	surveyed with IGF5A-B
I35 - Keel Hall	Red Tides	IG19V	20	SE	2Wx1H	surveyed with IGN1-9
I35 - Keel Hall	Red Tides	IG19W	40	E	3Wx15H	surveyed with IGN19X
I35 - Keel Hall	Long Haul	IBS27	5	up	2Wx2H	surveyed with IBS44
I35 - Keel Hall	Long Haul	IBS28	8	SE	3Wx2H	surveyed with IBS41-43
I35 - Keel Hall	Long Haul	IBS31	6	NW	4Wx2H	surveyed with IBS36-40
I35 - Keel Hall	Long Haul	IBS33	6	NW	4Wx4H	surveyed with IBS36-40, IBS45-58
I35 - Keel Hall	Art Gallery Room	EMG16N	20	SE	10Wx14H	surveyed with EMG71
I35 - Keel Hall	Art Gallery Room	EMG16M	12	E	1Wx11H	surveyed with EMG72-73
I35 - Keel Hall	Art Gallery Room	EMG16M	5	NW	6Wx10H	surveyed with EMG74-83
I35 - Keel Hall	Art Gallery Room	EMG16I	13	NW	2Wx28H	surveyed with EMG84-87
I35 - Keel Hall	Oasis	EY129	12	N	8Wx6H	surveyed with EY177-186, EY198-207
I35 - Keel Hall	Oasis	EY121	15	SW	16Wx6H	surveyed with EY187-197
I35 - Keel Hall	Oasis	EY143	8	E	6x3	surveyed with EY208-218
I35 - Keel Hall	Oasis	EY197	10	N	10Wx10H	surveyed with EY208-218
I35 - Keel Hall	Oasis	EY152	4	N	4x2	surveyed with EY208-218
I35 - Keel Hall	Oasis	EY157	5	E	4x2	surveyed with EY219-222
I35 - Keel Hall	Oasis	EY208	11	NW	7Wx8H	surveyed with EY223-235
I35 - Keel Hall	Oasis	EY209	11	W	7Wx12H	surveyed with EY236-243
I35 - Keel Hall	Oasis	EY239	3	NW	10Wx10H	surveyed with EY244-256
I35 - Keel Hall	Mirage Room	IFB16	8	N	6Wx20H	surveyed with IFB16A-B
I35 - Keel Hall	Mirage Room	IFC7	9	N	5Wx4H	surveyed with IFC7A-F
I35 - Keel Hall	Mirage Room	IFF1	28	SW	130Wx30H	surveyed with IFF1A-B
J35 - Zion	Zion	IGF34	25	E, up	8Wx5H	surveyed with IGF34A-B
J35 - Zion	Zion	IGF32	10	SE	20Wx3H	surveyed with IGK1-34, IGK7A-G, AA-AB
J35 - Zion	Zion	IGF47	11	W	9Wx9H	surveyed with IGN10-12
J35 - Zion	Zion	IGF46	11	SW	1Wx9H	surveyed with IGN13-14
J35 - Zion	Zion	IGF45	12	SW	2Wx7H	surveyed with IGN15-18
J35 - Zion	Zion	IGF60	10	NE	20Wx12H	surveyed with IGN19-20
J35 - Zion	Zion	IGF17	100	SW	15Wx5H	surveyed with IGN70-85
J35 - Zion	Zion	IGF30	60	S	50Wx30H	surveyed with IGK35-42
J35 - Zion	Zion	IGF21	20	NE, down	10Wx4H	surveyed with IGK43-92

New Leads (March, 2019 Lechuguilla Cave Expedition)						
Section	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
H36/H37 - Oz	Oz	OD9	10	SE	4Wx6H	Climb above pool. Technical climb, low potential.
H36/H37 - Oz	Oz	OD12	10	NW	4Wx2H	Formation choke
H36/H37 - Oz	Oz	OD13	20	N	8Wx15H	CR fissure going NW
H36/H37 - Oz	Oz	OD13	20	SE	25Wx20H	CR fissure over flowstone of Cloud Ten. High impact potential.
I35 - Keel Hall	Oasis	EY181	0	down	10Wx8H	Needs rope. Alternative route may exist.
I35 - Keel Hall	Oasis	EY196	5	E	5Wx1H	Looks grim and sharp.
J35 - Zion	Zion	IGN3	10, up	S	4Wx3H	CR climb above pool, resource concern, looks good
J35 - Zion	Zion	IGN20	0, up	SE	4Wx2H	Requires formation modification, not good
J35 - Zion	Zion	IGK76	5	N	8Wx4H	Clean lead, goes 50+ feet
J35 - Zion	Zion	IGK72	20	E	12Wx2H	Climb, needs handline, looks bad
J35 - Zion	Zion	IGK65	0	N	0.5Wx2H	Tight, looks grim, has air
J35 - Zion	Zion	IGK79	30	W	6Wx6H	Tricky traverse, bolts required, poor rock. Lead looks good.
J35 - Zion	Zion	IGK87	10, up	N	6Wx6H	Will require traverse across steep crumbly slope. Looks okay.
J35 - Zion	Zion	IGK32	10, up	N	8Wx5H	Easy climb. Possible passage at top. Looks okay, no air.
J35 - Zion	Zion	IGK7F	10, up	N	6Wx6H	Bolt climb, 30 feet up flowstone wall. Looks okay.
J35 - Zion	Zion	IGK7F	30	W	4Wx5H	Traverse with difficult moves. Bolts needed. Looks good.

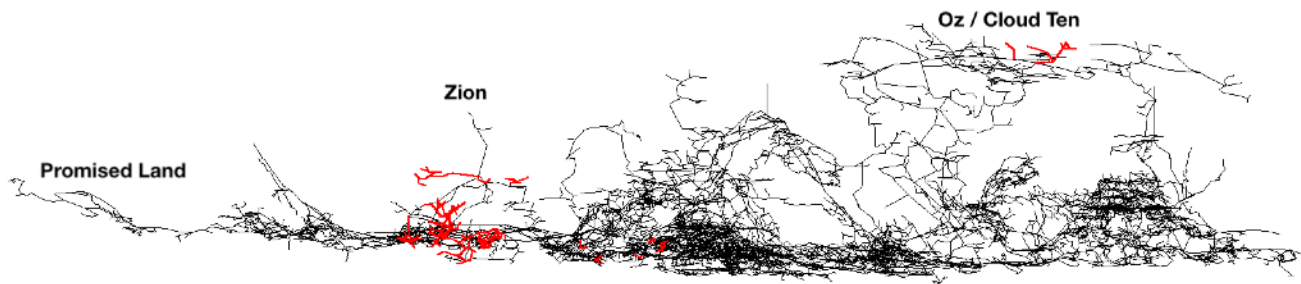
Maps

Below are plan and profile line plots showing the newly surveyed passages in the Far West (new survey in red).

Plan View Map of the Far West:



Profile View Map of the Far West:



Conclusions

The expedition was very successful in accomplishing many of the goals set out in the proposal, resulting in 5,949 feet of total survey of which 5,720 feet was new. Five technical climbs were safely carried out despite not having a drill. Work objectives were completed and resource impact was kept to a minimum. Nobody was injured and everyone had a good time. All of this was made possible through the efforts of highly skilled and experienced cavers/surveyors and careful pre-planning of survey objectives and logistics.

Thanks to all of the expedition team members for their drive, humor, flexibility and hard work. Special thanks to the many sketchers who produced excellent quality survey notes.

Finally, thanks to Erin Lynch, Aria Mildice and Ellen Trautner in the Cave Resources Office for providing information, training, housing arrangements, and gear preparation. Without their support none of this would be possible.

Sincerely,
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