
Lechuguilla Cave Expedition Report

Far West Expedition - September 17-24, 2016

submitted by: Derek Bristol - October 16, 2016

Summary

This report summarizes the results of a six-person expedition to the western branch of Lechuguilla Cave. The expedition was planned and led by Derek Bristol. All objectives were in the Far West portion of the cave with most of the focus on survey objectives in Oz, Keel Hall, Wild Wild West, Sanctuary, and the 1988 Room. The results of the expedition included 4,402.1 feet of total survey; 3,730.5 feet of new survey and 671.6 feet of excluded survey. The expedition added 0.71 miles to the length of Lechuguilla Cave, which now stands at 140.47 miles.

Expedition Goals and Accomplishments

The original proposal called for ten team members, and included a dedicated climbing team. Due to the short notice and scheduling limitations associated with this year's expedition, a team of only six participated. The team was very productive, though the number of goals achieved can reasonably be expected to be approximately 60% of what might have been achieved with a larger team. Each original goal from the expedition proposal is in italics. A summary of the results follows.

PRIMARY GOALS:

1. *Survey horizontal leads in Wild Wild West (EYWI, EYWC, EYWH, EYWM, EYXF, EYWB, EYWD, EYWE, EYWF).* **Partially Completed**

All of the leads in Starburst Chamber were completed over two trips to the area. Additionally, all leads in the Shining Path and Boomtown areas were completed with the notable exception of the water passage beyond EYWC26G. The leads going west from this well decorated area cross deep water that will require measures similar to what has been proposed to cross Lake Okeechobee. This will be put into a future proposal. Time didn't allow work on other areas surrounding the Outpost Room, including the EYWM, EYXF, EYWB, EYWD, EYWE and EYWF surveys. Several more trips will be needed to finish this area.

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

Most of the remaining leads in Sanctuary and the lower level maze below Sanctuary were completed. A few mop-up leads remain that will require one or two return trips to finish. Most of what remains is internal small boneyard passages that are unlikely to result in significant new passage.

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3. *Climb and survey leads in Oz (EKT72, EKT76, EOZ11, EKT87, OA2, EKT93, OZ32, OC11, OC22, OB34-41). **Partially Completed***

An effort was made to use a “sling-caster”, i.e. a fishing reel attached to a slingshot, to get a line over either a natural bridge or stalagmite up in the Wizard alcove that would allow access without the effort, impact and safety concerns of aid climbing up an overhung wall. Unfortunately this did not work but the climb was more thoroughly scouted, along with another technical climb above EKT87. Aid climbs were completed at EKT76 and EOZ11. The dome above EOZ11 led to a significant amount of large horizontal passage and two dome climbs, and one pit were left for future exploration.

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

This was not done due to being excluded by the Cave Resources Office prior to the expedition. This lead was identified and scouted during the 2013 Bosted expedition and will be included again in future proposals if the Fortini expedition doesn't complete it as proposed in 2016.

5. *Survey horizontal leads in Oz (OY19-21, EKT83, EKT92, EKT68). **Partially Completed***

The lead at EKT68 was surveyed to completion. Time did not allow other small horizontal leads to be surveyed.

6. *Survey the last few leads in Northern Exposure (IBDA3-13, IBD7). **Completed***

All of the leads in the steep pancake passages between Keel Hall and Birthday Present, in the area known as Northern Exposure, were surveyed to completion. As expected, these were all internal connections and no major new discoveries were made.

7. *Survey leads in breakdown under Long Haul and Keel Hall (IBB7-35, IBP4-42). **Not Completed***

This area is connected to Northern Exposure through the breakdown/break-yard complex under Keel Hall, but these leads weren't visited.

8. *Resurvey and/or resketch 1988 and 1989 Rooms. **Partially Completed***

A detailed resurvey of the 1988 and most of the 1989 Rooms was completed. The final shot in the 1989 Room (EYQ16-17) was not done due to an overhanging technical climb that had been de-rigged. Several leads off of the 1988 Room were also surveyed to completion. Two new technical climbing leads in the 1989 Room were identified.

SECONDARY GOALS:

1. *Survey alternate leads in I35 quadrangle. **Not Completed***

Time didn't allow work on these objectives.

2. *Survey alternate leads in H36 and I36 quadrangles. **Partially Completed***

A few leads in the IBN breakdown maze along the south side of Keel Hall were surveyed. Many more cut-arounds in this area remain.

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

Time didn't allow work on these objectives.

Team

Team members included Derek Bristol (CO, expedition leader, sketcher, climber), Jean Krejca (TX, sketcher, climber), Gilly Elor (OR, climber), Kevin Manley (CO), Heather Levy (HI, sketcher), and David Lambert (CO, sketcher). Four of the team members had previous experience in Lechuguilla Cave. It was the second Lech expedition for Dave, and the first for Gilly and Kevin. Everyone on the trip was safe, careful and focused on the goals of the expedition. It was a thoroughly enjoyable group to work with and the more than 4,400 feet of survey accomplished by such a small group is a testament to their skill and work ethic. All team members would be strong contributors to future expeditions and should be welcomed back to this and other National Park Service caves.

Detailed Daily Reports

Note: Trip leaders are underlined.

September 17, 2013 (Entering the Cave)

Derek, Jean, Gilly, Kevin, Dave and Heather rigged the entrance and entered the cave at 14:45. The team traveled quickly and efficiently to camp. With a large group of six, the team regrouped at Boulder Falls and EF Junction, but smaller groups kept moving towards camp. Dave had a mishap at the popcorn climb that bypasses the newly formed pool just before the Liberty Bell room. Despite passing packs across the pool and carefully following the route used by others along the left wall, he had a handhold break and fell into the water. He was able to dry out during the trip to camp and only had minor discomfort from getting wet. The team arrived together at 18:30. Water was gathered, the latrine set up, camp organized, and three Disto-X2s were calibrated. Everyone was in bed by 22:00.

September 18, 2013 (Northern Exposure, Keel Hall)

The teams, including all 6 members, left camp at 9:15 and traveled quickly and efficiently to Leaning Tower but had difficulty finding the turn-off to Far Planetarium. The



Dave and Kevin in the Western Borehole
(photo by Jean Krejca)

correct route was seen later while returning to camp. An alternate objective of surveying leads in the Keel Hall area was chosen instead of wasting more time looking for the correct route. After splitting up in Keel Hall, Derek, Jean and Heather traveled to the IBDA survey in Northern Exposure. After a little orientation the survey was started at one of the leads indicated at IBDA5. Several very tight popcorn lined fissures were surveyed that simply connected between existing pancake layers. Tie-ins were made to IHBA4, IBD8, and IBD7. Five leads were eliminated and no new leads created. This effectively finishes off the mazy area known as Northern Exposure the resides between Keel Hall and Birthday Present. 303.9 feet was surveyed in 32 shots using IBDA17-44. The team traveled back to Keel Hall and met the other half of the team.

Dave, Gilly and Kevin had the objective of surveying the leads underneath Keel Hall. They began by chimneying down into the east side of this area, but quickly realized this did not connect. So they returned to the main trail and were able to enter more easily a few stations up. No leads were marked with flagging but stations were easily identified. Two pit leads were surveyed underneath the breakdown jumble, each connecting back to known passage. 222.3 feet was surveyed in 19 shots using IBN62-76. The teams traveled back to camp together, arriving at 20:30

September 19, 2013 (Wild Wild West - Boomtown, Starburst Chamber)

The teams left camp at 9:35 and traveled quickly and efficiently together to the Far Planetarium turn-off near EY76. The flagged trail was followed to the rope pitch shortcut to the Outpost Room. The teams split up here and Derek, Jean and Heather followed the EYWC

to the pit above Shining Path. At Boomtown the team changed into aquasocks and checked the lead at EYWC26A. The water appeared to be shallow enough to use the poly bag waders we had brought. The team changed into clean gear and used the poly bags under aquasocks. They surveyed across the water using EYWC26E-G. After about 60 feet the water became too



Heather and Derek in EYWC26A lead in Boomtown (photo by Jean Krejca)

deep for the waders but the passage continued about 6-8 feet wide and high over 4-5 feet of water. Without a way to continue they

then climbed up to Trails End Room and the Beautiful Balcony, but the two leads indicated at EYWC48-50 were blocked by formations with no enlargement behind and no airflow. Both of these leads will be marked as too delicate due to low potential and the high potential impact required to explore. They then traveled back to Shining Path and surveyed a high lead above EYWC18. This was a short popcorn covered natural bridge that joins back at EYWC17A. They then reascended the rope and met the other team in the Outpost Room. 186.2 feet was surveyed in 6 shots using EYWC26E-G and EYWC37-38.

Dave, Kevin and Gilly made their way to the Starburst Chamber. Route finding was a little difficult and sometimes nerve-racking due to delicate aragonite. Upon arriving at the first lead, marked as delicate on the map, they found orange flagging stating "Beautiful, delicate area; Goes ~100'; Do Not Survey". The second lead was a tight hole at the top of a flowstone slope. They tried to bypass this delicate area by surveying an upper fissure but only connected to the east side of the flowstone with no way to continue. After having a quick snack they changed into clean gear near EYWI7 and returned to the flowstone lead. The tight spot had small aragonite and was at the bottom of a breakdown choke. They sent the smallest team member but, unfortunately, travel through this resulted in breaking a small aragonite formation near the tight spot and also at the bottom of the flowstone slope as small rocks fell. The flowstone continued up a massive slope, decorated with draperies and stalagmites, until reaching a choke. Two leads were left near EYWI28 under the flowstone ledge. 172.5 feet was surveyed in 14 shots using EYWI17-29. The teams traveled from the Outpost Room back to camp together, arriving at 21:35.

September 20, 2013 (Oz)

The team of all six departed camp at 9:10 and traveled together to Kansas Twister and ascended to Oz. Due to the large group and need to sequence up individual pitches, the ascent took a net of more

than 5 hours from camp. It is suggested that in the future teams of no more than four travel together for efficiency. The team went to Cloud Ten where photos were taken and two climbing leads were scouted. One lead is west of EKT87 and may be free climbable but with some risk of impacting flowstone below. The other climb is east of EKT87 and would need to be done in full clean gear



Heather above the first rebelay in Kansas Twister (photo by Jean Krejca)

but the area above appears to have a lot of FMD. Both leads appear to go to the same upper level passage and so only one needs to be climbed. A lead rope and light rack should be used, but the climb probably won't require full aid gear. Time was running short and it was decided to focus on the Wizard climb rather than the one at EKT87, so the teams headed back to EKT69 where Jean, Dave, and Heather surveyed a passage along the north wall that was missed during the original survey. The team of Derek, Kevin and Gilly went to the Wizard and tried several strategies for shooting a fishing line over a natural bridge. They were successful at getting the line over the bridge on a couple of shots but couldn't get the weight to drop down the other side. After several hours this effort was abandoned. It appears that the south wall could be climbed with traditional aid climbing techniques though the wall is overhung at the top. The fishing line strategy is a long-shot, literally, and probably won't be attempted again. If the strategy had worked it would have saved some time, effort and the risk associated with aid climbing up poor quality rock without the benefit of a rotary hammer.

Meanwhile, the other team identified a lead in the far wall from the rope leading up to the Cowardly Lion traverse. Jean traversed the loose slope to enter the lead and rigged a rope to aid the team in crossing and re-crossing the slope. The passage was very simple, but well decorated, with white snowballs lining the ceiling and aragonite bushes and popcorn covering the room floor. They surveyed two short passages to an end and exited the lead to link up with the other team. After meeting up the teams traveled together back to camp without incident, arriving at 00:30 on September 21. Not much survey was accomplished but better beta on the few remaining climbs was gathered. 159.8 feet was surveyed in 6 shots using EKT114-119.

September 21, 2013 (Sanctuary)

The teams left camp at 11:35, later than usual due to the late return the previous day, and traveled quickly and efficiently to Sanctuary via the Western Borehole, Helderberg Hall, and the Menagerie. The teams split up based on gender and Derek, Kevin and Dave looked for a descent route to the EMH survey. The route down via EMGG was too steep without a rope but



Gilly and Derek try getting a cord up into The Wizard (photo by Jean Krejca)

several side passages adjacent to this pit were found that had not been surveyed. When these were done a descent was found following the original EMH survey down a very delicate fissure. In the future vertical gear should be brought to follow a less delicate and previously rigged descent that is just south of the EMH aragonite fissure. The lead at EMH21 was found but ended almost immediately. The lead at EMH21A was found to connect to EMHU1C through a small window. This was not surveyed but can be sketched in. A lead at EMH16 was surveyed to a short loop that closes two leads in that room. Several short dead-end passages were also surveyed. Finally, a steep climbing route was taken from EMH8 up to an upper level where a tie-in was made after only two shots. A total of 371.3 feet was surveyed in 24 shots using EMGG48-55, EMH31, EMH16A-I, and EMH8A.

Jean, Gilly and Heather surveyed leads on the west edge of Sanctuary. The first lead tied into EMG36 and the EMGH designation was used. One high lead was left, and there are likely other leads still to do in the area, including at least one blue/white flag near EMG36. The leads involved a lot of boneyard that was overlaid onto existing survey. After squirming around this CR boneyard, the team dropped into a previously mopped passage and took a couple of photos. There's more to do in the area. This was the only boys vs. girls survey day of the expedition, and the girls won, of course with 2 extra shots accounting for 1.9 more feet. A total of 373.2 feet was surveyed in 26 shots using EMGH44-64. The teams met back in Sanctuary and returned to camp together without incident, arriving at 22:15.

September 22, 2013 (1988 Room)

The teams left camp at 10:40 and traveled together quickly and efficiently to the 1988 Room. None of the team members had ever been there but the route finding was very easy despite no signage. Using maps and a well flagged trail led easily through Helderberg Hall, Jackpot, and up into the 1988 Room. At the room the teams split up and Derek, Heather and Dave began a resurvey of the room starting at EYQ7, which is down the slope from the start of the room. Since the original survey had no back sights and poor quality sketch all stations were relocated and a full resurvey was conducted using the original stations. At EYQ12 the team ascended a fixed rope to



Heather and Dave in the 1988 Room (photo by Derek Bristol)

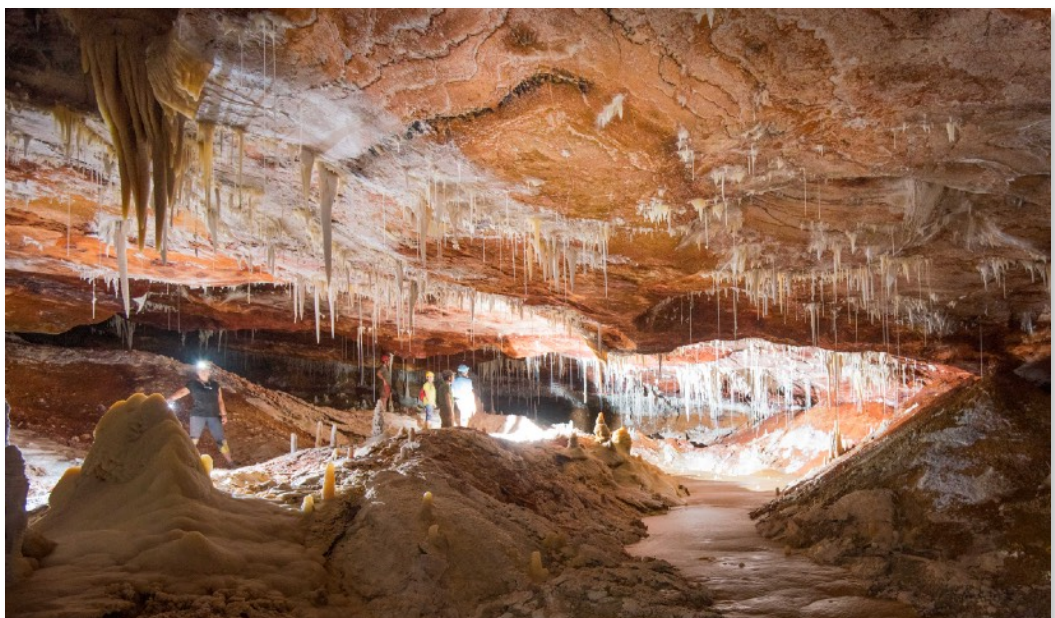
EYQ14. Heather and Derek did an exposed free climb to reach EYQ15 that should be rigged, but found the next part of the climb to be even more exposed and overhanging. It may be possible to toss a rope over a rock or projection near the edge of the climb, but any previous rigging had been removed. There appeared to be a couple of potential climbing leads near the ceiling of this upper level so a return trip may be justified with technical climbing gear. There is only one survey shot that wasn't resurveyed, so returning for this single dead-end shot alone is not warranted. A total of 611.5 feet was resurveyed in 12 shots reusing EYQ7-15.

While the other team (Derek, Heather, and David) conducted a re-survey of the room, Jean, Gilly and Kevin started surveying nearby leads. With Jean sketching, Kevin on back-sights and Gilly on point the first lead was located near EYQ9A. The lead started off as a short climb and quickly ended after a few shots. Another free climbable lead was found nearby which also ended after a few shots. Next the team moved to a lead off station EYQ9C. This went to a climb down to a complex lower level where they spent the remainder of the day. The survey went around breakdown/breakyard blocks and connected into the main 1988 room multiple times. One of the passages contained notable large selenite crystals that were photographed. A total of 468.9 feet was surveyed in 32 shots using EYQ46-72. The teams regrouped in the 1988 Room, and returned to camp together, arriving at 20:50.

September 23, 2013 (Wild Wild West - Starburst Chamber, Oz)

The team of Dave, Jean and Heather left camp at 9:45 and arrived at the Starburst Chamber approximately 12:00 and began surveying leads from the lead list. Dave (lead tape) climbed in and followed a CR tube that ran over the original Starburst Chamber survey level. The survey was tied in to the lower level at occasional pits, and into the Outpost room. The ties to the Outpost room should eliminate some of the Outpost leads on the map, but it was difficult to determine which ones from the working map. There was also a connection into the survey conducted earlier in the week, which originally began at EYWI10 and ended at EYWI28. That team did a

terminal shot to an unmarked EYWI29. The survey was begun at EYWI28 and followed the flowstone leads above to an end. The lead at EYWI9 marked "too delicate, ends" was indeed too delicate and a single shot was made down that passage with a Disto-X2. The team then



The "Cloud Ten" area of Oz (photo by Jean Krejca)

investigated leads marked on the lead list in that area - many of them went to small dead end rooms, decorated with popcorn and aragonite. Those leads were not all surveyed but were marked on the "new leads" page in the survey book (page 14 of 13) as complete / no go or as complete / surveyed. A total of 491.2 feet was surveyed in 35 shots using EYWI50-80. The team returned via the Western Borehole and coincidentally met the other team returning from Oz at the Leaning Tower.

The team of Derek, Gilly and Kevin traveled quickly and efficiently to Oz via Kansas Twister.

Climbing gear was picked up at EKT69 and carried into the borehole up to the base of the climb near EKT76. A ledge system to the right of the lead was used to gain some altitude and a pair of cams were used to establish a belay anchor at the left side of the ledge. Gilly belayed as Derek led. A good cam placement, a thin vertical piton, a bat hook, and a 3/8 x 2" SS bolt were placed as direct aid to access a free climbable narrow ledge that led the rest of the way to the perched lead passage. The final 25 feet was free climbed with two additional protection points based on draping slings over cemented rocks that may not have held a fall. Once reaching the passage a good boulder was used to anchor the static rope. Gilly seconded the climb and removed all gear except for the SS bolt and hanger. On the free climbing traverse a foothold broke and she took a short fall onto the dynamic rope belay, but was unfazed and uninjured. She finished the climb and Kevin came up the fixed static rope from directly below. The passage was surveyed using EKT77 as a tie-in. The first shot was 160 feet to the top of the breakdown



Heather in Cloud Ten (photo by Jean Krejca)

slope. The passage quickly became smaller and had very deep CR deposits. Within another 200 feet the passage became too tight. All side passages were checked and eliminated. The team descended and cut the rope to length. 75 feet of 9mm rope was left in place and the remaining 125 feet was taken to the next climb. The team traveled to the Wizards Elevator at EOZ10 and used the existing rappel anchor around a boulder as a belay anchor. Derek led along a steep and featureless slope to the left. The CR covered slope hid a series of decent ledges that made good footholds and the first 15 feet could be free climbed but no protection placements could be found so a 3/8 x 2" SS bolt was placed. A natural thread was found and then a long reach to the main vertical crack system was made to reach a good cam placement. The dome was intended to be climbed using direct aid, but each placement came with good hand and footholds and the entire climb was accomplished by free climbing alone. Several other cam and natural thread placements were found along the way. A good natural anchor was found at the top and the 125 foot x 9 mm rope was rigged. The climb was cleaned on rappel and the bottom of the rope tied off to the anchor below. There is about a 20 foot tail, but not enough to justify cutting to length. The team surveyed up the dome and followed good leads going both east and west. The east lead passed a good short dome that remains as a climbing lead and the survey ended at the edge of a 30 foot pit that will require additional rope. The west lead went to a large room with a 200 foot dome that also remains for future exploration. The top of this dome is very high and plots out to an elevation of -83 feet relative to the entrance, i.e. approximately the elevation of the air-lock. Climbing this dome will require direct aid techniques akin to what was used on the Kansas Twister climb. The entire climb appears to be in the poor quality rock of the Yates formation. The dome was named "The Nostril", an underground counterpart to the well known "Nose" route on El Capitan. Additional west trending passage was surveyed to a loose dig lead that, after plotting the data, appears to come out in the breakdown of Munchkinland. It probably isn't worth the effort to dig this open. A total of 1,044.9 feet was surveyed in 27 stations using OS1-11 and OC42-57. The team packed up and traveled back to camp without incident. The other survey team was met in the Western Borehole and the teams arrived in camp together at 00:30 on September 24.

September 24, 2013 (Exiting the Cave)

The team left camp in separate groups of three with Jean, Gilly and Heather leaving at 11:50 and Derek, Dave and Kevin leaving at 12:35. Both teams traveled quickly and efficiently without incident to the entrance. There was more dripping and running water than usual observed at Boulder Falls, and the deep pool that had formed just west of the Liberty Bell Room was at least 1.5 feet lower (only about 12-18 inches deep). The girls exited the airlock at 15:00, and the guys exited at 16:25 (the girls won again). The rope pad was left in place below the rebelay of the entrance rope. This is a good size and the cord is the right length for protecting this drop. It was felt that it would be more efficient to leave in place for other upcoming trips and expeditions.

Conservation

- There were a couple of small aragonite bushes that were accidentally damaged in Starburst Chamber during the survey due to a proliferation of these speleothems combined with very tight passage.

- A team member fell into a seasonal pool that had formed across the trail just before the Liberty Bell Room. This might be considered both a conservation and safety concern. The team member was uninjured, and although contact was made with the pool, this pool is very close to the entrance and was actually covering the normally well-traveled trail, so it is unlikely that this represents an impact to the water quality of the pool. If the pool were to form regularly or persist for extended lengths of time, then it would be appropriate to install a traverse line here, but the pool hasn't been seen before, and the level had dropped enough during the week we were there to allow stepping across on the way out of the cave, so a traverse line is probably not needed.
- Poly trash-compactor bags were used as makeshift waders to cross the first 60 feet of the shallow pool in Boomtown beyond EYWC26A. This strategy was discussed with and approved by the CRO prior to the expedition, and has been used to cross the Lake of the Lost Marbles in the Far East. The pool in Boomtown had a solid calcite coated floor and was shallow enough initially to allow this strategy to work. Unfortunately the pool becomes deeper and will require either deep wading or swimming to continue, and although the passage dimensions become smaller it does not appear to end.
- Bright lights were used to thoroughly sweep the Deep Seas camp and latrine area for micro-trash and other contaminants before departing.

Rigging

No problems were observed and no changes made to rigging along any of the usual travel routes. The second rope pad that was installed at the first rebelay in Kansas Twister is working well. The loop in the rope at this rebelay is quite short, which makes crossing it going up or down a bit more challenging; however, lengthening this loop can probably only happen once the rope is replaced. There is enough extra length to allow it, but the knots have been tightened so much by repeated use that they can no longer be untied.

A 200 foot x 9 mm PMI Pit rope was brought into the cave for use in rigging any new climbs. This was cut into two pieces with 75 feet rigged to a good natural boulder near OS1. The remaining 125 feet was rigged to a good natural anchor at the top of Wizards Elevator near OC42, with the bottom tied-off to the boulder near EOZ10. A tail of approximately 20 feet was left coiled at this lower anchor.

Two 3/8 x 2 inch SS wedge bolts were placed for protection during aid climbs in Oz. The nut and hanger on one of these was removed but had to be left on the other. No other bolts were placed. Extra stainless steel hardware was left in Deep Seas camp for future climbing objectives. A detailed inventory of both this hardware and ropes is in the tables below.

Hardware Location	Type	Size	Quantity
Deep Seas Camp	Fixe Single Wedge SS Bolt	3/8 x 3 inch	6
Deep Seas Camp	Powers Wedge SS Bolt	3/8 x 2 inch	4
Deep Seas Camp	SS Bolt Hanger	10 mm	8
Deep Seas Camp	Maillon Rapide SS	8 mm - long	9

Rope Location	Nearest Survey Station	Rope Length (ft)	Rope Diameter (mm)	Date Rope was New	Condition	Comments
Deep Seas Camp	EC41	40	11	2013	dirty	The old log shows this as 50', but it is actually 40'
Deep Seas Camp	EC41	30	9	2010	CR coated	No change from old log
Deep Seas Camp	EC41	65	11	2013		Rope indicated in old log is not in camp. Most likely used during the 2013 Bristol or Bosted expeditions - maybe near Southern Cross. Check those reports for disposition.
Deep Seas Camp	EC41	70	11	1991	CR coated	Removed in Dec, 2013. No longer in camp - update log.
Deep Seas Camp	EC41	50	11	1991	CR coated	Removed in Dec, 2013. No longer in camp - update log.
Oz	OS1	75	9	2016	New	Cut from a new 200 foot coil brought into the cave in 2016. Rigged to large natural.
Oz	OC42	125	9	2016	New	Cut from a new 200 foot coil brought into the cave in 2016. Rigged to large natural.
Kansas Twister (Rope 2)	EKT10	230	11	2012	Two bad spots butterflied out.	Despite the bad spots, these are right at the rebelay and don't present a problem. The rope can be left in place for now. Tight rebelay loop can't be lengthened because knots are too tight. When the rope is eventually replaced this old rope will likely need to be cut out.
Yellowstone Falls	EOZ22	Probably 100	11	2013	One butterfly from bad spot	Didn't check in 2016, but it is believed the butterfly knot is still in place, but isn't difficult to pass on the low angle slope. It is also believed that this rope was already cut to length and the excess used elsewhere. This should be documented in the 2013 Bristol expedition report.
Frostworks	EYWL37	100	11	1998	One butterfly from bad spot	Not checked in 2016

Safety

There was a climbing fall taken by the second climber while following the lead put up above EKT76. This climb included a long free-climbing traverse that had to be repeated in order to remove all of the climbing hardware. Several of the holds on this traverse were small surface rocks that were cemented in place with a secondary coating of calcite. One of these rocks broke off during the traverse and a small fall of ~5-10 feet was taken onto an upper belay with the dynamic climbing rope. There was no injury or impact due to the fall. An extra cam (SLCD) had been placed at the end of the traverse that limited the swing from the fall.

There were no other safety incidents of note. Team members exited the cave in the same condition they entered... at least the same physical condition.

Leads

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

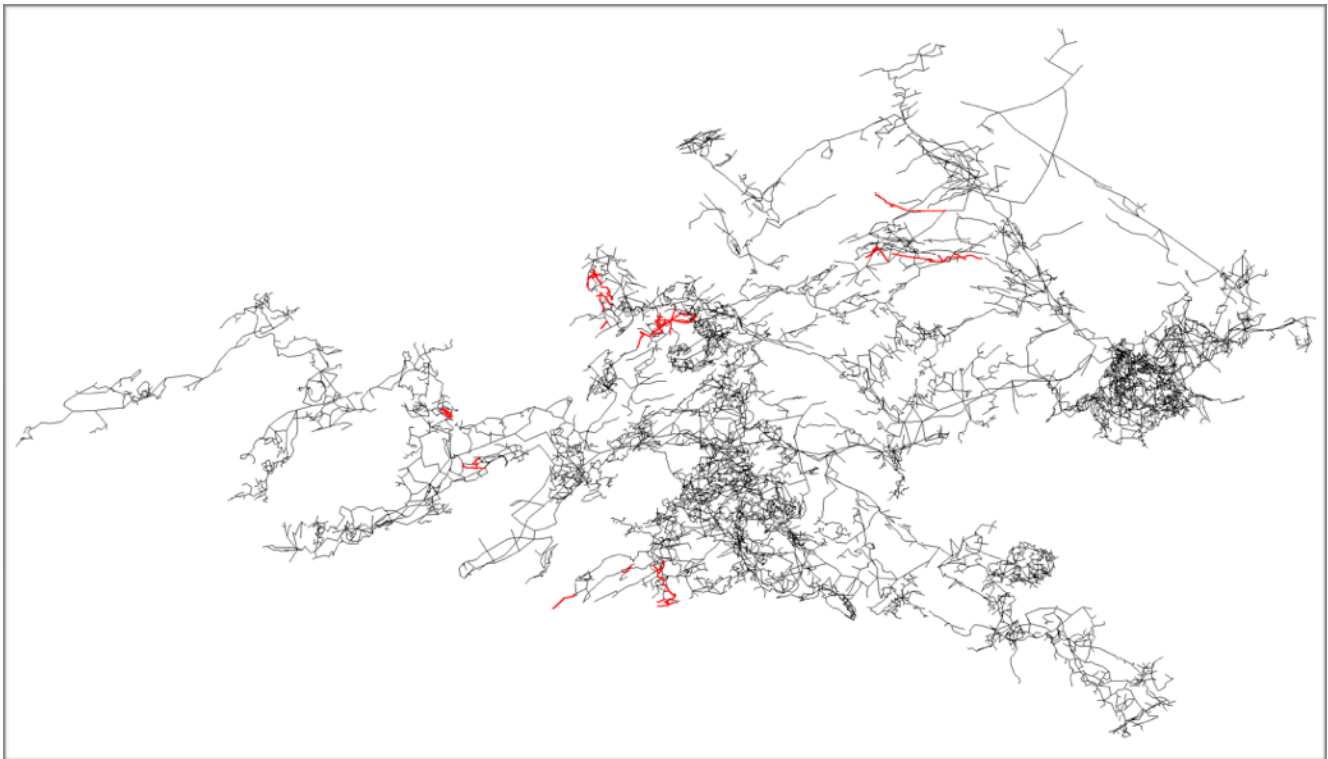
Completed Leads (Sept, 2016 Lechuguilla Cave Expedition)						
Section	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
I35 - Keel Hall	Northern Exposure	IBD7	25	NE	15Wx5H	surveyed with IBDA43-44
I35 - Keel Hall	Northern Exposure	IBDA3	13	NE	3Wx3H	surveyed with IBDA28-33
I35 - Keel Hall	Northern Exposure	IBDA5	7	N	2Wx4H	surveyed with IBDA21-36
I35 - Keel Hall	Northern Exposure	IBDA5	7	NE	2Wx2H	surveyed with IBDA17-20
I35 - Keel Hall	Northern Exposure	IBHA5	7	NW	1Wx1H	surveyed with IBDA39-42
I35 - Keel Hall	Keel Hall	IBN34	14	S	15Wx15H	surveyed with IBN62-68,68A
I35 - Keel Hall	Keel Hall	IBN11	11	W	5Wx5H	surveyed with IBN62-68,68A
I35 - Keel Hall	Keel Hall	IBN49	11	SE	8Wx8H	surveyed with IBN69-71
I35 - Keel Hall	Keel Hall	IBN34	12	W	9Wx18H	surveyed with IBN72-76
I35 - Keel Hall	Keel Hall	IBN58	21	SW	3Wx6H	surveyed with IBN72-76
I35 - Keel Hall	Keel Hall	EYWC26A	0	W	12Wx15H	surveyed with EYWC26E-G
I35 - Keel Hall	Boomtown	EYWC18	10	E	15Wx15H	surveyed with EYWC37-38
I35 - Keel Hall	Boomtown	EYWC17A	20	E, up	8Wx10H	surveyed with EYWC37-38
I35 - Keel Hall	Boomtown	EYWC48	15	NE	3Wx1H	too low and delicate - not a lead
I35 - Keel Hall	Boomtown	EYWC50	10	N	3Wx1H	too low and delicate - not a lead
I35 - Keel Hall	Starburst Chamber	EYWI7	15	E	8Wx20H	surveyed with EYWI17-24
I35 - Keel Hall	Starburst Chamber	EYWI10	20	NE	6Wx6H	surveyed with EYWI17-24
I35 - Keel Hall	Starburst Chamber	EYWI10	16	SW	4Wx7H	surveyed with EYWI25-29
H36/H37 - Oz	Oz	EKT69	73	NW	9Wx3H	surveyed with EKT114-119
H35 - Zanzibar	Sanctuary	EMGG1	15	SE	3Wx4H	surveyed with EMGG48-55
H35 - Zanzibar	Sanctuary	EMG37	25	SE	8Wx6H	surveyed with EMGG48-55
H35 - Zanzibar	Sanctuary	EMGG6	15	N	8Wx6H	surveyed with EMGG48-55
H35 - Zanzibar	Brown Plate Room	EMH21	15	W	6Wx4H	surveyed with EMH31
H35 - Zanzibar	Sanctuary	EMH16	10	N	4Wx10H	surveyed with EMH16A-I
H35 - Zanzibar	Sanctuary	EMH9	28	NW	2Wx6H	surveyed with EMH16A-I
H35 - Zanzibar	Sanctuary	EMH8	37	S	15Wx20H	surveyed with EMH8A
H35 - Zanzibar	Sanctuary	EMH4E	10	N	15Wx20H	surveyed with EMH8A
H35 - Zanzibar	Sanctuary	EMG36	20	W	10Wx6H	surveyed with EMGH44-64
H35 - Zanzibar	Sanctuary	EMG67	18	NE	7Wx50H	surveyed with EMGH44-64
H35 - Zanzibar	Sanctuary	EMG37	24	NW	7Wx5H	surveyed with EMGH44-64
H35 - Zanzibar	Sanctuary	EMG46	24	NW	8Wx4H	surveyed with EMGH44-64
H35 - Zanzibar	Sanctuary	EMG67	15	NW	8Wx14H	surveyed with EMGH44-64
H35 - Zanzibar	1988 Room	EYQ9	50	E	4Wx15H	surveyed with EYQ46-48,48A
H35 - Zanzibar	1988 Room	EYQ9A	27	E	1Wx1,5H	surveyed with EYQ48B
H35 - Zanzibar	1988 Room	EYQ9C	7	S	14Wx11H	surveyed with EYQ49-72
H35 - Zanzibar	1988 Room	EYQ10	50	NE	11Wx3H	surveyed with EYQ49-72
I35 - Keel Hall	Starburst Chamber	EYWI17	26	NW	1Wx7H	surveyed with EYWI50-68
I35 - Keel Hall	Starburst Chamber	EYWI15	21	W	2Wx3H	surveyed with EYWI50-68
I35 - Keel Hall	Starburst Chamber	EYWH6	21	S	17Wx9W	surveyed with EYWI50-68
I35 - Keel Hall	Starburst Chamber	EYWH4	10	NE	10Wx7H	surveyed with EYWI50-68
I35 - Keel Hall	Starburst Chamber	EWG1!	20	SE	8Wx3H	surveyed with EYWI50-68
I35 - Keel Hall	Starburst Chamber	EYWI9	28	NE	8Wx4H	surveyed with EYWI69
I35 - Keel Hall	Starburst Chamber	EYWI28	7	NE	2Wx2H	surveyed with EYWI70-79
I35 - Keel Hall	Starburst Chamber	EYWI7	8	E	4Wx24H	surveyed with EYWI80
I35 - Keel Hall	Starburst Chamber	EYWI4	0	down		doesn't go, ties to EYWI14
I35 - Keel Hall	Starburst Chamber	EYWI7	0	down		doesn't go
I35 - Keel Hall	Starburst Chamber	EYWI14	0	down		doesn't go, ties to EYWI4
I35 - Keel Hall	Starburst Chamber	EYWI3				doesn't go, low and tight
H36/H37 - Oz	Oz	EKT77	80	W	40Wx25H	surveyed with OS1-10
H36/H37 - Oz	Oz	EOZ10	65	up	15x20	surveyed with OC42-57,51A

New Leads (Sept, 2016 Lechuguilla Cave Expedition)						
Section	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
I35 - Keel Hall	Boomtown	EYWC26F	20	S	8Wx10H	possible CR coated climb along north wall
I35 - Keel Hall	Boomtown	EYWC26G	0	SW	8Wx8H	continuation of water passage, ~6 ft deep
I35 - Keel Hall	Starburst Chamber	EYW110	25	NE	3W	delicate
H35 - Zanzibar	Sanctuary	EMGH46	15	up	6Wx15H	high lead
H35 - Zanzibar	1989 Room	EYQ15	40	NE	3Wx2H	technical climb along NE wall
H35 - Zanzibar	1989 Room	EYQ15	20	E	6x6	technical climb in ceiling
H36/H37 - Oz	Oz	OC44	30	up	10x8	technical dome climb - possibly free climable
H36/H37 - Oz	Oz	OC46	5	S	1Wx3H	tight, high lead
H36/H37 - Oz	Oz	OC48	5	E, down	6x15	pit needs rigging
H36/H37 - Oz	Oz	OC48	5	E, up	2x4	tight dome above pit
H36/H37 - Oz	Oz	OC51	20	E	8Wx4H	traverse required, breakdown choked lead
H36/H37 - Oz	Oz	OC52	0	NW	8Wx2H	breakdown choked lead looks close to old EOZ
H36/H37 - Oz	Oz	OC51	200	up	10x15	"The Nostril" - high aid climb in Yates formation

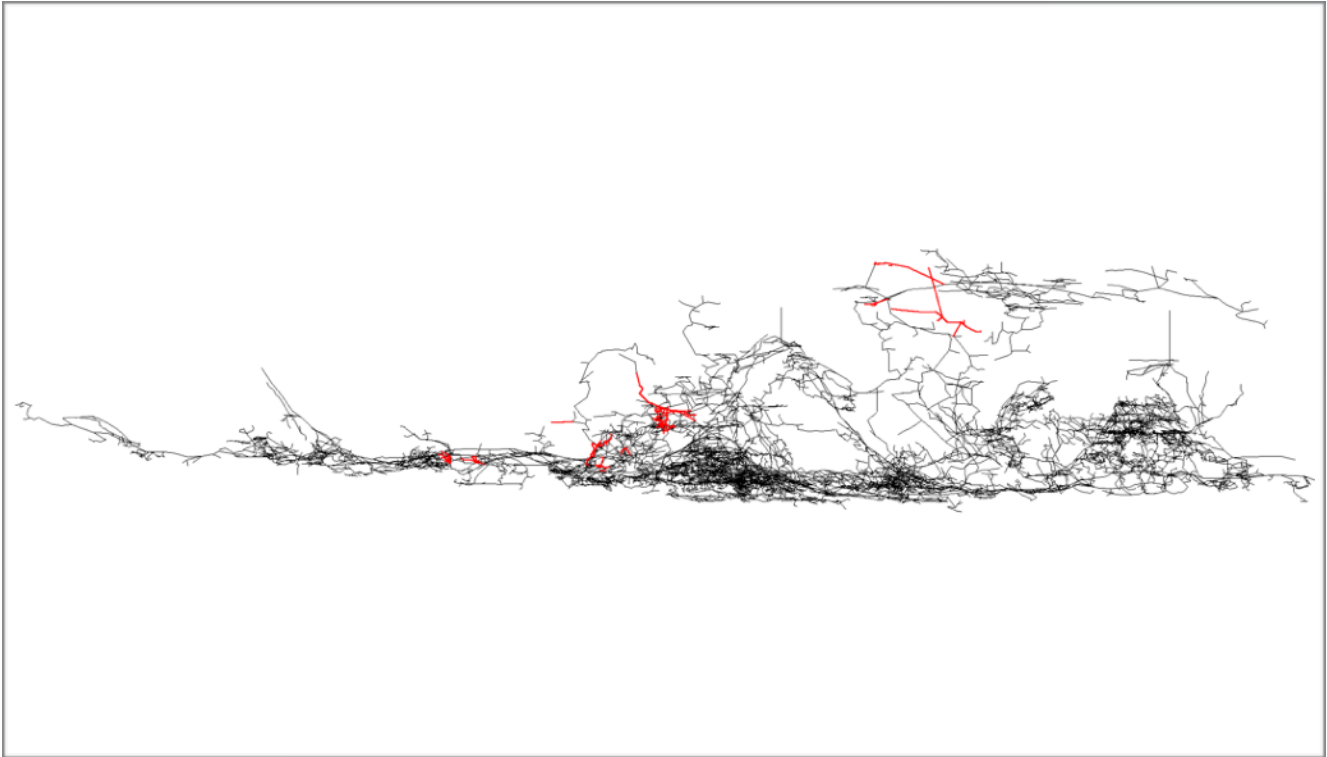
Maps

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 more than 4,400 feet of total survey including two aid climbs and a small breakout in Oz with several quality leads for a future expedition. 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. These goals were accomplished while maintaining the priorities of safety and resource protection.

Thanks to all of the expedition team members for their drive, humor, flexibility and hard work. Jean Krejca collected a large number of high quality photographs, and Jean, Dave and Heather produced accurate and detailed sketches.

Finally, thanks to Rod Horrocks 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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