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# Lechuguilla Cave Expedition Report

## Far West Expedition - February 25 - March 4, 2017

*submitted by: Derek Bristol - April 4, 2017*

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### Summary

This report summarizes the results of a ten-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 Red Lakes/Oasis, Oz, Keel Hall/Long Haul, and Wild Wild West. The results of the expedition included 6,160.7 feet of total survey; 5,887.5 feet of new survey, 230.7 feet of resurvey, and 42.5 feet of excluded survey. The expedition added 1.12 miles to the length of Lechuguilla Cave, which now stands at 141.94 miles.

### Expedition Goals and Accomplishments

The general expectations for this expedition were that teams would spend most of the allocated time mopping up unpleasant and unpromising leads in mazy breakdown areas such as Keel Hall, Long Haul, Outpost Room and Sanctuary. However, a technical climb completed on the first day of exploration, and the subsequent discovery of Zion shifted much of the focus to this area. Zion is a significant breakout on the southern edge of the west branch that also climbs nearly 500 feet above the Western Borehole. Additionally, a re-sketch of Oasis on the first survey day revealed many previously undocumented leads that led to an extensive boneyard maze under this large room that occupied teams for several days with many leads left to explore. Progress was made in completing some of the remaining leads in Keel Hall, Long Hall and the Wild Wild West. The team was very productive with several survey blunders corrected, a full detailed and accurate re-sketch of Oasis, and over a mile of new survey. 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 (EYWC, EYWH, EYWM, EYXF, EYWB, EYWD, EYWE, EYWF).* **Partially Completed**

The good but wet lead in Boomtown was not visited. There are still leads in the Red Tides area that are very close to this one and may preclude the need to cross the water. A team spent a day surveying leads near the Outpost Room adding to the EYWD survey and completing a few leads in the EYWC, EYWD and EYWM surveys. Many leads remain in this area.

2. *Survey horizontal leads in Sanctuary (EMG, EMGX, EMGH, EMH).* **Not Completed**

Due to discoveries early in the expedition, Sanctuary was not visited.

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3. *Climb and survey leads in Oz (EKT72, OC48, OC44, OC51, EKT87, OA2). **Partially Completed***

Two trips were made to Oz with only the pit at OC48 completed. The climb at OC44 was begun with some survey, but additional technical climbing is needed to further explore. The climbs at EKT72, EKT87, OC51, and OA2 were not attempted due to the climbing gear being moved to higher priority climbs that were discovered in Zion.

4. *Climb and survey leads in Red Lakes (IG19J, IG3, IG23, IG26, IG31). **Partially Completed***

Only the leads in Red Tides (3 of them off of the IG19 area) were done. One of these, a 70 foot aid climb named Rising Tides, led to a multi-level upper fissure with a pit that dropped down into a massive new area going away from known cave, called Zion. Approximately 3,000 feet of survey was accomplished (roughly half the total for the expedition) from this one lead with many additional leads remaining.

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

There was a possibility that a pit lead in Oz might connect to the top of this climb. This did not prove to be the case, and this lead should be pursued on a future expedition.

6. *Survey horizontal leads in Oz (OY, EKT, OC, OZ, EOZ). **Partially Completed***

A few of the horizontal leads were completed, but others remain. Additionally, several blundered shots that were identified by Erin Lynch as having bad FS/BS agreement were resurveyed.

7. *Continue work in Northern Exposure, Long Haul, and Keel Hall (IBDA, IBP, IBB). **Partially Completed***

The leads in the IBDA were completed. Several leads in the IBP were surveyed with a connection into the IBN and a very close tie to Velvet Underground in the IBB survey. Some of the leads in the western part of the IBB were also completed. No significant breakouts were made, but significant new passage and progress towards completion made.

8. *Survey leads in Mirage Room (IN, IH, IM, IMA). **Not Completed***

Discoveries elsewhere meant that there wasn't time to visit Mirage Room.

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***

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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), James Hunter (NM, sketcher, climber), Kevin Manley (CO, climber), Beth Cortright (NM, climber), Ian Chechet (MT, sketcher), Ellen Whittle (MT), Tammy Otten (OH), Blase LaSala (SD), and Pete Johnson (CO, climber). Six of the team members had previous experience in Lechuguilla Cave. It was the first Lech expedition for Ian, Ellen, Blase and Tammy. This is a large number of new people to bring on an expedition but we divided them onto teams with more experienced members, and everyone on the expedition was safe, careful and focused on the goals. There was a great group dynamic that is reflected in the expedition results. Ian, Ellen and Blase all did very well and should be welcomed back to Lechuguilla Cave in the future.



The 2017 Far West Expedition team in Deep Seas Camp (photo by Jean Krejca)

Tammy was excited and enthusiastic, and did a great job during surveys, but struggled a bit with the travel pace and heavy packs. She thought throughout the trip that this was due to a combination of the elevation and lack of conditioning, but since returning to civilization she has consulted with a doctor and is being treated for an irregular heart beat. A full diagnosis is still pending, but these issues need to get resolved before being considered for another expedition.

## Detailed Daily Reports

*Note: Trip leaders are underlined.*

**February 25, 2013 (Entering the Cave)**

Expedition members divided into three teams for the trip from the entrance to camp. James, Beth, Ian and Ellen rigged the entrance and started in at 15:00. Jean, Pete and Blase followed about an hour

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later. Derek, Kevin and Tammy brought up the rear another hour after Jean's team. All teams made the trip safely in times ranging from 3-4 hours. Once camp was set up, an orientation to the water source and the latrine procedures was given to the new team members and all seven Disto-X2s were calibrated before the team went to sleep around 22:00.

**February 26, 2017 (Oz, Oasis, Red Tides)**

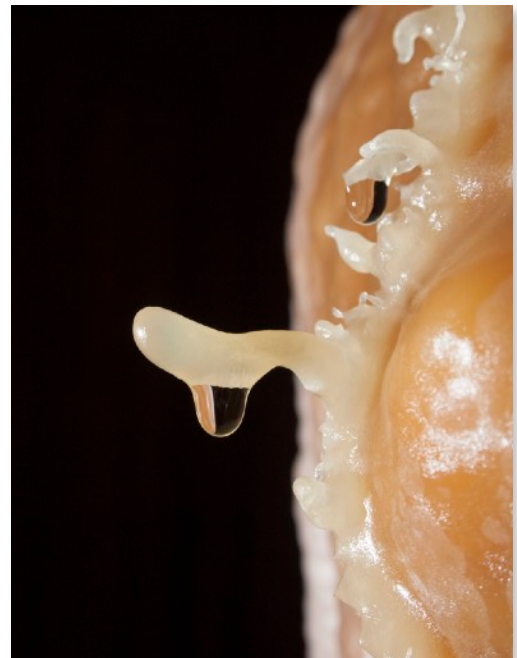
James, Beth and Pete left camp at 8:55 and traveled to Oz via the Kansas Twister and climbed the rope into the new area above the Wizards Elevator. They rigged the pit at OC48 but as Beth descended, station OB60, which is in the area below Yellowstone Falls, was immediately discovered and tied into with only one intermediate shot. A 60 foot rope was used to rig this pit, but after the tie-in the rope was de-rigged. The team then went to the dome lead at OC44 where James was able to free climb the first portion of the dome and rig the same 60 foot rope to a horizontal passage mid-way up the dome. This passage was surveyed to a dead-end pit in seven shots. A few leads remain in this area but a belay and climbing protection are needed to explore them. The team scouted The Nostril and the flowstone leads above EKT87 before returning to camp, arriving by 20:00. They surveyed 186.0 feet (174.3 feet of new, 11.7 feet redundant) in 9 shots.



The Rising Tides climb that led to the discovery of Zion. (photo by Jean Krejca)

The remaining team members all traveled together to Oasis via the Western Borehole, leaving camp at 9:30. The teams split up in Oasis. Jean, Blase and Tammy stayed in the Oasis room and re-sketched from EY97-101. A few new redundant shots were added and leads going down under the breakdown were discovered at EY105 and 106 that were later surveyed. 111.5 feet (0 feet new, 111.5 feet redundant) was surveyed in 3 shots using EY104-106.

Derek, Kevin, Ian and Ellen changed to clean clothes and shoes at the entrance to Red Lakes and climbed up to the newly discovered Red Tides area. The travel route up the flowstone in places is somewhat exposed and insecure, and the route was becoming impacted due to FMD, so a rope was later rigged to bypass these trouble areas. Once in Red Tides, Ian and Ellen surveyed the two side leads at IG19E and



Helictites in Zion. (photo by James Hunter)

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E, while Derek and Kevin led the technical climb above IG19H. The first 50 feet of the climb went through a chimney and up draperies and was free climbed with threads and cams for protection. The top of the climb lacked good features and had to be direct aided with one 3/8" bolt, one 1/4" bolt and a couple of bat hook placements. The 100 foot x 9 mm rope from Deep Seas camp was rigged to a good natural anchor and the team reunited to begin surveying up the climb. The top of the climb led to a high canyon with another climbing lead heading back east, a crawl going SE, and a FMD lined passage heading west that required a shoe change to follow. A total of 381.3 feet of total survey (350.8 feet new, 30.8 feet redundant) was accomplished in 13 shots. The teams met back up in Oasis and traveled back to camp together, arriving at 22:00.

*February 27, 2017 (Wild Wild West, Long Haul, Zion)*

James, Beth and Blase left camp at 9:25 and traveled out the Western Borehole to Long Haul where they took some time locating the IBB survey. The lead at IBB32 was killed with one shot. A lead at IBB35 was surveyed to a connection with IBB21. A lead at IBB23 was determined to connect to IBB18 and was too delicate to survey. A boneyard area at IBB15 was surveyed to a series of dead-ends before the team headed to camp, arriving at 20:05. A total of 219.5 feet of new survey was accomplished in 25 shots.



Large stalagmites in Zion. (photo by James Hunter)

Derek, Kevin, Ian and Ellen left camp at 9:30 and returned to the climb above Red Tides, named Rising Tides. A difficult chimney move that required changing to dirty boots was made above IG19T. A new survey designation was begun using IGF. The passage was narrow and very well decorated with a small pool, much flowstone, and some spectacular helictites. After a few survey stations the main fissure becomes clogged with formations but may continue. Ian rigged a rope to rappel into a small hole in the bottom of the fissure that opened into a very large and well decorated room. The rope drops to a ledge with exposed views of the room below. This flowstone covered ledge with its small pool was later named Angels Landing and the new area was named Zion. The rope was rebelayed to a stalagmite on the ledge and the survey was continued down a steep slope to the north. The survey was then taken clockwise around the large room and eventually up an over a large flowstone mound and into a much larger portion of the room towards the SW. The high point of the room has a large dome ceiling that was later climbed and is roughly 250 feet high, and the wide portion of the room has an average width of 170 feet with a ceiling height of 80 feet. The survey was ended as the room continued down a steep slope and where it became necessary to change from clean

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footwear back to dirty. The team returned to camp, arriving by 22:00. A total of 894.5 feet of new survey was accomplished in 28 shots.

Jean, Tammy and Pete left camp at 9:30 and traveled to Far Planetarium, up the rope, and onward to the Outpost Room. A pit lead at EYWD5 was surveyed for several stations and eventually tied back in near the Outpost Room to EYWC9, 11, and 14, as well as EYWM2 in the Outpost Room. A few side branches were surveyed in this area, but no new leads generated or left. The team returned to camp, arriving at 22:00. A total of 374.5 feet of new survey was accomplished in 32 shots.

### *February 28, 2017 (Zion)*

Following the major discovery of Zion on February 27 it was decided to take the entire team to this area to continue to push leads as well as take advantage of the photo gear brought by Jean and James to document the discovery. The team departed camp at 10:00 and traveled out to the changing area at the entrance to Red Lakes in the Oasis. A rope was rigged in Red Lakes to bypass the exposed climb that was both a safety and conservation concern. Additionally, a webbing hand-line was rigged at the climb above IG19T. James worked with Beth, Ian and Ellen on taking photos of the many draperies, flowstone and helictites. Jean worked with Kevin and Tammy likewise capturing many images of the well decorated room. Derek and Pete began surveying near the north side of Zion, eventually reaching a flowstone pit that would require additional rope to rig. They then continued surveying south in the big room into a dirty zone of very deep FMD. A few leads were left, including a promising continuation going south beyond IGF32. The survey was brought back around the east side of the room and tied back into IGF22. The team left in stages, all returning to camp by 22:15. Many amazing photographs were captured along with 626.1 feet of new survey in 11 shots.



Angels Landing in Zion. (photo by James Hunter)

### *March 1, 2017 (Zion, Oz, Oasis)*

Tammy wasn't feeling well and attributed her fatigue to the altitude. She opted to spend the day in camp resting and recovering.

James, Kevin and Beth departed camp at 9:05 and traveled to Zion together. The tail of the 9mm rope rigged at Rising Tides was cut off and used to re-rig the top of the anchor at Angels Landing. An additional 40 feet of 11mm rope was attached to this 9mm anchor with a maillon, which preserved some of the remaining rope for other rigging needs. After lunch, James began the flowstone dome lead above IGF17 using a mix of free and aid climbing moves. About 80 feet up an anchor was set at a large ledge with incredible draperies. James then led another 40-50 feet to a smaller ledge out to the

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right side of the drapery decorated ledge. Several side alcoves were explored on belay, but these were all blind. Fixed ropes were descended back to the ground and the team departed for camp, arriving by 20:20.

Jean, Pete and Blase left camp at 9:30 and traveled to Oasis via the Western Borehole. They returned to leads in the floor of Oasis at EY104-106. A hole down at EY104 was surveyed to an extensive breakyard/ boneyard complex. Several holes were found that connected back up into Oasis, but many new leads were discovered, though nothing extended beyond the perimeter of the Oasis Room. Several pit leads were left that go to a lower boneyard level. The team returned to camp, arriving at 21:00. A total of 358.1 feet of new survey was accomplished in 32 shots.



Giant formations in Zion. (photo by James Hunter)

Derek, Ian and Ellen departed camp at 9:30 and traveled to Oz via the Kansas Twister. Half way up the dome a detour was taken to resurvey shots in the EKT33-44 range. Several of the high angle shots in this area had poor FS/BS agreement, and each of these blunders was corrected with new survey shots. Once arriving in Oz, the team proceeded to leads in a small room at EKT92. Both of these leads were surveyed to dead-ends. The team then went to Yellowstone Falls where a lead in the floor at OB37 was surveyed in a single shot, but no continuing passage located. A lead along the wall in the

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original pit remains and will require a technical lead climb. It is a little too far to swing into with the existing rope. The team then traveled to the Wizards Elevator area where blundered shots at OC34! to OC35 and OC1 to OC3 were resurveyed. Additionally, a breakdown area near EOZ12 was investigated to see if there is a shorter route to the area around OC51, but no connection was found. A 30 foot dome above EOZ12 was surveyed but is blind at the top. The team then descended the first few pitches of Wizards Elevator to an exposed and loose fissure near the rebelay bolt at OC21. A few shots were taken into this fissure where it gets low and tight. The continuing lead did not look promising, but it couldn't be ruled out entirely. The team returned to camp, arriving by 23:00. There were some close calls with loose rock near the top of Wizards Elevator, and teams returning to this area should use caution. A total of 489.5 feet of survey (381.6 feet of new, and 107.9 feet of resurvey) was accomplished.

*March 2, 2017 (Zion, Keel Hall)*

James, Ian, Ellen and Tammy departed camp at 9:45 and traveled to Keel Hall via the Western Borehole. A lead at IBN8 was surveyed with a single shot. A lead at IBN10 went to a lower level and continued for quite a distance before tying into IBP29 through a very delicate aragonite coated area, and later looped back to IBN10. Two new leads were generated in the area. The team spent some time on the way back to camp repairing orange trail flagging in the Western Borehole and near Lake Louise before arriving at camp by 21:10. A total of 491.4 feet of new survey in 36 shots.



Pool and draperies in Zion. (photo by Jean Krejca)

The rest of the team departed camp at 10:10. Derek and Kevin returned to the climb started by James, which was named Space Shot after the multi-pitch classic in Zion National Park. Derek led a heavily decorated pitch past a section of delicate draperies that ended on a large ledge with good natural anchors using a mix of free and aid climbing techniques. Another pitch was led with entirely free climbing and natural anchors to a ledge with a heavily corroded stalagmite and a continuing flowstone lead above. At this point in the climb there was a concern that the static rope (9mm x 250



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foot) might not reach back to the ground. An anchor was set using natural features and the climb was descended with one rebelay established on a stalagmite that is about 100 feet below the top. The static rope just barely reached with about 5 feet left on the ground. The climb was re-ascended and surveyed using IGF17A-C.

Jean, Pete, Blase and Beth rigged the flowstone pit at IGF29 with the 11mm x 120 foot rope, and surveyed a lower level in clean gear. A middle level was surveyed along with a few even lower level fissures, but several small leads going up and down from the middle level were left. The group met back up with the climbing team and they traveled back to camp together, arriving by 23:15. A total of 642.9 feet of new survey was accomplished in 27 shots.



Zion! (photo by Jean Krejca)

*March 3, 2017  
(Zion, Oasis, Keel Hall)*

Derek, Blase, Tammy and Ian departed camp at

10:00 and traveled to Keel Hall via the Western Borehole. They stopped at EY90 and located a blundered shot at EY90B-C that was resurveyed. They then continued to the climb-down into Northern Exposure to begin pushing leads. Two leads marked at IBDA13 were not leads. One immediately cut under the ceiling to connect back to IBDA8 and the other is not a lead but a wall. A lead at IBP5 was surveyed in two shots to tie into IBP17. Then a loop was surveyed from IBS2 back around to tie back into IBP5 again. Another spur of the IBS survey went back up into Keel Hall and tied into IBP1. After traveling a bit south, a lead at IBP22 was surveyed in three shots to tie into IBN49. A couple of dead-ends were surveyed off of IBP21 and IBN95. Further south, near Long Haul, a lead off of IBP40 was surveyed a good distance with several side leads left and eventually tied into IBP43 in Long Haul. The team returned to camp, arriving at 21:30. A total of 573.4 feet of survey (562.1 feet new, and 11.7 feet of resurvey) was accomplished in 42 shots.

James, Ellen and Ian departed camp at 9:50 and traveled to Zion via the Western Borehole and Red Lakes. They ascended the fixed rope to IGF17C and James led the flowstone wall above for about 100 feet in rope length to a dead-end. A 11mm x 120 foot static rope was rigged to natural anchors and the climb surveyed. The team then surveyed a horizontal lead at IG17C that went to a small but well decorated room with an eleven foot long soda straw. Photos were taken here as well as the drapery

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ledge along the rappel route back to the ground. They returned to camp, arriving by 18:30. A total of 173.1 feet of new survey was accomplished in 5 shots.

Jean, Kevin and Pete departed camp at 10:00 and traveled to Oasis via the Western Borehole. They returned to the boneyard/breakyard complex under Oasis and continued the EY survey designation. Many interesting crinkle blisters were seen and clean gear is needed to explore some areas. Many stations were set and many new leads identified. There is a significant amount of work yet to be done in this area. They returned to camp, arriving by 21:30. A total of 388.5 feet of new survey was accomplished in 38 shots.



Draperies on Space Shot climb. (photo by James Hunter)

### *March 4, 2017 (Exiting the Cave)*

The teams left camp in separate groups of three or four with James, Beth, Ian and Ellen leaving first at around 8:00, Jean, Pete and Blase left about an hour later, and Derek, Tammy and Kevin left only 15 minutes after Jean's team. Tammy was moving relatively slowly so some of her weight was redistributed, and all teams were able to exit within 3-4 hours. No problems were encountered with any of the rigging or the airlock.

## Conservation

- There were areas within the clean zone of Red Lakes where FMD was being tracked. Some new tracking of FMD was caused during this expedition on the exposed climb up to the upper lake in Red Lakes. A rope was rigged to improve safety and reduce the FMD tracking issue, but the area would benefit from some restoration.
- Boot/clean shoe changing areas were established between IG19T and IGF1 where it is necessary to put on dirty shoes to cross a FMD covered climb, and then immediately change back into clean shoes to continue on into Zion.
- Orange flagged trails were established through Zion for both safety and to isolate any impact.

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- Bright lights were used to thoroughly sweep the Deep Seas camp and latrine area for micro-trash and other contaminants before departing.

## Rigging

It was noted that where the 230 foot rope is rigged at the bottom of Kansas Twister, there are now two butterfly knots at the first rebelay to isolate worn spots in the rope, along with two rope pads. The rope pads should be replaced by a single larger pad (18" wide x 4' long), and this section of rope should also be replaced at some point.

One 3/8 x 2 inch SS wedge bolt was placed for protection during the Rising Tides aid climb in Red Tides. Both the bolt and hanger had to be left. A 1/4 x 1.5 inch bolt was also used on this climb with the hanger later removed. No other fixed hardware was used to complete climbs in Red Tides, Zion or Oz.

A core shot was discovered in the ABCs Room access rope that was hidden from view behind the large natural anchor. James cut out the bad spot, re-rigged the natural with one piece of the rope and padded it, and connected the two pieces of rope back together with a double fisherman's knot. The knot is above the region needed for climbing or descending, but this rope could be replaced in the near future.

A 250 foot x 9 mm PMI Pit rope was brought into the cave for use in rigging any new climbs. This was rigged near the top of the Space Shot climb in Zion. Many other ropes from Deep Seas Camp were used in Red Tides and Zion. An accounting of all new rigging is found in the table below along with an inventory of bolting hardware left in Deep Seas Camp.

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



Formation area near the top of Space Shot. (photo by James Hunter)

## Rope Log (March, 2017)

Rope Location	Nearest Survey Station	Rope Length (ft)	Rope Diameter (mm)	Date Rope was New	Condition	Comments
Zion	IGF17C	250	9	2017	New	Brought into cave in 2017. Rigged in Space Shot climb.
Zion	IGF17E	125	11	2016	Good	Rigged at top of Space Shot. Brought from Deep Seas Camp.
Red Tides	IGF5	20	9	2016	Good	Rigged at top of Angels Landing to stals. Cut from tail of rope rigged at IG19R.
Red Tides	IG19R	80	9	2016	Good	Rigged at Rising Tides climb. Brought from Deep Seas Camp. Cut from 100' piece.
Red Lakes	IG12	70	11	2016?	Okay	Rigged in Red Lakes. Brought from Deep Seas Camp.
Oz	OC59	60	11	2016?	Good	Rigged in dome above OC44. Brought from Deep Seas Camp.
Zion	IGF6	40	11	2016	Good	Rigged to rope at IGF5 with maillon. Main rope into Angels Landing.
Deep Seas Camp	EC41	40	11	2005	Dirty	Not used.

## Hardware Log (March, 2017)

Hardware Location	Type	Size	Quantity
Deep Seas Camp	Powers Wedge SS Bolt	3/8 x 2 inch	9
Deep Seas Camp	Powers Wedge SS Bolt	3/8 x 3 inch	5
Deep Seas Camp	Fixe Single Wedge SS Bolt	3/8 x 3 inch	4
Deep Seas Camp	Fixe Double Wedge SS Bolt	3/8 x 3.75 inch	2
Deep Seas Camp	SS Bolt Hanger	10 mm	15
Deep Seas Camp	Maillon Rapide SS	8mm - long	5
Deep Seas Camp	Maillon Rapide SS	8mm - standard	4

## Safety

There were no significant safety incidents of note. 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.



Draperies in Zion. (photo by James Hunter)

Completed Leads (February, 2017 Lechuguilla Cave Expedition)						
Section	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
H36/H37 - Oz	Oz	OC44	30	up	10x8	surveyed with OC59-65, leads remain
H36/H37 - Oz	Oz	OC48	5	E, down	6x15	surveyed with OC58, tied into OB60
I35 - Keel Hall	Red Tides	IG19E	5	W	8Wx12H	surveyed with IG19L-M
I35 - Keel Hall	Red Tides	IG19F	5	NE	6Wx10H	surveyed with IG19N-P
I35 - Keel Hall	Red Tides	IG19H	70	up	20Wx10H	surveyed with IG19Q-W
I35 - Keel Hall	Long Haul	IBB32	10	SW		surveyed with IBB32A
I35 - Keel Hall	Long Haul	IBB35	5	NW		surveyed with IBB43-50
I35 - Keel Hall	Long Haul	IBB15	7	N		surveyed with IBB51-63
I35 - Keel Hall	Wild Wild West	EYWD5	10	W, down		surveyed with EYWD12-38
I35 - Keel Hall	Outpost Room	EYWC9				surveyed with EYWD12-38
I35 - Keel Hall	Outpost Room	EYWC11				surveyed with EYWD12-38
I35 - Keel Hall	Outpost Room	EYWC14				surveyed with EYWD12-38
I35 - Keel Hall	Outpost Room	EYWM2	0	up	2x2	surveyed with EYWD12-38
I35 - Keel Hall	Oasis	EY104	5	down	2Wx2H	surveyed with EY110-176
H36/H37 - Oz	Oz	OC21				surveyed with OC21A-C
H36/H37 - Oz	Oz	EOZ12	30	up	8x6	surveyed with EOZ12A
H36/H37 - Oz	Oz	EKT92	20	N, down	4Wx2H	surveyed with EKT92A-C
H36/H37 - Oz	Oz	EKT92	20	N, up	6Wx2H	surveyed with EKT92D-H
H36/H37 - Oz	Oz	OB37	20	down	4Wx2H	surveyed with OB37A
I35 - Keel Hall	Keel Hall	IBN8				surveyed with IBN8A
I35 - Keel Hall	Keel Hall	IBN10				surveyed with IBN77-105
I35 - Keel Hall	Keel Hall	IBP29				surveyed with IBN77-105
I35 - Keel Hall	Northern Exposure	IBDA13	5	NE		determined to be a cut-around to IBDA8
I35 - Keel Hall	Northern Exposure	IBDA13	5	S		no lead found
I35 - Keel Hall	Northern Exposure	IBP5				surveyed with IBS1-18
I35 - Keel Hall	Northern Exposure	IBP8				surveyed with IBS1-18
I35 - Keel Hall	Northern Exposure	IBP17				surveyed with IBS1-18
I35 - Keel Hall	Keel Hall	IBP22				surveyed with IBS19-20
I35 - Keel Hall	Keel Hall	IBP29				surveyed with IBS21
I35 - Keel Hall	Keel Hall	IBP29				surveyed with IBS22-23
I35 - Keel Hall	Keel Hall	IBP40				surveyed with IBS24-35

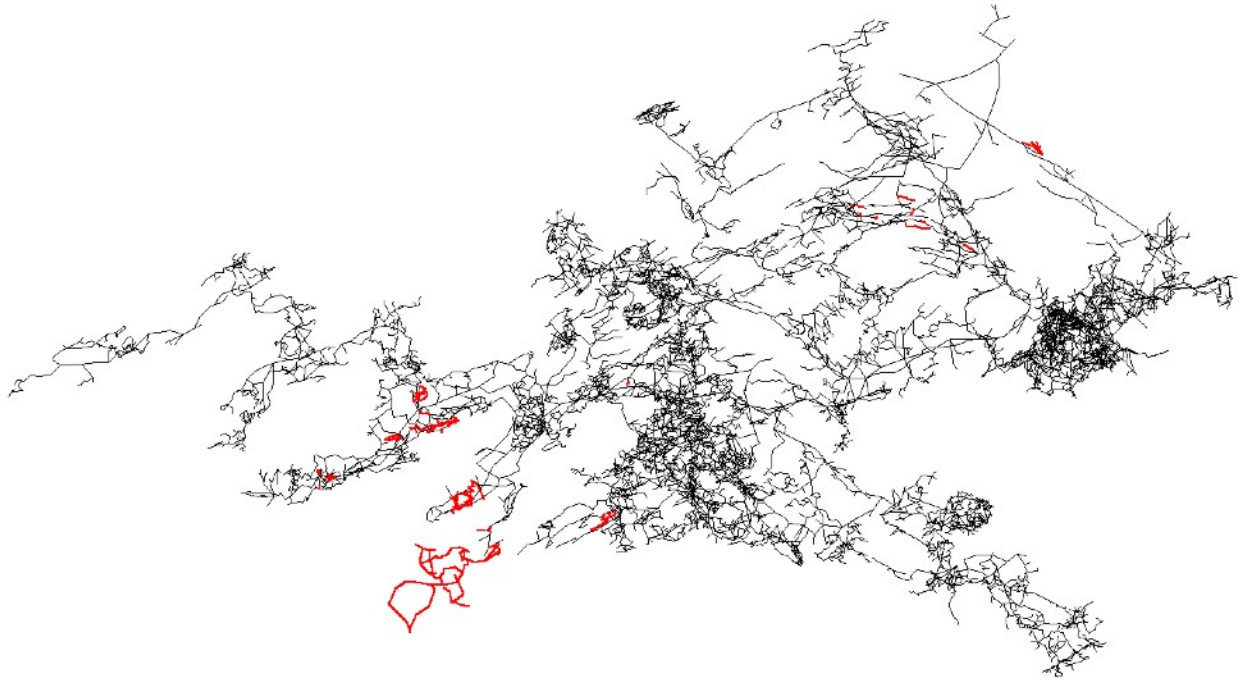
New Leads (February, 2017 Lechuguilla Cave Expedition)						
Section	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
H36/H37 - Oz	Oz	OC21C	5	E	4Wx1H	tight breakdown lead with gypsum
H36/H37 - Oz	Wizards Elevator	OC59	20	up	4Wx4H	hole in ceiling continues up
H36/H37 - Oz	Wizards Elevator	OC59	20	up	4Wx4H	horizontal passage requires climbing protection
H36/H37 - Oz	Wizards Elevator	OC60	15	up	2Wx2H	very tight tube, requires climbing to reach
I35 - Keel Hall	Keel Hall	IBN77	8	N	4Wx2H	into breakdown
I35 - Keel Hall	Keel Hall	IBN83	10	NW	2Wx2H	into breakdown
I35 - Keel Hall	Long Haul	IBS27	5	up	2Wx2H	small hole up
I35 - Keel Hall	Long Haul	IBS28	8	SE	3Wx2H	lead in breakdown
I35 - Keel Hall	Long Haul	IBS31	6	NW	4Wx2H	lead in breakdown
I35 - Keel Hall	Long Haul	IBS33	6	NW	4Wx4H	lead in breakdown
I35 - Keel Hall	Oasis	EY111	5	N, down	2Wx2H	pit lead
I35 - Keel Hall	Oasis	EY112	5	S, down	2Wx2H	pit lead
I35 - Keel Hall	Oasis	EY117	5	down	2Wx2H	pit lead
I35 - Keel Hall	Oasis	EY125	5	NE, down	2Wx2H	pit lead
I35 - Keel Hall	Oasis	EY137	4	S	4x2	pit lead
I35 - Keel Hall	Oasis	EY138	5	NE	4W	wall not defined
I35 - Keel Hall	Oasis	EY139	8	N	15W	wall not defined
I35 - Keel Hall	Oasis	EY139	5	SW	3x2	pit lead
I35 - Keel Hall	Oasis	EY141	5	NE	3x2	pit lead
I35 - Keel Hall	Oasis	EY142	12	SE, up	3W	lead
I35 - Keel Hall	Oasis	EY143	8	E	6x3	pit lead
I35 - Keel Hall	Oasis	EY149	10	S	2x1	crawl lead, requires crossing delicate pool
I35 - Keel Hall	Oasis	EY152	4	N	4x2	lead in boneyard
I35 - Keel Hall	Oasis	EY156	10	NE	2x1	very tight
I35 - Keel Hall	Oasis	EY157	5	E	4x2	goes to main route in Oasis Room, not surveyed
I35 - Keel Hall	Oasis	EY158	8	N	4x2	dome lead
I35 - Keel Hall	Oasis	EY161	4	N	2x1	tight lead going up
I35 - Keel Hall	Oasis	EY164	4	NE	4x2	pit lead
I35 - Keel Hall	Oasis	EY174	12	NE	6Wx1H	tight crawl
I35 - Keel Hall	Oasis	EY175	6	W	6x2	pit lead, 10 ft deep, free climbable
I35 - Keel Hall	Oasis	EY176	10	SE	2x2	goes up, unexplored
I35 - Keel Hall	Red Tides	IG19T	15	NW	12Wx8H	high CR lead that parallels the main IGF survey
I35 - Keel Hall	Red Tides	IG19V	20	SE	2Wx1H	tight crawl ("Mutton Buster") opens to room
I35 - Keel Hall	Red Tides	IG19W	40	E	3Wx15H	technical free climb above Rising Tides climb
I35 - Keel Hall	Red Tides	IGF3	10	NE	10Wx6H	high CR lead that likely connects to IG19T
I35 - Keel Hall	Red Tides	IGF5	10	W	2Wx6H	formation choked fissure - may continue beyond pit
J35 - Zion	Zion	IGF17	40	W, up	10Wx10H	technical climb up flowstone into CR fissure
J35 - Zion	Zion	IGF22	20	NE, down	10Wx4H	popcorn fissure going down along north wall
J35 - Zion	Zion	IGF30	60	S	50Wx30H	large depression in floor of room needs explored
J35 - Zion	Zion	IGF32	10	SE	20Wx3H	passage continues low following flowstone
J35 - Zion	Zion	IGF33	20	NE, up	5Wx3H	possible high technical leads along east wall of room
J35 - Zion	Zion	IGF34	25	E, up	8Wx5H	lead along east wall may require technical climb

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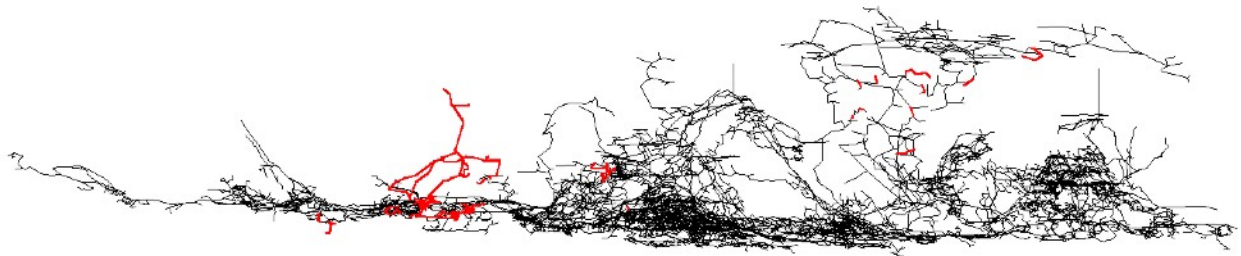
## Maps

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:



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## Conclusions

The expedition was very successful in accomplishing many of the goals set out in the proposal, resulting in more than 6,160 feet of total survey including two aid climbs and a significant breakout in Red Tides 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. Special thanks to Jean Krejca and James Hunter who had to sketch nearly every day, and also managed to take exceptionally high quality photos.

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,  
Derek Bristol  
7744 Gunsight Pass  
Littleton, CO 80127  
(303) 589-4469  
derekbristol@gmail.com