

Lechuguilla Cave Expedition Report

Far West Expedition

October 22-29, 2011

Summary

This report summarizes the results of a seven-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 and included new survey, re-sketching, and blunder correction in the Promised Land (H34), Zanzibar (H35), Rainbow Room (I34) and Keel Hall (I35) quadrangles. The results of the expedition included 5,286.9' of total survey; 4,162.8' of new survey and 1,124.1' of redundant and re-survey. Additionally, detailed sketches of Zanzibar, Long Haul and the Oasis Pool Room were drawn. The expedition added 0.79 miles to the length of Lechuguilla Cave and corrected a number of errors and omissions in older survey data and sketch notes.

Expedition Goals and Accomplishments

Each goal from the expedition proposal is in italics. A summary of the results follows.

PRIMARY GOALS:

1. *Survey leads in Congo and the Jungle (N32-47), Sparadise and Eden (N21,24) and resolve sketch problems with NA9 boneyard maze. **Partially Completed***

Leads at N48 and N47 were not leads and will be removed from the map. Over 1,000' was surveyed along the north and south side of the Congo between N64 and N66 including an obscure passage that extends NW, going off the edge of the known cave. Leads at N36 led to a boneyard maze complex under the Promised Land where nearly 500' was surveyed with a couple leads left for future work. The lead south of N34 was not explored. The lead at N32B is simply a hole through breakdown that connects to N54!, but no additional passage is present and survey was unnecessary. The lead south of N21 connects into the Apple Orchard. This short visual connection will be sketched and not surveyed to avoid unnecessary impact on the flowstone covered crawl. Time did not allow survey of the leads at N24K in Eden or a re-sketch of the NA9 maze in Sparadise.

2. *Survey leads in the SW corner of Zanzibar (IBHB and IBHC surveys). **Partially Completed***

The leads and passage at IBHC5-6 and IBD74 were not surveyed. It was determined that the lead at IBHB10 had been previously explored and surveyed and can be considered "too-tight" and without airflow.

3. *Correct all remaining loop errors in Keel Hall quad. **Completed***

All five loops in Keel Hall with error > 2.0 s.d. were investigated and the blunders were identified and corrected. A field check using a Palm computer and Auriga software verified that all of these loops now have errors of <1 s.d. Some analysis of the data around the Mirage Room and Wild, Wild West is needed to confirm there are no more bad loops.

4. *Re-sketch middle and southern portions of Zanzibar, west wall of Birthday Present and Long Hall north half. **Completed***

The entire Zanzibar room, west wall of the Birthday Present, and the entire Long Hall (from IBA3-12) were re-sketches with a high level of precision and detail. This will replace several previous surveys that left significant gaps in the sketch notes or lacked adequate detail for modern cartography standards. This isn't a quantitative accomplishment in terms of survey footage, but it's critical to completing a high quality map of the area.

5. *Survey leads along the IBD survey from Keel Hall to Zanzibar (IBD6-17, IBD37-41).* **Completed**

Leads at IBD16, 18, 25, 41 and 45 were surveyed to completion. The room indicated at IBD15 was correctly located and surveyed.

6. *Survey leads on N and NW side of Keel Hall (IBEA, IO18, IH4-10, IM14).* **Partially Completed**

The lead at IO18 was climbed and there is no passage to survey. The leads from IBEA5-21 were checked and did not go. There are still leads at IBE9, IBEA2, IH4, IH10 and IM14.

7. *Survey leads at W side of Rainbow Room and Long Haul (IBAA, IBC, IBA22, IBQ, IBA12, IBG, IBA4).* **Partially Completed**

IBAA was explored but no leads were found. IBC was not located or investigated. The lead at IBA22 didn't go. Leads in the IBQ, IBA12 and IBG surveys were surveyed to completion with the exception of a lead at IBQ29 that was too delicate. The lead at IBA4 was investigated and should be surveyed but time did not allow it on this expedition.

SECONDARY GOALS:

1. *Survey leads in lower levels of Mirage Room (IFF, ID and IN surveys).* **Not Completed**

This area was not visited.

2. *Check for leads and re-sketch east side of Birthday Present maze.* **Not Completed**

This area was not visited.

3. *Verify passages marked as "too-tight" and look for climbing leads while in Promised Land.* **Partially Completed**

No climbing leads were observed in Promised Land. The "too-tight" passage at N30B was not visited. There may be additional passage hidden under breakdown in the middle of the Congo. Only the walls were pushed.

OTHER ACCOMPLISHMENTS:

Several other survey and exploration activities took place during the week in the areas of study.

1. It was discovered just prior to the expedition that several surveys in Oasis, including the original discovery in 1988, failed to complete the survey or sketch of the Oasis Pool Room beyond EY103. Since the expedition team was already equipped with a full set of clean gear for planned trips to Promised Land, the Cave Resources Office granted permission and this area was finally completed.

2. Several climbing leads were noted in Keel Hall and Long Haul during the course of other survey activities in these areas. These leads were documented along with technical climbing requirements and photographs (see Far West Climbing Leads).
3. John Lyles discovered an old email indicating a lead at IBB6, under the Long Haul, that was subsequently surveyed and yielded ~600' of passage in aragonite coated boneyard.
4. A lead at IEB32 in Paris, TX was surveyed and yielded over 100' of new passage with a few new leads.

Team

Several original team members had serious family health emergencies within 3 weeks of the expedition resulting in some uncertainty in finding qualified replacements. One alternate was identified less than 48 hours prior to departing for Carlsbad, but in the end a full team of seven skilled project cavers was fielded. Team members included Derek Bristol (CO, expedition leader, sketcher), Andrea Croskrey (TX, sketcher), Jennifer Foote (NM), Heather Levy (LA, sketcher), John Lyles (NM), David Ochel (TX, sketcher), and Adam Weaver (SD). Five of the team members had previous experience in Lechuguilla Cave, while it was the first trip for David Ochel and Adam Weaver. Both of these cavers are physically strong, skilled in rope work, experienced surveyors and caved softly and safely. They would be strong contributors to any future expeditions. This was also the first Lechuguilla camp trip for expedition leader Derek Bristol. Significant logistical support and advice was provided to the EL by John Lyles, who has been on over 30 Lechuguilla camp trips. The team worked extremely well together and accomplished a significant amount of work given the size of the team and distance traveled each day to reach objectives.

Detailed Daily Reports

10-22-2001 (Entering the Cave)

JL, HL, AW and DB rigged the entrance and entered the cave at 13:00. The cave resources office warned of some recent difficulty unlocking the air-lock outer door. More than 20 minutes was spent trying to open the deadbolt. The bolt would turn about half way before resistance stopped it from retracting enough to open the door. The key would bend and felt as though it was on the verge of breaking-off in the lock cylinder. After a significant effort and discussion about returning to the cave resources office for help, the bolt was retracted just enough to clear the strike plate. The team signed in at 13:30 and proceeded to camp. DB carried a new 11mm x 180' static rope to replace the last rope at the bottom of the Great White Way. Short rests were taken at the bottom of Boulder Falls and EF Junction. The rope at the bottom of the Great White Way was replaced and the rigging modified slightly (see rigging section). The old rope was determined to be in good condition so it was carried the rest of the way to camp where it was left as a push rope for future exploration. The team arrived in camp at 16:20 (2:50 travel time, including 0:20 to replace the rope).



Adam Weaver at the Entrance

DO, AC and JF entered the air-lock at 14:20 and proceeded to camp without incident, arriving at 18:10 (3:50 travel time).

10-23-2011 (Zanzibar re-sketch and Promised Land)

Both teams were up at 7:00 and left camp at 8:50. JL led the way through Northern Exposure to Zanzibar where AC, JF and DO remained to re-sketch the room from IBD45-56, and from IBDB1-11. Stations IBR1-6 were added to help fill in missing detail. This re-sketching effort helps fill in some missing gaps in the original surveys where separate teams failed to overlap their sketches. It also resolves issues along the south side of Zanzibar where there were inconsistencies in the location of the cave wall from different surveys. 159.7' of redundant survey and no new survey were added.

The team of DB, JL, HL and AW headed to Promised Land, making a change to clean clothes at IBL2. Clean clothes were worn through Nativity Chamber, Apple Orchard, Eden and Billiard Parlor, with a quick change back to dirty boots and gloves for 50' at the transition between the Apple Orchard and Eden. Dirty gear was put on near the pool fingers at station N33 and the team went to the west end of Congo. The high level area that ends at N56 was investigated. There are



Photo: D. Bristol

Clean route through Promised Land

a number of gypsum coated rims along the climb up to this area, possibly indicating airflow, but no airflow was detected in the passage above. All possible leads were pushed and no continuing passage was found. The lead NW of N48 is just a wall alcove and did not warrant a survey shot. The lead south of N47 is just a slot between breakdown blocks that does not go to new passage. These leads will be removed from the lead list and map. DB and JL followed the north wall of the Congo looking for possible missed leads while HL and AW followed the south wall. JL found a low fissure about 100' east of N64

along the north wall that was continuing. At the same time DB found walking sized passage below the same point (i.e. north of N41) going NW and accessed through an obscure series of squeezes through breakdown. A survey was begun using N64 as a tie-in and going into the new walking size passage. Stations N78-103 were added in this area. Several side leads were noted and all were surveyed to completion for a total of 503.1' of new survey. Two leads required an exposed climbing move going up into a steeply angled onion skin layer, where the leads reconnected. This steep layer was climbed to a 9" constriction that led back into the Congo about 30' east of N79. This passage is very difficult to negotiate and was not surveyed but will be sketched on the map. A distinct ledge near the north wall of the Congo splits the passage somewhat and the original survey estimated the wall location and lacked detail. Using N64 as a tie-in again, the north wall of the Congo was surveyed using stations N104-109 and tying into N66 on the east end adding 274.4' of new survey, with no new leads. A short side passage south of N41 was surveyed using N110-116, adding 193.7' of new survey. Finally, leads heading down near N36 were investigated and a survey begun adding 51.2' of new survey with good leads left for later in the week. A total of 1022.4' of new survey was added for the day.

The Zanzibar team arrived back in camp at 22:00 and the Promised Land team returned at 2:00 on 10/24.

10-24-2011 (Loop Error Corrections in Paris, TX and Keel Hall)

Both teams were up at 10:30 and left camp at 12:30. The teams traveled together to Huapache Highway and entered Paris, Texas near EY92 and traveled to IEB26 in the boneyard maze. Here the teams split-up and checked a number of shots in three different blundered loops with s.d. > 2. The blunder in Loop 1 (Compass Far West loop #305) was a distance recording error in the IEC19-IEC20 shot. It was originally recorded as 12.9', but was re-measured to be 21.9'. This reduces the loop error from 3.51 s.d. down to 0.42 s.d.

BAD LOOP 1 (#305 in Compass)								
		Old Data (3.51 s.d. error)			New Data (0.41 s.d. error)			
From	To	Tape (ft)	Compass	Clino	Tape (ft)	Compass	Clino	Comment
IEC7	IEC8	19.8	248.0	2.5	19.9	248.0	3.0	
IEC8	IEC9	8.3	195.0	-5.0				
IEC9	IEC10	7.6	193.0	1.0				
IEC10	IEC11	14.9	184.0	-7.5				
IEC11	IEC12	9.0	97.0	-2.0				
IEC12	IEC13	20.1	212.0	11.0	20.2	213.0	11.5	
IEC13	IEC14	7.7	70.5	-23.0				
IEC14	IEC15	13.6	74.5	-2.0				
IEC15	IEC16	13.0	18.0	-40.5				
IEC16	IEC17	9.6	0.0	-90.0				
IEC16	IEC18	17.9	74.0	23.0				
IEC18	IEC19	12.6	320.5	30.0				
IEC19	IEC20	12.9	33.0	-1.0	21.9	35.0	-2.0	Change in distance is blunder
IEC20	IEC21	8.5	240.0	-6.0	8.6	240.0	-5.0	
IEC21	IEC22	16.7	334.0	-4.0	16.8	333.5	-4.5	
IEC22	IEC7	5.4	255.0	-11.0	5.3	255.0	-9.5	

The blunder in Loop 2 (Compass Far West loop #379) was a clino recording error in the IEB79-IEB82 shot. The original survey recorded this value as -16.0 deg, but it was changed during data entry to 0.0 deg because the profile sketch showed no inclination. The shot was verified as -15.0 deg. This reduces the loop error from 3.43 s.d. down to 0.43 s.d.

BAD LOOP 2 (#379 in Compass)								
		Old Data (3.43 s.d. error)			New Data (0.43 s.d. error)			
From	To	Tape (ft)	Compass	Clino	Tape (ft)	Compass	Clino	Comment
IEB78	IED21	10.5	299.0	0.0				
IED21	IED22	15.5	250.0	-27.0				
IED22	IED23	4.4	214.0	-20.0				
IED23	IEB82	4.8	287.0	5.0				
IEB78	IEB79	12.3	231.0	-13.5				
IEB79	IEB82	21.0	284.5	0.0			-15.0	original data was good

The blunder in Loop 3 (Compass Far West loop #352) was a tie-in error due to changes in direction of the IEC survey sequence. The original loop sequence went IEB27→IEB26→IEC3→IEC5→IEC6→IEC7→IEC8. The correct sequence is IEB27→IEB26→IEC3→IEC5→IEC7→IEC8. Changing the IEC6-IEC7 shot to read IEC5-IEC7 reduces the loop error from 2.59 s.d. to 0.75 s.d.

BAD LOOP 3 (#352 in Compass)								
		Old Data (2.59 s.d. error)			New Data (0.75 s.d. error)			
From	To	Tape (ft)	Compass	Clino	Tape (ft)	Compass	Clino	Comment
IEB26	IEB27	11.3	250.0	-11.0	11.2	249.0	-11.0	
IEB27	IEB28	16.8	239.0	-7.0	16.7	240.0	-7.0	
IEB28	IEB29	14.3	226.0	14.0				
IEB29	IEB30	6.9	298.0	17.0				
IEB30	IEB31	13.8	325.0	-24.0				
IEB31	IEB32	18.2	249.0	-33.0				
IEB26	IEC3	18.5	76.0	-14.0	17.9	76.0	-16.0	
IEC3	IEC5	4.2	119.0	-12.0	4.1	124.0	-13.0	
IEC5	IEC6	7.3	58.0	-16.0				not part of loop
IEC6	IEC7	25.9	240.0	7.0	26.0	240.0	7.0	shot is IEC5-IEC7
IEC7	IEC8	19.8	248.0	2.5				
IEC8	IEC9	8.3	195.0	-5.0				
IEC9	IEC10	7.6	193.0	1.0				
IEC10	IEB74	12.1	230.0	16.0				
IEB74	IEB75	17.2	258.0	20.0				
IEB75	IEB76	16.0	239.0	-1.0				
IEB76	IEB77	1.4	0.0	-90.0				
IEB77	IEB108	7.0	33.0	14.0				
IEB108	IEB109	5.2	309.0	-18.0				
IEB109	IEB112	12.4	329.5	-32.0				
IEB112	IEB113	4.1	346.0	-6.0				
IEB113	IEB114	6.7	31.0	3.0				
IEB114	IEB115	6.3	0.0	-90.0				
IEB115	IEB116	7.5	282.5	-27.0				
IEB116	IEB120	4.8	49.0	-16.5				
IEB120	IEB32	10.0	34.5	-6.0				

Both teams traveled to Keel Hall where IBN48 was quickly located just off the main trail. The blunder in Loop 4 (Compass Far West loop #401) is a 180 deg azimuth error in the IBN48-RIB3 tie-in. The shot from IBN48 to RIB3 was verified to have a front-sight of 129.5 deg (not 310.0 deg) and a clino of -19.0 deg. This change reduces the loop error from 2.53 s.d. down to 0.30 s.d.

The teams then traveled to the other side of the Keel and located IBE1. DB, AC, JF and AW began surveying clockwise around Loop 5 (Compass Far West loop #313), while JL, HL and DO surveyed counter-clockwise. This loop contains a very large number of steep angle shots in tight spaces making both front and back sights very difficult. Several minor and a few major corrections were found in this loop. The largest errors appear to be a compass error in IBE5-6 and a clino error in IBF21-IBEA5. However; a few shots, including IBE3-4 had to be replaced and may have contributed to the loop error. There were a few stations that couldn't be recovered and new stations were established. It is suggested that the data for the entire loop be replaced with the newly acquired data. It was determined that re-sketching was not necessary. The net result of replacing all the data is a reduction in the loop error from 2.14 s.d. to 0.82 s.d.

BAD LOOP 5								
		Old Data (2.14 s.d. error)			New Data (0.82 s.d. error)			
From	To	Tape (ft)	Compass	Clino	Tape (ft)	Compass	Clino	Comment
IBE1	IBE2	12.0	0.0	-45.0	12.0	0.0	-40.0	
IBE2	IBE3	18.0	204.0	-43.0	15.0	198.0	-31.5	IBE3 replaced
IBE3	IBE4	28.0	180.0	-80.5	27.1	0.0	-90.0	IBE4 replaced
IBE4	IBE5	49.7	289.0	-43.0	48.4	283.0	-40.0	
IBE5	IBE6	22.7	258.0	-54.0	21.9	229.0	-54.0	large compass error
IBE6	IBE7	34.5	335.0	-42.0	35.0	333.5	-43.0	
IBE7	IBEA1	23.7	45.5	-1.0	23.5	47.0	2.5	
IBEA1	IBEA2	11.8	54.0	1.7	11.8	51.0	-2.0	IBEA2 replaced
IBEA2	IBEA3	18.0	36.0	0.0	18.6	47.0	1.0	
IBEA3	IBEA4	27.2	79.0	1.0	26.9	80.0	0.5	
IBEA4	IBEA5	33.9	85.0	-4.0	33.7	86.0	-4.0	
IBF1	IBF1	37.2	84.3	-27.0	37.0	81.0	-27.0	
IBF1	IBF2	25.2	92.0	-10.8	25.1	91.0	-10.0	
IBF2	IBF3	5.8	0.0	-90.0	5.7	0.0	-90.0	
IBF3	IBF4	6.1	306.0	-43.8	6.0	310.0	-44.0	
IBF4	IBF5	11.2	315.5	-29.3	11.2	315.0	-28.0	
IBF5	IBF6	7.2	348.8	-21.0	7.1	352.5	-22.0	
IBF6	IBF7	15.2	29.0	-48.8	15.1	29.5	-49.0	
IBF7	IBF8	2.6	50.0	5.0	2.4	52.0	6.0	
IBF8	IBF9	14.7	0.0	-90.0	14.8	0.0	-90.0	
IBF9	IBF10	9.3	44.5	-47.0	10.0	44.0	-47.0	
IBF10	IBF11	8.5	0.0	-90.0	8.7	0.0	-90.0	
IBF11	IBF12	8.6	296.0	5.0	8.3	301.0	5.0	
IBF12	IBF13	10.0	292.0	-33.0	10.0	297.0	-33.0	
IBF13	IBF14	11.8	28.5	-49.5	11.9	27.0	-48.5	
IBF14	IBF15	13.0	284.0	-7.0	13.0	286.0	-8.0	
IBF15	IBF16	10.0	228.0	-43.0	9.9	229.0	-40.5	
IBF16	IBF17	9.3	74.0	-21.0	8.9	73.5	-21.0	
IBF17	IBF18	2.7	106.0	-21.0	3.0	104.0	-21.0	
IBF18	IBF19	7.1	0.0	-90.0	7.1	0.0	-90.0	
IBF19	IBF20	10.3	21.0	-18.0	10.3	23.5	-17.0	
IBF20	IBF21	9.2	282.5	-7.0	9.0	286.0	-6.5	
IBF21	IBEA5	5.2	33.5	6.8	5.1	35.0	15.0	large clino error

Several leads were checked including those north of IBEA6, west of IBEA21, the fissure above IBEA10, and the climb at IBEA15. None of these leads goes any further than can be seen from the original survey. These leads will be removed from the list. Several small leads south of the area between IBEA6-7 were determined to be too tight. Leads still remain in this area at IBEA2 and IBE9. Both teams traveled back to camp together, arriving at 21:30.

10-25-2011 (Northern Exposure/Zanzibar/Birthday Present Leads and Promised Land)

Both teams were up at 8:00. DB, AC, DO and JF left camp at 10:00 and headed to Promised Land via the IBL clean route and picked up the survey leads near N36 that were left on 10/23. N118 was used as a tie-in and a passage under breakdown was surveyed using N119-N126. N126 was tied into N35 and a total of 136.4' of new survey was added. A lead marked on the old survey SE of N36 was too tight. A terminal shot (N120) was made into this alcove.

A pit in the middle of the passage east of N36 had a couple obvious leads heading down that were not marked on the original survey notes. Using N117 as a tie-in, stations N127-N152 were surveyed in a breakyard (solutional passage within breakdown) complex under the main Billiard Parlor passage. Leads were left at N147 (3Hx2W), N148 (2Hx2W), and N130 (2Hx2W). The breakdown complex near N141 and N144 could also be pushed a little harder. The final station, N152, was tied into N36. 350.0' of new survey was added in



Photo: J. Foote
Yellow crystals at N129

this area bringing the total for the day to 486.4'. Some very bright yellow crystals were observed embedded in gypsum crust at N129. Some in the group commented that it had the appearance of sulfur. The lead at N32B was investigated but found to just be a hole through breakdown along the south wall of the Billiard Parlor connecting to N54!. This will be sketched onto the map but a survey shot was not necessary. The lead south of N21 connects back to the Apple Orchard at the top of the flowstone slope west of N16. A visual connection was made and this will also be sketched onto the map with no survey required. Time did not allow survey of the leads at N34, N24K, NB4, or re-sketch of the NA9 maze.

JL, HL and AW left camp at 10:30 and headed to Northern Exposure, the Birthday Present and Zanzibar to mop up leads in these areas. Leads and unsurveyed areas east and west of IBD16 were surveyed, along with additional leads at IBD18 and IBD25 using stations IBHA7-24. A total of 295.7' of new survey was added in Northern Exposure. Unfortunately it looks like one small loop (6 shots) created in this area has a blunder (2.43 s.d.) from either a bad distance or compass reading. This will need to be fixed through a field check.

The team then went to the Birthday Present and surveyed the west wall and pushed leads between Birthday Present and Zanzibar. Stations IBDJ12E-I were surveyed, connecting IBDJ12 to IBD40, and leads at IBD41 (stations IBD41A-E) and IBD45 (stations IBD45A-D) were surveyed, adding a total of 210.2' of new survey to this area. The east wall of Zanzibar was surveyed and sketched (IBDB7C-F) as well as a miserable corrosion residue lined passage in Christmas in August (IBDC10!-13!). These new IBDC stations accidentally duplicated stations used on the east side of Birthday Present. The markers left in the cave do not have the "!" designation. These surveys added another 126.8', bringing the total for the day to 632.7'. It was determined that a lead marked at IBHB10 was previously explored by JL and determined to be too tight. This lead will be removed from the map. Other leads in Zanzibar and Zombie Zoo including those at IBHC5, IBHC6, IBD74, IBK24, IBD54F, and IBD54G were not surveyed due to time limitations.

DB, AC, DO and JF returned to camp by 1:15 am, and JL, HL and AW returned to camp by 2:30 am on 10/26.

10-26-2011 (Keel Hall Leads and Oasis Pool Room Survey)

All were awake by 11:15. DB, JL, HL and JF left camp at 13:45 and headed to the Oasis Pool room. The original survey of this area in 1988 ended at EY103 and the north half of the room was not surveyed or sketched. Subsequent re-survey efforts in the area, including the REY and RFB surveys also did not complete the survey or sketch in this room. The team changed into clean gear at the designated changing area and located RFB5, which was used as a tie-in. Stations RFB6-12, RFB6A-C and RFB9A were used to complete the survey of this well decorated area. A total of 156.7' of new survey was added and 108.8' of survey that was redundant or otherwise excluded. The team



Photo: D. Bristol

Jen Foote in the Oasis Pool Room

returned to camp at 22:15.

AC, AW and DO left camp at 13:45 and headed to Keel Hall to mop up remaining leads. Leads at RIB16 and RIB37 were surveyed (RIB16A-N, RIB37A) for a total of 237.9' of new survey. A connection was verified between RIB16G and IBP12 through breakdown, but this connection was not surveyed. Leads at IB10 and IB12 were surveyed (IB10A-G, IB12A-C) for a total of 159.5' of new passage, bringing the total to 397.3' for the day. The team returned to camp at 23:45.



Photo: D. Bristol

Oasis Pool Room

10-27-2011 (Long Haul Leads)

All were awake by 9:00. DB, JF, HL and AW left camp at 11:15 and headed to the Rainbow Room. There were no leads marked in the high elevation fissures of the IBAA and IBC surveys, but some comments in the original survey suggested that this area may not have been fully explored. It's strategically important because it's along the western edge of the cave and is the highest elevation area in the western branch. DB made an exposed traverse to get into the steep IBAA fissure. About an hour was spent climbing to the top of this fissure and exploring various branches. The last recoverable station found was IBAA6. Several tight side passages in this fissure were obviously virgin but all of them ended or became too tight. There was no airflow noted. The entire area is 1-2' high and sits at about a 60 deg angle with flowstone on the floor and corrosion residue on the ceiling. Chimney climbing techniques are needed to negotiate the area and keep from falling several hundred feet back into the Rainbow Room below. It is probably worthwhile to send a strong team of free-climbers back to this area to fully survey all the branches of the fissure. The IBC passage was not located, but sketch notes show a second high ledge leading to this passage from the Rainbow Room. It is believed that both the IBAA and IBC leave from the same exposed ledge, but this will need to be verified on a future trip and corrected on the map. The lead at IBA22 was determined to be too tight and will be removed from the lead list. The team headed back to the west end of the Long Haul and surveyed 118.4' in breakdown using IBQ49-55 and IBA12F as a tie-in. The lead at IBQ32 was not located. This station could not be recovered, but this entire area of the breakyard complex under Long Haul was explored and no going passage was found so the lead will be removed from the map. Several team members felt there was good airflow in the area so some further exploration may be warranted. The lead at IBQ29 was explored by HL for ~150'. The passage continues ~3Hx3W and branches but does not end. The start of this lead is covered with many aragonite bushes. It was felt that significant damage would be inevitable if a survey team went through the area so it was not surveyed. The north wall of the Long Haul was surveyed from IBA12H to IT6 using new stations IT15-22. This added 236.6' of new survey, bringing the total for the day to 355.0'. The shot from IT6 to IT5 was sketched, completing the survey of the north wall of the Long Haul. No new leads were discovered.

JL, AC and DO left camp at 11:30 and traveled to the west end of Keel Hall. This area was surveyed and sketched, which had been missed on all previous survey trips. The lead north of RIB20 was also completed. Stations RIB45-55 were used and 312.8' of new passage was surveyed. Leads at IBG5 and IBG14 (under Long Haul) were surveyed using stations IBG14-18

for a total of 59.1'. The station at IBG18 was verified to connect to IBAP1 but it involves a difficult and delicate climb so the connection was not surveyed. A survey was begun at IBB5 (under Long Haul) into a walking-sized passage. Stations IBB8-10 were added for 68.0' of new survey with a continuing lead at IBB10 that was continued the next day. A total of 439.9' were surveyed for the day.

The teams, regrouped and AC, DO, JF and HL left for camp, arriving at 21:45, while DB, JL and AW went to scout a climbing lead in the Keel Hall. The lead at IO18 was located and free-climbed. The fissure was determined to be an alcove with no going passage and will be removed as a lead. A short side trip was made to the Mirage Room to familiarize the cartographer with the route. This team returned to camp, arriving at 22:30.

10-28-2011 (Long Haul Re-sketch, Climbing Lead Documentation, IBB Lead, Paris, TX)

All were awake by 8:00 and left camp together at 11:00. AC, JF, DB and HL went to the Long Haul and split into two teams of two to re-sketch the passage from IBA3-12. The line plot of the passage had been printed out on 8.5x11" grid paper prior to the expedition to facilitate this re-sketch. The original notes lacked detail in some areas and had voids where notes didn't overlap in other areas. This effort took several hours and when completed the team went through Long Haul, Keel Hall, Oasis and Huapache Highway scouting for potential climbing leads. Several were located and documented (see Far West Climbing Leads). It was still early so the team went to Paris, TX and surveyed a lead connecting IEB32 to IEB85 using stations IEA11-22 for a total of 107.3' of new survey. Leads were left going down at IEA15 (3'x2'), north at IEB117 (2Wx2H), and north at IEB32 (very tight – 2Wx1H). The team returned to camp, arriving at 22:45.

JL, AW and DO picked up the lead under Long Haul at IBB10 left the previous day. Stations IBB11-42 were used for a total of 565.1' of new passage. Leads were left east of IBB16, south of IBB32, and north of IBB35 all in breakdown or boneyard. The area has a coating of gypsum and aragonite. The final room was named the "shrubby room" after the large number of aragonite bushes. The team returned to camp, arriving at 22:15.

10-29-2011 (Exiting the Cave)

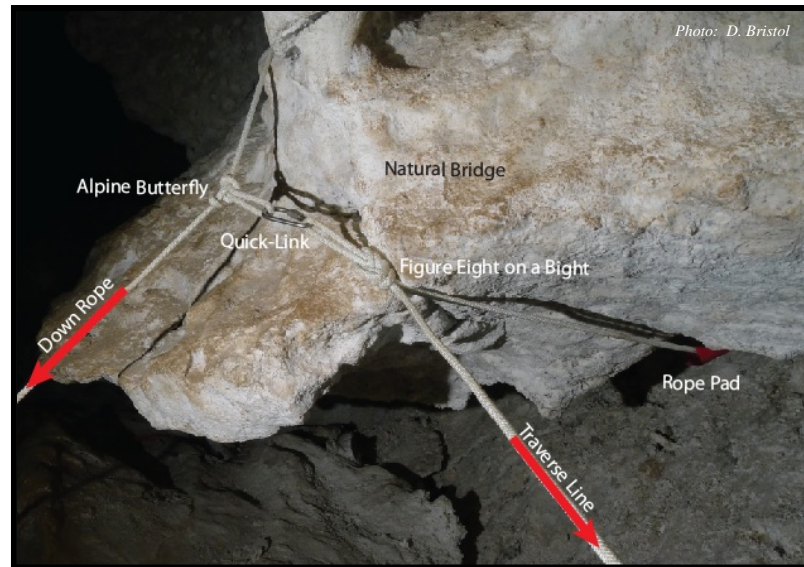
JL, AW, HL and DO left the Deep Seas camp at 9:00 and traveled to the entrance, arriving at the air-lock at 12:00 (3:00 travel time) without problems. DB, AC and JF left camp at 9:30 and arrived at the base of Boulder Falls (Colorado Room) just as the first team was finishing the climb. They arrived at the air-lock at 12:50 (3:20 travel time). One team member believed that part of their ascending system was slipping periodically during climbs. A pause was taken and the problem was determined to just be movement of the seat harness due to the counter-balancing of the tethered pack during sit-stand cycles.

Conservation

- A small amount of a freeze-dried meal was spilled on cave sediment in the lowest campsite at Deep Seas. The material was picked up immediately and it is believed that all the organic material was collected. It is possible that some mold growth might be observed on future expeditions.
- A pee bottle failed while surveying in new passage NE of Congo (at station N90). About ½ pint spilled into loose rocks on the floor. The bottle was a brand new MSR Dromedary, which is generally considered very durable. The bottle had a manufacturing defect with a ~4" seam that was completely unsealed. A backup bottle was used for the remainder of the day.
- In general things went very smoothly in the clean areas in Promised Land and Oasis. A small restoration kit (spray bottle, brush, sponges) was brought to these areas but was not needed. The only concern was a new pair of aqua socks with small rubber lugs that were showing signs of disintegration when traversing rough areas coated in calcite. The small pieces of rubber were picked up when observed. It is suggested that aqua socks be tested on concrete prior to visiting the cave to determine their durability.
- A few very faint muddy footprints were seen from an earlier party, just after the clean clothes changing area in Oasis. Some restoration may be warranted.
- There are some science experiments in progress in the Oasis Pool room. A plastic ruler and a log sheet in a zip-lock bag have been accidentally dropped in the pools.
- A small stalactite (~4-6" long) was accidentally broken by contact with a caver's helmet right by the boot transition area on the north side of the Apple Orchard. More caution should have been used and all cavers should have been doing more to spot each other.
- There are a number of places in the Northern Exposure, Zanzibar and Promised Land areas where there is mold growing on the orange trail flagging. It might be good to run some tests on different brands of flagging to see if a source can be identified that is less prone to this issue. This is likely due to the sizings/lubricants used on the flagging rather than the vinyl or plasticizer.
- A zip-sealed plastic bag containing semi-solid decomposed food was found on the trail in Christmas in August at the turn-off towards Nativity Chamber (near IBDB19). This was apparently accidentally left by an earlier survey party (probably in 2004). The bag was placed in a secondary container and eventually carried out of the cave.
- As a trial, one team member carried all of their pee out of the cave. Their pack weight going into the cave was 48 lbs (including a 10 lb rope and a large share of the group gear). With leaving the old rope at camp (-10 lbs), food and water consumed (-14 lbs), solid waste generated (+3 lbs) and liquid waste generated (+15 lbs), the net weight exiting the cave was 42 lbs. This was done safely, comfortably, without impact to the cave, and without suffering dehydration. In order to do this and keep pack weight to a reasonable 40 lbs it is necessary to use other gear that is very lightweight and not bring unnecessary extras.

Rigging

A new 180' x 11mm static rope was rigged at the bottom of the Great White Way. The original rope was anchored to a natural anchor and forms a ~30' traverse line over to a natural bridge where the rope was wrapped around the bridge using a pair of figure eight on a bight knots and a stainless quick-link. It was anticipated that there may be some abrasion of the rope against the bridge, so the rigging allows redundancy if the rope should fail at this natural anchor. The rigging allows the traverse line to act as a backup anchor, although there will be some extension and shock loading if the primary anchor were to fail. There was no significant abrasion damage observed on the old rope sheath, but it was being replaced anyway because it was reportedly 7 years old. The old rope was too dirty to clearly read the date. The new rope was rigged to the same anchors using roughly the same methods. The loop of rope going around the natural bridge was shortened slightly to prevent the rope shifting and abrading against the bridge. The knot on the down-rope side of the natural bridge was changed from a figure eight on a bight to an alpine butterfly. There is an oblique angle on this knot and it was felt that the butterfly was a better choice. A short wrap-around rope pad was placed on the underside of the natural bridge to prevent abrasion. Both ends of the new rope were labeled with the length and year. The old rope was determined to be in good condition with just a minor fuzzy spot ~35' from one end and was left at the Deep Seas camp for future push trips.



Rigging of the new rope (42 – Great White Way #5 at EG7)

The new rope placed in the Great White Way was not washed prior to being rigged. It is suggested that pre-washing of all ropes be considered prior to deploying them. This will remove much of the sizing that can be a source of food for microbes. This also helps shrink the ropes slightly so that their length is less likely to change, and better entangles the sheath and core, preventing slippage. Finally, removing the sizing increases friction while descending making it easier to control speed.

Rope 3.05 (Deep Seas Push Rope – 110' x 11mm) is no longer at camp and should be removed from the inventory.

The first rope west of Lake Louise (lower ABCs climb) was showing a little sheath abrasion at the anchor. This rope was flipped (i.e. bottom end rigged to natural anchor at the top) and the fuzzy spot examined. There was no softness in the rope and the abrasion didn't penetrate the sheath so the rope was determined to be safe. The fuzzy spot on the sheath is now about 10' off the floor. The rope pad that was at the traverse line at the top of the 2nd (upper) ABCs climb was removed and placed around the natural anchor at the lower ABCs climb. This traverse line is never weighted and it was decided that a rope pad is unnecessary.

A small diameter (~3mm) cord is rigged about 10' below the top of the upper ABCs climb with a non-locking carabiner as a redirect. This cord has several wraps around a natural anchor and was nearly abraded to the point of failure. A butterfly knot was tied to isolate this abraded spot on the cord. The redirect is important to avoid abrasion of the main rope, but a more durable cord might be placed here to avoid further concerns with the redirect. If the redirect were to fail it would cause a small pendulum, possibly resulting in an impact with the wall.

Safety

There were no illnesses or injuries, other than minor chafing and abrasions, during the course of the expedition. All cavers were able to participate on each day of the expedition.

Lead List

Completed and New Leads

Completed Leads (Far West Expedition 2011 - H34, H35, I34, I35)						
Far West Quad	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
H34 - Promised Land	Eden	N21	16	S		cut around to Apple Orchard at N16
I34 - Rainbow Room	Billiard Parlor	N118	10	N	pit	surveyed with leads remaining
I34 - Rainbow Room	Billiard Parlor	N32B	5	S	3'x3'	cut around to N54!
I34 - Rainbow Room	Congo	N41	80	N	10Wx4W	completed
I34 - Rainbow Room	Congo	N41	85	N	8Wx1H	completed
I34 - Rainbow Room	Congo	N47	16	S	5'x5'	no lead
I34 - Rainbow Room	Congo	N48	22	NW	2'x1'	no lead
I34 - Rainbow Room	Jungle	N36	38	E	4'x2'	surveyed under breakdown - completed
I34 - Rainbow Room	Zanzibar - West	IBHB10	5	S		too tight
I35 - Keel Haul	Birthday Present	IBD16	10	W		completed
I35 - Keel Haul	Birthday Present	IBD17	20	E		completed
I35 - Keel Haul	Birthday Present	IBD27	5	W		completed
I35 - Keel Haul	Birthday Present	IBD37	18	NE		surveyed and sketched with west half of BP
I35 - Keel Haul	Birthday Present	IBD37	15	NE		surveyed and sketched with west half of BP
I35 - Keel Haul	Birthday Present	IBD41	14	S		completed
I35 - Keel Haul	Keel Hall	IB10	10	NE		completed
I35 - Keel Haul	Keel Hall	IB12	8	W		completed
I35 - Keel Haul	Keel Hall	IBEA10	10	NE		too tight
I35 - Keel Haul	Keel Hall	IBEA15	4	SW		no lead up climb
I35 - Keel Haul	Keel Hall	IBEA21	2	W		too tight
I35 - Keel Haul	Keel Hall	IBEA6	10	N		no lead up climb
I35 - Keel Haul	Keel Hall	IBEA6	12	SE		too tight
I35 - Keel Haul	Keel Hall	IBEA6	17	SE		too tight
I35 - Keel Haul	Keel Hall	IBEA6	18	SE		too tight
I35 - Keel Haul	Keel Hall	IO18	5	N	3'x3'	climbed, no lead
I35 - Keel Haul	Keel Hall	RIB16	10	E		completed
I35 - Keel Haul	Keel Hall	RIB20	10	N		surveyed
I35 - Keel Haul	Keel Hall	RIB21	20	W		surveyed, no lead
I35 - Keel Haul	Keel Hall	RIB37	5	W		completed
I35 - Keel Haul	Long Haul	IBA12K	5	W		completed - IBA12F used as tie-in
I35 - Keel Haul	Long Haul	IBB6	5	W		surveyed for 600', leads remain
I35 - Keel Haul	Long Haul	IBG14	28	SE		completed
I35 - Keel Haul	Long Haul	IBG5	22	SE		completed
I35 - Keel Haul	Long Haul	IBQ32	6	NW		no lead
I35 - Keel Haul	Oasis	RFB5	10	S		completed
I35 - Keel Haul	Rainbow Room	IBA22	17	E		too tight
I35 - Keel Haul	Zanzibar	IBD39	30	N		surveyed and sketched with west half of BP
I35 - Keel Haul	Zanzibar	IBD45	5	E	1'x2'	completed
New Leads (Far West Expedition 2011 - H34, H35, I34, I35)						
Far West Quad	Area	Nearest Tie-In	Directions from Tie-In		Dimensions	Comments
			Distance (ft)	Bearing		
I34 - Rainbow Room	Billiard Parlor	N130	5	W	2Hx2W	heading down in breakyard
I34 - Rainbow Room	Billiard Parlor	N147	10	E	3Hx2W	heading down in breakyard
I34 - Rainbow Room	Billiard Parlor	N148	3	N	2Hx2W	heading down in breakyard
I35 - Keel Haul	Keel Hall	EY95	0	up	2Hx6W	technical bolt climb up overhanging wall
I35 - Keel Haul	Keel Hall	IO14	25	SW	2Hx6W	free climb with runners and belay
I35 - Keel Haul	Long Haul	IBA4	20	W	4Hx2W	free-climb from left
I35 - Keel Haul	Long Haul	IBA4	20	W	2Hx2W	free-climb from left with exposure
I35 - Keel Haul	Long Haul	IBA4	20	W	10Hx2W	technical climb, 14' up, rope lasso
I35 - Keel Haul	Long Haul	IBA6A	5	S	2Hx4W	technical climb, 11' up, 2 bolts required
I35 - Keel Haul	Long Haul	IBB16	5	SE		down to boneyard
I35 - Keel Haul	Long Haul	IBB32	10	SW		to breakdown, not likely to new passage
I35 - Keel Haul	Long Haul	IBB35	5	NW		more breakdown, looks uninteresting
I35 - Keel Haul	Long Haul	IBN1	10	S	2Hx6W	up steep fissure, 13' free climb with exposure
I35 - Keel Haul	Oasis	EY97	0	up	2Hx6W	technical bolt climb up overhanging wall
I35 - Keel Haul	Oasis	EY97	0	up	2Hx6W	technical bolt climb up overhanging wall
I35 - Keel Haul	Paris, TX	IEA15	0	down	3x2	boneyard, loose rock
I35 - Keel Haul	Paris, TX	IEB117	8	N	2Hx2W	boneyard
I35 - Keel Haul	Paris, TX	IEB32	4	N	1Hx2W	boneyard, very tight

Open Lead List (updated: November 19, 2011)

Open Leads (H34, H35, I34, I35)						
Far West			Directions from Tie-In			
Quad	Area	Nearest Tie-In	Distance (ft)	Bearing	Dimensions	Comments
H34 - Promised Land	Sparadise	N24K	9	N		
H34 - Promised Land	Sparadise	N24K	13	NE		
H35 - Zanzibar	Birthday Present	IBDJ12D	20	NE		climb?
H35 - Zanzibar	Birthday Present	IBDJ6	?	N	?	per Barber 11/13/03
H35 - Zanzibar	Birthday Present	IBH1	0	down	3'x1.5'	directly under IBH1 - per Barber 11/13/03
H35 - Zanzibar	Mirage Room	IFB16	5	N		already surveyed?
H35 - Zanzibar	Nativity Chamber	NB4	8	S		may be a climb
I34 - Rainbow Room	Jungle	N34	26	S	3'x10'	into breakdown, not shown on sketch
I34 - Rainbow Room	Zanzibar - West	IBHB5	7	SE		
I34 - Rainbow Room	Zanzibar - West	IBHB5	7	SE		
I34 - Rainbow Room	Zanzibar - West	IBHC5	4	NE		
I34 - Rainbow Room	Zanzibar - West	IBHC6	18	N		
I34 - Rainbow Room	Zombie Zoo	IBD74	3	W		
I35 - Keel Haul	Birthday Present	IBD10	14	SW		may have been checked
I35 - Keel Haul	Birthday Present	IBD6	25	NE		low, #11
I35 - Keel Haul	Birthday Present	IBD8	17	SW		#1
I35 - Keel Haul	Birthday Present	IBJ18	10	W		
I35 - Keel Haul	Keel Hall	IBE9	15	NW		
I35 - Keel Haul	Keel Hall	IBE9	15	NW		dome
I35 - Keel Haul	Keel Hall	IBEA2	8	S		
I35 - Keel Haul	Keel Hall	IBP12	5	W	2'x2'	
I35 - Keel Haul	Keel Hall	IBP21	10	NE	3'x3'	
I35 - Keel Haul	Keel Hall	IBP27	?	?	3'x3'	across drop, not shown on sketch or map
I35 - Keel Haul	Keel Hall	IBP28	12	E	3'x4'	
I35 - Keel Haul	Keel Hall	IBP28	12	W	3'x3'	
I35 - Keel Haul	Keel Hall	IBP4	5	S	1'x2'	grim, down, not drawn on sketch
I35 - Keel Haul	Keel Hall	IBP40	8	N	3'x2'	into breakdown
I35 - Keel Haul	Keel Hall	IBP42	5	W	various	breakdown
I35 - Keel Haul	Keel Hall	IH4	21	SE		
I35 - Keel Haul	Long Haul	IBA12N	5	SE		
I35 - Keel Haul	Long Haul	IBQ29	2	W		very delicate lead with many aragonite bushes
I35 - Keel Haul	Long Haul	IBA4	20	S		easy chimney climb to aragonite coated fissure
I35 - Keel Haul	Mirage Room	IFD17	7	SW		
I35 - Keel Haul	Mirage Room	IFD36	15	E		
I35 - Keel Haul	Mirage Room	IFF7	5	E		
I35 - Keel Haul	Mirage Room	IN10	16	E		
I35 - Keel Haul	Mirage Room	IN12	4	NE		
I35 - Keel Haul	Mirage Room	IN15	14	W		
I35 - Keel Haul	Mirage Room	IN15	7	S		
I35 - Keel Haul	Mirage Room	IN16	17	NE		
I35 - Keel Haul	Mirage Room	IN18	8	W		
I35 - Keel Haul	Mirage Room	IN18	5	SW		
I35 - Keel Haul	Mirage Room	IN19	8	NE		
I35 - Keel Haul	Mirage Room	IN19	12	NW		
I35 - Keel Haul	Mirage Room	IN20	7	W		
I35 - Keel Haul	Mirage Room	IN20	6	NW		
I35 - Keel Haul	Mirage Room	IN20	6	SE		
I35 - Keel Haul	Mirage Room	IN21	4	E		
I35 - Keel Haul	Mirage Room	IN23	10	W		
I35 - Keel Haul	Mirage Room	IN23	10	S		
I35 - Keel Haul	Mirage Room	IN23	10	SW		
I35 - Keel Haul	Mirage Room	IN23	22	SW		
I35 - Keel Haul	Mirage Room	IN23	31	SW		
I35 - Keel Haul	Mirage Room	IN4	5	NE		
I35 - Keel Haul	Mirage Room	IN7	28	SW		
I35 - Keel Haul	Mirage Room - south	IH10	10	SE		small, steep
I35 - Keel Haul	Mirage Room - south	IH10	16	NE		connects to IM14
I35 - Keel Haul	Mirage Room - south	IM11	7	W		
I35 - Keel Haul	Mirage Room - south	IM13	13	E		
I35 - Keel Haul	Mirage Room - south	IM13A	7	W		down to IF survey?
I35 - Keel Haul	Mirage Room - south	IM14	10	W		
I35 - Keel Haul	Mirage Room - south	IM14	5	SW		
I35 - Keel Haul	Mirage Room - south	IM2	20	W		down to IF survey?
I35 - Keel Haul	Mirage Room - south	IM4	5	SW		
I35 - Keel Haul	Mirage Room - south	IMA4	10	N		
I35 - Keel Haul	Northern Exposure	IBDA13	5	S		
I35 - Keel Haul	Northern Exposure	IBDA13	5	NE		
I35 - Keel Haul	Northern Exposure	IBDA3	13	NE		to IBD survey?
I35 - Keel Haul	Northern Exposure	IBDA5	7	N		
I35 - Keel Haul	Northern Exposure	IBDA5	7	NE		
I35 - Keel Haul	Northern Exposure	IBHA1	13	NE		

Far West Climbing Leads

Several potential leads were observed while working in Long Haul and Keel Hall. Time was taken on the last project day to document these leads. A 1450 lumen headlamp proved useful in spotting high level leads. The information below includes tie-in station, height of lead (measured with Disto), logistical/technical requirements and photographs.

Lead #1

Area	Nearest Tie-In	Description
Long Haul	IBA6A	11' climb up to overhanging ceiling ledge. Hole leads to vertical void beyond. Climb will require either 2 bolts or rope toss over small natural bridge on right.



11' climb in Long Haul at IBA6A

Lead #2

Area	Nearest Tie-In	Description
Long Haul	IBA4	Note on ground reads “lower left hole ends – right hole not checked 1-15-95”. Three possible leads. First two are free-climbable. Third is an overhanging lip 14’ off ground with solutional pockets that can be lassoed with a rope. Lead to the left goes to an aragonite coated fissure that appears to be virgin and is easily surveyed.



Multiple leads at IBA4

Lead #3

Area	Nearest Tie-In	Description
Long Haul	IBA2A, IBN1	Climb near south wall of east end of Long Haul. Lead is 13’ up and wall is overhanging. Might be free-climbable or accessed using cheater stick with etrier attached. Looks like dirty boot prints are on wall.



Lead at IBA2A / IBN1

Lead #4

Area	Nearest Tie-In	Description
Keel Hall	IO14	35' vertically above ground, 70' ledge traverse to access. Lead can be free-climbed with runners for protection and dynamic rope belay.



Lead at IO14

Lead #5

Area	Nearest Tie-In	Description
Keel Hall	Directly above EY95	Long, narrow fissure that forms arch over entrance to Keel Hall. May be continuation of steep fissure coming out of Mirage Room area (IH survey). Lead is 75' vertically above floor and requires bolting up overhanging wall to reach. Rock quality looks good for bolting. High effort, low reward lead. Might be possible to follow fissure from IH survey and traverse.



Photo: D. Bristol

Lead at EY95

Lead #6

Area	Nearest Tie-In	Description
Oasis	Between EY97-98	Two ceiling fissures high above room. Both leads are 70' vertically above floor. Require bolt ladder up overhanging wall to reach. Rock quality looks good for bolting. High effort, low reward leads.



Photo: D. Bristol

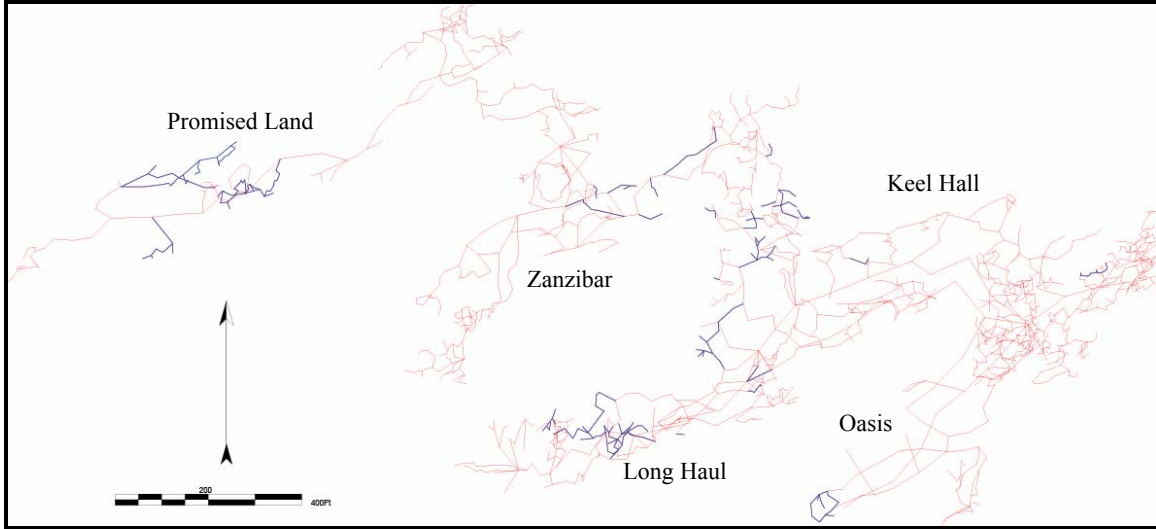


Photo: D. Bristol

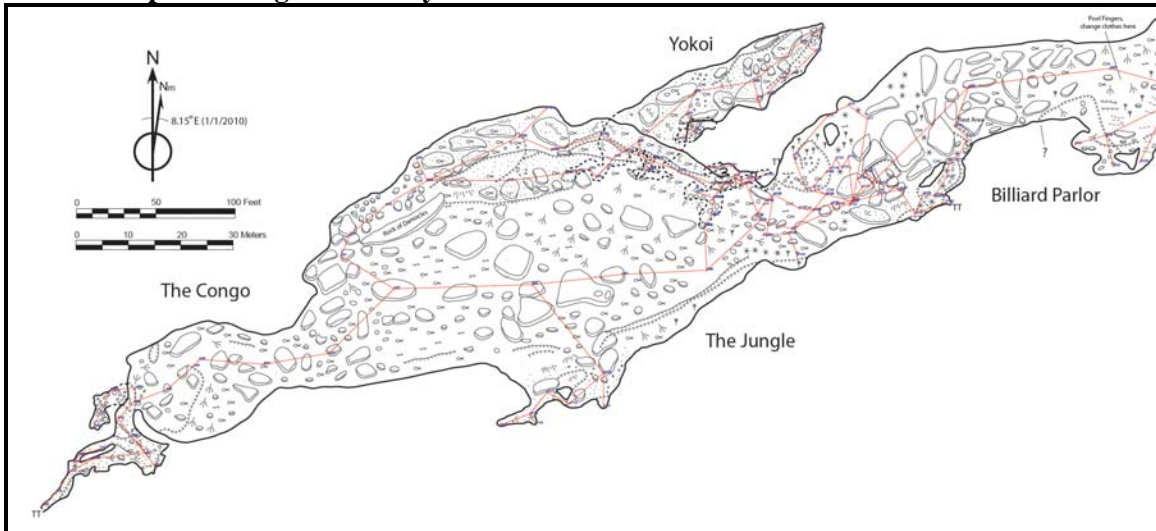
Leads at EY97-98

Maps

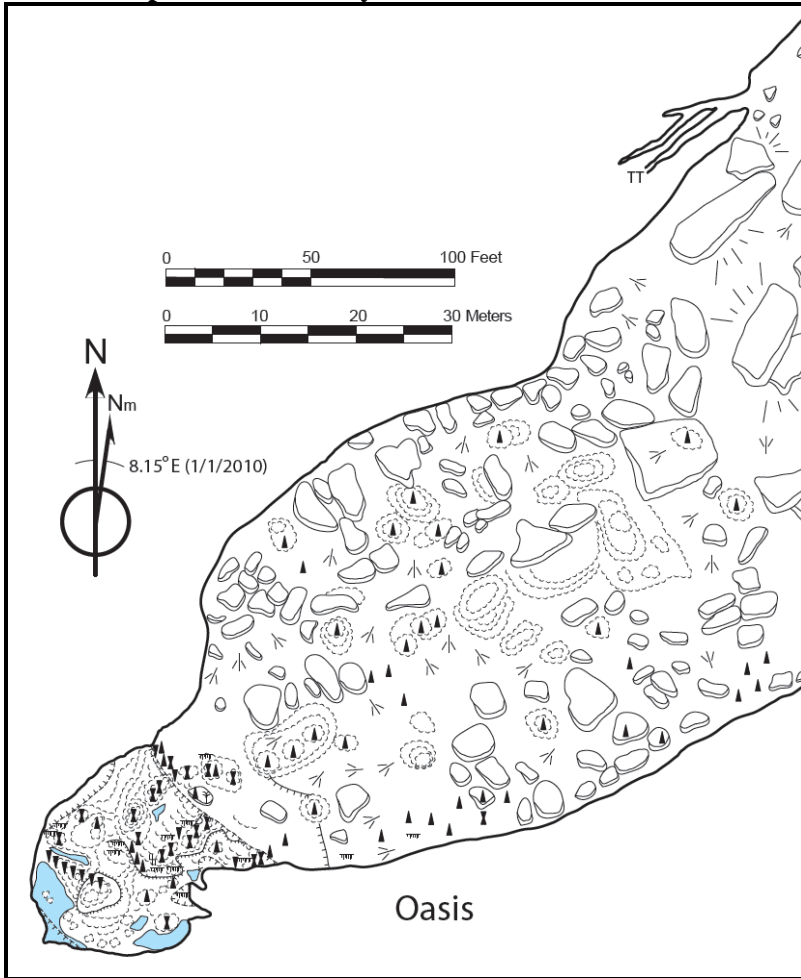
Line plot of Far West with new survey in blue.



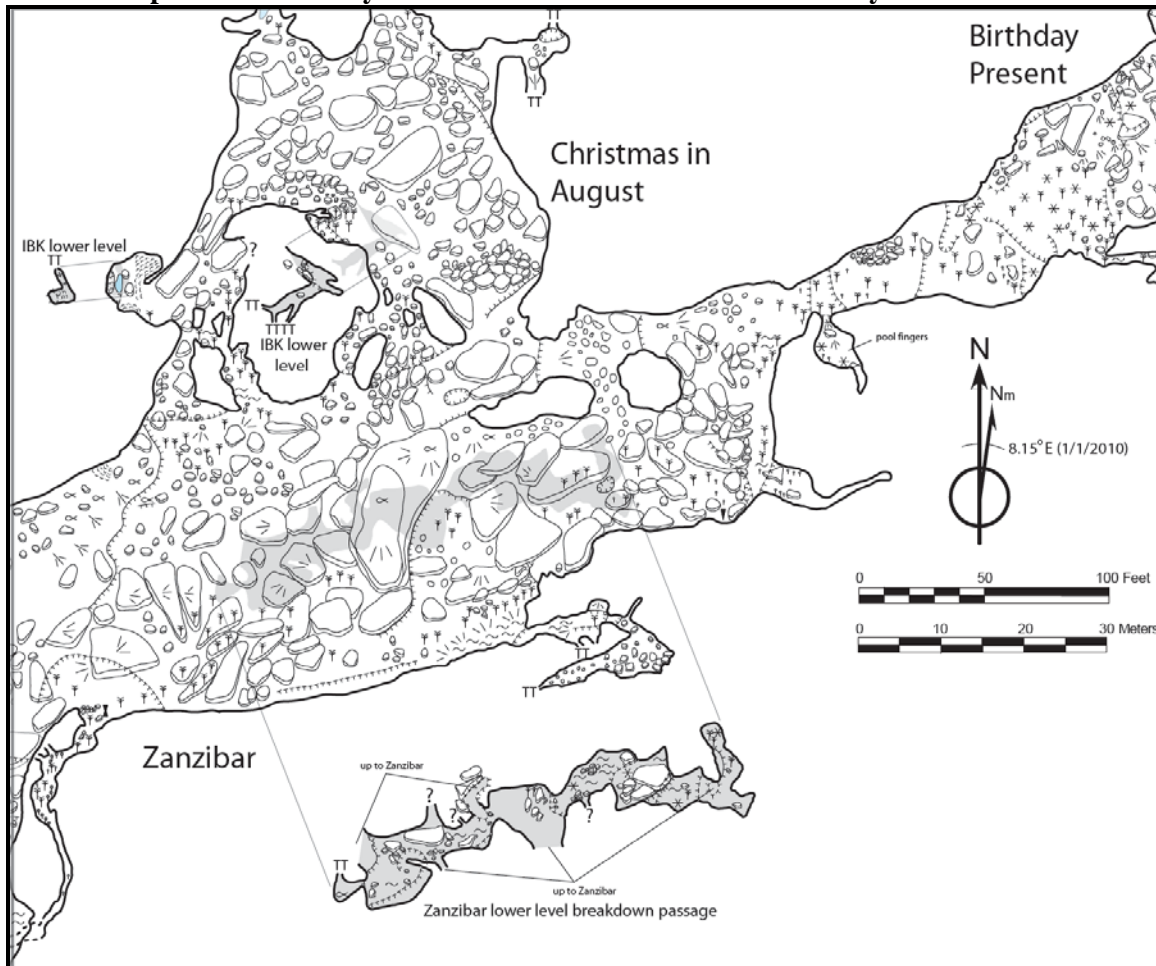
Drafted map including new survey in Promised Land



Drafted map with new survey in Oasis Pool Room



Drafted map with new survey and re-sketch of Zanzibar and Birthday Present



Conclusion

The expedition was very successful in accomplishing most of the goals set out in the proposal, resulting in 4,163' of new cave surveyed, five blundered loops corrected, and well over 1,000' of borehole passage in Zanzibar and Long Haul re-sketched. The team was able to produce results similar to larger 12-person western branch expeditions with half the people and survey objectives that were very far from camp.

Thanks to all of the expedition team members for their drive, humor, flexibility and hard work. Thanks to Heather Levy and Adam Weaver, who put their lives on hold with less than a weeks notice to fill a couple vacancies in the roster. A special thanks to John Lyles who advised and mentored everyone, especially the expedition leader. Without his knowledge and encouragement this expedition would not have been possible.

Finally, thanks to Dale Pate and Stan Allison in the Cave Resources office for providing information, training and giving an opportunity to less experienced Lechuguilla cavers.

Derek Bristol
Expedition Leader
November 19, 2011