NSS News
June 2021

American Caving Accidents 2019-2020

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NSS News

June 2021
Volume 79 Number 6

American Caving Accidents, 2019–2020

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Editor's Note 4
Bonny Armstrong
Description of Incident Results and Types 5
Caving Accident and Incident Statistics 1967-2020 6
2019 & 2020 Incident Maps 7
2019-2020 List of Reported Accidents and Incidents 8
2019 Caving Accidents and Incidents 10
2019 Cave Diving Accidents and Incidents 21
2019 Caving-related Accidents and Incidents 23
2020 Caving Accidents and Incidents 26
2020 Cave Diving Accidents and Incidents 31
2020 Caving-related Accidents and Incidents 32

Articles
Getting Back to Caving after COVID—or Any Long Absence from the Underground 34
Gretchen Baker
"Off Rope" Means a Lot More Than Just Off Rope 36
Andy Armstrong
National Coordinator of the NCRC 38
Anmar Mirza and Gretchen Baker
A Framework for Search and Rescue Team Culture Using Mission Command Philosophy 41
Christian Stenner
Steve Hudson Award 43

Technology
Review of the Wisdom 4 Headlamp 44
Jeff Cody

DEPARTMENTS

President's Message 46
Underground Update 47
Calendar 47
Classified Ads 47

ABOUT THE COVER

Front cover: Jim Fox being attached for a vertical rescue from Heart of Gould Cave, TN in January 2020. Photo by Rachel Saker.
Back cover: Jim Fox in a SKED being moved through a narrow passage during his rescue from Heart of Gould Cave in January 2020. Photo by Rachel Saker.

Editor's Note

Armchair caver. It's a term that you have probably heard—maybe even used—to describe that old person in your grotto. That "caver" who seems to have been 70 years old for the last 70 years. The one you have never seen go caving but has a million caving stories—stories of the good old days when men and women climbed rope with prusik knots, caved in blue jeans and wool sweaters, and completely ridgewalked the area that you've expressed an interest in. Then came the global pandemic of 2020, and I, like so many others, suddenly became an armchair caver as well.

Concern for our health, concern for the health of others, and in some cases local mandates have kept many of us from engaging in our favorite activities. Caving events, including the NSS Convention, NCRC trainings, and regional events, were cancelled—some for two years in a row. How could we possibly survive not caving every weekend or getting together with our grotto friends once a month? When you're a caver, it's hard to stop being a caver.

The COVID-19 pandemic has been difficult for many of us physically, psychologically, and financially. Cavers are a tough breed, though, and I have been encouraged to witness many examples of caver resiliency during the last 15 months. Grottos began hosting meetings virtually, and I was thrilled to be able attend meetings anywhere in the country. The 2020 NSS Convention was also held virtually. I missed seeing so many friends in person, but I also found it rather nice to be able to watch every presentation at a time that was convenient for me instead of having to make a choice between watching international exploration talks or helping to teach at the Vertical Section workshop.

The 2020 NCRC National Seminar was cancelled, but NCRC Board members and instructors created a webinar series (available on the NSS YouTube channel) that introduced a lot of new people to the organization and to cave rescue topics. Other groups within the NSS used this time to discover the benefits of meeting virtually and actually became more productive.

The NSS has now held its first two annual live debates for the Board of Governors' candidates. Not only has this increased member interest and participation, but I think it has also helped us all to make more informed election choices and understand the NSS governing body much better.

The year 2020 had the second lowest number of reported caving accidents in more than 50 years. January and February 2020 started out with the usual number and type of accidents. Then, during the pandemic, only two incidents (both of which involved novice cavers) required a rescue. Of course, this is largely due to fewer people caving. The one or two times that I went caving over the last year, our group discussed safety protocols in advance—we kept the group small, we wore masks, and everyone maintained social distance. We also considered how our actions might put would-be rescuers at risk. I saw enough online discussions to know that other caving groups were practicing the same precautions. The accident data for 2020 suggests that our sacrifices paid off.

***ACA* editor Bonny Armstrong caving in New Zealand, February 2020. Photo by Andy Armstrong.**

There are parts of 2020 that we'd all rather forget, but let's focus on the positive: as a community, we have learned new skills and discovered new and possibly better ways of doing some things. Pandemic technology gave us additional ways to connect and communicate that we will likely continue to use. In early 2021, as vaccination rates increase and restrictions are relaxed, more of us are actively returning to caving.

The future looks bright in the beam of my headlamp. I'm ready to get out of my armchair and get back underground. I hope to see you down there.

Acknowledgments: Although my name appears as editor, every issue of *ACA* is a collaborative effort of the *ACA* Committee. I am so grateful for this talented and dedicated group of friends who each bring unique expertise to the publication. If you happen to see Andy Armstrong, Rich Breisch, George Dasher, Vonny Droms, Mark Minton, Dr. Stephen Mosberg, Rene Ohms, Sarah Richards, Christian Stenner, Forrest Wilson, or Brian Dickey, be sure to thank them for their hard work.

A number of other people have contributed to this issue including, John Adsit, Kimberly Lughart, Jim Coke, Dave Bunnell, Darlene Ngyuen, Ray Keeler, Gretchen Baker, Anmar Mirza, Elizabeth Rousseau, and Rachel Saker.

Finally, I hope that readers will join me in expressing an immense amount of gratitude to the many cavers and rescuers who shared their stories with us. May we all be safer cavers and better rescuers because of them.

Bonny Armstrong
Heber City, Utah

Description of Incident Results and Types

American Caving Accidents (*ACA*) is a special publication of the National Speleological Society (NSS). Since 1967, *ACA* has served as the journal of record for caving accidents in North America. The purpose of collecting and reporting caving accidents and incidents is to help cavers educate themselves on the hazards of caving based on real-life incidents. These incidents, when reported accurately and in detail, should ultimately help readers become safer cavers by learning through others' experiences.

Reports are collected through submissions by cavers involved in the incident or rescue or by those who otherwise have some credible knowledge of the event. Caving incidents brought to the attention of *ACA* by media reports are verified for accuracy by contacting involved parties directly when possible.

As with previous issues, caving reports have been divided into two categories: regular caving and cave diving. These categories are further classified by incident result or outcome, and incident type (causes and contributing factors).

Some reported incidents are placed in a separate category called "caving-related." These include incidents in which a person needed rescuing from a cave that they did not intend to enter, incidents that occur on the way to or from a cave, incidents involving animals needing rescue from a cave, or other unusual circumstances. Because these incidents did not occur during normal caving activities but required caving gear, cave-rescue techniques, or cavers to affect a rescue, they are considered caving-related. Caving-related incidents are not included in the statistics.

Description of Incident Results

Fatalities–Fatalities from caving are relatively uncommon and average about three per year. Although fatalities tend to occur with inexperienced, ill-equipped persons, experienced cavers are not exempt.

Injury vs. No Injury–An injury is physical damage or harm inflicted on a person, usually by an external force. Examples include wounds, fractures, contusions, burns, smoke inhalation, and frostbite. Heart trouble, allergic reactions, migraines, and other conditions are not considered injuries and are categorized as a medical issue incident type.

Aid vs. No Aid–For the purposes of this publication, aid is considered rendered in the following cases: if one or more persons needed the help of others outside of those in their caving party to exit the cave, if outside or additional assistance was requested (even if not used), or if an ambulance or Life Flight was used to transport the patient to a medical facility.

Description of Incident Types

Acetylene-related–Acetylene-related incidents were more common in the 1960s and 1970s than during the last few decades. No acetylene-related incidents have been reported since 1996, probably because LED lights are now favored among the majority of cavers.

Bad Air–The presence of bad air in caves can be caused by biological decomposition, poor air exchange, carbon monoxide from fires, blasting fumes, or chemicals being washed into the cave.

Caver Fall–Caver falls continue to constitute a large proportion of caving accidents. For simplicity, any fall by any person in a cave, regardless of their experience, is considered a caver fall.

Difficulty on Rope or Ladder–The category of difficulty on rope or ladder was added to *ACA* in 1994 to encompass a variety of problems that may prevent a caver from being able to ascend or descend a rope or ladder.

Drowning–Drowning is often listed as the cause of cave diving fatalities since the triggering event is often difficult to identify. In non-scuba incidents, drowning may occur from attempting to freedive into an underwater cave, swimming in underground lakes or rivers, or being swept away by water.

Equipment Problem–This catch-all category includes problems such as rigging, light, and rope failures; and misuse or lack of equipment.

Exhaustion–Exhaustion is likely a contributing factor to many caving accidents and is probably underrepresented in caving accident statistics.

Flooding–Unexpected, rising water can lead to long-term entrapment underground, hypothermia, and possibly drowning. A good understanding of cave hydrology and the local weather forecast are necessary skills for safe caving.

Hypothermia–Hypothermia is often a secondary result in caving incidents resulting from a caver being stuck, injured, or stranded in a cave. Hypothermia is especially dangerous not only because of the physiological aspects, but because it impairs judgment, which can lead to mistakes and other accidents.

Medical Issue–Some incidents that occur underground cannot be contributed directly to the caving activity. Chronic or acute medical conditions may present suddenly such as cardiovascular events, migraines, allergic reactions, etc.

Lost–Getting lost underground can happen to experienced and beginning cavers. Strategies to avoid becoming lost include: go with someone who knows the cave, take a cave map (and know how to read it), and pay attention to landmarks. Always let someone know where you are going and when to expect your return. If you are overdue, a rescue can be quickly organized.

Lost Control on Rappel–This incident-type category was added in 2011 to cover incidents of persons losing control while on rappel. In previous issues, these incidents were listed under Caver Falls or Difficulty on Rope. While most out-of-control rappels also result in a caver fall, the contributing factor or cause is very different than those typical for caver falls.

Rockfall–Shifting or falling rocks, either from natural causes or human disturbance, can result in entrapment, injury, or even death. Pay extra attention near the top and bottom of pits.

Stuck–Stuck refers to the physical entrapment of a person which prevents them from moving from their position. Being stuck is a serious situation as it can lead to hypothermia and possibly crush syndrome.

Trapped or Stranded–This category describes any incident in which the caver or cavers are prevented from exiting the cave.

Other–This catch-all category includes incidents that don't quite fit in other categories. Examples include twisting an ankle or pulling a muscle during normal caving movement, missing a callout time, surface objects falling into a pit, vandalism of rigged entrance ropes, and entrapment of a finger between two objects.

CAVING ACCIDENT AND INCIDENT STATISTICS 1967-2020

Result of Incident

Result	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
Fatality	5	3	1	0	4	2	5	0	8	1	6	1	1	3	0	2	1	3	3	4	3	4
Injury and Aid	4	3	2	3	6	4	9	11	10	6	5	5	8	10	11	10	6	16	6	10	15	11
Aid, No Injury	5	5	2	6	1	7	11	6	15	2	9	13	9	8	12	8	18	17	6	21	15	20
Injury, No Aid	6	1	4	2	2	5	8	5	6	5	6	5	5	6	4	12	13	17	18	10	15	14
No Injury, No Aid	0	2	4	0	2	2	8	6	1	6	8	4	6	4	7	15	14	14	25	19	16	12
Total	20	14	13	11	15	20	41	28	40	20	34	28	29	31	34	47	52	67	58	64	64	61

Result	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Fatality	1	4	6	5	5	1	2	1	4	4	4	2	5	2	6	3	0	4	1	4	3	5	3	2	2	2	4	5	6	3	2	1
Injury and Aid	16	18	16	17	22	19	17	16	22	14	14	20	11	15	9	7	8	15	9	9	9	8	9	5	6	8	5	14	5	9	4	2
Aid, No Injury	20	23	20	28	33	26	17	16	13	13	18	15	13	8	14	12	8	12	9	7	5	7	6	10	10	6	8	10	8	11	4	4
Injury, No Aid	14	10	12	10	4	11	9	10	4	2	8	3	6	6	6	0	10	4	7	2	2	7	6	9	5	9	8	9	11	4	6	3
No Injury, No Aid	21	9	12	16	3	20	12	11	4	8	3	1	2	4	5	1	1	1	1	3	3	2	3	1	2	5	12	5	6	5	8	2
Total	72	64	66	76	67	77	57	54	47	41	47	41	37	35	40	23	27	36	27	25	22	29	27	27	25	30	37	43	36	32	24	12

Incident Type

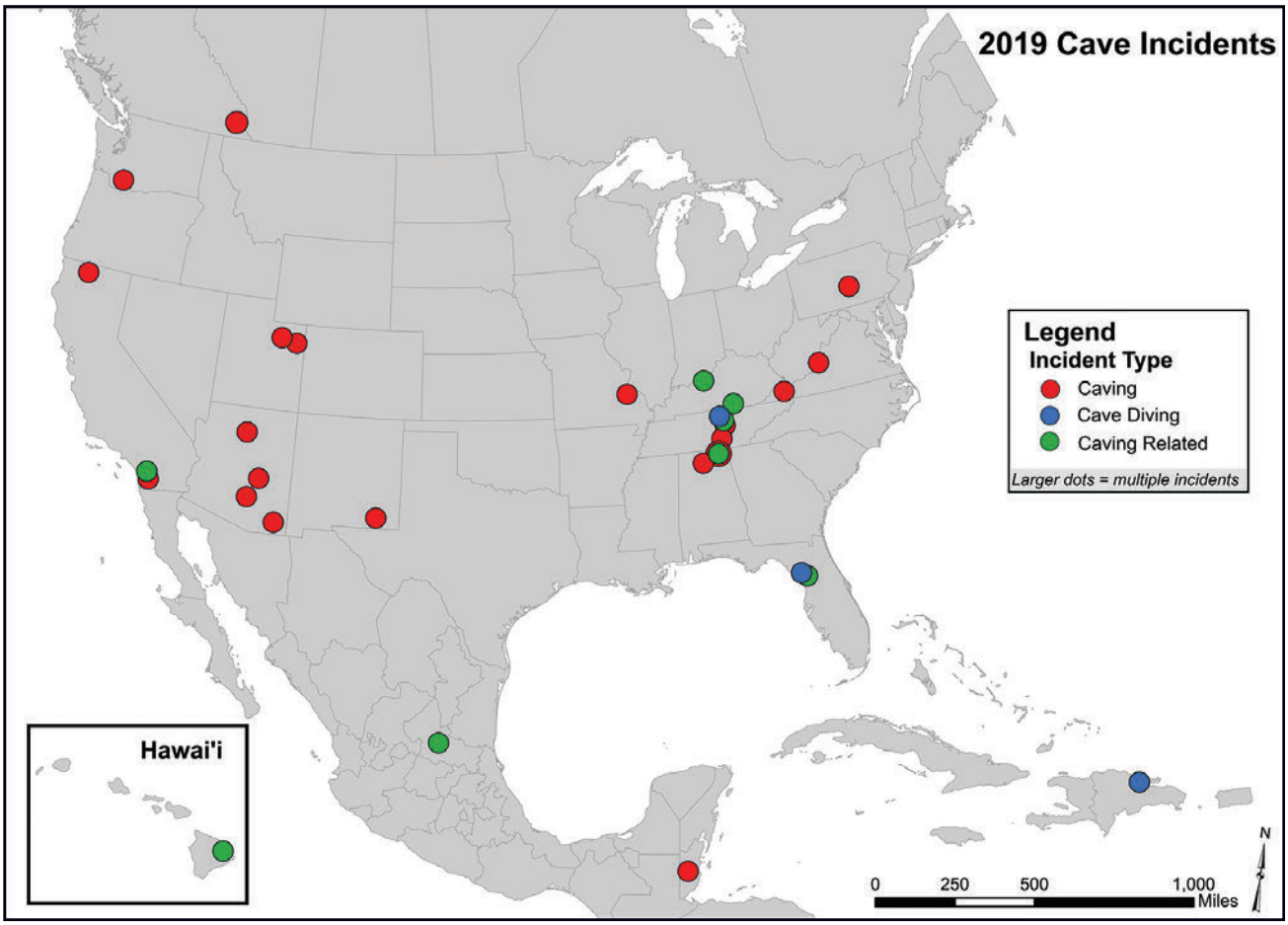
Type	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
Caver Fall	4	3	4	2	6	4	8	9	9	9	5	6	7	9	10	6	12	25	19	25	14	20
Trapped/Stranded	2	1	0	3	2	3	5	2	4	2	5	4	5	8	3	4	6	5	2	6	2	6
Difficulty on Rope	1	4	2	0	1	0	6	5	1	2	3	3	5	2	2	7	7	10	4	1	1	0
Rockfall	4	2	1	0	1	4	2	1	6	2	3	6	0	0	2	11	8	7	10	11	17	7
Lost	0	1	0	2	0	3	4	5	6	0	1	2	1	1	3	1	3	5	4	7	4	3
Flooding	0	0	1	0	0	0	0	1	3	0	1	1	3	1	3	6	2	0	3	0	3	3
Hypothermia	1	1	0	0	0	0	1	0	3	0	2	0	0	0	1	1	0	0	0	1	2	0
Illness/Medical Issue	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1	1	3	1	1	0	0	2
Exhaustion	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	2	1	0	0	1	1
Drowning	0	1	0	0	2	0	3	0	0	0	0	0	0	0	0	1	0	2	0	1	2	0
Stuck	1	1	0	2	0	1	1	0	1	1	1	1	0	1	0	1	3	2	0	3	1	0
Bad Air	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	3	2	1
Acetylene-related	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	3	0	0	1	3	0	1
Equipment Problem	0	1	3	0	2	2	2	4	6	3	3	2	3	2	4	1	4	6	4	11	15	14
Lost Control on Rappel	1	0	2	1	1	0	1	0	0	1	2	1	0	3	0	1	0	0	1	2	0	1
Other	2	0	0	1	0	1	4	0	0	0	3	2	4	4	3	2	1	3	7	2	4	8
Caving-related Incidents	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0	0	0

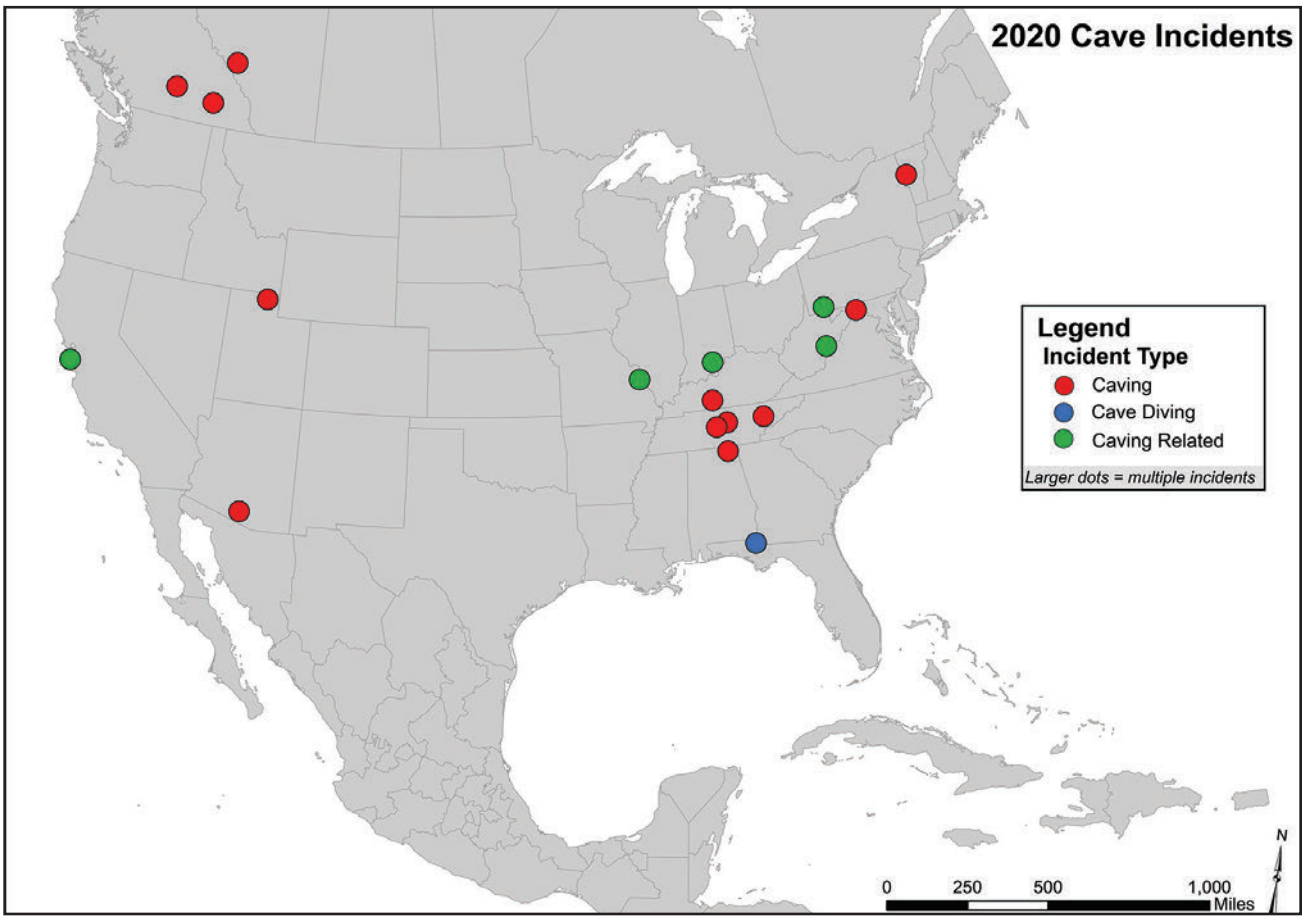
Type	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Caver Fall	19	22	22	22	19	20	15	21	27	15	20	17	14	20	14	5	10	12	11	11	10	13	8	8	10	10	10	13	13	7	9	3
Trapped/Stranded	0	8	6	6	1	13	18	19	13	10	17	4	9	10	15	6	5	7	4	3	3	4	2	3	5	5	2	6	5	0	3	0
Difficulty on Rope	0	0	0	0	3	11	4	6	5	1	4	3	1	5	5	1	2	2	2	2	1	2	4	1	2	0	4	3	2	1	3	2
Rockfall	11	11	12	16	11	12	10	5	5	2	4	2	3	3	5	3	7	4	4	3	1	1	1	3	1	3	0	3	1	0	2	2
Lost	9	4	3	2	5	12	7	4	5	3	3	3	1	1	5	4	2	3	4	2	0	1	2	1	1	1	0	2	1	4	1	1
Flooding	4	2	2	1	3	1	4	5	2	1	4	1	1	0	6	1	0	1	0	0	1	0	0	1	0	1	0	3	0	3	0	1
Hypothermia	5	0	2	4	0	3	6	6	2	2	2	3	1	1	3	0	1	2	1	2	0	1	0	0	0	0	0	0	0	0	0	0
Illness/Medical Issue	3	2	1	0	3	3	0	1	1	8	0	2	2	2	1	2	2	0	0	1	0	1	2	2	2	1	3	0	2	2	1	0
Exhaustion	3	0	2	4	2	4	1	4	1	1	2	3	1	2	1	0	0	2	0	1	0	1	0	0	1	0	1	2	1	0	0	0
Drowning	2	2	2	2	0	0	0	1	0	0	1	0	1	0	3	1	0	1	1	1	1	0	1	0	0	2	1	0	3	1	0	1
Stuck	1	1	3	5	5	2	1	2	0	1	5	3	5	0	1	6	3	2	0	2	2	3	1	5	0	2	1	0	0	3	0	1
Bad Air	1	1	2	1	1	2	2	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
Acetylene-related	1	0	0	0	1	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equipment Problem	20	15	15	16	8	11	4	4	2	2	0	0	3	2	0	0	0	4	4	2	1	1	0	0	1	3	6	1	2	2	2	0
Lost Control on Rappel	1	2	2	0	1	1	0	2	3	0	0	0	1	0	2	1	1	0	0	0	1	1	3	1	1	0	0	1	0	1	0	1
Other	6	8	4	5	4	6	6	3	2	3	2	3	3	2	1	1	2	1	0	3	1	2	3	2	1	2	8	5	6	6	3	0
Caving-related Incidents	0	0	2	1	0	2	0	1	1	5	2	11	2	9	4	20	9	8	4	6	3	15	9	13	11	7	4	4	3	6	8	5

Cave Diving Incidents

Result	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
Fatality	4	0	0	2	0	4	1	8	9	2	1	4	2	5	2	0	2	3	7	7	5	9
Injury and Aid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aid, no Injury	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Injury, no Aid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No Injury, No Aid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	1	2	1
Total	4	0	0	2	0	4	1	8	9	2	1	4	3	5	3	0	2	3	10	9	7	10

Result	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Fatality	4	8	2	5	6	8	6	2	2	0	5	7	9	3	5	6	2	1	5	7	2	1	5	7	6	0	5	6	1	4	3	1
Injury and Aid	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Aid, no Injury	0	0	1	1	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	1	0
Injury, no Aid	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
No Injury, No Aid	1	0	5	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	0	1	0	0	1	1	0	0
Total	5	8	8	7	6	9	7	2	2	1	7	8	9	4	5	7	4	2	5	8	4	1	5	11	8	2	5	6	2	5	4	1


2019 Cave Incidents
Legend
Incident Type
Caving
Cave Diving
Caving Related
Larger dots = multiple incidents
Hawai'i
0 250 500 1,000
Miles
N


2020 Cave Incidents
Legend
Incident Type
Caving
Cave Diving
Caving Related
Larger dots = multiple incidents
0 250 500 1,000
Miles
N

2019 Reported Caving Accidents and Incidents

Date	Cave	Location	Result	Incident Type
February 24	Tumbling Rock Cave	Alabama	no injury, no aid	difficulty on rope
March 21	unspecified cave	Belize	no injury, no aid	difficulty on rope
March 24	McAlisterville Cave	Pennsylvania	no injury, no aid	caver fall
April 27	Cyclops Cave	Virginia	aid, no injury	stranded/hypothermia
May 26	Peppersauce Cave	Arizona	injury and aid	caver fall
June 2	Thunder Canyon Cave	California	injury, no aid	caver fall
June 5	Locomotive Breath Cave	Virginia	aid, no injury	stranded
June 19	Blue Spring Cave	Tennessee	injury, no aid	caver fall
June 20	Big Room Cave	Tennessee	injury, no aid	medical issue
June 23	Mothra Cave	Washington	injury, no aid	caver fall
June 27	Plutos Cave	California	aid, no injury	stranded
July 6	Stephens Gap Cave	Alabama	fatality	caver fall
July 13	Lava River Cave	Arizona	injury and aid	caver fall
July 21	Coronado Cave	Arizona	injury and aid	other
September 5	Hughes Cave	Alabama	aid, no injury	lost
September 7	unspecified cave	Utah	no injury, no aid	rockfall
September 21	Toothbrush Cave	Utah	injury and aid	rockfall
September 22	Mine Shaft Cave	Missouri	no injury, no aid	difficulty on rope
September 28	Salamander Cave	Arizona	no injury, no aid	equipment problem
October 6	Valhalla Cave	Alabama	no injury, no aid	other
October 23	Lechuguilla Cave	New Mexico	no injury, no aid	equipment problem
November 23	Valhalla Cave	Alabama	fatality	caver fall
November 25	Bisaro Anima	British Columbia, Canada	injury, no aid	caver fall
November 30	Bisaro Anima	British Columbia, Canada	injury, no aid	other

2019 Reported Cave Diving Accidents and Incidents

Date	Cave	Location	Result	Incident Type
February 9	El Dudu Cave System	Dominican Republic	2 fatalities	drowning
April 16	Mill Pond Cave	Tennessee	aid, no injury	stranded
November 24	Manatee Springs	Florida	fatality	drowning

2019 Reported Caving-related Accidents and Incidents

Date	Cave	Location	Result	Incident Type
April 12	Stephens Gap Cave	Alabama	fatality	caver fall
June 1	unspecified cave	Florida	aid, no injury	dog rescued from pit
August 19	unnamed sinkhole	Kentucky	aid, no injury	calf rescued from sinkhole
September 6	unspecified sea cave	California	aid, no injury	boaters stuck in sea cave
September 9	Cueva de la Puente	San Luis Potosí, Mexico	injury, aid	caver fall
November 4	unnamed lava tube	Hawai'i	fatality	fell into cave
November 7	Capshaw Cave	Tennessee	aid, no injury	car drove into cave entrance
November 9	unnamed sinkhole	Kentucky	aid, no injury	calf rescued from sinkhole

2020 Reported Caving Accidents and Incidents

Date	Cave	Location	Result	Incident Type
January 17	Heart of Gould Cave	Tennessee	injury and aid	rockfall
January 25	Weybridge Cave	Vermont	no injury, no aid	difficulty on rope
February 1	Indian Grave Point Cave	Tennessee	injury, no aid	caver fall
February 9	Whitings Neck Cave	West Virginia	aid, no injury	stuck
March 20	Castleguard Cave	Alberta, Canada	injury, no aid	caver fall
May 11	Lost River Cave	Kentucky	fatality	drowning
May 23	Scroll Cave	Arizona	aid, no injury	lost/stranded
May 30	Valhalla Cave	Alabama	injury and aid	lost control on rappel
August 13	Bearcat Caves	British Columbia, Canada	aid, no injury	difficulty on rope
September 13	Snail Shell Cave	Tennessee	aid, no injury	flooding
September 15	Over the Hill Cave	British Columbia, Canada	no injury, no aid	rockfall
October 17	Nielsons Cave	Utah	injury, no aid	caver fall

2020 Reported Cave Diving Accidents and Incidents

Date	Cave	Location	Result	Incident Type
July 8	Hole-In-The-Wall Cave	Florida	fatality	drowning

2020 Reported Caving-related Accidents and Incidents

Date	Cave	Location	Result	Incident Type
January 28	unnamed sinkhole	Illinois	aid, no injury	pet duck fell into sinkhole
February 23	Buzzmans Cave	Indiana	aid, no injury	dog stranded in cave
May 7	unspecified sea cave	California	aid, no injury	trapped in sea cave
July 11	ridgewalking	Pennsylvania	aid, no injury	exhaustion
August 25	Sharps Cave	West Virginia	no aid, no injury	lost car keys

Please report all accidents, incidents, and near-misses from any year to
aca@caves.org

2019 Caving Accidents and Incidents

24 February 2019
Tumbling Rock Cave, Alabama
difficulty on rope, no injury, no aid

After spending a few hours in Tumbling Rock Cave, a female caver in her early 30s began descending a rope at the top of the Inner Sanctum room. Ten feet from the top is a rebelay. The caver expressed concern to the group about crossing the rebelay. She had crossed rebelays before but had not practiced them recently. Experienced cavers in the group decided to descend last so that they would be there to coach her through the process.

The caver rappelled down the top section of rope, clipped her short cowstail into the anchor, derigged her rack, and then rerigged her rack below the anchor into the bottom rope. The caver then found that she was unable to stand up in the rebelay loop and therefore could not unweight and unclip her short cowstail. Although she was wearing ascending gear, she was also unable to use an ascender and footloop to unweight her cowstail.

The experienced cavers at the top of the pitch uncoiled an additional 40-foot rope, threaded it through one of the topside anchors, and tied a figure-eight on a bight to the end of the rope. They clipped a carabiner to the loop and lowered the rope down to the stranded caver. Following the instructions of the more experienced cavers, she clipped the carabiner to the central maillon of her harness. Three cavers hauled her up high enough to unclip her short cowstail. She then rappelled to the bottom without further incident.

In his report, Garreau suggests that although the caver had crossed rebelays before, a lack of practice, mud on the caver and the rope, and fatigue may have been factors in the caver being unable to stand in the rebelay loop.

1. Dane R. Garreau, Incident Report, 18 December 2019.

Comments: Inexperience on rope often leads to this and similar types of incidents. Cavers wearing a complete vertical system should have the ability to move up or down a rope at any time, through the use of changeovers. It is unclear why the caver in this incident was unable to use her gear to move upward without assistance; perhaps it was due to exhaustion or to her unfamiliarity with problem-solving techniques for rebelays.

In addition, when using Frog or Texas Systems (that employ upper ascenders attached to the foot by a footloop), cavers should consider attaching the footloop to the system with a small, non-locking carabiner. This allows the footloop to be easily detached from the SRT (single rope technique) system and attached to any other anchor, including a rebelay, sometimes providing a crucial step up in time of need. A movable footloop is also an advantage in other situations such as pickoffs, crossing lips, and any situation where a short etrier would aid in transferring weight.

This team had the resources and critical thinking skills to devise a simple, effective system for solving the problem, talking the stranded caver through the necessary steps.

Cavers in Belize practice with a Ronin Lift ascender. Photo by Daniel Veelik.

21 March 2019
unspecified cave, Belize
difficulty on rope, no injury, no aid

A group of four cavers was exiting a cave in Belize after a day of surveying and trying to lower water levels in a nearly sumped passageway. The exit consists of eight pitches totaling approximately 300 feet. The top three pitches are 150 vertical feet combined and are rigged with rebelays. These top three pitches are nicknamed the Elevator Shaft due to the pit's relatively open nature. In 2019, a rigging team had also rigged the Elevator Shaft with a 300-foot dedicated rope to be used with a Ronin Lift Ascender, an electric ascending device, to aid tired cavers and/or heavy loads. The extra rope was left at the top, and tied off with a super Munter hitch (a version of the Munter hitch appropriate for heavy loads).

The last caver up the pit chose to use the Ronin Lift to exit. He had previously practiced with it on the surface. The Ronin Lift rope appeared muddy; apparently someone had accidentally climbed it. As the machine ascended, it slipped occasionally on the mud, so the caver removed mud off of the rope ahead of it with a cloth. This cloth got pulled into the Ronin Lift, and he could not ascend or changeover to descend and was hanging in free space, stuck on rope.

Fortunately, because the rope with the Ronin Lift was rigged with a super Munter hitch, the stuck caver was easily lowered to a ledge where he was able to regain circulation and drink some water. The cloth was extracted from the Ronin Lift and it became functional again. The last caver ascended the second time without problem, although he noted that being stranded on rope had left him feeling exhausted.

1. Gretchen Baker, Incident Report, 3 January 2021.

Comments: The user's perceived safety margin of a device, SRT system, or rescue system is often based on limited

data collected under a certain set of conditions. Safety must be reassessed when real-world conditions and/or modes of operation change. In this case, an unforeseen event (someone muddying the rope) caused the change in conditions. The change of conditions brought on an ad-hoc solution (the cloth) that seemed effective but had a critical failure mode.

The Ronin Lift was brought into the cave as a safety device, and it was first tested by the team above ground. The instructions advised not to put anything in front of it, but at the time it made sense to try to remove some of the excessive mud. Rigging the rope ahead of time with contingency rigging helped to make this a relatively quick rescue.

24 March 2019
McAlisterville Cave, Pennsylvania
caver fall, no injury, no aid

A group of experienced and novice cavers were on a Sunday trip to McAlisterville Cave. The group reached a steep climbdown, where the trip leader descended first to help the others. Alec Matheus (20) started down next. He sat on the edge of a ledge and placed his feet out and against the ceiling of the room that they were climbing down into. As he started to work his way down, his feet unexpectedly slipped, and he started to fall headfirst. The trip leader, who had experience in the cave and was aware that others in the group might have trouble with the climbdown, was positioned to assist and was able to catch Matheus, preventing any injury. The other two novice cavers decided not to continue down into this section of the cave.

1. Alec Matheus, Incident Report, 24 February 2021.

Comments: Matheus said that a lack of experience led to this incident and that the group probably should have used a handline.

27 April 2019
Cyclops Cave, Virginia
stranded/hypothermia, aid, no injury

On a Friday evening, six men, Andrew Webb (22), Mark Webb (55), Anthony Webb (34), David Gobble (55), Jason McFaddin (54), and Jeff Jackson (55), entered Cyclops Cave with the intention of camping overnight and exiting the cave on Saturday night. Cyclops Cave is a challenging, technical, multi-drop cave, and this group was unprepared and lacked proper equipment; they had one harness and one helmet among them. Andrew Webb had been to the cave before and served as the trip leader. He planned to use a bosun's chair (also called a boatswain's chair) and a block-and-tackle system to haul the group up several pitches to exit the cave. This system had worked well for him in this cave on previous trips. However, a week of rain had made conditions in the cave "terrible," he said, and the ropes were muddy and difficult to use. Additional rain Saturday night caused conditions in the cave to further deteriorate.

When the group tried to exit the cave, the ropes and pulley systems failed in the muddy conditions. As members of the team began to succumb to hypothermia and exhaustion, Andrew Webb decided that he would free-climb to the surface. In what he described as a "do or die" effort, he ascended hand-over-hand up muddy rope pitches to the surface, where he called 911 at 2:15 a.m. on Sunday. Cleveland Fire Department was the initial responding agency. The responders were able to make patient contact; they promptly requested additional resources from Virginia Department of Emergency Management (VDEM). The Eastern Region of the NCRC assisted in deploying trained resources to the scene.

Billy Chrimes of VDEM led a multi-organization rescue response that called upon resources from Blacksburg Volunteer Rescue Service (BVRS), Cyclops Cave Project cavers, Virginia Polytechnic Institute (VPI) cavers, Chattanooga-Hamilton County (Tennessee) Rescue Service Cave-Cliff Team, and NSS cavers from the Spring VAR event that was in progress concurrently.

Based on information from the initial responders, the BVRS team determined that the group was likely stranded at the bottom of Turtle Drop, a complex 40-foot pit with a steeply sloping pitch at the top to a rebelay, below which is a vertical drop to the bottom. The rope is kept free from protrusions by two redirects. Between Turtle Drop and the surface are three additional pitches: a 22-foot mostly free drop in a fissure, a tight 12-foot fissure, and a 13-foot entrance drop. The top two pitches can be navigated without rope by a fresh and experienced climber, but since vertical gear is needed for the other drops, cavers typically use SRT for the first two drops as well.

The rescuers were divided into three task forces, each charged with rigging one section of the vertical obstacles. The initial response/rigging team transported food, warm clothes, and hot chocolate to the cold, stranded cavers. They also brought in five harnesses and helmets to better equip the cavers for the trip out of the cave. The stranded cavers were grateful for the hot chocolate. An initial medical assessment revealed three patients in mild hypothermia and two patients in moderate hypothermia. Their symptoms ranged from tired to exhausted with slightly altered mental status. The patients were readied in harnesses, and rescuers determined no immediate need for a litter.

The cavers were hauled up the pitches using a combination of traditional haul systems and small-party rescue-type methods, including a rappelling counterweight. Rescuers found it necessary to install additional bolt anchors and eventually to modify the cave passage to better evacuate an exhausted patient. Evacuation of the first caver to the surface took three hours. The remaining cavers were moved much more quickly once the route and haul systems were established. As it became apparent that the rescue was progressing more quickly than expected, the responding Chattanooga team was asked to stand down, and they turned around near the Virginia border.

By 6:00 p.m. Sunday, all five men had been rescued from the cave. Andrew Webb said he'd definitely go back into the cave but planned to take a class with his brother first before doing so. He told ABC News that his father and uncle, who were diagnosed with pneumonia, were still under observation in the hospital. The other men, he said,

were sore but doing OK and glad to be out of the cave.

1. Enjoli Francis and Stephanie Ramos, "Man who climbed out of cave with his bare hands to get help for relatives stuck inside: 'It was either do or die,'" www.abcnews.go.com, 29 April 2019.
2. Brian Pascus and Peter Martinez, "Virginia cave rescue: 5 men freed from Cyclops Cave in southwest Virginia," www.cbsnews.com, 28 April 2019.
3. Wil Orndorff, "Cave Rescue at Cyclops Cave, Russell County, Virginia," Incident Report, 21 January 2021.

Comments: The caving group was unprepared and ill-equipped for a technical vertical cave. Gear and techniques (use of the bosun's chair) that had worked for other people, under different conditions, were inadequate after the cave had been subjected to heavy rain infiltration. Thankfully, the group had family members that were on alert to call for rescue.

Rescuers report that the success of this operation is due to three factors:

1. Common and frequent cave rescue training by responders in the region, primarily through National Cave Rescue Commission (NCRC) courses.

2. A well-stocked gear cache with enough resources to rig and operate four haul systems at once.

3. Coordination between state emergency managers and rescue teams, instead of individual resources, which increased efficiency and the comfort level of the authorities. BVRS in particular had 17 rescuers underground, with even more team members on site.

An injured woman is lowered from the entrance of Peppersauce Cave. Photo by C. Carothers.

26 May 2019
Peppersauce Cave, Arizona
caver fall, injury and aid

A mother (55) and daughter (26) took a recreational trip to the very popular Peppersauce Cave. They had visited show caves in the past, but this would be their first time exploring a cave on their own. Both women wore tennis shoes and bicycle helmets with two lights strapped to each helmet.

Mother and daughter were in the Main Lake Room, 700 feet from the entrance, when the mother slipped in the mud at the bottom of the ladder. She fell and fractured her right tibia, just below the knee. Realizing that this was a serious injury, the pair started slowly making their way out of the cave. The mother was able to climb the ladder slowly, taking one step at a time. At the top, she slid on her hip to the Big Room, dragging her leg behind her. Eventually, the daughter left to go get help. She wrapped her mother in a space blanket before departing.

In the Main Corridor, the daughter encountered cavers Ray Keeler, Blase LaSala, and others performing a LiDAR scan. She asked for help then left the cave to call 911. There was no cellular signal at the cave, so she had to drive until she could place a call.

The cavers performed an initial medical assessment and determined that by splinting the leg, they could start an evacuation with the mother's assistance. Keeler used his Crawldaddies knee pads as the splint, placing one on the front of the leg and one on the side to provide vertical stability. Keeler and LaSala acted as moving human crutches, helping the woman move forward and letting her sit and slide on her bottom when possible.

Responders from the Oracle Fire Department and the Pinal County Sheriff's Office arrived as the rescuers and patient were a short distance from the entrance. The woman was packaged in a litter and carried down to the parking area. Her daughter drove her to an emergency room.

Keeler followed up with the daughter a few days later via e-mail. The daughter responded, "My mom is in good spirits here at home, resting on the couch with a knee immobilizer and the dog keeping close watch on her. The ER told us she has a tibial plateau fracture, and they were extremely grateful that you had loaned her your kneepads! They said that those kneepads prevented further damage to her knee during the rescue! Thank you again for all of your amazing assistance. We feel so lucky that we happened to be in the cave at the same time as you. I don't know what we would have done without you."

1. Ray Keeler, Incident Report, 29 May 2019.

Comments: The most common injuries to cavers are to the extremities, and most patients with injuries to one or two extremities can be assisted out of the cave, using some amount of their own power to evacuate. The most important factors to consider in a rescue are what is best for the patient's medical condition, and the condition and abilities of the team. Both of these factors must be frequently reassessed throughout the rescue. The laser-scanning team that

the daughter happened upon was familiar with the cave and had been trained in several cave rescue courses, providing confidence to all that the evacuation would be possible. Because of the daughter's 911 call, the rescue team also knew that more help was on the way. This knowledge can also boost morale and keep momentum moving toward the cave entrance.

2 June 2019
Thunder Canyon Cave, California
caver fall, injury, no aid

While caving in Thunder Canyon Cave, a male caver (39) was negotiating a difficult climbdown when he slipped and fell. Although he fell only about 3 feet, an impact with a rock projection caused injury to his left shin.

The caver and his companion exited the cave and administered first aid to control the bleeding. The companion carried the injured caver's pack on the steep and lengthy hike back to their vehicle.

1. David Angel, Incident Report, 22 July 2019.

Comments: The caver said he didn't notice a much easier route under the obstacle and believed that he must have previously negotiated this downclimb. This led to overconfidence on a slippery climb. This incident highlights the importance of carrying basic first aid and splinting material when caving.

5 June 2019
Locomotive Breath Cave, Virginia
stranded/hypothermia, aid, no injury

Two men entered Locomotive Breath Cave on Saturday, 1 June 2019. They parked their rented truck at a local diner. The men were not experienced cavers, but said, "We wanted to really dive in and do the hard stuff." An hour into their adventure, their first flashlight died. They continued on, and soon they realized that they were lost. As their other lights died one by one, they decided to split up to look for the way out.

When one of the men did not show up for work on Monday, family members became concerned. The rental truck was eventually located using its OnStar® system. Friends suggested they may have gone caving although an initial search of Locomotive Breath Cave did not locate the men and search efforts were concentrated elsewhere.

Eventually, more resources were brought in, including rescuers with caving experience, and the men were quickly located in the cave. After four days in the cave, both men were hypothermic to the point that they had stopped shivering. They were given food and water, wrapped in warming blankets, and assisted out of the cave once they started shivering and were able to move. One of the men collapsed only 100 feet from the entrance and had to be carried the rest of the way out of the cave in a litter. Both men made a full recovery.

1. Eddie Callahan, "Update: Two males trapped in Low Moor cave rescued, in stable condition," www.wdbj7.com, 5 June 2019.
2. Eric Miller, "After four days trapped in a cave, Covington man thankful for the family that never lost hope," www.wdbj7.com, 8 June 2019.
3. Glen Hugus, Incident Report, 9 January 2020.

Comments: Even basic caving requires some amount of preparation and specialized gear and clothing. These men sought neither proper caving training nor permission of the landowner.

19 June 2019
Blue Spring Cave, Tennessee
caver fall, injury, no aid

On the third day of the 2019 National Speleological Society (NSS) Convention in Cookeville, Tennessee, a group of cavers went to Blue Spring Cave in White County, Tennessee. During the trip, a male caver (77) fell and injured his left side and back. An incident report was not submitted, but the resulting injury played a part in another incident the following day.

1. Alan Hatcher, e-mail communication, 12 December 2019.

20 June 2019
Big Room Cave, Tennessee
medical issue, injury, no aid

On the fourth day of the 2019 NSS Convention in Cookeville, Tennessee, a group of 14 cavers went to Big Room Cave. One caver (77) had fallen during a cave trip the day before and was experiencing some discomfort, but he continued with his plan to participate.

The group made it to the back of the Big Room in the cave. From there, 12 members of the group proceeded through Tombstone Pass, which involves crawling and negotiating tight passages. Alan Hatcher and Scott Hurley informed the trip leaders that they would stay behind and wait in the Big Room.

A half-hour later, Hurley traveled a short distance down the Tombstone Pass. Hurley soon met the 77-year-old caver returning alone and showing obvious signs of pain. Stooping or crawling greatly exacerbated the pain, but the caver thought that he could continue out of the cave if he went slowly. Hatcher accompanied the injured caver toward the exit while Hurley went to inform the trip leaders of their plans.

Traveling out of the cave, Hatcher helped the older caver with one climb; although his injury was becoming more painful, he required no further assistance to exit. At the surface, a caver with medical training assessed the injured caver and, seeing a large, painful bruise on his torso, recommended a trip to a medical clinic for x-rays. The x-rays revealed a fractured rib.

1. Alan Hatcher, Incident Report, 12 December 2019.

Comments: Cavers should exercise extra caution when caving with pre-existing injuries. Being in another state in a convention atmosphere with the opportunity to visit many amazing caves likely influenced the injured caver's deci-

sion to go caving again soon after his accident. Many rib injuries do not hurt immediately and may take up to a day or so to become sore and stiff. Cavers should realistically evaluate their condition before a trip to prevent issues arising deep inside a cave, thus increasing risk for themselves, their teammates, and potential rescuers.

23 June 2019
Mothra Cave, Washington
caver fall, injury, no aid

Three cavers were shuttling scientific equipment down a boulder-strewn slope into a glacier cave. The equipment was packed in large Pelican cases, and the cavers were spread out down the slope, methodically passing the cases down the slope to the next person, and then advancing to the front of the line to continue. At one point, Mark Dickey (37) had just handed off the last case and was maneuvering around the other two cavers to advance to the front of the line. As he began to pass, he felt the rocks below him start to shift. He stopped moving and told the others to traverse sideways across the slope. Once they were clear, Dickey also tried to move across the slope, but a substantial section of the boulder field below and around him began moving downhill. The shifting rocks caused him to lose his footing and roll a short distance, but he managed to land on his feet. One very large boulder, the size of a small car, narrowly missed hitting him.

Dickey exited the cave to recover for a few hours but was then able to resume normal activities. He reports that he was sore and bruised the next day but otherwise unhurt.

1. Mark Dickey and Jessica Van Ord, e-mail communication, 27 January 2021.

Comments: Boulder and breakdown slopes can be unstable, especially in virgin or infrequently traveled passages. Best practices such as staying close together so that moving rocks cannot pick up momentum between team members and maintaining clear communication can help to reduce risk on unstable slopes.

27 June 2019
Plutos Cave, California
stranded, aid, no injury

A group of four young adults entered Plutos Cave at 5:30 p.m. for the purpose of "meditation and spiritual enrichment." The cave is a 2,000-foot-long lava tube that is popular with the public. The group reached the end of the main passage without incident and meditated together for about two hours. At that time, one member of the group crawled down an extension of the passage to meditate on his own. When he did not return, his friends became worried and exited the cave to call 911.

Cavers responded to a Siskiyou County Search and Rescue callout and located the missing caver around midnight 100 feet down the crawlway. The man's single light source had failed during his solo meditation so he waited for several hours in the dark until help arrived. Rescuers determined he was uninjured, and after taking in some food and water, he was able to follow his rescuers out of the cave.

1. William Broeckel, Incident Report, 16 December 2019.

Comments: The National Speleological Society (NSS) recommends three sources of light per caver, regardless of the purpose or planned duration of the trip. Organizations planning group activities should invest the time and money to ensure that their participants are safely equipped for the activity.

Large passage in Plutos Cave, a lava tube in California. Photo by Dave Bunnell.

6 July 2019
Stephens Gap Cave, Alabama
fatality, caver fall

A 20-year-old soldier from the 101st Airborne Division died in a rappelling accident at Stephens Gap Cave. The man and a friend were on vacation when they decided to visit the cave. The friend rappelled twice. As the soldier rappelled, his friend claimed to have seen him "twisting around the rope," just before hearing a "pop." The soldier then fell the remaining 60 feet to his death. Inspection of the victim's gear revealed that his rappel device had been connected to his harness by two chained carabiners. The rappel device was still attached to the rope with one carabiner; the other carabiner was still attached to his harness.

1. Nolan Crane, "20-year-old dies rappelling at Jackson County cave," www.waff.com, 8 July 2019.
2. Kyle Rempfer, "101st Airborne soldier dies in off-duty rappelling accident," www.armytimes.com, 9 July 2019.
3. Kimberly Lughart, e-mail communication, 21 February 2021.

Comments: Based on the two-carabiner connection to the descent device and the audible "pop" at the moment of detachment, this appears to be what is called a "rollout" hardware failure. Rollout can occur when two or more pieces of hardware (like a carabiner and a descender) are chained together. Rotation of one or more pieces of hardware during a moment of unloading causes improper cross-loading, resulting in torque forces that can open or even break a carabiner gate once the system is loaded again. The victim was using a European canyoneering-style rappel device described as "similar to a Pirana." It was found on the rope at the point of detachment.

Canyoneers commonly extend their rappel devices away from their harnesses, often with a soft "dog bone," like the webbing seen between two carabiners in a rock climbing quickdraw. This rappel extension is used to create a lower center of gravity relative to the descending device while rappelling, thus reducing the likelihood of inverting. It also aids in rappelling through narrow slots. In this incident, there are several unknowns: Why did the victim extend his descender with two carabiners? Did he begin the rappel from the top with the carabiners cross-loaded, or did they become that way after stopping at a ledge or other obstacle on the way down, where the descending system may have been momentarily unloaded before continuing?

Lava River Cave passage, has several sections floored with loose breakdown. Photo by Dave Bunnell.

13 July 2019
Lava River Cave, Arizona
caver fall, injury and aid

A 43-year-old Phoenix, Arizona, woman was rescued from Lava River Cave. She reportedly was wearing inappropriate footwear and slipped and fell, injuring her hip approximately 500 feet into the cave. The Coconino County Sheriff's Search and Rescue team responded and found that the woman could not walk out on her own. They carried her out of the cave in a litter, and she was transported to Flagstaff Medical Center.

1. Eric Zott, "Injured woman rescued from Lava Caves near Flagstaff," www.azfamily.com, 13 July 2019.
2. Paul Clifton, "Lava River Cave Rescue," www.prescottnews.com, 20 July 2019.

Comments: Lava River Cave is a popular destination that is easily found by the general public following road signs and information on the internet. Despite cautionary information at the entrance, underprepared visitors with no helmets and improper footwear are often encountered in the cave.

21 July 2019
Coronado Cave, Arizona
other (unknown), injury and aid

The Cochise County Technical Response Team was notified of an injured woman (35) with a possible broken ankle in Coronado Cave. When rescue teams arrived, the reporting party said that the woman was out of the cave but would need to be carried the half mile to the trailhead. As the rescue teams collected their gear, the woman arrived in the parking lot, riding piggy-back on her husband's back. The patient's family transported her to the hospital.

1. Sarah Truebe, Incident Report, 6 August 2019.

Comments: It is not known what caused this accident or where in the cave the accident occurred. Coronado Cave is a popular, undeveloped cave for cavers and the general public.

5 September 2019
Hughes Cave, Alabama
lost, aid, no injury

Three people trespassed on private property and entered Hughes Cave at 3:30 a.m. A woman in the group reportedly began having a panic attack and was accompanied out of the cave by one companion at 6:00 a.m. Four hours later, the third person had not emerged, so his friends called 911. Rescue teams found the man after a few hours of searching the multilevel cave. He was lost but not injured.

1. WHNT News 19, "Missing man found in Morgan County cave," www.whnt.com, 5 September 2019.
2. Kelly Kennedy, "Man rescued from cave in Union Grove," www.rocketcitynow.com, 6 September 2019.

Comments: Trespassing, especially when it results in a rescue, jeopardizes access for everyone. Also, cave trips that begin at 3:30 a.m. probably have more statistical chance for a mishap.

7 September 2019
unspecified cave, Utah
rockfall, no injury, no aid

On 7 September 2019, a group of six cavers was conducting scientific research at a cave in northeastern Utah. The cave has a small funnel-like sinkhole entrance that slopes downhill to the top of a narrow, vertical pit in bedrock, approximately 40 to 45 feet deep. The team's rope was rigged to a nearby tree. From the tree, the rope angled across the sinkhole and down into the sloping entrance. The rope then turned a sharp corner across the bedrock lip of the pit. A rope pad was placed and secured over the bedrock corner

to help protect the rope from abrading on the sharp bend at the lip of the pit. To minimize the amount of debris that rope movement might send down the pit, the rope was also routed over a small log in the sinkhole. That positioning kept the loaded rope from touching the ground anywhere between the anchor tree and the padded bedrock corner at the top of the pit. The entrance area was also briefly cleared of small debris.

After finishing their planned research activities, the group started to exit the cave. The first three cavers climbed the pit and exited the cave with no issue other than the difficulties expected in a narrow slot with a sharp corner at the top of the rope drop. The fourth caver started up the rope but became concerned when he noticed small amounts of dirt falling down the pit with almost every sit-stand movement up the rope. Continuing up the rope slowly and carefully, trying to minimize the movement of the rope, and trying not to breathe the organic soil that kept raining down, the caver ascended to a point about 6 feet below the lip of the pit. From there, he was able to look up to examine the few remaining feet of the climb and discovered that the "bedrock lip" had broken free from the cave wall; it was now just a large rock rolling into and out of the pit with every movement of the rope. The group feared that the weighted rope was actually holding the rock in place against the wall at the top of the pit and that unweighting or moving the rope would allow the rock to fall.

This rock unexpectedly broke free from the wall while a caver was on rope. Photo by Eric Richards.

Concerned that the loose rock could not be passed safely, and with very little room for the caver to duck out of the way to let the rock fall past him, the group decided that the caver should switch to descending gear, and then climb down to a wider and safer location in the pit. From that safer location, the rope could be unweighted, and the rock could either be moved or allowed to fall safely. However, while the caver was switching from ascending to descending gear, the rope was partially unweighted for a moment, and the overhead rock immediately rolled out from behind the rope and fell down the pit. The caver felt the rope shift and suddenly drop a few inches, and he quickly pushed himself sideways out of the most likely rockfall path. The rock hit the wall above and below the caver, but missed damaging either the caver or the rope.

After spitting out a mouthful of dirt and declaring himself unharmed, the caver let the dust settle a bit and then finished climbing up and out of the cave. After climbing out, the top of the pit was re-examined and again cleared of loose debris. The fallen rock was found to be a rectangular block, weighing perhaps 25 to 30 pounds, that had been pulled and rotated free from the lip of the pit along pre-existing fractures. Examination of the lip of the pit before entering the cave had suggested it was solid bedrock.

1. David Herron, Incident Report, 26 January 2021.

Comments: It is often difficult to tell bedrock from "float" (unattached pieces of rock in the sediments) around and inside of a sinkhole cave entrance. Sloping sinkholes, especially in higher latitude or alpine terrain where seasonal freeze-thaw cycles and frost shatter are significant erosive forces, often contain fractured and weathered bedrock that should be inspected carefully when rigging. When possible, cavers should consider suspending rigging off of pit slopes with a redirect or isolating sections of pit with rebelays to reduce the likelihood of prying blocks at the lip loose under a tensioned rope.

21 September 2019
Toothbrush Cave, Utah
rockfall, injury and aid

Three people entered Toothbrush Cave with some rappelling gear but no helmets. The cave begins with a steep, rubble-strewn floor that leads to a 20-foot drop. A 20-year-old man rappelled the drop and at some point was struck on the head by a cantaloupe-sized rock. It is not clear how the rock became dislodged.

The man temporarily lost consciousness but was awake when rescuers arrived. The Uintah County Sheriff and SAR team packaged the man in a litter and raised him out of the cave with a high-angle rope rescue system. He was transported by ambulance to a medical center in Vernal, Utah.

1. Graham Dudley, "Man rescued from Uintah County cave after large rock hit him in the head," www.ksl.com, 21 September 2019.
2. Nate Carlisle, "Spelunker is rescued from eastern Utah cave," www.sltrib.com, 23 September 2019.

Comments: Helmets are essential safety gear for any vertical rope work, especially in potential rockfall zones. This pit in particular is exceptionally configured to send rocks down toward your head while climbing or rappelling; a large slope of loose frost-shattered rock funnels into the pit. The rig point outside of the cave makes it difficult to keep the tensioned rope from contacting rocks on the slope while a caver is beneath. Similar to the previous incident, this is another case where isolating the pitch into several segments may improve overall safety.

22 September 2019
Mine Shaft Cave, Missouri
difficulty on rope, no injury, no aid

Mine Shaft Cave is a dolomite cave that was filled with clay and mined for the clay's lead content. A group of cavers was surveying the system and rigged the 90-foot mined entrance pit. The pit is 6 feet by 6 feet square. The top is covered by a heavy steel cupula gate with side access. A 300-foot, 11-mm PMI Pit rope was rigged to the cupula gate in such a way that two ropes were available for rappelling or climbing. About 100 feet of rope remained on the surface.

Several cavers had already climbed out and left the area before the last group started up. A male caver (25) from the second group started up one of the ropes. After a while, a female caver started up the second rope and found the male caver still on rope and having difficulty ascending. She saw that his chest harness was very loose and a bungie cord was caught in one of his ascenders. Her attempt to help adjust his harness was unsuccessful, so she continued to the top to notify two cavers still at the surface that someone was stuck on rope. The topside cavers yelled down to the stuck caver and learned that his chest harness was about to slip off over his head, he did not have a rappelling device on his person, and he was exhausted.

Alex Litsch rappelled the second rope to see if he could help. Litsch carried a rope tether, a spare Croll and rappel rack, and carabiners. He found the stuck caver nearly horizontal with his knees at his chest about 40 feet above the floor. The stuck caver was wearing an old variation of a ropewalker system with a Pantin and Basic ascenders connected by a bungie. He had a QAS attached to the rope, but the length of webbing was too long for his reach. His chest roller was a Simmons single roller that had about a 6-inch gap between the roller box and his chest due to the chest harness being extremely loose; he was at high risk of slipping out of his chest harness. His seat harness was a rock-climbing style harness, and he had no other ascenders on him. Litsch also discovered that the stuck caver had attached his QAS tether to his leg loop and this is what he had been hanging by. Fortunately, Litsch was able to attach the spare Croll to the caver's belay loop and get the caver's weight transferred to it. The caver was now safe from falling out of his chest harness.

Next, Litsch attached the rope tether between his rack and the other caver's harness in preparation for a pick off. By now, the other caver was too exhausted to detach himself from his rope, so cavers at the top slowly lowered the stuck caver's rope until his weight was transferred to Litsch. Litsch was then able to rappel himself and the exhausted caver carefully to the floor.

At the entrance, Chad McCain built a 3:1 haul system. McCain describes the rigging as "…fairly straightforward, as there were ample trees around to rig to; however, the main issue was the cupola gate over the pit which required a deviation inside the gate, hanging from the roof of the gate, to keep the rope from rubbing on the steel of the gate during the hauling. The deviation required three long runner slings around angle iron, and fed through the expanded metal to hang a pulley to keep the rope off of all contact points. After the 3:1 Z-rig was set up, [we] hauled [him] out in a few minutes."

1. Chad McCain, Incident Report, 11 December 2019.

Comments: There is much to examine here for the discerning *ACA* reader. First, the second rope rigged in the entrance provided not only travel efficiency for a large group, but also played a crucial role in patient access and assessment and in the two-rope pickoff maneuver. Second, the topside team had the skills, gear, and critical thinking to rescue a caver from one of the most perilous situations in vertical caving—being stuck on rope. The cavers-turned-rescuers assessed that the stuck caver was in a critical situation and needed to be lowered to the ground before they attempted to build a haul system. This can seem counterintuitive at first, but getting the patient off rope ASAP is the priority, and lowering can often be accomplished in much less time than building an efficient haul system. Once the caver was safely off-rope, the team had time to build a haul system that accounted for and mitigated the potential friction issues. This resulted in a smooth, efficient haul of the patient to the surface.

Third, in the interesting "team pickoff" maneuver, when ready to rappel the patient to the ground, note that Litsch suspended the patient from the shared descent device rather than from his own seat harness. This is significant as it is not only more comfortable than hanging the patient from his harness connection, it also allows him as the rescuer a ready means of escape should the two-person rappel become fouled. Pickoffs are inherently risky for rescuers. This pickoff method mitigated some of the risk with help from above in the load transfer and in the tandem rappel connection choices.

Lastly, the poorly tuned and poorly fitting SRT system seems difficult to avoid as the root cause of this incident. It is generally considered careless to ascend a pitch with no means of changing over to rappel. Systems should be tuned to function for a particular individual. Harnesses and straps that are obviously loose, worn, or made of inappropriate materials are incidents waiting to happen. Sometimes these defects are difficult to detect in advance, but all cavers have some level of responsibility to speak up and attempt to correct when these types of things are observed, as doing so can prevent incidents and rescues. The real skill is found in those that make these subtle corrections while maintaining a positive learning experience for all involved.

28 September 2019
Salamander Cave, Arizona
equipment problem, no injury, no aid

At a caver campout event, a group of six cavers entered Salamander Cave in Arizona. The entrance is a three-pitch drop of approximately 40 feet. Deeper in the cave is an 85-foot pit. One caver (32) successfully descended the first pit and was trying to remove her harness for the short trek between the first and second drops when her D-ring maillon became stuck partially open. Her harness had metal attachment points, and the D-ring was not open enough to get

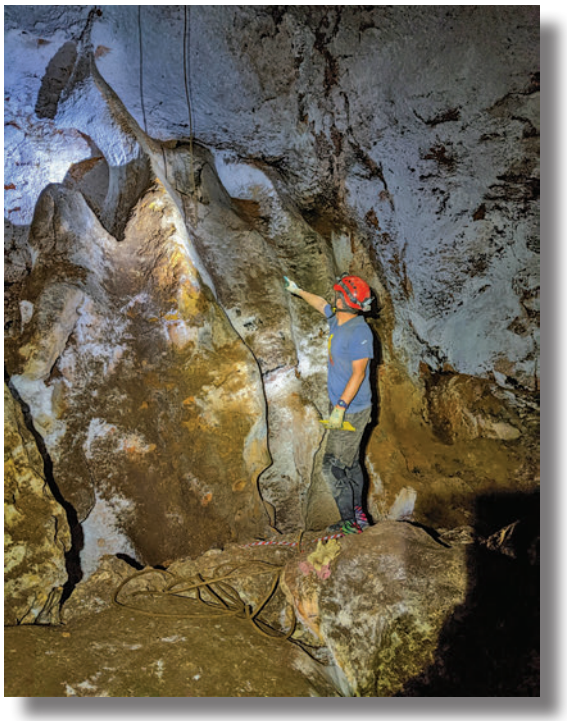
either metal attachment out. She also could not close the D-ring. The other cavers tried everything that they could think of (pliers, water to lubricate, using another link to wrench the opening, etc.). The D-ring was completely stuck.

Another caver loaned her a D-ring to descend the second drop, and she clipped her gear and harness to it, essentially bypassing the stuck D-ring. However, for the exit climb, there was no good way to pass the borrowed D-ring between her and its owner without it getting hung up along the way. The team discussed this and decided to have her use an oval carabiner to replace her D-ring with the hope that the harness straps and Croll would load along the major axis, rather than tri-loading the carabiner. On exiting the cave, the caver loosened all of her straps and easily removed the harness.

1. Sarah Truebe, Incident Report, 20 November 2019.

Comments: In her report, Truebe says it is still unclear why the D-ring stuck. Incidents like these have led many cavers to move to a harness connection with a swing gate, notably the Petzl Omni. Screwlink D-rings are still favored by many cavers due to their lack of a gate, which adds to a secure look and feel. These users learn that the D-ring must be kept closed, even when not in use. It is surprisingly easy to tweak the open D-ring to where the threads will no longer match the sleeve. Know the limitations of your devices and treat them accordingly.

The team devised solutions not only for the caver to be safe to exit, but to also continue with the trip. When an oval carabiner had to be substituted for the D-ring at the entrance, they correctly assessed its limitations in contrast to a D-ring, recognizing that the caver would need to keep this carabiner connection tensioned in use at all times while ascending the narrow pit. Unloading the carabiner by using wall projections and footholds would have allowed it to rotate into a less safe position, so the cavers planned and discussed this prior to action.



Shawn Thomas points to the end of a rope that broke in Lechuguilla Cave. Photo by James Hunter.

6 October 2019
Valhalla Cave, Alabama
other (wasp sting while on rope), no injury, no aid

Ten people went to Valhalla Cave with the intent of rappelling into and climbing out of the entrance pit. After five people rappelled into the cave, the sixth caver, a man in his late 20s, got on rope. He left a large pack at the surface and carried a smaller pack into the cave. His ascending equipment was inside this smaller pack.

Approximately 10 feet into his rappel, he was stung by wasps. The caver is highly allergic to bee stings, and his Benadryl® and EpiPen® were in his large pack on the surface. He was unable to do a quick changeover because his ascending gear was in his cave pack. He called up to the surface to let others know he needed his personal medical kit and then rappelled to the bottom of the pit. As soon as he called "off rope," the next caver quickly descended with the requested medical supplies. The caver took some Benadryl®, but did not feel the need to use the EpiPen®.

After a few minutes of rest, the caver decided to exit the cave and started to climb the rope. After ascending about 100 feet, he became exhausted and was unable to continue. Fortunately, the group included experienced SAR members, and they quickly constructed a 9:1 mechanical advantage haul system and hauled him out.

1. Kimberly Lughart, Incident Report, 26 January 2021.

Comments: Vertical cavers should plan ahead for unforeseen problems. One of the most basic ways of doing this is to wear ascending and descending gear regardless of intended direction of travel on the rope. Many cavers and medics would likely argue that essential drugs and medical gear should be along for the ride, rather than left behind on the surface.

There are many safety, medical, and psychological reasons to have a rested and recovered patient attempt to leave a vertical cave under their own power. Sometimes it doesn't work out. Cavers-turned-rescuers are advised to plan ahead for problems with possible solutions for haul or lower. This team of trained rescuers was able to quickly build and haul. In many cases it is advisable to pre-rig a caving trip for rescue with an easily converted haul or lower system.

23 October 2019
Lechuguilla Cave, New Mexico
equipment problem, no injury, no aid

During a resurvey of the Way Beyond Reason Room, a team composed of Max Wisshak, James Hunter, and Shawn Thomas experienced a major rope failure when a rope, likely placed in 1988, broke while they were jump testing it from the bottom.

The trio was resurveying the room to improve the original sketch. Hunter decided to climb a rope that had been

left by previous explorers to redo a survey shot and check for leads at the top. The rope was an 11-mm rope of unknown brand, and about 25 feet of it was on the ground. The sheath appeared to be fuzzy, but the fuzziness was uniform throughout the length that they could examine, and they observed no visible bad spots.

Having a significant amount of experience caving and climbing in Lechuguilla Cave, Hunter says that he is always suspicious of old anchors in the cave. He connected to the rope with both ascenders and sat down hard on the rope a couple of times. Then he moved his ascenders up higher and did a jump test, letting all of his weight (190 pounds with gear) fall onto the rope. The rope broke.

The location of the break was 15 feet above the ground, away from any knots or rock and above Hunter's ascenders. The cavers put a section of the rope with the broken end in a Ziploc bag and gave it to the cave resource managers for further analysis.

In their report, Wisshak and Hunter offer the following possible explanations for the rope failure: The spot where it broke may have been at the edge near the top of the climb where it got abraded but was flipped at a later time. Prior to getting installed on the climb, the rope could have experienced damage from rockfall. The rope may not have been new when it was installed, and its history, age, and use were not known. Or, the rope may have simply aged in the 30 years it had been in the cave to a degree that decreased its strength to the present critical value. For more information on the subsequent rope analyses, see Ron Miller's presentation, "*How Strong is that Rope*?" in the Lechuguilla Cave 150th Mile webinar symposium, available on the NSS YouTube channel.

1. Max Wisshak and James Hunter, "Incident Report: Rope failure in EX23A-28 climb in Way Beyond Reason Room," 2 November 2019.

Comments: Wisshak and Hunter make the recommendations that, "Although the unknowns associated with this rope may mean that this is an isolated event, we believe that all expedition leaders should be notified of this incident for safety awareness. In addition, we recommend that, at minimum, a two-person load test be performed before ascending any unknown ropes in Lechuguilla Cave." This is good advice for unknown ropes in *any* cave.

23 November 2019
Valhalla Cave, Alabama
fatality, caver fall

A 21-year-old college student fell 200 feet while trying to rappel Valhalla Cave's entrance pit. Trever Col was visiting the cave with four other students from Purdue University. The group had caving experience and a permit. They did not, however, have a rope long enough for the entrance drop, so they tied two ropes together using a double-fisherman's knot. When they rigged the ropes, they did so in a way that placed the joining knot just below the lip of the pit.

Col rappelled first. When he reached the knot, he rerigged his rappel rack below the knot and locked it off. At some point, however, Col became detached from his rack and he fell about 200 feet. Members of his group on the surface called 911 but did not attempt to enter the cave.

Chattanooga-Hamilton County Rescue Squad (CHCRS) responded. They pulled the rope out of the pit and found Col's standard length, six-bar SMC rappel rack attached to the rope and locked off. Upon reaching the victim, who had died from the fall, rescuers examined the rest of his gear. Attached to his harness D-ring was a partially open carabiner; a small notch in the carabiner's sleeve suggests that Col's weight forced it open.

Interviews with the reporting party revealed that the group had rigged and rerigged the pit several times, trying to get their primary rope to reach the bottom. When that was not possible, they tied two ropes together. Col, being the most confident in his knot-passing abilities had gone first. The group also indicated that they had intended to share and pass gear up and down the pit. This implies that the group did not have adequate gear. In addition to psychological stress and the knot-crossing, this is likely why they made the decision to not enter the cave to check on the victim's welfare.

1. Joshua Rhett Miller, "Purdue student falls 200 feet to his death inside Alabama cave," www.nypost.com, 25 November 2019.
2. Dave Bangert, "Purdue student dies after falling 200 feet while rappelling in Alabama cave," www.jconline.com, 24 November 2019.
3. Jason Duaine Hahn, "21-Year-Old Purdue University Student Falls 200 Feet to Death in Alabama Cave," www.people.com, 25 November 2019.
4. Brad Tipton, Incident Report, 25 January 2021.

Comments: The carabiner found on Col's D-ring had the small characteristic notch of a locked carabiner that has had its gate locking sleeve broken open (often inward) by torque forces applied by other hardware in a locked-gate rollout failure. When carabiner gates are cross-loaded in a configuration that produces torque forces, they can fail under a single body weight. In other incidents, carabiners that have inadvertently become unlocked have opened and detached under rollout conditions. Locked or unlocked, in either case these failures often result from situations where previously tested and loaded "chains of hardware" (for example a linked carabiner and descender) go from a state of being loaded to being unloaded and then reloaded. The chain of hardware goes slack when unloaded and is prone to rotation and cross-loading. It can be difficult to notice the moment of rotation, as this usually happens at a ledge, knot, rebelay, or other type of obstacle. These obstacles provide distractions in addition to mechanisms for unloading the descender.

The available facts suggest that Col likely used some number of ascenders to aid in the knot-crossing, but must have removed the last one from the rope without performing a successful three-point rappel test including visual, tactile, and operational checks of his descending system. Cavers should look at, and feel their descending system (including the connecting hardware) before loading or re-

loading any descent device and then test operate the device. At least one of these points of a rappel test should have caught a cross-loaded carabiner. Many cavers use a screw-link between their rack and D-ring, with the 7-mm, long oval being a popular choice. This connector can be lightly wrenched shut, preventing it from opening inadvertently. In addition, its narrow width prevents cross-loading, eliminating the hazard. Many other cavers prefer the versatility of a carabiner, as they can attach and detach the descender as needed. This is acceptable practice when incorporating the three-point rappel test before every loading event. In contrast, bobbin descenders must be used with a carabiner and specifically should not be used with a small screw-link, as doing so has led to the side plate opening during rappel. For best results, know the proper connectors for your descending device, and perform a three-point rappel test before committing your weight to any single-point-of-attachment descending system.

This group had been trained in vertical caving techniques and may have been competent to complete the trip had their single rope reached the bottom. Because their rope did not reach, the conditions of the trip changed, and the obstacles became more than they were prepared to negotiate. It can be difficult to call off a trip in the face of adversity, but when stretched beyond capacity, the best decision is often to retreat and live to cave another day. The mere fact that this group planned to pass gear up and down a 227-foot pit is a major warning sign and speaks to a lack of experience across the group. The American caving community would do well to study this incident in order to find ways to better educate interested groups. Anyone curious about vertical caving should be properly educated to the inherent risks, needed training, and appropriate gear and techniques in hopes of preventing further tragedies.

25 November 2019
Bisaro Anima, British Columbia, Canada
caver fall, injury, no aid

On the second day of a multiday expedition to push the bottom of Bisaro Anima by diving, Kathleen Graham (38) fell a short distance at Vimy Ridge, 400 meters below the surface.

The caving team was accompanied by a filming crew on this expedition. Graham and Christian Stenner were asked to do an "action shot" of the two of them carrying their heavy packs over Vimy Ridge. Graham explains, "We tried to climb smoothly with our heavy bags as we were being filmed. Then the scene cut and we were asked to do it again. Much to my relief, two other headlamps came into view. Now they could redo the scene and we were free to go. I hurriedly made my way around the clutter of humans. I went off route to get away from the lights, bags and people, scampering down the slope of unstable basketball-sized rocks. Then I was moving and the rocks were moving, I wanted to get out of the way, I didn't want to drop off the side, but I wasn't in control."

After she stopped moving, she had pain in her ankle but she could bear weight. She was assisted to Camp 1.5, a short distance above Vimy Ridge, where she spent the night. The next day Graham was accompanied by three other cavers who assisted her to Camp 0.5. They carried supplies in case progress was slow and another camp could not be reached in a day. Meanwhile, other cavers assisted by improving the rigging of some unprotected traverses between Camp 2 and Camp 1 to assist her exit. However, as she could bear weight, she was able to move through the cave on her own, needing only a hand in a few spots. Support in the form of first-aid tape was applied to the ankle, and her rubber boot helped minimize movement. She spent a day at Camp 0.5 resting before exiting the cave the next day. She spent two more days on the surface before the scheduled helicopter pickup for the entire team. Upon reaching a hospital six days after the incident, Graham had surgery to her ankle; a plate and six screws were placed to repair her broken ankle.

1. Katie Graham, e-mail communication, 23 January 2019.
2. Christian Stenner, Kathleen Graham, Adam Walker, and Jeremy Bruns, "The Battle of Bisaro Anima," *The Canadian Caver*, #88 (Winter 2020), pp. 5–16.

Comments: Taking a less traveled route where the rocks have not settled, carrying heavy weight, and the pressure of a serious dive along with frustrations from delays due to filming are likely contributors to the incident. The last thing to happen, the fall, is only one aspect of a chain of contributing factors that can be present in any incident. If the seriousness of the ankle break had been known, it might have caused the group to take more caution during the three-day exit and the additional two days on the surface. This can be hard to assess with a hardy patient and the appearance of a less serious injury. This incident illustrates how a caver with one injured limb can often aid in their own rescue, including significant ropework with a bit of assistance and additional rigging.

30 November 2019
Bisaro Anima, British Columbia, Canada
other (injured while crawling), injury, no aid

On the last day of a six-day expedition, the caving team's objective was to move equipment bags back to the surface. While moving heavy equipment bags through a crawlway above Camp 0.5, Jared Habiak (32) hit a rocky projection on the floor with his chest, causing great pain. He guarded the injury as best he could and climbed out of the cave on his own, including a 60-meter and 105-meter pitch along with some shorter pitches. The team spent the next day on the surface packing and awaiting helicopter pickup. Upon returning home and seeking medical attention, Habiak was diagnosed with a broken rib.

1. Christian Stenner, Kathleen Graham, Adam Walker, and Jeremy Bruns, "The Battle of Bisaro Anima," *The Canadian Caver*, #88 (Winter 2020), pp. 5–16.

Comment: Heavy bags and expedition fatigue likely contributed to this incident.

2019 Cave Diving Accidents and Incidents

9 February 2019
El Dudu Cave System, Dominican Republic
two fatalities, drowning

Two Italian divers, Carlo Basso and Carlo Barbieri, perished in the El Dudu cave system in the Dominican Republic on 9 February 2019. Neither diver was certified for cave diving, and neither was using gear suitable for cave diving.

The divers entered the cave at about 11:50 a.m., and when they had not returned by mid-afternoon, Phillip Lehman of the Dominican Republic Speleological Society (DRSS) was notified. Lehman and Angel Compres initiated a search without knowing what sections of the cave the divers had planned to visit. They discovered significant silt in their search, and they used that silt as a guide to where the divers may have gone. The silt led them into a tight side passage with extremely poor visibility; here they found a broken guideline going into the side passage. After a considerable search in worsening visibility, they called off the search. The next day the silt continued to impair visibility. As a result, the search continued for several days without any results.

On 12 February, one of the bodies was found in a side passage typically accessed only by divers with side-mount gear. Carlo Barbieri was caught in this tight space in such a way that the team was unable to recover his body. Several more attempts were made over the next few days.

By 21 February, only one of the missing divers had been found, and his body was still unrecoverable. The local recovery team halted its recovery operation, and two American divers with expertise in body recoveries and working in low visibility agreed to resume the effort. At first, Edd Sorenson and Mike Young had difficulty entering the country. The government felt that because the missing divers had not been recovered yet, it must be too difficult and dangerous. Officials finally agreed to let the Americans try, giving them eight days before ending all attempts at recovery.

On their first attempt, Sorenson was able to secure the body using a specialized harness that he had constructed. Young assisted by clearing rock and maintaining the line. Working in zero visibility with a four-point anchor system they had built, Sorenson and Young were able to bring the body to the cavern zone, where divers from the Dominican Republic navy helped bring the body of Carlo Barbieri to the surface. That recovery took about four hours.

The next day Sorenson and Young searched for the second diver, Carlo Basso. Passing beyond the location of the first victim, again working in zero visibility, Sorenson encountered walls, which indicated that they were at the end of the passage. At that point he found the second body, facing back toward him and slightly down in a crevice. Sorenson cut Basso's back-mounted cylinder off; the cylinder immediately floated up, indicating that it was empty. He later cut the staged front-mounted cylinder loose, and it sank into the crevice, indicating that it must have been full. That cylinder had also been entangled with a large mass of cave line that Basso had apparently pulled loose along the way.

While doing this work, Sorenson could not maintain contact with their cave line, so Young kept one hand on the line and one hand on Sorenson to enable him to work in safety. Once Sorenson cut the tangle of cave line away, they were able to pull Basso to the site where the other diver had been found. They then followed the same recovery process as had been used before with Barbieri. The second recovery took approximately four hours.

1. John Adsit, Report for American Caving Accidents, 27 December 2020.

Comments: It is difficult to determine what caused the fatalities, and what follows is only one theory. After entering the cave, and while following the main permanent cave line, the divers came to what is called a "jump"— another line leading off to a side passage; that is almost certainly how they came to where they were found. Following standard protocols, this jump started several feet away from the main line so that divers would not mistakenly follow it. If a diver intends to follow it, standard procedure is to make a temporary connection between the jump and the main line using a jump reel. That temporary connection is supposed to be removed upon exit.

When the recovery effort began, a jump reel was found at that location. It is possible that a previous diver had placed it there and not removed it, as should have been done, and that Basso and Barbieri decided to follow it. It is also possible that Basso and Barbieri put it there themselves, intending to take that jump. They may have known that it connected back to the main line at a point closer to the entrance, and they may have intended to make a circuit by following that jump line. (Circuits are considered an advanced skill and are taught only in the final portion of cave-diving certification.) Whatever the reason, Basso and Barbieri took that jump and followed it, running back parallel to the main line. They then came to a "T" intersection. Turning to the right would have taken them safely back to the main line, the completion of the circuit, and the exit. That "T" intersection may have been a surprise to them, in which case they may not have known which direction to go. They turned left instead, which led them into an increasingly narrow, silty passage appropriate only for advanced divers using side-mount gear.

Evidence suggests that as they went through that passage, the lead diver (Basso) had his front-mounted stage cylinder entangled in the line and that the line broke as he continued forward. The entangled line followed him, so that when they came to the end of the passage, realized their mistake, and turned around, there was no guideline for Barbieri to follow back. They may have been nearing the end of their air supply then as well. Basso was evidently unable to reach the regulator of his stage cylinder in those tight quarters.

Whatever the actual story, the fact is that two divers with no cave training and without appropriate equipment

entered a cave and attempted a dive requiring advanced training and equipment. If they intended to complete a circuit, which is an advanced skill, they did not follow correct procedure. They should have verified the exit, a process which would have included placing a personal marker on the exit side of the "T" intersection. As a result, not only did they die on that dive, they created an extremely hazardous recovery situation that could have taken the lives of the recovery divers.

16 April 2019
Mill Pond Cave, Tennessee
stranded, aid, no injury

On Tuesday, 16 April, a group of British cave divers were exploring Mill Pond Cave, a cave described as "treacherous" due to its tight passages and low visibility. The team included Josh Bratchley, a diver who had helped rescue a boys' soccer team from a cave in Thailand in 2018.

During the dive, a dive line broke, and around 6:00 p.m., Bratchley became separated from his team. His team spent several hours looking for him, but eventually called authorities at 1:00 a.m. on Wednesday. Because of the cave's difficulty, local authorities called Edd Sorenson from Florida. Sorenson has performed several cave-diving rescues and dangerous body recoveries over the last several years and is considered the most skilled person for cave-diving rescues. Sorenson arrived in Nashville on Wednesday at 3:00 p.m., and he entered the water at 6:00 p.m.

Sorenson was not in the cave long before he found Bratchley. Bratchley had located an air pocket while trying to find his way out of the cave. He decided that it would be better to wait for rescue than risk running out of air trying to find the way out. Sorenson questioned Bratchley to assess his physical and mental state. Bratchley was calm and alert and was able to follow Sorenson out of the cave to safety.

1. Kyle Davis, "Thai rescue team diver trapped in Tennessee cave rescued," www.abc15.com, 17 April 2019.
2. Meagan Flynn, "A diver who helped rescue the Thai soccer team was just saved from an underwater cave in Tennessee," www.washingtonpost.com, 18 April 2019.
3. Remington Hernandez, "Video Shows Rescue of Diver Trapped in Tennessee Cave," www.yournewsnet.com, 19 April 2019.

24 November 2019
Manatee Springs, Florida
fatality, drowning

On 24 November 2019, Zhou Min (28) of China died in a cave-diving accident in Manatee Springs in north Florida. Zhou was diving with her husband and two other divers who had come to Florida from China with the express purpose of diving Manatee Springs. Zhou was a relatively newly certified cave diver, described by her certifying agency (World Underwater Discovery, or WUD) as having 11 hours of experience. The others, including a cave-diving instructor, had more experience, including in Florida.

The flow into the Manatee Springs headspring is normally very strong, so divers do not enter the cave system at that point. They instead frequently enter at a nearby sinkhole called Catfish Hotel and then proceed upstream through the cave, encountering other openings (Sue's Sink and Friedman Sink) along the way. Such trips sometimes are done as traverses, meaning the divers enter in one area and exit in another.

In years past, divers would sometimes go downstream from Catfish Hotel and exit the cave at the Manatee Springs headspring, an adventurous traverse in the high flow. However, collapses in the passage near the headspring in recent years have made the opening much smaller and the exit more dangerous, and local experts warn that this is no longer a safe practice. In November 2019, rains had made the current even stronger than normal, making such a traverse even more dangerous.

The group was led by Wang Yuan, a WUD cave-diving instructor with more than 500 hours of experience, including experience in Florida caves (although not in the last few years). He reported that he has made the trip from Catfish Hotel to the Manatee Springs exit three times in the past, but he was not aware of the recent changes to the opening of the spring. The group's dive plan called for them all to exit downstream into Manatee Springs.

That plan called for team 1 (Wang Yuan and Chen Qian) to enter the cave at Catfish Hotel wearing rebreathers and using dive propulsion vehicles (scooters) to go against the current past Friedman Sink and then turn around to join team 2. Team 2 (Zhou Min and her husband, Fu Xiaoyu) was to enter Catfish Hotel an hour later wearing LP 95 back-mounted double cylinders, do a short dive on their own, meet up with team 1, and then proceed with team 1 downstream to the Manatee Springs exit.

Normal cave diving protocols call for verifying the viability of a planned exit on a traverse before the dive. This would normally mean going to the Manatee Springs area and inspecting it. They did not do this. According to his description of the incident, Wang Yuan believed that he and Chen Qian could tie off their guideline to the end of the main line before the spring and inspect the exit from within the cave before exiting, apparently assuming they would be able to turn the dive and return to Catfish Hotel if there were any perceived problems.

Wang reported that the flow was light when they tied off a reel to the main line and headed toward the exit. This called for them to ascend a slope, and as soon as they did, they were caught in a current that was too much to handle. He tried to hold onto stones to hold his position but could not do so. The current tore at his mask and his rebreather, interfering with his ability to breathe through it. Yuan was soon thrown out of the cave by the current.

According to Wang, he tried to get back into the cave to help the others. He could see light signals calling for help. At that point Fu Xiaoyu was also thrown out of the cave. Wang could see that Chen Qian was unconscious with the regulator still in his mouth, and he could see that past him Zhou Min did not have her regulator in her mouth. Chen's scooter and light head were firmly wedged in the rocks. Wang cut him free from the scooter, after which Chen was also thrown out of the cave. Wang decided to hope someone

on the outside could take care of Chen while he tried to get Zhou. He said he was unable to get to her because of the current and decided to return to help Chen. Wang and Fu found Chen and were able to revive him.

Per standard procedure, a team from the International Underwater Cave Rescue and Recovery organization was called to recover the body. They were able to do so the next day, but it required great effort and several dives.

1. Sarah Nelson, "Cave diver dies, became trapped in 'chimney,'" www.gainesville.com, 25 November 2019.
2. John Adsit, Report for American Caving Accidents, 30 December 2019.

Comments: The recovery required moving rocks and removing her equipment. Since this incident, the main line from Manatee Springs to Catfish Hotel has been removed, and a warning sign has been placed to discourage divers who enter at Catfish Hotel from heading toward Manatee Springs.

2019 Caving-Related Accidents and Incidents

12 April 2019
Stephens Gap Cave, Alabama
fatality, fell into cave

Juan Gerardo Cruces (25) was reported missing on 12 April 2019 when he did not return home from a trip to Stephens Gap Cave. Authorities located Cruces' car at the cave's parking area but did not find evidence of him at the cave. The Huntsville Cave Rescue Unit was called to assist, and they searched the cave more thoroughly. Cruces body was located; he had apparently died from an approximately 150-foot fall from the surface. The victim had a permit to hike to the cave, but there is no indication he had intended to enter it.

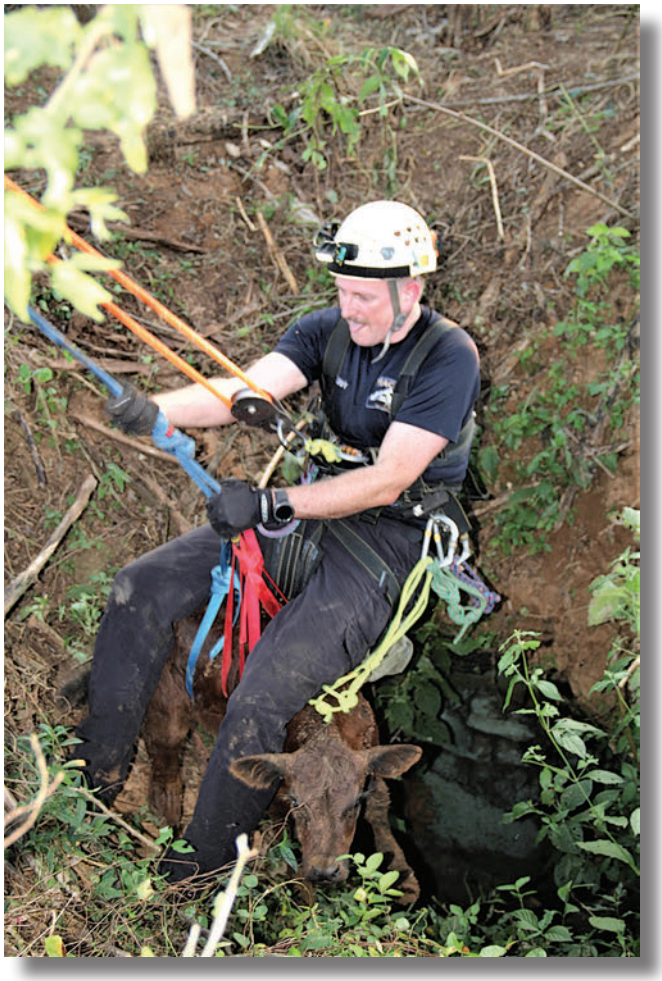
1. Ashley Thusius, "Madison man was found dead in a cave in Jackson County on Friday," www.waaytv.com, 15 April 2019.
2. Laura Christmas, "A Madison man died in an apparent accident while at a Jackson County cave," www.whnt.com, 15 April 2019.
3. Kimberly Lughart, email communication, 25 January 2021.

1 June 2019
unspecified cave, Florida
dog rescued from cave

A Florida man was hiking in Goethe State Forest when he heard a dog whimpering in distress. He followed the sounds until he located a dog stranded in a pit. The man was not able to climb down to the dog, so he dropped all of his hiking snacks into the cave for the dog. He then went home and asked for help on his nature website, Florida-Trailblazer.com. A number of people responded, and the next day the man led rescuers to the cave.

A good Samaritan rappelled into the cave and brought the dog out. "The dog was so happy. She just rolled around on the grass, wanting her belly rubbed." The dog, whose name is Sally, was wearing a collar with her owner's phone number. The owner was very happy to be reunited with Sally, who had been missing for almost a month.

1. McKinley Corbley, "Dog is Finally Rescued by Hiker Three Weeks After Falling into Cave Miles from Civilization," www.goodnewsnetwork.org, 5 June 2019.
2. Melanie Michael, "Florida hiker rescues dog trapped in cave for 3 weeks," www.wptv.com, 6 June 2019.
3. Alan Cressler, personal communication, 14 January 2021.



Mike Priddy of TRACER rescues a calf that had fallen into a sinkhole. Photo by Sherry Alvey Thompson.

19 August 2019
unnamed sinkhole, Kentucky
calf rescued from sinkhole

A calf was rescued from a sinkhole by the Technical Rope and Cave Emergency Response (TRACER) team from Radcliff, Kentucky. The calf had been in the sinkhole for an unknown period of time before it was discovered. TRACER's team leader Mike Wheeler said, "One thing that likely helped the calf remain in such good condition was an old cooler that had been tossed into the hole years prior. It had collected enough rainwater to help stave off any dehydration in the calf. The temperature in the pit was about 54

degrees, so it (the calf) was more comfortable than the rest of us."

A rescuer entered the sinkhole and put a harness on the calf. The calf was brought to the surface in less than 30 minutes.

1. The News-Enterprise, "Crews rescue calf from sinkhole," www.thenewsenterprise.com, 22 August 2019.
2. Mike Wheeler, email communication, 2 January 2021.

Comments: According to Wheeler, "So many times in the past, we have heard of stories, after the fact, of landowners, unaware that rescue options were available, having destroyed the animal in place because they could not see a way of recovering them. Our team has taken hundreds of hours of formal training and raised thousands of dollars to obtain the specialized equipment necessary to perform these dangerous tasks."

Like many rescue groups, TRACER relies on donations to purchase the equipment necessary for performing technical rescues. Please support your local rescue groups.

6 September 2019
unspecified sea cave, California
boat stuck in sea cave

Two men, ages 66 and 19, returning from a fishing trip near Coronado Island put their 26-foot-long fishing boat on autopilot while they slept. When they awoke, they found that their large boat was being pushed into a narrow sea cave near the tip of the Point Loma Peninsula.

Rescue crews were not able to maneuver a rescue boat into the cave, so lifeguards swam in and helped the two men to swim out to the rescue boat. The fishing boat could not be recovered for several days due to rough water. When a boat salvage company made another attempt to recover the boat a week later, they found that the rough water had smashed the boat "as if it had been in a trash compactor."

1. Christina Bravo and Audra Stafford, "'Something Out of a Movie: 26-Foot Fishing Boat Gets Stuck Inside Point Loma Cave," www.nbcsandiego.com, 6 September 2019.
2. Erika Cervantes, "Crews Begin Removing Wreckage of Boat Stuck in Point Loma Cave," www.nbcsandiego.com, 13 September 2019.

9 September 2019
Cueva de la Puente, San Luis Potosí, Mexico
caver fall, injury, and aid

Alicia Stanford (33), from Australia, was on an extended visit to San Luis Potosí, when friends suggested she join them for a hike in the mountains. Stanford, along with four others, were led through the forest to the opening of a large cave at the bottom of a steep, rocky slope. The trip leader said that they could spend one to five hours in the cave and that crawling would be involved. Stanford did not know a cave trip had been planned, and she expressed some anxiety about crawling on her elbow, which had been fractured a year prior. The leader dismissed her anxiety, and she decided she would at least go down to the mouth of the cave.

As the group navigated down the slope toward the cave, Stanford tripped and fell forward, landing face down. She knew immediately that both her left leg and right arm were fractured. When she attempted to stand, the pain was so intense that she "almost vomited." The trip leader and others went for help. As the sun went down and the temperature started dropping, Stanford and those who had stayed with her realized that they had no food, water, or extra clothing.

Five and a half hours after Stanford fell, volunteers from a lime mine and the nearest city arrived. They strapped Stanford to a backboard and applied inflatable splints to her arm and leg. They carried her to the bed of a pickup and then transferred her to an ambulance. During the long ride, the ambulance crashed into a tree that had fallen across the road. After the tree was cut and removed, the ambulance continued on its way, reaching the hospital at 4:00 a.m.

An hour before surgery, the hospital informed Stanford that they were unable to accept foreign insurance. Stanford's health insurance provider worked with third parties, but it took some negotiating with the hospital until they agreed to operate before payment could be made.

Stanford endured many months of pain and immobilization, difficulty returning to Australia, and several subsequent operations.

1. Richard Wood, "Gold Coast woman describes cave rescue ordeal," www.9news.com.au, 14 October 2019.
2. Alicia Stanford, "365 DAYS LATER: ACCIDENT IN THE MEXICAN DESERT," www.wonderswithalicia.com, 9 Sept. 2020.
3. Jim Coke, email communication, 31 December 2020.

Comments: Cavers visiting foreign countries are advised to consult with a travel nurse before the trip to receive necessary vaccinations and health warnings for the area being visited. A travel nurse can also provide insight into medical capabilities for the travel destination and advice on whether to be treated locally or to evacuate to a different city or country for better treatment. Travelers should be aware that their health insurance may not be valid everywhere and should consider purchasing additional medical and rescue insurance to use in the unfortunate event that their domestic plans will not provide for appropriate care.

Entrance to Cueva de la Puente. Photo from geocaching.com.

4 November 2019
unnamed lava tube, Hawai'i
fatality, fell into cave

When a 71-year-old man had not been seen for a few days, a friend became worried and called the police. At first, nothing at the man's home in Hilo looked amiss. Police then noticed a lawnmower and weed eater in the yard, and upon investigation, they found that the man had fallen through a small hole in the ground while trimming bushes. That hole opened to a 20-foot drop into a lava tube. Police speculate that the hole was hidden under dirt and vegetation and the man did not know it was there.

1. Mihir Zaveri, "71-Year-Old Hawaii Man Dies After Falling into Lava Tube," www.nytimes.com, 7 November 2019.

Comments: Care must be taken to prevent tragic accidents such as this when living, working, or traveling through cave and karst terrain. In many cave areas, and often in lava tube areas, there is only a thin overburden between the surface and any caves below, and holes in the ground like the one that claimed this man's life may be hidden.

7 November 2019
Capshaw Cave, Tennessee
car drove into cave, aid, no injury

A vehicle that was speeding on a wet road slid off the road and into the entrance of Capshaw Cave. The driver was uninjured, and the vehicle was promptly removed from the cave entrance by a tow truck.

1. Chuck Sutherland, Incident Report, 7 November 2019.

A car that slid off the road is towed from the entrance of Capshaw Cave. Photo by Chuck Sutherland.

9 November 2019
unnamed sinkhole, Kentucky
calf rescued from sinkhole

A group of cavers was preparing for a survey trip when a neighboring farmer knocked at their door, asking to borrow a rope. One of the farmer's calves was stuck in a sinkhole. Cavers Chris Bauer, Adam Mathis, Angela Pullano, and Laura Demarest offered to help.

The calf was badly wedged about 10 to 12 feet down in a funnel-shaped sinkhole about three feet in diameter. The calf had likely been there overnight.

Bauer used a reptile hook to position webbing under the calf's chest and around a leg. Then, using a 3:1 mechanical advantage haul system anchored to a tractor, the team extricated the calf from the sinkhole. In her report, Demarest says, "The calf was stiff and exhausted but took a long stretch, got to its feet with assistance and tottered over to its anxious mother to nurse. About 10 minutes later it was moving with no sign of injury — a success!"

1. Laura Demarest, Facebook post, 11 November 2019.

Comments: A few months later, the farmer brought a Thanksgiving ham to the caver fieldhouse as a "thank you."

Cavers and farmers waiting for a calf to recover after being rescued from a sinkhole. The caver in orange is sitting over the sinkhole. Photo courtesy of Laura Demarest.

2020 Caving Accidents and Incidents

17 January 2020
Heart of Gould Cave, Tennessee
rockfall, injury and aid

In January 2020, a group of cavers was exploring Heart of Gould Cave, rigging and exploring virgin pits as well as performing lead climbs. After checking several pits and promising leads, Jim Fox (50) was making his way back down a number of pitches. He rappelled a short rope that went over a boulder and ended at the top of a narrow ledge that straddled two pits, one of those pits being 107 feet deep. As he rappelled past the boulder, he saw that the boulder was barely wedged in place and was starting to move toward him. When he landed on the ledge, rocks began to fall. The first rocks hit him in the face, cutting his nose badly. The next rocks struck him in the shoulder, knocking him down. More rocks hit his back, damaging a lung, which caused him to cough up blood for a week. Finally, the big boulder fell, fracturing Fox's femur.

While some members of Fox's group attended to his injuries, one caver went for help, calling 911 around 6:00 p.m. The responding rescuers faced several challenges, including packaging Fox into a litter on the narrow ledge straddling two pits, blasting cave passages to widen them for the litter, and negotiating several tight spots and vertical obstacles. Fox reached the surface at about 3:00 a.m. and was transported by ATV to a waiting ambulance.

This was an extremely technical rescue performed by members of the Sparta-White County Rescue Squad, the Chattanooga-Hamilton County Rescue Service Cave-Cliff Team, the Knoxville Volunteer Emergency Rescue Squad, and the Huntsville Cave Rescue Unit, among others.

1. Laura Halm, "East TN rescue crews speak on saving injured man from cave," www.wjhl.com, 20 January 2020.
2. Joey Gill, "Man rescued from White County cave after being stuck for hours with broken leg," www.wsmv.com, 20 January 2020.
3. Jim Fox, e-mail communication, 26 March 2020.

Comments: This cave rescue presented significant challenges and was likely successful due only to the high level of skill and training of the responders as well as the sheer toughness of the patient. Femur fractures are high-risk injuries that require skilled medical care and evacuation. This rescue required medical care, rigging, passage modification, and more, all by rescuers that can travel up and down pits on their own. Cave rescue is a highly technical skill that requires a lot of training to maintain competence. The success of this rescue speaks highly to the teams' commitment to readiness.

Photo, top right:
Jim Fox is administered an IV during his rescue from Heart of Gould Cave. Photo by Rachel Saker.

Photo, bottom right:
Jim Fox is raised in a SKED after breaking his leg in Heart of Gould Cave. Photo by Rachel Saker.

25 January 2020
Weybridge Cave, Vermont
difficulty on rope, no injury, no aid

On 25 January around noon, eight cavers chipped the ice out of the entrance to Weybridge Cave in Vermont as part of a Boston Grotto trip. The group consisted of three experienced cavers plus five people who were relatively new to caving. Weybridge Cave is one of the few northeast caves open in the winter; it features a relatively tight vertical entrance consisting of two drops measuring 18 feet and 40 feet. Snowmelt had created a small but cold waterfall in the entrance drops.

After the group explored the cave, the trip leader positioned the experienced cavers at the top and bottom of the entrance pitches with the newer cavers in between them. The first of the less experienced cavers to start up the 40-foot pitch began experiencing difficulty just ten feet up from the bottom. Directly in the flow of the cold waterfall, the female caver (20) found that she could neither continue up nor perform a changeover. Fortunately, she could be pulled from below over to a large rock where she was able to get off rope and climb back down. The caver was given extra warm layers, and the rope was rerigged to be used as a haul system. Other cavers exited at this time to contact their surface watch since they were now past their scheduled callout time.

On her second attempt, the caver continued to have difficulty, so she was hauled up the 40-foot pitch. With only minor assistance, she was able to make it up the next, shorter drop.

1. Steve Severance, Incident Report, 12 June 2020.

Comments: Severance believes that a lack of sufficient food and water was the primary cause for the caver's difficulty on rope but acknowledges that more experience may have helped her with performing a changeover in the stressful situation. The group devised a good just-in-case rescue plan, and it worked when the time came to use it.

1 February 2020
Indian Grave Point Cave, Tennessee
caver fall, injury, no aid

During a caving trip, a 20-year-old woman slipped while attempting a short climb and fell on her wrist. A nurse in the group examined the injury and believed that the wrist may have been broken. An ACE bandage was used to wrap the injured wrist, and cavers flanked the patient to help her exit the cave without further injury. An X-ray revealed a chipped bone in the caver's wrist.

1. Chuck Sutherland, Incident Report, 4 February 2020.

Comments: The trip leader reports that it was a challenging climb with slick surfaces. Scouting for an easier way around the obstacle may have prevented the accident. Injuries to the extremities are the most common caving injuries, usually resulting from the most common incident type: "caver fall."

Rescue scene at the back entrance of Whitings Neck Cave. Photo by Earl Suitor.

9 February 2020
Whitings Neck Cave, West Virginia
stuck, aid, no injury

On a Sunday afternoon, a call went out to the Bedington Volunteer Fire Department and Martinsburg Fire Department Special Operations Unit (MFDSOU) that a caver was stuck in Whitings Neck Cave. MFDSOU contacted the Eastern Region National Cave Rescue Commission (ERNCRC) Subregion Coordinator, Earl Suitor, who mobilized local cavers.

The stuck caver was a man in his mid-20s who was visiting the cave with a group of friends from a Baltimore, Maryland, college. Rescuers report that the large man was wearing appropriate clothing and gear for caving, including a cave helmet with a headlamp. He became stuck in a crevice, head up, pinned from his hips to his ribs, with his arms free. The man's companions tried for an hour to free him before calling for help.

Fortunately, the cave has two entrances, which allowed rescuers to quickly reach him from both directions. Webbing was placed under the patient's arms, and a haul system was established. Cavers assisted MFDSOU by adding a Prusik to the haul system to capture any progress in the patient's movement. The attempt at hauling ceased when the patient complained of it being too painful. A ladder was placed below the patient, and an air-bottle-powered chisel was called for to widen the space in case that would be needed.

The patient was given food, water, and heat packs while rescuers repositioned the haul system and made footloops for the patient to stand in. The second attempt was successful in extricating the man who had by now been stuck for over four hours. He was able to exit the cave under his own power.

1. Dave McMillion, "Man rescued from cave in Berkeley County," www.heraldmailmedia.com, 9 February 2020.
2. Earl Suitor, Incident Report, 16 April 2020.

Comments: In his report, Suitor describes the good relationship between local cavers and the MFDSOU, which has been built while rescue training and caving together. At the time of this incident, the two groups had already sched-

uled a National Cave Rescue Commission (NCRC) Orientation to Cave Rescue (OCR) training together for later that year; unfortunately, the OCR was ultimately cancelled due to the COVID-19 pandemic.

20 March 2020
Castleguard Cave, Alberta, Canada
caver fall, injury, no aid

A group of five cavers was traveling to camps deep within Castleguard Cave for the first half of a 10-day expedition. First Fissure is a 2-kilometer-long vadose passage requiring constant bridging movements. While moving through First Fissure on the way to Camp 1, Christian Stenner (40) strained his right wrist after slipping and catching himself a few times. The pain in his wrist worsened throughout the expedition. On the last day, a hockey tape splint was applied, and Stenner was given painkillers to relieve the pain. After the expedition ended, Stenner was diagnosed with a sprain and spent a few weeks in a wrist brace.

1. Christian Stenner, "The Deep Camps," *The Canadian Caver*, 89, 2020.

Comment: Multiple slips and related strain can accumulate, manifesting later in a trip. Stabilization of the injured area can assist healing and recovery even if the injury appears minor at first.

11 May 2020
Lost River Cave, Kentucky
fatality, drowning

A 30-year-old man was seen jumping over a fence at the entrance of Lost River Cave on a Monday evening. Authorities responded to find that the victim had drowned in the underground river. No further information was released.

1. Ana Medina, Brandon Jarrett, and Gene Birk, "Man identified in Lost River Cave death investigation, no foul play suspected," www.wbko.com, 11 May 2020.

23 May 2020
Scroll Cave, Arizona
lost/stranded, aid, no injury

A man and a woman in their early 20s with very little caving experience entered Scroll Cave for a day of exploring. They had difficulty finding their way out of the maze-like cave and eventually ran out of light. When they did not return home, their worried parents called 911.

The Pima County Sheriff contacted the NCRC Southwestern Region Coordinator who then called local cavers. The missing couple was found about 500 feet into the cave. During the night, the couple collected and drank water from a dripping formation. The couple and some of the rescuers were hauled out of the entrance, which otherwise requires stemming a chimney with 20 feet of exposure.

1. Timothy Clemmons, "Rescue groups save two lost and disoriented cavers," www.kvoa.com, 24 May 2020.
2. Sarah Truebe, Incident Report, 24 May 2020.

30 May 2020
Valhalla Cave, Alabama
lost control on rappel, injury and aid

Chattanooga–Hamilton County Rescue Service (CHCRS) Cave-Cliff Team and Jackson County Rescue responded to a report of a teenage girl having fallen at Valhalla Cave. The reporting party was the girl's father.

A team was promptly sent down the pit to assess the girl. The girl was found accompanied by the trip leader, who was on the floor of the pit when the incident occurred. The trip leader observed that the girl lost control of her rappel early in the descent and accelerated rapidly toward the floor of the pit. The girl hit the ground feet first, sustaining a suspected pelvic injury and losing consciousness for an extended period of time. The patient was packaged in a full-body air splint and raised to the surface. From there, she was air-lifted to an emergency center.

An interview with the trip leader led CHCRS to determine that he was inexperienced in single-rope techniques (SRT) and unaware of how to properly execute a bottom-belay to slow the girl's descent. Additionally, the father of the patient told CHCRS that his daughter was inexperienced in SRT and had previously rappelled only once in a shallow pit two weeks prior. Other witnesses in the reporting party observed that the girl started her rappel with only four bars engaged on a standard six-bar rappel rack, as she had been instructed to do.

1. Brad Tipton, Incident Report, 25 January 2021.

Comments: Valhalla is a 227-foot-deep pit, which is not an appropriate choice for brand-new rappellers. Bottom belay is a simple technique that can often be used safely, especially when planned for. Care must be taken to ensure that bottom belayers are not subjected to rock-fall hazard. Best practice for a six-bar rack is to begin with all six bars engaged and to then remove them as needed. Take caution not to remove too many bars at the beginning of a rappel, as your entire weight is not fully supported by the rappel device until your legs are suspended in the air. If you are working your way down a slope, a significant portion of your weight is actually being supported by your legs, which can make it seem like there is too much friction on the device when in fact it is set correctly for the vertical portion of the drop. It is better to fight too much friction on the way to the edge rather than to get caught beneath the edge with too little friction, rappelling out of control, and unable to add a bar.

13 August 2020
Bearcat Caves, British Columbia, Canada
difficulty on rope, aid, no injury

A group of three inexperienced cavers in their late 20s went to the Bearcat Caves near Kamloops, British Columbia. At least one member of the group had been to the caves approximately 10 years earlier. One person from the group had successfully rappelled into the cave but had difficulty ascending out. A rescue call was initiated by his companions. As Alberta/BC Cave Rescue and Kamloops Search and

Rescue were getting to the site, the teams were asked to stand down, as the subject had eventually climbed out on his own.

1. Cassidy Simpson, Incident Report, August 2020.

Comments: If you are going to descend a rope, it is important to know how to ascend the rope when it is the only way to get back out of the cave.

13 September 2020
Snail Shell Cave, Tennessee
flooding, aid, no injury

Four people were exploring Snail Shell Cave when they noticed the water in the underground stream was rising. Unbeknownst to them, a thunderstorm was dropping 4 to 6 inches of rain on the surface and several counties had been issued a flash flood warning. The two younger men made it out of the cave, but the two older men took refuge on a ledge above the water. Rescuers were able to bring the older men out safely.

1. Yihyun Jeong, "Two men rescued after being trapped in Rutherford cave with rising water," www.tennessean.com, 13 September 2020.
2. WGNS Radio, "Rockvale area Cave Rescue on Sunday," www.wgnsradio.com, 13 September 2020.

Comments: Snail Shell Cave is part of a large underground river system that collects and transports groundwater from a wide area. It should not be entered in high-water conditions or when there is reason to expect significant rain.

15 September 2020
Over the Hill Cave, British Columbia, Canada
rockfall, no injury, no aid

Four cavers were exploring a virgin cave named Over the Hill Cave as part of an expedition exploring the area near White Rabbit Cave. A 0.8-meter-high squeeze through a boulder choke was encountered by the group. A few rocks

Water levels in Snail Shell Cave vary considerably with the seasons and rain levels. Some portions require flotation year-round. Photo by Dave Bunnell.

were removed using a webbing sling, and the four cavers passed through without incident. On the way out, Claire Gougeon (41) was the second person to pass through the squeeze. While she was sliding on her back through the squeeze, hundreds of pounds of rocks fell down. She was fortunate to reach a more spacious area while the rocks settled around her. Where her torso had been moments before was now 20 centimeters deep in rock and touching her legs on both sides. She was able to extract her legs without moving any more rocks.

The small exit now trapped the two cavers who were still on the far side. Gougeon and the first caver who had made it through began moving rocks to create a stable exit. They were eventually able to move and stabilize enough rocks to allow the other two cavers to pass through.

1. Claire Gougeon, personal communication, 20 October 2020.

Comments: Breakdown in virgin caves or passages has considerable potential for grave consequences. In some cases, a caver may be the first force to act upon an unstable pile in thousands of years.

Karst window entrances to Snail Shell Cave. The unroofed river flows between the two portions of the cave. Photo by Dave Bunnell.

17 October 2020
Nielsons Cave, Utah
caver fall, injury, no aid

Jason Weyland (25) and another caver entered Nielsons Cave at 9:30 a.m. for a day of bolting pitches and inspecting some domes for possible climbing leads. After descending the 317-foot entrance pit, they made their way through several obstacles and smaller pitches until they reached Fantasy Well, a 300-foot pit. The upper sections of the cave had been left rigged from a previous trip, and rope for the lower cave was stashed at the top of Fantasy Well. The rope for Fantasy Well was attached, but not rigged, to the anchor, and the rest of the rope was already stuffed in a rope bag. Weyland rigged the rope properly and attached the rope bag to his harness. Letting the rope feed out of the bag would eliminate his need for fighting with the weight of the rope while descending.

About halfway down Fantasy Well, Weyland realized that there were no grommets in the rope bag where the knotted end of a rope could be visible. He shouted up to his companion, who was the person who had stuffed the rope bag, and asked if the end of the rope had a stopper knot in it. His companion yelled back down the pit that yes, the rope had a stopper knot.

Forty feet from the bottom of the pit, the rope suddenly slipped through Weyland's braking hand and then his descender. Weyland fell 20 feet to a sloped shelf then another 20 feet to the bottom of the pit, a total of 740 feet below the surface. Weyland reports, "I was overcome with pain, mainly focused in my right foot and my right hand. In the process of falling, my headlamp was dislodged from my helmet. However, I managed to stand up and worked my way to my headlamp, gauging my pain as I made the effort. I was able to walk, albeit with pretty severe pain in my right foot."

Weyland's companion pulled up the rope and rigged another rope to the end so that he could reach Weyland. Fortunately, the other caver is also a medical doctor and was able to perform a thorough head-to-toe examination. He determined that Weyland did not have any broken bones, concussion, or other major trauma.

Jason Weyland's right foot two days after falling 40 feet in Nielsons Well. Photo by Jason Weyland.

Not sure if he would be able to climb rope, Weyland says that "I decided to just get on rope and see what it felt like to climb a few feet. Amazingly, frogging didn't seem to have any impact on my injuries, even with my foot loops being on my bad foot. Feeling some relief with this revelation, I was excited that I would still be able to use my Pantin as well. With [the other caver] offering to carry my bag out, I started my ascent of Fantasy Well." He continues, "Of all the obstacles I faced on my way out of the cave, crossing the big room to the entrance rope proved to be the most painful as it requires walking across a football-field sized room of large breakdown and shifting boulders." The cavers reached the surface at 1:30 in the afternoon after four hours in the cave. Weyland then hiked more than 3 miles back to the trailhead, carrying his own pack. X-rays later revealed no definite fracture and the patient was diagnosed with a severe sprain to his right ankle and sprains to his right thumb, left foot, and left wrist.

1. Jason Weyland, Incident Report, 21 October 2020.

Comments: In his report, Weyland, who is an experienced caver, says that a tough lesson learned is to "Always check for a stopper knot when getting on a rope already rigged or stashed in a bag. Even if someone assures you that they tied a knot in a stashed rope, make the extra effort to check for a stopper knot."

The rope that Weyland rigged was one that had been used in Fantasy Well in previous years. So why was it suddenly 40 feet too short? Rigging the pit had previously been done by cavers rigging to an anchor at the top, rappelling 30 feet onto a flowstone ledge, and then rigging to another anchor, thus creating a free hang to the bottom. In the past, this had been done with two ropes, a shorter rope for the top rappel and a longer rope for the second rappel. Weyland's companion had removed the ropes for inspection and cleaning. When he and Weyland returned on this day, the other caver forgot that Fantasy Well was usually rigged with a second 40-foot rope and supplied Jason only with what should have been the second rope. It is unclear why this was forgotten, why there was no knot in the rope, or why the other caver assured Weyland there was a knot in the rope.

Considering this and other rappelling-from-rope-bag incidents—some of them fatal—anyone planning on rappelling from a rope bag should pack their own rope or visually inspect the rope to ensure that the end of the rope is knotted. Some cavers like to put the rope through a grommet at the bottom of the bag so that the knot is visible while the bag is full. Other caving programs recommend putting two stopper knots in the end of the rope, one at 6 feet from the end of the rope and another closer to the end. This allows the caver to discover the knot and still have a usable piece below for attaching to another rope or rebelay.

2020 Cave Diving Accidents and Incidents

9 June 2020
Hole in the Wall Cave, Florida
fatality, drowning

Clyde Douglas (Doug) Rorex, age 68, died in the Hole in the Wall Cave in Merritts Mill Pond in Marianna, Florida, on 9 June 2020 when he ran out of breathing gas close to the exit. Rorex was a highly experienced cave diver who lived near the cave and was familiar with the caves in the area. He was diving solo in a side-mount configuration, as he did frequently at this cave.

When Rorex did not return from his dive at the expected time, the owner of a local dive shop, Edd Sorenson, was contacted to see if he could help. Sorenson has made several successful cave diving rescues in the area in the past, and he is frequently called upon for body recoveries. Sorenson entered the cave and quickly found Rorex deceased near the entrance.

Hole in the Wall Cave is named so because its entrance is literally a hole in the wall of the pond. Divers enter that hole and must immediately swim nearly straight down about 85 feet to the cave floor. At that point divers can choose to go in two directions. Rorex was found at the bottom of that chimney, with one of his regulators still in his mouth and both cylinders empty. All of his equipment was later shown to be working properly.

A subsequent analysis of Rorex's computer indicated that the total dive time was only 45 minutes. Highly advanced divers, including trained cave divers, calculate the rate at which they consume their air so that they can plan dives effectively. With the amount of gas Rorex had, an average cave diver diving at that depth would have expected to have enough gas for nearly twice that much time. This indicates that something unusual must have happened on the dive to cause an unexpected loss of air.

A computer profile of a dive in which the diver exits on the same path as the entry shows a symmetrical series of changes in depth as the diver exits, so it is possible to pinpoint the time at which the diver turned around and began the exit. In this case, Rorex turned the dive after being stopped at a constant depth for approximately 11–12 minutes. This time at a constant depth suggests that some sort of activity may have held him in one place—including a possible entrapment. If Rorex were entrapped, the increased workload of freeing himself could have increased his breathing rate substantially and caused him to use an excessive amount of air.

To check this entrapment theory, on the day after the fatality, Sorenson searched the most likely locations for an entrapment. Hole in the Wall Cave does not typically have strong flow, so a major silt disturbance would linger, and there would be signs of a struggle on the floor. Sorenson saw no sign of disturbances.

1. Forrest Wilson, email communication, 9 July 2020.
2. Deborah Buckhalter, "Merritt's Mill Pond cave diver identified; death deemed accidental drowning," www.dothaneagle.com, 9 July 2020.
3. John Adsit, Report for American Caving Accidents, 21 Dec. 2020.

With proper training and equipment, cave diving is a sport safely enjoyed by many.

Here a diver crosses a halocline in Maya Blue, a cave in the Yucatan peninsula of Mexico. This interface between fresh and saltwater is typically only observed in coastal caves.

This photo earned an Honorable Mention for SJ Alice Bennett in the 2020 NSS Photo Salon.

2020 Caving-Related Accidents and Incidents

This lucky duck was rescued from a sinkhole by Tony Schmitt and Dan Lamping. Photo by Dan Lamping.

Tony Schmitt ascends an incredibly tight sinkhole while rescuing a pet duck. Photo by Dan Lamping.

28 January 2020
unnamed sinkhole, Illinois
pet duck fell into sinkhole

Landowners in Monroe County, Illinois, began reaching out to caving organizations after their pet duck fell into a newly opened sinkhole on their property. The president of the Illinois Speleological Survey contacted Tony Schmitt and Dan Lamping to see if they could assist. Schmitt was familiar with the area, as he had looked for caves nearby. Schmitt and Lamping met with the duck owners that evening.

The sinkhole, which had formed at the edge of a sinkhole pond, was barely wide enough for human entry. The hole was entirely in soil and about 15 feet deep. The cavers rigged to a tree and placed a board at the lip to keep the rope from cutting into the soil. Schmitt carefully descended, knowing that there was a potential for the soil to collapse around him. When he located the duck, Lamping dropped a sack down to him, and he placed the duck in the bag. Schmitt then carefully climbed out and returned the duck to its grateful owners.

After the successful rescue, the landowners took the cavers on a tour of their property and showed them other sinkholes, although none of them turned out to be caves.

1. Daniel Lamping, Incident Report, 24 March 2020.

Comments: Helping with animal rescue is a great example of how cavers can be good neighbors, form lasting relationships with landowners, and truly become part of the karst country community.

23 February 2020
Buzzmans Cave, Indiana
dog stranded in cave

A champion coon hound named BuzzMan went missing during a sanctioned hunt. The dog was wearing a GPS tracking collar that stopped tracking at the entrance of a cave. The Indiana Conservation office called local cavers, who dug into a tight stream passage. After two attempts, BuzzMan was eventually located 600 feet into the cave in a larger stream passage. The dog was reported to be cold and hungry but otherwise unhurt.

1. Dustin Vogt, "Dog stuck in cave rescued in southern Indiana," www.kwtx.com, 25 February 2020.
2. Digital Staff, "Dog rescued after getting stuck in Indiana cave, www.wlwt.com, 25 February 2020.
3. Anmar Mirza, personal communication, 31 December 2020.

Comments: The cave was not accessible to humans until cavers dug it open. The cave was named in BuzzMan's honor.

7 May 2020
unspecified sea cave, California
trapped in sea cave

On the evening of 7 May 2020, a couple was rescued near the Ritz-Carlton hotel in Half Moon Bay, California, between Miramontes Point's 60-foot bluffs and Three Rocks Beach. The couple was most likely either at Drippy Grotto or Osprey Grotto, both of which are easily accessible from the beach below the hotel during low tide. The tide had

been low during the day, but had risen five feet, trapping the visitors in the cave. The couple called 911 as the tide trapped them in the cave. At 9:15 p.m., a California Highway Patrol helicopter and the Pillar Point Harbor Master rescue vessel arrived to provide lights and safety for a rescue swimmer. Coastside Fire Protection firefighters set up a rope system, and the rescue swimmer used a paddle board to bring each person safely back to the beach. The individuals were medically evaluated by the paramedics and firefighters and sustained no injuries.

1. Bay City News, "People trapped in beach cave below Ritz-Carlton in Half Moon Bay: The tide came in, and the beach disappeared," www.newsbreak.com, 8 May 2020.
2. Bruce Rogers, personal communication, 10 January 2021.

Comments: Knowing and abiding by publicly available tidal forecasts is a best practice for exploring sea caves. Many sea caves are safe and accessible only in the few hours around low tide.

Sea caves at Half Moon Bay, California. At low tide they're accessible from the beach but the unwary can be trapped by the rising tide. Photo by the California Coastal Record Project.

11 July 2020
ridgewalking, Pennsylvania
exhaustion, aid, no injury

After a day of ridgewalking with other cavers, a 31-year-old woman began showing signs of dehydration and possible heat exhaustion. The day was warm with relative humidity near 95%. When the cavers reached their vehicles, the woman drank some water and immediately began vomiting. Bouts of vomiting continued for almost 30 minutes, and her condition progressed to severe headaches, confusion, and eventually difficulty maintaining consciousness.

The cavers began driving until they had cell phone reception and called 911. They arranged to meet emergency personnel in the parking lot of a Dollar General store. While they waited, the cavers applied ice bags to the woman's body. After being transported to an emergency room, she received fluids through an IV and was discharged four hours later.

1. Ryan Maurer, Incident Report, 14 July 2020.

Comments: In his report, the trip leader says that this is a good reminder to maintain awareness of the health condition of team members and their fluid intake in order to prevent incidents like this.

25 August 2020
Sharps Cave, West Virginia
lost car keys

Two experienced cavers and two new cavers arrived at Sharps Cave in Pocahontas County, West Virginia. As the cavers were putting on their gear, there was some discussion about what to do with their car keys. Normally, the cavers would hide the keys somewhere on the vehicle, but since the parking area is near a highway, they decided that the vehicle owner would keep the keys in his cave pack.

Shortly after entering the cave, the two new cavers decided that they did not care for this particular activity, and the group exited the cave after about 45 minutes. Upon returning to the vehicle, the cavers discovered that the external pocket of the cave pack where the keys had been placed had a large hole in it, and the car keys were missing.

The group searched the weedy, overgrown path to the cave but did not find the keys. The vehicle's owner retraced the group's route in the first section of cave but returned to say he didn't find the keys. The other caver then offered to go back into the cave and retrace the entire route. The two cavers made it to the point where the group had initially turned around without locating the keys, but thankfully, they found the keys on their way out. They reported going from "totally bummed to elated in that one second."

1. Mark Hodge, email communication, 25 August 2020.

Comments: There really is no standard protocol for what to do with car keys while caving; it depends on each particular caving and surface security situation. Cavers should be aware that hard items like keys in external pockets or against the pack walls on the inside can quickly lead to holes worn through even the toughest pack materials.

Getting Back to Caving after COVID—or Any Long Absence from the Underground

Gretchen Baker, NSS 50323

Last September, I went on a cave trip that ended up being 18 hours long. The trip kicked my butt. It didn't need to be that long. It was that long because I was out of caving shape. Although I had done an eight-hour cave trip the month before, that had been the longest trip in many months. I had been doing a lot of running and hiking beforehand, but those activities had exercised just my legs and not the rest of my body. I was not prepared for all of the climbing, squeezing, lifting my pack, wading against water, and other movements a cave throws at you. I was not only embarrassed at how difficult it seemed, but also upset with myself. I needed to improve my physical conditioning if I wanted to be caving at my former skill level. I also realized that I needed to up my mental game. I didn't remember landmarks like I should have. I made wrong turns. I felt like a newbie.

I'm sharing this because I know many cavers have taken breaks from going underground. What's the longest time that you've taken off from caving? Maybe you took time off due to a new job, an injury, distance from caves, pregnancy, a new baby, or COVID-19. Whatever the reason, when you are ready for a cave trip, are you *really* ready?

Here are a few items to consider:

Your Body

Have you put on a few pounds or lost muscle tone during the pandemic or your break from caving? Do you still fit in your cave suit and harness? Are you flexible enough to perform stemming or climbing skills like you did before?

Learn from my lesson. Be physically prepared for your caving trip. That means doing exercises that simulate what caving will be like, such as core exercises, pushups, pullups, weightlifting, balance moves, and so on. You may need to up your cardio game. And when you start caving again, it may be wise to start with an easy or moderate cave trip. When you were caving frequently before COVID-19, caving may have seemed routine, and a particular climb in a cave before the pandemic may have seemed quite simple. Is it still simple if you haven't been climbing or using those muscles?

If you were accustomed to cold, uncomfortable conditions before the pandemic, but have been working from home in your climate-controlled house, will your body be able to adapt as easily? This is a problem for some wildland firefighters as they start the wildland firefighting season with protective clothing and heavy packs. After a few days they get acclimated, but it's rough at first.

Your Gear

When you last put away your cave gear, was it clean? Or were you thinking you'd go on one more trip and then forgot about it? Where is it now? Is it in a pile somewhere, caked in dried mud, crinkled, and moldy? Or have you used your cave gear for other purposes and now it's scattered?

Is your life-protecting gear (helmet, harness, webbing ropes, and soft parts of your vertical system) more than 10 years old? If so, it's time to replace them. Have the soles of your shoes oxidized and hardened? Have your batteries leaked or been discharged so long that they won't hold a charge? It's time to take out all your gear and carefully assess it.

Your Mind

Your mind is complex, and it might be the most important thing that you prepare to go caving.

Skill Fade

How long does it take for you to forget certain caving skills? Can you still don your vertical gear and do a changeover in just a few minutes? Can you rig a pit without retying the knot a couple of times?

While parts of caving are like riding a bike in that you never forget them, some skills need to be practiced. These may not be the same skills for each person. While one person may remember every single knot and how much rope is needed to tie it, another may need several tries or even some instruction on how to tie something that they once knew well.

Skills that are most likely to fade or get rusty are the ones that require a strict attention to steps, like pickoffs. If you have gained or lost weight during the pandemic, you may need to adjust to a new center of balance for certain maneuvers. Practicing in a controlled environment before you go underground is ideal.

Risk Tolerance

Throughout the pandemic we were advised to "recreate responsibly." We didn't want to be the patient in a search and rescue operation that put the rescuers at additional risk.

Now that the pandemic is easing, has your risk tolerance changed? Risk tolerance in the outdoors is defined as the amount of risk you are willing to take. Have you gotten so tired of being isolated that you are now willing to take more risks? Or has constantly assessing how likely you might be to catch the virus made you more risk averse? Understanding how you feel about risk may help you to consider your decisions.

Are you ready for this crawl after a long hiatus from caving? Photo by Gretchen Baker.

Heuristic Traps

Every day we make hundreds of decisions: what to wear, what to eat, what to buy. For many of these decisions, we don't review relevant information, weigh alternatives, and then decide. Instead, we use simple rules of thumb, or heuristics. These mental shortcuts use only one or two pieces of evidence. Although the result might not be perfect, it works well enough that we use heuristics frequently and often unconsciously.

However, heuristics may not be the best way to make decisions in high-risk situations. We may need to be more acutely tuned into more cues in order to have a good outcome. When we base our decision-making on just one factor, we may be falling into what is called a heuristic trap. This idea was developed for backcountry ski travel and avalanche safety (McCammon 2002). Here I adapt these heuristic traps to the caving environment.

Familiarity: You've done something before or seen it done, and it didn't seem too bad. You don't think it's a big deal. But something may have changed, and now one little mistake can cause a cascade of errors. For example, maybe you've rigged off this boulder before, and you think that because it has always worked before it will work again. You don't take the time to assess whether a recent storm has disrupted the ground underneath it. Or consider the case of the Thai cave rescue: the leader had gone into the cave many times before and consid-

ered that it was safe. He wasn't expecting big rains that would change the conditions and cause the group to become trapped.

Social proof: You saw a video or social media post about someone else in this cave, so that means you can do it. Plus, you want to show how cool you are, so you're going to explore the cave so that you can post your proof of work on social media.

Over-commitment to a goal: You and your cave group planned to go to a certain part of the cave. Someone started feeling exhausted, or the stream started rising, but you decided to forge ahead anyway. The goal has become so important in your mind that you won't deviate from it even if other conditions suggest that you need to reassess.

Expert halo: You tend to defer to the expert in the group. Even if you're not sure that what the expert is proposing is a good idea, you prefer not to question the expert's advice and be the one to rock the boat. Or you may be the expert and be unwilling to listen to questions.

Scarcity: You have a limited opportunity to make it happen. For example, you drove six hours to get to the cave. You're going to do it no matter what. Or perhaps you've traveled far within the cave to get to a virgin cave passage. You want to survey it and put it on the map, even if you have passed your turnaround time or you're feeling exhausted.

How many of these traps have you fallen into? When I'm honest with myself, I realize that at some point I've been in all of them. I've just been lucky that nothing went wrong. Fortunately, we can protect ourselves from these heuristic traps.

A wet alpine cave trip. Photo by Gretchen Baker.

Think about close calls, near misses, and accidents you've had over the years. Identify human factors that influenced those incidents. Is there a theme throughout these incidents? Perhaps one heuristic trap is more prevalent than others. This might be your Achilles' heel. Are you so goal-oriented that you never stop until you reach the goal? Or are you the expert and wear that halo, thinking that you can surmount any challenge the cave throws at you, no matter the expertise of the rest of your group?

Avoiding Heuristic Traps

In order to avoid these heuristic traps, there are a few things we can do: plan, use situational awareness, review scenarios, and create a good culture for leaders to make better decisions by allowing the group to ask questions. Let's explore these options in a little more detail.

Plan: One of the ways to plan is to use checklists. These have helped in numerous situations to make sure that everything is covered. Do you have a gear checklist? Have you filled out a Caver Contact sheet with information for your surface watch? Does your surface watch know who to call if you don't come out on time?

Use situational awareness: Another way to avoid heuristic traps is to assess what the current conditions are and maintain situational awareness. Each time you go caving, even if you go to the same cave every week, you need to evaluate all the factors at play. What's the weather? How is everyone in the caving group feeling? Have other people been in the cave recently?

Review scenarios: Reviewing scenarios or asking what-if questions can help you prepare for various possibilities on a cave trip. What if someone gets sick? What if the group splits up? What if a passage is blocked? Reading *American Caving Accidents* is a great way to play the what-if game.

Encourage and ask questions: Finally, encourage questions, and do not be afraid to speak up and ask questions if you aren't clear on the plan or you see something that is unsafe. Likely if you have a question, someone else does, too.

Your Team

We don't cave alone, so you need to consider the body, gear, and mind of your teammates. Are they also appropriately ready? Have their personalities changed during the lapse in caving? Are they able to balance your personal challenges? It's good to have a variety of mindsets with you on your caving trip.

I have learned from my experience last September. On a cave trip I did this spring. I had been working out and was ready for it. My teammates hadn't been in a cave for almost a year and hadn't been exercising their caving muscles. This particular cave required a lot of crawling. I was raring to go, but I had to remind myself not to be over-committed to the goal. Taking our time and enjoying the experience with the group was more important. Talking to them throughout the trip helped keep me centered, and we had a good trip. The next day I wasn't sore, but they were. It was their turn to learn the lesson!

If you and your team are physically, mentally, and emotionally ready for getting back into caving, go have fun! It's been hard for many of us to take a long break from caving. We have many reasons for going underground, and hopefully our break from it has helped us to appreciate it even more. Enjoy!

Checklist for Getting Back into Caving

- Improve your cardiovascular fitness
- Do some weight lifting and/or push-ups and pullups to improve your strength
- Stretch or do yoga a few times a week to enhance flexibility
- Pay attention to your nutrition; eating well will help to give you more stamina
- Practice skills that you may be rusty on before you go caving (such as rigging, knot tying, bolting) in a controlled environment (such as in an outdoor SRT practice)
- Ensure that you have all of your necessary cave gear and that it is clean
- Replace needed parts (such as cave gear that is worn out or soft parts and helmets that are older than 10 years)
- Check your cave lights and batteries
- Make a checklist for your caving trip
- Fill out a Caver Alert Information Sheet (http://ncrc.info/Safety)
- Practice situational awareness. A free Mountain Rescue Association course is available at https://mra.org/
- Watch the "Virtual Topics in Cave Rescue" series on the NSS YouTube channel (http://bit.ly/caverescuevideos) to refresh your perspective on caving safely

Reference

McCammon, I. (2004). Heuristic traps in recreational avalanche accidents: Evidence and implications. *Avalanche News*, *68*(1), 42-50.

"Off Rope" Means a Lot More Than Just Off Rope

Andy Armstrong, NSS 45993 RL FE

The caver ascended smoothly and slowly, focused and alert for any issues with the rope. Under tension from his body weight, the slender girth of the rope constricted to what seemed to be the diameter of a shoestring. On the previous day, the technical climbers on the expedition had finally reached the top of a 155-foot dome after days of free-climbing and hand-drilling. They rigged this brand-new 9-mm rope for the rest of the team to ascend and survey whatever passage might lead from the top of the dome. That night, the climbers had come back to camp with harrowing tales of sheath slippage on the new rope. The caver was now frogging up this very same rope to explore and survey whatever might be at the top. The thought of slipping a few inches at any moment did not help to alleviate the ever-present nerves brought on by climbing a skinny rope in the center of a large, black space.

A few minutes earlier, the previous caver up the rope (who just happened to be his significant other) had yelled "Off Rope!" loudly, signaling that all was ready. When the caver finally neared the lip, he looked up and saw that all was not, in fact, well. He first saw the large red PVC rope pad and immediately noticed that the thin rope was off to the side and not on the pad at all. In reality, the rope was laying over a rough rub point, presumably sawing up and down throughout his entire eight-minute climb. The caver, moving even more smoothly and cautiously, soon climbed past the rub point and breathed a sigh of relief when seeing that the rope had not yet sustained much abrasion. He replaced it onto the rope pad and continued to the top. Everyone came out okay, but the incident was alarming and caused a bit of—shall we say "intramarital friction" for the next few hours or so.

This is a true story that happened on a prominent caving project just a few years ago. I was the next person to go up the rope after this rope-off-the-pad incident. The caving couple involved is fairly well-known nationally. I count them among the safest, most competent cavers I know and among my very favorite people with which to explore and survey. This incident illustrates that whether an expert or beginner vertical caver, it is unfortunately easy for any of us to make common mistakes that can result in a less safe vertical environment for our teammates, even when those teammates include great friends and loved ones. This incident reinforces what we all know: that vigilance is key and that the devil is in the details for all of us. Along with many other instances, this experience helped me to form an opinion that we as American cavers have become dangerously lax in our on-rope/off-rope safety protocols.

Once I really started paying attention to it, I noticed fall-zone safety problems on almost every cave trip. I saw cavers walk all the way to the rope, or even clip into it, before calling "On Rope." Just as common is calling "Off Rope" before actually unclipping or walking away from the fall zone. It is unfortunately a somewhat familiar occurrence to reach the top of a pitch and find the rope off the pad, in a crack, on a sharp edge, rigged to a cross-loaded carabiner, or in some otherwise non-ideal situation.

Incidents that represent the potential for an accident are commonly termed "near-misses." Much can be learned by documenting and communicating near-miss incidents. Incident analysis in industrial settings shows us that for every fatality in a given environment, there are around 400 near-miss incidents leading up to it. Viewed from the opposite perspective, we can predict that for every accumulation of 400 near-misses in a particular environment, a fatality will result. Therefore, it is prudent to report, learn from, and prevent near-miss incidents. Reducing their number through awareness and training will result in fewer actual accidents over time.

Avoidable fall-zone near-miss incidents often result from one or more of these contributing factors, which we will examine in more depth below:

Loss of situational awareness resulting in distraction from safety focus, because of complacency, carelessness, fatigue, or fear-based instincts

A poor concept of Safety Zone – Danger Zone concepts and protocols due to lack of common training, discipline, and understanding

The common caving call of "**Off (or On) Rope" actually means quite a bit more than** "**I'm off (or On) the rope,**" and people are misunderstanding the true significance of these terms.

"Oh, I'm sorry, did I break your concentration?" –Jules Winnfield, *Pulp Fiction*

It is well understood that vertical caving carries inherent risk. Safety must be our top priority in vertical environments. These ideas are not controversial, yet we often find something else attempting to steal our attention away. Perhaps most simply, after dozens of uneventful caving trips we may simply become acclimatized to risk and omit safety checks or overlook potential hazards like a cross-loaded carabiner. Some people just seem to be careless, no matter their depth of training or experience. Everyone deserves a chance to learn, and anyone can make a mistake. However, when someone continually or repeatedly causes safety problems, the team must take corrective action.

Mistakes of all kinds are likely when people are tired. When cavers are exhausted at the top of a rope climb, they are likely to leave behind sub-optimal conditions for the next climber. Regularly checking on team fitness is a wise practice to cultivate, as fatigue in a vertical environment often leads to problems. Rigging may be pulled out of alignment by a caver's tethered pack as they negotiate an obstacle. A tired caver may inadvertently misalign the rigging and then forget to look down and check before continuing on.

Similarly, sometimes cavers experience a "fright" or an unusual amount of stress while ascending due to different environmental factors. Like fatigue, this can lead to an overwhelming desire to be off rope and a speedy departure at the top, resulting in a failed safety check of conditions for the next climber. What could cause such a fright? There are many factors, including potential or actual rockfall, rope sheath problems, any kind of "pop," and SRT system problems. It is possible that the incident described in the beginning of this article was caused by a sense of haste in wanting to get off of a skinny rope that was known to have sheath-slippage issues. A similar sense of haste is imparted by fear of not keeping up with the group. Promoting a safety culture that says, "We're all in this together," rather than, "You better keep up," goes a long way toward preventing distractions that can lead to trouble.

Whatever the trigger may be, the desire to get off rope at the top of a harrowing climb contributes to the large number of problems and near misses that occur between the top of a pitch and the first rebelay or rub point. Within the vertical environment, we must remain vigilant with our safety focus, with our own personal welfare and that of our teammates as the priority.

"Highway to the Danger Zone" – Kenny Loggins, *Top Gun*

There is no universal set of safety standards or source of training for American cavers, which means that most of us learn caving and vertical skills from various

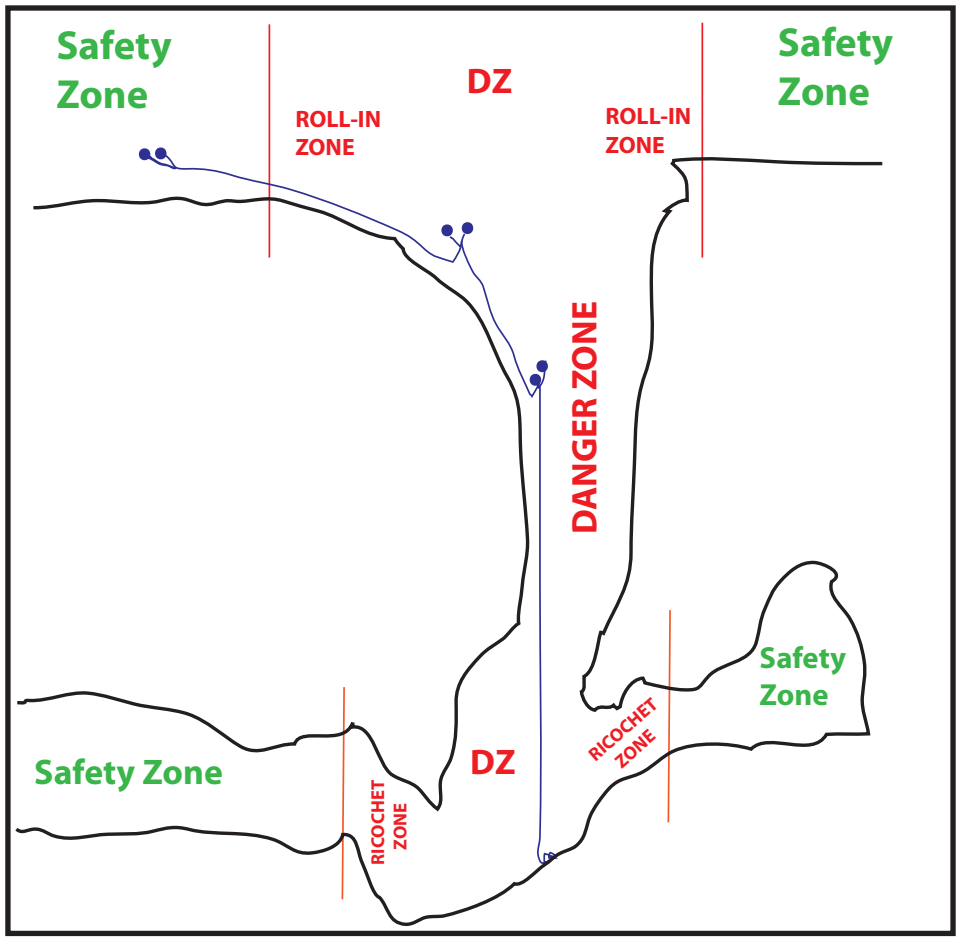


Diagram depicting Danger Zone and Safety Zone in a hypothetical vertical environment.

local teachers, books, websites, and online videos. Some of us may take a cave rescue or a vertical training course in another genre where we can pick up some good Single Rope Technique (SRT) habits and compare our gear to that of others from different regions. There is a wealth of good material out there, but it is left to the new vertical caver to sort and prioritize the variety of often-contradictory information. There is no clear overarching safety ethic across various vertical environments, and regional variance runs the spectrum.

In 2018, I was fortunate to attend a week-long cave rigging training in Hungary titled the "Technical 2" or "T2." Developed for cavers that have graduated from Hungary's "Basic Caving" and "T1" classes, the T2 training resembles a vertical caving boot camp, requiring 16 hours per day of mental and physical exertion. The experience reinforced my suspicion that standardized training and standardized gear can lead to safety benefits and self-rescue capabilities within a caving community.

One ethic of the Hungarians that particularly impressed me is the clear delineation of a Safety Zone and a Danger Zone surrounding every vertical pitch. The Danger Zone (DZ) is our "Fall Zone" and includes not only the pitch but also the area immediately surrounding it, where falling objects may cause harm, such as the roll-in zone at the top and the ricochet zone at the bottom. Although not always the case in the ricochet zone at the bottom, in general you should be clipped into a rope any time you are in the DZ. The Safety Zone above and below the pitch includes everywhere else in the world where you do not need to be clipped into a rope—almost certainly but not necessarily including wherever you are right now reading this article.

In Hungary, new cave riggers are taught to begin all rigging in the Safety Zone. This allows a danger-free situation for tying knots, uncoiling rope, and so on. The caver then enters the Danger Zone after clipping in to the rope. With apologies to Kenny Loggins, this approach line above the pitch becomes our "Nylon (or fiber of your choice) Highway to the Danger Zone." When ascending up and out, the highway should be taken all the way to an exit well within the Safety Zone—that is, the caver should remain clipped in to the rope until they are well within the Safety Zone.

On returning from Hungary, when I visited a few favorite local pits, I realized that my habit was to begin rigging much too close to or in some cases even within the DZ. The familiar sight of someone beginning their rigging at the edge of the DZ by leaning up against and wrapping rope from the "safe" side of a pit-edge tree now gives me the willies. We must remember that anywhere above the pit where something or someone could fall in is included in the DZ, and we need to be attached to rigging before we enter this area.

Training for vertical cavers should include a designated Safety Zone and Danger Zone and should use common verbal rope commands including "On Rope," "ROCK," and so on beginning in a controlled above-ground environment. This attention to detail within the safety of a controlled training environment will help newer vertical cavers to form habits that will then become second nature upon approaching a real DZ.

"You keep using that word. I do not think it means what you think it means." –Inigo Montoya, *The Princess Bride*

Let's face it: we say "Off Rope" soon after detaching from the rope, but we really need it to mean a lot more than that. Perhaps we can forgive our newer caving partners for being in information overload and sometimes reverting to the literal meaning of the words. This is most certainly what is happening in the Pavlovian brain when the sound of a descender detaching from the rope at the bottom of a pit causes a caver to proudly announce "Off Rope!" while nowhere near to being clear of the Danger Zone.

We need to do a better job of explaining to newer cavers that while we use the terms "On Rope" and "Off Rope," what we are really announcing is our respective entry or exit from the Danger Zone. Let's look at each term individually.

"On Rope!" The point of this call is to inform others that you will be occupying the Danger Zone and that they should refrain from throwing or dropping anything into the DZ while you are in it. Although necessary only if other cavers are ahead of you, it is traditionally shouted into the void regardless, especially when unsure if others could be within earshot. "On Rope!" is a signal to all that someone has entered the DZ and that everyone must be vigilant (and ideally quiet and listening) until the DZ is free. The term "On Rope" is preferable to "On rappel" or "Rappelling" because it covers more situations and can be called from the Safety Zone before clipping in.

A caver approaching a pitch should yell "On Rope" as a way of asking permission to enter the Danger Zone. In response,

the caver will hear silence, "No!" or "OK!" Silence usually means that no one is there and it is okay to enter the DZ. However, this is not always true, and cavers should continue to remain vigilant for any sign of an occupied DZ. "No!" means that the caver does not have permission to enter, because someone else is there. And finally, "OK" is a friendly acknowledgement that the rope call was heard and that it is ok for the caver to enter the DZ as requested.

The call of "OK" is not always necessary. For instance, if you are ready to enter the DZ from the bottom and the person climbing calls "Off Rope" at the top, you may immediately call "On Rope" and enter the DZ without needing to respond "OK." However, if you are not quite ready to climb, then you may want to reply "OK" back to the top so there is mutual understanding that the DZ is clear.

"Off Rope!" This call allows cavers following to know that you are clear of the DZ. It means much more than that you have simply detached from the rope.

When you call "Off Rope" at the bottom of a pitch, you are informing everyone at the top that you have both detached from the rope and fully exited the DZ. Ideally, when you call "Off Rope," you should be in a place where something dropped into the pit could never bounce and hit you. When rappelling, you should take care to place the rope onto rope pads and away from sharp edges, but anything you miss on the way down can usually be remedied by the next caver.

When you call "Off Rope" at the top of a pitch, you are informing everyone below you that you are fully clear of the Danger Zone. When exiting the DZ at the top of a pitch, a caver needs to ensure not only that they have fully exited but also that they have visually checked the condition of the rigging for the next caver coming up. Visually inspecting the rigging should be done continually by each caver on the way up to ensure that they are never leaving a less-safe condition for the following caver. When passing a rebelay, redirect, or rope pad, the ascending caver should pause and look down to make sure all is well. If the rope for the next caver is on a sharp obstacle or is hanging from a cross-loaded carabiner, we have an obligation to fix it for our teammates before continuing up. Only when the nylon highway is safe and ready for the next traveler should we call "Off Rope."

"On Rope" and "Off Rope" carry the additional risk of being confused for one another. Some caving cultures use "Rope Free" instead of "Off Rope" so that it is more easily distinguished from "On Rope" in noisy pits. This is an easy habit to adopt, and some American cavers have started to use it for greater clarity.

Regardless which terminology you prefer, let's make sure that when we call "Off Rope" at the top of a pitch, the caver at the bottom knows and trusts that what we are really communicating is the following:

I have detached from the rope and have fully exited the Danger Zone. I have checked all the rigging both before and after I used it and have made sure that everything is safe for your use, including carabiner loading and locking. I have double-checked to ensure that the rope is on all rope pads, off of all sharp edges, and hanging free from snags and ledges. The rope is safe and ready for you to ascend!

This is a lot of information to expect two words to convey. Let's ensure that newer cavers understand the significance of these words and the level of responsibility they are intended to carry. Likewise, let's make sure that our veteran cavers have not become complacent with old bad habits.

"Off Rope" means a lot more than just off rope!

This article benefits greatly from the thoughtful review and comments of: Caroline Bull, András Hegedüs, Scott McCrea, Sarah Richards, and one anonymous reviewer.

National Coordinator of the NCRC

Anmar Mirza, NSS 45765, and Gretchen Baker, NSS 50323

Outgoing NCRC Coordinator Anmar Mirza

Hi there, my name is Anmar Mirza, and until recently I was the National Coordinator for the National Cave Rescue Commission (NCRC). I served as the National Coordinator for the last 12 years. In this article I want to give an overview of what NCRC is and what it does. In addition, I'd like to talk a little about what I have done during my tenure and how NCRC has developed during that time. I will then turn over this article to our new National Coordinator, Gretchen Baker, who will introduce herself and talk about her vision of where she wants to take the NCRC as she assumes leadership.

Most cavers have heard of the NCRC. The NCRC is a Commission of the National Speleological Society and reports to the Administrative Vice-President (AVP) through the Education Division. Many cavers have taken training through the NCRC, and the NCRC is often a visible public presence during major rescues. The Commission conducts a lot of training, which is the most frequent reason that the caving community interacts with the NCRC. Aside from training though, the NCRC also has several important tasks. Among them are acting as the "voice" for cave rescue for the NSS, interacting with the various agencies that have responsibility for cave rescue, and maintaining the specialized equipment and lists of trained people that might be needed for cave rescue.

The NCRC is run by a Board of Regional Coordinators. The country is broken up into regions, each with a Regional Coordinator who is the first point of contact for cavers and agencies in those areas. Additionally, NCRC has a National Coordinator, Training Coordinator, Medical Coordinator, and Diving Coordinator. NCRC does not deal with cave diving per se, but it has an interface with that community through the Diving Coordinator. NCRC is not a membership organization, and the only people who are NCRC members are the Coordinators.

Cave rescue is unique among the various forms of rescue. The environment is a highly specialized one. The more serious rescues require people who are extremely comfortable and capable operating in the cave environment for time periods that can greatly exceed what is typical in emergency services. This means that most major cave rescues have to have significant caver involvement, and many are performed primarily by cavers. As a community, cavers are one of the few that by and large self-rescue. Since the inception of the NCRC in 1975, many thousands of cavers have been trained in rescue, and there have been hundreds of cavers that have directly benefited from the training that the NCRC has provided.

Currently the NCRC offers a wide vari-

ety of training to meet the varied needs of the caving community, from learning how to be a safer caver to taking care of minor problems that may occur to conducting a large-scale rescue. Everyone involved with NCRC is a volunteer, which helps to keep the cost to the students for training very low compared to almost every other similar form of training. It is the dedication of our volunteers that has allowed us to offer such a stunning array of training to fit almost every need. The NCRC Training Coordinator, currently Dr. Roger Mortimer, leads an Education Committee tasked with developing the curriculum that we teach. What exactly are those courses? Let's take a look!

Weeklong training:

- Level 1 is designed to develop team membership skills as well as introducing students to a wide variety of cave rescue skills.
- Level 2 develops more advanced rescue skills and team leadership.
- TOFE (Technical Operations and Field Exercises) is available after students have completed Level 2 or 3 and is focused on field exercises with a minimum of classroom time.
- Level 3 develops highly technical rescue skills and rescue management skills.
- IQ (Instructor Qualification) is training for new instructors and is by invitation only after students have completed levels 1, 2, and 3.

Other training:

- Orientation to Cave Rescue (OCR). 2-3 days. This weekend class is a basic introduction to rescue and is NCRC's most popular offering. Every year NCRC teaches numerous OCRs around the country.
- ICEE (In Cave Emergency Exercises). 2-3 days. This class is taught entirely inside the cave and includes camping and how to emergency bivouac. NCRC offers two ICEE options; one requires vertical skills, and the other does not. This class is geared toward the average caver who wants to be prepared but may not want to be involved in organized rescue.
- SPAR (Small Party Assisted Rescue). 3-7 days. This is a highly customizable class aimed primarily toward expedition cavers who may have to self-rescue using minimal equipment or help.
- Other. The NCRC can customize training to meet the needs of cavers, caving groups, and agencies.

Certain places in the country are cave-dense and have a high population with easy access to those caves, thus the need for rescue is relatively high. I say relatively because on the whole, cave rescues are not common compared to other types of emergency response. Car accidents or fires happen every day in a given area, but a county might go years between the need for a cave rescue, so local agencies are often unprepared. There are a few hotspots where cave rescue needs are much greater, and the local caving community develops experience in responding. Southern Indiana (where I live) was seeing a rescue a month or more from the 70s through the early 2000s. This is similar in the TAG area and some places in the Eastern Region.

This pace has slowed in recent years as cave access has been restricted and the number of people exploring caves has declined. Equally important though, new cavers are getting better training at basic caving techniques (thanks to NSS outreach!), and more of them are getting trained at basic rescue, so problems that might have required a callout a few decades ago are being avoided or are being taken care of by the caving group itself. Caving is safer than it ever has been on a per-person-hour basis, and NCRC has a large share of the responsibility for that! Aside from the benefit of people being safer, the impact to caves and landowner relationships is less.

My first cave rescue experience was when I was 14, and by the time I was old enough to take my first NCRC training at age 18 in 1988, I'd been on several cave rescues. One of my first caves was Buckner Cave in Monroe County, Indiana, (now an NSS Preserve where I am the Preserve Manager) and I was (and still am) caving there weekly, as were several hundred people. About once every month or two, someone would get lost, and we'd have to go find them; about once a year there would be a more serious problem requiring rescue.

In my early days of cave rescue, Don Paquette was the National Coordinator for the NCRC and lived in Bloomington, Indiana, where I was located. He took me under his wing and mentored me. As soon as I turned 18 in 1987, I became an Emergency Medical Technician and started learning wilderness emergency medicine. I quickly started helping to teach OCRs in the Central Region, traveling all over with the Central Region cadre several times a year to teach OCRs. By the time I took my first week-long training in 1992, I'd helped teach about a dozen OCRs. It took me a few years to attend my first weeklong training because I had no free cash at that time in my life and the cost of the seminars was still too much for me. More on how that affected my outlook in a bit.

In 1995 I became an NCRC instructor, and in 1999 I became the Central Region Coordinator. Then in 2009 I became the National Coordinator. I also served as the NSS Safety and Techniques Committee Chair for a few years. During my tenure I have been active in continuously improving and innovating cave rescue in general and the NCRC specifically. When I first started, many of the Regional Coordinators were people that few in the caving community knew, and many of them were people whose only caving experience was at NCRC. I worked very hard to bring people from the caving community into the Regional Coordinator and instructor roles, and today every single Regional Coordinator is someone who is part of the caving community.

To date, I have taught at approximately 140 seminars, including every national weeklong since my first as a student in 1992 as well as numerous regional weeklongs around the country. I also have been on about the same number of actual rescues, including some serious ones. I'm a project caver and have averaged a couple of cave trips a week since I started caving. The changes in curriculum that I have brought to NCRC have been informed by real-world experiences from that caving experience and those rescues blended with my professional experience in emergency services, including wilderness search and rescue and disaster response.

My teaching experience with NCRC led to me finding my passion for teaching, which is part of what I have done professionally for about the last decade. NCRC's instructor training is top notch, comparable to or better than what is often found in the professional world for the same amount of time invested.

Most current NCRC instructors and Regional Coordinators were students of mine at some point. I work hard to cultivate our newer students who show potential for being able to teach and contribute, and I am proud to call many of them friends as they've risen through the ranks. NCRC instructors are among the most dedicated and professional of any I have ever had the privilege to work with. It may seem cliché to say that, but I mean it without reservation. In my professional life, I often hold up the NCRC as the standard.

Though NCRC training is inexpensive (thank you volunteers!) by professional standards, it can be cost-prohibitive to our younger cavers who are most often in the position to be able to take the time to attend our seminars, as they have time, but not money. Our more active, experienced cavers may not have either time or money. Many years ago, I was involved in the

rescue of a caver from a cave in Kentucky. We had gotten called when the local rescue team decided that the rescue was too difficult, so I mobilized many of the experienced cavers we'd been training in the region, and we were able to successfully evacuate the caver from a difficult cave. When I talked with the caver after he'd gotten out of the hospital, I told him about NCRC and that the reason his rescue was successful was that most of the people who had performed his rescue had NCRC training. He and I talked about how he could give back to the caving community, and we explored the idea of him setting up a Cave Rescue Training Fund to give scholarships to people who are seeking NCRC training.

The Cave Rescue Training Fund is managed by the NSS, with a rotating committee of NCRC-involved people who award the scholarships. The seed money was provided by the rescued caver who set it up, and it has collected donations along the way. The scholarships are mostly awarded out of the interest the fund makes. The scholarship award can dip into principal if the markets are not great in any given year, but cannot exceed 5% of the fund and to date has not awarded scholarships out of the fund's principal. It is now an endowed fund managed by the National Speleological Foundation, thanks to a very generous donation by a long-time caver and former NCRC instructor. This scholarship can pay for half of a person's registration for a seminar, and we are now able to award 8–10 scholarships a year.

Another project I took on was the publication of the new *Manual of US Cave Rescue Techniques*. The second edition of the original manual was last published in 1988 and was wildly out of date. In the mid-2000s I took over the project, which had been languishing. With the help of several people, we fleshed out the chapters and started publishing it in binder format for our classes. In 2015, with the help of a large number of people, we were able to publish a professional bound manual. We have a commitment to updating the manual every three years, and I have remained the editor of the manual. We are now working on the third revision, which will have a new look and new content.

I've done a lot more in my tenure, but I wanted to hit some of the highlights. What I would like to do now is introduce Gretchen Baker, who was elected the new National Coordinator in February, 2021. I first met Gretchen when she went to Indiana University as a graduate student in the 90s and she started caving with and then became an officer of the IU Caving Club. Gretchen moved up through NCRC training to become an instructor. She has served as an Education Committee member and as the Western Region Coordinator. I had served four terms as National Coordinator and said I would not run again. We had two very excellent candidates who stepped forward, and the decision between them was not an easy one. I think having two highly qualified candidates is a good problem to have! I felt comfortable turning over the National Coordinator position to either of them, and Gretchen was elected. Over the last few weeks, I have been helping Gretchen to transition into her new role, and she's already bringing new life and new perspectives. She has my full support and confidence. Gretchen, over to you now!

Incoming NCRC Coordinator Gretchen Baker

New National Coordinator

Thanks, Anmar! I am honored to have been chosen by the Board of Regional Coordinators (BORC) of the NCRC for this position. I look forward to serving the organization and moving it forward.

Here's a little about me: My name is Gretchen Baker, and I love caves! From the time I started caving during college at Jewel Cave in South Dakota until now, I look for excuses to go underground. My current job, as ecologist and cave specialist at Great Basin National Park, lets me go underground frequently for my job. I also head into caves during my free time. I particularly like cave science and exploration. One year I caved from the near-sea level caves of Quintana Roo, Mexico, spending hours in water sketching well-decorated passage to the top of Mt. Rainier, where I had helped carry scientific gear to explore and study the glacier fumarole caves that top the volcano, including the highest elevation cave lake in North America.

I started cave rescue training when I was in graduate school in Indiana, and haven't looked back. I became an NCRC instructor in 2005 and have traveled to many states and Canada to teach. I remember that the first NCRC event that I taught at after my IQ class was in Puerto Rico, and I missed my first wedding anniversary. Fortunately, my husband has been very supportive of me traveling and teaching, and while I'm gone, he takes over all the family duties, including care of our two kids and various pets.

I helped with curriculum when I joined the Education Committee and then moved to the Western Region Coordinator position, where I worked to strengthen the Western Region program. I was asked by some instructors to run for the National Coordinator position. It was a daunting thought, as I knew Anmar put a lot of time into it and there were some difficult tasks ahead. After talking with my husband and other instructors, I decided to put in my name. When I wrote my letter of intent, I shared my vision for the organization, and I'd like to share a condensed version of that here.

The Future

As National Coordinator, during the next three years there are three things I want to particularly focus on: the NCRC Instructor Team, improving communications, and encouraging cross-training.

Our Instructor Team is the key to a successful NCRC. We have so many talented instructors, and I want to make sure that we are acknowledging the time and effort that they are putting in to teach the best that they can. We will be starting to track how long instructors have been teaching so we can recognize them at milestones. We also will be looking for opportunities for instructors to do some bonding, such as on caving and canyoneering trips.

One way you can help is if you've taken an NCRC class, send a note to an instructor (or to me, and I can pass it on) letting them know what you remember from the class or something useful you've used from the class. I can't tell you how good I felt when I heard a former student talk about the hypothermia kit he had learned about in an OCR and how it saved his life when he got hurt in a cave. Getting that feedback makes it all worth it.

Communications are the key to everything. Within NCRC, we are going to be having more frequent instructor meetings via Zoom to keep everyone up to date. We're also working on updating the NCRC website, posting more on the NCRC Facebook page, and keeping up communications with partners.

Cross-training can come in a couple different forms. For NCRC, we teach cave

rescue with an American twist. We often use micro-racks and prussiks. We customize our vertical systems; in fact, the only time I saw a class with more than one person having exactly the same vertical system was in Canada. Taking classes about cave rescue in other countries can show us additional and different techniques. Learning about other rope disciplines, such as canyoneering, climbing, mountaineering, arborist, the Society of Professional Rope Access Technicians (SPRAT), and more, can help us to learn other ways to use ropes. Not all of it will be applicable to caving, but it can help us to think more objectively about what will work best for cave rescue in our areas. I encourage this cross-training not only for NCRC instructors, but for all cavers. It's always nice to have a few additional tools in the tool box.

Upcoming Training

The most frequent question I get is about training. The pandemic has put most training on hold, but we expect to see more training courses offered soon.

The national weeklong seminar is scheduled for August 27—September 4, 2021 near Albany, New York. This is an opportunity to take one of several weeklong classes. Likely, there will be a couple of regional weeklong trainings in fall 2021 and at least one in the winter of 2022. In addition, we're anticipating several OCRs and SPARs, but we do not have specific dates yet. If you are interested, keep an eye on the NCRC website at ncrc.info, or contact your regional coordinator (listed on the NCRC website).

If you can't wait for training, here are a few other things you can do:

Check out the "Virtual Topics in Cave Rescue" series on the NSS YouTube channel (http://bit.ly/caverescuevideos).

Take a wilderness first aid (WFA), wilderness first responder (WFR), or emergency medical technician (EMT) class. We always need more medically trained people on cave rescues; plus this kind of knowledge helps to keep you and the people you cave with safer.

Check out the free Incident Command System (ICS) classes on the FEMA website: https://training.fema.gov/nims/

I appreciate this opportunity to introduce myself. If you have any questions, please contact me at GretchenBaker@caves.org.

National NCRC Coordinators

1975—1979 Dan Smith
1980—1982 Lee Noon
1983—1984 Tom Vines
1985—1991 Don Paquette
1991—1994 Steve Hudson
1994—1999 Bernard "Butch" Feldhaus
1999—2009 John Punches
2009—2021 Anmar Mirza
2021—present Gretchen Baker

A Framework for Search and Rescue Team Culture Using Mission Command Philosophy

Christian Stenner NSS 61663

A rescue operation in a cave is a difficult and dynamic situation characterized by obstacles and logistical challenges that do not exist in other forms of search and rescue (SAR) operations. The underground environment has inherent challenges that are obstacles to timely command, communications, and decision making. A dynamic environment demands agility and adaptability to achieve success. The strategic military philosophy of Mission Command is a worthwhile organizational tactic for achieving success in situations with uncertainty. This article presents a brief overview of Mission Command and how it may integrate into rescue organizations. Elements of Mission Command have shown success in enhancing command and control which may be beneficial to cave rescue and regular SAR operations.

During a number of challenging cave rescue incidents and exercises, command and control difficulties were encountered and successfully overcome. These instances were the basis of realizing that some elements of the Mission Command philosophy were already being practiced inadvertently by our cave rescue team and that exploring it further could yield benefits.

For example, a three-day cave rescue exercise in the Canadian Rocky Mountains provided a great example of how Mission Command can benefit cave rescue operations. In this case, the remote mountain plateau was cut off from communications from the command post due to failure of the required radio repeaters. The incident command team had dispatched more than 100 cavers and rescuers to the mountain only to spend the next few days wondering if the rescue was even happening at all. Cavers, understanding the intent of the exercise, executed the required operations without further direction and took initiative to self-organize to the tasks at hand without waiting for reassignment. This was a command-and-control nightmare for the planning and command teams, but the rescue exercise was completed.

Similarities have been observed in other incidents over time, especially in the initial stages of an incident where communication networks such as cave radios were yet to be put in place. The rescuers, having an understanding of the implicit task and the required safety parameters under which to operate, were able to take advantage of opportunities without further direction. Decision making was decentralized, and team leaders closer to the action felt they were able to assess and make quick decisions when necessary.

Mission Command combines centralized command intent with decentralized execution, and empowers subordinate initiative and decision making, within defined constraints (U.S. Army, 2019). Originating in Prussian armies of the 1800s, Mission Command has been adapted and modified and is now practiced in the militaries of the United States, Canada, and other nations (Shamir, 2011). German tactician von Moltke wrote the following about Augtragstaktik (mission tactics) which summed up a major part of the philosophy: "A favorable situation will never be exploited if commanders wait for orders. The highest commander and the youngest soldier must be conscious of the fact that omission and inactivity are worse than resorting to the wrong expedient" (Storr, 2003; Dupuy, 1977). Subordinates are given clearly defined goals, their commanders' intent, their missions, and the context of those missions (U.S. Army, 2019). They then decide within their delegated freedom of action how best to achieve their missions. Orders focus on providing intent, control measures, and objectives, allowing for greater freedom of action by subordinate commanders (Stewart, 2010).

The strategy has been further developed, and the key principles of the strategy are described by the U.S. Army (2019) as follows:

- Competence
- Build cohesive teams through mutual trust
- Create shared understanding
- Provide a clear commander's intent
- Exercise disciplined initiative
- Use mission orders
- Accept prudent risk

The same strategies are advocated by leadership and business empowerment gurus, whereby organizations create a system of trust and mutual understanding of the objectives and then let those empowered people achieve great results. Looking at the key tenets of Mission Command, other parts of the strategy are likely used in one form or another in various successful organizations but with varying terminology. It's likely that some SAR teams and organizations are already using some elements of the strategy but with different descriptive terminology.

Search and rescue operations tend to require hierarchical structures and command networks for safety and operational reasons. How then do elements of the Mission Command framework integrate into an Incident Command System (ICS) based control structure? To be clear, Mission Command is not a replacement for ICS but speaks more to a cultural framework and leadership philosophy which can enhance speed of decision making and initiative. This can happen within the ICS structure. In most cases where there is clarity on what is essential to complete the task and orders can be given through reliable communication means, subordinate team leaders and individual rescuers may not need to exercise elements of the strategy. But not everything always goes to plan. Having a cultural framework in place based on Mission Command can help operations when command and control breaks down or other opportunities arise. As leadership advocate Simon Sinek has said, "Always plan for the fact that no plan ever goes according to plan." These strategies should be enacted and integrated into team culture well before an incident response.

One aspect which is critical to Mission Command success is competence (U.S. Army, 2019). Because Mission Command grants more freedom of action, it also demands more of subordinates (Caroe, 2020). To have the trust required of decentralizing decision making, leaders must have confidence in the skills of the team. A well-trained and cohesive cave rescue team can likely be trusted with decisions made at lower levels. In cave rescue, there are some roadblocks to this. Student rescuers or rescuers who perform cave rescue infrequently may not understand the big picture or may memorize systems rather than the concepts behind them. And cavers called into rescues as convergent volunteers can have a wide range of skills. Both of those situations demand increased scrutiny by leaders, and improvisation might violate principles of safety to the rescuers or the casualty.

General Stanley McChrystal remarked on trust in his book *Team of Teams*. He stated "Purpose affirms trust, trust affirms purpose, and together they forge individuals into a working team" (McChrystal et al., 2015). This demonstrates the interrelationship between elements of Mission Command of building cohesive teams through mutual trust, creating shared understanding, and providing a clear commander's intent. Taking a cue from organizational culture, having clear mission and vision statements reinforced by leaders and well understood by every member helps to fulfill the tenets of having clear intent and shared understanding. Many people understandably glaze over when talk of mission and vision comes about, but many times it is because they become empty statements as they are not reinforced or demonstrated by leaders and supervisors. When teams have developed a shared understanding and mutual trust, then a much better framework is in place for them to operate based on centralized intent. Former nuclear submarine Commander L. David Marquet, (2015) remarked on this similarly in his book *Turn the Ship Around!: A True Story of Turning Followers into Leaders*: "Empowerment does not work without the attributes of competence and clarity."

Under Mission Command, subordinates have a duty to exercise disciplined initiative, but within the commanders' intent (Caroe, 2020). With regard to the dynamics of teams that may be involved in a cave rescue, that initiative might be delegated to the team leaders and not necessarily individual cavers who may not be as skilled and trusted. This element is key to the original concept of Mission Command, where the leaders close to the action were better positioned to make decisions, provided they were empowered to do so. Empowering those with competence can enable swifter outcomes, a key in cave rescues where the "golden hour" of delivering a casualty to medical aid is almost never attainable.

Other elements can be integrated into a team's organizational culture as well. "Use mission orders" closely equates to proper briefings and is likely a standard operating procedure already. Where Mission Command is concerned, there is a specific element about these orders. Orders should focus on what needs to be accomplished and not on how exactly to do it, relying on those closer to the action to determine the exact best way to achieve the task (U.S. Army, 2019). This is not unlike a cave rescue rigging team devising the best way to rig a pitch based on what they observe rather than having it dictated to them.

Implementing Mission Command has not been without challenges, however, and

A cave rescue briefing. Photo by Charlene Forrest.

many militaries have had struggles with fully adopting the principles involved. One challenge is in truly adopting decentralized execution in the way required (Brender, 2016; English, 2014). The hierarchical structures of militaries (and sometimes emergency services agencies) are not always comfortable with delegating control to the extent that Mission Command might advocate. Pushing some of the decision-making authority down to the lowest levels is hard to swallow in organizations that have explicit chains of command and especially detailed orders and procedures. McChrystal et al., (2015) recognized this discomfort and remarked that his teams "decentralized until it made us uncomfortable, and it was right there—on the brink of instability—that we found our sweet spot."

Other elements of the philosophy--of exercising disciplined initiative and accepting prudent risk, in the style of Mission Command--might also be uncomfortable for organizations. These elements arise from one of the original elements as written by von Moltke. Mistakes were preferable to hesitancy to enable decisive bold action (Stewart, 2010, as cited in Sharpe and Creviston, 2015). If organizational culture is to allow decentralized execution when the time comes, an understanding must be there with team leaders that sometimes this may mean mistakes. Of course, centralized intent or mission/vision should always reinforce safety of the responders, casualty, and public, so clarity on what "bold action" is allowed should be tempered by the shared understanding of the safety of all rescuers.

While Mission Command excels in the uncertainty of combat, it does so with the assumption that leaders and soldiers are tactically and technically competent (Caroe, 2020). Achieving competency requires training, education, and self-development. The levels of knowledge of junior personnel in techniques and procedures within their specialist domains need to be high. If the technical capabilities of the team are lower

and must be more tightly controlled and supervised, decentralized execution might not be a prudent style.

The different command philosophies have evolved to suit organizations concerned and their purposes. While Mission Command philosophy has evolved to exploit opportunities in combat, elements of the philosophy can carry over to other kinds of operations such as those in emergency services and search and rescue groups. This can especially be true in dynamic situations where the regular command and control structures are not available, such as in communications interruptions like those experienced underground.

Traditional organizational cultural philosophies exist in stable environments where uncertainty is an exception—something to be specially managed. Mission Command accepts that there is chaos and uncertainty and builds a cultural framework to be resilient to that uncertainty. In a cave rescue there is great benefit to having this resilience built into the cultural framework ahead of time, so that better outcomes are possible. At the least, giving clear direction and parameters for the team well in advance of an incident can facilitate positive outcomes. Teams will benefit from having that cultural framework in place, to include enhanced trust, clear intent, and enhanced organizational cohesion even if decentralized decisions are never required.

About the Author

Christian Stenner is the Alberta Provincial Coordinator for Alberta/British Columbia Cave Rescue Service, and a Captain in the Canadian Armed Forces Reserve. He has been a caver for over 16 years and has been involved in expedition caving in Canada, the U.S.A., and Mexico. He holds a certificate in professional management with specialization in risk management from the University of Calgary, and the Canadian Risk Management designation.

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Steve Hudson Award for Service to Cave Rescue

Steve Hudson (NSS 11444 RL,FE,OS) was a founder of the National Cave Rescue Commission (NCRC) in the late 1970s and supported it through the next four decades. He served as one of its first instructors, as the Southeastern Region Coordinator, as the National Coordinator, and as the Training Coordinator. Hudson owned and operated Pigeon Mountain Industries (PMI) and was an internationally acknowledged expert on rope and rope rescue. He used his experience to raise standards and practices in industrial rope access as well. He was a founder of the Society of Professional Rope Access Technicians (SPRAT) and an author of *High Angle Rescue Techniques*. Hudson served as Deputy Director of Emergency Services for Walker County, Georgia, and was a recipient of its Distinguished Service Award. He was also the recipient of the International Technical Rescue's Lifetime Achievement Award. Hudson donated countless hours to teaching rescue techniques to make cavers safer. In recognition of his lifetime of service, the National Speleological Society created the Steve Hudson Award for Service to Cave Rescue.

Steve Hudson Award for Service to Cave Rescue recipients:

2016—Diane Cousineau
2017—Harold & Nancy Chrimes
2018—Don Paquette
2019—Rod Dennison
2020—Ken Laidlaw

Wisdom Lamp 4

The Wisdom Lamp 4 is a multi purpose Lamp made by New Wisdom Investment Limited. Like many other lights these are made in Shenzhen China, this is a large city near Hong Kong .The US Distributor is Northwest Mine Supply in Wallace, Idaho. Wisdom also manufactures other mining lights and chargers. Not long after I began caving I used a miners lamp popular with cavers from the 1950s to 1990s called The Kohler Wheat Lamp. During that era The Kohler Wheat Lamp was considered by US cavers to be the best electric headlamp. Mining lamps are typically made very sturdy as they are designed for daily use. This particular model is compact and suitable for cave exploration and many other outdoor activities. Wisdom is starting to market this light to the caving community. Using the included accessories this light can be used for bicycling, night hunting, mining, cave exploration and just about anywhere light is needed. As of this writing the cost of this light is 159.00 dollars.

The light uses a Cree S5 LED. It is powered by 2 Panasonic 18650B Lithium Ion batteries. These batteries are arranged in a parallel arrangement giving the light 7000mAh of power. The construction is bulletproof PC. The mold design strengthens the hardness of the housing and lessens internal stress allowing for impact resistance suitable for the demands of any cave environment. The water resistance according to the specs is 50 meters. This is much more than other lights cavers now use.This is possible due to the entire light being sealed including the batteries. The weight is 169 grams. The light can be charged with the included USB cord. Also included is a wall plug, mine was a European style plug but I did have an adaptor for US style wall plugs. These adaptors are not expensive and can be found at Wallmart where they sell suitcases or in airports as well as online. An optional external charger is offered as well. The light slides into this charger. Instead of using a "female end" charge port found on many sport lights this light has charge points on the exterior made of stainless steel and the charger contacts steel and gold plated brass. The USB cord connects to these points magnetically. This is a much better design as it does not allow dust and water in like the more traditional charge port. The light can also be used as a power bank for charging cell phones or other small devices using the included cord that connect to these same charge points. The light housing measures 3 inches wide and 2 and 3/4 inches tall. A flat blade is mounted that allows it to connect to included head strap that has a angle adjustment on the blade itself, something I have yet to see on any other light. You can also mount this light to a helmet by drilling two holes and running a tight wide zip tie horizontally or by simply purchase ing a flat blade mount.Also included in my package a bicycle handlebar mount and the magnetic mount that the flat blade slides into to attach it to a metal surface for hands free light for situations like working under the hood of a car or anywhere hands free light is needed.Also included is a nice lanyard. The light has a two year warranty and here in the USA, the light can be sent during this time to the US Distributor for warranty service.

One thing I like about this light compared to some is a rather simple switch operation. Only three output settings with a nice range of the three. Low of 50 Lumens, medium of 265 Lumens and a high of 533 Lumens. The Lux ratings on these three outputs are 1800, 12,000 and 25,000. Run times are listed at 60 hours for the 50 lumen setting, 13 hours for the mid setting of 265 lumens

Like many popular headlamps, the batteries are contained in the same housing as the light, avoiding the pitfalls of a wired connection.

and 5 hours for the high setting of 533 lumens. Do not assume that since your favorite light may have higher lumens it is brighter. I made that assumption also until I got this in my hands. The light also has a "gear lock" feature that allows you to use just one of the three output settings. This can be done with a simple double press of switch when on. Pressing the button when off for three seconds will put the light in SOS mode. Once press while in this mode will shut the SOS off. Cavers do not use this feature but this may be required for mining safety. This may come in handy for a search and rescue situation. A few lens covers are included to give you a range of optic options. The bare lens will give a somewhat concentrated far reaching spot. A spot much further reaching than any I have yet to see on a headlamp. The included diffuser lens covers give you a variety of flood options and one is for red light if needed. These covers snap on easily and stay attached via a tiny lanyard like cord to keep you from losing it. I find the covers handy for protecting the bare lens from possible scratching while in transit or if the light needs to be carried in a cave pack. I

A magnetic connector is used to attach a USB cable for charging. This reduces the possibility of flooding the light but can be a problem for reading a compass near it.

Left: Detachable diffuser changes the lamp from a spot beam to a flood. It attaches to the main unit with a lanyard

Wisdom 4 light in use on a wet cave trip. The light has an underwater rating of 50 meters and because it doesn't open, there are no o-rings to maintain to ensure integrity.

tried these covers at home in the dark and found one particular that gave a nice flood that lights up around your feet without having to point the light at your feet. A battery indicator feature is activated by pressing the switch when off for more than 1.5 seconds. The main light LED and two auxiliary LEDs flash a series of light combinations to indicate current battery status. Once you get about one hour from the battery being drained the lamp will softly flash one time every five seconds as a reminder that battery is nearly used up. During this flashing you can turn the flashing off with a two second press of the switch.

I received my sample in January of 2021. The package I received has all the accessories I described above. I charged it up as it like many Lith Ion lights it was sent with a partial charge. I turned it on inside the house first before dark and was impressed. I waited until dark and took it out in my large backyard and turned it on .....all I can say was WOW !! A far reaching spot beam with a "hotspot " that is most similar to spot specific flashlights. I compared it to some of my best headlamps both multi sport style and more expensive cave specific small batch lights and none were close in spot intensity and range. I waited a couple weeks and took it to a moderate passage size Indiana cave and was impressed. At first my fear was with the bare lens that it would not put enough light around my feet without having to look directly down. I prefer a spot beam for traversing through a cave.This was not a problem for me . I also tried one diffuser that at home seemed to be the most usable flood pattern for caving and also was impressed. A week later I took this light to a larger passage Kentucky cave with 100 plus foot tall domes and this light had no problem lighting these domes. I also swim laps regular at my local gym and took it to the pool and placed it on bottom running in about 4 feet of water for close to an hour and that did not seem to be any issue.I have a high level of confidence this light will hold up to the rigors of cave exploration.This light also has numerous third party certifications that I assume are required for mining safety. I have copies of each of the certifications including ISO.

Comparison of the Wisdom Light spotlight (left) with spot from a more expensive light rated at 1200 lumens.

This is the final part of my review where I will give the pros and cons of this light as far as its use for cave exploration. No light I have yet to see has no cons. The pros certainly outweigh the cons and I also take into consideration this is a multi sport lamp made by a company that makes mining lights. This light produces a more intense spot than any cave worthy headlamp I have yet to see and I have seen and reviewed many.The tilt feature on the flat blade is something new to me. The water resistance rating is greater than any other non dive rated headlamp I am aware of, much greater in fact. The spot intensity is due in part to the large and very polished reflector. Larger and deeper than reflectors on any other cave worthy headlamp I have yet to see. This is a smart design as it is better to get your output from the reflector than by simply pumping more lumens. This will allow the light to run longer, not draining the battery as soon or getting near as hot and having to step down on its high setting not long after turning on the highest output setting. This to me is a huge plus. The accessories and diffusers give a wide variety of optic options. A very well thought out design in many ways. The price is reasonable considering what all you get. This outperformed many more expensive lights. The weight to me feels fine mounted to the front of a climbing helmet. The cons are few, one is that you cannot remove the batteries, I understand why this is done to make it more waterproof. This may be an issue for some cavers depending on the nature of their trips. Expedition cavers are used to being able to replace batteries and have unlimited run times for multi day expeditions. Most cavers are recreational and trips typically last 4 to 6 hours maybe. Run times will be more than sufficient for those trips. I will say here you can get the low setting of 50 lumens that gives sufficient light to traverse many caves for 60 hours. I ran mine on the mid setting and only turning the high setting up to spot tall domes or look at larger trunk passage. Another con is it produces a magnetic field as the charge cord connects connects via a magnet. Magnets can throw off survey devices cavers use to maps caves. This will only be an issue to those who map caves. Again the majority of cavers are recreational cavers. Another very slight con is the light has a somewhat sensitive switch. The batteries can not be removed so it may be possible for this light to get turned on accidentally while in transit or storage. I am told there is a switch cover but my sample did not include one. The only cavers out there that may have an issue with this light are the few multi day expedition cavers and those who survey. Overall, I have a very positive impression of this light and do not think it can be touched in spot distance output and the value for what it cost is very nice.This will be my " go to" headlamp for now.

I would like to thank Northwest Mining Supply and New Wisdom Investment for their sample and allowing me to review this light.

Jeff Cody

PRESIDENT'S MESSAGE

NSS Convention

As most of you know, the Summer 2021 NSS Convention has been moved to a virtual convention. Please check the NSS and the convention web sites for the latest updates on events. While I will miss getting to see old friends and making new ones at an in-person convention, a virtual convention allows folks that normally cannot make it to join in and get a taste for our annual meeting. I hope to see everyone in person at the 2022 South Dakota convention.

NSS Special Board Meeting on April 19th

At the special NSS Board of Governors meeting on April 19th, the board modified a number of bylaws related to the timing of officer elections. The officers are elected by the BoG each year. The election of the NSS President was moved from the spring BoG meeting to the fall meeting and the new president will be seated at the close of the following spring meeting. The board also moved the election of the vice-presidents from the summer annual meeting to the spring BoG meeting. The Society seats elected board members at the summer meeting. Moving the selection of officers allows newly elected board members to become familiar with the NSS operations and prospective candidates. The board also passed an act to implement the use of Google Documents for preparation of Board agendas.

Annual Convention Board of Governors Meeting

The annual NSS Board of Governors meeting will be held virtually on Saturday, July 24, 2021 at 9 am PDT and if needed, on Sunday, July 25th at 9 am PDT. Information on how to attend the meeting will be posted on the NSS webpage.

NSS Headquarters

As of July 1st, we will owe $45,331.28 to pay off the mortgage. Rentals are occurring now and are expected to be back to normal by the beginning of 2022. Maureen Handler, Chris Foster, the Dogwood City Grotto and other volunteers have taken advantage of the lull in rentals over the last few months to replace the fluorescent lights in the ballroom with LED lights. The replacement will save on cooling costs, electricity, and bulb replacement. This work was completed at the end of April.

We are still raising additional funds to expand our museum exhibits and hope to purchase a total of five additional cases this year. The existing cases are almost full and funds to purchase three additional cases have been donated.

Brick sales for the Memorial Patio around the flagpole at the Headquarters are continuing. This has been a popular fundraising program with the Headquarters, and we are hoping to have 250 bricks sold for a fall bricklaying effort. If you would like to sponsor a case or donate a commemorative brick, please contact the NSS office at (256)-852-1300 or visit the webpage.

Grottos and individual volunteers have been participating in work weekends following social distancing protocols. In the last few months, the Dogwood City Grotto installed most of the privacy slats in the new fence along Pulaski Pike, Sewanee Mountain Grotto painted the front of the building a limestone gray and also donated the paint for the work. The Huntsville Grotto has helped remove the old cabinets and other material in the back five rooms. We are reviewing architectural drawing to turn some of the rooms into a conference and educational center.

Work weekends at the Headquarters are scheduled for the 3rd weekend of each month. For more information on volunteering, contact Maureen Handler, OVP at ovp@caves.org.

Briteweb has been selected as our contractor and they are working on redesign of the NSS website. We anticipate the new website will be up and running at the end of July or early August. I know that many of us are looking forward to the website upgrades.

Membership

Membership increased slightly (56) during the month of March. As of 30 April 2021, we had 7,448 members with the 70,971 being the highest NSS number issued. This is an increase of 56 members from March 2021. Membership appears to be holding steady or slightly increasing over this year to date. Please consider renewing your membership in the NSS.

Geary Schindel

The Fine Arts Salon

The NSS is holding the annual NSS Auction over the week of our Black Box/Salon. If anyone would like to contribute any work, we would be delighted! The Salon opening will be filmed and a guided tour around the exhibits and what HQ has to offer in displays and display cases. This will be shown online at Virtual Convention.

As Salon Chair, I am looking for a variety of artwork to be entered to be shown, Judged, or not judged. That is an option for all entrants for this exhibition. Quilters should let me know sizes and dimensions of quilts ready to enter this year's Fine Arts Salon to be held at Huntsville HQ over the weekend of 23-24th July 2021. Judging will occur Saturday afternoon, and winners will be announced at the Black Box Opening. This event is to be filmed for Virtual Convention so all NSS membership will see our lovely gallery and the contents on show over the rest of the month of July and on into August.

"The Pedestal" by the late Glenn Mills, will be the main feature for the Black Box opening and Salon July 24th 2021 in Huntsville. This is your inspiration and color palette for Artwork displayed in the box. Competition will be tough as the room is tiny…but it needs IMPACT! Any artwork that cannot make the mark for the box may also STILL be deemed worthy and will hang in the main gallery for the main competing event—the 2021 Fine Arts Salon Competition. It is not compulsory to compete as some of us just want to see and show great art. The competing event will be judged by professionals from professional art establishments in Huntsville, including the Huntsville Museum of Arts. https://hsvmuseum.org/

Form to enter this years NSS Fine Arts Salon:. https://documentcloud.adobe.com/link/review

Deadline to enter: 23rd July. Venue is NSS HQ, 6001 Pulaski Pike, Huntsville.

Black box gallery opening date: Saturday, 24th July.

For more info visit the SpeleoArt Facebook page.

If you are planning on being at this event, please ask for an invitation. Thanks.

Carolina Shrewsbury
carolina@hawaiiflow.com

UNDERGROUND UPDATE

Ian Reuter

West Virginia Caver

West Virginia Grottos
April 2021, Vol. 39, Number 2

Returning to the CrawlMaster 900 leads in The Maxwelton section of the **Great Savannah Cave System**, cavers explored and surveyed through the two borehole leads that had been left behind on last trip. Close to 800 feet of mostly walking passage was surveyed, however, two of the best leads terminated in a mud plug and a sumped pool.

Following an enticing breeze into a collapsing sinkhole, Nikki Fox and Campbell Hunter happened upon a lost sandstone cave. They could find no documentation of the cave, so they recruited Greg Springer to help survey the find. All 685 feet of cave passage is located within sandstone, making it a geological oddity and the longest known sandstone cave in West Virginia. **Tolly's Secret Cave**, named after the landowner who enthusiastically gave the cavers the lead, is a mazy, collapse-filled cavern with numerous calamite (tree-like horsetails) fossils and a few small coal seams.

Nikki Fox and Casey Tucker followed a high lead in the Sweetwater section of the **Great Savannah Cave System**, finding good wind and a fair amount of passage. After completing a sketchy 17-foot free climb, Casey was able to rig a rope for the duo to gain easy access to a wide, low passage that continued for several hundred feet. While there is some vertical error in the survey, current estimates place this new passage less than 40 feet below the bottom of a known surface sink, hinting at the possibility of another entrance to the Great Savannah System.

Sag Rag

Shasta Area Grotto
January-February 2021, Vol. 40, No. 1

Liz Wolff published an updated map of **Plutos Cave**, one of the largest lava caves in the Shasta region. The new map shows 2755.5 feet of passage and better details the fractured nature of the cave. A few smaller passages left off the initial 1983 map that terminate in a breakdown room were also added to the map. After overlaying the new data and a surface survey on Google Earth, this terminal breakdown room appears to be less than 10 feet from a blowing surface feature. However, without technical digging or heavy machinery Liz thinks it is unlikely a new entrance will be opened.

Underwater Speleology

Cave Diving Section of the NSS
July-December 2020, Vol. 47, Number 3-4

Cenote Canún is a skeleton and artifact filled underwater cave on the northeastern coast of the Yucatan peninsula. First explored and documented by divers during a National Geographic expedition in the early 2000s the cave contains the remains of 14 humans, bones of several extinct species of animal and an abundance of manmade vessels. More recently, cave divers Luis Sánchez and Antonio Ceballos, who are undertaking additional exploration in Cenote Canún, have discovered additional artifacts and two new sets of human remains.

CALENDAR

July 24, 2021—The annual NSS Board of Governors meeting will be held virtually on Saturday, July 24, 2021 at 9 am PDT and if needed, on Sunday, July 25th at 9 am PDT. Information on how to attend the meeting will be posted on the NSS webpage.

July 25-July 30, 2021—Virtual NSS convention, see http://nss2021.caves.org/

July 25-July 30, 2021— Western Region Speleo-Ed, Weed, California. Camping, cave trips, workshops, social events! http://wr2021.nsswest.org/

August 6-8, 2021—Come to the 68th Annual Indiana Cave Capers 2021 Edition! This year we are back at Crawford County 4H Fairgrounds near Morengo, Indiana, home of the 2007 NSS National Convention. This will be another great Capers hosted by the Central Indiana Grotto featuring access to some of the most rare and beautiful caves in Indiana. Enjoy camping, live music, banquet, speaker, prizes and more! Watch for pre-registration discounts and more info coming soon. For more information, go to www.cigcaves.com

August 13 - 15, 2021—Karst-O-Rama, at Great Saltpetre Cave Preserve, Mt. Vernon, Kentucky. We're bringing Karst-O-Rama back! Great cave trips and camping, vendors, and a live band with a costume party pair well with our sauna, hot tub, creek splashing, and, of course, feeding your thirst at the Guano Grill for three days of downright speleo-fun! This year's theme has yet to be decided. KOR is hosted by the Greater Cincinnati Grotto with pre-registration discounts and info available soon! For more information, see our website at: karstorama.com/.

October 7-10th, 2021—(Columbus Day weekend). The TAG Fall Cave-In, hosted by the Dogwood City Grotto. Pre-registration to open soon.

November 1-5, 2021—2021 National Cave and Karst Management Symposium (NCKMS 2021) will be held in San Marcos, TX Featuring Dale Pate, to speak at the banquet! Field trips to local caves and special access to local show caves! Glass-bottom boat tour of local spring! T-shirt! Online pre-registration is open. Reserve your hotel room for reduced rates. More details at symposium2021.nckms.org

CLASSIFIED ADS

Speleobooks Private Collection - 50 Year Sale. https://speleobooks.secure-mall.com/ 518-295-7978 emily@speleobooks.com No convention this year so Speleobooks owner Emily Davis is offering her life long collection of rare cave books for sale. We look forward to seeing you at future caving events.

West Virginia Cave Books
www.WVASS.org

Caver Owned Camping in the Heart of TAG. Special price to NSS members. Visit us on Facebook or CaversParadise.com 5/22

Is your Grotto or Region looking for new caves to explore in the Virginia area? RASS can offer your group a complimentary place to camp in Bath County, VA, once the COVID-19 situation has improved. There are more than 100 caves within an hour drive. We support cave conservation and education. Contact Richie Ellison at rellison1120@gmail.com

The Richmond Area Speleological Society (RASS) supports cave conservation, education and research by offering grants to assist projects aligned with these goals. To receive a grant request application please email us at rass-grants-committee@googlegroups.com. Applications reviewed quarterly. 12

New WV Cave Books: Bulletin 20 Caves & Karst of the Culverson Creek Basin, WV by Lucas, Balfour, and Dasher. 336 pages, 364 caves, 208 photos, 80 maps. Color copy on USB drive. $35 postpaid;.Bulletin 21 Caves and Karst of Mercer & Summers Counties, WV by Schaer and Dasher. 186 pages, 226 caves, 131 photos, 62 maps. $25 postpaid. WVASS, PO Box 200, Barrackville, WV 26559 WVASS@PrehistoricPlanet.com 12

NEW BOOK: ***Caving Alabama with the Huntsville Grotto*** by Frances Johnston, assisted by Jim Johnston, NSS 1718F. Early discoveries from 1956 on. Full color, softback only, 8 1/2 x 11 size, 146 pages, view and order direct from Amazon.com to your home, price $19.98. 6

AD RATES: Now based on the number of lines your ad takes up. It is a flat rate of $3 per line. As a guide, a line holds 43-45 characters + spaces at our font and size. 10% discount for runs of 3 months or more.Payment must precede publication, but copy should be e-mailed to the editor (nssnews@caves.org), to reserve space. Copy should be received one month prior to publication date (e.g., by May 1 for a June issue). Make checks payable to the National Speleological Society and send to: Att: NSS NEWS ADVERTISING, 6001 Pulaski Pike NW, Huntsville, AL35810.

June 2021

American Caving Accidents 2019-2020