Issue 119

Are You A Professional Diver?
Or, Are You A Recreational Diver With A Specialty Card?

Distance Determination For Firearm Recovery

Detection Of Latent Prints On Handguns After Submersion In Water

The Public Safety Diving Discipline.
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Greetings,

You may have noticed that the issues of PSDiver Magazine are not coming out as fast as they used to. Since I retired, I have tried to focus more time on not working. I try, but I am not very good at it. In fact, I enjoy just about every aspect of the work I do in Public Safety Diving. But some of the work does take a toll both physically and mentally.

The last issue released focused on PTSD, Critical Incident Stress etc. I was apprehensive to do it. There are dark mental places I avoid on purpose. I presented the idea of making PTSD more relatable by telling their personal stories, to friends who have had their own issues with long term PTSD. Because they did, I felt I should as well. It was surprisingly difficult to do.

After 34 years of being in the fire service and doing the related Public Safety Diving, I have a few issues myself, with PTSD. For full disclosure, I did not edit or do any revision on what I wrote. I didn't even read it again until after I published the issue. It was not my best writing but it was personal. I don't typically “do” personal. I pushed my limits and didn’t anticipate the consequences.

We all need to set limits. Pushing those limits is not the same as pushing yourself to run a little faster. Pushing those limits is like seeing how far you can walk in lava and not flinch. No matter your ability, you will still be burned and carry scars for life.

I inadvertently opened some of those mentally locked doors where all the bad stuff is shoved and kept at bay. Some of it escaped and I’ve had difficulty getting it all locked up again.

The sleeplessness, anxiety in crowds and even some of the ‘quick to anger’ issues returned. I am aware of it, it is slowly improving, but I have only a little control of it. I never would have thought, it never even occurred to me that I could or would have those experiences again. I don’t “do” personal, and reveling even this much is a little unsettling. But if it can happen to me, it can happen to you. Recognizing the problem, gaining an understanding of why we are acting the way we sometimes do, acknowledging that the relationship problems we have on occasion is probably our fault - is important. Without that understanding and acknowledgement, there is no path to recovery. Recovery - not cured as if you had a sinus infection. I do not think PTSD is something that can be cured. It has to be dealt with. The worse the issues, the harder it is to get to that point – maybe even impossible for some.

Learning what works for you as an individual can be a long, slow process. If I can help someone else, I will. But for any of us to be of help, we cannot fall into the dark. I will be very selective, about what I will talk about or even willing to think about. No platitudes offered – I willing to help you but that will likely be guiding you to someone much more qualified to do it.

There is a lot of help available if you need it. Just understanding the markers and the external effects will help. But, you have to make that choice to find it and then accept it. You get to choose how to battle your demons and choose how you live your life. You choose your path. You can find what will work for you but you have to choose to look.

PTSD is much more complex than you may realize. Do you know something is wrong but do not want to voice it? Are you constantly bickering with the people closest to you? Do you force yourself to stay awake at night and hope sleep comes quickly when you do go to bed? Drinking too much? Pop a pill here and there to take the edge off or…?

If you had easy access to confidential help, would you use it? I did a quick Google search for “help for PTSD” - 40 Million results. It may be the 1st or the 100th pick to find what you need. Help is there, waiting for you.

You just have to make that choice.
Are You A Professional Diver or a Recreation Diver with a Specialty Card?

By Mark Phillips

EDITORIAL:

What follows is MY opinion. My opinion is not reflective of any agency, fellow instructors or any organization. If you disagree with me, I am ok with that.

In my years of diving and instructing, both recreationally and public safety, I have become frustrated. The skills I teach in basic open water scuba are essential to my approach to scuba diving but are not always required by the certification agencies.

When I was first certified to scuba dive in the late 70’s my class took a few weeks to complete. Today, that same class and be taught in a single weekend.

The physics have not changed, nor has our inability to breathe water. The equipment has changed and in some ways may have simplified some of the physical learning process. The academic portion of beginning diving education can be done online and is subject to subjective follow-up by the instructor. How much time is really necessary to teach someone how to scuba dive?

Do we want new divers to just be good enough to dive and survive, or do we want them confident and excited about their new hobby? I think it is fairly easy to do the first in a weekend but impossible to do the latter. But we still do it. How many of your team members were certified in 3 days?

Recently I was discussing the use of a snorkel in public safety diving and where I thought it had a place. Others in the group disagreed. Some did not use a snorkel – ever. Really? Ever?

To me, the ability to use, to properly use, a snorkel requires some fundamental skills that directly transition into scuba training and even relate to our abilities to survive an underwater emergency. For me, a snorkel is a basic part of recreational diving. If I am in clear water and need to move to a different location, I can swim face down in the water and see what is around me. The snorkel allows me to breathe ambient air and conserve my cylinder gas. The ability to see in clear water and be awed by the sights is part of the excitement a new diver experiences. For me, the ability to use a snorkel and be comfortable with it is a basic scuba skill.

So where is the use of a snorkel taught in open water scuba? What about using fins, how fins differ, and how certain kicking styles are better than others for certain fins? We teach that in basic scuba, right? Or did you just learn a single kick that provided forward motion?

What about your mask? Did you learn how to clear it? Really? Did you learn the difference between a purge and a non-purge mask? Which did you learn to clear? Could you clear either if necessary? If the guy next to you on the boat dropped his cylinder on your mask and the dive master gave you one of his to borrow, do you have the ability, the skill and understanding of the techniques to clear any mask?

When you learned how to weight yourself did you learn anything about dual weighting? Did you use and learn only how to weight in an integrated weight BCD? When you practiced ditching the weights, did you actually drop them or did you simulate dropping them? I bet you didn’t drop them in your open water evolution...

I have mentioned a mask, snorkel, fins and weights so far. Some of you are a little uncomfortable right now because you can’t honestly answer the questions with a “yes”. It’s not your fault if you didn’t know better. If you can do it all, I have a challenge for you because my experiences are proving that most of those who say they can really can’t.

When we work with or are training experienced divers and ask them to perform some basic scuba skills, we witness firsthand the surprised, sometimes shocked reactions from them when they cannot do what they assumed was far too basic to worry with, much less practice.

Let’s go backwards in time a bit. Guy Gilpatric wrote a book in 1938 called “The Compleat Goggler”. It is a collection of short
stories about spearfishing written by Mr. Gilpatric for the Saturday Evening Post during the years 1934, 1935, 1937 & 1938. It described his experience designing goggles that could be used underwater and early spearfishing. It was this book that partially influenced Cousteau’s eventual scuba system.

The first true scuba devices are probably much older than you think. The early applications were not for looking at fish. I will leave it to you to research when scuba first became a recreational thing. But it had become so popular by December of 1951; the first issue of Skin Diver Magazine was released. At the time, you went to a hardware or sporting goods store or mail ordered scuba gear. In time the sport developed enough to allow standalone scuba shops to thrive.

The first scuba certification course in the USA was offered by the Los Angeles County Department of Parks and Recreation. In 1954, the training program was created by Albert Tillman and Bev Morgan now known as LA County Scuba. Recreational Dive Tables, based on early Navy Dive Tables, were introduced in 1956.

On January 4, 1958 the first showing of the black and white TV show Sea Hunt was broadcast. That show, in my opinion, catapulted the “newish” sport of scuba diving to unimaginably heights. If you were alive and able to watch television between 1958 and 1961, you wanted to “be like Mike”. Those who have no idea who I am talking about are now lost, the rest just went to a happy place.

**Scuba education exploded.**

In 1959, The YMCA developed the first nationally organized scuba diving course and certified their first skin and scuba diving instructors in the United States - NAUI in 1960 and PADI in 1966.

We claim to be professional divers, or at least argue that we are NOT just recreational divers. What is it that you think separates the two?

Did you know that the air tube on a German U-Boat (submarine) that allowed for air intake and exhaust was called a snorkel? Air – in and out while underwater – imagine that.

**Snorkeling.** That is the word. It is a sport, a hobby and a basic skill. It predates scuba diving and scuba diving utilizes the skills and equipment used for snorkeling. Equipment can include a snorkeling vest that can be inflated or deflated at will, a camera, a spear gun, tickle sticks and collections bags or whatever. Knowing how to use the most basic gear allows a lot of options.

**Why the history lesson?** As an instructor, I teach snorkeling as preliminary instruction to scuba. It may not be in minimal agency standards but I am allowed to expand. My students learn how to snorkel, not float on the surface and get sunburned backs like cruise ship tourists. (We used to refer to the cruise ship snorkelers as “Red Back One Horn Butt Fish”). My students learn how to use each piece of equipment, breath holding, ear equalization, air management, mask clearing, snorkel clearing, descents, ascents and a variety of fin kicks.

I believe Snorkeling is the most basic, necessary, skill set we can teach. When we move to scuba, we focus on the equipment, its function and how everything works together. The very basic skills
have already been learned. When we get to open water they are excited and when they go through their first skills sets, they are eager to do more. I work them until they are bored. Bored tells me they are ready to move on. Bored tells me they have met the challenge and mastered the skills.

In the beginning, my students earn each piece of equipment. For you instructors who are questioning this; after their swim and tread, I start them off with a snorkel - nothing more. I explain how it works, how to breathe with it, all the minutia involving a snorkel. Then, to prove to them it works as I described, I ask them to hold it in position on the side of their head with their left hand and secure the mouthpiece in their mouth with their right. Both hands are used – they cannot pinch their nose.

Because we took time to get comfortable and I earned some trust, they will usually dip their face in the water; shyly at first then with more determination. Then they take their first breath then their second, then a third.

They stay face down in the water until I tap them on the head. They just learned a snorkel can provide air if they are in the water face down but more importantly, they learned how to breathe from an air source underwater without a mask on. When they learn to flood and clear their snorkels, they learn breathing skills and how to protect their airway from atomized or droplets of water when inhaling.

We move to the weight belt. They learn how to load it, how to don it, how to remove it and the benefits of dual weighting if they are diving with an integrated BCD. They need it for the mask skills that follow.

My students are only allowed a non-purge mask. They are allowed to use their weight belts while learning how to clear their masks. Initially I do this with them sitting on the bottom and the belt across their laps. THEY have no idea how difficult this position can be when trying to clear a mask. They are usually not 100% successful but my goal is to keep them task focused, not worried about the water inside their mask. They learn that water in the mask, around their nose is an inconvenience, not a situation to panic over. When they are comfortable, in shallow water, they don their weight belt. Then they lie on the bottom of the pool and practice the mask clearing skills.

When we get to fins, nothing else is allowed. Just fins. They hold the side of the pool and just kick. They learn how to get power, how to flutter, to frog kick. Then with just fins, they swim the length of the pool using one of the kicks. No, they can’t breathe with their face in the water; I have them clasp their hands behind their backs and keep their faces out of the water. I have found that this forces them to kick efficiently and with enough power to move them and prevents bicycling. Their body position will change when they finally earn all of the pieces but it is that initial muscle memory, the sensation of efficient movement that I want them to learn. When we complete the training with each piece of equipment, they are finally allowed the use of all of it together.

They will have the knowledge, the understanding of how each piece of their snorkeling gear functions and works together. Good skills are habits are already ingrained and by this point in time, they have completed each of the skills individually. The next step is for them use them together. They can snorkel. But they came to learn scuba. They have to earn it.

**Graduation Challenge**

To graduate to scuba, they must snorkel to the deep end of the pool, descend, equalize their ears, ditch their weight belt and set it, not drop it, on the bottom. Then with their remaining snorkel gear, ascend and snorkel back to the shallow end of the pool– all without lifting their heads.
from the water. They turn around, snorkel to the deep end, make a
decent to their weight belt, don it, fully flood and clear their mask
a minimum of 4 times, make a controlled ascent, clear their
snorkel at the surface and snorkel back to the shallow end of the
pool – all without lifting their head out of the water.

Students who are taught to master a skill who are given the mental
tools to have a better understanding of their equipment, how to
move underwater, are more comfortable, more excited and while
not totally fearless, are confident in their skills.

Within our field of diving, we lack some of the basics that build
divers. We have no agreed upon definition of what a Public Safety
Diver is, what their function is, or the prerequisite skills,
experience and knowledge necessary to achieve the title. We have
no mark to reach, no defined levels of skills mastery. We work with
what we have and believe it is good enough. You do not have to
agree with me, but has “good enough” really become acceptable?
What do you compare your skills to? What mark do you work
toward? Right now, being neutrally bouyant and and performing
basic scuba skills without kneeling on the botom of a pool is about
all I see.

It intimidates experienced divers when asked to take the
graduation challenge or a version of it. Could you do it? Were you
ever even taught those skills? There is value in learning these
basics. Ditching a weight belt, clearing a mask underwater multiple
times on a single breath, ear equalization methods – all develop
skills, confidence and comfort in the water.

So why this rambling on about basic scuba skills? We are
professional divers after all...

Skills Degrade

Without attention to basics, advanced skills disappear. Poor skills become
the norm and eventually become acceptable. New team members may
never be exposed to anything else and while able to survive a trip
underwater, have no concept of what real proficiency is or can be.

What will you do in zero visibility if your mask is knocked off or a
regulator fails or you are entrapped and running low on air? Are

you depending on a backup diver to come rescue you or bring you
an air supply? If you run out of air or have a critical malfunction at
depth, will you bolt to the surface? In zero vis, how do you know
there is a free path to the surface? Could you hold your breath long
enough for another diver to reach you if that is your only option?

Will you panic if you lose your mask? Do you know how to clear a
flooded FFM? Are you diving with a gas switch block and pony
cylinder? Do you have a secondary way to access air from the pony
if the block fails or the second stage on your FFM fails?

If you need to make an emergency ascent, will you remember to
ditch your weights? I can almost guarantee everyone one said yes.
But how do you know? When exactly was the last time you
practiced ditching weights?

Do you complain about doing annual skills reviews? Are you one of
those people who argue about it and gripe the whole time? Are you
embarrassed because you are unsure and don’t want the others to
see you? Do something about it. Set higher goals. Don’t allow “good
enough” to become good enough! Take the opportunity to develop a
mentoring program. Teach each other the best skills you each have and
build on them.

Does it take hours to go through a full scuba skills review? Why? If
you and your team had developed an actual mastery of basic scuba
skills, you could be finished quickly enough to do additional
training.

Skills need to be learned, mastered and then must be
maintained.

We all start with recreational scuba. Are you a recreational diver
who took a three day weekend class a few years ago and have
some dark water experience or are you a professional diver who
has mastered recreational scuba and advanced to a much higher
level of diving? Are you a professional diver? Are you satisfied with
“good enough”?

Take the graduation challenge I described.
Have the courage to discover weaknesses in your own skill sets. Hone your skills. Master the basics, teach the newcomers to your team the skills you’ve mastered and set a professional example for them to follow.

We have no definition of skills mastery within the PSD community. We have limited standards to teach or train to and they do not define mastery, or even entry level PSD requirements. There is no consolidated organization that watches over us as a whole. Argue NFPA and OSHA if you like but neither is all encompassing. We claim to be professional divers, or at least argue that we are NOT just recreational divers. What is it that you think separates the two?

Consider this; technical diving is a recreational sport. It was technical divers who had trained to a higher level who affected the rescue in the recent Thai cave incident. How would they have fared if their level of skills matched yours of basic scuba?

**Good enough can no longer be the acceptable mark to reach.**

You are 50 feet deep, your first stage regulator just failed. Your pony is routed to the gas switch block mounted on the side of your BCD. You turn the knob expecting a rush of air when you inhale.

**Nothing happens.** Is the valve turned on at the cylinder? Panic is building; do you have the skills to find, reach and then turn that knob? Can you even reach it without taking off your kit? When you do reach it, your lungs are starting to scream—AIR- AIR- AIR .... **And it is already on. EMPTY.**

Where do you think your panic level is now? Even if you signaled for help, they are not going to reach you before you bolt or inhale water. What? I’m wrong? **When exactly was the last time you had training just for this scenario or any out of air scenario? Would you survive?**

We can add all the excuses, modify all the elements, say we wouldn’t do that in the first place – you are already doing it. But what if...? What if your unthinkable, your unimaginable situation happened? Do you have the skills to afford you the possibility of surviving the incident? Or will you be DRT?

What if it happened? If you are being honest, you probably don’t like the answer. But what if my assertions are even partially right and there is room for improvement in your most basic skills? What if, by working a bit and practicing you are able to meet my challenge? Your comfort in the water will be greater. Your ability to problem solve will be increased. Your ability to manage stress and control panic will increase.

If you had a crystal ball and looked two months into the future and saw yourself, 50’ deep, entangled, out of air, panicked and seconds from drowning, what would you be willing to do now to change that outcome?

There are over 110 PSD fatalities documented on the PSDiver.com web site. I would bet that none of those individuals started their dive believing it was going to be their last. We are professional divers. We should train, function and build as a professional team.

**Ok, I get it.** Some of you are mad and ready to argue against my opinion; to the death in some cases. Do something about it. But before you come after me, you might want to actually see if I am right or not.

**TAKE THE GRADUATION CHALLENGE.**
The PSDiver Workshop Initiative

This year we decided to become proactive. It is one thing to write articles, argue on message boards or make cute memes, but to implement a plan of action, put our own money on the table and develop a workshop program is a whole other thing. We beta tested our workshops with a variety of recreationally and Public Safety trained divers. We worked until we were confident that the workshops we wanted to offer could make a difference to divers, no matter what their ABC affiliation or level. Our results so far have been extraordinary.

The first workshop we introduced was the PSDiver SURVIVAL Workshop. This workshop is focused on the individual diver and is not a team building or enhancing program.

Designed for the individual diver, we teach a series of skills designed to build confidence and comfort underwater when task loaded and low or out of air. We call it “building panic resistance”.

We are not teaching divers how to dive. While we are not teaching any dive team concepts or skills, we will give you a new perspective on risk management, skills and training proficiency. We introduce methods of equipment configuration to better a diver’s efficiency and muscle memory. This workshop focuses on the individual diver, not the search and recovery of anything.

If you were entangled in zero vis, at depth and suddenly ran out of air, what would you do? Do you have the skills and training to free yourself before you pass out or inhale water?

If you are tangled, out of air or unable to get air and at depth, how long do you have to make a decision, perform an action or multiple actions before you die?
5 SECONDS?

Would 5 more seconds make a difference? What about 10 or 20 seconds or a minute more? If in just 5 additional seconds, you could solve the problem, what would those seconds be worth to you? What would you be willing to do to gain that time?

The PSDiver SURVIVAL Workshop is focused on building just those few seconds.

We teach skills and techniques that most divers have never seen. We will show you how to hone your skills to be more proficient and deliberate with your movements. Our goal is to extend your capabilities when the worst of conditions exist, and afford you the potential to survive.

This is not a “sharks and minnows” program or a training agency specialty. It is the PSDiver SURVIVAL Workshop.

Not all emergencies underwater are going to be life threatening but some will. The PSDiver SURVIVAL Workshop will teach you how to turn some of those emergencies into manageable inconveniences.

The PSDiver ASE Workshop

In May of 2018 we launched the second PSDiver Workshop. The PSDiver ASE Workshop (Automobile Subsurface Extrication).

When a vehicle goes into the water, it is rarely an accident. Occupants are not always able to escape; sometimes they are purposefully prevented from escaping. If the entry is witnessed and there is a potential for rescue, this workshop includes how to perform a Hasty Recovery when recovery of the entire vehicle might be quicker than attempting to extract victims from the vehicle underwater.

If rescue is not an option, the workshop offers a range of methods to bring the vehicle to shore. Methods include utilizing traditional tow truck hooks and equipment to air bag rigging and deployment to lift the vehicle and pulling it to shore by hand.

It can be difficult for teams to learn these or similar techniques. Teams may only have the opportunity to
perform these techniques on actual vehicle recoveries and the training potential for the team is almost always lost.

**We Bring Our Own Car!**

Depending on your location, we can solve that problem. We bring a specially designed and environmentally clean vehicle with us.

In the PSDiver ASE Workshop, teams will learn how to *choke, cinch and seize* ... Rigging and Lift Bags. This is an extraordinary team, department or regional training program.

**AND...** Next year we are planning on the release of our third workshop. It will be a team tweaking, team building, diver growth, skills update and more workshop. Our current plan is to announce it either late this year or early 2019.

The first will be conducted in Georgia. Date, Location, and additional information will be posted on all our social media sites and [PSDiver.com](http://www.PSDiver.com).

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We are working to take away your excuses. With funding provided by corporate sponsors, we have kept the cost of our workshop extraordinarily reasonable.

Our current workshop sponsors include: Dive Alert Network, Darkwater Vision, JW Fishers, OmniSwivel, FrogSpit, Humans in the System, GlasMaster

For announcements, schedules and locations of the PSDiver SURVIVAL and ASE Workshops,

Follow our [PSDiver Monthly Facebook Page](https://www.facebook.com/PSDiverMagazine) -- Join our Facebook [Public Safety Divers - PSDiver Group](https://www.facebook.com/groups/PublicSafetyDiversPSDiver/) -- or visit our web site [www.PSDiver.com](http://www.PSDiver.com).

If you would like information on becoming a sponsor or hosting a workshop, email Mark Phillips at Mark@PSDiver.com.

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Dive Safe,

Mark Phillips

Editor / Publisher

PSDiver Magazine
More 2018 PSD Fatalities

John Beevis
Employee City of Pembroke, Retired Staff Sgt OPP Auxiliary Member, Renfrew County Chapter Harley Owners Group; Died tragically on a dive operation, on Saturday May 26, 2018 at Deep River. John was 56 years old.

Diver Dies In Plan Recovery Operation
May 29, 2018

DEEP RIVER – A local diver died Saturday after being tangled in a rope as he tried to recover a crashed plane from the Ottawa River.

Police said Monday that 56-year-old John Beevis, Laurentian Valley, was engaged in a recovery operation when he became entangled in a rope that was attached to the plane and could not be transferred. The members of the OPP Underwater Search and Recovery Unit (USRU) recovered the man at the diver later that day.

The recovery operation was launched after a small private plane lost power and the pilot, the only resident of the planet, made an emergency landing on the river near Balmer Bay on Friday night around 6.30pm. Members of the Upper Ottawa Valley Detachment of the Ontario Provincial Police OPP responded after being notified of the event. The 49-year-old pilot, who had resigned from the Deep River airport, experienced minor injuries and could safely swim to the beach. The Transport Safety Authority (TSB) was notified and investigated.

The operation went on Saturday morning when the accident that claimed Beevis's life occurred. Several units in OPP responded, among other things, to OPP Marine Unit, OPP Helicopter, OPP Emergency Response Team (ERT), USRU and an OPP Officer (SOCO). Deep River Police and Fire Department together with Renfrew County Paramedics, Ornge and Garrison Petawawa Fire Department also participated in the scene. The police said that an autopsy will be conducted and the investigation will continue.
Juan Bucio

Chicago Fire Department diver dies after rescue attempt in Chicago River
MAY 28, 2018, By Tom Negovan

CHICAGO — A Chicago Fire Department rescue diver has died after an incident during a rescue attempt in the Chicago River Monday night. He's been identified as 46-year-old Juan Bucio.

CFD Marine Unit divers went into the waters of the Chicago River near the 2600 block of South Ashland in response to reports of a missing man who fell out of a boat and into the river. While three divers went into the water, only two came out. A statement from CFD said communication with the diver was temporarily lost. The rescue effort then switched to the diver, who was pulled from the river and put into an ambulance.

When the ambulance arrived at the hospital under police escort, paramedics could be seen administering CPR to the diver. Authorities later revealed that he had succumbed to his injuries.

Two other firefighters were transported to Northwestern Memorial Hospital for evaluation, and both are in stable condition.

2 Investigators: A Closer Look At Fire Department Diver Juan Bucio’s Final Moments
May 30, 2018 By Dave Savini

CHICAGO (CBS) — Video of fallen Chicago Firefighter Juan Bucio's final moments is raising new questions about the rescue operation that cost him his life Monday night in the Chicago River.

Bucio disappeared under the waves of the river near 26th and Ashland while searching for a missing boater, and was pronounced dead after he was pulled out several minutes later.

CBS 2 was on the scene as rescue crews tried to locate Bucio under the waves, and eventually pulled him from the river.

Fire Department dive teams responded to a call about a man who fell off a boat shortly before 8 p.m. Monday on the Chicago River near Canalport Riverwalk Park.

A helicopter dropped Bucio and his partner into the river to search for the boater.

The two had been in the water for some time when they began swimming to a Chicago Fire Department boat.
CBS photographer Scott Placko was videotaping the river rescue effort when Bucio and his partner ran into trouble, and crews on the boat began yelling out to them.

“They were face-to-face at the front of your boat. ... He ripped his mask off and then he went down,” someone said over Fire Department radios.

Three minutes passed before other divers entered the water to find Bucio. His body was pulled out after several minutes. An ambulance took him to Stroger Hospital, where he was pronounced dead at 10:02 p.m.

The chief in charge of safety for the Chicago Fire Department watched CBS 2’s video from the scene on Tuesday, but did not comment, including on questions about the apparent 3-minute delay before other divers were sent into the water to look for Bucio.

Meantime, the boater firefighters were searching for 28-year-old Alberto Lopez, has not yet been found. Friends said the father of three fell off a boat in choppy water on the river Monday night.

CFD diver Juan Bucio died of rare heart condition, authorities say
JULY 17, 2018

Authorities announced the cause of death of Chicago Fire Department diver Juan Bucio, who died on Memorial Day while searching for a man who fell off a boat on the Chicago River.

The Cook County Medical Examiner’s Office determined that Bucio died of a rare heart condition called lymphocytic myocarditis that can cause heart failure. His death was also ruled accidental.
Bucio, 46, was a 15-year veteran of the Chicago Fire Department, spending the last 11 years on the Marine and Dive Operations Unit.

Bucio was part of a crew that was searching for a man who fell off a boat and into the river in the 2600-block of South Ashland Avenue at about 8 p.m. on Memorial Day. CFD officials said Bucio disappeared suddenly and lost communication with his team while searching for that man, identified as 28-year-old Alberto Lopez.

"Yelled out a mayday and they sent in another team to find firefighter Juan Bucio. He was located near the bottom," Chicago Fire Commissioner Jose Santiago said. "An order was given to switch out divers to bring the second team in, give them a break. At that time they were coming towards the boat. His partner turned around and he was missing. That quick."

Once divers found him, he was rushed with a police escort to Stroger Hospital, where he was pronounced dead.

Bucio was honored with purple bunting hung around the city, and several fundraisers have been held in his name.

Prior to CFD, Bucio was a Chicago police officer from 2000-2003, a police spokesman confirmed.

The Chicago Fire Department said it's examining the results of the autopsy as part of its continuing investigation.

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**Saman Gunan**

06 July 2018

Rescue efforts for a Thai soccer team trapped in a cave complex recently took a tragic turn: A former Thai navy diver died after running out of air while delivering oxygen tanks to the 12 boys and their coach underground.

Retired Petty Officer Saman Gunan (also reported as "Kunan") was delivering air tanks to the stranded boys and their coach, who are in a subterranean chamber with oxygen levels running low, the BBC reported.

To reach the boys, Gunan and other divers had to navigate recently flooded passageways in the Tham Luang cave complex, where the children have already been trapped for close to two weeks. But Gunan ran out of air on the way back to the surface. He was found unresponsive at 1 a.m. local time today (July 6) and was transported to a nearby hospital, where he died without regaining consciousness, according to the Bangkok Post.

**Thai soccer team rescued, from caves – former SEAL dies attempting to save boys**


August 10, 2018

In late June, members of the “Wild Boars” Thailand Boys’ soccer team and their coach became trapped in a cave in
northern Thailand. It was nearly two weeks before they were discovered.

The path to the team required a five-hour trip to deliver oxygen to the cave. Narrow channels and jagged rocks encompassed the pathway to the boys, who admitted that they were not strong swimmers, making the rescue that much more difficult.

A retired Thai Navy SEAL lost his life aiding in the effort. Sgt. Major Saman Gunan was volunteering during an overnight mission to place extra air tanks inside the cave.

He passed out underwater and could not be revived. He was 38 years old and survived by his wife.

Gunan was an accomplished triathlete (a sport requiring one to swim, bike, and run) and champion trail runner. He was one of the top triathletes in Thailand and was part of The North Face Adventure Team. His team posted a message on its Facebook page remembering the former Navy SEAL. “We will never forget your enthusiasm (sic), power, passion and kindness. You died helping others, the ultimate sacrifice.”

After weeks within the cave, the boys and their coach were eventually rescued.

Find it Before You Dive It: Hull Mounted vs Towed Side Scan Sonar Systems

By Vince Capon, Black Laser Learning

Choosing a sonar system used to be relatively easy. For the first few decades, the models offered for Search & Rescue didn’t differ significantly. Klein, Edgetech, Marine Sonic Technology then, later, Imagenex, Tritech and JW fisher, all offered systems which had different features and different software, but all were towed systems.

During the past decade, both hardware and software developments have changed the game.

Autonomous Underwater Vehicles (AUV’s) and remote-control surface vessels such as Sonar EMILY have been introduced and many Search and Rescue (SAR) organizations have found hull mounted systems, originally developed as fish finders, to be effective, economical alternatives under certain conditions.
Side Scan Sonar/Side Imaging® Sonar - Hull Mounted vs Towed

With the advent of inexpensive hull mounted sonar systems such as the Humminbird® Side Imaging® sonar and professional software, users want to know if this unit will be as effective as a towed side scan sonar system. The answer is absolutely, positively, maybe!

The hull mounted and towed sonars are two different tools. Both create high resolution bottom imagery but their operational parameters, required experience level and cost are very different.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlimited with sufficient cable</td>
<td>&lt; 150 ft</td>
<td>&lt; 150 ft</td>
<td>Unlimited with depth applicable pressure housing and peripherals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Acoustic Shadow</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pronounced with proper towfish height</td>
<td>Depth dependent</td>
<td>Depth dependent</td>
<td>Pronounced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surface Motion</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptible</td>
<td>Highly susceptible</td>
<td>Highly susceptible</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ease of Deployment and Operation</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Easy</td>
<td>Easy</td>
<td>Complex</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boat Driver Skill Level</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Moderate</td>
<td>Low (with autonomous option)</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Loss of Unit</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Low</td>
<td>Low-Moderate</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vessel Requirements</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small to large, dependent upon cable length and use of splash-proof computer system</td>
<td>Small to medium</td>
<td>None</td>
<td>Small to large, vehicle size dependent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post Mission Analysis</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional software</td>
<td>Equal to towed with SAR HAWK™</td>
<td>Equal to towed with SAR HAWK™</td>
<td>Professional software</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Training Required</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Minimal</td>
<td>Minimal-moderate</td>
<td>Significant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th>Hull Mounted</th>
<th>Sonar EMILY</th>
<th>AUV/UVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>$$$</td>
<td>$</td>
<td>$$$</td>
<td>$$$$</td>
</tr>
</tbody>
</table>

Which factors most influence the choice of side scan sonar system?

Most purchasers focus strictly on cost but cost alone does not take into account all the characteristics important to deployment of the most optimal side scan system. Factors such as water depth, frequency of use, data processing, etc. all play a role in choosing which type of sonar system is best for your mission. The matrix below outlines the most important factors which present the advantages and disadvantages of different sonar system deployments. Let’s go through them detail.
Depth

Why is depth so important? It has to do with the distance between the sonar transducer and the bottom. Side scan sonar effectiveness depends on the sonar pulse moving across the bottom rather than straight down or perpendicular to the imaged surface like an echosounder or depth finder. As the sonar pulse travels through water the pulse energy decreases resulting in a lower signal to noise ratio. Also, the longer a sonar pulse travels the more the ping expands, reducing resolution. Shorter ranges also ping faster, putting more pings on objects being imaged and, the more pings, the better the sonar can resolve the target. Therefore, it is important to choose a system designed to operate at the right depth.

As the water depths increase, towed systems can deploy more cable, allowing the transducers to maintain an optimal distance above the sea floor. This distance above the bottom is also known as the towfish altitude. I have operated towed side scan sonars in as little as 3 feet of water and in over 10,000 feet of water. Given enough cable and a large enough support vessel, in the simplest sense, depth is not an issue for a towed system.

However, as depth increases, fixed, hull mounted systems logically increase the distance between the transducer and the bottom. A sonar pulse from a hull mounted sonar working in 100 feet of water must travel 100 feet before it reaches the bottom but also look further to see out to the side. In order to see imagery in 100 feet of water a typical sonar slant range setting for a hull mounted system would be 150 to 200 feet. The maximum effective depth for hull mounted sonars depends on a number of factors such as the sonar frequency, size of the target, its reflectivity, bottom type, bottom clutter, etc. but for smaller inexpensive systems, it is typically under 150 ft. for large targets and less than 100 feet for small targets such as drowning victims.

That is not to say every deep-water search for a small target will be unsuccessful. For example, recently a parks service group located a drowning victim in 120 feet of water with an inexpensive hull mounted system.

In summary, hull mounted systems have depth limitations but towed systems can work in greater water depths without losing resolution as long as the operator has sufficient cable to operate the system at the proper towfish altitude.

Sonar EMILY and other surface robots face the same limitations as hull mounted systems.
Autonomous underwater vehicles (AUV) and unmanned underwater vehicles (UUV), however, can theoretically operate at any depth for which the robots have been designed.

**Acoustic Shadows**

One critical component of side scan sonar image analysis is acoustic shadows. Shadows draw our eye to targets, indicate holes or mounds, provide target details and, last but not least, allow us to estimate the height of objects.

One can use a flashlight to simulate the sonar and how shadows are created by different targets and bottom features. Place an object on a table with the flashlight illuminating from slightly above and to the side. Notice the shadow length. Now move the flashlight higher and watch the shadow length shorten.

The higher the sonar relative to the bottom the shorter and less pronounced are the shadows. Hull mounted systems produce less of a shadow in deeper water than towed systems which keep the transducer relatively close to the bottom.

**Surface Motion**

Side scan sonar requires steady forward motion to create quality imagery. When the sea state kicks up data quality is reduced. Hull mounted sonars and surface robots suffer more than towed systems because the tow cable decouples some of the boat motion from the towfish. AUVs/UUVs are independent of surface motion except when working in very shallow water.

**Ease of Deployment/Operation**

Hull mounted systems are by far the easiest to deploy and operate. The sonar is attached to the hull and, as long as the boat driver does not run aground, operationally you’re good.

Towed systems require the deployment and recovery of cable. The boat driver must steer straight lines and not turn too sharply which causes the towfish to dive towards the bottom. Once mastered, and with practice, these operations become second nature, however, at first they can be daunting.
AUVs/UUVs are very complex to program, operate and deploy effectively. These systems need to be monitored and the team ready to recover a vehicle which aborts its mission or becomes entangled in an obstacle. While anyone can chuck an AUV/UUV into the water, if it is not programed or monitored properly, more than one vehicle owner has come home with significantly less equipment then he or she started with.

**Boat Driver Skill Level**

As previously explained, towed systems require a skilled and practiced team to be successful. The boat driver will make or break your search. He has to maintain very specific speeds, steer straight lines and turn without dropping the towfish into the bottom. Having taught many folks to tow sonar systems, I can say that boat driving is by far the toughest skill to both teach and learn. More than once I have grabbed the throttle or wheel to avert disaster. It did not make me very popular but that customer was not going to lose a towfish on my watch.

Hull mounted systems do require straight survey lines but you’re never in danger of losing the sonar by turning too sharply or slowing down when you should be speeding up. Should you get in trouble, you can always stop, something you never do while towing. These systems are ideal for surveying around piers and obstructions where maneuverability is limited.

Obviously, robots which execute searches with no human input are easy-peasy.

**Potential Loss**

AUVs/UUVs are highly susceptible to being lost without some physical connection to the surface. While experienced AUV/UUV operators rarely lose a vehicle, it is not uncommon when running search OPS to have a robot snag on fishing gear, a wreck, or even under an uncharted ledge.

For reasons described previously, towfish can be lost even with a cable to the surface. I have been on a ship where a deep-water system has hit an uncharted submerged cliff and I have friends who have snagged shipwrecks. While towed systems can be lost, more often it is a question of damage.

Surface robots could be lost if you’re running from shore and the battery dies or the vehicle develops a problem. Most surface robot operators have a chase boat or some alternative method of recovery.

Obviously, you have to work extremely hard to lose a hull mounted system. Don’t run aground and you’re good.
often any damage occurs moving on and off trailers if the transducer has not been properly mounted.

**Vessel Requirements**

Generally towed systems operate from slightly larger vessels unless working very shallow water. I have run towed systems from a 12-foot inflatable in calm clear weather. However, I tend to want more boat when deploying cable and a shelter for my computer and monitors. Deeper towed search OPS require winches and longer lengths of sonar cable all of which require bigger boats. The general rule of thumb is cable required equals 3 times the water depth.

Small hull mounted side scan sonars can generally be operated from vessels less than 100 ft or from a surface robot as small as 5 feet in length.

The smaller AUVs and UUVs can be launched from shore or small inflatable boats. Deep water AUVs/UUVs usually require larger boats with special launch and recovery equipment.

**Post Mission Analysis**

Traditional towed systems and AUV/UUV systems have software for reviewing sonar data. These software systems allow you to mark and measure contacts as well as determines coverage and present data for reports. There are many third-party software packages which can process sonar data as well.

Hull mounted systems have less sophisticated operating software which makes them easier to use but they have fewer functions. It is hard to show sonar coverage and measure contacts without employing professional 3rd party software which has been expensive and required significant training. Fire rescue personnel, sheriffs and other public safety groups rarely have the time to learn and stay fresh with these systems. There are a few inexpensive software programs but these are clunky and cumbersome to use. SAR HAWK™ is a recently introduced software system for use with Humminbird® sonars which inexpensively closes the data processing gap between hull-mounted and towed systems. First and foremost, it provides the ability to view sonar data in the command center on a high-resolution monitor at the data’s full resolution. SAR HAWK™ also provides the...
ability to create coverage maps superimposed on Google Earth, to locate and measure targets, and to produce reports.

**Training Requirements**

Search operations have three skill requirements of the search team:

- Ability to operate the sonar
- Ability to understand what they are seeing on the sonar
- Ability to effectively drive search patterns with the boat
- Image analysis requires the relatively the same training and skill level across all systems and is not a differentiator. There is however, a substantial difference in the skills required to operate the different sonar systems and to drive the boat.

Hull mounted systems are the easiest to use and are best for sporadic use. They require the fewest computer skills and the least training. Operators definitely benefit from training but the training level is less than required by towed or robotic systems. Also, while a steady hand on the wheel improves the search coverage, the sonar equipment is not at risk.

Surface robotic system such as sonar EMILY are more complex but still relatively easy to learn. The analysis skills are the same as any other side scan sonar system. Search patterns are easily handled with autonomous search pattern capabilities.

Towed systems are more complex than hull mounted and require a fair amount of knowledge and computer skills to operate. Coordination between boat driver and sonar operator is critical to successful search operations. If the boat driver does not respond to the sonar operator’s instructions, at a minimum, data quality is reduced and, in the worst case, the towfish impacts the bottom. These systems are best used by dedicated teams with frequent missions which keep skills fresh.

AUVs/UUVs require a very high degree of training and computer skills. These vehicles must be programmed and maintained, all of which requires significant training. Like towed systems, these systems are best for dedicated teams who spend a lot of time working with the unit.

One final note on training: regardless of the system, training must be followed up by practice. Sonar search OPS are a skill which must be practiced. Without practice, the probability of mission success is reduced.

**Cost**

Hull mounted systems are relatively inexpensive when compared to towed systems. Towed systems vary in cost with less expensive models now available but still are more expensive than even the most high-end hull mounted system. AUVs/UUVs are coming down in price but still are more expensive than all the other systems.

**Summary**

When looking for a side scan sonar system you need to consider your environment, types of targets, available vessel, skill level, available team training time, your...
mission and your pocket book. Hull mounted systems are relatively inexpensive and very effective in shallow, relatively flat water. Towed systems are more versatile and effective in more environments. The more expensive towed models have better software and provide a higher quality sonar image at longer sonar ranges with ability to cover more area quickly. However towed systems are more expensive and require more training, practice and experience to use effectively.

If you are working on large deep-water bodies, towed systems are definitely preferred. However, working inland on smaller bodies of water, enclosed harbors, canals or shallow coastal bays hull mounted systems can be a very cost-effective alternative.

**Notes:**
- Humminbird® uses the trademarked Side Imaging® terminology for a side scan image. Throughout this document the term side scan will refer to all side looking, bottom imaging sonars. Please also note the matrix and discussion do not include the depth sounder, echosounder, Down Imaging® or fish finder sonars present on most hull mounted systems.
- While less expensive towed systems are available, you get what you pay for. Less expensive systems have less effective software and do not perform as well as the more expensive systems.

*By Vince Capon, Black Laser Learning*
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**Saving lives one dive at a time: The incredible story of an Underwater Search and Rescue Team**

Julian Rogers | @PokerStars | 1 month ago In News

**How a dedicated team of scuba-diving volunteers on the Isle of Man is always on hand to carry out underwater searches and recoveries of missing persons...**

Situated in the Irish Sea between the UK and Ireland, the 220 square-mile piece of land that is the Isle of Man boasts a dramatic and rugged landscape complimented by unspoilt beaches and stunning bays. But being an exposed and windswept island with around 100 miles of coastline means there is always the danger that locals and visitors could somehow end up in the sea. If indeed a person does go missing in the waters surrounding the island or there is a suspected drowning, that’s when the Isle of Man Underwater Search and Recovery Team swings into action.

The search team, which is a registered charity, was established in the wake of the tragic death of 19-year-old Joshua Caley who went missing on New Year’s Eve 2015. Joshua, a maths student at Manchester University, had returned home to the Isle of Man to celebrate Christmas with his family. However, on New Year’s Eve he was out with
friends when CCTV captured him falling into Ramsey Harbour. Although the coastguard and emergency services launched a widespread search of the waters and coastline, the Isle of Man didn’t have a dedicated search and recovery unit to scour the sea bed.

"Many people think the government has a team of divers to send in in the event it was needed, but that is just not the case [on the Isle of Man]," says the charity’s secretary, Michelle Haywood, who also runs Discover Diving, the island’s only diving centre. There had been underwater search teams drawn from the fire service, but they were disbanded some time ago.

Borne out by frustration at there being no formal mechanism to mobilise and manage coordinated sub-aquatic searches, Michelle and other scuba divers on the island set about forming the underwater search and recovery team.

Scrambled at the request of the island’s Civil Defence or the Isle of Man Constabulary, the divers, of which there are around 30 spanning in age from their late twenties to early fifties, have the qualifications and kit to work in lakes, ponds, rivers, quarries and around the coast of the Isle of Man and its territorial waters. "Some of our members have equipment that will allow them to go as deep as 80 or 100 metres, when your average commercial diver will stop at 30 metres," Michelle explains. "We understand the tides and the sites and can access bits of the underwater underworld that I guess other divers can’t."

Dive Buddies

The dive team is made up of highly qualified scuba divers and those who dive, or have dived, in a professional capacity. For instance, Chairman Sean O’Connell worked as an inshore commercial diver for nine years and also served as a police officer in Dublin for 16 years, five of which were spent full time in the police dive team where he was involved in upwards of 90 searches a year for missing persons. "I searched for suicides, murder victims and accidental drownings; you name it, I looked for it," he says.

"And if you can imagine most things that are liquid, I’ve been in them - rivers with zero visibility, canals, lakes, the sea and sewers. I’ve lost count of the amount of bodies I’ve recovered from water." Sean, who has lived on the island for 18 years, adds: "After working in search and recovery for the police I know how important it is for a family to receive the remains so that they have somebody to mourn and bury."

Sometimes the team will go out in boats equipped with sonar equipment to recover sunken watercraft or, as was the case recently, recover submerged fishing gear worth around £20,000. It took volunteers three days and around a dozen
dives to untangle it from rocks and bring it to the surface. The relieved fisherman made a donation to the charity. Other times it can be the most trivial of searches; a few Sundays ago, three of the team recovered a smartphone that a woman had accidentally let slip into the harbour. After 24 hours immersed in seawater, her phone switched back on and she also expressed her gratitude by making a donation.

The divers are supported by shore-side volunteers to aid with coordinating searches, communications, ferrying kit around or even making welcome cups of tea.

Furthermore, not all those who end up in the sea and drown will sink - some will float and eventually wash up on shore, so the volunteers will need to be on hand in this scenario. With the charity’s establishing a bigger presence on social media and conducting fundraising to raise its profile, Michelle receives many requests from recreational scuba divers to join up and help with searches. Yet it’s one thing gaining a scuba diving qualification whilst on holiday in the aqua-marine waters of a sun-drenched resort and something totally different exploring the Isle of Man’s freezing-cold waters, often with impaired visibility, in the hunt for a missing person.

"Some people haven't got the experience or really thought through the ramifications," Michelle warns. "It's certainly not for those who have done a little bit of diving on holiday and think they would like to jump in. The waters around the Isle of Man can be some of the fastest moving, darkest and coldest that you can dive in around the British Isles. That’s what makes diving around here so great, but it makes it a challenge too. And if you are having to do tasks in those conditions it just adds to the stress levels." Sean echoes this opinion: "Searching for human remains in water, and sometimes in difficult conditions, is completely different to going out and having a pleasure dive. If you're successful, it has a pretty grim outcome."

**Generous Donations**

Scuba diving certainly isn't an inexpensive pastime. Yet while the volunteers use their own wet suits, breathing apparatus and other diving paraphernalia, the charity organises fundraising events, such as 24-hour dives (one planned again this summer), and also seeks donations from members of the public and local businesses for more specialised kit.

Other equipment is loaned by Discover Diving. But thanks to a donation by PokerStars in 2016, the charity was able to purchase four full-face masks fitted with a state-of-the-art communications system to allow the divers to talk with one another underwater and with members of the team on the surface.

As well as co-ordinating widespread underwater searches, this system could be used to inform the crew on the
shore to clear the area if a body has been located, says Sean. "If you are going to bring a body to the surface you don't want any family members in the vicinity - they don't need to see it as it can be quite a disturbing thing."

Top of the charity's wish list at the moment is a secure trailer for storing and transporting equipment to search sites (£2,000), stretchers (£680 each) for safe lifting from the water, and an underwater infrared vision system (£12,000) to comb waters in zero visibility.

The charity also requires a generator to provide power in isolated spots and has just ordered specialist underwater mannequins to practise handling and retrieving a body from water. In fact, the team regularly carries out training exercises to re-create the conditions of real-life search recoveries; for example, donning blacked-out masks in a swimming pool in order to learn how to effectively search by touch alone. "It's disconcerting and not the easiest skill in the world to acquire," Sean reveals.

Although Michelle, who has been diving for 24 years, says they do carry out some "scary deep dives", no member of the team is put at risk by going into rough or dangerous conditions. Safety is the utmost priority. "When someone is already under the water there isn't much more that is going to happen to them than what already has. So you wouldn't put any searchers at risk. Lots of people will say, 'if I go missing on a dive, do not send anyone in to look for me - if I haven't surfaced then I'm already dead so don't put anyone else at risk'."

**Primed and Ready To Respond**

With the Isle of Man, a British Crown dependency, being home to a modest population of around 84,000, Sean says it's rare that the charity will be deployed to investigate a suspected drowning. But they still need to be prepared and ready to go at a moment's notice. "It doesn't happen very often but that doesn't mean we can relax and stop training," he says. "The last thing we need is a bunch of people going to a potential drowning and they are not comfortable. If you get people in that situation, panic can set in quite quickly because nobody knows how they are going to react in any given situation."

It may sound like a well-worn cliché, but Sean insists scuba diving and the sea really is in his blood. After working as a UN police monitor in war-ravaged Bosnia in the late nineties, he was accepted onto an expedition to the Titanic to explore the wreck laying on the sea bed of the Atlantic Ocean. This involved descending almost two- and-a-half miles for over 10 hours alongside two colleagues in a cramped submersible...
with no bathroom facilities. "It was fantastic [the trip, not the conditions in the sub]," he recalls.

For Sean, the best aspect about being involved with the Isle of Man Underwater Search and Recovery Team is the camaraderie and working together as a team. "Everyone is enthusiastic and wants to be part of it because that's the type of people they are. It's a community thing and that in itself is a positive." It's also very much an egalitarian organisation, as Michelle explains: "When we are planning things out no one person decides what we are going to do. Everyone has so much experience that they come up with suggestions. We always go in with our preferred plan - plan A - but there is always a plan B. And it's really good fun working with all the other divers."

Unfortunately for the Caley family, Joshua's body was never recovered.

To discover more about the invaluable voluntary work of the Isle of Man Underwater Search and Recovery Team, visit:

http://iomunderwatersearchteam.weebly.com/

If you wish to make a donation, the charity's Just Giving page can be found at:

https://www.justgiving.com/underwatersearch-recovery

Distance Determination for Firearm Recovery

Nathan P. Bunch$^{1,2}$, Patrick Willoughby$^4$, Stephen Schumaker$^{1,4}$, Jeffery J. Lynn$^2$ and Jon E. Sprague$^2$

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Corresponding Author: Distance Determination for Firearm Recovery

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ABSTRACT

In order to help establish a general search area for discarded weapons following the commission of a crime, male and female volunteers participated in throwing twelve different firearm types. Average distance, maximal distance, and velocity was calculated for each firearm. The RG 14 revolver .22 caliber handgun was thrown the furthest with a maximum distance of 67.0 m. The weight and average distance thrown for each firearm was correlated, suggesting a strong correlation between the weight of the firearm and the distance thrown. The strong correlation of the two variables suggest that the heavier the firearm, the shorter the average distance thrown or visa-versa the lighter the firearm, the further the average distance thrown. These findings indicate gender and the weight of the firearm need to be considered when establishing a search field for a discarded firearm. The findings from this study can be utilized to establish a maximal and average search area for firearm retrieval.

Table 1  Firearm’s Length and Weight

<table>
<thead>
<tr>
<th>Firearm</th>
<th>Length</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butler Single-Shot .22 Cal</td>
<td>12.5 cm</td>
<td>192.6 g</td>
</tr>
<tr>
<td>RG 14 Revolver .22 Cal</td>
<td>14.3 cm</td>
<td>424.8 g</td>
</tr>
<tr>
<td>COBRA Semi-Auto 380</td>
<td>14.1 cm</td>
<td>628.8 g</td>
</tr>
<tr>
<td>Astra Semi-Auto 9mm</td>
<td>16.7 cm</td>
<td>624.9 g</td>
</tr>
<tr>
<td>Springfield Semi-Auto .45 Cal</td>
<td>18.9 cm</td>
<td>743.4 g</td>
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<tr>
<td>Arminius Titan .38 SPL</td>
<td>22.9 cm</td>
<td>850.8 g</td>
</tr>
<tr>
<td>Cobray Semi-Auto 9mm</td>
<td>28.6 cm</td>
<td>1563.7 g</td>
</tr>
<tr>
<td>Hi-Point 9mm</td>
<td>79.7 cm</td>
<td>2617.6 g</td>
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<tr>
<td>Mossberg Pistol-Grip 12-Gauge</td>
<td>77.8 cm</td>
<td>2702.1 g</td>
</tr>
<tr>
<td>Mossberg Sawed-Off 20-Gauge</td>
<td>90.2 cm</td>
<td>2781.0 g</td>
</tr>
<tr>
<td>Forehand Arms Sawed-Off Single-Shot 12-Gauge</td>
<td>49.5 cm</td>
<td>1941.8 g</td>
</tr>
</tbody>
</table>

INTRODUCTION:

Following commission of firearm related crimes, suspect firearms are often discarded in lakes, ponds, rivers, or fields. Forensic dive teams and other criminal investigators are routinely confronted with the challenge of determining the appropriate size of the initial search field when attempting to recover those firearms. Current methods used to predict search field sizes can vary drastically, from simply throwing an object of similar size and weight (e.g. rock); to pure speculation and may often utilize metal detectors and sonar (Rezos et al, 2009). While the use of more sophisticated technologies like metal detectors and sonar are helpful, the lack of a general search field impedes the efficiency of the recovery process.

The goal of this study is to provide an experimentally tested, consistent mechanism of establishing firearm search field parameters for investigators. Thus providing improved firearm recovery speed and efficiency, as suggested by the
National Institute of Justice ("About the NIJ’s Investigative and Forensic Sciences", 2016). The study was designed to determine the maximal and average distance a firearm can be thrown by males and females. With this information, investigators will be able to define a sufficient search field based on a simulated experimental model.

**MATERIALS AND METHODS:**

**Materials**

Butler single-shot .22 caliber handgun; RG 14 revolver .22 caliber handgun; COBRA semi-automatic .380 caliber handgun; Astra semi-automatic 9mm handgun; Springfield semi-automatic .45 caliber handgun; Arminius Titan .38 SPL handgun; Cobray semi-automatic 9mm handgun; Hi-Point 9mm rifle; Mossberg pistol-grip 12 gauge shotgun; Mossberg sawed-off 20 gauge shotgun; Higgins 583.19 bolt-action 12 gauge shotgun; Forehand Arms sawed-off single-shot 12 gauge shotgun; Precision Forensic Testing MD-36 firearm measuring device with certified rule (1/32 inch graduation); Mettler balance (0.001 gram); two (2) DeWalt Model DWHT34038 300 foot tape measures (1/8 inch graduation); two (2) marking placards; two (2) timing devices (0.01 second)

**Methods:**

Twenty-eight (28) assorted firearms were acquired from the Springfield Ohio Police Department in collaboration with the Ohio Attorney General’s Bureau of Criminal Identification and Investigation (BCI) in Bowling Green, Ohio.

Of the twenty-eight (28) firearms acquired, twelve (12) were selected for this study based on three primary factors:

1) popularity/likelihood of involvement in crime
2) assortment of representative weights and lengths
3) durability relative to the experimental design.

Firearm selection was performed in conjunction with Ohio BCI firearm examiners using visual examination and anecdotal casework experience. Overall length and weight were recorded for each of the twelve firearms selected (see Table 1).

Twenty participants (10 female and 10 male) volunteered to throw the firearms. Demographic data for participants is presented in Table 2.

Two (2) comparable throwing stations were established. All firearms were thrown in a west to east direction across a level grass terrain. Each station included individuals assigned
to mark throw launch points, record the time in air, mark the first point of contact with the ground and measure the thrown distance. Launch point was considered the forward most part of the foot at the time of release. Time in air was measured from the time of release to the contact with the ground (nearest 0.01 second) and recorded. First point of ground contact was marked with a location placard. Throwing distance was measured from the launch point to the first point of contact (nearest 1 inch) and recorded.

Each of the twenty (20) volunteers threw each firearm two (2) times. Test data including volunteer demographics; distance of each throw in feet and inches; and time in air of each throw were recorded in real time in a prepared spreadsheet.

Weather conditions were observed and recorded at the beginning of the first throw and the end of the last throw. Initial throwing time weather was clear; temperature 19°C; WSW wind at 21 kmh; humidity 73%. Concluding throwing time weather was partly cloudy; temperature 29°C; West wind at 26 kmh; humidity 25%.

**Statistical Analysis**

The following were calculated from the raw test data: mean distance thrown for each firearm in feet and inches; mean distance thrown for each firearm in meters; standard deviation for each throw in feet and inches; and standard deviation for each throw in meters. Velocity of each firearm throw was calculated using the distance thrown in meters and dividing it by the time in air (d meters/T seconds). Mean velocity was calculated by averaging the velocity of each throw. All calculated statistical averages are expressed as the mean ± standard deviation. Linear regression was performed by correlating the weight of each gun and the average distance for males and females.

**RESULTS AND CONCLUSIONS**

The Butler single-shot .22 caliber handgun was the smallest and lightest firearm in the study. The Butler single-shot .22 caliber handgun travelled the furthest average distance among all firearms included in this study, with female and male participants averaging 17.8 ± 5.6 m and 36.0 ± 12.7 m respectively. The gun was thrown a maximal distance of 65.3 m by a male and 28.4 m by a female participant (Table 3).

The RG 14 revolver .22 caliber handgun was the second smallest and lightest firearm thrown. RG 14 revolver .22 caliber handgun travelled an average distance of 15.9 ± 4.8 m and 32.4 ± 11.4 m among all female and male participants respectively. The gun travelled a maximal distance of 67.0 m by a male and 27.0 m by a female participant. (Table 3; Note: 67.0 m was the maximum distance recorded in this study.)

For perspective, the Mossberg sawed-Off 20-gauge shotgun travelled an average distance of 7.9 ± 2.0 m and
Table 3  
Male and Female Average Distance, Maximum Distance, Average Velocity

<table>
<thead>
<tr>
<th>Gun</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Distance</td>
<td>Max Distance</td>
<td>Average Distance</td>
<td>Max Distance</td>
</tr>
<tr>
<td></td>
<td>Meters (m)</td>
<td>Feet (ft)</td>
<td>Meters (m)</td>
<td>Feet (ft)</td>
</tr>
<tr>
<td>Butler Single-Shot .22 Cal</td>
<td>35.9 ± 12.7 m</td>
<td>65.3 m</td>
<td>16.5 ± 2.9 m/s</td>
<td>17.8 ± 5.6 m</td>
</tr>
<tr>
<td></td>
<td>17.0 ± 1.8 m/s</td>
<td>28.4 m</td>
<td>12.0 ± 1.8 m/s</td>
<td>20.9 m</td>
</tr>
<tr>
<td>RG 14 Revolver .22 Cal</td>
<td>32.4 ± 11.4 m</td>
<td>67.0 m</td>
<td>14.6 ± 2.8 m/s</td>
<td>15.9 ± 4.8 m</td>
</tr>
<tr>
<td></td>
<td>15.9 ± 4.8 m</td>
<td>27.0 m</td>
<td>10.4 ± 2.0 m/s</td>
<td>13.1 ± 3.7 m</td>
</tr>
<tr>
<td>COBRA Semi-Auto 380</td>
<td>27.4 ± 7.8 m</td>
<td>43.0 m</td>
<td>12.9 ± 3.1 m/s</td>
<td>13.9 ± 3.5 m</td>
</tr>
<tr>
<td></td>
<td>10.2 ± 1.4 m/s</td>
<td>20.8 m</td>
<td>11.1 ± 2.5 m/s</td>
<td>13.7 m</td>
</tr>
<tr>
<td>Astra Semi-Auto 9mm</td>
<td>28.1 ± 9.8 m</td>
<td>60.9 m</td>
<td>13.0 ± 3.3 m/s</td>
<td>14.9 ± 3.5 m</td>
</tr>
<tr>
<td></td>
<td>11.1 ± 2.5 m/s</td>
<td>21.5 m</td>
<td>11.8 ± 4.0 m/s</td>
<td>13.1 m</td>
</tr>
<tr>
<td>Springfield Semi-Auto .45 Cal</td>
<td>26.1 ± 6.3 m</td>
<td>39.5 m</td>
<td>12 ± 2.0 m/s</td>
<td>14.1 ± 2.9 m</td>
</tr>
<tr>
<td></td>
<td>10.4 ± 1.6 m/s</td>
<td>17.1 m</td>
<td>9.0 ± 1.7 m/s</td>
<td>13.7 m</td>
</tr>
<tr>
<td>Arminius Titan .38 SPL</td>
<td>25.2 ± 6.3 m</td>
<td>37.6 m</td>
<td>13.1 ± 2.9 m/s</td>
<td>14.2 ± 3.7 m</td>
</tr>
<tr>
<td></td>
<td>10.3 ± 2.9 m/s</td>
<td>20.9 m</td>
<td>7.4 ± 2.0 m/s</td>
<td>13.1 m</td>
</tr>
<tr>
<td>Cobray Semi-Auto 9mm</td>
<td>18.9 ± 3.4 m</td>
<td>27.1 m</td>
<td>10.4 ± 1.6 m/s</td>
<td>11.0 ± 2.1 m</td>
</tr>
<tr>
<td></td>
<td>9.0 ± 1.7 m/s</td>
<td>14.1 m</td>
<td>7.3 ± 2.0 m/s</td>
<td>13.7 m</td>
</tr>
<tr>
<td>Hi-Point 9mm Rifle</td>
<td>14.4 ± 3.3 m</td>
<td>17.2 m</td>
<td>9.9 ± 1.8 m/s</td>
<td>8.3 ± 2.5 m</td>
</tr>
<tr>
<td></td>
<td>7.4 ± 2.0 m/s</td>
<td>13.1 m</td>
<td>7.5 ± 1.8 m/s</td>
<td>11.5 m</td>
</tr>
<tr>
<td>Mossberg Pistol-Grip 12 Gauge</td>
<td>16.1 ± 4.1 m</td>
<td>22.0 m</td>
<td>9.7 ± 2.2 m/s</td>
<td>8.0 ± 2.4 m</td>
</tr>
<tr>
<td></td>
<td>7.3 ± 2.0 m/s</td>
<td>13.7 m</td>
<td>7.5 ± 1.8 m/s</td>
<td>11.5 m</td>
</tr>
<tr>
<td>Mossberg Sawed-Off 20 Gauge</td>
<td>15.9 ± 4.2 m</td>
<td>25.4 m</td>
<td>9.7 ± 1.3 m/s</td>
<td>7.9 ± 2.0 m</td>
</tr>
<tr>
<td></td>
<td>7.5 ± 1.8 m/s</td>
<td>11.5 m</td>
<td>7.5 ± 1.8 m/s</td>
<td>11.5 m</td>
</tr>
<tr>
<td>Forehand Arms Sawed-Off Single-Shot 12</td>
<td>20.5 ± 4.1 m</td>
<td>27.7 m</td>
<td>11.0 ± 1.8 m/s</td>
<td>11.1 ± 2.5 m</td>
</tr>
<tr>
<td>gauge</td>
<td>9.3 ± 2.3 m/s</td>
<td>16.5 m</td>
<td>7.3 ± 2.0 m/s</td>
<td>13.7 m</td>
</tr>
</tbody>
</table>

Conversion Table Added by PSDiver
15.9 ± 4.2 m for females and males respectively. The maximal distance for the Mossberg sawed-Off 20-gauge shotgun was 25.4 m for males and 11.5 m for females. The average distance, maximal distance, and velocity for the remaining hand guns and long guns can be found in Table 3.

The Higgins 583.19 bolt-action 12-gauge shotgun was not used for final calculations due to the stock being damaged. Therefore, there was insufficient data to make an analysis of the particular firearm.

In Figure 1, a trend was identified correlating the weight of each firearm and the distance thrown. The trend showed that the greater the weight of the firearm, the lower the average distance thrown. The linear regression of the weight and average distance thrown of each firearm for males had an $R^2$ value of 0.89 for males and 0.96 for females. This suggests a strong correlation between the weight of a gun and the average distance the gun was thrown.

**Conclusions:**

In conclusion, this study provides valuable search field establishment information to forensic dive teams and investigators seeking to recover discarded firearms. There was a clear difference in average distance thrown between males and females, with males throwing, on average, a significantly greater distance than females. Maximum distance thrown was also found to be greater for males than females for all weapons included in this study. Upon using the weight of each firearm and the average distance thrown, a strong correlation was found. The weight of the firearm was determined to be a factor in the distance thrown, based on the correlation of the two variables. The strong correlation of the two variables suggest that the heavier the firearm, the shorter the average distance thrown or visa-versa the lighter the firearm, the further the average distance thrown. These findings indicate gender and the weight of the firearm need to be considered when establishing a search field for a discarded firearm.

**REFERENCES:**

http://www.nij.gov/about/pages/oifs.aspx


Detection of Latent Prints on Handguns After Submersion in Water


Written by Mary Kathryn Book and James Tullbane

RECENTLY, the authors of this article worked to determine the potential for recovering latent prints from handguns that had been submerged in water. The purpose of this research is to provide guidance for the FBI’s Underwater Search and Evidence Response Team (USERT), for evidence recovery divers in the public-safety field, and for latent-print examiners involved in the collection, detection, preservation, and processing of weapons after submersion in water.

Currently, no studies have been published pertaining specifically to latent-print detection on handguns that have been submerged. This study was performed by the authors from a field and laboratory perspective to explore the possibility of latent-print detection and recovery on handguns after submersion in water. The study is intended to serve as a guide for divers as well as latent-print examiners in establishing protocols when such items are recovered as evidence.

Current Protocols

Within the FBI, handguns are located and collected by divers in the field. They are photographed in place, secured, and packaged in the water in which they are found. They are then submitted to the Laboratory for processing. In many instances, the handguns are submitted directly to the Firearms and Toolmarks Unit (FTU) without being processed for latent prints. This research was performed by the authors to determine if the hand-guns could be processed for latent prints immediately after removal from the water.

Background

This study tested the likelihood of detecting latent prints using various time trials, substrates, water types, and temperatures. The following hypothesis was formulated:

Length of time in water + higher water temperature = drastic reduction in the detection of latent prints on handguns

Latent prints are deposited when the friction-ridge structure of the skin comes into contact with a suitable surface. Pores must exude perspiration or another transfer medium must be present for a print to be left behind. Latent-print residue is typically either eccrine or sebaceous. Eccrine, or sweat prints, are largely made up of water. The remaining constituents include organic compounds and inorganic salts. Sebaceous prints include fatty acids, lipids, cholesterol, and glycerides deposited when the finger comes into contact with a surface. Sebaceous prints are often left when an individual touches hair, skin, or another object that contains a coating of oil.

Because the majority of latent-print makeup is water, submerged evidence has a greater likelihood of prints dissipating prior to initial processing. Sebaceous prints, however, are less soluble; therefore, there is potential for detection and development of latent prints after items have been submerged in water.
Handguns in particular have a difficult substrate for successful development and detection of viable latent prints. Several factors contribute to low latent-print recovery rates, including phosphate finishes, textured surfaces, oiling, and the storage of guns and wiping them clean after use. With the addition of water to the equation, the probability of detecting latent prints suitable for comparison lessens greatly.

**Initial Set-Up**

Because there was very little frame of reference for time that a latent print will last on a submerged weapon, the time trials were originally set up from one to 21 days. Since the results were still positive at 21 days, this research includes nine time trials that take the study up to 70 days.

Seventy-two handguns were provided by the FTU. For the initial set-up, specimens were wiped clean with a cloth. Six fingerprints were placed on the weapon.

The shape of the handgun as well as surface type determined the placement of prints. Prints were “spiked” with natural and artificial sebaceous matrices. One natural female print, one natural male print, and one print using Lightning Powder’s Latent Print Reference Pad for sebaceous oil secretions were placed on each side of the barrel. Print placement was marked on the handguns. The guns were photographed once after latent prints were deposited (prior to submersion in water) and once after final processing was complete.

Since the purpose of this study focused on how long a latent print could survive on a submerged handgun, all handguns were placed in a container within the Laboratory. The survivability under ideal conditions was tested prior to adding variables to the equation. A controlled environment was necessary to set a baseline for preliminary results. In order to establish a controlled environment, handguns were submerged in plastic containers filled with water rather than in actual bodies of water. Fresh-water was collected from a nearby lake. Tap water with Instant Ocean was utilized to create a saltwater environment. The containers were labeled accordingly with a naming system to positively identify samples.
Trials

Nine trials were completed. Trial 1 through Trial 9 represent time elapsed after initial submersion of the handguns. Print processing occurred on days 1, 2, 7, 14, 21, 28, 42, 56, and 70.

The study introduced several variables to include handgun material, water type, water temperature, and the development method.

Eight handguns per trial were processed to include all variables. Table 1 represents the process followed.

| Trials (number of days) | Cold (SGF) | Cold (WetPrint) | Warm (SGF) | Warm (WetPrint) |
|-------------------------|------------|----------------|------------|----------------|---|
| One (1)                 | 6          | 6              | 6          | 6              |
| Two (2)                 | 3          | 1              | 10         | 9              |
| Three (7)               | 7          | 4              | 4          | 4              |
| Four (14)               | 5          | 11             | 7          | 7              |
| Five (21)               | 7          | 9              | 3          | 3              |
| Six (28)                | 5          | 6              | 4          | 3              |
| Seven (42)              | 7          | 5              | 3          | 4              |
| Eight (56)              | 6          | 4              | 5          | 4              |
| Nine (70)               | 5          | 4              | 3          | 3              |
| Totals                  | 51         | 51             | 46         | 43             |
| Percent Recoverable     | 47%        | 47%            | 43%        | 40%            |

Trial 2 through Trial 9 repeated the same process. The designation of one through nine represents time in water. In total, 72 weapons over a 70-day period were processed (Figure 3).

After each trial, the condition of the water was observed and documented at initial removal of the handgun. A visual examination was conducted upon removal from water and in some instances prints were detected visually prior to processing.

The guns were then processed immediately with either small particle reagent or WetPrint, dried with a heat gun, processed in a superglue fuming chamber, and photo-graphed. One of the variables tested was processing technique. Is it better to process while wet or allow the handgun to dry prior to processing?

Results

This is the first published study specifically pertaining to the detection of latent prints on handguns after submersion in water. Latent prints were developed up to 70 days. The results indicate that regardless of method of development, processing handguns immediately after removal from water yields positive results (Table 2).
In cold-water trials over a 70-day period, 40 fingerprints were developed on metal handguns in saltwater, 39 prints were developed on metal handguns in freshwater, 12 prints were developed on polymer handguns in freshwater, and 11 were developed on polymer handguns in saltwater.

In warm-water trials over a 70-day period, 34 fingerprints were developed on metal handguns in freshwater, 27 prints were developed on metal handguns in saltwater, 17 prints were developed on polymer handguns in saltwater, and 11 were developed on polymer handguns in freshwater.

**Discussion**

Results from this study have potential to act as a guide to divers as well as lab examiners in determining if latent-print examinations are feasible. How long should a diver proceed with caution? At what point should the firearm be submitted directly to a firearms unit instead of being examined for latent prints? These results are considered preliminary because additional variables need to be
introduced. That being said, these results provide a guideline for latent-print detection in ideal conditions.

Prior to this research, there was no indication as to how long a latent print could survive or if it was necessary for a diver to use caution when handling a recovered firearm. The results indicate that in ideal conditions, it is possible to develop a latent print on a submerged weapon up to 70 days. There were several other findings:

- Processing handguns immediately after removal from water increases print detection; the method of development was insignificant.
- An increase in water temperature negatively impacts latent-print detection and development.
- The data indicates that the best results occurred with metal weapons in cold freshwater.
- The addition of heat and salt drastically reduces the detection of latent prints.

Consistently, polymer handguns produced the fewest latent prints. Polymer handguns in saltwater yielded more latent prints than in freshwater. During visual examination, it appeared that the saltwater caused a reaction with the latent-print residue.

Although a layer of visible rust coated the hand-gun, it did not fully preclude latent-print detection and development.

Metal was more receptive to prints than polymers. That result is consistent with other studies concerning latent prints on firearms or similar substrates.

Several types of metal handguns were utilized in this study. Although metal, the guns were made of various materials. The type of metal seemed to play a large role in latent-print detection. Stainless-steel handguns yielded the best results.

Prior to this study, it was not known how long a latent print would remain on a handgun after submersion in water. Although many additional variables need to be introduced, it is apparent that in ideal conditions, a sebaceous latent print may be recoverable from a submerged firearm up to 70 days after its deposition. This study should provide sufficient preliminary results for a dive team to adjust protocols.

Results suggest that crime-scene personnel recovering submerged weapons should exercise caution to ensure any recoverable impressions are not inadvertently compromised in the recovery process. It may also assist latent-print examiners in adopting processing procedures when weapons enter the laboratory. Regardless of processing technique, processing the handguns

![Cold-water Trials — The number of latent prints recovered.](image)

![Warm-water Trials — The number of latent prints recovered.](image)
immediately after removal from water yields the best results. The final trial in this study produced positive results. While this information concludes this phase of the research, future research endeavors include the addition of a stirring device to imitate moving water, adding silt or sand to the containers, placing handguns in actual bodies of water, and longer time trials.

Preliminary studies only tested up to 70 days. At the completion of this portion of the study, the basic question still remains: Exactly how long will a latent print survive on a submerged firearm?

About the Authors
Mary Kathryn Book is a Physical Scientist/Forensic Examiner in the Latent Print Operations Unit at the FBI Laboratory in Quantico, Virginia. She has served in this position for approximately nine years. For the past five years, she has worked closely with the Bureau’s Evidence Response Teams by providing latent-specific and human-remains processing training. She is also an active member of the FBI’s Disaster Squad.

James Tullbane is a Supervisory Special Agent on the Technical Dive Team in the Evidence Response Team Unit. As an FBI Agent for more than seven years, he has been involved in counterterrorism and criminal investigations. He was a member of the Underwater Search and Evidence Response Team (USERT) for five years and served as the senior team leader for four of the five years.

The authors would like to give special thanks to the following:
• SSA Kevin J. Horn, ERTU USERT Program Manager
• Michael Williams, Forensic Imaging Unit Latent Photographer
• FBI Laboratory’s Latent Print Units and Firearms and Toolmarks Unit

Mother of 4-year-old Boy Arrested, Admits She Dumped Body
06/21/2018 - by Ryan Tarinelli, Associated Press

The mother of a 4-year-old boy whose naked body was found on a South Texas beach last year admitted to authorities that she beat him and denied him medical care after he suffered a head injury from running into a wall, then drove to Galveston in the middle of the night and dumped the body in the water, according to court documents.

Galveston police identified the child as Jayden Alexander Lopez. Authorities had named him "Little Jacob" after no one came forward to report him missing.

Galveston police chief Vernon Hale announced Wednesday that the child’s mother, Rebecca Rivera, and her girlfriend Dania Amezquita-Gomez, had been arrested and charged with fabricating or tampering with physical evidence.

An affidavit says Rivera, in an interview on Tuesday, told authorities she woke up in the middle of the night after her son had died, carried his body to her vehicle and drove to Galveston with her other
young child and Amezquita-Gomez.

According to an affidavit, she said she put her dead son into the water because he went to the beach previously and he liked the water.

Last month, in an interview with authorities, Amezquita-Gomez acknowledged being in the vehicle but did not give any other details about where they went or about the dead child being in the vehicle, according to the affidavit. She reported being too drunk to remember the details.

Rivera admitted that she abused the boy, saying "she was stressed out and took this out on Jayden by striking him with 'whatever I could find,'" according to the court documents.

Rivera told authorities that about two weeks before the boy's death, he had bumped into a wall, causing a head injury. Rivera told police she used alcohol to clean the injury but she and her girlfriend began to argue, causing the alcohol to spill onto the child's face.

According to the court documents, she said her child's face started to swell, and over the next two weeks his health "deteriorated." He reportedly complained of stomach aches and became visibly more lethargic, the mother told police.

Rivera also told police her girlfriend blamed the child for problems in the couple's relationship, the affidavit says. Jail records did not list attorneys for either woman.

Bryan Gaines, a supervisory senior resident agent with the FBI, called the crime "appalling" at a press conference Wednesday announcing the arrests.

"No one reported Jayden as missing. No one was looking for Jayden. Jayden had no advocate other than us," he said. "Someone took a beautiful, innocent child and discarded him in the ocean as if he was a piece of trash."
Investigators made the unusual move of releasing a photo of the face of the dead boy earlier this year, hoping it would generate new leads about his identity. Authorities had previously released a sketch of the child with a phone number to call with tips. Police on Wednesday said tips led to a possible name for the boy and a DNA comparison led to the positive identification.

Lois Gibson, the forensic artist who created the sketch, said she was at home when she heard news of a break in the case.

"I cried, I cried with relief," said Gibson, who works as forensic artist at the Houston Police Department.

The Public Safety Diving Discipline. Safety at the expense of common sense, or can both co-exist?
By Mark Michaud

I retired in September of 2015 after a 24 year career with the Slidell Police Department. We were a smaller agency and had no budget for a dive team but we have plenty of water. In spite of that I educated myself and became the department diver after I recognized the need. Over the years we added a few more members. In 2003 I attended an underwater investigations class based on Cpl. Bob Teather’s book and teaching at the University of Southern Mississippi Gulf Coast Campus. Along the way I made it through the recreational world up to PADI Dive-Master. I started Cavern and Cave training through the National Speleological Society Cave Diving Section around 1999. Over a few years I completed Cavern and Intro to Cave Diving and then Apprentice and Cave which we refer to as Full Cave.

Later I attended and completed Cave Recovery which consisted of 2 parts through the International Underwater Cave Rescue and Recovery organization. There was topside management and the actual recovery process.

After logging over 100 Safe Cave dives I received the Abe Davis Award for safety in cave diving. Three quarters of my cave dives were solo. Gas management, planning and self-sufficiency was a large part of cave training because to be a good buddy you have to truly have the skills.

I certified as an open water diver around 1995. I bought some gear and would find interstate borrow ponds and local bayous to dive in. For the next few years, if it had water in it I dove in it. I knew that the education I received would not give me experience.

You can’t teach experience.

By 1996 I was doing vehicle recoveries. Over time I became proficient in recovery work of many kinds. I would, go on to, find things from false teeth and jewelry, to guns and boat motors and, well, you name it I may have found it. Eventually I purchased a Kirby Morgan Superlite 27 and taught myself to dive that. After Hurricane Katrina I purchased commercial lift bags and started lifting vehicles,
boats, barges, etc, to make extra money. I recovered several hundred vehicles in the year after Katrina. I was contacted by a towing company out of Kansas who need a diver as he was doing recoveries for CoPart. The storm surge, or tidal wave, that Katrina brought, literally washed everything into bayous, canals, lakes, etc. I became known as the guy who could find most anything, as long as that “thing” was in the search area. I also bent the ear of people who were smarter than I was while learning these things and still do that today.

Our department was the second to be CALEA accredited in the state of Louisiana. That was taken very seriously and it has been maintained since 1995. That taught me what I needed to know when diving for evidence even before I received formal training in the PSD discipline. From 1992 until 2008 I accompanied many K-9’s on tracks for bad guys. I was the cover person for the handler and my primary job was his safety. We had four K-9’s (1 per shift) and I also worked with our Sheriff’s K-9s when they were close for us to assist them. Along the way you notice what the handler notices as far as interest and alerts. You learn when they are casting to see what is there and when a K-9 is following something solid. Around 2008 I decided I couldn’t keep up with them anymore. Learning perimeters and searching in this manner has gone a long way to making me a solid searcher.

Along the way I added the Humminbird fishing sonar and then a 360 sonar to use in personal and departmental searches. These are really solid and affordable tools that can make you successful. They are also more likely to be used on a regular basis than high end equipment. I made a few big catches along the way and that gained notoriety. (Google Mark Michaud police diver and hit news and video for more, or look at back issues of Public Safety Diver magazine.) When I retired I had money put away in a DROP account. The need was arising so I took that money and purchased an older, Kongsberg Mesotech MS1000 scanning sonar with a 1071 675 khz single frequency in the tool box.

Add to that, the gear I have “MacGyvered” – I didn’t have the, deep, pockets to just run out and purchase a lot. That may have been the best thing I ever had to do. Creating what you need when you can’t afford to buy it makes for a better understanding of what you are doing.

I write all of this to give you a background of how I created my own path into the “not so normal discipline” of Public Safety Diving. Having credibility is important to those you wish to influence. I wish to influence you in ways that make you feel you can do anything and if you don’t have something, you can MacGyver it. Many agencies are small and do not have a big budget. What is in the budget is spent on gear because it makes sense. It is also spent on classes and training.

But it is experience that makes those tools and training pay off. Prior to retiring I began to work with many agencies in
the area. I worked with NOPD, Louisiana Department of Wildlife and Fisheries, NOFD, St Bernard SO, St John SO, Mississippi Department of Marine Resources, the list goes on.

I developed a reputation for locating and recovering missing people, or evidence without any safety incidents as well as being an insider with nearly a quarter a century of Law Enforcement experience. I also work in and out of the norms that we hold so dear. As Josh Gibbs (Daphne Search and Rescue) said to me “We have to keep pushing the limits to see what we can do and not just accept the word of someone who has never tried but still says it can’t be done.”

I want to write about what I see as holes in the discipline of Public Safety Diving; things I think can be filled to make us much more effective. When I say Public Safety Diving I am not solely referring to diving. It is much more than that by proxy. Teams are expected to plan and implement the search, the tools needed and the recovery. We are expected to have answers. Men like Mark Phillips and Buck Buchannan (to name a few) have worked hard to get some sort of standards and standardization in this discipline. The need is there for many reasons.

Over time, team members come and go for a variety of reasons. This is expected. But the preventable death of a team member while performing the duty and tasks of the team is unacceptable. Systems, or standards are necessary.

This is not about that. This is also not about taking away from that, but more so, it is about complementing what they are doing.

Having a standard does not imply being successful. It is a foundation to build on. This is not anti-tether or anti FFM or anti buddy and so on. This is about personal responsibility, what do I expect of myself, and what can I do to make me (and my team) successful? Sometimes it may look like you are stepping outside of the standards when you are not.

Mark Phillips made a comment a while back about this. I can’t quote, but it basically said, if a person drowns and you can see them on the bottom of a pool you don’t need FFM with comms and a tether to do the recovery. If a person can’t hold their breath and grab a baby from the deep end of the pool, and do the recovery they shouldn’t be doing this line of work. You didn’t violate anything jumping in, grabbing that victim and surfacing for a hand off to others. You used common sense. We have to let ourselves understand that concept and not totally focus on doing everything by the “standards”.

No matter what gear we choose, or what rules we abide by, it is on me to be the best I can be. I owe that to myself, my family and my team. I also owe this to the families of the victims. I must strive for excellence or I will drown in mediocrity.

I hope to write several articles that go with this and cover the holes that I see in what we do. I will also bring suggestions to patch those holes. What I will bring will work with any standard you choose.

I teach PSD around here but I am not a certified scuba diving instructor. Ok, take a deep breath here, before you decide to mark me
as unqualified. I am not teaching anyone to be a diver. I teach divers who are already certified. I teach them to be better. I teach skills and techniques. Once you get scuba certified, you never have to take another class to dive anywhere in the world – ever. A card does not a diver make.

I mentor divers who are certified and are responsible for their own safety. I teach them things that make them better and more efficient in the water. I don’t disregard a formal PSD course. That should be in everyone’s toolbox. We benefit from them greatly. But there is so much more to learn and to know than is taught in a three or four day class.

We are sold, into the idea, that PSD is some mystical thing. It is not. We are diving. If I am looking for a deer stand or a body, I am searching and diving.

I teach cave / tech skills such as securing gear in ways that are clean and not dangling or protruding out too far. I teach propulsion techniques, such as the frog kick (and helicopter) that make you divers more efficient in the water and reduce the bottom silt. I teach using dry-suits when it gets cold, or for diving in contaminated water. I teach proper weighting, buoyancy and trim. I teach systems to dive in zero, or little visibility. I teach being self-sufficient and being more comfortable in the water so that you dive the same way you drive. Diving should become second nature so that you can focus on the work you are there to do.

We are sold into the idea that Public Safety Diving is some mystical thing. It is not. We are diving. PSD is nothing more than searching while diving. How we handle the target when located is where things differ. Boom….that’s what the PSD courses are for.

I write all of this to make this point: We get card after card, we train like crazy based on recreational standards, and then we get killed or can’t find what we are looking for. No one wants to be a floater recovery expert. This has to stop. This is not the 1960’s. The strides that have been made in equipment, has been matched in operational training too.

What separates us from recreational divers is, or should be experience. Recreational divers have recreational skills. Public Safety divers have to have a different level of skills to dive in the typical conditions we see. A card is just a card. A card does not make you a diver; much less a Public Safety Diver any more than a $1,000 camera will make you a photographer. We have to master the discipline. We have to gain experience.

If a family member was missing in the water, would you be comfortable with YOU and YOUR TEAM’s knowledge and ability to implement the search and to complete the task through recovery? Do YOU have the dive and search skills to take on any location in your area of responsibility? Do you have the experience?

Mark Michaud
Slidell PD Retired
Southeast Louisiana Underwater Search and Recovery

ADIPOCERE

Goo of Death Helps Solve Mystery of Headless Corpse


June 7, 2011 By Wynne Parry

A headless human corpse floating in a bay of Lake Brienz in Switzerland — first thought to be a dead sheep as its thigh bones and an upper arm bone protruding from its torso were encased in a cement-like cocoon — has divulged its secrets.

The macabre substance coating the torso and parts of the remaining limbs is called adipocere, a fatty, waxy material that sometimes forms from a decomposing body's soft tissues. Adipocere is familiar to investigators — it can make identifying a body and pegging its time of death tricky — but it is foreign to those of us who don't come into regular contact with decomposing bodies.

"When you see such a kind of body with adipocere, it is absolutely clear it is not a fresh body," said Michael Thali, then a young resident doctor in Bern and now a professor of forensic medicine at the University of Zurich. "I was thinking then this body must be some months or even some years [old]."

But after some creative CSI know-how, Thali, who had taken this body on as his first big case, realized their corpse was much, much older, from some 300 years ago. Other clues suggested the man had drowned and was engulfed by the surrounding sediments only to be uncovered after some earth-shaking in the region. [8 Grisly Archaeological Discoveries]

Blue And White

When a body is discovered the most urgent question investigators must answer is: How long has this person been dead? The answer determines whether the body becomes the focus of criminal investigation or of historical interest.

At first, Thali estimated this corpse to be about six months to five years old. Then he noticed the adipocere, which is naturally white, had unusual patches of intense blue. He suspected the blue had come from the person's clothing, a theory he later dismissed in favor of algae. But biologists from the University of Bern, where he worked at the time, informed him it was likely a mineral.

If a mineral had precipitated on the body's adipocere shell, Thali suspected the person had died much earlier.

Thali and colleagues performed an X-ray and a physical examination. To peek beneath the shell that encased the remains, including the preserved heart and other soft structures, Thali and his colleagues had to cut through it with a saw.

Corpse Wax

Records of adipocere extend back to the exhumation of remains in a Paris cemetery at the end of the 18th century.
Sometimes considered a form of mummification, it forms when decomposition takes a strange turn, and fat in the soft tissue transforms into the hardy soap-like substance. This substance acts as a preservative and resists normal decomposition, according to Douglas Ubelaker, a senior scientist at the Smithsonian Institution's National Museum of Natural History and an author of a review of two centuries of research on adipocere.

"We know certain factors that seem to be important in triggering that transformation," Ubelaker said. These include an oxygen-free environment, the presence of certain bacteria and body fat, warm temperature, a mildly alkaline environment and moisture, either in the environment or from the body itself. While formation can take time, some research indicates that it can begin within a few days after death in the right environment.

Its texture can vary. While this corpse's adipocere resembled concrete, fresher adipocere can be softer.

"A lot of people say it's greasy, I always think of it like a thick cottage cheese consistency, because it's kind of lumpy, also," said Ann Ross, an anthropologist at North Carolina State University, who has encountered adipocere in her own investigations. "Now you'll never eat cottage cheese."

In 1997, Ross, who was not involved in the Swiss research, consulted on the project Physicians for Human Rights to help identify the remains of Bosnians killed by Serbian forces about six years earlier during war in the former Yugoslavia. The project ultimately recovered about 74 bodies that had been thrown down a 262-foot (80-meter) mine shaft.

The shaft was damp, and while most of the bodies were just skeletons, many had some adipocere, and she remembers coming across an upper arm bone wrapped in the stuff.

"Most of us, we consider it a nuisance, and it's true because it is very difficult to get off the bone," she said.

And it's the bones that contain clues to the person's identity, including their sex, age at time of death, and any sign of trauma. The teeth can be used to make identifications, and they along with the mid-facial region of the skull can offer clues to a person's ethnic ancestry, she said.

After removing the adipocere from the pelvic bones, Thali and colleagues determined their body had belonged to a man — a woman's pelvis is adapted for giving birth. And so the corpse became the "blue man."

**A Natural Preservative**

Because it preserves soft tissues, which in this case included the blue man's heart, stomach and intestinal tract, adipocere can create the appearance that an individual died much more recently than he or she actually did, according to Ubelaker, who was not involved in the Swiss research. "Once it forms, it is extremely tenacious material so it can be misleading," he said.
But adipocere's preservative nature also has an advantage. The blue man's stomach and intestines, for example, contained cherry pits, which, if decomposition had taken its course, would not have survived long. These were evidence of the individual's diet, and, more important, material that researchers could date, Ubelaker noted.

Using radiocarbon dating, a method that relies on the presence of radioactive carbon atoms, researchers examined a cherry pit and bone collagen from the corpse. The radiocarbon dating put the man's death back as far as 300 years.

His Story

Based on the concentration and type of diatoms — a type of algae — found in the man's bone marrow, Thali and colleagues believe he drowned.

About one week before the body was discovered, two weak earthquakes occurred in Switzerland. This may have caused an underwater landslide that exposed the once-buried body, according to Thali and his colleagues, who describe their work in a study published online in the journal Forensic Science International.

The blue mineral — the most exciting aspect of the case, according to Thali — is an iron phosphate called Vivianite, described only three times before on bodies, including that of the 5,300-year-old Italian ice mummy Ötzi.
EdgeTech Releases
New Discover Blue Software for Search & Recover (SAR)

EdgeTech, the leader in high resolution sonar imaging systems and underwater technology, has released a new side scan sonar software packaged, Discover Blue. Discover Blue was developed specifically for police organizations, fire departments, dive teams, and other groups that utilize side scan sonars for search and recovery (SAR) efforts. Developed specifically for this community, the software offers a number of unique features only available with Discover Blue.

Discover Blue side scan sonar software offers the first ever Target Adaptive Software. This unique software feature allows the sonar operator to select a target type from a list of common underwater targets. Then, it automatically configures the side scan sonar system with the best settings to aid the operator in utilizing the sonar to locate the target of interest in the most effective and efficient manner. The software is customizable to each team allowing them to add their agency name and logos for reporting. It also allows for one agency to enter multiple teams for different shifts so each team within that department can use their own preferred settings. Analyzing a target is made easy with simple cursor click and drag measurement tools in the software. Additionally, once a target is marked and analyzed, report generation can be outputted to a number of common formats.

Discover Blue’s coverage mapper module has advanced navigation features such as survey line planning and left/right steering indicators to assist in survey line control. Background navigation charts, and satellite imagery, can be layered or blended with individual transparency control. Another unique Discover Blue feature is the tow height guide display lines which are visible on sonar waterfall showing the operator if the side scan is in the ideal tow height window.

From mission planning to target identification and reporting, EdgeTech Discover Blue and the EdgeTech 4125-SAR side scan sonar system provide SAR teams a complete package that can be deployed and operated quickly effectively for every search and recovery job. The new Discover Blue software comes standard on all EdgeTech 4125-SAR systems.

EdgeTech is committed to supporting the SAR community and always has a 4125-SAR system in stock and ready to ship. For more information please visit: www.edgetech.com

JW Fisher’s Celebrates 50 Years of Innovation and Service

Can you guess what year we’re describing? Boeing unveiled the iconic 747 jumbo-jet, Apollo 8 orbited the moon, the first bank ATM was introduced, the first vehicle airbag systems were developed, and the “911” national emergency telephone service was established. It is also the year that Jack W. Fisher began developing underwater search
equipment, setting the stage for JW Fishers to become the most trusted name in underwater search equipment. What year was this? You guessed it; 1968!

The JW Fishers story began in the mid-1960s when Jack, an avid diver, required an underwater metal detector for use on a salvage project. He discovered that there was no such device available, and over the next several years built his own; the Mark 1. Jack’s detector quickly gained popularity and, after marketing the product, customer demands for new and more powerful models developed quickly. As a result, the company expanded the product line from diver-held detectors to boat-towed metal detectors (Mark 7) and magnetometers (Proton 1).

In the early 1980’s, exploration of our oceans was reaching new heights and underwater video options became a necessity. The DV-1 dropped camera system was introduced to maintain industry leadership. In 1987, the award-winning Pulse 8X hand held underwater metal detector hit the open market with large success. It became the “workhorse” of the metal detector world and was rated #1 by U.S. Homeland Security in 2014. JW Fishers’ first ROV, the SeaOtter, was introduced in 1989. This 85-pound remote operated vehicle had four motors, a color camera, and a depth rating of 500 feet.

Over the next two decades, JW Fishers brand and technologies advanced rapidly. In 1994, the company moved from its original location, a facility hand-built by Jack and the original JWF team, to a newer and larger building more suited for the company’s expanding family and product line. In 1994, a larger ROV, the SeaLion, was introduced with a 1,000’ depth rating. This beast weighed-in at 125 pounds with six motors and a variable speed, reversible propulsion system. Ultimately, both ROVs received a redesign to become smaller and more powerful in the mid 2000’s.

In 1993, JW Fishers’ first Side Scan Sonar system was introduced, allowing operators to “paint the bottom” of the ocean floor on thermal imaging paper. Acoustic pingers were also added as a way to mark the location of underwater sites and oceanographic instruments. Cable and pipe trackers followed suit in addition to scanning sonar systems and JW Fishers’ sub bottom profiler. The JWF brand was again expanded in 1999 when the first iteration of the www.jwfishers.com website was launched.

Recently, Fishers introduced the SAR-1 Search and Recovery metal detector; JW Fishers’ first wireless, “snareless” metal detector specially designed for use by public safety dive teams, law enforcement agencies, and military units that need to locate metal objects in poor water visibility. The
SAR-1 alerts the operator to the presence of metal through vibration along with a high intensity LED display.

JW Fishers’ decades of innovative momentum has continued into 2018 with the debut of our newest boat towed detector; the Proton-5. This fifth-generation magnetometer boasts new backlit LCD screens, auto-tuning, and a modular design for easy storage.

Today, the Fisher family continues to operate JW Fishers as they pursue Jack’s vision of service as an industry leader and by offering the most complete line of underwater search equipment. The greater JWF family also remains strong with team members working with the company, on average, for over 20 years! This efficiency and expertise allows JWF to maintain an active research and development effort to explore new technologies. It also allows us to offer our customers the latest and most cost-effective equipment available. We stand behind every product with a warranty and service that is second to none.

Our products are in use by underwater archaeologists, treasure hunters, commercial diving companies, fire and rescue units, law enforcement agencies, engineering firms, scientists, and military units worldwide. The JW Fishers family is beyond excited to have spent the past 50 years supporting an incredibly diverse and exciting industry. We are also excited, without a doubt, to continue serving you and your team for the next 50 years and beyond!

JW Fishers will be celebrating the milestone year with a tribute on www.jwfishers.com.

The 50th anniversary page will have various catalogs throughout the years, every news release starting from the very beginning, old pictures and an interactive timeline that shows the history of JW Fishers Manufacturing.

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Chief Operating Officer

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If you would like information on becoming a sponsor or hosting a PSDiver Workshop, email Mark Phillips at Mark@PSDiver.com.

Resources

Chemical Spill Information
1-800-424-9300.

DAN Medical Information Line
1-919-684-2948

DAN 24-Hour Emergency Hotline
(1-919-684-9111) to help divers in need of medical emergency assistance for all incidents

Centers for Disease Control and Prevention
1600 Clifton Rd. Atlanta, GA 30333, USA
800-CDC-INFO (800-232-4636)

National Suicide Prevention Lifeline
Call 1-800-273-8255 Available 24 /365

First Responder Support Network
The mission of the First Responder Support Network is to provide educational treatment programs to promote recovery from stress and critical incidents experienced by first responders and their families.

Crisis Resources.

IAFF RECOVERY CENTER
Treatment for successful recovery from substance abuse, PTSD and other co-occurring behavioral health