

**Ropeless Fishing using the ARC-1XD in Commercial Pot Fisheries: A Guide to Successful
Setup and Implementation from the Individual Fisher to the Entire Fishing Fleet**



Purpose

The purpose of this document intends to cover all questions pertaining to the ARC-1XD in its application of Ropeless Fishing. This includes common questions, history, explanation of functions, implementation steps and more.

This document is all inclusive for those wishing to convert to Ropeless Fishing using the ARC-1XD System.

If you feel something was left out or would like to contact us for further conversation, please send an email to salesinfo@desertstar.com or j.wolf@desertstar.com

At A Glance

This document is setup from the perspective of an interested fisher. All content is chronologically organized according to the steps a fisher should take to first learn about Ropeless Fishing and the ARC-1XD in section 1 and implement the system in section 2. Along the way, this document will attempt to cover most if not all questions a fisher may have about the ARC-1XD Ropeless Fishing System, as well as serve as a implementation guide for commercial scale fishery use.

What this document does not intend to do, is conclusively state the condition, or future of Ropeless fishing nor commercial pot trap fishing. Please note this document is the conglomeration of data and insight into a developing technology, as it occurs. In no way do we intend to state absolutes but are reacting in the manner we know how given a dire circumstance.

Please also take note, while this document will be highly optimistic of Ropeless Fishing, that is not to say fishers must opt for this technology, this document serves to educate those interested.

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Section 1

Overview; Why is Ropeless Fishing Needed?

The premise of Ropeless Fishing assumes that removing rope connections from commercial pot (lobster and crab) fishing gear would yield more advantages over keeping traditional rope connections. The problem of course becomes, if no rope is used, then how is the gear retrieved? This is where the term Ropeless Fishing becomes confusing. Within the realm of fishing without rope, several types of Ropeless fishing exist (which will be covered later). In some cases, a Ropeless fishing system can still incorporate rope in practice, however the presence and time the rope is present can change. A system can be called “Ropeless” whether it entirely removes the use of rope, or even if it just changes the amount of time and presence of the rope. There are several types of Ropeless Fishing systems which will be covered later in this document.

How can removing or changing the presence of rope in the vertical water column yield worthy benefits?

Vertical rope is by far the most dangerous and loss inducing aspect of any pot fisher's business that most are all too familiar with. This comes in three forms being: weather impacts, man-made complications, and marine entanglements. Each of these categories primarily cause risk in the 'high energy zone' which resides just below and at the water's surface, although risk also resides elsewhere.

Environmental Risk to Gear

The forces and variables that pot fishing gear are under is quite significant. If a storm rolls through, the surface of the water becomes highly susceptible to fast moving water currents, high winds, and more. This means the surface buoy can easily be dragged, along with the bottom trap(s). At the same time, underwater currents are quite common as well, meaning even if the surface of the water is calm, traps and ropes can still be dragged around. What this also means is, if one of these conditions is just strong enough, the surface buoy for that trawl or single will be pulled under the water's surface. If a fisher is out on the water when this occurs, that fisher has effectively lost their gear while that buoy is under. Although it doesn't necessarily mean the gear is gone, a fisher's time is valuable. Spending extra time searching or stressing out about potentially lost gear hurts both their business as well as their mental health. If a buoy is pulled under and the fisher is unable to retrieve that trap for the day, that now means time was spent on fuel, operation of the boat, and paying crew for no return, it's a business loss that is entirely avoidable.

Man-Made Risk to Gear

Man-made variables also play a large role in the loss, entanglement, and damage done to countless traps every year. In particularly busy waters like shipping lanes pose risk to buoys and ropes that are susceptible to something called ship strikes. Imagine being the captain of a large container ship. You are leaving a port, destined for some far-off location. You are moving a vessel that weighs the equivalent of 358,000 cars, and measures over 1,000ft long. Now imagine a shipping lane riddled with small 8” diameter buoys marking the surface location of pot trap gear. The point here is that the container ship captain, in some cases not only can’t, but don’t see any benefits in trying to avoid these buoys. So instead, hundreds of thousands of buoy lines are cut and lost due to ship strikes every year around the globe. This is made worse by the fact this creates a two-fold issue.

Once a buoy line is cut, and the fisher is no longer able to retrieve that gear, the trap continues to collect catch. Ghost fishing is then the second insult to injury. In some cases, fishers use traps specifically designed to “break-down” or offer a chance of escape to the catch after a long period of time should ghost fishing occur. Yet, even with these safe guards in place, millions of traps are lost and continue to fish every year (Scheld et. al.). The total value of those lost traps and the catch they contain is staggering. A removal program in the Chesapeake Bay theorized the removal of 37,000 ghost fishing or derelict pots, which would result in \$21 million in wholesale value (Scheld et. al.). It’s important to note, wholesale value is the most direct cost of lobster/crab, yet that wholesale value will also produce other value in terms of re-sale of product in restaurants/grocery stores, providing jobs, taxes and more. Furthermore, a mere 10% recovery of derelict pots (ghost fishing gear) on the global scale would be worth **\$831 million** (Scheld et. al.).

The point here is that, lost pot fishing gear is a massive value loss for any fisher. Beyond just the business impact, ghost fishing keeps attracting other lobsters and/or crab, thus further reducing catch and stock levels and negatively affects marine ecosystems.

Nonetheless, ghost fishing means crab or lobster continues to be caught which means less useful abundance of that catch. Not only can no fishers use that catch, but those crabs or lobsters stuck in perpetually active traps cannot continue to reproduce and grow the stocks population. Further, dying lobster or crab acts as bait and attracts other lobsters and crab, meaning that lost trap will continue to fish and provide no useful return, which leads to the effect ghost fishing has on quota systems.

Some, if not most commercial pot trap fisheries (broken up area's or regions of fishing zones) have a quota system for catching crab and lobster. Overall it works by limiting an area's total allowable catch (TAC) for the fishers in that area. Quota may then be purchased in small quantities. For instance, in Canada the fishing area of LFA 41 off the southern tip of Nova Scotia offers up to 720 tonnes for quota (A line in the ocean) . This means fishers in that area cannot catch and sell more than 720 tonnes. This practice is also common place in every other commercial fishery, regardless of species being caught because of concerns for overfishing, or fishing and catching a stock of species faster than "they" can re-produce to replenish the stock. Ghost fishing then means that stock is reduced overall for next year's catch, while also not providing any revenue. So, it's not only bad for business in the short and long-term, but it's also bad for the species that live there.

Aside from unintentional human variables, there are also common place intentional harm/damage done to pot gear. This takes two flavors, one from non-commercial fishers, and the other from fellow fishers. In places like Cape Cod Massachusetts, where the lobster fishing fleet is strong alongside tourism, fishers often encounter trap tampering. Whether it is someone looking to pull up a trap for some free lobster, or simply mess with gear, this is certainly a concern for fishers in more heavily trafficked areas. But this isn't exclusive to just tourists and non-commercial fishers. The phenomena of catch theft is also quite problematic for fishers worldwide. In the Gulf of Maine, the issue of catch theft has become so bad that one non-profit group is offering \$11,000 dollars simply for information on those who commit catch theft (Writer, E.R.).

Gear Induced Risk to Marine Species

Then there's the most commonly discussed and most significant issue presented by traditional use of rope with commercial pot fishing gear. The entanglement and subsequent functional extinction of the Northern Right Whale, and entanglement of other marine species. Since 1970, the Northern Right Whale (among many others) has been listed as endangered under the Endangered Species Act (NOAA). Concerns over the Right Whale population decline have become a controversial and heavily debated topic within the commercial pot trap community, both on the Atlantic and Pacific Coasts of the United States and Canada. However, this issue is not specific to these regions alone, this is one of several issues which has been brought to limelight.

With that said, the Northern Atlantic Right Whale population over the last decade has been in steady decline due to ship strikes and entanglement in pot trap gear. The Committee on the Status of Endangered Wildlife Canada found that in 2003, the population of the Northern Right Whale had declined to 220-240 mature animals, for a total population of 322 animals (Canadian Wildlife Service). A report by the Woods Hole Oceanographic Institution located in Woods Hole Massachusetts similarly found the Northern Atlantic Right Whales population had reached roughly 350 individuals (Reeves et. al.). Since 2006 however, the population has increased by only 2.8% per year up until 2016, the minimal growth expectation of a large marine mammal species. Last year, in 2017, the North Atlantic Right Whale Consortium held its annual meeting, concluding that population overall had reached 451 individuals through a collection of several assessment methods (Associated Scientists). Among several, the PACE method was determined to be the most accurate. The PACE method also shows a trend of decline in the population since 2010 until present. Furthermore, in the last year alone, no new calves were born in the face of increasingly record-breaking deaths by human activities.

But, if we take a step back and ask, is human activity really to blame, then we should examine the cousin species, the Southern Pacific Right Whale. Similar to the Northern Right Whale, both species underwent a period of whaling in the 18th century. Upon the end of that period roughly 300 Southern Right Whales remained. However, unlike its Northern cousin species, the Southern Right Whale population has since rebounded to 12,000-15,000 individuals (World Wildlife Fund).

Why the stark difference among the two species?

Human activity is largely to blame. Namely, ship strikes from larger container ships, and more notably entanglement in the rope of commercial trap pot fishing rope. Since the re-bond of the Southern Right Whale, in 27 years only one human related death has been recorded, which was caused by entanglement in fishing gear (YALE). Compare this to the Eastern Coast of the US and Atlantic Canada and the story is quite different.

Beginning in 2015, 9 whales were visually confirmed to have undergone significant injuries from commercial pot fishing gear. In 2016, a total of four Northern Right Whales were reported as deceased. One from ship strikes, two from entanglement and one unknown case where the body could not be recovered for examination (Marine Mammal Commission). In that same year, another 11 whales were reported to have been entangled and undergone severe injuries (Marine Mammal Commission). 2017 was far worse yet, with 17 deaths (12 in Canada and 5 in the US) (NOAA, Right Whale) and another two so far for 2018.

Of these deaths, female whales die more than males, with an estimated 100 breeding capable females, the future of the northern right whale looks bleak (NOAA Fisheries). Also considering the distribution of mortality cause has transitioned from 35% of deaths due to entanglement to 85% of deaths due to entanglement, the issue of ropes in the vertical water column becomes quite clear (Press, A). And worse yet, 80% of Northern Right Whales have visible scars from entanglement (Oceana).

While the situation for the Northern Right Whale looks depressing, we also know hope is not all lost. Earlier we mentioned the Southern Right Whale and it's re-bound from 300 to 12,000-15,000 individuals. This too is possible for the Northern Right Whale, but only in the circumstance that humans begin to accommodate the Northern Right Whale, and many other marine species for that matter.

The point or common thread in all these scenarios that Ropeless Fishing attempts to point out is, all these problems only exist because of rope. Therefore, the removal of that rope but not traps, will solve all of these issues and enable Northern Right Whales to swim freely while improving the business of fishers.

History

This section will cover how and why the ARC came to be, thus denoting a long-verified field history of the ARC.

In 2005, Michael Domeier with funding from the Pflieger Institute of Environmental Research conducted an acoustic survey near the Channel Islands in Northern California (Domeier, M.). The study called for a submergible and recoverable system of recording arrays. In order to retrieve these underwater acoustics recorders, the researcher (Michael Domeier) would need on-demand access to the gear. Thus, Desert Star developed the ARC-1XD. The basic premise was to deploy a vertical string of equipment with an anchor, the ARC, the recorder, and the buoy on a single line. The anchor at the bottom of the line would submerge the entire system to the sea-floor. Meanwhile the buoy at the very top of the line would keep all components floating

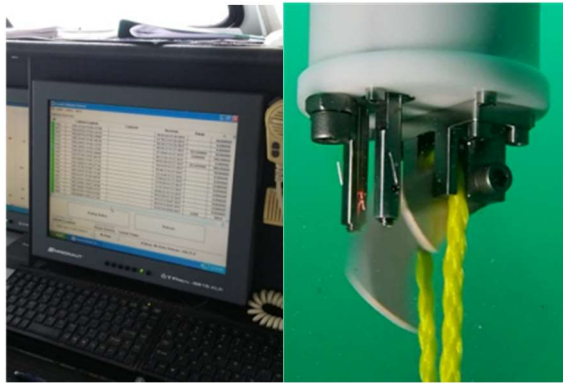
vertically in the water, with the ARC attached above the anchor, and the recorder attached above the ARC.

Then, in 2011, the New South Wales Rock Lobster Fishery reached out to Desert Star with an interest in the ARC-1. Originally, the New South Wales Fishery was interested in the ARC not to prevent whale entanglements, but rather stop a growing issue of ship strikes, catch theft, and subsequently ghost fishing (when a trap cannot be retrieved and keeps fishing without any access to catch). A pilot project commenced, and before the end of the pilot, two fishers were convinced the ARC was the right technology for Ropeless Fishing. In 2013, the ARC-1XD saw its first ever use in a commercial fishery setting. Since then, New South Wales has continued to use the technology as well as provide continued feedback and suggestions which are used in the ARC today.

Since then, five other pilot projects have been done with the ARC with one in New Zealand, one in Massachusetts, and three others in Atlantic Canada. You may read these findings [here](#).

[ARC Ropeless Fishing System Components](#)

This section will cover each component of the full ARC-1XD Ropeless Fishing System, their function and other details necessary for successful implementation.



ARC-1XD/2XD (Release Mechanism)

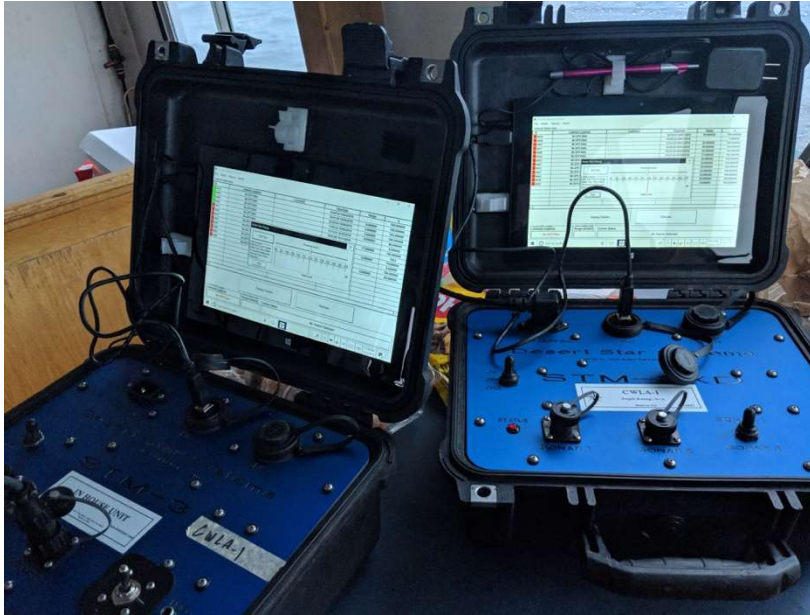


The Acoustic Release Control One Extended Duration is the core of the ARC Ropeless Fishing System. Serving as a release mechanism, the ARC has only one moving part which makes it highly reliable. Upon receiving a release command, the ARC will discharge a pulse through a nickel chromium burn wire seated between two titanium posts. Upon the burn-wire dissolving, tension on the release lever will loosen, allowing a cord seated through two holding posts to release from an anchor or configured fishing gear.

Key characteristics of the ARC-1 fusible link mechanism for use in ropeless fishing:

- ✓ The mechanism is fast-acting, meaning that you can service your traps quickly.
- ✓ The mechanism is very simple, with only a single moving part (the lever). This simplicity translates to reliability. There isn't much that can go wrong.
- ✓ The mechanism also lasts a very long time. All metal parts are titanium which will not corrode. ARC-1XD after their sixth year of use in NSW remain in good condition.

Consider the ARC-1XD acoustic release mechanism a component in your customized and optimized ropeless fishing system. You have much flexibility and can use it many ways. The reliability of your ropeless fishing system will depend on how you choose to implement the other components, principally the design of the bottom stored rope release bag including float and rope selection, operating conditions such as biofouling potential, the overall method of operating the system such as use of individual release or broadcast release mode, and your preparedness when a snag hits and you must grapple.

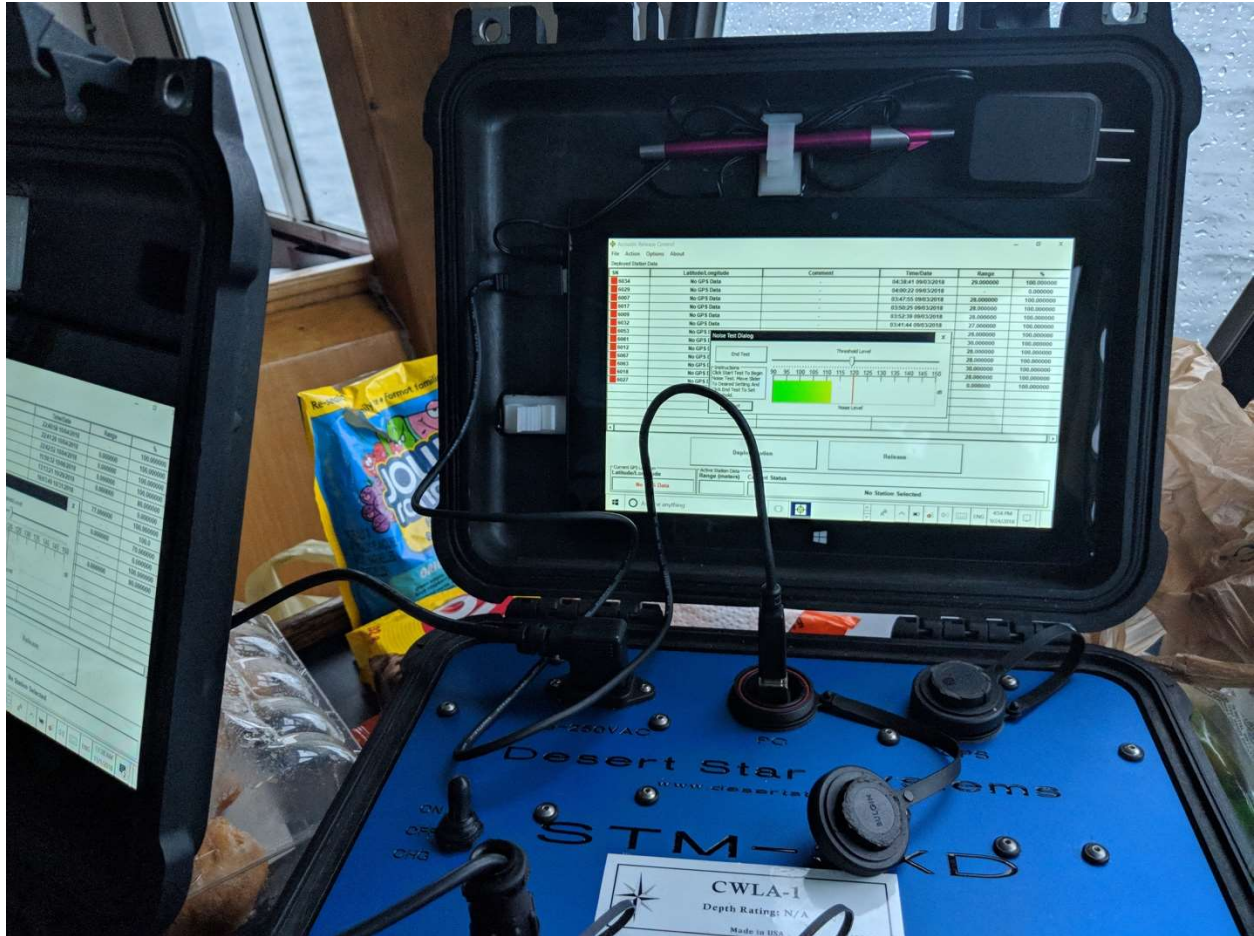


STM-3/4 (Signal converter for communication)

The STM-3 deck box contains the sonar electronics that ranges to and commands the ARC-1XD acoustic releases.

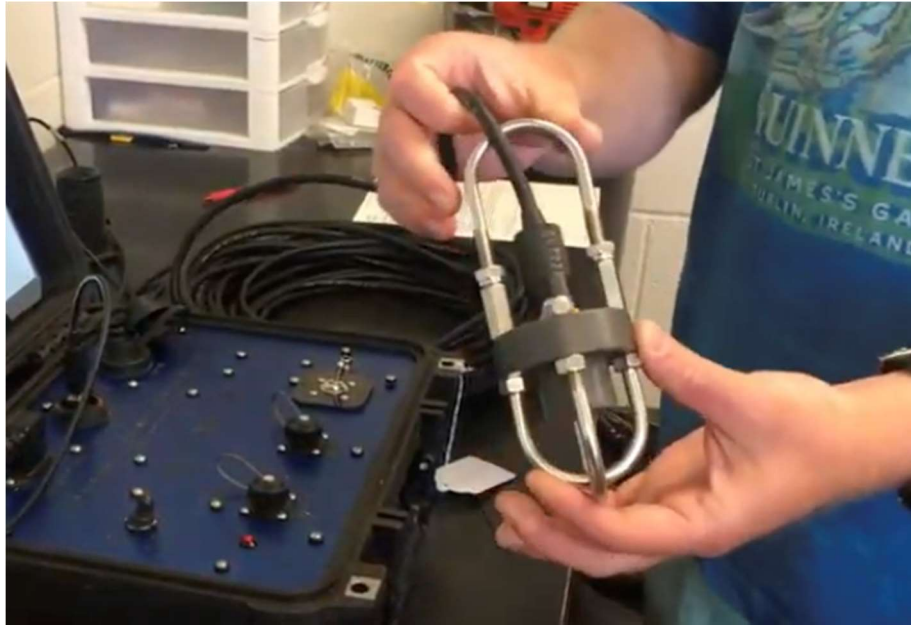
The STM-3 is mounted in a waterproof (when closed) or splash resistant (when open) Pelican case. It's instrument panel can also be removed from the Pelican case and then mounted in a console or against a bulkhead of your boat. Keeping the STM-3 in the Pelican case is convenient for temporary use and portability.

DB-Control Software with Tablet (Command Software)



The DB-Control software is custom made to operate and release ARC units. This software is provided on a tablet, laptop or computer and is not free use. This software has several functions from noise testing to ensure there is no interference with other onboard gear, to interrogating releases and so on. For more information, view page 29 of this document.

Over-the-side and thru-hull transducer (Communication with computer and ARC)



The thru-hull and over-the-side transducer are both responsible for sending a sonar message from the boat to the ARC. While only one is needed at a time, we provide both and recommend both be kept on-hand.

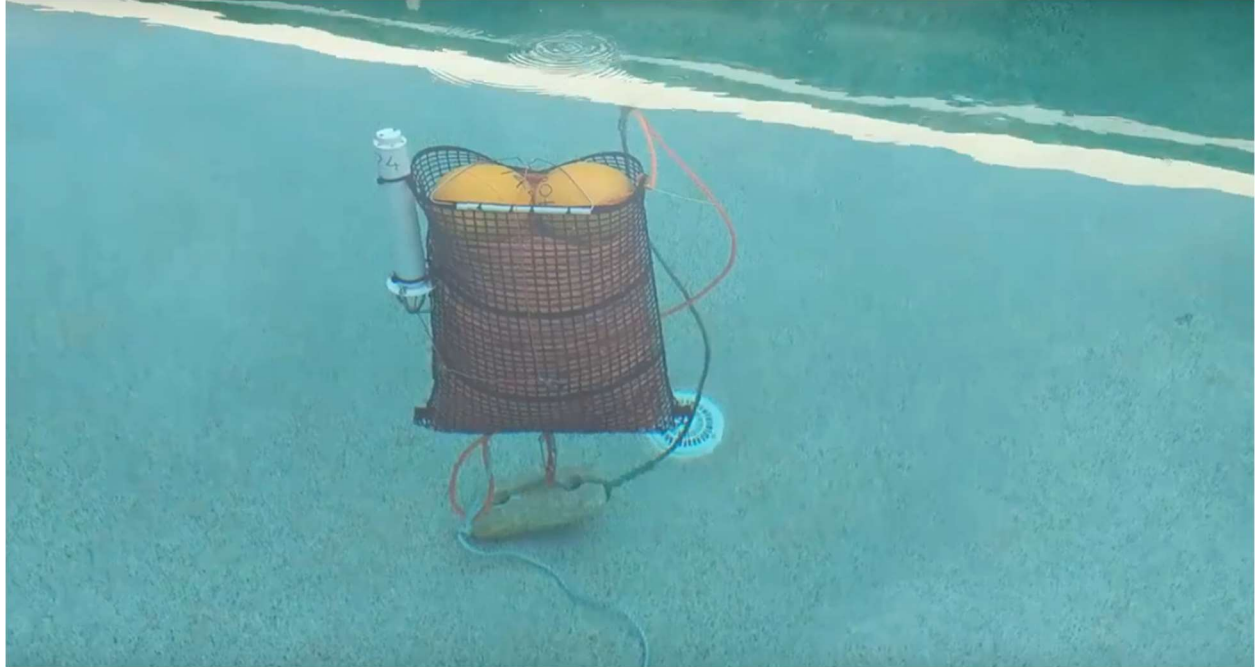
Over-the-side Transducer

For use in testing situations like the bucket and harbor test later discussed in this document. This transducer is hand-held and is therefore accessible and portable. It is highly recommended this transducer is not used for everyday applications yet may also provide fishers in the evaluation phase a means of testing without drilling into their hull. This transducer is also omni-directional, meaning it transmits messages in 360 degrees, resulting in a beam pattern that reaches well horizontally, but not as well vertically.

Thru-Hull Transducer

This transducer is a more permanent fixture for a boat and is installed within the hull (see Thru-hull installation section later in this document).

Release Bag/Stowed Bottom Bag



Comprised of easy to find plumbing parts from any home improvement store, a release bag allows rope to be stowed on the sea-floor nearby a trap or trawl. Using a random feed much like an anchor begin stowed, standard fishing rope is wound into the oyster mesh bag. The ARC is attached to the side and holds in the rope and buoys via a release cord. Upon triggering the ARC, the release cord will be set free, and the buoys on the top opening of the bag will create enough positive buoyancy to open the bag. Upon the bag opening, 8' hard plastic bouys will rise approximately 1 fathom per second.

Bottom end of 10mm haul rope; linked to trap or anchor via a stub rope to set bag floating height

Release cord (released by ARC, opens top of bag to set floats free). Cord is routed through shackles and tensioned by bungee on other side of bag.

ARC-1XD Acoustic Release (supplied by Desert Star Systems)

Bag material: 20mm plastic oyster mesh (made by Nylex)

Stainless steel float retainer with 3/4" (16mm) PVC pipe hinge. Retainer is constrained by release cord

Two 8" (20cm) hard floats with depth rating well exceeding max. fishing depth (made by Trawlworks and others)

Rest of bag is filled with approx. 90 fathoms of 8mm rope. It provides slack to recover in high currents.

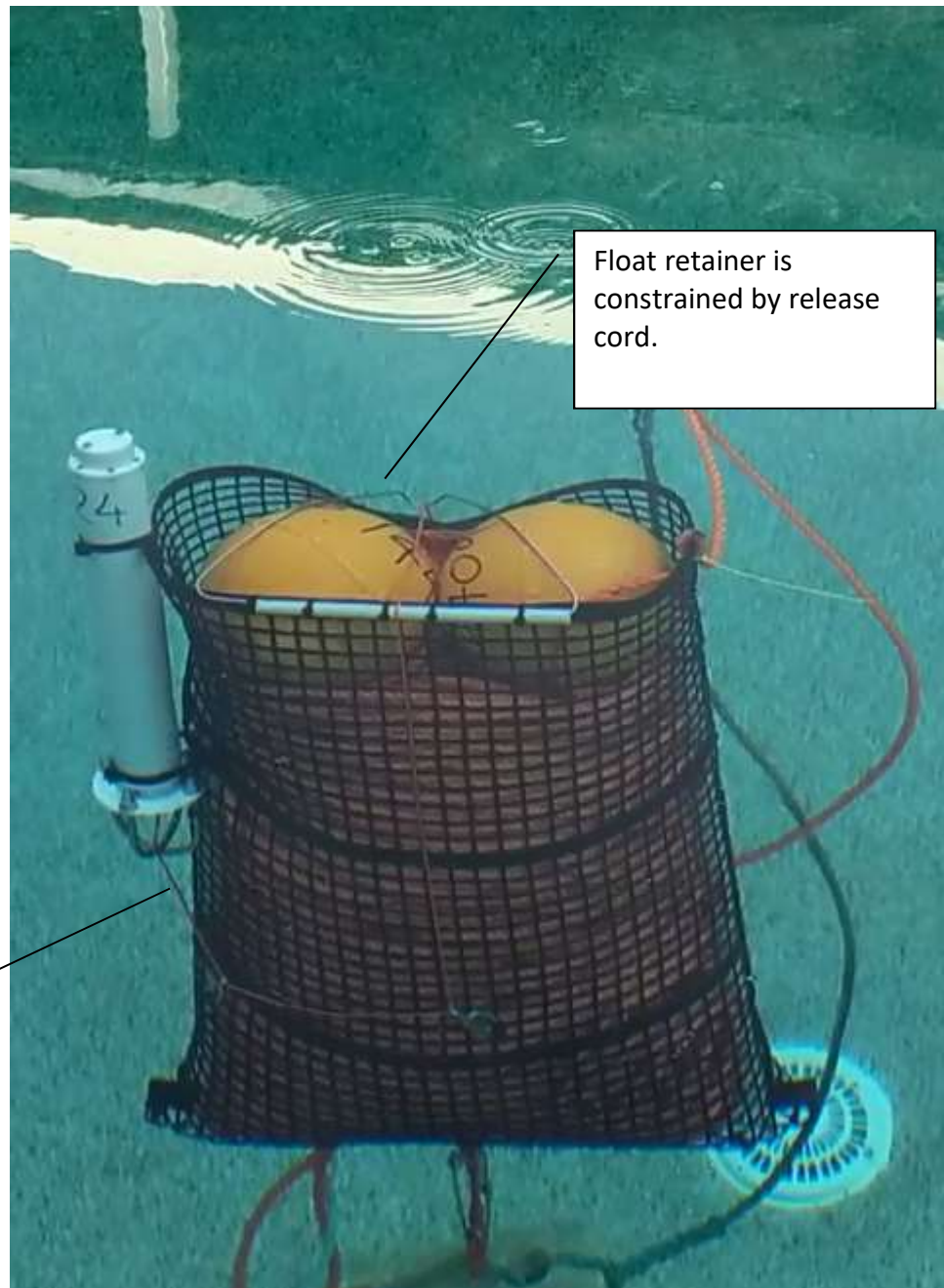
110 fathoms of 10mm polyprop rope. This bag is designed for fishing at up to 110 fathoms. A smaller bag design should be used for shallow water fishing.

U-Shaped PVC pipe keeps bag shape

Clip to tie bag to haul rope



[Click this link for a series of videos detailing the manufacture of the bags](#)

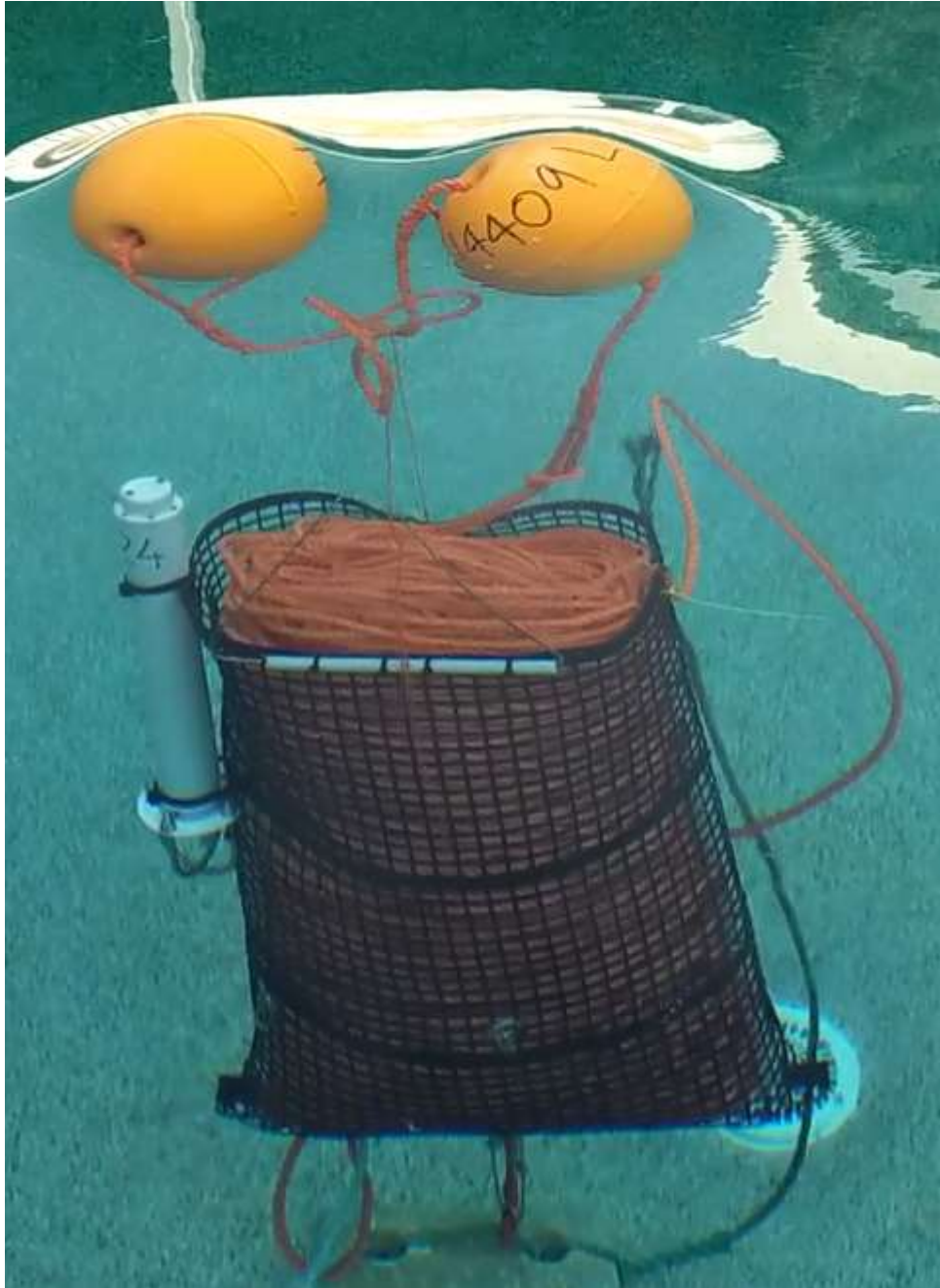


Float retainer is constrained by release cord.

Release cord is held in place by ARC-1

Before release: ARC lever arm is closed, holding the release cord in place. Release cord constrains the stainless steel float retainer in the closed position.

Release: Upon receipt of the release command from the boat, the ARC lever opens. The release cord is set free and pulls out, allowing the float retainer to open driven by the flotation force of the floats.



After release: The floats surface, trailing first the slack rope (8mm) and then the haul rope (10mm). Once the trap is hauled, the bag will be completely empty of rope, and the now empty bag will only be attached to the haul rope by the bottom clip. The bag will be unclipped from the haul rope upon surfacing and set aside for re-fill. The haul rope is not blocked and feeds through the winch all the way until the trap surfaces.

[Click this link for a video of the pool test of the bag](#)

Manufacturing the New South Wales style Release Bag

Below is a video filmed by Marco Flagg (CEO and founder of Desert Star Systems) featuring Steve Rosskelly during the production of a standard release bag. We have also included a briefer text description/steps to follow as well (below the video).

Please note this is only one possible design. Of many possible designs the New South Wales release bag has perhaps the most rigorous and extensive field history of any release bag.



To view the video, simply click the image, doing so will redirect you to YouTube.

List of materials

- Oyster Mesh Grid
- Zip ties (small, medium and large sizes)
- 20ml diameter pvc plumbing pipe
- Electrical tape
- Thin metal rod for retainer
- Poly propylene twine or nylon bridal
- Pvc plumbing glue (standard or marine)
- Hog-ties for guiding rings
- PVC adapter joints

Suggested but not necessary

- C-ring tool

Notes on the New South Wales Release Bag

This section intends to cover a few common questions encountered when talking about the New South Wales variant of the release bag.

First, this variant uses only two side posts as a frame and in some cases may allow the hard oyster mesh to ‘cold set’. The issue of cold setting occurs when some of the oyster mesh is free

to fold over when sitting on the bottom of the sea-floor. Once folded over, the plastic mesh will harden and become set in place. If this process takes place, the ARC will still function, however upon triggering the release, the buoys likely will not be able to open the bag. There are two solutions to this problem.

Second, if using this variant of release bag (or others like it), ensure your rope and buoys fill the bag such that the buoys are slightly sticking out of the top of the bag. The retainer should be somewhat hard to close.

Third, remove any commonly unused oyster mesh. After cutting your mesh and finishing your bag, you may notice some of the oyster mesh sticks out of the top of the bag, or your rope simply never fills the bag entirely. If this occurs either shorten the bag to an appropriate length or fill the bag with more slack line.

Fourth, in the case of marine bio-fouling, this issue can be solved with regularly serviced cleaning schedules. In the case of New South Wales, significant bio-fouling has been observed in systems deployed for several months in warmer waters near the equator. In order to avoid any bio-fouling (which may seal the release bag shut) you should power wash and perhaps submerge your release bag(s) in bleach after every long-term deployment. You should also service all release bags in the off season, even if you plan to use the equipment in colder waters.

[Release Bag Design Recommendations](#)

The New South Wales release bag is designed for that specific fishery at roughly 110 fathoms deep. Therefore, it contains 110 fathoms of 10mm diameter polypropylene hauling rope and

another 90 fathoms of smaller 8mm slack rope. The slack line is used to maintain slack until a surfaced float can be grappled (within seconds to a minute), allowing the floats to reside at the surface longer than normal in higher currents.

However, this bag may not suite all fisheries and likely needs to be modified for your needs.

Here are some design recommendations:

1. Begin by sizing your bags to the appropriate hauling and slack length you desire. Use the hauling rope to reach the deepest fishing location.
2. Splice the stronger haul rope to weaker slack rope as needed for your currents. Have enough slack rope to be able to grapple the pop-up float before it gets pulled under by strong currents.
3. Tamp down the rope with a broom or similar when filling the bag, so the rope will not be loose.
4. The bag must always be filled with enough rope to keep the hard floats at the top in such a way that the bag does not fold over the floats. The stiff plastic mesh may 'set' in a given fold in coldwater. In particular if the bag is deflected in high currents, the floats may not pull out if there is too much of a fold. See the pool test for a properly filled bag. Filling the bag to the right level may require a bit more or less rope for each bag, depending on manufacturing and rope size tolerances.
5. The ARC-1XD must always be attached to the side of the bag in such a way that the sonar transducer endcap is above the bag so that the signal is not shielded.
6. The ARC-1XD must be attached so that the tip of the lever points away from the bag. Jamming may happen if the mechanism is rotated so that the lever is parallel to the bag.

7. Use 2mm or 3mm polypropylene release cord, with a loop spliced into each end (no knots!)
8. Route the release cord through the ARC-1XD cage such that the force on the cord is always straight up from the ARC, and not at an angle. This is to prevent jamming.
9. Use two 316 stainless steel chain links to route the release cord first to the center of the flat side of the bag and another two 316 stainless steel chain links to route the cord over the top of the bag, centered on the retainer, and down the other side to a bungee tensioner.



Avoiding Snags in Your Release Bag

Snagged lever: The lever arm is pointing parallel to the bag, not away from the bag. This resulted in the release cord snagging the lever arm, preventing it from fully opening and releasing the release cord. **Lesson:** Make sure the ARC-1XD is mounted to the bag such that the tip of the lever arm points away from the

bag.



Not enough rope in bag: The mesh is folding over the floats, and the plastic may 'set' in this configuration after a prolonged time in cold water. If the current is high and the bag is 'leaning over', the floats may not exit the bag.

Lesson: Fill each bag with enough rope to keep the floats

unobstructed at the top. Be sure to tamp down the rope during the fill process such as with a broom. The rope lay needs to be tight in the bag.



Enough rope in bag: The floats are near the top of the bag, and the mesh isn't folding over the float. These floats can be expected to exit the bag even when the bag is swept near horizontal in strong currents.

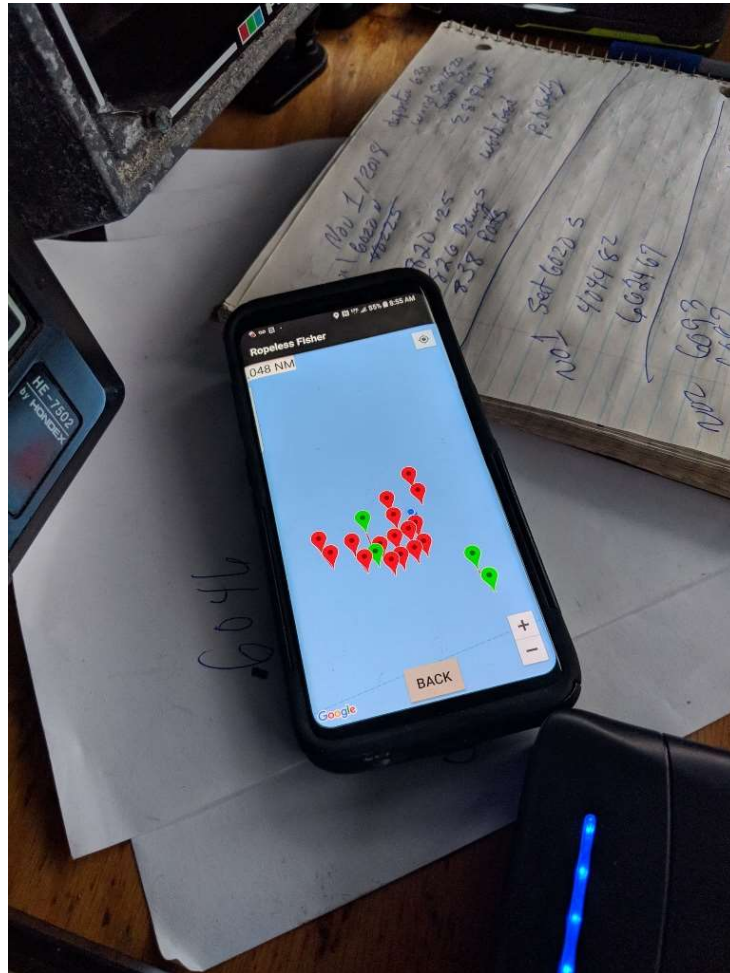
A smaller bag



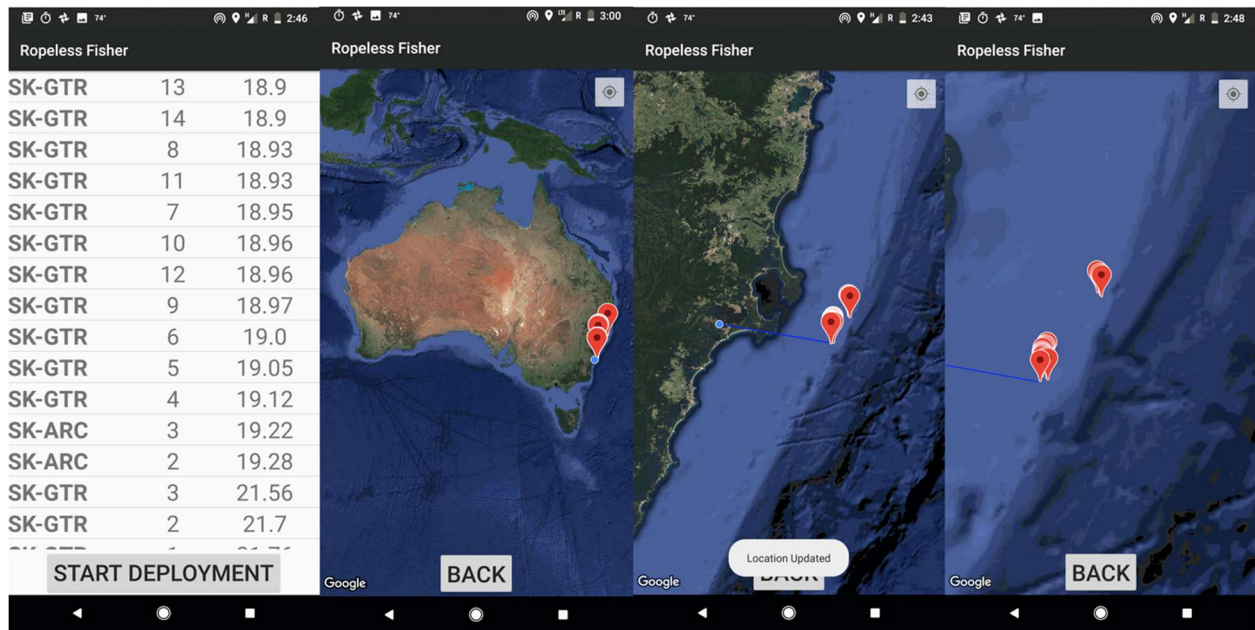
An example of a smaller bag design with less rope, and two stacked hard float bubbles, for shallower water fishing with smaller traps. This bag does not use a hinged stainless steel float retainer. Instead, the release cord constrains the floats directly. See NSW Dept. of Primary Industry

Operation Manual for ARC-1XDf for details.

Avoiding Gear Conflicts; Virtual Gear Marking with the Ropeless Fisher App



Given the lack of surface buoys when fishing without ropes, some form of gear marking and identification system must be in-place to prevent gear conflicts. Without any marking system, other pot fishers as well as mobile gear fishers are quite likely to (at some point) entangle their gear with others. To prevent this issue, and further improve gear marking procedures, Desert Star has developed the Ropeless Fisher App.



The App is free to use for everyone, and currently available on any GPS enabled Android device. The basic concept remains the same as a surface buoy. A fisher may set a location pin for every trap or beginning/end of a trawl. That location pin is then displayed in a map and list view for the fisher. Other fishers may also see this gear, but only according to a ‘visibility radius’ set by the gear owner. Take for example the common visibility radius of a standard surface buoy, we’ll say roughly .25 to .5 miles. In the same way, a fisher can set his radius to that distance, which mimics the traditional gear marking system, while enabling Ropeless Fishing and better informing fishers, and regulators.

As it stands (DEC2018), Ropeless Fisher is ready for experimental fishing including pilots, and evaluations. If you plan to use Ropeless Fisher for common marking practices please contact Desert Star to discuss your plans and security of the application.

Desert Star also plans to incorporate other features into Ropeless Fisher for a more seamless experience in the future. These planned updates include:

- Adding the fisher's email address in the details of a gear set, so that a gear owner can be contacted.
- Authentication of fishers and their email address through their association or fishery's department to deter malicious action by anonymous users.
- Limitation of the number of authorized virtual markings to match the sets of gear owned by the fisher.
- A Fishery Inspector's version of the app, which can map all gear independent of the visibility radius.
- In jurisdictions where this may be required for ropeless fishing, fishery inspector's access to acoustic release codes to raise gear for physical inspections.
- Access to the Ropeless Fisher source code and/or database specification for fishery departments and other organizations for the purpose of security inspections or to use
- Ropeless Fisher code as a starting point for a department/organization specific version of the app.

Offline Limitations

Ropeless Fisher stores information on Google's Firebase cloud database. It works fully when you are online and with limitations when offline. Your app synchronizes with the Google Firebase whenever you are online, meaning your gear markings are uploaded to Firebase and other gear markings from your fishery are downloaded to your device. When offline, you can only see gear that was marked when you were last online, and others can only see your new gear locations once you have returned to cell coverage and your device synchronizes again with Firebase.

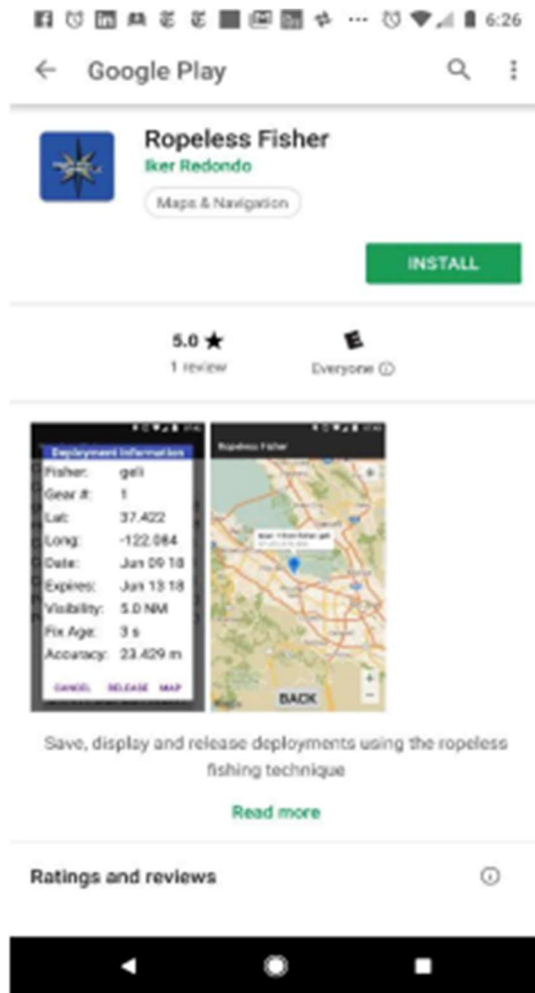
What you need to run Ropeless Fisher

Ropeless Fisher does have some basic requirements for successful use, those are:

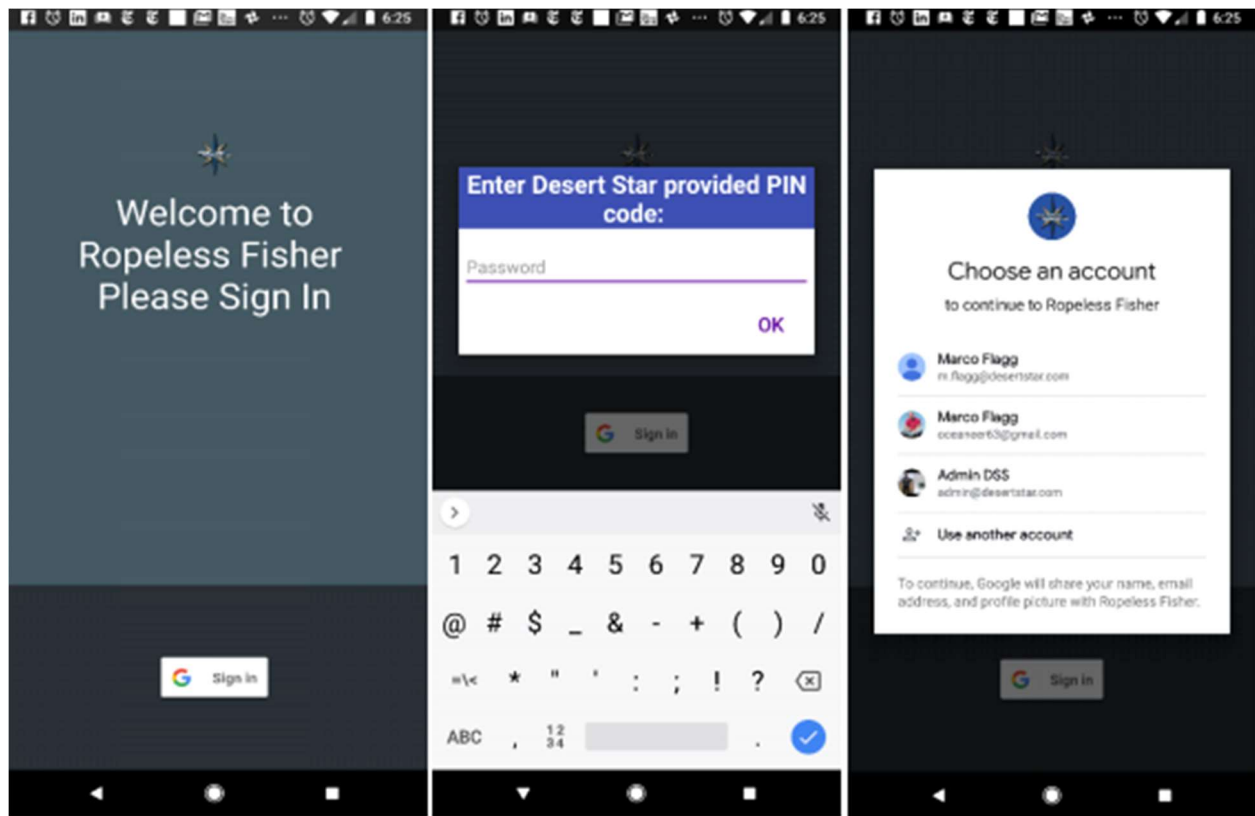
- A GPS enabled Android device
- A gmail account registered to the GPS enabled Android device.
- An internet connection for updating the database, although you may mark traps and use the application when offline to find gear locations.
- A clear view of the sky GPS positioning.
- A fixed pin code designed to prevent potentially confusing people not associated with fishing. This pin code is: 2391.

Ropeless Fisher Walkthrough

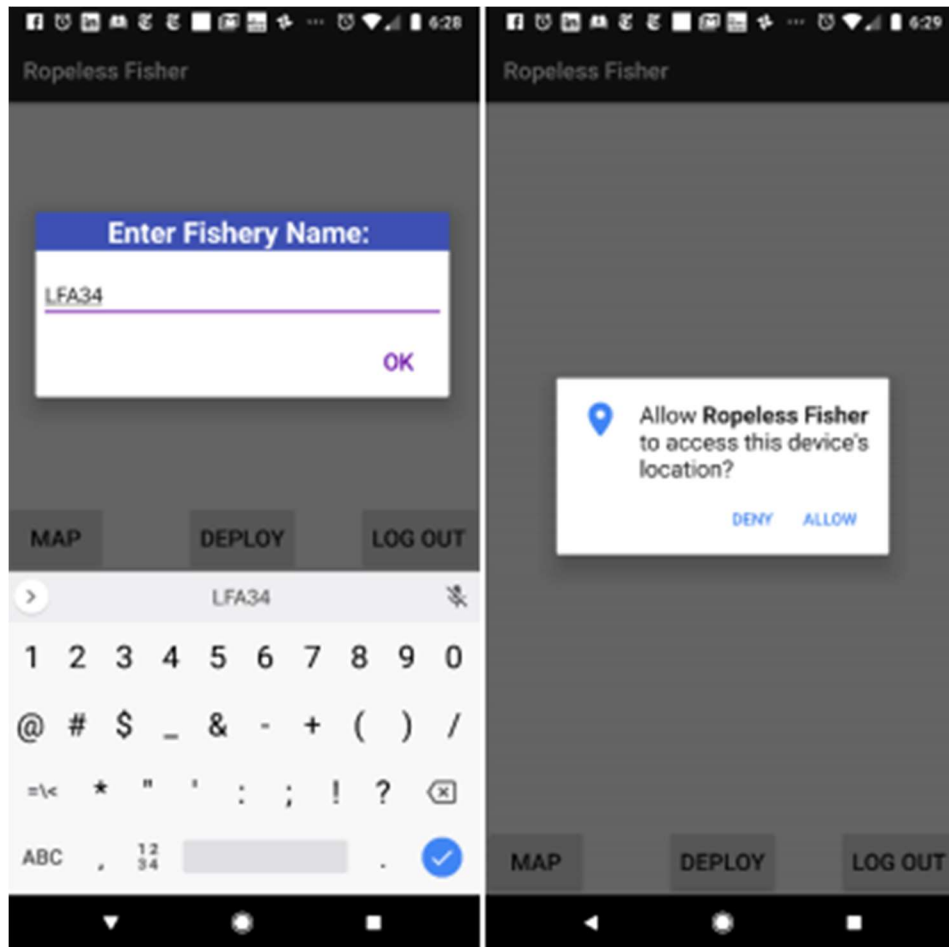
- 1) Download Ropeless Fisher from the Google Play Store and install.



- 2) Press the 'sign in' button and enter the pin code "2391". Then select a Gmail account to use. Also, allow Ropeless Fisher to access your devices location.



- 3) Enter the name of your respective fishery. Note: you will only see gear within your selected fishery. However, for every gear deployment you may switch between fisheries.



- 4) Deploy a new trap or trawl. You will see a list of gear in the vicinity, which includes your own gear and other fisher's gear if you are within their visibility radius. The list view displays the name of the gear owner (most left column), the gear number (center), and distance to that gear (right). Trawls are displayed by two numbers such as 1 and E1, indicating the start and end of a trawl.

In order to deploy gear, hit the 'Deploy' button. Confirm whether you are deploying a single or trawl, then fill in all information on the next screen. Note, a single will require only one press of the deploy button, whereas for a trawl, you must log both the beginning and end of the trawl.

From top to bottom here are explanations of the information you must fill-out:

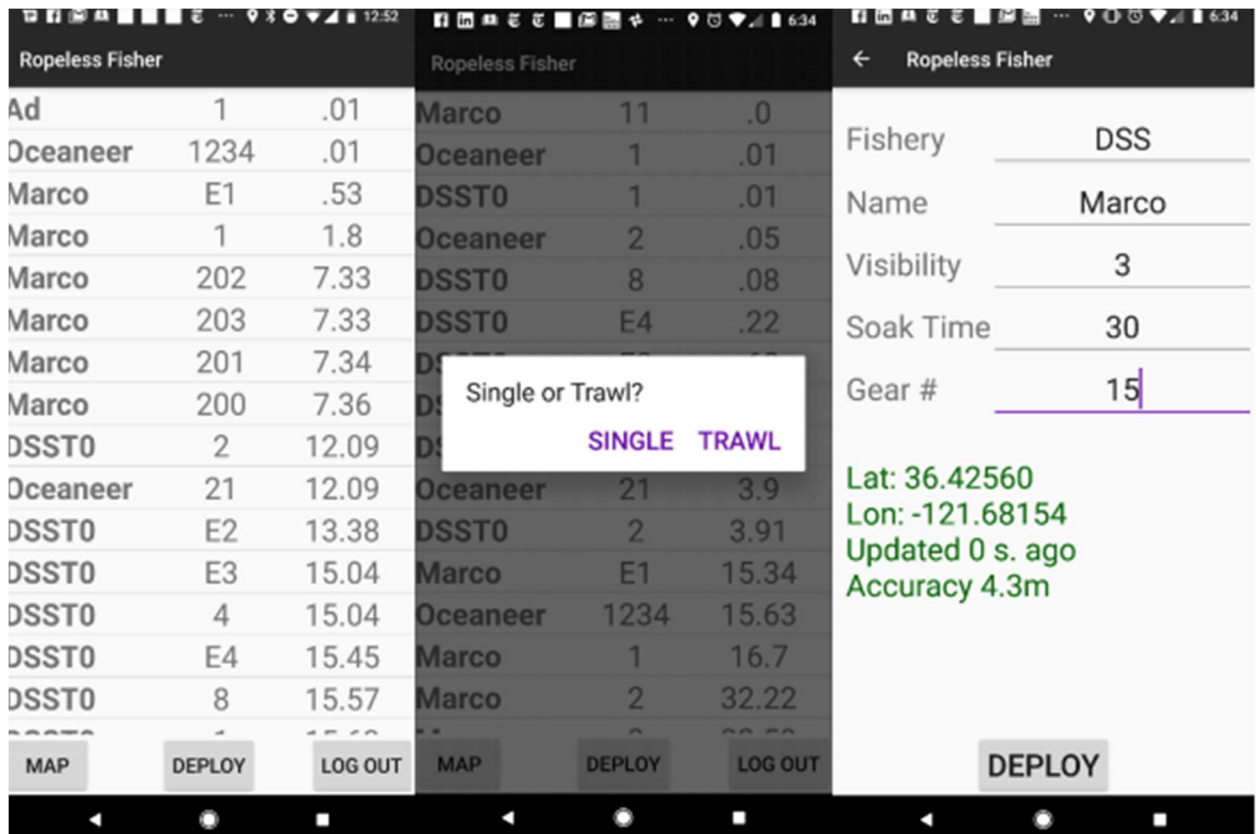
Fishery – The fishery you are practicing in.

Name – Your legal first and last name.

Visibility – How far other fishers can be until they see your gear. Please note, regulators can see your gear from any distance.

Soak Time – The amount of time you plan to let your gear sit in the water.

Gear # - Your own or assigned number which corresponds to your trap or trawl.



Bellow the information lines is a set of text indicating a location fix. You may want to ensure the accuracy is at or below 5 meters when deploying gear!

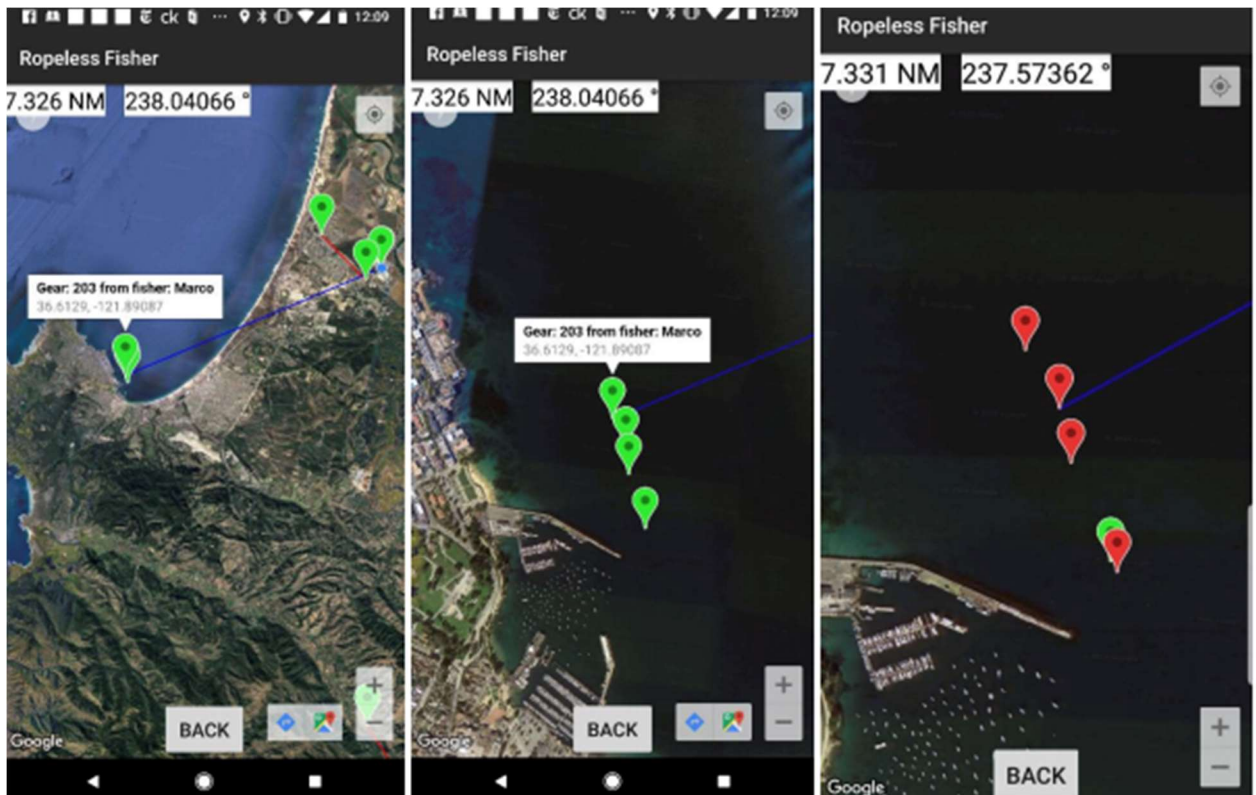
Now hit 'DEPLOY', this is the same moment when your actual gear should be set into the water.

5) For additional information in the list view, simply click any gear set. From here you may hit the 'Release' button to clear only your own virtual marking. In the future, this will include a capability to trigger the STM-3/4 without needing to do so on a separate tablet or computer.

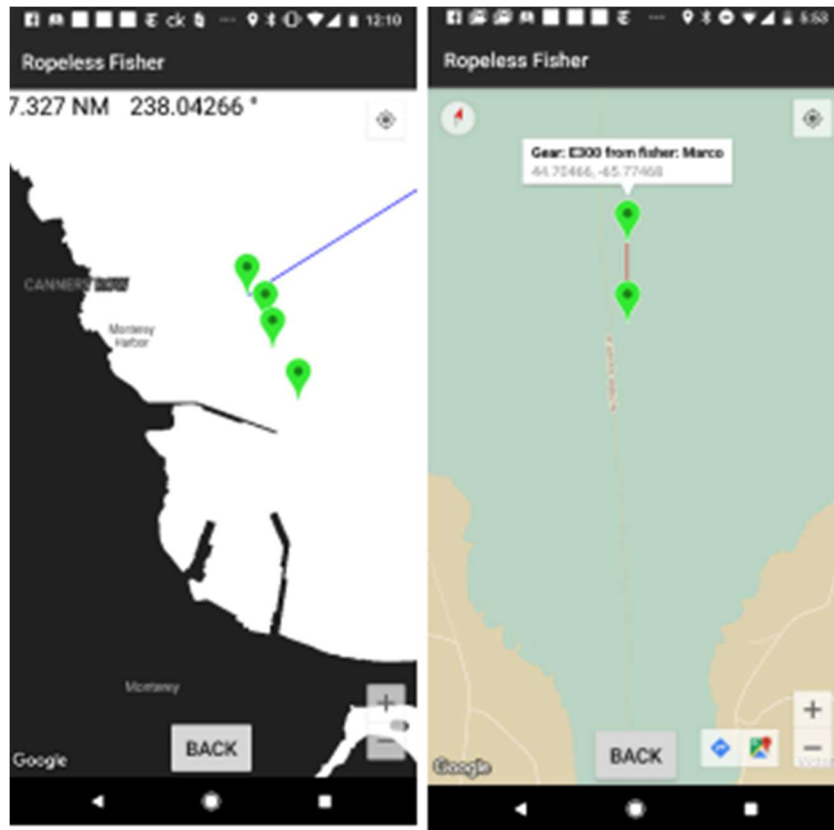
6) In order to view gear locations via a map view, press the 'Map' button.

This will show present locations using Google Earth including your location (blue dot) and a blue line connecting you to gear you selected.

Range and bearing information are displayed at the top. You may zoom in and out as far as you need. Your own gear is shown by green markers, other fishers gear are red markers.



- 7) Finally, you may call up the map display in a high visibility white/black mode for better viewing in bright sunlight (left), or in a chart like view (right).



[For more check out the Ropeless Fisher webpage by click this text!](#)

Section 2; Implementation

Getting Started Guide

This section will cover the chronological steps that one should take when receiving gear and converting to a Ropeless Fishing System.

Please note, all steps should be followed in the order they are presented, do not skip any steps!

Receiving and Inspecting Gear

Upon receiving your equipment, you should thoroughly inspect all gear for potential damage or missing items as they were shipped.

If this is your first time receiving your ARC equipment set, you should receive the following:

- ARC system(s)
- Surface Control Station (STM-3/4)
- Over-the-side transducer
- Thru-hull transducer
- ARC accessory kit
 - Release wire spool
 - Spare batteries (AA batteries)
 - Allen wrenches for servicing (two sizes)
- Supplemental desktop computer, tablet, or laptop
 - DB-Control software pre-installed and drivers up-to-date

- Tablet or laptop for use with Ropeless Fisher
- *Please note, you may receive any combination of the laptop, desktop, tablet variation. In some cases, fishers prefer to install a new desktop. Others like to have two devices, one for operating Ropeless fisher, and one for the DB-Control Software. While others may even opt to not order any laptop's, computers or tablets. Again, please reference your final invoice.

Visual Inspection of the Gear

Desert Star individually tests every unit sent to you, however during the processing of shipping, equipment may be damaged or mishandled. Therefore, it is highly important to visually inspect your gear as the second step to the implementation process.

1. Begin with the ARC(s). Inspect the outer housing and ensure there are no visible cracks, dents, or out-of-place markings.
2. Inspect the top and bottom of the ARC, ensure all screws are present.
 - a. Note the bottom of the ARC contains the release mechanism.
 - b. Note the top of the ARC contains just the transducer for communication purposes.
3. Now inspect the battery section of the ARC. For instructions on how, please reference the 'Servicing the battery section' part of this document.
 - a. Note, it is important all batteries are present, and the polarity of the batteries is correct.
4. Inspect the STM-3/4 (surface station), any computers, and transducer. Ensure no cracks or other visual problems are present.

Next, you need to inspect the software side of the gear you have received.

Please make sure to have charged all equipment for several hours, or even overnight before continuing with this section (just in case).

Inspecting the ARC software

Luckily this section does not require a computer! Lightly tap one of the allen wrenches on the transducer of the ARC. Now turn the ARC upside-down (with the release section facing the sky). Look at the printed sticker on the side of the ARC and look to the upper right-hand corner. Just above this, you should see a green LED blinking. This indicates the ARC is functioning properly.

Please note, the LED may be difficult to see in sunny conditions, and in some cases may take several light taps before it turns on (tap the transducer end of the ARC lightly with a wrench).

Inspecting your associated computers and surface station.

Now we dive into the actual computer-based software side of things. This section will assume you received a tablet computer for use with your surface station (STM-3 or STM-4)

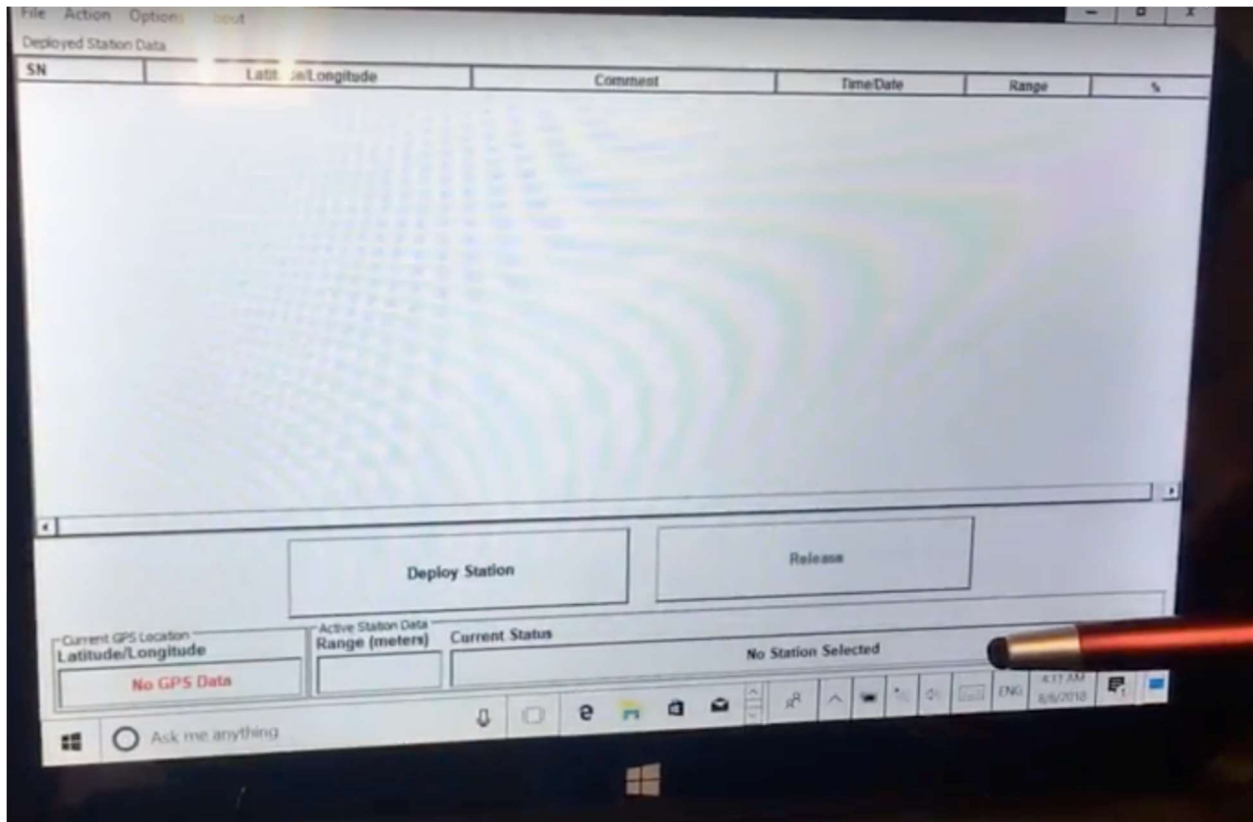
1. Open your Surface Station.
 - a. Here you will find a tablet attached to the top inside of the lid, along with a Stylus, USB connector, and AC plug in for power.
 - b. Power on your tablet and let it boot (turn on). Log into the computer and let it sit for 20-30 seconds to load all programs.

2. Now, look at the desktop (main screen) and open the 'DB Control Software'. This piece of software is responsible for interrogating the release command and can do several other useful things.
3. Locate the female USB connector attached to your tablet computer.
 - a. Ensure it is plugged into the USB port on your tablet.
 - b. Now plug the USB connector into the Surface Station where the label 'PC' is located.
 - c. **Note, at this stage only the tablet should be powered on!**
4. Now turn on the Surface Station by flipping the power switch up, into the 'On' position.
 - a. Allow the surface station 15-30 seconds to power on and go through it's boot sequence.
5. Upon the surface station turning on and going through the boot sequence your tablet should recognize the connection. Wait roughly 10-20 seconds to ensure this has worked.
 - a. In Windows, you may see a small icon in the lower right-hand corner which says a new device was recognized and drivers are being installed (this is good).

You will now confirm that a connection has been established between the tablet and surface station.

6. Now launch the 'DB-Control' software from your Desktop by clicking the software icon twice. In some cases, it may help to launch the software via the administrator account.
 - a. To launch via the administrator account, right click on the icon and click 'Administrator', enter your password and press okay.

Upon launching the software, you will see the following screen:



7. There are a several functions and capabilities of the DB-Control software, however in this section we will only cover confirming an establish link. For testing and troubleshooting protocols please see the next section.
8. Note the bottom right of the screen, there should be a message which says, “No Station Selected”. In order to ensure the tablet and STM are communicating you need to verify the connection.
9. Select the ‘Action’ option on the top left-hand corner of the screen. Then select ‘Test Surface Station’. The dialogue box in the bottom right hand corner, should be a brief period say, “Surface Station Selected”.

10. Now you have verified that the computer/tablet, and surface station are functioning properly. Next, we will move onto testing the over-the-side transducer and ARC's by conducting a 'Bucket Test'.

The Bucket Test; Interrogating an ARC release test

In this section we will cover testing your complete equipment set, in the most basic sense.

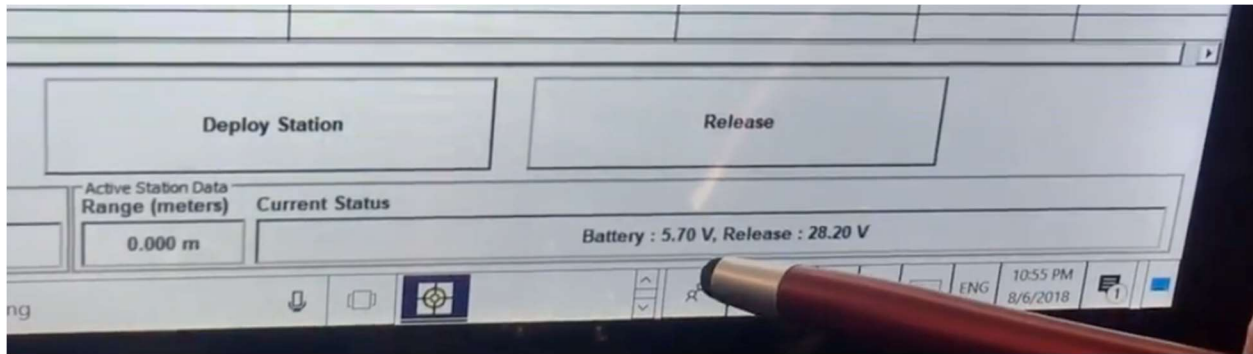
We must note, if this test is done successfully this does not mean you should skip all other steps and go straight to Ropeless Fishing. Instead this is one of several critical steps towards ensuring you and the gear-set are as successful as possible.

1. Begin by implementing the procedure from the "Inspecting your associated computers and software" section.
2. Now plug in your over-the-side (OTS) transducer into your STM3/4.
3. At the time of this writing, the supplied OTS transducer will look like the following:

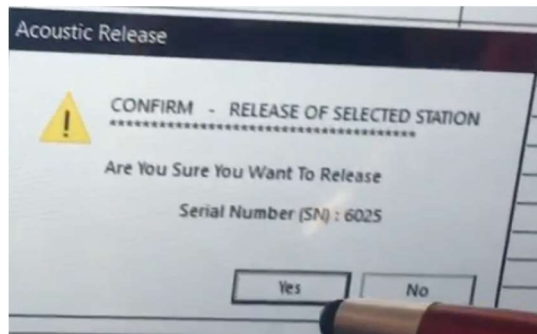


4. Now plug the end of the OTS transducer into the STM. Turn the connector clockwise until the transducer connector pins screw down into the STM connector. Then tighten the connector cap for added protection.
5. Now, find a 5-gallon bucket, very large bowl or another container which may hold the end of an ARC and the OTS transducer. (NOTE, do **NOT** use a glass enclosure as this may bounce around the acoustic signals, leading to unrealistic mission conditions and a failed bucket test. Also do **NOT** perform this or any test in the air, as cracks may develop in the Delrin housing, all tests should be conducted underwater.).
6. Ensure your ARC is working (reference previous section) and place the top side (transducer side) down into the container filled with water. It is important the top side is completely submerged in water. The water may be any reasonable temperature.
7. Now, place the OTS transducer in the water as well, ensure the transducer is completely submerged in water as well.
8. Launch the 'DB-Control' software and establish a connection between the tablet and Surface Station.
9. If this is the first time you are testing or using an ARC, click the 'Deploy' button.
10. In the prompt box, enter the ARC serial number (4-digit number printed on the sticker of the ARC) and click 'Okay'. We also supply a digital reference sheet for your serial numbers as well.
 - a. Worth noting, the serial number of your ARC is like a pin code to accessing that specific ARC. Please do not share the code. Also, keep that code and keep references to that code handy. This code is unique to every fisher in different fisheries.

11. After clicking 'Okay', the software will enter a communication test phase. This will simply ensure the ARC and STM are communicating with one another. If you haven't already, follow the instructions in the dialogue box.
12. This test should only yield two 'ID Packets'. If the software attempts to send more than two, there is likely a problem (please reference next section for trouble shooting).
 - a. A note on ID Packets. These are commands without release instructions. This means the surface station will send out a message saying "Hey, are you there?". The ARC (if working properly) will respond saying "Hi, yes I am here!". Two iterations of this phase will happen.
13. After the communication test is successful, the bottom right dialogue box will say "Station Activated", and the station (ARC) will pop-up in the list of stations on the main portion of the 'DB-Control' software screen. This ARC is now ready for testing and future deployments.
 - a. PLEASE NOTE: At this stage the dialogue box will display **VERY IMPORTANT** battery life information of the ARC. Since the ARC functions from a two-battery system (recall from earlier) you will see two battery readings.
 - i. The first should have a yield of 5V or higher, this is the lithium battery which supplies power to the onboard electronics (important for communication).
 - ii. The second should yield 20V or higher, these are the four alkaline batteries responsible for the actual charged release.



- iii. If either reading is lower than recommended, inspect your gear, ensure battery polarity is correct, connections are secure. If those options fail, simply replace batteries and test again.
- 14. With the OTS transducer and ARC top end still submerged in water, click the ARC in the software selection. Click the 'Release' command. This command is used for actual release in testing and real-world scenarios.
- 15. A pop-up confirmation message will appear, click 'Yes'.



- 16. You should now see the following sequence of messages in the dialogue box.
 - a. Arming station for release. Please Wait.
 - i. (Establishing a communication link between the STM and ARC)
 - b. Station Armed. Triggering release.

- i. Successful communication link established, the release command will now be sent.
 - c. Activating (serial number) ... Sending ID Packet 1
 - i. The release command is being sent.
 - d. Station release command acknowledged.
 - i. The release command was sent successfully, and the ARC replied that it will follow the command.
17. At this point, the ARC has received the release command and is building a charge.
- This stage takes 14-20 seconds before the release spark.
- a. A note on safety of the release spark. We strongly recommend all hands, feet, and other body parts be kept away from the bottom end of the ARC (release end). However, the electricity is non-lethal and actually quite safe. The charge used is high current, but low amplitude. This means the electricity running through the wire is going very fast, however very little electricity is actually running through the wire. Also, this entire process only occurs for a split second between the two burn posts no more than $\frac{1}{4}$ inch apart.
18. Finally, check the ARC wire has been burnt by moving the release lever up and down. Upon success of every ARC, re-arm the ARC (covered in next section) and begin preparation for harbor testing.

Re-arming an ARC

This section will cover re-arming the nickel chromium burn wire of the ARC.

1. Gather your wire, and allen key. Turning anti-clockwise, unscrew the two burn wire post screws.

2. Remove any left-over burn wire and re-insert a 1.5-inch section of wire between the burn wire posts.
3. Screw both burn-wire screws into their posts, making sure not to tighten them too much and also ensuring the release lever is below the burn wire.
4. Your ARC is now ready for re-deployment.

That's it, it's that simple ☺ .

Harbor Testing

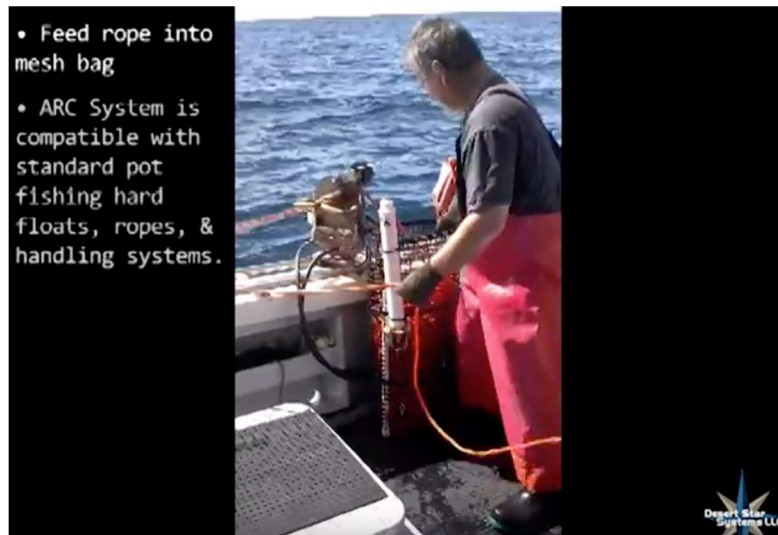
This section covers a necessary facet of the overall testing process. This will incorporate the use of your release bag (or other stowing method) and the ARC, STM etc... This is important because it ensures all equipment is working in unison with one another in real mission settings, without jeopardizing the equipment.

For this, simply go down to your dock/harbor/marina and find a spot on the dock with some space. (Also, from our experience be prepared to answer questions from others asking what you're up to! Don't be afraid though, most people are naturally curious and want to know more about Ropeless Fishing).

In this case we will only cover the most common form of equipment set-up (the stowed release bag and ARC on side method). This method is tried and true within the New South Wales Fishery, ACA fishers in LFA34 off the shore of Nova Scotia Canada, Fishers off the coast of Grand Manan Islands in Canada, and to some extent the waters off the coast of Cape Cod Massachusetts (at the time of this writing).

1. Begin with your release bag, ARC and a series of zip ties, or titanium hog-ties.
2. Hold the ARC on the side of the release bag, ensure the top side of the ARC (transducer side) is held several inches above the top side of the release bag.
 - a. This is critical because, if the transducer is blocked too much, it may not be-able to effectively communicate with the surface station.
3. Now attach one zip tie or hog-tie around the center of ARC, ensuring the zip-tie wraps around the body of the ARC and through the oyster mesh. Do this for the bottom and top of the ARC as well. Depending on your personal preferences you may wish to place more zip-ties or hog-ties.
 - a. A note on zip-ties, please use larger zip ties for the body of the ARC.
4. Now place zip-ties around the cage of the release end of the ARC, and through the oyster mesh. This further ensures the ARC is attached.
5. At this point you should also have all relevant hog ties and other necessary connections set-up on the mesh bag. For more in-depth coverage refer back to the 'Release Bag' Section of this document.

Filling the release bag.

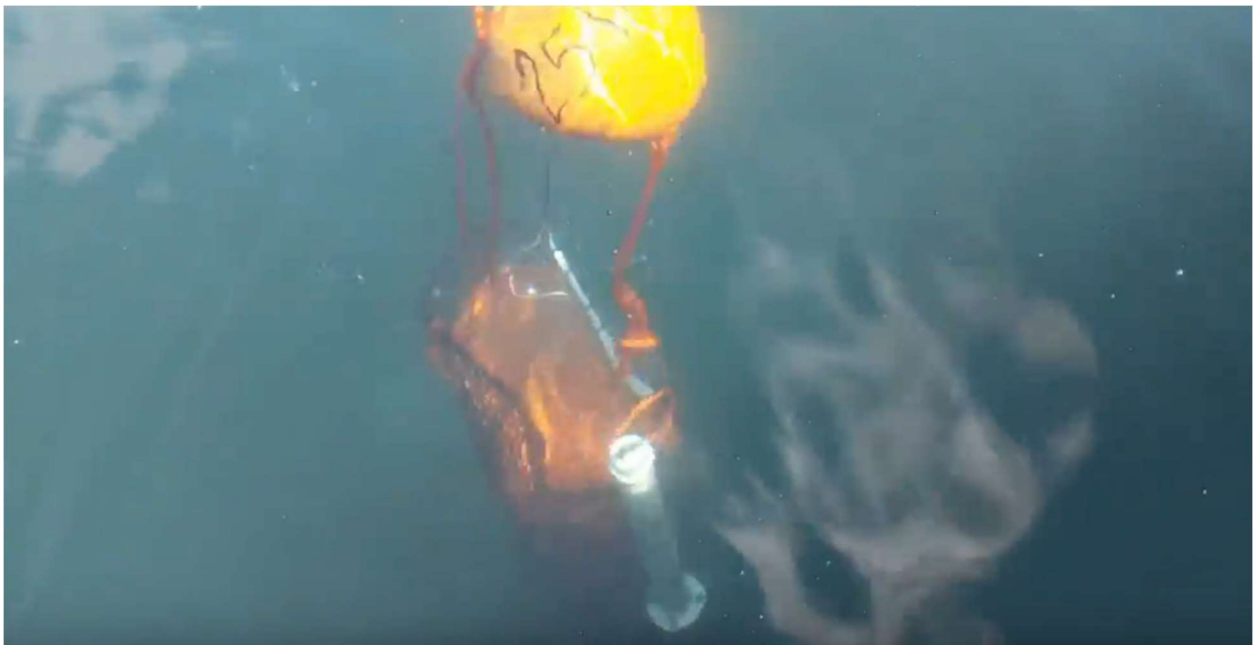


- Feed rope into mesh bag
- ARC System is compatible with standard pot fishing hard floats, ropes, & handling systems.

This is your first introduction to properly filling the release bag. Before jumping in, there are a few things to note in order to be successful.

1. Your release bag should correspond to the amount of rope you fish with. This means, upon filling your release bag, the bag itself should be full of rope, and hard floats sitting on top (slightly bulging out).
2. Often times, fishers prefer to use extra slack in the line. This may mean using a thinner line for the buoy end, and your standard hauling strength line for the other section of rope.
3. The only recommend method of filling a release bag is to coil the rope in. This is like mimicking the way an anchor is stored. Although the feeding seems somewhat random, the lay of the feed ensures no snags or tangles occur.

4. Now we will move onto filling the release bag. Please note, at this stage you shouldn't be using any wench or gear on your boat (a much faster and real-world method will be covered later). For the time being, fill the bag by hand, mimicking a wench feed style lay.
5. PLEASE NOTE: Since this is only a harbor test, you don't need to release your entire rope length. Say for example you fish with 100 fathoms, yet the harbor is at most 15 fathom. Measure out approximately 18-25 fathom and tie that end point to the side of the oyster mesh portion of the release bag with a zip-tie. This will save you a lot of time because only that 18-25 fathom will exit for multiple harbor tests. (Later on make sure to cut the zip tie when moving to boat trials).



Also ensure (like mentioned previously) the rope fills the release bag most of the way, and the hard floats are slightly popping out of the top of the bag. Now, lower the retainer and secure your release bag.



Securing the release bag for deployment

This section will cover the process of setting the release bag (once the ARC is already affixed and the bag is already filled).

1. Begin by taking your release cord and placing it between the holding posts of the ARC.
2. Secure the burn-wire, ensuring the release lever is below the wire.
3. Run the release cord around the cage of the ARC, ensuring a 90-degree angle.
4. Run the release cord through the hog ties that were attached to your bag when you manufactured it.
5. Run the release cord over the retainer.
6. Using a carabina, attach the release cord loop end to the carabina.

Phew! Now you're ready for the harbor test. Make sure you have a safety line attached to the release bag (just in case!), and an anchor attached as well (large cement bricks work fine).

1. Now through that baby in the water and let it sink.
2. Go through the start-up process of the tablet and surface station.
3. Lower the OTS transducer into the water. We recommend doing this some distance away to ensure communication is successful over a longer distance.
4. Go through the process of interrogating a release.
5. Wait 14-20 seconds after a successful acknowledgement. You will soon see the hard float(s) appear on the surface of the water.

Preparations for At-Sea Testing; Installing the STM-3/4

The STM-3 deck box contains the sonar electronics that ranges to and commands the ARC-1XD acoustic releases. The STM-3 is mounted in a waterproof (when closed) or splash resistant (when open) Pelican case. It's instrument panel can also be removed from the Pelican case and then mounted in a console or against a bulkhead of your boat. Keeping the STM-3 in the Pelican case



is convenient for temporary use and portability. But, bulkhead or console mounting makes for a much cleaner installation and is recommended for permanent use.

Permanent installation of the STM-3 deck box (F/V

Seeking):

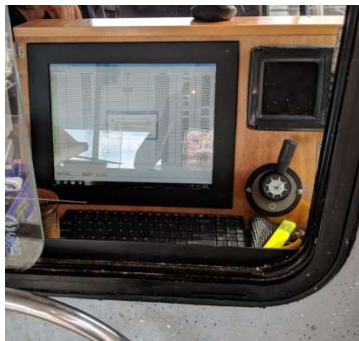
The STM-3 instrument panel is removed from the Pelican case and mounted on a bulkhead of the boat (left). The through-hull and the over-the-side sonar transducers are wired to the box and selectable via a toggle switch. An industrial PC (black box on right) runs the DB-ARC control software.



The ARC-1XD releases are controlled via the control screen and keyboard mounted in the wheel house.

Note: ARC-1XD release control is currently via the DB-ARC Windows application as shown here. An integration of the control capability into the 'Ropeless Fisher' app

running on an Android tablet is planned. Communication between the tablet and STM-3 deck box will be wireless via Bluetooth.



Installation on F/V Andree-Dean. The control display is installed in a console at the steering position. The STM-3 deck box is inside the

console, and remains mounted in its Pelican case for easy swap-out.

STM-3 Deck Box Electrical Connections

- ✓ Through-hull sonar transducer plugs into SONAR #1 connector.
- ✓ Over-the-side test & backup sonar transducer plugs into SONAR #2 connector.
- ✓ USB connection to a PC running DB-ARC control software
- ✓ Optional USB connection to a GPS receiver, for auto-recording of ARC-1XD positions

- ✓ Optional 110-250 VAC power connection. The STM-3 also has an internal re-chargeable battery

Thru-hull Sonar Transducer Mounting

The ARC-1XD on your traps are interrogated and commanded through ultrasonic signals not unlike the pings from your boat depth sounder. And, similar to a depth sounder, a hull mounted transducer is required. The transducer is of the through-hull variety, meaning that a 50mm diameter hole is cut in the hull and the transducer is sealed into that hole. This transducer is made to our specifications by Airmar, and housed in their P319 housing. The installation instructions are available [here](#). Please study them closely.

A critical installation consideration is the 'dead rise angle' or pointing angle of the transducer. The transducer has a flashlight like circular beam covering 60 degrees at full performance (-3dB points) and about 90 degrees at reduced performance (-10dB points). The transducer should be pointed either straight down at the sea floor, or where possible tilted somewhat forward at an angle of about 15 degrees to concentrate the search area for the ARC-1 ahead of the boat.

You may be able to achieve straight-down pointing (zero dead rise angle) by mounting the transducer on the keel of your boat. This is the most common situation in NSW where fiberglass hull boats with an integrated keel are used. But, in many other cases keel mounting is not practical and the v-shape of the hull means that the transducer would point somewhat to port or starboard. If the dead rise to port or starboard is too extreme (>30-45 degrees), then there may even be no 'sonar illumination' directly under the boat and you would have to run a course to the side rather than directly over your traps for effective communication. This is not desirable.

In those situations, the transducer should be mounted on a fairing block that compensates for the hull angle and points the transducer in the desired direction. Again, our recommendation for ideal pointing is 15 degrees forward. But, a zero dead rise is a good and well tested solution as well.

If hull mounting is not at all possible for the pilot program: Each system is also supplied with an 'over the side' transducer that can be lowered over the side of your boat. This transducer is caged, and a lead weight can be attached to keep the transducer submerged even if your boat is underway at a limited speed. However, the combination of a cable running across your deck and the need to remove the transducer from the water before cruising at high speed makes this a very limited solution. Use it only as a last resort!



The over-the-side transducer (left) and the through-hull transducer (right). The through-hull transducer allows ranging to and commanding the ARC-1XD releases while your boat is underway.

The over-the-side transducer has a limited such capability when lowered over the side and weighted. But it should only be used as a last resort.

[Choosing Individual or Broadcast Release Mode](#)

When interrogating a release, the STM-3 surface station has two methods of interrogating a release. The principal difference is in how the release command is sent and how the ARC responds to those commands. Please read both sections before reading the 'Choosing a mode' section.

Individual Release Mode

This mode requires the fisher to select a specific ARC using the provided DB-Control Software on a provided tablet or computer. Upon selecting an ARC, an acoustic command will be sent to the ARC, which in turn sends back a message. This allows ranging information to appear in the Control Software, which will allow you to position your boat accordingly. You will also see essential battery information, which will notify you should a battery change be needed (about once every season). This mode will also allow the selection and a separate release command to be given.

Individual Release Mode is typically used for larger traps/trawls in deep and/or fast-moving currents. This mode provides the most precision in terms of the ARC position and will allow a fisher to manure their vessel more accurately. However, this mode does take slightly longer to operate in compared to Broadcast mode.

An application example for individual release is in the NSW rock lobster fishery. Here, the East Australian Current can run strong for weeks and even months at a time, making fast hooking of the floats with slack rope a significant productivity enhancer. Fishers there now operate in currents in excess of two knots, compared to a maximum limit of 0.75 knots when using GTR or static surface buoys. Fishing depths are from 60 to 110 fathoms.

Broadcast Release Mode

This mode allows the STM-3 to transmit a fisher specific release code every 5-8 seconds. The ARC being targeted does not reply but will instead automatically pop-up. Therefore, this method is faster and typically results in buoys popping up ahead of the boat upon approach. for a black

out period of one hour. This is designed to prevent pre-mature release of ARC's as the fisher sets them back in the water (since the STM-3 keeps transmitting).



The smaller and simplified STM-4 deck box is available for users practicing only broadcast release. (The box is typically used with the lower cost ARC-2 release, which operates in broadcast mode only. But it may also be used with the ARC-1.). The STM-4 broadcasts the fisher specific release code

about once every ten seconds, causing buoys to pop up ahead of the approaching boat. A computer is not necessary.

An application example for broadcast release is in the New Zealand scampi fishery where pilot testing is scheduled to start in the summer of 2018. Small, open boats are used in that fishery and operation of a computer to command individual releases is considered not practical. But, the fishing is also in shallow water and strong currents are not an issue.

Which Mode to Choose?

The choice of which mode to use ultimately depends on the fisher's preference, however there are other environmental and operational circumstances to consider. For instance, fishing grounds which experience high currents may be best suited for individual release mode due to its

precision in use. Whereas more in-shore or calm fisheries which service traps at a rate of one every 10 or so minutes may find it less labor intensive to use broadcast mode instead. Broadcast mode can also allow a cost reduction in that the STM-4 (broadcast mode only) and the ARC-2XD are less expensive than the STM-3 and ARC-1XD. Yet, the ARC-1 can use both individual and broadcast mode, whereas the 2XD can only use broadcast mode. This means, only the ARC-1 can reply back with ranging information and battery status.

Due to this difference, one should first satisfy these questions if considering the STM-4 and ARC-2XD over the STM-3 and ARC-1XD:

- Any release (ARC-1XD or 2XD) operating in broadcast mode, cannot reply back with ranging or battery status information. Is the potential for this lack of information enough to warrant concern, and do alternative methods of gear recovery exist in the case of a potential failure?
- To what degree do you, the fisher, experience complications from high currents? If currents are high in your fishing area, consider that individual release mode will give you more precision than broadcast mode when locating your ARC and other gear. This allows you to know where the buoy should pop-up and grab it quickly enough to avoid the buoy from being pulled under by the current.
- While the ARC-2 and STM-4 are cheaper in cost than the ARC-1 and STM-3, the ARC-2 is only partially serviceable by the fisher. The ARC-2 has a non-rechargeable lithium ion battery which may degrade in battery life anywhere from 3-10 years in time. This means the ARC-2 has a lifetime limit, while the ARC-1 is easily serviceable by the fisher,

technician or Desert Star, leading to an average expected lifetime of 10 years before major servicing. Therefore, which is most cost effective for your practice?

Other Preparations

This section intends to cover some things we ourselves (Desert Star crew) has learned when testing out at sea. Please note, there may be some circumstances this document does not account for. Also note, each boat, fisher and fishery are unique and may call for something different. Once an ARC has been triggered by broadcast mode, that same ARC will not be able to release. With that in mind, create a checklist for all materials and run through that list before leaving for the at-sea testing. A checklist may look like this:

Materials	Quantity
ARC and stowed bag system with rope	2 or more
Hard 8' floats	2 per system
STM-3/4 and tablet/laptop	1
ARC accessories, allen keys, spare burn wire, spare screws	1 set
Ropeless Fisher enabled device	1
Spare lithium and AA batteries for ARC	At least enough for one ARC
Multi-meter	1

Notes on the checklist

1) Typically, you should test as much of your gear as possible. However, that may be impractical right off the bat, so test at least 3 or more systems on the first go.

2) Commonly fishers (regardless of current or fishery) like to use two 8” hard floats per system.

You may use any floats you desire.

3) STM-3/4 and tablet/laptop should be charged overnight (or on the vessel if needed, standard AC power required).

4) The ARC accessories refer to the allen wrench, spare burn wire, screws and so forth. Your first time may be messy, so be prepared!

5) The Ropeless Fisher App is covered in the next section, just ensure an Android device running Ropeless Fisher is present (and charged).

6) Spare batteries for the ARC should always be on-board the vessel, it’s always a good idea to have spares just in case.

7) A multi-meter can be used to ensure ARC batteries and power is sufficient in case anything goes wrong.

Next, some tips on how to conduct the at-sea testing. Here we provide a short list to run down, and a more in-depth section.

Perhaps most important is to realize you should ease into all testing. Even if you are confident and the gear has a very high likelihood of working as intended, be patient and meticulous in your testing.

The short list (recommended first time at-sea testing practices)

- 1) Inform other fishers of your testing to ensure they don’t overlay gear on yours.
- 2) Prepare mentally for potential problem solving and use patience.
- 3) Conduct a noise test of the boats equipment before going out to sea.
- 4) If using a trawl, submerge one end, and use a safety line on the other end (for phase 1).

- 5) If using singles, submerge the gear, and ensure you can grapple if necessary.
- 6) Always begin testing in rather shallow waters, preferably 20-30 fathom (for phase 1).
- 7) Approach the system WITH the water current.
- 8)

Now for a more in-depth list of tips.

- 1) At the time of this writing, the use of ARC's is pretty well documented, and success is common. The most major problem a fisher will run into, are not issues with the gear itself, but coordinating with other fishers instead. Make sure you inform other fishers around your grounds of your practices. In most (but not all) instances, fisheries have 'unwritten' rules of where each fisher is fishing, and most fishers agree that informing their neighboring fishers is quite easy.
- 2) The use of problem solving is going to be crucial in these next few days, weeks etc. The issues you may face will most likely relate to what crew member should do which task, when to re-set ARC's, using the Ropeless Fisher app and so on. The take away is that using any Ropeless Fishing system will require a modification to your fishing routine, there is simply no way to get around it. The good news however is, the change in routine with the ARC doesn't need to be drastic, and it will end up saving your gear and potentially the lives of your ocean community as well.
- 3) This is crucial to ensure the STM and ARC communication isn't drowned out by other equipment onboard your vessel. To conduct this test, ensure your STM, tablet and over-the-side transducer are setup on your boat.
 - a. Now enter the AC-control software.

- b. Click 'Action' in the top menu bar, then 'Noise test'.
 - c. Ensure that (with all equipment on) there is no interference beyond 150db. If so, the communication between your surface station and the acoustic release will likely not be as efficient as possible.
- 4) If using a trawl, it is a good idea to begin with an "insurance policy". Begin by submerging only one side with an ARC system. The other trawl side should be a standard surface buoy line and is hence named the 'Safety line'.
- 5) If using a single trap, your "insurance policy" is slightly different. Submerge the trap in a location which allows for easy grappling, such as shallow water with a level (flat) seabed.
- 6) As a general rule of thumb, ease yourself into testing and begin in more shallow waters (20-30 fathom) Note this will reduce range of your in-hull transducer.
- 7) Sonar communication is a sound signal passed through water. In very high currents, that sound signal may be distorted so much so, that the ARC cannot 'hear' any commands. If this is the case, the best practice is to slow your vessel during approach and move WITH the water current.
- 8) The beam pattern of your thru-hull transducer is similar to that of a flash light. Meaning, only ARC's within the beam pattern can receive commands. Now imagine, the closer to a wall the flash light is, the smaller the radius is, this principal is the same with the thru-hull transducer. If testing or fishing at shallow depths, you will need to be closer to your gear, as opposed to deeper waters which allow for wider beam patterns.

Aside from these common tips, it is also recommended (before and during at-sea testing) that you begin to think about the logistics of your new equipment. For instance, if you are a one-man crew, you will need additional time to set-up the ARC's for each trawl/single. In many cases however you likely will have at least one other crew or more. In that case, the captain should cover functions like interrogating the release, using Ropeless Fisher and so on. Meanwhile, deckhands should cover their respective tasks such as re-arming bags and ARC's and so on. This equipment will become part of your routine, so allow time for adjustment and note that your first few runs will be much slower than when you get used to the system. For reference, fishers in New South Wales mention they actually save more time using the ARC, however their very first runs added several minutes to the process of retrieving traps.

Summary

In Section I we covered the principals and reasons for which Ropeless Fishing is needed. From conservational concerns regarding the impact of fixed lobster and crab POT fishing gear, to

man-made risks, Ropeless Fishing offers a series of significant and never-before-seen advantages for fishers worldwide. Common setups for Ropeless Fishing applications were explored, as well as tips and advice from fishers who have been using the ARC-1XD for several years at the time of this being written. Finally, section 1 finished with Ropeless Fisher, a virtual gear marking and gear de-conflicting app available for free to all.

In Section II we covered the implementation of the ARC-1XD and associated gear from the reception to at-sea testing. Visual inspection, testing gear in a controlled setting, harbor testing in real yet recoverable conditions, then finally moving to on-boat testing is a process which should be followed to ensure success. Furthermore, installing relevant sonar transducers, and choosing your release mode will play a significant role in how Ropeless Fishing affects your fishing practice.

Thank you for reading all of or part of this document, if you feel something was left out, please let us know by emailing us at: salesinfo@desertstar.com. We would also like to thank all the fishers, policy makers and others who have made this possible and encourage you the reader to keep an eye out for future updates.

www.desertstar.com/ropeless-fishing

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