Ricketts Launch and Recovery System Development and Testing Cruise on the R/V David Packard - February 2026

Andrew Hamilton

Summary

In February 2026 we undertook an effort to implement an improvement to the constant-tension mode in the Doc Ricketts Launch and Recovery System on the R/V David Packard. As installed, the constant tension mode lacked sufficient responsiveness to keep up with wave- and ship-motion induced variations in tension. The original intention for this system included the ability to deploy the ROV alongside the vessel and have the ROV umbilical maintain tension to control the vehicle in a safe and predictable way before the actual dives began. This capability is required in order to attach/detach the lift-line that is required to hoist the ROV out of the water, and is desirable in some cases to allow the ROV pilots to complete their pre-dive activities without the need to actively position the ROV. The constant tension mode implemented by the vendor was not suitable for this requirement, and only covered very slow motions such as those that occur when the ROV is moved out of the hanger to the deployment position by extending the crane trolley and extension horizontally. In particular there was no tension feedback in the system, the original implementation consisted only of setting a constant torque in the traction-winch motors, and this approach is unable to compensate for faster motions that required the umbilical be quickly-hauled in or payed-out.

In the months leading up to this implementation activity and test cruise, we identified an alterative control strategy that uses the already installed load-cell to monitor the umbilical tension and modulate the traction-winch motor torque to maintain a target tension. Through numerical modelling and analysis, we were fairly confident this basic capability could work, but questions remained about how practical it would be to modify the existing software system to accommodate this mode. Additionally, it was not clear what speeds the traction-winch would need to achieve to keep up with the most severe sea states the system is intended to work in. These considerations and also the possibility that the system contained unknown non-linearities and resonances made this implementation effort a high-risk affair, and the short time-frame available to have the necessary software engineering resources on-site also limited our options in how we proceeded.

After a week of on-shore development and a four-day test cruise in Monterey Bay with Erlend Hansen here to assist with the programming, we were able to implement the required constant tension mode and necessary software features to make this an operational system. During the test cruise we had mild conditions and while this greatly assisted our development, it limited our ability to test the system in all expected sea-states. In the conditions we experienced, the system performed well in the new constant tension mode and we were able to simulate additional ship motions by turning the ship to be beam-to the incoming swell. An example of the system in use can be viewed here: Ricketts_Alongside. Through these exercises we developed a near-complete understanding of the system and its implementation, but additional testing and use will be required to understand its behaviors in larger sea states. We expect this testing can occur during planned operation of the ROV and may involve the adjustment of some parameters that influence the new features we've implemented. This can be done without Erlend being onsite and only after gaining this experience can we say definitively that this problem is solved.

As a result of this work, a handful of upgrades/changes that could be implemented have been identified, most of these are fairly straightforward hardware changes and one of them should be implemented as soon as is practical, while others need to await more testing and use of the system. The most important immediate upgrade is an improvement of the over-boarding "out-hauler" system. As detailed below this system may benefit from a drive wheel made of a softer material than the current nylon wheel which tends to slip too easily on the greased umbilical. This should be a straightforward effort to help reduce the chance of the umbilical becoming slack inside the vessel and possibly jumping the traction-winch sheave. A second immediate change to consider is the addition of an uninterruptable power supply to keep this system powered for the short time of shore-power switch-over that occurs at the start and end of each cruise. The remaining suggested upgrades are related to the peak-speed requirements of the system and their will depend on the observed performance of the system in larger sea-states. All of these are described in more detail below in the section *Future Upgrade Options* below.

With an anticipation that this system can meet the needs of the ROV, we are led to the question of long-term maintainability. During this development and test period we learned a lot about the system, its history, and the support options that are available. This is described in detail below in the section *System Maintenance Issues and Options*.

Implementation and Performance Details

The fundamental capability that has been added is an improved constant tension mode that monitors the umbilical tension through the installed load-cell, and directs torque to the main traction-winch motors in order to maintain the tension close to a target tension. Although conceptionally simple, the tension-control performance of the resulting implementation was subject to risks that were hard to entirely resolve beforehand. We were successful in developing this capability, and in the process uncovered a natural resonance in the tether system that is currently limiting how accurately the tension target can be maintained. Fortunately, in spite of this detail the performance currently achieved appears to be satisfactory for the application within the testing done to date and our expectations. Nevertheless, there is room for improvement here with some mechanical changes to the system that could be considered if better tension-tracking performance becomes needed as we explore use in larger sea-states. More details on those possible modifications are described below in the section *Future Upgrade Options*.

The basic tension-tracking capability described in the previous paragraph is the lowest level capability that was needed. Also important are techniques to smoothly enter and exit this constant-tension mode, limitations on the peak rotational speeds the traction winch is allowed, and considerations and modifications necessary to ensure the umbilical storage drum can keep up with the required traction winch speeds. All of these features have been implemented and have resulted in a number of parameters that can be changed to optimize the performance of the system, the most important are listed below.

Parameter	Description
TargetTension_kg	This is the tension target the system works to maintain.
speedLimitHaul	The maximum traction-winch RPM allowed for hauling-in tether.
speedLimitPay	The maximum traction-winch RPM allowed for paying-out tether.
Kp,Ki,Kd,Tf	PID control loop gains

Table 1: Settable parameters affecting constant tension mode behavior, these and others can be adjusted from the Human-Machine Interface console.

The parameters in Table 1 are the main items that can be tuned to adjust the behavior of the system. The TargetTension_kg parameter represents the tension the system is aiming to maintain in the tether, values between 300kg and 700kg were tested during the February cruise. In normal operation the system kept the actual tether tension within a few hundred kg of the target as expected. Subjectively the ROV was a bit better behaved alongside at the higher tether-tensions which limited its lateral movement a bit more effectively and kept the ROV mostly under the over-boarding sheave.

The speedLimitHaul and speedLimitPay values have the most significant impact on the behavior of the system and need the most testing in higher sea-states. The traction-winch motors currently have a maximum upper speed limit of 25 RPM, which is a speed that should just keep up with the expected motions in sea state five based on our analysis. However, this has not yet been fully validated and in fact we do expect that occasionally the sea will lift the ROV up faster than the traction-winch can haul in, leading to slack-wire conditions and a subsequent tension peak when the tether becomes tight again. It is not yet clear what the best strategy for this situation is. On one hand the option of allowing the traction-winch to run up to it's maximum of 25RPM will limit the occasions the tether becomes slack, but result in a lot of winch speed and tax the storage-drum system to keep up. And on the other hand, limiting the traction-winch speeds to a slower value using the parameters outlined in Table 1 will cause the tether to become slack more often, but the system should do a better job of limiting the subsequent tension peak. This is because when the speed is limited, there is less energy to deal with in the spinning-traction winch and the motor torque will be able to stop the winch and start paying out more quickly when the tension returns. This second approach is currently implemented and the limits are set to 20RPM for haul-in, and 18RPM for pay-out. During the test cruise we were able to create slack-tether conditions by limiting the haul-in speed to a much smaller value (10RPM) and the system managed to recover from these slack events with a modest tension-peak of 1400kg when the tether became tight again. Investigating this behavior and setting these limits in higher sea-states is the primary goal of further at-sea testing. We will note here that it is the magnitude of the subsequent tension peak that is the problem when the tether becomes slack, as long as the tether inside the ship on the various sheaves remains reasonably tight and doesn't jump off any of the sheaves. This is the situation that leads to the suggested improvements in the out-hauler system described below.

There remains one software addition that could be done to increase the margins with regard to the chance over-running the storage drum capabilities. As originally implemented, the approach was to be sure the system had enough capability to always be able to respond to expected accelerations of the traction winch. The new constant tension mode results in faster traction-winch speeds so we increased the performance of the storage drum to keep up. More experience is needed but when the haul-in and pay-out speeds are increased to their limit of 25 RPM, the storage drum will have some risk of bottoming out the slack-wire compensator. The slack-wire compensator is a pulley device that momentarily allows faster umbilical accelerations than the large storage drum can keep up with, but is important to not exceed its travel limits. A software protection is possible that limits the traction-winch speed if the slack-wire compensator were to approach it's end of travel, but we ran out of time during this implementation and testing period to correctly identify the best way to implement this and still have time to test these features. As we learn about the desired pay-out and haul-in speeds, we may revisit this and choose to implement this software protection.

Future Upgrade Options

There are five upgrades to the system to consider at this time, all of which are fairly small efforts compared to what has been done so far.

- A change of the out-hauler drive wheel to a softer material to improve the out-hauler performance
- The addition of an un-interruptible power supply for the winch system computer and logic components to avoid issues at shore-power cutover.
- An improvement to the hydraulic power unit that supplies oil pressure and flow for the slack-wire compensator.
- A software update to protect against the chance of an over-speed causing the storage-drum and slack-wire compensator from being pushed beyond their limits
- The addition of an additional idler wheel in the umbilical path through the ROV hanger area.

These are described individually below.

The out-hauler system is intended to keep the umbilical tight inside the ship and keep any umbilical slack that occurs outboard of the final over-boarding sheave. In working with Erlend during this cruise we learned how this system is implemented and it appears to be limited by the relatively hard nylon sheave that is meant to grip the umbilical at the over-boarding sheave and keep it tight through a constant-torque implementation. Changing this to a softer polyurethane wheel would be straightforward and allow this system to put more tension on the umbilical with less slip. There are vendors who make such components and we would need to do some adaptions to allow it to bolt into the existing motor shaft and flange.

At the start of the test-cruise, an unusual event happened in which it appears the shore-power cut-over at departure caused some parameters to be corrupted in the communication cards that allow the ABB traction-winch drives to communicate with the Beckhoff PLC that controls the system. This was an issue that really should absolutely not be caused by a power-cycling, and our best guess is that ABB has a problem with these components that can be rarely triggered (it's never happened before on this vessel, we know this because the issue was not corrected by a second power-cycle so would have persisted). As a result of this a procedure was put in place to shut down this equipment during the shore-power cutover, which may help although without knowing exactly why this happened it's not a guarantee. A second mitigation which would at least reduce the chance of this recurring is the addition of a small uninterruptible power supply to the Macgregor cabinet to keep the logic components of this equipment powered during the power switch-over. There may be issues with this, but it could be considered in any event. We also worked to back up as much of the configurations as we can onto the ship laptop, but more work needs to be done to develop procedures to restore any corruption that happens.

The slack-wire compensator system includes a hydraulically activated ram that takes up excess cable during high accelerations of the traction-winch. Currently there are two pump and motor systems that are operating in an on-off mode, turning on when the oil pressure drops below a limit. This could be improved for two reasons. The first is that the motor cycling is hard on the relays controlling the motors, at the least the ship should have some spares as these relay will fail with enough use. The second reason is that if this oil pressure drops for greater than 10 seconds, the winch system is programmed to turn off, abruptly. With the new system demanding faster speeds this is more likely to happen and will be disruptive to launch and recovery operations. During the implementation and test week, we did adjust a number of parameters in this system to provide considerably more margin, but a more reliable and elegant solution would be to add a VFD drive that adjusts its speed continuously to maintain the required oil pressure.

Also related to the slack-wire compensator system, and as discussed above, it would be desirable to add a software protection for over-speeding the storage-drum system. Currently the system does not have such protection which may end up limiting how much of the traction-winch speed capability we are able to use. Further testing in higher sea-states will help identify these needs a bit more clearly. It’s possible this feature could be added by engaging Erlend remotely from Norway and it would be a single day effort to implement and test dockside.

Finally, an unanticipated resonance occurred in the system when the ROV over-boarding crane is fully extended. In this configuration the umbilical stretches through the ROV hanger for about 22 feet, and has the tendency to oscillate transversely as a power-line might in the wind. This oscillation is of such a frequency that the tension control loop reacts and perpetuates any oscillation. Ultimately this oscillation limits how tightly the system can regulate umbilical tension as a tighter gain tuning than what we implemented causes this oscillation. Currently this appears to be the limiting factor in how accurately the system can control tension, and recover from umbilical slack without a large subsequent tension peak.

In addition to the particular above-listed items, an additional review effort also makes sense to identify possible failure modes in the new system. A byproduct of the increased tension control performance is the fact that the traction-winch motors are now free to exert more torque than they were previously allowed to, leading to the possibility of high-tension events in the case of component or wiring failures. The peak torque capabilities of the motors are now set at a point that can lead to tensions that are about half the break-strength of the main umbilical, although this will never occur unless there are component failures. Along with these considerations, a few operational procedures such as checking that the load-cell is reporting a sensible value before engaging constant-tension mode have been developed and should be documented along with procedures to follow in the case of unexpected behaviors.

System Maintenance Issues and Options

During the time with Erlend here, we spent time exploring the situation with MacGregor and what the options may be for future support of this system. It appears that MacGregor as a company has lost all interest in supporting these systems and absent a contract with them compelling them to provide such support, our options are a bit limited. The required support falls into two types, those related to software and those related to spare parts and mechanical items.

For software support, the only option currently is to continue to engage Erlend through MacGregor as we have done in this effort. This is certainly possible for the next immediate number of years, but isn’t a great long-term solution as Erlend will retire eventually or otherwise become unavailable, and/or MacGregor will stop facilitating this which may be their right as the owners of the software. It does not appear that there are others training up behind Erlend to understand the intricacies of these systems so in that way the software will become obsolete at one point for reasons of maintainability. MBARI is not alone in this situation and Erlend’s company Setpoint has addressed this for a number of other vessels by developing a software solution for this hardware that can be installed on the existing computing platforms without hardware changes. This change would cover the software needs of all the MacGregor systems on the ship. It appears other vessels are choosing the expense of this route in the near-term to ensure they have supported systems. We discussed this possibility at the beginning of this effort in September with Erlend, but at that time their solution was only just becoming available and it was clear it was premature to consider for the Packard in light of the need to add features. In a short time however, this will become a practical path and we learned that the Setpoint agreements with MacGregor include provisions for Setpoint to keep access to features they develop in the process of maintaining existing MacGregor systems. This means that the new constant-tension capabilities we have developed here could be ported to the Setpoint solution without entanglements. Very casually Erlend offered when asked that the effort involved to make this switch would be six to eight weeks of office work followed by two weeks of commissioning and test on-board the vessel, no hardware changes would be required. Before committing to this path however we would want to understand the future viability of Setpoint, their commitment to maintaining these systems long-term, and their willingness to enter into an appropriate service agreement. Setpoint itself is a small group of five or so engineers that departed MacGregor, but have recently joined a larger automation group Haneseth (https://www.haneseth.no) that involves hundreds of staff and a range of divisions and activities.

Hardware support of the launch and recovery system and associated winches is less clear but also perhaps less critical. Most of the components in the system such as the motors, drives, gearboxes, hydraulic pumps etc. are generally available. The MacGregor specific items are the winch-drums themselves along with the associated bearing solutions. One would expect these components to have a long life in this limited duty-cycle application, and probably could be replaced one by one in the future with new components from another vendor as long as software support was available. The overhead crane and trolley system itself is complicated and may have some MacGregor specific components, so maintenance needs there will need to addressed as needs arise.