R/V *Sikuliaq* Debrief Questions – UNOLS Fleet Improvement Committee 2015

Dear Chief Scientist:

The UNOLS Fleet Improvement Committee requests that you provide feedback on your recent cruise on the *R/V Sikuliaq*. The purpose of these questions is to help determine how key underlined design and outfitting features of the vessel have either benefited or hindered your cruise objectives. The FIC will use your feedback to inform design recommendations for future Ice Capable and Global Class Research Vessels. A member of FIC will contact you by phone shortly after your cruise to get your responses. You may also submit written responses to me if you prefer.

Sincerely,

Clare Reimers
FIC, Chair
Email: creimers@coas.oregonstate.edu

In answering these questions it is important to note that this was the first science cruise for the RV Sikuliaq and overall, given where the ship and crew started from, it is an excellent ship with a professional, diligent, and hard working crew that did all they could to ensure the successful completion of the cruise.

1. Size: The *R/V Sikuliaq* has a LOA of 261 ft, a beam at midship of 48 ft, and has berths for 26 scientists and technicians. Science labs occupy 2250 sq ft and the deck working area is 4360 sq ft. **Has the overall size of the vessel either enabled or hindered you in meeting the science objectives of your cruise? Is there sufficient lab space of the appropriate type? Are there sufficient berths available to accommodate an optimal science party? Were the living arrangements satisfactory? Please explain using specific examples that relate to your science objectives.**

The size of vessel, deck space, laboratory space enabled the completion of the scientific objectives. We were launching and recovering the AUV Sentry that comes with two containers, by no means a huge amount of gear, but there was plenty of deck and laboratory space to accommodate everything we would want. I've also been on several interdisciplinary cruises doing ROV work and the Sikuliaq would have been able to accommodate that kind of research cruise as easily, or perhaps more easily than other global class ships. Lab space is plentiful with good divisions that would allow a number of different types of work to be done. As of our cruise which was the first science cruise the labs were sparsely populated with extra benches/ tables and chair and there was minimal if any only knee space for sitting and working at bench tops. But in talking with the marine techs there are plans to change the configuration.

Living arrangements are quite good and I liked having the all the science berthing and mess etc on one level.

One issue was there isn't a lounge with comfortable couches and chairs for movie watching, reading and relaxing. The only place people can go to relax and get some down time is their cabin. Making what is the conference room now into a lounge will greatly improve the living conditions and habitability of the ship. I presume this has already been addressed.

2. Performance: The endurance of the *R/V Sikuliaq* is ~45 days with an expected range of 9,000 nm at 11 knots. The vessel has a design maximum speed in calm open water of 14 kt and is designed to operate in 3 ft of ice at 2 kts. **Have any of these performance capabilities of the vessel either enabled or hindered you in meeting the science objectives of your cruise? If the ship operated in ice during your cruise, how was the performance? Please explain using specific examples.**

At least for our cruise the quoted cruising speed isn't 11 knots it was closer to ~10 knots in good sea states but even then fuel consumption was rather high. I'm sure that with more operational experience the trade off of speed verses fuel consumption will be dialed in. One reason I mention this is that in my conversations with Captain Hoshlyk and the Navigation officer there were some questions as to whether the original funded ~50 day cruise with the long transit distances at 10-11 knots would have been possible given the current fuel capacity.

Ship did not operate in ice during our cruise.

3. Over-the-Side Handling Systems: The *R/V Sikuliaq* has been outfitted with a system that allows "hands free" launch and recovery of CTD and other systems within a Baltic Room on the starboard side using an overboarding boom with docking head and motion controlled winch systems. It also has:

- An articulating Stern A-Frame
- Port and Starboard Knuckle, Extension Boom Cranes
- Two Mo-Comp Hydro Winches (.322 EM Cable)
- Traction Winch with two tension member drums (.680 EM Cable and 9/16 3X19 Wire Rope)

Did these systems have a positive impact on your work and if so how? Are there any negative impacts associated with these systems?

We did ~20 CTD cast with water sampling and I've done a ton of CTD cast on other research cruises. The over-the-side handling systems and hands free launch and recovery is fantastic as far as I'm concerned! So much easier and safer, and it cuts down on the ships personnel. We did a handful of cast in some pretty heavy seas with large swells

which is where you really see the benefits of the system, namely in terms of safety and the ability to operate in heavier seas.

The port and starboard Knuckle, Extension Boom Cranes also worked well and were more than capable of handling the launch and recovery of the AUV Sentry. I can easily see these cranes being an asset to other kinds of deck operations. During the cruise there were some hydraulic problems with these cranes that could have resulted in damage to the AUV, but those were more warrantee issues.

We did not use the other winches and A-Frame, but again I can certainly see that with a few additions the Stern A Frame would be capable of launching and recovering even a submersible.

4. Hull Mounted Sonar Suite: The ships sonar flat is outfitted with:
- Kongsberg Ksync - Sonar Synchronizing system
- Kongsberg EM302 .5X1 - Multibeam
- Kongsberg EM710 .5X1 - Multibeam
- Kongsberg TOPAS PS-18 - Parametric Sub Bottom Profiler
- Kongsberg EK60 (18, 38, 70, 120, and 200 kHz) - Split Beam Sonar
- Knudsen 3260 12 kHz - Chirp PDR
- Benthos UDB-9000 - Acoustic Modem
- Teledyne RDI OS 75 kHz - Acoustic Doppler Current Profiler (UHDAS)
- Teledyne RDI OS 150 kHz - Acoustic Doppler Current Profiler (UHDAS)
- LSE 297 50 kHz - Bridge Navigation Sonar
- LSE 297 200 kHz- Bridge Navigation Sonar
- HAP 5050 Array - Self Noise Monitoring Array
- Doppler Speed Log

Which of these systems were essential to science objectives during your cruise? What is the quality of the data collected?

Multibeam mapping using EM302 and EM710 was one of the central objectives of this cruise. We also used the Ksync, the TOPAS PS18 and the Doppler Current profilers. Quality of the bathymetry and backscatter data collected was quite good and we were able to process the data quickly and use it in the AUV dive planning. The computer laboratory where all these system are controlled is well set up, functional and efficient. Having Konsgberg Helmsman linking the computer room and bridge made planning and executing survey lines much easier. We were mapping seamounts and were adjusting survey tracks on the fly based on data from a just completed survey track. The one limitation is bubbles adversely affecting the hull mounted sensors such that even in moderately large swells there were some tracks directions that lead to poorer data quality. This is part a function of the ice breaking hull design and not much can be done about it I suspect. Overall I'm quite impressed with these systems.

5. Retractable Centerboard with mounted acoustic transducers: The *R/V Sikuliaq* is fitted with a retractable centerboard that can be lowered to 8 feet below the keel and on which there is an EK 60 array and a spare 12' acoustic well for ship and science use. Transducers are changeable alongside. **Has this arrangement had any significant positive or negative impacts on your work?**

We mounted USBL transducer on the retractable centerboard for subsea navigation of the AUV Sentry. Operating the centerboard for this purpose was much easier and more efficient (saved time) than mounting the USBL transducer on a swinging pole that has to be raised and lowered for each dive. Having the swinging pole would have limited the mobility of the ship and the types of operations we could have done during an AUV Sentry dive. Thus the retractable centerboard had a clear positive impact on our work.

6. Acoustically Quiet: The *R/V Sikuliaq* was designed, engineered and built to meet ICES 209 noise limits above 200 Hz at 8.0 knots. Radiated airborne noise within the ship is also designed to be at low levels. **Have you noticed any difference compared to other vessels, and has this had any positive or negative impacts on your work?**

I didn't notice the noise with the exception of the banging anchor (a warrantee issue that will be fixed I'm sure) and the thruster noise (see note below) so that is a positive impact.

7. Vans and deck space: The van set up of the *R/V Sikuliaq* for any particular cruise is "modular" in that there is a choice between more deck space or more enclosed lab, berthing or storage space. The design of the *R/V Sikuliaq* incorporates the ability to fit three 20 ft ISO Containers vans on the aft deck for berthing, lab space or other uses and a 10 ft van forward on the 02 Deck. These vans are mounted to dedicated deck fittings, and provided with services such as power, water, comms, drains etc. **If you have used the vans, how well did they accommodate your space requirements? Did this modularity have a positive or negative impact on your cruise planning and work at sea?**

We did not use the modular vans but as noted above the ability of the ship to very easily accommodate the two Sentry containers and the AUV Sentry in exactly the desired configuration suggest this will be positive aspect of the RV Sikuliaq.

8. Dynamic Positioning: The *R/V Sikuliaq* was designed and outfitted with dynamic positioning (DP) capabilities. This is accomplished by using twin rotatable Z-Drives, a trainable bow thruster and a commercially available computer controlled precision navigation system. All of these components add cost, maintenance requirements and complexity to the operation of the vessel. **How important was the DP system to your work? How well did this system operate during your cruise?**

The DP system was critical to our work both for tracking the AUV Sentry and for station keeping during CTD operations. The bow thruster seems to be underpowered, it was over heating if used a lot and it was extremely noisy at times. One should double check my assessment with the Chief Engineer as this is only my impression. None of the issues

adversely impacted the science mission except for the noise being loud enough to wake people up in certain cabins. This over stressing of the bow thruster may also have been a function of crew learning the optimal way of running the system as it seemed to get better as the cruise went on.

9. Lab Arrangement: The *R/V Sikuliaq* labs were pre-outfitted with lab benches and science services (air, electricity, water, seawater, etc). **Did you find the existing arrangement easy to modify and was the quantity of service outlets for air and water adequate, too many or too few?**

Lab arrangements were easy to modify but we did not have need to do many modifications and labs were not fully furbished at the time so it was easy to set up what we wanted where we wanted.

10. Pilothouse Arrangement: The *R/V Sikuliaq* has some areas for observers to sit and stand in the Pilothouse, as well as on top of the pilothouse. **Did you find those areas adequate for science observations?**

We were required to maintain marine mammal watches on the bridge and the areas for observers to sit and stand in the Pilothouse and on top of the pilothouse were ideal and worked very well.

11. Internet access and bandwidth**: Did you plan telepresence activities and were facilities satisfactory? Did you have high speed internet or special bandwidth requirements for science? Was the internet connectivity adequate for other broader impact, science or normal communication activities?**

We were expecting the telepresence system in some capacity would be available in order to facilitate dive planning with the co-PI on shore. However, the telepresence system was not operational and no specific high speed or special bandwidth requirements were planned although they were requested specifically in pre-cruise planning calls. Because of the large number of items to prepare we were not able to test the system as planned.

Overall Internet was far too slow to the point of not working at times. Only a limited number of the science party were allowed onto the ships Wi-Fi network, with the remaining people having to use the ship computers. I understand it is the same situation for the crew as well. Everyone tried to limit Internet use to only work functions but even then communications was too slow to meet many of my shore side work obligations, as was the case for most people. Involving the onshore co-PI in dive planning discussions was difficult most of the time, and frustrating some of the time. Perhaps we've been spoiled, but many have the expectation of being able to maintain some communication with the shore so we can continue to be productive in our other work. The communication challenges were the most frustrating aspect of our SIkuliaq cruise.

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12. Other Features: **Can you describe other design, outfitting or operational features of the *R/V Sikuliaq* that had significant positive or negative impacts on your work at sea? Should these features be requirements of other new UNOLS Research Vessels? Were there any important design features missing which would benefit a wide variety of projects?**

Phone Debrief responses by Dr. Masako Tominaga on R/V Sikuliaq conducted by F. Martinez on 11-24-15.

This was a geophysical cruise on R/V Sikuliaq using ship based multibeam, magnetics and seismics and near bottom magnetics using the Sentry AUV and MISO Deep-Tow vehicle to investigate the Jurassic Quite Zone in the Western Pacific.

Dr. Tominaga mentioned that the post cruise assessment report also has detailed information on the ship performance and capabilities during her science cruise. Also, she participated on two Sikuliaq sea trials and submitted additional assessments on those cruises that may be of interest. However, I did not read these prior to our phone conversation and do not know if FIC members have access to these reports.

1. Size) Dr. Tominaga was especially complementary of the large deck space to work with, which prevented interference between various activities on deck. Even with a van on the deck there was no problem with over-the-side operations.

She found the lab spaces lacking for geophysical cruise work, however, requiring the science party to make space available and fashion restraints to secure computer equipment. Lab spaces appear to be geared to chemistry. The science party had to prepare available space for computers, etc. and find table space for laying out maps & charts. The need for ample table space is especially keen for mapping work that produces large charts from the multibeam system and AUV/ROV vehicles.

Dr. Tominaga found that living spaces were generally pleasant and adequate. The one annoyance she mentioned was that loud conversations would sometimes take place in the passageway near the galley near some science party staterooms. She attributed this to a lack of awareness of the 24 hr. science work schedule and that this may improve as awareness develops.

2. Performance) The main issue here was described as a strong roll of the ship. This made extra precaution necessary on deck and even inside. Dr. Tominaga described one 28° roll that disrupted the kitchen and the strong rolling made it difficult to prepare meals. She did not know if roll compensation features were available or properly working.

Speed and endurance were OK. The maximum underway speed they used was 12 knots. They operated at 1.5 to 2.0 knots when using Sentry. This entailed lots of work on the Z-drives.

3. Over-the-side handling equipment.
Used stbd. crane for Sentry and A-frame for deep-tow system. She commented on the good work of the crane operators. She found the ball on the knuckle crane dangerous due to roll. Had to be held. The pre-refit A-frame worked well, although had some hydraulics problems.

4. Hull mounted sonar suite.
Dr. Tominaga was pleased with the EM302 multibeam system, which apparently worked well even though the water depths (5700-6000m) were beyond the design specifications of the system. She also found that the Kongsberg Topas sub-bottom profiler worked very well

and commented that it was an improvement over the Knudsen system. They also used the Teledyne sonar and Doppler speed log but had no specific comment on these. She found the noise monitoring sonar useful when tracking the AUV and assessing noise during acoustic modem communication.

5. Retractable centerboard with mounted acoustic transducers.
Dr. Tominaga was very pleased with the retractable centerboard. She commented that this improved very much USBL tracking of the deep towed vehicle by lowering the transducers away from the noisy environment near the ship's hull.

6. Acoustically quiet.
Dr. Tominaga did not specifically comment on this feature.

7. Vans and deck space.
Dr. Tominaga commented that the Sentry group had two vans on deck and even so the large deck space facilitated the handling of over-the-side equipment, which required tag lines.

8. Dynamic positioning.
Dr. Tominaga commented that DP was needed during launch and recovery of the vehicles and during towing. She felt that the DP was not optimal, but was not sure if the Captain and crew were still learning the response of the Z-drives due to lack of experience on this ship or if there was some mechanical problem.

9. Lab arrangements.
As Dr. Tominaga commented previously, she thought the labs were designed more with chemical work in mind rather than geophysical surveys. Science party had to find space for and secure computer equipment and large table space for laying out maps was lacking.

10. Pilot house.
The main comment here was that the back deck can't be observed from the main pilot house and that the aft pilot house had to be used during various operations.

11. Internet access and bandwith.
Dr. Tominaga noted that the internet capabilities did not meet expectations for normal communications. She did not note any high intensity telepresence activities. However, she noted that using AUV's there is often a need for troubleshooting from the home lab, sending back data and uploading new software, so that this capability is needed even for normal science operations and it has an impact on the success of the science mission. She thought that even normal email was not always reliable, which is now expected for communication with colleagues on land. Despite improvements in equipment the bandwidth is still shared among several ships, which slows communication at times.

12 Other Features.
In this category, Dr. Tominaga only reiterated the bad roll of the ship. She did not know if this was a consequence of the ice capable design operating in the open ocean but noted that

it was worse than on other ships. She noted it may lead to requesting increased weather contingency time when using this ship.