My name is Scott Pegau and I am the Research Program Manager for the Oil Spill Recovery Institute (OSRI) in Cordova, Alaska. OSRI's mission is to support research, education, and demonstration projects designed to respond to and understand the effects of oil spills in the Arctic and sub-Arctic marine environments. As the Research Program Manager I am responsible for guiding OSRI's funding towards the best ecological and technological research and development related to oil spill recovery. OSRI is one of a very small group or organizations that fund this type of research. I also have experience as a researcher who has submitted proposals for conducting oil spill related research and development.

My comments focus on trying to develop new cleanup technologies that are likely to be utilized. I address the issue from the funding organization's perspective, however, there are many similarities faced by businesses that are trying to develop new technologies. Issues associated with restoration can be different, although they have some similarities.

When considering on the issues that impede introduction of new technology and approaches into spill response I find that there are several causes, but primarily there are three root issues that come into play.
1) Oil is a toxic substance. This creates numerous difficulties in proving a system works by making it difficult to test the system.
2) Oil spill response in the U.S. is conducted by a large number of small businesses. There are six spill response organizations in Alaska alone. Because they are small businesses there are generally limitations to the types of equipment they can afford or operate. The relatively small spill response community can create difficulties for outside approaches to be adopted.
3) The spill response efforts are highly scrutinized with high probability of litigation. This leads to wariness in using unproven technologies during spill response.

Note the Catch 22 situation between the first and third root issue.

When looking at developing new technologies the first issue to consider is "What type of technology is needed?" Most development is in response to lessons learned at an earlier spill. I am closely watching events in the Gulf to help inform me of gaps in our response capabilities. Unfortunately, the degree of information control being applied in the Gulf is making that job extremely difficult.

When dealing with situations that haven't occurred before this is a little trickier. Often issues are fairly obvious, like needing to improve the abilities in inclement weather conditions, or the ability to operate in different sea ice conditions. Based on experience we can guess at a majority of issues that need to be addressed, but our experience only provides us with a theoretical model of the situation. As with any model there are differences between the model and reality. These differences lead to adapting our approaches on the fly. Such an example in the Gulf is the use of dispersants at the well head, which is an application outside of what they were designed for. The way to reduce these unexpected issues is to conduct the appropriate experimental spills so we can learn in a more controlled set of conditions and extent than relying on spills-of-opportunity. Such controlled spills have not been possible since the early

1980s in the U.S., which is probably one of the greater factors in preventing the advancement of spill response capabilities. We can't fix problems we are not aware of.

Another issue regards knowing whether a new technology works or is any better than the existing systems. Standards are needed against which new equipment can be tested. How can a manufacture invest in developing new equipment if they don't know what the measures of success are? Or, a responder be confident that a new piece of equipment works if there are no standards? There are now testing standards for skimmers, but I don't think many of the skimmers have been actually tested using the standards. Additional standards need to be developed so manufacturers are aware of the tests their equipment must pass if it is to be considered for spill response. This will also provide a measure that demonstrates the equipment is proven technology to the response organizations that are the potential adaptors of the technology.

This can become more complicated if protocols are written with one technology named rather than listing the required capabilities. If the measurement protocols require a Turner fluorometer then there is no incentive for other companies to develop competing equipment because it cannot break into the market.

Beyond developing standards there must also be an ability to demonstrate that the technology meets those standards. This means there must be an ability to test the design, potentially at several different levels. Benchtop testing is needed during development, large scale laboratory tests are needed to show it may work in the environment, and in the end actual field tests must occur. There are many difficulties in conducting these tests.

One example to consider is the development of a new oil detection sensor. Among the first things needed is a sample of oil to work with. I am involved in such a project so I am learning the difficulties involved. The Advisory Board and Scientific and Technical Committee that guide OSRI funding includes members from the oil industry, and I work with a number of other individuals in the industry so I have a much better starting point than most, but here is what I am finding.

Based on recommendations from my Board I made a request for two liters of oil from the North Slope. I was put in contact with a couple of very cooperative people who thought it would be no problem to provide a couple liters of oil, but they had to check with the lawyers. The latest response is that they expect that it will take two to three months to get a decision whether my request can be filled. I could go to the National Institute of Standards and Technology and purchase oil for $379 for 50 ml (over $300,000 per gallon). This is not an option for someone who needs to test a large piece of equipment. A much more clearly defined means is needed for people to access affordable samples of oil and other materials, such as dispersants, for use in the development of new technology.

Once a new technology is developed it must be tested either in the lab or in the field. There is a strong reluctance to apply an unproven technology during an actual spill response so the

preference is to operate in a laboratory environment. However, there are very few large scale testing facilities. The Minerals Management Service Ohmsett facility is the large national facility. It is fairly expensive to rent, which creates difficulties for small businesses trying to prove their approach. The last quote I saw for operating the facility was for approximately $40,000 for three days of testing of a new large skimmer. There is a lot of work involved in being able to conduct these tests so I don't think the cost is unrealistic, but it can be prohibitive to smaller organizations. The funding for testing of this new skimmer was provided by a partnership of four organizations including OSRI. MMS has been very willing to let people test equipment when other tests are running, but it is difficult to figure out how to properly schedule these tests. Small businesses would greatly benefit if a small number of days were made available at the national facilities for testing their technologies at lower costs. For Arctic issues this means being able to work at the U.S. Army Cold Regions Research and Engineering Laboratory ice facilities.

In the end we still need to prove the technology in the field. Currently that is done by waiting for a spill-of-opportunity. When a spill occurs there may be a reluctance to use newer technologies in case it fails. It is also very difficult to arrange a test in a timely manner. There are a large number of potential technologies that are being marketed to the spill responders during a spill. The volume of new techniques may inhibit any being selected for testing. There are several ways that the issue of field testing may be overcome. One way is to develop a list of technologies waiting for testing during a spill-of-opportunity. Most importantly, have a clearly defined approach to get technologies on the list.

At this point most of improvements are incremental because they are easiest to get into the field. Another method to get equipment field tested is to allow controlled releases. The U.S. hasn't had controlled spills since the mid 1980s. I believe that lack of testing our knowledge is one of the biggest factors in our not moving forward in spill response capabilities.

Finally, consider developing a national testing and training facility associated with a natural seep. While natural seeps don't provide all the conditions necessary to test all equipment they do provide an opportunity to test equipment in the field.

The biggest issue facing field testing is regulatory. Regulations often prevent the newest technologies from being tested. For example, there is a lot of interest in using Unmanned Aerial Vehicles for spill response. These vehicles face significant hurdles in getting FAA permits to be used. This is not to say the hurdles are not appropriate and if people keep the regulations in mind there are still opportunities for advancement. OSRI tested a balloon-based surveillance system for spill response because tethered balloons have a simpler regulatory environment. This system allows for spill responders to get a greater view of the spill around them and gets the information directly to them instead of waiting for reports from aircraft, when they are flying.

At other times the regulatory environment is more difficult to work with, for example getting permission for a controlled spill. An alternative to using oil in the environment is to develop an

oil simulant to use in testing and training. Oranges and popcorn have been used as simulants, but have very limited application for actual testing of equipment. More appropriate simulants have been developed, but cannot get approval for use. Even normally benign and natural substances can have negative impacts when used at higher concentrations. It is becoming difficult to get permission to even use oranges or popcorn because they are not natural to the marine environment.

Most of my comments so far have focused on the development of new response technologies, but there are a number of other aspects of research that may transition from the scientific world to the spill cleanup and restoration activities. One issue that must be overcome is that the scientific research needs to be cutting edge to get funding. This generally means very specialized equipment or training that is not ready or appropriate for transition into everyday use. Remember spill response organizations are generally small businesses that cannot afford to hire people with the skills needed to apply the cutting edge science that may not be used for a decade.

It is difficult to incorporate cutting edge science during a spill response because people are extremely busy and don't have time to learn how to integrate the science into their current tools. This not true for restoration, which has more time to develop in its approach and has to be flexible in approach because of the range of species and environments that may be damaged. One thing OSRI tries to accomplish is to provide a bridge between the science and response world. It is critical to develop organizations that can bridge these worlds. By working to identify potential transitions and testing their application for spill response before a spill occurs we can help transition new science into cleanup and restoration efforts.

OSRI works closely with the Alaska Ocean Observing System and spill responders to provide opportunities for the newest models and observing capabilities to be used by spill responders and for the scientists to understand how to provide their data in a manner that can readily be incorporated by responders. Being a bridge between science and the applied world is not easy. I am trained as a scientist and often think that I have some great idea. Fortunately, I work with a number of spill responders that help me understand the issues with applying those ideas. It is important to have groups that bring responders together with scientists to see where overlaps between capabilities and needs exist.

Finally, we need to consider funding for bringing on the new approaches and equipment. There is little funding dedicated to spill recovery outside of industry. Minerals Management Service, U.S. Coast Guard, the Coastal Response Research Center (with NOAA), and Oil Spill Recovery Institute are primary funding organizations. Budgets are commonly under one million a year and organizations like OSRI funds improvements in environmental knowledge along with development of new equipment. Over the past few years the funding level has continued to decline. This may be in part because there hasn't been a major spill in years so people did not think that this type of research was necessary. The lack of a national oil pollution research plan makes it more difficult to sell the need for particular research. There is also a very appropriate focus on improvements in spill prevention. It is important to remember that no matter how

much prevention is in place we still must be able to respond if those measures fail. The Deepwater Horizon accident is emphasizing that need.

Funding from national programs, such as from the National Science Foundation, is difficult to obtain. This is largely because the needs are not cutting edge science. I submitted proposals for improvements in spill detection systems to national requests-for-proposals and generally the comments indicate the reviewers are looking for more complex systems than are needed in a spill response. Dedicated opportunities with required application are the approach that has succeeded.

The standard peer-review funding process generally does not promote innovation. Reviewers examine a proposal with the thought "Will this work succeed?" and if there is doubt the proposal won't be funded. For innovative improvements the reviewers need to ask: "Will this work fail?" and "If it fails, what will we learn from the attempt?". The best approach to funding is through organizations that bridge the response and science worlds. However, with limited funding these organizations will also tend to fund the work most likely to succeed, which tends to be incremental changes. The advantage of limited funding is that industry, government, and non-governmental organizations must partner together, which provides for coordination between the funders.

The bridge between industry and science also must bridge national and regional interests. Without a doubt there are many issues common between the Gulf of Mexico and Alaskan waters, but there are important differences as well. OSRI has an advantage in that we can focus on issues that are consistent with the desires of people in Alaska. At the same time the need to partner with other groups means many of our projects have applications nationally. National funding organizations generally do not have a means to address issues that are regionally important.

Industry is the largest funder of new developments and are supporting some pretty amazing projects. The disadvantage with industry being the leaders of development is that their interests may not align well with the people living in the area where spill response may occur. For example, there is an emphasis on research on dispersants, which are controversial to people in Alaska. They also tend to respond primarily to regulatory requirements and financial advantages. These drivers do not necessarily focus research in the most appropriate directions.

This leads us back to research and development by other businesses. These are the businesses that need the improvements in standards and testing opportunities described earlier. Funding organizations often get requests for help supporting new developments by these businesses. It is an area that remains difficult for me. I believe that we should provide opportunities for any business to tackle a defined problem rather than supporting a single business to develop their approach. At the same time there are definitely times when opportunities arise to assist in the development of particularly promising technologies that we should not pass up. If the process for businesses to get technologies tested and approved it should reduce pressure on the funding organizations.

Even if an approach is approved for use there is no guarantee it will be adopted by oil spill response organizations. In Alaska, the largest spill response organizations are industry supported consortiums. This gives an advantage to industry supported developments and makes it a bit more difficult for outside industries to break into the field. I suspect that this is one of the reason there has been more interest in developing dispersants versus developing solidifiers.

In conclusion there are some issues that we cannot deal with, such as the fact we are working with a toxic substance, and others that we can, such as improving the process for getting new technologies adapted. We must remember that spill response is conducted by a large number of small businesses. The decentralized approach limits the technologies that can be afforded. Oil spill response organization cannot afford to purchase and maintain high end technologies like spill surveillance aircraft with cutting edge technologies that many other countries operate. To purchase and operate highly specialized equipment would best be done by a national spill response group. This could be a duty of NOAA, MMS, or US Coast Guard.

Transitioning of newer technologies could be made easier by developing a clear set of standards that equipment must meet, providing facilities that provide testing opportunities, and clearly outlining how to take advantage of spills of opportunity, or better yet develop field testing opportunities through controlled releases or potentially using natural seeps.

It is important that research is coordinated. Currently this is primarily done informally by looking for opportunities to partner with other organizations for funding projects and sharing research plans. The Interagency Coordinating Committee for Oil Pollution Research, which was formed under the Oil Pollution Act of 1990, has increased its activity, even before the current spill, but hasn't reached the point where they have a research plan that helps to guide the efforts of the member agencies.

It is important to renew funding opportunities. Additional funding should go through organizations that can bridge the worlds of science and spill response. MMS, U.S. Coast Guard, Coastal Response Research Center/NOAA, and the Oil Spill Recovery Institute all are organizations that have established that bridge. It is also important to realize that there are regional differences in spill response needs that should be accounted for when funding new research.