

# Great Lakes Environmental Research Laboratory Review Summary Report

November 16-18, 2010

Ann Arbor, Michigan

Report Submitted by Captain Bob Houtman

Review Committee Chair

A review of the Great Lakes Environmental Research Laboratory (GLERL) was conducted 16-18 November, 2010 in Ann Arbor, Michigan. This Summary Report is a compilation of individual Panel member comments. No attempt has been made to develop a consensus position on any specific Theme or topic. The format for the Panel Summary Report continues the Theme Areas approach used by the GLERL Staff to present its newly-realigned program. A subset of the recommendations submitted by the Panel members in each Theme Area have been included in this Summary Report to help articulate perceived strengths and weaknesses and to point to potential future planning and decision-making by the GLERL leadership and NOAA Headquarters staff. The Review Panel members thoroughly enjoyed this opportunity to learn more about GLERL and wish to sincerely thank the NOAA Headquarters Staff and GLERL Director and staff for the superb pre-review planning, logistics, travel, and on-scene support provided, which were essential in helping make this review a big success. The Review Panel members included:

Captain Bob Houtman, National Science Foundation, Chair

Dr. Robert Beardsley, Woods Hole Oceanographic Institution

Dr. G. Ross Heath, University of Washington

Dr. Thomas Johnson, University of Minnesota, Duluth

Dr. David Lodge, University of Notre Dame

Dr. Shirley Pomponi, Harbor Branch Oceanographic Institution, Florida Atlantic University

Dr. Steven Ramberg, Pennsylvania State University, Applied Research Laboratory

## **Introduction**

The Great Lakes Environmental Research Laboratory (GLERL) did an outstanding job preparing for and presenting its program during the review. The Panel greatly appreciated the flexibility of the staff in making last minute adjustments to the agenda and schedule to allow more one-on-one sessions with the Theme Team members. These sessions were extremely valuable for evaluating the perspectives, concerns and visions of the staff and are the basis for several of the Panel member recommendations. The Panel found the follow-up meetings with the GLERL Director and NOAA Headquarters leadership to be very useful. The Panel also found the written input from the stakeholder questionnaires and the opportunity to have a face-to-face dialogue with the stakeholders to be essential in understanding how the GLERL products and interactions with local and regional counterparts and collaborators are viewed. In general, the

amount of time allocated for the review was appropriate, given the size and complexity of the GLERL mission. Several Panel members commented that the order of the Theme Areas presentations, with Observing Systems and Advanced Technology before the discussion of Ecosystem Dynamics and Ecological Modeling and Forecasting, may indicate the need for more strategic planning between the Theme Areas and an overall GLERL lab perspective (**Recommendation #1**). Another approach to the presentation of the lab's efforts would have been to first identify the unique research questions being addressed by GLERL through the Ecosystem Dynamics followed by the Ecological Modeling and Forecasting theme and then describe the tools needed to support these mission areas by showing the work done by the Observing Systems and Advanced Technology theme.

### **GLERL Laboratory Review - List of Recommendations**

(Items are listed in the order in which they appear in the text)

1. Develop bold, integrated, strategic plans with 1, 5, and 10 year milestones for individual research areas and GLERL as a whole
2. Address staff issues through targeted additions in mission critical areas
3. Increase collaboration with CILER, USGS, and industry (SBIR) to maximize funding and fiscal efficiency
4. Upgrade laboratory equipment and computing resources
5. Strategically expand observation and research to other Great Lakes as they fit into mission goals
6. Develop observing systems for year round and extreme environment application
7. Develop detailed design/construction/maintenance plans for current systems and for future expansion plans
8. Plan for publication in Science or Nature every few years to boost deserved recognition
9. Development and implementation of adaptive sampling programs that integrate new statistical sampling designs and new technologies
10. Develop a more comprehensive conceptual and methodological approach to the food web that can reasonably be expected to detect the presence and impact of new species
11. Expand and develop research in mission critical areas such as biogeochemistry, food web dynamics, and integrated bio-physical and ecosystem modeling
12. Better communication is necessary within and between the theme programs on the development and implementation of mission goals
13. Attention to the progress of Jorg Imerger and Jason Antenucci of CWR at the University of Western Australia in terms of coupling biogeochemical and physical models
14. Continue and develop the increasingly important connection to NOS (CDL and CO-OPS)
15. Continue to develop and communicate complex model forecast results and uncertainty in critical areas related to human health and safety

## Overall Impressions and Comments

The overall impression by the Panel is that this is a time of major transition for the GLERL Team but it is settling well into its new structure and approach. The new Director, Marie Colton, has done an excellent job with the Laboratory's re-alignment by taking the lab from a structure based on Disciplinary Groups to Theme Teams with an ability to focus on overarching science topics that bring the various disciplines and support structures together in a coordinated manner. The Panel believes it is now time to move ahead with the myriad of details associated with developing a cohesive strategic plan for the entire lab so the vision and future goals become clear and appropriate metrics can be developed to determine progress and inform management decisions (**Recommendation #1**). Overall, the Panel found the GLERL work products to be of very high quality with clear relevance to the NOAA Mission and significant value to the regional stakeholders and society in general. There have been many clear examples of very impressive and pre-eminent research being conducted at the lab and development and transition of significant new observing technologies and data management capabilities to support the GLERL mission since the last review in 2000. The GLERL staff and leadership appear to strongly support the NOAA culture of transparency.

A very brief summary of the impressions and comments brought out by various Panel members in their individual Evaluation Worksheets includes:

- a. A highly skilled and talented workforce, dedicated to the GLERL Mission is evident
- b. GLERL is poised to take significant major steps forward in mission-critical areas
- c. Current staffing levels and projections for the future are a significant concern  
(**Recommendation #2**)
- d. More effective use of CILER support can provide significant opportunities for GLERL  
(**Recommendation #3**)
- e. Collaborations and partnerships with local and regional stakeholders should be expanded  
(**Recommendation #3**)
- f. Realignment of the lab into Theme Areas by the Director appears to be the right decision
- g. Cross-Theme Team strategic planning is now needed to develop the overall lab mission  
(**Recommendation #1**)
- h. Funding limitations have impacted the GLERL mission and additional funds are needed
- i. GLERL can serve the nation by being the Great Lakes "test-bed" for ecosystem modeling
- j. Investment in state-of-the-art lab and field equipment is essential to support future efforts  
(**Recommendation #4**)
- k. Availability of computer resources has hindered the forecasting and modeling work
- l. The unique role and mission of GLERL should be better focused and articulated  
(**Recommendation #1**)

## Observing Systems and Advanced Technology (OAST) Theme Comments

While the Panel members found the OAST dedication, innovation and contributions to development of the Great Lakes Observing System to be impressive, several noted this Team was more difficult to evaluate as its activities either directly related to or supported the other Teams. There was a paucity of the typical indicators of quality and performance, such as publications/H-factor and involvement in professional organizations, however there has been a very clear and excellent track record of developing and transitioning important technologies to operations in support of the engineering research and development and technical support functions. These include the Plankton Survey System, Real-Time Observing Stations, web-based data management, new in-situ miniature sensor development and the “Green Fleet” to name just a few. While these technologies are certainly important to the GLERL mission they could also have broader application throughout NOAA and thereby become part of the larger research and development program.

On the question of the relevance of this Team’s activities, Reviewer Pomponi summed it up by saying “The Advanced Technology Group is the backbone for the tools, technologies, operations, and data management that support the Ecosystem Dynamics and the Ecological Modeling and Forecasting Groups. Their focus on development of a Great Lakes observing system is directly related to NOAA’s mission, research plans, and guiding documents, as well as to the needs of the state managers of Great Lakes resources and other stakeholders. Most of the GLERL customers from whom we received input rely heavily on the decision support tools that have been developed and are maintained by the Advanced Technology Group (e.g., ReCON project, satellite imagery products, CoastWatch) as well as the facilities that support field operations (i.e., research vessel fleet).” She further notes that “Based on my experience with research vessel operation, the operation and management of the GLERL research vessel fleet—and the approach to balancing operations with innovations—should be used as a NOAA OMAO and UNOLS model!”

Reviewer Ramberg expressed concern that “...the core of technologists within this theme is subcritical by any standard. One PI for remote sensing algorithm development is an obvious example. The balance between ongoing support to others and technology “push” activities is problematic. Indeed, I would worry that an attempt to achieve some balance within GLERL would mean that neither can be achieved well.” He suggests “...external collaborations in this theme become more important than elsewhere in GLERL (**Recommendation #3**). Future staffing here should be selected with this in mind (**Recommendation #2**). For that reason, and in view of the potential for regional academic institutions that are rich in these areas, I would suggest the main focus of CILER might be here.” Reviewer Beardsley noted the “...challenge will be how to encourage and incorporate participation of members of other themes into this theme’s planning effort. An example is setting priorities in designing and developing an expanded and improved in-situ observing system with the specific real-time measurements needed to improve the GLCFS forecasts. I encourage the team leaders to think “boldly” in their

planning, and estimate how targeted staff additions may be needed to best achieve the theme (and GLERL's) goals and objectives in the coming years (**Recommendation #1, #2**). I think two clear goals are: 1) expand in-situ observing to the other lakes as needed for ecosystem modeling and forecasting (and perhaps ecosystem dynamics) and 2) develop year-round in-situ observing capability.” (**Recommendation #5, #6**)

### **Observing Systems and Advanced Technology Theme Recommendations**

The Panel members noted that the OAST Team is small and talented but dedicated and ready to expand to fill the additional support roles needed as the GLERL re-alignment and strategic planning moves ahead. The Team has taken on a significant number of projects with the current limited number of staff and has been operating primarily in a response mode. The Team recognizes its strengths and weaknesses and several Panel members recommended that if the staff is not increased that the Team must focus on a smaller number of projects, explore the use additional technology opportunities already developed by other organizations rather than developing them in-house, and continue to develop partnerships both inside and outside NOAA. The National Science Foundation's Ocean Observatories Initiative (OOI) and NOAA's UAV and UAS programs are expanding the uses of new technology including gliders, UAVs and UASs which can have valuable application in support of the GLERL mission and could potentially support a strategic plan to expand observing to the other Great Lakes. (**Recommendation #3, #6**).

Reviewer Pomponi recommended "...continued development of a Great Lakes observing system. For example, they could take advantage of the advances that have been made in platform and sensor development for extreme environments (**Recommendation #6**). I encourage them to continue to develop partnerships and collaborations with research and commercial experts in platform and sensor technology, as they have demonstrated with the SBIR advanced sensor development project (**Recommendation #3**). These could be very helpful in the design of instruments for year-round deployment in the lakes. GLERL has an opportunity to make incremental (and even transformational) innovations in observing system platform and sensor development.” Reviewer Ramberg commented on the opportunities for the “Use of AUVs and Gliders for year round observations over larger components of the GL system...” He pointed out that “Exploitation of remote sensing from satellites is good and very appropriate, however, many such systems are developed with open ocean specs in mind regarding spatial resolutions and adjacent land effects. This suggests the use of manned or unmanned aircraft as a sensing platform.” He also pointed that possible “Use of EO/IR remote sensing aboard the UAVs or fixed land sites or even on the GLERL vessels would seem to offer new capabilities at low cost (example is Rob Holman's beach video camera systems)...” (**Recommendation #6**), and that, “GLERL should become more active in the NOAA SBIR program and an advocate for the STTR element of that program (**Recommendation #3**). This STTR element requires

partnering between small business and academia which would be a natural for the region and very complimentary to a CILER emphasis on this theme.”

Reviewer Beardsley made several recommendations in this Theme Area, stating: “The multi-sensor ROV is a good example of an advanced technology being adapted for benthic sampling by GLERL engineers in collaboration with other partners and successfully used by GLERL scientists for research.” He also stated “I support the conceptual design and continued development of ReCON led by Steve Ruberg. This is clearly in GLERL’s strategic plan and NOAA’s mission. I encourage expanding and increasing this effort in the following ways: 1) develop and deploy new stations as requested and prioritized by the other theme leaders (**Recommendation #5**); 2) consider new approaches (e.g. Iridium, cable, AUVs, gliders, docking stations, acoustic links) to break two major barriers: the ~ 20 mile offshore distance limit set by the current “cell phone” telemetry communication link, and surface ice cover (**Recommendation #6**), and 3) develop detailed design/construct/maintenance plans for future expansion plans to help guide GLERL’s combined strategic planning effort (**Recommendation #7**).

### **Ecosystem Dynamics Theme Comments**

In general, the Panel was very impressed with the GLERL efforts in the Ecosystem Dynamics Theme Area and recognizes the relevance of its work. As Reviewer Johnson points out “The Great Lakes have been a magnet for human settlement in the interior of the United States, through provision of fresh water, transportation, fisheries, aesthetic beauty, and recreation. They hold 20% of the world’s surface fresh water. All of these assets have substantial economic impact on the region and on the country.” He goes on to say “The Great Lakes are large, complex ecosystems that may provide only subtle hints of environmental abuse for decades before thresholds are passed and severe damage is apparent. This is not always the case – for example, the invasion of the *dreissenid* mussels has been an obvious affront to the benthic communities of the lower Great Lakes. Yet its adverse impact on the spring bloom in Lake Michigan would not have been recognized without the substantial time series of past plankton dynamics in that lake that was diligently gathered by the GLERL field station personnel in Muskegon.” Reviewer Pomponi states: “The research conducted during the evaluation period, as well as the group’s long-term vision and goals for future work, addresses societally-relevant needs at both the regional and national levels. The Great Lakes is a poster child for issues such as invasive species and HABs; GLERL is making significant contributions to understanding and predicting impacts. Customers and end-users are engaged.”

The top level performance of this Team is well documented in terms of the typical indicators such as number and impact of publications, awards, involvement in professional organizations and collaborations. As Reviewer Pomponi notes “The individuals in this group have conducted high quality research, which has supported the development of information

products that have had a significant impact on resource management.” Reviewer Heath expresses “My only concern is that GLERL’s scientific work is not getting the recognition from the broad scientific community that it deserves. One way to address this would be to plan for publication of an article in Science or Nature every year or two (**Recommendation #8**). Such articles are read by scientists from many disciplines around the world and often form the basis for stories in the popular press. In this era of tight budgets, being seen to do important top notch work is almost as important as the intrinsic value of the research.”

Reviewer Lodge noted four reasons the work by this Theme Team on Ecosystem Dynamics and especially invasive species and harmful algal blooms is so important “First, it has been sustained over many years..., Second, the trend illustrates dramatic and biologically and economically important changes..., Third, results have been communicated effectively in writing and presentations..., and Fourth, it has motivated improved management and policy to prevent future invasions and harm.” He points out, however, that the quality and relevance could be improved by:

- “...further development of strategic planning and implementation of adaptive sampling programs that integrate new statistical sampling designs...” (**Recommendation #1, #9**)
- “... a more comprehensive conceptual and methodological approach to the food web that can reasonably be expected to detect the presence and impact of new species..” (**Recommendation #10**)
- “...more primary publications in higher quality journals...” (**Recommendation #8**)
- “...better integration of the empirical work at all levels of the food web with ecosystem models...” (**Recommendation #11**)

Several reviewers expressed opinions on the inter-relations of the Ecosystems Dynamics Theme Team efforts with the ecosystem modeling. Reviewer Heath points out that “Ecosystem management has been a basic mantra in NOAA for a number of years. Yet its actual application has been minimal. This is due to the absence of ecosystem models with credible predictive ability. GLERL is closer to having in hand the ecological and environmental knowledge needed to build such models than any other group in NOAA, due in no small part to the tractability of the Great Lakes relative to open coastal systems, and to the multi-year research programs that have maintained focus on key components of the Great Lakes ecosystem.” He suggests GLERL “develop 1, 5, and 10 year milestones (of decreasing specificity) so that it can assess its own progress towards its long-term goals and allow external reviewers to better assess whether the goals and estimated rate of progress towards them are realistic.” (**Recommendation #1**)

The Panel noted the time series data sets in Lake Michigan are the best available throughout the region due to the dedication of the GLERL Team, however, funding limitations have forced ecosystem research program at GLERL to be limited in geographic extent and in topical scope. (**Recommendation #5**) A major concern of the Panel in this theme area is the

reduction of GLERL's previous strength in isotopic geochemistry and biogeochemistry research capabilities due to staff reductions. (**Recommendation #2, #11**)

### **Ecosystem Dynamics Theme Recommendations**

Several Panel members expressed the opinion that NOAA Headquarters and GLERL have an opportunity to capitalize on the capabilities of the laboratory to make significant strides in understanding the interrelationships of Ecosystem Dynamics in general by using the Great Lakes as a test bed. Reviewer Johnson states: "NOAA GLERL should be encouraged to undertake a bold, new strategy in their Ecosystem Dynamics program (**Recommendation #1**). They need to look at the Great Lakes ecosystem in its entirety, recognizing that the lakes span a broad spectrum of aquatic environments, from deep, oligotrophic Lake Superior to shallow, highly eutrophied Lake Erie, and develop an ambitious program of long-term environmental measurement in each of these systems (**Recommendation #5**). This would not require the establishment of a GLERL field station like Muskegon on each of the lakes. Their presence on all of the lakes could be established at relatively little cost by more effectively using CILER to place 2-3 GLERL scientists at key academic institutions in the Great Lakes basin." (**Recommendation #3**) This could also be achieved by entering into partnerships with other supporting universities in the region and utilizing the resident staffing expertise.

The Panel sees a strong need for increased staffing for this Team by adding additional expertise in biogeochemistry research and ecology research with an emphasis on benthic biology, phytoplankton, and microbiology (**Recommendation #2**). There are various options available to fill this need, including the recruitment of postdoctoral fellows through CILER, taking greater advantage of "Other Peoples' Money" such as is being done with the EPA work, and increased collaborations with the other academic institutions and organizations throughout the Great lakes Region, including specifically the United States Geological Survey lab in Ann Arbor. (**Recommendation #3**)

The Panel noted that GLERL has an excellent new building facility, however, based on the lab tours and the closed door interview sessions, it is clear there is a great need for state-of-the-art lab equipment to support cutting-edge research efforts. (**Recommendation #4**)

The Panel also noted the need for increased communications both within the Ecosystem Dynamics Team and between the other Theme Teams (**Recommendation #12**). Reviewer Pomponi notes "The efficiency and effectiveness of future research and development of information products, as well as creating an environment that fosters innovation, would be greatly enhanced by integration of the projects not only among the three groups, but also within the Ecosystem Dynamics Group. Their continued success will be directly related to how well they will work together as a team, not as independent programs co-existing in the same building." She further states "GLERL could be more efficient and effective by continuing the

path it's now on to integrate the three research area/theme groups. ... The three themes are interdependent, and GLERL's continued success will be directly related to how well they can integrate both within and among Ecosystem Dynamics, Ecological Modeling, and Advanced Technologies—and how well they can lead collaborative programs with their academic, state, federal, industry, and international partners.” (**Recommendation #3**)

### **Ecological Modeling and Forecasting Theme Comments**

The Panel was very impressed with the quality, relevance and performance of the GLERL efforts in the Ecological Modeling and Forecasting Theme Area. The modeling and forecasting work is extremely high quality and the forecasting tools and products are being used on a daily basis by customers and stakeholders throughout the region. As Reviewer Johnson writes “This is probably the most impressive role of NOAA-GLERL at present. The wave and circulation models developed by David Schwab and colleagues are the best known and used in the Great Lakes community. ...this group is modeling the dynamics of all of the Great Lakes, and not just focusing on Lake Michigan or areas of intense environmental stress. ... The forecasting tools provided by the GLERL models are actually used by commercial shippers on the Gt. Lakes, at times involving the modification of shipping routes and schedules to adjust to storm conditions, and by the U.S. Coast Guard in their search and rescue operations.” Reviewer Lodge says “The vision...is excellent in terms of both scientific excellence... and relevance... the quality of the component parts of this theme has been excellent.” “The implementation of a forecasting system that integrates physical and ecological process and their feedbacks to each other remains in the future. The quality of the planning for that effort appears excellent, but with much work remaining to achieve an effective integration of the empiricists and the modelers.” He notes “Forecasts of coupled physical-biological phenomena (e.g., of pathogens, food webs, invasion impacts) and of mostly physical phenomena (e.g., lake levels, climate change, waves, ice) that are accurate and precise enough to warrant responses by management agencies and the public are desperately needed.” (**Recommendation #11**)

Reviewer Beardsley says “NOAA is the “operational ecosystem science” mission agency. As a core component of OAR, GLERL has a unique role in the Great Lakes area, including sole leadership in “ecosystem modeling and prediction” separate from the USGS, EPA and other agency objectives and activities in this region. The GLERL staff has developed a number of key models and analysis/display methods that meet both immediate objectives and some of the longer-term objectives of this theme.” He also sees the need for the lab to develop an overall strategic plan and an implementation pathway, as noted in his comment “I anticipate that more strategic planning by the team leaders and staff in the coming months will lead to a more comprehensive and integrated plan to improve/expand the existing “integrated ecological modeling framework” to better meet GLERL’s evolving goals and objectives in this theme.” (**Recommendation #1**) Reviewer Beardsley has been impressed over the years with the efforts

in this theme area and considers “the focused research and development of GLCFS from the very early efforts in the late 1970s to its present state to be exemplary, probably only possible in a research/application-oriented federal laboratory with long-term continuous support for the vision and efforts of the GLCFS development team led by David Schwab.”

Several comments were made by the Panel members regarding the computing resources and staffing levels needed in this theme area. Reviewer Ramberg states: “The staff in this area is near to “critical mass” for the tasks ahead. It is sufficient to continue productivity but not by much and national recognition for these products will undoubtedly increase demand via participation in attempts at forecasting and ecosystem management that will occur elsewhere.” **(Recommendation #2)** Reviewer Beardsley notes that “Developing a good understanding of these processes and their variability is both an important research question and important for improving coupled atmospheric/ocean model prediction. I suggest that you think about the adequacy of your present understanding and modeling and consider adding a new mesoscale meteorologist to focus on improving GL weather prediction and GLCOS.” **(Recommendation #2)** And Reviewer Pomponi identified the lack of adequate computing resources as a factor hindering the output of this Theme Team. **(Recommendation #4)**

### **Ecological Modeling and Forecasting Theme Recommendations**

The Panel members identified a number of possible ways to further the GLERL efforts in this Theme Area. Reviewer Johnson points out that the modeling team “is now getting into coupling biogeochemical models into physical models. There has been a fair amount of progress in this area made by scientists at the Centre for Water Research at the University of Western Australia, under the direction of Jorg Imberger and Jason Antenucci. It was not apparent to me that the GLERL team was aware of this, and I encourage them to learn more about CWR’s approach.” **(Recommendation #13)**

Reviewer Lodge says “For success to be achieved in coupling physical and biological models, at least one new scientist may be needed who has experience in such modeling efforts and is comfortable moving between the physical and biological research communities.” **(Recommendation #2)**

Reviewer Ross states “In my view, GLERL needs to continue its outstanding ecosystem modeling focus. **(Recommendation #11)** It needs to develop a multiple-year plan with realistic milestones to address the many remaining process and modeling questions, and it needs to nucleate collaborative partnerships that will help address parts of the problem and help it to establish a visible presence throughout all the Great Lakes.” **(Recommendation #1)** Reviewer Beardsley makes several points:

- “The connection between GLERL and NOS (CDL and CO-OPS) that David Schwab and coworkers have developed is excellent and will become increasingly important...”  
(**Recommendation #14**)
- “Continued leadership in this theme will be dependent on access to sufficient computing resources, both at GLERL and remote supercomputer centers.” (**Recommendation #4**)
- “...members of this theme have pioneered the use of new methods and ways to display complex model forecast results (e.g. Google Earth in GLCFS) and quantify and communicate forecast uncertainty (e.g., water level and human health risk). I encourage you to continue to push ahead in this effort, ...” (**Recommendation #15**)
- “...I encourage OAR management to recognize the unique role and mission of GLERL (in comparison to the other ERLs), and the new opportunity for GLERL to use the GLs atmosphere/water/land system as a perfect “testbed” to develop and apply new “ecosystem management” methods to a mostly-closed system of critical national and international importance.”

## **Conclusions**

In summary, the Review Panel finds that the Great Lakes Environmental Research Laboratory is poised to have a significant research and operational impact both regionally and nationally in the years ahead. The leadership and staff personnel are dedicated to the organization and have made impressive strides towards re-defining the programs along the new theme areas and ensuring support of the NOAA strategic directions. The regional stakeholders are strong supporters of GLERL and are active users of the observational data and forecast products. GLERL and NOAA Headquarters leadership must now address the issues which will determine how successful the lab will actually be in the future. These issues include the need for increases in staffing and funding levels, and the opportunity to assign GLERL with focused, unique mission objectives that can have a significant impact on society and the nation. Highly relevant objectives include expanding the current observational systems to all the Great Lakes on a year-round basis and designating GLERL as the “test bed” for ecosystem modeling and forecasting for the entire Great Lakes region. The Panel looks forward to any future opportunities to interact with GLERL leadership and staff.