EXTERNAL REVIEW
OF THE
COOPERATIVE INSTITUTE FOR OCEANOGRAPHIC SATELLITE STUDIES (CIOSS)
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

SUBMITTED TO THE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
SCIENCE ADVISORY BOARD
ON
OCTOBER 18, 2006

SUMMARY

An external review of the research, education, and outreach programs of the Cooperative Institute for Oceanographic Satellite Studies [CIOSS] at Oregon State University was conducted October 17-18, 2006 in Corvallis, Oregon. Guidelines for conducting the review were provided by the NESDIS within the National Oceanic and Atmospheric Administration (NOAA). The review was conducted under the auspices of the NOAA Science Advisory Board (SAB) and, therefore, is subject to the requirements of the Federal Advisory Committee Act (FACA). A list of review panel members is provided in Appendix I. The review panel's on-site agenda is provided in Appendix II.

Findings

- The CIOSS vision of becoming a center of excellence for satellite remote sensing research and education is well stated and much needed, if this nation is to realize the full benefit of its significant investment in the technology to support ocean monitoring from space.
- CIOSS provides NOAA/NESDIS a flexible way to respond to challenges associated with emerging programmatic needs such as the GOES-R risk reduction and NPOESS algorithm working group activities.
- The CIOSS vision includes a good mix of research and outreach.
- CIOSS has made remarkable progress over its short existence with fourth year support from NOAA exceeding $3M. It has made considerable progress towards achieving its long-term goals.
- CIOSS is conducting high quality and timely research to support NESDIS' mission.
- CIOSS has demonstrated strong research productivity through peer-reviewed publications and national advisory panel roles.
- The CIOSS science plan is well aligned with the NOAA/NESDIS Strategic Plan.
- CIOSS has collaborations with a few cooperative institutes and other NOAA entities. Some of these collaborations include funding. These collaborations facilitate coordination between NOAA offices. CIOSS research and products address both regional and national needs and in some instances, such as modeling, address broad NOAA needs.
- The four CIOSS research themes represent a comprehensive approach to defining oceanographic satellite research.
- CIOSS has an outstanding K-12 outreach program, built on partnering with broader OSU efforts in the Science and Math Investigative Learning Experiences (*SMILE*) program.
- NOAA's compressed timeline for mandated review and competition dates of its cooperative institutes is detrimental to CIOSS and NESDIS. An extension of the timeline should be considered.
- The External Review Team gives CIOSS an "Outstanding" evaluation and recommends its continuation to the full term.

Recommendations

- CIOSS should continue working with NESDIS to ensure that the goals and themes of CIOSS are consistent with NESDIS needs.
- CIOSS should continue to increase collaboration with other NOAA cooperative institutes and laboratories in the region and throughout the country.
- The creative inclusion of the SMILE program in the outreach theme should be continued with appropriate review of mutual goals.
- NOAA should consider the SMILE program as a prototype for broad NOAA and national implementation.
- CIOSS should continue to work with NESDIS to maintain a diverse research portfolio that capitalizes on the research strengths of its staff.
- The analysis of the COAST ocean color dataset should continue as new sensors for monitoring marine ecosystems come on line.

I. OVERVIEW OF CIOSS

The Cooperative Institute for Oceanographic Satellite Studies (CIOSS) was established at Oregon State University (OSU) in 2003, creating a cooperative (Federal/Academic) center of excellence for research involving satellite remote sensing of the ocean and the air-sea interface. The primary collaborations are between research scientists in the NOAA/ NESDIS Center for Satellite Applications and Research (STAR) and the OSU College of Oceanic and Atmospheric Sciences (COAS).

The CIOSS mission is to enhance and improve the use of satellite remote sensing for oceanographic research, operational applications and education/outreach. CIOSS research projects address improvements in satellite sensors and the algorithms used to produce fields of geophysical variables, improvements in models that use the satellite fields, and analysis of combinations of satellite, model and *in situ* data sets. CIOSS outreach includes scientific outreach to members of the research community, and both formal and informal education. By accomplishing its goals, CIOSS helps NOAA fulfill its role of leadership for both remote sensing and modeling in the Integrated Ocean Observing System (IOOS). CIOSS works with the NOAA *CoastWatch* program to help create and improve remote sensing products that will be useful to members of the IOOS Regional Associations.

II. SCIENCE PLAN

A. What is the scientific (not programmatic) vision for the institute?

CIOSS strives to be a center of excellence for research and education, which involves satellite remote sensing of the ocean and its air-sea interface, along with models of the ocean and overlying atmosphere.

CIOSS provides a mechanism to bring together the resources of a research-oriented university (OSU), NESDIS and other NOAA line offices, with additional partners at other universities, government and private agencies. With these partners, CIOSS conducts research of mutual interest to CIOSS/COAS and NOAA. This research helps NOAA to accomplish its Mission Goals and helps NESDIS to fulfill its role in providing the remote sensing component of the "national backbone" for the Integrated Ocean Observing System (IOOS), which includes operational and research components within NOAA, ONR, NSF and NASA. CIOSS contributes to the development of ocean observing and modeling systems, along with public understanding of those systems, through:

- Research that helps to develop and improve our understanding of, and operational products related to, the upper ocean and air-sea interface. It does this by using data from present and past satellites and by helping to plan future satellite sensors;
- Research that helps to incorporate and assimilate satellite products and understanding into ocean and atmosphere circulation models; and
- Education and training in the same topics, reaching a wide range of “audiences” in formal education (K-16 education, graduate school, ongoing professional training) and informal education (public outreach).

B. How is it related to the NOAA Strategic Plan?

The first CIOSS goal is to “foster and provide a focus for research related to NOAA’s mission responsibilities and strategic objectives...” CIOSS research is selected based on mutual interests with NOAA such that most CIOSS projects address one or more of the Mission Goals in NOAA’s strategic planning documents.

C. What are the goals and objectives of CIOSS?

CIOSS is designed to accomplish the following broad goals and objectives:

- Foster and provide a focus for research related to NOAA’s mission responsibilities and strategic objectives in the coastal and open ocean, emphasizing those aspects of oceanography and air-sea interaction that utilize satellite data, along with models of oceanic and atmospheric circulation;
- Collaborate with NOAA research scientists involved in satellite-based ocean

remote sensing through: evaluation, validation, and improvement of data products from existing and planned instruments; development of new multi-sensor products, models, and assimilation techniques; and investigation and creation of new approaches for satellite data production, distribution, and management;
- Improve the effectiveness of graduate-level education and expand the scientific training and research experiences available to graduate students, postdoctoral fellows and scientists from NOAA and other governmental laboratories and facilities; and
- Educate and train research scientists, students, policy makers and the public to use, and appreciate the use of, satellite data in research that improves our understanding of the ocean and overlying atmosphere.

D. What criteria are used to measure progress in accomplishing these goals and objectives?

The criteria used to judge progress in achieving the CIOSS goals are primarily those stated in the "Performance Measures" for Administration, Research and Outreach activities, found in the original CIOSS Five-Year Plan, with appropriate modifications based on the CIOSS management experience.

E. What are the major scientific themes in CIOSS?

CIOSS has three tasks related to the NOAA CI:
- Core office administration and outreach
- Research and additional outreach funded by NOAA/NESDIS
- Research and outreach funded by other agencies.

The scientific themes that make up the research core of CIOSS are as follows:

- **Theme 1: Satellite Sensors and Techniques**: Evaluation of existing and proposed satellite sensors, algorithms, techniques and applications. Development of satellite oceanography techniques and applications;

- **Theme 2: Ocean-Atmosphere Fields and Fluxes**: Development, evaluation and analysis of improved fields of physical and biological parameters in the upper ocean, and of surface parameters and fluxes at the air-sea interface, using combinations of remote sensing, *in situ* data and modeling.

- **Theme 3: Ocean-Atmosphere Models and Data Assimilation**: Use of satellite-derived fields to force and evaluate numerical models of the oceanic and atmospheric circulation, including the assimilation of those fields using methods of inverse modeling. For some applications, the ocean models will include components of marine ecosystems.

- **Theme 4: Ocean-Atmosphere Analyses**: Dynamical and statistical analyses of data sets derived from satellites, models and *in situ* instruments, in order to increase our understanding of the physical, chemical, biological, geological and societal processes that affect and are affected by the ocean-atmosphere system.

- **Theme 5: Outreach**: Three broad outreach areas are included, each of which is related to CIOSS research and makes use of research results.
    - **Formal Education** of students (K-12, undergraduate and graduate students), other scientists, resource managers and the general public in aspects of oceanography, surface meteorology and the use of remotely sensed data sets and numerical models. Short courses and training workshops are included in this category, as are workshops designed to develop or evaluate present and planned sensors and techniques.
    - **Informal Education** of the same groups in the same subjects, but in contexts outside of the formal educational system, short courses and workshops. This may take the form of web-based material, presentations, forums, and exhibits at public science museums.
    - **Data Access** includes activities that enhance the use of data sets derived from satellites and models by research scientists, students, educators, resource managers and the general public.

E1. How were the major scientific themes identified?

The themes are based on the CIOSS vision and goals, taking into account the areas of expertise of the CIOSS researchers and NESDIS requirements.

E2. Which themes/sub themes are near completion?

CIOSS, being in the fourth year of funding is too young to be expected to have themes nearing completion. Indeed, the work on its five themes may never be finished, given that the themes are very broad and that the research is inherently an ongoing activity in which progress is usually incremental.

E3. What are the emerging thematic areas? Why?

The question might better be stated, “Do you anticipate any changes in the themes or sub-themes?”

In view of the broad scope and complementary nature of the themes, it is unlikely that they will ever change substantially. The areas of emphasis among the various CIOSS projects may change however.

Clearly the changes in the NPOESS suite of sensors and the fate of the GOES-R HES-CW color sensor will affect CIOSS research plans. CIOSS leadership is well

aware of this and is taking appropriate action to sustain the COAST funding.

The success of the vector winds project suggests that this activity has a potential for expansion and CIOSS leadership will no doubt pursue additional funding for this research area.

As CIOSS develops its relationships with NOAA/NESDIS personnel, it is expected that there will be minor changes in the areas of emphasis from time to time. This should be expected and encouraged, as flexibility is the advantage of having CIOSS.

F. Scientific partnerships

1. What is your relationship to the NOAA laboratories and other NOAA entities?

CIOSS has relationships with several NOAA entities and receives funding from them. The interaction CIOSS has with multiple NOAA entities can help break down the barriers between the line offices. These relationships will help initiate the interdisciplinary research that is needed in order for IOOS to succeed.

Findings

- The CIOSS vision of becoming a center of excellence for satellite remote sensing research and education is well stated and much needed if we are to take advantage of the emerging satellite derived data products.
- The CIOSS vision includes a good mix of research and outreach.
- CIOSS has developed a logical science plan that recognizes the needs of NESDIS and the special capabilities of the researchers in CIOSS.
- The CIOSS science plan is well aligned with the NOAA/NESDIS Strategic Plan.
- CIOSS has already made considerable progress towards achieving its long-range goals and objectives.
- CIOSS has collaborations with a few cooperative institutes and other NOAA entities. Some of these collaborations include funding. Such collaboration facilitates coordination between NOAA offices.

Recommendations

- CIOSS should continue working with NESDIS to ensure the goals and themes of CIOSS remain consistent with NESDIS needs.
- CIOSS should continue to increase collaboration with other NOAA cooperative institutes and laboratories in the region and throughout the country.
- The creative inclusion of the SMILE program in the outreach theme should be continued with appropriate review of mutual goals.

III. SCIENCE MANAGEMENT PLAN

How does the Institute identify new intellectual opportunities?

CIOSS scientists identify new research opportunities by being actively engaged in research as individuals, as members of CIOSS, and as members of the community at large. Some of the new starts, such as the collaboration between Dick Reynolds and Dudley Chelton to utilize satellite data to improve the fidelity of reconstructions of the surface temperature field originated as ideas of one or two researchers; others, such as the COAST project, originated as team efforts designed to address a particular need. Some new starts originate within CIOSS; others, *e.g., COAST*, are part of a broader community-wide research effort. The existence of CIOSS has increased the level of interaction among scientists at OSU and between OSU and NESDIS scientists, expanding opportunities to pursue multi-investigator projects.

Individuals and groups are encouraged to pursue new research projects as opportunities arise. CIOSS core research funds are frequently used to subsidize new starts, providing enough funding (typically $20K to $50K per project) for ideas to get sufficient traction to enable the PIs to compete for outside research funding. The administrative structure of CIOSS, with its Council of Fellows and its Executive Board, and its periodic meetings and reviews is designed to closely monitor ongoing research activities and to suggest corrections or (more rarely) new directions as science and funding needs dictate.

E. What is the demographic structure of the Institute employees?

The reviewers found a dynamic, opportunistic group of Institute staff, which is representative of the OSU population, with no particular inherent weaknesses.

F. What is provided for human resources development (Recruitment, Rewards, Training)?

Beyond attention to its broader academic and research missions, CIOSS does not currently have resources for human resources development.

G. What is the state of the financial health of the Institute? (Provide a budget summary and identify imbalances or needed adjustments.)

The budget is documented in the CIOSS briefing materials and will not be duplicated here. CIOSS has shown tremendous growth since its founding and been very opportunistic in finding new support. The cancellation of the GOES-R sensor that CIOSS was addressing may lead to short term budgetary challenges. Overall the reviewers found CIOSS to be a robust and healthy CI.

H. How does the Institute intend to work towards accomplishing its financial goals?

CIOSS will continue to submit research proposals to NOAA and other funding agencies as opportunities arise.

I. Are their any issues in interacting with NOAA that require attention?

NESDIS should broaden discussions with CIOSS concerning its strategic directions and needs. While it is clear that CIOSS is very complementary to NESDIS expertise, and that NESDIS has exploited CIOSS for "quick reaction" science (GOES-R studies), it is not apparent that NESDIS fully appreciates the synergy that can be realized by drawing upon CIOSS scientific expertise in formulating its own long term programmatic plans.

J. Are their any issues in interacting with the University that require attention?

None that was apparent to the reviewers.

IV. SCIENCE REVIEW

A. What are the Institute's most recent scientific highlights and accomplishments?

A clear strength of the CIOSS program is that many of the Fellows and PIs are national leaders in areas of ocean satellite science and are interested in conducting research to support the NESDIS mission. The COAST project, to help GOES-R Risk Reduction, is an excellent example of CIOSS working to rapidly assemble a national team that is addressing a NESDIS need with excellent science. A clear highlight at a smaller scale is the collaboration between Reynolds (NESDIS) and Chelton (CIOSS) that resulted in a new and improved blended SST product. The work with ocean vector winds has proven very productive. It has both resulted in excellent science that advanced our understanding of the coupling between surface wind and SST as well as produced a user-friendly wind climatology that has nationwide application. The ocean model work focusing on a high resolution regional model that assimilates satellite science is good science that contributes to the NESDIS mission both by incorporating satellite data into models and providing model output to complement satellite data. We concur with the PIs that this work would be strengthened if it were integrated with broader NOAA modeling efforts when such a program is developed. The HAB work addresses an important issue and satellites have the potential to help describe and predict the distributions of toxic blooms but this work will require significant interdisciplinary collaboration. Lastly, we are impressed with the productivity of CIOSS PIs as measured by the number and scope of their peer-reviewed publications.

Numerous letters of support for CIOSS from various NOAA partners indicate important contributions provided by CIOSS. We think the link between CIOSS and the *Coastwatch Westcoast* node is a very productive collaboration that may serve as a model for interactions between CIOSS and other *Coastwatch* nodes.

Findings

- CIOSS is conducting high quality and timely research in support of NESDIS's mission.

- CIOSS research and products address both regional and national needs and in some instances, such as modeling, address broad NOAA needs.

- The four CIOSS research themes represent a comprehensive approach to defining ocean satellite research.

Recommendations

- The External Review Team recommends CIOSS continue to work with NESDIS to maintain a diverse research portfolio that capitalizes on the research strengths of the CIOSS staff.

- The External Review Team recommends that the analyses of the COAST ocean color dataset continue to benefit future sensors.

V. EDUCATION/OUTREACH

A. What types of educational activities/opportunities (K-12, undergraduate and graduate students) does the institute offer on an ongoing basis?

CIOSS offers a balanced portfolio of "Outreach to the Scientific Community", "Formal Education" of K-20 students and "Informal Education". "Outreach to the Scientific Community" is provided through training and data analysis workshops and advisory board participation. "Formal Education" consists of formal classroom education at the level of K-12 (Science and Math Investigative Learning Experiences, *SMILE*), undergraduate and graduate students (college educational courses and research, and short courses and training workshops). "Informal Education" opportunities are provided through exhibits/displays, forums, presentations and web-based materials. Significant activity exists in all these areas.

Far and away the most innovative approach is the *SMILE* program, which is a partnership with the Oregon State University and 12 school districts throughout the state of Oregon at the elementary, middle and high school levels. SMILE is

an academic enrichment and college readiness program for historically underrepresented and other educationally underserved students. SMILE's goal is to increase the numbers of historically underrepresented and other educationally underserved students who graduate from high school prepared for college, pursue higher education and prepare for careers in engineering, mathematics, science, health professions, and teaching.

The goals of the CIOSS/SMILE partnership are to: bring ocean sciences and remote sensing to teachers, students and community members by 1) engaging graduate students and researchers in creating and delivering outreach, 2) increasing teacher understanding of ocean sciences and use of satellite data to engage students, 3) providing learning opportunities for high school students in clubs and on campus that engage them in applied ocean sciences, and, 4) promoting student's interest in science, in science careers, and the importance of higher education.

The CIOSS benefits from this partnership are:
• Increased opportunities for researchers and graduate students to communicate with high school teachers and students
• Increased capacity to accomplish effective outreach
• Expanded outreach and engagement with underserved audiences through effective after-school programming
• Greater teacher awareness and content knowledge about the role of satellite research in ocean science
• Increased awareness and knowledge among high school students of ocean sciences research and careers
• Facilitated engagement and support for a COAS graduate student in the SMILE office

B. What are the current and planned outreach efforts?

There are robust activities in all focus areas, with reasonable levels of investment in resources. The programmatic implementation is sustainable at the current levels of investment and there are both committed leaders and partners, so there is a strong sense that these activities will continue.

Findings

CIOSS has an outstanding K-12 outreach program, built on partnering with broader OSU efforts in the Science and Math Investigative Learning Experiences (*SMILE*) program.

Recommendations

The Review Team recommends that NOAA consider the K-12 program as a

prototype for broad NOAA and national implementation.

VI. OTHER CONSIDERATIONS

The External Review Team noted that the CIOSS review could be considered as prototypical of future recompetition reviews in the 5-10 year time scale as CIOSS is one of two new Cooperative Institutes (CIs) awarded by a competitive process. All the CIs will be recompeted in this time period, so that, all new CI institutions will face many of the same challenges impacting CIOSS. These challenges include a substantially shortened continuation review (3 years after receipt of support), an extended period of education about the intricacies of the NOAA process, and, the need to participate in the NOAA PPBES process for several cycles before this impact can be assessed.

Thus, the External Review Team strongly encourages the NOAA Science Advisory Board to consider review and modification of the current CI policy on the time frame for recompetition. We recommend modifying the process to have an initial review that doesn't take place until 3 years after support is in place, followed by a success-based renewal at 7 years that would provide funding for an additional 7 years. If these changes were enacted, recompeted CI's that receive favorable reviews at years 3 and 7 would have a lifetime of 14 years.

VII. SUMMARY AND CONCLUSIONS

An external review of the research, education, and outreach programs of the Cooperative Institute for Oceanographic Satellite Studies [CIOSS] at Oregon State University was conducted October 17-18, 2006 in Corvallis, Oregon. Guidelines for conducting the review were provided by the NESDIS within the National Oceanic and Atmospheric Administration (NOAA). The review was conducted under the auspices of the NOAA Science Advisory Board (SAB) and, therefore, is subject to the requirements of the Federal Advisory Committee Act (FACA). A list of review panel members is provided in Appendix I. The review panel's on-site agenda is provided in Appendix II. The External Review Team found CIOSS to be robust, healthy and growing, and, providing significant contributions to NOAA's mission in response to tasking from NESDIS.

The reviewers specifically wish to thank all the NESDIS and CIOSS staff that facilitated the review process – everything went "like clockwork".

APPENDIX I

LIST OF EXTERNAL REVIEWERS

[1] Otis B. Brown, Candidate Chairperson
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Dr. Otis Brown is the Dean of the Rosenstiel School of Marine and Atmospheric Science, University of Miami; and a professor in the Division of Meteorology and Physical Oceanography. He is one of the world's experts in studying the ocean through observations obtained from instruments aboard earth-orbiting satellites. Dr. Brown has participated in research cruises throughout the world including the Atlantic and Indian Oceans and the Arabian Sea. He has over 100 scientific publications and has received national recognition from organizations such as the American Association for the Advancement of Science, the American Meteorological Society, the National Research Council and the National Aeronautics and Space Administration. As a professor at The Rosenstiel School Dr. Brown has mentored students, fellows and faculty and built one of the Nation's leading programs in remote sensing. Dr. Brown serves as the chair of Southeastern Universities Research Association Board of Trustees and is a member of the EPA Hypoxia Advisory Panel, the Ocean Council and other high-level scientific steering committees.

[2] Jeffrey J. Polovina, Ph.D.
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Jeffrey Polovina is a biological oceanographer with broad interests including: i) understanding the population dynamics of large pelagic animals, especially their movements and uses of pelagic habitat, and ii) large-scale climate and ecosystem dynamics in the North Pacific. Several tools and data sets that he frequently uses include: electronic tags applied to pelagic animals, ecosystem

and coupled ocean-ecosystem models, and satellite remotely sensed data. He received a Ph.D. in mathematical statistics from UC Berkeley in 1974. He's also an adjunct faculty in the Oceanography Department at the University of Hawaii and a Senior Fellow at the Joint Institute of Marine and Atmospheric Research (JIMAR) in Hawaii.

[3] Cooperative Institute Representative
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John M. Wallace is a Professor in the Department of Atmospheric Sciences at the University of Washington. His current research is in the field of climate dynamics. He received his Ph.D. from MIT in 1966. He is a member of the National Academy of Sciences and a Fellow of the American Meteorological Society, the American Geophysical Union, and the American Academy of Arts and Sciences.

[4] Larry Atkinson
Samuel and Fay Slover Professor of Oceanography and Eminent Scholar
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Dr. Atkinson is the Samuel and Fay Slover Professor of Oceanography at Old Dominion University. He is a Fellow the American Association of Science and was editor of JGR-Oceans and Oceanography. His current research interests continue his interests in the general oceanography of the ocean margin including western boundary currents and coastal upwelling. He is also leading an Ocean. US initiative to create a surface current mapping system for the US using HF Radar. He received his Ph.D. from Dalhousie University in Halifax, Nova Scotia, Canada in 1972.

APPENDIX II

Draft Agenda – CIOSS Science Review
October 17-18, 2006
OSU/COAS, Corvallis, Oregon

Tuesday, October 17, 2006 (Day 1 Science Review)
Burt 193

7:30-8:30am – Continental Breakfast (Room 152 available for Review Team to meet in Exec Session)

8:45am – Welcome by OSU (John M. Cassady, OSU Vice President for Research)

9:00am – Welcome by COAS (Mark Abbott, COAS Dean)

9:15am – Intro of Review Team by Ingrid Guch, Purpose of Review

9:30am – Overview of CIOSS (Ted Strub)

10:00am – Coffee Break

10:30am – "Science Plan" – Vision and Mission, Themes and Introduction to the Project Activities (Ted Strub)

11:00am – CIOSS Fellows present Science and Outreach activities: 30 minutes each for: (1) Outreach and (2) COAST and other ocean color research/outreach.

12:00pm – Lunch (buffet-style, open discussion)

1:00pm – Continue presentations on Science and Outreach activities: 30 minutes each for: (3) Winds and air-sea interactions; (4) Modeling; (5) IOOS and CIOSS; and (6) six 5 minute (2-slide) presentations of other individual projects.

3:00pm – Coffee Break

3:30pm – Open Discussion

4:15pm - Reviewers to meet privately to discuss day's presentations, Determine any issues needing additional CIOSS response and give these to the Director (Burt 152)

5:00-7:00pm – Reception and Poster session hosted by CIOSS

Wednesday, October 18, 2006 (Day 2 Science Review)
Burt 193

7:30-8:45am – Continental Breakfast (Room 152 available for Review Team to meet in Exec Session)

9:00am – Science Management Plan (Ted Strub)

9:30am – Review Panel Semi-Executive Session, Burt 152: Receive responses to over-night issues (Review Panel alone or, at the panel's request, meeting individually with CIOSS Director, Deputy Director, Council of Fellows, COAS Dean, OSU officials, Al Powell, Ingrid Guch, Kent Hughes, Paul Menzel and Stan Wilson)

12:00pm – Lunch (unhosted)

1:15pm – Review Panel deliberations and report writing (Burt 152)

4:00pm – Reviewer Panel feedback to CIOSS Director and Council of Fellows

4:30pm – Adjourn