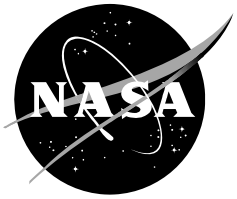

Strategic Planning Session Report #2
NASA Stennis Space Center, Applied Science Program
Gulf of Mexico Initiative

Session Convened on August 21, 2008
Corpus Christi, Texas

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Executive Summary

The NASA Applied Science Program, Gulf of Mexico Initiative hosted a Strategic Planning Workshop on August 21, 2008, in Corpus Christi, Texas. The workshop provided an introduction to NASA's new Gulf of Mexico Initiative and initiated a dialogue with the coastal community on the topic of partnerships.

Workshop participants are characterized and listed. Presentations given are summarized graphically:

- the Coastal Online Assessment and Synthesis Tool,
- Gulf of Mexico applications projects,
- NASA ROSES A.28 solicitation on Earth Science for Decision Making: Gulf of Mexico Region,
- NASA missions and ocean sensors,
- the DEVELOP program, and
- the GOMA Applications Pilot Project.

A panel discussion transcript details ideas and concerns for the best methods for developing partnerships that enhance the transition from coastal research to operations.

1.0 Introduction

A Gulf of Mexico Initiative (GOMI) Strategic Planning Workshop was held in Corpus Christi, Texas, on August 21, 2008. The workshop provided an introduction to NASA's new Gulf of Mexico Initiative and initiated a dialogue with the coastal community on the topic of partnerships. This report describes the workshop, characterizes the participants, and includes a transcript of the panel discussion.

Mr. Ted Mason of NASA's Applied Research & Technology Program Office (ARTPO) welcomed participants and reviewed the agenda for the afternoon session. Dr. Teresa Fryberger presented an overview of NASA's Applied Sciences Program goals, focus areas, and projects. She introduced the NASA ROSES A.28 solicitation on Earth Science for Decision Making: Gulf of Mexico Region as one way in which NASA is making a contribution to the coastal community. The next presentation, given by Mark Glorioso, Chief of ARTPO at Stennis Space Center, provided an overview of the Gulf of Mexico Initiative. Bill Graham of ARTPO introduced the new 3–5 year Strategic Plan. Richard Brown of Science Systems and Applications, Inc., gave a demonstration of COAST (Coastal Online Assessment and Synthesis Tool) (Figure 1). The final item on the agenda was a panel discussion on partnerships.

Figure 1. Gulf of Mexico Initiative displays including an interactive demonstration on how to use the COAST visualization tool.

2.0 Workshop Participants

The workshop was attended by 71 participants, including several members of the NASA Stennis Applied Science Program Steering Committee. A breakdown of the participants' affiliation and geographical distribution is shown in Figure 2 and Figure 3.

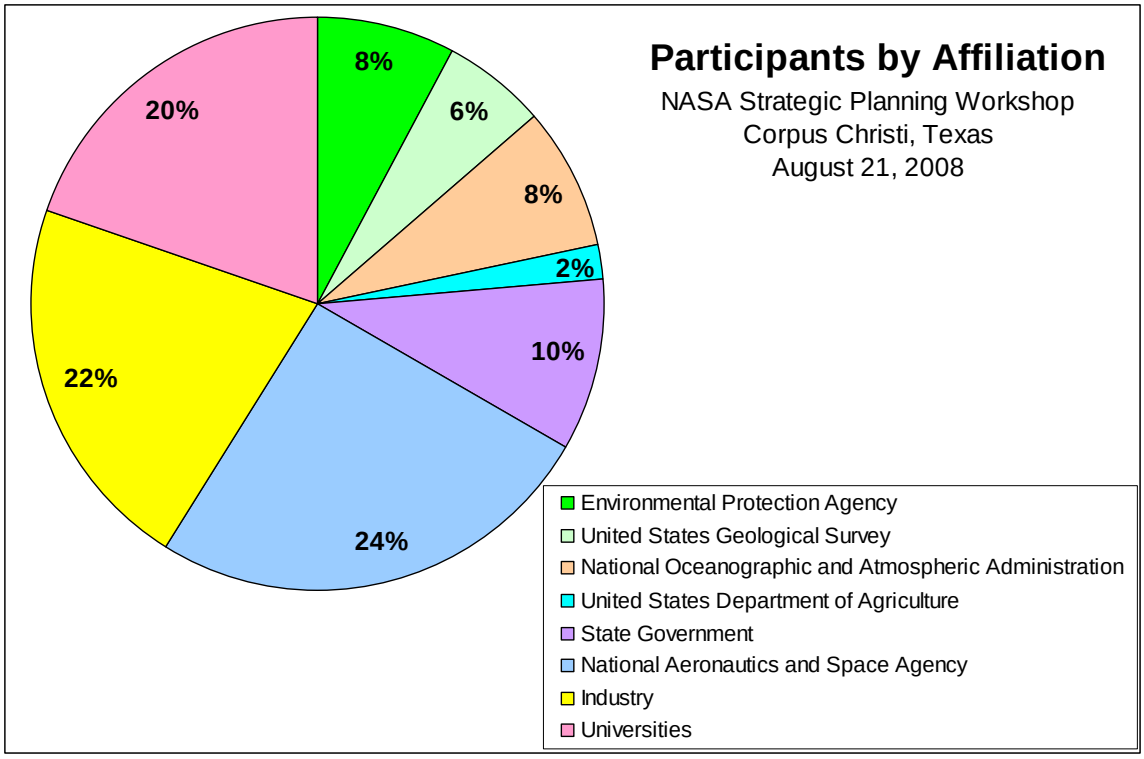

Figure 2. This graph illustrates participant representation from all sectors of the coastal community.

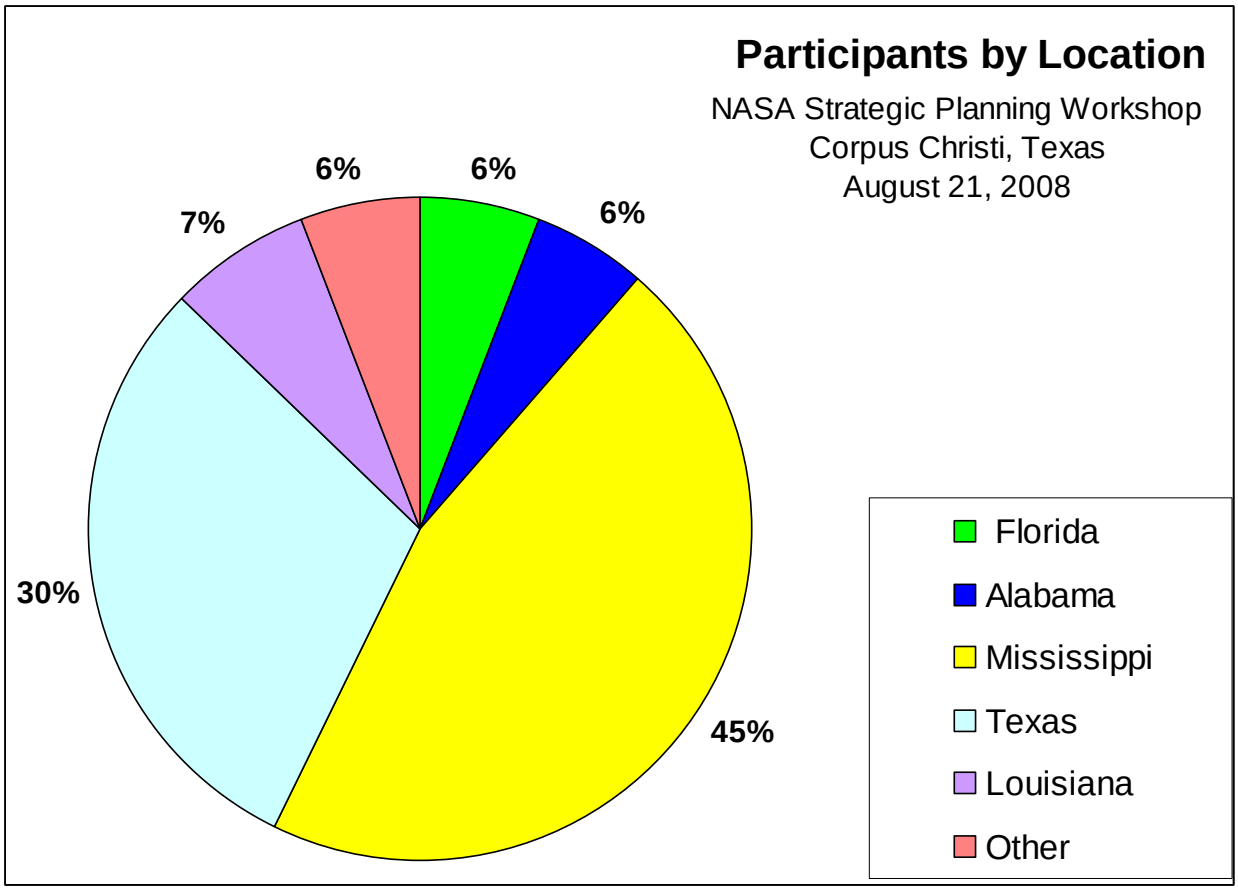

Figure 3. Participation was weighted toward the host state and the local audience.

3.0 Panel Discussion

3.1 Panelists

- Dr. Hal Leggett, Secretary of Louisiana Department of Environmental Quality (LDEQ)
- Mr. Bruce Moulton, Texas Commission on Environmental Quality (TCEQ)
- Dr. Teresa Fryberger, Associate Director of Applied Sciences (NASA)
- Mr. Bryon Griffith, Director of the Gulf of Mexico Program (EPA)
- Mr. Buck Sutter, NOAA Southeast Regional Office, Marine Fisheries Service, St. Petersburg, FL
- Dr. Dawn LaVoie, Gulf of Mexico Science Coordinator (USGS)
- Dr. Larry D. McKinney, Executive Director of the Harte Research Institute

Figure 4. Panelists.

3.2 Panelist Questions

- Discuss a successful collaboration that resulted in adding an operational product.
  - What are the criteria for adding an operational product? (Local/State/Fed)
  - How long does it really take to transition research to operations?
- What are the barriers that the research and operational partners need to consider when transitioning a research application project?
- Internal to your organization, what is the long-term view of regionalization and how does it affect partnerships?
- What are the major barriers to implementing Remote Sensing prototype products for state and local agencies?
- How important is it at the federal, state, and local perspective to link climate change and climate variability to projects proposed for the GOM?
- Discuss the best methods to publicize successes in partnership relationships and applications.

3.3 Panelist Discussion

Ted Mason: The panel will be moderated by Mark Glorioso, whom you've met already. So at this time we're going to get right into the panel discussion and I'll turn it over to Mark and hope we have some good dialogue. Thank you.

Mark Glorioso: We're going to introduce the members; before we do I want to thank you all for being here. Our panel discussion today is very critical to us - about trying to find ways to partner. We really want to take this where the rubber meets the road and put these things together, so we're hoping this is a lively, spirited discussion, many questions, many answers and that we can get on. At this point I'd like to let Dr. Fryberger set the tone. Then we'll just go down the row and we can each introduce ourselves; say who you are, where you come from, and why you're doing this.

Dr. Teresa Fryberger: I'm the Director of the Applied Sciences Program at NASA. I have only been there less than 2 years, so I still feel sort of new, still undergoing some culture shock coming into the NASA world. Prior to coming to NASA I was at the office of Science and Technology Policy in the White House; prior to that I was in the Department of Energy and in two of the National Labs: Pacific Northwest and Brookhaven National Laboratories. So I have kind of a long and checkered history. I started out as a physical chemist with a Ph.D. from Northwestern University. From there I went to what was then the National Bureau of Standards as a post doctoral fellow and then I got roped into the government. And I'm really pleased to be here and I would like to echo Mark's words, that the partnership aspect of Applied Sciences is the most difficult one for us and so we really welcome your ideas.

Buck Sutter: I'm representing NOAA on this panel. My daytime job is that I'm the Deputy Regional Administrator for the National Fisheries Service in St. Petersburg, Florida; southeast meaning everything from North Carolina through Texas and the U.S. Caribbean. My background is in fisheries biology. I worked for both the State of Mississippi and the State of Florida for about 7 years each as a population dynamics and offshore acoustics researcher. But what I've been involved mainly in over the last couple of years is looking internally within NOAA to collaborate across all different line offices within NOAA and then more recently with the Gulf of Mexico Alliance. So I have a fair amount of history with working together on both the federal side and the state side, so I look forward to hearing what these other folks have to say about that.

Larry McKinney: I'm the Director of the Harte Research Institute, and I've been there for about two and a half weeks. My perspective here on the panel really is more from my previous career with Texas Parks and Wildlife as Director of Coastal Fisheries and Water Resources dealing with that end of the data and information, trying to make use of this information to make the management decisions. So that's the perspective I came from when I joined the steering committee, which I've enjoyed; it's been a great experience for me. I'm interested in making that link, that science link and particularly in my new role in linking that science to folks that can use this information. And that is my role in the Alliance where I have chaired the old Habitat ID PIT, which is an attempt to help to bring all that information to useful areas. I'm excited about the opportunity, what NASA has put on the table; I think it's a huge step for us here in the Gulf of Mexico and I'm excited about going forward.

Bryon Griffith: I'm EPA's representative here on the panel. I'm Director of the EPA Gulf of Mexico Program Office at the Stennis Space Center, representing in that capacity the collaborative management coastal ecosystem program for what EPA refers to as a 3rd grade water body in the nation. My background is the least technical undoubtedly on the panel, at least on the sciences side. I am a graduate of Southern Mississippi. I was one of a cadre of management trainees in the late 70's that was taken into the government to bridge management and science. The federal government at that point in time was doing a little introspection and said we think we do a lot of great things – we just have no clue who we do it for and why. As a consequence my career has been built around operations improvements – high-performance management improvements in government. This is my 30th year and I'm proud to have been able to take that expertise and return it to the Gulf region where my long-time ties are, both spiritually and family.

Harold Leggett: Secretary for the Louisiana Department of Environmental Quality, like Bryon a graduate of the University of Southern Mississippi. I'm probably the most policy-oriented person up here. I'm the person that you spend most of your time trying to communicate with; the example I use is years ago when I was in school my research project was evaluating the impacts of eutrophication and water quality on fecundity and mortality of ictalure spontitus. Twenty years later I'd say how many fish can I raise in a gallon of water. The message of that is – that's how most of you in this room need to try to speak to people like me. Most of you in this room are scientists – I used to be a scientist, I've forgotten all that. When you speak to people like me, you need to keep it simple; you need to break it down into terms that people like me can understand because I still have to take that and communicate it to a true politician and that's the message for you today. I really applaud what I'm hearing from NASA. I really applaud the whole approach that I'm seeing with how the Gulf of Mexico is being dealt with, not only – excuse the expression – "save the whales," but also "save the economy," "save the resources," make sure they are there for all the folks to use. And I think that's going to be a huge huge change in this program – not necessarily what they've been doing but in being able to sell it for us to truly make a difference in the Gulf. If we're going to truly reduce the hypoxia zone, we have to make sure we have folks like our friends in Iowa, who've been doing great things. But the rest of the folks in this country realize that the Gulf of Mexico has a big impact on what you do. What I'm seeing from NASA and Stennis is that we're taking it and making it simple. We're taking the science and making it apply so that people like me can understand it, so that the general public can understand it, so when it comes time to dole out dollars they say wait a second, I understand what that means. So thanks for inviting me today; I look forward to hearing your comments and giving you my perspective again as the bureaucrat.

Bruce Moulton: I'm with the Texas Commission on Environmental Quality and I am a policy advisor to our commissioners and senior management in my agency. Governor Perry appointed my agency to be the lead in both Gulf of Mexico Program as well as the Gulf of Mexico Alliance. In that capacity, I have been the contact person primarily for the Alliance as well as for the Gulf program. Now, what are we doing here today and why am I interested in what NASA's doing? I have to make an informed decision to a lot of decision makers within our state; a lot of this goes to our Governor for him to make key decisions. I'm looking for decision making tools that can help me translate the science that you folks are generating into, as Hal said, simple terms that our decision makers can understand. We've got a lot of legislators out there that they say you've got to put it in simple terms for them to understand. I am very interested in what everybody has to offer up here and with that I'll pass it on.

Dawn Lavoie: I am the USGS science coordinator for the Gulf of Mexico and I want to say right up front that USGS is the research lab for the Department of Interior; we have no land management responsibilities; we have nothing to do with policy. We are a research organization and we provide information. I think we are struggling with the same kind of issues that NASA is struggling with; for example, when we have a research product, how do we make sure it's useful? I've been with the USGS for six years. My background is oceanography. I spent 20 years with the Naval Research Lab at Stennis and I was very glad to be able to be reassigned to open an office down here after Katrina. So thank you for inviting me.

Mark: Very good. As we begin, does everyone have a copy of the questions that are on the screen in front? Good. I thought it would be useful, actually I say "I" very loosely. Ted and Craig put a lot of thought into this thing, and obviously a good approach is to talk about what a successful collaboration might have been and how did we actually carry on an operational transition and one of my favorite questions, how long does it really take to transition research to operations? Coming from the mission evaluation room in mission control center in Houston, I know that in flying Space Shuttles, we did not allow the engineering community to walk in with the latest and greatest tools and stick it on the computers and that's how we're going to fly the shuttle is a similar problem, so anyone on this panel that has thoughts or opinions on this, I'd like to open the discussion with that question.

Buck: This is kind of an old one, but I think it's one that just about everybody in the room has touched in one way or another, and that is the SEAMAP program. The acronym is the Southeast Area Monitoring and Assessment Program. Back when I was fresh out of grad school going from New England down to Mississippi of all places, one of the things I was involved with in setting up a program is how can we develop a sampling protocol that can be used at least in the State of Mississippi and that led into looking at other similar programs that Louisiana, Texas, Alabama, and Florida had. Together with a lot of other folks that motivated the states to approach the federal government at that time, it was the National Fisheries Service that said, wouldn't it be nice if we were all using the same fishing gear so we could all compare what our results were, a lot like what NASA's done in developing some of these other programs. You just kind of use your own money, get something started, and when the value of that comparison – when we see a number – it all has the same meaning; then we can start really making some comparisons. That work that began in 1982-1983 has now been one of the longest running programs that provides not only biological data but fisheries data and has become a cornerstone on a lot of decisions that are being made on how we manage resources in the Gulf. It basically started out as a way to find practical ways to work together, and by the fact that we have a common problem and realizing we didn't have enough money – Mississippi couldn't sample the whole Gulf of Mexico for how many sea trout they can catch, how many shrimp they can catch – but we all had the same collective problem and that has become a long-time operation and provided some really good information for a long time in the Gulf.

Teresa: I can't really answer these panelists' questions quite in the same way that you all can. So I thought I would talk a little bit about how it's viewed at headquarters: these partnerships and some of the experience we've had.

At first I want to do a little definitional thing in the world of satellite people, which in the civilian world, at least, is primarily NASA, NOAA, and USGS a little bit. We view the so-called problem of research to operations, which has been a long-time issue in Washington and is getting worse than ever, as really something very specific, and that is the satellite missions that are developed at NASA get transitioned to NOAA for operational use. In this sense we're talking about something much broader than that definition and I just want to make it clear.

Our definition today can include such things like including algorithms into prediction models for the FAA for icy clouds, for example. Visualization and data integration tools such as COAST and then technologies like thermal sensors put on an aircraft, such as for fire. So it's a much broader definition here and I just want to make sure we're on the same page. So what we're really talking about here is tech transfer but I think there are a few added barriers. So I'd like to say what my perception of these barriers is.

1. One of the barriers with NASA in particular is that we cannot guarantee continuity of data. Our satellites are research satellites and we generally cannot guarantee long-term observations. If you had a decision support system and you needed satellite observations from NASA, you could wind up in trouble and I think were are going to be facing that with the debacle called NPOESS, which is the transfer of a particular instrument on NPOESS and that is MODIS. It's a tool that is really a work horse of applications as well as Landsat and it is supposed to have been transferred over to the new version, which is NPOESS run by NOAA and the Air Force, and the company building it has had all kinds of problems and we may face a gap in that data, so that's a big issue.

2. Another issue is infrastructure. By that I mean, if you're the weather service for example, you have an infrastructure, your operation works – you're getting out your forecasts. It costs you money and time and the possibility of a screw-up to incorporate something new into your decision support system. That is actually quite a barrier and we have found that it's easiest actually to work overseas in

developing countries because they don't have any infrastructure and they'll take it so we have a number of examples where that's worked very nicely.

3. Also capacity and end-user communities; if it's only three civilian agencies that really do this satellite stuff and it's still new enough technology, the expertise is not widespread for using remote sensing. So we often find that folks don't have the expertise to take something over from us, or they don't have funding and they don't have any way to get funding to build the capability that they need. We've run into that over and over and over; as I mentioned earlier, the Forest Service's money's distributed across the country and they barely have enough to stay alive. Building this kind of expertise is still a challenge. I think it is happening, but it is taking a long time.

4. Another issue is just simply the capacity of our program. We (Applied Science) are a little program at headquarters; thank goodness we've got our Centers to reach out into regions like this – at Headquarters we're five people. We have to know a little bit at least about the science and we have to know about the applications and as you know, it takes a lot of work to maintain a partnership.

5. Also NASA generally looks at the Earth at global to regional scales. We do not do high-resolution sensing and a lot of applications need that. So that's another complication that people frequently don't understand because they're not in the business. And also where the decisions are made. The decisions are not made in Washington, DC; they are made in the States. So that gives us a huge body of end users to find and work with, and that's a challenge.

6. And the final one that I find somewhat problematic at both ends is that most agencies do not have a good way to do cost-benefit analyses, including whatever it is we have to offer. I think it's essential that we be able to develop that tool because it's not always going to be worth it.

So that's kind of the barriers I see. We have a number of successes, some of which I've alluded to, and we've tried a whole number of things. We've tried working directly with local areas, communities, and individuals, and we pretty quickly got in trouble because we were doing some things somewhat orthogonally to what the Federal people were trying to do. So we got in trouble. You have to work through Federal agencies, etc. It's a bureaucratic issue but can be a real issue. We have a lot of partnerships with Federal agencies, but in a way having to work through Federal agencies in Washington, DC, doesn't really get you where you need to go. Because they're not actually making the decisions and they're not actually using the tools, so we have to find a way to get out of DC.

NASA is the only Federal agency to my knowledge that funds research in other Federal agencies; we've paid them to work with NASA. The problem is that they want us to keep doing it, but we cannot continue the funding indefinitely. We have found that the best way to proceed is to develop a few long-term partnerships. Some examples of our biggest successes are with the Department of Agriculture and the US Forest Service. We are thinking maybe we need just a few key long-term relationships. Also, instead of paying the other agencies, maybe they should cost-share with us, and then they'd have more in it. It's critical that we plan whatever we will be delivering with our partner at the outset. Otherwise, we're bringing something that we think is cool but they probably can't use.

Larry: Sensor life vs. length of time to set up an operation can be an obstacle. If it takes a long time to set up the operation, the sensor might not be there any longer. Scale is an obstacle; NASA generally doesn't work well at the State and local levels. However, the HABs project is a success, and hypoxia monitoring shows promise.

Dawn: Within the USGS, one of our most successful programs that has been transitioned to an operational sense is our stream gauging program. It was intended to be a 50/50 partnership. With partners buying into the process, they have a vested interest. Stream gauging is done where it is needed and the

data gets to where it needs to be. Over time, it has grown to a budget of $150 million per year. USGS contributes $60 million per year and partners contribute $90 million per year. Partners now put up more funding than originally anticipated because there is a demand for stream gauging. In a program like this, your partners publicize it for you. That's a measure of real success.

Hal: If I'm willing to give you money, that tells you it is important to me. I spend lots of money across Louisiana looking for fecal coliform. If you find a better way to do it that saves me money, that's a good thing. The States want to participate. I'm not going to get any more resources; I've got to use my money wisely or find a better way to do it. If you come to me and say, "Here's what I can do for you," this will allow States to shift resources to other needs.

Bryon: The States are the client, not the Federal government. We need to be cognizant of whether it's Hal that's asking for something for the State of Louisiana, or whether it's yet another bridge to an interesting piece of research that one very potent researcher wants to put this to work for. The latter is not sustainable. The implementation of something that actually changes the dynamic in Louisiana relative to the cost of operating a public health and safety program for fecal coliform identification is sustainable. Bruce, you said that there was excitement in the PIT team but you didn't really see the operational managers that would take that technology and put it to work. That's a dangerous zone in a time of reducing resources, which we are in right now. We really need to key on the client. The States are not skilled in identifying the particular tools they need for a given task. If these partnership ventures bring that tool to bear, then I'm a receptive client. Technologists and scientists tend to jump; they don't like it, it's seemingly slow and arduous, but it's the most critical step. The classic government attitude of "If we build it, they will come" is no longer valid. The government must tackle problems that are real and have a grounded client base.

Mark: Buck, you mentioned the SEAMAP project. Can you talk about that? It seemed like a success to you.

Buck: Regarding SEAMAP, the States needed to look beyond State boundaries. The Gulf of Mexico is on the short end of funding, and the States needed to work together. The States realized that everyone must work together on a common problem, set aside parochial views, and trust each other. The States were already sampling and finding out how much fish/shrimp they had, and the idea of everyone doing it collectively didn't require much modification. The Federal government had the same problem; they didn't have the sampling from inshore, and they had the responsibility for the EEZ. There was a small amount of seed money available. The States worked with a Federal EEZ match to generate a collective money pot. We went from zero funding to now about a $5 million a year program.

New money leverage takes longer; reallocating existing money takes less time. When you try to put a tool into a system that already has a way of doing things, it can be a long and costly process. But if it's an agreed-upon tool that people can see the value of, it can happen more quickly. A State can't manage on its own any more; it needs agencies such as MMS, DOI, USGS, EPA, etc. GOMA is the perfect way.

Mark: Who else knows of partnerships that have resulted in something positive?

Larry: HABs has worked all the way from Texas to Florida. One reason for its success is the public issue of red tides, being able to at least begin to predict them. It's brought State and Federal agencies together. It's clearly one that uses a NASA tool for remote sensing.

Bryon: HABs is an excellent example of collaboration, but also one of the clearest examples of things we have to improve – its sustainability. It involves three activities - detection, tracking and forecasting, and ultimately prediction. In this particular case, that application is on the cutting block for funding.

Background resource management agencies are helping to prop it up. One reason is the absence of integrating that truly into the criticality picture of the clients we serve, the Health Secretaries in the five U.S. States or the health ministries of the Mexican states. We don't know how to bind ourselves into that full Alliance collaboration and make the recognition that stamping that application down is not acceptable. We are a young region in terms of competing for coastal funds. We need to get better faster than the other coastal management regions to bring in the tools we need. We tend to get a project going and then want to move on to something else. But we need to wait until the project is firmly established. We need to stay on track, but we've been deemed as an area that doesn't stay on track very well. We need to bind together in the Alliance structure and recognize what an incredible offering $8 million worth of research work is, and begin to plug and play how some of these questions and answers that State managers have might come to work.

Mark: For the SEAMAP success, the States combined their funding; they recognized the need to work together. Fisheries management is not just a NOAA issue. There is integration between EPA, NOAA, and other agencies that is key. We haven't done enough to transition projects like HABs. It takes time to integrate a new procedure. We need someone on the State side to ground the scientists and involve them in transition, and talk about how important that is. We need to provide a story you can tell to the legislature, like three pictures with five bullets that you can sell, that they can understand.

Bryon: Here's another issue. In the first hour this afternoon, there was a wow factor, for two reasons: there was lots to be wowed by, and it was recognized that many people here didn't know that you did this work. The government is very complex. By design, the federal government has diversified our ability to do anything in separable parts of government. If Hal had had an application to use satellite technology to minimize by a factor of 10 the manpower effort to go onto the field and sample for fecal coliform, he doesn't know unless we tell him that there's a piece of that that is EPA, and USGS, and NASA, and NOAA. He'll go out and use one, and leave four out. If we want to be the best region in the Nation, we need to become the best educated region on how the government structure is put together, so that we can cross-reinforce and support each other's efforts.

Hal: In this group I see academics, scientists, and government representatives, but few business people; they are not engaged. We need to figure out how to get them engaged.

Dawn: There is a culture barrier, a gap between researchers and users. Researchers may tend to be introverted. They are excited about the research, but not as much about the follow-on steps needed to get it into the community. It's rare to find the person who can follow the entire process and bridge the gap.

Hal: GOMA is a good way to bridge the gap. There is good work going on here that's fairly unique. The five Gulf States, the sixth largest economy, that means a lot to many people. We need to get the message out.

Mark: I really appreciate the research to the end user that Dawn brought out. We need translators. We don't know how to do that. We're trained either in research or policy or something; it's a lifetime of training to figure out how to speak all the different languages. That leads to the last question; how do we publicize our successes? How do we get the word out?

Larry: Jason and Aaron gave a directed, focused presentation. That's the kind of presentation we need to make to local managers – here's what we can do for you in your program. Scientists tend to keep adding on and making it more complicated; they need to keep it simple. "Nothing gets a concept across like a disaster." Unfortunately, this is often what it takes. Let's try to get it across before the disaster.

Teresa: I'd like to applaud the DEVELOP students and program because it's building the kind of translators you were talking about. The students are working in teams, they have different backgrounds, and they focus on clear communications.

Mark: Jason, what was the number you translated the forestry stuff into carbon credit value?

Jason: About $242 million.

Mark: If you hear $250 million worth of anything, everybody perks up. That's also what's lacking: what's in it for me? It's dollars and cents most of the time. We as scientists working on these things need to constantly be thinking along those lines. What's the impact in dollars? I've seen tons of economic studies on the Gulf of Mexico, so how hard could it be to map loss of seagrass to impact on the grouper population?

Bryon: The vision and direction of the Alliance is one of great hopes for the Federal partners because we are the least capable of tooting our own horn. It sounds self-serving; it comes across as a thud in almost any audience. Turn that around, and imagine the empowerment of that collective on a regional scale, not a State scale, for the Governors' Alliance to see anything akin to those headlines that were presented in advance of the presentations, and you have a completely different outcome relative to the advertising. Then you will have a wellspring of energy that will grow up a legislative understanding within the legislative caucus of the region. Anytime you have any one organization trying to do that, it is something they cannot master. For example, NASA had little publicity until the Space Shuttle disaster. The Alliance is critical in that collective process, and there are attempts to replicate it in other regions of the country.

Bruce: I served on a National Science Foundation panel to translate science into information for decision makers. The panel included 45 scientists and 2 policy makers. We're all sitting around the table; it's not going to help us in decision making. I go in and brief some of my commissioners on occasion, and one of them sat there one day and said, "Tell me, I'll forget. Show me, I'll remember. Involve me, I'll understand." That's the key to getting good involvement in these collaborative efforts we see along the Gulf.

Teresa: I really think that's a great point and it is an age-old problem. Scientists talking to themselves is an age-old problem. But I also think it's partly the translator. It's also hard to get people to come. I don't know how many stakeholder kind of meetings we've put on in various venues and people don't come. Maybe they don't come because they know a bunch of nerds are going to fire a bunch of stuff they don't understand. How do you get over that?

Bruce: We can't walk into the front door with a tool and hand it to the decision makers because that won't work. And we've experienced that on the state level. We have some great models out there, some great tools, and you take an answer in and you hand it to the stakeholders, authorities, coastal communities, and say, "All right, here's the answer." They will say, "Hey wait a minute, we weren't involved with developing that answer." What we've gone back to is more of a grassroots approach to developing ecosystem management plans and things like that. But, as long as they get in on the ground level, base level, front-loading – have their input – then you will get buy-in, but if you walk in the front door and say here's the answer, it's never going to go anywhere.

Mark: How important is climate change and how it impacts what we're trying to accomplish in the GOM?

Hal: It's an important issue, a significant issue. I don't see where it has any linkage to Gulf of Mexico. Yes, there is some issue, it's a much broader issue, you can have some linkage. I look at it as that's the

pretty candy right now, climate change; it's really popular and people want to throw lots of money at it. I think issues in GOM are significant enough on their own that they don't need any pretty candy tied to it.

Teresa: That's an interesting perspective. You're right, everybody's jumping on the bandwagon, especially in Washington. You see, but the tides have turned, we're no longer proving that the climate is changing; now, everybody's talking about decision support. I'm interested to know – are people using this in the States on real decision support issues, or is this something we're all making movies about in DC?

Larry: I think the comment from my colleague from Louisiana is right on, as to kind of what the status is, because I don't think it's understood. I think what does it really mean to us at the state level, I think it's even worse at a local level. We initially had to deal with a Texas coastal city that's north of us that will go unnamed, a very developing area, in some efforts to look at the future. Do we need to take a look at how sea level rise or climate change affect development or long-term plans? They actually funded some studies and the scientist came back to give the reports. As they started giving the reports, they said, no, actually we don't want to hear that, because if we hear that our developers will start running out of here like crazy. No, we don't want to hear that, we survive here by selling real estate. It goes to that old song, what's the lifetime politics? I think it's one of those persistent levels you begin to lay out; what does it mean to me. And we'll see the traction be gained at the state level. If we can demonstrate, if it's demonstrative, that there are impacts and there are impacts at the foreseeable future; if we see in the 30- or 50-year horizon, if we can make that case, then you will see some exception.

Teresa: I thought the presentation yesterday morning from the Department of Transportation really laid it out, that begins to grab you. I think I agree that we have a lot of issues. I think sustainability – which we're not allowed to use in the United States – I think rebuilding for sustainability is important.

Larry: You're right, that transportation presentation was good. When you laid the map of I-10 across Louisiana, Mississippi, okay, 25,000 miles of roads or whatever that number was, might be flooded.

Teresa: But most of us don't have that much of a long-term planning horizon.

Larry: We have more immediate problems right in our face and we're trying to deal with those, much less the next 25-30 years.

Dawn: However if you are going to start to talk about restoring barrier islands in Mississippi and Louisiana, then you are talking about millions and millions of dollars. You kind of want to know how long the sand you pump on those islands is going to last and I think sea level rise frequency of storms or rather increasing intensity of storms as you start to predict the lifespan of your project over the next 30 years is a critical parameter we need to model and put into those plans; otherwise we are wasting a lot of money.

Mark: States and Federal government give different answers.

Larry: It's a scale issue from your responsibility; federal agents for the most part are looking at the GOM as a whole and when your perspective broadens or narrows, that's going to affect what issues are going to be on the top of your plate.

Bryon: At any scale when you're talking about millions of dollars, you got proposals on the street and you got proposals under review. I would just offer again that before those proposals are actually finalized and decided, you have an extraordinary forum in the Alliance to do some confirmation that you are in fact choosing problems to go after solving that have a clientele for which whatever investment amount you use has a chance to have a return on investment that you'd be proud to be associated with at the end. That

is essentially, theoretically, why one of the reasons for the outcropping of the regional government structures is to now take the absolutely required leveraging and make sure we are targeting problems for which there is a quantifiable and qualifiable client.

Teresa: That's a great issue. One of the things we do in our review panels is that we not only have scientists, but we try to include end users when we can. That will be absolutely vital here. We haven't quite figured out how we're going to do this yet, but we really want to engage people on both sides of the issue.

Hal: I would add the words, "what is the greatest return on investment." When you evaluate the cost of proposals potential return on investment the ultimate decisions are made on which one has the greatest return.

Dawn: You also have to look at the cost incurred if something is not funded and nothing is done. We need to think about how we evaluate the cost of things

Buck: I agree with both points about how decision makers relate to what's going on and how we put it in the right context, but I think it's critically important that we avoid as much confusion as possible. I'm sure that as someone who is in a legislative type position and has the ability to make decisions about funding and what kind of programs go forward and which ones don't probably collect from all different directions about is sea level real, is it not real? Are fisheries overfished or not overfished? I think one of the values that we haven't really articulated too much is that the Alliance allows all the different partners, whether you're one of the 13 federal agencies or one of the 5 states, we talk about Mexico, and that is to get on the same page and really realize we're talking in the same terms so that when we do have that opportunity to have an elevator discussion or talk to a school group, we are all singing from the same hymnal. We're all realizing that were talking about the same problem; we are in concert with each other, not in conflict. Keeping the confusion out of these key issues we all have identified as a critical part that the Alliance really plays a key role in helping to avoid.

Mark: I appreciate what this panel has done for us.

3.4 Questions from the Audience

Audience Comment: (inaudible)

Mark: That's one of the main reasons we bring this forum together; you meet each other, you hear this discussion, you know what the end users require. This is for you to figure out how to solve the problems more than for us to tell you how to do it. I'd like to ask Teresa to close the session.

Teresa: Are there any more questions?

Guest: NOAA has a program for Ph.D. students to look at commercializing the NOAA science products and find value for them. Does NASA have such a program?

Teresa: NASA does not have that in Earth Science. We are a collection of scientists. We have post-doctoral fellowships and an educational program more focused on science, with the exception of the DEVELOP program.

Guest: Regarding translators, you're good at the research and development at NASA; wouldn't it be easier to partner with some organization that can do the communication instead of trying to teach yourself how to do it?

Teresa: Scientists tend to think they can do anything. The Federal government doesn't feel that they need to communicate. We're not very good at it. My program is now working on a communications plan that will get communications people involved. It takes special kind of people who will spend the energy working across that barrier.

Steve Wolfe: Going back to the transition between research and operations, I wonder if there's a step that's not really being discussed outright. We in the State and Federal government have been paying for research because the State regulators need tools for microbial source tracking, to get a handle on beach closures. We found out that the Gulf Alliance had a workshop and there was good research, and the researchers were developing new science and then going on to the next step. The States and regulators were paying for tools from the research, but the researchers were going on to the next step. They found that things the researchers had developed two or three steps ago were desperately sought by the regulators and managers; they had never been standardized so that regular folks could use them. You spoke on the difficulty of selling Washington on funding the transition to different agencies. You've convinced the agency of that need, but it has never made the transition to where the politicians see the benefit because it's only had one layer of transfer to a tool. There need to be more layers of transition to a tool. Also, regarding COAST, I'm sensitive to the software developers who release software and someone asks, "Can it do this also?" As much as I like COAST, for our managers to use COAST on a day-to-day basis, they need a COAST Lite version. There's one more notch to make the transition.

Teresa: You raised a number of issues. NASA has a huge amount of data over many years in the DAACs, or data analysis centers, and we're very good at putting that information out to the research community for free. In the Applied Sciences Program, we're going to work with our data centers to get them to help us develop near-real-time products that can be used by decision makers. We'll need to do it on a project-by-project basis. The other issue you raised, and Bryon spoke about, was the issue of getting things funded. In the government, the topic of environment is one of the most broken things in government; we don't have a Department of Environment. I am a co-chair on the U.S. Group on Earth Observations, which is composed of Federal agencies. There are 15 agencies funded by different committees in the House and Senate. There are so many things that fall through the cracks regarding the environment as a result of that.

A guest: Can someone address the role or value added of regional university consortia, particularly as it relates to the ability of the Federal government to fund or collaborate with us and the States in moving to the transition to an operational product? It seems to me that NOAA is interested in this.

Bryon: From an operational standpoint, we are very supportive of regional consortia constructs, and I could give you 35 minutes on why that's the case, or I can give you 5 seconds. In the new competitive structure at that level, pre-arrived-at arrangements between large university consortia are easier for us to operate within.

Teresa: The consortia also bring the expertise to bear on a problem much better than a single university. In closing, I really want to thank you all for coming. I talked at the beginning about long-term relationships; that's where we have the most success. I really hope we will have one with the Gulf of Mexico Alliance. I'd also like to thank my Stennis friends for organizing this and for doing such a great job shifting gears over the last year. Thank you all; I found this very useful.

4.0 Lessons Learned

- If possible, do not schedule a workshop at the beginning or ending of an associated conference. If necessary, schedule an evening session in the middle of the week.

- Target a local audience sooner; local universities, Chamber of Commerce, local news, etc.
- Utilize roving microphone for audience questions even if the sound carries well in the room because the video may not pick up the dialogue.
- Do not deviate from planned break schedule.
- COAST presentation should have been designed around an application.
- The senior NASA person present should be the panel moderator.
- Panel moderator should guide discussion through each question in the sequence planned.
- Panel discussion time could be longer.
- Always use the facility IT person.

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Appendix A. Acronyms

Acronym	Definition
ARS	Agricultural Research Service
COAST	Coastal Online Assessment and Synthesis Tool
DAAC	Distributed Active Archive Center
DEQ	Department of Environmental Quality
DOI	Department of the Interior
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
GOM	Gulf of Mexico
GOMA	Gulf of Mexico Alliance
GOMI	Gulf of Mexico Institute
Habitat ID PIT	Habitat Identification Priority Issue Team
HABs	Harmful Algal Blooms
HRI	Harte Research Institute
IT	Infrastructure Technology
LDEQ	Louisiana Department of Environmental Quality
LSU	Louisiana State University
MDEQ	Mississippi Department of Environmental Quality
MMS	Minerals Management Service
MODIS	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration
NGI	Northern Gulf Institute
NOAA	National Oceanographic and Atmospheric Administration
NESDIS	National Environmental Satellite, Data, & Information Service

NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPS	National Park Service
TPWD	Texas Parks and Wildlife Department
NSL	National Sedimentation Laboratory
NWS	National Weather Service
SEAMAP	Southeast Area Monitoring and Assessment Program
SSAI	Science Systems and Applications, Inc.
SSC	Stennis Space Center
TCEQ	Texas Commission on Environmental Quality
TSRI	Tri-State Resource Center
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USM	University of Southern Mississippi

Appendix B. Invitation and Participants

Please Save the Date

NASA SSC Applied Science Program, Gulf of Mexico Initiative
Strategic Planning Session

Thursday, August 21, 2008
Padre Island Ballroom
Omni Corpus Christi, Marina Tower
Corpus Christi, TX
1:00 pm to 5:00 pm

NASA's Applied Science Program at Stennis Space Center (SSC) has developed a draft 3-5 year Gulf of Mexico Coastal Strategic Plan. We will be presenting the draft Strategic Plan and conducting a panel discussion on the best methods for developing partnerships.

Panel Guests:

- Dr. Hal Leggett, Secretary of Louisiana Department of Environmental Quality (LDEQ)
- Mr. Bruce Moulton, Texas Commission on Environmental Quality (TCEQ)
- Dr. Teresa Fryberger, Associate Director of Applied Sciences, NASA
- Mr. Bryon Griffith, Director of the Gulf of Mexico Program, EPA
- Mr. Buck Sutter, NOAA Southeast Regional Office, Marine Fisheries Service, St. Petersburg, FL
- Dr. Dawn LaVoie, Gulf of Mexico Science Coordinator, USGS
- Dr. Larry D. McKinney, Executive Director of the Harte Research Institute

Session Objectives:

- Introduce the goals, capabilities, and coastal application projects and activities developed by the Applied Science Program
- Introduce the draft Coastal Strategic Plan and its goals and objectives
- Panel discussion on the best methods to develop partnerships that enhance the transition from coastal research to operations

Online Registration, Agenda & Hotel Logistics at www.coastal.ssc.nasa.gov

For more information please contact: Craig Peterson
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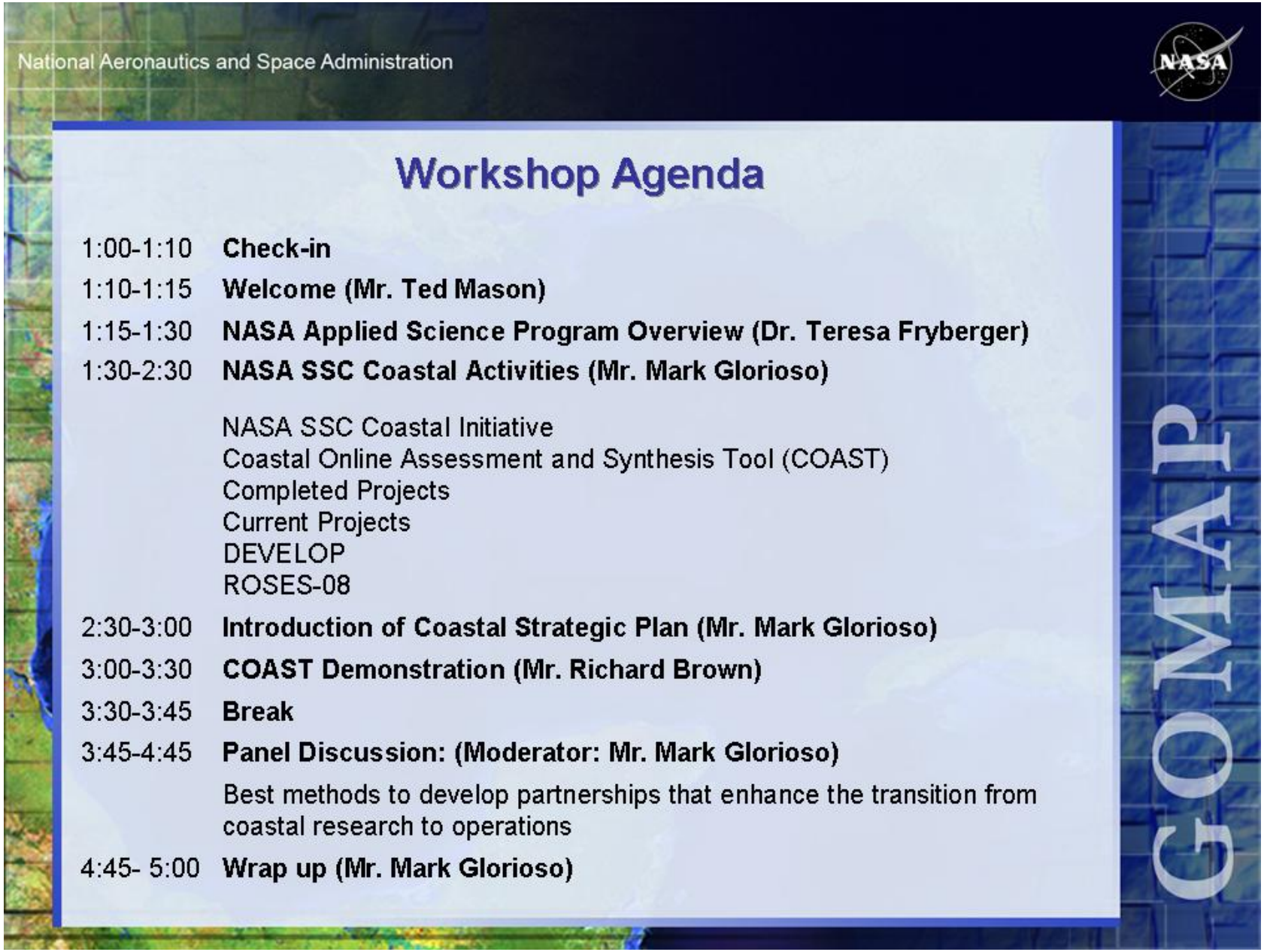
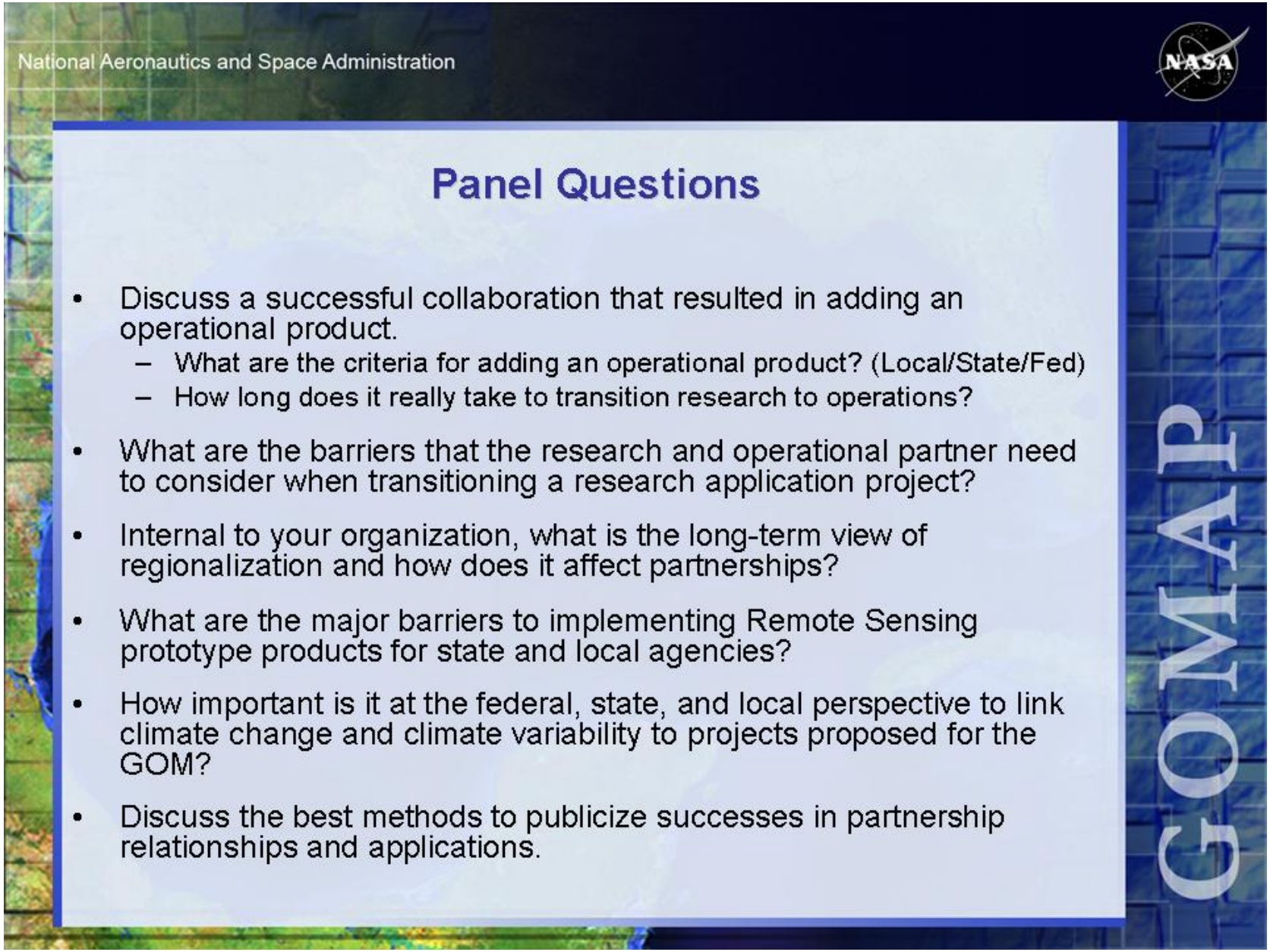
Appendix C. Hand-Outs (14 Total)



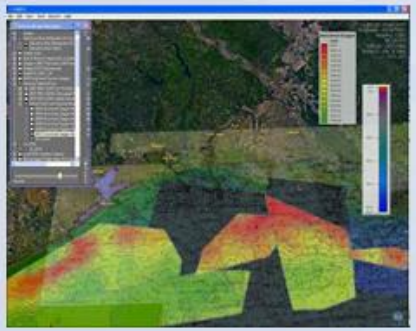

National Aeronautics and Space Administration
NASA
Panel Questions
• Discuss a successful collaboration that resulted in adding an operational product.
– What are the criteria for adding an operational product? (Local/State/Fed)
– How long does it really take to transition research to operations?
• What are the barriers that the research and operational partner need to consider when transitioning a research application project?
• Internal to your organization, what is the long-term view of regionalization and how does it affect partnerships?
• What are the major barriers to implementing Remote Sensing prototype products for state and local agencies?
• How important is it at the federal, state, and local perspective to link climate change and climate variability to projects proposed for the GOM?
• Discuss the best methods to publicize successes in partnership relationships and applications.
GOMAP

National Aeronautics and Space Administration

COAST:
Coastal Online Assessment and Synthesis Tool

Purpose: **Integration and visual analysis of coastal Gulf of Mexico datasets** ***End-User***: **Coastal interest community**

The Coastal Online Assessment and Synthesis Tool (COAST) geobrowser is being developed at NASA Stennis Space Center (SSC) to integrate previously disparate coastal data sets from NASA and other sources into a common desktop client tool that will provide insightful new data visualization and analysis capabilities for coastal researchers, managers, and residents. COAST enhances the capabilities of the immensely successful NASA open source 3D geobrowser, World Wind, developed at the NASA Ames Research Center.



Benefits Of An Open Source GeoBrowser …

- *Free – core development is already paid for*
- *Extensible – install or develop functions that add value to you*
- *Worldwide developer community – new tools and support*

Why is it different?

- *Integrate your own data with other data sources and visualize the results*
- *Fuse different data types, such as spatial and spectral, for simultaneous visual analysis*
- *Visualize temporal changes in areas of interest*

Availability: Initial beta testing and first generation refinements are complete!

COAST 1.0.0 is available for download via the NASA SSC Coastal Program website, www.coastal.ssc.nasa.gov

Project Leads: Craig Peterson (NASA, Stennis Space Center), Ted Mason (NASA Stennis Space Center), and Richard Brown (SSAI, Stennis Space Center)

GOMAP

National Aeronautics and Space Administration

Completed NASA SSC Gulf of Mexico Application Projects

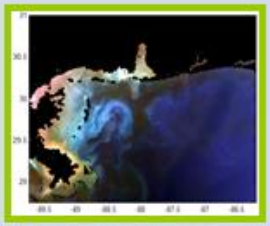
Regional Sediment Management

Purpose:
Detect Suspended Sediments Using MODIS and VIIRS Simulated Data

End User:
U.S. Army Corp. of Engineers

Study Area:
Alabama, Mississippi, Louisiana

Project Leads:
Jean Ellis (NASA)
Maria Kalcic (SSAI)



Suspended Sediments Map

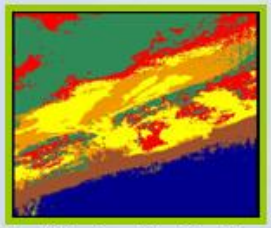
Coral Reef Early Warning System

Purpose:
Determine if NASA Next Generation Sensors can produce Key Data Layers for the NOAA CREWS Decision Support Tool

End User: NOAA

Study Area:
Looe Key, FL; Kaneohe Bay, HI

Project Leads:
Callie Hall (NASA), Lee Estep (SSAI)



Benthic Classification Map

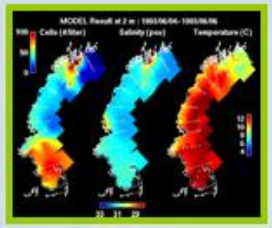
Harmful Algal Bloom

Purpose:
Identify Current and Future NASA Data Products that can be used in the NOAA HABMAPS Decision Support System

End User: NOAA

Study Area: Gulf of Mexico

Project Leads: Callie Hall (NASA), Lee Estep (SSAI)



HAB Forecast Map

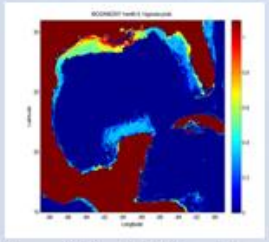
Hypoxia

Purpose:
Predict the Spread of Hypoxia using MODIS Data and the Time Series Product Toolkit

Potential End User:
Regional Planners

Study Area: *Gulf of Mexico*

Project Leads:
Callie Hall (NASA), Bruce Spiering (NASA), Maria Kalcic (SSAI)



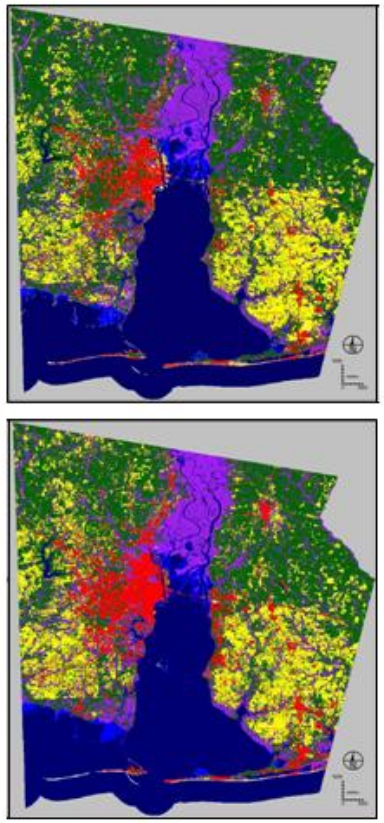
Hypoxia Probabilities Map

GOMAP

National Aeronautics and Space Administration

Gulf of Mexico Alliance Application Pilot: Land-Use and Land-Cover (LULC) Change from 1974–2008 around Mobile Bay, AL

***Purpose*: Assess LULC changes of Mobile and Baldwin counties, AL, for 1974–2008** ***End-User*: Mobile Bay NEP**



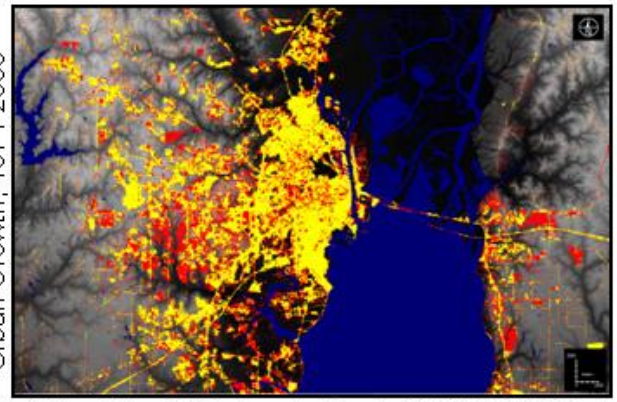
(Top) Landsat MSS (11/12/1974); (Bottom) Landsat TM (3/16/08)

Landsat-derived geospatial statistics to analyze LULC in Mobile and Baldwin counties have been calculated for nine dates between 1974–2008. Project data and data products are tailored for Mobile Bay NEP and will be available on-line [Regional Ecosystem Data Management (NOAA/NCDDC)].

Class	1974 Total Acres	1974 Percent	2008 Total Acres	2008 Percent
Open water	485,302	26.4	504,431	27.2
Barren	3,504	0.2	1,954	0.1
Agriculture	272,024	14.8	284,436	15.3
Non-woody wetland	38,631	2.1	39,964	2.2
Upland forest	674,298	36.6	586,523	31.6
Woody wetland	270,618	14.7	282,213	15.2
Urban	96,688	5.3	151,644	8.2
Total	1,841,065	100.0	1,857,165	100.0

Landsat-derived LULC change statistics from 1974-2008.

Urban Growth, 1974-2008



Yellow: 1974 and 2008 urban extent (Landsat MSS, 11/12/1974); Red: Urban growth from 1974 to 2008 (Landsat TM, 3/16/08); Backdrop: USGS DEM, darker grey shades indicate lower elevations

Project Leads: Jean Ellis (NASA, Stennis Space Center) and Joseph Spruce (SSAI, Stennis Space Center)

GOMAP

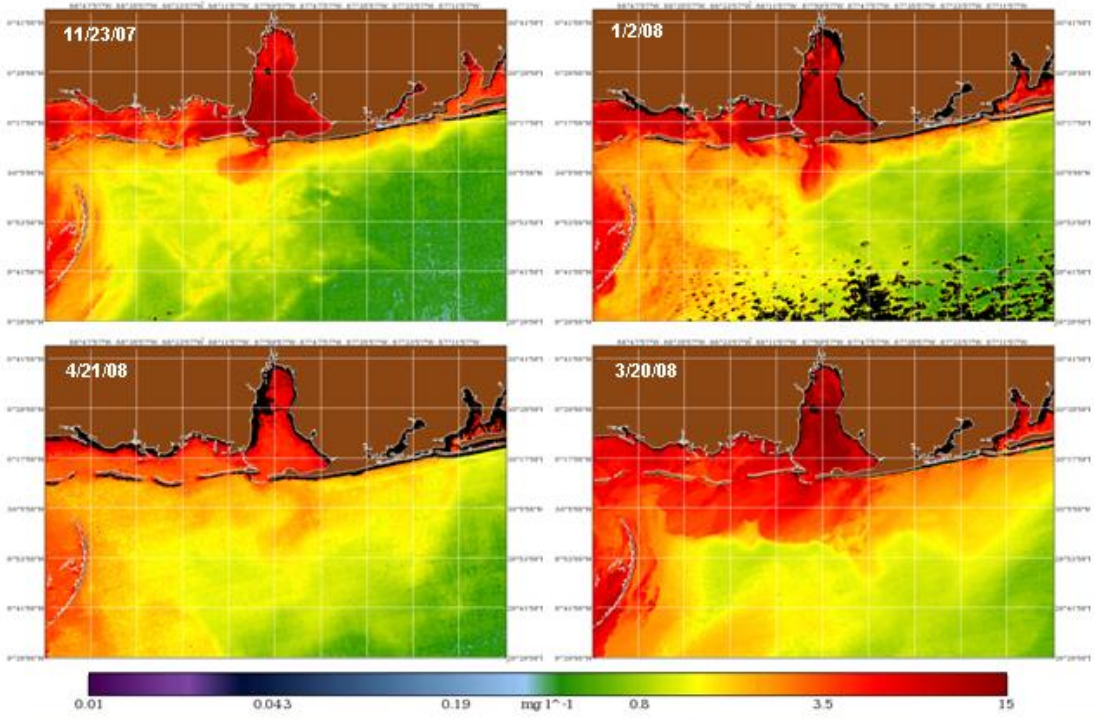
National Aeronautics and Space Administration

Satellite Estimation of Suspended Particulate Loads in and around Mobile Bay, AL

***Purpose*: Examine spatial and temporal variability of the Mobile Bay sediment plume**

The variability of the Mobile Bay sediment plume, which impacts water clarity, dissolved oxygen levels, and ultimately seagrass health, will be tracked using MODIS (250 m) and in situ measurements from 10/1/07 to 9/30/08. Total suspended solids are partitioned into organic and inorganic content. Plume area will be delineated and a time-series analysis will be produced.

Total Suspended Solids (organic and inorganic particulates, mg/l)



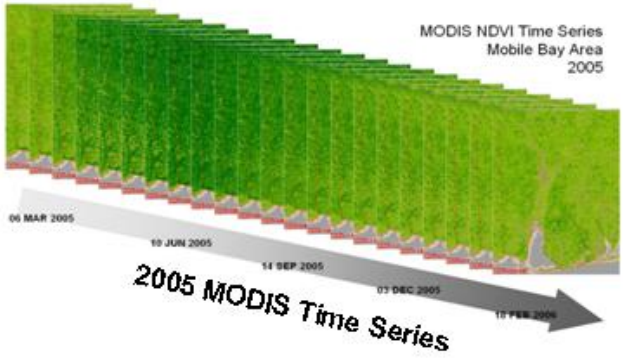
Project Leads: Jean Ellis (NASA, Stennis Space Center), Richard Gould and Gina Smith (Naval Research Laboratory, Stennis Space Center)

GOMAP

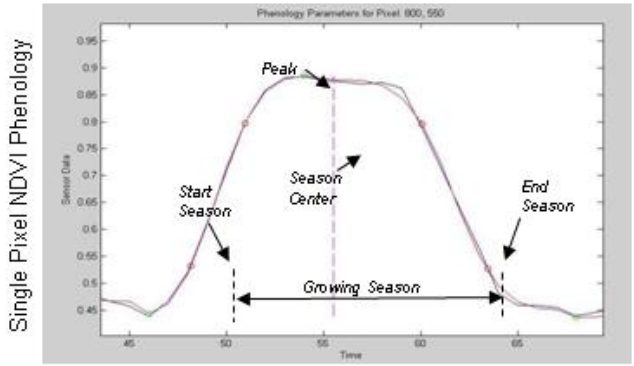
National Aeronautics and Space Administration

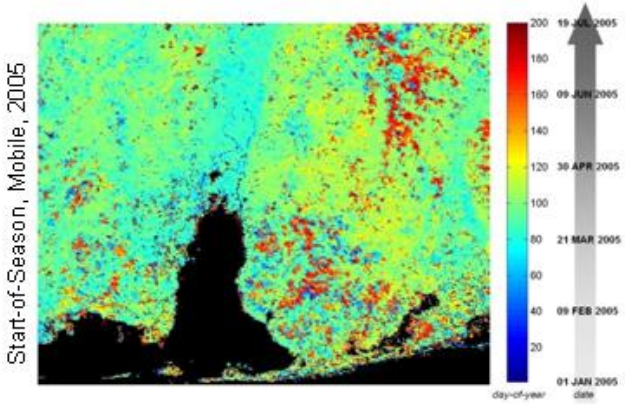
Estimating Relative Nutrient Contributions of Agriculture and Forests Using MODIS Time Series

***Purpose*: Demonstrate viability of nutrient source products for small to medium watersheds around Gulf of Mexico**
***End-User*: MDEQ, potentially other state environmental agencies**



Around the Gulf of Mexico, high-input crops in several regions make a significant contribution to nutrient loading of small to medium estuaries and the near-shore Gulf. In addition to crops, management of timberlands in proximity to the coasts also plays a role. Nutrient source information products can be derived from remotely sensed time series data. Conceptually, these products are intended to complement estuarine nutrient monitoring.





Project Leads: Bruce Spiering (NASA, Stennis Space Center) and Kenton Ross (SSAI, Stennis Space Center)

GOMAP

National Aeronautics and Space Administration

Use of NASA Satellite Data in Monitoring Gulf Coast Forest Conditions

Purpose: **Assess potential of Gulf Coast forest monitoring products derived from NASA satellite data**
End User**: USDA Forest Service, USGS NWRC, and the LA-DNR**

Regional monitoring of forest damage from hurricanes

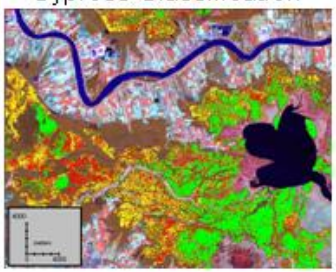
Stand-specific monitoring of baldcypress forest

Study areas – coastal Mississippi and Louisiana

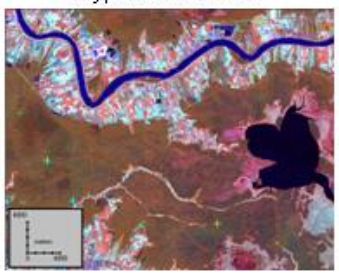
Status – developed and began to assess preliminary products

- Baldcypress stand condition products from Landsat and ASTER data
- Hurricane Katrina forest damage products from MODIS data

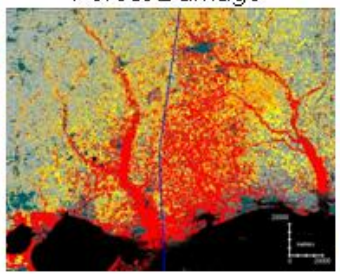
Landsat
Cypress Classification



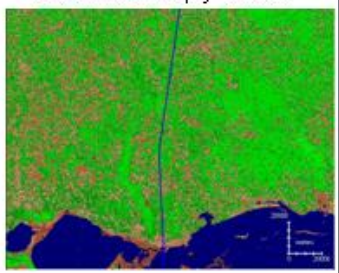
Reference
Cypress Points



MODIS-Based
Forest Damage



NLCD
% Tree Canopy Cover



Project Leads: Joseph Spruce (SSAI, Stennis Space Center) and Duane Armstrong (NASA, Stennis Space Center)

GOMAP

National Aeronautics and Space Administration

Coastal Marsh Monitoring for Persistent Saltwater Intrusion

***Purpose*: Assess the feasibility of using NASA satellite data to monitor persistent saltwater intrusion in coastal marshes**
***End User*: USGS National Wetlands Research Center and Louisiana Department of Natural Resources**

Approach: Use time series of vegetation indices to identify stressed vegetation (NDVI), moisture indices to determine if persistent flooding is cause of stress (NDMI, NDWI), and CDOM absorption to determine flood water salinity (a_g – salinity relationship)

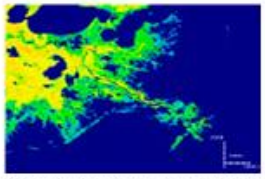
- Sensors: MODIS, Landsat, Hyperion, ALI, ASTER
- Tools: Time Series Product Tool (TSPT)

Study Area: Sabine-Calcasieu River Basin (Louisiana)

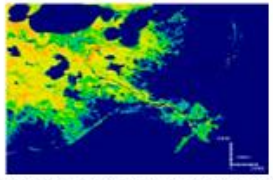
Decision Support: Coast-Wide Reference Monitoring System (CRMS) created by Louisiana Coastal Wetlands Conservation & Restoration Task Force

- Determine effectiveness of Breaux Act restoration projects by providing reference sites for which no paired reference areas exist
- Ensure strategic coastal plan for Louisiana is effective in re-creating sustainable coastal ecosystem

Selected Accomplishments: Analyzed NDVI, NDMI, NDWI time series (2004–2006) of study area; isolated storm surge events and time-shifts in output indices and implemented user-defined region-of-interest selection with TSPT; validated satellite data products with extensive in situ data from CRMS monitoring sites; preliminary generation of additional indicators based on multiple time series variables.



Cumulative NDVI Integral 2004



Cumulative NDVI Integral 2006

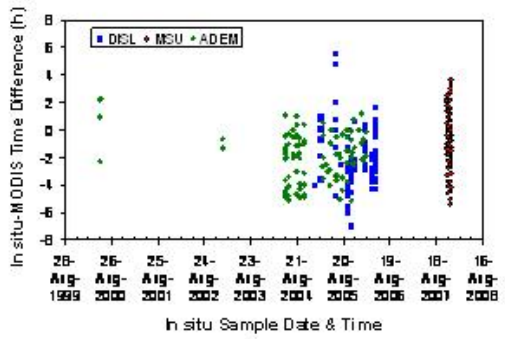
Project Leads: Callie Hall (NASA, Stennis Space Center), Maria Kalcic and Lee Estep (SSAI, Stennis Space Center), Greg Steyer and John Burras (USGS)

GOMAP

National Aeronautics and Space Administration

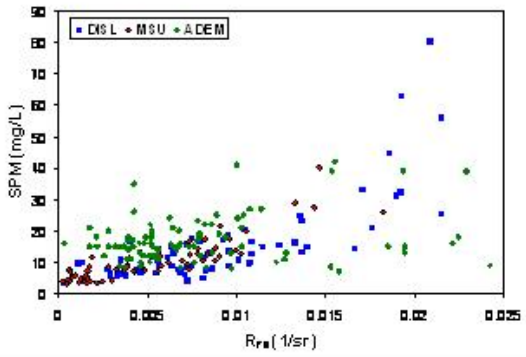
A Standardized Remote Sensing Product for Water Clarity Estimation within Gulf of Mexico Coastal Waters

Purpose: **Develop a standard remote sensing data product for total suspended sediment**
End User: **Gulf of Mexico Alliance Nutrients and Water Quality Priority Issue Team**



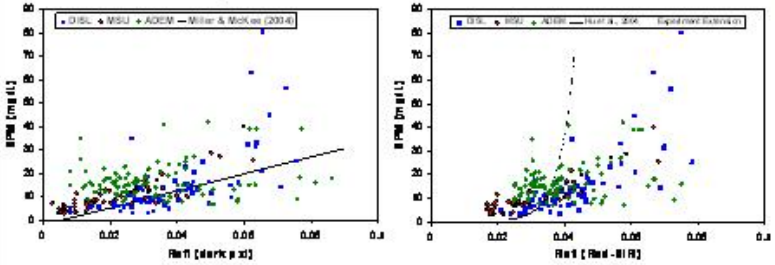
In situ data from 2002 to 2007: Total suspended sediment (TSS) suspended particulate matter (SPM) Secchi disk depths.

Data courtesy of:
MSU, DISL-MSU-NASA, and Alabama Department of Environmental Management (ADEM). Additional data (not shown) has been provided by University of South Mississippi (USM) and Louisiana Department of Environmental Quality (LDEQ).
Additional data are welcome!



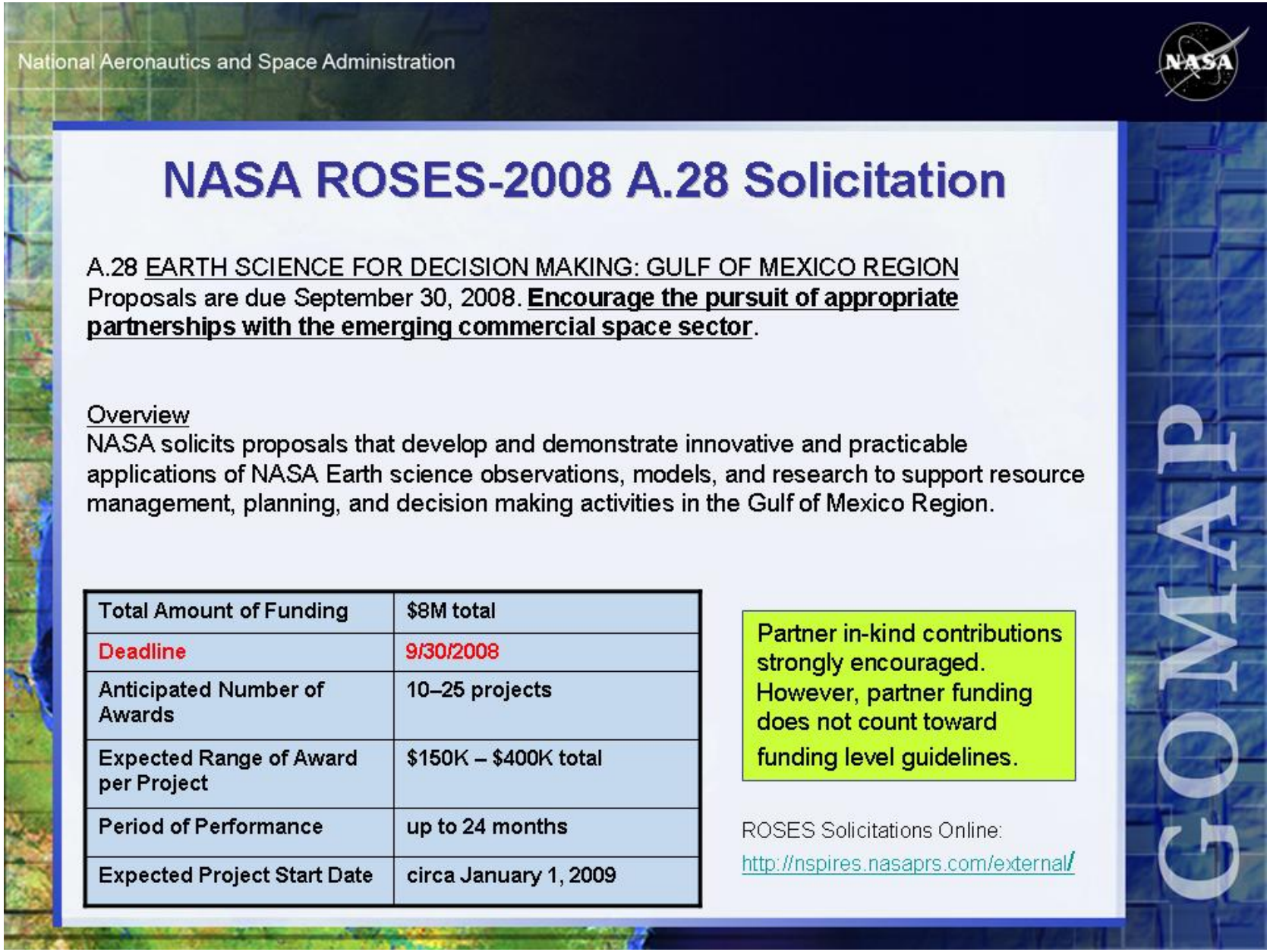
Obtained and atmospherically corrected MODIS data that was temporally and spatially concurrent to the in situ measurements. Mobile Bay data shown here.

Tested the correspondence between published algorithms and our data. Mobile Bay data are shown here.



Project Leads: Jean Ellis and Callie Hall (NASA, Stennis Space Center), Slawomir Blonski and DeNeice Guest (SSAI, Stennis Space Center)

GOMAP

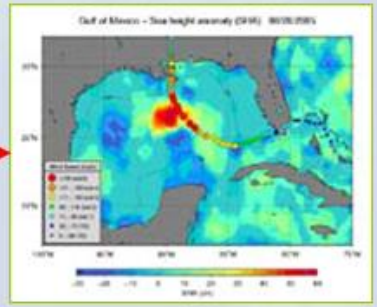


National Aeronautics and Space Administration

Current Missions: Direct Coastal Applications

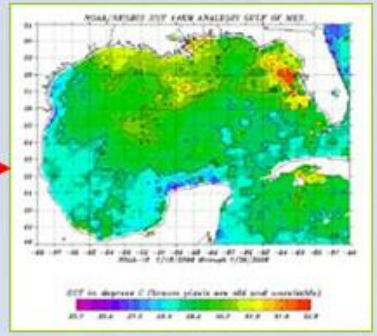
Jason-1 and Jason-2

- Ocean Surface Topography
- Sea Surface Height Anomalies
- Ocean Circulation
- Wave Heights
- Wind Speed



Terra and Aqua

- Colored Dissolved Organic Matter (MODIS)
- Algal Blooms (MODIS)
- Sea Surface Temperature (MODIS/AMSR-E)
- Ocean Surface Roughness (AMSR-E)

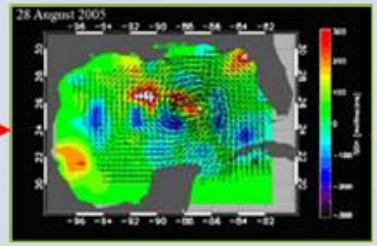


GRACE

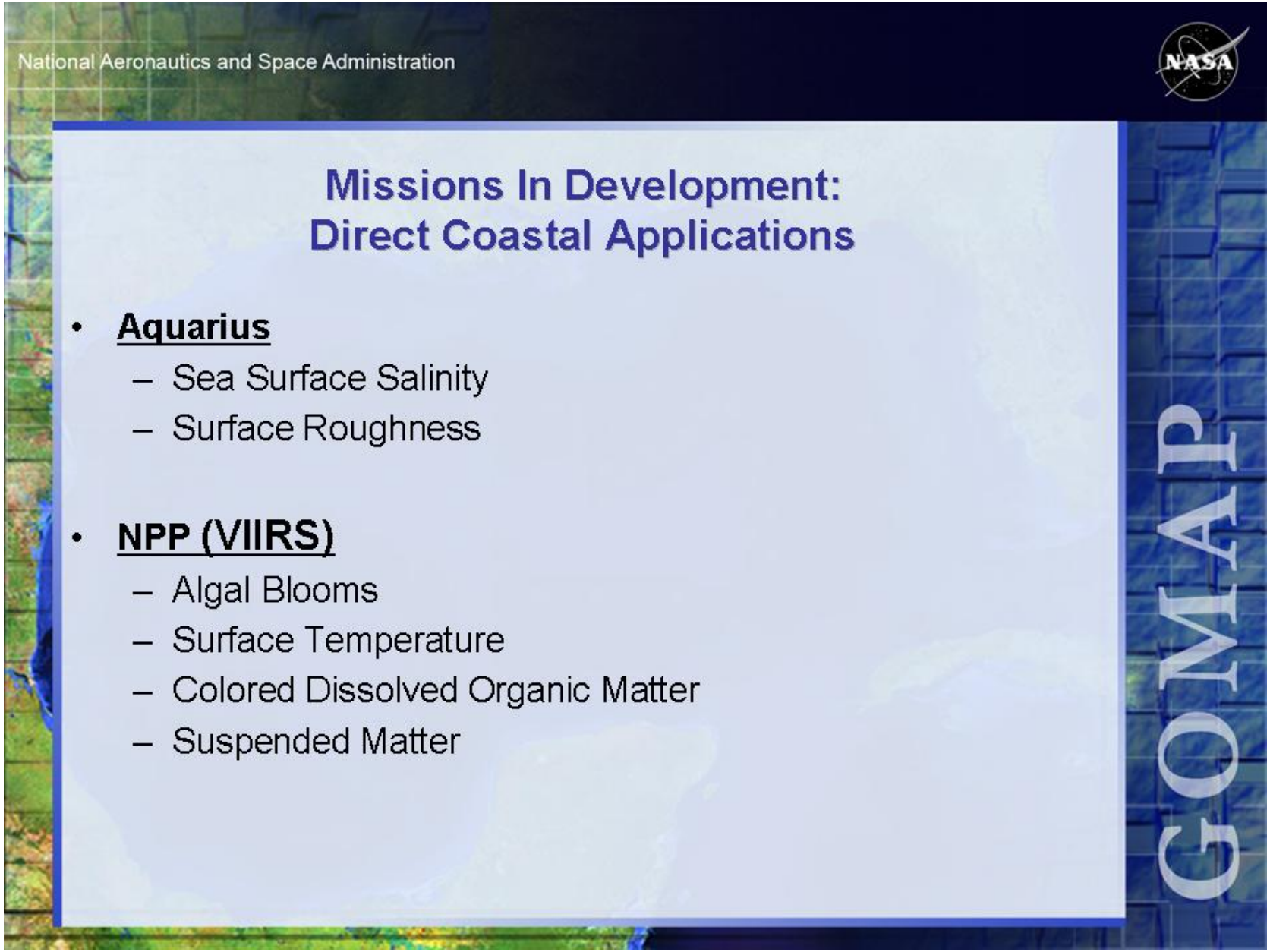
- Ocean Circulation

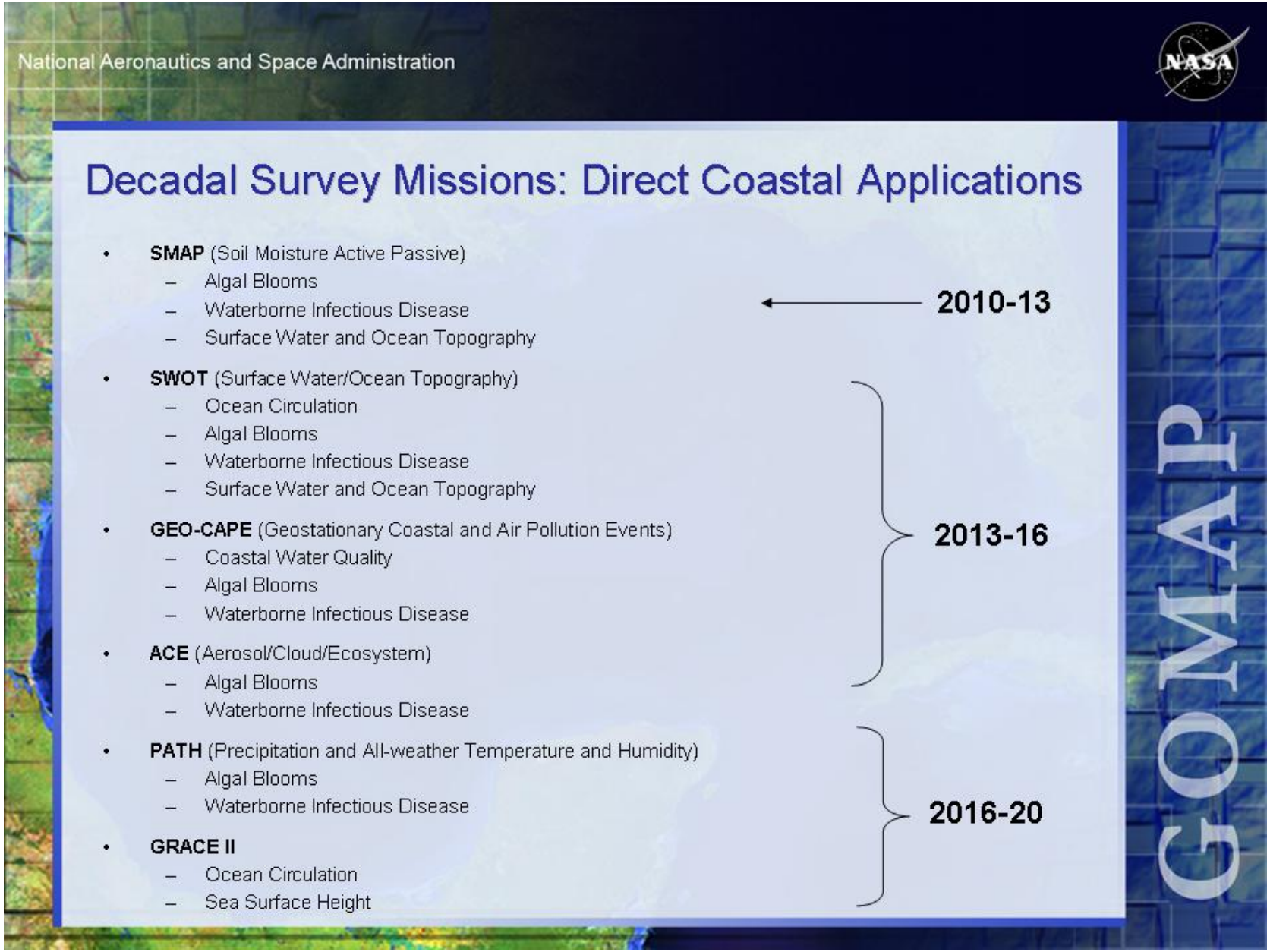
QuikSCAT

- Wind Speed and Direction Over Oceans



GOMAP




National Aeronautics and Space Administration
NASA
Decadal Survey Missions: Direct Coastal Applications
SMAP (Soil Moisture Active Passive)
Algal Blooms
Waterborne Infectious Disease
Surface Water and Ocean Topography
2010-13
SWOT (Surface Water/Ocean Topography)
Ocean Circulation
Algal Blooms
Waterborne Infectious Disease
Surface Water and Ocean Topography
GEO-CAPE (Geostationary Coastal and Air Pollution Events)
Coastal Water Quality
Algal Blooms
Waterborne Infectious Disease
ACE (Aerosol/Cloud/Ecosystem)
Algal Blooms
Waterborne Infectious Disease
2013-16
PATH (Precipitation and All-weather Temperature and Humidity)
Algal Blooms
Waterborne Infectious Disease
GRACE II
Ocean Circulation
Sea Surface Height
2016-20
GOMAP

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Appendix D. Brochures

D.1. COAST

Mapping the Data: Data sources and accessibility for COAST

Applicable sources of online data are being compiled and submitted for consideration for inclusion into the COAST project interface. Access methodologies of various types (WMS (Web Mapping Service), online data/product directory, FTP (file transfer protocol), KML (Keyhole Markup Language), OPENDaP, etc.) are being identified for each data source and appropriate tools are being tested for integration into COAST to allow flexible data input options.
Sources of data identified as useful for inclusion in COAST that are accessible through one of COAST's data inclusion tools (TVT, Image Overlay Tool, WMS to Layer Tool, KML Import) will be mapped and stored as accessible layers within the UI. Data access tools are being modified/created as needed to allow ease of mapping to the data as well as user control over class and temporal mapping of the data.

Sharing and Showing: Developing presentation formats within COAST

Techniques/tools are being developed to allow for manual and scripted presentations of data analysis sessions to be shared by users and also to allow for an easily shared collaborative capability within COAST. Initial efforts will focus on creating a capability similar to Dapple's (Geosoft) Worldwind-based "Export Scene" function that allows a project session state to be saved with all data layers, mappings, and viewshed in a single definition file. As an example, this small file could then be shared or posted online to allow a collaborative common reference between project principals.

Exploration and Testing: COAST as project data integrator for Coastal data

COAST capabilities are being tested/demonstrated with ongoing Hypoxia and Regional Sediment modeling studies data that has been identified for investigation and integration into COAST data layers. Modifications or additions to the COAST capability toolset for use with these projects will be identified, tested through user groups, and integrated if proven value added to the community. The SSC development team will also be investigating the possibility of including COAST project definition files as links from ARTPO Web site project description pages and hub sites. If proven feasible, this would take on a similar functionality to the KML Google Earth link schema that would launch a COAST viewer (after download) from the Web site for immediate online project data discovery by individuals. It is hoped that this functionality would provide a significant value-added capability for the current subject data user community.

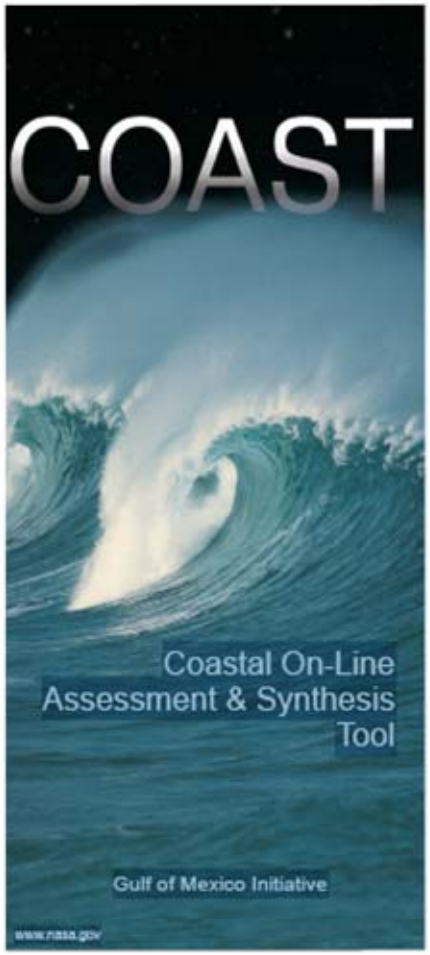
For more information please contact the following at Stennis Space Center:

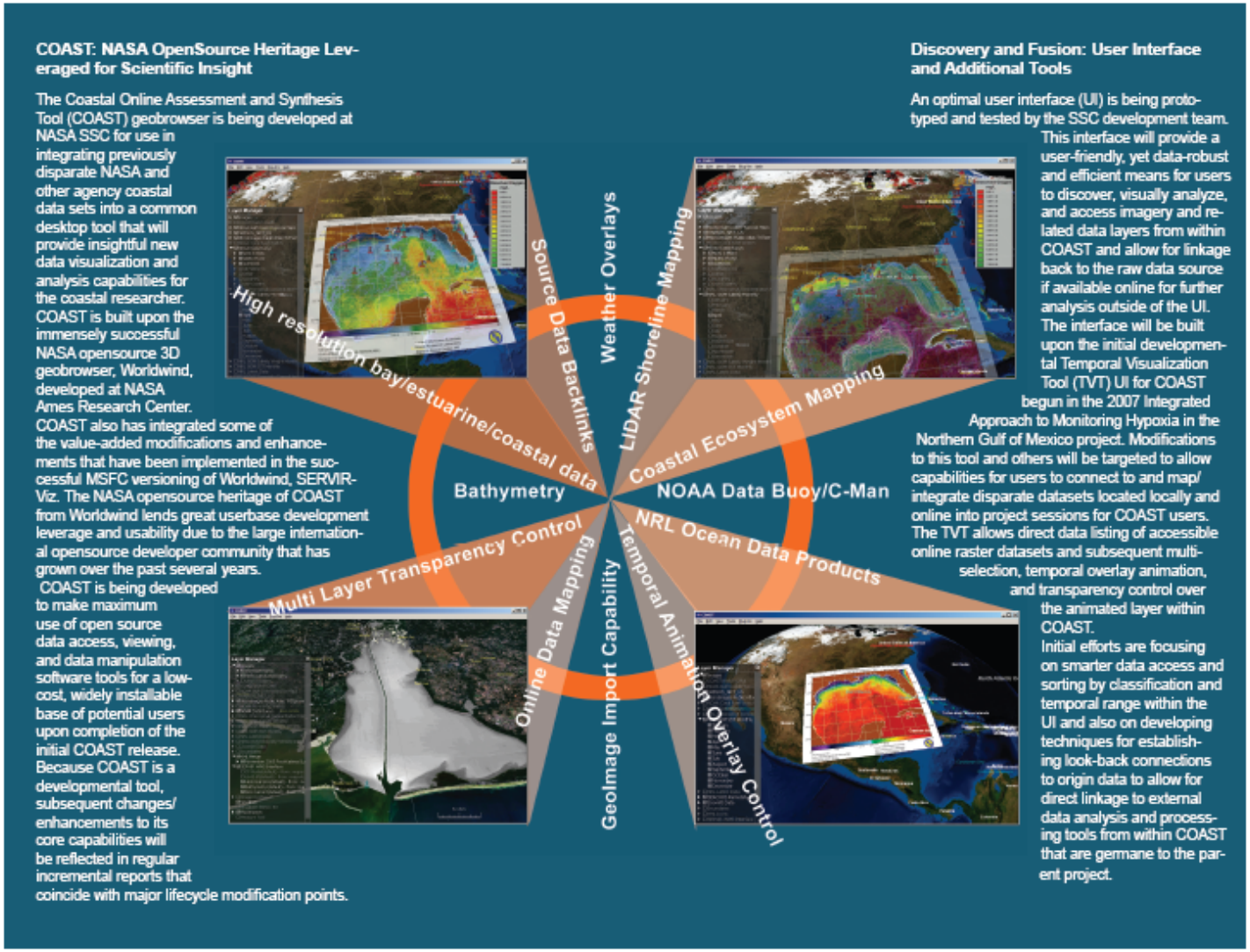
Bill Graham
Phone: 228.688.1889
Email: William.D.Graham@nasa.gov

Craig Peterson
Phone: 228.688.1984
Email: Craig.A.Peterson@nasa.gov

Gulf of Mexico Initiative

National Aeronautics and Space Administration




COAST: NASA OpenSource Heritage Leveraged for Scientific Insight
The Coastal Online Assessment and Synthesis Tool (COAST) geobrowser is being developed at NASA SSC for use in integrating previously disparate NASA and other agency coastal data sets into a common desktop tool that will provide insightful new data visualization and analysis capabilities for the coastal researcher. COAST is built upon the immensely successful NASA opensource 3D geobrowser, Worldwind, developed at NASA Ames Research Center. COAST also has integrated some of the value-added modifications and enhancements that have been implemented in the successful MSFC versioning of Worldwind, SERVIR-Viz. The NASA opensource heritage of COAST from Worldwind lends great userbase development leverage and usability due to the large international opensource developer community that has grown over the past several years.
COAST is being developed to make maximum use of open source data access, viewing, and data manipulation software tools for a low-cost, widely installable base of potential users upon completion of the initial COAST release. Because COAST is a developmental tool, subsequent changes/enhancements to its core capabilities will be reflected in regular incremental reports that coincide with major lifecycle modification points.
High resolution bay/estuarine/coastal data
Source Data Backlinks
Weather Overlays
LIDAR Shoreline Mapping
Coastal Ecosystem Mapping
Bathymetry
NOAA Data Buoy/C-Man
NRL Ocean Data Products
Multi Layer Transparency Control
Online Data Mapping
GeoImage Import Capability
Temporal Animation Overlay Control
Discovery and Fusion: User Interface and Additional Tools
An optimal user interface (UI) is being prototyped and tested by the SSC development team. This interface will provide a user-friendly, yet data-robust and efficient means for users to discover, visually analyze, and access imagery and related data layers from within COAST and allow for linkage back to the raw data source if available online for further analysis outside of the UI. The interface will be built upon the initial developmental Temporal Visualization Tool (TVT) UI for COAST begun in the 2007 Integrated Approach to Monitoring Hypoxia in the Northern Gulf of Mexico project. Modifications to this tool and others will be targeted to allow capabilities for users to connect to and map/integrate disparate datasets located locally and online into project sessions for COAST users. The TVT allows direct data listing of accessible online raster datasets and subsequent multi-selection, temporal overlay animation, and transparency control over the animated layer within COAST.
Initial efforts are focusing on smarter data access and sorting by classification and temporal range within the UI and also on developing techniques for establishing look-back connections to origin data to allow for direct linkage to external data analysis and processing tools from within COAST that are germane to the parent project.

D.2. DEVELOP


California Ecological Forcasting Project
Determining Coastal Upwelling Indices
Mexico Air Quality Project
Tracking Pollutant Pathways
DEVELOP has awarded internship opportunities to students from across the nation since 1998
DEVELOP has extensive publications including press articles, abstracts, poster presentations, and radio interviews
DEVELOP has a national impact with projects, student participation, and leveraged resources
DEVELOP projects have been utilized by community policy and decision makers
NASA Center DEVELOP Contacts
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NASA-DL-Develop@mail.nasa.gov
NASA Ames Research Center: Dr Jay Skiles
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Moffett Field, CA 94035
650.604.3614
joseph.skiles@nasa.gov
NASA Goddard Space Flight Center: Fritz Policelli
Mail Stop 610
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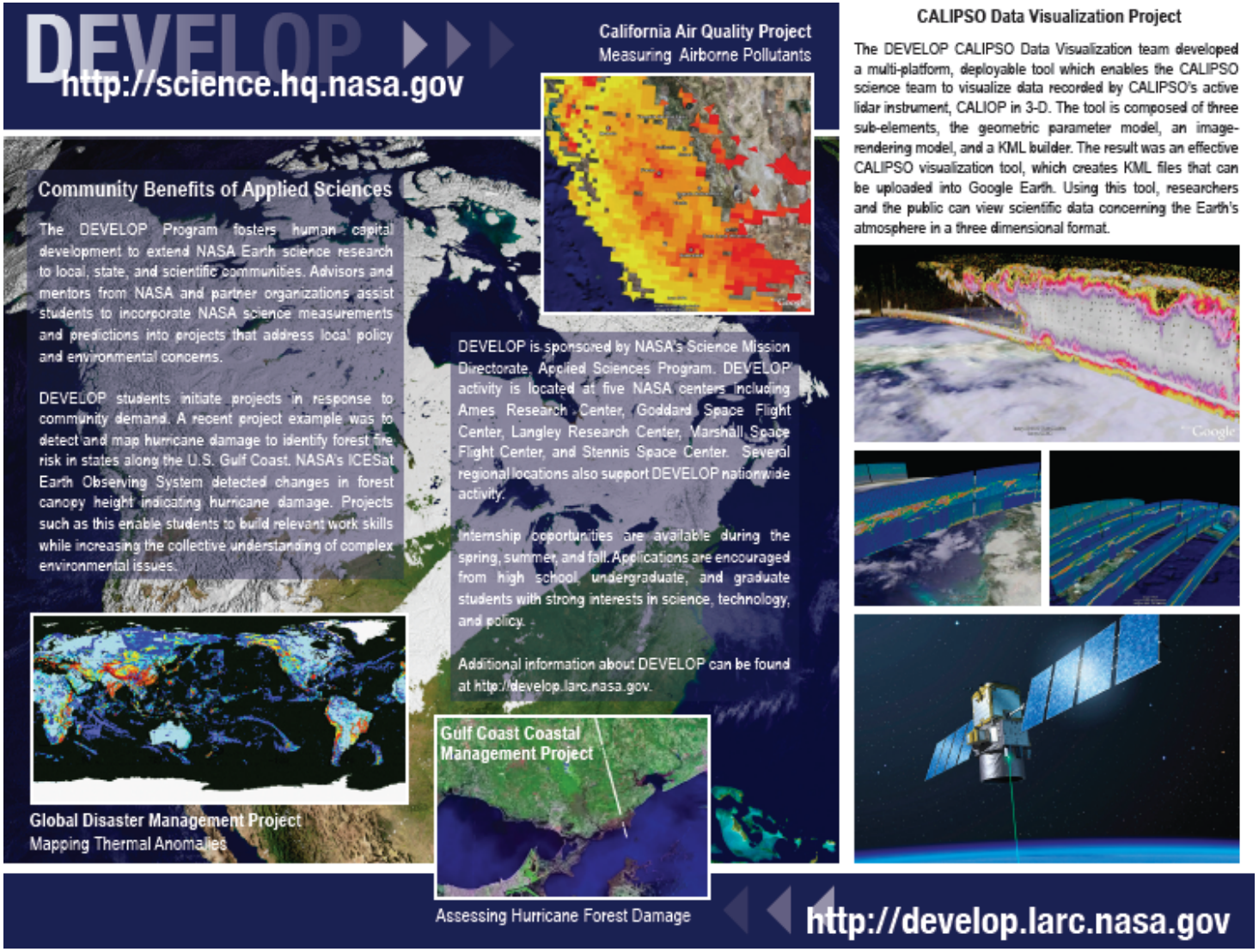
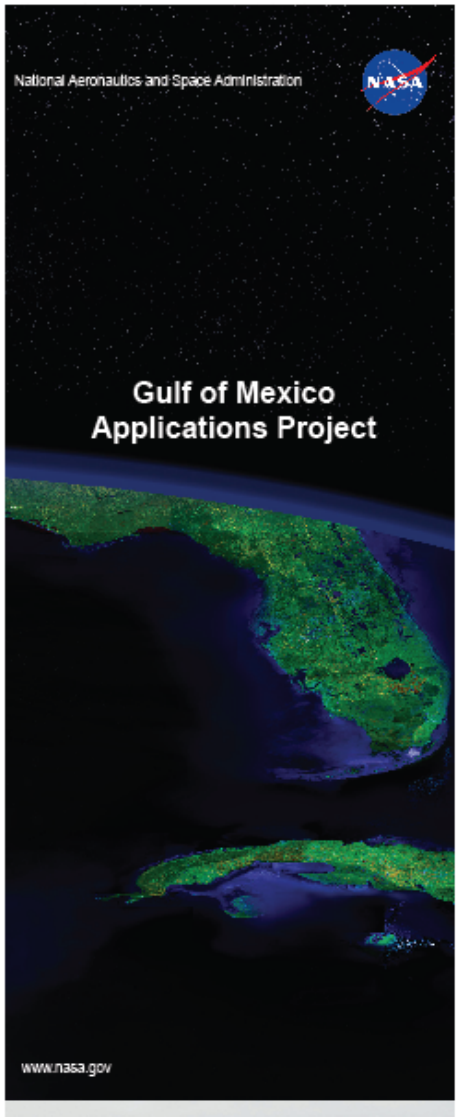
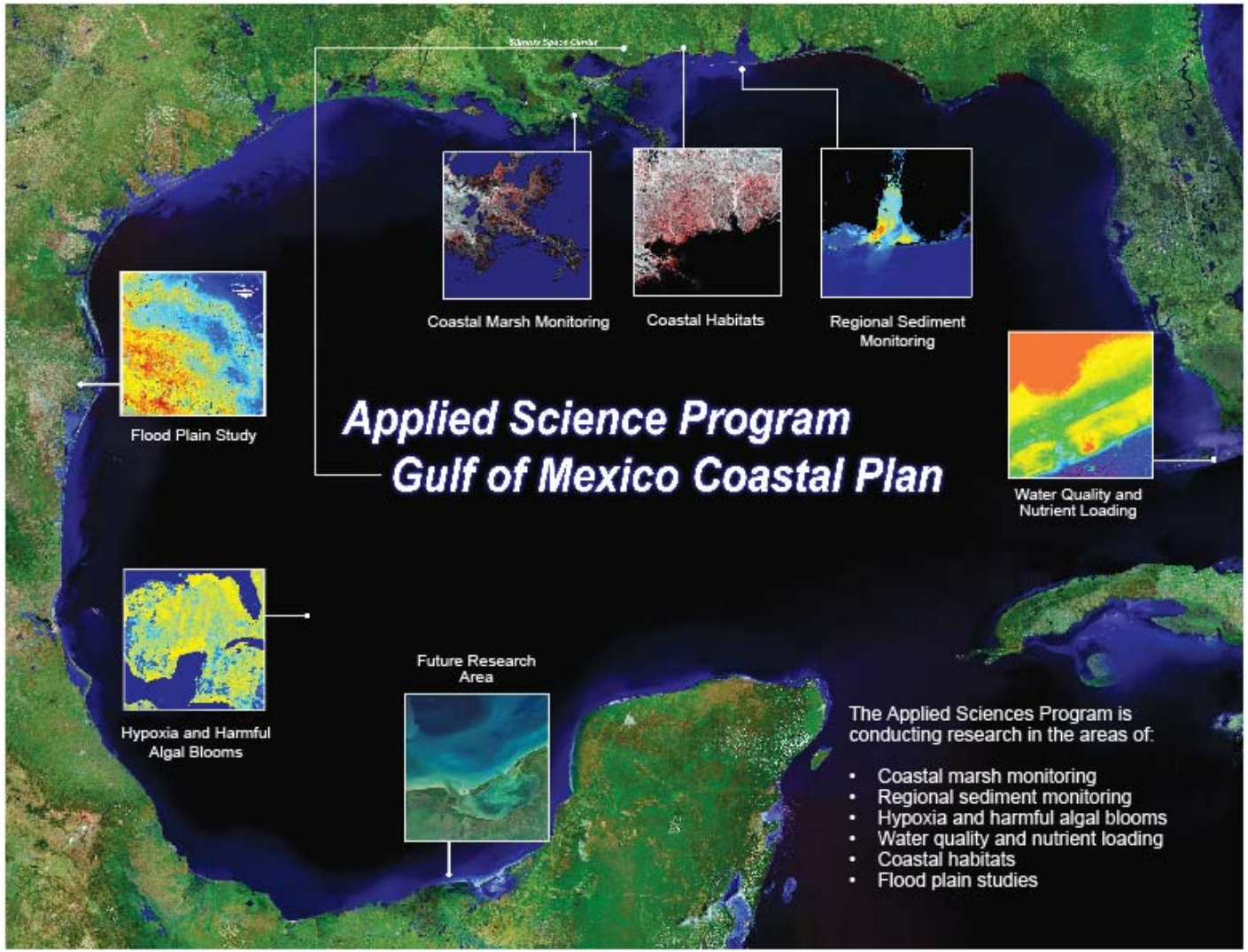
National Aerospace and Space Administration
www.nasa.gov
NP-2008-09-66-LaRC


National Aeronautics and Space Administration
NASA
Community Benefits of Applied Sciences
DEVELOP


DEVELOP
http://science.hq.nasa.gov
California Air Quality Project
Measuring Airborne Pollutants
Community Benefits of Applied Sciences
The DEVELOP Program fosters human capital development to extend NASA Earth science research to local, state, and scientific communities. Advisors and mentors from NASA and partner organizations assist students to incorporate NASA science measurements and predictions into projects that address local policy and environmental concerns.
DEVELOP students initiate projects in response to community demand. A recent project example was to detect and map hurricane damage to identify forest fire risk in states along the U.S. Gulf Coast. NASA's ICESat Earth Observing System detected changes in forest canopy height indicating hurricane damage. Projects such as this enable students to build relevant work skills while increasing the collective understanding of complex environmental issues.
DEVELOP is sponsored by NASA's Science Mission Directorate, Applied Sciences Program. DEVELOP activity is located at five NASA centers including Ames Research Center, Goddard Space Flight Center, Langley Research Center, Marshall Space Flight Center, and Stennis Space Center. Several regional locations also support DEVELOP nationwide activity.
Internship opportunities are available during the spring, summer, and fall. Applications are encouraged from high school, undergraduate, and graduate students with strong interests in science, technology, and policy.
Additional information about DEVELOP can be found at http://develop.larc.nasa.gov.
Global Disaster Management Project
Mapping Thermal Anomalies
Gulf Coast Coastal Management Project
Assessing Hurricane Forest Damage
CALIPSO Data Visualization Project
The DEVELOP CALIPSO Data Visualization team developed a multi-platform, deployable tool which enables the CALIPSO science team to visualize data recorded by CALIPSO's active lidar instrument, CALIOP in 3-D. The tool is composed of three sub-elements, the geometric parameter model, an image-rendering model, and a KML builder. The result was an effective CALIPSO visualization tool, which creates KML files that can be uploaded into Google Earth. Using this tool, researchers and the public can view scientific data concerning the Earth's atmosphere in a three dimensional format.
http://develop.larc.nasa.gov

D.3. SSC Applications Program




Coastal Marsh Monitoring
Coastal Habitats
Regional Sediment Monitoring
Flood Plain Study
Applied Science Program
Gulf of Mexico Coastal Plan
Water Quality and Nutrient Loading
Hypoxia and Harmful Algal Blooms
Future Research Area
The Applied Sciences Program is conducting research in the areas of:
• Coastal marsh monitoring
• Regional sediment monitoring
• Hypoxia and harmful algal blooms
• Water quality and nutrient loading
• Coastal habitats
• Flood plain studies

D.4. Ocean Sensors

Ocean color products are generated from radiometric measurements in the visible and infrared spectral regions. MODIS and SeaWIFS provide data at 1-km resolution, and MODIS also provides 500-m and 250-m resolution at some wavelengths.

Two main types of seawater have been defined. Case I waters, typically open ocean surface waters, exhibit a strong correlation between scattering and absorbing substances and chlorophyll a concentration. The primary source of chlorophyll a is marine phytoplankton, so mass loading may be derived from chlorophyll concentration. Case II waters, found near coasts, contain suspended sediments and CDOM (colored dissolved organic matter) as well as phytoplankton and are therefore more optically complex. CDOM comes mainly from river inflow, and suspended sediment may arise from river inflow, bottom resuspension, or coastline erosion.

Phytoplankton, CDOM, and suspended sediment exhibit somewhat different absorption spectra and can sometimes be distinguished with algorithms based on spectral characteristics. CDOM absorbs strongly in the blue region of the electromagnetic spectrum. For SeaWIFS and MODIS, algorithms which detect and quantify CDOM (and which correct for their presence in the calculation of chlorophyll concentration) use the bands centered at approximately 412 nanometers. The following figure (Carder et al., 2003) displays generalized absorption spectra for water, CDOM (gelbstoff), and phytoplankton (pigments). The spectrum of suspended sediment is similar to that for CDOM.

Phytoplankton
When phytoplankton growth is stimulated by an overabundance of nutrients from sources such as sewage discharge or runoff of agricultural fertilizers used on land, the consequences can be quite serious. Dense blooms of phytoplankton can essentially block sunlight from reaching the bottom in shallow areas of bays or estuaries and can cause the massive decline in the Submerged Aquatic Vegetation (SAV) that has been taking place in places like Chesapeake Bay. These grasses are vital nursery grounds for many species of fish and invertebrates and their loss can have dire ecological results. In addition, when these blooms die and the plankton sink to the bottom, bacterial decomposition of all this organic matter essentially strips the water of oxygen. Fish, shellfish and most other living things require oxygen to survive and decaying phytoplankton blooms have been the cause of many massive fish kills over the years (GSFC, 2008).

Colored Dissolved Organic Matter
CDOM colors water yellow, brown, or black. Black water rivers generally arise in watersheds with low relief, so that erosion rates are low and the sediment load that they carry is minimal. They usually drain regions that have significant wetland areas, which provide a large amount of plant material that enters and decays in the water. The color of the water arises from the plant pigments that dissolve in the water. Commonly referred to as "tannins", these colored pigments are more accurately referred to as humic acids. The waters of these rivers are therefore somewhat acidic and low in dissolved oxygen concentration (due to the utilization of oxygen in the bacterial decay of plant matter). The following figure shows CDOM-colored water entering the Gulf of Mexico (NASA, 2008).

Continued >

Absorption spectra for water, CDOM, and phytoplankton.

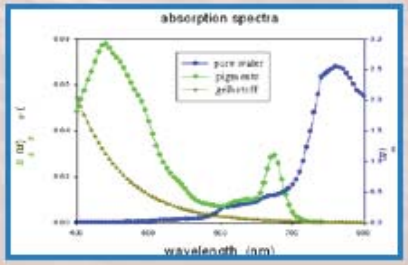


Image of the Louisiana coast shows suspended sediment (tan), phytoplankton (green to dark green), and possibly coccolithophores or the blue-green algae Trichodesmium (light blue, farther from the coast) (Visible Earth, 2002). Image Credit: Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC

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National Aeronautics and Space Administration

Ocean Sensors

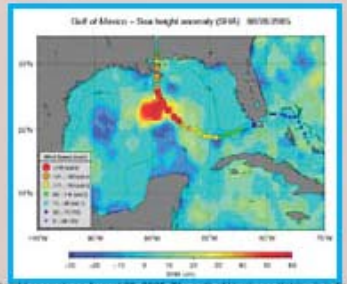
Gulf of Mexico Initiative

www.nasa.gov

Sea Surface Height

Sea surface height anomalies, the difference between the observed and the average sea surface height, are measured by the **Jason-1** and recently launched **Jason-2** (Ocean Surface Topography Mission) satellites. The sea surface heights are directly related to the ocean upper layer depth of warm water, which is a key ingredient in hurricane development or strengthening. The higher the sea surface height anomaly, the warmer the layer of water. Thus, if the sea surface height anomaly is high, one can estimate that the potential exists for a tropical system to further develop.

Warm features, such as the anticyclonic rings shed by the Loop Current and warm eddies, are characterized by a deepening of warm water (by tens of meters) towards their centers, and by different temperature and salinity characteristics than the surrounding waters. These deviations of the normal ocean thermal conditions produce variations in the sea surface height that may range from a few centimeters to more than a meter (NASA, 2005). Ocean altimetry is also used for generating ocean current maps; in the Northern Hemisphere, currents tend to flow clockwise around a high zone and counterclockwise around a low zone. The CCAR (Colorado Center for Astrodynamics Research) has been providing ocean-current maps in the Gulf of Mexico to help marine-mammal researchers locate and count sperm whales. The sperm whales often congregate in nutrient-rich eddies near the edge of the Gulf's Loop Current where squid - their primary food source - are plentiful. CCAR ocean-current maps also helped a private oil company find a suitable towing route through the Gulf of Mexico for a submersible drilling rig used in deep water oil and gas exploration. The company avoided problematic eddy currents and took advantage of beneficial eddies, reducing transit time by 50 hours on the 400-mile journey and saving the company $650,000 in rig downtime and towing costs. (University of Colorado, 2005).



Sea height anomaly on August 28, 2005. The path of Hurricane Katrina is indicated with circles spaced every 3 hours in the Gulf of Mexico and their size and color represent intensity (see legend). The hurricane intensified to category 5 as it passed near the warm core eddy of the Loop Current, then diminished to category 4 by the time it struck the coast.
Credit: NASA

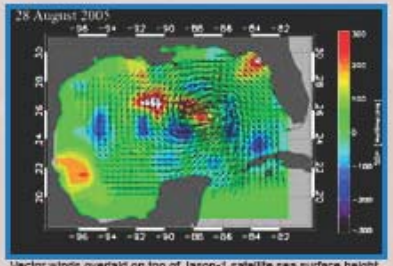
Ocean Surface Winds

The **SeaWinds** instrument on the QuikSCAT satellite is a specialized microwave radar that measures near-surface wind speed and direction under all weather and cloud conditions over Earth's oceans. SeaWinds provides wind-speed measurements of 3 to 20 m/s with an accuracy of 2 meters/second, and direction with an accuracy of 20 degrees. Level 2B data includes ocean wind vectors at 25 km and 12.5 km resolutions.

The **AMSR-E**, a passive microwave radiometer on the Aqua satellite, measures ocean surface roughness, which is converted into a near-surface wind speed. These winds are one important component of how much water is evaporated from the surface of the ocean.

Operational Objectives:

- Improve weather forecasts near coastlines by using wind data in numerical weather- and wave-prediction models.
- Improve storm warning and monitoring.



Vector winds overlaid on top of Jason-1 satellite sea surface height anomaly (SSHA) map, 28 August 2005, during the passage of Hurricane Katrina (Sharma and D'Sa, 2006).

Ocean Circulation

The GRACE mission, consisting of two satellites flying 220 km apart, accurately maps variations in the Earth's gravity field. One cause of variations is surface and deep ocean currents, which transport mass and heat between different regions of the Earth. The dynamic ocean topography, and thus the currents, can be computed in two ways: 1) from measurements through the ocean depth of temperature and salinity, using instruments dropped from ships or from moored buoys, or 2) the difference between sea surface heights measured by satellite altimeters combined with geoid information provided by GRACE. The latter method provides a more accurate and complete picture of ocean circulation.

Sea Surface Temperature

Sea surface temperature (SST) is defined as the water temperature at 1 meter below the sea surface. This temperature is estimated from measurements performed with the **MODIS** (Moderate-resolution Imaging Spectroradiometer) sensor on Aqua and Terra, as well as the **AVHRR** (Advanced Very High Resolution Radiometer) on **POES**. The resolution for both of these is 1 km. The Imager on **GOES** also provides SST data. The satellite measurement is made by sensing the ocean radiation in two or more wavelengths in the infrared part of the electromagnetic spectrum which can be then be empirically related to SST. The satellite measured SST provides both a synoptic view of the ocean and a high frequency of repeat views, allowing the examination of basin-wide upper ocean dynamics not possible with ships or buoys. In addition, the passive microwave radiometer **AMSR-E** on Aqua provides SST through most types of cloud cover, supplementing infrared based measurements of SST that are restricted to cloud-free areas.

Sea surface temperatures above 26°C (79°F) are required for the formation of tropical storms and hurricanes. A warm surface layer extending to depth produces an increase in sea surface height. As the warm layer depth increases, development of a tropical storm becomes more likely. A parameter called the TCHP (Tropical Cyclone Heat Potential) derived from sea surface temperature and height, provides an estimate of the likelihood of growth of a tropical storm.

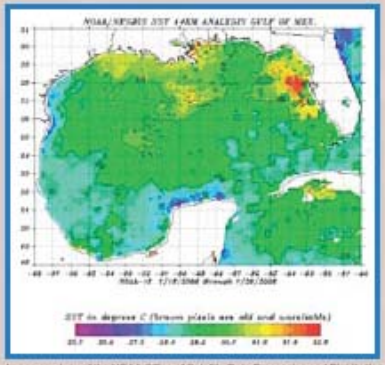


Image courtesy of the NOAA Office of Satellite Data Processing and Distribution

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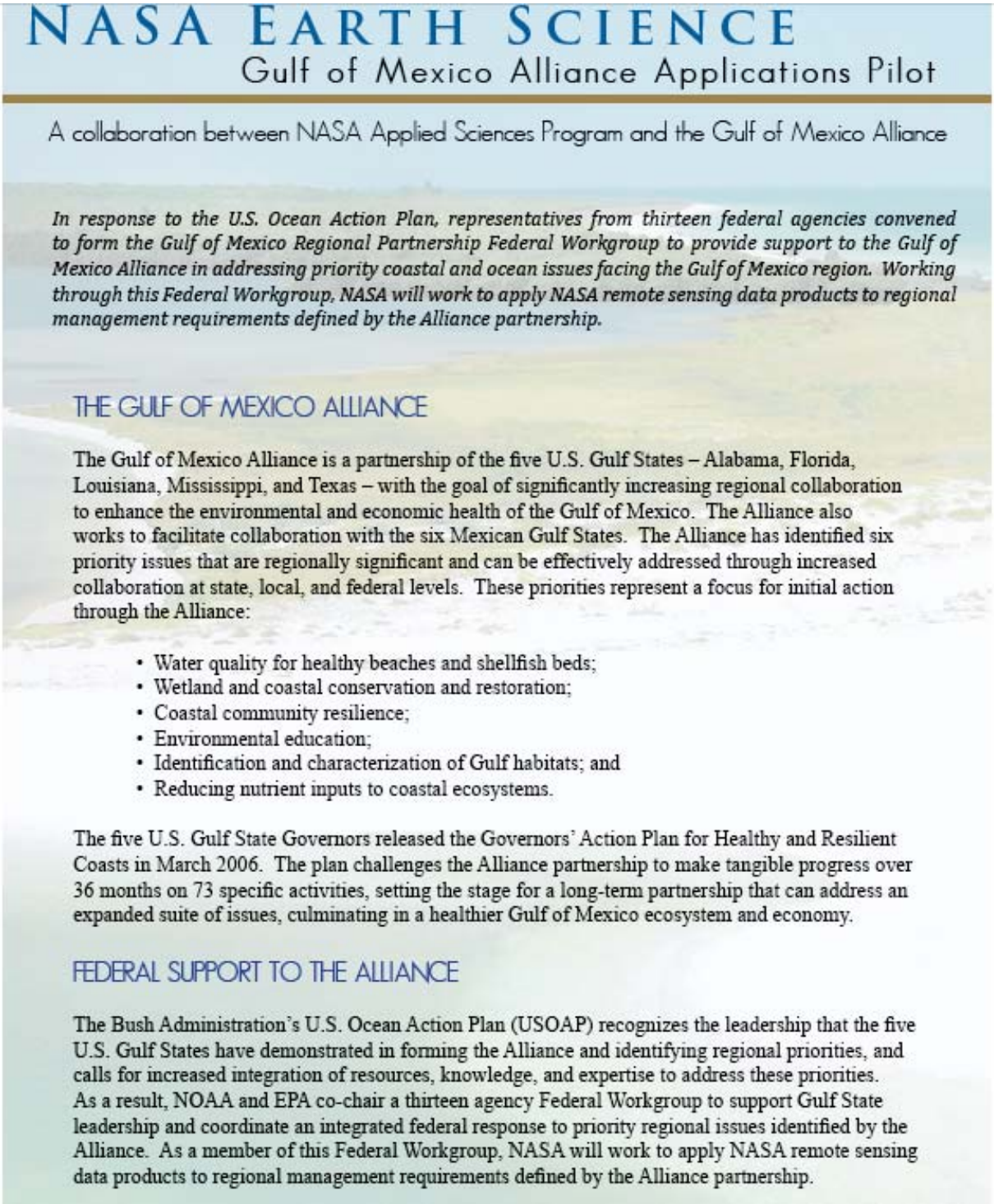
Appendix E. Supplementary Materials

E.1. GOMA Pilot Project



NASA EARTH SCIENCE

Gulf of Mexico Alliance Applications Pilot

A collaboration between NASA Applied Sciences Program and the Gulf of Mexico Alliance

In response to the U.S. Ocean Action Plan, representatives from thirteen federal agencies convened to form the Gulf of Mexico Regional Partnership Federal Workgroup to provide support to the Gulf of Mexico Alliance in addressing priority coastal and ocean issues facing the Gulf of Mexico region. Working through this Federal Workgroup, NASA will work to apply NASA remote sensing data products to regional management requirements defined by the Alliance partnership.

THE GULF OF MEXICO ALLIANCE

The Gulf of Mexico Alliance is a partnership of the five U.S. Gulf States – Alabama, Florida, Louisiana, Mississippi, and Texas – with the goal of significantly increasing regional collaboration to enhance the environmental and economic health of the Gulf of Mexico. The Alliance also works to facilitate collaboration with the six Mexican Gulf States. The Alliance has identified six priority issues that are regionally significant and can be effectively addressed through increased collaboration at state, local, and federal levels. These priorities represent a focus for initial action through the Alliance:

- Water quality for healthy beaches and shellfish beds;
- Wetland and coastal conservation and restoration;
- Coastal community resilience;
- Environmental education;
- Identification and characterization of Gulf habitats; and
- Reducing nutrient inputs to coastal ecosystems.

The five U.S. Gulf State Governors released the Governors' Action Plan for Healthy and Resilient Coasts in March 2006. The plan challenges the Alliance partnership to make tangible progress over 36 months on 73 specific activities, setting the stage for a long-term partnership that can address an expanded suite of issues, culminating in a healthier Gulf of Mexico ecosystem and economy.

FEDERAL SUPPORT TO THE ALLIANCE

The Bush Administration's U.S. Ocean Action Plan (USOAP) recognizes the leadership that the five U.S. Gulf States have demonstrated in forming the Alliance and identifying regional priorities, and calls for increased integration of resources, knowledge, and expertise to address these priorities. As a result, NOAA and EPA co-chair a thirteen agency Federal Workgroup to support Gulf State leadership and coordinate an integrated federal response to priority regional issues identified by the Alliance. As a member of this Federal Workgroup, NASA will work to apply NASA remote sensing data products to regional management requirements defined by the Alliance partnership.

PILOT OVERVIEW AND OUTCOMES

NASA Applied Sciences Program will research and develop specific applications of NASA remote sensing data products based on the requirements and input of state and local coastal resources managers. During the first year of this effort, NASA will work within the regional collaboration network of the Gulf of Mexico Alliance to evaluate the utility of NASA data products in enhancing the decision-support capabilities of coastal resource managers. Ultimately, NASA will lead the deployment of an Internet-based desktop capability to deliver to these managers NASA remote sensing data products in a decision-support tool. Recognizing that NASA is a research mission agency, it will be necessary for NASA's federal agency partners to transition the final pilot product to an operational capability and host the decision-support tool. NASA will work within the Gulf of Mexico Alliance Federal Workgroup to secure the necessary partnerships.

This effort will be piloted in the Mobile Bay and Weeks Bay, Alabama, and Grand Bay, Mississippi study area, preeminent examples of dynamic estuarine ecosystems in the northern Gulf of Mexico. In addition, Grand Bay and Weeks Bay are components of NOAA's National Estuarine Research Reserve System and Mobile Bay is a component of EPA's National Estuary Program. NASA will investigate, through future efforts, the transferability of pilot project products to the rest of the Gulf of Mexico region and other coastal regions of the U.S.

NASA will proactively coordinate with other related efforts in the Gulf of Mexico region and specifically in the study area, including:

- NASA's Gulf of Mexico Regional Collaborative (www.gomrc.org)
- USGS, USACE, and NOAA's Priority Habitat Information System, or PHINS (ecowatch.ncddc.noaa.gov/habid_public)
- NOAA's Integrated Ecosystem Assessment (IEA) in the Gulf of Mexico region, where NOAA seeks to improve the operational management of coastal and marine ecosystems by integrating physical, biological, and social information.

INITIAL MILESTONES

October 2007 to March 2008 – NASA and its Federal partners will conduct interviews to develop, evaluate, and validate candidate applications of NASA remote sensing data products to state and local coastal resource management requirements.

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E.2. ROSES Solicitation Summary

NASA Science Mission Directorate

Research and Applications Opportunities

Research Opportunities in Space and Earth Sciences – 2008

Element A.28: Earth Science for Decision Support – Gulf of Mexico

The NASA Science Mission Directorate issued a broad, directorate-wide solicitation in February 2008 for proposals for Earth and Space Science projects: *Research Opportunities in Space and Earth Sciences 2008 (ROSES-2008)*. The NASA Earth Science Division's Applied Sciences Program added an element to ROSES-2008 in June 2008 to solicit proposals for applications-related projects focusing on the Gulf of Mexico.

Element A.28: Earth Science for Decision Support – Gulf of Mexico
The Applied Sciences Program seeks proposals that develop and demonstrate innovative and practicable applications of Earth science products (e.g., satellite observations, model outputs, visualizations) to support resource management, planning, and decision making activities in the Gulf of Mexico region. Projects are expected to be for 24 months or less.

The solicitation particularly focuses on topics identified by the Gulf of Mexico Alliance (http://www.dep.state.fl.us/gulf/default.htm) and the Governor's Action Plan for Healthy and Resilient Coasts (http://www.dep.state.fl.us/gulf/plan.htm).

The solicitation strongly encourages multi-organizational and multi-disciplinary teams, including direct involvement of end user organizations as part of the project team. The solicitation also strongly encourages proposing teams to partner with organizations, universities, and institutes in the Gulf of Mexico region, especially those with expertise in Earth science research and applications.

Information about the NASA Applied Sciences Program is available at:
http://nasascience.nasa.gov/earth-science/applied-sciences

The Solicitation is available through: http://nspires.nasaprs.com or http://grants.gov

	Element A.28
A.28 Amendment in ROSES-2008:	June 26, 2008
Notices of Intent:	Not Applicable
Full Proposals Due:	September 30, 2008
Selections Announced (approx.):	December 2008
Project Start (approx.):	Jan./Feb. 2009

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E.3. NASA Missions to Models CD-ROM

An electronic copy of this booklet is provided on the enclosed CD-ROM. This booklet provides reference information about Earth and Earth-Sun system models with a NASA affiliation. For the purposes of this booklet, a NASA affiliation is considered to be either a history of NASA funding or use of NASA science products.

Models in the booklet are categorized as "ESMF" (The Earth System Modeling Framework) or "other NASA-affiliated". These categories are further divided into NASA-led and partner-led subcategories. ESMF is a significant multi-agency effort (funded in part by NASA) to create a modeling framework that enhances interoperability among various Earth system models.

An electronic copy of this booklet is provided on the enclosed CD-ROM. This booklet provides reference information about Earth and Earth-Sun system spacecraft with a NASA affiliation.

Observation systems and missions listed here are categorized by Deployed NASA-Led Earth Missions; Deployed NASA-Led Solar Missions; NASA-Led Earth Missions In Development; NASA-Led Solar Missions In Development; Interagency Partnerships; Interagency Partnerships In Development; Interagency Partnerships In Development-Solar; International Partnerships; International Partnerships In Development; International Partnerships-Solar; International Partnerships In Development-Solar; and Commercial Partnerships.