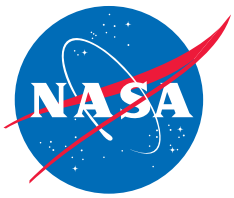
NASA EARTH SCIENCE DIVISION

APPLIED SCIENCES PROGRAM

Crosscutting Solutions: Integrated Benchmarked Systems

Project Plan: 2007–2011

v. 6.1



IBS Project Plan Signature Page

The Integrated Benchmarked Systems Project Manager and the Crosscutting Solutions Program Management have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the Program to serve the Applied Sciences Program, the Science Mission Directorate, and NASA.

Approved:

(Signature on File)

Lucien Cox
Program Manager, Crosscutting Solutions Program
NASA Headquarters

Date

Approved:

(Signature on File)

Ted Mason
Integrated Benchmarked Systems Project Manager
NASA Applied Research & Technology Project Office
John C. Stennis Space Center, Mississippi

Date

Concurred:

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Mark Glorioso
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Steve Hipskind
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Shahid Habib
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Joan Presson
Marshall Space Flight Center

Date

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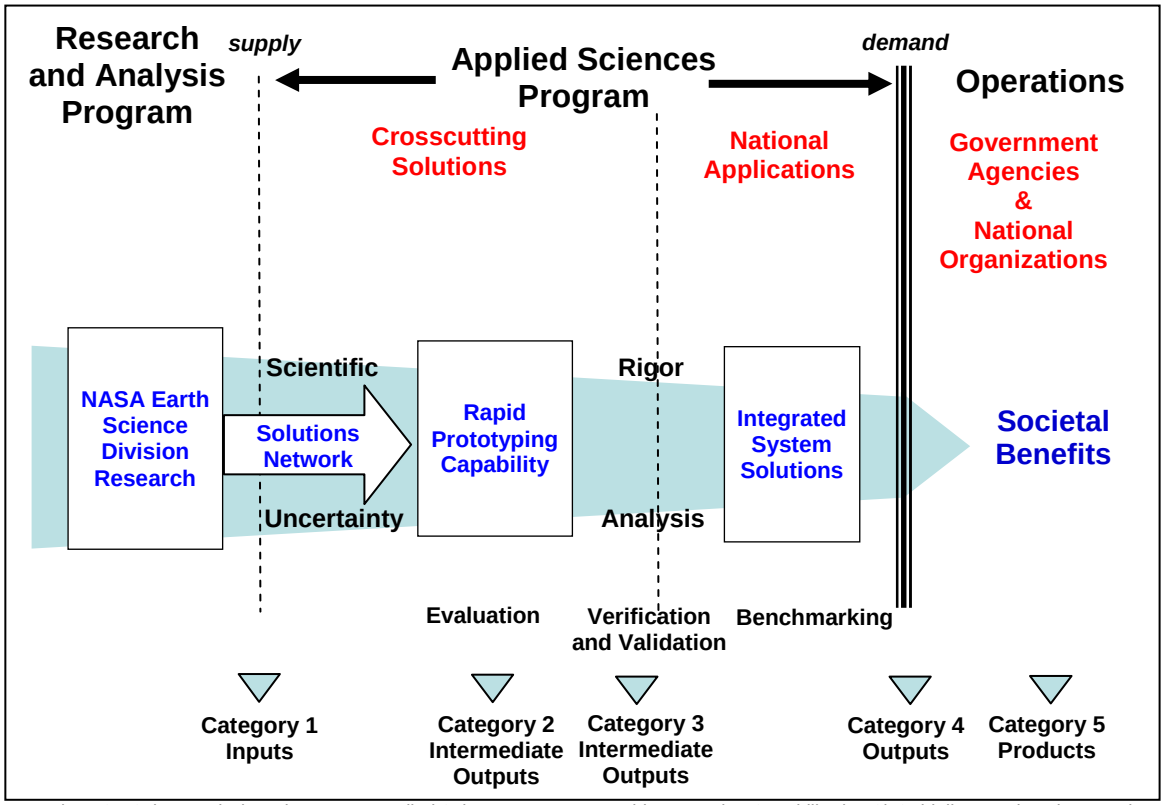
Crosscutting Solutions Program: Integrated Benchmarked Systems Project Plan

1.0 Purpose

IBS (Integrated Benchmarked Systems) is that part of the Crosscutting Solutions Program whose purpose is to provide the systems engineering services and support to the performance of evaluation, verification, validation, and benchmarking of NASA research results within the Applied Sciences Program's National Applications programs (see Figure 1 and Table 1). As such, the IBS project supports each National Application and its related partnerships with operational agencies. IBS can provide crosscutting systems engineering functions, such as requirements analysis, investigation of alternatives, solution design and integration, testing, V&V (verification and validation), and benchmarking. Additional functions provided by IBS include development and management of an RPC (Rapid Prototyping Capability) for investigations of the utility of NASA science research results for partner operational use, NASA Grants Management and Technical Oversight, and V&V of commercial remote sensing products for science use through participation in the JACIE (Joint Agency Commercial Imagery Evaluation) team. The Integrated Benchmarked Systems project also provides critical support to the Applied Sciences Program through program management support and coordination of the *Decision Support through Earth Science Results* solicitation, the *Research Opportunities in Space and Earth Sciences* solicitation, and Mississippi Research Consortium ISS (Integrated System Solutions) projects.



Sources: 1) *NASA Science Mission Directorate, Applied Sciences Program Rapid Prototyping Capability (RPC) Guidelines and Implementation Plan*, and 2) NASA, 2005. *Plan for Applied Sciences Activities Within the Crosscutting Solutions Program Element:* NASA's Applied Sciences Program, Draft, Version 7, November 17, 9 p. http://aiwg.gsfc.nasa.gov/esappdocs/SciencePlanSSCver72.doc (accessed August 18, 2006).

Figure 1. Applied Sciences activities for transitioning from research results to operations and societal benefits.

Table 1. Categories and associated products.

Category	Product	Contents	Outcome
1	Peer Reviewed Research Result	• Product of sound scientific theory • Reproducible • Science Data Products • Algorithms • Technology • Models • etc.	Provides potential input to the Solutions Network
2	Experiments	• Output of Solutions Network • Matches research results to potential configurations related to application areas • Prioritization of candidate solution configurations to be evaluated in RPC • Estimates of level of effort required for testing within RPC • Identify appropriate RPC location and personnel	A set of recommendations on candidate solutions and associated RPC experimental designs
3	Results of Experiments (Evaluation Report and/or Verification and Validation Report)	• Assessment of actual performance of research result with regard to target application • Performance analysis and assessment with regards to user-defined metrics	Documented, verified, and validated solution published for consideration for research and operations or ISS activities
4	Benchmark Report	• Performance of DSS or research and operations capability with NASA research result • Published document with procedures and uncertainty analysis of performance for research result to be implemented operationally	Documented assessment of value added to DSS through integration of NASA research
5	Operational	• Operational system description • Examples of improved decision making	Operational implementation documented

This project encompasses fiscal years 2007 through 2011 and directly supports NASA Strategic Plan sub-goal 3A: *Study Earth from space to advance scientific understanding and meet societal needs*.[1]

2.0 Project Goal and Objectives

The goal of the Integrated Benchmarked Systems project is to ensure the integrity, quality, and reliability of innovative solutions delivered by the Applied Sciences Program to its customers, thereby enhancing the decision-making capacities of partners and their customers. The objectives of the program are as follows:

[1] National Aeronautics and Space Administration, 2006. *2006 NASA Strategic Plan.* NP-2006-02-423-HQ, 44 p., http://www.nasa.gov/pdf/142302main_2006_NASA_Strategic_Plan.pdf (accessed August 17, 2006).

1. Develop and manage a Rapid Prototyping Capability for investigations of the utility of NASA science capabilities for partner use.
2. Perform characterization/V&V of commercial and international sources of data for Earth science research through participation in the JACIE team.
3. Perform project management support, coordination, and integration of competitively selected proposals that focus on extending NASA Earth science results to decision support tools in the 12 National Applications.
4. Provide program-level support for review of proposals, program element implementation, and deliverables.

3.0 Project Team

3.1 Project Management

Crosscutting Solutions Program Manager:	Lucien Cox, NASA HQ, Applied Sciences Program
IBS Project Manager:	Ted Mason, NASA ARTPO, Stennis Space Center

3.2 NASA Centers

Stennis Space Center	POC: Ted Mason
Goddard Space Flight Center	POC: Shahid Habib
Langley Research Center	POC: Lin Chambers
Marshall Space Flight Center	POC: Joan Presson
Ames Research Center	POC: Steve Hipskind
Jet Propulsion Laboratory	POC: Dave Tralli

3.3 Partner Organizations

Because IBS provides crosscutting support to all National Applications, the IBS partner organizations include the government agency and academic partners for each Application. Each National Application Program Plan defines the partners and network involved in carrying out the objectives of the application program. Some of the National Application partners include the USDA's (U.S. Department of Agriculture's) FAS (Foreign Agricultural Service), NOAA (National Oceanic and Atmospheric Administration), the EPA (Environmental Protection Agency), and the Department of Homeland Security.

In addition, the IBS partner network includes other organizations that contribute to and benefit from overall IBS support activities. These partners and stakeholders are listed in the project element plans found in Appendix A through Appendix C.

4.0 Project Elements

The NASA Applied Sciences Program collaborates with Federal agencies to enable and extend the application of NASA's Earth Science research results to serve the partners' management, policy, and decision-making responsibilities. NASA's Applied Sciences Program follows a systematic approach involving three phases – evaluation, validation & verification, and benchmarking – to examine opportunities for application of Earth science observations to support the partners' decision support tools. The Program's desired outcome is for the partner organizations to use project results to enable the use of Earth science products to enhance their operational decision-support capabilities. The implementation of the IBS project is divided into three (3) project elements. Element 4.1 provides for the development and management of a Rapid Prototyping Capability for investigations of the utility of NASA science

capabilities for partner use; Element 4.2 provides commercial data characterization support to the NASA Earth science research community; and Element 4.3 provides for the development and management of grants and other solicitations. Each element is described below and in the project element plans attached as appendices to this document. Note that tasks and deliverables described in Appendix A through Appendix C are subject to the availability of funds.

In addition to the formal project elements, the IBS project provides engineering and science support to the evaluation, V&V, and benchmarking of NASA observations and predictions for use in decision support systems and tools for NASA's National Applications. Figure 1 provides a graphical depiction of a framework for the extension of applied sciences activities that involves RPC to accelerate the evaluation of research results in an effort to identify candidate configurations for future Benchmarking efforts. Systems engineering activities include the evaluation of DST requirements, identification of NASA measurements and models to serve DST requirements, integration of NASA inputs within DSTs, V&V of NASA observations and predictions within the context of DST performance, and benchmarking of the impact to decision-making resulting from NASA contributions. **Specific systems engineering requirements and activities are/will be defined through National Applications Program Plans.**

4.1 Rapid Prototyping Capability

The Rapid Prototyping Capability is being established to systematically and rapidly evaluate configurations of NASA research results in simulated decision support and/or operational environments to identify configurations that could be further developed and tested in an Integrated System Solution or other operational configuration. The overall goal of the RPC is to provide for an accelerated simulation and testing of candidate configurations with current and future Earth observation mission measurements and research results in accordance with NASA's 2006 Strategic Plan.

Rapid Prototyping Capability conducted experiments will establish/evolve the development of a collaborative laboratory environment that includes access to NASA tools (such as the Earth Science Gateway and the Earth-Sun Science System Components Knowledge Base) and is networked to the organizations delivering outputs of NASA research assets. This will require physical and organizational network connections to numerous data and information sources, e.g., NASA DAACs (Distributed Active Archive Centers) and laboratories with models from the Earth System Modeling Framework and from OSSEs (Observing System Simulation Experiments).

The RPC is expected to be a distributed system with links to NASA observations, models, analysis tools, databases, and other relevant information and components. The RPC will include nodes at the following NASA centers SSC, GSFC, MSFC, LaRC, and ARC. Examples of NASA-funded organizations that utilize RPC methods to transition research results to operations include the NASA/NOAA Joint Center for Satellite Data Assimilation and the SPoRT (Short-Term Prediction Research and Transition) Center. These organizations provide the science capacity and physical infrastructure that enable direct interaction between NASA basic and applied research scientists and NOAA meteorological scientists. These examples of collaborative RPC efforts provide working environments that foster the scientific rigor required in the development and transition of the research results throughout the transition from research to operations.

Activities for the Rapid Prototyping Capability project element are summarized below:

1. Stennis Space Center

    a. Report to the NASA Crosscutting Solutions Program Manager the status and progress for all five Centers on how they are performing their RPC experiments, and other responsibilities, including budget allocations and expenditures. Manage and track budget allocations and expenditures at all five Centers. Provide budget reports to Headquarters on a quarterly basis. Help resolve problems/issues at the five Centers and report outcomes to NASA Headquarters. Provide RPC project management support to the Crosscutting Program Manager for development and implementation of *the NASA Science Mission Directorate, Applied Sciences Program Rapid Prototyping Capability (RPC) Guidelines and Implementation Plan*. Interface regularly with the RPC Council Chair and resolve any issues with the five Centers, including the development and execution of RPC activities for the Crosscutting Solutions Integrated Benchmarked Systems Sub-Element Plan. When approved by the RPC Council, conduct 2 to 3 RPC experiments in FY 2007 and report results on the RPC hub.

    b. Maintain, operate, and conduct experiments on an RPC systems node for the Applied Sciences Program.

    c. Provide *active* project management and support for RPC experiments at SSC and those of the MRC (Mississippi Research Consortium).

2. Langley Research Center

    Report directly to the IBS Project Manager the status of all IBS activity at your center including budget allocations and expenditures. Request guidance, clarity, and problem resolution from the IBS Project Manager as needed. When approved by the RPC Council, perform two RPC experiments in FY 2007 and report results through the RPC hub system. Develop a process to conduct uncertainty analysis on RPC experiments for future incorporation into an ISS.

3. Marshall Space Flight Center

    Report directly to the IBS Project Manager the status of all IBS activity at your center including budget allocations and expenditures. Request guidance, clarity, and problem resolution from the IBS Project Manager as needed. When approved by the RPC Council, develop and conduct 3 RPC experiments in FY 2007 in accordance with the *NASA Science Mission Directorate, Applied Sciences Program Rapid Prototyping Capability Guidelines and Implementation Plan.* Support SSC RPC hub development as required.

4. Goddard Space Flight Center

    Report directly to the IBS Project Manager the status of all IBS activity at your center including budget allocations and expenditures. Request guidance, clarity, and problem resolution from the IBS Project Manager as needed. When approved by the RPC Council, conduct at least 3 RPC experiments in FY 2007 and report results through the RPC hub. Support SSC RPC hub development as required.

5. Ames Research Center

   Report directly to the IBS Project Manager the status of all IBS activity at your center including budget allocations and expenditures. Request guidance, clarity, and problem resolution from the IBS Project Manager as needed. When approved by the RPC Council, conduct at least 2 RPC experiments in FY 2007 and report results through the RPC hub.

Specific activities of the Rapid Prototyping Capability project element, including tasks, schedule and milestones, deliverables, and budget, are described in Appendix A and the detailed RPC Work Breakdown Structure.

4.2 Joint Agency Commercial Imagery Evaluation

International and commercial access to space for terrestrial observations is currently experiencing unprecedented growth. By the year 2010, more than 50 imaging satellites with better than 40-m GSD (ground sample distance) are expected to be operational worldwide (Stoney, 2006). Total worldwide investment in new satellite imaging systems easily runs into the billions of dollars. Several of these systems produce very high spatial resolution datasets with better than 10-m GSD. These higher resolution systems can answer questions that cannot be addressed with coarser resolution systems and serve an increasingly vital role in a variety of science and application arenas. This growth in availability of spaceborne data sources, coupled with U.S. government resource constraints for developing new Earth science missions, will lead to a greater reliance by NASA and other agencies on commercial and international data sources.

Many of these new systems are candidates for the GEOSS (Global Earth Observation System of Systems): an international satellite constellation designed to monitor the Earth in a coordinated, comprehensive, and sustained fashion. The GEOSS model intrinsically provides for sharing multi-source remote sensing data products within the 62 member countries, the European Commission, and the 43 participating organizations. The need to characterize these data products is essential because many systems are not typically calibrated in a manner consistent with or required by the science community. The requirements behind the development and launch of these systems are often driven by factors other than basic or applied science (e.g., disaster management, intelligence gathering, and commercial markets). Subsequently, the systems themselves and the data products produced by the systems may not be very well characterized by scientific standards. Understanding the data characteristics and operational aspects of these systems will be a key component to the success of future remote sensing research utilizing the full array of upcoming systems.

Integrated Benchmarked Systems provides critical support to the Science Mission Directorate's Applied Sciences Program through understanding the utility of commercial and international remote sensing products for science use through involvement in the JACIE (Joint Agency Commercial Imagery Evaluation) team. The JACIE team is an interagency collaboration between NASA, the USGS (U.S. Geological Survey), the NGA (National Geospatial-Intelligence Agency), and key academic institutions that is focused on the characterization of commercial and international remote sensing data products for government use. These highly leveraged cal-val (calibration-validation) efforts have been widely recognized to be of significant benefit to NASA researchers, other Federal agencies, the DOD (Department of Defense), and the commercial sector, and they provide a giant step toward the GEOSS era of seamless utility of a worldwide network of imaging systems.

System and image-product cal-val is essential for transforming remotely sensed imagery from "pretty pictures" to "quantifiable information. Cal-val provides the traceability that allows scientists to perform rigorous scientific analyses, and end-users with the product confidence to include the information

extracted from the imagery in operational decision support. Cal-val helps to capture the system performance envelope, allowing prospective users to select the system(s) that best fit their information needs. Furthermore, cal-val provides the means to remove sensor-specific and environmental anomalies from the data, allowing comparison of imagery from one system to another and one date to another in common units.

The JACIE project element will focus on performing cal-val on satellite image products that are either currently being used or are being considered for NASA Earth science research. These include evaluations of sensor products being considered as Landsat data gap replacements, and high spatial resolution commercial image products being used by NASA scientists in conjunction with coarser resolution NASA products.

A summary of the JACIE project element activities are as follows:

- Provide cal-val support to the Landsat Data Characterization Working Group by evaluating the on-orbit performance of non-NASA moderate resolution imaging systems through vicarious calibration techniques.
- Provide support for NASA's contribution to the U.S Commercial Remote Sensing Space Policy Implementation
- Report results to the NASA Earth science community through an annual workshop, reports, presentations, and/or peer-reviewed publications.

Specific activities for the JACIE project element, including tasks, schedule and milestones, deliverables, and budget, are described in Appendix B.

4.3 Grants Management and Technical Oversight

Through the Integrated System Solutions portions of the *Decision Support through Earth Science Results* solicitation, the *Mississippi Research Consortium Integrated System Solutions and Rapid Prototyping Capacity* solicitations, and the *Research Opportunities in Space and Earth Sciences* solicitation, the Applied Sciences Program supports results-oriented projects focused on systematic methods to enable the integration of Earth and Solar science research results (e.g., satellite observations, model predictions, visualization techniques) into existing DSTs related to one or more of the 12 National Applications.

These solicitations are envisioned to be flexible enough to accept application concepts at various stages of maturity, provided there is an *existing* decision support tool. The Applied Sciences Program seeks projects that will validate methods, develop rapid prototypes, and benchmark performance to enable government agencies, industry groups, non-governmental organizations, and others to adapt and/or adopt NASA Earth and Solar science measurements and predictions into operational use on a sustained basis.

The Applied Sciences Program emphasizes a systems engineering approach involving Evaluation, Verification and Validation, and Benchmarking, to 1) identify Earth and Solar science results of value to the partners' decision systems, 2) address technical issues and develop rapid prototype solutions and products, and 3) document the performance of the results to support the transition and partners' adoption in their operational use. The Program also emphasizes the appropriate use of open consensus standards toward interoperability of disparate systems. The proposed projects should benefit both NASA and the partnering organizations; successful projects will improve the decision support system through the use of NASA-sponsored observations and model predictions.

Detailed activities for the Grants Management and Technical Oversight project, including tasks, schedule and milestones, deliverables, and budget, are described in Appendix C.

Table 2. MRC project list.

ISS	PROPOSAL TITLE	PI	Proposal #
	Application of Remote Sensing Data for Enhancing Radiation Detection and Mapping Tools	Winstead	USM-2
	Integration of NASA Research Results to Enhance Decision Support Tools for Asthma Surveillance, Prediction, and Intervention	Farugue	UMMC
	Proj 1. Integrating Climatic and Fuels Information into National Fire Risk DST	Shaw	MSU-3-1
	Proj 4. Crop Surveillance and Bioproductivity Estimation to Support USDA FAS	Shaw	MSU-3-4
	Proj 11. Integration of NASA Results and Data from Land and Atmospheric Studies for Cross-Cutting Applications	Shaw	MSU-3-11
RPC	**TITLE**		**PROPOSAL #**
	Rapid Prototyping Capability for Earth-Sun System Sciences	Moorhead	MSU-2
SN	**TITLE**		**PROPOSAL #**
	Harvesting NASA Earth-Sun Science Results in Solutions Networks	Shaw	MSU-1

5.0 Budget

The IBS budget for FY 2007 is presented in Table 3. Additional budget and phasing detail are provided in Appendix A through Appendix C.

Table 3. Proposed FY 2007 IBS budget.

ACTIVITY	FY 2007 Budget ($k)	NASA SSC Civil Servant FTE	Contractor WYE
Rapid Prototyping Capability (App. A)			
SSC	739		
MSFC	501		
LaRC	470		
GSFC	463		
ARC	300		
JACIE (App. B)	275		
Grants Management and Technical Oversight (App. C)	350		
Decision Support through Earth Science Results Solicitation – ISS[2]	6,876.95		
MRC Solicitation – ISS**			
MRC Solicitation – RPC**	5,000		
ROSES (Research Opportunities in Space and Earth Sciences) Solicitation – ISS[3]	TBD		
IPA Support	300		
IBS TOTAL	**15,274.95**		

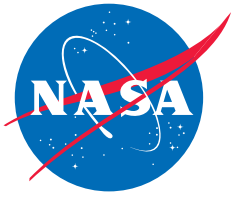
[2] Cooperative Agreement Notice NNH04ZYO010C: Decision Support through Earth Science Results, issued September 17, 2004. http://research.hq.nasa.gov/code_y/nra/current/NNH04ZYO010C/index.html (accessed August 24, 2006).

[3] NASA Research Announcement NNH06ZDA001N: Research Opportunities in Space and Earth Sciences – 2006 (ROSES-2006), issued January 23, 2006. http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={307FF8D5-59A9-E2E0-0637-6ED8AB166C4F}&path=open (accessed August 24, 2006).

Appendix A

NASA EARTH SCIENCE DIVISION
APPLIED SCIENCES PROGRAM

Crosscutting Solutions: Integrated Benchmarked Systems
Rapid Prototyping Capability Project Element Plan



Appendix A. Rapid Prototyping Capability Project Element Plan

A.1. Purpose and Scope

One of the key components of the IBS is Rapid Prototyping Capability (RPC). The primary objective of the RPC is to provide a framework within which prototyping experiments can be conducted that target the 12 priority focus areas of the National Applications using research results from current and future Earth-observation missions. To meet this objective, innovative and predictive capabilities will be adopted within a science and engineering framework.

In FY 2006, the Applied Sciences Program began building an RPC to evolve the tools and processes in use to more efficiently and effectively perform the systems engineering tasks necessary to extend the benefits of NASA research capabilities through decision support and to transition from research to operations. In FY 2007–FY 2011, the focus of the RPC will be to host and conduct various short-duration evaluations or projects to test the viability of using NASA Earth-science research results to assist National-Application focused decision support needs and to dramatically reduce the amount of time needed to perform these evaluations. The recommendations resulting from systematic analyses conducted through Solutions Networks (SN) will continue to help guide the activities conducted using the RPC. The evaluations resulting from the RPC will assist in guiding future ISS (Integrated Systems Solutions) activities.

The NASA Applied Sciences Program extends the results of NASA ESD research and knowledge beyond the scientific and research communities to contribute to identified National Applications with societal benefits. The program focuses on (1) assimilation of NASA ESD research results to improve decision support systems, and (2) the transition of NASA research results to evolve improvements in future operational systems. NASA's R&A Program within the ESD has established seven research focus areas to study the complex processes associated with Earth-system science: Atmospheric Composition, Carbon Cycle and Ecosystems, Climate Variability and Change, Earth Surface and Interior, Water and Energy Cycle, Sun-Solar, and Weather.

Results of NASA research conducted in these seven diverse science-discipline focus areas provide the candidates to demonstrate the capacity to improve future operational systems through activities administered by NASA's Applied Sciences Program.

While advancing the state of science or technology, *every* scientist and engineer conducts assessments to determine the value or impact of his or her work. Like tools used by scientists and engineers to determine sensitivity of performance on an *individual basis*, the RPC is a *community* tool to efficiently ingest a wide range of Earth-science observations and/or model outputs, to incorporate model techniques, to run decision support systems or models, to compare the results with a baseline, and to quantify the performance in terms of capacity to contribute to future operational systems. The RPC includes sensitivity analysis tools, sensor simulation tools, and computer-based workbenches to prototype the performance of research capabilities in operational environments.

RPC-conducted experiments will establish/evolve the development of a collaborative laboratory environment that includes access to NASA tools (such as the Earth Science Gateway and the System Components Knowledge Base) and is networked to the organizations delivering outputs of NASA research assets. This access will require physical and organizational network connections to numerous data and information sources; e.g., NASA DAACs and laboratories with models from the Earth System Modeling Framework, and OSSEs.

This plan encompasses fiscal years 2007 through 2011 and directly supports NASA Strategic Plan sub-goal 3A: *Study Earth from space to advance scientific understanding and meet societal needs.*[1]

A.2. Project Goal and Objectives

The goal of this project element is to implement an RPC to systematically and rapidly evaluate specific NASA Earth-science research results in a simulated decision support and/or operational environment and to identify components and/or configurations that could be furthered developed and tested in an ISS or other operational configuration.

Specific FY 2007 objectives of the RPC project are as follows:

- Based on complexity, perform 6 to 15 rapid prototyping experiments to evaluate specific NASA Earth-science research results in a simulated decision support and/or operational environment in FY 2007.
- Simulate appropriate Earth-science observations in support of the rapid prototyping experiments.

A.3. Project Team

Project Management

Crosscutting Solutions Program Manager:	Lucien Cox, NASA HQ, Applied Sciences Program
IBS Project Manager:	Ted Mason, NASA ARTPO, Stennis Space Center

NASA Centers

Stennis Space Center	POC: Ted Mason
Goddard Space Flight Center	POC: Shahid Habib
Marshall Space Flight Center	POC: Joan Presson
Langley Research Center	POC: Lin Chambers
Ames Research Center	POC: Steve Hipskind
Jet Propulsion Laboratory	POC: Dave Tralli

Partner Organizations

Mississippi Research Consortium member universities competitively selected to conduct MRC activities.

[1] National Aeronautics and Space Administration, 2006. *2006 NASA Strategic Plan.* NP-2006-02-423-HQ, 44 p., http://www.nasa.gov/pdf/142302main_2006_NASA_Strategic_Plan.pdf (accessed August 17, 2006).

RPC Council

Member	*Responsibility*
William Koshak	Applied Sciences Program RPC Council Lead
Lucien Cox	Requirements/Objectives
DeWayne Cecil	Quantification and Communication of Uncertainty
Robert Moorhead	Laboratory Infrastructure
Tsengdar Lee	High Performance Computing
Marge Cole	Geoscience Interoperability
Stephen Marley	Architecture Design/EA
Lars Peter Riishojgaard	Observing System Simulated Experiments (OSSEs)
Craig Peterson	Project Scheduling
Doug Rickman	Experiment Reports/Evaluations
Lawrence Friedl	National Applications Lead

A.4. Roles and Responsibilities

Stennis Space Center provides overall RPC management support to NASA Headquarters, manages the MRC RPC activities, conducts rapid prototyping experiments, develops and maintains the RPC Hub.

Marshall Space Flight Center supports RPC evaluations with SPoRT activities and with the SERVIR interface[2], conducts rapid prototyping experiments, and supports RPC hub development as required.

Goddard Space Flight Center provides OSSE expertise and support, conducts rapid prototyping experiments, and supports RPC hub development as required.

Ames Research Center supplies the RPC with supercomputing resources, including those created by Project Columbia, provides the World Wind software, and conducts rapid prototyping experiments.

Langley Research Center conducts rapid prototyping experiments and develops a process to conduct uncertainty analysis.

Jet Propulsion Laboratory leads development of the Metis software and provides expertise on its use.

Mississippi Research Consortium develops the capabilities document and preliminary design for the RPC, conducts the preliminary design review, develops the RPC implementation plan and system design document, implements and tests the MRC node(s) of the RPC, provides the RPC system review and documentation, and conducts rapid prototype experiments.

A.5. Implementation Approach

Three basic components comprise the RPC project element: overall RPC project management for the Applied Sciences Program, rapid prototyping and RPC experiment outcome outreach.

A.5.1. RPC Project Management

The IBS Project Manager will provide overall RPC project management for the Applied Sciences Crosscutting Solutions Program Manager. Project status, milestones and deliverables associated with the RPC experiments summarized below in Table A–1 will be monitored, tracked, and shared as appropriate

[2] SERVIR: The Mesoamerican Regional Visualization and Modeling System. http://servir.nsstc.nasa.gov/index.html (accessed September 13, 2006).

between NASA headquarters, participating field centers and MRC participants. This oversight function will enable additional leveraging opportunities between participants and as such accelerate the demonstration of using NASA Earth-science observations and predictions within decision support systems and tools associated with the National Applications program elements.

Table A–1. Applied Science Program FY 06/07 RPC experiments.

Project Title	Funding Source	Fiscal Year	National Application	Organization Lead	Collaborators
Rapid Prototyping of NASA Next Generation Sensors into the SERVIR* System	MRC	Planned FY06 Executed FY06/07	Disaster Management	University of Mississippi	MSFC GSFC/SSAI
Enhancement of USDA SCAN using NASA LIS and AMSR-E	MRC	Planned FY06 Executed FY06/07	Water Management	Mississippi State University	GSFC/SSAI GMU ITD SSC/SSAI USDA NRCS
RPC Experiment Quarterly Report: Improving Watershed Modeling Through Enhanced Data Inputs from NASA Remote Sensing Sources	MRC	Planned FY06 Executed FY06/07	Water Management	Mississippi State University	USGS USACE GSFC
Crop Surveillance and Bio productivity Estimation to Support USDA FAS PECAD/CADRE	MRC	Planned FY06 Executed FY06/07	Agricultural Efficiency	Mississippi State University	USDA ITD SSC/SSAI GSFC
Rapid Prototyping of Hyperspectral Image Analysis Algorithms for Improved Invasive Species Decision Support Tools	MRC	Planned FY06 Executed FY06/07	Invasive Species	Mississippi State University	

A.5.2. RPC Experiment Outcomes

RPC experiment outcomes will be made available to the community of practice. The Applied Sciences RPC Council will recommend results from conducted experiments in special sessions in nationally and internationally recognized forums, such as AGU (American Geophysical Union) workshops. Results will be presented at priority conferences such as those hosted by the International Society for Photogrammetry and Remote Sensing and by the American Society for Photogrammetry & Remote Sensing. The RPC Council will make RPC information and related experiment outcomes available on the RPC Central Web site.

FY 2008-2011 RPC project element activities will be similar to those described in FY 2007. The project activities will be modified as budget allows.

A.6. Deliverables

A.6.1. FY 2007 Deliverables (All Centers and participating organizations)

1. A minimum of 3 RPC experiment proposals as defined in the *NASA Applied Sciences Program Rapid Prototyping Capability (RPC) Guidelines* to be performed in FY 2007.
2. An RPC Experiment Report for all proposals/experiments approved by the RPC Council. Reports will be delivered to the RPC Council for review and approval via the RPC hub. Reports will be formatted in accordance with the RPC Guidelines. Report delivery dates will be defined in each proposal.
3. If warranted by the RPC Experiment PIs and the RPC Project Team, draft papers will be prepared based on FY 2006 RPC experiment results and submitted for peer review in FY 2007.

4. The RPC Central Web site (hub) will become operational by the second quarter of FY 2007 (SSC only).
5. A process will be developed to conduct Uncertainty Analysis on RPC experiments (LaRC only).

A.6.2. FY 2008-2011 Deliverables

Deliverables will be defined annually.

A.7. Budget

The RPC project element budget is presented in Table A–2.

Table A–2. RPC FY 2007 budget.

Activity	FY 2007 Funding Allocation	FY 2007 Funding Received		Carryover Available for FY 2007
		Amount	Date Received	
SSC RPC Experiments	$739,000	$400,000	1/18/2007	$228,000
RPC Hub	$175,000	$100,000	1/18/2007	$0
LaRC RPC Experiments	$380,000	$200,000	1/18/2007	$400,000
LaRC Uncertainty Analysis	$90,000	$0	N/A	$0
MSFC RPC Experiments	$370,000	$0	N/A	$1,200,000
MSFC RPC Hub Support to SSC	$131,000	$0	N/A	$0
GSFC RPC Experiments	$420,000	$100,000	1/18/2007	$300,000
GSFC RPC Hub Support to SSC	$43,000	$0	N/A	$0
ARC RPC Experiments	$300,000	$100,000	1/18/2007	$0
RPC Total	$2,648,000	$900,000		$2,128,000

A.8. Management Signatures

Ted Mason
RPC Project Element Manager
NASA Applied Research & Technology Project Office
John C. Stennis Space Center, Mississippi

Date

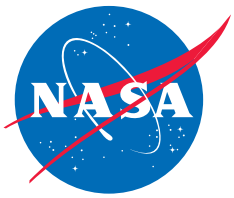
Appendix B

NASA EARTH SCIENCE DIVISION

APPLIED SCIENCES PROGRAM

Crosscutting Solutions: Integrated Benchmarked Systems

Joint Agency Commercial Imagery Evaluation Project Element Plan



Appendix B. Joint Agency Commercial Imagery Evaluation Project Element Plan

This appendix will be modified/updated to include requirements for the activities identified in this section. This updated appendix will be delivered to NASA HQ Applied Sciences Program for approval by 1 June 2007. Upon approval, that document will be amended to this IBS Project Plan.

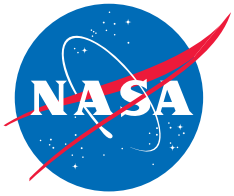
Appendix C

NASA EARTH SCIENCE DIVISION

APPLIED SCIENCES PROGRAM

Crosscutting Solutions: Integrated Benchmarked Systems

Grants Management and Technical Oversight Project Element Plan
C.1 Research, Education, and Applications Solutions Network
C.2 Decision Support through Earth Science Results Administration: Integrated Benchmarked Solutions Component
C.3 Mississippi Research Consortium
C.4 Congressional Mandates Administration



Appendix C. Grants Management and Technical Oversight Project Element Plan

C.1. Purpose and Scope

Through the Integrated System Solutions portions of the Decision Support through Earth Science Results solicitation, the Mississippi Research Consortium Integrated System Solutions and Rapid Prototyping Capacity solicitations, and the Research Opportunities in Space and Earth Sciences solicitation, the Program supports results-oriented projects focused on systematic methods to enable the integration of Earth and Solar science research results (e.g., satellite observations, model predictions, visualization techniques) into existing decision support tools related to one or more of the NASA Applied Sciences Program's 12 National Applications.

These solicitations are envisioned to be flexible enough to accept application concepts at various stages of maturity, provided there is an *existing* decision support tool. The Applied Sciences Program seeks projects that will validate methods, develop rapid prototypes, and benchmark performance to enable government agencies, industry groups, non-governmental organizations, and others to adapt and/or adopt NASA Earth and Solar science measurements and predictions into operational use on a sustained basis.

The Applied Sciences Program emphasizes a systems engineering approach, involving Evaluation, Verification and Validation, and Benchmarking, to 1) identify Earth science results of value to the partners' decision systems, 2) address technical issues and develop rapid prototype solutions and products, and 3) document the performance of the results to support the transition and partners' adoption in their operational use. The program also emphasizes the appropriate use of open consensus standards toward interoperability of disparate systems. The proposed projects should benefit both NASA and the partnering organizations; successful projects will improve the decision support system through the use of NASA-sponsored observations and model predictions.

This plan encompasses fiscal years 2007 through 2011 and directly supports NASA Strategic Plan sub-goal 3A: *Study Earth from space to advance scientific understanding and meet societal needs.*[1]

C.2. Project Goal and Objectives

GM&TO (Grant Management and Technical Oversight) comprises the various technical and administrative aspects associated with the placement and management of competitive and non-competitive grants and cooperative agreements. Pre-award activities entail the request for proposals (solicited and non-competitive), proposal review, technical evaluation, award documentation preparation, financial preparation, and release to the NSSC (NASA Shared Services Center) for official award. Post-award activities involve the monitoring of technical and financial progress through quarterly reports and interaction with the grantee to ensure relevance to NASA programmatic objectives.

Grantees from a competitive award (e.g., Decisions, ROSES, REASoN) must comply with the NASA programmatic and administrative requirements specified in the corresponding solicitation. Grantees from non-competitive awards (earmarks) must demonstrate and maintain relevance to the NASA program funding that award.

[1] National Aeronautics and Space Administration, 2006. *2006 NASA Strategic Plan.* NP-2006-02-423-HQ, 44 p., http://www.nasa.gov/pdf/142302main_2006_NASA_Strategic_Plan.pdf (accessed August 17, 2006).

C.2.1. Research, Education, and Applications Solutions Network

REASoN (the Research, Education, and Applications Solutions Network) is a competitively sourced approach to bring together Earth observations, science model predictions, and decision support tools to benchmark integrated solutions to serve society.

C.2.2. Decision Support Through Earth Science Results Administration: Integrated Systems Solutions Component

Through the Integrated Systems Solutions component of this solicitation, NASA seeks proposals for projects with approaches to evolve a network of organizations within the Earth science community of practice (e.g., universities, industry, government, non-profits, etc.). The nodes of the network are funded by NASA and/or the partner organizations engaged in the proposed project(s) to achieve NASA's Earth science mission.

The purposes of the Integrated Systems Solutions projects are as follows:

1. Assess the effectiveness of applicability of NASA science and technology results through the sponsored projects and activities;

2. Routinely identify, prioritize, and communicate relevant results for use in the National Applications;

3. Identify and analyze existing interactions of contributing organizations;

4. Formulate plans to further optimize the effectiveness of the users network(s); and

5. Evolve the network(s) configurations to broaden its reach with minimum development and maximum reach.

The projects will be flexible enough to accept network concepts at various stages of maturity. Each proposed project will include a baseline assessment of the network, analysis of network configurations, optimization (and evolution) of network configurations, routine identification of Earth science results, and prioritization and communication of results to the 12 National Applications. The projects will develop effective network configurations (including dynamic changes allowing for evaluation), demonstration(s) of network function, block and/or wiring diagrams, and analysis of network performance. The projects will maintain metrics on the network (including effectiveness) and the use of Earth science results through the network. The projects will develop an estimate of the resources (cost and schedule) needed to sustain the network on an ongoing basis and of how the network will achieve a sustaining status independent of NASA sponsorship.

C.2.3. Mississippi Research Consortium

The Mississippi Research Consortium Integrated Systems Solutions activities will focus on systematically "harvesting" the results of research sponsored by the NASA Science Mission Directorate's Research and Analysis Program. Research capabilities in the form of observations from NASA spacecraft, predictive models, simulations, algorithms, and knowledge derived from NASA's investment in Earth science are candidate inputs for transition from research to operations and/or solutions that improve decision support systems in the 12 National Applications.

The Integrated Systems Solutions tasks will include the following:

1. Systematically identifying NASA science results with focus on the capacity to serve in a) transition from research to operations, and/or b) assimilation into decision support tools.

2. Characterizing and communicating the current state of a set of network partners and components with the capacity to harness NASA research results for integrated systems solutions and research to operations activities.
3. Developing and communicating a plan for the strategic evolution of a Integrated Benchmark Solutions. The Earth science community-of-practice evolves continuously and continues to generate new knowledge.

C.2.4. Congressional Mandates Administration

The goal of this effort is to encourage earmark recipients to consider alignment of their project goals with the stated mission objectives of NASA and to facilitate performance measurement and tracking by the Agency. The effort encourages communication between earmark recipients and NASA administrators to establish mutually beneficial goals and appropriate performance metrics. It discourages the development of divergent purposes that do not address NASA mission goals and that limit earmark recipient access to the Agency's unique scientific and technical resources, which may be focused on unrelated projects. The effort includes the following tasks:

1. Determining a schedule for the overall process of awarding funds.
2. Ensuring compliance with Federal and NASA policies, and scientific guidelines.
3. Coordinating proposal evaluations with Headquarters program-level contact and NASA procurement officers.
4. Initiating, establishing, and maintaining formal communication with project principal investigators. This should begin as soon as the earmark is made known to the Agency, which may happen even before the appropriations bill is signed into law. The goal is to promote teamwork and collaboration early in the process.
5. Communicating NASA programmatic strategies and expectations to Principal Investigators.
6. Establishing mutually beneficial goals.
7. Working with Principal Investigators to define project scope and deliverables.
8. Establishing performance metric.
9. Completing procurement paperwork.
10. Receiving and reviewing progress reports.
11. Tracking project performance.
12. Reporting project performance and procurement issues to Headquarters program managers.

C.3. Project Team

Project Management

Crosscutting Solutions Program Manager:	Lucien Cox, NASA HQ, Applied Sciences
IBS Project Manager:	Ted Mason, NASA, Stennis Space Center
GM&TO Project Element Manager:	William D. Graham, NASA, Stennis Space Center

NASA Centers

John C. Stennis Space Center	POC: William D. Graham
Shared Services Center	POC: Nick Etheridge

Partner Organizations

None

C.4. Roles and Responsibilities

NASA, Stennis Space Center: SSC has the GM&TO responsibility for the MRC, Decisions '04, and REASoN awards, and for various congressionally mandated procurements as assigned annually. GM&TO represents the administrative component of grant project management. Technical oversight remains the responsibility of the Technical Officers and Program Managers within the functional lines of Applied Sciences. SSC Acquisition Management, formerly Procurement, has the responsibility of placing new contracts, grants, and cooperative agreements with commercial entities; and of placing the renewing contracts, grants, and cooperative agreements with commercial entities, government and non-profits organizations, and academia.

NASA Shared Services Center: NSSC will be responsible for placing new grants and cooperative agreements with government and non-profits organizations and with academia.

C.5. Implementation Approach

NASA's ARTPO (Applied Research & Technology Project Office) at SSC conducts the management and technical oversight for the grant activities listed. The ARTPO team comprises civil servants and contractors performing management, engineering, and science that contribute to the accomplishment of programmatic and technical tasks. The GM&TO function also requires collaboration with the other Solutions Networks and IBS components for successful implementation.

C.6. FY 2007 Deliverables

The Principal Investigators will deliver to NASA the critical science, technical, and reporting deliverables relative to the awards made by the solicitation identified in this document. ARTPO will interface with each of the PIs on a regular basis and report significant activity when available. Because each of these grants are incrementally funded on an annual but irregular basis from HQ through SSC, ARTPO will track and obligate funds, after receipt and authority to disburse, to the various grants in a timely manner.

C.6.1. Research, Education, and Applications Solutions Network

- Weekly reporting of significant activity from grantees.
- Quarterly reports of all grantees' activity as the quarterly reports are received from the grantee.

C.6.2. Decision Support through Earth Science Results Administration: Integrated Systems Solutions Component

- Weekly reporting of significant activity from grantees.
- Quarterly reports of all grantees' activity as the quarterly reports are received from the grantee.

C.6.3. Mississippi Research Consortium

- Weekly reporting of significant activity from grantees.
- Quarterly reports of all grantees' activity as the quarterly reports are received from the grantee.

C.6.4. Congressional Mandates Administration

- Weekly reporting of significant activity from grantees.
- Quarterly reports of all grantees' activity as the quarterly reports are received from the grantee.

C.7. Schedule and Milestones

C.7.1. FY 2007 Schedule and Milestones

- Continuous – Maintain regular contact with grantees.
- March 2007 – Submit individual FY 2007 grant funding requirements to HQ for distribution of funds.
- September 2007 – Obligate all FY 2007 funds to the appropriate grants and cooperative agreements.

C.7.2. FY 2008–FY 2011 Schedule and Milestones

Schedules and milestones will follow those defined in FY 2007 for the remaining years of this project element plan.

C.8. Budget

The GM&TO project element budget for FY 2007 is shown in Table C–1.

Table C–1. GM&TO FY 2007 budget.

Activity	Procurement ($k)	NASA SSC Civil Servant FTE
Research, Education, and Applications Solutions Network	$1,975,955	.125
Decision Support through Earth Science Results Administration: Integrated Systems Solutions Component	6,876,095	.125
Mississippi Research Consortium	TBD	.125
Congressional Mandates Administration	TBD	.125
GM&TO Total		.50

MRC and Congressional Mandates are determined according to the Congressional calendar and are listed as TBD until such time as these items become Public Law.

C.9. Performance Measures

GM&TO project performance will be assessed using several methods.

1. Weekly activity reports provided by contractor staff to NASA ARTPO.
2. Weekly activity reports provided by NASA ARTPO to NASA Headquarters Applied Sciences Program.
3. Participation in weekly NASA Applied Sciences Program staff teleconferences.
4. Program reviews conducted at Stennis Space Center.

C.10. Management Signatures

William D. Graham GM&TO Project Element Manager NASA Applied Research & Technology Project Office John C. Stennis Space Center, Mississippi	Date