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United States Government Accountability Office
Washington, DC 20548

October 15, 2009

Congressional Requesters

Subject: *NASA: Briefing on National Aeronautics and Space Administration's Programs and Associated Activities*

The National Aeronautics and Space Act of 1958, as amended, established the National Aeronautics and Space Administration (NASA) as the civilian agency that exercises control over U.S. aeronautical and space activities and seeks and encourages the fullest commercial use of space.[1] NASA's activities span a broad range of complex and technical endeavors, from investigating the composition, evaluation, and resources of Mars; to working with international partners to complete and operate the International Space Station; to providing satellite and aircraft observations of Earth for scientific and weather forecasting; to developing new technologies designed to improve air flight safety. The agency currently engages in these endeavors against a backdrop of growing national government fiscal imbalance and budget deficits that are straining all federal agencies' resources. Although NASA's budget represents less than 2 percent of the federal government's discretionary budget, the agency is increasingly being asked to expand its portfolio to support important scientific missions, including the study of climate change. Therefore, it is important that these resources be managed as effectively and efficiently as possible.

The National Aeronautics and Space Administration Authorization Act of 2008 (Pub. L. No. 110-422)—directed us to review whether NASA's programs and associated activities with a fiscal year 2009 funding level over $50 million—are duplicative with other activities of the federal government. We briefed the committees on the results of our review, and this letter summarizes that briefing, including our scope and methodology, which is reprinted in full as enclosure I. As agreed to by the committees, this concludes our work performed under this mandate.

Summary

We identified 33 of 38 NASA programs that meet the mandate's $50 million threshold. These programs represent about 81 percent of NASA's fiscal year 2009 budget and support 226 projects, each of which may consist of numerous types of research and related activities. We focused on three areas within —Science, Aeronautics Research, and Education—for review and excluded other activities such as space operations and exploration missions that are unique to NASA. We judgmentally selected projects

[1]Pub. L. No. 85-568 § 102 (b) and (c) (1958) (codified as amended at 42 U.S.C. § 2451(b) and (c)).

and activities from each of the three areas and compared them against similar activities in other organizations. We found no apparent duplication among the selected projects or activities. Although we did not look at all programs within NASA, policies, procedures and mechanisms are in place that facilitate the avoidance of duplication by engaging in collaboration and coordination between NASA and other federal agencies. For example, NASA coordinates its work with other agencies by participating in formal groups such as the National Science and Technology Council and various interagency working groups. The Office of Federal Coordinator for Meteorological Services and Supporting Research, in conjunction with NASA and other federal agencies, facilitated the development of the Interagency Strategic Research Plan for Tropical Cyclones, which provides the strategy for improving the effectiveness of severe-weather forecasts and warnings through strategic coordination and collaboration among the major players working in meteorology research and development. NASA's Quarterly Roundtable with the National Oceanic and Atmospheric Administration provides opportunities for the agencies' leadership to discuss efforts, resolve issues, conduct joint strategic planning and leverage resources. NASA also participates on the Fixed-Wing Executive Council with the Air Force, Army, Navy, and Office of Secretary of Defense. The council meets with industry three times a year to collaborate on strategies for meeting warfighter needs. To provide a forum for dialogue about issues related to aeronautics research, NASA's Fundamental Aeronautics Program convenes the Fundamental Aeronautics Annual Meeting, attended by researchers and members of other federal agencies and departments.

NASA also has established many memorandums of understanding with other federal agencies that mitigate duplication and assist in the coordination of activities. For example, the agency's memorandum of understanding with the National Science Foundation facilitates collaboration between the two agencies by coordinating their education efforts. The memorandum outlines each agency's roles and responsibilities, areas for collaboration, and how to obtain resources and agency expertise. NASA's Aeronautics Research Mission Directorate participates in multiple agreements with the Federal Aviation Administration, the Air Force, and other federal agencies to coordinate efforts in aeronautics research and to facilitate the free exchange of information, reduce duplication, share resources, and assist with long-term planning.

There are laws, policies, and procedures in place to help NASA avoid duplicating the efforts of other federal agencies. The National Aeronautics and Space Act directs that aeronautical and space activities shall be conducted in ways to most effectively utilize scientific and engineering resources, with close cooperation among all interested agencies in order to avoid unnecessary duplication of effort, facilities, and equipment. Furthermore, NASA's *Governance and Strategic Management Handbook* provides process-related checks and balances ranging from peer reviews conducted at the lowest level to oversight reviews conducted by the agency's Program Management Council.[2] NASA's procedural requirements for spaceflight programs and projects require project teams, in the early phases of each project, to assess opportunities for using technology developed by other government agencies,

[2] NASA Policy Directive 1000.0A (Aug. 1, 2008).

academia, and the commercial sector.[3] Teams must also take into account opportunities to use the infrastructure and workforce in other government agencies, industry, academia, and international organizations. Similarly, for other research and technology programs and projects NASA's procedural requirements recommend searches of the research and technology literature prior to investments in new research areas in order to minimize duplication of effort and to look for opportunities to augment research and technology from other agencies.[4] The procedures also require: assessments of related technology development activities in other NASA programs, other agencies, and the commercial sector in order to eliminate duplication and program status reviews and independent assessments.

Agency Comments

We provided a draft of the enclosed briefing to NASA officials for their review and comment. On October 6, 2009, NASA provided technical comments and stated that they generally agreed with the information presented.

Scope and Methodology

To assess policies and procedures in place to ensure that NASA's programs and activities are not duplicative of similar efforts within the federal government, we reviewed NASA policies and procedures used to manage and coordinate program activity and interviewed officials responsible for developing and implementing those policies. Also, we interviewed NASA officials responsible for managing partnerships and policy interactions between NASA and other executive branch offices and agencies. We reviewed background information related to the mission and activities of the Office of Science and Technology Policy and the National Science and Technology Council to determine their role in coordinating programs and projects. To obtain additional perspectives on the effectiveness of coordination of research within the federal government, we interviewed an official from the National Science Foundation.

To identify NASA programs and activities, if any, that appear to have a similar scope and purpose to other federal programs, we identified 33 of 38 programs in NASA's fiscal year 2009 budget estimates that met the $50 million threshold in the statutory mandate. These 33 NASA programs support 226 projects, each of which may consist of numerous types of research and related activities. However, we excluded programs and activities from the Space Operations Mission Directorate, Exploration Systems Mission Directorate, and cross-agency support activities because their activities are unique to NASA.

From the Education, Aeronautics Research, and Science Directorates, we judgmentally selected for in depth review (1) Higher Education STEM (Science, Technology, Engineering and Mathematics), (2) Fundamental Aeronautics-Subsonic Fixed Wing, and (3) Earth Science projects related to weather research. We selected these three areas because they represent a range of programs and activities across

[3] NASA Procedural Requirements 7120.5D, NASA Space Flight Program and Project Management Requirements (Mar. 6, 2007).
[4] NASA Procedural Requirements 7120.8, NASA Research and Technology Program and Project Management Requirements (Feb. 5, 2008).

NASA, appear to engage in activities similar to those conducted by other federal agencies, and have the largest funding levels within each area.

To determine if these three areas are duplicative with other federal programs, we reviewed detailed information regarding selected areas and compared it to other activities across the federal government. Specifically, for Higher Education STEM we reviewed NASA's fiscal year 2009 higher education portfolio and compared it to the descriptions of other federal agency programs. For Fundamental Aeronautics and Earth Science selected projects, we compared them to descriptions of programs contained in the budget estimates for Defense Advanced Research Projects Agency and/or the National Oceanic and Atmospheric Administration. We also identified relevant coordinating bodies and reviewed the applicable Program Assessment Rating Tool reports because they include evaluations of possible duplications of any other federal, state, local, or private efforts. We interviewed program officials about formal and informal mechanisms for coordinating with other government agencies. The results of our analysis cannot be projected across NASA programs. Although we identified various coordination mechanisms across the federal government, we did not assess the effectiveness of these mechanisms.

We conducted this performance audit from March 2009 to October 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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We are sending copies of this letter and briefing to the NASA Administrator and other interested congressional committees. In addition, these documents will be available at no charge on GAO's Web site at http://www.gao.gov.

If you or your staff have any questions, please contact me at (202) 512-4841 or chaplainc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this letter. GAO staff who made contributions to this project are listed in enclosure II.

Cristina T. Chaplain
Director, Acquisition
and Sourcing Management

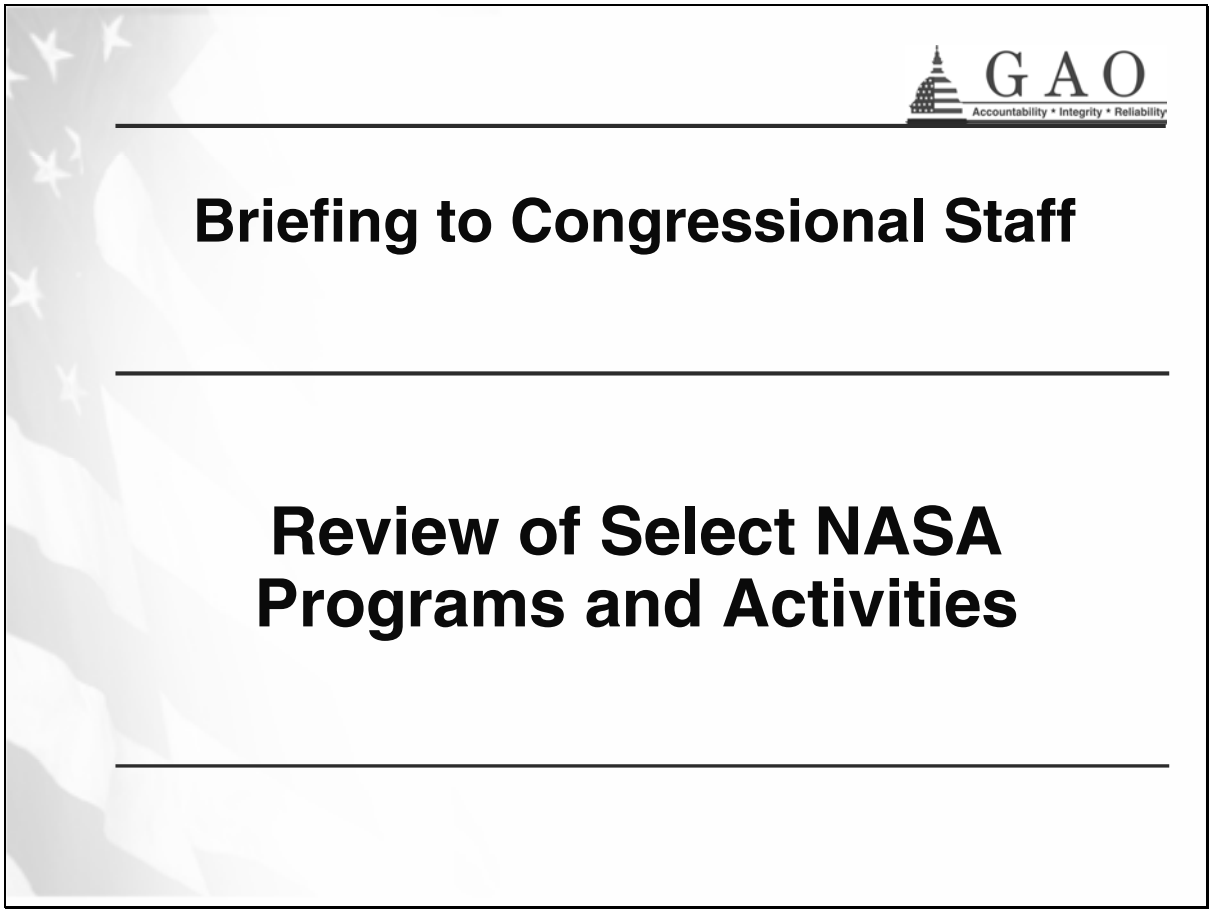
Enclosures – 2

List of Requesters

The Honorable John D. Rockefeller IV
Chairman
The Honorable Kay Bailey Hutchison
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Bart Gordon
Chair
The Honorable Ralph M. Hall
Ranking Member
Committee on Science and Technology
House of Representatives

The Honorable Gabrielle Giffords
Chair
The Honorable Pete Olson
Ranking Member
Subcommittee on Space and Aeronautics
Committee on Science and Technology
House of Representatives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Briefing to Congressional Staff
Review of Select NASA Programs and Activities

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Introduction

The National Aeronautics and Space Act of 1958, as amended, established NASA as the civilian agency that exercises control over U.S. aeronautical and space activities and seeks and encourages the fullest commercial use of space.[1] NASA's mission is to pioneer the future in space exploration, scientific discovery, and aeronautics research. Its activities span a broad range of complex technical endeavors from investigating the composition, evaluation, and resources of Mars; to working with its international partners to complete and operate the International Space Station; to providing satellite and aircraft observations of Earth for scientific and weather forecasting; to developing new technologies designed to improve air flight safety. NASA's fiscal year 2009 budget included about $18 billion for its programs which cover 240 different activities. The National Aeronautics and Space Administration Authorization Act of 2008 (Pub. L. No. 110-422) required us to submit to Congress a report on NASA's programs and associated activities with annual funding of more than $50 million that appear to be similar in scope and purpose to other activities within the Federal government. We defined duplication as the inadvertent or deliberate repetition of programs, projects or research efforts with no benefit. This briefing addresses the following objectives:

1. What policies and procedures are in place to ensure that NASA's programs and activities are not duplicative of similar efforts within the Federal government?
2. What NASA programs and activities, if any, appear to have a similar scope and purpose to other federal programs?

[1]Pub. L. No. 85-568 § 102 (b) and (c) (1958) (codified as amended at 42 U.S.C. § 2451(b) and (c)). The Department of Defense retains the activities peculiar to or primarily associated with the development of weapon systems, military operations, or the defense of the United States. Id. at § 102(b).

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Summary

- No duplication was found in areas selected for review.
- Although we did not look at all programs within NASA, policies, procedures and mechanisms are in place to avoid duplication.
- Policies and procedures are in place to:
  - Oversee limited program resources that further NASA's mission.
  - Avoid duplicating the efforts of other federal agencies.
- NASA personnel actively seeks to coordinate, and avoid duplication, with other federal agencies through:
  - Participating in the National Science and Technology Council, interagency working groups, and other formal mechanisms.
  - Developing informal working relationships across agency boundaries.

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Scope and Methodology

1. To assess policies and procedures in place to ensure that NASA's programs and activities are not duplicative of similar efforts within the Federal government, we:
   - Reviewed background information related to the mission and activities of the Office of Science and Technology Policy and the National Science and Technology Council.
   - Reviewed the results of the Office of Management and Budget's Program Assessment Rating Tool process which evaluates whether a program is designed so that it is not redundant or duplicative of any other Federal, state, local or private effort.
   - Reviewed NASA policies and procedures used to manage and coordinate program activity and interviewed officials responsible for developing and implementing those policies.
   - Interviewed NASA officials responsible for managing partnerships and policy interactions between NASA and other U.S. Executive Branch offices and agencies.
   - Interviewed an official from the National Science Foundation to obtain perspectives on the effectiveness of coordination of research within the federal government.

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Scope and Methodology (cont.)

2. To identify NASA programs and activities, if any, that appear to have a similar scope and purpose to other federal programs, we:
   - Identified 33 of 38 programs in NASA's fiscal year 2009 budget estimates that meet the $50 million threshold in the statutory mandate.
     - These 33 NASA programs represent about 81 percent of fiscal year 2009 budget.
     - These programs support 226 projects, each of which may consist of numerous types of research and related activities.

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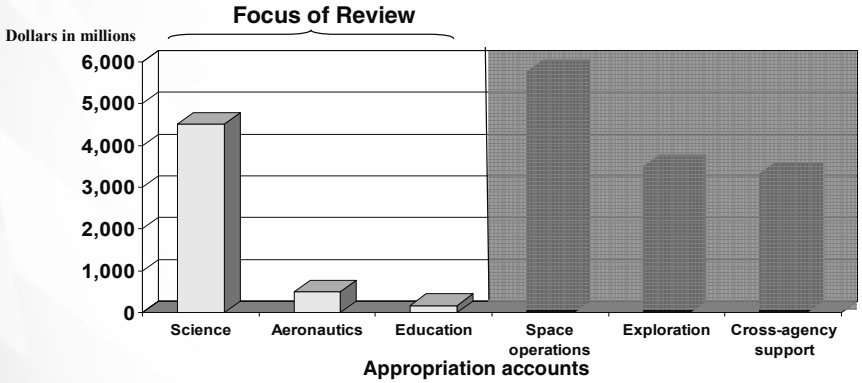
Scope and Methodology (cont.)



- We excluded programs and activities in certain areas that are unique to NASA, including:
  - Space Operations Mission Directorate
  - Exploration Systems Mission Directorate
  - Cross-agency support activities

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Scope and Methodology (cont.)

- We judgmentally selected three areas for in-depth review. These areas are:
  - Education
    1. **Higher Education - Science, Technology, Engineering and Mathematics (STEM)**
  - Fundamental Aeronautics
    2. **Subsonic Fixed Wing**
  - Earth Science
    3. **Projects related to climate and weather research**
- These three areas:
  - Represent a range of programs and activities across NASA.
  - Appear to have similar activities conducted by other Federal agencies.
  - Have the largest funding levels within each area.

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Scope and Methodology (cont.)

To determine if these three areas are duplicative with other Federal programs we:

- Reviewed detailed information regarding selected areas and compared it to other activities across the federal government.
- For education, we reviewed NASA's fiscal year 2009 higher education portfolio and compared it to other federal agency program descriptions.
- Identified relevant coordinating bodies.

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Scope and Methodology (cont.)

- Within Fundamental Aeronautics and Earth Science we selected projects and compared them to program descriptions contained in the budget estimates for the Defense Advanced Research Projects Agency and/or National Oceanic and Atmospheric Administration.
- Reviewed the applicable Program Assessment Rating Tool, which includes an evaluation of potential duplication with any other federal, state, local, or private effort.
- Interviewed program officials about formal and informal mechanisms used to coordinate with other government agencies.

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Scope and Methodology (cont.)

- Interviewed officials from other agencies involved in coordinating or performing climate and weather-related research, including:
  - Office of Federal Coordinator for Meteorological Services and Supporting Research
  - National Oceanic and Atmospheric Administration

Limitations

- The results of our analysis cannot be projected across NASA programs.
- We identified various coordination mechanisms across the Federal government, but we did not assess the effectiveness of those mechanisms.

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Scope and Methodology (cont.)

We conducted this performance audit from March 2009 to October 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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BACKGROUND

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Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies[2]

- **Defining and articulating a common outcome**
  - The compelling rationale for agencies to collaborate can be imposed externally through legislation or other directives or can come from the agencies' own perceptions of the benefits they can obtain from working together.
- **Establishing mutually reinforcing or joint strategies to achieve the outcome**
  - To achieve a common outcome, collaborating agencies need to establish strategies that work in concert with those of their partners or are joint in nature. Such strategies help in aligning the partner agencies' activities, core processes, and resources to accomplish the common outcome.
- **Identifying and addressing needs by leveraging resources**
  - Collaborating agencies should identify the human, information technology, physical, and financial resources needed to initiate or sustain their collaborative effort. Collaborating agencies bring different levels of resources and capacities to the effort. Collaborating agencies can look for opportunities to leverage each others' resources.

[2]GAO, *Results-Oriented Government: Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies*, GAO-06-15 (Washington, D.C.: October 2005).

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BACKGROUND

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Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies (Cont.)

- **Agreeing upon agency roles and responsibilities**
  - Collaborating agencies should work together to define and agree on their respective roles and responsibilities, including how the collaborative effort will be led. In doing so, agencies can clarify who will do what, organize their joint and individual efforts, and facilitate decision making. Committed leadership by those involved in the collaborative effort, from all levels of the organization, is also needed to overcome the many barriers to working across agency boundaries.
- **Establishing compatible policies, procedures, and other means to operate across agency boundaries**
  - Agencies need to address the compatibility of standards, policies, procedures, and data systems that will be used in the collaborative effort. Furthermore, as agencies bring diverse cultures to the collaborative effort, it is important to address these differences to enable a cohesive working relationship and to create the mutual trust required to enhance and sustain the collaborative effort. Frequent communication among collaborating agencies is another means to facilitate working across agency boundaries and prevent misunderstanding.

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BACKGROUND

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Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies (Continued)

- **Developing mechanisms to monitor, evaluate, and report on results**
  - Agencies need to create the means to monitor and evaluate their efforts to enable them to identify areas for improvement. Reporting on these activities can help key decision makers within the agencies, as well as clients and stakeholders, to obtain feedback for improving both policy and operational effectiveness.
- **Reinforcing agency accountability for collaborative efforts through agency plans and reports**
  - Federal programs contributing to the same or similar results should collaborate to ensure that goals are consistent and, as appropriate, program efforts are mutually reinforcing. Federal agencies can use their strategic and annual performance plans as tools to drive collaboration with other agencies and partners and establish complementary goals and strategies for achieving results. Accountability for collaboration is reinforced through public reporting of agency results.

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BACKGROUND

Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies (Continued)

- **Reinforcing individual accountability for collaborative efforts through performance management systems**
  - High-performing organizations use their performance management systems to strengthen accountability for results, specifically by placing greater emphasis on fostering the necessary collaboration both within and across organizational boundaries to achieve results.[3]

[3] GAO, *Results-Oriented Cultures: Creating a Clear Linkage between Individual Performance and Organizational Success*, GAO-03-488 (Washington, D.C.: March 14, 2003).

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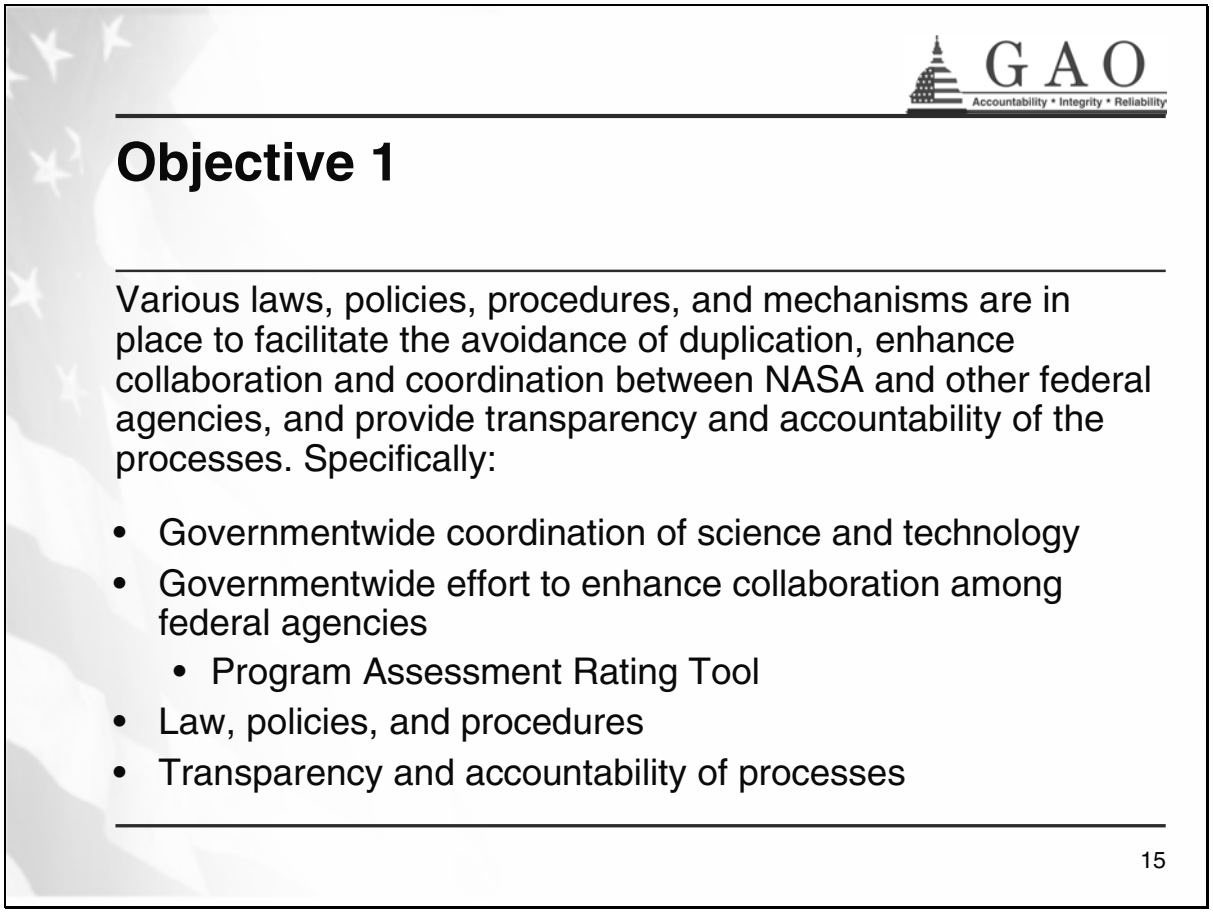
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Objective 1
Various laws, policies, procedures, and mechanisms are in place to facilitate the avoidance of duplication, enhance collaboration and coordination between NASA and other federal agencies, and provide transparency and accountability of the processes. Specifically:
• Governmentwide coordination of science and technology
• Governmentwide effort to enhance collaboration among federal agencies
• Program Assessment Rating Tool
• Law, policies, and procedures
• Transparency and accountability of processes
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OBJECTIVE 1:POLICY AND PROCESS

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Government-wide Coordination of Science and Technology

- Office of Science and Technology Policy
  - Established by Congress in 1976 with a mandate to advise the President and others on the effects of science and technology on domestic and international affairs and authorized to promote interagency efforts to implement sound science and technology policies and budgets.
- National Science and Technology Council
  - Established by executive order in 1993, this cabinet-level council is to coordinate science and technology policy-making process for the entire executive branch federal research and development enterprise.
  - Develops coordinated strategies into investment packages aimed at accomplishing multiple national research and development goals.
  - The Council is organized under four primary committees:
    - Science
    - Technology
    - Environment and Natural Resources
    - Homeland and National Security.

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OBJECTIVE 1:POLICY AND PROCESS

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Governmentwide Effort to Enhance Collaboration Among Federal Agencies

- Office of Management and Budget (OMB) developed the Program Assessment Rating Tool (PART) as a diagnostic tool meant to provide a consistent approach to assessing federal programs during the executive budget formulation process.
- PART assesses four program areas:
  1. Program purpose and design
     - Is the program designed so that it is not redundant or duplicative of any other federal, state, local, or private effort?
  2. Strategic planning
  3. Program management, and
  4. Program results.
- In conducting a PART assessment, OMB considers, among other things, whether a program coordinates and collaborates effectively with related programs.

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OBJECTIVE 1:POLICY AND PROCESS

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Program Assessment Rating Tool Results for 13 NASA Programs

Program name	Last PART assessment	Is the program designed so that it is not redundant or duplicative of any other federal, state, local or private effort?
Constellation Systems	2006	Yes
Integrated Enterprise Management	2006	Yes
International Space Station	2008	Yes
NASA Advanced Capabilities in Space Exploration	2007	Yes
NASA Aeronautics Technology	2007	Yes
NASA Astronomy and Astrophysics Research	2007	Yes
NASA Earth Science	2008	Yes
NASA Earth-Sun System Research	2005	Yes
NASA Education Program	2008	Yes
NASA Innovative Partnerships	2008	Yes
Solar System Exploration	2006	Yes
Space Shuttle	2005	Yes
Space and Flight Support	2007	Yes

Source: Office of Management and Budget

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OBJECTIVE 1:POLICY AND PROCESS

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Relevant Law, Policies, and Procedures

- National Aeronautics and Space Act of 1958
  - The aeronautical and space activities of the United States shall be conducted so as to contribute materially to the most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment.
- NASA Policy Directive (NPD) 1000.0A - Governance and Strategic Management Handbook
  - Provides for process-related checks and balances ranging from peer reviews conducted at the lowest level to oversight reviews conducted by the agency's Program Management Council.

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OBJECTIVE 1:POLICY AND PROCESS

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Relevant Law, Policies, and Procedures (cont.)

- NASA Procedural Requirements 7120.5D – NASA Space Flight Program and Project Management Requirements
  - Project teams in the early phases of a project must, among other things:
    - Assess the opportunities to use technology developed in other government agencies, academia, and the commercial sector.
    - Take into account the opportunities to use the infrastructure and workforce in other government agencies, industry, academia, and international organizations.

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OBJECTIVE 1:POLICY AND PROCESS

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Relevant Law, Policies, and Procedures (cont.)

- NASA Procedural Requirements 7120.8 - NASA Research and Technology Program and Project Management Requirements
  - To minimize duplication of effort and to look for opportunities to augment research and technology from other agencies, recommends a literature search of research and technology prior to investment in new R&T areas.
  - Requires an assessment of related technology development activities in other NASA programs, other Government agencies, and the commercial sector to eliminate unnecessary duplication of effort.
  - Requires program status reviews and independent assessments.

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OBJECTIVE 1:POLICY AND PROCESS

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Relevant Law, Policies, and Procedures
(cont.)

- NASA Procedural Requirements 7120.7 - NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements (education falls under this section)
  - Requires an education and public outreach plan, which describe planned efforts and activities to improve science literacy by engaging the public in understanding the program, its objectives, and benefits. Summarizes plans to stimulate interest in science, engineering, and technology through program-related outreach activities.

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OBJECTIVE 1:POLICY AND PROCESS

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Transparency and Accountability of Processes That Help Reduce Duplication

- For research and technology programs, internal and external reviews prior to approval, and independent assessments at least biennially
- Technical content and performance information for programs/projects provided in annual budget justification
- OMB review using Program Assessment Rating Tool
- NASA requirement to disseminate results of science and technology research and development both internally and externally, where appropriate

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Objective 2

Areas selected for review:

- Higher Education Science, Technology, Engineering, Mathematics
- Fundamental Aeronautics - Subsonic Fixed Wing
- Earth Science

Mechanisms to help avoid duplication:

- External directives, policy, procedure, plan or law
- NASA policy, procedure or plan
- Coordination mechanism

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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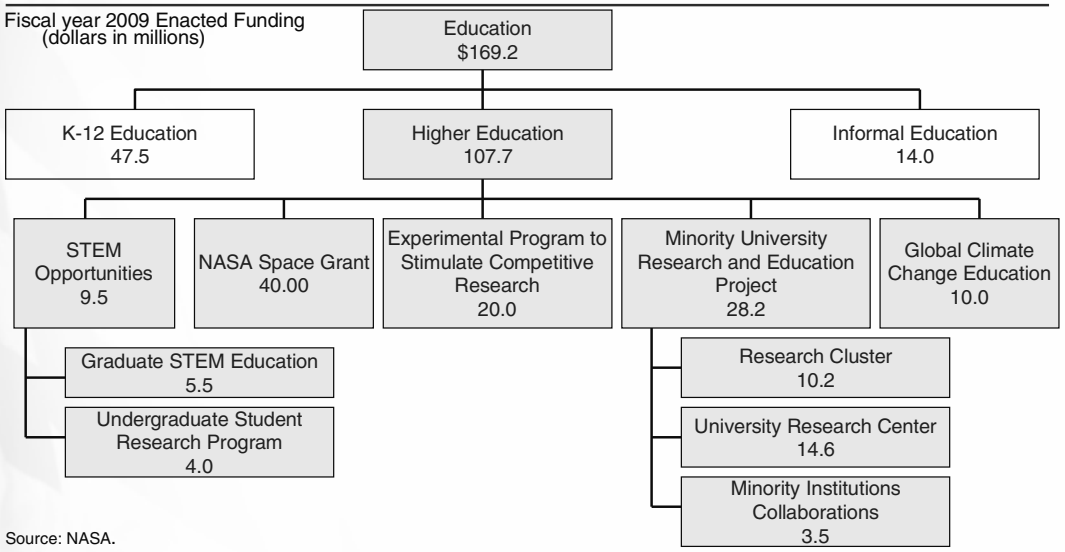
Overview of NASA's Higher Education STEM Portfolio

Fiscal year 2009 Enacted Funding
(dollars in millions)



Source: NASA.

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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No Duplication Found in Review of NASA's Higher Education STEM Portfolio

- We reviewed NASA's Higher Education STEM portfolio and determined it was not duplicative of other federal agency STEM programs.
- In fiscal year 2007, 12 federal agencies, including NASA, funded 66 Higher Education STEM programs.[4]
  - The other agencies were Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Homeland Security, the Interior, and Transportation; Environmental Protection Agency; and National Science Foundation.
- We found policies, interagency working groups, a memorandum of understanding, and informal coordination in place to avoid duplication of other federal STEM programs.

[4] Department of Education, *Report of the Academic Competitiveness Council (*Washington, D.C., 2007).

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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External Directives and Law

- **Executive orders**
  - NASA officials told us that executive orders impact how the programs are run and how federal agencies coordinate with each other, including meeting to discuss strategies and support each other.
  - Three executive orders address educational excellence:
    - Hispanic Americans (Exec. Order 13230),
    - Tribal Colleges and Universities (Exec. Order 13270), and
    - Historically Black Colleges and Universities (Exec. Order 13256).
- **America COMPETES Act** (Pub. L. No. 110-69)
  - Outlines specific areas for NASA to contribute to the Nation's efforts to promote innovation and competitiveness, including participating on the President's Council on Innovation and Competitiveness and submitting an annual report to Congress regarding its STEM education programs.
  - NASA officials told us the that law acknowledges NASA's unique role in addressing the federal government's workforce challenges.

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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NASA's Internal Policies and Procedures

- **Education Strategic Coordination Framework** – Coordinates the Agency's approach to education by aligning the education portfolio with the Agency's strategic plan.
  - Creates a framework for NASA's investments in education which use NASA content, people, or facilities to involve and inspire educators, students, and the public through NASA's unique mission, research and innovations.
  - NASA officials told us that by aligning their education portfolio with the agency's strategic plan, they avoid duplicating efforts of other federal STEM education programs.

- **Education Communication Strategy** – Develops an outreach campaign to promote NASA's educational opportunities to inspire, engage, educate, and employ students, educators, and the general public about NASA's exploration message.

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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NASA's Internal Policies and Procedures (cont.)

- **Education Coordinating Committee (ECC)** – Serves as the overall planning, coordination and integration office for NASA's educational portfolio.
  - Oversees programs within the Office of Education, the four mission directorates, the 10 centers, as well as functional offices.
  - Through the Assistant Administrator, the ECC is also the primary point of contact with other federal agencies.
- **NPR 7120.5D – NASA Space Flight Program and Project Management Requirements** (discussed on page 20)
- **NPR 7120.7 - NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements** (discussed on page 22)

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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Coordination Mechanisms That Help Avoid Duplication

- **National Science and Technology Council**
  - **Subcommittee on Education and Workforce Development (Committee on Science)** – NASA officials told us that this is the primary interagency body for coordinating federal STEM education policies.
    - Member agencies meet monthly to discuss ongoing federal policy and coordinate agencies' efforts.
    - The subcommittee provides opportunities for members to share program information across agency boundaries.
  - **Subcommittee on Innovation and Competitiveness (Committee on Technology)** – NASA officials told us that recently the subcommittee increased its focus on the role of STEM education for national innovation and competitiveness which lead to an increased involvement by NASA's Office of Education.
- **Interagency Aerospace Revitalization Task Force**
  - Established in 2006 to develop strategies for addressing challenges faced by the aerospace industry, including a mandate to develop integrated federal policies to promote STEM education and training in the public and private sectors as well as coordinate agency resources.

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OBJECTIVE 2: NASA HIGHER EDUCATION STEM

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Coordination Mechanisms That Help Avoid Duplication (cont.)

- **Memorandum of Understanding with the National Science Foundation**
  - Facilitates collaboration and coordinates the two agencies educational efforts.
  - Outlines each agency's roles and responsibilities, and areas for collaboration and how to leverage available resources and agency expertise.
- **Other Project-Specific Interagency Working Groups**
  - International Space Education Board
  - Experimental Program to Stimulate Competitive Research Interagency Coordinating Committee
  - Historically Black Colleges and Universities Working Group
  - Tribal College Working Group
- **Informal Coordination**
  - NASA officials told us that there is informal coordination at the working level, through relationships between agency staff members.

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OBJECTIVE 2: AERONAUTICS

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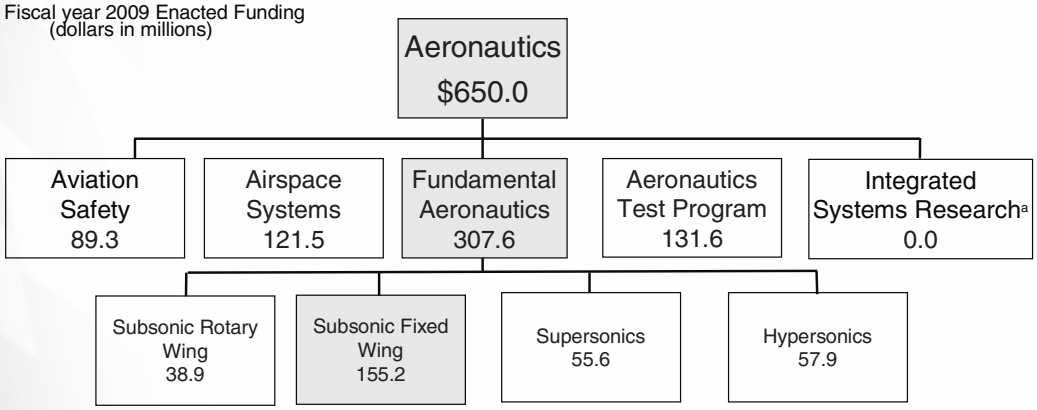
Overview of NASA's Fundamental Aeronautics Portfolio

Fiscal year 2009 Enacted Funding
(dollars in millions)



Source: NASA Fiscal Year 2010 Budget Estimates.

[a]New program for fiscal year 2010 that will take an integrated system-level approach to reduce the environmental impact of aviation in the area of air vehicle technologies.

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OBJECTIVE 2: AERONAUTICS

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No Duplication Found in Fundamental Aeronautics - Subsonic Fixed Wing Portfolio

- No duplication found in the areas we reviewed.
- Major focus is on developing improved prediction methods and technologies for lower noise, lower emissions, and higher performance for subsonic aircraft.
- Aeronautics research coordinated on a national level.

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OBJECTIVE 2: AERONAUTICS

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External Directives, Law, and Policies

- **Executive Order 13419 - National Aeronautics Research and Development**
  - Supported by the accompanying National Aeronautics Research and Development Policy, which provides guidance for aeronautics research and development programs through 2020.
    - Policy prepared through collaborative, interagency process by National Science and Technology Council.
- **America COMPETES Act (Pub. L. No. 110-69)**
  - The NASA Administrator shall coordinate NASA's aeronautics activities with the relevant programs at other federal agencies, including the Departments of Transportation, Defense, Commerce, and Homeland Security.
- **National Plan for Aeronautics Research and Development and Related Infrastructure**
  - Integrated plan that the aeronautics research and development enterprise should pursue for research and development and related infrastructure.

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OBJECTIVE 2: AERONAUTICS

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External Directives, Law, and Policies (cont.)

- **Technical Appendix to the National Plan for Aeronautics Research and Development and Related Infrastructure**
  - Fulfills a requirement in the plan to provide a supplemental report with additional technical content on aeronautics research and development goals and objectives as well as a preliminary assessment of current federal aeronautics research and development activities to identify areas for potential increased emphasis and any areas of unnecessary redundancies.
- **Decadal Survey of Civil Aeronautics (2006)**
  - Prioritizes research projects to be undertaken by NASA in the next 10 years.
  - Identifies national priorities for non-NASA researchers.
  - Points out synergies between civil aeronautics research and research objectives associated with national defense, homeland security, and the space program.

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OBJECTIVE 2: AERONAUTICS

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NASA's Procedures and Plans

- **NASA Procedural Requirement 7120.8 - NASA Research and Technology Program and Project Management Requirements** (discussed on page 21)
- **Subsonic Fixed Wing Project Technical Plan**
  - Publicly available document describes NASA's aeronautics research objectives for this area.
- **NASA invites members of other organizations to conduct reviews of external work conducted under the NASA research announcements**

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OBJECTIVE 2: AERONAUTICS

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Coordination Mechanisms That Help Avoid Duplication

- **National Science and Technology Council**
  - **Aeronautics Science and Technology Subcommittee (Committee on Technology) -** Advises and assists with development of policies, strategies, and plans relating to federally sponsored aeronautics research. Currently working on updating the National Plan for Aeronautics Research and Development and Related Infrastructure.
- **Memorandums of Understanding**
  - **US Air Force Flight Test Center/Air Force Research Laboratory/NASA Dryden Flight Test Center Alliance** - To reduce duplication and replication between the Edwards Air Force Base and NASA Dryden Flight Test Research Center, in 1995 this alliance was established and is co-chaired by Dryden Flight Research Center Director and Edwards Air Force Base Commander.

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OBJECTIVE 2: AERONAUTICS

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Coordination Mechanisms That Help Avoid Duplication (cont.)

- **Memorandums of Understanding** (cont.)
  - **Department of Defense -** Charters the National Partnership for Aeronautics Testing and expands cooperation between the two and facilitates establishment of an integrated national strategy for management of the respective aeronautical test facilities.
  - **U.S. Air Force** - Facilitates coordination of aeronautics research efforts between the two organizations and is intended to ensure free exchange of information, reduce duplication, and assist with the long-term planning.
  - **Federal Aviation Administration** - Agreement to cooperate and collaborate in relevant areas of aeronautics and space transportation research.

Other Coordination

- Fundamental Aeronautics Annual Meeting
  - In addition to researchers, members of other agencies and departments often attend these meetings.

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OBJECTIVE 2: AERONAUTICS

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Coordination Mechanisms That Help Avoid Duplication (cont.)

- **Interagency Working Groups/Coordinating Entities**
  - **Versatile Affordable Advanced Turbine Engine Technology Program** - Develops and demonstrates advanced multiuse turbine engine technologies.
  - **NASA-Air Force Executive Research Committee Vertical Take-off and Landing Science and Technology Partnership Council** - Responsible for the executive direction and oversight of the Air Force and NASA's joint aeronautics research and development efforts.
  - **Fixed-Wing Executive Council** - Participants from Air Force, NASA, Army, Navy, and the Office of the Secretary of Defense meet with industry three times a year to discuss opportunities for collaboration and the future national direction, and develop strategies to meet warfighter needs.

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OBJECTIVE 2: AERONAUTICS

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Coordination Mechanisms That Help Avoid Duplication (cont.)

- **Interagency Working Groups/Coordinating Entities** (cont.)
  - **Joint Council on Aging Aircraft** - Principal participants: NASA, Air Force, and Navy; purpose is to optimize effectiveness of their efforts in aircraft aging.
  - **Vertical Take-off and Landing Science and Technology Partnership Council** – Provides strategic direction to the Fixed and Rotary Wing Science and Technology Community.

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OBJECTIVE 2: NASA EARTH SCIENCE

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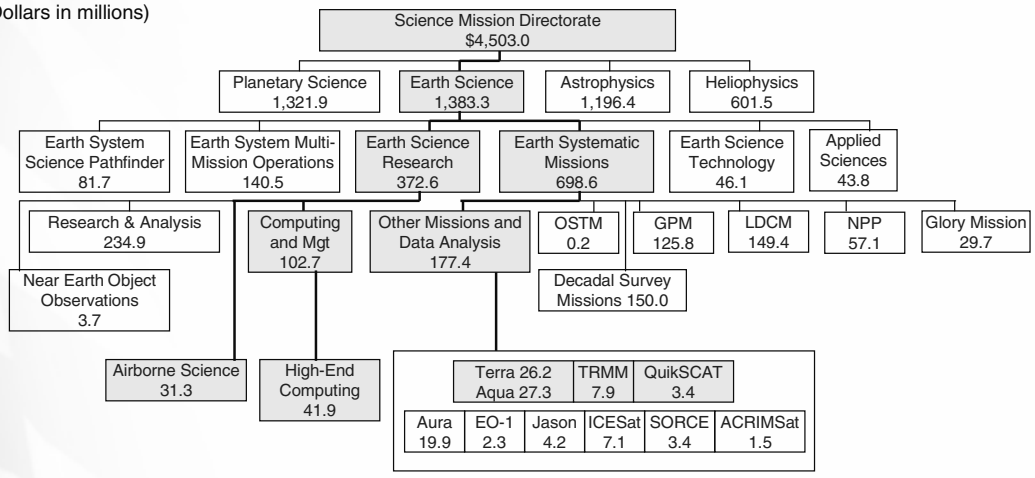
Overview of NASA's Science Mission Directorate Portfolio

(Dollars in millions)



Source: NASA.

Note: Fiscal Year 2009 Enacted Funding excluding funding under the American Recovery and Reinvestment Act of 2009 and rescissions.

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OBJECTIVE 2: NASA EARTH SCIENCE

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No Duplication Found in Earth Science Portfolio

- No duplication found in areas we reviewed.
- External and internal policies promote interagency collaboration regarding Earth Science efforts.
- NASA coordinates with other federal agencies in attempts to avoid duplication through:
  - Participating in multiple interagency working groups.
  - Sharing data, ideas, and resources.
  - Conducting joint field experiments.
- NASA provides a unique role in Earth Science that is leveraged by other federal agencies, including:
  - Sensor development.
  - High-altitude aircraft systems.

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OBJECTIVE 2: NASA EARTH SCIENCE

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Earth Science Areas Reviewed

- **GAO reviewed five programs/projects under Earth Science**
  - **Airborne Science Program**
    - Provides aircraft systems that further science and advance the use of satellite data.
  - **Tropical Rainfall Measuring Mission (TRMM)**
    - Measures precipitation, clouds, lightning, and radiation processes over tropical regions.
  - **Moderate Resolution Imaging Spectroradiometer (MODIS) onboard Terra/Aqua**
    - Derived data products range from vegetation, land surface cover, ocean chlorophyll fluorescence to cloud and aerosol properties, fire occurrence, snow cover and land, and sea ice cover on oceans.
  - **Quick Scatterometer (QuikSCAT)**
    - Records sea-surface wind speed and direction data under all weather and cloud conditions over Earth's oceans.
  - **High-End Computing**
    - Plan and provides high-end computing systems and services to support NASA's mission needs.

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OBJECTIVE 2: NASA EARTH SCIENCE

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External Policy, Plans, and Laws

- **Interagency Strategic Research Plan for Tropical Cyclones** - Provides strategy to improve effectiveness in operational forecasts and warnings through strategic coordination and increased collaboration among the major players in the operational and research and development (R&D) communities.
- **US National Space Policy (2006)** - States that the Secretary of Commerce, through both NASA and the National Oceanic and Atmospheric Administration (NOAA), shall ensure to the maximum extent possible that civil space acquisition processes and capabilities are not duplicated.
- **Report:** ***Earth Science and Applications from Space – National Imperatives for the Next Decade and Beyond*** - Makes recommendations to advance earth science research, including:
  - NASA's support for research via orbital and suborbital platforms.
  - NASA, NOAA, and the U.S. Geological Survey support for Earth system modeling, including provision of high-end computing facilities.

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OBJECTIVE 2: NASA EARTH SCIENCE

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External Policy, Plans and Laws (cont.)

- **High-Performance Computing Act of 1991 (Pub. L. No. 102-194)**
  - Purpose is to help ensure the continued leadership of the United States in high-performance computing and its applications by improving the interagency planning and coordination of federal research and development on high-performance computing and maximizing effectiveness of the federal government's high-performance computing efforts.
- **Clean Air Act Amendments of 1990 (Pub. L. No. 101-549)**
  - Requires that NASA and NOAA monitor and submit to Congress reports on tropospheric concentrations of chlorine and bromine and on the level of stratospheric ozone depletion.
- **Federal Plan for High-End Computing** - Specifies:
  - An interagency R&D road map for high-end computing core technologies.
  - A plan to improve federal high-end computing capacity and accessibility.
  - Recommendations relating to federal procurement of high-end computing systems.

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OBJECTIVE 2: NASA EARTH SCIENCE

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NASA's Procedures and Plan

- **NPR 7120.5D – NASA Space Flight Program and Project Management Requirements** (discussed on page 20)
- **NPR 7120.8 - NASA Research and Technology Program and Project Management Requirements** (discussed on page 21)
- **NASA Science Mission Directorate Science Plan 2007-2016** - Includes the following principles:
  - Active participation from research community.
  - Partnerships in achieving NASA's science objectives and realizing societal benefits from NASA's research.

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OBJECTIVE 2: NASA EARTH SCIENCE

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Coordination Mechanisms That Help Avoid Duplication

- **Office of Federal Coordinator for Meteorological Services and Supporting Research**
  - Mission is to ensure the effective use of federal meteorological resources by leading the systematic coordination of operational weather requirements and services, and supporting research, among federal agencies.
- **National Science and Technology Council**
  - **Subcommittee on Disaster Reduction (Committee on Environment and Natural Resources)** – Facilitates national strategies for reducing disaster risks and losses by providing a federal forum for sharing information, development of collaborative opportunities, and formulation of guidance for policymakers.
  - **Subcommittee on Networking and Information Technology Research and Development (Committee on Technology) –** Coordinates planning, budgeting and assessment activities of member agencies, including NASA.
- **NASA / NOAA Quarterly Roundtable** – Resulted from Section 306 of 2005 NASA Authorization Act that directs NASA, NOAA and other agencies to prepare transition plans for existing and future Earth observing systems; NASA official stated that these roundtables help senior leadership remain engaged in the issues, including transition of satellites.

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OBJECTIVE 2: NASA EARTH SCIENCE

Coordination Mechanisms That Help Avoid Duplication (cont.)

- **Joint Center for Satellite Data Assimilation** – Collaborative effort with NASA, NOAA, and Department of Defense dedicated to improving ability to assimilate satellite data.
- **Interagency Coordinating Committee for Airborne Geosciences Research and Applications** – Primary purpose to increase effective utilization of the federal airborne fleet in support of airborne geoscience research programs.
- **Interagency Working Group for Airborne Data and Telecommunication Systems** – Interagency effort fostering interoperability between airborne platforms and instrument payloads within the government research community.
- **U.S. Weather Research Program** – Interagency effort to accelerate improvement in high-impact weather forecasting ability.
- **Other Coordination Mechanisms**
  - NASA Science Mission Directorate has approximately 73 memorandums of understanding in force with over 25 federal agencies.
  - Working relationships that span agency boundaries.

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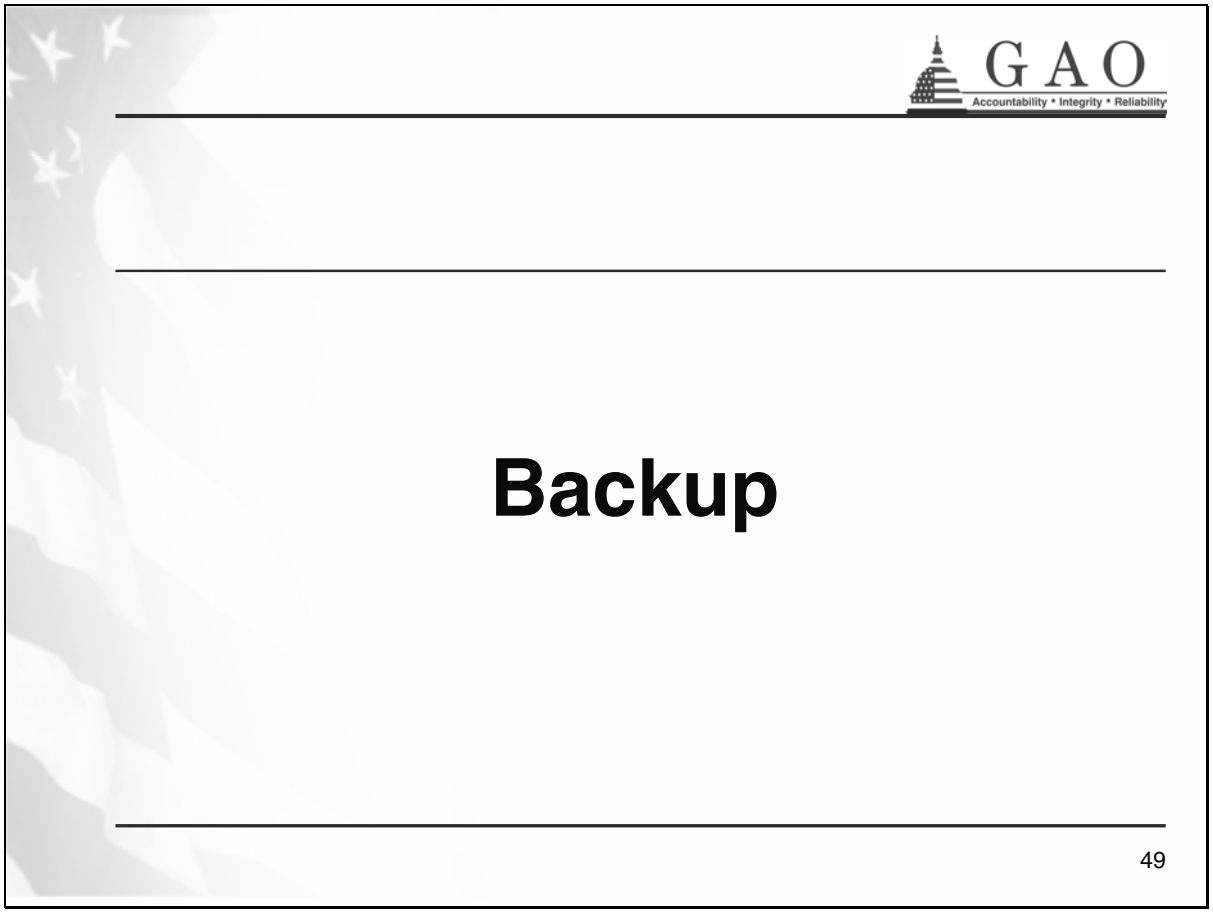
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Backup
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BACKUP: BACKGROUND

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NASA Authorization Act of 2008

SEC. 1122. Report on NASA Efficiency and Performance

(a) *IN GENERAL.—Not later than 1 year after the date of enactment of this Act, the Comptroller General of the United States shall submit to Congress a report that contains a review of NASA programs and associated activities with an annual funding level of more than $50,000,000 that appear to be similar in scope and purpose to other activities within the Federal government, that includes—*

(1) a brief description of each NASA program reviewed and its subordinate activities;

(2) the annual and cumulative appropriation amounts expended for each program reviewed and its subordinate activities since fiscal year 2005;

(3) a brief description of each Federal program and its subordinate activities that appears to have a similar scope and purpose to a NASA program; and

(4) a review of the formal and informal processes by which NASA coordinates with other Federal agencies to ensure that its programs and activities are not duplicative of similar efforts within the Federal government and that the programs and activities meet the core mission of NASA, and the degree of transparency and accountability afforded by those processes.

(b) DUPLICATIVE PROGRAMS.—If the Comptroller General determines, under subsection (a)(4), that any deficiency exists in the NASA procedures intended to avoid or eliminate conflict or duplication with other Federal agency activities, the Comptroller General shall include a recommendation as to how such procedures should be modified to ensure similar programs and associated activities can be consolidated, eliminated, or streamlined within NASA or within other Federal agencies to improve efficiency.

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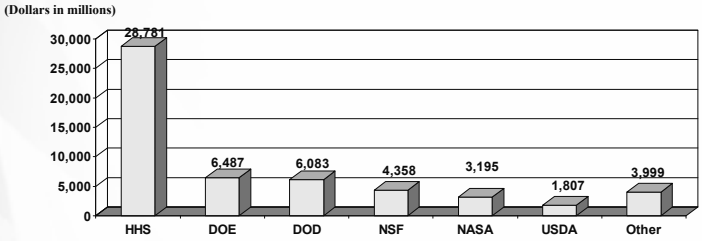
BACKUP: BACKGROUND

Federal Obligations for Research Fiscal Year 2008



Field of science (Dollars in millions)	HHS	DOE	DOD	NSF	NASA	USDA	Other
Environmental	435	326	326	734	730	16	841
Life	23,359	320	712	649	184	1,469	840
Math and computer	184	920	958	849	56	19	144
Physical	392	2,450	728	829	854	91	262
Social and psychology	1,924	0	70	203	13	143	552
Engineering	937	2,461	3,007	789	1,202	64	799
Other	1,550	10	282	304	157	4	562

Source: National Science Foundation, January 2009.
Note: Fiscal year 2008 projected current dollars in millions

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BACKUP: BACKGROUND

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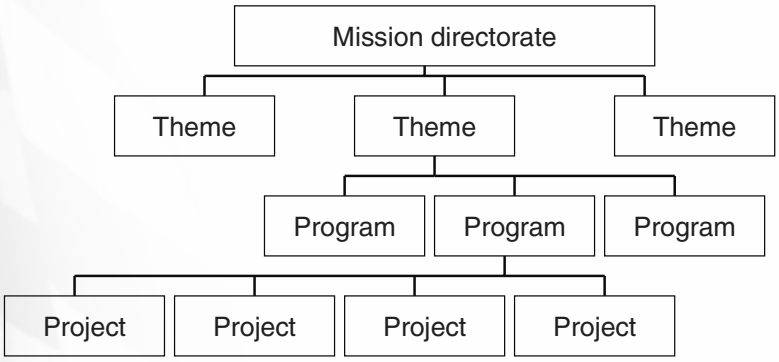
Overview of NASA's 38 Programs

Based on our review of the fiscal year 2009 budget submission, we determined that there were 38 programs in four mission directorates[5] and a mission support office. Each Mission Directorate can support a theme, which can support a program, which can support a project.



[5]NASA's four mission directorates are Science Mission Directorate, Aeronautics Research Mission Directorate, Exploration Systems Mission Directorate, and Space Operations Mission Directorate.

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BACKUP: BACKGROUND

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Overview of NASA's 38 Programs – Science Mission Directorate (SMD)

SMD supports 4 themes and 22 programs.

Area	FY07 (Actual)	FY08 (Actual)	FY09 (Enacted)	FY10 (Requested)
SMD	$4,609.9	$4,733.2	$4,903.0	$4,477.2
Earth Science 6 programs - 55 projects	1,198.5	1,237.4	1,704.6	1,405.0
Planetary Science 6 programs - 50 projects	1,215.6	1,312.6	1,325.6	1,346.2
Heliophysics 5 programs - 47 projects	830.8	787.6	591.6	605.0
Astrophysics 5 programs - 43 projects	1,365.0	1,395.6	1,281.2	1,120.9

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BACKUP: BACKGROUND

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Overview of NASA's 38 Programs – Science Mission Directorate

Earth Science Theme

1. Earth Science Research
2. Earth Systematic Missions
3. Earth System Science Pathfinder
4. Earth Science Multi-Mission Operations
5. Earth Science Technology
6. Applied Sciences

Planetary Science Theme

1. Planetary Science Research
2. Discovery
3. New Frontiers
4. Mars Exploration
5. Outer Planets
6. Technology

Astrophysics Theme

1. Astrophysics Research
2. Cosmic Origins
3. Physics of the Cosmos
4. Exoplanet Exploration
5. Astrophysics Explorer

Heliophysics Theme

1. Heliophysics Research
2. Living with a Star
3. Solar Terrestrial Probes
4. Heliophysics Explorer Program
5. New Millennium

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BACKUP: BACKGROUND

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Overview of NASA's 38 Programs –
Aeronautics Research Mission Directorate (ARMD)

ARMD supports one theme and four programs.

Area	FY07 (Actual)	FY08 (Actual)	FY09 (Enacted)	FY10 (Requested)
ARMD	$593.8	$511.4	$650.0	$507.0
Aeronautics 4 Programs – 12 projects	593.8	511.4	650.0	507.0

Aeronautics Theme

1. Aviation Safety
2. Airspace Systems
3. Fundamental Aeronautics
4. Aeronautics Test Program

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BACKUP: BACKGROUND

Overview of NASA's 38 Programs –
Exploration Systems Mission Directorate (ESMD)

ESMD supports two themes and five programs.

Area	FY07 (Actual)	FY08 (Actual)	FY09 (Enacted)	FY10 (Requested)
ESMD	$2,869.8	$3,229.4	$3,905.5	$3,963.1
Constellation Systems 2 programs – 8 projects	2,114.7	2,675.9	3,433.2	3,505.4
Advance Capabilities 3 programs – 7 projects	755.1	623.5	472.3	457.7

Constellation Systems Theme
1. Constellation Systems Program
2. Commercial Crew and Cargo

Advanced Capabilities Theme
1. Human Research Program
2. Exploration Technology Development
3. Lunar Precursor Robotic Program

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BACKUP: BACKGROUND

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Overview of NASA's 38 Programs –
Space Operations Mission Directorate (SOMD)

SOMD supports three themes and six programs.

Area	FY07 (Actual)	FY08 (Actual)	FY09 (Enacted)	FY10 (Requested)
SOMD	$5,113.5	$5,427.2	$5,764.7	$6,175.6
Space Shuttle 1 program – 1 projects	3,315.3	3,295.4	2,981.7	3,157.1
International Space Station 1 program – 1 projects	1,469.0	1,685.5	2,060.2	2,267.0
Space and Flight Support 4 programs – 4 projects	329.2	446.2	722.8	751.5

Space Shuttle Theme
1. Space Shuttle Program

International Space Station
1. International Space Station Program

Space and Flight Support Theme
1. Space Communication and Navigation
2. Launch Services
3. Rocket Propulsion Test
4. Crew Health and Safety

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BACKUP: BACKGROUND

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Overview of NASA's 38 Programs – Office of Education

The Office of Education supports one theme and one program

Area	FY07 (Actual)	FY08 (Actual)	FY09 (Enacted)	FY10 (Requested)
Education	$115.9	146.8	169.2	126.1
Education 1 program – 11 projects	115.9	146.8	169.2	126.1

Education Theme

1. Education

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BACKUP: NASA EARTH SCIENCE

Office of Federal Coordinator for Meteorological Services and Supporting Research (OFCM)

- The Department of Commerce formed OFCM in 1964. OFCM's mission is to ensure the effective use of federal meteorological resources by leading the systematic coordination of operational weather requirements and services, and supporting research, among the federal agencies.
- OFCM carries out its tasks through an interagency staff working with representatives from the federal agencies who serve on program councils, committees, working groups, and joint action groups.
- OFCM hosts annual Interdepartmental Hurricane Conference where information is gathered and shared among agencies, academia, and the private sector.

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Abbreviations

ACRIMSAT	Active Cavity Radiometer Irradiance Monitor Satellite
ARMD	Aeronautics Research Mission Directorate
DOD	Department of Defense
EO-1	Earth Observing -1
ESMD	Exploration Systems Mission Directorate
GPM	Global Precipitation Measurement
ICESat	Ice, Clouds, and Land Elevation Satellite
LDCM	Landsat Data Continuity Mission
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NPD	NASA Policy Directive
NPP	National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project
NPR	NASA Procedural Requirements
OFCM	Office of the Federal Coordinator for Meteorological Services and Supporting Research
OMB	Office of Management and Budget
OSTM	Ocean Surface Topography Mission
PART	Program Assessment Rating Tool
QuikSCAT	Quick Scatterometer
SMD	Science Mission Directorate
SOMD	Space Operations Mission Directorate
SORCE	Solar Radiation and Climate Experiment
STEM	Science, Technology, Engineering and Mathematics
TRMM	Tropical Rainfall Measuring Mission

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Enclosure II: GAO Contact and Staff Acknowledgments

GAO Contact

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