U.S. Commercial Remote Sensing Space Policy: Civil Agency Implementation Plan

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Implementation Plan Working Group (IPWG)

EXECUTIVE SUMMARY

This Civil Agency Implementation Plan presents an approach to guide U.S. civil government support for the U.S. Commercial Remote Sensing Space Policy (CRSSP), signed by the President on April 25, 2003.[1] The policy and the plan recognize that civil agencies have wide-ranging goals and interests in commercial remote sensing systems, data, products, and services. The goals include advancing and protecting U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and sustaining and enhancing the U.S. remote sensing industry.

Implementation Action #8 directs the civil agencies to consider (1) civil requirements for imagery and geospatial information that can be effectively provided by commercial remote sensing space capabilities; (2) allocation of resources to meet civil requirements; (3) mechanisms for interagency coordination to meet requirements, including with the National Imagery and Mapping Agency (NIMA); and (4) feasibility of designating a single agency as a civil procurement agent.

This plan focuses on civil agency needs while sharing execution across multiple agencies in a "Civil-Focus, Shared-Execution" model of governance. To execute this plan, participating agencies agree to collect and, where possible, share their requirements for remote sensing products to support collective interests. These requirements will be consolidated through cost-effective procurement vehicles to strengthen price and licensing negotiations in support of shared-use opportunities. Acquired products will be stored in a common library for access and reuse by other users.

Plan execution is strengthened by the resources and infrastructure of the agencies that have agreed to share responsibilities for the collective benefit. A committee of executives from departments and independent agencies will provide high-level oversight for implementation and operation of these capabilities. To oversee these activities, each civil agency will be requested to identify a senior manager with knowledge of the agency's mission and programs to serve on the Senior Steering Committee. Representatives knowledgeable in each agency's application of remote sensing will be solicited to participate in an Interagency Working Group responsible for coordinating implementation activities.

[1] This plan is the response to Implementation Action #8 in the CRSSP.

Some initial actions are needed to achieve near-term objectives and longer-term partnership goals—and to provide visible progress in implementing this plan:

- **Requirements.** Processes will be established to collect, compile, and communicate short-term requirements for products (to address agency needs that can be met with existing systems and products) and long-term observation requirements (as a basis for building new sensor systems and long-term budget requests).

- **Budget Strategy.** Requirements will be translated into funding requests, considering existing agency budgets and justification for new and sustained funding necessary to increase access to and use of commercially available remote sensing products and services.

- **Prioritization Schema.** A prioritization schema will be established to equitably allocate new budget for interagency requirements and to influence acquisition and distribution of products and services in support of the collective community in accordance with funding availability.

- **Governance.** The U.S. Geological Survey (USGS) will serve as the lead agency for implementation and execution of this plan. The National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Agriculture (USDA), the National Aeronautics and Space Administration (NASA), and NIMA will share responsibilities in collecting requirements, supporting data acquisition, and assisting in library services.

- **New Initiatives.** New initiatives will be identified, developed, and evaluated to stimulate partnerships between civil agencies and industry.

- **Procurement Methods.** Existing federal contracts will be used to immediately benefit the civil community. As needed, contracts will be adapted or initiated to add customized product or delivery options, improve buying power, and expand licensing provisions.

While this plan is designed to provide the maximum benefits to the civil agencies for purchasing or otherwise obtaining commercial space-based products, it does not preclude an agency from contracting directly with a commercial data provider to satisfy agency needs. Further, while this plan encourages consideration of commercial space capabilities, it does not compromise the agency's freedom to consider all remote sensing data sources.

In summary, through interagency cooperation and utilization of existing agency infrastructure, the civil agencies will seek opportunities to maximize the application of commercial remote sensing data systems, products, and services to their mission activities. A fundamental criteria for success of this plan is the need to identify funding allocations beyond those represented in existing civil agency budgets.

I. PURPOSE AND OBJECTIVES

A. PURPOSE OF THE CIVIL AGENCY IMPLEMENTATION PLAN

This document provides an initial implementation plan to guide U.S. civil government support for the U.S. Commercial Remote Sensing Space Policy (CRSSP), signed by the President on April 25, 2003. This policy recognizes that civil agencies have potentially wide-ranging interests in using commercial remote sensing systems, data, products, and services to meet their geospatial needs. As part of its implementation actions, the policy directs the civil agencies to "submit a plan for establishing an effective long-term partnership between U.S. civil agencies and U.S. industry that supports the goals of this policy." These goals include advancing and protecting U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities and sustaining and enhancing the U.S. remote sensing industry.[2]

An interagency group with memberships from U.S. civilian agencies developed this implementation plan for using commercial remote sensing space capabilities to the maximum extent possible, in accordance with the policy. The plan provides an integrated approach to optimize the use of commercial systems and data in support of U.S. civil agency missions and functions.

B. KEY OBJECTIVES OF THE POLICY

In support of the policy goal, the U.S. government (including civil agencies) is directed to

- *Rely to the maximum practical extent on U.S. commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, homeland security, and civil users;*

- *Focus United States Government remote sensing space systems on meeting needs that cannot be effectively, affordably, and reliably satisfied by commercial providers because of economic factors, civil mission needs, national security or foreign policy concerns;*

- *Develop a long-term, sustainable relationship between the United States Government and the U.S. commercial remote sensing industry.*

[2] For details on the CRSSP, see "U.S. Commercial Remote Sensing Policy," fact sheet, April 25, 2003, which can be accessed in Appendix A and at http://crsp.usgs.gov.

The commercial remote sensing space policy includes other policy goals beyond the scope of this implementation plan that are being addressed by other interagency groups.[3]

C. KEY OBJECTIVES AND TASKS OF THIS IMPLEMENTATION PLAN

This plan responds to the following four items quoted from Implementation Action # 8 of the policy: "the strategy will consider

1. Civil requirements for imagery and geospatial information that can be effectively provided by commercial remote sensing space capabilities

2. Allocation of resources to meet civil requirements

3. Mechanisms for interagency coordination to meet requirements, including with NIMA [National Imagery and Mapping Agency]

4. Feasibility of designating a single agency as a civil procurement agent"

To respond to the CRSSP guidance, the National Aeronautics and Space Administration (NASA), the Department of Commerce (DOC) through the National Oceanic and Atmospheric Administration (NOAA), and the Department of the Interior (DOI) through the U.S. Geological Survey (USGS) established a working group to develop the implementation plan. The result emerged from the activities and oversight of two main groups: an Interagency Review Board (IRB)[4] and an Implementation Plan Working Group (IPWG).[5] Additional details on the implementation plan process are included in Appendix B. In the development of this plan, the IPWG coordinated with a wide range of other U.S. government activities under way in response to the policy, including those of NIMA.

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[3] These additional U.S. policy goals are to provide a timely and responsive regulatory environment for licensing operations and exports of commercial remote sensing space systems and to enable U.S. industry to compete successfully as a provider of remote sensing space capabilities for foreign governments and foreign commercial users, while ensuring appropriate measures are implemented to protect national security and foreign policy ("U.S. Commercial Remote Sensing Policy," 2003).

[4] The IRB comprises the Associate Administrator of NASA for Earth Science Enterprise, the Assistant Administrator for NOAA's Satellite and Information Services, and the Director, U.S. Geological Survey.

[5] The IPWG is headed by USGS (DOI), with NASA and NOAA (DOC) as key supporting members. The IPWG also has representation from the Department of Homeland Security (DHS), the Department of Energy (DOE), DOI, the Department of Transportation (DOT), the Federal Aviation Administration (FAA), National Park Service (NPS), the National Science Foundation (NSF), U.S. State Department, U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), and the U.S. Forest Service.

II. BACKGROUND

Civil agencies have diverse needs for remote sensing data and derived information products to support their various missions. Historically, civil agencies have relied on a variety of information sources, including aerial photography and satellite imagery, to meet their requirements for geospatial information.

Although some civil agencies routinely use commercial satellite data products and services,[6] most face significant impediments to taking greater advantage of this underutilized information source (for details, see Appendix C). Examples include:

- The price of commercial satellite imagery has generally been much higher than traditional sources of geospatial information, such as aerial imaging and ground-based data collection.
- At current funding levels, even high-priority aerial acquisitions and cost-share opportunities remain unfunded.
- Flexible licensing arrangements have been unaffordable for sharing imagery within agencies and with other federal, state, and local government entities; tribes; nongovernmental partners; and the public.
- Limited purchasing power has resulted from constrained budgets and the lack of an integrated approach to acquiring commercial satellite data.
- Some civil agencies still have insufficient knowledge about how to best acquire and utilize commercial satellite data products and services.

The National Intelligence Community and the Department of Defense (DoD) faced similar impediments to obtaining and successfully using commercial remote sensing space data and services. When substantial new funding became available to NIMA, progress was made in partnership with commercial industry. This new funding facilitated increased buying power with the potential for larger orders and increased negotiating options. Changes in the market brought about by the NIMA product buys have provided some benefits for the civil agencies. But without budget sufficiency, the ability of the civil agencies to benefit from these remote sensing products and services is limited.

Another complication for U.S. decisionmakers is the complex set of trade-offs that arise in choosing among different data sources to supply the geospatial information they need. For example, trade-offs exist between moderate-to-low resolution civil and high-resolution commercial space systems and between airborne and spaceborne remote sensing technology. Civil agencies also make use of international data providers, including foreign civil and commercial observation satellites. Commercial satellite data exist within this complex dynamic of supply and demand as one potential source for addressing the particular geospatial requirements of civil agencies.

[6] The following U.S. commercial observation satellites are currently on orbit: Space Imaging's IKONOS (September 1999), DigitalGlobe's QuickBird (October 2001), and Orbimage's OrbView-2 (August 1997) and OrbView-3 (June 2003).

III. IMPLEMENTATION CONTEXT

The IPWG identified several guiding principles and desired outcomes that will be essential for realizing the potential benefits of the CRSSP Implementation Plan.

A. GUIDING PRINCIPLES

U.S. civil agencies should consider these guiding principles in implementing the plan:

- **Explicit emphasis on commercial remote sensing space capabilities:** Agency decisionmakers should explicitly weigh the possible use of commercial remote sensing space capabilities for satisfying their agencies' data or system acquisitions needs.

- **Considering a broad range of commercial remote sensing capabilities:** Agencies should look to commercial industry as a source not only for imagery data but also for value-added products, services, technologies, and satellite systems.

- **Effective short- and long-term actions for developing a partnership with industry:** Although short-term actions are needed for sustaining U.S. industry, the key to successfully implementing the CRSSP will be developing a sound foundation for a long-term partnership between the agencies and industry.

- **Good governance as a key consideration in implementing the policy:** Nothing in the policy should be seen as encouraging agencies to disregard cost, efficiency, or requirement satisfaction in making their choices.[7]

B. DESIRED OUTCOMES

The following types of desired outcomes were identified by the civil agencies as measures of success in implementing this plan:

- **Policy Responsiveness.** The implementation plan must be consistent with the administration's CRSSP guidance that includes development of an effective long-term partnership between the civil agencies and the U.S. commercial remote sensing industry. It must also be responsive to the missions and objectives of the civil agencies, consistent with sound business practices, and obtains approval and sustained support from Congress.

[7] For example, if for a particular civil agency remote sensing need, purchasing aerial remote sensing data is more cost-effective or efficient than purchasing satellite remote sensing data, then that agency should meet its need using the aerial source.

- **Adequate Budgets.** Civil agencies must have sustained and adequate funding to integrate commercial remote sensing space capabilities into operational use. Adequate funding must exist to task industry resources for reliable collection, processing, and information extraction services. With adequate funding, an environment for civil agency and industry partnerships could be realized.

- **Improved Communication with Industry Stakeholders.** Civil agencies must create a more effective and coherent interface with commercial industry that includes more streamlined contractual mechanisms and an improved and consolidated approach to informing industry of agencies' near- and long-term remote sensing requirements.

- **Civil Agency Stakeholder Efficiencies.** Participating civil agencies must be able to leverage their combined buying power to achieve lower prices and increase license flexibilities. Also, the civil agency governance approach must meet the needs of the widest range of civil agencies.

IV. U.S. CIVIL AGENCIES NEED FOR REMOTE SENSING INFORMATION

An extraordinary number of key civil operational and scientific needs are supported by remote sensing information. The opportunity exists to address national priorities with continued research and funding. At a high level, remote sensing needs can be related directly to top-level agency missions (see Appendix D, Section II, for examples). These needs can also be viewed in terms of crosscutting application areas or agency specific programs.

A. CROSSCUTTING AGENCY APPLICATION AREAS

Historically, U.S. civil agencies have made use of commercial remote sensing space capabilities, but not through an integrated strategy. The IPWG defined a set of crosscutting applications to help understand the value of remote sensing and to identify opportunities for expanded and coordinated civil data acquisition. The following list, not intended to be comprehensive, identifies some common application areas (see Appendix D, Section I, for more details):

- agriculture management
- emergency management
- environmental monitoring and management
- homeland security
- mapping
- natural resource, coastal and land management
- research and development
- transportation
- weather and climate.

These crosscutting areas are not formal requirements; however, they provide an initial focus for coordinating requirements across civil agencies, and detailed requirements can be derived from them.

B. PROGRAM USES OF REMOTE SENSING INFORMATION

Many federal programs rely on various aerial and space remotely sensed data sources, both government and commercial.[8] Table 1 below lists some of these programs and their relationship to application areas. The table shows that each program contributes to numerous application areas, and conversely each application area is supported by a number of programs. This relationship suggests that application areas may be useful categories for aggregating civil remote sensing needs at a high level and locating

[8] More than 80 federal programs were identified in Federal Geographic Data Committee, Civil Imagery and Remote Sensing Task Force, *Report to the Administration: The Value of Civil Imagery and Remote Sensing*, 2002.

opportunities for interagency coordination in data collection and sharing. For example, remote sensing data used for the national wetlands inventory may also be relevant for forest fire monitoring, conservation planning, and transportation planning. An important caveat is that particular data specifications vary greatly by program, and a detailed requirements assessment is needed to determine practical opportunities for data sharing.

The government relies heavily on the use of remote sensing technology to make these programs effective. The programs, as well as many others not listed that have not been funded to take advantage of remote sensing, would significantly benefit from the availability of current, regularly updated, broad area commercial imagery coverage.

C. EXPLORING NEW INITATIVES: "SNAPSHOT OF AMERICA": A COLLABORATION ON NATIONAL BASELINE IMAGE LAYER

Commercial, high-resolution[9] satellite image data and derived information products have recently become available to civil agencies, yet relatively few federal scientists or managers have begun to exploit these resources to satisfy their specific programmatic requirement for remotely sensed data, let alone address the potential for new uses (see background information in Appendix C). Therefore, data have not been widely available to serve other information needs or to stimulate new applications. Civil agency uses for commercial high-resolution satellite products and services will, in some cases, evolve only after agencies have ready access to a broad geographic sampling of commercial space imagery. To help address such issues, this implementation plan calls for the development and evaluation of possible new initiatives to more fully satisfy the requirements of current programs and create new uses (and demand) for commercial remote sensing, especially in agencies that do not traditionally rely on, or cannot afford to procure, data. Any such new initiatives will be driven by formally articulated and evaluated civil agency remote sensing requirements.

One concept that could possibly be developed into an initiative is "Snapshot of America," a priority-driven U.S.-wide data layer of commercial high-resolution satellite data processed into formats that allow easy retrieval and direct insertion into civil agency geographic information systems. As this layer is gradually filled in by commercial providers, the imagery could become available for unrestricted civil agency use in order to explore and develop practical uses that would emerge within specific agencies but could be available to any civil agency that might benefit. This baseline image layer could also be useful in the crosscutting application areas and federal programs, such as the National Map, the Flood Map Modernization Program, and the Vegetation Mapping Program. This "Snapshot of America" national data layer concept will need to be developed and evaluated based on agency requirements, priorities, cost, and technical feasibility before being proposed as an actual initiative.

[9] High resolution, in this sense, is a popular term for 4-meter multispectral/1-meter black-and-white imagery with a relatively small ground "footprint" as compared with a Landsat scene. Three commercial U.S. satellites currently fly similar sensors, with one at a lower orbit that allows for somewhat sharper imagery.

Table 1: Sample of federal programs and applications that use aerial and space remote sensing information[10]

Sample of Federal Programs that Use Remote Sensing	*Cross-cutting Applications*								
	Agriculture management	Emergency management	Environmental monitoring and mgt.	Homeland security	Mapping	Natural resource, coastal, and land mgt.	Research and development	Transportation	Weather and climate
The National Map	x	x	x	x	x	x	x	x	
Gap Analysis Program	x		x		x	x	x		
National Satellite Archive	x	x	x	x	x	x	x	x	
Vegetation Mapping Program	x	x	x		x	x	x		
Multi-resolution Land Characteristics	x		x		x	x	x		x
National Wetlands Inventory	x		x		x	x	x		
Global Crop Assessment Program	x		x	x	x	x	x		
Forest Fire Monitoring	x	x	x	x		x	x		x
National Resources Inventory	x		x	x	x	x	x		
Soil Survey	x		x				x		
Conservation Planning	x		x		x	x	x		
Flood Map Modernization Program	x	x	x	x	x	x	x	x	x
Hazards US Risk Assessment Model	x	x	x	x		x	x		
Superfund Program	x	x	x	x		x			
Global Climate Change	x		x	x		x	x		x
Solid Earth and Natural Hazards			x		x	x	x	x	x
National Spatial Data Infrastructure	x	x	x	x	x	x	x	x	x
Global Change Research	x		x			x	x		x
Levee Maintenance Program	x	x	x	x	x	x	x	x	x
TIGER Program			x	x	x		x	x	
Transportation Corridor Planning		x	x	x	x		x	x	
Infrastructure Inventory/Management		x	x	x	x		x	x	
Safe Flight Program				x	x		x	x	x
Aeronautical Charting Program		x		x	x		x	x	x

[10] "X's" indicate relationships between the program and the application area. The X's are for example only at this point and are not intended to be authoritative. Federal programs are listed for example only, using the list from the Federal Geographic Data Committee (FGDC), Civil Imagery and Remote Sensing Task Force, "Report to the Administration: The Value of Civil Imagery and Remote Sensing," 2002, online at http://fgdc.gov/fgdc/coorwg/2002/cirs_report.doc

V. GOVERNANCE FOR THE IMPLEMENTATION PLAN

The IPWG developed and assessed a variety of management options by which the civil agencies could effectively implement the policy. These elements were seen as central to all options:

- a distinct civil identity and focus for commercial remote sensing
- a distinct senior leadership body representing all civil agencies
- a civil-agency-wide requirements collection mechanism and an associated prioritization process
- a formal implementation agreement between the agencies
- an evaluation period of the governance with a formal reporting mechanism.

A coordinated approach to the use of commercial remote sensing invariably will create more opportunities for the civil agencies than the status quo. Successful implementation of the new policy will require the dedicated attention of the civil agencies, especially in the near term, and substantial capacity building. Specifically, it will require the development of key functionalities, including

- requirements assessment
- budget strategy
- interagency coordination
- prioritization schema
- procurement processes
- financial management
- contract management
- library services
- quality control
- reporting.

These functionalities (see details in Appendix E) will draw on existing infrastructure and processes as much as possible and develop new capabilities as needed.

A. "CIVIL-FOCUS, SHARED-EXECUTION" MODEL FOR GOVERNANCE

A number of governance models were defined and evaluated, as listed in Appendix B, Section VIII, and the "Civil-Focus, Shared-Execution" model was selected as the best governance option because it

- provides civil agency leadership
- has the greatest potential for endorsement and implementation by civil agencies
- establishes a focus on civil agency requirements (separate from the national security community)
- leverages several government agencies to share in its execution

- appears to have smaller cost implications
- can be implemented in the shortest amount of time
- uses existing infrastructure and processes for immediate policy compliance and development of future capabilities.

The civil agencies, through the Civil-Focus, Shared-Execution model, will work cooperatively to define, implement, and oversee functionality required to ensure maximize utilization of commercial remote sensing data in government-funded programs. Another important collaborator in this model is NIMA, which also has important capabilities. This model will take advantage of both civil agency and NIMA infrastructure.

Governance of this process will require interagency coordination and cooperation at several levels. Much additional investigation and definition of responsibilities remain to be accomplished, but some general recommendations are being made regarding coordination mechanisms and their respective arenas of responsibility for executing this governance model.

B. LEADERSHIP AND COORDINATION

There are three levels of interagency groups that are recommended to provide the civil leadership desired:

- The **Deputies Committee** will be composed of department-level executives from the civil agencies. It would meet annually (or as required) to provide guidance for the implementation of this plan in the near term and successful execution for the long term.

- The **Senior Steering Committee** ideally would comprise Senior Executive Service (SES)–level civil agency managers with knowledge of remote sensing applications in agency mission and programs. It will provide overall guidance and direction to the agencies, identify agency responsibilities, and coordinate the establishment of appropriate agreements. Additionally, and of importance for the civil agencies, it will establish the civil prioritization schema and ensure that it is adhered to as defined by the agencies. The committee would meet monthly (or as required) initially, then quarterly as operational status is achieved. It is recommended that the current IRB continue to provide senior oversight until such time as the Senior Steering Committee is established.

- The **Interagency Working Group** will be composed of senior agency management and technical people at the GS-14 and GS-15 level and will provide direct oversight of the execution functions established in the plan. The group will receive guidance from the Senior Steering Committee and other appropriate agency management offices. This group's responsibilities include working with and providing guidance for working-level staff involved in planning, developing, and executing functional capabilities. Additional ad hoc interagency working groups will be formed as needed.

It is recommended that all civil agencies provide at least one remote sensing expert who understands their agency's remote sensing needs to be a point of contact for this group and, if applicable, to participate as a member of the group and in ad hoc group activities.

Where appropriate, these civil interagency groups will coordinate with non-civil departments and agencies, such as NIMA.

C. FUNCTIONALITY DEVELOPMENT AND AGENCY KEY RESPONSIBILITIES

Many different agencies have important equities in remote sensing and, therefore, responsibility for implementation of the policy, which will ultimately benefit their programs. This plan proposes several agencies—chosen by their unique expertise and interest in the policy—to perform specific functions in collaboration with all interested civil agencies. These agencies would formulate the civil budget, conduct their financial management, provide library services and data management, conduct quality control (through existing means, such as the Joint Agency Commercial Imagery Evaluation [JACIE],[11] or new venues), track the data requests, establish metrics for reporting, and provide an annual report on their activities. The USGS and USDA have tentatively accepted roles and responsibilities for these functions; NOAA has agreed to be the lead for collecting and documenting civil agency space-based long-term requirements. In addition, USGS will serve as lead agency, providing interface for all the agencies. Other agencies are invited to assume any of the civil functions identified in this model. Where appropriate and feasible, the civil agencies will also collaborate with NIMA in the execution of these functionalities.

The plan currently identifies the following agencies as having responsibilities in this governance model. However, this does not preclude other civil agencies from defining a role for themselves. The agencies that follow will meet more frequently than the aforementioned committees as needed to execute these key operating functions:

- **USGS.** The USGS will serve as the interface—i.e., lead agency—for the civil agencies in the execution of this implementation plan. The USGS will provide secretariat services, with support from its field centers for engineering, development, and operations expertise as required. The USGS will lead an interagency process to collect and compile civil agency requirements, both current and near-term, for products available from existing commercial space systems (see Appendix E). Finally, the USGS will investigate, and implement as needed, capabilities to provide maximum flexibility, economies of scale, and efficiency in data acquisition and management, distribution, and reuse of commercial remote sensing products and services.

[11] The JACIE team is an interagency group, including NASA, USGS, and NIMA, that in cooperation with academia and industry characterize commercial remote sensing satellite data.

- **USDA**. The USDA Foreign Agricultural Service, as the Affiliate Archive for Global Food Security**,** will aid USGS in the execution of library services, data management activities, data reuse tracking, and quality control activities.

- **NOAA.** NOAA will lead the civil agency process for collecting and documenting civil agency space-based long-term requirements. NOAA will work with all civil agencies to call for, synthesize, and report on long-term data requirements that may drive development of future commercial opportunities. NOAA will establish a long-term data requirements process to identify, characterize, verify, and validate all environmental space-based observation requirements on behalf of all civil agencies.

- **NIMA.** An aspect of this Shared-Execution model is the agreement of the civil agencies to partner with NIMA in an enhanced and collaborative way to facilitate implementation of the policy. NIMA has extensive infrastructure, commercial vendor interface, library services, and experience in commercial imagery and has agreed to collaborate with the civil agencies to implement the policy. Civil agencies will leverage NIMA's expertise to the maximum practical extent and conversely may offer support to NIMA, as appropriate, to ensure the partnership is effective.

- **FGDC.** FGDC will provide the lead on standards issues that may arise during implementation and will provide consultation and review to ensure appropriate linkages to Geospatial One-Stop,[12] NSDI (National Spatial Data Infrastructure), and related initiatives.

Through this shared program, the civil agencies will be able to maximize their purchasing, take advantage of the investments that civil agencies and NIMA have made in infrastructure, and will be able to set their own priorities for data requests through the creation of a prioritization schema.

While the plan is designed to provide the maximum benefits to the civil agencies for purchasing, or through other means obtaining, commercial space-based data, nothing in it precludes civil agencies from going directly to the commercial data provider to satisfy their agency needs.

D. PRIORITIZATION SCHEMA

A process is required to ensure that civil agency requirements for commercial products and services are documented, collected, analyzed for synergy, prioritized when appropriate, and communicated to the commercial industry data providers. Based on the results of the requirements process, a prioritization schema may be needed to address any competing product orders with respect to satellite tasking or data processing, whether among civil agencies or between civil or DoD agencies. Also, if significant new funds are

[12] The Geospatial One-Stop is one of 24 e-government initiatives sponsored by the Federal Office of Management and Budget, which is aimed at making it easier, faster, and less expensive for all levels of government and the public to access geospatial information.

appropriated to meet a collective need of the civil community (see “Snapshot of America” discussion), the prioritization schema must provide an equitable opportunity for agencies to obtain timely products and services.

E. REQUIREMENTS PROCESS

Understanding the extensiveness of civil agency requirements for remote sensing is a key to the successful implementation of this policy. The proposed Civil-Focus, Shared-Execution model includes the development and execution of a formal requirements process. The current lack of a lead agency for operational land remote sensing and a process to collect, consolidate, and publish civil agency requirements for remote sensing has been barrier to greater operational use. To mitigate this problem, USGS and NOAA will initiate a two-prong attack. USGS will work with the civil agencies to document commercial remote sensing products and services that can be met with existing sensor systems and technologies. For agencies with operational programs that use space based remotely sensed imagery, the process should be straightforward. For the other agencies, this process needs to be formally facilitated because current business processes may need to be modified to exploit space-based observations. Near-term requirements will also be assessed to serve as the basis for a short-term budget strategy. NOAA will work with all civil agencies to call for, synthesize, and report on long-term requirements that may be satisfied by government systems or that may drive the development of future commercial opportunities.

In a related effort to develop future architectures, NOAA will work with civil agencies to use outputs of the long-term requirements process as a basis for building new sensor systems and long-term budget requests. In support of this effort, NOAA will lead a National Security Space Architect-sponsored study to develop a space-based environmental monitoring system architecture, which would encompass capabilities currently provided by civil, commercial, defense and intelligence systems. Today, the National Security Space (NSS) Environmental Monitoring "System" is more a collection of independent sensors versus an integrated sensor network with supporting infrastructure. The current collection of sensors is operated by various members of the NSS community, resulting in redundancies and shortfalls. An integrated NSS Environmental Monitoring System (EMS) should provide a network that more efficiently meets operational and scientific needs. A NOAA-led Architecture Development Team, operating in support of the National Security Space Architect's Office, will develop an end-to-end EMS architecture by the end of FY 05. The results of this effort could lead to a more cost-effective portfolio of systems and processes to support National Security needs in the 2020+ timeframe.

The diversity of civil agency requirements varies greatly in terms of product type (raw imagery or processed as GIS-ready); spatial, spectral, radiometric, and temporal resolution; geographic extent; geometric accuracy; timeliness; format; and who needs to have access to the imagery. For example, an NSF-funded scientist may require raw imagery for a 50-mile square area over the past 10 years at 5-meter resolution to study volcanic deformation patterns, while a DHS Federal Emergency Management Agency

(FEMA) manager may need current 1-meter imagery processed into a geographic information system (GIS) flood map for a local area to share with local governments in an emergency response to a flood. In many cases, civil agencies will require imagery-derived information products (value added) in addition to or instead of imagery. The USGS/NOAA efforts should generate common requirements that could be used to develop interagency and private-public partnerships. However, many civil agencies will have unique, mission-critical requirements that are not common and/or cannot wait for partnerships to develop. When licensing agreements permit, agencies that buy data on their own should incorporate their image acquisitions into a civil imagery library so that other agencies may be able to benefit from the investment.

F. TRANSITIONING REQUIREMENTS INTO SYSTEMS

Existing commercial capabilities do not address the full breadth of civil agency needs. The civil agencies must strive to shape the market for their own unique purposes, in part to establish a long-term relationship with industry. Specifically, the civil agencies need to work with industry to ensure that new systems are better able to meet aggregate civil agency long-term requirements. NOAA, in consultation with other civil agencies, will explore methods and processes to transition interagency long-term requirements into systems, for example, identifying systems that could be placed on contract with commercial industry.

G. EVALUATION OF THIS GOVERNANCE MODEL

Implementation activities will be monitored by the Interagency Working Group and by the Senior Steering Committee. The Senior Steering Committee will provide annual progress reports concerning the adequacy and performance of the governance structure to the Office of Science and Technology Policy (OSTP) and the National Security Council (NSC) to assist in determining whether further changes in the policy and the governance structure may be warranted.

VI. KEY ISSUES

Other issues affecting the U.S. civil agencies emerge as a result of this policy.

A. BUDGET

Civil agency expenditures for commercial space remote sensing products have been constrained for several reasons, as discussed in Section II of this plan. Total civil agency expenditure in FY 2002 for commercial satellite imagery products is roughly estimated to be on the order of $10,000,000. The collective civil agency requirement is thought to be greater than this funding level; however, a detailed assessment of the actual civil agency requirements and the adequacy of required budget is currently under review. Through the development of this plan, the IPWG confirmed that existing commercial capabilities are relevant to mission needs and could satisfy some of the many longstanding or emerging requirements such as shoreline mapping, agricultural management, and homeland security, subject to development of such applications and availability of adequate funds.

Upon approval of this plan, the civil agencies will take the necessary steps to 1) implement the principles and recommendations identified in this report by using the interagency coordination mechanism identified here; 2) carry out further assessment of requirements and adequacy to fulfill them based on the available and/or emerging commercial products and services; and 3) establish or enhance the associated infrastructure handling, archival, distribution, and periodic reporting (see discussions in Section V, C, and Section VI, A), of data and information associated with such acquisitions.

B. DATA ISSUES

The CRSSP raises a number of data-related issues, some of which will be addressed outside the scope of this implementation plan. Two key issues are:

1. Licensing issues

For both research and operational projects and programs, civil agencies typically develop data and information products for broad distribution, thereby extending taxpayer-funded user benefits to the broadest possible community (see discussion in Appendix C). In light of these cooperative interests, civil agencies will seldom purchase space remote sensing data or derived products under commercial license restrictions if similar but unrestricted products can be acquired at comparable cost. Also, these civil agencies that buy data but do not require broad distribution to satisfy their programmatic objectives cannot afford to unilaterally fund additional license costs incurred for data sharing.

Another consideration arises when agency programs access commercial remote sensing data by delegating the procurement responsibility to cooperators. For example, a researcher may be funded to procure commercial remote sensing data as part of a grant. However, the grantee should have the flexibility, if possible, to procure these data through the government's volume-based contracts, taking advantage of negotiated bulk discounts.

Even with unrestricted distribution rights, the use of licensed imagery typically requires that meta-data be carried with the imagery, including proper attribution in library or archive databases or when used in reports and publications. Where these data are acquired and shared with cooperators, the government will incur costs to enforce and track these attendant license restrictions.

In any of the scenarios described above, it is desirable to make these taxpayer-funded data widely available to other government users; however, care must be taken to accommodate these diverse needs of civil agencies while conforming to negotiated licenses and procurement stipulations.

2. Tiered data access and control

In the future, commercial vendors will have the option to orbit new technologies capable of collecting data not licensed for commercial availability. In such cases, the U.S. government and government-approved users would have exclusive access to the special categories (also known as "upper tier" data) of commercial remote sensing space data, based on national security considerations. The two-tiered system differentiates between "upper-tier" for U.S. government and government-approved users and "lower tier" data for general commercial availability. Criteria for which data are placed in each tier will be determined on a case-by-case basis according to evolving national security concerns regarding technology, resolution, etc.

Upper tier data will be available to all U.S. government agencies under appropriate control measures subject to the condition that agencies may not redistribute the upper-tier data outside the U.S. government or government-approved user community without prior NOAA approval. There may also be situations in which NOAA would consult with DoD and the Intelligence Community to support sharing of the upper-tier data with state and local governments throughout the United States, such as for homeland security needs, as part of cooperative federal, state, and local programs.

C. ARCHIVE PRESERVATION

This plan provides for long-term preservation, access, and reuse of commercial remote sensing products and services acquired by the civil agencies (see discussion of functionality, Appendix D), consistent with guidelines of the National Satellite Land Remote Sensing Data Archive (NSLRSDA) mandated by Public Law 102-555, the Land Remote Policy Act of 1992. The Act charges DOI with responsibility (delegated to the USGS) for population and maintenance of a permanent, comprehensive government

archive of global land remote sensing data for long-term monitoring and study of global environments.

This plan does not, however, resolve an outstanding issue: the preservation of a data archive upon determination by a commercial operator that continued preservation is no longer commercially viable. To address this issue, the DOC license issued to operators of private remote sensing space systems requires:

> "Before purging any data in its possession, the Licensee shall offer such data to the Archive at the cost of reproduction and transmission. The Archive may make these data available immediately to the public at a price equivalent to the cost of fulfilling user requests."

While this condition allows the opportunity for evaluation and consideration of the need for long-term preservation and availability of that commercial archive, under current budget authorization, the USGS cannot respond effectively to a purge or termination decision. The time period from a commercial firm's notification of a purge/termination action to the date the action is to commence is insufficient, given the necessity to secure funding to carry out the transfer. As lead agency for the civil agency community and custodian of the NSLRSDA, the USGS will work with NOAA to define a strategy for presentation to the Deputies Committee and the Senior Steering Committee that addresses this issue.

D. GOVERNMENT–PRIVATE SECTOR RELATIONSHIP

A successful long-term partnership needs to support industry and position the government to help shape and ensure the future availability of optimum remote sensing products and services. High-performance industry suppliers in turn can further stimulate demand in the federal and consumer marketplace to fuel a continuously developing, robust, and enduring remote sensing industry. The combined set of requirements that will be articulated by civil agencies and communicated with a single voice will be meaningful only with the power of funding behind it; the mere aggregation of unfunded future product needs will not translate into new system capabilities and effect beneficial changes in the marketplace.

This policy implementation effort must creatively envision, practically evaluate, and aggressively fund potential long-term architecture solutions that are commercially viable and responsive to government needs. All reasonable requirements-based options—for example, large data procurements and creative approaches, including leased or subscription satellite services, forward funding to influence system design, and yet-to-be discovered solutions that increase the long-term availability of responsive technologies and services—need to be considered. Civil agency and industry should leverage expertise and creativity to examine new ideas for government-industry partnerships.

VII. ACTIONS REQUIRED

Some initial actions are needed to achieve near-term objectives and longer-term partnership goals—and to provide visible progress in implementing this plan.

- **Requirements.** Initiate interagency short and long term requirements identification processes by the lead agencies (see Section V, C and E).

- **Budget.** Identify new budget to procure commercial space remote sensing products and services that satisfy unfunded requirements (see discussions in Sections V, C and Section VI, A).

- **Prioritization Schema.** Establish a prioritization schema that equitably allocates new budget to satisfy interagency requirements (see Section V, D)

- **Governance.** Establish the management structure to implement the Civil-Focus, Shared-Execution governance model (see Section V). Each civil agency will be requested to identify official representatives as follows:

  —One SES-level civil agency manager with knowledge of remote sensing applications in agency mission and programs to serve on the Senior Steering Committee (see Section V, B).

  —One senior agency representative to serve on the Interagency Working Group (see Section V, B.)

- **New Initiatives.** Identify, propose, and evaluate new initiatives in support of long term partnerships between civil agencies and industry, such as “Snapshot of America” (see Section IV, C).

- **Transitioning Requirements Into Systems.** Explore methods and processes to transition interagency long-term requirements into systems, such as identifying systems that could be placed on contract with commercial industry (see Section V, F).

- **Data Procurement and Management.** Assess data procurement and library management options (see Section V and Appendix E).

The responsibility of these actions and implementation of this plan falls to the Interagency Working Group under the direction of the Senior Steering Committee.

APPENDIX A: CRSP FACT SHEET

U.S. COMMERCIAL REMOTE SENSING POLICY
April 25, 2003

FACT SHEET

The President authorized a new national policy on April 25, 2003 that establishes guidance and implementation actions for commercial remote sensing space capabilities. This policy supersedes Presidential Decision Directive 23, U.S. Policy on Foreign Access to Remote Sensing Space Capabilities, dated 9 March 1994. This fact sheet provides a summary of the new policy.

I. Scope and Definitions

This policy provides guidance for: (1) the licensing and operation of U.S. commercial remote sensing space systems; (2) United States Government use of commercial remote sensing space capabilities; (3) foreign access to U.S. commercial remote sensing space capabilities; and (4) government-to-government intelligence, defense, and foreign policy relationships involving U.S. commercial remote sensing space capabilities.

For the purposes of this document:

- "Remote sensing space capabilities" refers to all remote sensing space systems, technology, components, products, data, services, and related information. In this context, "space system" consists of the spacecraft, the mission package(s), ground stations, data links, and associated command and control facilities and may include data processing and exploitation hardware and software; and

- "Commercial remote sensing space capabilities" refers to privately owned and operated space systems licensed under the Land Remote Sensing Policy Act of 1992, their technology, components, products, data, services, and related information, as well as foreign systems whose products and services are sold commercially.

No legal rights or remedies, or legally enforceable causes of action are created or intended to be created by this policy. Officers of the United States and those agents acting on their behalf implementing this policy shall do so in a manner consistent with applicable law.

II. Policy Goal

The fundamental goal of this policy is to advance and protect U.S. national security and foreign policy interests by maintaining the nation’s leadership in remote sensing space

activities, and by sustaining and enhancing the U.S. remote sensing industry. Doing so will also foster economic growth, contribute to environmental stewardship, and enable scientific and technological excellence.

In support of this goal, the United States Government will:

- Rely to the maximum practical extent on U.S. commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, foreign policy, homeland security, and civil users;

- Focus United States Government remote sensing space systems on meeting needs that can not be effectively, affordably, and reliably satisfied by commercial providers because of economic factors, civil mission needs, national security concerns, or foreign policy concerns;

- Develop a long-term, sustainable relationship between the United States Government and the U.S. commercial remote sensing space industry;

- Provide a timely and responsive regulatory environment for licensing the operations and exports of commercial remote sensing space systems; and

- Enable U.S. industry to compete successfully as a provider of remote sensing space capabilities for foreign governments and foreign commercial users, while ensuring appropriate measures are implemented to protect national security and foreign policy.

III. Background

Vital national security, foreign policy, economic, and civil interests depend on the United States ability to remotely sense Earth from space. Toward these ends, the United States Government develops and operates highly capable remote sensing space systems for national security purposes, to satisfy civil mission needs, and to provide important public services. United States national security systems are valuable assets because of their high quality data collection, timeliness, volume, and coverage that provide a near real-time capability for regularly monitoring events around the world. United States civil remote sensing systems enable such activities as research on local, regional, and global change, and support services and data products for weather, climate, and hazard response, and agricultural, transportation, and infrastructure planning.

A robust U.S. commercial remote sensing space industry can augment and potentially replace some United States Government capabilities and can contribute to U.S. military, intelligence, foreign policy, homeland security, and civil objectives, as well as U.S. economic competitiveness. Continued development and advancement of U.S. commercial remote sensing space capabilities also is essential to sustaining the nation's advantage in collecting information from space. Creating a robust U.S. commercial remote sensing industry requires enhancing the international competitiveness of the industry.

IV. Licensing and Operation Guidelines for Private Remote Sensing Space Systems

The Secretary of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), licenses and regulates the U.S. commercial remote sensing space industry, pursuant to the Land Remote Sensing Policy Act of 1992, as amended, and other applicable legal authorities. The Secretary of Defense and the Secretary of State are responsible for determining the conditions necessary to protect national security and foreign policy concerns, respectively. NOAA, in coordination with other affected agencies and in consultation, as appropriate, with industry, will develop, publish, and periodically review the licensing regulations and associated timelines governing U.S. commercial remote sensing space systems.

To support the goals of this policy, U.S. companies are encouraged to build and operate commercial remote sensing space systems whose operational capabilities, products, and services are superior to any current or planned foreign commercial systems. However, because of the potential value of its products to an adversary, the operation of a U.S. commercial remote sensing space system requires appropriate security measures to address U.S. national security and foreign policy concerns. In such cases, the United States Government may restrict operations of the commercial systems in order to limit collection and/or dissemination of certain data and products, e.g., best resolution, most timely delivery, to the United States Government, or United States Government approved recipients.

On a case-by-case basis, the United States Government may require additional controls and safeguards for U.S. commercial remote sensing space systems potentially including them as conditions for United States Government use of those capabilities. These controls and safeguards shall include, but not be limited to: (1) the unique conditions associated with United States Government use of commercial remote sensing space systems; and (2) satellite, ground station, and communications link protection measures to allow the United States Government to rely on these systems. The United States Government also may condition the operation of U.S. commercial remote sensing space systems to ensure appropriate measures are implemented to protect U.S. national security and foreign policy interests.

V. United States Government Use of Commercial Remote Sensing Space Capabilities

To support the goals of this policy, the United States Government shall utilize U.S. commercial remote sensing space capabilities to meet imagery and geospatial needs. Foreign commercial remote sensing space capabilities, including but not limited to imagery and geospatial products and services, may be integrated in United States Government imagery and geospatial architectures, consistent with national security and foreign policy objectives.

With regard to the national security remote sensing space architecture, the Secretary of Defense and the Director of Central Intelligence, in consultation with industry as appropriate, shall:

- Determine which needs for imagery and geospatial products and services can be reliably met by commercial remote sensing space capabilities;

- Communicate current and projected needs to the commercial remote sensing space industry;

- Competitively outsource functions to enable the United States Government to rely to the maximum practical extent on commercial remote sensing space capabilities for filling imagery and geospatial needs;

- Establish the National Imagery and Mapping Agency (NIMA) as the agency of primary responsibility for acquiring and disseminating commercial remote sensing space products and services for: (1) all national security requirements; and, (2) in consultation with the Secretary of State, all foreign policy requirements.

With regard to civil remote sensing space capabilities, the Secretaries of Commerce and the Interior and the Administrator of the National Aeronautics and Space Administration (NASA), in consultation with other United States Government agencies, and with industry, as appropriate, shall:

- Determine which civil needs can be met by commercial remote sensing space capabilities; and

- Communicate current and projected needs to the commercial remote sensing space industry.

United States Government civil agencies acting individually, or when beneficial, together, shall:

- Competitively outsource functions to enable the United States Government to rely to the maximum practical extent on commercial remote sensing space capabilities for filling civil imagery and geospatial needs;

- Acquire and operate United States Government systems that collect data only when such data (1) are not offered and will not be made available by U.S. commercial remote sensing space systems; or (2) require collection, production, and/or dissemination by the United States Government due to unique scientific or technological considerations or other mission requirements; and

- Coordinate with NIMA procurement of all U.S. commercial remote sensing data and products that are restricted to United States Government or United States

Government-approved users pursuant to NOAA license conditions due to U.S. national security or foreign policy concerns.

Agencies shall allocate the resources required to implement these objectives within the overall policy and resource guidance of the President and available appropriations. Civil agencies may acquire commercial remote sensing space products and services directly, through cooperative arrangements with other civil agencies, or through NIMA. When procuring through another agency, civil agencies will reimburse the procuring agency, consistent with the Economy Act.

VI. Foreign Access To U.S. Commercial Remote Sensing Space Capabilities

It is in U.S. national security, foreign policy, and economic interests that U.S. industry compete successfully as providers of remote sensing space products and capabilities to foreign governments and foreign commercial users. Therefore, license applications for U.S. commercial remote sensing space exports shall be considered favorably to the extent permitted by existing law, regulations and policy when such exports support these interests.

The United States Government will consider remote sensing exports on a case-by-case basis. These exports will continue to be licensed pursuant to the United States Munitions List or the Commerce Control List, as appropriate, and in accordance with existing law and regulations. The following guidance will also apply, when considering license applications for remote sensing exports:

- The United States Government will take into account exports' potential contribution to achieving the goals of this policy, the overall relationship, particularly the existing defense and defense trade relationship with the proposed recipient nation, and broader U.S. national security, foreign policy, and economic objectives;

- As a general guideline, remote sensing exports that are currently available or are planned to be available in the global marketplace also will be considered favorably;

- Exports of sensitive or advanced information, systems, technologies, and components, however, will be approved only rarely, on a case-by-case basis. These items include systems engineering and systems integration capabilities and techniques, or enabling components or technologies, i.e., items with capabilities significantly better than those achievable by current or near-term foreign systems. The Secretary of State, in consultation with the Secretary of Defense and the Director of Central Intelligence, shall maintain a Sensitive Technology List that includes these items. This list shall be made available to U.S. industry, consistent with national security and foreign policy concerns. The Department of State shall use the list in the evaluation of requests for exports; and

- Sensitive or advanced remote sensing exports, including but not limited to a sub-set of items specifically identified on the Sensitive Technology List, will be approved

only on the basis of a government-to-government agreement or other acceptable arrangement that includes, among other things, end-use and retransfer assurances that protect U.S. controlled technical data, and broader national security and foreign policy needs. Such agreements also may include protections for intellectual property and economic interests. To facilitate timely implementation, the disposition of export license applications will be expedited after completion of such agreements or arrangements.

VII. Government-to-Government Intelligence, Defense, and Foreign Relationships

The United States Government will use U.S. commercial remote sensing space capabilities to the maximum extent practicable to foster foreign partnerships and cooperation, and foreign policy objectives, consistent with the goals of this policy and with broader national security objectives. Proposals for new partnerships regarding remote sensing that would raise questions about United States Government competition with the private sector shall be submitted for interagency review. In general, the United States Government should not pursue such partnerships if they would compete with the private sector, unless there is a compelling national security or foreign policy reason for doing so.

VIII. Implementation Actions

Implementation of this directive will be within the overall policy and resource guidance of the President and subject to the availability of appropriations. Agencies have been directed to complete a series of specific implementation actions within 120 days from the date of this directive.

APPENDIX B: IMPLEMENTATION PLAN WORK GROUP ACTIVITIES

I. IPWG PURPOSE

To address implementation of and response to the CRSSP, an interagency IPWG was formed. During this period, the IPWG pursued activities to understand both public and private views of current and future commercial remote sensing space capabilities and their potential for satisfying the requirements of civilian agencies. The group identified historical impediments to the use of commercial remote sensing, considered opportunities for increasing usage, and investigated a number of possible approaches for optimizing civilian agency interaction with commercial providers and stakeholders.

II. IPWG COMPOSITION

The IPWG was formed under the direct oversight of NASA, NOAA, and the USGS as directed by the policy, with the USGS identified as the lead agency for the working group. Beginning with its initial meeting on May 22, 2003, the IPWG sought expertise from a variety of civil agencies with existing or potential need for remote sensing products and services. The IPWG met approximately 30 times during the course of plan development. During this period, the following agencies actively participated in one or more sessions:[13]

- Department of Agriculture (Farm Service Agency, Foreign Agricultural Service, National Agricultural Statistics Service, U.S. Forest Service)
- Department of Commerce (NOAA)
- Department of Energy
- Department of Homeland Security (FEMA, U.S. Coast Guard)
- Department of the Interior (USGS, Bureau of Land Management, Bureau of Reclamation, National Park Service)
- Department of State (U.S. Agency for International Development [USAID] and Bureau of Oceans and International Environmental and Scientific Affairs)
- Department of Transportation
- National Aeronautics and Space Administration
- National Science Foundation
- Environmental Protection Agency
- Federal Aviation Administration
- U.S. Army Corps of Engineers

[13] The RAND Corporation and the Aerospace Corporation have also supported the work of the IPWG.

III. INTERACTION WITH SENIOR MANAGEMENT

The IPWG sought guidance and feedback from senior officials of civil agencies, the NSC, and OSTP. Key meetings took place on May 29, 2003; June 26, 2003; and August 12, 2003, providing opportunities for the IPWG to submit updates on progress and receive clarification on implementation plan issues.

The specific activities of the IPWG have been guided by the IRB, which consists of senior officials from NASA, NOAA, and the USGS, consistent with the CRSSP guidance. Along with informal updates, the IRB was briefed on the IPWG's progress on July 22, 2003. On August 18, 2003, the IPWG provided a decision briefing to the IRB and received immediate guidance on how to proceed with finalizing the strategy for the implementation plan.

IV. INTERACTION WITH CIVIL AGENCIES

Interaction with the civil agencies included IPWG participation, civil agency outreach sessions, and interaction with civil agency advisory groups having relevant interests and expertise. In addition, the IPWG created a website for receiving comments and feedback from the civil agencies and others.

A. Key Activities

In addition to the regular meetings of the IPWG, several information sessions were held to seek civil agency guidance and report on progress to date:

- Civil Agency Forum sessions
  —June 26: Washington, DC
  —July 21: Denver, CO
  —August 26: Washington, DC

- Briefing to NOAA's Federal Advisory Committee on Commercial Remote Sensing:
  —July 22: Boulder, CO

- Briefing to the FGDC
  —August 12: Washington, DC

V. CIVIL AGENCY THEMES AND CONCERNS

The IPWG discussions with the civil agencies over the past several months have highlighted several important themes and concerns. These included

- balancing choices among space, aerial, and other data providers
- relationship to the Landsat Data Continuity Mission (LDCM)
- budget and long-term funding issues

- data continuity and timeliness
- releasibility and accessibility of data
- one-stop shopping for capabilities
- possible legal/liability issues associated with use of commercial data
- procurement and licensing
- role of NIMA and the national security community.

VI. INTERACTION WITH NIMA

The IPWG established contact with NIMA. These discussions were directed to improved understanding of NIMA's existing and future contracting mechanisms and capabilities for acquiring and managing commercial satellite imagery data and products. Key meetings between IPWG personnel and NIMA officials occurred on July 22, 2003, and August 8, 2003.

VII. INTERACTION WITH THE COMMERCIAL REMOTE SENSING SATELLITE FIRMS

The IPWG endeavored to advise commercial satellite firms regarding its progress in formulating the implementation plan for civil agencies.

A. Key Activities

The following activities were hosted by the IPWG:

- June 19: Silver Spring, MD
- July 22: Boulder, CO
- August 27: Reston, VA

Industry participants in these sessions have included representatives from the following firms:

- Astro Vision/Astro Vision International
- Ball Aerospace
- Boeing Corporation
- DigitalGlobe
- OrbImage
- Resource 21
- R. V. Davis and Associates
- Space Imaging
- SPOT Image.

The IPWG discussions with commercial satellite firms and related professional organizations identified several additional themes and particular concerns:

- civil agency requirements and funding

- contracting mechanisms
- current focus on near-term contract (FY04/FY05 budget years)
- desire for a "ClearView" or "ClearView-like" arrangement
- desire for a long-term funding commitment from the U.S. government
- coherent requirements set from civil agencies may be impossible
- industrial base issues
- broad licensing opportunities already exist
- congressional issues
- regarding data continuity: "We will be there"
- foreign competition issues
- encourage experimentation (NASA data buy, etc.).

The IPWG also broadly interacted with other elements of the U.S. remote sensing community, including commercial firms, relevant professional associations (e.g., ASPRS [American Society for Photogrammetry and Remote Sensing], MAPPS [Management Association for Private Photogrammetric Surveyors]), and the Space Enterprise Council of the U.S. Chamber of Commerce.

VIII. GOVERNANCE MODELS EXAMINED

The IPWG developed and evaluated four alternative models for interagency governance:

Status Quo. This model describes the current practice of the civil agencies as a basis of departure for evaluation of other alternatives rather than as an alternative unto itself. Agencies that acquire commercial products under this model typically negotiate a data buy, large or small, directly with a commercial data provider without regard to the potential applicability of the acquired product to other agency requirements. With some exceptions, such as the National Aerial Photography Program (NAPP) or the National Digital Orthophoto Program (NDOP), these acquisition actions do not typically represent the collective set of requirements for multiple agencies and, therefore, do not gain the benefits of the resulting buying power. Data thus acquired, particularly those derived from space-based assets, usually are not available for shared use, since the attendant licensing and/or data distribution rights are not a consideration in the procurement. As a result, little or no coordination exists among the civil agencies in defining the acquired data, whether it is available for reuse, or how a copy of the product can be accessed.

Civil-Focus, Shared-Execution. This model is characterized by agreement on the part of participating agencies to coordinate individual agency requirements. It aims to consolidate the needs of multiple agencies to gain benefits of volume buying in the procurement process. This model requires that individual agencies collect their requirements for remote sensing products, share that information with other agencies to define common interests, and agree to consolidate these requirements into a single procurement strategy for strength in negotiation. Once procured with sufficient licensing

considerations to support shared use, the products are copied for storage in a common library for access and reuse by other interested users.

Finally, the participating agencies recognize that multiple agencies have resources and infrastructure that can contribute to successful execution of these processes and agree to share responsibilities to the benefit of all; hence, “shared-execution” Thus, to ensure adequate definition and sharing of requirements, a consolidated procurement strategy, and maintenance of common library services, extensive coordination and discipline (i.e., governance) among the civil agencies and their cooperators (e.g., NIMA) is required. A lead agency provides a management nucleus (i.e., secretariat functions) to ensure continuing oversight of the necessary coordination processes, in addition to executing particular elements of the governance process.

Joint Center. This has the same general functionality considerations as those of the Shared Execution model—i.e., coordination among the agencies to benefit the common good. However, implementation requires participating agencies to designate personnel to serve in a “joint operations center,” collocated for efficiency and consistency of purpose. Joint center staff would be limited to those senior management personnel required to oversee agency coordination activities, while specific agencies would still have assigned responsibilities for operational support in specific areas, such as requirements collection, procurement processes, library services, etc. The joint center management team would be responsible for overall program guidance and oversight on behalf of the collective civil community.

Executive Agent. This model is also characterized by the same general functionality considerations as those of the Shared Execution model; however, its implementation is managed through the designation of an executive agent acting on behalf of the civil agency community. Most significant would be the assignment to the executive agent of appropriated funds earmarked for purchasing data for civil agency purposes. Specific agencies could still have assigned responsibilities for operational support in specific areas, such as requirements collection, procurement processes, library services, etc.; however, the funding for support of these activities could be consolidated under the executive agent budget with interagency agreements established for reimbursement of costs incurred by agencies participating in the governance process.

APPENDIX C: BACKGROUND—PAST CIVIL AGENCY EXPERIENCE WITH COMMERCIAL REMOTE SENSING SPACE

I. BRIEF HISTORY OF USE

U.S. civil agencies have varied experiences in taking advantage of overhead images, both through aerial and satellite imaging, to address agency-specific geospatial information needs. Since the 1930s, some agencies have systemically acquired aerial photographs to help accomplish their missions. Many of the diverse aerial photography requirements were consolidated into national cost-share programs, such as NAPP. With the mainstreaming of GIS technology into many agencies over the past two decades, the NAPP was complemented with an additional cost-share program, the NDOP. These cost-share programs continue today and draw on the combined resources of federal, state, and local government agencies to fund the collection of aerial imagery and the production of digital orthorectified imagery.

In contrast, civil agencies have been making use of commercial remote sensing space capabilities, but not through an integrated strategy or cost-sharing partnerships. The main barriers to forming cost-sharing partnerships have been licensing restrictions on data sharing and cost. The commercial space remote sensing vendors have only recently started offering unrestricted licenses that allow broader data sharing. Once cost-share agreements have been made for licensed data, adding additional agencies as data users can be costly. There is no question that numerous agency needs can be met by commercial remote sensing space systems if the sensors, satellites, and corporate business plans are designed to cost-effectively meet a set of requirements that is well defined and coordinated by the civil community.

In recent years, growth in the availability and usefulness of GIS software, coupled with increasingly powerful computers, has steadily increased civil agency dependence on GIS-ready remotely sensed data. With the advent of scanned aerial photos and digital satellite images, GIS users in civil agencies have been able to incorporate remote sensing image data with other geospatial data layers—such as digital terrain maps, elevation data, ownership boundaries, road networks, etc.—to derive highly useful end products—such as wildfire fuels maps of remote areas and more-timely drought-impact assessments in agricultural regions.

Civil agencies have been procuring substantial volumes of products and services from the commercial remote sensing industry for many years. Over the United States, most commercial image data are acquired as film products from aerial photography firms. Value-added companies are then contracted to scan and georeference the photos to produce digital images having minimal terrain distortion. In recent years, the federal civil agency NAPP has spent approximately $3 million per year on photo acquisitions and $10 million on derived digital images. NAPP is a multiagency consortium administered by DOI’s USGS. The other major national aerial photography program is the USDA’s

National Agricultural Imagery Program (NAIP), which spends $2–20 million per year on GIS-ready products derived from film or from data acquired by digital aerial cameras. The USDA also spends $3–5 million per year acquiring and scanning aerial imagery for its National Resources Inventory.

Some civil agencies have also been routinely using commercial satellite data since the mid-1980s, when data from two government-funded satellite systems, Landsat (U.S.) and SPOT (France), began to be marketed on a commercial basis. Throughout this period, the USDA's Foreign Agricultural Service has been the largest operational user of commercial remote sensing satellite data among U.S. civil agencies, spending an average of $2 million per year. Recently, NASA and DOT have purchased commercial remote sensing satellite data and value-added services in order to investigate their usefulness. Some very promising results have emerged.

Civil agencies have been assessing the quality and usefulness of digital images from the two existing commercial high-resolution satellites (Space Imaging's IKONOS and DigitalGlobe's QuickBird). NIMA/USGS/NASA–sponsored JACIE workshops have been invaluable to this process. Commercial satellite image data have shown strong potential for a number of civil applications, as should the data from the new Orbimage satellite. However, there have been a number of barriers to the expanded use of commercial high-resolution satellite data by civil agencies, such as coverage, cost, licensing, and the lack of civil agency leadership.

II. TRADITIONAL IMPEDIMENTS TO COMMERCIAL REMOTE SENSING SPACE USE BY CIVIL AGENCIES

Coverage. High-resolution commercial satellites are not designed to provide broad-area, moderate-resolution coverage on short notice; they capture highly detailed, customer-selected imagery and information over specific sites. In other words, for rapidly producing a new image map of the entire country, many users turn to Landsat or SPOT data, but for a close-up of a city, a commercial high-resolution satellite image is best. Neither product is better, as each has distinct uses. Another coverage example illustrates the complexities: Landsat or SPOT can cover the entire coastline of Florida in relatively few orbital passes, or an aerial photography firm could be contracted to fly along the coast all day in clear conditions until the job is completed. However, with the very narrow image swath of a high-resolution satellite and the earth's rotation between fixed satellite orbits, it would require many passes on different days to gradually fill in the meandering coastal area of Florida. While there could be some appeal for using high-resolution commercial satellites for covering large areas (such as the entire state of Kansas during a single growing season), current commercial satellites do not have the collection capacity, especially while serving numerous other customers.

Systems and system response. In addition to inherent limitations in high-resolution satellites with respect to geographic coverage, there are also limitations with respect to the spectral range of available U.S. commercial systems. The U.S. commercial

satellite firms have no radar or hyperspectral imaging capability on orbit, and therefore the civil agency community often makes use of foreign sources or aerial platforms.

Timeliness is another factor that can limit demand for commercial products. The process of obtaining commercial imagery has not been optimized. When pressed for time, agencies will seek the most expedient source. If satellite vendors can increase timeliness, there will be more cases where these data may be advantageous – especially in emergency management and homeland security applications.

Cost. The cost per square mile of high-resolution satellite data has to date been significantly higher than aerial data as a result of the large capital investments typical of satellite development, launch, and operation. While competition and other market factors have already brought prices down for commercial satellite images, the gap remains problematic for civil agencies. For example, for the 2003 flying season, the USDA's NAIP program has contracted for 450,000 square miles of 1-meter resolution true-color orthorectified imagery for an average of $12.10 per square mile. By contrast, the list price for 1:12,000-scale natural color imagery from one commercial satellite data provider is $129.50 per square mile. Purchasing the 450,000 square miles at this price would cost $58.3 million, while the NAIP acquisition costs only $5.4 million. Cost is not only a factor in purchasing the data but in adopting a new technology.

Sometimes, acquiring high-resolution commercial satellite data is the preferred solution to a civil agency problem, but the agency does not have sufficient funds to purchase the data. In addition, agencies face costs in terms of augmenting infrastructure, software and hardware, skills and expertise, and training. For example, an indirect cost that numerous civil agencies are unable to cover is the expense of training employees on the methods and benefits of using satellite imagery versus more-traditional methods of completing their work.

Licensing. Licensing has been a significant barrier to widespread federal government use of commercial space-based remote sensing. All commercial providers currently license their data. However, aerial imagery is typically purchased by the government without license restrictions and with full rights to the data. Commercial satellite data providers started out in 1999 with fairly restrictive licenses for purchasers of data. This was a hindrance to many civil government users who typically operated in a data-sharing mode, especially among scientists and hazard-mitigation managers. While multiple-use licenses have been available for civil agencies from commercial remote sensing space companies, the prices have been unaffordable for numerous agencies. Fortunately, the costs of multiple-use, or even governmentwide licenses are now beginning to decline.

Typically, the agencies that procure aerial mapping or crop-assessment photographs at taxpayer expense have allowed the public to purchase copies of film products or derived digital products at the cost of fulfilling a user request. Such taxpayer-funded products have carried no user restrictions. This heritage has left some civil agencies frustrated at the idea of purchasing commercial satellite data with public funds

without being able to afford to release the data for public use. To mitigate this problem, commercial data providers are currently looking into such concepts as delayed release to the public or lower-cost public-use licenses.

Leadership. The lack of civil agency coordination for remote sensing in the U.S. government has been a barrier to both the civil and commercial sectors. There has been no lead agency to support the civil remote sensing community by documenting and communicating governmentwide civil agency requirements, serving as a civil-community point of contact for industry, working with NIMA and Congress to resolve civil agency funding shortfalls for commercial space products and services, serving as a civil agency procurement agent for commercial space products and services, serving as an archivist and r-distributor of commercial data procured by civil agencies, or building and flying operational land satellites if no commercial alternatives are available or planned.

III. OTHER COMPARATIVE ASPECTS OF AERIAL AND SATELLITE IMAGERY

The choice of a platform (aerial or satellite), a sensor type (digital or film), and specifications (geometric, spatial, radiometric, etc.) is made within the context of specific programmatic need. For example, a project's location and configuration, budget, data distribution needs, and the particular data specifications based on the features to be sensed will all be factors in determining the appropriate and cost-effective technology. The following generalizations may be useful, but the ultimate choice needs to be made by the agency, based on their specific need.

Aerial. The U.S. aerial industry has been well established for decades. Aircraft can be stationed at or rapidly mobilized to reach specific targets and can nimbly follow linear features, such as roads, shorelines, or other irregular configurations independent of feature orientation, at any particular sun angle (time of day), and can fly under clouds. Aircraft typically collect imagery at nadir. Aircraft can be configured and reconfigured with the broadest range and most sophisticated array of sensors. A host of providers are available across the United States. Aircraft can fly at a variety of altitudes, subject to airspace restrictions, to control resolution and swath width. Aerial operations are not licensed by the federal government and can collect at extremely high resolutions.

Satellite. Commercial satellites have global reach unimpeded by airspace restriction, covering domestic, oceanic, foreign, and other areas where aircraft providers are not readily available because of remoteness or denied area access. On stable orbits, satellites are always "mobilized" and can be programmed to collect exact footprints on a repeat basis. "On orbit" capabilities mean that small area collections can be made without incurring mobilization costs. To increase their collection capacity and interval of repeat coverage, collection is often performed off-nadir, which may not be as desirable for some applications. The sensor characteristics, while fixed and noninterchangeable, are stable and currently produce high-fidelity panchromatic and multispectral imagery. In some cases, U.S. commercial providers are amassing archived data sets for resale at reduced costs. Via telemetry, imagery can be rapidly conveyed to customers worldwide. Viability

for foreign collection, particularly to support DoD missions, is becoming increasingly clear. Strength in the domestic imagery market is less clear, especially in meeting established federal program needs for new imagery over large areas during limited time windows. Satellite companies also face challenges in terms of regulatory, capitalization, launch, and market uncertainties.

APPENDIX D: THE VALUE OF REMOTE SENSING TO U.S. CIVIL AGENCY MISSIONS

I. CROSSCUTTING APPLICATION AREAS PROVIDES START FOR COORDINATING REQUIREMENTS

Since U.S. civil agencies have diverse needs for and uses of remote sensing that cut across scientific and operational boundaries, to coordinate requirements it is useful to develop a list of crosscutting application areas. This list is not meant to be comprehensive but to capture some key areas which potentially have crosscutting remote sensing data needs and to span the range of diversity in the federal requirements (especially with respect to the range of licensing and data sharing needs). It provides an initial list of some of the main requirement areas for remote sensing information that could potentially be addressed by the commercial remote sensing satellite industry. Each of these crosscutting areas is briefly described below to illustrate how multiple federal agencies have important responsibilities and activities in each area and how they use or could use remote sensing data.

Agriculture Management. Federal activities to help manage agricultural production systems are critical to ensuring the health and efficiency of U.S. food and fiber production. Multiple federal agencies, such as USDA, DOI's Bureau of Land Management (BLM), and EPA, use remote sensing to help with their agricultural related activities. For example, USDA uses remote sensing to improve crop production estimates; aid farmers' in determining when and where to apply fertilizer, herbicides, pesticides, and irrigation; and to reduce fraud, waste, and abuse of farm program funds. BLM uses remote sensing information to help make grazing decisions, and EPA could use it to help assess the effects of agricultural practices on the environment.

Emergency Management. Emergency management includes planning, readiness, response, and recovery activities related to actual and potential disasters, such as floods, earthquakes, tornadoes, hurricanes, forest fires, chemical spills, and terrorist incidents. Multiple agencies have responsibility related to emergency management. DHS FEMA and U.S. Coast Guard has responsibility to provide emergency response assistance; USDA Forest Service and NPS routinely fight major forest fires; and NOAA provides disaster-related weather information. Remote sensing data are used by such agencies to help assess patterns of disaster damage, predict weather, and assess the best way to fight forest fires.

Environmental Monitoring and Management. Many different federal agencies, such as EPA, NASA, USDA, the U.S. Fish and Wildlife Service, USGS, NOAA, and U.S. Coast Guard have responsibilities to monitor and/or manage environmental conditions to protect human health and the environment. Remote sensing information can be used in environmental modeling, enforcement, research, and education, and in the safe discovery, removal, and remediation of hazardous sites. For example, EPA can use

remote sensing to help communities monitor the movement of airborne pollutants, such as particulates and ozone that raise ambient levels of air pollutants and make it more difficult for a city or state to meet air quality standards. NOAA uses remote sensing to monitor land cover in the U.S. coastal areas and to help assess the health of coral reefs.

Homeland Security. Multiple federal agencies, including DHS, DOE, DOT, and USDA use remote sensing to help in homeland security assessment, prevention, planning, and response activities, often in collaboration with state and local governments. For example, federal agencies have used remote sensing information to help plan for safety and security at significant events and operations, such as at the Super Bowl, port security, counter-terrorism surveillance, inaugurations, transportation network security, and the Olympics. Remote sensing is used to analyze various security-related scenarios and inventory critical infrastructure, such as power installations, pipelines, bridges, and a variety of other features and structures for homeland security purposes. Information derived through remote sensing was critically important in the response and recovery efforts following the events of September 11, 2001.

Mapping. Multiple federal agencies, including USGS, NOAA, DOT, U.S. Census, U.S. Coast Guard, and USDA, have responsibilities to mapping for safety, accessibility, and other key needs. Such responsibilities include producing accurate maps, often as digital GIS databases, using such digital maps and supplying this information to the public. Much of the information content of mapping and GIS information products was or can be derived from remotely sensed data, including the data layers comprising topographic maps, elevation datasets, and land cover information. Multiple federal agencies produce or fund the production of such mapping products. For example, USGS produces topographical maps and the *National Map* to ensure the availability of consistent, accurate, and current geographic information to meet diverse national needs. U.S. Census produces TIGER (Topologically Integrated Geographic Encoding and Referencing) data files to ensure accurate street-level mapping for the U.S. Census and its products. NOAA produces nautical charts to aid in international shipping transportation and safety within the United States.

Natural Resource, Coastal and Land Management. Many different federal agencies, such as the USDA Forest Service, BLM, NPS, U.S. Coast Guard, and DOE, are also managers of federal land and natural resources, such as USDA having responsibilities for forest management and DOE for energy management. Remote sensing information is used to help monitor, inventory, assess, and manage for diverse uses, including logging, mining, natural gas and oil extraction, hunting, hiking, river-rafting, skiing, snowmobiling, fishing, boating, and wilderness and ecosystem preservation. For example, geothermal activity can be detected using thermal sensors to identify possible new energy sources and remote sensing information can help forest managers identify the effects of pests and invasive species.

Research and Development. In addition to operational uses of imagery and remote sensing systems, federal civil agencies conduct and sponsor significant amounts of basic and applied research and development activities that use remote sensing data.

Such agencies include NSF, NASA, USGS, EPA, and USDA. Researchers use remote sensing and imagery at global, regional, and local scales to collect data, monitor conditions, investigate phenomena, and validate measurements related to earth sciences and conditions on the earth. For example, NSF funds university scientists, and the USGS conducts research that uses remote sensing information to assess and quantify change in regions of active volcanic and tectonic activity.

Transportation. Remotely sensed data support the design, operation, and management of transportation systems for moving the nation's people and freight. For example, remote sensing information can be used to help the FHWA assess highway maintenance needs for the national highway system and to develop high-accuracy airport map databases that FAA air traffic controllers can use to improve airline traffic flow, relieve airport congestion, and reduce runway incursions. Multiple federal agencies, such as DOT, FAA, DHS(FEMA and U.S. Coast Guard), the U.S. Army Corps of Engineers, and NOAA, can use such remote sensing information to better monitor, assess, plan, and operate U.S. air, rail, road, and waterway transportation systems.

Weather and Climate. Many federal agencies depend on accurate weather and climate information to meet their mission in regard to the aforementioned management areas: agriculture, emergency, transportation, and natural resource and land management. Such agencies include USDA, DHS (FEMA and U.S. Coast Guard), NOAA, EPA, DOI, and NASA. Remote sensing technology is a significant source of weather information. For example, remote sensing images can be used to improve the monitoring of snow hazards and support winter weather services—which saves lives and highway maintenance costs for federal, state, and local transportation agencies—and to monitor the path of hurricanes to help federal agencies mobilize emergency response activities. NASA and NSF conduct or fund remote sensing related monitoring and research on global climate change.

II. CIVIL AGENCY MISSIONS THAT MIGHT BE SATISFIED BY COMMERCIAL REMOTE SENSING

Another approach to understanding the potential for remote sensing to meet agency requirements is to identify the areas where U.S. civil agency missions depend on remote sensing. The agencies use or could potentially use remote sensing information to help meet many different agency goals and missions. Table A provides some examples of areas where remote sensing information can help meet specific objectives related to agency goals and missions. This table is illustrative only and not meant to be comprehensive. This table is based on agencies' most recent strategic plans as listed on their web sites.

TABLE A: Examples of how remote sensing can help meet agency missions

Federal Agency	Mission	Sample Goal(s)	Sample Objectives/Sub-Objectives	Sample of How Remote Sensing Information Can Help Meet Them
FEMA (DHS)	Lead America to prepare for, prevent, respond to, and recover from disasters and terrorism	1. Reduce loss of life and property. 2. Minimize suffering and disruption caused by disasters and terrorism	1. Improve public readiness for disasters 2. Reduce loss of life from disasters 3. Improve readiness and response to terrorism	1. Flood plain mapping 2. Identification of hot spots/power blackouts 3. Identification of drought conditions 4. Identification of content in chemical or biological plumes
DOT	Develop transportation policies and programs that contribute to providing fast, safe, efficient, and convenient transportation at the lowest cost	Safety, mobility, global connectivity, environmental stewardship, and homeland security	1. Reduce transportation-related deaths and injuries 2. Reduce pollution and other adverse environmental effects of transportation and transportation facilities 3. Increase reliability throughout the transportation system	1. Monitor serious hazardous materials transportation incidents and amount of hazardous materials spilled 2. Monitor ratio of wetland acres replaced per acre unavoidably affected by federal-aid highway projects 3. Monitor visibility conditions at airport runways Monitor trafficability for shipping on nation's waterways
NASA	Understand and protect our home planet	Understand earth's system and apply earth system-science to improve the prediction of climate, weather, and natural hazards	1. Accurate characterization of global change (e.g., warming) 2. Accurate assessment of stratospheric ozone amount and risk to human health 3. Reduce life and property risk by increasing lead time and accuracy of predicting hazardous events	1. Data and information from remote sensing systems enable researchers to understand the complex earth system and the causes and consequences of global change 2. Measurement of global carbon sources and sinks 3. Measurement of glaciers and polar ice caps 4. Measurement of ozone, pollutants, and other trace gases.

TABLE A—Continued

Federal Agency	Mission	Sample Goal(s)	Sample Objectives/Sub-Objectives	Sample of How Remote Sensing Information Can Help Meet Them
NOAA	Understand and predict changes in earth's environment Conserve and manage coastal and marine resources	Protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management	Protect and restore ocean, coastal, and Great Lakes resources; recover protected species; and rebuild and maintain sustainable fisheries	1. Mapping the shorelines 2. Mapping and identifying health of coastal environment 3. Measuring near-shore bathymetry Monitoring national marine sanctuaries Detecting harmful algal blooms and oil spills
NSF[14]	To promote the progress of science…	Support basic research to understand processes and process interactions that make up the earth system	1. Study and develop models of tectonic and volcano-tectonic processes. 2. Study and monitor representative ecosystems around the globe to understand how these respond to changing natural and anthropogenic conditions.	1. Provides a basis for assessing and quantifying change in regions of active volcanic and tectonic activity 2. Provide uniform information about surface conditions on a variety of time scales, ranging from hours to seasonal changes

[14] From "NSF GPRA Strategic Plan FY01–FY06."

TABLE A—Continued

Federal Agency	Mission	Sample Goal(s)	Sample Objectives/Sub-Objectives	Sample of How Remote Sensing Information Can Help Meet Them
USDA	Provide leadership on food, agriculture, natural resources, and related issues based on sound public policy, the best available science, and efficient management	1. Enhance economic opportunities for agricultural producers 2. Support increased economic opportunities and improved quality of life in rural America 3. Enhance protection and safety of the nation's agriculture and food supply 4. Protect and enhance the nation's natural resource base and environment	1. Continuously monitor U.S. and global crop conditions 2. Minimize fraud, waste, and abuse of farm programs by comparing reported crops with actual plantings 3. Restore, rehabilitate, and maintain fire-adapted ecosystems, using appropriate tools to provide sustainable environmental, social, and economic benefits 4. Ensure that acres covered in federal fire management plans are in compliance with Federal Wildland Fire Policy. 5. Estimate/forecast U.S. and global agricultural production, by commodity and country, for release as a principal U.S. federal economic indicator	1. Characterize vegetation type/land use and management 2. Measure crop yields and potential (moisture and drought) 3. Characterize deforestation due to natural and man-made activities (fires, timber harvest, urban growth) 4. Map fire fuels (forests) and proximity to urban areas 5. Map extent of noxious weeds and other invasive species

TABLE A—Continued

Federal Agency	Mission	Sample Goal(s)	Sample Objectives/Sub-Objectives	Sample of How Remote Sensing Information Can Help Meet Them
U.S. Coast Guard (DHS)	To protect the public, the environment, and U.S. economic interests—in the nation's ports and waterways, along the coast, on international waters , or in any maritime region as required to support national security	1. Maritime search and rescue 2. Marine safety 3. Recreational boating safety 4. Marine pollution education, prevention, response and enforcement 5. To provide the maritime component of homeland security and homeland defense within DHS and DoD	Increased security for all U.S. ports and waterways under Coast Guard jurisdiction	1. Periodic high-resolution imagery acquisition over U.S. ports and waterways provides baseline data for direct image analysis of the critical physical parameters unique to each port and waterway 2. Imagery combined with GIS critical infrastructure location data layers, provides the basis for intelligence analysis, including event mitigation, preparedness, and response
EPA[15]	To protect human health and the environment	1. Clean and safe drinking water 2. "Fishable" and "Swimmable" surface waters 3. Healthy communities and ecosystems 4. Clean air	1. Improve water quality on a watershed basis 2. Provide sound scientific foundation through research and characterization of environmental outcomes 3. No net loss of wetlands 4. Decrease introduction of aquatic invasive species 5. Improve water monitoring programs 6. Characterize ecosystem processes	1. Use remote sensing images to help communities and states to develop watershed plans 2. Providing data to help develop a set of performance indicators that measure environmental status 3. Monitor water quality 4. Land cover mapping and change detection 5. Coral reef mapping 6. Track regional particulate transport 7. Monitor the introduction and movement of invasive species 8. Monitor wetland and streambank restoration

[15] Missions, goals, objectives, and sub-objectives come from "2003 Strategic Plan—U.S. Environmental Protection Agency," draft, March 5, 2003. Some of these have been summarized to fit in this chart. Sample remote sensing use is based on the discussion of means and strategies to achieve the objectives within this plan.

TABLE A—Continued

Federal Agency	Mission	Sample Goal(s)	Sample Objectives/Sub-objectives	Sample of How Remote Sensing Information Can Help Meet Them
USGS	Serves the Nation by providing reliable scientific information to: 1. Describe and understand the Earth, 2. Minimize the loss of life and property from natural disasters. 3. Manage water, biological, energy, and mineral resources. 4. Enhance and protect our quality of life.	1. Provide science for a changing world in response to present and anticipated needs focusing efforts to predict and monitor hazardous events in near-real and real time and to conduct risk assessments to mitigate loss. 2. Provide science for a changing world in response to present and anticipated needs to expand our understanding of environment and natural resource issues on regional, national, and global scales and enhance predictive/forecast modeling capabilities.	1. Guiding land-use decisions to ensure the availability of natural resources and the safety of growing communities. 2. Providing information on the availability, quality, and development impacts of energy resources. 3. Understanding ecological functions and assessing predicted change at varying temporal and spatial scales. 4. Mitigating the impacts of earthquakes through better maps and information concerning potential ground shaking and through rapid notification of the onset of earthquakes.	1. Land use and land cover mapping. 2. Inventory and monitor land use change. 3. Inventory natural resources. 4. Map deforestation patterns. 5. Map geologic structure for hazard assessment. 6. Characterize coastal environments and trends. 7. Biological resource and habitat analysis. 8. Floodplain assessments. 9. Watershed and water quality analyses. 10. Support for homeland security activities. 11. Minerals and energy assessments.

APPENDIX E: FUNCTIONAL CAPABILITIES REQUIRED FOR POLICY IMPLEMENTATION

To effectively implement this plan, functional capabilities outlined in the following paragraphs are essential. Each will require additional discussion, debate, and definition within the appropriate interagency working groups and by subject-matter experts. Design of these capabilities will proceed upon approval of this plan. Education and training needs will also be addressed during the implementation period.

Interagency Coordination. A coordination process is required that encourages the maximum practical use of commercial remote sensing within civil agency programs. Coordination is needed to effectively compile, synthesize, and communicate agency remote sensing data requirements; oversee development of required infrastructure; provide input for agency financial planning processes; and ensure ongoing communication of civil program requirements to the remote sensing industry. All agencies whose missions can benefit from remote sensing should be involved in the coordination process. The interests of all agencies should be equitably supported.

Requirements Assessment. A process will be established to collect, compile and communicate civil agency requirements for data and/or products that are available from industry now plus long-term requirements that will enumerate breadth of additional requirements and give the commercial sector guidance on where future investments in space remote sensing sensors will be needed. The process must be responsive to the operational and scientific needs of civil agencies, foster the development of partnerships, provide high-level justification for budget requests, and stimulate development of a long-term relationship between government and industry.

Prioritization. A process is required to ensure that civil agency requirements for commercial products and services are collected, consolidated, prioritized, and communicated to the industry. The process must equitably address the acquisition and distribution of products and services in support of the collective community where funding is provided for those purposes. The process must also provide mechanisms to deconflict competing government orders for products and services.

Budget Strategy. Compilation and communication of remote sensing requirements will achieve no end without the funding necessary to satisfy them. A budget strategy and supporting process must consider what funding already exists and is managed by the civil agencies to support acquisition of remote sensing products and services and the rationale and justification for additional funding sources necessary to increase use of commercially available remote sensing products and services.

Procurement. The proverbial “rubber meets the road” happens once a requirement is converted into a product order submitted through a contract mechanism to acquire commercial remote sensing products or services. Procedures and contracts must be implemented that address civil agency needs while taking advantage of the negotiating

strength of the collective civil community. In the immediate future, existing contractual mechanisms established by NASA, NOAA, USDA, USGS, NIMA, and others would be utilized. As budgets increase and demand grows, civil agencies will seek new contractual mechanisms to add customized data or delivery options, improve civil agency buying power, and expand licensing provisions for sharing products and services. Knowledge of contractual guidelines, industry capabilities, and products and services must be developed and communicated. Further, mapping those capabilities to civil agency needs and tracking the flow of products to ensure satisfaction of agency requirements are necessary to sustain the acquisition of commercial space products and services.

Library Services/Management. To realize maximum benefit from the government's investment in this plan, the civil community will define a strategy and infrastructure that supports storage, access, and reuse of imagery and derived products. Products acquired using a centralized mechanism will be stored in a civil library. When appropriate, products acquired for one agency's program will be stored in this library. Sharing and reuse issues must be considered in the design and analysis of infrastructure for data and product libraries, contractual negotiations, data pricing and redistribution policies, and sustainable techniques and facilities for data distribution.

Financial Management. A process will be developed to thoroughly capture and report on sources and expenditure of funds to ensure financial accountability to the civil agency community, to commercial industry, and to the Office of Management and Budget. Procedures must be established to identify, manage, track, and report on resource allocation and expenditures for commercial remote sensing data products and services. Annual budgets must be prepared to support data purchases, pay expenses associated with the operational support of the civil agency infrastructure, and account for any reimbursable income derived from redistribution of products from the data library.

Quality Control. As new products and services become available through industry sources, civil agency users need to be assured that these products and services are validated and verified for appropriate use in the programs of the civil agencies. Industry is becoming increasingly thorough in its quality control and assessment programs. Comprehensive and cooperative quality evaluation procedures involving industry and government personnel, such as the JACIE program, must be supported to sustain confidence in commercial product offerings.

Metrics/Reporting. Metrics are required to track changes in the frequency of use and reuse of commercial data sources, increases in funding available for remote sensing data acquisition, and the growth and/or emergence of applications that benefit agency programs. The quantity, quality, reliability, and timely delivery of products and services will be continuously documented. Civil requirements will be assessed, documented, and reported. Metrics will be monitored to document the value of the investment in commercial imagery and service to agency programs. Given previous shortfalls in achieving satisfaction with commercial remote sensing satellite capabilities, it is particularly important for civil agencies to monitor the effectiveness of this implementation.

APPENDIX F: ACRONYMS

BLM	Bureau of Land Management
CRSSP	Commercial Remote Sensing Space Policy
DHS	Department of Homeland Security
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FDGC	Federal Geographic Data Committee
FEMA	Federal Emergency Management Agency
FY	Fiscal Year
GIS	Geographic Information System
IRB	Interagency Review Board
JACIE	Joint Agency Commercial Imagery Evaluation
NAIP	National Agricultural Imagery Program
NAPP	National Aerial Photography Program
NASA	National Aeronautics and Space Administration
NDOP	National Digital Orthophoto Program
NIMA	National Imagery and Mapping Agency
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NSC	National Security Council
NSLRSDA	National Satellite Land Remote Sensing Data Archive
OSTP	Office of Science and Technology Policy
SES	Senior Executive Service
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey