OFFICE OF SCIENCE AND TECHNOLOGY POLICY

ACTION: Notice of Request for Information (RFI).

SUMMARY: The purpose of this Request for Information (RFI) is to solicit input from all interested parties regarding recommendations for the development of a National Plan for Civil Earth Observations ("National Plan"). The public input provided in response to this Notice will inform the Office of Science and Technology Policy (OSTP) as it works with Federal agencies and other stakeholders to develop this Plan.

DATES: Responses must be received by December 6, 2013 to be considered.

SUBMISSION: You may submit comments by any of the following methods.

- Downloadable form: To aid in information collection and analysis, OSTP encourages responses to be provided using this form. Please enter your responses in the fillable fields that follow the questions below.
- Email: OSTP encourages respondents to email the completed form, as an attachment, to earthobsplan@ostp.gov. Please include "National Plan for Civil Earth Observations" in the subject line of the message.
- Fax: (202) 456-6071.
- Mail: Office of Science and Technology Policy, 1650 Pennsylvania Avenue, NW, Washington, DC, 20504. Information submitted by postal mail should allow ample time for processing by security.

Response to this RFI is voluntary. Respondents need not reply to all questions listed. Each individual or institution is requested to only submit one response. Responses to this RFI, including the names of the authors and their institutional affiliations, if provided, may be posted on line. OSTP therefore requests that no business proprietary information, copyrighted information, or personally-identifiable information be submitted in response to this RFI. Given the public and governmental nature of the National Plan, OSTP deems it unnecessary to receive or to use business proprietary information in its development. Please note that the U.S. Government will not pay for response preparation, or for the use of any information contained in the response.

FOR FURTHER INFORMATION CONTACT:

Timothy Stryker, 202-419-3471, tstryker@ostp.eop.gov, OSTP.

SUPPLEMENTARY INFORMATION:

Background

The U.S. Government is the world's largest single provider of civil environmental and Earth-system data. These data are derived from Earth observations collected by numerous Federal agencies and partners in support of their missions and are critical to the protection of human life and property; economic growth; national and homeland security; and scientific research. Because they are provided through public funding, these data are made freely accessible to the greatest extent possible to all users to advance human knowledge, to enable industry to provide value-added services, and for general public use.

Federal investments in Earth observation activities ensure that decision makers, businesses, first responders, farmers, and a wide array of other stakeholders have the information they need about climate and weather; natural hazards; land-use change; ecosystem health; water; natural resources; and other characteristics of the Earth system. Taken together, Earth observations provide the indispensable foundation for meeting the Federal Government's long-term sustainability objectives and advancing the Nation's societal, environmental, and economic well-being.

As the Nation's capacity to observe Earth systems has grown, however, so has the complexity of sustaining and coordinating civil Earth observation research, operations, and related activities. In October 2010, Congress charged the Director of OSTP to address this challenge by producing and routinely updating a strategic plan for civil Earth observations (see *National Aeronautics and Space Administration Authorization Act of 2010, Public Law 111-267, Section 702*).

Responding to Congress, in April 2013, OSTP released a National Strategy for Civil Earth Observations ("the National Strategy").

In April 2013, OSTP also re-chartered the U.S. Group on Earth Observations (USGEO) Subcommittee of the National Science and Technology Council's Committee on Environment, Natural Resources, and Sustainability. USGEO will carry out the National Strategy and support the formulation of the National Plan.

As requested by Congress, the National Plan is being developed by USGEO to advise Federal agencies on the Strategy's implementation through their investments in and operation of civil Earth observation systems. The Plan will provide a routine process, on a three-year cycle, for assessing the Nation's Earth observation investments; improving data management activities; and enhancing related interagency and international coordination. Through this approach, the Plan will seek to facilitate stable, continuous, and coordinated Earth observation capabilities for the benefit of society.

Congress also requested that development of the National Plan include a process for collecting external independent advisory input. OSTP is seeking such public advisory input through this RFI. The public input provided in response to this Notice will inform OSTP and USGEO as they work with Federal agencies and other stakeholders to develop the Plan.

Definitions and Descriptions

The term "**Earth observation**" refers to data and information products from Earth-observing systems and surveys.

"**Observing systems**" refers to one or more sensing elements that directly or indirectly collect observations of the Earth, measure environmental parameters, or survey biological or other Earth resources (land surface, biosphere, solid Earth, atmosphere, and oceans).

"**Sensing elements**" may be deployed as individual sensors or in constellations or networks, and may include instrumentation or human elements.

"**Observing system platforms**" may be mobile or fixed and are space-based, airborne, terrestrial, freshwater, or marine-based. Observing systems increasingly consist of integrated platforms that support remotely sensed, *in-situ*, and human observations.

Assessing the Benefits of U.S. Civil Earth Observation Systems

To assist decision-makers at all levels of society, the U.S. Government intends to routinely assess its wide range of civil Earth observation systems according to the ability of those systems to provide relevant data and information about the following Societal Benefit Areas (SBAs):

1. Agriculture and Forestry
2. Biodiversity
3. Climate
4. Disasters
5. Ecosystems (Terrestrial and Freshwater)
6. Energy and Mineral Resources
7. Human Health
8. Ocean and Coastal Resources and Ecosystems
9. Space Weather
10. Transportation
11. Water Resources
12. Weather

The U.S. Government also intends to consider how current and future reference measurements (*e.g.*, bathymetry, geodesy, geolocation, topography) can enable improved observations and information delivery.

To address measurement needs in the SBAs, the U.S. Government operates a wide range of atmospheric, oceanic, and terrestrial observing systems. These systems are designed to provide: (a) sustained observations supporting the delivery of services, (b) sustained observations for research, or (c) experimental observations to address specific scientific questions, further technological innovation, or improve services.

Questions to Inform Development of the National Plan

Name (optional): Martin Frederick

Position (optional): Corporate Director, Civil Space Programs

Institution (optional): Northrop Grumman Corporation

Through this RFI, OSTP seeks responses to the following questions:

1. Are the 12 SBAs listed above sufficiently comprehensive?

Yes

a. Should additional SBAs be considered?

The addition of a land management SBA could prove beneficial and provides the category where Landsat data for land resources/land use is best classified.

Essential environmental variables should be listed in addition to the SBAs to establish the critical set of measurements that need to be acquired on a sustained basis.

b. Should any SBA be eliminated?

No benefit from eliminating SBAs is apparent, whereas it's noted that weather, climate, and space weather are fundamental information needs.

2. Are there alternative methods for categorizing Earth observations that would help the U.S. Government routinely evaluate the sufficiency of Earth observation systems?

Yes. Essential environmental variables should be listed in addition to the SBAs to establish the critical set of measurements that need to be acquired on a sustained basis. These EEVs have an established recognition within the community and are recognized by the World Meteorological Organization.

Agencies could consider using a matrix approach to map SBAs to Earth observation systems. For example, one axis in matrix could include a listing of USG Civil sensing systems and a second axis could include each SBA in order to align SBA's with sensing systems so that gaps in SBA coverage could be identified. It would be beneficial to list essential environmental variables (i.e. temperature, precipitations, land cover, etc. needed for observations by the U.S., identifying those the USG has plans to observe on a sustained basis.

3. What management, procurement, development, and operational approaches should the U.S. Government employ to adequately support sustained observations for services, sustained observations for research, and experimental observations? What is the best ratio of support among these three areas?

Sustained observations of the critical earth sensing parameters depend on several critical tenets. Principle is the implementation of stable funding with associated agency procurement authorization to acquire, field, and operate the systems and follow on or next generation upgrades. Services and societal benefits that rely upon space-based observations depend upon uninterrupted data streams, and every effort should be made to eliminate potential for satellite coverage gaps caused by budgetary instability.

A proven strategy that minimizes gap risk in the operational observing systems is the use of "block buy" acquisition for the space platforms. This was successfully used in the past on the DMSP, GOES and POES programs. The government commits to a minimum number of spacecraft (typically 3) with options for the next block. Technology and new capabilities can be developed and matured during the build out of initial block and inserted in the next block at little to no risk. This approach also ensures unit to unit price reductions, production efficiencies, and increases the robustness of the system architecture. The next block replacements for aging observation satellites should be steadily developed to ensure they are on-orbit before the end of design life is reached by a predecessor system. Preplanned a small overlap in on-orbit assets provides important calibration handoff while also increasing resiliency and sample rate

A robust R&D to operations plan with associated flight R&D satellites or payloads can provide additional resiliency to operational systems in observation and gap mitigation if the next operational satellite is delayed. In addition to core, high reliability spacecraft to meet national operational needs, gap mitigation strategies can include rapid response spacecraft that can be completed on a limited time horizon. Such systems can offer redundancy and simpler system engineering, and lower per unit cost.

Several of these approaches for operational systems are further outlined in the recent NOAA NESDIS Independent Review Team Report of 2013.

In addition to steady development of follow-on systems, the U.S. Government should also fund research for new systems. R&D investment is the engine for future sensing enhancements and a robust R&D program that continues technology advances and for insertion into next generation research and operational sensing systems should be a critical element of US sensing plans

All of these initiatives help sustain the space industrial base so that it can meet national needs in SBAs.

4. How should the U.S. Government ensure the continuity of key Earth observations, and for which data streams (*e.g.*, weather forecasting, land surface change analysis, sea level monitoring, climate-change research)?

Principle in the approach is assessment of the SBAs and associated EEVs with prioritization of the key earth observations (e.g. Weather monitoring) so that the prioritized data streams can be maintained given budgetary environments. Continuity of the key earth observations then is dependent on a stable and executable acquisition and development and fielding of the required earth observation systems.

5. Are there scientific and technological advances that the U.S. Government should consider integrating into its portfolio of systems that will make Earth observations more efficient, accurate, or economical? If so, please elaborate.

For improved Earth observations systems there is a need to constantly innovate on both the science and technological aspects. The U.S. Government should maintain the key role of investing in basic and

applied research to ensure the U.S. maintains its role as world leader in technology development by providing the impetus to push forward new developments under civil and DoD agencies to support remote sensing programs. These science and technology developments incubate new ideas and provide the risk reductions necessary to transition those innovations into the operational use. R&D investment is the engine for future sensing enhancements and a robust R&D program that continues technology advances and for insertion into next generation research and operational sensing systems should be a critical element of US sensing plans Improvements in sensing technologies, calibration techniques, communications capability, and new platforms (unmanned aircraft systems) should all be considered for integration into future earth observation systems.

6. How can the U.S. Government improve the spatial and temporal resolution, sample density, and geographic coverage of its Earth observation networks with cost-effective, innovative new approaches?

The U.S. Government can improve these capabilities by using multiple data sources, especially with environmental satellite missions and sensors shared between multiple agencies, governments and emerging commercial remote sensing data companies. Increased space assets in constellations and orbit planes can provide the increased sample density. Ensuring flight rates that provide overlap between legacy and new on orbit assets support calibration handoff with the added benefits of increased sample density. NG also recommends the use of emerging capabilities in unmanned airborne platforms working in concert with space systems to increase resolutions and sample density.

7. Are there management or organizational improvements that the U.S. Government should consider that will make Earth observation more efficient or economical?

No input on this question

8. Can advances in information and data management technologies enable coordinated observing and the integration of observations from multiple U.S. Government Earth observation platforms?

Key information and data management technologies to leverage are the use of metadata standards, search and browse functions in accessible data repositories, and web services linked to cloud computing and storage.

9. What policies and procedures should the U.S. Government consider to ensure that its Earth observation data and information products are fully discoverable, accessible, and useable?

NG recommends policies that promote standardization for metadata, both nationally and internationally will support discovery. The ISO 19115 metadata standard is an example. Processing and data product system constructs that are implemented with modularity facilitate ease of incorporation of new algorithms and missions. Additionally, use of geospatial, web services over the Internet linked to cloud computing and storage can affordability improve the access and discovery. Collaboration tools and environmental decision support tools can improve the effectiveness for impact-based decision support as called for in the NOAA Weather Ready Nation Roadmap 2.0.

10. Are there policies or technological advances that the U.S. Government should consider to enhance access to Earth observation data while also reducing management redundancies across Federal agencies?

The US Government can enhance collection and access to Earth observation data by leveraging emerging mature technology and ongoing technology improvements in a number of areas. Earth Sensing increasingly can benefit from improving communications technology and bandwidth both from space to ground and for ground routing and distribution.

A number of current and planned earth remote sensing instruments are constrained in both spatial and spectral resolution which can be downlinked due to satellite to ground communication bandwidth limitations. Instruments aggregate data both spatially and spectrally in order to fit inside current data rate constraints, limiting the optimal use of the sensors. . A number of high-impact, environmental remote sensing disciplines such as hurricane observation, mega-city air quality, wild fire detection and monitoring, and monitoring of coastal oceans would benefit dramatically from enabling the downlinking of sensor data at higher spatial and spectral resolutions. Next generation remote sensing technologies in hyperspectral, lidar, and radar can leverage higher bandwidth communications. The enabling technologies of multi-Gbps Ka-Band communication and multi-Terabit SSRs are currently available with high technological maturity enabling high data volume mission requirements to be met with minimal mission constraints. Leveraging existing and ever-increasing high bandwidth ground fiber networks (both commercial and government) to move data from ground receive sites to processing centers and users) can enhance earth observation data availability and utility. Increased use of multiple data-download sites and antennae worldwide and existing fiber optic capacity to rapidly transport Earth observation data significantly decreases data latency and increases the value of the data to users.

R&D investment is the engine for future sensing enhancements and a robust R&D program that continues technology advances and for insertion into next generation research and operational sensing systems should be a critical element of US sensing plans.

11. What types of public-private partnerships should the U.S. Government consider to address current gaps in Earth observation data coverage and enhance the full and open exchange of Earth observation data for national and global applications?

The emerging opportunities for Commercially-provided remote sensing data may supplement Government systems and provide selected products as they become proven over the next years. A critical consideration to the use of commercial data will be ensuring robust calibration/validation efforts and sensor and system data availability to ensure sensor effects are properly accounted for and that biases are removed or accounted for before data is allowed into operational forecast systems

12. What types of interagency and international agreements can and should be pursued for these same purposes?

International partnerships have proven critical in building a worldwide robust earth sensing capability as demonstrated in critical areas such as weather monitoring. These international partnerships (e.g. U.S. partnerships with EUMETSAT, JAXA, etc.) should continue to be leveraged to ensure a robust resilient capability. Data exchange via quid-pro-quo Earth-observation-data-sharing agreements provides a foundation for dependable use of international data.

Selected U.S. provision of instruments for flight on international assets (such as AMSU and AVHRR for EUMETSAT on METOP) has proven beneficial to synchronization of worldwide observations with like instruments on U.S. platforms and thus should be considered for future agreements (e.g. ATMS for flight on future EUMETSAT low earth orbit weather). Use of a selected common set of observation instruments among international platforms also has benefit to ground architecture costs via common data ingest and processing.

A substantive portion of remote sensing information is essential to US national and economic security interests (e.g. weather observations). In these areas the U.S. Government needs to continue a government -led organic remote sensing capability; supported by a robust U.S. industry to address and maintain all the critical earth sensing needs and users of our nation rather than rely solely upon international agreements. A key element is ensuring continuity of a robust spacecraft and payload US industry capacity with sufficient throughput to maintain industrial base. In addition for these systems key to national and economic security interests, it is essential to maintain resilience in system availability. The U.S. Government should ensure programs have stable funding, continuing acquisition, and robust sparing so the United States is capable of maintaining system performance.

The U.S. Government should continue ongoing efforts to modernize the ITAR and control of space systems that allow appropriate export of sensors, components, and technologies (e.g. space microelectronics) for remote sensing. This will help support and maintain a strong U.S. industrial base [delete c] for land remote sensing, weather collections and other critical capabilities.

For interagency benefits, efforts should also be made to evaluate and leverage contributions that DoD and national interagency capabilities can contribute to the civil remotely sensing data. These capabilities may come as by-products from non-environmental data sources that can be exploited to extend their benefits to Earth observations for weather, climate, and natural hazards monitoring.