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): Dr. Peter Fox and Dr. James Hendler

Position (optional): Tetherless World Constellation Chairs

Institution (optional): Rensselaer Polytechnic Institute

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

1. Are the 12 SBAs listed above sufficiently comprehensive?

Within the current coverage, several areas are implicit and thus may not get the attention they deserve without being called out in some more direct way. For example, EO data can help with studies of urban environments, including spread over time, planning areas, etc. Similarly, while human health, ecosystems and biodiversity are included, the cross-cutting environmental issues, for example air (and water) quality, can get overlooked because of the different times scales involved (e.g. timescales of climate and air/water quality changes are quite different), and other environmental areas are similarly buried within broader topics. It may be worth explicitly identifying some of these crosscutting topics along with the SBAs (See also response 2 below).

2. Should additional SBAs be considered?

Food Webs: we note that these may be considered part of ecosystems, but this would include larger issues of how the local food webs cause global change, including in impacting human behaviors (for example, movement of people in response to changes in food web) as well as crossing many SBA ecosystems (land, fresh, ocean/ coastal).

3. Should any SBA be eliminated?

No response.

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

The SBAs categorize areas of use for integrated environmental observations (EO) rather than for specific EO themselves, i.e. often many types of EO are required for a particular SBA. Two broad categories of EO based on method of observation/ measurement are in-situ and remote sensing and sub-categories within them (optical, radio). There are further categories of EO based on disciplines, e.g. geophysics, chemistry, biology, etc. What this highlights is that categories depend on a "world view" and that developing suitable models of these worldviews will lead to a better understanding of relations among the views as well as to integrative views, such as the SBAs invoke. Evaluation of sufficiency, as well as coverage, requires an understanding of "sufficient for whom", i.e. the different worldviews enable this assessment.

5. 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?

No response.

6. 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)?

One of the existing processes via the National Academies is the decadal survey and committee process. In many cases these surveys, especially for Earth sciences, are mapped to agency priorities (e.g. NASA and NOAA). Recently gaps are appearing in the EO suite due to restricted and reduced funding (e.g. as highlighted in the 2012 report "Earth Science and Applications from Space: A Midterm Assessment of NASA's Implementation of the Decadal Survey"). It is essential that the demonstrated value of advances in understanding and applications for SBAs are regularly identified, reported and disseminated. In addition, robust development of cost-benefit models and analyses are required for all stakeholder groups. In addition, secondary benefits, i.e. use of EO data in other domains is not sufficiently well emphasized.

7. 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.

The emerging area often called "big data," but more accurately the data science aspects thereof, must be considered more directly and more specifically with respect to collection and sharing. New algorithms, including predictive analytics, machine learning, etc. make it so that the same data can do more, and often that secondary purposes (many with economic impact) can be found for data collected for a primary purpose. Areas such as how to make data more discoverable, integrateable, sharable, linked, analyzable, etc. are becoming much more of an area of scientific and engineering considerations. The informatics and discovery areas that are enabled by better design of data formats, definitions, simplified metadata models, etc. are all emerging as key technological advances the Government must integrate into its planning of the portfolio. (See also response 9,10 below)

8. 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?

No response.

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

If one begins with the perspective of the many uses EO data in addressing problems in the SBAs, then management strategies can be optimized for the use scenarios versus the common efficiencies sought for the generation of the data. Inattention to down-stream use introduces many inefficient and costly tasks, especially for integration, and preservation; both are key for secondary benefits. An open government approach begins by collecting with the idea that the data will be shared, early on in the pipeline, i.e. by 3rd parties, other agencies, industry, etc. Enabling agencies to regularly use and integrate other agencies data with upfront investments can lead to significant returns on investment. We note that this would also make it easier for EO collectors to comply with the May 9, 2013 Executive Order on making data sharable (and the M-13-13 "open data policy" memo) as we discuss in response 10 below.

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

Integration of observations are being facilitated using virtual observatory (VO) approaches, especially for interdisciplinary communities. Many of these are becoming mature and use advanced technologies for a deeper, semantic, level of integration. However VOs are not yet integrated into an industrial model, in that the vast majority are still being funded as research projects. While full institutionalization of VOs is not yet achievable, providers of EOs need to embrace VOs based on current models and bring them into the arena of large integrated observational data holdings. Underpinning these VOs and integration is the articulation of robust information models (IMs) both conceptual and logical, to facilitate a shared data and information architecture based on how data is discovered, access and used (versus generated).

11. 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?

The government must consider adoption of Internet and Web-based approaches to discovery, access and use for information content. For example, widespread agency use of the dataset schema extension to schema.org would allow search engine providers the ability to index dataset landing pages that contain suitable embedded metadata. While several successful efforts have been undertaken, the scale is small. Coupled with this issue is the need to revisiting EO metadata approaches using lessons learned from data.gov, data.nasa.gov, HHS open data efforts (health.data.gov) and other large-scale open government sharing sites at the Federal and state levels. For example, different levels and amounts of metadata are needed for discovery, than are needed for access, and in turn use, of EO data. The heavy weight ISO/FGDC approach only works so far when EO data is to be used in highly specific SBA applications, whereas a lighter-weight approach would be helpful for integrating these datasets with external datasets, for example using health data to analyze the effects of air ozone measurements taken from an EO platform. Different EOs have different metadata schemas and traditional approaches to mapping or standardization have met with limited success. For SBAs, integration needs should drive the nature of metadata needed, and a single, heavyweight model, would no longer be the policy of choice given changes in the information technology environment over the past few years.

12. 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?

Openness of data is not just mandated by the Executive Order of May 9, 2013, but has been shown in numerous cases to help agencies better share with each other and especially to reduce redundancies across agencies while enhancing the ability of third parties to build applications that use the data in both commercial and scientific endeavors. OSTP has released many of the guidelines recommended for data sharing among Federal agencies, and we recommend that these principles and policies be mandated on EO data. We note this would also facilitate those agencies interested in challenges or "codeathons" that would enhance external development and ideation efforts. The model of the "Health data palooza" (http://healthdatapalooza.org/), which spun out of OSTP efforts is a model that should be emulated for EOs efforts.

13. 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?

Full and open exchange: move to a model of VO frameworks so that apps can plug into it. These development can in turn benefit from the experience obtained from widespread use, and thus can be used by developers to mature the frameworks. Private industry should be engaged for innovation, and academia to keep it fresh, evolutionary and to act as a neutral broker in the public-private partnerships that emerge. Data science has also emerged as a key linchpin for virtual observatory projects and will increasingly be so for the civil EOS projects. Presently, agencies know how to do observations, but once the data is in the sharing space on the ground, there is less knowledge, and the experiences of the commercial community, in particular web technologies and open data practices, must be brought to bear. Thought must be given to project change in the next decades over how data will be stored shared, archived, and used. This has been the emphasis of our comments above, and is a crucial aspect of the development of successful public-private partnerships.

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

We would urge the government to more fully engage with the Research Data Alliance (rd-alliance.org) which brings scientists and others from around the world together to explore exactly the sorts of issues discussed above, and to create interest groups around key data types. Engaging the scientific community in the design of best practices for sharing and archiving EO data would be enhanced through this mechanism. CODATA also played a key role in developing the GEOSS Data Sharing Principles and may provide guidance for EOs.