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): Lawrie Jordan, and Jeanne Foust

Position (optional): Director of Imagery, and Global Manager of Interoperability Standards

Institution (optional): Esri

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?

Consideration should be given to expanding Disasters SBA to explicitly include Emergency Response.

   b. Should any SBA be eliminated?

No.

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

Esri has no suggestion regarding optional methods of categorizing Earth observations. The approach of focusing on Societal Benefit Areas is beneficial as it keeps the focus on the utility of Earth observations in pragmatic applications.

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?

Esri strongly suggests the adoption of an Earth observation platform that utilizes existing widely deployed technology. Esri has built such a platform that is used across hundreds of thousands of organizations and the geospatial community at large. This platform is being continuously upgraded by a dedicated engineering team with the ambition of fundamentally transforming geographic information systems (GIS) and how people use it.

The new generation of our technology, ArcGIS, has been embraced by thousands of organizations including the U.S. federal agencies that provide Earth observations and is already providing great value to our users in their efforts to leverage maps and geographic knowledge across their institutions and beyond. At the foundation of Esri's work are the belief and vision that geography is a science that creates *a better understanding of our world. Using GIS, geography has also become a unifying framework for integrating many forms of digital information. GIS is an important technology in almost every industry, improving efficiency, communication, and decision making and, therefore, a U.S. civilian Earth observation platform would be of vital service to improve efficiency in the use of imagery in the GIS community.*

<u>ArcGIS as a Platform—A Platform for Civilian Earth Observation</u>

Esri's ArcGIS Online is an entirely new part of ArcGIS and extends ArcGIS into a platform, providing both online mapping/geographic analysis, as well as enterprise portal and geospatial content management. It complements and extends on-premises ArcGIS resources by providing cloud computing, as well as rich content and services.

ArcGIS as a platform provides open geospatial capabilities to any user and allows access by an application on any device anywhere, anytime. The concept of dynamic web maps is a central aspect of this platform and facilitates the organization, sharing, and use of geospatial content, maps, and data within groups and across divisions of an organization, as well as between organizations and the public.

ArcGIS also includes a large library of applications and templates that are used to access and apply this content in multiple settings, including mobile, tablet, and desktop environments.

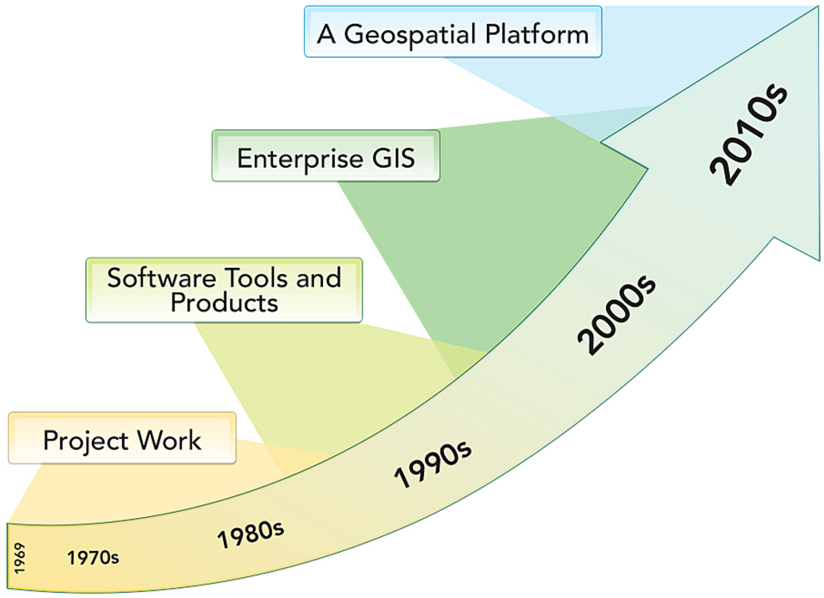
Some of the fundamental features of the new ArcGIS platform are the following:

- *Ready to use*
- *Self-service mapping*
- *Applications across all devices and browsers*
- *Content*
- *Services (routing, address, geoprocessing, analysis, etc.)*
- *Strong developer access and tools*
- *Platform for easily hosting and sharing applications and content*
- *Dynamically scalable and redundant (cloud infrastructure)*
- *Open and accessible using standards*
- *Supports all geospatial data types, including real-time server networks*
- *Provides an ecosystem of applications, content, and communities for users and partners*
- *Provides simple access to GIS using a software-as-a-service (SaaS) model*
- *Integrates with ArcGIS desktops*
- *Integrated with business intelligence (BI) tools (Microsoft Office, SharePoint, etc.)*

<u>Historical Context of Esri's ArcGIS Platform</u>

Over the last four decades, Esri has evolved both its business model and technology offerings through four distinct phases, always focused on GIS software services and support.

In the early years (1969 to 1980), Esri applied GIS as services work. These were largely GIS-based planning, engineering, and environmental projects. We used our own custom software to carry out *hundreds of mapping and geographic analysis projects at scales ranging from small sites to global analysis.*



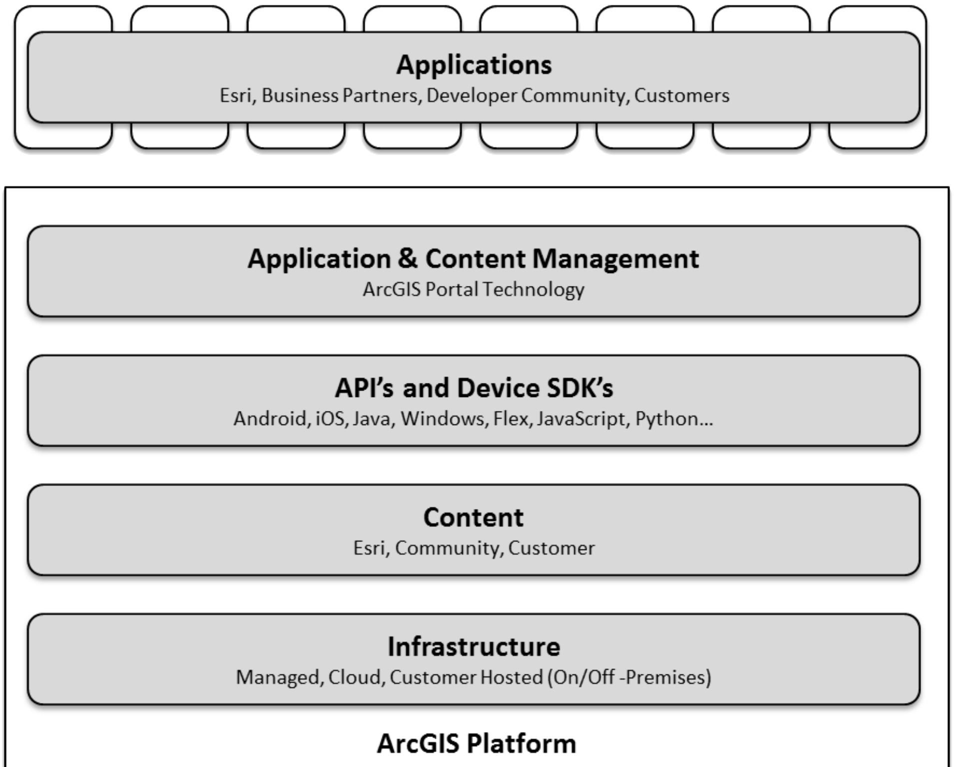
In the 1980s and 1990s, Esri's focus shifted dramatically toward developing and disseminating generic GIS software tools and products. Our work centered on developing software products that enabled users to do their own applications and build full GIS systems. We also provided technical and educational support and implementation services and developed a robust partner network that resulted in our partners being technical and marketing leaders in their fields.

Over the last 15 years, Esri has focused on extending our products to support enterprise GIS implementations. This entailed expanding the capabilities of our products, adding enterprise licensing and support services, and providing new solution architecture needed to support enterprise-scale systems.

The next big step has involved transforming ArcGIS into a geospatial platform. This is a dramatic shift and a major turning point for both our users and Esri itself. One of the exciting parts of this shift is the huge opportunity this architecture provides our users. It is also worth noting that the engineering we have done ensures that the technologies that our existing users employ (desktop, server, databases, etc.) are fully integrated.

ArcGIS as a platform leverages web and cloud patterns using a SaaS business model. It provides a place for sharing user content, as well as a large library of ready-to-use basemaps and geospatial services as part of the platform. Finally, the platform supports many easy-to-use applications, including self-service mapping and ready-to-use templates that support individuals, organizations, governments, and developers.

Below is a view of the structure of the ArcGIS platform:



The Goal Is About Opening GIS to Everyone

One of the primary drivers of ArcGIS as a platform is to make GIS easier, not only for new users but also for advanced users. In addition, the platform is open, extendable, and can be leveraged by others, facilitating both the integration of other geospatial technologies as well as other enterprise IT and web services.

Who Uses the Platform?

The ArcGIS platform is designed to support three different user communities:

- ***Professionals** can use the platform for mapping, geographic analysis, and data management and sharing. ArcGIS enables organizations to easily share their information in a common environment. This technology has been carefully designed to integrate with traditional GIS workflows as well as non-GIS expert systems. This includes users who wish to enable geospatial access across organizations with common platform technology, sharing services, content, applications, and related know-how.*

- ***Developers** can use the platform to leverage its content and services to make their own applications and services that embed or interact with the core ArcGIS platform capabilities. Developers can extend the system into new areas and provide new focused workflows and tools for GIS and non-GIS users. We believe that enabling developers on the ArcGIS platform will be important to all our users.*

- ***Businesses and IT organizations*** *can use the platform to integrate mapping and geospatial analysis into business systems (e.g., BI, ERP, CRM). We call this ArcGIS for Location Analytics. In 2013, Esri is working to enhance the integration of the ArcGIS platform with a number of business system technologies. These include Microsoft Office, SharePoint, and Dynamics, as well as business intelligence solutions from IBM Cognos, MicroStrategy, and SAP. This integration is transforming the applications of GIS into other dimensions of IT within organizations. This technology pattern not only allows anyone in an organization to easily make maps with their business data but also supports the integration of traditional business data with the other types of GIS information traditionally housed within GIS organizations.*

What's Next?

Moving forward, Esri will focus on four major areas: enterprise, online, applications, and developers.

The first and foremost direction of Esri will be to continue incremental releases of its enterprise technologies (desktop, server, etc.). With respect to desktop improvements, the upcoming releases will continue to take advantage of the most modern computing advances in the desktop/Windows space and add new features and make quality and functional enhancements in mapping 3D visualization and analysis. ArcGIS for Server will continue to be advanced with new enhancements that support private clouds, big data, servers, networks, dynamic image processing, and other real-time streaming data. These and other improvements will be made available in a series of incremental releases every three to six months over the next few years.

The second major development direction involves the evolution and extension of ArcGIS Online. This cloud GIS environment is rapidly expanding in both capabilities and use. Today, users have created and shared more than 1 million maps, datasets, and applications and are creating more than 100 million online maps every day. This success is based and built on a large set of foundation mapping and content capabilities that are being extended with a growing amount of spatial analysis tools. We also continue to add and improve our basemaps and content for our users to exploit, including imagery and demographic data, as well as related online services for geocoding, routing, and geographic analysis. For traditional users, it is envisioned that these online services will both complement and extend the work they do on premises at our user sites. This is bringing GIS to a whole new community that uses only ArcGIS Online via web clients and mobile devices.

Our third focus is the release of a new family of applications. These applications are easily configurable and support generic categories of geocentric work (e.g., data entry and editing, mapping, spatial analysis, geodesign, and 3D visualization). These applications are part of ArcGIS and will allow users to leverage not only the information contained in ArcGIS Online but also distributed services located in on-premises servers, both in our customer base and from our partners.

Our final focus is on enabling developers to build applications and extend our system. Developers can leverage our tools to extend our applications, but they are also building new applications for the desktop, mobile devices, and web browsers. These applications both enable traditional GIS work and open up *whole new opportunities to geoenable other systems, providing location awareness, or a map-based paradigm, for understanding information. Esri continues to support the leading development patterns (HTML5, WPF, .NET, Java, and others) and platforms, giving developers the choices they require.*

The Role of Standards

Key to the success of any platform is the adherence to open standards, and Esri has aggressively done this with its implementation of ArcGIS. Over the years, we have invested millions of dollars to ensure that our products support industry, geospatial, developer, and IT standards.

In addition, Esri has worked closely with the Open Geospatial Consortium, Inc. (OGC), for many years and remains one of its largest supporters, integrating its standards into our base platform. We are also working closely with the ISO and WWW communities so that our product suite remains standards-based across the IT and web worlds.

Esri, along with strategic business partners, is committed to building interoperable and open commercial off-the-shelf software products. Open access to geographic data and software functionality using widely adopted, practical standards is our primary focus.

The ArcGIS platform conforms to open standards and enterprise IT frameworks that allow organizations to incorporate GIS into any application on a variety of computing and mobile devices. ArcGIS supports multiple approaches to standards and interoperability:

- *Geospatial standards—Esri is a principal member of the Open Geospatial Consortium (OGC), and actively participates in the development of many specifications. Members of Esri's standards and interoperability team serve as representatives on some of the ISO/TC 211 committees. Esri also support FGDC standards.*

- *IT standards—Esri supports and complies with virtually all commonly accepted IT standards. For our users, this means compatibility and interoperability support with major enterprise systems such as enterprise resource planning (ERP), customer relationship management (CRM), enterprise application integration (EAI), work management systems, and others.*

- *Industry standards—Esri anticipates the needs of specific industry communities for implementing key standards and interoperability protocols for data formats for domain areas such as hydrographic charting, etc.*

Platform for Sharing Earth Observations

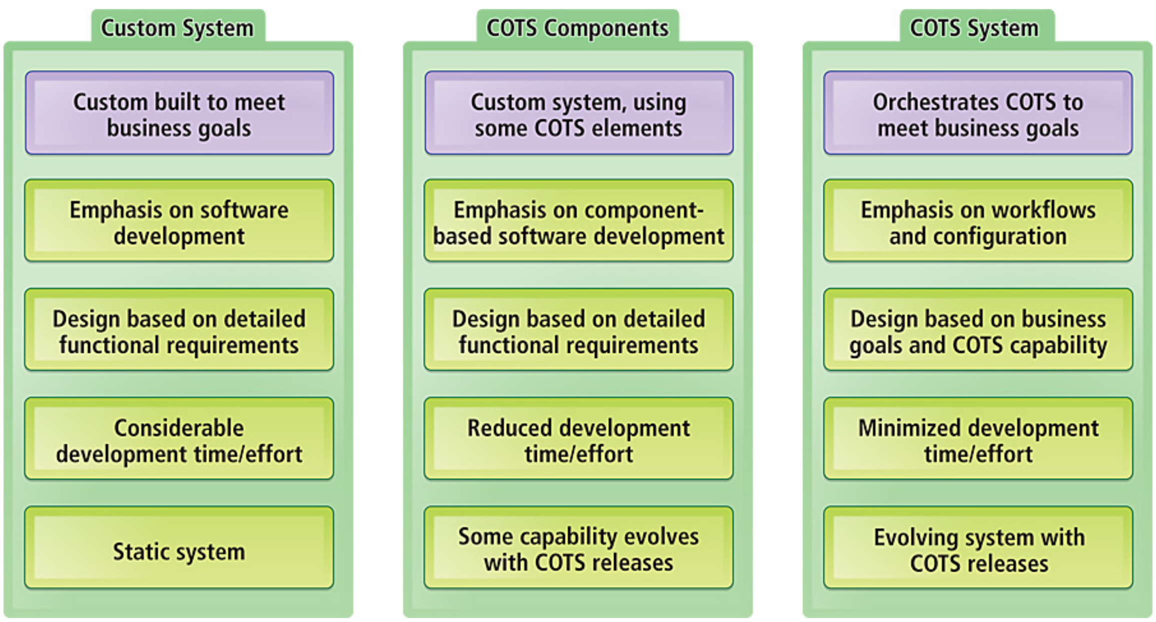
ArcGIS is a platform for sharing geospatial intelligence around the world. Looking to the future, we see our platform strategy as being of great benefit and value to our users, partners, developers, and ultimately the world itself. It is already creating an ecosystem and community of GIS users who are leveraging each other's resources and knowledge.

Considerations for Earth Observation Platform

The ArcGIS platform is designed to deliver geographic information via a variety of clients, from the desktop to web-based and mobile clients, ensuring that everyone who needs the information has access to it without requiring special software or skills. In other words, the delivery of geographic information has been uncoupled from its management, making it possible to configure the system to support multiple departments and business processes without compromising the underlying data. "Simple" and "ready to use" are prevailing principles.

This means that an enterprise GIS is no longer built by stitching together individual software packages but instead is a federated system that can support many different uses. As a result, the user experience can be significantly tailored to each type of user through configuration rather than customization of the system. Users can orchestrate the system to meet the needs of a business or operating unit and bring operational systems online more quickly and for much less expense. The system will then evolve as commercial-off-the-shelf (COTS) releases increase its capability over time.

Enterprise GIS systems are built following three basic patterns: custom systems, COTS component systems, and COTS systems. The trade-offs between patterns need to be considered before embarking on a system implementation.



There are many benefits to the COTS system approach. Commercial software is developed based on years of working with customers to understand what they need, building in the best practices learned along the way. Implementing a COTS-based enterprise GIS allows organizations to benefit from those best practices rather than reinventing the wheel and creating new processes from scratch. In this way, a system can evolve with the technology, allowing users to benefit from new capabilities as they become available.

The fundamental premise of a COTS approach is to exploit all the power and functionality the commercial software has to offer and implementing that capability as designed. One of the most notable differences a COTS implementation affords over a custom one is the ability to get functionality into the hands of users early and often. By utilizing COTS, much of the functionality is ready for users to exercise quickly. This leads to better acceptance by end users and dramatically improved feedback when compared to the traditional approach of doing a needs assessment and gathering requirements, where end users have less understanding of the capability of the new system. The COTS approach relies on users to provide feedback continually and participate actively in the configuration of the system. Implementation time for a COTS system is significantly reduced because there is no development to be done. Maintenance requires fewer specialized resources—users can leverage standard technical support and a wider labor pool trained in the COTS technology.

A COTS solution will most likely provide the best long-term return on investment (ROI) as well. While the perception may be that it is less expensive to build versus buy, any initial savings are reduced greatly by having to take on responsibility for isolating and correcting any design problems, providing ongoing technical support and training, adapting the product to advances in technology, and providing data migration tools to move data from one release to the next when the product data architecture is modified.

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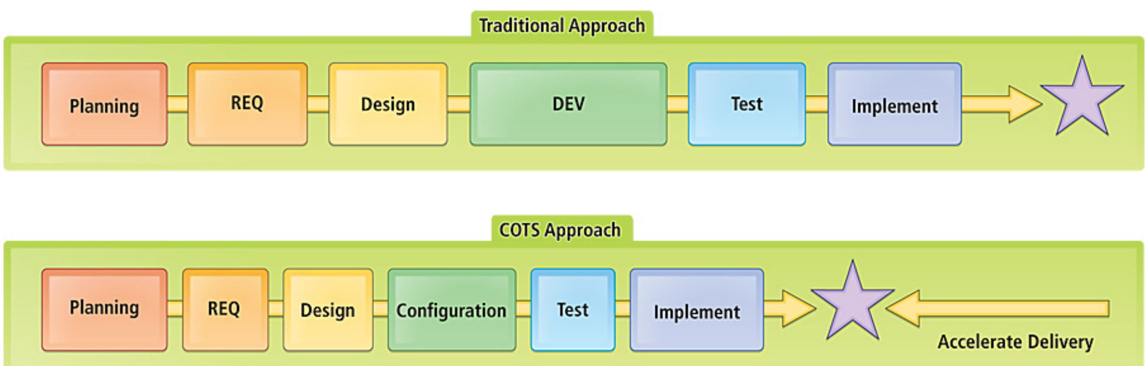


COTS-based enterprise GIS may not be the right approach for an organization if its culture, history, and structure won't support it. Taking a COTS approach versus building an enterprise GIS requires fresh thinking, leadership, and agility. The COTS approach is predicated on a focus on business goals instead of a list of detailed feature functions—it puts the emphasis on what the system needs to do, not how the system will do it.

This can be challenging in environments where there is a history of procurements to build custom systems. In large organizations, determining core business requirements is often easier said than done. Internal user groups brought in to help the process often have difficulty separating business requirements from technology or design requirements in their minds.

A COTS approach also asks users to consider new business processes, which can challenge the change management capabilities of an organization. Traditional system procurements often fall into the trap of re-creating old workflows out of new software, usually because people and organizations resist change. It takes leadership, communication, and follow-through to overcome the tendency to stick with the familiar way of doing things.

Even when a system has been proclaimed a COTS implementation, the best intentions of many people often push systems toward customization. Some customization may be required to support particularly complex processes. The trade-offs of custom development, however, must be kept in mind to avoid moving a COTS-based system into a custom- or component-based implementation (COTS modules mixed with custom modules). Many heavily customized COTS systems cannot be easily scaled or extended because there is inadequate design documentation; the technology on which it is based is no longer supported; resources with needed skill sets are no longer available; or the COTS versus custom modules are not clearly delineated, creating dependencies between components that minimize the potential for reuse.

To further increase the ROI from investment in the ArcGIS platform, sharing and reuse of geospatial content and functionality is supported in a number of ways:

- ***Content****—Content can be shared through web services such that different client applications can access the content and use it in specific workflows supported by those applications. We envision a number of generically available web services, for example, for display as a background to maps, for locating objects in the port based on the function-location code, for routing, or for specific repeatable analyses. Esri envisions using the free plugin ArcGIS for AutoCAD as part of our solution for Geo 2.0 (www.esri.com/software/arcgis/arcgis-for-autocad). Integration with other applications that cannot yet consume web services may be supported using COTS import/export capabilities of ArcGIS. ArcGIS supports many different enterprise-level database technologies, including Oracle, SQL Server, Netezza, Informix, PostgreSQL, and DB2. Esri also supports big data analytics, including Hadoop (esri.github.com/gis-tools-for-hadoop/) that may, for example, be used to analyze ship movements over a period of time in near-real-time.*

- ***Webmaps—****Multiple web services may be combined in webmaps that focus on conveying a specific piece of information to a particular user (these are often called information products). The webmaps are reusable in different applications on multiple devices. Webmaps can also be used in commercial-off-the-shelf enterprise software products, including but not limited to Microsoft SharePoint, Microsoft Dynamics, Microsoft Office, SAP, mobile devices, browser, and desktop GIS. Expert users can work within the ArcGIS ArcMap desktop environment to produce and publish information that is then used across the organization as webmaps.*

- ***Applications—****As part of the ArcGIS platform we provide a number of template applications and configurable applications that consume web services or webmaps and make these available to specific business processes. While providing a complete solution for a geospatial information platform, we realize that there will be specific workflows or expert systems that may require specific functions or applications. The ArcGIS platform provides a rich set of* *developer options, based on modern application programming interfaces such that developers have a broad range of options for developing focused applications. Esri makes a rich set of documentation and samples available to the developer community (developers.arcgis.com). Esri provides many of its applications as open source through GitHub (esri.github.io) and fully embraces the collaboration between developers to add or enhance these tools jointly.*

- ***Business partners****—Esri business partners such as Microsoft, SAP, QPS, and Strategis have integrated ArcGIS technology into their software, thus simplifying the interface and reducing the data transfer/exchange complexity by working directly on the same enterprise database. Over 2,000 Esri business partners would be a rich resource to be both contributors and users of a U.S. civilian Earth observation platform.*

Confidentiality, Integrity, and Availability of Information Should Be Guaranteed

While Esri's solution promotes wide and shared use of information resources, we understand there is a need for strong access control mechanisms. The ArcGIS platform provides a suite of access control capabilities at various levels in the architecture:

- *The data management environment and the read-only viewing environment are logically separate geodatabases. Read-only users will be provided with read-only tools.*
- *ArcGIS for Server includes capabilities for securing access to web services based on user roles and integrates directly with Microsoft Active Directory.*
- *ArcGIS Online allows for controlling who can access web services, web maps, or other content registered in this geospatial content management system, regardless of how users access this content (desktop, browser, or mobile clients).*

For more information on the ArcGIS security capabilities, refer to the Enterprise GIS Security resource center at resources.arcgis.com/en/communities/enterprise-gis/01n200000004000000.htm.

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)?

Given the diversity of data streams in terms of original instrumentation or sensor, format, timeframe and quality, the government should first provide working definitions of, and describe the roles for the continuity of the various measurements and datasets key to Earth observation from space, the atmosphere, on the ocean surface, and within the ocean water column. The government should also use established methodologies and/or metrics that can be used for observations collected over varying extended periods; prioritize the relative importance of observations over these time periods; and identify the characteristics of and extent to which data gaps and/or performance degradation are acceptable for categories of observations. The government should also continue to assess the infrastructure necessary for achieving continuity or near-continuity of the data products derived from the various sensors and platforms. A valuable reference is from the recent 2013 National Academy of Sciences workshop: Lessons

Learned in Decadal Planning in Space Science (www.nap.edu/catalog.php?record_id=18434) and in current deliberations underway for a decadal survey of ocean sciences (dels.nas.edu/Study-In-Progress/Guidance-National-Ocean/DELS-OSB-12-03). Please also see Esri's answer to numbers 3, 5, and 10.

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.

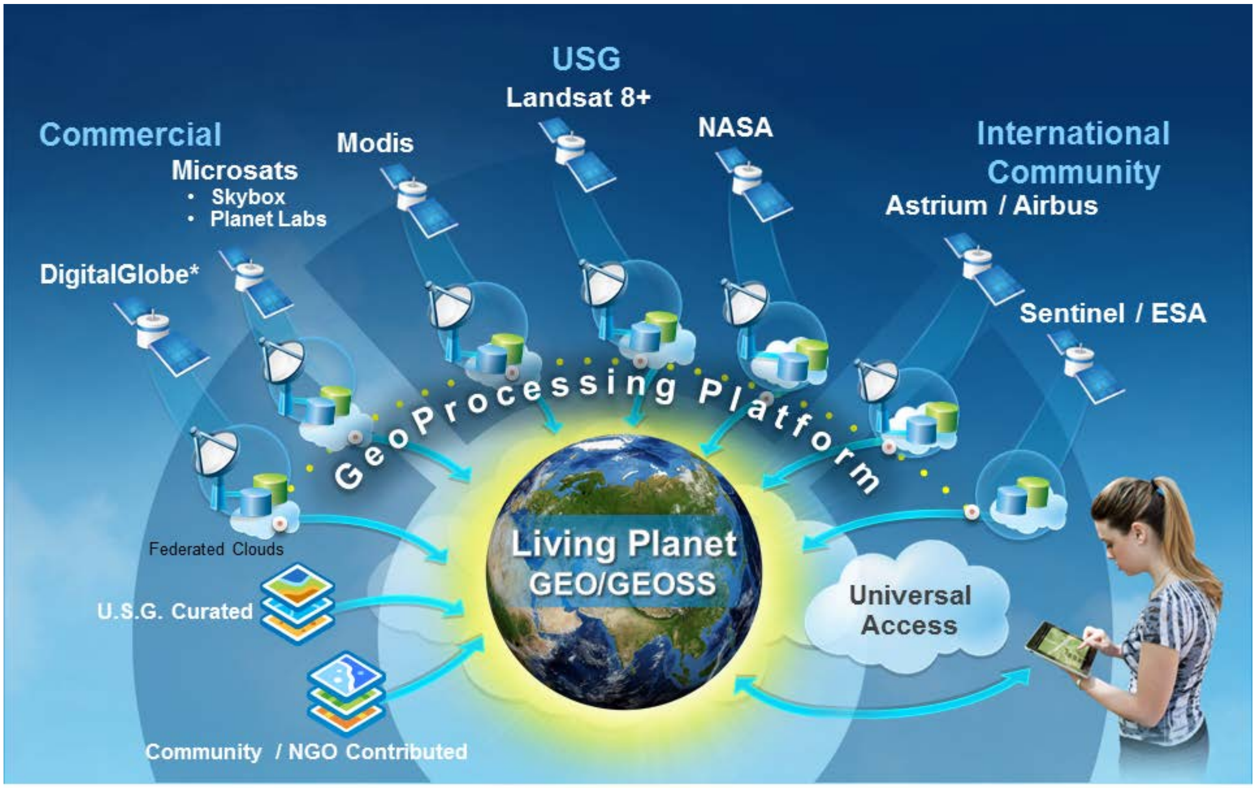
*Recent advances in information technology as well as civil remote sensing of the Earth have set the stage for the dawning of a **new era in geospatial big data.** Vast amounts of data collected by numerous sensors and sources worldwide can now be combined together dynamically, becoming discoverable, accessible, and useable by global communities of interest. This trend is on a trajectory that is rapidly allowing us to advance beyond mere static data collection and archiving, further enabling information awareness and understanding, and leading us towards knowledge and better decision making.*

In this new era, a sustainable, successful National Plan for Earth Observation with international community participation and acceptance should take into consideration several key design elements and functional characteristics. Esri suggests these include:

- *A strong foundation built on a combination of proven, well-engineered **commercial-off-the-shelf** GIS platform technology and **open standards**-based data and protocols*
- *Leverage the IT trend of **"moving the processing to the data"** (if it's big data, don't move it)*
- *Enhanced citizen access through **any type of device** (smartphones, tablets, web, etc.) without any training or specialized knowledge*
- ***Highly simplified** and intuitive dashboards and story maps for captivating public interest and informing citizenry by bringing Earth observation information to life through storytelling*
- ***Leverage public/private partnership,** and extend boundaries to encompass both national and global applications and sources*
- *Take advantage of GIS frameworks for full integration of emerging geospatial data trends in **social media** (Facebook, Twitter, etc.)*
- ***Maintain integrity** of source information and metadata for scientific and authoritative users*

The Concept of Operation (CONOPS) that Esri is proposing for consideration under this RFI incorporates all of the above elements into a unique, cloud-based solution that is dynamic, near real-time, and highly visual.

*This concept is called **"The Living Planet"** and it is shown below. Unlike traditional globes with a single image carpet layer or "skin" that is only 1 pixel deep, the Living Planet has a surface that is "alive" and deep, with dozens of Earth observation systems contributing image streams from space in near real-time, along with community contributed authoritative layers for oceans (bathymetry, sea surface, and water column), land terrain elevation, social media, etc.*



The Living Planet | Dynamic Earth Observation
"Always On" | Near Real Time, All The Time, Everywhere

The geoprocessing platform resides in the ground stations where each E/O data stream comes in (i.e. bring the processing to the big data). Each ground station has a dedicated edge-cloud, and these are federated and dynamically linked to the Living Planet. This provides synoptic, multi-source, multi-resolution E/O data to global users in near real-time, everywhere, all the time, on any device—it's "always on" and always with you.

Highly simplified views are available through story maps and dashboards that allow non-technical users to gain quick and simple access to a new view and a new vision of the importance of Earth observation data.

Time-enablement in the Living Planet allows historical change detection and corresponding impacts on areas of concern such as climate, oceans, forests, and natural resource depletion to be seen and understood in an entirely new way.

Sustainability and reliability is assured by the use of proven, well-engineered COTS platform technology, and interoperability and openness is guaranteed through the adoption of open standards.

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 Esri concept of a Living Planet includes bringing together all civilian sources from U.S. Government and commercial providers along with community contributed authoritative layers for land terrain, bathymetry, ocean surface, and the ocean water column. All sources in the Earth observation platform could include open and freely available data and apps along with a "marketplace" for both commercial added-value data/apps for costs and free no-cost open data/apps from NGOs, commercial providers, and citizen geographers.

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

*Esri has no input at this time other than to suggest studying the National Geospatial Advisory Council's (NGAC) thoughts on building a national geospatial platform for the U.S., as well as the governance of the emerging EarthCube initiative funded by the National Science Foundation (*earthcube.ning.com/group/governance*).*

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?

See Esri's answers to numbers 3 and 5.

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?

Please see Esri's answers to numbers 3, 5, and 10.

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?

A National Earth Observation Plan must ensure an operational architecture that is both open and fully functional. Information technology policy for such a plan should embrace delivering:

- *National Earth observation platform that brokers the delivery of government and non-governmental civilian Earth observation*
- *Platform that integrates with and supports widely deployed geographic information systems (GIS)*
- *Platform that is interoperable*
- *Platform that uses existing commercial proven solutions along with open source data and applications*
- *Built using well-known and recognized development and testing regimes*
- *Scalable*

- *Extensible*
- *Secure*
- *Full-featured GIS on web functionality with startup data*
- *Deployable across the cloud, the web, servers, multiple clients, and mobile devices (in other words a flexible architecture to meet user needs)*
- *Cloud hosted and/or on-premises hosting which allows seamless data deployment for meeting both open and secure data architecture requirements of users of such a national earth observation platform*
- *Cost effective in that all of the above is provided as much as possible'out of the box, meaning using existing cloud hosting and geospatial solutions and without the added expense of in-house software development.*

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 U.S. Government might consider pursuing the types of public-private partnership that exist at both the larger sectorial level, where governments, industry partners such as Esri, and relevant stakeholders would be the drivers, but also at the community level (e.g., where citizen science Earth observation takes place). Such partnerships should, in particular, leverage private industry participation in solution development and the use of market systems and business intelligence instruments. Please see Esri's answer to number 12 below.

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

Esri suggests studying as a model the interagency/international agreements and public-private partnerships in place among the various partners of GEOSS, the UNESCO IOC's International Oceanographic Data and Exchange (www.iode.org) and its new Associate Data Unit structure, the NSF-funded DataOne initiative (www.dataone.org), the various regional associations of the Integrated Ocean Observing System (www.ioosassociation.org), and the Research Data Alliance (rd-alliance.org). Again, holding a workshop or webinar on this topic would be instructive.