



NASA OFFICE OF INSPECTOR GENERAL

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SUBJECT: Final Memorandum, *NASA's Compliance with the Geospatial Data Act for Fiscal Year 2022* (IG-23-001; A-22-06-00-FMD)

The Geospatial Data Act of 2018 (GDA) seeks to foster efficient, government-wide management of geospatial data—information identifying the geographic location and characteristics of natural or constructed features and boundaries on Earth.¹ The Act codifies committees, processes, and tools in support of the National Spatial Data Infrastructure.² It also formalizes governance processes related to geospatial data, provides policy and guidance for the use of geospatial data and technology, and facilitates cooperation between the public and private sectors.

In addition, the Act requires Inspectors General to audit the collection, production, acquisition, maintenance, distribution, use, and preservation of geospatial data by covered agencies at least once every 2 years.³ Specifically, the Act requires a review of agency compliance with (1) the geospatial data

¹ The Geospatial Data Act of 2018 became law on October 5, 2018, as a component of the FAA Reauthorization Act of 2018 (Pub. L. No. 115-254, Subtitle F). Geospatial is a type of spatial data that directly or indirectly references a specific geographical area or location related to the Earth. According to the U.S. Geological Survey, the terms “spatial” and “geospatial” are equivalent.

² The National Spatial Data Infrastructure is the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data.

³ A covered agency is one that collects, produces, acquires, maintains, distributes, uses, or preserves geospatial data on paper or in electronic form to fulfill the agency’s mission, either directly or through a relationship with another organization. Under the Act, covered agencies include 15 Executive Departments, the U.S. Environmental Protection Agency, and NASA, but excludes the U.S. Department of Defense and any element of the intelligence community.

standards established under Section 757, (2) the 13 agency responsibilities listed in Section 759(a), and (3) the limitation on the use of federal funds in Section 759A. See Enclosure II for a summary, listing, and description of the 13 agency responsibilities.

The Council of the Inspectors General on Integrity and Efficiency (CIGIE) convened a working group to coordinate a government-wide approach for the fiscal year 2022 geospatial audit. The group notified relevant congressional committees that the audit would primarily focus on covered agencies' progress toward compliance with the 13 responsibilities listed in Section 759(a) of the Act since the geospatial data standards have not yet been established. See Enclosure III for a copy of the letter CIGIE sent to Congress. Therefore, we evaluated the extent to which NASA is managing its geospatial data in accordance with the Act. In addition, we evaluated the Agency's implementation of recommendations made in our previous report (see Enclosure IV).⁴ Moving forward, we anticipate geospatial data strategies, standards, and criteria will be further clarified for agencies' use in implementing the Act, and we will examine these topics in subsequent audits.

Background

Since 1990, the federal government has recognized the need to organize and coordinate the collection and management of geospatial data. In 2002 the Office of Management and Budget (OMB) revised Circular A-16—which provides guidance regarding coordination of federal surveying, mapping, and related spatial data activities—to establish the Federal Geographic Data Committee (FGDC) and promote the coordinated use, sharing, and dissemination of geospatial data nationwide.⁵ The GDA, coupled with the broader Open, Public, Electronic, and Necessary Government Data Act of 2019, created a regulatory framework to address sharing geospatial data.

NASA's stewardship of geospatial data aligns with its mission to explore the unknown in air and space, innovate for the benefit of humanity, and inspire the world through discovery. Scientists and policymakers depend on the continuous flow of geospatial information—such as data on natural disasters, ice sheet measurements, flooding projections, weather modeling, mapping, coastal erosion and water level data, transportation information, and population distribution—to inform their decision making. This information is generated through numerous NASA and partner satellite missions and field research campaigns. For more than 25 years, NASA has made its data available at no cost to research communities, private industry, academia, and the general public. To enable the efficient production, archiving, and delivery of data, NASA participates in government-wide efforts to develop data standards, create and curate metadata, and build tools to enable search and discovery, all of which help ensure interoperability with other systems, agencies, and organizations.⁶

⁴ NASA Office of Inspector General (OIG), *Audit of NASA's Compliance with the Geospatial Data Act* ([IG-21-001](#), October 2, 2020).

⁵ OMB Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (August 19, 2002).

⁶ According to OMB Circular A-16, metadata are information about data and/or geospatial services, such as content, source, vintage, spatial scale, accuracy, projection, method of collection, and other descriptions. Reliable metadata, structured in a standardized manner, are essential to ensuring that geospatial data are used appropriately, and that any resulting analysis is credible.

Roles and Responsibilities

NASA has one of the world's largest repositories of Earth science data, with more than 14,300 unique data products. As a matter of long-standing policy and practice, NASA archives Earth science mission data to ensure long-term usability and promote widespread usage by scientists, educators, decision makers, and the general public. Broadly, geospatial data and records management responsibilities are divided among five groups at the Agency:

- The Office of the Chief Information Officer (OCIO) is responsible for the Agency's Records Management Program and compliance with federal regulations and requirements. Within the OCIO, the Chief Data Officer and Records Officer direct records management, including preservation. The Chief Data Officer is also currently the Senior Agency Official for Geospatial Information (SAOGI).
- The Chief Archivist in NASA's History Division provides archival and technical guidance for the management and preservation of historical records.
- The Earth Science Data Systems Program within the Science Mission Directorate (SMD) oversees the life cycle of NASA's Earth science data from acquisition through processing and distribution.
- Distributed Active Archive Centers (DAAC) are operated collaboratively by NASA and contractor staff and are responsible for processing, archiving, and distributing NASA's Earth science data. The archives are stored at 12 DAACs located at NASA Centers, universities, and other federal agencies and are organized according to science discipline or theme.
- The Office of Strategic Infrastructure collects, sustains, and utilizes geospatial data to support facilities, logistics, and environmental planning and management functions at NASA Centers and field locations.

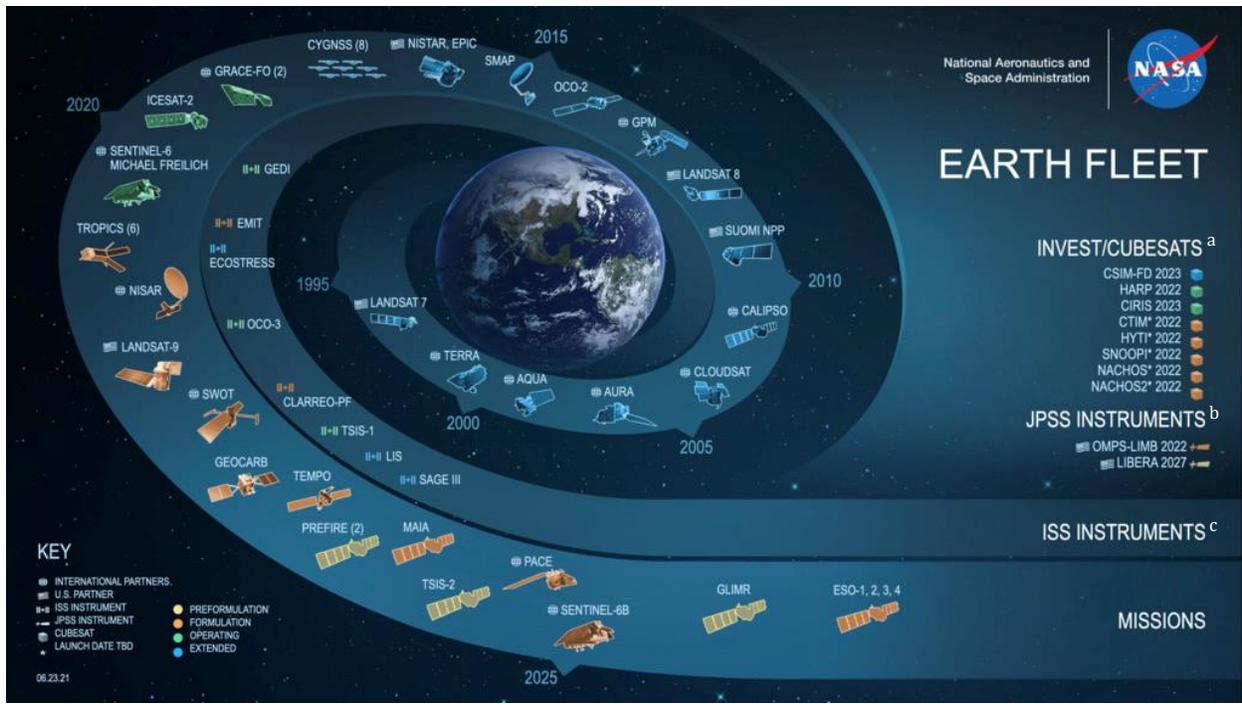
Data Generation, Presentation, and Collection

Geospatial data generally combines location information (usually coordinates of latitude and longitude), attribute information (the characteristics of the object, event, or phenomenon concerned), and temporal information (the time or lifespan at which the location and attributes exist). With geospatial data, location information can be static or dynamic. Examples of static data include the location of a road and earthquake event; dynamic data include the location of a moving vehicle and pedestrian or the spread of an infectious disease like COVID-19. Maps are the most common way of presenting geospatial data. Maps with geospatial data can provide evidence for decision-making, serve as teaching tools, and improve our understanding of natural and human-made phenomena.

Geospatial data is collected in a number of ways, with the Global Positioning System (commonly known as GPS)—which uses satellite and ground instruments to provide users with accurate position, navigation, and timing information worldwide—being the most familiar. Another example is remote sensing systems that measure (via satellite, airplane, or balloon) emissions and reflections from the Earth and its atmosphere. The data is stored using a variety of methods, such as in a Geographic Information System, which analyzes and displays geographically referenced information. The power of geospatial data lies in the ability to derive new information from relationships between various data layers (e.g., an ice thickness data layer over ice coverage locations). Raw data is collected through NASA's satellite and Earth-based instruments, transmitted to ground stations, and distributed to

processing facilities where additional layers of data are correlated. See Figure 1 for a graphic depiction of NASA’s Earth Science fleet of satellites used for collecting geospatial data.

Figure 1: NASA’s Earth-Observing Satellite Fleet



Source: NASA’s Earth Observing System Project Science Office.

^a In-Space Validation of Earth Science Technologies (InVEST) projects have validated new instruments and information systems by installing small satellite platforms on bread loaf-sized CubeSats (research nanosatellites).

^b The Joint Polar Satellite System (JPSS) is composed of polar-orbiting environmental satellites that provide full coverage of Earth, meteorological data, and observations of the atmosphere, oceans, and lands.

^c International Space Station (ISS) instruments focus on such topics as the Earth’s changing climate, vegetation measurements, carbon dioxide distribution, and the Sun’s energy input to Earth.

Data Use

NASA uses geospatial data in many ways. For example, the Agency’s Ice, Cloud, and Land Elevation Satellite-2, or ICESat-2, measures the height of Earth’s land and sea ice, forests and vegetation, and urban areas, creating a three-dimensional (3D) portrait of our planet’s surface. ICESat-2 plays a critical role in mapping years of ice sheet loss. Landsat 9—a joint mission with the U.S. Geological Survey to observe and measure changes on Earth’s land surface—provides critical data about tropical deforestation, urban expansion, water use, coral reef degradation, natural and man-made disasters, and climate change. See Figure 2 for examples of geospatial data visualization.

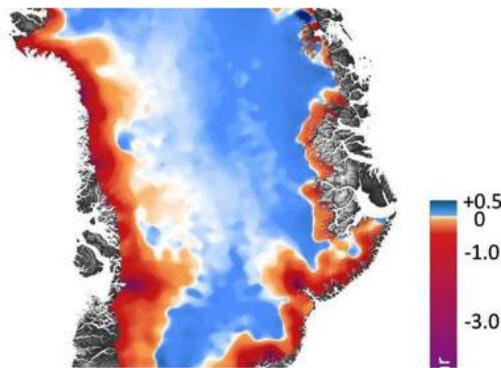
Figure 2: Examples of Geospatial Data Visualizations



Another "winter" day with highs in the 80s. Burbank topped out at 89 degrees, and Ojai hit 90! A Heat Advisory remains in effect for portions of LA County through Sunday.



8:30 PM · Feb 10, 2022 · TweetDeck



Sources: Clockwise from top right: University of Washington, ICESat-2; NASA, Landsat 9 (bottom right); and National Weather Service (left).

Note: ICESat-2 shows the amount of ice gained or lost by Greenland between 2003 and 2019. Dark reds and purples show large rates of ice loss near the coasts while blues show smaller rates of ice gain in the interior of the ice sheet (top right). Landsat 9 shows land surface temperatures just before a winter heat wave hit Southern California in February 2022 (bottom right). National Weather Service Los Angeles heat advisory tweet, February 10, 2022 (left).

Records Preservation

Geospatial data, like other data captured and produced by the federal government, can have historical significance that requires preservation. The National Archives and Records Administration (NARA) and NASA share responsibilities for management of Agency records. NARA has general oversight responsibilities for preservation of permanent records documenting the activities of the federal government while NASA is responsible for identifying and submitting lists of its records with a proposed disposition schedule to NARA. Representatives from both NARA and NASA develop a disposition schedule to ensure all NASA records are retained for the appropriate length of time. While NARA provides authoritative instructions for the retention, destruction, and retirement of records held by NASA, it is only at the conclusion of this process that a final NASA records schedule is approved by the Archivist of the United States.

Preserving any type of information necessitates retaining both the information itself and sufficient context surrounding the information to render it understandable in the future. Importantly, as the information's present context changes over time as technology changes, the preserved context can be referred to by future custodians. For geospatial data, the problems of capturing and preserving enough of the data's context are especially challenging. In simpler contexts, knowledge of the format (for instance, a PDF document) is sufficient to support future usability of data. Geospatial data, however, tends to require much more complex contextual information. For example, understanding

remote sensing imagery in a scientific model requires detailed knowledge of the specific platform and sensor characteristics, and in many cases calibration and processing steps as well.⁷ It is only in combination with this contextual information—also known as metadata—that geospatial data can be rendered useful for scientists and the public.

⁷ Remote sensing is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance. Special cameras, typically on satellites and aircraft, collect remotely sensed images to help researchers “sense” things about the Earth such as temperature changes in oceans, changes in farmland or forests over several years, and tracking of clouds to predict weather.

NASA IS MAKING PROGRESS TOWARD COMPLIANCE WITH GDA BUT KEY ACTIVITIES REMAIN INCOMPLETE

NASA has made significant progress toward fully implementing the GDA's 13 agency responsibilities since our first audit, which covered the Agency's progress as of fiscal year 2020. However, we found deficiencies impacting 6 of the 13 responsibilities under the Act during fiscal year 2022. See Enclosure II for the status of the NASA Office of Inspector General's (OIG) assessment of the Agency's progress implementing each of the 13 responsibilities within the Act.

NASA Has Not Completed an Implementation Plan or Fully Defined Roles and Responsibilities

The first requirement of the GDA is for a covered agency, such as NASA, to prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data and activities appropriate to its mission. NASA has made progress toward fully implementing the GDA's 13 agency responsibilities since our first audit in 2020. Specifically, the Agency developed a Geospatial Data Strategy, began drafting an implementation plan for that strategy, assigned personnel to a key role, and initiated a process to identify and catalog an Agency-wide inventory of geospatial data. However, NASA has not completed its implementation plan or fully defined roles and responsibilities of Agency officials.

During our previous audit, we recommended NASA develop an implementation plan or "Roadmap" with detailed action items, milestones, and responsibilities for geospatial data management (IG-21-001, recommendation 2).⁸ In May 2021 NASA issued its Geospatial Data Strategy, a document that provides a broad understanding of the required goals and objectives of how the Agency plans to fulfill the GDA requirement. Subsequently, NASA began developing an implementation plan. However, upon review of the current draft plan, we found that it lacks key activities and milestones for fully meeting the 13 covered agency responsibilities. Additionally, the draft plan does not include Agency officials' roles and responsibilities for geospatial data management.

Specifically, the draft implementation plan is missing key activities such as developing a complete and accurate geospatial data inventory and NARA-approved records schedules for NASA's geospatial data. NASA's Geospatial Data Strategy acknowledged the need to develop an inventory and determine the scope and value of preserving geospatial data. However, the detailed action items and milestones for completing the 13 required GDA responsibilities are not included in NASA's draft implementation plan. Consequently, our previous recommendation remains open.

We also found that roles and responsibilities have not been defined within the Geospatial Data Strategy or the draft implementation plan. Specifically, the role and responsibilities of the SAOGI, NASA's point of contact to the FGDC, as well as Agency officials within the Office of Strategic Infrastructure and OCIO were not identified within the Strategy or draft plan even though they are all key stakeholders for NASA's geospatial data holdings.

⁸ [IG-21-001](#).

We believe NASA has not completed an implementation plan for its geospatial data strategy or fully defined roles and responsibilities of Agency officials because the role of the SAOGI has not been strategically positioned within the Agency. OMB guidance calls for the appointment of a SAOGI who can oversee, coordinate, and facilitate NASA's management of geospatial data.⁹ At NASA, the role of the SAOGI is currently assigned to the Agency's Chief Data Officer, a technical position within NASA's OCIO. Based on discussions with the NASA Chief Data Officer, industry best practices position the role at a higher organizational level because it should occupy a change leadership rather than technical role.

Contributing to the issues NASA has experienced in implementing the GDA, SMD holds the bulk of the Agency's geospatial data and the subject matter expertise to manage it yet does not have the statutory responsibility for managing NASA's compliance with the Act. That responsibility falls on the NASA OCIO which has budget and oversight authority for the Agency's data and information. However, the SAOGI is not actively engaged in developing the implementation plan for NASA's Geospatial Data Strategy. Instead, that task was assigned to SMD who, similarly, does not have the authority to drive GDA activities. Conversely, the OCIO does not employ the subject matter expertise to manage NASA's geospatial data holdings. SMD officials responsible for developing the Agency's response plan said they have little authority over the budget and activities needed for its implementation. Therefore, we believe the SAOGI appointment should be strategically aligned in a way to leverage both SMD and OCIO capabilities, as well as involve other key offices like the Office of Strategic Infrastructure. By addressing the placement of the SAOGI within the Agency, NASA will be better positioned to fully implement its Geospatial Data Strategy.

NASA Has Not Established a Complete and Accurate Inventory of Its Geospatial Data

NASA has not developed a complete and accurate Agency-wide inventory of its geospatial data assets. The GDA's second requirement for covered agencies is to collect, maintain, disseminate, and preserve geospatial data such that the resulting data, information, or products can be readily shared with other federal agencies and non-federal users. Although NASA has made progress toward meeting this responsibility, the Agency will not meet this requirement until it develops a complete and accurate inventory.

Most of NASA's geospatial data is Earth science data acquired, processed, archived, and distributed by SMD's Earth Science Division. NASA's vast inventory of Earth science data is cataloged in the Agency's Common Metadata Repository. While most of NASA's geospatial data pertains to Earth science, some geospatial data is not related to Earth science and is not cataloged in the Repository. For example, geospatial data sets relate to Agency facilities and are managed by the NASA Office of Strategic Infrastructure, which results in the data not being included in the Agency-wide inventory of geospatial data. NASA officials acknowledged that an unknown number of non-Earth science geospatial data assets likely exist in other Agency organizations.

NASA lacks a complete and accurate inventory of geospatial data because the Agency has not yet fully implemented a process to identify and catalog its geospatial data. The Agency began such an effort but to date the project is immature and lacks clearly defined plans and milestones.

⁹ OMB Memorandum M-06-07, *Designation of a Senior Agency Official for Geospatial Information* (March 3, 2006).

The effort to catalog all Agency data assets relies on two key components:

1. *The Enterprise Data Platform (EDP)* will provide a comprehensive searchable data catalog of all NASA data assets. The EDP is being developed and implemented using an Agency-wide approach to provide a suite of data management and analytics services for NASA's geospatial data and for the Agency's vast inventory of non-geospatial data. Once the EDP is fully populated, the Agency will have a complete inventory of its geospatial data assets.
2. *NASA's data stewardship program* tasks mission and mission support data domain experts throughout the Agency to serve as data stewards. Data stewards will identify data assets within their domains and ensure they are properly characterized in the EDP.

The EDP and data stewardship program are critical to the Agency's development of a complete and accurate inventory of geospatial data assets, but significant work remains to ensure both components are mature and fully functional. Populating the EDP with a catalog of data assets will rely on input from the data stewardship program. However, the program was described to us as being only in the "organizational design" stage of development and the Agency was unable to provide documentation describing program objectives, milestones, procedures, or roles and responsibilities.

Without a complete and accurate inventory of its geospatial data, as described above, NASA has not met GDA expectations for the second agency responsibility. The lack of an inventory also limits NASA's ability to fully meet other responsibilities established by the GDA as described below.

- *Responsibility No. 3, Promote Data Integration.* Covered agencies must integrate geospatial data from all sources. The goal of data integration is to bring disparate information into a common framework that provides users with cross-source functionality such as consolidated search and centralized data access. Integration promotes sharing by making information more accessible. Without a complete inventory of geospatial data, NASA cannot be assured that all significant geospatial data assets have been integrated into a common framework.
- *Responsibility No. 5, Allocate Resources for Geospatial Data Management Responsibilities.* Covered agencies must allocate resources to meet their responsibilities for effective geospatial data collection, production, and stewardship. NASA has a long history of investing significant resources toward collecting, curating, and disseminating geospatial data. However, without a complete and accurate inventory of geospatial data, the Agency cannot be assured that resources are allocated in a way that most effectively meets the responsibilities established by the GDA.
- *Responsibility No. 8, Promote Application of Geospatial Data Assets.* Covered agencies must use their geospatial information in a way that makes geospatial services and information more useful to the public, enhances agency operations, supports decision making, and improves reporting to the public and Congress. Without a complete inventory of geospatial data assets, NASA may be missing opportunities to use its data in ways described by the GDA.

Challenges Persist with Developing NARA-Approved Records Schedules for NASA's Geospatial Data

NASA has been collecting and managing geospatial remote sensing data since it began sending Earth observing satellites into space in the 1960s. This data is collected through the satellite's instruments, transmitted to Earth, and received by NASA and partner ground stations. NASA also collects geospatial data through airborne missions and field research campaigns. Additionally, the Agency maintains geospatial data related to its geographically distributed Centers and field locations. Remote sensing data is collected in raw form and then rendered usable by NASA's science data systems. Data is sent to the appropriate DAAC for processing and dissemination to the scientific community and the public. While NASA has the infrastructure and expertise to effectively maintain its geospatial data holdings, the fourth responsibility in GDA requires that NARA and NASA coordinate development of geospatial data records schedules.

Currently, NASA does not have the required records schedules approved by NARA for capturing processed satellite observation data including the terrestrial measurements captured utilizing orbiting scientific instrumentation. During our 2020 audit, we held discussions with NARA and NASA representatives and determined there was no affiliated archive agreement in place between the two agencies. In response, we recommended that NASA collaborate with NARA to determine whether an agreement should be established (IG-21-001, recommendation 4). Affiliated agreements are an alternative to the usual physical transfer of permanent historical records into a NARA facility from the creating agency; instead, these agreements permit records to be maintained and made available to the public at a non-NARA facility by non-NARA staff. Essentially, the records are treated like any other records in the National Archives, but the affiliate is responsible for all costs associated with establishing and maintaining the records and archival facility. In February 2022, NARA and NASA discussed the possibility of establishing an affiliated archive agreement. While NARA acknowledged that very large datasets pose unique challenges that require further exploration within the larger community of federal Chief Data Officers, it was reluctant to establish new affiliated archives at this time; therefore, we closed the 2020 audit recommendation. Nevertheless, NARA officials said they will continue to work with NASA to explore options for maintaining and preserving large bodies of scientific data.

According to NARA, records are designated as permanent if they have sufficient historical or other value to warrant their continued preservation by the federal government. Such records may be kept because they document an agency's origins, organization, functions, and significant transactions and activities. Alternatively, records may be kept because they document the persons, places, things, or matters dealt with by an agency; that is, they contain information with significant research or reference value.

While the GDA requires covered agencies to ensure that data products and other records created from geospatial data and activities are included in NARA-approved record schedules, there is some ambiguity concerning which levels of scientific data should be included. The NASA Records Officer continues to work with NARA and subject matter experts within NASA to determine how best to ensure the appropriate data is maintained and preserved. NASA collects immense amounts of data through its Earth-observing satellite and airborne missions and field research campaigns. This data in turn goes through various levels of processing prior to and while being shared with the public and scientific community. For example, NASA defines Level 0 and 1A data as raw instrumentation data directly from the satellite; Level 1B through Level 4 data has been processed, is human readable, and contains valuable static geospatial measurements and readings which are used by researchers to expand our

knowledge of Earth and develop solutions to various problems we face as its inhabitants. See Table 1 for a listing of each data level and its description.

Table 1: Data Processing Levels

Data Levels	Description
Level 0	Reconstructed, unprocessed instrument and payload data at full resolution, with all communications artifacts removed.
Level 1A (L1A)	L1A data is reconstructed, unprocessed instrument data at full resolution, time-referenced, and annotated with ancillary information not applied to Level 0 data.
Level 1B (L1B)	L1B data is L1A data that has been processed to sensor units.
Level 1C (L1C)	L1C data is L1B data that includes new variables to describe the spectra. These variables allow the user to identify which L1C channels have been copied directly from the L1B and which have been synthesized from L1B and why.
Level 2	Derived geophysical variables at the same resolution and location as L1 source data.
Level 2A (L2A)	L2A data contains information derived from the geolocated sensor data, such as ground elevation, highest and lowest surface return elevations, energy quantile heights, and other waveform-derived metrics describing the intercepted surface.
Level 2B (L2B)	L2B data is L2A data that have been processed to sensor units.
Level 3	Variables mapped on uniform space-time grid scales, usually with some completeness and consistency.
Level 3A (L3A)	L3A data is generally periodic summaries (weekly, 10-day, monthly) of L2 products.
Level 4	Model output or results from analyses of lower-level data (e.g., variables derived from multiple measurements).

Source: NASA Earth Science Data and Information System Project.

NASA’s Earth Observing System Data and Information System is designed as a distributed system with major facilities at NASA’s 12 DAACs located throughout the United States. These institutions are custodians of the bulk of NASA’s geospatial data and ensure that data will be accessible to end users. Even so, the GDA requires covered agencies to maintain records schedules for their geospatial data products and activities. In our previous audit, we recommended NASA develop records schedules in coordination with NARA for historically significant geospatial data assets, but at this time NASA is still working with NARA to determine which geospatial data should be included in NARA-approved records schedules (IG-21-001, recommendation 3). Considering the significance of NASA’s observations of Earth over the many years of mission operations, we feel it is imperative that NARA and NASA continue to work together to determine an acceptable path forward to meet the intent of the GDA. This effort should include establishing the appropriate level of scientific data for inclusion in those records schedules.

RECOMMENDATIONS, MANAGEMENT'S RESPONSE, AND OUR EVALUATION

The Geospatial Data Act provides an opportunity for NASA to enhance its management, coordination, and preservation of geospatial data. While NASA continues to implement elements of the Act, the Agency needs to make additional decisions in collaboration with the FGDC, the results of which we plan to assess during future audits. To utilize the Agency's existing expertise in data management, effectively align national and NASA strategies, and ensure that geospatial data is appropriately considered for historical preservation, we recommended that NASA's Chief Information Officer, in coordination with the Associate Administrator for Science Mission Directorate and the Assistant Administrator for Strategic Infrastructure, should ensure:

1. The role of the SAOGI is strategically positioned within the Agency to have responsibility, accountability, and authority needed to meet GDA-assigned agency responsibilities.
2. Roles and responsibilities of the SAOGI and other key stakeholders are defined in both the Geospatial Data Strategy and its implementation plan.
3. The implementation plan for the Geospatial Data Strategy contains detailed action items and milestones, including those for developing a complete and accurate inventory of the Agency's geospatial data.
4. Continued coordination with NARA to establish the appropriate level of scientific data for inclusion in NARA-approved records schedules.

We provided a draft of this report to NASA management who concurred with our recommendations and described planned actions to address them. We consider management's comments responsive; therefore, the recommendations are resolved and will be closed upon completion and verification of the proposed corrective actions.

Management's comments are reproduced in Enclosure V. Technical comments provided by management have been incorporated as appropriate.

Major contributors to this memorandum include Mark Jenson, Financial Management Audits Director; Aleisha Fisher, Team Lead; James Pearce; and Christopher Reeves. Lauren Suls provided editorial and graphic support.

If you have questions or wish to comment on the quality or usefulness of this memorandum, contact Laurence Hawkins, Audit Operations and Quality Assurance Director, at 202 358 1543 or laurence.b.hawkins@nasa.gov.

Paul K. Martin
Inspector General

Enclosures—5

Enclosure I: Scope and Methodology

We performed this audit from January 2022 through September 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Our audit objective was to evaluate the extent to which NASA had fulfilled its responsibilities for managing its geospatial data in accordance with the GDA for fiscal year 2022. Since the geospatial data standards under Section 757 have not yet been established, we follow the approach of CIGIE's working group and that of our previous audit, which was to focus the scope of our work on NASA's progress toward compliance with the 13 responsibilities listed in Section 759(a) of the Act.

To determine whether NASA had fulfilled its responsibilities under the Act, we reviewed applicable laws and regulations; examined the Agency's Geospatial Data Strategy; and interviewed NASA personnel including the Chief Data Officer, Chief Science Data Officer, Acting Chief Archivist, and the Records Officer. Additionally, we held discussions with U.S. Department of Commerce OIG officials and the CIGIE working group. Finally, we performed the audit steps outlined in the CIGIE guidance.

Assessment of Data Reliability

We did not use computer processed data in the performance of this audit.

Review of Internal Controls

We assessed internal controls as necessary to satisfy the audit objectives. Specifically, we assessed the control environment internal control component and the underlying principles relating to establishing structure, responsibility, and authority. However, because our review was limited to this internal control component and underlying principles, it may not have disclosed all internal control deficiencies that may have existed at the time of this audit. Any internal control deficiencies identified are discussed in this report. Our recommendations, if implemented, should correct the identified control deficiencies.

Prior Coverage

During the last 5 years, NASA OIG and the Government Accountability Office have issued 6 reports relevant to the subject of this report. They can be accessed at <https://oig.nasa.gov/audits/auditReports.html> and <https://www.gao.gov>, respectively.

NASA Office of Inspector General

Audit of NASA's Compliance with the Geospatial Data Act ([IG-21-001](#), October 2, 2020)

NASA's Management of Distributed Active Archive Centers ([IG-20-011](#), March 3, 2020)

Review of NASA's Fiscal Year 2019 Digital Accountability and Transparency Act Submission ([IG-20-004](#), November 7, 2019)

NASA's Compliance with the Digital Accountability and Transparency Act of 2014
([IG-18-004](#), November 7, 2017)

Government Accountability Office

Open Data: Additional Action Required for Full Public Access ([GAO-22-104574](#), December 16, 2021)

Open Data: Agencies Need Guidance to Establish Comprehensive Data Inventories; Information on Their Progress is Limited ([GAO-21-29](#), October 8, 2020)

Enclosure II: Agency Responsibilities Under Section 759(a)

Section 759(a) of the GDA establishes 13 responsibilities each covered agency is required to implement to manage its geospatial data. Table 2 lists each responsibility, its description, and the status of the OIG's assessment of NASA's progress in implementing each responsibility.

Table 2: Covered Agency Responsibilities

Responsibility Number	Agency Responsibility (Short Title)	Description	OIG Assessment
1	Agency Geospatial Strategies	Prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data and activities appropriate to the mission of the covered agency, in support of the strategic plan for the National Spatial Data Infrastructure.	Made Progress Toward Expectations See memorandum section, "NASA Has Not Completed an Implementation Plan or Fully Defined Roles and Responsibilities"
2	Support Geospatial Data Sharing	Collect, maintain, disseminate, and preserve geospatial data such that the resulting data, information, or products can be readily shared with other Federal agencies and non-Federal users.	Made Progress Toward Expectations See memorandum section, "NASA Has Not Established a Complete and Accurate Inventory of Its Geospatial Data"
3	Promote Data Integration	Promote the integration of geospatial data from all sources.	Made Progress Toward Expectations See memorandum section, "NASA Has Not Established a Complete and Accurate Inventory of Its Geospatial Data"
4	Ensure Records Retention Schedule for Geospatial Data	Ensure that data information products and other records created in geospatial data and activities are included on agency record schedules that have been approved by the National Archives and Records Administration.	Made Progress Toward Expectations See memorandum section, "Challenges Persist with Developing NARA-Approved Records Schedules for NASA's Geospatial Data"

Responsibility Number	Agency Responsibility (Short Title)	Description	OIG Assessment
5	Allocate Resources for Geospatial Data Management Responsibilities	Allocate resources to fulfill the responsibilities of effective geospatial data collection, production, and stewardship with regard to related activities of the covered agency, and as necessary to support the activities of the Committee.	Made Progress Toward Expectations See memorandum section, "NASA Has Not Established a Complete and Accurate Inventory of Its Geospatial Data"
6	Use Data Standards	Use the geospatial data standards, including the standards for metadata for geospatial data, and other appropriate standards, including documenting geospatial data with the relevant metadata and making metadata available through the GeoPlatform.	Not Applicable See Enclosure III, "CIGIE Letter to Congress"
7	Support Coordination and Partnerships	Coordinate and work in partnership with other Federal agencies, agencies of State, tribal, and local governments, institutions of higher education, and the private sector to efficiently and cost-effectively collect, integrate, maintain, disseminate, and preserve geospatial data, building upon existing non-Federal geospatial data to the extent possible.	Meets Expectations
8	Promote Application of Geospatial Data Assets	Use geospatial information to— (A) make Federal geospatial information and services more useful to the public; (B) enhance operations; (C) support decision making; and (D) enhance reporting to the public and to Congress;	Made Progress Toward Expectations See memorandum section, "NASA Has Not Established a Complete and Accurate Inventory of Its Geospatial Data"
9	Protection of Privacy and Confidentiality	Protect personal privacy and maintain confidentiality in accordance with Federal policy and law.	Meets Expectations
10	Declassified Data	Participate in determining, when applicable, whether declassified data can contribute to and become a part of the National Spatial Data Infrastructure.	Not Applicable

Responsibility Number	Agency Responsibility (Short Title)	Description	OIG Assessment
11	Non-Duplication of Data	Search all sources, including the GeoPlatform, to determine if existing Federal, State, local, or private geospatial data meets the needs of the covered agency before expending funds for geospatial data collection.	Meets Expectations
12	Ensuring High-Quality Data	To the maximum extent practicable, ensure that a person receiving Federal funds for geospatial data collection provides high-quality data.	Meets Expectations
13	Point of Contact	Appoint a contact to coordinate with the lead covered agencies for collection, acquisition, maintenance, and dissemination of the National Geospatial Data Asset data themes used by the covered agency.	Meets Expectations

Source: NASA OIG analysis of Agency information.

Enclosure III: CIGIE Letter to Congress



October 18, 2021

The Honorable Maria Cantwell
Chairwoman
The Honorable Roger F. Wicker
Ranking Member
Committee on Commerce, Science,
and Transportation
United States Senate
Washington, D.C.

The Honorable Eddie Bernice Johnson
Chairwoman
The Honorable Frank Lucas
Ranking Member
Committee on Science, Space,
and Technology
U.S. House of Representatives
Washington, D.C.

Dear Chairwomen and Ranking Members:

The Council of the Inspectors General on Integrity and Efficiency (CIGIE) recognizes and appreciates your leadership on issues of geospatial data. In particular, we believe the enactment of the Geospatial Data Act of 2018 (P.L. 115-254) will improve the continuing development of geospatial data and technology. To make sure this happens, the Geospatial Data Act provides for oversight by way of the Federal Inspectors General. Specifically, the Geospatial Data Act requires the biennial completion of a review of Covered Agencies' compliance with standards established by the Act, Covered Agencies' responsibilities detailed in the Act, and Covered Agencies' compliance with the prohibition of Federal funding for non-compliant datasets.

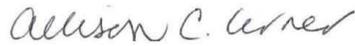
We are writing this letter on behalf of CIGIE to inform you of an important distinction with the biennial Geospatial Data Act audits by the Inspector General community. Specifically, the Fiscal Year 2022 mandatory audit scope period overlaps with the estimated Geospatial Data Act implementation period established by the Federal Geographic Data Committee (FGDC). As part of the implementation phase, the FGDC is evaluating the existing body of standards, among other items. Due to the continuing implementation of the Geospatial Data Act, conducting the mandatory audits as prescribed by the Act would result in reports submitted by the Inspectors General in October 2022 being inconclusive for two of the three audit requirements.

To address this challenge while continuing to meet the mandatory audit requirements, CIGIE convened a working group with representatives from the Covered Agency Inspectors General to reach a consensus on an audit approach for the Fiscal Year 2022 audits. The Covered Agency Inspectors General determined that audits focused on the Covered Agencies' progress toward compliance with the Geospatial Data Act, including the agencies' compliance with requirements under subsection (a), would likely provide the best value to the Covered Agencies, Congress, and the Public. This is a somewhat narrower approach than what the law requires because it is currently difficult to determine which standards the audits should use in evaluating compliance. Also, because the law establishes a five-year implementation period before limiting the use of Federal funds for non-compliant activities, this requirement would not be evaluated in the Fiscal Year 2022 audits.

This consensus approach will afford each Covered Agency Inspector General latitude to perform additional testing based on the Covered Agency's geospatial footprint, as determined necessary by the applicable Inspector General.

Should you or your staffs have any questions about our approach or other aspects of our collective Geospatial Data Act oversight activities, please do not hesitate to contact us at (703) 292-4978 or (703) 248-2296 respectively.

Sincerely,



Allison C. Lerner
Chair, Council of the Inspectors General on
Integrity and Efficiency
Inspector General, National Science
Foundation



Tammy L. Whitcomb
Chair, Council of the Inspectors General on
Integrity and Efficiency, Technology
Committee
Inspector General, U.S. Postal Service

cc: The Honorable Gary C. Peters, Chairman
The Honorable Rob Portman, Ranking Member
Senate Committee on Homeland Security and Governmental Affairs

The Honorable Carolyn B. Maloney, Chairwoman
The Honorable James Comer, Ranking Member
House Committee on Oversight and Reform

The Honorable Jason Miller, Deputy Director OMB and Executive Chair, Council of the
Inspectors General on Integrity and Efficiency

The Honorable Gene Dodaro, Comptroller General, GAO

Enclosure IV: Status of Prior GDA Report Recommendations

We close recommendations from prior audits if corrective actions were completed and verified. However, if recommended or additional corrective actions are necessary, prior recommendations will remain open until evidence is provided that adequately satisfies the intent of the recommendation. Table 3 lists the status of prior OIG recommendations related to NASA’s compliance with the GDA as of October 5, 2022.

Table 3: Status of Prior GDA Recommendations from OIG Report IG-21-001

Recommendation Number	Recommendation	Status
1	Appoint a senior agency official for geospatial information to coordinate with the Federal Geographic Data Committee to align NASA’s geospatial data strategy with the national strategy and assist in the development of the required data, metadata, and quality standards.	Closed
2	Develop a unified Strategy Implementation Plan or “Roadmap” that defines detailed action items, milestones, and responsibilities for geospatial data management in support of missions across NASA.	Open
3	Develop records schedules in coordination with NARA for NASA’s historically significant geospatial data assets.	Closed
4	Collaborate with NARA to determine if there is value in establishing affiliated data archive agreements for NASA’s remote sensing/earth observing geospatial data assets.	Closed

Source: NASA OIG.

Enclosure V: Management's Comments

National Aeronautics and Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001



September 30, 2022

Reply to Attn of: Office of the Chief Information Officer

TO: Assistant Inspector General for Audits

THRU: Associate Administrator for Science Mission Directorate
Assistant Administrator for the Office of Strategic Infrastructure

FROM: Chief Information Officer

SUBJECT: Agency Response to OIG Draft Report, "NASA's Compliance with the Geospatial Data Act (GDA) for Fiscal Year 2022" (A-22-06-00-FMD)

The National Aeronautics and Space Administration (NASA) appreciates the opportunity to review and comment on the Office of Inspector General (OIG) draft report entitled, "NASA's Compliance with the Geospatial Data Act for Fiscal Year 2022 (A-22-06-00-FMD), dated September 6, 2022.

In the draft report, the OIG makes four recommendations addressed to the Chief Information Officer, Associate Administrator for Science Mission Directorate, and the Assistant Administrator for Strategic Infrastructure to utilize the Agency's existing expertise in data management, effectively align national and NASA strategies, and ensure that geospatial data is appropriately considered for historical preservation.

Specifically, the OIG recommends the following:

Recommendation 1: The role of the SAOGI is strategically positioned within the Agency to have responsibility, accountability, and authority needed to meet GDA-assigned agency responsibilities.

Management's Response: NASA concurs. The organizational assignment and designation of the NASA Senior Agency Official for Geospatial Information (SAOGI) will be reassessed to ensure the responsibility, accountability, and authority needed to meet the GDA-assigned Agency responsibilities are strategically placed.

Estimated Completion Date: June 30, 2023.

Recommendation 2: Roles and responsibilities of the SAOGI and other key stakeholders are defined in both the Geospatial Data Strategy and its implementation plan.

Management's Response: NASA concurs. The NASA Geospatial Data Strategy will be updated to include defined roles and responsibilities as proposed by the Federal Geographic Data Committee (FGDC). In doing so, the SAOGI will relay the cross-organizational engagement strategy and ensure NASA's position to effectively address geospatial information issues, policies, budgetary requirements, and activities.

Estimated Completion Date: June 30, 2023.

Recommendation 3: The implementation plan for the Geospatial Data Strategy contains detailed action items and milestones, including those for developing a complete and accurate inventory of the Agency's geospatial data.

Management's Response: NASA concurs. NASA recognizes the requirement for an Enterprise Data Catalog which would include a complete and accurate inventory of NASA's geospatial data. NASA will develop an implementation plan for the Enterprise Data Catalog with detailed action items and milestones, as resources allow. The GDA-mandated complete inventory of NASA's geospatial data will be considered a priority initiative within the implementation plan. GDA objectives, milestones, procedures, roles, and responsibilities will become formalized in support of this and other NASA data endeavors. Engagement in these initiatives will be coordinated with the SAOGI, achieved through cross-organizational participation, and informed by ongoing FGDC direction.

Estimated Completion Date: September 30, 2024.

Recommendation 4: Continued coordination with NARA to establish the appropriate level of scientific data for inclusion in NARA-approved records schedules.

Management's Response: NASA concurs. The NASA Records Officer will continue to work directly with NASA's Science Mission Directorate and the National Archives and Records Administration (NARA) in the development of a records retention schedule for NASA science data. The Records Officer, in consult with the NASA SAOGI, will then submit the schedule to the NARA for Archivist approval. Once approved, the schedule will be included in the NASA Records Retention Schedules.

Estimated Completion Date: September 29, 2023.

We have reviewed the draft report for information that should not be publicly released. As a result of this review, we have not identified any information that should not be publicly released.

Once again, thank you for the opportunity to review and comment on the subject draft report. If you have any questions or require additional information regarding this response, please contact Jeremy Yagle at (757) 864-9622.

Sincerely,

JEFFREY SEATON Digitally signed by JEFFREY SEATON
Date: 2022.09.30 10:47:26 -04'00'

Jeff Seaton
Chief Information Officer