

## Commercial GEOINT Activity Leaderboard: Assessing the Commercial GEOINT Landscape

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### ABSTRACT

The revolution in small satellite technology and its proliferation within the Earth observation marketplace has opened up extraordinary opportunities for the national security space and intelligence communities. Innovative technologies and new business models have the potential to complement the capabilities used for geospatial-intelligence (GEOINT) analysis in the spatial, spectral, radiometric, and temporal domains. To assess the value of this revolution, the Commercial GEOINT Activity (CGA) is evaluating these commercial offerings for their value as GEOINT sources. Toward that end, the CGA Leaderboard is a web-based capability that captures data on these sources. This information is evaluated within a password-protected environment in an effort to glean insight into which companies warrant a more in-depth assessment through demonstration programs or cooperative R&D agreements. The CGA Leaderboard will provide a clear view of the industry's core capabilities and the breadth of its offerings, allowing NGA and NRO to refine future requirements and inform strategic acquisition decisions. Lastly, the direct interaction with the commercial GEOINT marketplace will expose both agencies to the innovative ideas of these emergent companies and ultimately inform architectural, policy, and workforce transformation initiatives.

### INTRODUCTION

The advent of Space 2.0, or New Space, in the Earth observation marketplace is beginning to open up extraordinary opportunities for the national security space and intelligence communities to leverage new technologies and business models. The development of new, and generally smaller, sensor packages that could potentially complement the traditional National Technical Means (NTM) architecture in the spatial, spectral, radiometric, and temporal domains would radically change how geospatial-intelligence (GEOINT) analysis is conducted in the future. In this new environment, a new evaluation framework is required to equitably compare new GEOINT providers across these domains.

Two main areas of inquiry for current and future commercial GEOINT providers stand out. Capability-focused evaluations, based upon a satellite constellation's capabilities, configuration, and sensor types, should be conducted against a consistent set of

capability benchmarks. Second, a variety of risk factors should be included in the evaluation. Those risk factors should range from business maturity, the potential for data compromise, the ease of data integration, and the availability of the company's data and service at any one time.

Once available to the commercial marketplace, the ability to communicate these aspects of the commercial GEOINT marketplace to the government and to receive timely feedback from it will reduce these traditionally high transactional costs. In fact, any feedback from the government on how well a commercial provider's new product or service aligns to a needs benchmark will help fill a major information vacuum for industry.

This paper will provide an in-depth look into the foundational tenants of an assessment framework developed by the Commercial GEOINT Activity (CGA), the web-based capability to facilitate the submission of data from commercial GEOINT

providers, and how it integrates with the larger community based assessment process.

## **BACKGROUND**

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### *The Commercial GEOINT Activity*

In early 2016, at the direction of the Director of National Intelligence, the directors of the National Geospatial-Intelligence Agency (NGA) and the National Reconnaissance Office (NRO) collaborated on the creation of a new organizational entity to focus on commercial GEOINT providers. That organizational entity became the Commercial GEOINT Activity by October 2016 and was staffed with three divisions: Industry and User Engagement, Assessment, and Policy.

The Industry and User Engagement division is focused on building a collaborative network with industry, as well as, developing a web-based interface for gathering market research data from commercial GEOINT providers. That market research data flows to the Assessment team, who was mandated to develop a framework for that assessment process. Finally, the Policy division interfaces with the National Security Council (NSC) and the National Oceanic and Atmospheric Administration (NOAA) on new technologies that could be submitted for a NOAA satellite remote sensing license within 12 months.

Because the CGA team was intentionally limited in size to no more than 15 people, the assessment framework would have to leverage Intelligence Community groups to complete the assessment. The team created a framework focused on automated scoring of GEOINT market research data. Data will be provided by commercial partners and submitted into existing community assessment processes provided by National System for Geospatial-Intelligence (NSG) organizations, like the GEOCOM's Collection Subcommittee's Source Assessment and Integration Working Group (SAIWG), and demonstration resources provided by the parent agencies.

### *The Assessment Framework*

The assessment framework provides a consistent, repeatable means to screen commercial offerings for suitability toward satisfying government GEOINT

functional needs. This screening process will be semi-automated to allow high throughput through the assessment process. The assessment framework's automated capability required the development of a web-based interface, available through the open World Wide Web that could capture data about a company's product or service, transport it to a database held within NGA's security firewall, and display feedback on how that submission was rated against a benchmark of optimized functional capabilities. This web-based interface is known as the CGA Leaderboard.

The assessment framework will consider non-functional elements that capture information about a company's business maturity, a capability's output in a degraded mode, the company's foreign interaction, and how well they integrate within the national architecture. These non-functional elements help to inform potential users of issues that will need resolution prior to any integration into the national GEOINT architecture.

Ultimately, the assessment framework, through the CGA Leaderboard capability, represents an initial market research process that gathers information on the products and services available in the GEOINT marketplace. This initial triage of GEOINT companies will focus NGA and NRO's attention on those companies that provide the best capabilities for the NSG community's needs. The next step in the framework requires a community-wide evaluation of those identified companies through demonstrations within NGA and NRO, as well as, the established SAIWG assessment process.

Once this evaluation and demonstration process has been completed, a more in-depth architectural, systems-of-systems analysis will take place through a variety of tools. These tools will help identify the architectural changes needed to fully integrate the new commercial capability into the operational baseline. Upon understanding the merit and architectural impacts, CGA will provide recommendations to NGA and NRO's directors for investment through normal acquisition processes or through newly developed programs, like NGA's Commercial Initiative to Buy Operationally Responsive GEOINT (CIBORG), which leverages General Services Administration's IT Schedule 70 contracts.

## **INDUSTRY ASSESSMENT METHODOLOGY**

The industry assessment framework is based on a foundational ontology of commercial GEOINT. And

from that ontology, CGA developed its assessment framework taxonomy for GEOINT products and services.

### ***An Ontology of Commercial GEOINT***

Historically, commercial GEOINT has provided the US Government and the national security community with space-based images within the RGB/ panchromatic spectrum and from active sensors. Products from these images were primarily focused on mapping with limited added intelligence value. The potential explosion of New Space/Space 2.0 companies in the marketplace could lead to a wider range of products and services for a diverse number of mapping and intelligence-related activities.

Assuming the government will continue to need maps, the US intelligence community will also focus its attention on where to find or discover objects and activities and to characterize those objects or activities. Companies which provide daily, global coverage—also known as high temporal resolution—of the Earth may be able to satisfy activity discovery-type missions. Those companies focused on high spatial or spectral resolution imagery can meet the needs of the activity characterization missions. Therefore, activity and change naturally formed the foundations of a commercial GEOINT ontology.

Activity discovery-type needs, though, require more than just raw images. These needs require deep learning-based algorithms that can process high-temporal resolution data streams and identify change within the image data set. Therefore, this category should be broken down into its value chain elements, as well. A company can sell the raw, pixel-based data set, a derived product from the pixel data set (e.g. a set of geospatial feature layers or graphics), or structured data that represent the attributes of those geospatial features. These three elements—pixels, derived data, and structured data—can also be applied to the other categories as well—activity characterization and mapping products.

Activity characterization requires object-detection and recognition algorithms to process vast amounts of imagery to provide meaningful data streams that accurately describe what is occurring or what is present within a particular scene. Work in geographic object-based, image analysis (GEOBIA) at the Los Alamos National Labs provides an example of object characterization.<sup>1</sup>

Finally, mapping continues to be a need for any future, commercially provided GEOINT product or service. NGA has traditionally used high resolution data to create a variety of its safety of navigation products and will continue to do so in the future. With the advent of telemetry-based mapping companies, the category of mapping should be expanded to include those services that provide derived products and structured data that can enhance current foundation products

Based on this overall ontology, attributes are assigned within three categories: mission utility, ease of integration, and availability attributes. The fields associated with these attributes can be different, whether the focus is on activity discovery, activity characterization or mapping. Also, these attribute values are weighted to emphasize certain attributes with more impact on satisfying specific needs. Attributes can be combined to create optimized functional profiles that directly relate to company's value proposition.

### ***Measuring Risk***

In addition to gathering data through these functional profiles, there are elements of risk that must be considered in the process, as well. With regard to commercial GEOINT providers, the national security community is interested in the availability of a company's product or service, in the level of protection from outside influence, in the business maturity of the company, and in its ease of integration into the national architecture.

The availability of a product or service focuses on the stability of the company's ability to reliably deliver the data and analytic streams to the government. Companies that cannot deliver their product or service reliably should be assigned a higher risk level. Similarly, those companies that provide access to foreign entities their data, services, or customer information could be assigned a higher risk, depending on the US government's sensitivity to that foreign entity.

Business maturity for New Space/Space 2.0 companies is directly related to revenue streams. A company with an immature business model, usually indicates that it does not have a reliable revenue stream. If the Earth Observation market has an "illusion of resilience"—newer technology is slower to take hold and show reliable revenue streams within an ecosystem over older

technology—then the core issue to watch, from a risk perspective, is the company’s revenue stream.<sup>2</sup>

The ease of integration can be broken down into the standards used for producing image pixels or data streams, the level of data protection, and the interoperability with between commercial vendors and government systems. Ultimately, the ease of integration speaks to the level of effort required for bringing commercial capabilities within the national security infrastructure. If additional coding or systems architecture work is required for seamless integration into government systems, then the overall risk level for a product or service increases. For example, companies that are bundling their products and services on one platform to maximize their revenue streams, but create proprietary environments to cut off their competition would likely impede integration with government systems. This represents a higher risk than separately licensed products or services.<sup>3</sup>

These risk levels would not necessarily preclude future government investment in a company’s product or service, but would be flagged for future consideration when investment recommendations are made to the NGA and NRO directors. Early identification of issues that require higher levels of effort can help align appropriate resources to mitigate additional friction during the integration process.

### *Normalizing Across the Taxonomy*

Each functional profile, as defined by the government, was created from examining specific GEOINT information needs. For some missions, high spatial resolution data is required to properly characterize activity that can be placed into its proper context for intelligence analysis. Those companies providing such data and/or services should have a weighted score, based on those attribute values that optimize the functional characteristics of high-resolution spatial data.

For example, if a company is providing an exquisite sensor constellation that is focused on high spatial accuracy with an eight-bit RGB sensor array delivering imagery every 14 days over specific geographic areas, the company will use a functional profile optimized for spatial accuracy. Companies that focus on providing high spectral resolution with a multispectral sensor would be mapped to the spectrally optimized functional profile.

The overall function of the optimized functional profile serves to help sort through a company’s value proposition and identify those companies that could provide what the government needs to complement existing GEOINT sources. In essence, the profiles provide a method of organizing how the government does its GEOINT market research before a formal acquisition process is initiated.

Based on the total weighted scores within each optimized functional profile, the maximum score represents an optimum fit between that functional profile and the GEOINT needs within the government. A company’s “performance fit” score, then represents how that product or service meets the GEOINT need. Therefore, the maximum score normalizes each functional profile across all functional profiles. That way, the government can easily identify where a company’s product or service is strong or weak relative to other product or service offerings in that category.

In order to provide meaningful feedback to companies on their offering’s match for the government’s GEOINT needs, the Leaderboard provides quintile ranking feedback. Each company can see how each of their submitted product profiles scores against each applicable functional profile. Products and services that score within the top quintile in any one optimized functional profile would be viewed favorably for future demonstration opportunities with the government. Those who score outside the top quintile rankings would be able to see where they are misaligned with the optimized profile and make adjustments, if necessary. However, companies that are specializing within specific profile niches, like high-resolution spatial, spectral, or temporal data, may not see the need to adjust within a functional profile that does not align with their focused profile niche.

## **INFRASTRUCTURE AND DATA TRANSPORTATION**

In order for this assessment framework to effectively inform the market research activities of CGA, a web-based entry and data transportation capability was built outside of government firewalls and integrated with database/analysis capabilities within an unclassified, but secured area of NGA’s information infrastructure. This capability was named the CGA Leaderboard.



## INTEGRATION INTO THE COMMUNITY ASSESSMENT PROCESS

The CGA Leaderboard capability, however, is only the first phase in a more comprehensive, intelligence community-focused assessment process (see figure 3), led by the National System for Geospatial-Intelligence's (NSG) National Geospatial-Intelligence Committee (GEOCOM), with participation from individual elements within NGA and NRO. The intent is to acquire demonstration sets of data or applications from the companies that fall within the top quintiles of product profiles fit and risk rankings, so that they can be tested by a wide variety of communities within the NSG.

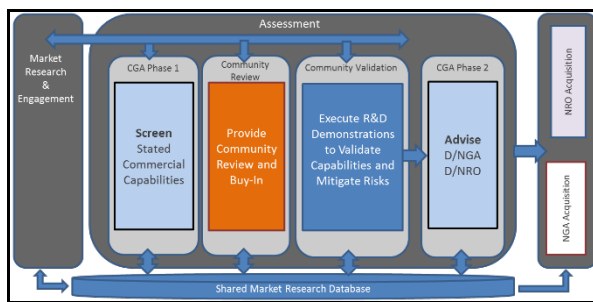


Figure 3--Community Assessment Process

There is a formal evaluation process led by the Source Assessment and Integration Working Group (SAIWG) that includes all the members of the GEOCOM in its in-depth assessment of specific companies and their products or services. Once the CGA Leaderboard has acquired and scored a company's product or service, the SAIWG evaluation process should kick off with additional assistance from NGA and NRO offices, who can perform more in-depth tests of the capabilities.

If a product or service achieves a recommendation from the SAIWG process, then it should be evaluated from a systems-of-systems perspective. A notional commercial product or service should at least provide complementary capabilities or enhance existing national capabilities in order to be considered for the formal acquisition process. Since CGA is not an acquisition authority for either NGA or NRO, any final recommendations that are made to their respective directors on a company's product or service will need to transition into either a formal acquisition process or through the CIBORG/GSA IT Schedule 70 contract vehicle.

## INTENDED IMPACTS

The CGA Leaderboard methodology and capability is intended to transform the relationship between the national security space and commercial GEOINT marketplace into one of more transparency and dialog. CGA expects that the Leaderboard will provide a clearer view into the GEOINT industry's maturity and viability. Likewise, industry will now get immediate feedback on how synchronized they are with the unclassified needs of the government.

This transparency will help in the intentional integration between commercial and national GEOINT capabilities. And leveraging the innovation of New Space companies should allow NGA and NRO to revolutionize GEOINT data and analytic services for the intelligence community.

There is also an intentional push to transform how both government entities design their information and space architectures, policies, and workforce development initiatives. The CGA Leaderboard will expand the realm of the possible for both NGA's and NRO's future.

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## References

1. Lakshman, P., Pope, P.A., Sentz, K., "Semantic Segmentation of multispectral overhead imagery," proceedings of the International Society for Optics and Photonics, vol. 9872 987203-1, Bellingham, WA, 2016
2. Walls, B., "The Space 2.0 Movement (The Role of the Ecosystem)- Part II," Winston and Cooper, <http://winstoncooper.com/the-space-2-0-movement-the-role-of-the-ecosystem-part-ii/>, accessed on 10 April, 2017.
3. Zhu F., and Furr, N. "Products to Platforms: Making the Leap," Harvard Business Review, April 2016, <http://hbr.com>, accessed on 10 April 2017.