COMMERCIAL CAPABILITIES TO IMPROVE MISSION SUCCESS

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ABSTRACT

Two key trends are shaping the current government space environment. Intense budget pressure is limiting investment, and space is becoming an increasingly contested environment that our warfighters depend on for mission success. There is a strong need for affordable solutions that offer flexibility in acquisition and operations and increase overall resilience of the architecture. Against this backdrop, new and sophisticated commercial capabilities are being developed for communications and earth imaging missions. In the area of communications, the current generation of High Throughput Satellites (HTS) and various hosted payloads are being developed for commercial use and can provide augmentation opportunities. In remote sensing, new entrepreneurial ventures are redefining the parameters of earth imaging systems.

This paper presents several models of commercial acquisition of systems for both communications and earth remote sensing missions. These examples are taken from successful and emerging programs that offset existing government requirements and offer flexibility in acquisition approaches. We review the current generation of commercial HTS communications and earth imaging satellites in the context of military requirements.

We use case examples to illustrate creative acquisition approaches that can give the government increased flexibility in delivering space capabilities. We identify four acquisition models for increasing the government's flexibility in acquiring satellite capabilities: (1) traditional government procurement using commercial-like practices; (2) government-commercial hybrid acquisition with hosted payloads; (3) interoperable commercial model (fully compatible commercial capabilities available for lease); and (4) fully commercial service that satisfies government needs. Each of these models is illustrated with examples in the current satellite market for communications and remote sensing. The goal is to illustrate the range of options the government can exploit to achieve cost effective solutions and add critical capabilities in the current budget-constrained environment.

INTRODUCTION

Military spending is under intense pressure, and it is being felt very acutely in the Air Force space acquisition budget. The Air Force Space and Missile Systems Center (SMC) budget has been declining dramatically in recent years. At the same time, there is increasing concern about the congested, competitive, contested nature of the space environment.

As a result there is a growing need for affordable, resilient alternatives as well as acquisition flexibility. The Department of Defense (DoD) initiative known as Better Buying Power 3.0 addresses topics that relate to acquisition flexibility and the increased use of commercial technologies. In his recent white paper, Undersecretary Kendall states that "the way we structure our business deals does affect how industry performs" and "some commercial technologies with military utility are advancing at a faster pace by far than comparable military unique technologies. However, for a variety of reasons many firms that are active in commercial markets choose not to pursue business with the Department, or with our prime contractors. The Department needs to understand the barriers that exist and find ways to reduce or remove them."[1]

This paper focuses on the enduring needs for satellite capabilities serving the needs of the US DoD and trends in commercial satellite capabilities. New commercial satellite technologies are advancing at a faster pace than many military programs, and as they become available, they open alternatives that may be advantageous for the

US government. We explore several of these acquisition approaches and highlight the advantages they offer in terms of flexibility, speed of deployment, and funding profiles.

ENDURING NEEDS FOR SATELLITE CAPABILITIES

The DoD is a large consumer of satellite communications, and has unique requirements (such as protection and survivability for some missions. These core needs for military satellite capabilities can be satisfied through a variety of technical approaches. In addition, total ownership cost can be lower for government-owned systems. These factors dictate a certain amount of government-owned capability. Core MILSATCOM needs can be augmented in a variety of ways, including hosted payloads, leased bandwidth, and even aerial layer networks in some instances. Exhibit 1 illustrates a layered MILSATCOM architecture that encompasses core missions and augmentation functions.

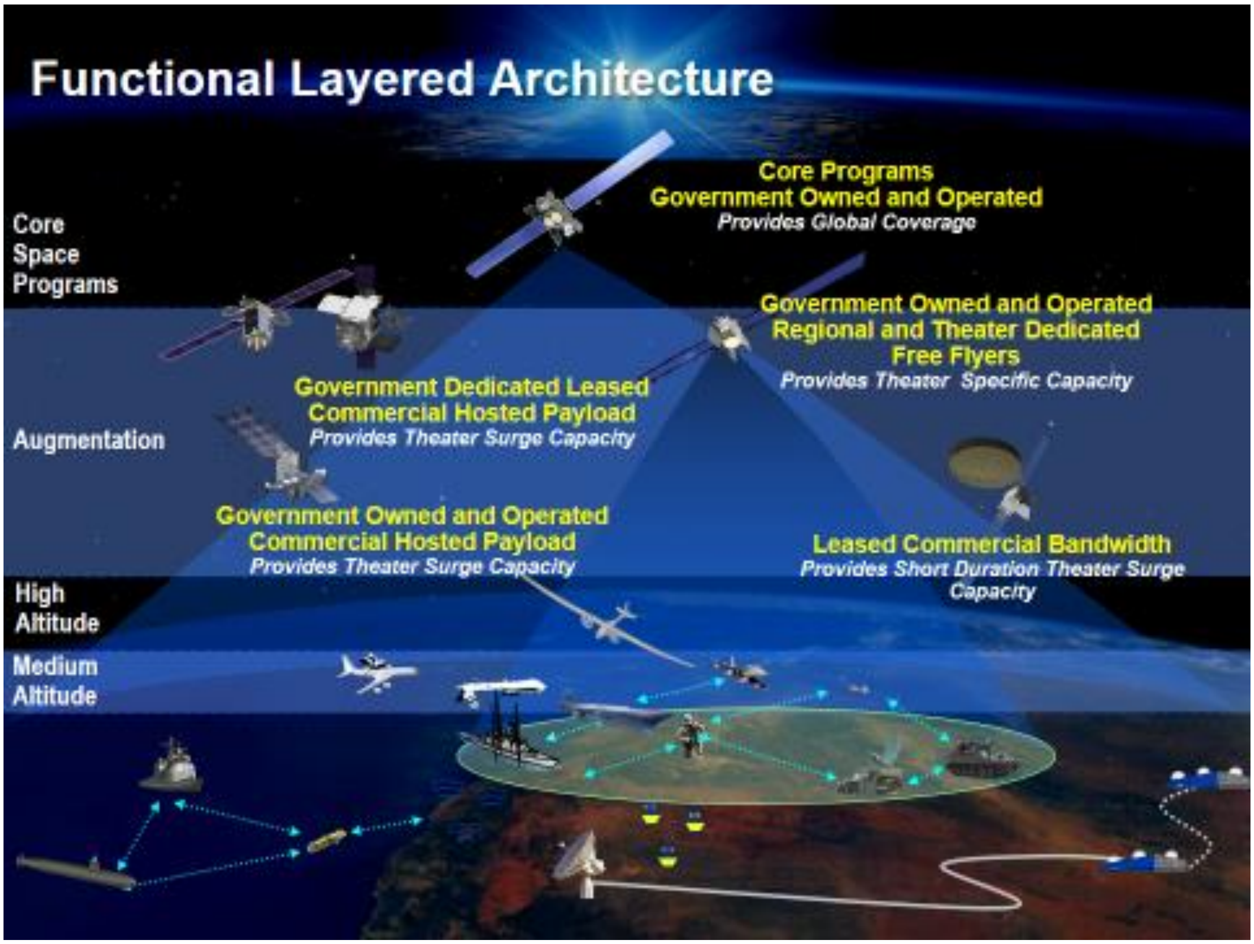

Exhibit 1: Functional layered architecture. Core space capabilities and augmentation services comprise the enduring needs of the DoD space architecture.

There are many factors that need to be considered when determining the DoD communications architecture. These considerations include resilience, disaggregation, protected communications, cyber threats, utility of commercial bandwidth, budget flexibility and others. A Recent CSBA report[2] provides a discussion of many of the relevant issues shaping the future MILSATCOM architecture. The complexity of balancing all the issues required to deliver require a wide variety of approaches to be used. As the driving issues get debated and resolved, a full spectrum of acquisition approaches will be required, including those discussed in a later section of this paper.

TRENDS IN THE COMMERCIAL SATELLITE MARKET

Against the backdrop of budgetary and adversary threats in the military space architecture, the commercial communications market is adding capacity at an accelerated rate. The global space economy grew by 4 percent in 2013, with the majority of that growth fueled by commercial space products, services, infrastructure, and support industries. The growth in data-producing and -consuming devices is driving the explosion in data production and consumption. And the broader demand for connectivity points to even faster growth. By 2018, there will be an estimated 20.6 billion connected devices globally, nearly 3 times the global population[3]. Annual global Internet Protocol (IP) traffic carried by all sources is expected to grow even more dramatically (Exhibit 2), at an overall Compound Annual Growth Rate (CAGR) of over 20%.

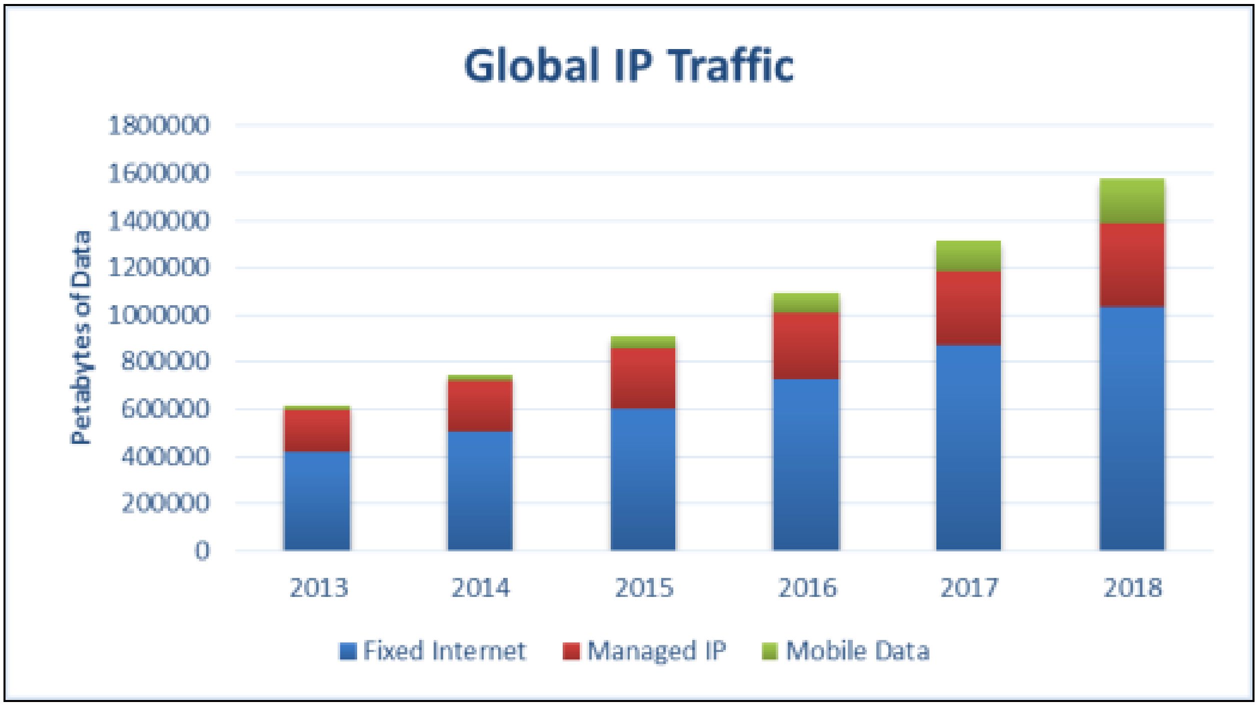

Exhibit 2: Global Internet Protocol (IP) Traffic. Global traffic is growing steadily, with mobile IP traffic becoming a more significant need.[4]

Size and Characteristics of the Market and Market Trends

The worldwide satellite market for data driven services is projected to grow from $9.1B in 2013 to over $16.6B in 2023, a 5.5% CAGR (see Exhibit 3). Compared with the annual growth of over 20% for all traffic, it is clear that the projections for satellite services are lagging overall demand. It is possible, however, that the emerging generation of HTS can achieve competitive cost per bit performance and grow at rates that are more consistent with the overall trends.

Based on industry research, traditional broadcast satellite solutions have not been economically competitive against terrestrial solutions. New HTS technologies and architectures that enable efficient frequency reuse and high bandwidth per spacecraft enable much lower service costs in the same range as terrestrial services. At these lower price points, satellite solutions become viable alternatives to terrestrial solutions opening markets that are not traditionally served by satellite solutions.

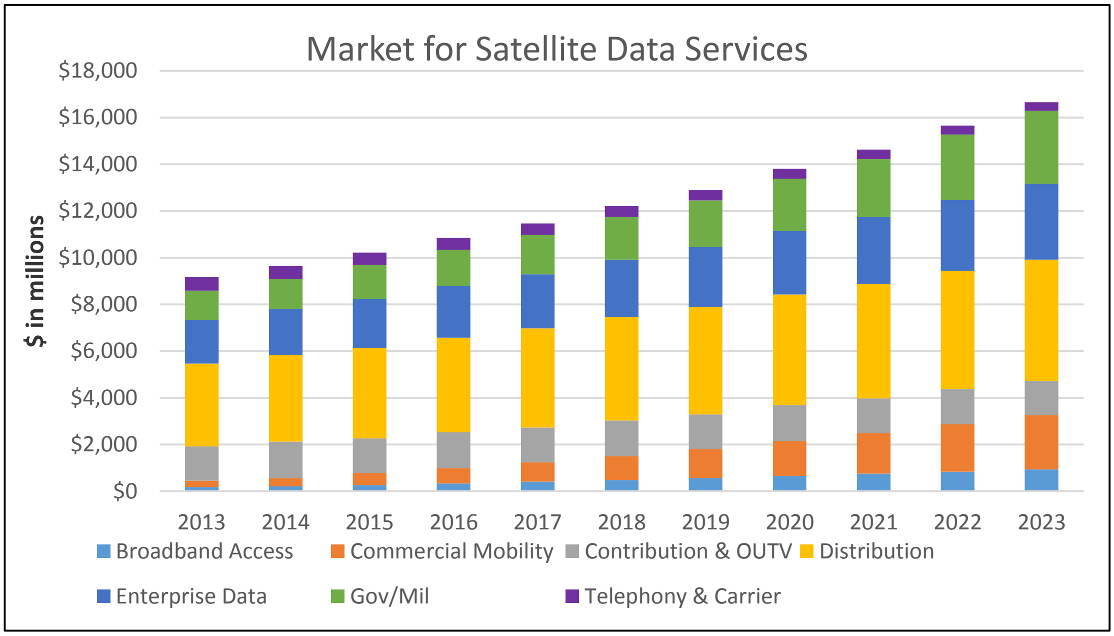

Exhibit 3: Market for Satellite Data Services. Satellite services are projected to grow steadily in all market sectors. Source: NSR, 2014.[5]

ACQUISITION ALTERNATIVES

Commercial satellite capabilities and price points are improving at an unprecedented rate. Some estimates show it is "feasible that 20-30 Terabits of capacity could be launched by 2020."[6] This inflection point in commercial capacity opens new possibilities for flexible acquisition of SATCOM capabilities to support DoD. In particular, the provisioning of commercial or commercial-like approaches to acquisition of satellite services is not a one-size-fits-all proposition. Several viable approaches have been successfully applied, and this section summarizes several examples as an illustrations of the many solutions that are available.

Traditional Government Model with Commercial-Like Procurement

The Wideband Global SATCOM (WGS) system acquisition of the Block 2 Follow-On (B2FO) satellites illustrates a traditional government ownership model employing commercial-like procurement practices. The B2FO procurement takes advantage of a commercial operating model on WGS vehicles 7-10 and implements a Wideband Digital Channelizer upgrade, which is included on satellites WGS-8 and beyond. One of the B2FO satellites is supported by an international partnership supported by Canada, Denmark, Luxembourg, the Netherlands and New Zealand in exchange for access to a portion of the WGS constellationm bandwidth. A similar international partnership was implemented with Australia for WGS-6.

The B2FO oparating model incorporates cost savings from commercial practices without compromising mission assurance or on-orbit availability for the critical WGS mission. The commercial operating model takes advantage of the relatively large number of satellites in the WGS constellation and enables increased speed of decision making and reduced government program office and contractor staffing of Systems Engineering and Program Management as well as business operations. Additionally, a commercially based test program provides schedule reductions for delivering the B2FO satellites. Exhibit 4 summarizes the commercial-like procurement approach in which the government fully procures a satellite system, but takes advantage of commercial practices where they provide a cost savings without reducing mission critical capbility or mission assurance.

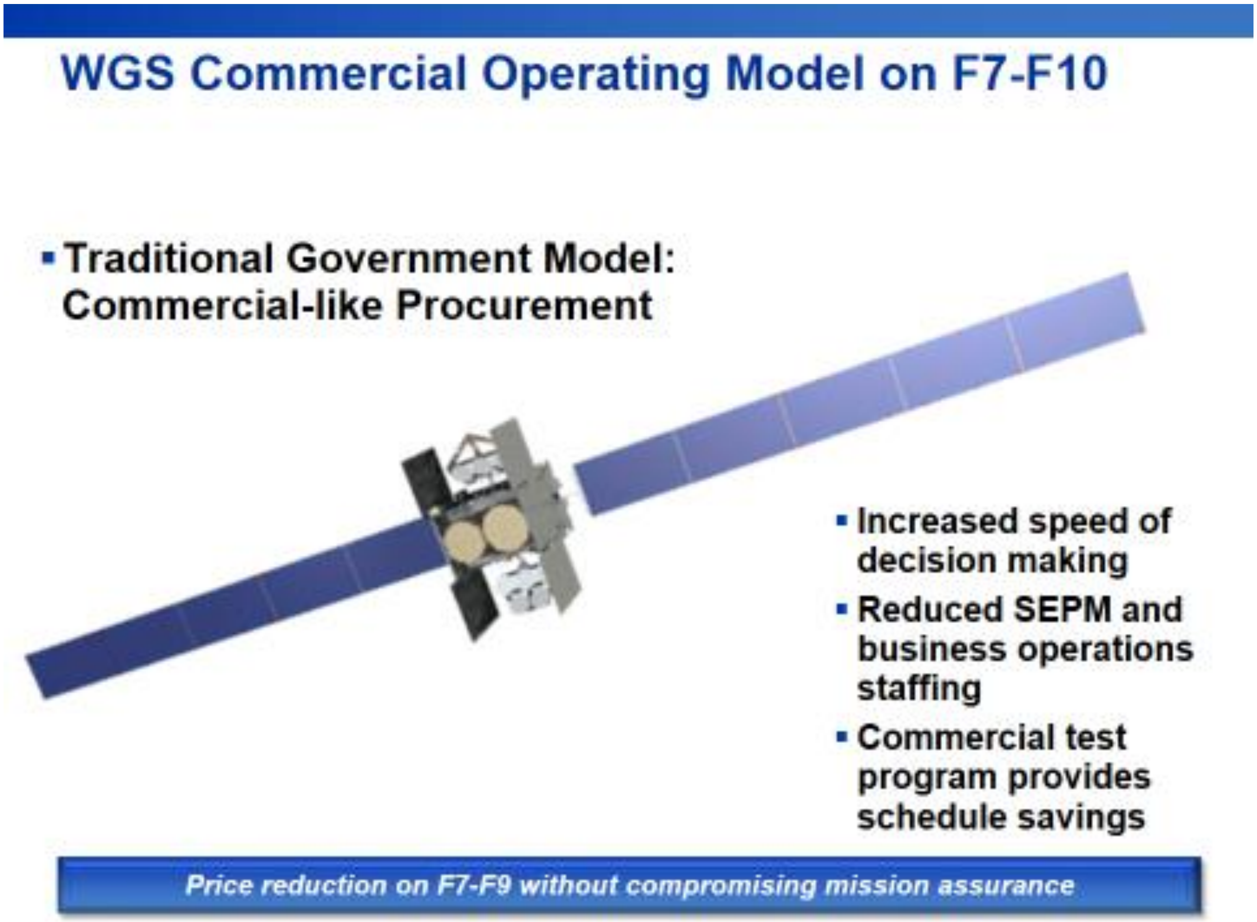

Exhibit 4: Commercial operating model. Government procurement of WGS Block II Follow-On satellites adopted commercial practices and reduced cost.

Government-Commercial Hybrid Model

An example of a hybrid government-commercial model is the Intelsat IS-22 satellite with a hosted UHF payload for the Australian Defence Force (ADF). Intelsat is the original commercial satellite services provider and a leading provider of information worldwide, with over 50 operational satellites in orbit. Intelsat's global headquarters is located in Luxembourg, and their administrative headquarters is in the US.

The IS-22 satellite was part of a procurement of four Boeing 702MP satellites. All four were C and Ku band spacecraft desgined to accommodate hosted payloads. The primary mission of the satellites is to provide fixed satellite services for Intelsat, supplying video, network, and voice services worldwide. In addition, Intelsat and Boeing worked together to create an acquisition and operations model for governemnt hosted payloads on commercial satlellites. ADF chose IS-22 to carry an additional Ultra-High Frequency (UHF) payload when it was launched in March 2012 after a satellite devlopment of 29 months. The UHF payload has 18 25-kHz channels. Under an agreement with the Australian government, use of the UHF payload is reserved for the ADF and the US military. The UHF band is widely deployed for military use because of its adaptability to small, mobile terminals used by ground, sea and air forces. Australian officials have cited the procurement of the hosted payload as a significant cost savings and the most rapid way for the ADF to deploy capabiltiy to support the warfighter.[7]

An identical UHF hosted payload was carried on IS-27 which was destroyed in an unsuccessful launch attempt in February 2013. Exhibit 5 summarizes the IS-22 model of a commercial satellite hosting a government payload.

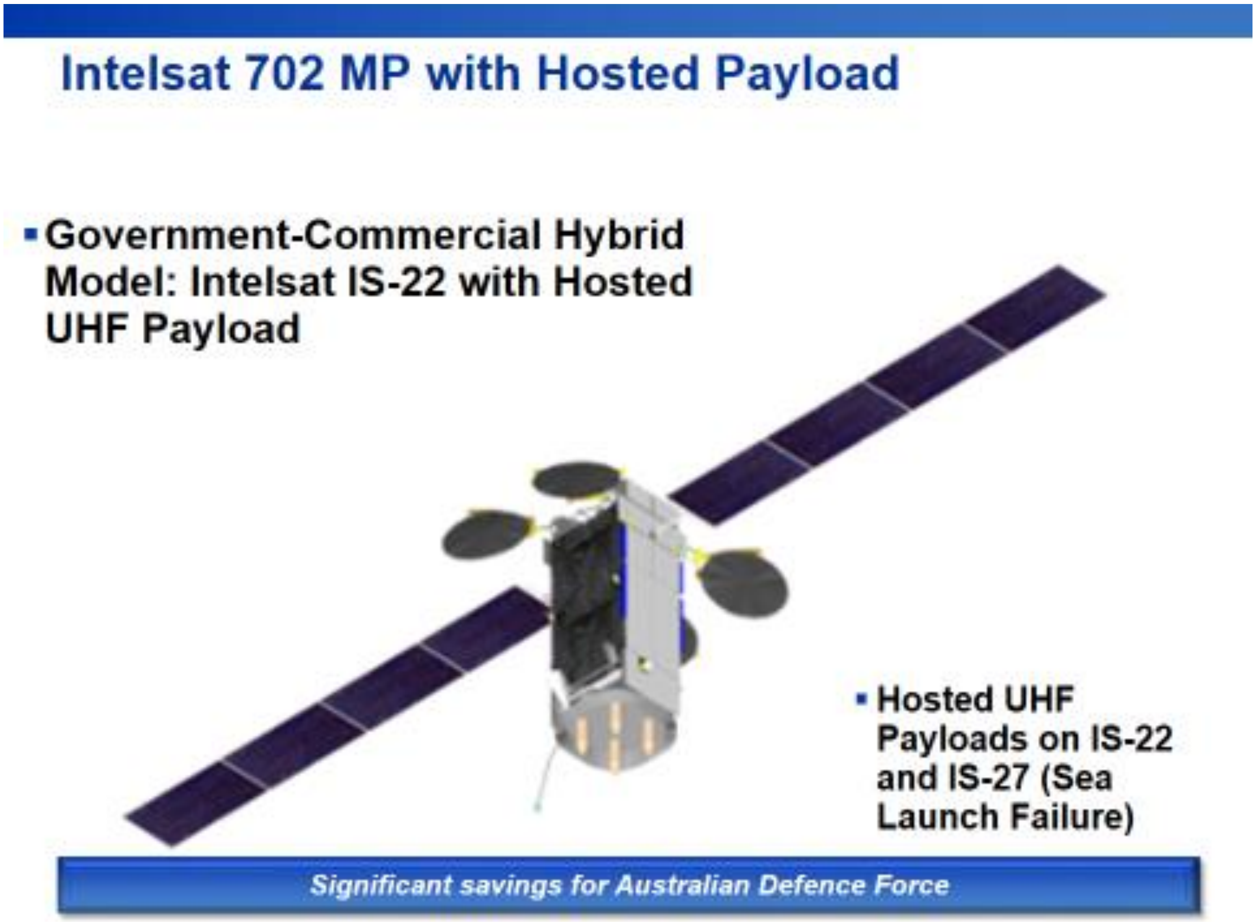

Exhibit 5: Hybrid government and commercial model. Government procured payload hosted on a commercial satellite resulted in affordable solution for the Australian Defence Force.

Commercial Model

An example of a commercial service model for providing mission capability is embodied the Inmarsat-5 (I-5) system. Inmarsat is a global mobile satellite service company headquartered in Britain, and they procured the I-5 which will initially be three 702HP satellites providing global coverage in Ka band. The primary mission for I-5 is for high throughput service supporting aviation, maritime, enterprise and government sectors with reliable and assured access to high-throughput communications through a combination of fixed narrow spot beams. The first satellite was launched in December 2013, the second launch occurred in February 2015, and global service is expected by the end of 2015 (see Exhibit 6).

Each of the I-5 satellites also hosts a High Capacity Payload (HCP) which provides dual military/commercial Ka connectivity. The steerable beams on the HCP are available as a service to commercial or government customer. They military Ka service is fully interoperable with WGS terminals and ground stations. This allows users to augment WGS capacity, and allows a greater number of users access to assured capacity using their existing WGS terminal equipment. The augmentation approach supports government missions such as broadband communications to deep-sea vessels, airborne ISR platforms, or terrestrial users. These commercially available services can be used seamlessly with other WGS users, offering a dimension of flexibility in the acquisition and allocation of connectivity without impacting the terminal requirements of the users.

Exhibit 6: Commercial services acquisition model. Commercially funded hosted payload offers leased services compatible with military frequencies and user equipment.

Emerging Commercial Model

Satellite imaging is a parallel area where a services approach has emerged as a way to satisfy both commercial and government needs. An emerging model is evolving from this approach that incorporates commercially available services that provide operationally relevant capability in a resilient platform. This approach is not yet fully realized, but several systems in development that may define this new category. One such system is the 502 Phoenix prototype introduced by Boeing in 2013. The basis for this approach is a commercially developed bus that is suitable for remote sensing missions as well as a resilient platform for government missions. Exhibit 7 shows the 502 Phoenix bus. The ability to consider smaller commercial satellites as part of a resilient architcture, an augmentation system, or a dispersed collection system may enable even greater flexibility and mission responsiveness in the future.

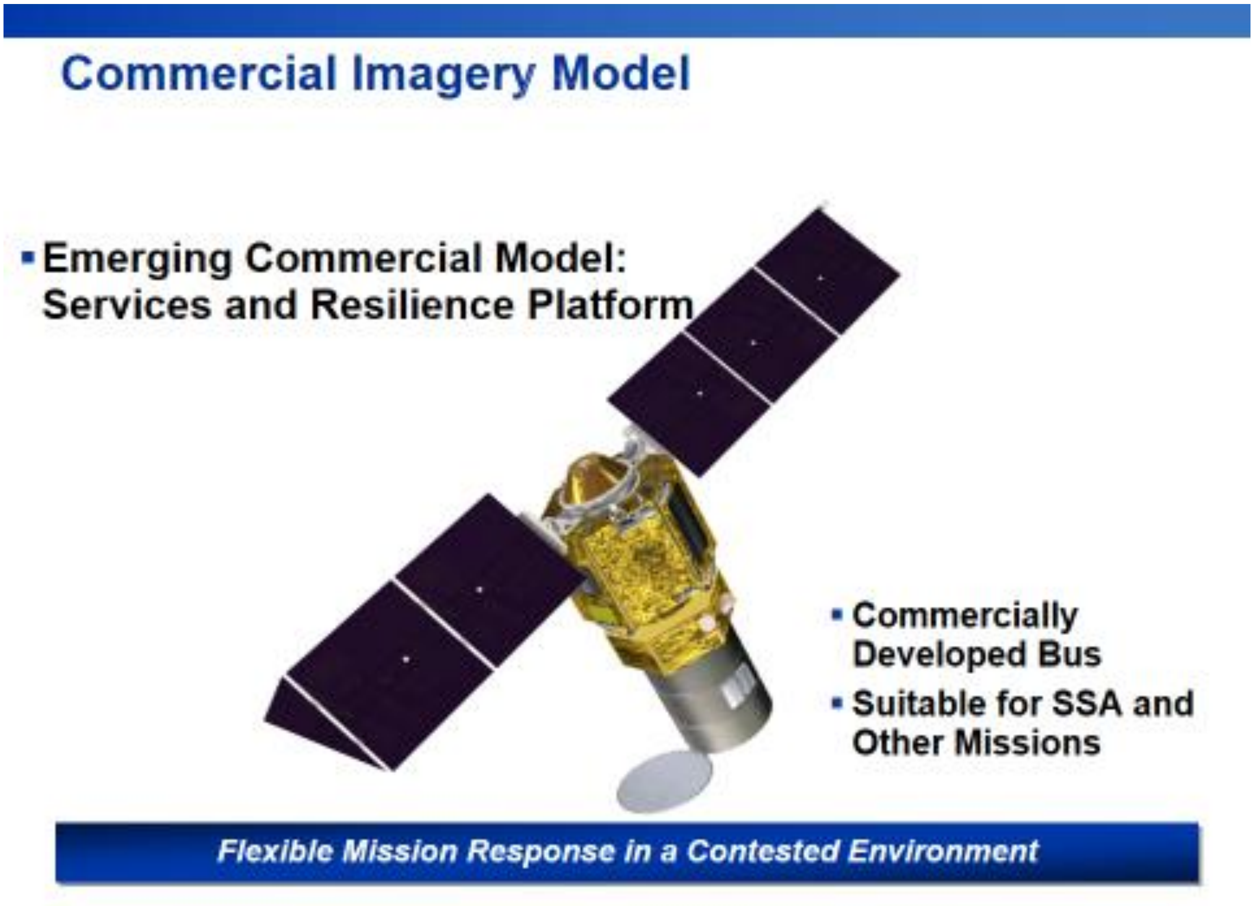

Exhibit 7: Commercial imagery model. Commercially developed system offers resilience through dispersed, lower-cost satellites.

CONCLUSION

An increased focus on commercial approaches to military needs requires a nuanced understanding of a range of "commercial" approaches to satellite capacity. This paper introduced several alternative acquisition approaches that can give the government increased flexibility in delivering space capabilities. In particular, we discussed four acquisition models for increasing the government's flexibility in acquiring satellite capabilities: (1) traditional government procurement using commercial-like practices; (2) government-commercial hybrid acquisition with hosted payloads; (3) interoperable commercial model (fully compatible commercial capabilities available for lease); and (4) fully commercial service that satisfies government needs. The rapid development of commercial technology, the insatiable demand for bandwidth and the creativity of the space acquisition community will doubtless develop additional innovative approaches to supporting warfighter needs.

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[1] Honorable Frank Kendall, "Better Buying Power 3.0," *White Paper*, Office of the Under Secretary of Defense, Acquisition, Technology and Logistics, 19 September 2014. http://www.acq.osd.mil/fo/docs/Better_Buying_Power_30-091914.pdf

[2] Todd Harrison, "The Future of MILSATCOM," Center for Strategic and Budgetary Assessments, 2013. http://csbaonline.org/publications/2013/07/the-future-of-milsatcom/

[3] Satellite Industry Association (SIA), Annual State of the Satellite Industry Reports. http://www.sia.org/annual-state-of-the-satellite-industry-reports/2014-sia-state-of-satellite-industry-report/

[4] Cisco Visual Networking Index (VNI) Global Mobile Data Traffic Forecast Update http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

[5] "Global Satellite Capacity Supply and Demand," Northern Sky Research, 11th Edition, July 2014.

[6] Prashant Butani, "LEO HTS Constellations: What Happens If?," Northern Sky Research, http://www.nsr.com/news-resources/the-bottom-line/leo-hts-constellations-what-happens-if/

[7] "Case Study: Australian Defence Forces UHF Payload," Hosted Payload Alliance. http://www.hostedpayloadalliance.org/Hosted-Payloads/Case-Studies/UHF,-the-Australian-Defence-Force-(ADF)-and-Intels