A New Paradigm for US Academia and the National Security Space Community


Dr. Brandon “BT” Cesul
Sr. Scientist, IAI-Ann Arbor
August 2016
The opinions expressed in this article are the author's own and do not reflect the view of Integrity Applications Incorporated, or any USG entity referenced within.
Background

• US Gov’t National Security Space (NSS) community is in the middle of a transformation
  – POTUS Strategic Space Initiative (SSI) based on increased risk to US space architecture
  – Multiple NSS entities looking for ways to tap into innovation and capability being developed in the small sat community

• Special attention being put toward leveraging US Academia
  – Existing utilization of US academia has been through UARC support, military affiliated universities, and select bilateral engagements
  – NSS looking to expand outreach for multiple problems, that US Academia potentially has the resources to solve

From Space News, 18 May 2016:
“While the NRO is often associated with some of the space industry’s heaviest and largest satellites, Sapp said the NRO is also launching cubesats, and not just as experiments or technical demonstrations. ‘Now, we’re using them for actual mission application,’ (Sapp) said. The NRO has sponsored more than 15 cubesats on various launches over the last five years. ‘Cubesats, smaller sat, combined with affordable launch, are a huge enabler for us,’ she said. ‘It’s exciting.’ “
"Modern armed forces cannot conduct high-tempo, effective operations without reliable information and communication networks and assured access to cyberspace and space."

DOD Strategic Guidance, January 2012

Space is increasingly contested in all orbits. Today space systems and their supporting infrastructure face a range of man-made threats that may deny, degrade, deceive, disrupt, or destroy assets. Potential adversaries are seeking to exploit perceived space vulnerabilities. As more nations and non-state actors develop counterspace capabilities over the next decade, threats to U.S. space systems and challenges to the stability and security of the space environment will increase. Irresponsible acts against space systems could have implications beyond the space domain, disrupting worldwide services upon which the civil and commercial sectors depend.
Not Just a “Black World” Concern

China tests a direct ascent ASAT system, 2007

Russia Flight Tests Anti-Satellite Missile
Moscow joins China in space warfare buildup

Russia tests a direct ascent ASAT system, 2015

Iran jams BBC broadcasts, 2009

Libya jams Thuraya satphone signals, 2011
And Not Just Anti-satellite Activity

China has reportedly developed and tested its first anti-satellite ballistic missile (ASBM) called DF-21D, with a maximum range exceeding 1,450 kilometres (900 mi.), according to the U.S. National Air and Space Intelligence Center. The Intelligence Center did not believe it was deployed in 2009. The guidance system is thought to be still in an evolutionary process as more UAV and satellites are added.

The US Department of Defense stated in 2010 that China has developed and reached initial operating capability of a conventionally armed hypersonic land-based anti-satellite ballistic missile based on the DF-21. This would be its first ASBM and weapon system capable of targeting a moving aircraft carrier strike group from long-range, land-based mobile launchers. These would combine maneuverable reentry vehicles (MaRVs) with some kind of terminal guidance system. Such a missile may have been tested in 2005-6, and the launch of the Jianbing-9/Yaogan-1 and Jianbing-9/Yaogan-2 satellites would give the Chinese targeting information from SAR (Synthetic Aperture Radar) and visual imaging respectively. The upgrades would greatly enhance China’s ability to conduct sea-denial operations to prevent US carriers from intervening in the Taiwan Strait.

The United States Navy has responded by switching its focus from a close blockade force of shallow water vessels to return to building deep water ballistic defense destroyers. The United States has also assigned most of its ballistic missile defense capable ships to the Pacific, extended the SMD program to all Aegis destroyers and increased procurement of SM-3 BMD missiles. The United States also has a large network optimized for tracking ballistic missile launches which may give carrier groups sufficient warning in order to move away from the target area while the missile is in flight.

Use of such missiles has been said by some experts to potentially lead to nuclear exchange, regional arms races with India and Japan, and the end of the INF Treaty between the United States and the Soviet Union, to which the People’s Republic of China is not a party.

Some have also suggested China could develop a “MIRV’d” DF-21D with multiple independent missiles.

China has recently launched a series of satellites to expand its ASBM efforts:

- Yaogan-VII electro-optical satellite - 9 December 2009
- Yaogan-VII synthetic aperture radar satellite - 14 December 2009
- Yaogan-IX Naval Ocean Surveillance System (NOSS) constellation (3 satellites in formation) - 5 March 2010
- Yaogan-XVI Naval Ocean Surveillance System (NOSS) constellation - 20 November 2012
Common Perception

“The US Gov’t Space Program”

Logos of NASA, the U.S. President's Seal, the U.S. Air Force, and the National Reconnaissance Office (NRO).
US National Security Space (The Reality)
The Risk Equation

Risk = Threat x Vulnerability x Intent
The Risk Equation

Risk = Threat x Vulnerability x Intent
So we are faced with:

• Increasing risk...

• Lack of skilled manpower from intelligence to acquisitions to policy....

• Reduced resource environment....

• An atrophied industrial and R&D base...
Threat Environment

So we are faced with:

- Increasing risk...
- Lack of skilled manpower from intelligence to acquisitions to policy....
- Reduced resource environment....
- An atrophied industrial and R&D base...

SOLUTIONS

- Research into threat and vulnerability mitigation via technical means
- Improved recruiting via targeted skill sets and establishing continuous professional development programs
- Utilize non-traditional hi-skill expertise sets that may be lower cost... to you!?!?
- Invest in R&D locations capitalizing on next-gen manufacturing techniques and innovative mission designs
So we are faced with:

- Increasing risk...
- Lack of skilled manpower from intelligence to acquisitions to policy...
- Reduced resource environment....
- An atrophied industrial and R&D base...

SOLUTIONS

- Research into threat and vulnerability mitigation via technical means
- Improved recruiting via targeted skill sets and establishing continuous professional development programs
- Utilize non-traditional hi-skill expertise sets that may be lower cost... to you!?!?
- Invest in R&D locations capitalizing on next-gen manufacturing techniques and innovative mission designs

US ACADEMIA!
So we are faced with:

- Increasing risk...
- Lack of skilled manpower from intelligence to acquisitions to policy...
- Reduced resource environment....
- An atrophied industrial and R&D base....

US ACADEMIA?

SOLUTIONS

- Research into threat and vulnerability mitigation via technical means
- Improved recruiting via targeted skill sets and establishing continuous professional development programs
- Utilize non-traditional hi-skill expertise sets that may be lower cost... to you!?!?
- Invest in R&D locations capitalizing on next-gen manufacturing techniques and innovative mission designs
The Plan to Engage Academia

• No single plan exists—pockets of advancement are trying to coordinate with each other
  – NASIC (Intel Community), AFOSR, NRO, DARPA, DIA, AF Space Command
  – Probably would benefit from some unity of effort

• Focus is on three primary steps
  – Improve recruiting of “space universities” for NSS jobs
  – Increase engagement opportunities for US academia to provide SME or capability to NSS in limited situations
  – Establish some common clearance mechanisms to ensure access to academia at time of need
Providing a Forum – NASIC / AFIT Space Intelligentsia Workshop

30+ USG NSS entities
20+ universities

TS/SCI level discussions on what and how NSS can better engage with US Academia

Next workshop being planned for Winter 2016

Focus: What can Academia bring to the NSS?

POC: Trevor Glick, NASIC/SMDT, trevor.glick@us.af.mil; BT Cesul, IAI-A2, bcesul@integrity-apps.com
Recruiting at “Space Universities”

• NSS has a recruiting problem, recognizes it, and is doing something about it
  – Targeted recruiting at schools with demonstrated commitment and success in space systems, operations, and policy graduates
  – Geographic and demographic diversity being realized
  – Breaking paradigms of “well I didn’t do that and I’m fine” with hiring authorities’ attitudes is difficult

• NASIC leading the IC in changing recruiting
  – Sharing candidate pools with other NSS entities
  – Resource sharing with DNI Recruiting efforts
  – Treating it like “college football” recruiting—know where the best is, develop relationships with the ‘coaches’, establish pipelines, and be present at the ‘summer camp circuit’

POC: Duane Harrison, NASIC/GXS, duane.harrison@us.af.mil

First targets of enhanced space recruiting program
Increasing Engagement Opportunities

**Totals for All Schools (2003-2012)**

<table>
<thead>
<tr>
<th>Active</th>
<th>Graduated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>87</td>
<td>108</td>
</tr>
</tbody>
</table>

**Employment Status of Graduates**

- Government (IC) 21
- Industry (IC) 62
- Other (non IC) 4

% IC Employed 95%

**Classified Co-Op Program, restart in 2017?**

**AFSPC Chief Scientist’s Innovation Days**

**NASIC**

“Under-utilization” study
POC: BT Cesul, bcesul@integrity-apps.com

**DIA “Academic-Analyst Exchange” Program**

**New AFOSR Initiatives**

**Basics**

- **POC**: BT Cesul, bcesul@integrity-apps.com

- **Ongoing**: [View More](#)
Common Clearance Mechanisms

• Working with the NSS almost inherently means working in the classified arena
  – Academia access to stable security clearances has been an issue
  – Initiatives underway at NASIC, AFSPC, and DIA to try to address the issue

• But clearances for academia is a double edged sword

**Advantages**
• Ability to interact with fuller set of NSS actors on wider problems
• More efficient research proposals and operations with proper context
• Students with clearances are more attractive to prospective employers

**Challenges**
• Some campuses are averse to classified work for multiple reasons (legacy culture, foreign contacts, etc)
• Facilities and administrative tails can be prohibitive entry barriers
• Classified work may not be “counted”
Wrap-Up

- Multiple NSS entities are looking at ways to leverage US Academia (and the broader smallsat community) to solve NSS problems
  - Risks are higher, resources are lower (than needed to solve traditionally), and skilled manpower is decreasing
  - US Academia has ways to contribute to solving all these issues
- Three main thrusts are ongoing, but as of now, uncoordinated
  - Individual good works going on, but would benefit from some strategic leadership herding the cats
  - 2017 looks to be a pivotal year as Boulder Lab, Co-op program, NASIC initiatives come to fruition (potentially)
  - Space Intelligentsia workshop for Winter 2016-17 is being scheduled—please contact POC’s if interested in participating
“The rapidly expanding technologies affecting US Space Operations are reflected in foreign elements efforts to expand their space based capabilities or deny ours. The IC needs the advanced knowledge associated with these technologies which are uniquely resident in academic institutions. A strong program to enhance the relationship between the IC and these institutions is critical to ensuring continued US Space Superiority. To this end, the Defense Intelligence Officer for Scientific and Technical Intelligence, Dr. Sean Kirkpatrick, is championing an effort to connect with US academia, to include potentially enhanced and formalized cooperative agreements that can support interactions at classified levels.”

“Securing the assistance of US universities in helping our national space security problems is a priority for me and the seniors I’ve talked to.”

Dr Kirkpatrick is now the Deputy J2 at USSTRATCOM, assisting ADM Haney in standing up the JICSPOC. among other things

Mr Parikh is now an SES at NGA leading the Source Strategy Office

Presentation POC: Dr Brandon “BT” Cesul, bcesul@integrity-apps.com, (734)997-7436 x4647