TOPICS INCLUDE

- Defining key vulnerabilities that our current space assets face—now and in the future
- Strategies to change how we think about our space capabilities
- Two of the greatest challenges we face in developing a comprehensive program to defend our space assets
- Solutions for overcoming these critical challenges

Protecting Our Space Capabilities: Securing the Future

Leading experts discuss the future space environment and how we can best ensure the viability of our space capabilities in the long term.

EXECUTIVE SUMMARY

In July 2008, Toffler Associates, the consulting firm founded by Alvin and Heidi Toffler, authors of *Future Shock* and *Revolutionary Wealth*, assembled a forum of commercial, military, and other government leaders to examine where our space systems are headed, dangers they will face in the future, and what we must do to sustain and protect our space capabilities over the next 15-20 years. A key goal was to answer the question: "What can be done to secure our use of space in the future?" These are the highlights of that thought-provoking forum.

Protecting Our Space Capabilities: Securing the Future

One hundred years ago, a nation's prosperity, influence and the well being of its citizens rose and fell with the dominance of the seas. Today, it is the environment beyond the world's oceans—and beyond the atmosphere itself—where the success of our national future resides.

The space environment, and how we plan for the protection of our vital space capabilities, both are facing a crossroads. Our dependence on space-based assets and their criticality as elements of our national infrastructure are increasing exponentially. And with this dependency comes an exponential vulnerability from the growing matrix of threats that can disrupt and destroy our space systems.

Why Space is Important

Our nation's space and related industries generate over $41 billion dollars a year, with U.S. aerospace and aviation industries representing approximately 10% of our GDP.[1]

Recognizing this, Toffler Associates is working with the U.S. Air Force and others to understand and prepare for the challenges our national space capabilities face today and will face in the future. Independently, Toffler Associates brought together business, military and other government space leaders in July of 2008 to provide a new perspective on the challenges threatening this nation's space capabilities and to discuss potential solutions to these challenges.

A key goal of this dinner event was to answer the question:

"What can be done to secure our use of space in the future?"

The first step to addressing this question is to understand how these threats to our space capabilities might manifest themselves.

Our Current Space Assets: Defining the Vulnerabilities

On January 11, 2007, the government of China shot down one of its own weather satellites. While this incident served as a wake-up call to some that any space system is indeed vulnerable to attack, most citizens are still unaware of just how many threats there are to orbital satellites and what the impact might be if one or more of these satellites is destroyed.

Threats can come in many forms, including:

- **Ballistic threats**—Any object capable of colliding with a satellite, whether intentionally launched to cause harm or unintentionally colliding with a satellite as a piece of space debris, represents a ballistic threat. The object can be as sophisticated as the guided missile from the arsenal of China or some other nation, or as basic (as one of the dinner participants put it) as a "trash-can full of nails" launched into orbit.

- **Jamming threats**—Ground based signals can be used to interdict and disrupt satellite signals, rendering the orbiting system as ineffective as if it had been physically destroyed.

- **Ground station threats**—A nation or group without the capability to launch something into space to reach an orbital satellite can still accomplish a hostile goal via an attack on a ground station. Without the control or the ability to downlink information that resides in the ground station, the satellite becomes useless to those who rely on it.

- **Cyber threats**—Similar to a jamming threat, a cyber attack can thwart or even cause the destruction of a space system by interrupting the computer systems that control the system's effective operation. This is perhaps the means of attack that is most problematic, as the ability to create widespread impact is potentially easy for many and because many of the effects, or the attack itself, could be hidden from a satellite owner or operator.

Threats of all Sizes

- In 2003, it is believed that Cuba jammed the satellite signal of the "Voice of America" broadcast beamed into Iran.

- During both recent military actions in Iraq and Serbia, intelligence suggests that both the Serbian government and the regime of Saddam Hussein attempted to purchase Russian-made GPS jamming technology for the purpose of jamming GPS guided bombs.[2]

The reality is that the potential for damage to American society resulting from an attack on our space-based capabilities is much higher than in the past. The U.S. has an asymmetric advantage over other nations when it comes to how we are able to use space technology and capabilities to enhance our daily lives. Communications, navigation, and financial networks are just a sample of the services that we depend on to keep our society running productively – services which in turn depend

on space systems for their day-to-day functioning. The problem is that this asymmetric advantage is simultaneously an asymmetric vulnerability. We are so dependent on our space systems that an interruption in their proper function will disrupt American society much more than that of other nations.

Added to the inherent vulnerability is the fact that currently we lack a coherent defense or deterrence strategy to prevent an attack on our space assets. During the Cold War, this nation had a very clear deterrence posture to deal with the nuclear weapons threat posed by the Soviet Union. We also had a posture that effectively deterred any interference with our space assets because most of what we and the Soviets did in space was inherently linked to nuclear deterrence. During the Cold War, an attack against space assets would have been seen as a precursor to nuclear warfare. Today, so much of what the U.S. and others do in space is commercial in nature, or in any case unrelated to the nuclear "balance of power." The end result is that there are no longer such clear disincentives to attacking our space capabilities because they are mostly "decoupled" from nuclear deterrence.

After China shot down a satellite and proved their ability to be a space threat, the global uproar that ensued was strong, at least in some circles, but short-lived. Both the general public and government officials prefer to view space as a sanctuary despite evidence to the contrary—a high ground where our satellites are above politics and threats; but they couldn't be more wrong.

Time to Change How We Think about Space

The threats to our space assets are real. And participants in the Toffler Associates dinner discussion felt it is time to change our strategy for thinking about space. The first step is to admit that, at this time, we do not yet *have* a cohesive strategy in place. Hopefully that's about to change.

The United States Air Force and the National Reconnaissance Office have come together to create a new space strategy based on three key principles:

The Space Protection Program

The U.S. Air Force Space Command (AFSPC) and the National Reconnaissance Office (NRO) joined to create a new initiative to provide advice to the military and intelligence community on how to best protect space assets.

Recommended options coming from the program could include the development of new hardware or changes in tactics and procedures for space defense. The first goal is the development of a Congressionally mandated space protection strategy for the country.[3]

- Planning
- Organization
- Clear chain of command

The first product of this strategy is the Space Protection Program (SPP) — a completely new organizational structure with a completely new mission.

The SPP meets two of the three new requirements: organization and a clear chain of command. While the planning phase is still under development, one new concept is already planned to enhance our defensive abilities: Space Situational Awareness (SSA).

Where the Dollars are going

According to the House-Senate conference report on the FY2008 defense appropriations bill, Conferees added $100 million above the Bush administration's request for nearly $200 million to increase space situational awareness.

This funding includes:

- $63 million for "counterspace systems" that would warn of impending threats to U.S. satellites, destroy or defend against attackers, and interrupt enemy satellites
- $7 million for so-called offensive counterspace systems
- $18 million for second-generation counter-satellite-communications system "to provide disruption of satellite communications signals in response to U.S. Strategic Command requirements"
- At least $28 million for Rapid Identification Detection and Reporting System designed to provide "attack detection, threat identification and characterization, and support rapid mission impact assessments on U.S. space systems."[4]

SSA

The relationship between SSA and space protection or defense is simple, but vital: we have to know what spacecraft and other objects are in space, where they are, and ideally who owns them, what their capabilities are, and even what their intentions are, before we can ensure protection of our space capabilities. The concept of SSA being discussed under the Space Protection Program moves beyond "buying more sensors and figuring out how to use them," as one participant put it. It involves a holistic assessment of the capabilities this nation already has, including commercial resources and data available to us from our allies. The goal is to then build a network of all the sensing capability of all of these assets together.

When we have a high degree of data-sharing between the U.S. military, commercial and international interests and a hostile action occurs, we can more easily deter-

mine where the attacking object came from, what it attacked, and the nature of threat (such as from debris, satellite damage or destruction, or disruption in data.)

Two Challenges to Overcome in Space Protection

While the actions being taken and considered under the SPP are positive steps in the right direction, participants in our discussion recognized that there are significant hurdles to overcome if we are to realize real, measurable progress in securing the future sustainability of our space systems. The group centralized these issues around two primary challenges, and presented some possible solutions to address these challenges.

Challenge #1: Apathy

The participants identified apathy as a major roadblock to gaining the support needed for a comprehensive and thorough space defense initiative. Indifference to the importance of the issue can be found in three segments of society:

- The general public currently does not fully appreciate the importance of space in our daily lives or our national defense, due in part to a lack of coverage and explanation in the general media.

- Congressional leaders follow the will of the people. Without significant interest from their constituents, space protection funding is a low-priority issue in the minds of many elected officials. While the issue of space protection is rising on the radar of many in Capitol Hill, there is still a long way to go.

- Commercial entities that own space-based assets tend to think that their satellites would never be targeted by a hostile group. They rely heavily on insurance, seeing it as a more cost-effective alternative to defense given the unlikely nature, in their opinion, of an attack against their systems.

These are views that must change, if we are to successfully shift our space protection program to a model that is ready for the future challenges.

Solution #1: Education and Leadership

The dinner participants believed that a stronger education effort, combined with executive leadership, is the key to mobilizing more support for space protection programs and initiatives. These efforts should include:

- Communications programs targeted to the general public. We need to educate on just how important space systems are to the normal lives of the populace, and how something as simple as space debris can cause a major interruption in the technologies that they depend on every day.

Understanding the Impact

The U.S Chamber of Commerce Space Enterprise Council is working with the George Marshall Institute to create a "top off exercise" on a "day without space assets." Since economic and national security are increasingly intertwined, they are bringing together the business community and the national security community to open lines of communication and understand what it really means if a space asset goes down.[6]

- Increased outreach to Congress. One participant noted that in 32 years, he had provided a threat briefing on our national space assets to Congress only a handful of times. But he has provided 15-20 briefings to Congress in the past year alone. This suggests a burgeoning shift in perception in the halls of government, and one that needs to continue.

- More education focused on the private sector. Private commercial entities need to be reminded that with more and more military communications moving across leased commercial satellites[5] (for example, 70% of U.S. Central Command's (CENTCOM's) traffic today), the corporate world is indeed a target for those who would do harm. Companies with space assets are owners and operators of an increasingly vital part of our national infrastructure, and they need to take their own defense seriously for sake of everyone involved.

- Leadership on the part of the Executive Branch. The group recognized that education efforts can only go so far. It is the Executive Branch of government that ultimately must assume responsibility for the issue of space defense, independent of public and Congressional support on the issue. The Executive Branch needs to build a global collation of partners to support a space protection program, and it needs to advocate for development of technologies that can best support space situational awareness and related efforts.

Better education and leadership can make a difference in building the national support we need to take aggressive action on this issue.

Challenge #2: Dissuasion and Deterrence

Our focus on dissuasion and deterrence has faltered in recent years with the collapse of the Soviet Union and a change in how space is used and perceived. During the Cold War, we had a "parity of assets" in which each side had just as much to lose if they destroyed a satellite of the competing power.

That situation no longer exists, as the United States is much more dependent on its space assets than any other nation on Earth. This situation in turn drives the question: If one of our space assets is attacked and destroyed, what exactly is the proportionate response? The problem is, today, we cannot answer that question as clearly as we must be able to do, and the responsibility for determining the answer and backing it up with capabilities and declarations also is unclear.

This problem is compounded by the fact that the face and nature of the potential adversaries who might challenge us in space or attack our space capabilities is changing. Right now, we are dealing with "rational space actors" that include large governments such as China and Russia – entities that we know how to reason with. But, as one participant stated, in as little as 5-10 years we might be dealing with "irrational space actors," those countries or groups whose ideology cannot be reasoned with but which will have the capability to interfere with or destroy our space assets. In that scenario, dissuasion becomes a significant challenge.

Solution #2: Flexibility and Distribution

The answer to this challenge is twofold, involving improvements in both our space and foreign policy and in how we think about the distribution of our space assets.

Flexible Space Policy

Many of the participants in this discussion believed we are facing today a situation similar to the beginning of the Cold War. When the nuclear "balance of power" was a brand-new concept, the United States' policy on deterrence and dissuasion was based on a rigid, monolithic model. This model had only one response if a hostile incident occurred, and it was realized early on that this thinking would ultimately result in escalation of hostilities, not de-escalation of tensions. Several study groups came together with policymakers and others and developed a more flexible model for deterring and dissuading the Soviet Union.

Similar thinking is needed today to ensure that the U.S. has a proper and proportionate response to any interference with our space systems. As a nation, we need to decide what critical space assets we are going to protect. Then we need a clear declaratory strategy that states what the response will be if an asset is compromised by a hostile power. And this response must be flexible. It must be customized to the type of nation or group involved, the type of asset that was interfered with, and the exact level of interference.

A Global Effort

Addressing the 58th International Astronautical Congress (IAC), the government of India warned that space may become the "battlefield of the future."

India proposed a "robust" international mechanism for protection of space assets since they were "vulnerable to attacks."[8]

The dinner participants believed that the effectiveness of this approach will be augmented by building a coalition of nations that will respond with one voice along this "flexible spectrum" to any hostile act in space. The more sensors in space provided by friendly nations, the more evidence we will have in the event of a hostile act. When these nations observe an incident for themselves using their own equipment, building national condemnation for an attack will be that much easier. The concept can be thought of as "mutually assured observation," and it greatly raises the deterrence capability of both the U.S. and the global community.

A Question of Response

U.S. Rep. Terry Everett (R-AL), chairman of the House Armed Services Strategic Forces Subcommittee, recently disclosed in an interview allegations that China illuminated a U.S. satellite with a laser. The Chinese laser did not pose a "serious threat" to the U.S. satellite, and was likely fired in an attempt to demonstrate the technology, and possibly gauge the U.S. response.

The question then becomes: "What is the proper response to such an action?"[7]

The group also felt that we need to enhance our ability to project our national space power in innovative ways. One example cited was how the Chinese government is involved in sharing its space power with developing nations on the African continent. In exchange for fuel oil, these nations gain access to the telecommunications and other space-based capabilities provided by China. It is this type of creative thinking that is missing from our current policies—thinking that can result in new international cooperation worldwide to our benefit.

Asset Distribution

The reality is that the U.S. does not have the ability to protect all of its space assets, military and commercial, using defensive technology alone. This ability will not be possible for several more years if ever, and such a comprehensive system will probably be prohibitively costly to develop.

The group agreed that creating a more distributed network of space assets is a better option. Right now, the foundation of most of our space systems dates back to the original space program. It is a model based on placing as much capability and sophistication as possible into every satellite we launch. The problem with this concept is that attacking one satellite then can result in great damage to the national space infrastructure.

Distribution in Action: Robust Capability for GPS

Toffler Associates completed a study years ago that found that with a network of 28 Global Positioning System satellites, between a third and half of the system would need to be destroyed in order to achieve a significant impact on the accuracy of the system.[9]

The participants believed that a better model is to build simpler assets with a particular capability spread out through multiple units. Think of the benefit this way:

- If there are 5 satellites carrying telecommunications traffic, destroying one satellite reduces the capability of that network by 20%.
- If there are 30 satellites carrying the same volume of traffic, destroying one satellite only reduces the capability of the network by just over 3%.
- It is much more difficult, as well as a clearer and greater demonstration of aggressive intent, for an attacking power to destroy the 6 satellites necessary to have the same impact as before.

By distributing space assets, we remove the criticality of any one asset. While it is difficult to protect

Rethinking Technology

The Air Force's Operationally Responsive Space Office has set a new goal to develop satellites in months rather than years for projects such as the next generation of the Global Positioning System and the Transformational Communications Satellite system. The office is also working on satellites that could be launched in days or weeks to replace aging technology.[10]

all space assets, it is much simpler to ensure the overall capability of the system. Effective dissuasion is the result, as the costs/benefit analysis of an attack no longer favors a hostile entity.

In order to create a highly distributed network of smaller, simpler assets or systems in space, the dinner participants pointed to a couple of steps that must happen:

- We must rethink our acquisition model. The current system supports big-dollar, big-capability satellites. There are currently start-up firms, funded by agencies such as DARPA, that specialize in simple, low-costs systems, but they need more support from the acquisition community as a whole.

- We need to leverage research in other commercial areas that specialize in low-cost systems, such as the space tourism industry.

By reallocating dollars to systems that are less vulnerable to attack, we can reallocate our space defense focus to other mission-critical tasks.

The Future of Space Protection

As one participant aptly put: "How, and how much, we are going to depend upon space in the future is beyond all of our imagination." But that does not mean we cannot plan for the assurance of our space systems, whatever form they make take 10, 20 or 30 years from now. Another participant agreed, noting that "Protecting and securing our ability to use space to our competitive, as well as asymmetric, advantage is of extraordinary strategic importance to the nation." The bottom line is that we lead the world in space, and with new insight and a break from the static traditional models of the past, we can protect our leadership role as the space environment evolves in the new century.

The group concluded that space protection is an important issue for the nation's security, and this dinner discussion helped identify some principles that can and should be adopted, and actions that could be taken, to enhance the protection of our nation's space capabilities. As with many such efforts, the dinner group's discussion did not identify all of the steps and actions that must be taken, but Toffler Associates will remain engaged with this group and conduct other activities to add to the national discourse about this important issue.

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