# Army Space Journal

A Professional Journal on U.S. Army Space Operations

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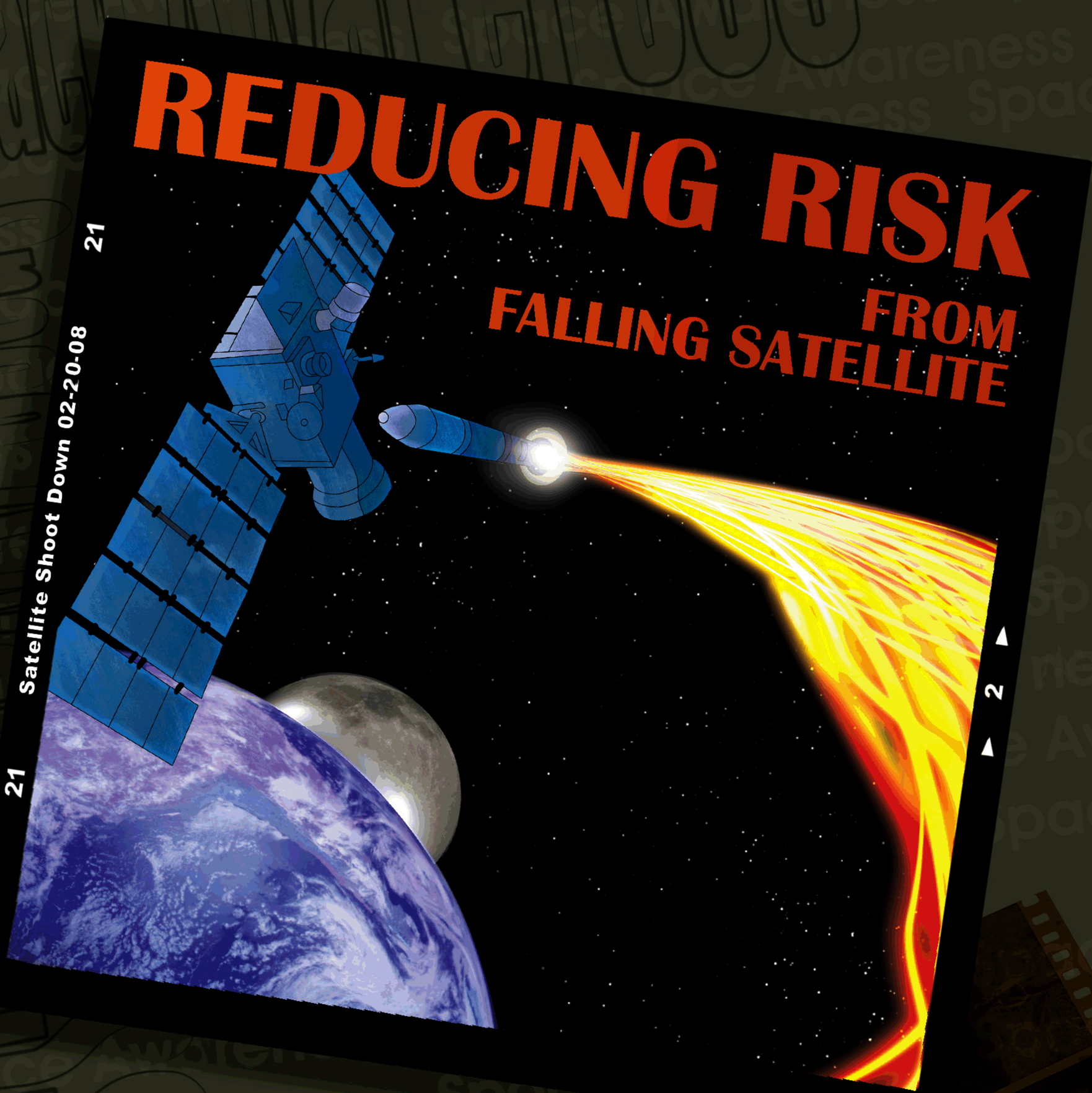


# Editor's Blog

Well, the man at the podium finally did it — he temporarily lost his marbles. In doing so, he gave excellent material for the editor's blog. The tongue-in-cheek briefing covered the concept of operations for fielding a future directed energy system. And, yes, the name for the system was really Directed Energy Sea Mammals. And, yes, he really included an illustration of a dolphin with a laser attached to its head with duct tape. We appreciate BG John Seward's humor. His last column for the ASJ in his role as the Deputy Commanding General for Operations is in this edition. He picks up new duties this summer as the Deputy Commanding General for U.S. Army Pacific Command. His parting shot came during his farewell ceremony in Colorado Springs, Colo.

The next blog entry comes in a conventional way from a neighbor who retired from the Army decades ago. "You have too many acronyms for me to understand what you're talking about," he said over a cup of coffee on my front porch. "I mean, I like the magazine and all but, man, how do you guys keep up with all the acronyms and stuff?" I told him it was a special code amongst the Army Space techies to keep the outsiders out and the insiders in. The neighbor's comments reminded me of Seward's farewell parody on the cerebral Space community. Seward's laser-mammal bit in his ceremony gave way to a spiel on the overwhelming alphabet soup of acronyms we maintain in our world.

Most of the e-mails we get here at the Journal are from readers requesting to update their addresses in our mailing list. I guess we can take that as a positive sign — at least folks aren't asking us to remove them from the list! On some of the e-mail requests, though, we get some much appreciated information from the audience. "I really enjoy getting the ASJ, especially since I am in school and away from the Army currently," wrote MAJ Eric Strom. "It's a great way to keep up with what is going on out in the Space community." Air Force CAPT Brent Ziarnick wrote: "Your Journal is always very interesting and of exceptional quality. I always look forward to getting it in the mail. The Army does Space right!"

We've also exchanged a series of e-mails with John Marrs. He is busy putting together final touches on his retrospective on the Army Space Initiatives Study. This will provide the focus for our summer edition. "Along the way several folks have asked why I have bothered to write this paper," he last wrote. "I don't have a simple answer. It certainly is for and in honor of the ASIS team whose work should be recognized. It is for the young Army Soldier or Officer just getting into the Space business so that they have a sense of the work done by those that went before them. It is for all those folks in the midst of doing good things in making Space work for the Army Warfighter. Finally, it is to provide a memory jogger for those of us who worked in Army Space over the last few decades so as to get something on paper before those memories fade completely. I don't have the

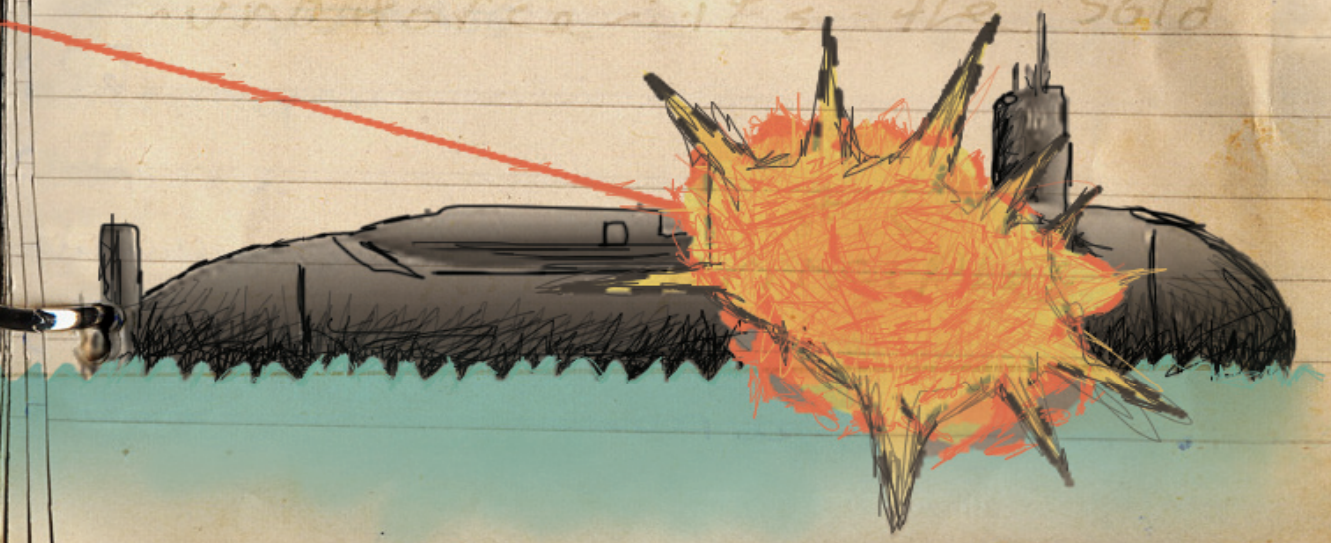
Directed Energy Sea Mammal (DESM)

hubris to think that this is definitive — it is not a history. To paraphrase on old TV line — there are a thousand stories in this saga — mine is only one."

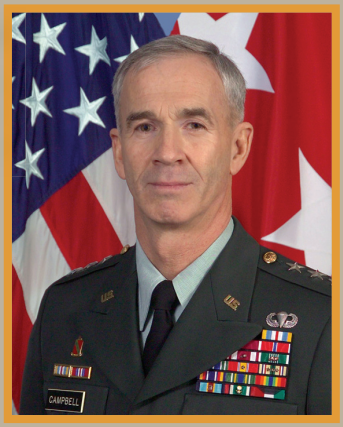
We also saw a significant e-mail trail on creating the Saint Dominic award for Space professionals. "A new award has been minted to commemorate contributions of the Army Space community to our national defense," wrote COL Timothy Coffin, 1st Space Brigade commander. "The award is in three degrees. A bronze level award recognizes individuals who have proven their worth in supporting Army Space activities. A silver level award recognizes broad contributions of significant merit in positions of great leadership. The gold award is the penultimate award normally reserved for presentation at an individual's retirement. The award itself is a medallion representing Saint Dominic — often known as the Patron Saint of Astronomers. The medallion is significant because on its back is a small piece of the Explorer One launch gantry — the supporting structure for the Army's and Nation's first satellite launch into Space."

The last blog entry is a plea for your comments. Enter the conversation by sending your e-mail comments to michael.howard@smdc-cs.army.mil.

Mike Howard
Editor-in-chief



**LTG Kevin T. Campbell**
Commanding General,
U.S. Army Space and Missile Defense Command/
Army Forces Strategic Command



# Utilizing Space Assets

## Space Awareness

Welcome to the spring edition of the Army Space Journal. I believe you will find the array of articles and transcripts that deal with this month's topic of Space Awareness both informative and enlightening. The Army's continued utilization of Space-based assets is vital to providing the Warfighter the tools necessary for prosecuting the Global War on Terror and beyond. The U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT) is focused on providing the Army dominant Space and Missile Defense capabilities. Our Soldiers, Civilians and contractors devote their time and energy either providing operational support in Operation Iraqi Freedom/Enduring Freedom, developing innovative solutions through research, development and acquisition, or by developing the Army's Space and missile defense doctrine and concepts through the Future Warfare Center. We also rely on input from Warfighters and Space professionals as we develop programs or improve those we currently utilize. This publication provides an excellent forum for professionals to discuss ideas and concepts related to the Army's employment of Space-based assets.

I agree with the statement that CPT Stacy Godshall uses in his article, "gaining more understanding of the Space climate is essential to understanding how to conduct both satellite operations and human Space exploration and missions."

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In this month's issue is the Department of Defense news briefing with GEN James Cartwright, Vice Chairman of the Joint Chiefs of Staff, discussing the shoot-down of the failing satellite in February. The shoot down was an excellent example of how interagency and Joint teams can work together to accomplish a very complex task. The shoot down may not have replicated a missile intercept, but it did replicate the coordination, teamwork and communication necessary for any operation. The Army participated as part of a larger team that successfully destroyed the failing satellite.

Equally interesting is the article by the chiefs of the five Division Space Support Elements that participated in Operation Iraqi Freedom V. The Space Support Elements are critical assets to Division commanders as they access Space-based products for the Warfighter. Pushing FA40's to Army units has been one of SMDC/ARSTRAT's initiatives. The Army has more than 200 FA40 Space Operators assigned to units within the Army, as well as Department of Defense and other federal agencies. The importance of these Space professionals in supporting our Warfighters and in promulgating Army interests cannot be understated.

While global warming occupies the interest of mainstream media, a topic that I believe will begin to receive more attention in the future is the impact the solar cycle will have on our planet and thereby on military operations. Increasing our understanding of solar cycles and their affect on Space-based assets will give us insights we can use in Space system design. I agree with the statement that CPT Stacy Godshall uses in his article, "gaining more understanding of the Space climate is essential to understanding how to conduct both satellite operations and human Space exploration and missions." This is a topic that deserves more discussion and certainly more articles.

These and other articles within the ASJ provide an opportunity to expand our knowledge base about how we utilize our assets in Space, about what may adversely affect those assets, and about how we can best use those assets to support the Warfighter.

Lastly, the Army Space Journal is your publication. I encourage you to provide comments about the articles to the editor and to submit articles about Space topics that may be of interest to the community. This is your magazine — use it.

Secure the High Ground!

"SECURE THE HIGH G

**CSM Ralph Borja**
U.S. Army Space and Missile Defense/
Army Forces Strategic Command

# Space Enhancements & Missile Defense

Communication is a vital Space Enhancement and could not be done without the 53rd Signal Battalion Companies that control the payload of communications satellites. *Photo by DJ Montoya*

Over the course of my first year as the Command Sergeant Major of U.S. Army Space and Missile Defense Command/ Army Forces Strategic Command, I've had the opportunity to travel throughout our truly "worldwide" command, with Soldiers assigned to places such as Kwajalein Atoll; Misawa and Okinawa, Japan; Wheeler Army Air Field, Hawaii; Camp Roberts, Calif.; Vandenberg Air Force Base, Calif.; MacDill Air Force Base, Fla.; Colorado Springs, Colo.; Omaha, Neb.; Qatar; Bahrain; Iraq and Afghanistan. I've met outstanding Soldiers doing a phenomenal job and who are working twenty-four hours a day; seven days a week to support the Warfighter and our Nation.Our Soldiers provide our Nation

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Soldiers with the 1st Space Company (Theater Missile Warning) load equipment that will be part of the newest JTAGS detachment in Misawa, Japan. *Photo by DJ Montoya*

with the Global Ballistic Missile Defense capabilities that help protect the United States from attack. They also provide America's Warfighters with the Space Enhancements that enable our ability to decisively defeat any enemy on the battlefield.

From the perspective of the Soldier, Space has profoundly impacted combat operations and has changed the face of modern warfare. Our Army is no longer a static, forward deployed force. Today's Army is a modular force, fully capable of placing maximum fire power on a target with minimal notice. Today, we successfully deploy multiple unit configurations into unfamiliar areas in support of Joint and/or multi-national operations because of our effective use of Space Enhancements. Army Field Manual 3-14, Space Support to Army Operations, identifies five enhancement areas:

- Communications;
- Position, velocity and timing;
- Environmental monitoring (Space and terrestrial weather);
- Intelligence, surveillance and reconnaissance (ISR); and
- Theater missile warning (TMW).

Space Enhancements assure the Army's ability to deploy its Warfighting capability to any location in the world. They allow our troops to maintain full situational awareness of their position, the position of friendly forces, terrain information, current and projected weather conditions, enemy troop locations and capabilities. Space Enhancements also gives our Troops the ability to effectively communicate with other Warfighters/Joint Services/Allies within their area of operation, and to reachback to rear support capabilities, including the United States.

Global Ballistic Missile Defense is another key mission area supported by our Soldiers. To meet the Army's commitment to missile defense, SMDC/ARSTRAT has Soldiers continually on point, manning Joint Tactical Ground Stations, Forward Based X-Band Radars and Ground Based Interceptor sites around-the-clock. These Soldiers continually train and carry out missile defense exercises in order to assure their ability to quickly and decisively respond to a missile attack.

Soldiers within SMDC/ARSTRAT are doing an outstanding job of supporting the Warfighter. We have Army Space Support Teams in the field, assuring the Warfighter has access to and fully understands Space Enhancements. SMDC/ARSTRAT Soldiers are deployed, operating Joint Tactical Ground Stations, providing missile warning to Warfighters in the field. Our Soldiers provide Satellite and Gateway Access Approval to the Warfighter, assuring their ability to communicate both within their Area of Operation as well as allowing reachback to the continental United States.

During the past year, SMDC/ARSTRAT Soldiers played a critical role in configuring the first Wideband Global SATCOM satellite for

Enhancements >> continues page 12

**BG John E. Seward**

Deputy Commanding General for Operations
U.S. Army Space and Missile Defense Command/
Army Forces Strategic Command

# Space Smart

## Army filling gaps in Space Capabilities

Several years ago, the Army identified its gaps in Space-based capabilities through the U.S. Training and Doctrine Command capabilities needs analysis process. The needs included: enhanced satellite communications; tactically responsive sensors and sensors that link directly to the shooters, timely and actionable Space-based intelligence; surveillance and reconnaissance; and an expanded bench of Space professionals.

In the last year, the Army has made progress towards filling or mitigating those gaps. In this article, I want to highlight some of that progress. This is not intended to be an exhaustive list by any means, but is one that covers several operational areas in which we — the Army, and the Space operations field — have made headway. Generally, the successes fall into three areas: providing support to Soldiers and commanders, expanding the pool of Space-smart Soldiers, and educating people about what Space-smart Soldiers and U.S. Army Space and Missile Defense Command/Army Forces Strategic Command do for our Army and the Joint community.

### PROVIDING SUPPORT TO SOLDIERS AND COMMANDERS

**Deployed Space Expertise:** Currently, approximately 90 Soldiers and Civilians are deployed from the 1st Space Brigade to support Operation Iraqi Freedom warfighters with enabling Space capabilities. Since 2003, the brigade has continuously had people deployed on Army Space Support Teams, Commercial Exploitation Teams, Joint Tactical Ground Station (JTAGS) detachments, and other jobs needing Space experts. That is quite an accomplishment for such a relatively small organization.

Another approximately 20 Space professionals and enablers are deployed in Space Elements (SE) that are organic to fires brigades, Divisions, Corps and Army headquarters. The Space Element assists the commander with accessing and integrating Space capabilities and Space-based technology into the fight. For example, Space Elements leverage the latest overhead non-imaging infrared sensors to provide direct support to operations and educate commanders and staffs on the current capabilities to protect satellite communications.

**Wideband Global SATCOM (WGS):** One of the themes in my presentations is that whatever capabilities or equipment we provide to the warfighter; they must serve the Soldier, staff sergeant, lieutenant, or battalion commander. The launch of the first of six WGS satellites

Since 2003, the brigade has continuously had people deployed on Army Space Support Teams, Commercial Exploitation Teams, Joint Tactical Ground Station detachments, and other jobs needing Space experts.

in October 2007, and placing it in operation in April in the U.S. Pacific Command area of operations, is an excellent example of meeting that goal. That one satellite provides 10 times more throughput than a current Defense Satellite Communications System Satellite. Think about the increased ability of Soldiers in that area of operation to communicate, share timely and actionable intelligence, surveillance, and reconnaissance information, and to download other critical information. Five more WGS are scheduled for launch through 2013.

**Newly deployed JTAGS:** In January, SMDC/ARSTRAT permanently stationed another JTAGS in Japan to augment the early missile warning already provided by JTAGS-Korea to commanders in the Pacific area of operations. The presence of JTAGS-Japan provides a more robust Theater Ballistic Missile Defense and Ballistic Missile Warning Capability. The new JTAGS helps fill the sensor-to-shooter gap.

### EXPANDING THE POOL OF SPACE-SMART SOLDIERS

This past year the number of Functional Area 40 (FA40) Space Operations Officers grew from 187 to 224. Although this increase has provided the ability to meet more of the Army's requirements, we still need more and will continue to pursue additional Space professionals in order to fill both Army and Department of Defense demands. Additionally, the newly formed Army Space Cadre Office has been working with the rest of the Army to identify a cadre of individuals whose roles and responsibilities require some level of Space experience or training. Once formalized, this database will serve as a mechanism to track those personnel and their Space-related experience and training. When complete, nearly 2000 Space enablers could be added to the Space cadre pool.

Every year, about 80 officers – most of whom are not FA40s — take the 3Y "Space Activities" course at Intermediate Level Education schools. That program continues to increase the number of officers in other branches and functional areas who understand how Space operations and Space systems can be a combat multiplier.

### EDUCATING PEOPLE ON SPACE OPERATIONS

**Kudos to BG Stuart Pike**, Assistant Adjutant General for Space, Colorado Army National Guard. General Pike put together a conference for all The Adjutant Generals and their subordinates to discuss Space and missile defense. A dozen general officers were present, including commanders who have or will receive Space Elements or Space Support Officers. Instructors from the Space Operations Officers Qualification Course presented a day-long

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During the past year, SMDC/ARSTRAT Soldiers played a critical role in configuring the first Wideband Global SATCOM satellite for operational use.

Theater Missile Warning is a critical Space Enhancement to the Warfighters on the ground. *Photo Courtesy 1st Space Company, 1st Space Brigade*

## Enhancements

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operational use. Members of the 53rd Signal Battalion work 24/7 providing the Warfighter with access to not only Wideband Global SATCOM, but also the Defense Communications Satellite System constellation of satellites which provide the bulk of the Department of Defense's military wideband satellite communications.

SMDC/ARSTRAT Soldiers successfully activated the U.S. Army's Forward Based X-Band Transportable Radar detachment last October at Shariki, Japan. This radar provides early warning against potential ballistic missile threats to the U.S. homeland, deployed forces and allies. It is the first radar site of this kind to be fielded and forward deployed.

We have outstanding Soldiers committed to supporting Operations Iraqi and Enduring Freedom. This is truly Warfighters supporting Warfighters. All of our Soldiers are intensely focused upon their assigned missions. They are dedicated to providing the best possible support. As noted earlier, this support comes through Space Enhancements as well as Global Ballistic Missile Defense. To carry out their missions, our Soldiers undergo highly technical training. All are crew certified within their respective mission areas, and many are required to provide around-the-clock support to the Warfighter.

Our Soldiers can be justifiably proud of their accomplishments in support of SMDC/ARSTRAT's vision and mission. Their outstanding performance and continued dedication have assured that "Securing the high ground starts at SMDC/ARSTRAT." Well done Team.

## Space Smart

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executive course. General officers from Alaska and California, Colorado's partners in the Ground-based Midcourse Defense mission, represented missile defense. The discussions were fruitful and the group reconvened in Fort Greely, Alaska in April. One outcome has been the creation of a General Officer Steering Committee from Alaska, California and Colorado General Officers to address Space and missile defense issues that concern the Army National Guard.

**Outside Organizations:** This past year, SMDC/ARSTRAT units on Peterson Air Force Base hosted civic leaders, recruiters, classes from military schools, and senior enlisted advisors and senior officers to educate them on the command's Space and missile defense missions. Without fail, we heard "I didn't know you did that!" Getting the word out helps build an educated and informed support base. And these are just a few of the ways the Army is filling its gaps in Space capabilities.

As I mentioned up front, one of my themes is that whatever capabilities or equipment we provide the warfighter must serve the Soldier, staff sergeant, lieutenant or battalion commander. During my tenure in SMDC/ARSTRAT, I have been impressed with its focus on Soldiers with boots on the ground. That is a driving force behind the majority of the command's operations, plans and supporting efforts. As I leave the command and my direct association with the Space operations field, I would like to applaud the officers, Soldiers, and Civilians throughout the Army who are providing enabling Space-based capability to warfighters. Well Done!

## Initiative

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concept must change also. Maintenance operations and overall capabilities remain unchanged; however, maintenance functions previously consolidated at brigade level must move to battalion level. Tables of Organization and Equipment will change. A portion of the brigade's maintenance related force structure will be cut while additional force structure in the battalions will be stood up.

As can be seen in the three examples above, the Army is dynamic and always evolving, which is driving changes to Space operations and causing SMDC/ARSTRAT to reassess and refine Space force structure. Army Space Forces must adapt to meet the operational needs of our ever changing Army and Joint forces. As the Space Proponent, SMDC/ARSTRAT must routinely assess and update equipment, doctrine, training, facilities, as well as organizational structures in order to ensure we continue to provide ready and relevant Space-based/enabled capabilities to the Army. The ongoing Major Restructuring Initiative provides us the mechanism to conduct this assessment and make necessary changes to our units' force structures.

SMDC/ARSTRAT has been on the cutting edge of innovation and technology for many years. The command has developed and fielded innovative Space capabilities, greatly enabling the combat effectiveness of the American Soldier. During the majority of this decade, SMDC/ARSTRAT has worked successfully to operationalize Space-based/enabled capabilities and push them down and forward to the tactical warfighter. The Space Major Restructuring Initiative carries this work forward and ensures that future Army forces will continue to be supported by relevant, responsive and capable Army Space Forces.

**COL Bruce Smith**
Director
Directorate of Combat Development
Future Warfare Center

# Major Restructuring Initiative

## The Cutting Edge

The Army, led by U.S. Training and Doctrine Command, is in the midst of assessing operational capabilities and working to determine its future organizational force structure. Transformation in technology, doctrine, tactics as well as ongoing operations have changed how the Army fights and operates; these changes inevitably raise questions about the Army's organizational structure. First, and foremost, does the Army's current structure meet its operational needs? Second, does the organizational structure meet future operational requirements? How should our combat organizations change; do we need additional maneuver units, or new information operation capabilities? Is our sustainment structure or command and control structure sufficient to meet current needs as well as future requirements? The Army is trying to answer these and other related questions now. U.S. Training and Doctrine Command has just completed an Army-wide review of Corps and Division headquarters structures and will soon embark on an Army Service Component Command review as well. The goal of the reviews is to ensure operational headquarters and units are able to command and control and employ forces effectively on future battlefields. These Army-wide changes will impact how Space and Missile Defense forces are structured and employed as well.

Over the past five months a group of people from across U.S. Army Space and Missile Defense Command/Army Forces Strategic Command have been meeting to examine and analyze 1st Space Brigade's organizational structure and determine if any changes should be made. In January, the Directorate of Combat Development began leading an extensive review of all Space force structure in an event named the Major Restructuring Initiative (MRI). This Initiative grew out of the realization of the need to conduct a comprehensive review of Space and missile defense force structure and make all necessary changes in totality, rather than continue to update portions of our structure incrementally. This is a command-wide effort and involves elements from the 1st Space Brigade, Battle Lab, Staff Elements as well as external support from Headquarters Department of Army G-3/5/7, Combined Arms Support Command and the Signal Center and School. The focus of the Major Restructuring Initiative this year is to determine the organizational design of the 1st Space Brigade in order to ensure it has the necessary units, personnel and structure to meet future operational requirements. The plan is to complete the Space Major Restructuring Initiative (Phase 1) by August and then present it to the Commanding General for his review and approval. Upon his authorization the results will be forwarded to U.S. Training and Doctrine Command for review and then on to Headquarters Department of Army G-3/5/7 for approval and implementation. Changes to the 1st Space Brigade's structure will then be recorded on its various Tables

In short, the development and employment of the Space Element is forcing us to reexamine how Space-based/enabled capabilities are best provided and consequently reassess the Army Space Support Team's force structure.

of Organization and Equipment. Later this year, following the completion of our assessment of Space capabilities and structure, the command will expand the scope of the Major Restructuring Initiative to assess Ground-based Midcourse Defense requirements and the adequacy of the 100th Missile Defense Brigade's force structure.

The 1st Space Brigade's structure was originally designed almost eight years ago. At that time the goal of the force developers was to move Space-based/enabled capabilities from the institutional Army into the operational Army. Army Space Forces were stood up for the first time as Tables of Organization and Equipment units. This was a watershed event in the development of Army Space capabilities. Army Space became operational and integrated into the tactical Army. This change brought expanded Space support to land component forces, as well as improved responsiveness. Since this transition Space forces have be an integral part of maneuver, sustainment, and stability operations in both Afghanistan and Iraq as well as the rest of the world. Today's high degree of integration of Space capabilities as well as their adaptiveness and responsiveness to operational demands is, in part, possible because Space Forces are Tables of Organization and Equipment units.

Since Army Space Forces were first put on Tables of Organization and Equipment earlier this decade, and the associated battalion and brigade headquarters were stood up, numerous events have occurred making these units' structures increasingly inadequate for current operations, not to mention future operational requirements as well. For example, changes in Army doctrine, weapons and systems, and sustainment concepts are affecting the 1st Space Brigade's operations and necessitate the need to assess its organizational design. Since the Global War on Terror began the Army has significantly changed the way it plans for and utilizes Space-based/enabled capabilities by standing up and assigning organic Space Elements to Army, Corps, and Division-level staffs. This change has further operationalized Space within the Army and has better integrated it into the full spectrum of operations. However, the stand up of these organic Space Elements has impacted the Army Space Support Team's operational employment. The Army Space Support Team mission, coordination requirements, and equipment are evolving with the stand up of the Space Element. In short the development and employment of the Space Element is forcing us to reexamine how Space-based/enabled capabilities are best provided and consequently reassess the Army Space Support Team's force structure. Additionally, materiel changes over the past six years are driving organizational changes as well. Changes to equipment design and procurement plans have impacted, or will impact, the 1st Space Brigade's operational capabilities. Joint Tactical Ground Station equipment has been modernized and will continue to be upgraded to include improving its communications systems, integrating Space Based Infrared Systems processing capabilities, and dismounting the system from the mobile shelter. These materiel changes affect operational capabilities which in turn have the potential to cause changes to the force design. Lastly, the Army is changing its concept of maintenance. The Army is moving from its current system of sustainment and support to a new "Two Level Maintenance" concept. Consequently the 1st Space Brigade's sustainment

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## Space Smart

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executive course. General officers from Alaska and California, Colorado's partners in the Ground-based Midcourse Defense mission, represented missile defense. The discussions were fruitful and the group reconvened in Fort Greely, Alaska in April. One outcome has been the creation of a General Officer Steering Committee from Alaska, California and Colorado General Officers to address Space and missile defense issues that concern the Army National Guard.

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2.14.08

# Mitigating a Threat

## Pentagon announces plans to shoot down falling spy satellite

EDITOR's NOTE: On Feb. 14, 2008, Deputy National Security Advisor James Jeffrey, Vice Chairman, Joint Chiefs of Staff GEN James Cartwright and NASA Administrator Michael Griffin spoke at a press briefing regarding the U.S. decision to shoot down a falling U.S. spy satellite. Below is a portion of the transcript from that briefing. You can find the briefing in its entirety at http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4145.

**GEOFF MORRELL**: As you know, for several weeks now this department and many others in the United States government have been closely monitoring a rapidly decaying U.S. intelligence satellite. Together we've been looking at options to mitigate any possible risks to human life as this — that could be caused with this satellite reentering the Earth's atmosphere.

Today we've assembled a group from across the government to come in here to explain the course of action that President Bush has selected. You'll hear first from Deputy National Security Adviser James Jeffrey; followed by the vice chairman of the Joint Chiefs, General "Hoss" Cartwright; and NASA Administrator Michael Griffin. Please allow them to finish their statements before chiming in with questions.

And with that, Ambassador Jeffrey?

**JAMES JEFFREY:** We first discussed the satellite publicly at the end of January after we had determined that it was coming down and as news reports began breaking. Following further decisions, we have decided to, of course, brief you today. We just finished briefing members and staff of both the House of Representatives and the Senate a little bit earlier today, and we're also doing a diplomatic roll-out across the world this afternoon.

What I'd like to do, is to sketch some of the background to the decision. Upon notification of the descending NRO (National Reconnaissance Office) satellite, the president and his national and homeland security advisers reviewed the options available to us to mitigate risk from the descending satellite. As background, I'd like to note that over the past 30-plus years there have been many satellites and other manmade objects falling from Space, of course. They have fallen with very little damage and no injuries.

What makes this case a little bit different, however, and in particular for the president in his consideration, was the likelihood that the satellite, upon descent to the Earth's surface, could release much of its thousand-plus pounds of hydrazine fuel as a toxic gas.

The likelihood of the satellite falling in a populated area is small, and the extent and duration of toxic hydrazine in the atmosphere would be quite limited; nevertheless, if the satellite did fall in a populated area, there was a possibility of death or injury to human beings beyond that associated with the fall of satellites and other Space objects normally, if we can use that word. Specifically, there was enough of a risk for the president to be quite concerned about human life.

Vice Chairman of the Joint Chiefs of Staff GEN James Cartwright, U.S. Marine Corps, talks about plans to destroy an unresponsive U.S. reconnaissance satellite with an interceptor missile during a Pentagon press briefing on Feb. 14, 2008. Cartwright was accompanied by Assistant to the President and Deputy National Security Advisor Ambassador James Jeffrey (left) and NASA Administrator Michael Griffin (not pictured). *Department of Defense photo by R. D. Ward*

And on that basis, he asked us to review our options

Apart from the normal consequence mitigation actions that we are prepared to deploy both at home and internationally to deal with the hydrazine, the one viable option we had, we concluded, was to use a tactical missile from an Aegis ship to strike the satellite in order to reduce the overall risk. This missile was designed, of course, for other missions, but we concluded that it could be reconfigured, both the missile and the various other systems related to it, on a one-time reversible basis to do the shot.

After further review of this option, and in particular consideration of the question of saving or reducing injury to human life, the president, on the recommendation of his national and homeland security teams, directed the Department of Defense to carry out the intercept.

Let me talk very briefly about the diplomatic side of this and then I'll turn it over to the vice chairman.

The United States has certain obligations based on treaties and other agreements related to activities in Space. The 1967 U.N. treaty on exploration and use of outer Space, in particular, calls on states to keep others informed of activities of potential concern.

While we do not believe that we meet the standard of Article IX of that treaty that says we would have to consult in the case of generating potentially harmful interference with other activities in Space, we do believe

The USS Lake Erie launches a Standard Missile-3 at a non-functioning National Reconnaissance Office satellite as it traveled in Space at more than 17,000 mph over the Pacific Ocean, Feb. 20, 2008. *Defense Department Photo Courtesy U.S. Navy*

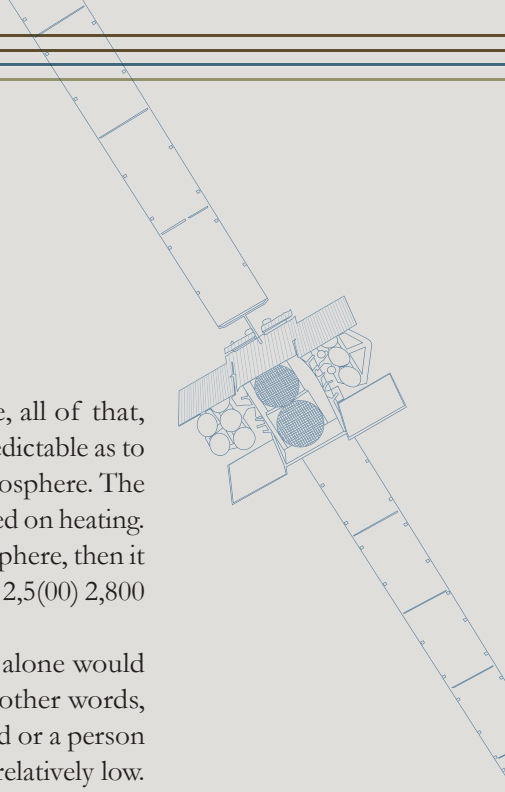
that it is important to keep other countries informed of what is happening.We let many countries know at the end of January that the satellite was descending, that it would likely have hydrazine, and talked a bit about the consequences of that. Today, we're reaching out to all countries and various organizations — the U.N., some of its subordinate agencies, the European Space Agency and NATO — to inform them of the actions that we're describing to you today.

**GEN JAMES CARTWRIGHT**: Just to re-baseline, this is a National Reconnaissance Office satellite. It was launched on 14 December, 2006 It's about roughly 5,000 pounds in its weight. Historically, a satellite of this size and that weight, roughly half of it would survive reentry.

We're saying in the modeling somewhere around 2,800 pounds would survive reentry. What is different here is the hydrazine. In this case, we do have some historical background that we can work against for the tank that contains the hydrazine And we had a similar tank on Columbia that survived reentry. So we have a pretty reasonable understanding that if the tank is left intact, it would survive the reentry.

This satellite essentially went dead for communications and control very shortly after it attained orbit. It was a nominal launch, a nominal insertion into orbit, but then, on orbit, within the first few hours stopped communicating.

A satellite like this — really, all of our satellites have fuel that is reserved, along with redundant systems, to ensure that there is propulsion to allow for what we would call a controlled de-orbit, but the ability to put it, say, in the ocean. But with no communication with this satellite, that's — that is what is different here. That's what distinguishes this particular activity, is we have no way to communicate to invoke the safety measures that are already onboard the bird.



To take it just a little bit further, hydrazine, in this case — normal case is that when it's used as rocket fuel, it's in a gaseous state. We bring it up to a liquid state with heaters This has had no benefit of heaters because there's no power on the bird. So this is a frozen state of hydrazine, which leaves for us another unknown: how much of it would melt on the reentry, therefore would be in either a liquid or gaseous phase.

In a worst-case scenario for the hydrazine, it's similar to chlorine or to ammonia in that when you inhale it, it affects your tissues in your lungs. You know it's — it has the burning sensation. If you stay very close to it and inhale a lot of it, it could in fact be deadly. But for the most part here, we're talking an area, say, roughly the size of two football fields that the hydrazine could be dispersed over, and you would at least incur something that would make you go to the doctor. If you stayed inside that zone, if you got very close to it and stayed, you could get to exposures that would be deadly.

So that's a sense of what we're dealing here with Columbia, and I'll let the administrator talk to that part of it but with Columbia, the hydrazine tank came down in Texas in a wooded area, unpopulated, and unlike this, we had the mitigating in front of it — they'd burned most of it. The mission was at its end. So it was almost no hydrazine left You could walk up very shortly after the event and walk right up to the tank's proximity and it wouldn't have affected you.

Now, we didn't handle it that way. We treated it as a toxic. Anybody who should encounter something like this ought to treat it as a toxic. Don't approach things like this.

Now, having said that, what we tried to do here at the department was to look at the risks that exist for what we call a normal reentry. This is normal for this satellite, not having the ability to deorbit it, it would basically enter the atmosphere. As I said, it would incur the heating. It may break up. And exactly what the pieces look like, all of that, we're not sure. It's very, very unpredictable as to exactly where it would hit the atmosphere. The atmosphere raises and lowers, based on heating. But when it encounters the atmosphere, then it would come down, as I said, about 2,5(00) 2,800 pounds' worth of mass

Those calculations and that alone would not be reason to take action. In other words, the likelihood of it hitting the land or a person as a hunk of metal or material is relatively low. It's the hydrazine here that is the distinguishing characteristic

I've also, like you, read the blogs. This is — there's some question about the classified side of this. That is really not an issue. Once you go through the atmosphere and the heating and the burning, that would not be an issue in this case. It would not justify using a missile to take it and break it up further.

Our objective here was to reduce the risk — could we reduce the risk to Space platforms, to airborne platforms, and to terrestrial platforms — the Earth, cities, people, etc.

In the first case, one of the first actions that we took together was we believe that the window that we were looking at to intercept this vehicle can be accomplished after we bring the Shuttle down.So we're going to bring the Shuttle down before we even consider this option.

The second is that we looked at the various capabilities that we as a nation hold, and what held the highest likelihood of success for us was to move to a mobile platform and a tactical weapon which we have good understanding of the performance of the weapon. That came to the standard missile — Navy missile that has been in the inventory for several years, has a very solid track record. We understand how to use it and how it works and what its likelihood of performance would be. In addition, it has a

mobile platform. And the intent in the mobile platform is, what we would like to be able to do, is to intercept this missile at a point at which we could have a high likelihood of bringing it down in an unpopulated area.

Second objective is to hit the tank, the hydrazine tank, and rupture it so that we can off-gas this hydrazine as early as possible so the least amount of it returns to the Earth, okay.

So those are the two key objectives. It is looking at the likelihood of mitigating on orbit, in the air or on the land.

On the orbit side, in Space, what we're attempting to do here is to intercept this just prior to it hitting the Earth's atmosphere. That does two things for us. It reduces the amount of debris that would be in Space — so in this case, what we're looking for it to try to have the debris, over 50 percent of it within the first two orbits or the first 10 or 15 hours would be deorbited. The second piece here is looking at other, unmanned bodies in Space, in low-Earth orbit, and the Space station to make sure that we did not increase the risk to other bodies in Space. So that was a criteria we're trying to understand.

Next is when the orbit comes down through the air, is there anything that would increase the risk to normal, general aviation. We have a set of standards — the FAA (Federal Aviation Administration) has a set of standards that it uses to re-vector aviation when there is a hazard in the air.

Would we cause a hazard in the air? If we did, would it be predictable enough that we could re-vector? That was a criteria we had to get through.

And then the last criteria was on earth, can we, in any way, help mitigate the opportunity for this to come on land, to land in a populated area?

And so we worked our way through those, and I'll let the director talk to the Space side of this equation. But suffice it to say, we believe that if we intercept this just prior to entry, and remember, this is not an aerodynamic body. If it were a ballistic missile and had aerodynamic properties, you could see it rising in one hemisphere and predict where it's going to come down in the next. And therefore that's how you'd accomplish an intercept.

A) This has no aerodynamic properties. Once it hits the atmosphere, it tumbles; it breaks apart; it is very unpredictable and next-to-impossible to engage. So what we're trying to do here is catch it just prior to the last minute, so it's absolutely (as) low as possible, outside the atmosphere, so that the debris comes down as quickly as possible. B) On the intercept, first, if we can hit the satellite, which we believe we have a high confidence we can do, that will slow the satellite down, which means it'll deorbit more quickly, and we can predict more accurately where it will deorbit, so we can potentially put it in a position in the ocean.

On the land side of the equation, again, objective would be to breach the tank and let the hydrazine escape. Second is to break apart the satellite, at least, so that the pieces can burn up on reentry a little easier, and we bring them down quicker. The last piece on land, we talked through a little bit, where we have an extensive program that we use regularly with deorbiting bodies, that notifies the world that we have something coming in, but this is highly unpredictable.

Again, they're not aerodynamic. So we can generally get a quadrant of the earth, you know, down to the last day. But it's down to the last one or two hours before we can tell you potentially a land mass, but not more accurately than that. So this is very difficult, because you have a very non-aerodynamic body trying to move through the air.

A couple of the other pieces here, to help put a little finer point on some of these. We're using the Standard Missile 3, well understood. It has the ability to get up just beyond the atmosphere, so it has the kinetic energy to be able to reach this satellite as it prepares to reenter.

We believe that the window for this activity will start here in the next three or four days. And we will be open for about maybe as many as seven or eight days.

Much of this depends on the heating of the atmosphere. So we're trying to build, knowing

Vice Chairman of the Joint Chiefs of Staff Marine GEN James Cartwright, left, and Deputy Defense Secretary Gordon England follow the progress of a Standard Missile-3 as it races toward a non-functioning National Reconnaissance Office satellite in Space over the Pacific Ocean, Feb. 20, 2008. *Defense Department Photo by U.S. Air Force Tech. Sgt. Adam M. Stump*

that, where would the best position be from the Earth to launch a missile to intercept that would drive this down into the ocean? And that's our objective, get rid of the hydrazine and have this fall in the ocean.

We'll use one missile with two back-ups. We'll have three ships on station, but it'll be one shot. The other missiles are there principally in case something in the launch phase does not work. We will have radars and Space sensors pointed at the area so that we have some sense of whether we were successful or not.

In the case that we're not successful with the first shot, we'll reassess, but two things will be working against us. One, the satellite will continue to progress across the Earth, and so, as it does, we'll only have a certain of amount of time before if we shot we'd have a higher likelihood of bringing it down on land, and we're not going to shoot if that's the case.

We have to be able to assess if parts of the satellite came apart is the — which part is which, and that's a very difficult thing to do. In other words, if the satellite grazed but did not directly impact, how do you decide whether you should take a second shot? And we'll work our way through that, but it'll be a conscious decision that we'll make.

We'll have a window, we believe probably might get as much as two days to make an assessment and come back before we really find it not feasible to reengage this target and to let it normally decay in its orbit. So it's a relatively small window. We'll take one shot and assess, and then we'll come back and look.

We feel confident that we will be able to assess, but this is not necessarily something that will occur in minutes. And that's the challenge, is to try to understand what it is we have after we've taken the shot, and what it'll take to come to the calculus that would say go ahead and reengage again, or reengagement will either increase the risk to Space, increase the risk to the air, or increase the risk on the ground. If either — any of those are the case, then we will not take a second shot.

At the end of this, just from my perspective, what to me was compelling as we reviewed the data is that if we fire at the satellite, the worst is that we miss, and then we have a known situation, which is where we are today.

If we graze the satellite, we're still better off because likely we'll still bring it down sooner and therefore more predictably. If

we hit the hydrazine tank, then we've improved our potential to mitigate that threat. So the regret factor of not acting clearly outweighed the regret factors of acting. And as long as that's the case, we felt that the responsible activity was to go ahead and try to engage the satellite.

**MICHAEL GRIFFIN**: My colleagues have said almost everything that would need to be said. I'll add a couple of quick remarks.

The first is that of course we've already alluded to the fact that we have a shuttle on orbit at the moment and a Space station on orbit permanently with a permanent crew, so we looked very carefully — from the first, NASA has been involved in this — we looked very carefully at increased risks to shuttle and station, and broadly speaking, they are negligible. They are at least a factor of 10 smaller than risks we take just being in Space anyway in the Shuttle. So they are not significant with respect to the risks we already assume to fly the Shuttle. On the Space station, of course, it's a different issue. The Space station is much more robust than the Shuttle. But even there the risk posture does not increase significantly. And so we are very comfortable that this is a decision made carefully and objectively and safely.

There are good times to conduct the intercept and poor times to conduct the intercept, based on the positioning of the station, and I and my colleagues will work together to make sure that, if possible, we pick one of the good times. But even the bad times are not too bad, and I would assure all of you that we've — we're conducting this with due regard to the safety of people on orbit.

I would make the point that — I would want to reinforce the point that GEN Cartwright made, is that there is a very large amount of uncertainty in predicting the landing zone of an entry object. It's generally acknowledged by specialists in the field that the best you'll do is to get within around 10 percent of the remaining lifetime of the bird, and that's the best

So, a month ahead of time, you will know when it will land within about three days. That, of course, allows the satellite to make multiple revolutions around the entire surface of the Earth So in essence, a month ahead of time, you have no idea. Ten days ahead of time, you'll be uncertain by at least a day.

Again, it will make 16 revolutions around the Earth in that day. It could land anywhere. On the day that you land, you will be uncertain by several hours. The satellite will make at least two orbits in that period of time, which again, sweeps out a very large fraction of the Earth

So it was necessary to make the decision about whether to engage days, weeks, even longer, if possible, ahead of when it will actually land, because it is simply not possible to predict whether it will land in the middle of the Pacific or in a populated area. The decision had to be made before we could be certain where it would go.

I would also — to again emphasize General Cartwright's point that almost anything that we can do with this turns out to be either neutral or better. Neutral is if we miss. Nothing changes. If we shoot and barely touch it, the satellite is at this point just barely in orbit. Almost anything that you do to it when it is just barely in orbit is going to cause it to reenter within the next couple of orbits. And of course, if we shoot and get a direct hit then that's a clean kill and we're in good shape.

So there is almost nothing we can do here that makes it worse. Almost everything we can do, technically, makes it better, which was a very strong factor weighting the decision. With that, I will close. I don't think we need anything more.

The USS Lake Erie launches a Standard Missile-3 at a non-functioning National Reconnaissance Office satellite as it traveled in Space at more than 17,000 mph over the Pacific Ocean, Feb. 20, 2008. The objective was to rupture the satellite's fuel tank to dissipate the approximately 1,000 pounds of hydrazine, a hazardous material which could pose a danger to people on Earth, before it entered into the Earth's atmosphere. *Defense Department photo courtesy U.S. Navy*

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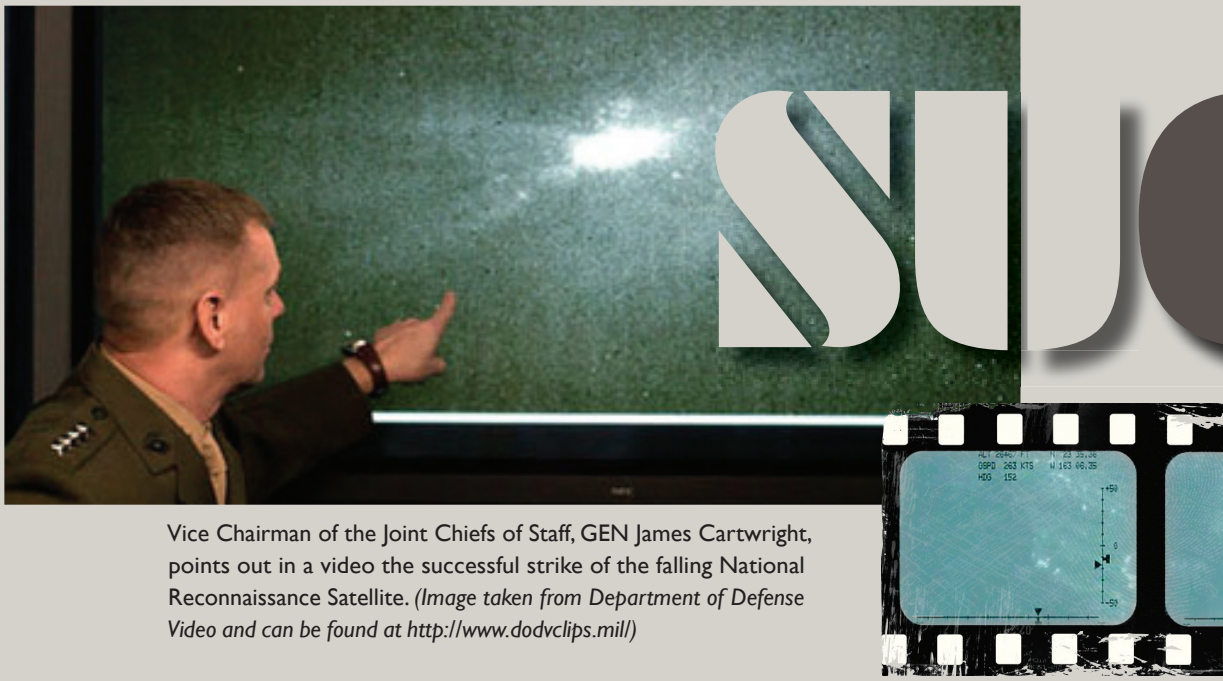


Vice Chairman of the Joint Chiefs of Staff, GEN James Cartwright, points out in a video the successful strike of the falling National Reconnaissance Satellite. *(Image taken from Department of Defense Video and can be found at http://www.dodvclips.mil/)*

**GEN JAMES CARTWRIGHT**: Let me give you just a couple of pieces, and then we'll run a video to give you a sense of what we saw last night.

At 10:26 (p.m. Pacific Standard Time), the Lake Erie launched a Standard Missile 3 from the Pacific. They were northwest of Hawaii. At 10:50, the Joint Space operations center out in Vandenberg confirmed the breakup of the satellite. The intercept occurred at 153 nautical [sic – statute] miles above the earth.

And what I'd like to do is run the video. We have two videos here. The first one is essentially the launch and the flyout. The second one is the intercept.

That's the launch. And this is the second video, and that's the satellite.

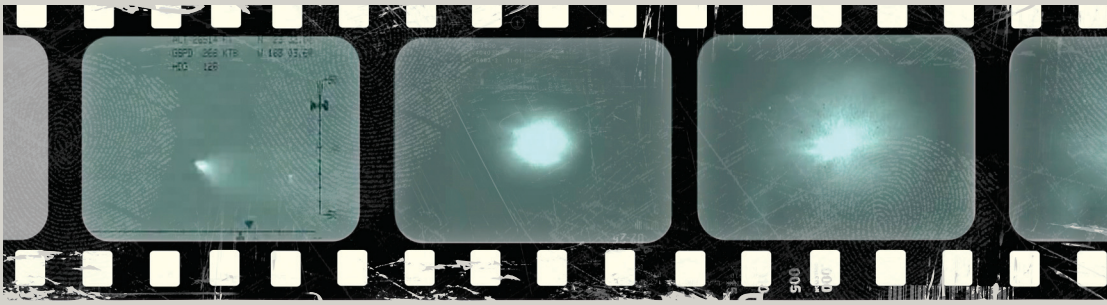
Q – Before or after?

**CARTWRIGHT**: Right at the hit.

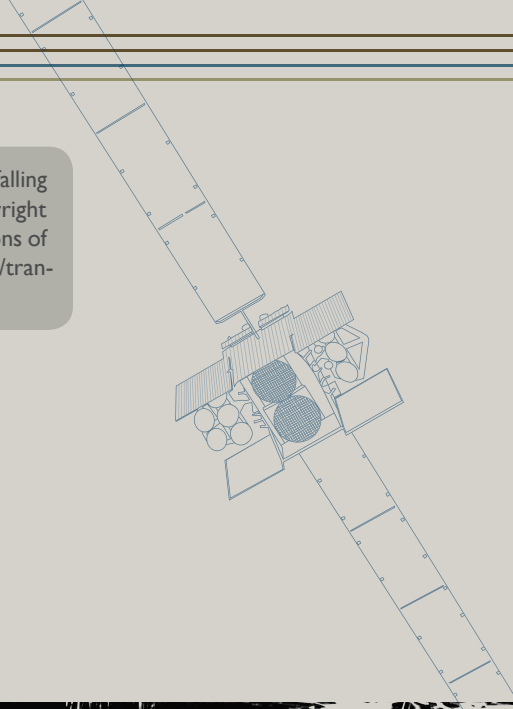
And so what you're seeing, you slow it down, what you'll see there is you'll see the intercept. You'll see the hit of a mass. There you go.

And what we're watching right now is this cloud that's forming right here, and I'll walk you through a little bit of what we think we're seeing there.

Our objective was to intercept the satellite, reduce the mass that might survive reentry, vector that mass as best we could into unpopulated areas, ideally the ocean, breach the hydrazine



EDITOR's NOTE: On Feb. 20, 2008, a U.S. Naval Ship launched a missile that successfully intercepted a falling U.S. reconnaissance satellite. The next morning Vice Chairman, Joint Chiefs of Staff, GEN James Cartwright presented videos of the event to the press and answered questions. The following pages include portions of the transcript from the briefing. You can find the briefing in its entirety at http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4152.



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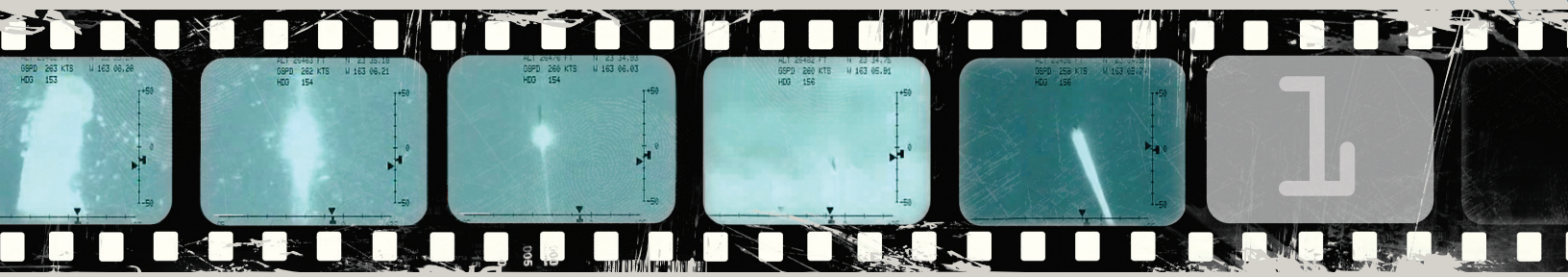


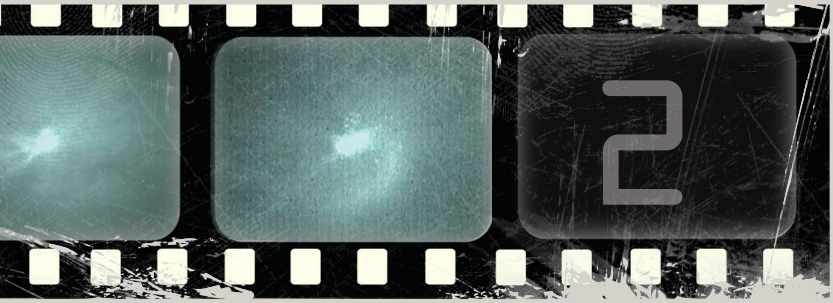

tank, so that we could vent the hydrazine off, the toxic fuel, and then have all of that done prior to impact.

The intercept occurred; you just saw that. We're very confident that we hit the satellite. We also have a high degree of confidence that we got the tank. We're still working our way through that. We will not be at a point where we are ready to say for sure.

But let me give you a sense of what we've got. We have a fireball, and given that there's no fuel, that would indicate that that's a hydrazine fire. We have a vapor cloud that formed. That, again, would be likely to be the hydrazine. We also have some spectral analysis from airborne platforms that indicate the presence of hydrazine after the intercept. So again, that would indicate to us that the hydrazine vented overboard in some quantity, and we're starting to see that in Space.

Any one of those as a stand-alone is not a smoking gun, so we're putting the pieces together. I would tell you that it's probably going to take us another 24 to 48 hours to get to a point where we are very comfortable with our analysis that we indeed breached the tank. The imagery that we have, the high-definition imagery that we have, indicates that we hit the spacecraft right in the area of the tank. So each of the pieces put together — we're pretty confident, but we're not standing there; I don't have a picture that shows you a tank.

What we have afterwards is a debris field. We're tracking that debris field. It is already starting to reenter. We're seeing reentries in the Atlantic and specific [sic — Pacific] right now, and we'll track that over the next 24 to 48 hours. It generally takes us about a day to two days to start to get a good sense of each piece of material that's up there. Thus far, we've seen nothing larger than a football, which tells us that we're in the right area. But again, it's not conclusive, because it's



going to take us more time to make sure that we've got all of the reporting in, we've been able to correlate the data.

Most of what we see in Space, we use radar to see. So when you use radar at that kind of distance, you may see an object that appears large, but it could be that it's reflective and not actually large in mass. And so we're trying to work our way through that. And after you see several passes, you'll see a change in angles, and then you'll be able to correlate the data and understand that you either have a large object or you have a small object that's just glinting. And so that's what we're trying to work our way through right now. As I said, we do have some reentries beginning. We expect that that will continue through the day today and into tomorrow.

All of the activity that we went through last night, we provided updates through the night to the State Department, so that they could keep their embassies informed. So that reporting has gone out. We are standing by for consequence management. We have seen nothing yet in the way of reporting or in the way of reentry that has survived to the Earth. Okay. We have reentry in the atmosphere, but we don't necessarily have anything hitting the Earth.

And so those are the key pieces of information that we have this morning. Obviously, as we went through the process last night — from the secretary taking his brief about eight hours prior to the shot — we — General Chilton from Strategic Command recommended to the secretary that we had a window, that all systems were go.

One of the things we watched was the weather. We had some indications yesterday that we might have high seas, but when we actually got the ship on station, the ship reported that the seas were about two to three feet, which was well within the limits. So we had a good weather window, but what we were facing is, there is a low moving into the area, that would be in the area for the next four or five days. So we decided that we would proceed last night. The secretary made that decision, and then we moved forward.

The United States Strategic Command out in Omaha, Neb., ran the intercept, commanded the forces. We had a great team from Space and Missile Defense Command out at Colorado Springs, Colo., that worked the terrestrial sensors, from the Joint Space Operation Center in Vandenberg, Calif., that worked that the Space sensors, and the Missile Defense Agency that worked all the telemetry, worked the test cards that we used to prepare for this, did all the modifications of the system.

So you can imagine at the point of intercept last night there were a few cheers from people who have spent many days working on this project.

I'm not at the point yet where we're ready to say we got that tank, but we have reduced the mass. There is substantially less than the amount that we forecast, the 2,800 pounds at reentry; substantially less is available out there; the pieces are substantially smaller. As I said, right now we're seeing nothing bigger than a football. So by all indications, we're on a positive path that this was a successful intercept.

Q – General, regarding the debris, do you have any estimate of how many pieces of debris were created? And also, are you — can you rule out that any potentially hazardous or harmful pieces would actually fall in populated areas over the next few days or so on?

**CARTWRIGHT**: We're looking at the count, but it will probably take us 24 to 48 hours to get that count right, because each radar we've got to correlate as it passes from one to the next; am I counting something twice, or did I miss something? And like I say, I think that will take us most of today, into tomorrow.

From the standpoint of can I rule out that hazardous material will fall to the Earth, not at this point, but that's why we have the team standing by ready to go out and respond to that. We've

NASA Administrator Michael Griffin, right, addressed the press during a Pentagon Briefing Feb. 14, 2008. Griffin was joined by Vice Chairman of the Joint Chiefs of Staff GEN James Cartwright, U.S. Marine Corps, and Assistant to the President and Deputy National Security Advisor Ambassador James Jeffrey (off to the left). The topic of the briefing was the U.S. government's plans to destroy an unresponsive U.S. reconnaissance satellite with an interceptor missile. The 5000 pound satellite would pose a possible risk to life if allowed to fall to Earth due to the large quantity of dangerous hydrazine rocket fuel onboard. *Department of Defense photo by R. D. Ward*

notified the embassies, taking all due diligence to try to make sure that we have made the notifications necessary and that we're prepared if we find any hazardous material.

Q – Have you got any requests from other countries to provide them with additional information about the debris issue?

**CARTWRIGHT**: Not at this time. I think the State cables are handling that nicely right now.

Q – General, are there any countries in particular that you have issued warnings to or advisories to that they might be particularly vulnerable if there is any debris falling at the moment?

**CARTWRIGHT**: No.

Q – General, you say no debris has hit the Earth, that you know of. Can you rule out that some might have at this point?

**CARTWRIGHT**: Cannot. Cannot. It could have been smaller, could have escaped the sensors. If that's the case, generally that's a good sign, because a large piece of debris that would have been significant, so to speak, would generally heat up and we would have seen it either by radar or by infrared. And we did not see anything survive the atmosphere in that case.

Q – I know you said that this isn't any sort of test of missile defense, but what does this successful hit say about missile defense or that capability that you have in that area?

**CARTWRIGHT**: The elements of missile defense that were used here were the sensors, and the netting together of the sensors. That was the key piece that we would take from the missile defense system. The missile itself is a standard missile in the Navy inventory; the ship is a standard ship in the Navy inventory. We added a lot of instrumentation. We made some modifications to the software to be able to go after a satellite.

You know, this is a one-time mod. It is — if you put this mod in, we can't use the ship or the missile for another function without taking the mods out. So it's not something that we would be entering into the service in some standard way. This is a one-time type of event. But the assistance that the Missile Defense Agency brought, their technical expertise in this area, was invaluable in helping us put together all of the pieces that were necessary to make this intercept.

Q – I know you said this is a one-time event, but given the amount of junk that's up in Space and the chance that something might — that this might happen again, is there a chance this might become a reoccurring mission for the Navy?

**CARTWRIGHT**: No. The issue here, again, was the hydrazine. The mass itself would not justify us shooting at it. We've had satellites reenter before. When we design the satellites, we design them to have the fuel and the capability to be vectored in a more precise way into the ocean where they won't harm someone. What we have here is a satellite that went on orbit and immediately went dead and would not respond to our commands. We don't have that happen. We have several fail-safes that we try to put in place to make sure it doesn't. It did. This is the only one that we know of that this has occurred on. And so we see this as a one-time event. We will go back with the National Reconnaissance Office and with U.S. Space Command and make sure in the design side was there anything we missed that might

**"THIS WAS UNCHARTED TERRITORY. THE TECHNICAL DEGREE OF DIFFICULTY WAS SIGNIFICANT HERE."**
**— GEN James Cartwright**

further reduce the opportunity of this occurring again from the design standpoint.

Q – One quickie, on the techie question. How fast was the Standard Missile 3 going? And then I had a follow-up.

**CARTWRIGHT**: (Chuckles.) I'd have to get you — let me get you that information. We have said that the combined velocity of the two is 22,000 miles per hour rough order of magnitude. Okay?

Q – Okay. A satellite question. Now that you've had a successful hit, the attention's going to turn to why the satellite failed.

**CARTWRIGHT**: Right.

Q – Can you give — and NRO is not that helpful. Can you tell me in layman's language, was this a design problem, a manufacturing problem or what, based on what you know to date?

**CARTWRIGHT**: And let me take — on that last point, based on what I know. Not being able to drive up to the satellite and look, we have had satellites over the years — I'm not going to guess on this particular one, but let me give you a sense. We have had satellites over the years fail, generally an electrical failure. Could be that the battery failed. Could explode and cause problems. Could be that it was hit by a piece of debris that we didn't track. Any of those are possible. So a smoking gun, so to speak, on exactly why is something that has alluded us to date just because we can't get any diagnostics to tell us what's going on, because it's not responding to — or didn't respond to us.

Q – One follow-up. Was this an operational imaging satellite that caused a gap in U.S. intelligence capabilities, or an experimental package out there that, while not a good thing it failed, it doesn't impact or degrade U.S. intelligence capabilities?

**CARTWRIGHT**: Well, again, this has been off-line for two years, so anything that would have potentially been of value from an experimental satellite was not here for the last two years. So the impact today, negligible. What I don't know, and what you need to talk to the NRO about, is what was the mission and what was it designed to do and what would its contribution be. And that's for them to decide.

Q – Can you — I mean, we're hearing that the tank took a direct hit with the missile. You showed us the vapor cloud and in the video. Can you give us a better sense of why it is that you can't be certain that the tank itself was breached at this time?

**CARTWRIGHT**: Sure. We're looking at preliminary data, and we have a bunch of techies that are trying to work their way through the data. They want something that they can really be absolutely sure of before they will come to that conclusion.

No one of the pieces of data that we have thus far is enough to be conclusive. We have a high degree of confidence, based on the imagery that we have and the destruction pattern, that the missile impacted the satellite in the area of the tank. We have the cloud that appears to be hydrazine. We have what appears to be the plume and the fire, all of which would lead us to that conclusion.

So we have a reasonable degree of confidence, but we're looking for some more refinement of the data, the ability to go through that. My sense is that we will probably work that through the next 24 hours before we're comfortable saying conclusively that we did or that there is still ambiguity that we're trying to work our way out of.

Q – Is the reasonable degree of confidence that it hit on the tank the video or photos from SM-3, and will you release those to us?

**CARTWRIGHT**: Well, the videos from the SM-3 are key in the analysis. They give us an idea of where we hit on the satellite body and put us in the area. But they — unto themselves, at 22,000 miles per hour, you're looking at frames — there are large gaps in between. And so we're trying to understand, to a level of confidence, that we actually hit where we thought we did, that when — where we hit would have caused a breach in that tank.

Q – Is a fireball caused by anything else?

**CARTWRIGHT**: Yes. Well, that's what we're trying to understand. Generally speaking, no. So we believe that that's a contributor. Was this fuel that could have been in a line, not in the tank? No, we're not sure, when the satellite failed, where all the — there are several degrees of ambiguity here that we're trying to work our way through. Was it big enough to say that it was the tank? What would it look like if it's frozen? We don't have a lot of experience with hydrazine blowing up in a frozen mass, and so we're trying to work our way through that – and that's some of the effort that has to go on today. I'm sorry

Q – General, are you confident that no sensitive equipment or intelligence could have survived this hit?

**CARTWRIGHT**: Our sense is that most of anything that would have been sensitive intelligence would be destroyed on the reentry, that the likelihood of that destruction would be increased by reducing the size of the fragments. Is it a hundred percent? No, but if it survives, it survives. I mean, that would not — as I've said before, that unto itself was not enough reason to go after this satellite with a missile. It's the hydrazine that we're focused on. If something falls to the Earth that is sensitive and classified, we have a process to try to recoup it, but it'll fall to Earth, and that'll be it.

Q – Let me follow up to some of the earlier questions. The vapor cloud, could — are there any other alternative reasons that it could have formed?

**CARTWRIGHT**: What we're trying to put together — when we put that together with the spectral analysis, that gives a better sense. The vapor cloud could be debris. It could be debris. But what we're seeing is the spectral analysis is showing that it appears to be that it's hydrazine. And so that's where the analysis is focusing in on, is, is that — when you correlate two different images, are we looking at the same point in Space? Have we got this about right, or are we looking at two different points and we're seeing hydrazine in one area and the cloud is just debris? And that's what we've got to correlate today. That's the analysis work that's going on.

And we're trying to pull all these pieces together

Marine GEN James Cartwright, Vice Chairman of the Joint Chiefs of Staff, informs Defense Secretary Robert M. Gates of the successful missile intercept from the Pentagon's National Military Command Center, Feb. 20, 2008. *Defense Department Photo by Air Force Tech. Sgt. Adam M. Stump*

and make sure that we're not stringing facts together erroneously, that what we're trying to do here is correlate them with some degree of confidence.

Q – And also you had talked about the — that if you did not need to use the other two missiles, that they would be — that the software that was used to — that was programmed then for the mission would be — (inaudible). When will that happen? When will they be —

**CARTWRIGHT**: Well, they'll return to port. They'll be downloaded. There was software associated with sensors, software associated with those weapons and the ship. That'll be taken out of the system.

There's also some wiring — test wiring that goes into this kind of a thing, to give us a better sense of what was going on. And that'll have to all be removed. So it'll take us a few — probably a couple of weeks to get all of that accomplished.

Q – Although you still have analysis to do to see just exactly how successful you were, you've got to feel pretty good about this, right? I mean, this was uncharted territory.

**CARTWRIGHT**: Yes. This was uncharted territory. The technical degree of difficulty was significant here. You know, it — you want to reach out to each one of those people that probably gave up their weekends and nights to get this done in 30 days and put it together, whether they were the Sailors on the ship, the technicians, the software programmers, STRATCOM's operations teams. I mean, all of those people, you want to reach out and just grab them by the hand and thank them for what they did.

You can imagine, at the point of intercept, there were a few cheers that went up in operation centers and on that ship, but with the understanding that we still have some work to do.

The consequence-management part of this, and making sure that we track that, is critical, because the intent here was to preserve human life. While the technicians are looking at what they did in their part and feeling very good about it, at the end of the day, what's important to us is what debris is out there that could fall, where is it going to fall, and if it falls in some area that's populated, getting to it and making sure nobody gets hurt.

Q – General, you were pretty confident of hitting the satellite. The trick was hitting the tank, I understand, and it appears very likely

that y'all did. Would you care to offer a percentage of probability of success of hitting the tank? Ninety percent, do you think, from the evidence you have now, or do you want to go into that?

**CARTWRIGHT**: From our position, you always want to hedge your bet, because there's no absolute certainty. But I would tell you, from watching and from participating, that we're in the very, very high — 80, 90 percent sure that the tank was breached. That's my opinion. We're going to try to validate that with assessment today. We are proceeding as if we didn't. In other words, we're posturing ourselves to go out and recover a hydrazine tank that maybe didn't get breached. And we'll hold those measures in place until we have a degree of certainty that the tank was breached and that the hydrazine was vented off.

Q – You had mentioned you can't rule out that hazardous debris could fall to Earth in a populated area. Can you give us a ballpark? Is that — you know, percentage-wise the chance that it might actually come in contact with humans?

**CARTWRIGHT**: No. And let me just kind of go to the statistics side of this. If you believe that in rough order of magnitude, there are 6 billion people on the Earth, most of the statistics would put each of them equidistant apart across the face of the Earth and say, now what's the chance that any one of them got hit. They would do it on a standard temperature day, no wind, et cetera. So the difficulty here in statistics is that you can make them say pretty much anything that you want, and they're not terribly revealing, particularly if you happen to be standing at the point of impact.

But what we try to do is put to that assessment what's the reasonable man approach here? One, it was clear to us that the hydrazine was unique in that it could expand beyond the area of a single mass hitting the Earth and affect people. I used the example of two football fields; again, standard day, a couple of knots of wind, dispersals, standard humidity, all of those things. What does that look like in a city? What does that look like in a forest? What does that look like in an open field? All of them very different, all very different.

But the intent here in looking at the analysis side of those statistics was — where we came to was that there was a reasonable chance that this hydrazine, if it fell in a populated area, would affect people. Would it affect them the same? Would they approach it? Would they walk away from it? I can't get inside of the head of a person. There's too many variables there.

So what we did was we said you have to treat this as if it's going to hurt someone, and if you can mitigate the threat, if we can reduce that opportunity, then you should take action if you have the opportunity. And that really was the driver for us.

So statistically, I can make them say almost anything we want. From an assessment standpoint, the hydrazine was unique here. That's what broke out — not the size of the mass, not the reentry, not the classified nature. It was the hydrazine that drove this. It's the only factor that we've seen that would justify doing something like this.

Q – (Off mike) — the debris from the impact is, can you give a high, low —

**CARTWRIGHT**: In the area of the satellite on orbit? I'm sorry, doing the wrong direction. On

## "It is not a missile defense system. In other words, we had to modify it away from missile defense in order to do this, so the two don't correlate."

**— GEN James Cartwright**

orbit, we believe right now, one, that the size of the debris is smaller than we'd forecast it would have been?. I used the example of thus far, we haven't really catalogued anything bigger than a football. We've still got some looking to do. We may have missed something. It could have been masked, et cetera, but we're looking.

We are seeing reentry. We forecast that there would be a substantial amount of reentry on the first three revolutions or in about the first 48 hours we'd have a good percentage of it down. That seems to be holding true, but again, we've got to work our way through. And that's part of what's hard here, is something that was there on one revolution that's not there on the next. Did we miss it, or did it reenter? And so we're trying to work that cross-sensor, try to match radars to infrared, et cetera to put that together. So there's a lot of ambiguity right now, but the trends and the vectors are in a positive direction.

Q – One other reason that was speculated to be behind this was that essentially this was, for lack of a better term, "target practice," that the military wanted to basically present a new capability, another reason for missile defense, maybe send a message about our capabilities in Space. What do you say to those allegations?

**CARTWRIGHT**: I guess — two things. I mean, I'm certainly not in a position to tell people how to think. But this is not — this is a modified system. It is not a missile defense system. In other words, we had to modify it away from missile defense in order to do this, so the two don't correlate. Number two, on the idea that this was potentially an ASAT type of activity and we were trying to gain data for ASAT — remember that we did that in the 1980s. We really don't need to go back. We understand ASAT. This is — there's no reason to go back and reprove what we've already done.

From the standpoint of missile defense and some sort of justification that that would be a reason to go out and do this, the SM-3 has a great track record in missile defense. Again, this is not — I mean, it's a modified missile. It's not the same type of profile, so it doesn't correlate. Will I be able to convince everybody that that's the case? No, but at the end of the day, it would have been, in our judgment, irresponsible to try — to not try to remove some of this risk. And that's what drove us.

Q – I was going to ask him to put his STRATCOM hat on and look at — compare this hit with the difficulties of a ground-based interceptor type of hit. Missile defense true believers may use this and say, oh, geez, the system really works. But you know the difficulty of — can you just, one minute, how the — this is different than going after a, you know, four-foot warhead?

**CARTWRIGHT**: The key difference here is that this is not an aerodynamic body. The satellite can't fly in the atmosphere. A reentry vehicle can fly in the atmosphere. So if we launch from over here towards this direction, as soon as we launch, we can start to know about where this is going to land, because it's an arc. It's ballistic. This is not ballistic. The orbit is relatively predictable. But once you touch that atmosphere, this is not a pointy body that will fly through the air. It flips, it flops, it breaks apart. So that's substantially different than trying to aim at an aerodynamic body that has some consistent properties of flying through air mass. Okay. So — very different. Very different intercepts.

Q – It wasn't flying in the atmosphere, was it?

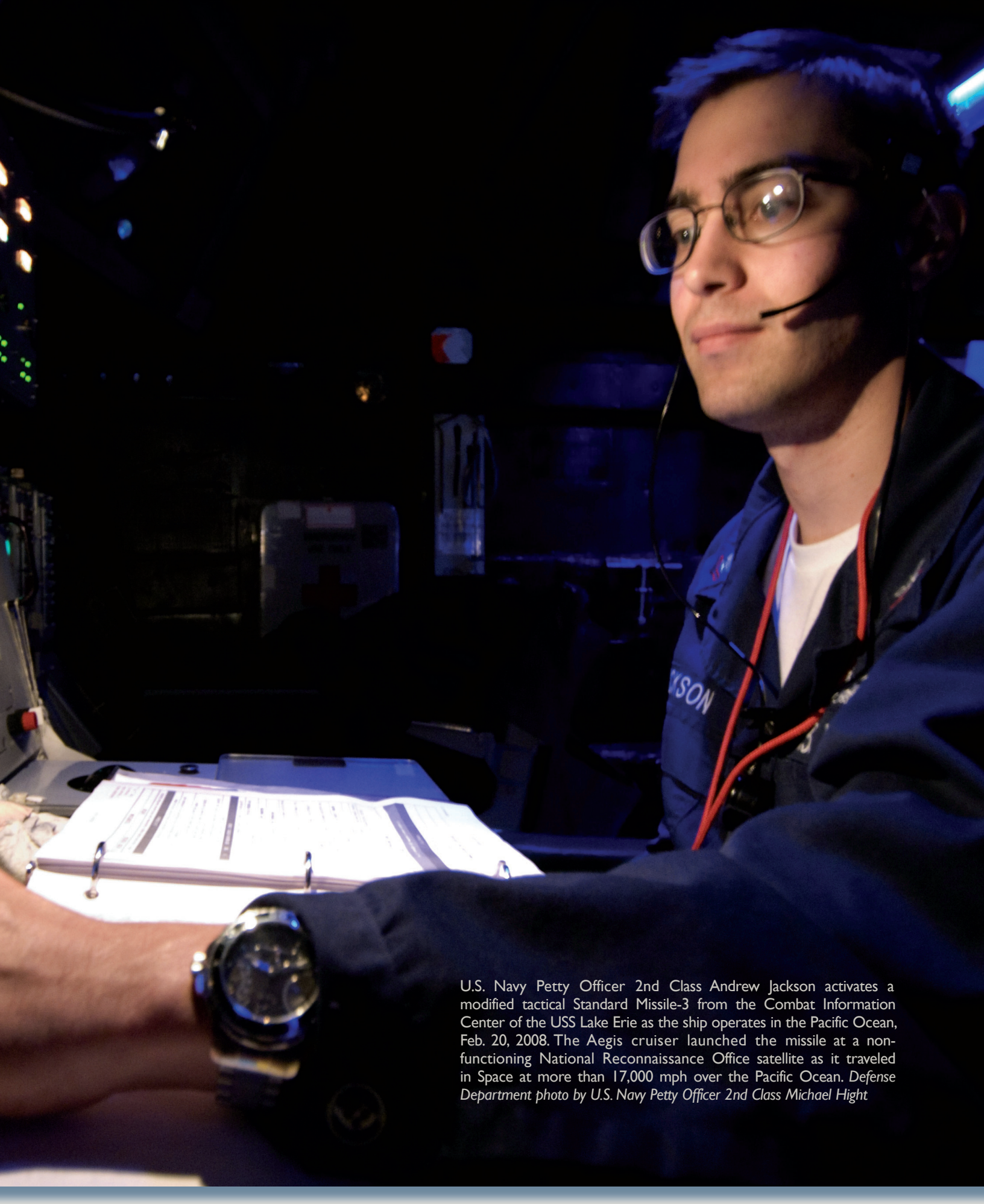
**CARTWRIGHT**: No. We're catching it up. So we've got the stability. But again, what you're dealing with in an orbit is a substantially different type of flight regime than an arcing body that is ballistic.

Q – Does the whole episode then add to the knowledge that could be used or applied to missile defense at all?

**CARTWRIGHT**: Other than netting the sensors together, which is what we use for missile defense, not really. I mean, it doesn't cross over.

Q – Can I just have a quick clarification? Is a second strike, a second shot, ruled out now? Do the ships stand down? You said you were going on the assumption, at the moment, that you haven't hit, even though you believe you did.

**CARTWRIGHT**: We believe that is really on the far edge of possibility. We're not proceeding as if we're going to take another shot. If we find something today that is very conclusive that the tank is still in Space, that it hasn't been ruptured, we may do an assessment. But I would tell you, the probability of another shot at the current time is very low.



U.S. Navy Petty Officer 2nd Class Andrew Jackson activates a modified tactical Standard Missile-3 from the Combat Information Center of the USS Lake Erie as the ship operates in the Pacific Ocean, Feb. 20, 2008. The Aegis cruiser launched the missile at a non-functioning National Reconnaissance Office satellite as it traveled in Space at more than 17,000 mph over the Pacific Ocean. *Defense Department photo by U.S. Navy Petty Officer 2nd Class Michael Hight*

# Army Space @ Schriever IV

By George Luker

After all was said and done, it was clear to those who participated in *Schriever IV* that this premier Space wargame continues to be an important venue for learning just how Space effects — and especially disrupted or degraded Space effects — influence Joint, coalition, intelligence, interagency and commercial operations. The *Schriever IV* Space wargame not only helped Joint wargame participants grapple with Space and high-altitude concepts and capabilities, it helped the U.S. Army Space and Missile Defense Command arrive at important findings that will benefit Army and Army Space warfighters in the future.

George "Luke" Luker is currently a military analyst who served 25 years in the U.S. Air Force (B-52s, T43s, and Joint/Combined Air and Space Operations). When he retired in 2004, he first supported U.S. Army Space and Missile Defense Command/Army Forces Strategic Command's Global Missile Defense mission; since 2005 he has supported the Space and Missile Defense Battle Lab's efforts in Army Title X and Joint wargame planning and execution.

## Army team members provided significant feedback on game execution, highlighting gaps and seams in Joint Space processes, Combatant Command actions and reactions and overall command decisions involving Space.

**Background:** The *Schriever*-series wargame began in 2001 and has been held biennially through 2007, with the *Schriever IV* wargame serving as the capstone event for the 2006-2007 wargame cycle. *Schriever IV* planning and execution was headed by a team from Air Force Space Command's Space Innovation and Development Center. To prepare and shape the main Space wargame event, the center held a series of conferences, seminars and workshops that served as planning events for stakeholders and previews for this year's wargame concepts, scenarios and objectives. Four major seminars were offered and served as the major focus areas for the wargame: Policy & Rules of Engagement, Counterspace, Information Operations and Homeland Defense. Findings generated from these seminars were used to influence the main Space game's scenarios, scenario injects and operational environments on a global scale. The seminars and workshops also produced analysis materials which game developers, game controllers and analysts used to validate wargame execution. The capstone wargame was conducted at Nellis Air Force Base, Nev., from March 24-30, 2007, and included over 440 participants assembled from numerous organizations: Air Force Space Command, U.S. Army Space and Missile Defense Command, U.S. Northern Command, U.S. Strategic Command, U.S. Joint Forces Command, and U.S. Special Operations Command. Various other Department of Defense officials, non-Department of Defense agency representatives, and allies from the United Kingdom, Canada and Australia also took part. The global epoch for the Space wargame scenario was set in the year 2025. The main event was conducted in an environment classified as Secret.

## Objective 1

**Assess Army Space players' contributions to crisis action planning.**

- Explore Space planning issues with U.S. Strategic Command in the development of suitable theater Space support concepts.
- Examine placement of FA40's and their required skill sets for theater level assignments.
- Help clarify and codify the Director Space Forces concept in the rewrite of JP 3-14.
- Continue to selectively identify experienced personnel to participate in Schriever wargames.
- Include the Army G-2 and G-6 communities to solicit their active participation in future Space Wargames and experimentation.

## Objective 2

**Examine platform/payload employment, warfighter roles and responsibilities, and command control of HALE platforms in an integrated framework of layered ISR, networked C2, and strike capabilities, paying special attention to homeland defense.**

- Develop High Altitude Long Endurance command and control (C2) and tasking, processing, exploiting, and disseminating (TPED)11
- Further develop High Altitude Long Endurance operational concepts, lighter than air (Global Observer) and heavier than air (airships).
- Continue to integrate High Altitude Long Endurance into wargames and initiate a relationship with Air Combat Command as they assume High Altitude Long Endurance proponency role for the Air Force.

## Objective 3

**Assess how Army Space players and forces leverage and integrate Space assets to detect, deter and destroy threats.**

- Advocate and support Army Space Links-and-Nodes Gap Analysis to determine the effects degraded or lost Space capabilities have on the success of Army forces in executing full-spectrum operations.
- Assess graceful degradation strategies during wargames.
- Advocate and support an operational risk assessment focusing on efforts of lost Space capabilities; participate in ongoing protection studies (e.g., a Johns Hopkins University Study) to leverage insights in developing an Army mitigation strategy.
- Examine and, as necessary, implement training for FA40s in the area of collection management processes.
- Provide more robust training of the Army Space/High Altitude Toolkit and order of battle before wargame execution.
- Develop specific Information Operations and Space Vignettes for table top examination and champion Information Operations integration into future wargames and experiments.

Objective 4

**Assess how Land Component operational Space control requirements are integrated into the Joint Space Control decision-making and tasking processes.**

- Coordinate with Schriever V wargame planners to shape a black-white (Special Access Program/Special Access Required) integration construct to ensure improvements to Joint Space Control processes.

**Army Participation**: Army Space wargame support came primarily from the Future Warfare Center and the Space and Missile Defense Battle Lab. The planning phase encompassed over a year-and-a-half effort by the Battle Lab's Frontiers Division, the office of primary responsibility since Army Space and missile defense wargaming falls under their command charter. During that time, they worked closely with Air Force Space Command's Space Innovation and Development Center to help form wargame concepts, scenarios, objectives and capabilities along the way.

One of the critical elements of integrating Army and Army Space into *Schriever IV* was ensuring the wargame was staffed by uniquely experienced Army participants. Each Army participant was chosen carefully for their past operational experience, current assignment, and their level of Space and technical expertise. The primary means of ensuring the best qualified participants were included was by extending as many invitations as possible to FA40 Army Space Operations Officers and other qualified Army officers with Space expertise. Table 1 identifies the participants' organizations and player positions; Army management and support personnel are also listed.

It should come as no surprise that the Army did exceptionally well at *Schriever IV*. Army personnel not only attended *Schriever IV* in strength, they advocated effectively for Army Space and high altitude equities, requirements and capabilities in Joint operational environments. The Army took the part to promote Army Space concepts and the utility of Army Space forces. They sought out ideas during the wargame that could lead to Doctrine Organization, Training, Materiel, Leadership and Education, Personnel and Facilities solutions. At the same time, Army participants had the opportunity to make the Air Force and the Space community aware of Army Space requirements.

In the area of capabilities the Army team well-represented and advocated for future Army Space and high altitude resources, especially the High-Altitude Long-Endurance airship, a lighter-than-air asset, and the Global Observer, a heavier-than-air asset. The Army contingent introduced and highlighted these systems during the main wargame event as part of delivering Intelligence Surveillance and Reconnaissance, Communications, Targeting and Strike capabilities to the warfighter. Army members also participated in *Schriever IV* to update their knowledge of the Air Force's roles, missions, and strategies in executing the Department of Defense Executive Agent responsibilities for Space.

Moreover, the Army team exploited *Schriever IV* to examine and refine the Army Theater Support Concept, the Army Space Master Plan, and the Army Space Operations Concept Capability Plan. The Army emphasized a realistic operations tempo to ensure identification of seams and gaps in Space capabilities, command-and-control, and requirements. As a result, Army team members successfully examined theater Space support concepts, identified requirements for examining future Space command and control procedures, and appraised emerging concepts such as operationally responsive Space in Joint operational environment

**PARTICIPANTS OF SCHRIEVER IV:**

- MAJ Sam Russ
- LTC Andrew Weate
- LTC Victoria Miralda
- Scott Chappell GS13
- COL Doug Gneiser, Space Law
- COL Robert Bruce
- COL Scott Netherland
- MAJ Donald Johnson
- Steve Lord (Contractor)
- Dr. Cindi Schmitt (Contractor)
- Ken Kriner (Contractor)
- BG (Ret) Steve Ferrell

**WARGAME MANAGEMENT AND SUPPORT**

- Frontiers Division Chief, LTC Saundra Yanna
- Frank Cox GS14
- MAJ Stephen Harms
- Space Analyst, George Luker (Contractor)

**Initial Observations:** Throughout the event, the Army wargame team internally documented observations and comments made by Army Space players. After preparing a "quick look" assessment during the game, the following chief observations were presented to LTG Kevin Campbell just prior to his attending the Senior Leader Forum held on the final day.

- High-Altitude Long-Endurance capabilities have the potential to provide persistent critical Space-like capabilities for Combatant Commands. These assets were heavily employed in game for persistent communications and intelligence, surveillance and reconnaissance.

- An Army strategy is needed to protect Army access to Space services in a stressed environment.

- Combatant Commands need better visibility and understanding of supporting Space Architecture.

- Space command and control processes in 2025 should leverage net-centric capabilities that enable timely integration of Space effects.

- A strategic end-state should be defined to drive decision-making processes before Space warfare is initiated.

- Army strategic vision is needed to more effectively employ Army Space Professionals within the Joint Force.

- Joint Functional Component Command-to-Joint Functional Component Command integration and synchronization are paramount to delivering global strategic services to the Combatant Commands.

- Army needs to develop a strategic vision to more effectively employ Army Space Professionals within the Joint Force (military & civilian).

- Restrictive Rules of Engagement, Policies, and "today think" retarded decision-making processes during the wargame, thereby causing missed opportunities for discovery.

These quick-look observations led the way for more rigorous, systematic analyses by the Space and Missile Defense Battle Lab, which produced more concrete findings, most of which follow this section.

Objective 5

Document interactions of Army Space Forces with Joint, Coalition, and Interagency partners in planning, integration, coordination, and execution of Space control missions to defend the homeland and global theaters.

- Advocate and support an Army Space Links-and-Nodes Gap Analysis to determine the effects degraded or lost Space capabilities have on the successes of Army forces in executing full spectrum operations.
- Using the results of the Army Space Links-and-Nodes Gap Analysis, advocate for Army prioritization of information requirements and integration strategies with U.S. Strategic Command.
- Advocate for Army Space information requirements for support to land components in the areas of tactical, operational, and strategic communications, Precision, Navigation, and Timing, intelligence, and reachback to sanctuary, be included in rewrite of JP 3-14.
- Assess Space asset prioritization during wargames.
- Identify Army commercial asset data requirements and the mission utility. Inform Army decisonmakers of findings to ensure they advocate for those requirements in the proper forums.
- Advocate and support in Army Space Links-and-Nodes Gap Analysis to include a risk assessment of Joint Blue Force Situation Awareness data disseminated from all available Space systems.
- Include coalition partners in Army doctrine development and planning
- Integrate coalition partners' capabilities into Army Space future concept work.

**Final Recommendations:** Army team members provided significant feedback on game execution, highlighting gaps and seams in Joint Space processes, Combatant Command actions and reactions and overall command decisions involving Space. Analysts kept records of their Army participants' oral and written comments and compiled them into a final report on Schriever IV. The table on the previous pages, broken down by Army objectives for the game, and taken directly from the Schriever IV Final Report, provide recommendations for U.S. Army Space and Missile Defense Command and Future Warfare Center to consider and act upon.

**Outstanding Performers:** Out of the twelve main Army members who took part in *Schriever IV*, three of them were selected as "Outstanding Performers," all chosen by the individual game cells in which they participated. LTC Victoria Miralda, currently serving as the 1st Space Brigade Executive Officer, was commended for her superb support of the Joint Space Operations Center cell; LTC Sam Russ, assigned to the U.S. Navy's Space and Naval Warfare Systems Command, was tapped for his exceptional contributions to the U.S. Northern Command cell; and Steve Lord, supporting the Space and Missile Defense Battle Lab's Experiments and Transformation Division, was recognized for his consummate expertise within the Industry cell. Overall, only twelve outstanding performers were chosen for the wargame, which highlights the Army team's key contributions to the event.

Objective 6

**Document ROE and policy issues that arise during Schriever IV.**

- Examine High-Altitude Long Endurance in Department of Defense and interagency games emphasizing homeland defense to further assess legal issues.
- Incorporate resolution of legal aspects of High-Altitude Long Endurance into operational concepts.

Objective 7

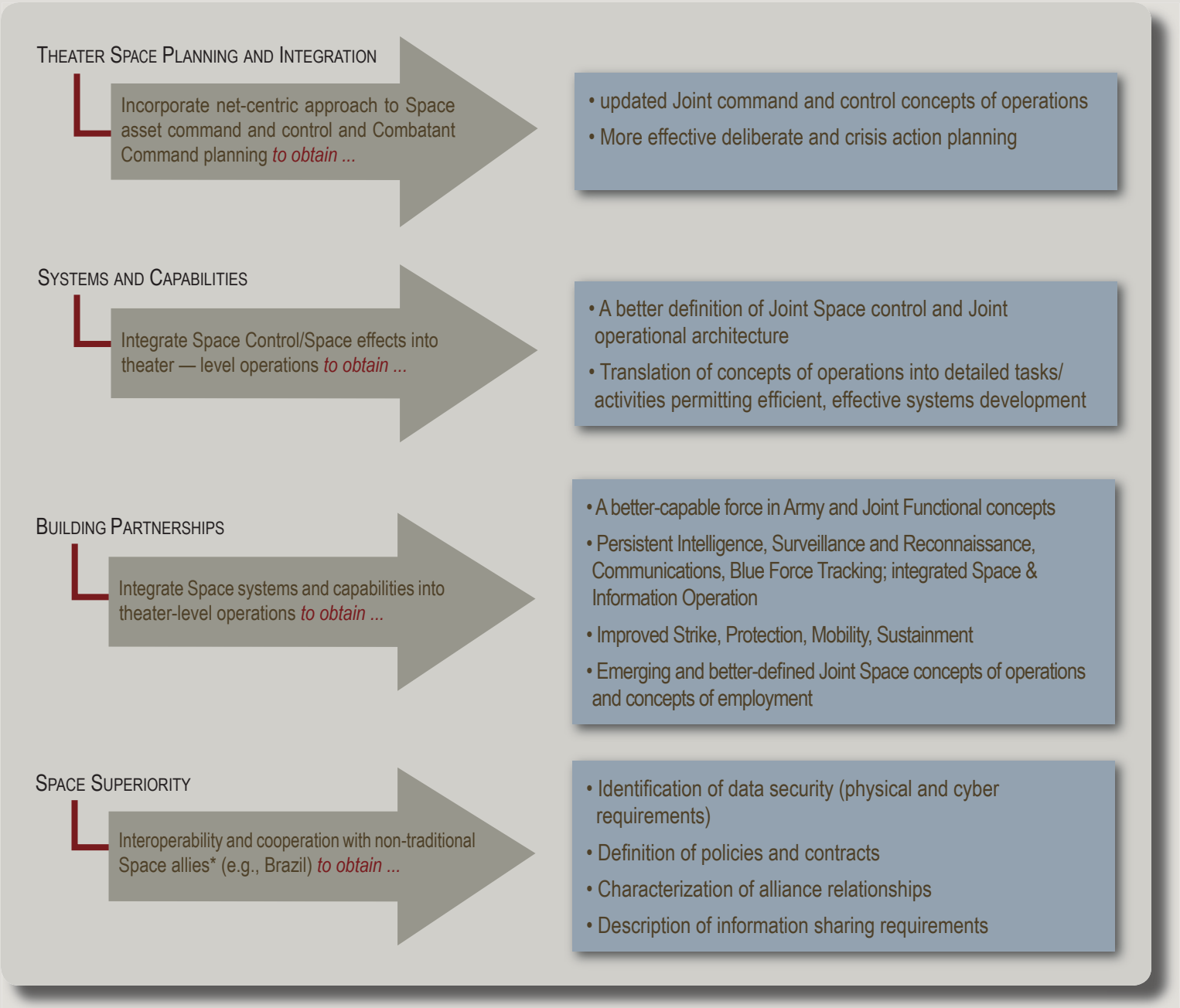
**Begin assessing future Army Space Power technologies that bring capabilities to Army and Joint warfighters.**

- Advocate for Space officer information requirements to be included in a User Defined Operating Picture/Single Integrated Space Architecture Picture concept.
- Generate Army requirements of inclusion in the User Defined Operating Picture/Single Integrated Space Architecture Picture.
- (SMD Battle Lab) Pursue experiments and analysis opportunities to assess User Defined Operating Picture/Single Integrated Space Architecture Picture operational and tactical relevance.

**The Road Ahead: Schriever V & Unified Quest:** The *Schriever IV* wargame was valuable for identifying and assessing Space operations' command-and-control seams and underscoring the numerous challenges for Joint, coalition, industry, intelligence and interagency interoperability. U.S. Army Space ad Missile Defense Command and the Future Warfare Center will continue to stay engaged in the *Schriever* wargame series to support our focus on Joint requirements and further socialize Army equities in the Joint warfighting arena. In June of this year, Air Force Space Command's Commander, General Kevin P. Chilton, approved the next iteration of the *Schriever* series, *Schriever V*. Accordingly the Future Warfare Center and the Space and Missile Defense Battle Lab's Frontiers Division, along with other key Army Space stakeholders, will join with the Air Force Space Command/Space Innovation and Development Center *Schriever* team in October of this year to begin planning *Schriever V*.

While *Schriever IV* provided numerous insights that Army Space can take back into *Schriever V*, *Schriever IV* likewise yielded results that the Army Space wargames team can transfer to *Unified Quest*, Army's Title X wargame series, held annually and culminating at the Army War College, Carlisle Barracks, Pa. In *Unified Quest* 2008, sponsored by Army Training and Doctrine Command, U.S. Special Operations Command, and U.S. Joint Forces Command, Frontiers Division's wargames team will take a more active and holistic approach to Army Space, focusing especially on Space effects and Space operations that support operational and tactical commanders.

During this year's version of *Unified Quest*, the Army has the opportunity to examine gaps, seams, and friction points between Joint, coalition, interagency communities especially at the theater level of Space operations and operational command. Out of a trends analysis brought about by reviewing the entire *Schriever*-series of wargames — *Schrievers I-III* and reinforced by *Schriever IV* — Space and Missile Defense Battle Lab analysts and wargame team detected four major focus areas: Theater Space Planning and Integration, Space Superiority, Systems and Capabilities, and Building Partnerships. From these focus areas, analysts and the Battle Lab wargames team assigned the operational contexts under which these focus areas would operate, then developed constructive objectives for the command to pursue in the shaping of this year's *Unified Quest* wargame. Ultimately the integration of Army Space focus areas and objectives into *Unified Quest* will build




on Army Space's authority and more strongly influence the "Big-A Army," Army Training and Doctrine Command, U.S. Special Operations Command, U.S. Joint Forces Command, the other services, interagencies, and coalition partners. Figure 3 depicts in more detail how focus-area trends translated into constructive objectives for this year's *Unified Quest* — and for all Joint wargames to follow.

**Figure 1**: Schriever Historical Trends Translated into Army and Joint Wargame Objectives

Schriever IV has been deemed by many as an unparalleled success, and this success was due in large measure to the expertise and support of the Army participants. They did their utmost to make the preparatory seminars and the wargame event productive experiences for Army Space, the Army, the Air Force, other services, coalition partners, industry representatives, and in the end, the warfighter. The Frontiers Division of the Army Space and Missile Defense Battle Lab is truly grateful for the efforts they put forth. Without their devotion to the Army Space mission, this wargame event would not have yielded the substantive findings that ultimately will be integrated into future command concepts, wargames, experiments, doctrine and fielding.

# Space Climate

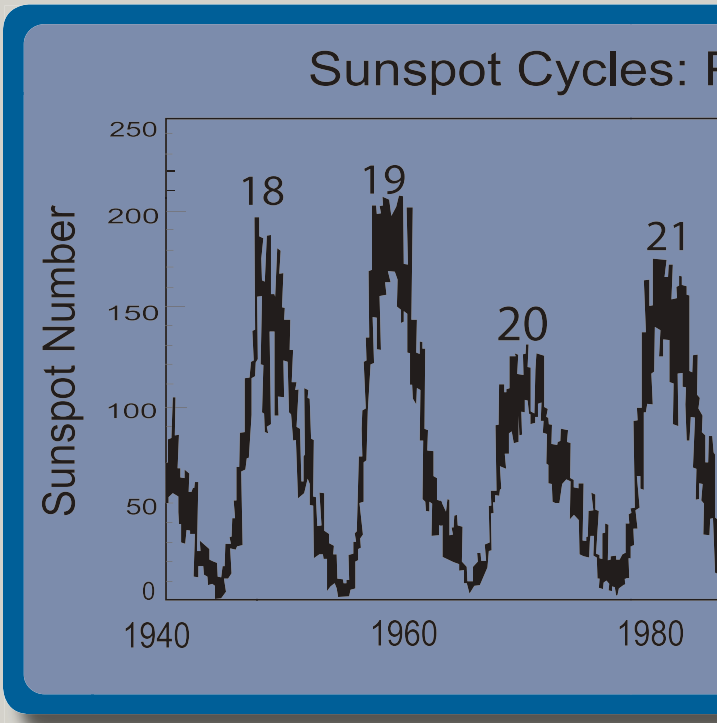
## and the Military Decision Making Process in Solar Cycle 24

By CPT Stacy Godshall

### 1. Introduction

January 2008 was the beginning of a new solar cycle called solar cycle 24. In this new 11 year cycle, as with all solar cycles, the sun will have an increase in magnetic activity until the maximum is reached in about 2012 or 2013, and then decrease until about 2019 when minimum will be reached. This type of dynamic activity in the sun has been visibly manifested for centuries in the number of sunspots on the sun, with the maximum of the cycle corresponding to the maximum of the number of sunspots. The maximum of solar cycle 24 will possibly have a peak 30-50 percent greater than the peak of solar cycle 23 as depicted in Figure 1 [Dikpati, et al, 2006; Phillips and Hathaway, 2006], and thus it will possibly be an intense cycle for geomagnetic storms.

As mentioned, these cycles have been the object of study for scientists for centuries. What has not occurred in centuries past however is the analysis of the solar cycle and its impact on military operations. This is obvious since no military operations have needed to incorporate the solar cycle and its dynamics into planning since it generally had no effect on operations. Times have changed and the military has extensively utilized Space assets in operations for approximately the last twenty years. Thus for two solar cycles, specifically cycles 22 and 23, we have incorporated Space weather into mission analysis. Weather in general has had significant impact on operations since warfare began; either benefiting one force or the other. The following are just a few examples of such operational impacts created by weather conditions. In 1915, German forces use of poison gas and wind blew the chemicals back onto German lines and destroyed four Prussian regiments. In 1944, the D-Day weather forecast was for conditions favorable to air, sea and ground operations together — a rare event. In 1966, U.S. Army material replacement cycle in Vietnam speeded up from eight years to two years due to tropic moisture's degradation of wood, cloth and electronics. In 1990, Desert Storm Diurnal



winds prevented Iraq from launching ballistic SCUD's during daytime operations; winds apparently blew chemicals in unsuspected directions. Likewise, Space weather has and will increasingly continue to have an impact on operations. Just in the last two solar cycles, there have been solar flares and other solar dynamic activities which have caused impacts on civilian satellite systems including but not limited to the following: GPS signal scintillation caused by geomagnetic storm induced ionospheric density variations, increased satellite drag, anomalous data readings, and satellite charging effects. Therefore, just as in the past when weather has impacted specific weapon use, timing of operations, or outcome of an operation, we will need to be able to analyze the current weather conditions as well as past statistical data which will enable for the pattern of possible future Space weather conditions and thus a Space weather situational awareness. The military decision making process by way of mission, enemy, terrain and weather, troops and support available, time available, civil consideration (specifically terrain and weather) can incorporate analysis from the past two decades of scientific data to formulate a "Space climate" if you will. In FM 3-0, terrestrial and atmospheric climate is described as "… the prevailing pattern of temperature, wind velocity, and precipitation in a specific area measured over a period of years. Climate is a more predictable phenomenon than weather. It is also better suited to operational-level analysis. Planners typically focus analysis on how climate affects large-scale operations over a geographically diverse area." Therefore, Space climate can also be based on the following pattern during solar cycle 24.

As a solar cycle progresses from minimum to maximum, the dynamics of the solar activity change as well. Geomagnetic storms can occur during almost any part of the cycle and originate from solar activity such as solar flares, coronal mass ejections, and Corotating Interactive Regions of solar wind (regions in which fast and slow solar wind mix to create solar wind shock fronts). However, there is extensive data which shows that such activities and subsequent geomagnetic storms occur at certain times more than others just as hurricanes occur in the Atlantic Ocean at certain times of the year. It is the geomagnetic storms which will have an increased place in the weather portion of the military decision making process and mission analysis of the future. This due to the fact that the in this solar cycle and beyond.

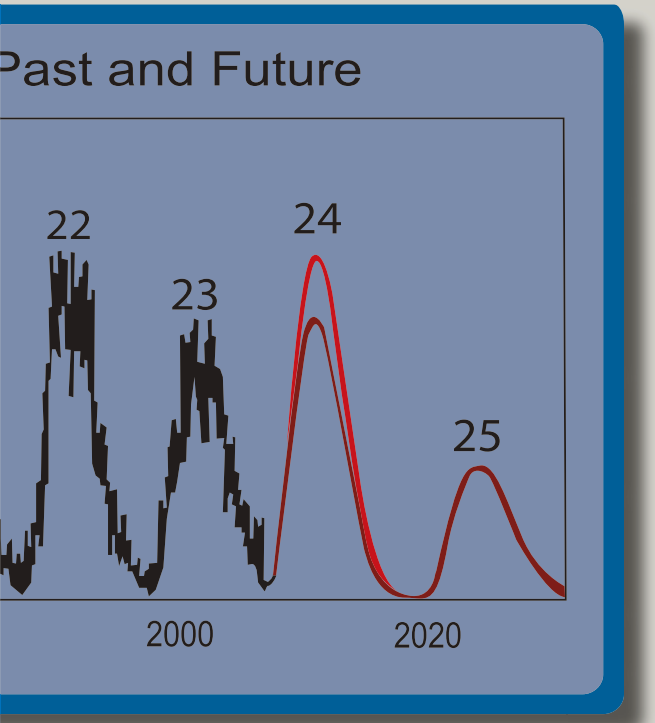



**Figure 1**: Past sunspot numbers for respective solar cycles and predicted levels for cycles 24 & 25.

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Fok, Mei-Ching, et al., 2008, Radiation Belt Environment

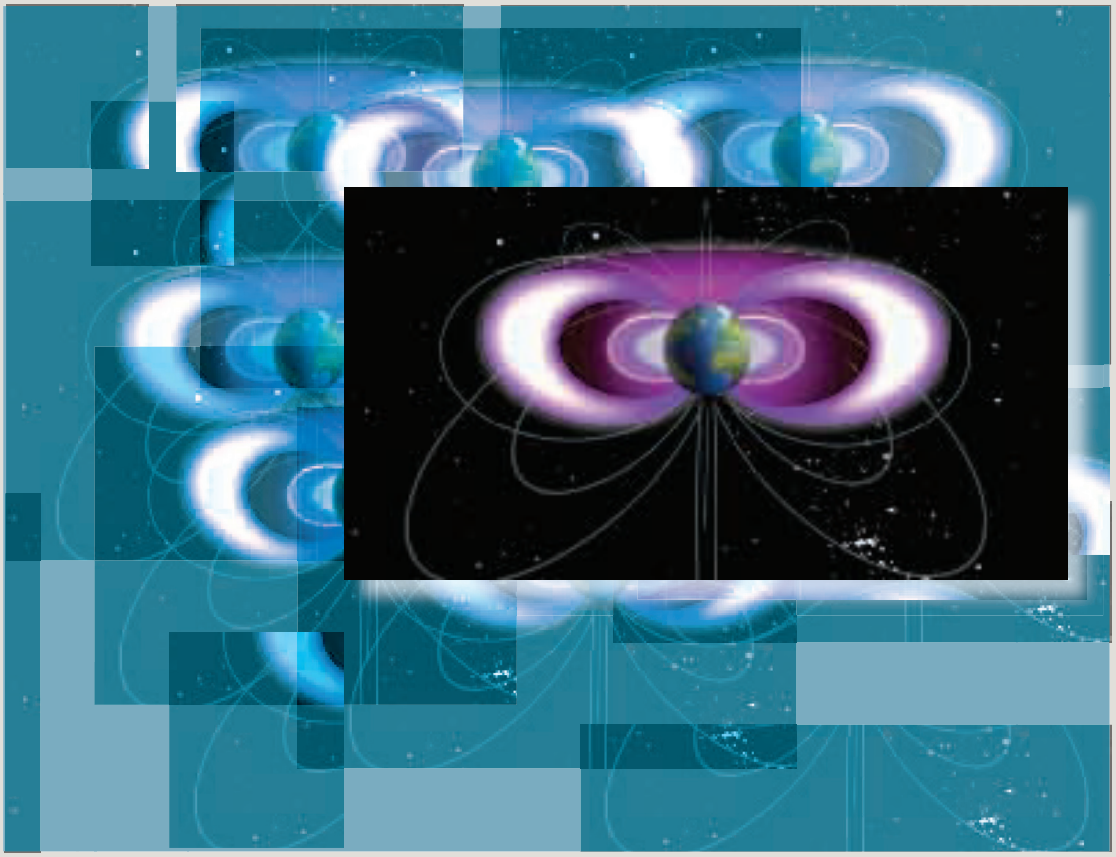

**Figure 2:** The Van Allen Belts include the inner belt, the outer belt, and the slot region between the two. Inner and outer belts are depicted as a cross section of a donut shape around the Earth.

geomagnetic storms (which are produced by the solar activity effects on the Earth's magnetosphere) produce the above mentioned impacts of signal scintillation, satellite drag, anomalous data readings, and satellite charging effects but also cause variations in the Earth's radiation belts (also known as the Van Allen Belts). The Van Allen Belts are regions in which high energy particles become trapped and therefore maintain high concentrations which can also have negative impacts on satellite systems. There are three main regions known as the inner belt, outer belt, and slot region as depicted in Figure 2 (courtesy of UTSA Physics and J. Goldstein).

There are many satellite systems which reside in orbits which typically are not collocated with the Van Allen Belts and thus are not affected by them. The outer Van Allen Belt however changes locations into the slot region [Thorne et al., 2007] and/or has changes in intensity and concentration levels [Iles et al., 2002] during certain types of storms and thus will at those times affect satellite systems that had been previously unaffected. These types of storms can be grouped into what are called geomagnetic superstorms. There is an index which measures the strength of storms known as the Dst index which has a unit of measure of nano Tesla (a Tesla is a unit of magnetic field strength and nano = 10-9). Any storm with a magnitude of Dst greater than 250 nano Tesla is in the superstorm category [Echer,

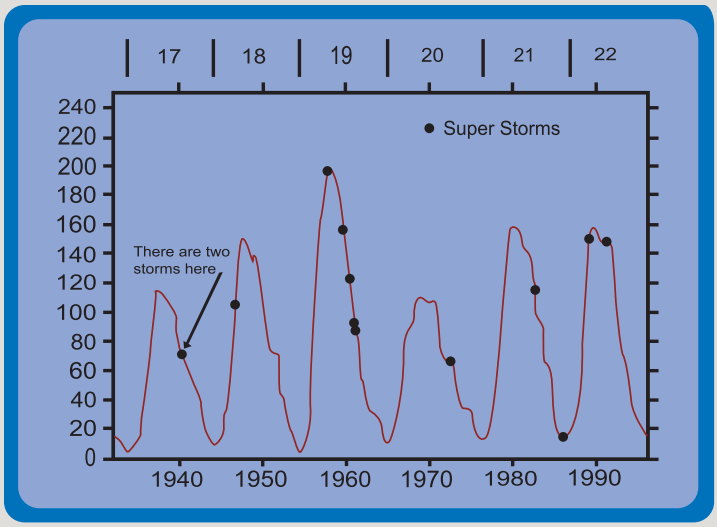


**Figure 3**: Declining solar cycle phase dependence for superstorm in cycles 17-22.

et al., 2008].

## 2. Superstorms

There are certain solar events that are the catalyst for geomagnetic storms and are thus the drivers of said storms. There are two types of geomagnetic storms, specifically Corotating Interactive Region driven or Coronal Mass Ejection driven. In a study by a group of physicists lead by Dr. Bell, the number of storms that have this type of strength account for about two percent of all storms and amount to a total of 13 that occurred between 1932 and 1997. In that study, it was determined that superstorms occurred most likely on the declining phase of the cycle from the maximum to the minimum as shown in Figure 3 [Bell et al., 1997]. In addition, that study also determined that superstorms also most likely occur near the equinoxes with most of those occurring near the spring equinox.

Similar statistical data is also available from solar cycle 23 as well. In particular, there were eleven superstorms in total with six of those being in the declining portion of the cycle [Echer et al., 2008].

For most of these storms, it was determined that the solar event combination that caused them was a very fast, full halo (direct line of sight from the sun to the Earth) Coronal Mass Ejection followed by a Coronal Hole Stream [Kataoka & Miyoshi, 2008]. The Coronal Hole Stream is a stream of very fast solar wind. This combination is particularly effective as far as geomagnetic storms are concerned [Kataoka & Miyoshi, 2008].

Figure 4 from [Kataoka & Miyoshi, 2008] shows the Coronal Mass Ejection/Coronal Hole Stream event origination at the sun. The image from Solar and Heliospheric Observatory is a visual manifestation of the combination of the fast halo Coronal mass Ejection followed by the Coronal Hole Stream. This imaging is an early warning of a possible superstorm. However, event combinations which include a Corotating Interactive Region driver are not visibly seen and are even more effective at increasing the intensity of the outer Van Allen Belt [Miyoshi & Kataoka, 2006]. This fact that Corotating Interactive Region driven storms are more dangerous was further clarified by observations of the NASA-Air Force Combined Radiation Release and Effects Satellite, which showed the largest intensity increases were indeed occurring in the declining phase of the solar cycle when Corotating Interactive Regions and Coronal Holes Streams dominate the events

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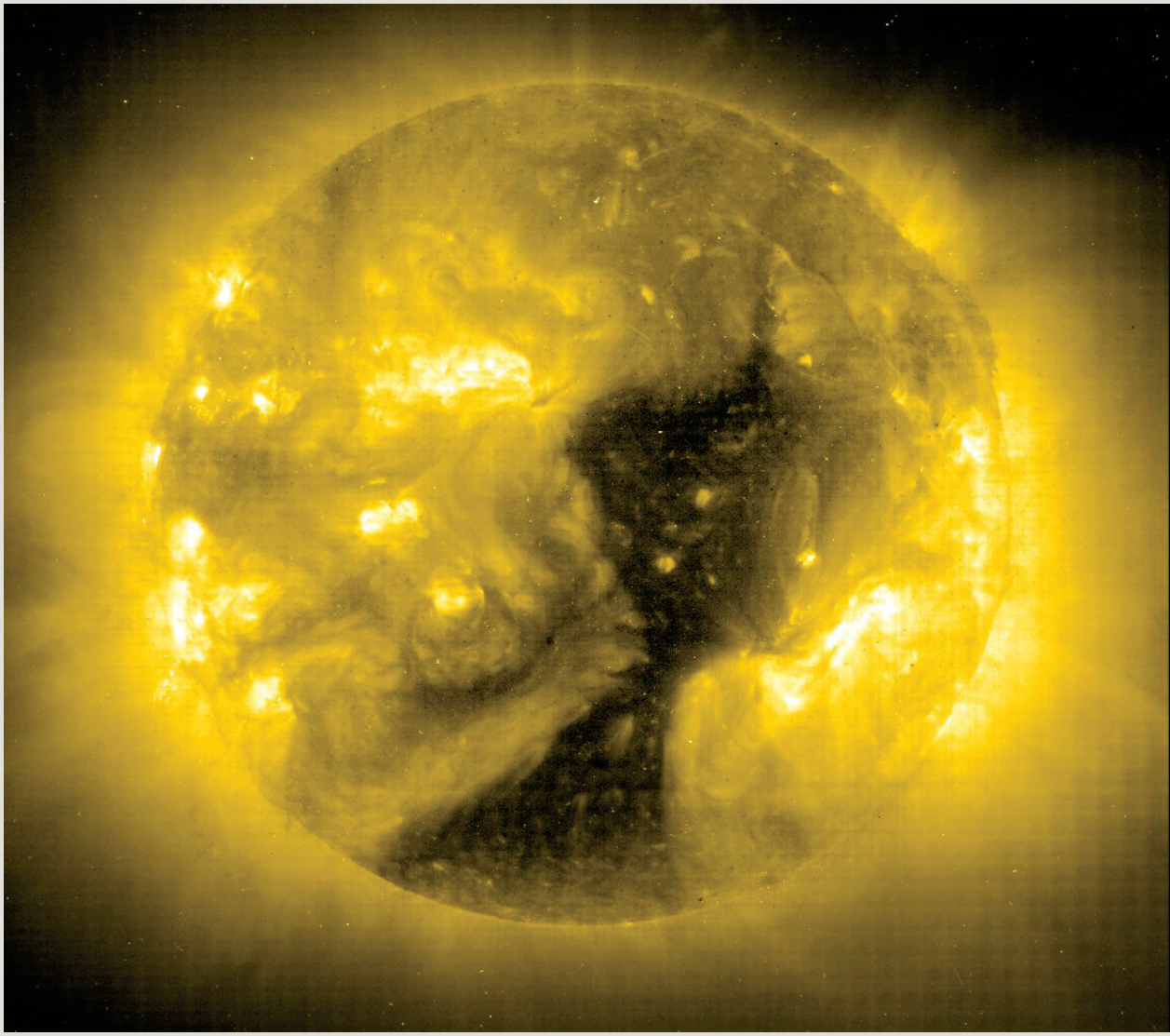

**Figure 4:** Coronal hole (seen as the dark area in the lower center of the sun) over central meridian in southern hemisphere with western sector Coronal Mass Ejection. The Coronal Mass Ejection is shown as the bright activity on the right hand side of the sun in this image from the Solar and Heliospheric Observatory.

originating from the sun [Hudson et al., 2007].

## 3. Conclusions and Future Work

Changes in the equipment we use to accomplish our mission leads to changes in the military decision making process. These changes lead to the need for incorporation of parts of the analysis that once did not need to be incorporated. Solar activity can lead to geomagnetic storms and changes in the outer Van Allen Belt. The varying intensities of the Van Allen Belts are dependent upon the combination of specific solar events which occur at specific times in the solar cycle. With the combination of a Coronal Mass Ejection or a Corotating Interactive Region followed by a Coronal Hole Stream being one of the most dangerous solar events most likely occurring near the spring equinox of the declining phase of the solar cycle, we must be able to incorporate the possibility of these events occurring into the Space climate aspects of the military decision making process. That is to say, that we must be able

**Figure 5:** (Artist rendition) Combined Radiation Release and Effects Satellite (NASA-USAF mission) measurements of the outer belts clarified superstorm likelihood during declining phase of solar cycle.

to conduct the military decision making process with the knowledge that near the spring equinoxes from 2013 to 2018, superstorms will most likely occur and thus impact whatever missions are being conducted at the time.

Gaining more understanding of the Space climate is essential to understanding how to conduct both satellite operations and human Space exploration and missions. With this as a motivation several initiatives are under way, or will soon be, to gain that understanding. In particular, the United States Air Force is sponsoring two of these initiatives with one being the High Frequency Active Auroral Research Program. This program is designed to emit High Frequency radio waves into the ionosphere which will in turn stimulate small volumes of the ionosphere. The goal of this ionospheric stimulation is to determine if it will reduce the radiation in that given small volume of the ionosphere. The second of the initiatives is the Demonstration and Science Experiments satellite which is due to launch in 2009. These experiments are designed to measure electron energy levels and Very Low Frequency waves to include those from the High Frequency Active Auroral Research Program for effects on radiation. Lastly, Demonstration and Science Experiments will have an instrument that will measure specific aspects of the slot region. In addition to the U.S. Air Force initiatives, NASA will launch the Radiation Belt Storm Probes in early 2012. The probes are designed to measure changes in Van Allen Belts as a result of solar wind and solar event drivers. Lastly, planning has begun on the NASA Solar Sentinels mission which would help scientists learn to predict solar storms in time to warn astronauts. This mission would also be useful in warning terrestrial-based assets of the likelihood of superstorm induced effects on satellite systems. The proposed locations include one Spacecraft of the sentinel cluster to be at the L3 Lagrange Orbital point on the far side of the sun. The Lagrange Orbital points are stable orbits with one currently occupied by the Solar and Heliospheric Observatory and one will be occupied by the James Webb Space Telescope [Godshall, 2003].

With these tools to gather data, an in depth analysis can be made of the Space climate for operations that may take place

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# Realities of Space Age

## & the Realities of Carl von Clausewitz's Theories of "Fog and Friction"

<< story

<< about the author

By Rodger S. Pitt
MAJ, Military Intelligence
Army Space Operations Officer
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MAJ Rodger Pitt is an FA40 (Space Operations) officer serving in the National Reconnaissance Operations Center as the National Reconnaissance Office's enterprise interface with external agencies (Service Components, Combatant Commands, the Intelligence Community and the Joint Staff) for compartmented programs. His previous tour was at the Naval Post Graduate School where he completed two Masters of Science Degrees: Space Systems Operations and Physics. His thesis research topic was "Mitigating Plasma-Induced Communication Signal Attenuation for Hyper-Sonic Reentry Vehicles." He is en route to the 1st Infantry Division, Fort Riley, Kan., to stand up their Space Support Element.

The advent of Space force enhancement[1] capabilities, as applied directly to improving the effectiveness of forces across the full spectrum of operations by providing worldwide operational assistance to combat elements,[2] potentially reduces the effects of Carl von Clausewitz's famous "fog and friction" of war. The Space assets utilized in Space force enhancement can be critical combat multipliers by providing combatant commanders with real time information that greatly enhances situational awareness and decision-making. But a cautionary note accompanies these technological advances. Satellite technologies provide a commander with a wealth of data, which, if not properly synthesized, have the potential to overwhelm. Thus, modern "fog and friction" can be caused by having to decipher too much information, just as it arises when leaders possess too little data to make measured decisions.

Carl von Clausewitz (1780-1831) described the essence of war in his famous work, "On War":

> "Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and end by producing a kind of friction that is inconceivable unless one has experienced war . . . Fog can prevent the enemy from being seen in time, a gun from firing when it should, a report from reaching the commanding officer."[3]

# the

Friction is the force that makes the apparently easy task so difficult to complete.[4] According to Alan Byerchen, a student of both Clausewitz and nonlinear dynamics, "friction" can be defined by the information theory that states that the more possibilities a system embodies the more information it contains. Constraints on those possibilities are needed to extract signals from "noise." One aspect of the fog of war concerns how the overload of information, the "noise," produces uncertainty as to the actual state of affairs.[5]

There have been many theorists over the years who have analyzed Clausewitz's theories on friction; some speculated that as the technology revolution came to fruition the friction of war would diminish. It is generally believed that the onset of the digital age, and the additional information available to commanders, would greatly reduce the fog and friction of war to virtually nothing. Technological advancements, however, have only improved the access to data and increased the amount of data collected. Technological advancements have not been able to automatically synthesize the collected data into useful intelligible knowledge that aids in a leader's decision.

In 1996, Barry Watts, former Director of both the Office of the Secretary of Defense Program Analysis and Evaluation and the Northrop Grumman Analysis Center, wrote that general friction has been a continuing feature of war since Napoleon, which consistently and strongly confirmed general friction's persistence. Thomas Keeney, former professor of military strategy at the National War College and current Acting Director of the Strategic Studies Program at the Merrill Center for Strategic Studies within John Hopkins University, "observed that friction's persistence is the one Clausewitzian concept that most military officers, especially those from combat arms, instinctively embrace."[6] These authors may not have considered the massive benefit that Space systems can provide to the warfighter and how they might affect the fog and friction of war.

According to the Army's Space Support to Army Operations Field Manual (FM 3-14), "Space is the newest of the warfighting media, alongside air, land, and sea."[7] Prior to DESERT STORM, Space systems were designed, built, launched, and operated for the primary purpose of supporting the communication, information and intelligence needs required by national agencies in direct support of the National Strategic Objectives. In August of 1991, the Air Force Magazine quoted the Assistant Secretary of the Air Force, Martin C. Faga as saying "DESERT STORM was the first large scale opportunity for our forces in the field to understand that Space systems are vital to their success."[8] Moreover, the Army's Space Brigade Operations Field Manual recounts both the first comprehensive use of Space systems and the most recent success in war by stating that:

> "Operation Desert Storm is generally accepted as the first Space war—the first conflict in history to make comprehensive use of Space system support. Military, civil and commercial Space systems significantly aided the coalition's air, ground and naval forces by providing communications, navigation timing, and intelligence, surveillance, and reconnaissance. In Operation Iraqi Freedom, joint and Army dependence on Space capabilities exceeded that of Operation Desert Storm by an order of magnitude. Space capabilities have contributed to many recent successes in combat and military operations other than war. The greatest successes have come through their application on global and theater levels when synchronized with the principles of unity of command and objective."[9]

As a result of this success, the Army has dedicated, trained Space operations officers who are permanently assigned to the Space Support Element at every Division in the Army. These Space operations officers integrate Space force enhancement and Space control[10] operations by working closely with the entire battle staff to ensure Space support is optimized for all six warfighting functions.[11] In order to better understand how Space systems affect Clausewitzian "fog and friction," one must first grasp Space-based capabilities.

- Global Position System (GPS)
  - GPS Constellation Status (accuracy predictions).
  - Space-based navigation signals for precision-guided munitions.
  - GPS and Satellite Communications are both used to track supply movements from embarkation at continental United States facilities through points of debarkation to the Soldiers intended to use the supplies.
- Space-based Remote Sensing
  - Space-based imagery are provided to enhance analysis of optimum staging areas and lines of communication.
  - Hyperspectral (such as Hyperion) and multispectral (such as LANDSAT) imagery for intelligence, terrain analysis and targeting analysis.
- Satellite Communications (SATCOM)
  - Access to dedicated, secure SATCOM on the Defense Satellite Communications System and the MILSTAR (a.k.a. Military Strategic and Tactical Relay) constellation for long-haul communications that are critical to command and control.
  - Alternate communications through other Space systems such as Iridium, International Maritime Satellite, and International Telecommunications Satellite Organization.
- Space-based Intelligence, Surveillance and Reconnaissance (Space assets that find and identify targets)
- Space control (in-theater negation and surveillance)
- Satellite reconnaissance advanced notice products
- Space-based Blue Force Tracking
- Theater Missile Warning (TMW)
- Space environmental status
- Space assets that provide global weather situational awareness
- Protect friendly Space assets and capabilities

The warfighter can communicate, navigate, target, find, and fix the enemy using a variety of different communication, Global Position System (GPS), and Intelligence, Surveillance and Reconnaissance satellites, respectively. Other satellites can provide data that help anticipate weather and protect friendly forces. The military also endeavors to control Space so adversaries cannot overcome the United States' asymmetrical advantages in Space.[12]

Space-enabled capabilities are sophisticated combat multipliers that are used to help warfighters shape the following operations: shaping the operational environment; prompt response; mobilizing the Army; forcible entry operations; and sustained land dominance. The following Space force enhancement capabilities[13] "are vital to overall military mission accomplishment, provide the advantages needed for success in all joint operations, and support the principles of war."[14] These Space-enabled capabilities provide the warfighter with a greatly increased situational awareness within the battlespace and make that knowledge available in near real time. Furthermore, the Army's FM 3-14 states:

> "The Army of today leverages Space capabilities to accomplish a wide variety of missions. Space-based and Space-enabled communications; position, velocity and timing; environmental monitoring; intelligence, surveillance and reconnaissance (ISR); and missile warning support are robust capabilities that continue to be necessities for success on the battlefield. Robust Space capabilities are a prerequisite for the Army of the future. They enhance information superiority and situational awareness, aiding high-tempo, noncontiguous, simultaneous distributed operations."[15]

Even though Space professionals provide tremendous leverage to warfighting capabilities by utilizing and exploiting these Space-enabled capabilities, caution must be taken as these capabilities make an exponential amount of additional information available to all levels of operations. The astronomical amount of information, provided by Space-based and Space-enabled assets, is vastly challenging to synthesize into useful intelligible knowledge that will aid in a leader's decision making. Joint Intelligence doctrine states that:

> "Intelligence is not an exact science; there will always be some uncertainty in the minds of intelligence analysts as they assess the adversary, and the commander and staff as they plan and execute operations. Likewise, intelligence, as synthesis of quantitative analysis and qualitative judgment, is rarely unequivocal and is therefore subject to competing interpretation."[16]

However, the required information must be available at the right time and in the right format for leaders to understand. Therefore, this vast amount of information must be filtered, processed, analyzed and produced into timely, actionable intelligence so that leaders can take full advantage of it. Until this plethora of information can be truly synthesized, Clausewitz's fog and friction will simply move from a lack of information to a lack of synthesized information. In other words, data from the battlefield is available, but full knowledge of the battlefield is not yet realized by the commander or it is deciphered too late.

The fog and friction shift between lack of information to lack of synthesized information may change as the military and intelligence communities move further and further into the digital age with technological sophistication that stretches "the battlefield into multidimensional battlespace, which includes the land, sea, air, outer Space and the electron."[17] The later term denotes that the form of war is becoming information-oriented. Timothy Thomas, a Department of the Army civilian

at the Foreign Military Studies Office at Fort Leavenworth, Kan., analyzed an article published in the China Military Science journal in 2002 where Major General Dai Qingmins, head of the 4th Department of the General Staff, compares China's integrated network-electronic warfare[18] concept with the U.S. network-centric warfare[19] concept. Both of these "concepts evade the fog and friction of war, assuming perfect information and ignoring those problems at their own peril."[20]

Timothy Thomas posits that "nowhere does Dai entertain fog and friction in the information age; he presents his argument as if there were no such problems . . . The struggle for information superiority is vital since it is a precondition for seizing sea, air and Space superiority."[21] This oversight, or intentional omittance, of the fog and friction of war in the information sphere (electron) by two major military powers seems to make an argument that these key aspects underlying Clausewitzian's theories will no longer be valid if perfect information[22] can be achieved. But therein lies the problem, the military does not operate on information in perfect form, nor is it currently able to synthesize information in such a way that instantaneously provides the commander with complete knowledge of all enemy actions on the battlefield that could possibly effect a commander's decision.

As technology and processes continue to advance, it is worth remembering the quote from David Keithly and Stephen Ferris in their article, "Auftragstaktik, or Directive Control, in Joint and Combined Operations."

> "A GRAVE CONTEMPORARY MISTAKE IS TO REGARD TECHNOLOGICAL ADVANCES IN COMMUNICATIONS AS A MEANS FINALLY TO OVERCOME THE FOG AND FRICTION OF WAR. TECHNOLOGICAL SOPHISTICATION SHOULD NOT DETER US FROM ENDEAVORING TO IDENTIFY LESSONS FROM THE PAST AND, ACCORDINGLY, TO LEARN FROM THE SUCCESSES AS WELL AS THE FAILURES OF EARLIER WARRIORS . . . ONE CONTEMPORARY OBSERVER HAS BEEN PROMPTED TO SUGGEST THAT WHATEVER THE ADVANCES IN RADIOS, COMPUTERS, SATELLITES, AND SOPHISTICATED ELECTRONIC COMMUNICATIONS SYSTEMS, WAR'S FOG WILL REMAIN AS RESISTANT TO TECHNOLOGICAL FIXES AS THE COMMON COLD HAS TO THE MARCH OF MODERN MEDICINE. THIS NOTION ACCENTUATES THE NEED TO CONSIDER ENDURING FUNDAMENTALS."[23]

Barry Watts has discussed that the implications of "friction" on future war will undoubtedly involve human foibles, inaccessible information and nonlinear dynamics. The greater the stress, he argues, the more data will be ignored; "noise" will be mistaken for information, and information misconstrued. No matter how much technological advancement constrain general friction in some areas it will simply balloon in others.[24] Space force enhancement capabilities have enabled access to a wealth of information to now be available to commanders, but have not addressed the ability to synthesize this wealth of information. Therefore, due to current technological infeasibility to make "decisively intelligible synthesized knowledge" out of a "wealth of information" and the fact that it is virtually impossible to obtain perfectly synthesized information the Clausewitzian theories on the fog and friction of war continues to be relevant.

*Special thanks to Dr. Ed J. Cross, Military History Professor Fort Belvoir Satellite Campus, U.S. Army Command and General Staff School for his contributions in editing this article.*

# —Endnotes—

1 Space Force Enhancement – Combat support operations to improve the effectiveness of military forces as well as support other intelligence, civil, and commercial users. The Space force enhancement mission area includes: intelligence, surveillance, and reconnaissance; integrated tactical warning and attack assessment; command, control, and communications; position, velocity, time and navigation; and environmental monitoring. (Joint Publication (JP) 3-14, Joint Doctrine for Space Operations, 9 August 2002)

2 FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, 2-1.

3 Carl von Clausewitz, On War, ed. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 119-120.

4 Ibid. 119-121.

5 Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War", International Security, Vol. 17, No. 3 (Winter, 1992-1993), 76-77.

6 Barry D. Watts, "Clausewitzian Friction and Future War", Institute for National Strategic Studies, National Defense University, McNair Paper 52 (October 1996), 37.

7 FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, 1-1.

8 JP 3-14 (Joint Doctrine for Space Operations), Chairman of the Joint Chiefs of Staff, 9 August 2002, II-4.

9 FM 3-14.10 (Space Brigade Operations) Headquarters, Department of the Army, October 2007, 1-1.

10 Space Control – Combat, combat support, and combat service support operations to ensure freedom of action in Space for the United States and its allies and, when directed, deny an adversary freedom of action in Space, The Space control mission area includes; protection of US and friendly Space systems; prevention of an adversary's ability to use Space systems and services for purposes hostile to US national security interests; negation of Space systems and services used for purposes hostile to US national security interests; and directly supporting battle management, command, control, communications, and intelligence. (Joint Publication (JP) 3-14, Joint Doctrine for Space Operations, 9 August 2002)

11 Warfighting Functions are: 1) movement and maneuver; 2) intelligence; 3) fires; 4) sustainment; 5) command and control; and 6) protection. These six warfighting functions are multiplied by leadership and complemented by information to make up the eight elements of combat power. (FM 3-0, Army Field Manual for Operations, February 2008, 4-1) This sentence is paraphrased from FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, D-1 & D-2.

12 Ibid. Foreward.

13 Ibid. 1-11 thru 1-14.

14 JP 3-14 (Joint Doctrine for Space Operations), Chairman of the Joint Chiefs of Staff, 9 August 2002, ix.

15 FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, 1-1 & 1-2.

16 JP 2-0 (Joint Intelligence), Chairman of the Joint Chiefs of Staff, 22 June 2007, I-3.

17 China's National Defense in 2002, white paper (Beijing: Information Office of the State Council of the People's Republic of China, December 2002), available at <http://www.aseansec.org/ARF/ARF-DWP/China-2002.doc>.

18 INEW – A series of combat operations that use the integration of electronic warfare and computer network warfare measures to disrupt the normal operation of enemy battlefield information systems while protecting one's own, with the objective of seizing information superiority—similar to the U.S. definition of IO [Information Operations]. (Timothy L. Thomas, "Chinese and American Network Warfare, National Defense University, 16 March 2008, 77, available at <http://www.ndu.edu/inss/press/jfq_pages/1538.pdf>)

19 Network-centric warfare (NCW) – An information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision-makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace. (David S. Alberts, John Garstka, et al., Network Centric Warfare: Developing and Leverage Information Superiority (Washington, D.C.: National Defense University Press, 1999), 2.)

20 Timothy L. Thomas, "Chinese and American Network Warfare, National Defense University, 16 March 2008, 77 available at <http://www.ndu.edu/inss/press/jfq_pages/1538.pdf>.

21 Ibid. 78.

22 Perfect Information – A term used in economics and game theory to describe a state of complete knowledge about the actions of other players that is instantaneously updated as new information arises. (Wikipedia, available at <http://en.wikipedia.org/wiki/Perfect_information>)

23 Keithly, David M. and Ferris, Stephen P., "Auftragstaktik, or Directive Control, in Joint and Combined Operations" Parameters Autumn (1999): 118-133.

24 Barry D. Watts, "Clausewitzian Friction and Future War", Institute for National Strategic Studies, National Defense University, McNair Paper 52 (October 1996), 126.

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# FA40 Proponent/ Army Space Cadre News

BY LTC CHRISTOPHER A. LIVINGSTONE

LTC Christopher Livingstone is an FA40 Space Operations Officer dual-hatted as the Chief, FA40 Personnel Proponent Office and Chief, Army Space Cadre Office. Livingstone previously served with the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command in the 1st Space Battalion. He also served as an Ordnance Officer in the 1st Infantry Division, 1st Armor Division, 1st Cavalry Division, and First U.S. Army prior to entering the Space Operations Career Field in 2003. PH: (719) 554-8753; Fax 8764; DSN 692.

## New Office Location

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The FA40 Personnel Proponent Office (PPO) and Army Space Cadre Office have moved from Building 3 and Peterson Air Force Base into the Atrium II complex in Colorado Springs, Colo. Although we will maintain our Peterson Air Force Base mailing address, our actual location is 1150 Academy Park Loop, Suite 212.

The FA40 Space Operations e-mail address remains the same for communication with the FA40 Personnel Proponency Office (FA40-Space@smdc.army.mil). Mailing addresses, office symbols, fax numbers, and POCs for both offices are as follows:

# Space Cadre

## Army Space Cadre Update

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Our current focus remains on a 2nd data call with the goal to standardize Space Enabler billets across the Army, identify additional Space Enabler billets and develop templates to apply across Army Service Component Commands, Corps and Divisions. We recently briefed our recommendations to the Space Council of Colonels. In July 2008 our recommendations will go forward to the Army Space Council for consideration.

Additionally, we are working with the Army G-1 to develop a system which will allow the Army to track and report on the Space Cadre. On a test basis, we have also developed an Army Space Professional Brief for all FA40s. This is based on an Air Force system and will display professional experience, schooling and certification well beyond the capacity of the Officer Record Brief. We are working to refine this Space Professional Brief and in the near term we will send out to all FA40s for validation. This system has the potential to be a great management tool for Human Resources Command and the FA40 Personnel Proponency Office. Additionally, it will exist as a multi-service system in the Defense Integrated Military Human Resources System.

We continue to work in concert with the Air Force and Navy to develop a "way ahead" for the identification and coding of civilian "Space" personnel. Currently, none of the Services have a civilian Space career track, although there are many well trained and experienced civilians working in Space positions. Analysis continues to determine the best way ahead for all Services.

Many individuals have asked what is the Army Space Cadre Office, what is your mission, role and function? To the right, I have tried to answer some of those questions by putting in what we developed as our "charter". As the office matures and we move beyond the identification phase of the Space Cadre we will continue to refine our roles and functions.

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### ROLES AND FUNCTIONS

**A**. Establishment. Congress directed the Secretary of Defense to "promote the development of Space personnel career fields within each of the military departments." The Secretary of Defense directed each Service to grow "a cadre of Space qualified professionals." As the Army Specified Proponent for Space, U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT) was assigned the mission to develop and track a cadre of Space-qualified professionals comprised of military and civilian personnel. The Army Space Cadre Office was officially created in September, 2007 and is located on Peterson Air Force Base, Colo., under the auspices of the Deputy Commanding General for Operations, SMDC/ARSTRAT. Additional oversight is provided by the Senior Army Space Council chaired by the Army G-3.

**B**. Mission. As the Army's single focal point for Space Cadre, the Army Space Cadre Office is responsible for identifying Space Cadre members, tracking Space Cadre positions, personnel and training data, and reporting data and metrics in accordance with Department of Defense directives and guidance. The Army Space Cadre Office does not manage Army personnel in any regard.

**C**. Definition. In 2005 the Senior Army Space Council process established two categories of Space Cadre: Space Professionals: (military and civilian) who are career Space specialists, whose principal duties include planning, developing, resourcing, acquiring, integrating, or operating Space forces, concepts, applications, or capabilities in accordance with Department of Defense Directive 3100.1 and Joint Publication 3-14. Currently, only FA40 Space Officers are Space Professionals. Space Enablers: (military and civilian) personnel assigned to positions whose primary career field is not Space, but perform unique tasks or functions or may require skills to apply Space capabilities. Supplemental Space training is directly related to the duty positions of assignment.

**D**. Benefit to the Army. Identifies and develops more personnel with the knowledge to integrate Space capabilities into current operations and future planning; advances the level of Army Space expertise across the Total Force; increases Space training and awareness Army wide.

**FA40 PPO**

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## New FA40 Proponent Office Personnel

Mike Connolly has assumed the responsibilities of the FA40 Personnel Proponent Office Deputy. Mike comes to us from the defense contracting arena where he supported the Ballistic Missile Defense Systems Managers Office as well as the 100th Missile Defense Brigade. Prior to his retirement, then COL Connolly (FA40) served in numerous FA40 positions to include two assignments in Cheyenne Mountain where he was a Mission Director, Chief, Standards and Evaluation Division, J6, Command Director and Chief of Staff. Additionally, he was a Joint Space Support Team Chief and Deputy J36 (Current Operations) at U.S. Space Command. Lastly, he served at the Executive Assistant to the Commander U.S. Strategic Command during the period in which USSTRATCOM assumed the responsibility for the Nation's Military Space mission. Mike brings with him a wealth of knowledge and experience that will greatly contribute to the overall success of the FA40 Personnel Proponency Office and the FA40 community.

By press time, Bryant Rushing will have also joined the FA40 Personnel Proponency Office after his successful completion of a Reserve Mobilization where he served as the J1, Joint Functional Component Command-Integrated Missile Defense. Bryant's experience and knowledge will be utilized in supporting the personnel functions required of the Proponent Office. Expect to see more about Bryant in future editions of the ASJ.

## Education/Training

The FA40 Personnel Proponency Office is currently working on the 2008 U.S. Army FA40 Space Operations Symposium to be held at the Scitor facility in Colorado Springs, Colo., Sept. 3-5, 2008. The objectives of this Symposium are to provide an Operational Update to the Army Space Operations Professionals (FA40); educate FA40's on force improvements and new initiatives at strategic, operational and tactical levels; discuss Army Space Operations Officer's Roles, Responsibilities and Opportunities; and provide a forum for Army Space Professionals to discuss Army Space issues that impact the Army and their community.

Although the target audience is Career Field Designated FA40 officers, interested military members, Department of Defense Civilians and Defense Contractors with appropriate security clearances are welcome to attend on a space available basis.

If you would like to receive additional information on the Symposium and be added to the distribution list, send an e-mail to: michael.connolly@smdc-cs.army.mil.

•Benefit to Army Organizations – Enhances Space expertise of individuals serving the Organization mission and provides targeted Space training appropriate for designated Space Cadre personnel. Allows Organizations to capitalize on emerging Space capabilities.

• Benefit to Personnel Management Offices – Expands developmental opportunities and recognition of the career area with tailored training for Space Cadre positions and establishment of an additional management tool in the Space Cadre tracking system.

• Benefit to Soldiers – Expands the multi-skilled level of the Soldier with expansion of training opportunities and recognition of the Space expertise skill gained; provides greater training opportunities for Space related training, higher potential for return Space related assignments and eligibility for award of the Air Force Space Badge.

**E**. Correlation. The Army Space Cadre Office works directly for the Deputy Commanding General for Operations and the Commanding General, SMDC/ARSTRAT, with oversight by the Senior Army Space Council in response to Department of Defense Strategic Space requirements.

## How Do We Contact You?

In order to maintain contact and stay up-to-date on all of the FA40 and Space Cadre issues, personnel, news and announcements you are highly encouraged to frequently check your AKO account. The Personnel Proponency Office/Army Space Cadre Office will use this common address as the primary means to provide you useful and pertinent information.

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## Air Force Space Badges – Dress Miniatures

The FA40 Personnel Proponent Office, with the assistance of the Peterson Air Force Base Military Clothing Sales Store and The Institute of Heraldry, is attempting to procure all levels of Air Force Space Badges – Master, Senior and Basic – in Dress Miniature format, suitable for wear on Army Mess Dress Uniforms. These Dress Miniature medals, designed by The Institute of Heraldry, are shiny silver in color, and approximately 1¼ inch wide. They are intended for wear on the lapel of the Army Mess Blue and Mess White uniforms, only, in accordance with Army Regulation 670-1. The Peterson Air Force Base Military Clothing Sales Store anticipates delivery of the first batch to its facility on or about Jul. 1, 2008. When this occurs, the FA40 Personnel Proponency Office will broadcast an e-mail with instructions how to special order them through the Army Air Force Exchange Service Military Clothing Sales Stores, worldwide.

# Successes from the

LTC Jim Meisinger prepares for a mission during his deployment as the 3rd Infantry Division Space Element Chief.

# e Field:

# OIF V

Five Division Space Elements participated in Operation Iraqi Freedom V – the 25th Infantry Division, 1st Cavalry Division, 3rd Infantry Division, 1st Armored Division, and 4th Infantry Division. This article is a collaboration between the five Division Space

# The Division Space Element in OIF V

Element Chiefs (LTC Dan Cockerham, LTC Rick Dow, LTC Jim Meisinger, LTC Scott Parks and LTC Scott Gensler) who worked together during the operation, generally spanning late 2006 to late 2008. We are not going to discuss the Corps Space Element or the Division Space Element in a garrison environment. We do not imply our experience applies universally to Space Elements in other fights, although much of it does.

Traditional Space force enhancement has matured greatly on the Division staff, freeing up the Space Element to pursue other capabilities. Four of the five Division Elements mentioned above have taken the lead for their Divisions in Special Technical Operations and Alternate Compensatory Control Measures. These classified capabilities have little to do with Space but the Space operations officers' familiarity with special technical operations made them a logical fit to take the lead on the Division staff.

Division Space Elements have also either worked directly with or been closely associated with Information Operations. Two of the Space Element Chiefs were actually slated as the Division G-7. One served as officer in charge of information operations, special technical operations, Alternate Compensatory Control Measures, and reconciliation. Two of the Element chiefs worked heavily on personnel recovery issues. Two of the Element chiefs served as G-3 principles — Chief of Operations in one case, and Deputy G-3 in another. All of the Element chiefs kept "senior Space operations officer" as a task throughout the deployment, although always as a secondary position.

The Space Element Majors have been able to focus more closely on special technical operations and Alternate Compensatory Control Measures in addition to handling the occasional Space issue. Only three were removed completely from their jobs. One was placed in the rear

Photos courtesy 25th Infantry Division, 1st Cavalry Division, 3rd Infantry Division, 1st Armored Division and 4th Infantry Division Space Elements.

**TOP LEFT:**
A Space Element Chief and an ad hoc team of Soldiers prepare for an Alternate Compensatory Control Measures mission.

**TOP RIGHT:**
LTC Dan Cockerham, left, and COL Tom Kula get together for lunch at Camp Speicher Iraq.

**BOTTOM RIGHT:**
LTC Rick Dow looks ready to rumble after being caught on camera.

**BOTTOM LEFT:**
A Space Element MAJ flies to a Brigade Combat Team headquarter to train the staff.

detachment, one worked as a Fragmentary Order writer and then in the public affairs office, and one was placed in charge of the Division's "reconciliation cell." Their contributions to the fight were considerable and valued, but not for their Space expertise.

Unlike the Division Space Element at home station, the Space Element in a combat zone must deliver capabilities to the current fight that work NOW. At home station, the Element has time to examine potential capabilities and determine how to integrate them into plans and operations. The time for this task disappears once deployed and faced with the relentless demand to have an impact on the enemy every day.

The rank structure of the Space Element added to the vulnerability of plucking for non-Space responsibilities. A Lieutenant Colonel on a Division staff is expected to contribute on a level commensurate with his rank. While he must be a specialist in his field, he must also supervise others and coordinate activities across multiple disciplines. Other career field Lieutenant Colonels on the Division staff include the comptroller, who has significant and very well-defined responsibility; Information Operations, who has broad responsibility as coordinating staff as well as super-

COL Tom Kula and LTC Dan Cockerham at the 25th Infantry Division Headquarters in Camp Speicher Iraq.

vision of a Psychological Operations company; and Public Affairs, who also has significant responsibility and oversight of a public affairs detachment.

When a Division commander or chief of staff looks at his slate of Lieutenant Colonels for "slack," he won't touch those officers whose loss will really hurt. When the Space operations officer explains his responsibilities according to doctrine, the thought process of the senior leader is "So, if I give you an additional responsibility I only pay an incremental cost to the G-2, G-5, G-6, G-7, SWO, etc., but I gain a competent Lieutenant Colonel to tackle a significant problem for me? Here's your new job." The authors of this paper aren't saying this is right, we are just observing what actually happened with five Division Commanders during OIF V.

The upside is significant depth built into the bench of former Division Space Element chiefs who have a great deal of experience across the warfighting functions.

The two man Space Elements felt this pressure more acutely than the larger Space Elements. It's a simple matter of staff "critical mass," and "less people accomplish less." When a two-man Element loses an officer for a period of time, or loses half of that officer's time to another task, it severely cripples the Element. There isn't a reserve to fall back on or shift tasks to. The worst case example of the five examined was 3rd Infantry Division as Multi-National Division-Center. For most of the deployment, the deputy was wholly committed to another task and the chief rotated through three other jobs with the Space Element as an additional duty.

Fortunately, the Divisions were able to draw considerable direct support from the III Corps and XVIII Airborne Corps Space Elements, the Corps Army Space Support Team as well as the Alternate Compensatory Control Measures support provided by Task Force Troy. The Space Elements also drew support from across their respective Division staffs, which was more forthcoming as each deployment progressed. The life cycle of a deployed headquarters has three phases: settle in and find a workable battle rhythm, then about 10 months of stability with ever-increasing efficiency, and finally a month or so getting ready to redeploy and transition to the next unit. As efficiency increases, the rest of the staff becomes more willing to donate labor to non-doctrinal tasks.

Some have argued that the Division Space Elements have a long way to go in "integrating Space into plans and operations." When pressed for examples, the answers invariably include such things as countering Global Positioning System Electromagnetic Interference, getting more types of imagery from different sources, Overhead Non-Imaging Infrared, and blue-force tracking, to name a few. Such statements reveal a lack of understanding of what's happening in Iraq right now, the level of expertise in our tactical Army across the board, and what a Division staff does vice a Corps or Army level staff.

The Space Elements did examine a variety of other possible Space-related capabilities, including those mentioned above. These included AUTONOMIC (a classified counter-Improvised Explosive Device capability), some Measurements and Signal Intelligence capabilities, and electronic warfare options, just to name a few. The challenge facing a deployed Space Element as opposed to a Space Element in garrison, is that if a capability isn't ready for employment right now, the Element does not have the time or resources to complete it's development. The capability provider must complete this work before presenting it to the end-user. This problem isn't unique to Space related capabilities.

The Space Element's current equipment set consists of two powerful laptop computers with external hard-drives and in four of the five examples a SATURN left over from the old Modified Table of Organization and Equipment. The

Multi-National Division Baghdad Space Elements used their SATURN to support Alternate Compensatory Control Measures and to support their G-6 with the unfiltered commercial access. The Multi-National Division-North Space Elements used their SATURN to support Alternate Compensatory Counter Measures, Information Operations initiatives, and command group internet. The Multi-National Division-Center Space Element did not have a SATURN. None of the teams used it for imagery download, and none of the teams did imagery manipulation with the laptop computers. The Space work that the boxes were used for could easily have been accomplished by regular laptops.

The authors collectively make several recommendations to future Division Space Elements heading to Iraq. First, get smart on Special Technical Operations and Alternate Compensatory Counter Measures, as you will inherit roles in these missions from your predecessors. If you become a one-man Space Element, that will be all you can handle. Work aggressively to integrate them into plans and operations and in support of the subordinate elements. Second, leverage the Corps Space Element and supporting Army Space Support Team. They will provide daily products and information on theater-wide Space issues and will assist with Requests for Information and reachback. Third, don't worry too much about the Space Support Element Toolset-Light. It is not useful in this fight at the Division level. Finally, expect opportunities to do other things and do your best at them.


**ABOUT THE AUTHORS**

LTC Dan Cockerham served as the 25th Infantry Division SSE Chief. 25ID deployed as Multi-National Division-North from August 2006 to October 2007

LTC Scott Parks serves as the 1st Armored Division SSE Chief. 1AD deployed as Multi-National Division-North in October 2007 and returns home December 2008.

LTC Scott Gensler serves as the 4th Infantry Division SSE Chief. 4ID deployed as Multi-National Division-Baghdad in December 2007 and returns home February 2009.

LTC Jim Meisinger served as the 3rd Infantry Division SSE Chief. 3ID deployed as Multi-National Division-Center from March 2007 to June 2008.

LTC Rick Dow served as the 1st Cavalry Division SSE Chief. 1CD deployed as Multi-National Division-Baghdad from November 2006 to December 2007.


The life cycle of a deployed headquarters has three phases: settle in and find a workable battle rhythm, then about 10 months of stability with ever-increasing efficiency, and finally a month or so getting ready to redeploy and transition to the next unit.

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# Training Insights

BY LARRY MIZE

2008 Space Operations Officer Qualification Course Schedule

– SOOQC 08-01 June 9 – Aug. 15, 2008
– SOOQC 08-02 Sept. 15 – Nov. 21, 2008

Contact Larry Mize, SMDC FWC DCD Chief of Training at: larry.mize@smdc-cs.army.mil (719) 554-4545 for more information.

Larry Mize graduated from Xavier University with a Bachelor of Science in Mathematics in 1973. He entered active service in the United States Navy serving a career specializing in Naval Intelligence, Aircraft Carrier Operations, Naval Special Warfare (SEALs), and Space Operations. He attended French language training at the Defense Language Institute and Subsequently served as the U.S. Navy Liaison Officer to the Commander French Forces Indian Ocean/French Foreign Legion/ Commandos Marine in Djibouti. He attended Naval Postgraduate School and was awarded a Master of Science in Space Systems in 1986, subsequently serving at U.S. Space Command and U.S. Strategic Command. Mize is currently Chief of Space and Ground- based Midcourse Defense Education Training.

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## 2008 FA40 Space Operations Officer Qualification Courses (SOOQC)

Space Operations Officer Qualification Course 08-01 is scheduled for June 9 – Aug. 15 in Colorado Springs, Colo., and will be followed by Space Operations Officer Qualifications Course 08-02, Sept. 15 – Nov. 21. Every year has experienced increased student throughput and 2008 represents the most significant thus far since Space Operations Officer Qualifications Course training began in 2001. Both 2008 courses will maximize student throughput with 28 students in attendance. These increased numbers in 2008 are a result of thirteen former U.S. Air Force officers that have transitioned to Army service as FA40s and new Career Field Designated FA40s now accessed as Army Captains at the seven-year mark. In preparation of the 2008 bow wave, Future Warfare Center Directorate of Combat Development programmed classroom capital improvements have now been completed. Capital investments consisted of new student workstations with dual screen monitors that will better facilitate systems and software learning, an instructor control and monitoring station at the podium for enhanced instructor led training, upgraded hardware/software installs to handle the increased technologies associated with new Space analytical tools, and a new workstation configuration floor plan to facilitate small group instruction, self-paced development, practical exercises and traditional lecture.

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## Future Warfare Center Director of Combat Development Conducts Resident Army Space Cadre Enabler Training

Following successful pilot courses during 2007 in Huntsville and Colorado Springs, Future Warfare Center Directorate of Combat Development conducted the first formal 2008 iteration of Army Space Cadre Enabler residence training with its Army Space Cadre Enabler Basic Course Feb. 25-29 in Huntsville, Ala. This training was hosted by the Technology Center and attended by 75 Research, Development and Acquisition, Future Warfare Center, G-staff personnel and invitees from Program Executive Office Missiles and Space, NASA, Aviation and Missile Command and other Redstone Arsenal organizations. This 40-hour course provides Space operations fundamentals training with instruction at the unclassified, secret and Top Secret/SCI levels. The POI covers Law; Policy; Doctrine; Organizations; Orbital Mechanics; Launch; Rendezvous; Spacecraft Subsystems and Design; Acquisition; Telemetry, Tracking and Control; Satellite Systems-SATCOM; Missile Warning; Global Positioning System; Intelligence, Surveillance and Reconnaissance; Meteorological and Oceanographic; Space Environment; and Threats. To support the Colorado Springs Army Space Cadre Enabler training, this 40-hour course was held Apr. 14 - 18 in Building 3.

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# Future Warfare Center

## Directorate of Combat Development

FWC

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— DELIVERS ONLINE SPACE TRAINING

The Future Warfare Center Directorate of Combat Development Army Space Cadre Training Development Team has been assigned the responsibility to formulate a strategy and execute a plan that identifies gaps in Space training and to fill those gaps by providing appropriate training. Training could be in the form of resident training, online training, distributed learning (dL), computer-based training (CBT), Web-based training (WBT), books, or other Space training literature or modules. The Directorate of Combat Development Cadre Training Development Team has made available initial Space distributed learning training consisting of modules in two basic courses: "Space Awareness" and "Army Space Cadre Basic Course." Distributed learning opportunities from outside the command are available as well, such as from the National Reconnaissance Office and the National Security Space Institute.

The Space Awareness Course lessons consist of (1) an introduction and overview, (2) characteristics of Space systems, (3) force enhancements, (4) contributions to the warfighter, and (5) foreign Space systems. The Army Space Cadre Basic Course contains lessons on: Global Positioning System, Orbital Mechanics, the Space Environment and SATCOM Fundamentals. Both of these courses are on the Army

Learning Management System Web site. To get to the site log into Army Knowledge Online (AKO) then click on 'My Training' under the Self Service drop down Menu or use the link, http://www.lms.army.mil/ and you will be directed to log into your AKO account. Once on the Learning Management System site, on the right side of your screen click on the 'catalog search' box and type the full name of the lesson you want to take. It is important that you type the full name of lesson as listed below otherwise your search will not return any lessons. The lesson information will appear on your screen. Click on 'Register,' this will register you into the lesson. After you are registered you can click on 'Launch Content' and you can begin taking the lesson. If you need to leave and come back to the lesson, you can. Once logged back into the Army Learning Management System Web site your lesson enrollments will appear in the 'Current Enrollments' area of your welcome page (lower right side). Click on 'Launch Now' of the lesson you want to continue and then you can go to the next module of the lesson.

These two courses can also be found on AKO. Access them by first going to the Future Warfare Center Directorate of Combat Development Training Web site at: http://www.smdc.army.mil/2008/FWCTrainingDiv.asp under the "AKO Folders."

Click on the lesson/course you want to take. You will be prompted to log into AKO. Once logged into AKO you will be at the lesson folders. You will have to SAVE each individual file to your hard drive, and then unzip the file. The files are made to play in MicroSoft Internet Browser 5.5 SP1 and later. Click on the index.html file to start the program. You should take the lesson in the order of the 'Read me First.txt' located with the lesson files.

The NSSI is offering 16 hours online and the courses are located at NIPR: https://halfway.peterson.af.mil/nssi/cbts/index.htm. The National Security Space Institute courses available are: Space History – SPI 270 (Approximately two hours to complete), Orbital Mechanics – SPS 271 (Approximately three hours to complete), Space Environment – SPS 270 (Approximately three hours to complete), Global Positioning System – GPS 270 (Approximately three hours to complete), SATCOM – COM 271 (Approximately two hours to complete), and Introduction to Department of Defense Acquisition – ACQ 270 (Approximately three hours to complete).

The National Reconnaissance Office is offering 18 hours online and are located at SIPRNET http://cleon.NRO.smil.mil or JWICS http://cleon.NRO.ic.gov

The courses offered are as follows: The National Systems Information Course (Approximately six and a half hours to complete), Joint Tactical Exploitation of National Systems (Read Manual), Space 300 (National Systems Overview) Course (Approximately three hours to complete), Space Enabled Warfighter Operations Course (Approximately one and a half hours to complete), Commercial Remote Sensing Overview Course (Approximately one hour to complete), Introduction to Imagery Intelligence Course (Approximately 20 minutes to complete), Introduction to Electronic Intelligence in Fusion Analysis Course (Approximately three hours to complete), Mini Transmitter Overview Course (Approximately 30 minutes to complete), and Compact Disk-Space Education Tool (Approximately two hours to complete).

For questions regarding on going Army Space Cadre Training Development efforts please contact Thomas Coleman thomas.coleman@smdc-cs.army.mil at (719) 554-4541, DSN 692.

# Future Warfare Center

## Directorate of Combat Development

### — PILOTS SENSOR MANAGER QUALIFICATION COURSE

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With initial fielding of the AN/TPY-2 (Forward Based Mode/FBM) radar, the Army was designated lead–service for the AN/TPY-2 (FBM) radar in February 2006. SMDC Future Warfare Center-Directorate of Combat Development (FWC-DCD) has been involved in the development of a qualification course for the radar sensor managers for the last year and a half. Following the U.S. Training and Doctrine Command Systems Approach to Training process, a critical task selection board was held on Fort Shafter, Hawaii, in February 2007. The board selected 23 critical tasks which were approved by U.S. Army Space and Missile Defense Command's Deputy Commanding General for Operations in May 2007. Following the approval of the 23 critical tasks, FWC DCD worked jointly with the 94th Army Air and Missile Defense Command in conducting task analysis of the 23 critical tasks. From the task analysis, Task Analysis Reports and Lesson Outlines were written. Missile Defense Association DFOT provided two full-time instructors/training developers in February 2008 to assist with the development of the lesson plans and presentation material. In April 2008, a validation course was conducted at U.S. Strategic Command Headquarters at Offutt Air Force Base, Neb., with four students from SMDC, the 94th Army Air and Missile Defense Command, and Joint Functional Component Command-Integrated Missile Defense. The validation course produced significant comments and feedback which will allow improvements to be made to the presentation material prior to the first offering of the Sensor Manager Qualification Course in July 2008. Follow-on Qualification Courses will be taught on a semi-regular basis, in order to meet the needs of the Army and supported Combatant Commands and organizations.

The role of the Army Sensor Managers is to remotely operate the AN/TPY-2 (FBM) radar by using the Command and Control, Battle Management and Communications system, in addition to providing situational awareness of other Ballistic Missile Defense assets to multiple combatant commands. Through Command and Control, Battle Management and Communications, the Sensor Manager can adjust or change the operational status of the radar, as well as the Mission Profiles and/or Focused Search Plans. The AN/TPY-2 (FBM) radar supports both Ground-Based Missile Defense (GMD) and Ballistic Missile Defense missions by providing classification and discrimination level track data. The track data is fed to both the GMD Fire Control system, as well as Command and Control, Battle Management Communications.

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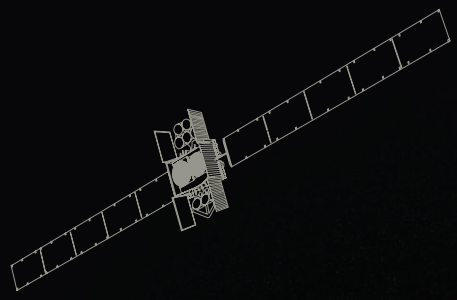
# SMDC and MDA sign Agreement to Transition GMD Operator Course

Larry Burger, Director of U.S. Army Space and Missile Defense Future Warfare Center, and BG Gary Conner, Program Director of the Ground-Based Midcourse Defense Program Office of the Missile Defense Agency signed an agreement on Feb. 22, for the transition of the GMD Operator Course to the Army. The course is one of six courses taught at the Missile Defense Agency's GMD Training and Exercise Center in Colorado Springs, Colo. Army Operators from the 100th Missile Defense Brigade and the 49th Missile Defense Battalion have been attending the eight-week course since 2003 to qualify as GMD Operators. The Future Warfare Center's Directorate of Combat Development provides a Contracting Officer's Representative to the GMD Training and Exercise Center with responsibility also as the GMD Operator Course Manager. Army GMD Operators receive a unique ASI T3 (Additional Skill Identifier) following completion of the Operator Course. Future Warfare Center and Missile Defense Agency view this as a positive step of limited transition that will lead to further transition initiatives of GMD Training and Exercise Center training to the Army.



# New & Greater Communication Capabilities for the Warfighter

## WIDEBAND GLOBAL SATCOM

### SATELLITE LAUNCHED

A new era for satellite communications began with the launch of Wideband Global SATCOM-1, which is now providing invaluable communications capabilities to the warfighter. WGS-1 was launched aboard an Air Force Evolved Expendable Launch Vehicle from Cape Canaveral, Fla., Oct. 11, 2007. After six months of extensive testing, WGS-1 successfully activated on Apr. 14, 2008 and on Apr. 15, users were transitioned from the Defense Satellite Communications System B9 Satellite to WGS-1.

# WIDEBAND GLOBAL SATCOM: COMING TO A THEATER NEAR YOU

By Sharon L. Hartman
Public Affairs Office

SCHOFFIELD BARRACKS, Hawaii — "In 1900, Admiral Alfred T. Mahan, one of the great American military strategists, said: 'communications dominate the war; broadly considered, they are the most important single element in strategy, political or military.' Admiral Mahan's statement is even more relevant today," said BG John E. Seward during a ribbon cutting ceremony that marked the beginning of a new era for satellite communications.

On May 1, Seward, deputy commanding general for operations, U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT), and BG Ronald M. Bouchard, director, J-6, U.S. Pacific Command, took part in a monumental occasion that celebrated the official activation of the first Wideband Global SATCOM (WGS). The WGS-1 was launched aboard an Air Force Evolved Expendable Launch Vehicle from Cape Canaveral, Fla., Oct. 11, 2007. After six months of extensive testing, WGS-1 was successfully activated on Apr. 14, 2008, and on Apr. 15, users were transitioned from DSCS B9 to WGS-1. The ribbon cutting ceremony symbolized the activation of WGS-1, which is now providing invaluable communications capabilities to the warfighter.

GEN Kevin Chilton, Commander, U.S. Strategic Command, accepted Combatant Command of WGS-1 by signing the WGS-1 COCOM acceptance memorandum on Apr. 11, 2008. This set in motion the activation of WGS-1, according to LTC Michael Perry, Chief, SATCOM Support Center (SSC) Branch. The activation of WGS-1, which provides coverage over the Pacific theater, was no easy task.

"This required tremendous coordination and timing from many organizations from Washington, D.C., to Korea," said Bouchard. "A couple of stumbling blocks appeared at the last minute, but we prevailed and we now have an operational satellite servicing the U.S. Pacific Command Area of Responsibility.

"This region is often characterized by the tyranny of distance. It comprises more than 50 percent of earth's surface; from the west coast of the United States mainland to the east coast of Africa, from the Arctic to Antarctic. Most of the area of responsibility is blue water where it's very difficult to plug into the information highway. So satellite communications is crucial for U.S. Pacific Command forces. The WGS-1 satellite provides incredible communications capacity for the U.S. maritime forces as well as the ground troops deployed."

The activated satellite is the first of six WGS satellites which will transform the Department of Defense's communications architecture to support future warfighting technologies. Over the next five years, the additional five WGS satellites will be launched, providing worldwide communications coverage.

Each of the WGS satellites will supply more than 10 times the capacity of a Defense Satellite Communication System (DSCS) satellite. The WGS constellation will augment and eventually replace

BG John E. Seward, Deputy Commanding General for Operations, SMDC/ARSTRAT, and BG Ronald M. Bouchard, director, J-6, U.S. Pacific Command, cut the ribbon symbolizing the activation of the Wideband Global SATCOM. WGS-1 was launched Oct. 11, 2007 and was activated Apr. 14, 2008, and is now providing invaluable communications capabilities to the warfighter. *Courtesy Photo*

DSCS, which has been servicing the Department of Defense Satellite Communication needs since 1982. The last DSCS satellite was launched in 2003.

"As you may know, the expected life of a satellite is only 10 years, so we have been operating on borrowed time," said Bouchard.

"The development and launching of this satellite was the culmination of a 10-year cooperative effort between Boeing, the U.S. Air Force Space Command, U.S. Strategic Command; and U.S. Army Space and Missile Defense Command/Army Forces Strategic Command," added Seward.

"Members of this command have been involved in the WGS program from the very beginning — a briefing in 1997 to a Senior Warfighters Forum — developing the requirements for the system, testing the system, and culminating in its launch on Oct. 10, 2007."

WGS combines distinctive commercial spacecraft capabilities developed by Boeing, according to Perry. The design includes 19 independent coverage areas, including eight steerable and shapeable X-band beams formed by separate transmit and receive phased arrays; 10 steerable Ka-band beams served by independently steerable, diplexed gimbaled dish antennas, including three with selectable polarization; and one X-band Earth coverage beam. The onboard digital channelizer divides the uplink bandwidth into over 1500 independently routable 2.6MHz subchannels. This provides any coverage to any coverage including crossbanding. The system will provide much needed capacity, coverage, connectivity, and control to the warfighter.

For now, as far as the PACOM theater is concerned, "WGS will enable USPACOM to meet its mission, in concert with other U.S. government agencies and regional military partners such as our long-time ally, Australia, to promote security and peaceful development in the Asia-Pacific region by deterring aggression, advancing regional security cooperation, responding to crises, and fighting to win," added Bouchard.

Concluded Seward: "Ten years in development – a long time; 10 times the capacity – a large increase. And why? Today, as in Admiral Mahan's time, the ability to communicate dominates warfighting."

# THE NEED TO KNOW

The Wideband Global SATCOM (WGS) Satellite is a high-capacity satellite communications system designed to support the Warfighter with newer and far greater capabilities than those provided by current systems, yet it is compatible with existing systems and terminals. WGS provides two-way X-band and Ka-band communications as well as Ka-band broadcast services to U.S. Armed Forces and other agencies worldwide. The procuring agency is the U.S. Air Force Space Command's Space and Missile Systems Center at Los Angeles Air Force Base, Calif.

Jointly funded by the U.S. Air Force and U.S. Army, the WGS contract includes options for as many as six Boeing 702 satellites and associated spacecraft and payload ground control equipment. Operational, logistics and training support are also included in the program.

WGS will augment and eventually replace Department of Defense communications services currently provided by the Defense Satellite Communications System (DSCS), which provides Super High Frequency wideband communications, and by the Ka-band Global Broadcast Service, which uses direct broadcast satellite technology to provide critical information to U.S. and allied forces. With the initial launch, Oct. 10, 2007, aboard an Air Force Evolved Expendable Launch Vehicle, WGS provides early transformational capabilities supporting government objectives for a Transformational Communications Architecture in 2009 and beyond.

WGS combines unique commercial spacecraft capabilities that Boeing has developed, including phased array antennas that can electronically steer and shape X-band beams as well as digital signal processing technology providing for an extremely powerful, flexible architecture. Based on the Boeing 702 bus, the satellite has a dry mass of more than 3,000 kg and will produce more than 11 kilowatts of power at the end of its 14-year design life. The system provides tremendous operational flexibility and delivers the needed capacity, coverage, connectivity and control in support of demanding operational scenarios.

**Capacity**: WGS offers 4.875 GHz of instantaneous switchable bandwidth. The system will provide capacity ranging from 1.2 Gbps to more than 3.6 Gbps to tactical users, depending on the mix of ground terminals, data rates and modulation schemes employed. Thus, each WGS can supply more than 10 times the capacity of a DSCS III Service Life Enhancement Program satellite.

**Coverage**: The WGS design includes 19 independent coverage areas that can be used throughout the field of view of each satellite to serve Warfighters between 65 degrees North and South latitude. This includes eight steerable and shapeable X-band beams formed by separate transmit and receive phased arrays; 10 steerable Ka-band beams served by independently steerable, diplexed gimbaled dish antennas, including three with selectable polarization; and one X-band Earth coverage beam.

**Connectivity**: The enhanced connectivity capabilities of WGS enable any user to talk to any other user with very efficient use of satellite bandwidth. A digital channelizer divides the uplink bandwidth into over 1,500 independently routable 2.6 MHz subchannels providing any-coverage-to-any-coverage connectivity (including X-to-Ka and Ka-to-X crossbanding) for maximum operational flexibility. In addition, the channelizer supports multicast and broadcast services and provides an extremely effective and flexible uplink spectrum monitoring capability for network control.

**Control**: The ground control segment leverages commercial off-the-shelf hardware and software, such as Raytheon's Eclipse™ telemetry and command system,

for a robust and reliable design that is easy to operate and maintain. This design reduces manpower requirements and other life cycle costs. The Army Wideband Satellite Operations Centers (WSOCs) around the world and the Air Force Satellite Operations Center at Schriever Air Force Base, Colo., will be the primary control facilities for WGS. Satellite control can be performed via X-band or Ka-band links, as well as SGLS or USB S-band links.

## SATELLITE DESIGN

The Boeing 702 satellite is the world leader in capacity, performance and cost-efficiency. Enabling technologies for the advanced 702 design are the xenon-ion propulsion systems, highly efficient triple-junction gallium arsenide solar cells, and deployable radiators with flexible heat pipes.

Xenon-ion propulsion systems are 10 times more efficient than conventional bipropellant systems. Four 25-cm thrusters remove orbit eccentricity during transfer orbit operations, perform orbit maintenance, and perform station change maneuvers as required throughout the mission life. Xenon-ion propulsion systems engines are produced by Boeing Electron Dynamic Devices.

Deployable radiators with flexible heat pipes provide substantially more radiator area, resulting in a cooler, more stable thermal environment for both bus and payload. This increases component reliability and reduces performance variations over the satellite's service life.

The figure to the right depicts the payload block diagram. It shows how the X-band and Ka-band antenna suites are interconnected via the digital channelizer to provide the unique flexibility and connectivity of WGS.

## WGS TEAM

As the prime contractor and WGS integrator, Boeing Satellite Systems leads a team that includes several major subcontractors. Harris Corp., a leading provider of wideband satellite communications ground terminals, will supply the satellite's Ka-band antenna subsystem as well as system engineering support for satellite-to-ground terminal interface verification. ITT Industries, a principal supplier of wideband satellite communications network management and control systems, will develop and integrate the WGS payload command and control element for installation within the WSOCs. Northrop Grumman Information Technology is supplying wideband satellite communications network planning software under separate contract and is leading the WGS effort for system security engineering. Science Applications International Corporation (SAIC) has extensive satellite communications systems engineering capabilities and supports the overall WGS systems engineering effort.

## LEVERAGING COMMERCIAL TECHNOLOGY

WGS marked the Department of Defense's first use of Federal Acquisition Regulation Part 12 for satellite system procurement. Use of FAR Part 12 allowed the government to obtain the best value for the Warfighter by leveraging commercially available products to the greatest extent practical.

As the leading provider of advanced satellite communications systems for Geomobile, broadcast and packet-switched satellite communications, Boeing Satellite Systems has been able to leverage a wealth of commercial experience and technology for WGS. This includes the company's extensive investments to develop the Boeing 702, as well as phased arrays and satellite digital processing. Together these developments helped to provide the enormous capacity and tremendous flexibility sought for the WGS space segment. They further allow WGS to evolve and satisfy additional transformational requirements of the Warfighter, such as improved connectivity for intelligence, surveillance, and reconnaissance from unmanned vehicles and network-centric communications architectures.

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Information taken from SMDC/ARSTRAT
WGS Fact Sheet

# SENIOR ENLISTED LEADERS TRAIN, BOND, SHARE YEARS OF EXPERIENCES

Left, SFC John Bruce, 2nd Space Company, 1st Space Battalion, poses a question during the 2008 Senior Enlisted Leaders Training Conference, May 23-26 at Vandenberg Air Force Base, Calif.

Top Right, SMDC/ARSTRAT Leaders, CSM Ralph Borja, left, and Commanding General, LTG Kevin T. Campbell, center, catch up with 82nd Airborne Division CSM Thomas Capel.

Bottom Right, SMA Kenneth O. Preston, center, takes a moment to talk to SMDC/ARSTRAT Soldiers during a break at the conference. *Photos by DJ Montoya*

**By Dottie White**
**SMDC/ARSTRAT Public Affairs**

VANDENBERG AIR FORCE BASE, Calif. — Senior non-commissioned officers of the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command gathered here March 23-26 for the 2008 SMDC/ARSTRAT Senior Enlisted Leaders Training Conference.

"We are gathering together this week for a little bonding, teamwork, socializing and sharing of experiences with our brethren who are here at today's conference," said SMDC/ARSTRAT CSM Ralph C. Borja. "This is what it's all about — dialoguing and interacting with one another, getting advice and input … the whole nine yards."

LTG Kevin T. Campbell, commanding general, SMDC/ARSTRAT, spoke to the group about the importance of their mission. He remarked about their great courage and enthusiasm and how they know there is no giving up on the battlefield.

"We have these detachments spread around the world operating 24/7 — whether it's providing communications or imagery or a special Space capability, which we have within our combat formations — these things are ongoing all time, so there is no stopping or shutting down for the weekend," said Campbell.

"I'm impressed each time I go out there to see the professionalism, leadership and enthusiasm amongst your Soldiers doing what they have to do.

"I can say after a year and three months in this business, not once have we failed a COCOM or an Army Unit in providing a service we said we were going to provide," Campbell said. "A lot of that is about you in this room. It's about you leading the troops making sure they are trained and ready day in and day out. I commend you for what you do every day, and your mission is every day, 24/7."

The Sergeant Major of the Army Kenneth O. Preston spoke to the group about the big picture of what is going on in the Army. He also focused on the current pace/tempo of deployment that the Army is currently under and what the future holds as it's tied to predictability and stability for Soldiers and their Families and also strategic messages about telling the Army story.

Other sessions on day one included an overview briefing on the Defense Integrated Military Human Resources System (DIHMRS) by MSG Marlin Simms; a research, development and acquisition overview brief by Michael Schexnayder, deputy to the command for RDA; and a Future Warfare Center brief by Terry Nelson, SMDC/ARSTRAT Battle Lab.

Day two sessions kicked off with a war fighter overview brief by CSM Thomas R. Capel, 82nd Airborne Division, who recently returned from a 15-month tour in Afghanistan.

Day two also included briefings from SGM Thomas S. Gills and SGM Arlita Crawford from the Human

## “I’m impressed each time I go out there to see the professionalism, leadership and enthusiasm amongst your Soldiers doing what they have to do.”

— LTG Kevin T. Campbell

Resources Command who discussed NCO and enlisted promotions; Lorese Dudley, SMDC/ARSTRAT Safety Office provided a safety overview briefing; and COL Kendal Cunningham, SMDC/ARSTRAT G-3 discussed command priorities and objectives for fiscal years 2008-2009.

The second day concluded with a former SMDC/ARSTRAT Command Sergeants Major discussion panel with SGM Randall Williams as the moderator. Then former CSMs Wilbur V. Adams (April 2000-March 2003) and William O. “Bill” Morgan (February 1996-June 1997) provided opening remarks followed by questions from the NCOs in attendance.

On the final day of the conference, the senior NCOs split into two groups to go on a staff ride and tour at the Satellite Development Plant in El Segundo, Calif. The attendees received briefings and were able to see up-close how this unique facility operates and produces satellites.

# ARE YOU SMARTER THAN A "FOURTH" GRADER?

By Sharon L. Hartman
Public Affairs Office

COLORADO SPRINGS, Colo. — In 1978, when the first experimental Block I satellite was launched, few knew what a Global Positioning System was or how far it would come today. Thirty years later, GPS has become a household name, and such an important part of technology that many elementary schools are teaching it as part of their science curriculum. Odyssey Elementary School, a Science, Technology, Engineering and Math school in Falcon School District 49, is one of those schools, and two of their fourth grade classes recently had some subject matter experts brought in to help teach the GPS section of their Earth and Space Science curriculum.

1st Space Battalion's CPT Charles Hayes III, CPT Michael Luepke, SFC Dustin Swinney and SGT Tony Lopes, all part of Army Space Support Team 3, with the help of Odyssey fourth grade teacher, Erik Russell, put together a unique experience for the 9- and 10-year-olds, May 5 and 6. The team gave a one-hour presentation on the GPS constellation that captivated the inquisitive class. Then, after the presentation, the students were put into smaller groups and taken to a nearby park where they ran through a navigation course using GPS units.

"Last summer I took a course with the Space Foundation and we did a similar activity at UCCS (University of Colorado — Colorado Springs), hiking like a scavenger hunt through the hills," said Russell.

"I thought that would be a great idea, so I wrote a grant and the Falcon Education Foundation gave me a thousand dollars to buy a bunch of GPS units."

"It's fun because it's almost like a treasure hunt," said 10-year-old Emmanuel Walker. "We get to learn and we get to know where different points are. It's fun while we're finding it. It's almost like a discovery or finding treasure."

To get through the course, each group of four or five students was assisted by a Soldier, teacher or volunteer. The groups had to find seven different waypoints and had a challenge at each point. The original idea was to bury golf balls or a similar object for the students to find, but it "seemed kind of anti-climatic to me," said Hayes.

"It seemed to me to reinforce the lessons that we taught them, we needed to test them on the knowledge that we had presented in a fun manner."

"It's always good to get out there with kids and to help teach them ... I think it's good. Good for the Army, good for us, good for them."

— CPT Michael Luepke

Instead of golf balls, the students found cards with multiple choice questions that were based on information from the presentation given by the Soldiers.

According to Sydney Mitchell, also 10 years, "This was a little bit different because we've never done a waypoint; we've only done coordinates like latitude and longitude. I also learned that a (GPS) satellite orbits around the Earth two times every day."

One of the questions Walker encountered: "What is the minimum number of satellites needed for the GPS constellation?" His quick and correct answer: "24!"

Russell had originally arranged for a friend from Schriever to come out and co-teach the class, but plans fell through after an unexpected schedule change. Fortunately one of Russell's students, Britney Gizzi, had a father who stepped in to help. LTC Lee Gizzi put the word out to 2nd Space Company Commander, MAJ Todd Leitschuh that the school needed help. Leitschuh turned to his Army Space Support Teams to see who was interested and Hayes volunteered his team.

"Colonel Gizzi's been great, and Captain Hayes and all the guys have been really instrumental in putting this together," said Russell.

"I had only done it once before, so I've learned a great deal from them. The presentations were great for the kids and they learned a lot as well."

But the students were not the only ones who received some knowledge during the event. The Soldiers learned a few things themselves.

"I didn't know this was a magnet school to begin with, and when I found out they were a math and science school, I thought that was interesting. The fact that the kids had a pretty good basic understanding of satellite and navigation, and that they had already studied it for some time, I thought that was fantastic for that grade," Hayes said.

According to Luepke, "They were using little robots that they could preprogram to go around a route and things like that." "They were using Bluetooth with (the robots); speaking into the Bluetooth, and telling the robots what to do. Next week, I think they have rockets," added Swinney.

The experience was a memorable one for everyone involved.

According to Hayes, "The whole thing was great. The classes were attentive, they were well behaved. They knew why we were there, what we were there to teach and they seemed eager to learn. I thought the whole thing was an exceptional experience."

"It's always good to get out there with kids and to help teach them," was Luepke's comment. "I think it kind of personalizes the Army for them a little bit. A lot of them have aunts, uncles and parents in the military, but to have somebody come in and be able to interact with them in school, ask them some questions, to have a dialogue I think it's good. Good for the Army, good for us, good for them."

**ABOVE**: As they prepare to find their next waypoint, Emmanuel Walker, a fourth grader at Odyssey Elementary School in Colorado Springs, Colo., points north in response to a question from his teacher Erik Russell.

**LEFT:** SFC Dustin Swinney guides a group of students from Odyssey Elementary School through a navigation course. *Photos by Sharon L. Hartman*

# SATCON WARRIOR RETURNS AS A DECORATED WAR HERO

By SSG Matthew Blumer,
Unit Reporter

COL David E. Leckrone, Multi-national Division-Central South Commander, pinned the Combat Action Badge on SGT Jamie Sanders, a member of Delta Company, 53rd Signal Battalion, who volunteered to deploy to Iraq. Sanders received the Badge for actions he took while his camp was under mortar attack. Sanders played an active part in coordinating for air quick reaction forces to aid in isolating the source of the mortar attacks as well as assisted in conducting ground quick reaction forces to secure the perimeter of the camp. *Courtesy Photo*

CAMP ROBERTS, Calif. — A Soldier from Delta Company, 53rd Signal Battalion, having voluntarily served on a year long deployment to Iraq, has returned as an Iraq War Veteran. SGT Jamie Sanders, already a well seasoned senior DSCS III satellite controller, having been with U.S. Army Space and Missile Defense Command/Army Forces Strategic Command since 2000, decided it was his time to volunteer for service in Iraq. His original tasking there was as a Satellite Communications radio transmission operator for the Multi-National Division Central-South under management of the Polish Army. The Division, located at Camp Echo near Diwaniah in the southern region of Iraq, is a predominantly Shia Muslim region. During his year at Camp Echo, Sanders played an integral role in providing communications and overseeing the video teleconferencing between the Polish General at Camp Echo and the Multi-National Corps Iraq Commander, LTG Ray Odierno.

In addition, he established video teleconferences for numerous commanders from many countries including the United States, Romania, Armenia, Denmark, Mongolia, Lithuania, Latvia, El Salvador, Bosnia-Herzegovina, Ukraine and Iraq. In addition to being charged with video teleconferences, Sanders performed duties as the assistant to the Combined Staff Command, Control and Communications (C6) liaison officer, C6 NCOIC, Intelligence (C3) Analyst and Intelligence (C2) Operations NCO and was known as the tactical operations command post subject matter expert for intelligence and operations.

## Sanders contributed immeasurably to the Multi-National Division-Central South needs and would not hesitate to take on new duties.

Sanders bravery during deployment was recognized by several awards and medals he received. One medal, the Combat Action Badge, is only awarded to those who have exhibited exceptional bravery while engaged in combat with enemy forces. His Combat Action Badge was awarded following an attack on Camp Echo. Though Camp Echo is a 2.7 wide mile camp, it is not large enough to avoid frequent mortar and Iraqi insurgent attacks. From February to July 2007, while working in the Tactical Operations Center (TOC), 120 MM and 240 MM mortars targeted Camp Echo's key infrastructures and created severe damage in several areas. During one attack, two mortars struck within 25 feet of where Sanders was working. Sanders played an active part in coordinating for air quick reaction forces to aid in isolating the source of the mortar attacks as well as assisted in conducting ground quick reaction forces to secure the perimeter of the camp.

Sanders also showed exceptional bravery while deployed to Iraq when he decided to provide driving assistance to Multi-National Division — Central South. His scope of duties did not include driving, however he made a choice to put himself in harms way behind the wheel of a HUMVEE on numerous occasions to support personnel movements to and from Camp Echo. In doing so, he earned the drivers badge.

Other accomplishments during his Iraq deployment include duties that went outside of Sanders realm of SATCOM expertise to include establishing and maintaining internet access to Soldiers on the entire camp for which he was awarded an Army Achievement Medal. In addition, Sanders received a Joint Service Achievement Medal for his exceptional performance and making improvements to tactical operations center, and for his versatility and ability to adapt beyond his duty scope. For example, when the Command and Control and the Command, Control and Communications Intelligence sections needed assistance, Sanders stepped up to the plate and learned the job. Sanders contributed immeasurably to the Multi-National Division Central-South needs and would not hesitate to take on new duties. His contribution to the intelligence section assisted in providing tactical operational support to Military Transition Teams, Border Transition Teams, and Operational Detachment Alpha Teams. His list of U.S Army awards culminates with a well-deserved, end-of-tour Joint Service Commendation Medal.

Sanders received other prestigious awards during his deployment including the Bust of Abraham Lincoln, a Danish Medal, and the Warriors Medal of Valor. The Bust of Abraham Lincoln is an achievement award given to only one Soldier per year for providing outstanding support; it was given to Sanders by the Illinois National Guard commander Col. David Leckrone, the Deputy Commander for the area of operation. Another most prized possession Sanders brought back from his deployment was a Danish Medal for completing a Danish-contingent 25 kilometer forced march. The five-hour march was completed in desert heat conditions. The Warrior Medal of Valor was presented to Sanders by the Native American Congress of America.

# ALPHA COMPANY SOLDIER REDEPLOYS

By SGT Justin Tjernlund
Unit Reporter

**ABOVE:** SSG William Strong reflects on his time in Afghanistan as he heads home from his 16-month volunteer deployment. *Courtesy Photo*

FORT DETRICK, Md. — Recently, Alpha Company welcomed the return of SSG William Strong from a 16 months deployment to Afghanistan. Although he changed stations shortly after arriving to become an instructor at Fort Gordon, Ga., Strong had a little time to relate his experience to his fellow Soldiers at Alpha Company.

"Being [in Afghanistan] allowed me to better appreciate the work that Soldiers across the [53rd Signal] Battalion are doing," related Strong. "Having that experience myself gave me a better concept of the operation as a whole and the part that I had been playing."

Strong insisted that while his job wasn't exactly the same as it had been with Alpha Company; that he benefited from his prior training and experience. "Normally, a regular 25S would have been performing my job, which would have been sufficient, but they generally lack the training to see the interplay and impact that their communications have with others. Having the training and experience with [ASI – 1C], was beneficial to all deployed signal units."

While in Afghanistan, Strong participated in satellite anomaly resolution, interference geolocation, and worked with global positioning systems with the 82nd Airborne Division Headquarters. While working with the GPS systems was a departure from what he normally works with in the 53rd, Strong said that his experience at an operations center helped him adjust to the new task. While performing his mission, he worked closely with the Landstuhl Operations Center (Charlie Company, 53rd Signal Battalion) in order to coordinate communications.

During his time deployed, Strong also stressed the importance of the new WGS satellites being introduced to the military community. "While deployed, we relied on commercial satellites for nearly 90 percent of our communications," explained Strong. "This was mostly due to the current limitations of bandwidth on the [DSCS III's]. The problem with this is that with commercial satellites, we did not receive the same commitment to support as we have from the military satellites."

The reason for the difference, explained Strong, was that the bandwidth that we purchased on the commercial satellites has been at a low budget value, so we did not receive the same level of committed support that higher paying customers received. "In contrast, the level of support on the DSCS satellites was outstanding, due largely to the expertise and commitment of Soldiers of the [53rd Signal Battalion]," said Strong.

While deployed, Strong also participated in classified operations of which he was unable to describe in detail for this article.

"Suffice it to say, it helped to keep my time there interesting," explained Strong, "but I am definitely glad to be back in the States."

Of his time spent away from the unit, one of his past Soldiers, SGT Jason Sachinger, had this to say of him: "I really missed him during his deployment; he was a great squad leader and an asset to our unit … I know that he definitely represented the best of the battalion. I wouldn't be surprised to see more of us being sent over there because of his success."

# COLONEL INDUCTED AS ARMY SPACE PIONEER

By Andy Roake and Mike Howard
SMDC/ARSTRAT Public Affairs

Retired COL Ronan Ellis (left) and LTG Kevin T. Campbell (right), commander of SMDC and Army Strategic Forces Command, unveil Ellis' photo, which will hang in the Space Pioneer Conference Room in Building 3 at Peterson Air Force Base, Colo. Ellis was honored on April 11 as the fourth Army Space pioneer recognized by the U.S. Army Space and Missile Defense Command. Ellis was the first commandant of the Army Space Institute and the second commander of Army Space Command. *Photo by Dennis Howk, Department of the U.S. Air Force*

PETERSON AIR FORCE BASE, Colo. – More than 50 people applauded in the foyer of Building 3 while retired Army COL Ronan Ellis was honored on April 11 as the fourth Space pioneer recognized by the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command.

LTG Kevin T. Campbell, commander of SMDC/ARSTRAT hosted the ceremony and helped Ellis unveil his photograph, which will hang in the Space Pioneer Conference Room in Building 3 alongside the photographs of other Space pioneers. Ellis was the first commandant of the Army Space Institute and the second commander of Army Space Command.

Ellis had an almost prophetic vision of Army Space operations that laid the groundwork for almost all of the Army's current use and dependence on Space-based capabilities and products which has immeasurably impacted the way today's Army and the Army of the future will shoot, move and communicate.

He was directly responsible for putting GPS (Global Positioning Satellite) receivers into the hands of ground forces prior to offensive operations during Operation Desert Storm in 1991. While the GPS constellation at the time was not fully complete, the small light-weight GPS receivers, informally called "sluggers," enabled ground forces to find their way through the flat, featureless deserts in Iraq, Kuwait and Saudi Arabia.

Campbell pointed out that Ellis' efforts enabled Soldiers to find their way in a new way, to know where friendly forces were in a navigation-challenging terrain and undoubtedly saved countless lives.

# HAVING A BALL CELEBRATING PIONEERS

Previous Army Space Pioneer inductees include retired MG John Medaris, who contributed to the successful launch of America's first satellite; retired BG Robert Stewart, the first Army astronaut; and retired LTG C.J. Le Van, who was a visionary in missile defense.

By DJ Montoya
Public Affairs
1st Space Brigade

COLORADO SPRINGS, Colo. – The theme of "Celebrating Pioneers in Space" along with recent accomplishments of the Wideband Global SATCOM (Satellite Communications) satellite served as the backdrop for this year's U.S. Army Space and Missile Defense Command/Army Forces Strategic Command Ball at the Antlers Hilton Hotel in downtown Colorado Springs, Colo.

COL Michael Yowell, commander of the 100th Missile Defense Brigade, Ground-Based Midcourse Defense, welcomed a gathering of close to 500 by saying, "When you think about it we just celebrated the 50th anniversary of the Command last year. This year it has been 50 years since the Army put a satellite into Space on Explorer 1. Nearly a decade after that man walked on the moon. After that we had Army Astronauts in Space. So tonight we have the distinguished guest speaker whose vision and foresight laid the ground work for many of the things we enjoy today throughout the entire Command. So 17, 18, 50, years from now we are going to be reaping the benefits of the work from our Soldiers, civilians and contractors throughout (today's) Command."

The highlight of the evening came with the introduction of retired Army COL Ronan I. Ellis. Ellis served as the first commandant of the Army Space Institute at Fort Leavenworth, Kan., from January 1987 through April 1989. He also became the second commander of U.S. Army Space Command in Colorado Springs, Colo., from May 1989 through April 1991.

"His vision of Army Space operations was almost prophetic," said MAJ Kyle Zablocki, master of ceremonies for the evening's events. Ellis laid the groundwork for almost all of the Army's current use and dependence on Space-based capabilities and products, which immeasurably impacted the way today's Army, and the Army of the future, will shoot, move and communicate."

At the Army Space Institute, Ellis aggressively pursued providing Space support at the small unit level. Before the creation of the Institute, most military Space systems were dedicated to supporting strategic missions. In 1987 he predicted that advance positioning systems would be available to battalion commanders with continuous information on the location of subordinate units. He also saw that Space-borne communications would overcome the line-of-sight limitations of ground-based systems and that the battalions would have immediate access to satellite imagery and weather data. All of these capabilities and more are now available and are considered essential to modern ground combat operations.

While commanding ARSPACE, the service component command of U.S. Space Command, Ellis saw much of his Space vision come to fruition during Operations Desert Shield and Desert Storm. Even before Iraqi forces rolled into Kuwait, his Soldiers were demonstrating the small lightweight Global Positioning System receiver and then training trainers for deploying units from Fort Bragg, N.C., Fort Campbell, Ky., and Fort Stewart, Ga. ARSPACE eventually provided 800 sluggers to deployed units and orchestrated the urgent purchase of 10,000 commercial GPS receivers.

"The groundwork laid by Ellis' keen foresight, makes this is a truly historic occasion for SMDC/ARSTRAT," said Zablocki.

Ellis recalled those early days at the Army Space Institute saying, "I suddenly started to realize there were Space things that we could use as Soldiers. Out of that came a concept. The bottom line back then was that we as the Army went back into Space and had to utilize what was already there. By getting receivers and receiving the information that was

coming down (all the assets were pretty much in either the test phase or operation) came a small lightweight GPS receiver called a slugger."

"That put the revolution of GPS in the tactical arena. And then we said well after receivers we need to do a better job in a few years on processing that data so it is not just raw data, rather its data we can use as Soldiers. The best example of where that went is the Joint Tactical Ground Station. Now we process that information to support theater use. Before all that information was just for strategic use."

"And then finally, we said back then, in 1987, that the Army then had to be involved in the design of satellites specifically to support what we need them to do."

SMDC/ARSTRAT has taken Ellis' advice to heart as the WGS SATCOM system expert. The Command is about to activate the first WGS satellite supporting warfighting operations in the Pacific Theater. Members of SMDC/ARSTRAT have been involved in the WGS program from the very beginning — from the 1997 briefing to a Senior Warfighters Forum, to requirements development, testing and the first launch on Oct. 10, 2007. WGS-1 is the first of six WGS satellites planned, initiating the transformation of Department of Defense's communications architecture to support future warfighting technologies.

Ellis concluded by saying, "The message of all of this is you have got to start with an idea. And make sure it is a good idea. And then you have got to press on. You and your predecessors here at SMDC/ARSTRAT have pressed on and we truly are Space users for the Army and for the nation."

Before the closing of the official portion of the ball, over 25 individuals made up of Soldiers, civilians and Family members were honored.

The lion's share received the Honorable Order of Saint Barbara — patroness of artillerymen — medallion. Members from both the 100th Missile Defense Brigade (GMD) and the 1st Space Brigade received the award from LTG Kevin T. Campbell, commanding general for SMDC/ARSTRAT. The honor recognizes those individuals who have demonstrated the highest standards of integrity and moral character, displayed an outstanding degree of competence and served the U.S. Army with selflessness.

The Honorable Order of Molly Pitcher was presented to five spouses for their significant contributions to the U.S. Army through their volunteer efforts and their many years of unwavering support to the Army.

**BELOW**: Awardees toasted from the grog bowl during the 2008 SMDC/ARSTRAT Ball. *Photo by Michael L. Howard*

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# A New Era for Satellite Communications

# WGS

## Wideband Global SATCOM