SatCom For Net-Centric Warfare *November/December 2010*

MilsatMagazine

Ka-band Mounted Battle Command On-The-Move
Photo courtesy of EM Solutions

CHRONICLES

The Orbiting Vehicles Series: OV2 + Onwards
by Jos Heyman 26

COMMAND CENTER

James Ramsey, President
MTN Government Services
MilsatMagazine Editors 38

FOCUS

The Antenna Challenge
William Hafner & James Montgomery 18

Enhanced Situational Awareness
Rick Lober 34

Enhancing Mobility Through COTM
Karl Fuchs 45

The Importance Of Compression
Sandy Johnson 58

Mission Critical Audio Conferencing
Sudhir Gupta 68

INTEL

Satellites + Remotely Piloted Aircraft
Colonel Keith W. Balts, USAF 04

Iran: Space Launch Capabilities
Tiffany Chow 50

Securing Tactical Mobile Networks
Martin Roesch.......................................63

SATELLITES + REMOTELY PILOTED AIRCRAFT

AUTHOR: COLONEL KEITH W. BALTS, U.S.A.F.
VICE-COMMANDER, 30TH SPACE WING, VANDENBERG AFB

Advances in technology allow modern forces to fight battles at extreme distances, separating the shooter from the target. Whereas Colonel Prescott delivered his famous directive in person and on the battlefield, the ground commander in Afghanistan communicates with the *remotely piloted aircraft* (**RPA**) unit in Nevada while inputs stream in from the

A pre-flight inspection of an MQ-1B Predator unmanned aircraft at Ali Base, Iraq. The Predator is a medium-altitude, long-endurance, remotely piloted aircraft. DoD photo by Airman 1st Class Christopher Griffin, U.S. Air Force.

> ***Don't fire until you see the whites of their eyes...***
>
> ***—Col. William Prescott Battle of Bunker (Breed's) Hill, 1775***

distributed common ground/surface system in Virginia and the combined air and space operations center in Qatar.[1] Similar to RPA operations, space operations are distinguished by vast geographic separation between the ground and (space) vehicle segments. According to General ***Kevin Chilton***, commander of **US Strategic Command**, space operations are "absolutely global in nature and indifferent to physical terrain or lines drawn on a map."[2]

Forces able to distribute their operations geographically can gain advantages in force protection, economy of force, flexibility, and system and personnel costs; however, such distribution also exposes them to unique vulnerabilities and challenges. With the advantages in mind, the military has already fielded many remotely operated systems or has them under development, demonstrating an evolutionary trend toward more, not fewer, distributed operations.

The RPA example above is a prolific one in the air domain; examples exist in other physical domains as well. General *Chilton* has punctuated the growing reliance on distributed operations for the space and cyberspace domains, identifying them both as media "in which the United States can expect to be challenged."[3]

In general, fourth-generation warfare theory also supports this trend by suggesting that military operations are more "likely to be widely dispersed and largely undefined."[4]

In light of this relatively new trend, military leaders need to consider potential second-order effects, uniquely associated with distributed capabilities, that may detract from the advantages that these capabilities bring to the fight. Comparing space and RPA operations illuminates several of these effects. By leveraging the experience gained from decades of space operations, military leaders can translate applicable lessons learned from a relatively

> *Combat identification for unmanned aircraft systems (UAS) during time-sensitive targeting can be messy and may include inputs from the distributed common ground/surface system, the combined air and space operations center, the ground commander, and, of course, the UAS pilot.*
>
> *—Pilot of a remotely piloted aircraft flown during Operation Enduring Freedom*

mature unmanned community to a comparatively young one. Many of these lessons also apply to remotely operated capabilities in other domains.

Why should we compare space and RPA operations? Of all the terrestrially based remotely operated systems, RPAs currently make up the preponderance of those systems distributed across significant distances — that is, outside the immediate area of responsibility. Operators of other remote systems are in fairly close proximity to the vehicles they control, but those systems may grow more distributed over time; thus, their communities could also benefit from this discussion. Unlike the recent trends in air, land, and sea domains, historically, space operations have always been distributed (and remotely operated) due to the unique physical attributes of, technical challenges peculiar to, and risks in the space domain.

As General *C. Robert Kehler*, commander of Air Force Space Command (**AFSPC**), remarked during a visit last year to **Creech AFB**, Nevada, home of Air Force RPAs, "We understand remote split operations in AFSPC. We have been operating UASs for many years. It's just that those

The final phase of the training is held at the MQ-1 Predator Formal Training Unit (FTU) at Creech AFB, Nevada, where students learn to fly and fight with the MQ-1 Predators. Photo courtesy of USAF

UASs fly outside the atmosphere, and we fly things that are more than 22,000 miles away. We do that with remote split operations."[5]

Military space operations do involve several manned weapon systems, especially ground-based platforms performing space-related missions. Examples include launch vehicles, MOS space situational-awareness sensors, and space-control systems with a direct physical, rather than a remote, connection to the weapon system; however, this article addresses satellites because they represent the preponderance of space operations and are, in essence, remotely operated space vehicles. Satellite system architectures closely resemble RPA architectures as both consist of control segments, vehicle segments, and the links connecting them.

Nevertheless, the crisscrossing evolutions of satellites and RPAs distinguish the two. On the one hand, space operations began in a distributed mode but have grown closer to the fight by deploying new systems and expertise into the theater of operations.[6] RPA operations, on the other hand,

Global Hawks

distribute key elements of traditional air operations away from the theater. Despite their differences in capability and operating domain, space and RPA operations share enough characteristics to make them worthy of comparison as examples of distributed operations.

Background, Analysis, and Embedded Recommendations

With the space community's more than five decades of experience in distributed operations, what lessons apply to the RPA community? The *doctrine, organization, training, materiel, leadership and education, personnel, and facilities* (**DOTMLPF**) construct used by the *Joint Capabilities Integration and Development System*, offers a framework for comparison and analysis.[7]

A DOTMLPF analysis of space operations reveals some recommendations that can help remotely operated communities in other domains better prepare for future distributed operations.

Doctrine

Despite the importance of doctrine to military success, especially the effective employment of new technologies, military personnel have noticed a lack of an overall doctrine for RPAs.[8] The uniqueness of these aircraft and other remotely operated systems warrants specific guidance to address shortfalls and differences in existing doctrine. Current *command and control* (**C2**) doctrine posed significant challenges to space operations in the late 1990s and early 2000s as space capabilities became more integrated with traditional military operations.

Two nuances, unique to space operations at the time, forced leaders in-theater and in US-based space organizations to re-examine existing C2 doctrine for establishing command relationships. First, space units can create effects within the traditional area of operations without the need to fully deploy or undergo a change of operational control (CHOP) to theater. Second, space capabilities can create effects across the entire area of operations — even across multiple areas of responsibility

General C. Robert Kehler, commander of Air Force Space Command

simultaneously or within the same tactical timeframe (*i.e.*, a single execution cycle for satellite planning, similar to a single ***Global Hawk*** sortie).

Traditional criteria for establishing command relationships did not address these nuances, so conflict ensued between supported and supporting commanders over how best to resolve this doctrinal gap. After years of experimentation, exercises, operational experience, and heated exchanges, the Air Force developed specific doctrinal criteria to help commanders establish the appropriate command relationships, such as operational control, tactical control, or a supporting affiliation.[9]

Using this doctrine as a baseline, the RPA community should establish exact criteria for defining command relationships when units do not need to fully deploy or when their weapon systems can create simultaneous effects across traditional areas of operations.

Organization

During the past two decades, space expertise and organizations evolved within geographic commands in order to better integrate space capabilities into traditional military operations; advise senior theater leadership on space capabilities; and plan, coordinate, and execute theater space operations. The speed and effectiveness of this evolution depended on the location and organizational affiliation of the space personnel involved.

Initially, very few space-savvy personnel existed outside of **US Space Command** (**USSPACECOM**) to assist theater commanders in integrating these new capabilities.[10] Similarly, theater expertise did not flow back into USSPACECOM to help career space officers understand the environment, requirements, and culture of traditional military operations. To remedy this situation, in the mid-1990s USSPACECOM, AFSPC, and their equivalents from other services began deploying space support teams to theater organizations for planning, exercises, and real-world operations.

The next step involved creating a permanent presence in major theater headquarters using liaison officers — specifically, officers working side-by-side with theater leadership but reporting to USSPACECOM or its subordinates. Finally, the Air Force assigned space experts — mostly graduates from the space course at the **US Air Force Weapons School** — to major theater headquarters, reporting directly to theater commanders.

This evolution from deployable teams to liaison officers to permanent party experts was a key element in increasing the effectiveness of space capabilities as geographic theater commanders gained more influence over space requirements and integration.[11] While this evolution occurred at the junior-officer level, a similar one occurred at the senior level, although

USAF UAV Training Simulator, photo courtesy of USAF

it lagged the junior-level process by several years. Senior space officers served as liaison officers, deployed, and then eventually became permanent members of theater headquarters as directors of space forces (DIRSPACEFOR), positions created to facilitate coordination, integration, and staffing activities in support of space-integration efforts for the combined force air component commander.[12]

A critical milestone, establishment of the DIRSPACEFOR position, gave space operations a forum and voice in theater headquarters that junior officers could not always provide. It also enabled senior space leaders to gain direct experience in theater operations.

RPA operations had their roots in theater operations, but the evolution of theater space organizations is noteworthy because it demonstrates a desired end state for expertise in distributed operations. If the RPA community succumbs to the temptation to distribute too much expertise away from the theater, it could find itself in the same situation as the space community in the early 1990s. By keeping sufficient junior- and senior-level RPA experts embedded within theater organizations, rather than relying on liaisons, the RPA community will ensure effective integration of current and future capabilities. Although not examined here, several organizational changes also occurred inside space organizations to better support theater activities.

TRAINING

Distributed operations carry with them the disadvantage of simultaneous authorities exercised over a single unit by both the "organize, train, and equip" chain of command of their military service and the operational chain of their combatant commands. When units do not CHOP into or out of a theater, commanders experience a dilemma in unity of command in that they must fight a war while they train for it. Space operations mitigate this disadvantage by establishing recurring training requirements for line crews and real-world proficiency standards for training and evaluation personnel (as well as unit leadership). Having to perform periodic real-world operations not only keeps instructors and evaluators proficient, but also enables them to help backfill line crews so the crews can interrupt their normal schedule rotation to fulfill monthly training and evaluation obligations. Major system upgrades and procedural changes can also stress the steady-state manpower levels needed to balance training requirements and real-world operations.

Manpower needs must account for potential surge capacity for major modifications to the weapon system, procedures, or real-world operations tempo. Policies and requirements put in place by the space community could serve as a baseline for RPA units that must also train while they fight. Distributed operations offer a key training benefit insofar as recorded data can contribute to better debriefings of individual missions and help train other operators. Unfortunately, the exclusive use of this data can also lead operators to "drink their own bathwater" by learning the wrong lessons in the absence of external perspectives from supporting or supported forces. Collaboration tools and opportunities to visit related locations in person can generate these external perspectives. Funding for site visits, key conferences, and select debriefings will help distributed operators improve their performance; in turn, those operators will educate forward units on the capabilities and limitations of emerging weapon systems. In fact the first real benefits from the evolution of theater space organizations came from educating theater commanders on space capabilities, which also led to increased credibility for the space community.

MATERIEL + FACILITIES

As satellites and RPAs differ widely due to the operational domains involved, materiel

Predator UAV firing a missle

The role of simulators in distributed operations also enters into a discussion of the materiel element. Control nodes for remotely operated systems depend heavily on computers and data manipulation, making their functionality easier to simulate than manned systems that operate in the physical environment.

considerations worthy of comparison reside mainly in facilities associated with the control segment and communication links. Despite tight cost constraints, requirements for control nodes should include capacity for growth in both size and coordination demands. The ability to surge efficiently beyond routine mission objectives will enable operators to carry out infrequent but complex operations that necessitate crew augmentation, accommodate outreach opportunities without interfering with operations (*i.e.*, hosting tours for external organizations), and integrate unforeseen future capabilities. Expanding part of the system without major redesign represents another advantage of distributed systems over traditional manned systems.

Simulators for distributed operations can be incredibly realistic, especially for weapon system displays that use text and graphics versus live video or audio feeds. Close synchronization of upgrades between real-world systems and simulators is paramount as both training and operations occur simultaneously.

Finally, effective distributed operations depend upon links to the outside world. These links are important not only for vehicle connectivity and situational awareness but also for operators to feel connected to the mission and the people they support or who support them. Similarly, realistic visualization tools and meaningful collaboration capabilities can amplify contributions made by personnel operating outside the traditional area of operations.

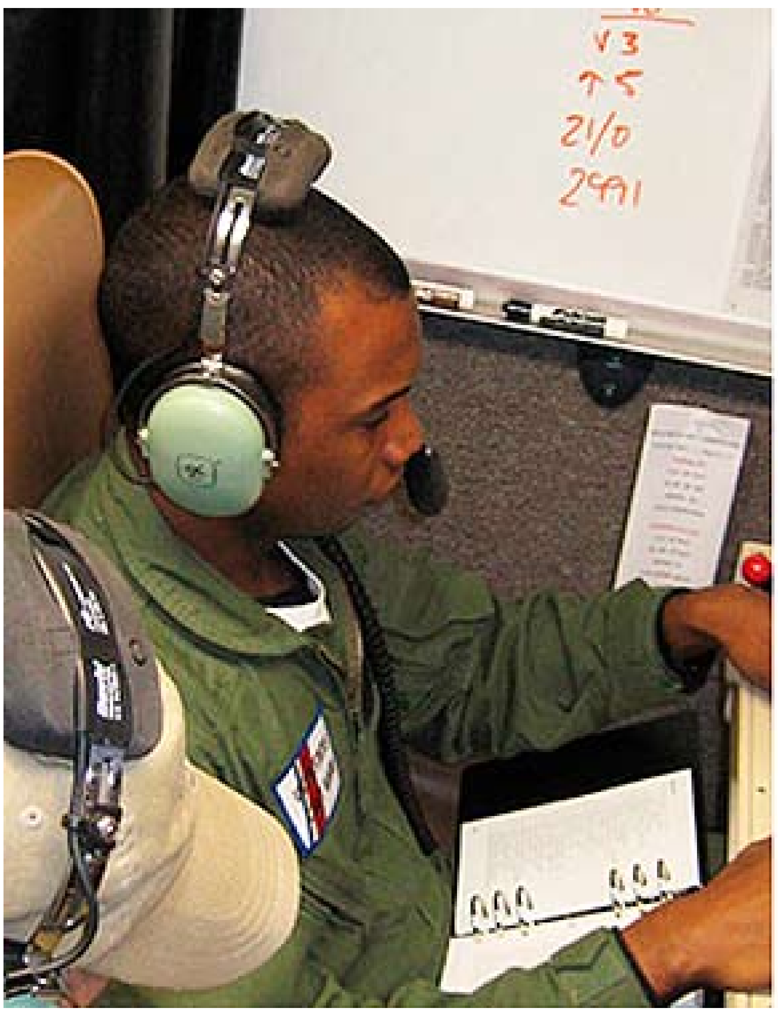
Three-dimensional common operational pictures and training tools, along with live video feeds, assist operators in comprehending the environment not physically present around them. Video teleconferencing, live chat, and ample travel opportunities can also build and maintain professional relationships for successful collaboration, allowing operators to understand the nuances and nonverbal communication behind the inputs they receive. Protection of control nodes and links should also occupy a high position on commanders' lists of priorities since they often represent the most vulnerable aspects of the weapon system.

LEADERSHIP + EDUCATION

The crisscrossing evolutions of the space and RPA communities also produce useful comparisons for overcoming leadership and education challenges associated with distributed operations. Leaders of distributed operations face two significant obstacles instilling a warrior ethos and motivating personnel who operate away from their "band of brothers" in the war zone. Some of this disconnectedness can even lead to post-traumatic stress disorder among RPA crews involved in lethal operations.[13] Even though space operations do not currently involve lethality, motivated operators with a war-fighter mentality are still

critical to mission success, especially personnel integrated directly with ongoing military operations.
Initially, the RPA community has the benefit of drawing its personnel from manned systems — these individuals bring their deployed experience with them. The challenge lies in sustaining that perspective in their new community while educating the next generation of operators who might not have the benefit of theater experience. Video teleconferencing, instant messaging, and other electronic collaboration methods can go only so far in creating and sustaining a feeling of connectedness with other personnel and weapon systems involved in the operation beyond the immediate control node. The experience is just "not as potent an emotion as being on the battlefield."[14]

Distributed operations may yield huge cost savings and reduce risk, but to periodically connect operators with the battlefield, commanders should allocate funding and man-hours for trips to the theater and other distributed elements. Waiting three years for new operators to take on a liaison or embedded RPA position in-theater is too late to benefit the mission during their first operational tour.



From left: LT Thomas Shuler; a predator MQ-9 UAS; CBP ground control station,photos courtesy of U.S. Coast Guard

PERSONNEL

The military space community grew out of an engineering culture whose early space operators included either officers with technical degrees or technically savvy contractors.

In the 1990s, the Air Force transitioned to nontechnical officers and eventually to enlisted personnel as the mainstay of space operations, at the same time keeping contractors involved to balance the loss of technical expertise. Although this move helped operationalize space capabilities and save money, the pendulum had swung too far, diluting experience at the junior and midcareer levels. The Air Force reacted by pushing for more technical, advanced degrees and for specialization within the career field to counter the degradation in technical proficiency. Moreover, the conversion to enlisted personnel cost young officers early opportunities to gain this expertise as part of their professional development. It is difficult to develop senior leaders in a community that offers few opportunities to acquire technical experience at a junior level. (Approximately 75 percent of second-tour space officers served as missileers in their first assignment.)[15]

U.S.A.F. UAV training at the Air Force Weapons School, photo: USAF

U.S.A.F. Reaper UAV

In summary, the RPA community should not abandon its origins, even though technology permits it to do so. Rapidly training new officer accessions or enlisted personnel to operate RPAs may seem attractive, but such policy changes should occur gradually, allowing commanders to identify and resolve second- and third-order effects before drastic corrections become necessary.

Conclusion

Distributed operations offer unique advantages in warfare, but they can also include serious side effects. By examining space operations and applying lessons learned to other distributed operations, military leaders can minimize negative second-order effects and thereby ensure mission success.

Lessons within each DOTMLPF element can prevent the repetition of mistakes when new domains open or when remotely operated systems appear in the existing operational environment. Distributed operations stretch our current understanding of established domains, thus driving the need for unique doctrine and organizational structures. Furthermore, personnel policies, leadership development, and training programs must adapt to incorporate nuances never before encountered in traditional warfare — or at least not encountered to the extent revealed by modern distributed operations.

Finally, placing more emphasis on the design of control nodes, perhaps at the expense of some vehicle prominence, will allow leaders to leverage the most versatile and flexible segment of distributed weapon systems. By taking a hard look at how space operators approached these elements, military leaders can improve the integration, evolution, and mission contributions of newer distributed systems such as RPAs. As space operations evolve toward and RPAs evolve away from their traditional operating environments, they learn many lessons for sharing — such as two remotely operated ships passing in the fight.

Editor's Note:
This article originally appeared in Air & Space Power Journal, Fall 2010 issue, and is presented courtesy of the United States Air Force.

About the author

Col. Keith W. Balts is the vice commander of the 30th Space Wing and Western Range at Vandenberg Air Force Base, Calif. The wing's forces conduct spacelift and range operations, and support operational and developmental missile system testing for the Department of Defense from the West Coast of the United States. Vandenberg Air Force Base is the only U.S. platform for polar orbit launches and the only location to conduct intercontinental ballistic missile testing without over-flying populated areas.

Colonel Balts received his commission as a distinguished graduate of Air Force Reserve Officer Training Corps. He has served in various operational and staff positions involving satellite command and control, space control, missile warning, national reconnaissance and theater space operations. Colonel Balts has served at the squadron, numbered Air Force, major command and national agency levels. He commanded a space warning squadron and the Air Force's largest isolated installation within the continental U.S. He also served in the Combined Air Operations Centers for Operation Southern Watch and Operation Enduring Freedom.

Colonel Balts is a command space operator with qualifications in four satellite systems and two ground-based radars. Prior to assuming his current position, Colonel Balts was a student at the Naval War College, Newport, R.I.

FOOTNOTES

1 National Park Service, "Bunker Hill Monument," http://www.nps.gov/bost/historyculture/bhm.htm (accessed 22 September 2009); and Joseph L. Campo, to the author, e-mail, 28 September 2009.

2 Gen Kevin P. Chilton, "Cyberspace Leadership: Towards New Culture, Conduct, and Capabilities," Air and Space Power Journal 23, no. 3 (Fall 2009): 5, http://www.airpower.au.af.mil/airchronicles/apj/apj09/fal09/fal09.pdf (accessed 21 May 2010).

3 Ibid., 6.

4 William S. Lind et al., "The Changing Face of War: Into the Fourth Generation," Marine Corps Gazette 85, no. 11 (November 2001): 66.

5 Military doctrine does not specifically define remote split operations; rather, the term refers to operations described in this paragraph in which the operator and platform are geographically separated from each other. SSgt Alice Moore, "AFSPC ComNotes Commander Visits UAS Operations at Creech AFB," Schriever Air Force Base, 25 March 2009, http://www.schriever.af.mil/news/story.asp?id=123141399 (accessed 21 May 2010).

6 Maj Keith W. Balts, "The Next Evolution for Theater Space Organizations: Specializing for Space Control," in Space Power Integration: Perspectives from Space Weapons Officers, ed. Lt Col Kendall K. Brown (Maxwell AFB, AL: Air University Press, December 2006), 124, http://www.au.af.mil/au/aul/aupress/Books/Brown/brown.pdf (accessed 21 May 2010).

7 Sean C. Sullivan, "Capabilities-Based Planning: Joint Capabilities Integration and Development System and the Functional Capabilities Board," course reading (Newport, RI: Naval War College, 20 August 2008), 4.

8 P. W. Singer, Wired for War: The Robotics Revolution and Conflict in the Twenty-first Century (New York: Penguin Press, 2009), 210.

9 Air Force Doctrine Document (AFDD) 2-2, Space Operations, 27 November 2006, 10–14, http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_2.pdf (accessed 21 May 2010).

10 Today, USSPACECOM's space-operations mission resides in US Strategic Command.

11 Balts, "Next Evolution," 124.

12 AFDD 2-2, Space Operations, 7.

13 Scott Lindlaw, "UAV Operators Suffer War Stress," Air Force Times, 8 August 2008, 1, http://www.airforcetimes.com/news/2008/08/ap_remote_stress_080708/ (accessed 9 January 2010).

14 Singer, Wired for War (see caption for third unnumbered plate in the photo gallery following p. 308).

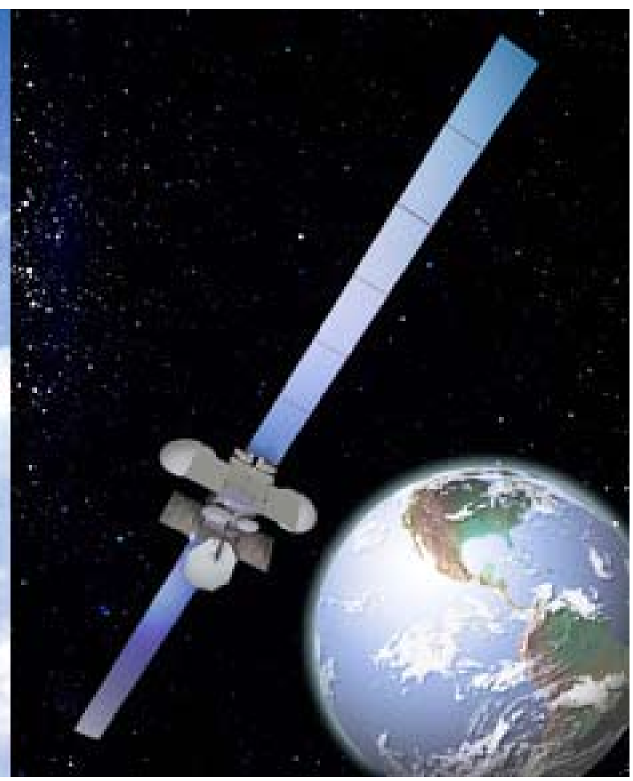
15 US Air Force, "13S Career Paths, Deliberate Force Development," briefing, AF/A3O-ST, January 2009, slide 21.

THE ANTENNA CHALLENGE

AUTHORS: WILLIAM HAFNER AND JAMES (PAT) MONTGOMERY, PHD
EMS TECHNOLOGIES, INC.

Without question, the military's need for mobility and bandwidth continues to grow exponentially. This is reflected in the launch of the latest ***WGS*** satellite this summer and the U.S. Air Force's decision to pay **Boeing** to lay the groundwork for a seventh wideband military communications satellite to route video, voice and data messages to deployed troops.

The government's own satellite investments will significantly increase the U.S. military's broadband capabilities in the Ka- and EHF-band arena, and will no doubt help lessen the military's dependence on Ku-band and other commercial sources for bandwidth. Today, 80 percent of the military's bandwidth comes from commercial sources at a price tag of



WGS

approximately $600 million annually in 2009, according to **DISA**'s *SATCOM, Teleport and Services* office.

We estimate that some 15 different military platforms will be in line for WGS. Boeing's ***BAMS*** UAV for the Navy has already received the WGS upgrade and ***Global Hawk*** will soon be upgraded.

What does this mean for antenna designers and terminal developers in the ***SATCOM-on-the-move*** world? Two things — one, there are many niche markets that companies can fit into and do well — whether they specialize in miniature SATCOM or large airborne systems.

Two, smaller and greater SATCOM functionality are king. The radio side of the satellite market already has fully embraced this move, where terminals and modems of even non-SATCOM radios are shrinking in size as they increase the number of SATCOM functions. However, what about the antennas that need to talk to the satellite? They are limited by physics — the physical area of the aperture must be of a size and aspect ratio to achieve the gain and pattern performance required to meet the link requirements.

In many cases, military users have to choose between a small, low-profile antenna with lower data rates, or a larger antenna to get the bandwidth necessary to support mission-critical applications such as situational awareness. These combat operations must be managed in real time across land, sea and air. In the world of airborne military operations, low-profile antennas are needed for two reasons — to hide the antenna from view and to make it aerodynamic.

Twenty years ago, the only antenna answer was a parabolic dish combined with a feed system. In applications where low profile was tactically desired or required, alternatives were not available and the only choice was to attempt to meet the needs with undersized apertures severely constrained in link performance. Antenna design innovators are exploring ways to meet the low-profile needs with smarter designs that have the low-profile physical characteristics along with the growing bandwidth needs of the warfighter in mind.

Today, the industry is exploring a number of novel approaches using flat plate apertures suitable for low profile implementation — from multi-layer printed circuit apertures which can support wide bandwidth, to designs consisting of interlaced narrow band slot arrays supporting multiple frequencies.

The design challenge is to come up with low-profile antenna systems that neatly fit the shape of a vehicle without sacrificing performance. User needs can be driven by a desire to maintain a discrete presence to conceal the aperture from view. Other applications can be driven to low profile by aerodynamic needs of flight in both manned and unmanned systems. For some unmanned systems, including ***Global Haw***k and ***Predator***,

Global Hawk UAV

the flight system was literally designed around a mechanically steered parabolic dish system. However, most of the addressable market requires retrofit of an antenna system to an existing aerodynamic platform.

These platforms were never designed for large exterior additions that can result in unacceptable impacts to the flight ability of the aircraft. Low profile is the key to success in adding an external SATCOM system to an existing airframe.

PLETHORA OF SATELLITE OPTIONS

The military has more satellite spectrum at their disposal than ever before. The rich options available include a combination of commercial and military satellites in operation now and planned:

- *In the commercial satellite arena, Ku-band dominates the current leased bandwidth market for the military. C-band provides additional capacity in regions either underserved by Ku-band or in tropical zones where rain fade immunity makes C-band the logical choice. Up and coming in the commercial market are the Ka-band offerings. With multiple players entering the market with consumer and commercial offerings, strong consideration is underway for military use of the commercial Ka-band networks with promise of even smaller terminals and higher bit rates.*

- *In the military domain, the choices are no less interesting. Included is the WGS fleet coming on line with its integrated X- and Ka-band operations. AEHF will be fully activated in the next several years, replacing the current aging Milstar fleet with new advanced features.*

- *In addition to the aforementioned, there are military/commercial hybrid systems that are currently offering X-band services on commercially owned satellites operating at military bands. Commercial Ka-band network operations are also including military Ka-band as part of the satellite payload system to capitalize on the military/commercial hybrid approach at Ka-band.*

The decisions on usable bandwidth are constantly under evaluation for best value within a complicated scenario. Commercial bandwidth is interesting because the capital investment is taken on by the satellite operator. The users, military and commercial alike, lease capacity to meet their demands.

The downside for the user is that the bandwidth is available on a first-come, first-served basis, with pricing and availability varying with world events. With military-owned satellites, the military user community is in control of its destiny, but the downside includes the capital expenditures necessary to purchase and operate the satellites. In addition, satellite lead times and the unpredictable timing and location needs of bandwidth make long term management difficult.

CAPACITY OUTPACED

During the ongoing operations in the Middle East over the past decade, regional Ku-band capacity management has been a challenge with demand frequently outpacing availability. The military has looked for other options, most notably in Ka-band systems with the rollout of the DoD's WGS, made to give fresh capacity options to the military. The higher Ka-band frequency spectrum offers significant advantages, including smaller footprints and creating opportunities to reuse frequency at much higher power *(see the graphic on this page for a snapshot of each band, frequency* *range and the advantages and disadvantages that each band offers*).

AN ANTENNA FOR ANY BAND

As advances in radios enable users to switch from one frequency to another, the need to develop this next-generation interchangeable, "any band" antenna is the next big innovation on the horizon. It is a challenging problem to solve, as evident by the investments being made by Air Force and Army Labs as well as DARPA.

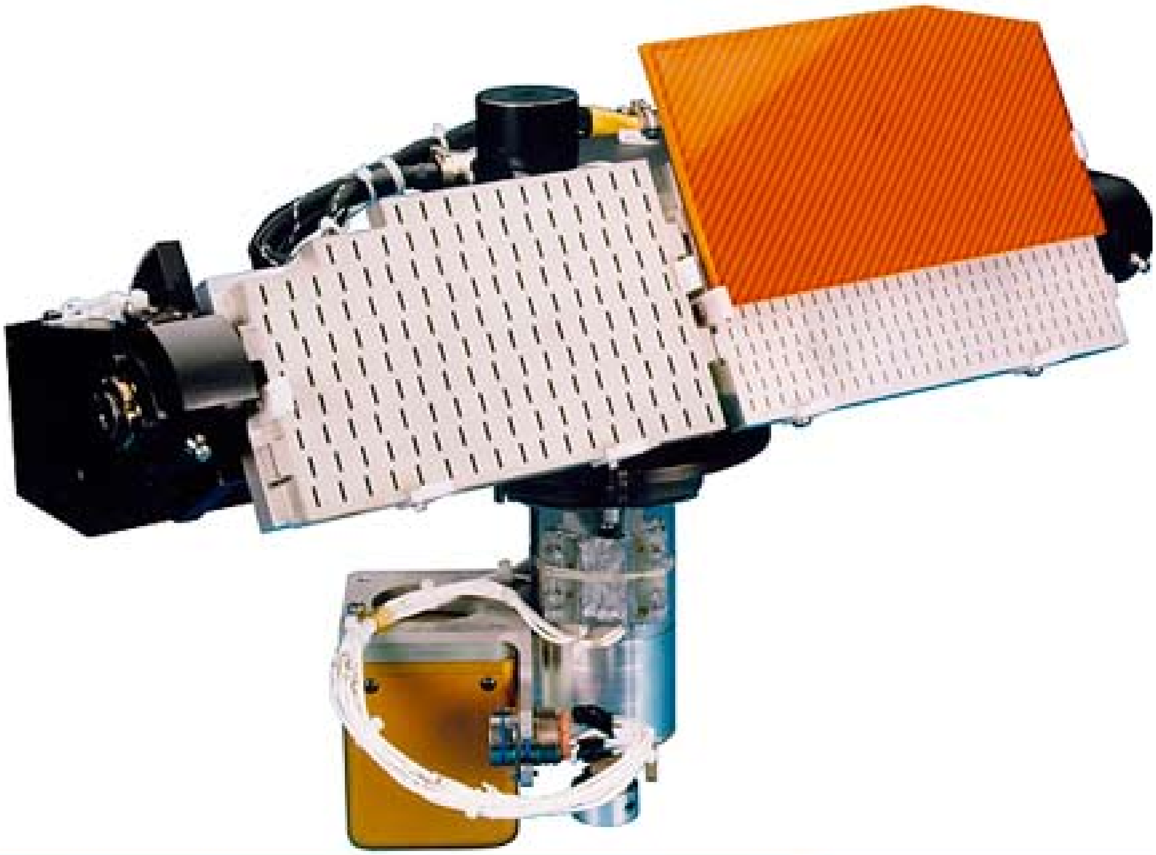
The difficulty that prime contractors and their suppliers are grappling with is the physics of the problem. With the reuse of aperture for multi-band applications, sacrifices that reduce performance are generally necessary, *e.g.*, aperture efficiency.

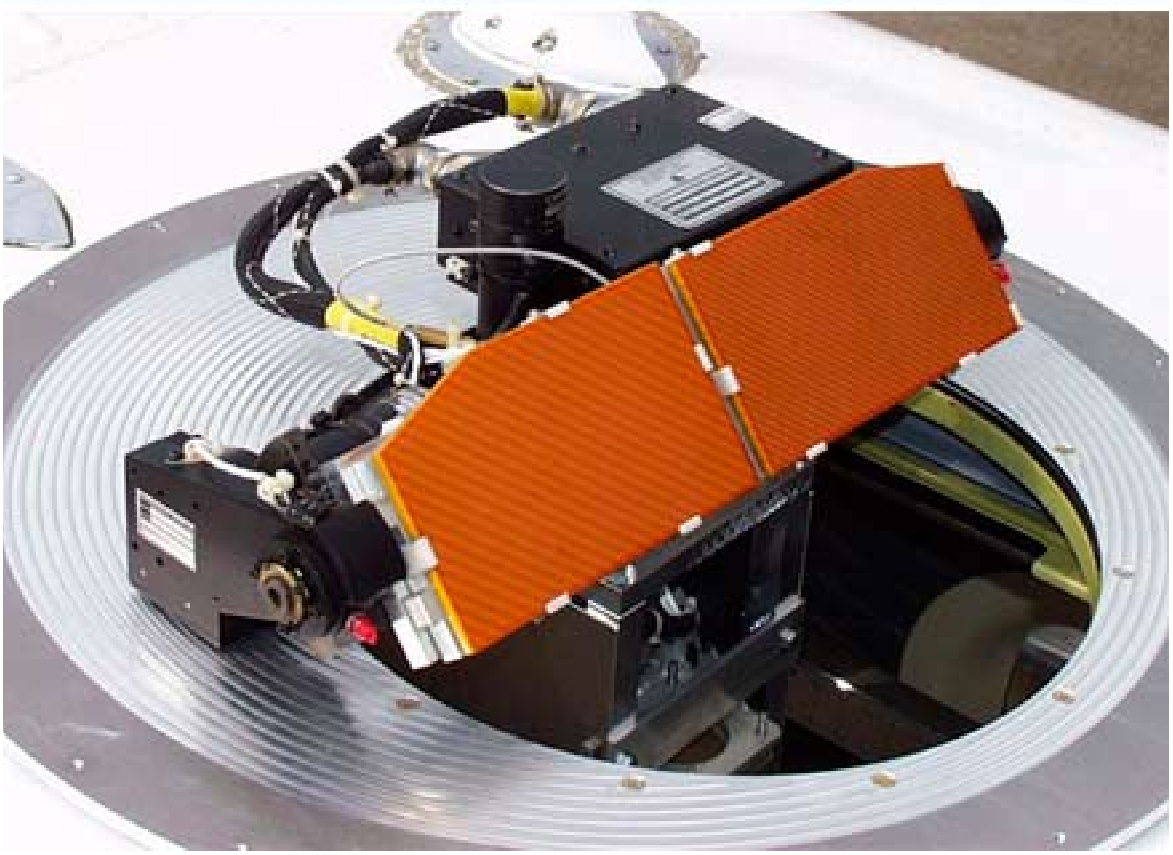
This results in a larger antenna to function within two or more bands in

EMS Defense & Space

Satellite Spectrum: At a Glance

Satellite Band	Frequency Range	Pluses/Minuses	Programs
C-Band	4 - 5 GHz	rain fade immunity/larger antenna/ not ideal for mobile applications	DSCS, XTAR, WGS
X-Band	6 - 10 GHz	rain fade immunity, adjacent satellite spacing is generally wide/larger apertures- not ideal for mobile applications	DSCS, XTAR, WGS
Ku-Band	12 - 18 GHz	deployed worldwide, covers oceans, not ideal for mobile apps (for VSAT), expensive, nearing full capacity and more susceptible to rain fade	Intelsat, NASA TDRS, Hughesnet
K /Ka-Band	20 – 30 GHz	higher frequency/ smaller dish/ lower latency/ less expensive, equipment uses spot beam technology	WGS, Viasat I, Eutelsat, Communications, Yahsat, Wildblue
Q-Band (EHF)	20/44 GHz	dedicated military links/ anti-jam/ data rate not as high as Ka-band/ frequency hopping makes connections difficult	Advanced EHF





Top: EMS D&S AS-Ka Antenna Systems
Bottom: EMS D&S AS-Ka Antenna Systems Installation
Photos: EM Solutions

one aperture. Other concepts include "back-to-back" apertures, where the aperture swept volume accommodates multiple bands with two separate band-specific apertures facing in opposite directions and switched by pointing for the selected band of operation.

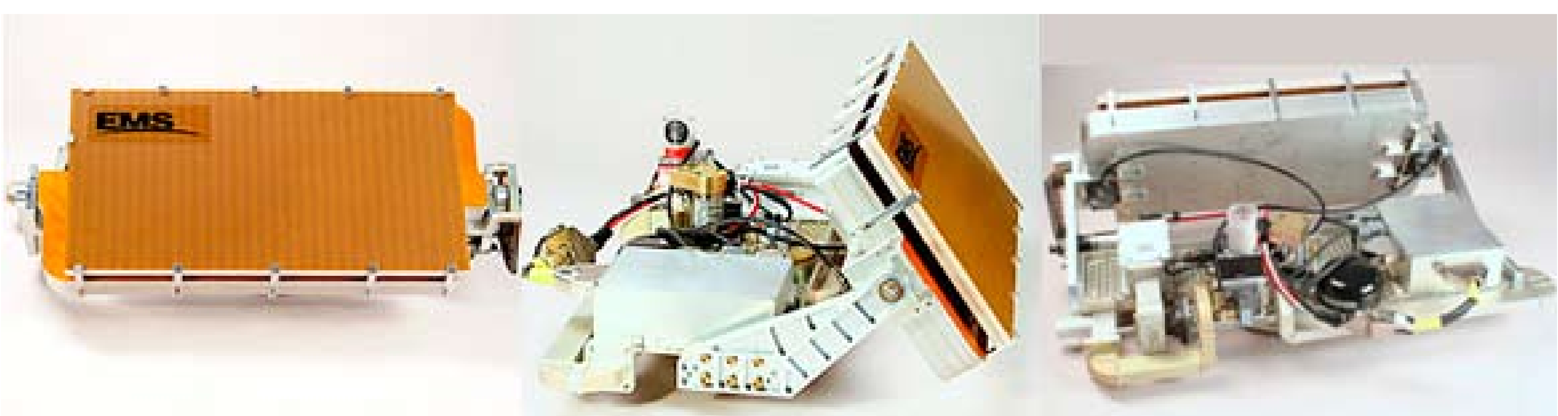
The needs of our military will continue to push the industry to solve this challenge. As key UAV platforms such as Global Hawk seek to move from today's Ku-band to the WGS of tomorrow, they will need an antenna that can help them transition and move within those bands seamlessly, depending on their mission requirements. This may be solved with the addition of a totally separate aperture on a separate part of the fuselage or by updating an existing dish antenna with a complex multiband feed assembly.

Whatever form the next-generation, multi-band antennas take — whether they are two antennas situated back to back or a reflector with a feed that can be switched out from mission to mission. The question is when will this multi-band and switchable capability be a reality? We believe it will be three to five years before we see an efficient dual-band antenna, but there are current solutions in development now.

The industry is advancing with the development of low-profile antennas for a single purpose. In the last four or five years, there has been a real effort to solve some of the problems, be it Ka-band for airborne, or Ku-band for any ground mobile. Today, these are point solutions for a specific platform, satellite or specific mission.

We believe the key for the industry to meet this challenge is to focus on our strengths — our niche. No single company is going to dominate the entire market; rather, there will be those who specialize in key technology areas. **EMS Technologies** specializes in developing airborne and low-profile antenna solutions for aircraft that fly fast and with high efficiency.

Without question, there is a lot of opportunity to design the solutions for the military that enable the mobile warfighter. The user community has as many unique applications as can be created by the marketplace. This multitude of requirements create the demands and challenges we must overcome to support the needs of the warfighter user community. It's a challenge we welcome.



AS-X WaveStorm™ AS-X Antenna System

About the Authors

William Hafner, principal engineer within the Defense & Space Division of EMS Technologies, Inc., provides technical leadership for EMS' Ku-band airborne SATCOM antenna systems and supports strategic business development initiatives for the company's SATCOM antenna architecture. Hafner's engineering career has spanned a broad range of technology areas and he has held a number of engineering and business development positions with increasing responsibility for EMS. Prior to his current role, he was director of Broadband Programs for the Satellite Networks Division and principal engineer for the Corporate Business Development Group. Previously, Hafner worked with SPC Electronics as business development and product line manager for microwave and millimeterwave transceivers for the Very Small Aperture Terminal (VSAT) and terrestrial markets. Hafner has authored numerous papers and technical proposals on high frequency communications links and holds patents on a Multi Beam Satellite Communications System and High Data Rate Satellite Communications and Method. He received his bachelor's degree in electrical engineering from the Georgia Institute of Technology in 1983.

xDr. James P. (Pat) Montgomery is a technical fellow for EMS Technologies Defense & Space Division. In his current position, Dr. Montgomery serves as a principal member of the engineering staff and provides technical leadership with significant business impact on key programs for EMS. He has more than 40 years experience working with antennas and microwave technology and has worked in several technical leadership positions since joining the company in 1986. Prior to his current role, Dr. Montgomery served as corporate chief engineer, leading the development of the EHF Antenna System for the B-2 stealth bomber. Previously, Dr. Montgomery was principal engineer for the Georgia Tech Research Institute (GTRI), where he was responsible for the development of a number of programs involving EHF frequency selective surfaces, RCS measurement systems, RAM permittivity and permeability measurements and large telemetry antenna systems. Before joining GTRI, Dr. Montgomery served as a member of the Technical Staff at Texas Instruments working on radar phased array and slotted waveguide array aperture development as well as the development of many planar near-field testing systems and related software. Dr. Montgomery holds a Ph.D. and M.S.E.E. from the University of Colorado in electromagnetics, where he also served as a guest worker at the National Bureau of Standards. He obtained his B.S.E.E. from the University of Texas at El Paso. Dr. Montgomery is a Life Senior Member of the IEEE.

THE ORBITING VEHICLES SERIES — OV2 + ONWARDS —

AUTHOR: JOS HEYMAN, FBIS, TIROS SPACE INFORMATION

This article continues the look at the OV satellite history from the author that was published in the September/October 2010 issue of MilsatMagazine on Page 82.

The OV2-5 was designed for solar, magnetic and cosmic ray research in space. On Sept. 28, 1968, it was boosted from the ground by a Titan III launch vehicle into a circular equatorial orbit at an altitude of 22,000 miles above the Earth. It was designed with an operating life in space of at least one year. (U.S. Air Force photo)

OV2

The ***Orbiting Vehicle (OV)2*** series of satellites were built by **Northrop** for use with the ***Titan IIIC*** launch vehicle. The series was initially developed for the ***Advanced Research Environmental Test Satellite*** (**ARENTS**) program, which was intended to obtain supporting data for the **Vela** series, which was cancelled.

The ***OV2-2*** and ***OV2-4*** flights in the series were cancelled.

Launched on 15 October 1965, the objective of ***OV2-1*** was to monitor biological hazards of the near-Earth charged particles. It had a mass of 59 kg and 14 instruments were carried to measure energetic particles, electromagnetic field strengths, very low frequencies and radiation effect on tissue equivalents, and included a plexiglass simulated human torso, high- and low-energy particle detectors, two plasma probes and two magnetometers. The satellite was launched with several other satellites on what was essentially a test of the Titan IIIC launch vehicle. It remained attached to the second stage of the launch vehicle due to a failure of the release mechanism.

Titan IIIC launch vehicle, NASA photo

OV2-2 was to carry out optical measurements from a 400 km circular orbit to provide a better understanding of the physics of space radiation and its relation to the Sun. The satellite was to be launched in 1966 and would have carried instruments similar to those to be carried on OV2-3. The mission was cancelled.

OV2-3 was launched on 21 December 1965 and carried 15 experiments to gather data on solar and geomagnetic activity in cosmic ray and trapped particle fluxes arising from such disturbance. The satellite tested various components from the cancelled **ARENTS** program, including a solar cell array, a solid propellant rocket for satellite spin-up, cold gas jets, a solid propellant rocket for orbital maneuvers, a solar aspect sensor and two fluxgate magnetometers. The 192 kg payload failed to separate from the Transtage and contact was lost after launch. OV2-3 gathered data on solar and geomagnetic activity and changes in cosmic ray and trapped particle flux arising from such disturbances. It carried 15 instruments but contact was lost soon after launch.

OV2-4, which was to be flown in 1966 but was cancelled, was to carry out optical measurements from a highly eccentric trans-lunar orbit from which it would have studied space radiation.

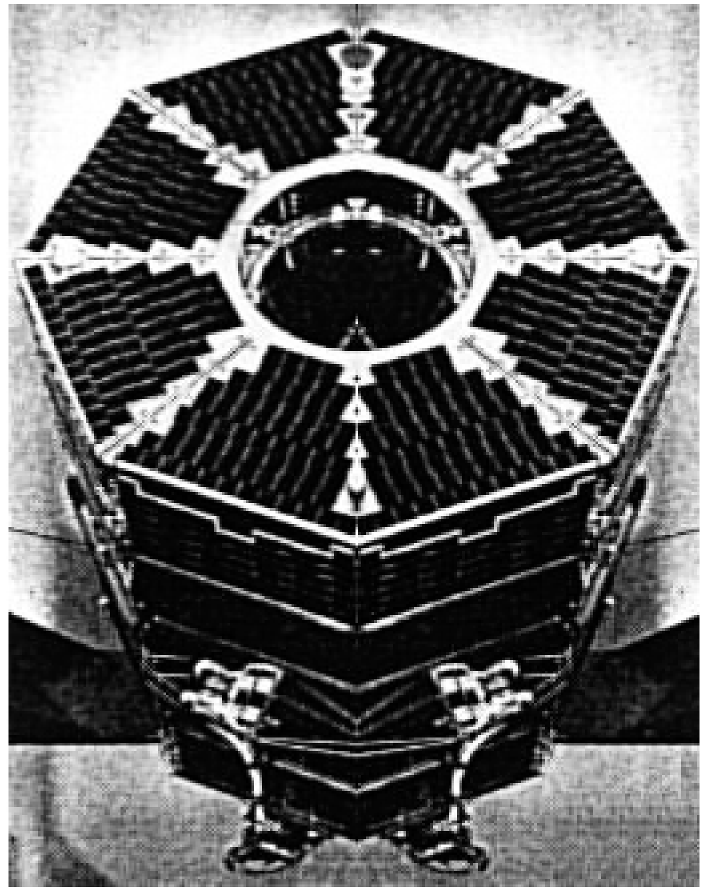
OV2-5, the final spacecraft in the OV2 series was launched on 26 September 1968. The OV2-5 satellite collected data on the space environment at a synchronous orbit altitude, including cosmic rays, trapped particle fluxes and changes in fluxes arising from solar and geomagnetic disturbances. The satellite carried 11 experiments to measure cosmic rays, trapped radiation fluxes and changes in fluxes arising from solar and geomagnetic disturbances. The instruments included proton/electron spectrometers, a dE/dX range telescope, a low-energy Faraday cup, an electron density fan, a Lyman-alpha scanning photometer, a magnetometer, positive and negative plasma sensors and an Orbis-High beacon.

Although only seven of the 12 appendages of the satellite deployed successfully, most of the instruments provided data. OV2-5 had a mass of 204 kg. The combined payloads on this flight have also been referred to as **P67-2**. The collection of data on the space environment in a geosynchronous orbit was the objective of the cancelled OV2-5.

OV3

The ***OV3*** series of satellites were built by **Space General** and were of an octagonal shape measuring 74 cm in diameter. They were used with ***Scout*** launch vehicles.

OV3-1, which was launched on 22 April 1966 with a mass of 68 kg, conducted radiation studies by measuring the angular distribution and energies of charged particles in the magnetosphere and upper ionosphere. It was also known as ***Ops-1527***. The payload included proton and electron spectrometers, electrostatic analyzers, plasma probes, several Geiger-Mueller counters and two magnetometers.



OV3

The 80 kg ***OV3-2***, launched on 28 October 1966, studied the electron and ion density and structure of the outer radiation belt and provided data on charged particle variations in the extreme upper atmosphere during the solar eclipse of 12 November 1966. Instrumentation included an electrostatic analyzer to measure proton and electron spectra, an impedance probe to measure electron density, a plasma probe to measure positive and negative charged particles as well as a mass spectrometer to measure ion species.

OV3-3 mapped and monitored particle radiation in space with omni-directional

Scout launch vehicle, photo courtesy of NASA

proton/electron spectrometers, high and low-energy hydrogen/helium nuclei telescopes, a Faraday cup electron and proton spectrometer, a medium-energy magnetic electron spectrometer and a tri-axial magnetometer. It was launched on 4 August 1966.

The 79 kg ***OV3-4*** satellite was launched on 10 June 1966 and undertook radiation studies of the inner Van Allen belt and was also known as *Personnel Hazards Associated with Space Radiation* (**PHASR**) and **Ops-1427**. The payload consisted of a tissue equivalent radiation chamber, a linear energy transfer spectrometer, electron and proton spectrometers, a solid state charged particle spectrometer and a tri-axial magnetometer.

The fifth satellite in the series, ***OV3-5***, did not achieve orbit on 31 January 1967, due to a launch vehicle failure. The 94 kg satellite carried two mass spectrometers, three ion density gauges and an impedance probe to measure properties of the atmosphere at altitudes between 250 and 860 km, including the constituents and density of the atmosphere and its temperature. It was also known as ***Atmospheric Composition Satellite (ATCOS)-1***.

OV3-6, also known as ***Atmospheric Composition Satellite (ATCOS)-2***, measured the properties of the upper ionosphere, including its composition, density, pressure and temperature. Instruments included two mass spectrometers, three ion density gauges and an impedance probe. The satellite, which was launched on 4 December 1967, operated for 5 days.

OV4

The ***Orbiting Vehicle (OV)4*** satellites were technology spacecraft associated with the proposed *Manned Orbiting Laboratory* (**MOL**) that was proposed by the US Air Force and was eventually cancelled.

Launched with a ***Titan IIIC*** on 3 November 1966, along with several other satellites, the 136 kg ***OV4-1R*** satellite was used in conjunction with 109 kg **OV4-1T** to test the feasibility of using the ionosphere's F layer as a wave guidance for HF and VHF

OV2

Name	Launch	Re-entry	Notes
OV2-1	15-Oct-1965	27-Jul-1972	Failed to separate from LCS-2
OV2-2	—	—	Cancelled
OV2-3	21-Dec-1965	17-Aug-1975	Radiation studies
OV2-4	—	—	Cancelled
OV2-5	26-Sep-1968		

OV3

Name	Launch	Re-entry	Notes
OV3-1	22-Apr-1966		Radiation studies; Ops-1527
OV3-2	28-Oct-1966	29-Sep-1971	Radiation studies
OV3-3	4-Aug-1966		Radiation studies
OV3-4	10-Jun-1966		Radiation studies; also known as Personnel Hazards Associated with Space Radiation (Phasr) or Ops-1427
OV3-5	31-Jan-1967	—	Ionospheric studies; also knwoin as Atmospheric Composition Satellite (Atcos)-1; failed to orbit
OV3-6	4-Dec-1967	9-Mar-1969	Ionospheric studies; also known as Atcos-2

OV4

Name	Launch	Re-entry	Notes
OV4-1R	3-Nov-1966	5-Jan-1967	Receiver
OV4-1T	3-Nov-1966	11-Jan-1967	Transmitter
OV4-2	—	—	Cancelled
OV4-3	3-Nov-1966	9-Jan-1967	Modified Titan II stage; also known as Ops-0855

OV5

Name	Launch	Re-entry	Notes
OV5-1	28-Apr-1967		Materials sciences research; also known as ERS-27
OV5-2	26-Sep-1968	15-Feb-1971	Radiation studies; also known as ERS-28
OV5-3	28-Apr-1967		Radiation studies; also known as ERS-20
OV5-4	26-Sep-1968		Heat transfer studies; also known as ERS-21
OV5-5	23-May-1969		Radiation studies; also known as ERS-29
OV5-6	23-May-1969		Solar flare studies; also known as ERS-26
OV5-7	—	—	Solar studies; cancelled
OV5-8	16-Aug-1968	—	Materials sciences research; failed to orbit
OV5-9	23-May-1969		Radiation studies

transmissions between satellites out of line of sight of each other. OV4-1T carried a transmitter operating at 20, 34 and 46 MHz whilst OV4-1R carried a receiver. In addition, the satellites measured cosmic noise and the electron and air densities of the lower ionosphere. The project has also been referred to as ***Whispering Gallery***.

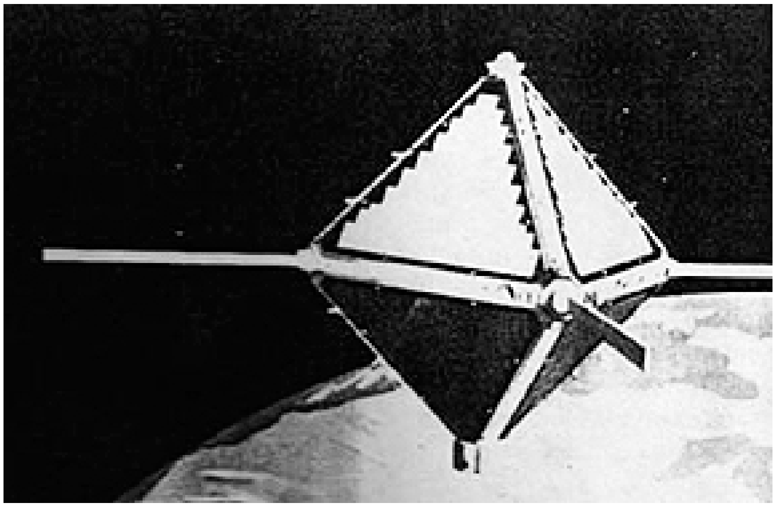
A second set of *Whispering Gallery* satellites, designated as ***OV4-2*** and due for launch in 1967, was cancelled, along with the entire MOL program.

The 9661 kg ***OV4-3***, launched on 3 November 1966, was a boiler plate model of the Manned Orbiting Laboratory, to which the reconditioned ***Gemini-2*** (which had been used on a sub-orbital flight on 19 January 1965) was attached. The objective of the flight was to test the launch vehicle configuration as well as to qualify the MOL heat shield. The mission was also referred to as ***Gemini B-Heat*** or ***Project Manifold*** and was also known as **Ops-0855**.

OV5

The ***Orbiting Vehicle (OV)5*** satellites were built by **TRW** and were octahedrons with sides of 28 cm each, or tetrahedrons. They were launched as secondary payloads on Titan IIIC launches.

The 6 kg ***OV5-1*** was also known as ***Environmental Research Satellite (ERS)-27*** and conducted solar flare studies by measuring the X-radiation. Launched on 28 April 1967, the instrumentation consisted of a beryllium window proportional counter



OV5

to measure X-rays from solar flares, solid state detectors to measure the background radiation, photomultipliers to measure the background radiation and six Geiger-Mueller counters for X-ray measurements.

On 26 September 1968, ***OV5-2*** was launched. Also known as ***Environmental Research Satellite (ERS)-28***, the 10 kg satellite was ejected from the launch vehicle during the early stages of the flight. It conducted radiation studies by monitoring the electron and proton environments in the Van Allen belts. The instruments consisted of three sets of omni-directional spectrometers, several Geiger-Mueller tubes and directional detectors to measure electrons and protons.

The 8.6 kg ***OV5-3*** — AKA ***Environmental Research Satellite (ERS)-20*** — conducted material studies to determine the effect of the space environment on metals. Launched on 28 April 1967, the payload consisted of 16 small arms which swept across organic and inorganic material samples outside the satellite, to measure the friction and drag characteristics.

The ***OV5-4*** was launched on 26 September 1968. Also known as ***Environmental Research Satellite (ERS)-21***, the 12 kg satellite obtained experimental data on the heat transfer in liquid under zero-gravity conditions in support of the **SNAP** design of propellant systems. The test tank contained heating elements immersed in fluid freon and an expandable bellows externally pressurised with a fluid mixture to permit constant vapor pressure measurements. The fluid pressures and temperatures were measured at various points in the tank. The experiment failed prematurely.

On 23 May 1969, three OV5 satellites were launched on the same Titan IIIC launch vehicle. The ***OV5-5***, also known as ***Environmental Research Satellite (ERS)-29***, was a 11 kg satellite to gather data for basic research on solar radiation and its effect on the magnetosphere. Using a VLF plasma wave detector, an altitude sensor, a magnetometer and seven particle detectors, it measured the VLF proton and electron fluxes as well as the temporal variations of such fluxes. The combined payloads on this flight have also been referred to as **S68-3**.

OV5-6 was another 11 kg satellite to gather data for basic research on solar radiation. The payload consisted of a solar flare monitor, six particle detectors, solid state detectors, a

The Atlas 10B launch vehicle awaiting launch.
Photo courtesy of Los Angeles Air Force Base

magnetic spectrometer, a Faraday cup and a fluxgate magnetometer. It was also known as the ***Environmental Research Satellite (ERS)-26***.

OV5-7's objective was to measure solar radiation. It had been intended to fly the payload on the launch vehicle that carried ***OV1-17*** and others on 18 March 1969, but OV5-7 was cancelled to make way for the ***OV 1-17A (Orbiscal-2)*** payload.

OV5-9 collected data on solar flares and low-energy radiation. The payload of the 13 kg satellite consisted of low-energy proton detectors, a dE/dx-E telescope, a Cerenkov counter, a VLF radiation detector, a solar X-ray monitor and a solar flare electron detector.

OV5-8 was one of 13 satellites launched on 16 August 1968 on an ***Atlas*** launch vehicle with a ***Burner II*** upper stage to conduct a materials friction experiment. The protective shroud surrounding the second stage of the launch vehicle failed to separate and the satellites, collectively referred to as **SESP P68-1**, were not deployed.

In their days, the Orbiting Vehicle series of satellites were remarkable in that details of the experiments were published, unlike other US Air Force satellites, which were classified and remain so — in most instances — today. We will probably never know the extent to which these small satellites were associated with classified programs, as they undoubtedly were.

About the author

Jos Heyman is the Managing Director of Tiros Space Information, a Western Australian consultancy specializing in the dissemination of information on the scientific exploration and commercial application of space for use by educational as well as commercial organisations. An accountant by profession, Jos is the editor of the TSI News Bulletin.

ENHANCED SITUATIONAL AWARENESS

AUTHOR: RICK LOBER, VICE PRESIDENT AND GENERAL MANAGER
HUGHES DEFENSE AND INTELLIGENCE SYSTEMS DIVISION

Situational awareness is a vital requirement supporting U.S. homeland security and border control as well as military interests. In 2005, the *Department of Homeland Security* (**DHS**) established the ***Secure Border Initiative***, a multi-year plan to help secure U.S. borders. The Initiative notes that the means to effectively secure the border is achieved through situational awareness and the ability to respond to potential issues immediately.

In the same year, the *Joint Functional Component Command for Intelligence, Surveillance and Reconnaissance* (**JFCC ISR**) was established under the **United States Strategic Command**. It serves as the control center for ISR (*Intelligence, Surveillance, and Reconnaissance*) operations and is vital in enabling global situational awareness for the U.S. military.

Over the past five years, **Hughes** has made significant progress in developing situational awareness technology and solutions. In Camarillo, California, the *Hughes Defense and Intelligence Systems Division* (**DISD**) demonstrated breakthrough technology to enhance situational awareness — the ***Advanced Airborne Video Solution***.

The demonstration took place on an Albatross aircraft and showcased live, uninterrupted, and highly-secure video transmissions with **D-1** video resolution and *pulse-code modulation* (**PCM**) audio at air-to-ground data rates of more than 2 Mbps.

GROUND-BREAKING RESULTS

The demonstration results were ground-breaking. The Hughes solution features two-way, Ku-band satellite connectivity, which performed at speeds much greater than what is currently available in the commercial market, while still maintaining or exceeding currently available quality and performance. Customers can view transmissions from any secure, IP-based network, allowing for continuous communication during deployment or at headquarters.

Users can also use a geotagging feature to easily help identify areas of concern. Other airborne video systems currently on the commercial market are limited to a 200 mile range. They also require *line-of-sight* (**LoS**) communications, making them inefficient in mountainous or urban terrains.

They are also markedly slower with lesser quality, hindering the missions of those in the homeland security, defense, and government sectors.

The ***Hughes Advanced Airborne Video Solution*** meets the situational awareness needs of homeland security and defense missions, and is also a cost-effective and a proven, *commercial-off-the-shelf* (**COTS**) platform.

Hughes first developed its Advanced Airborne Video Solution to meet the needs of its partner, **Row44** and the commercial airline industry with on-board, broadband Internet services. To respond to the airline industry's need for situational awareness capability, Hughes developed a COTS platform for airborne use, employing its highly successful **HX** technology.

The developed platform became the ***Hughes Advanced Airborne Video Solution*** and it provides the speed, quality, and security necessary to meet the requirements of homeland security, defense, and *Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance* (**C4ISR**) customers.

The Advanced Airborne Video Solution uses Hughes HX technology and *Expert Network Management System* (**ExpertNMS**) capabilities. ExpertNMS provides superior usability and features a highly intuitive and interactive interface, with advanced diagnostics capable of monitoring an entire network to optimize performance.

WORLDWIDE COVERAGE

Currently, the Advanced Airborne Video Solution has global reach operating over Ku-band satellites. Hughes is continuing its research and development efforts increasing global Ka-band capability, which will enable customers to use smaller aircraft antennas and facilitate even greater data rates.

Hughes partnered with leading-edge technology providers for a demonstration of its Advanced Airborne Video Solution, including **Row 44**'s flying test-bed aircraft; **TECOM Industries, Inc.** ***KuStream™*** 1000 bi-directional Ku-band antenna; **Streambox**'s highly secure video coding and viewing sub-system; and **Intelsat General**'s communications link via its ***Horizon-1*** satellite located at 127 degrees West.

Air-to-ground video over 2 MBPS

Footage from the demonstration is available at:

http://www.defense.hughes.com/resources/airborne-2-minutes.

About the author

Rick Lober joined Hughes in late 2008 as the Vice President and General Manager of the Defense and Intelligence Systems Division. He has over 25 years experience with both COTS-based and full MIL communications and intelligence systems starting as a design engineer and progressing to a P&L executive. He has previously worked at Cubic Communications, Inc. and Watkins-Johnson Company and received his BS and MSEE degrees from the University of Illinois, Urbana.

JAMES RAMSEY, PRESIDENT MTN GOVERNMENT SERVICES

Editor's Note: MTN Government Services (MTNGS) is a wholly owned subsidiary of MTN Satellite Communications (MTN).

Jim Ramsey is a military veteran with more than 35 years of communications and leadership experience. Jim served at the White House Communications Agency (WHCA) as a Presidential Communications Officer for both President Bill Clinton and President George W. Bush. He was responsible for planning, installing and maintaining communications requirements for over 1,000 presidential trips, commanded four units, and ended his tour as the Operations Officer. Jim was inducted into the WHCA Hall of Fame in 2005.

MILSATMAGAZINE

Jim, could you please tell us about your background and what brought you to MTNGS?

JIM RAMSEY

I joined **MTNGS** in February 2009 with the charge of establishing a wholly owned subsidiary focused on expanding MTN into the public sector, government and the military.

Prior to MTNGS, I served in the U.S. Army and retired as a Lt. Col. (LTC) after a successful 26-year career as a Communications Officer.

After retiring from the U.S. Army, I was appointed by President *George Bush* as the CIO of the **2004 G8 Summit**. Additionally, I served as the senior vice president for **MorganFranklin Corporation** and as senior vice president for **Protection Strategies Incorporated**. I've spent my entire career advising, planning and installing tactical communications worldwide. I was first introduced to MTN when I hired the company to provide communications for a television broadcast from an aircraft carrier.

Field View

MILSATMAGAZINE

Can you give us a brief description of MTNGS and its position in the military satellite business?

JIM RAMSEY

As a newly formed subsidiary, we have the added benefit of leveraging MTN's robust VSAT managed services network and infrastructure, which already supports our successful private sector businesses globally. We are a technology and market leader in the maritime VSAT sector with a very strong position as a major provider of VSAT products and services to the cruise industry, commercial shipping and large luxury private yachts. Our services benefits provide high-quality, reliable, redundant and responsive global VSAT managed services with a staff that understands the public sector.

Our staff has served in the military services, has been part of our nation's most critical organizations, has deployed communications worldwide in support of the *Department of Defense* (**DoD**), civilian agencies and *Non Governmental Organizations* (**NGO**), and has worked with a single *Special Forces Team* in Afghanistan.

MILSATMAGAZINE

We understand MTN was an early pioneer in VSAT technology for the DoD. Can you describe some of those early programs?

JIM RAMSEY

MTN was contacted in April 1986 by the Pentagon to design and build a stabilized satellite communications platform capable of delivering a full transponder worth of information. In just five months from inception, design and integration, the first full-bandwidth stabilized maritime terminal was delivered to the U.S. Navy, where it resided as a classified device through May 1988. At that time, the Company began to redeploy the technology onto commercial vessels such as cruise ships and the U.S. Army boats under contract with the Drug Enforcement Administration (DEA).

Sometime in 1989, the U.S. Navy tried to recall the then *U.N. Classified* technology for redeployment, but realized it had already been redeployed in the commercial arena, so they continued to work with MTN on a sole-source commercial basis in developing what was known as the **Challenge Athena** program. The program's only purpose was delivering **C3I** information to and from their command and control vessels, as well as all their large deck vessels on a global basis.

MILSATMAGAZINE

Could you give us an overview of MTNGS' current service offerings?

JIM RAMSEY

Currently, we offer a complete VSAT managed services capability globally. This includes VSAT hardware, TDMA and SCPC network solutions, installation, VSAT training and consulting, and 24/7/365 maintenance and support. As we continue to grow, we plan to offer a complete end-to-end integrated network solution in which VSAT will only be part of the solution.

MILSATMAGAZINE
Would you please describe MTNGS' network infrastructure?

JIM RAMSEY
MTN provides a seamless global service to all of our users, whether classified or unclassified. This is provided through three teleport stations around the world, two of which we control and through which we lease capacity. All of the teleports are connected today by redundant fiber connections complete with alternate routing and alternate carriers, so there is no common sharing of services in case of a fiber cut or natural disaster. All ground infrastructure components have multiple backups and parallel routers, and all teleport hubs are redundant with automatic failover.

MILSATMAGAZINE
Jim, who are the primary customers for MTNGS?

JIM RAMSEY
We created this subsidiary to focus across the entire public sector and support those who need rapid, reliable, redundant, sustainable and deployable

communications. Our end-user customers include the DoD and other agencies within the government, including the *National Oceanic and Atmospheric Administration* (**NOAA**) in providing broadband satellite connections for their research vessel fleet. We subcontract through various prime contractors for different programs. We also serve a number of NGO's for missions such as disaster relief and recovery operations.

MILSATMAGAZINE

How are you able to conform to security requirements for handling DoD traffic through your network?


NOAA's Okeanos vessel

JIM RAMSEY

This is our constant focus. We take the DoD security requirements seriously and we understand the responsibility associated with being a DoD contractor. MTNGS has to meet the requirements of the *National Industrial Security Operating Manual* (**NISPOM**), *Intelligence Community Directives* (**ICD**), *Director of Central Intelligence Directives* (**DCID**), and the *Joint Air Force Navy* (**JAFAN**) *Directives*. Our clients have various security requirements and challenges we work to comply with, and we execute all projects in a highly effective manner. We are also in the process of receiving our **ISO 9006** certification. We constantly engage in working groups and forums throughout the DoD network to strengthen and enhance our security for the DoD traffic. It is obvious to us that protecting the traffic through our network is essential to growth and the safety of our men and women in uniform.

MILSATMAGAZINE

How has the new DISA purchasing platform for satellite communications affected your business?

JIM RAMSEY

We are anxious, as are all within our industry, to see how the *Future Commercial Satellite Communications* (**COMSATCOM**) *Services Acquisition* (**FCSA**) will change the industry. As a **GSA Schedule 70** contractor, we have submitted our proposal for the addition of the two new **SINs** (**132-54** and **132-55**), and submitted a proposal for *Custom SATCOM Solutions* (**CS2**). We strongly believe DISA's efforts in bringing this program to the war fighters is vital and will add efficiency, effectiveness and a more streamlined approach to supporting DoD for commercial satellite resources and managed networks.

MILSATMAGAZINE
Do you see increasing demand for commercial satellite bandwidth for DoD? What mission areas?

JIM RAMSEY
Absolutely! We can see across the entire communications sector, the increased demand for bandwidth and throughput for situational awareness, command and control, advanced weapons, and intelligence systems. We also believe the flexibility, investment, and research and development of the private industry can facilitate the increasing demand for throughput. Study after study published within the DoD shows the demand for satellites is outgrowing the ability for the public sector to keep up with. We are truly proud of the fact that we can help support our men and women in uniform and fill the gaps in satellite capability and technology across the spectrum for the DoD. I learned as a soldier that the private sector can bring technology, responsiveness and flexibility to the DoD when needed and to fill those gaps in growing requirements.

MILSATMAGAZINE
What is your strategy for the government and military markets moving forward?

JIM RAMSEY
This is simple — to consistently deliver beyond expectations what we say we can deliver, on time and under budget. It is essential to our business to partner with our customers to seamlessly integrate our company into the mission and to ensure every customer/client is treated as a priority. Our government and military are faced with huge challenges today; therefore, it is critical that our delivery of communications is part of the solution and not a hindrance to accomplishing all missions at hand. Our solutions must be seamless a extension of the network enterprise to enhance the ability to face ever-demanding challenges.

Our core values include personal and professional integrity, customer service that is far above and beyond expectations, collaborative relationships, a “can do” attitude, and uncompromising support to our people and to our clients.

These core values are embraced by our staff and have become nonnegotiable with MTNGS. We strongly believe our core values, our people and the execution of our tasks are what will help us grow within the public sector.

MILSATMAGAZINE
Where would you like to see MTNGS in one year? Five years? 10 years?

JIM RAMSEY

We are building a solid foundation of clients, relationships and strong past performances during the initial years of MTNGS. During the next five years, we plan to expand our business as a more end-to-end integrated communications provider through partnerships, internal growth and, possibly, acquisitions. We want to leverage our capabilities and global reach throughout the public sector using VSAT and/or other technologies. Over the next 10 years, we plan to be a major player within the public sector for communications with innovations of future technology, seamless and reliable network infrastructure, and our constant re-investment in research and development programs.

MILSATMAGAZINE

Finally, we understand you have strong feelings about corporate responsibility to support charitable causes. What is MTNGS doing currently in this area?

MTN 9707 Antenna

JIM RAMSEY

I strongly believe it is a privilege and responsibility to give back as a contractor within the public sector, as a leader in our industry and as a resident of our community. We recently worked with the *Loudon County Youth Program* (an after school program) and several others within the community to donate backpacks full of school supplies to children who couldn't afford these necessities. It was an amazing event that touched all of us. We had over 1,000 people attend and gave away 300 backpacks. Last year, we also worked to create a strong support program across the DoD to help deployed military families and surviving spouses (*Wounded Warriors*, *Patriot Foundation*, *Disabled Sports* and several others within the DoD community).

We also created a strong support program within the NGOs for medical care, education, hunger relief and numerous other efforts around the world. It is an obligation and privilege that my staff and I are passionate about, and we will continue to give back through MTNGS.

ENHANCING MOBILITY THRU COTM

AUTHOR: KARL FUCHS, VICE PRESIDENT OF ENGINEERING,
IDIRECT GOVERNMENT TECHNOLOGIES (IGT)

Communications On The Move (**COTM**) continues to be a vital technology to help the warfighter achieve mission success. Broadband Internet Protocol (IP) connectivity in a mobile environment on the ground, at sea, and in the air, provides instant access to information, which is paramount to military organizations for reconnaissance, situational awareness and critical communications needs.

By providing real-time, secure and reliable video, data, and voice transmission via satellite for warfighters and military support organizations, satellite communications enables military groups to carry out important national security missions in areas that lack supporting communications infrastructure. Satellite COTM routers are ideal for battlefield ISR missions as they require limited setup time; and are ready for rapid deployment in any theater of operations around the world. Satellite COTM routers are extremely compact and scaled to fit in a soldier's pack. Additionally, COTM remote routers designed for military applications are ruggedized for continual operations in adverse conditions and when soldiers are on the move. COTM enabled satellite networks allow COTM routers and itinerant terminals to operate seamlessly around the world.

goal has been difficult due to the requirement for very high in-bound data rates through ultra small antennas. Further complicating ISR is the use of high-speed aircraft which introduces the Doppler Effect, where high speeds, turbulence and rapid shifts in altitude create problems in receiving satellite signals.

Recent developments in airborne COTM, however, are making reliable high-definition (HD) video a reality for critical airborne communications.

Mobile communications over satellite is not a new idea, but a number of technological advancements in the past few years have made widespread deployment more cost effective and transparent to the end user. Smaller satellite dishes, globally persistent IP addressing and the efficient use of spread spectrum technology have all enhanced the mobility of communications over satellite.

AIRBORNE ACQUISITION

The greatest developments in COTM technology are taking place in terms of airborne communications.

The need for high-definition (HD) video from mobile military aircraft communications has long been a requirement for Intelligence Surveillance and Reconnaissance (ISR). In the past, achieving this

Airborne COTM can be just as reliable as ground-based COTM with the use of specialized wave forms that support increased vehicle speeds. By using automatic beam switching and persistent IP addressing for airborne communications, an aircraft can be flown from the United States to Europe and on to a final destination in Southwest Asia and maintain a seamless global network of advanced communications while switching satellites throughout its journey. This network even extends to soldiers departing the aircraft with communications-equipped manpacks that include mobile satellite router boards. Paratroopers can quickly and easily set up communications on the ground to suit any mission.

The stringent security requirements of the military are particularly challenging in SATCOM because of the broadcast nature of the medium. Recent upgrades in *Transmission Security* (**TRANSEC**) include the ability to obfuscate any traffic volume or remote terminal acquisition activity, which either on its own, or when coupled with other intelligence information, may prove useful to an adversary.

TRANSEC ensures an adversary cannot detect traffic types, patterns or network acquisition activity. The challenge of obfuscating acquisition activity is particularly daunting for COTM applications since transient blockages necessitate frequent reacquisition.

To address these critical issues, **iGT** has developed a unique acquisition algorithm as part of their TRANSEC offering. Airborne COTM that supports high-definition video communications continues to evolve and be tested to meet the most stringent military standards. An important demonstration of enhanced mobility via COTM occurred earlier this year.

THE EXERCISE

In June 2010, nearly 70 military, government and industry members took part in the annual worldwide *Joint User Interoperability Communications Exercise* (**JUICE**), demonstrating reliable satellite technology in conjunction with military operations. JUICE, a **Department of Defense** exercise sponsored by the *Executive Agent Theater Joint Tactical Networks* and hosted by the **U.S. Army's** *CECOM Life Cycle Management Command Software Engineering Center*, evaluated new and emerging technologies in a joint task force operational environment. The exercise occurred at 11 locations in eight states, as well as, Germany. JUICE set out to accomplish six key objectives, including optimizing mobility for tactical networks in limited bandwidth battle space.

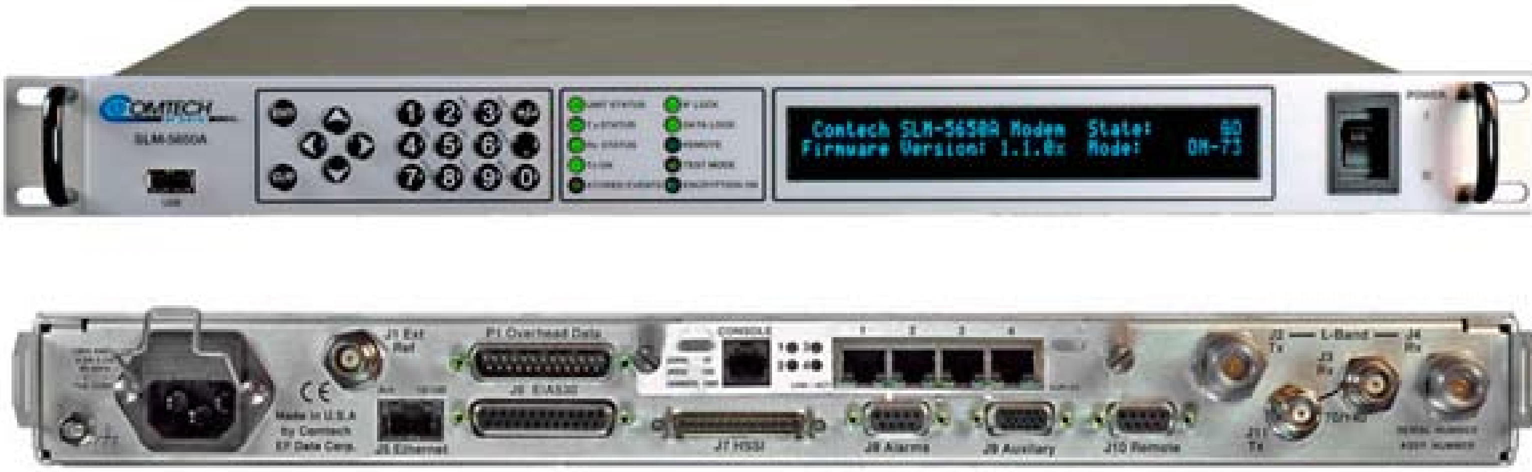
A *Coalition Warfighter Interoperability Demonstration* (**CWID**) forward-operating site successfully participated in several SATCOM-on-the-move *video teleconference* (**VTC**) bridge sessions with JUICE command and control and the Fort Monmouth SATCOM-on-the-move vehicle.

The purpose of the VTC sessions was to advise **JUICE C2** that the CWID unit was ready to deploy and begin its observation run of the local area. Once Fort Monmouth was notified and the CWID mission was acknowledged, the VTC session was dropped and periodically reestablished in five-minute and 10-minute increments.

Another test scenario involved *U.S. Army Special Operations Command Paratroopers* from the **112th Signal Battalion** (Airborne) who were scheduled to parachute from an Air Force C-130 aircraft into a Fort Bragg, NC, training area. The paratroopers were to be equipped with an **iDirect *iConnex e850mp*** SATCOM modem embedded in a Ku-band micro-terminal. Once on the ground, the plan was for the paratroopers to set up a live, *Everything over IP* (**EoIP**) video teleconference session with an Army vehicle traveling in Fort Monmouth, New Jersey, over the JUICE 2010 *Time Division Multiple Access* (**TDMA**) SATCOM *Non-classified Internet Protocol Network* (**NIPRNet**).

A scheduled Fort Bragg parachute jump from the C-130 was preempted at the last minute. As an alternate plan, the jump package was trucked over to the landing zone and unpackaged as though it had been dropped. The Special Operations Command unit successfully deployed the EoIP communications system, which performed with the network and joined in the Satellite VTC bridge sessions with JUICE C2 and the SATCOM-on-the-move vehicles at Fort Monmouth and CWID Dahlgren, Virginia.

The Alaskan shelter and three USC-60 satellite terminals were used in JUICE 2007. (U.S. Air Force photo by TSgt Rebecca M. Henrichsen.)



Comtech SLM-5650A satellite modem

After the **112th Airborne** forward-operating unit joined the satellite network, it participated in regular VTC bridge sessions with JUICE C2 and the Ft. Monmouth and Dahlgren COTM vehicles. They reported on their mission's observations of the area and the environmental conditions encountered.

JUICE provided an excellent opportunity to evaluate the latest advances in military communications technology. These advances offer greater efficiency, increased mobility and lighter, more ruggedized technologies that will improve the safety and agility of our troops in combat situations.

The JUICE demonstrations particularly show that COTM is greatly enhancing mobility for the warfighter on the ground and in the air. COTM improvements will continue in the future and should include greater connectivity, bandwidth, speed, reliability and availability. In addition, improvements in TRANSEC technology will help ensure that transmissions are safe and secure. These upgrades will make increased mobility a reality and lead to even more safe and successful missions.

About the author
Karl Fuchs is Vice President of Engineering, iDirect Government Technologies (iGT). Fuchs leads iGT's team of federal systems engineers and serves as chief architect for new product integration. Fuchs has more than 15 years of experience in the areas of technology and the federal government.

iDirect Evolution® e8000 satellite router — select graphic for further information

IRAN: SPACE LAUNCH CAPABILITIES

AUTHOR: TIFFANY CHOW, SECURE WORLD FOUNDATION

With the success of a domestically-built and launched satellite in February 2009, the **Islamic Republic of Iran** (Iran) became the first Islamic nation, and the ninth[1] nation overall, to launch its own payload into orbit. Since then, Iran has expanded its activities in space: reporting that it has committed significant funds to its space program, announcing new satellite and rocket plans,[2] and promising to put a man in orbit by 2025.[3]

Iran's space program is a collaboration between research organizations, the government, industry, and universities and may have been developed with foreign assistance.[4] Iran asserts that its space program is entirely based on civilian and research goals, whether they be communications or environmental monitoring, but ***Ahmadinejhad*** also says "the scientific arena is where we [Iran] should defeat [Western] domination."[5] While Iran assures its space program is a peaceful one — some worry about its true intentions as many space capabilities are inherently dual-use in nature. In particular, most space launch technologies are applicable to long-range ballistic missile development.

Iran's Safir launch vehicle

After its first successful satellite launch, Iran offered help to any Muslim country who wanted to establish its own space program,[6] creating proliferation concerns among analysts. Iran's space program is thought to be both an attempt to gain international prestige and a technological demonstration of potential ballistic missile capabilities. This **Secure World Foundation** article will offer an overview of Iran's space launch capabilities including launch sites, vehicles, and satellites.

SPACE + TECHNICAL CAPABILITIES

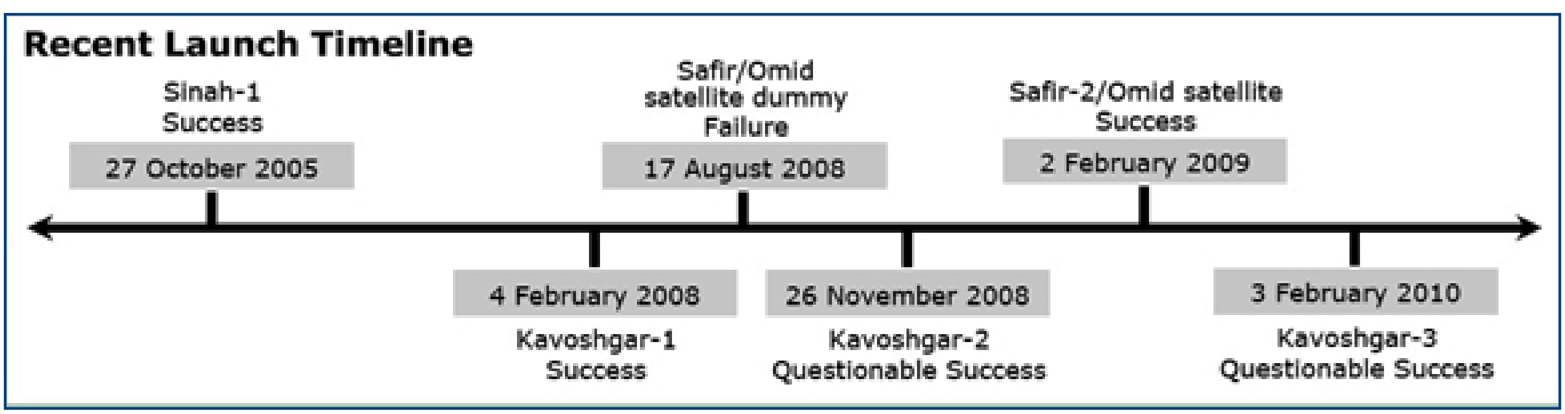
LAUNCH SITES

Currently, Iran has four known launch sites, though it does not always use them or reveal which site it has used in any particular launch:

- » ***Emamshahr in northeastern Iran.***[7]
- » ***Semnan, part of the Iranian Space Research Center,***[8] ***also in northeastern Iran (site of Safir-2/Omid launch).***
- » ***Qom in western Iran.***[9]
- » ***The newest launch site is six and a half miles northeast of Semnan and is thought to have been built with help from the North Koreans for the recently announced Simorgh launch vehicle.***[10]

LAUNCH VEHICLES

- » *Safir, "Ambassador."*[11] *Safir is a two stage launch vehicle*[12] *based roughly on the North Korean Taepo Dong-1,*[13] *measuring 22 meters in length, 1.25 meters in diameter, and about 26,000 kilograms in weight.*[14] [15] *It cannot carry more than a 100 kilogram payload.*[16] *Safir-1 was test-launched carrying a dummy satellite on Aug. 17, 2008, and while Iran claimed it was a success, outside analysts stated it failed shortly after liftoff and never reached its intended position.*[17] *On a later flight, the Safir-2 successfully carried the Omid satellite into space on Feb. 3, 2009, and placed it into a low Earth orbit.*[18] *The Safir series is also thought to be based on Iran's Shahab ballistic missile series,*[19] *with its first stage being "almost indistinguishable from the Shahab-3."*[20]
- » *Kavoshgar, "Explorer." Believed to be liquid-fuel propelled, this is a sounding rocket and thus not officially intended to be a satellite carrier.*[21] *After the rocket reaches about 100 kilometers in height, the payload*



then separates and returns to Earth with a parachute.[22] The Kavoshgar is similar in design to the Shahab-4, a missile based on Soviet Scud missile technology.[23] Three Kavoshgars have been launched. Kavoshgar-1 was successfully launched on Feb. 4, 2008.[24] The performance of Kavoshgar-2, launched on Nov. 26, 2008, received conflicting coverage between state and other media sources and led many to

Kavoshgar 3

question its success.[25] Kavoshgar-3 was launched on Feb. 2, 2010[26] carrying turtles, worms, and a rat. Its performance was also questionable as the Iranian government failed to provide any solid proof of its success. The launch of Kavoshgar-3 was treated like a military display, creating even more suspicion about Iran's peaceful intentions. The rocket was launched not from one of Iran's designated space launch sites, but from the back of a military truck used to launch a similar military rocket.[27] Defense Minister General Ahmad Vahidi oversaw the launch,[28] prompting the following newspaper commentary, "'Iran will not tolerate any unpeaceful use [of space] by any country,' Defense Minister General Vahidi trumpeted as he stood in his military uniform."[29] While Iran states the Kavoshgar-3 launch was meant to be for experimental research, many doubted its scientific value.30

» Simorgh, "Phoenix."[31] At 27 meters long, 85 tons, and with liquid fuel propulsion system capable of a thrust up to 143 tons, Iranian officials state that Simorgh will be able to carry 100 kilograms up to an altitude of 500 kilometers. Simorgh was announced by Ahmadinejhad as part of the National Day of Space Technology on Feb. 3, 2010.[32] According to Iranian reports, it will be able to handle heavier payloads than the Safir and thus deliver the Mesbah-2 and other new satellites into space.[33] In the event of difficulties with the Simorgh, Vice President of Iran's Aerospace Systems Industries Seyyed Mehdi Musavi-Badjani stated that Iran might use foreign launch vehicles to deliver these satellites into space.[34]

Simorgh

SATELLITES

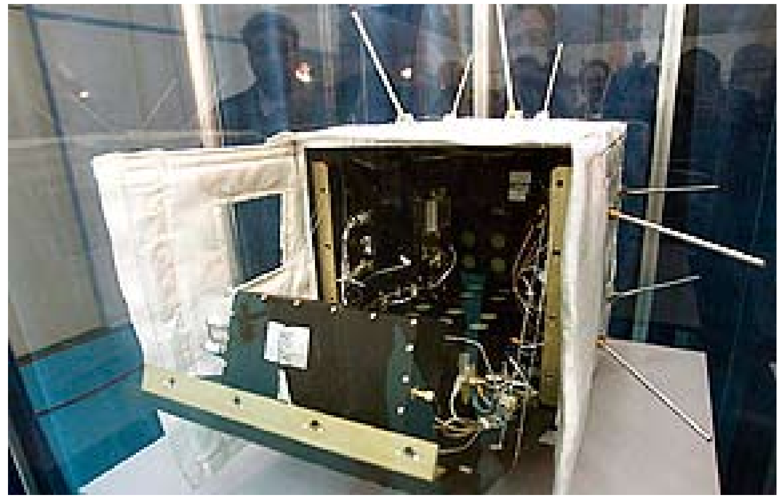
- *Sinah. At 160 kilograms, Sinah was launched on Oct. 27, 2005, by Russia. Though it is the first Iranian commercial satellite, it was built in and launched by Russia.*[35]

- *Zohreh, "Venus." Plans for the geosynchronous orbit (GEO) satellite Zohreh have been in the works since the 1970s, but have run into various obstacles along the way including international pressure and U.S. export control regulations. In early 2005, Iran signed a deal with Russia to continue its development.*[36] *Zohreh is intended to meet "certain television and telecommunication needs" in Iran.*[37]

- *Omid, "Hope."*[38] *Omid is a 40 centimeter cube weighing 20-27 kilograms.*[39] *It was intended to circle the earth in low Earth orbit and is Iran's first indigenously-built and -launched satellite.*[40] *Iran states that the Aug. 17, 2008, launch of the Safir-1, carrying the dummy Omid satellite, was successful, but the international community largely agrees that it was not.*[41] *Directly after the launch, Iranian officials at first stated that the Safir-1 successfully delivered the Omid satellite into space. An* anonymous report from an Iranian official corrected that earlier claim, stating that the Safir-1 was only carrying a dummy satellite, not the real Omid.[42] Additionally, the footage released by the Iranian press appears to have been spliced from an earlier Kavoshgar launch.[43] On Feb. 3, 2009, the Safir-2 successfully delivered the Omid satellite into orbit[44] with an inclination of 55.5 degrees, a perigee of 246 km, an apogee of 377 km, and a period of 90.76 minutes.[45] It remained in low Earth orbit till Apr. 24, 2009.[46] Omid was reportedly equipped with telemetry and Geographic Information System technology, used as a telecommunications satellite, and collected data to aid Iranians in building their own operational satellite.[47]

» Mesbah, "Lantern."[48] Mesbah is a cube of about 50 centimeters on one side, weighing around 60-75 kilograms,[49] and intended to orbit at an altitude of 900 kilometers for three years.[50] Mesbah-1 was built in Italy and originally intended to be launched by the Russians at the same time as Sinah-1.[51] Russians report that the satellite never arrived for launch. After the Italians refused to help Iran with the launch, the Mesbah-1 disappeared from the public's and media's eye. Iran stated it collaborated with Russia and Italy on the Sinah-1 and Mesbah-1 satellites, but both Russia and Italy denied this, saying that Iran simply purchased the satellites from them.[52] In July 2009, with no explanation, Russia refused to launch any more Iranian satellites.[53] Iranians state they have built a Mesbah-2 based on the original Italian design, which they intend to launch themselves. Mesbah-2 reportedly

Sirah, 1st Iranian Comsat



Omid satellite

Rasad satellite

weighs around 65 kilograms. Iran reports it will launch the Mesbah-2 itself in March 2011 on the recently announced Iranian Simorgh rocket.[54] Like Mesbah-1, Mesbah-2 is intended to serve as a telecommunications satellite.[55]

» Tolu, "Sunrise." Tolu was unveiled by Ahmadinejhad as part of the National Day of Space Technology on Feb. 3, 2010.[56] It will be Iran's first remote-sensing satellite. On May 25, 2010, the Vice President of Iran's Aerospace Systems Industries Seyyed Mehdi Musavi-Badjani announced that Tolu would be launched using the Simorgh launch vehicle in March 2011.[57]

» Navid-e-Elm-o-Sanat, "Herald of Science and Industry." Navid-e-Elm-o-Sanat was also unveiled by Ahmadinejhad as part of the National Day of Space Technology on Feb. 3, 2010.[58] It is intended to serve as a research satellite for Iranian universities.[59]

» Rasad, "Observation." Rasad-1 was launched during Iran's Government Week (Aug. 28 to Sep. 3, 2010)[60] on the back of a domestically-built carrier according to Reza Taqipur, Iran's Minister of Communication and Technology.[61] No further information is currently known about this satellite.

Editors' note:
This article was first published on the Secure World Foundation's website, September 2010.

About the author

Tiffany Chow is located in the Washington Office Assistant for Secure World Foundation, where she provides support to the Washington Office Director and SWF's Legal and Policy Advisor. She has been active in the international relations and international security fields for the past four years and brings to SWF a diverse range of experience, both academic and administrative.

Prior to joining Secure World Foundation, Tiffany worked for the Center for American Politics and Public Policy at UCLA, where she assisted the Director and Administrative Director with research projects and program logistics. Before that, she interned with the Monterey Institute for International Studies' Center for Nonproliferation Studies (CNS) in Washington, DC, where she provided research support on a wide array of topics including export control issues in the United Arab Emirates, United Nations Security Council Resolution 1540, and the potential for microreactors to be used for the proliferation of chemical weapons. Tiffany held this internship while participating in the prestigious UCLA Quarter in Washington program, where she also completed a large-scale independent research paper entitled "Reevaluating the Nonproliferation Regime: An Application of John Ruggie's Regime Theory."

FOOTNOTES

1 USSR/Russia, United States, France, Japan, China, United Kingdom, India, Israel, Iran. Some sources cite eight countries because the United Kingdom no longer maintains its own launch capability.

2 Dareini, Ali Akbar. "Iran launches new research rocket into space." Associated Press Worldstream, Feb. 3, 2010.

3 "Iran to Send Larger Satellites into Space." Fars News, Aug. 22, 2010. There are conflicting reports on

when Iran will be able to send an astronaut into space. Original plans stated by 2020. This estimate was revised to 2025. Within this article, the date is revised to 2024, with implementation plans being ahead of schedule for 2019.

4 Forden, Geoffrey. "Secret Iranian Missile Memos." ArmsControlWonk.com. <http://www.armscontrolwonk.com/2458/secretiranian-missile-memos> Sep. 14, 2009

5 "Iran shoots rat into space." Iran Times International, Feb. 12, 2010, with Russia to continue its development.

6 "Iran ready to transfer space technology to Muslim states – official." BBC Monitoring Middle East, Aug. 18, 2008.

7 Wade, Mark. "Iran." Astronautix. <http://www.astronautix.com/country/iran.htm> March 10, 2010.

8 Inbar, Tal. "Iranian Space Program – Global Aspects." Paper presented to the International Astronautical Congress in Daejeon, Republic of Korea, Oct. 12-16, 2009. Pp. 2.

9 Wade, ibid.

10 "New Iran rocket launch site shows N. Korea links: Jane's." Agence-France Presse, March 5, 2010.

11 Celerier, Pierre. "Iran says it has sent another rocket into space." Agence-France Presse, Nov. 26, 2008.

12 Crail, Peter. "Iran Makes First Successful Space Launch." Arms Control Today, March 2009.

13 Daragahi, ibid.

14 Postol, Theodore. "Technical Addendum to the Joint Threat Assessment on the Iran's Nuclear and Missile Potential: A Technical Assessment of Iran's Ballistic Missile Program." Pp. 49. <http://docs.ewi.info/JTA_TA_Program.pdf> June 3, 2010.

15 "Iran ready to transfer space technology…," ibid.

16 Daragahi, ibid.

17 Mikkelsen, Randall. "Iran satellite launch a failure: U.S. official." Reuters.com Aug. 19, 2008. <http://www.reuters.com/article/idUSN1935578420080819>.

18 Daragahi, ibid.

19 Crail, ibid. Kaminis, Markos N. "Iran's New Hope – Space, the Next Frontier." Wall Street Greek, Feb. 12, 2009.

20 Inbar, 3.

21 "Iran shoots rat into space," ibid.

22 Inbar, 7.

23 Cohen, Ariel. "Sword and Shields: Iran's ICBM threat." UPI, Sep. 29, 2008. Inbar, 3.

24 Dareini, ibid.

25 Celerier, ibid.

26 "President implies Iran launched rocket yesterday." BBC Monitoring Middle East, Feb. 3, 2010.

27 "Iran shoots rat into space," ibid.

28 Dareini, ibid.

29 "Iran shoots rat into space," ibid.

30 "Iran rocket launch puts West on high alert," ibid.

31 "Iran shoots rat into space," ibid.

32 "Iran to Send…," ibid.

33 Dareini, ibid.

34 "Iranian official says three satellites to be launched by March 2011." BBC Monitoring Middle East, May 25, 2010.

35 Cohen, ibid.

36 Inbar, 5.

37 "Iranian official says…," ibid.

38 Karimi, Nasser. "Iran claims first launch of its own satellite." The Associated Press, Feb. 3. 2009.

39 Shiga, David. "Just how advanced is Iran's space programme?" New Scientist, Feb. 4, 2009.

40 Karimi, ibid.

41 Daragahi, ibid.

42 Ghazi, Siavosh. "Iran launches home-built satellite rocket." Agence France Presse, Aug. 17, 2008.

43 Brugge, Norbert. "Iran's first space launch vehicle "Safir IRILV." Feb. 9, 2010 <http://www.b14643.de/Spacerockets_1/Diverse/Safir-IRILV/Safir.htm>.

44 Daragahi, ibid.

45 Inbar, 6.

46 Space-Track.org.

47 Daragahi, ibid.

48 "Iran plans new satellite launch." UPI, Dec. 1, 2009.

49 Inbar, 4.

50 "Russia won't launch aging Mesbah satellite." Iran Times International, Oct. 9, 2009.

51 Dareini, ibid.

52 "Russia won't launch aging Mesbah satellite," ibid.

53 "Iran shoots rat into space," ibid.

54 "Iran plans new satellite launch," ibid.

55 "Iranian official says…," ibid.

56 "Iran shoots rat into space," ibid.

57 "Iranian official says…," ibid.

58 "Iran shoots rat into space," ibid.

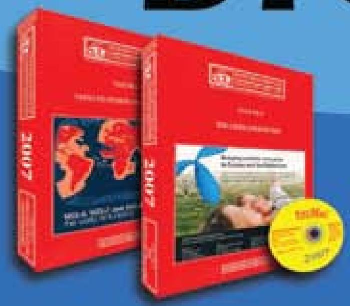
59 "Iranian official says…," ibid.

60 "Iran to launch new satellite in September 2010." BBC Monitoring Middle East, Jul. 7, 2010.

61 "Iran plans new satellite launch in late August: minister." Agence France Presse, Jul. 7, 2010.

The BIG Book of Satellite Communications

Still at Your Finger Tips After 25 Years.



The 2010 International Satellite Directory

Visit: www.satnews.com/directory

The Directory is a comprehensive guide to the people, companies, products, services and the market of the booming satellite industry. With changes of all kinds affecting this dynamic industry, the Directory remains a powerful tool, mapping in detail an otherwise uncharted and complex segment of modern communications.

NO RISK GUARANTEE!
We firmly believe that the International Satellite Directory will be so invaluable to you that we guarantee it. Use the Directory and if you are not totally satisfied, simply return it to us within 21 days of receipt for a full prompt refund.

Directory Contents Includes:

- International Agencies
- Manufacturers of Satellites and Space Equipment
- Manufacturers of Satellite Ground Equipment
- Network Systems
- PC-Satellite Connectivity
- Users of Satellite Systems
- Providers of Satellite Services
- General Services
- Satellite Operators
- Geosynchronous Satellites
- EIRP Maps
- Uplink Facilities
- Buyer's Guide and Index

THE IMPORTANCE OF COMPRESSION

AUTHOR: SANDY JOHNSON, COO, SATCOM GLOBAL

For those units of the armed forces operating in remote parts of the globe, the ability to communicate with colleagues, friends and family has, until now, been restricted, due to affordability and the lack of communication channels.

However, there is a revolution currently taking place in the world of satellite communications. As a result, it is now possible for users who spend long periods of times in these distant locations, whether on land or at sea, to benefit from the high quality voice and data communications they have become increasingly used to using at home.

The key to this step change is compression. The latest data compression technologies provide two major benefits, which now makes the provision of advanced communications channels a viable proposition for command staff and individual military personnel.

First, the adoption of an advanced, flexible codec delivers a new level of high quality two-way voice and data communications in an easy-to-use and secure environment. At a fraction of the cost of existing satellite communications, this makes such affordable to all.

In addition, the technology is designed from the ground up to support ultra-efficient satellite communications delivery via both pre-paid and post-paid options. This provides the military and civil organizations alike with the flexibility and transparency to take back control of their telecoms costs.

KEEPING IN TOUCH

Staying in touch with family, friends, and colleagues has been difficult for those working in tough and out-of-the-way land-based or maritime environments. This has been especially problematic for military personnel operating in war zones in inhospitable terrains that are thousands of miles from home.

Individuals, often away for extended tours of duty and also attempting to save as much as they can to send money home and support their families, the options have historically been limited. In most cases, they have not been able to communicate from their operational base — they have had to wait until they reached the nearest city or next port in order to use a local, expensive, pay-as-you-go phone.

In the past few years, matters have improved with the development of satellite communications, as it has become more common for the local command to provide some form of calling facility — for example, offering vouchers which allow military personnel to call home from their base, and at a time that best suits them and their surrounding conditions.

The ability to take advantage of this capability, however, has continued to be restricted by the high cost of calls, typically $1 per minute or more. In response, with the greater utilization of *Voice over IP* (**VoIP**) solutions, technology is helping to make such communication much less expensive.

The issue extends significantly beyond a simple requirement to be able to call home using a pre-paid voucher. At home, and on-shore more broadly, military personnel are increasingly able to take advantage of a wide variety of sophisticated voice and data communications options. These range from instant messaging to sending and receiving emails to searching the Internet. All occur within a secure, controlled environment and offer a much better value for the money, all as a result of compression technologies.

With the greater availability of IP in the home environment, when in outlying geographies, individuals similarly want to send and receive emails and photograph attachments — the modern day equivalent of the traditional 'long awaited letter (to and from) 'home'. At the same time, they may also want to be able to fill some of their leisure time surfing the net. This has also been beneficial for senior staff who wish to send and receive business-critical information via voicemail with colleagues at command center or other remote locations.

In enabling this enhanced two-way communication capability, for the first time in a pre-paid environment, family or friends have the ability to leave a voicemail message. The call can then be returned at a convenient time, an acitivty that has long been taken for granted in the world of terrestrial landline and mobile communications.

ONE WORLD, ONE NETWORK

Another key beneficiary is the bill payer or owner of the communications device. Those with responsibility for remote land bases or fleets are typically reliant on satellite communications for all communications between the command center and outlying operating units. Telecoms are an important element of the budget in managing each site.

The availability of new satellite-based solutions using compression technology represents a revolution in enabling truly global land-based and maritime communications, both in terms of cost and range of facilities. The cost of communicating is dramatically reduced by using VoIP end-to-end by installing a **Horizon *Multi-VoIP*** unit in each remote location and another in the operational center.

Previously, the center, or hub, would require the use of a landline phone, with a call to each location via a PSTN line, an expensive option costing in the neighborhood of $3-4 per minute. Now it is possible to call any outlying base or vessel directly through the local user extension number and to make a VoIP-to-VoIP call, using the background IP channel, by-passing the PSTN operator.

The concept of email data compression in remote terrestrial or maritime environments is not new. Recent developments have taken performance and cost reduction to a new level. Until now, access on such broadband products has been limited to one voice channel, resulting in long queues to make a call.

With the introduction of a flexible new proprietary codec, it is possible to have multiple connections, with as many as eight handsets on one Horizon Multi-VoIP unit. Not only does this allow eight people to make calls simultaneously, data can also be passed across the background IP channel at the same time. Users can also maximise savings by selecting from several call settings for optimal cost/quality voice delivery. This is a radically different form of communication and is both highly intuitive and easy to install. The savings that can be realized here are huge, as this technology slices the cost of such calls to just cents per minute.

IMPROVED EMPLOYMENT TERMS

Operationally, the availability of instant messaging is another valuable new capability. Historically, sending data across a satellite communications network in this manner has been highly bandwidth intensive — up to 25 kbps and, once again, quite costly. With the advent of instant messaging and peer-to-peer VoIP, the satellite system is optimized, using less than 2 kbps. This provides an ideal low-cost, two-way conversation option.

This also offers a number of additional advantages. The instant messaging text facility enables correspondence to be delivered into print, which can be valuable in ensuring clarity of communication. The local commander, for example, can communicate rapidly with the command center. This is most important when receiving an immediate requirement for equipment, engineering, or other specialist support.

In a challenging economic climate, this clearly offers a notable benefit to the armed forces overall in their ability to operate effectively within tight budgets. It also offers the additional plus of boosting the operator's ability to recruit and retain individuals with specialist skills — and in effect become an 'employer of choice', by including superior, low cost voice and data communications facilities as part of a more competitive remuneration package.

SHRINKING THE WORLD

For military personnel operating in dangerous war zones or dealing with civil emergencies, such as natural disasters, the ability to access the Internet and stay in contact with home on a regular basis by phone, email and text offers a much smaller world. For administrators, the visibility and control of communications costs using such provided tools means they can offer these benefits without expenditures spiralling out of control as they seek for, and then retain, the best recruits.

About the author

Sandy is a co-founder of SatCom Global with Mark White and has been in the industry since 1995 when she joined Next Destination Limited as Finance and Operations Manager. Sandy has played a key role in the implementation of SatCom's proprietary billing system, online technical support and airtime services websites. She has responsibility for the Sales performance and Operations in the Group.

SECURING TACTICAL MOBILE NETWORKS

AUTHOR: MARTIN ROESCH, CTO, SOURCEFIRE

Network Centric Warfare has played a transformative role in military operations during the first decade of the new millennium. Fueled by major advances in information technology, at the core of this new paradigm is an ever-expanding network infrastructure that enables ubiquitous, real-time communications by connecting every person and every device for superior military operations. The result is enhanced real-time situational awareness by being able to exchange more information with

those in the field from a host of devices and ad-hoc networks.

At the same time, this extensive infrastructure has made network security a challenge and created difficulties in achieving Information Assurance. Not only do these vast networks contain and transmit sensitive information but they also connect to larger ***Department of Defense*** (**DoD**) data centers that house sensitive as well as classified information. The desire for network-centric systems has exposed infrastructure and devices to unprecedented, and often unintended, information access.

An increase in the number and sophistication of *Advanced Persistent Threats* (**APT**s) has compounded the need for swift and effective security measures at all potentially vulnerable points. An adversary with an interest in obtaining and maintaining a foothold in a target organization for an extended length of time, an APT has at its disposal sufficient resources — money, equipment and skill — to evolve attacks in direct response to detection capabilities of the target. These groups are typically state-sponsored and

interested in data to support political, military and economic objectives.

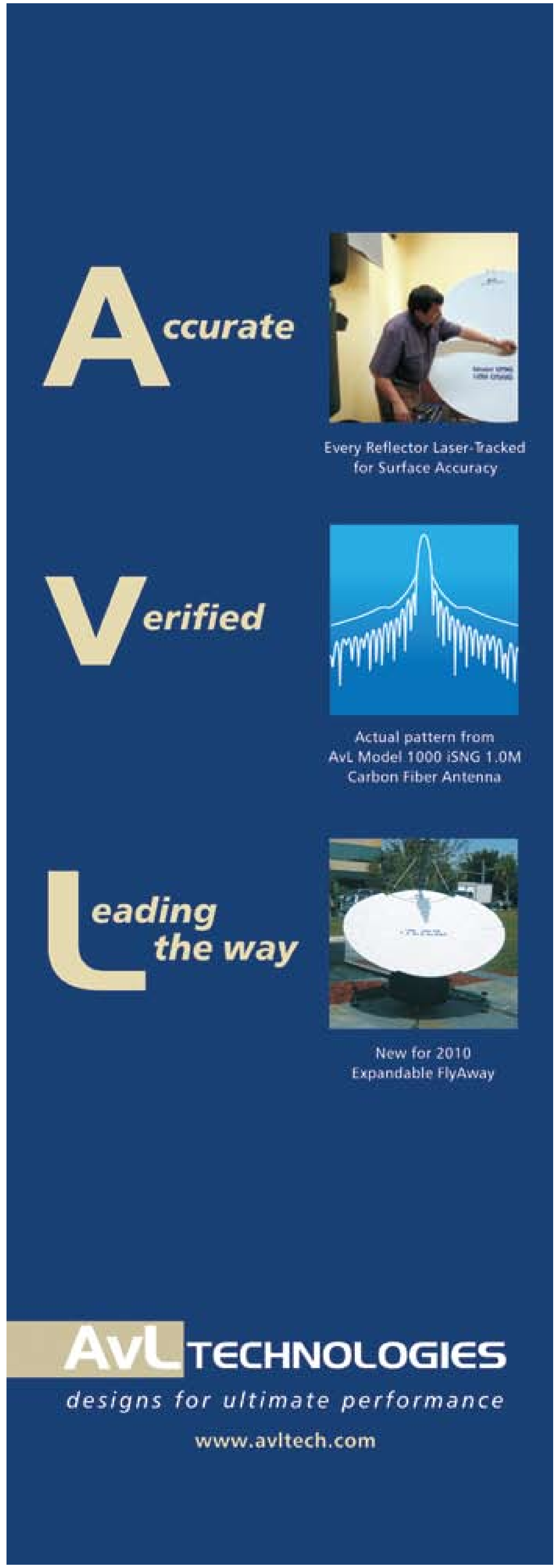
The ***Comprehensive National Security Initiative*** (**CNCI**) launched by President *George W. Bush* and expanded by President *Obama* to include support for an updated U.S. cybersecurity strategy emphasizes the need to secure classified networks. Defense in Depth programs demand a comprehensive security approach that includes layered defenses with various security technologies deployed from the data centers to the network backbone and all the way to the field level.

To date, it has been extremely challenging to extend Defense in Depth programs and comply with CNCI to protect mobile networks in the field. Ad-hoc, tactical networks lack the physical resources to implement the same security infrastructure as the larger networks they must access. There is a dearth of security solutions that offer a small form factor, can scale to support growing networks, satisfy budget requirements and meet military specifications.

In the face of these challenges, military organizations and operations are enhancing the security posture of tactical field networks by deploying hardware-based, or physical, security solutions that can integrate with highly mobile field-based communications systems already in use. **Sourcefire** is partnering with systems integrators to bring its leading intrusion prevention and detection capabilities to the tactical edge with solutions being fielded with various agencies.

Physical security solutions are quite effective in minimizing threats but identifying solutions with the flexibility to meet stringent size, ruggedized design, weight, and power restrictions of field-deployable systems can be challenging. They also have to be physically shipped to their eventual location which is not possible for certain remote and hostile destinations.

Enter *virtualization security* (**VirtSec**) solutions. Virtualization has been widely touted for its many benefits including reduced operating costs, increased flexibility, and energy efficiency. For tactical mobile networks these benefits translate into increased security options and the ability to support a Defense in Depth strategy. VirtSec solutions are hosted on virtual machines, not separate hardware appliances, which, in turn, can be hosted on existing ruggedized, lightweight military specification hardware already deployed at the tactical edge. Because they don't require a separate form factor, VirtSec solutions can be quickly deployed and start protecting networks right away. They can extend to the far corners of the network, where IT security resources don't exist or the deployment of physical security hardware is impractical. To take advantage of the benefits that virtualization provides, Sourcefire has adapted its physical network security solutions to deliver comprehensive virtual intrusion detection and prevention capabilities.

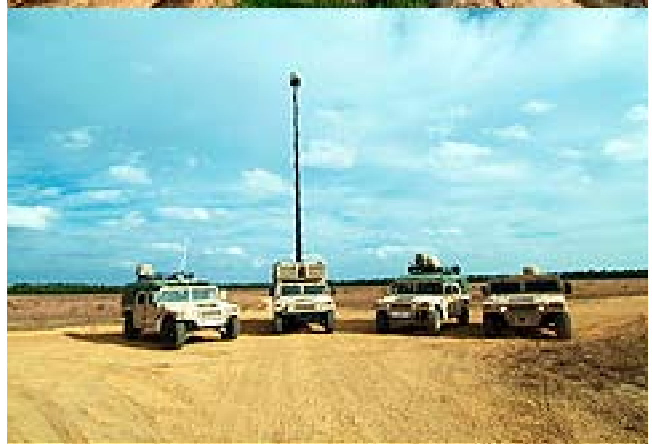


VirtSec solutions bring security to areas that were previously difficult to reach and protect. For example, tactical LANs and ad-hoc SATCOM environments staged within a matter of hours to provide mission-critical communications in the field can now be monitored by virtual security solutions deployed from a centralized operations center.

Virtual security solutions provide flexible, near instantaneous network monitoring and protection. This makes them ideal for supporting initiatives across every branch of the military, increasing protection of their on-the-move, high-speed, high-capacity backbone communications networks.

A few potential networks that could benefit from this approach include the Army's *Warfighter Information Network - Tactical* (**WIN-T**), the Navy's *Consolidated Afloat Networks and Enterprise Services* (**CANES**), the Air Force's *Theater Deployable Communications Integrated Communications Access Packages* (**TDC ICAP**) and *Special Operations*. In addition, the scalability of a virtualized approach could also help protect the vast and dynamically changing endpoints of the DoD ***Global Information Grid*** from continuously evolving security threats.

VirtSec solutions inherently support key objectives of Network Centric Warfare specifically by helping to achieve situational awareness, providing global visibility of networks all the way to the field level, and delivering forensic information about breaches occurring



Top: A WIN-T Increment Two test vehicle awaits movement instruction during the WIN-T technology demonstration at Naval Air Engineering Station, Lakehurst, NJ. (U.S. Army photo by Russ Meseroll.)

Bottom:
The WIN-T demonstration days educated the Army community about WIN-T and demonstrated its early progress. Here, WIN-T test vehicles are shown at the WIN-T technology demonstration. (U.S. Army photo.)

at the edge. But in order to provide these robust capabilities virtual security technologies must offer continuous network intelligence and full network visibility in the following three areas:

» ***Events****: Analyze network traffic and either block attacks or alert IT security resources to compromise; provide detailed forensics to help investigate security events.*

» ***Users**: Quickly link user identity (name, division, contact information) to security events for trace back.*

» ***Devices**: Provide awareness of all network assets including operating systems, client applications and services; detect configuration changes and traffic anomalies to help identify friendly and non-friendly network behavior.*

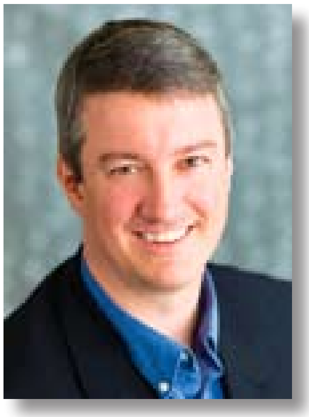
In addition, because IT security experts aren't typically deployed in the field, the ability for VirtSec technology to deliver information back to security resources for attribution and action through a centralized management console is essential.

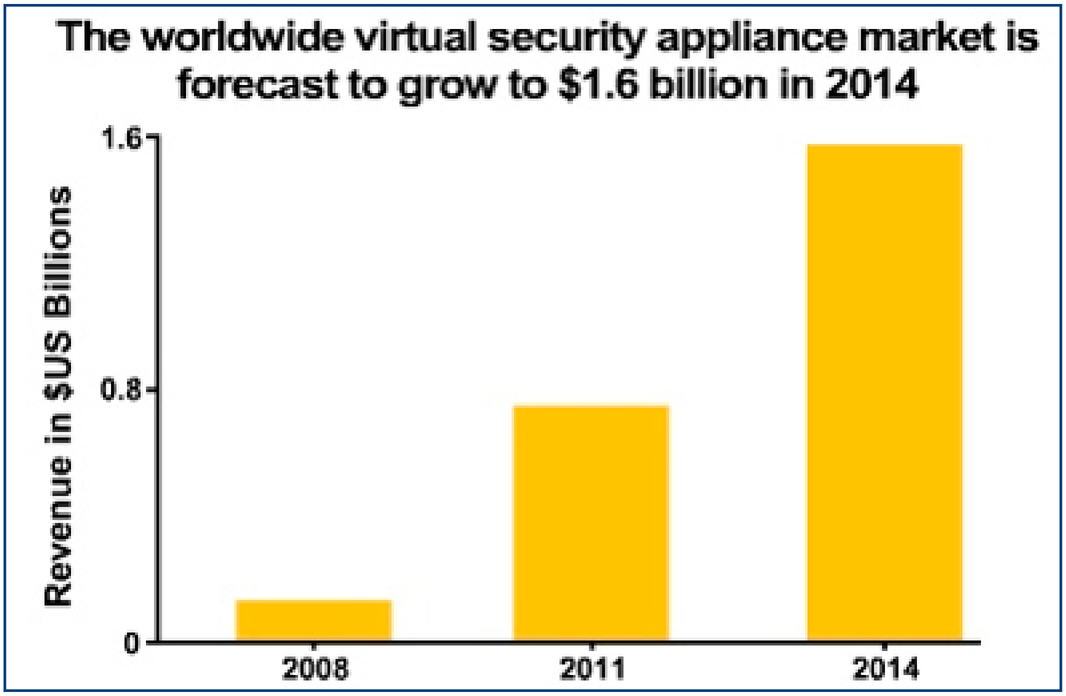
With America's digital infrastructure increasingly under attack the need to protect our military digital assets has never been more important. As all branches of the military continue to align their policies in practice, securing tactical mobile networks in the field should emerge as a major focus for the next decade.

VirtSec solutions will play a critical role in supporting a Defense in Depth strategy for Information Assurance and complying with the CNCI to secure all classified networks including locations or network segments that may have been impossible to monitor before.

About the author

Martin Roesch has a long history of identifying real-world cybersecurity challenges and developing solutions to address them. He founded Sourcefire in 2001 to deliver commercial security solutions that leverage his open source innovation, Snort, and today serves as Sourcefire's CTO.





© Infonetics Research, Virtual Security Appliances Biannual Market Size and Forecasts, June 2010

MISSION CRITICAL AUDIO CONFERENCING

AUTHOR: SUDHIR GUPTA, CEO, XOP NETWORKS

Mission Critical Audio Conferencing is typically used in applications such as:

- *Air Traffic Control*
- *Satellite Launch Control*
- *Air Force Command & Control*

Most of the systems that are currently deployed in the field today were developed in the eighties and nineties and hence are TDM (***Time Division Multiplexing***)-based.

VoIP based packet networking has matured significantly over the last decade. According to several research analysts, shipments of IP PBXs have out stripped the shipments for legacy TDM PBXs. Similarly, VoIP based value-added services platforms, such as conference bridges, are also available from multiple vendors.

Given this backdrop, this article discusses how mission critical conferencing can benefit from VoIP based packet networking. Also mentioned are lessons learned from an actual deployment of VoIP-based mission critical conferencing applications at a large satellite launch services company.

The net result of the new VoIP technology is to give significant CAPEX (up to 50 percent less), and OPEX savings (up to 40 percent less). The overall system is significantly more reliable and has inherent flexibility that can be engineered to customer requirements. The network also benefits from the low cost CPE that come with VoIP networks.

The legacy mission critical conferencing networks are built using TDM-based conference bridges and TDM-based Keysets as shown in *Figure 1*. The Keysets are connected to the Bridge using redundant leased phone lines.

Typically, the Keysets are wired into the headboard of the participant's desk. By pressing mechanical push button keys, the participant is able to dial into the selected conference call. Then, using the PTT handset, the participant is able to speak into the conference as needed. Functionally, the network serves its purpose but has several issues with it as mentioned next.

Issues With Legacy Mission Critical Conference System

Figure 1 below shows a typical legacy mission critical conferencing network.

Monolithic Architecture

The current implementation of ***Mission Critical Conference Bridges*** is monolithic in nature. Such systems use proprietary signaling between its different sub-systems. All critical components are duplicated and sometime even triplicated to meet the five 9's availability requirement. This adds complexity and additional hardware that ultimately increases the size, power, and cost of such equipment.

Technology Obsolescence

The current Mission Critical Conference Bridges were developed in the 80s and 90s. The prevalent technology available to vendors at that time was mainly *Time Division Multiplexing* (**TDM**). Hence, majority of the Mission Critical Conference Bridges deployed today are built with expensive TDM-based building blocks. These products have no path forward for adding newer

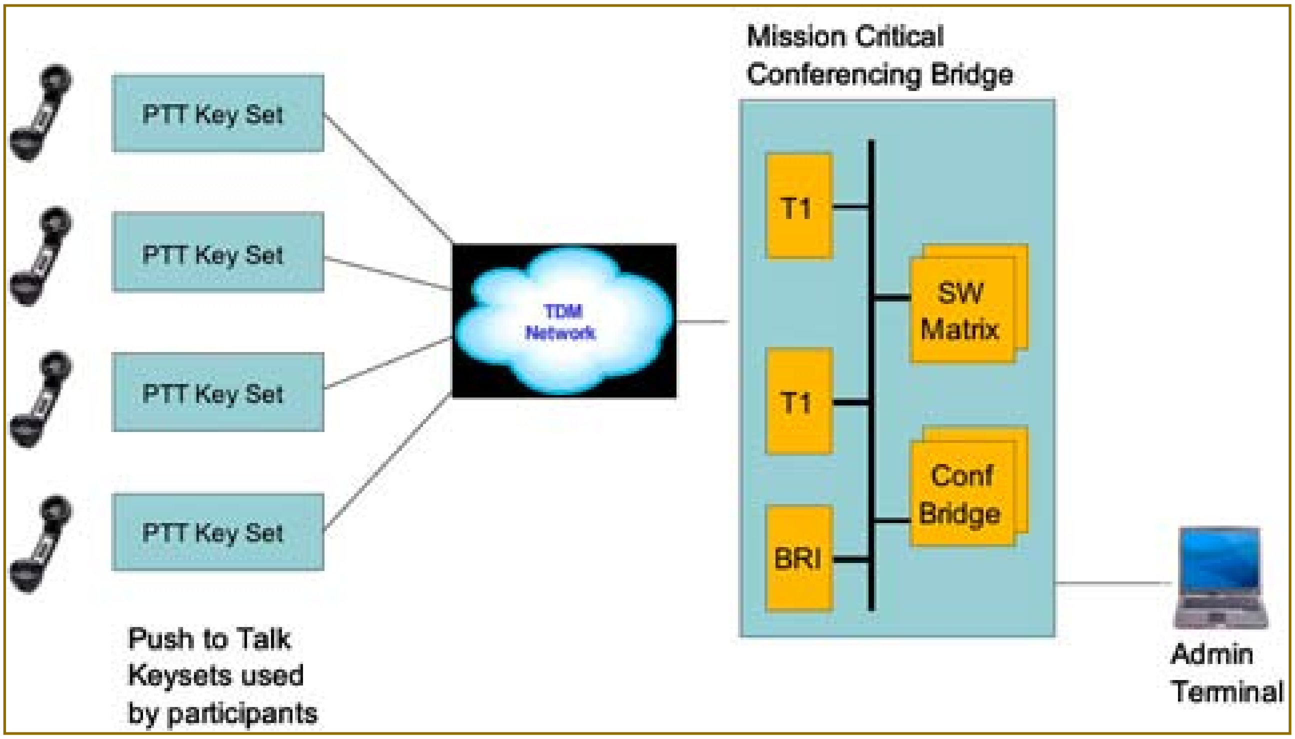


Figure 1: Legacy TDM based Mission Critical Conferencing Network

technologies, such as VoIP, Presence, Instant messaging, and so on.

PROPRIETARY SYSTEM

The current Mission Critical Conference Bridges also use proprietary signaling between their Keysets and the main Mission Critical Conference Bridge unit. The net result is that a customer has to buy the entire network from the same vendor, limiting innovation and requiring new feature requests to be determined by the vendor's timeline instead of an end customer's need.

MECHANICAL FAILURES ON KEYSETS

Legacy Mission Critical Conference Bridges work hand-in-hand with mechanical push button-based keysets. Due to normal wear and tear, such devices eventually suffer mechanical failures. Usually, spare seats are set up in a *Network Operation Center* (**NOC**) that can be used in case of such failures — this also adds to the overall expense.

IP-BASED NETWORK IMPLEMENTATION

Figure 2 below shows a VoIP based Mission Critical Conference Bridge network. It is comprised of a pair of primary and secondary hot standby IP PBXs and a pair of primary and secondary hot standby VoIP based audio conference bridges. The databases of each pair is replicated and kept in sync in real time.

The voice traffic from the *Public Switched Telephone Network* (**PSTN**), from remote locations (handsets connected to voice gateways/ routers) and variety of SIP phones, is dual homed to both IP PBXs.

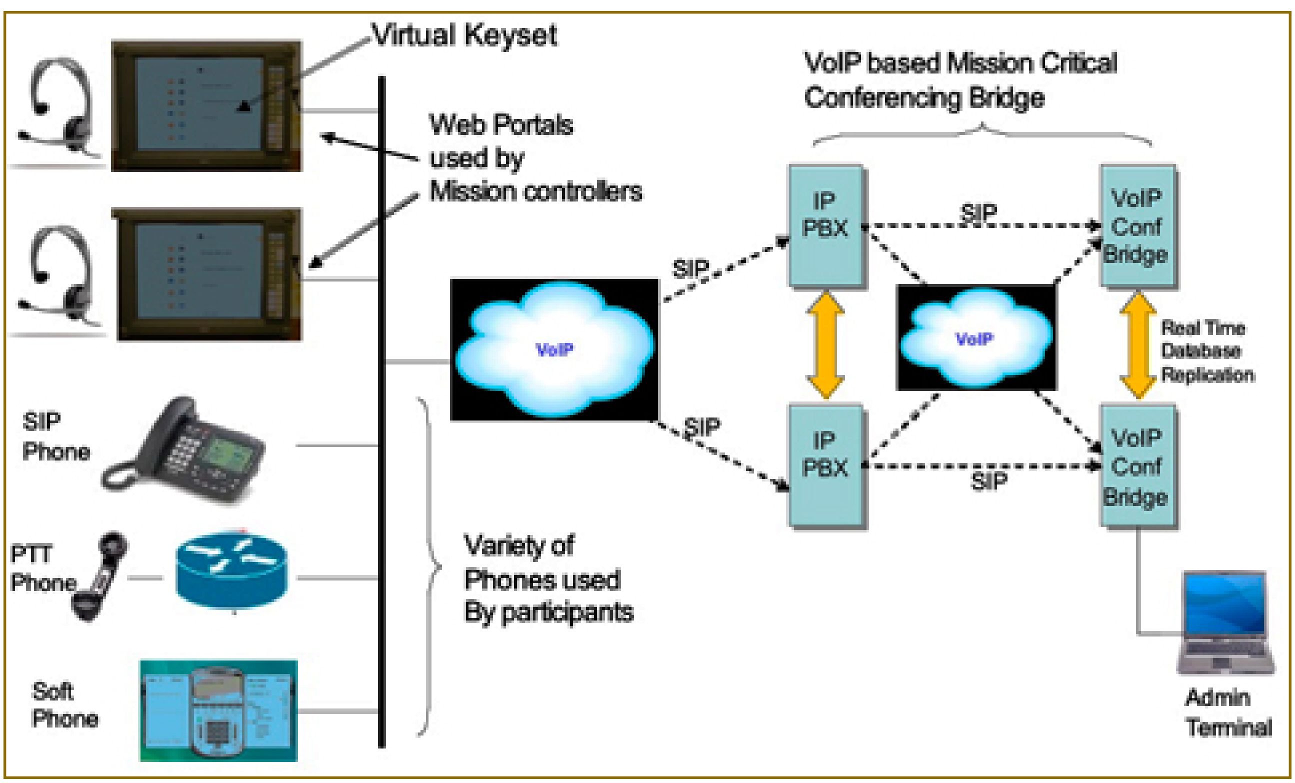


Figure 2: VoIP based Mission Critical Conferencing Solution

Under normal operation, all the VoIP traffic is handled by the primary IP PBX and the primary VoIP Bridge. In case of a network outage or failure of the primary IP PBX, the traffic is automatically routed to the secondary IP PBX. In this case, the secondary IP PBX will continue to send the conferencing traffic to the primary VoIP Bridge. In the event the primary VoIP Bridge is also not available, the traffic will flow to the secondary VoIP Bridge.

As the failed network elements are restored the traffic automatically moves back to the primary route. This network architecture is analogous to the packet based **SS7** network that is used for signaling between network switches and is one of the most resilient telephony networks in the world.

THE VIRTUAL KEYSET

Figure 3 below shows a virtual Keyset. It supports a command and control web portal. It also provides a softphone that is used to call into the mission critical conference bridge.

The virtual Keyset is dual homed to both primary and secondary hot standby IP PBXs. In the event, due to any networking issue, the soft phone looses connectivity to the primary IP PBX, it will automatically try to register with the secondary IP PBX. This extends 'high availability' coverage to the soft phone imbedded in the virtual Keyset itself.

The command and control web portal allows an operator to join a given conference based on a web

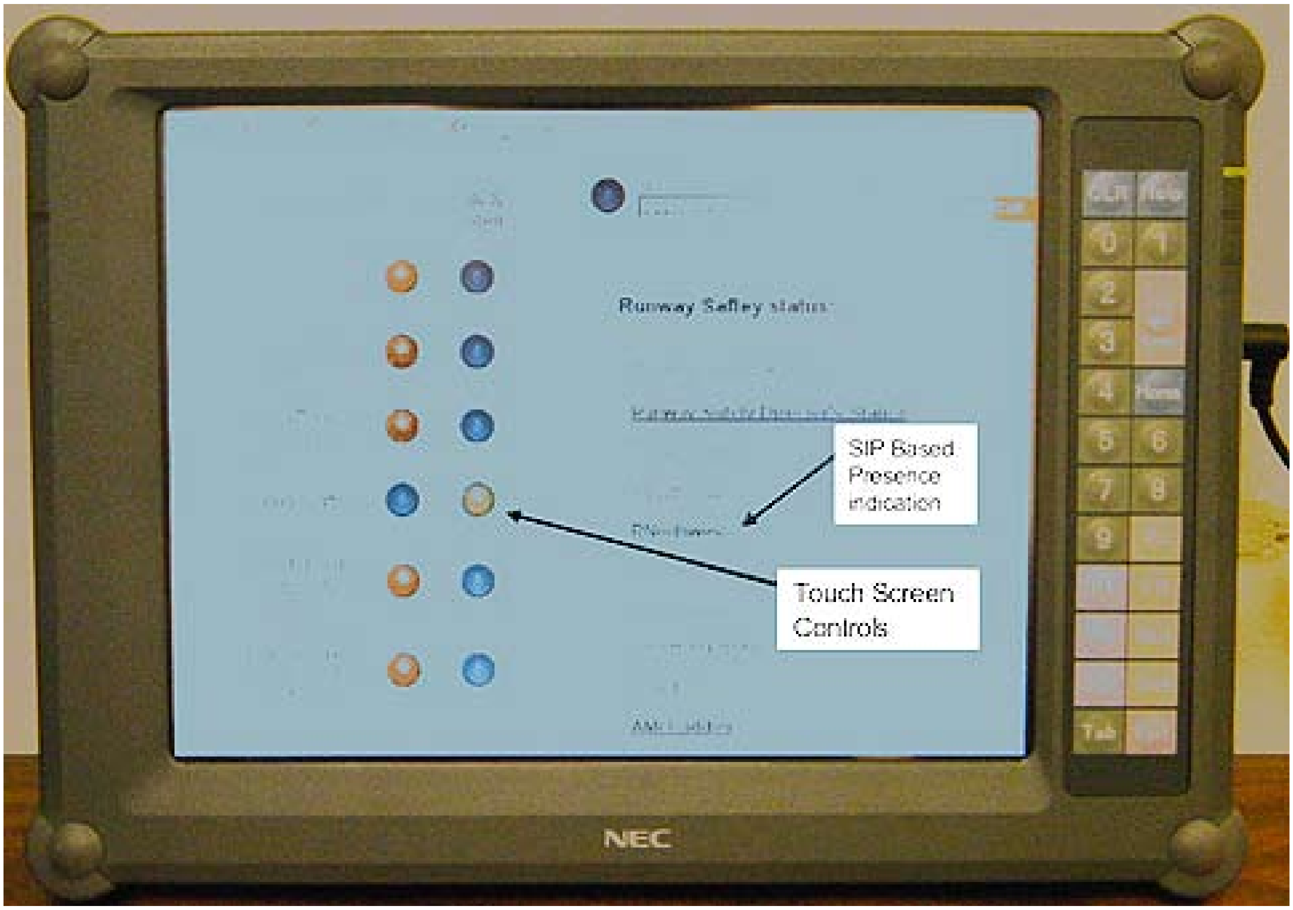


Figure 3: A Virtual Keyset

click or just by touching the screen (in case the monitor supports touch sensitive screen). As there are no mechanical keys involved, this command and control system is immune from any mechanical failures. The use of a softphone coupled with the command and control portal improves the availability figures for the overall network.

The command and control portal allows the mission controllers to see participants that are associated with different rooms, those that are available to take calls based on 'presence' information and those that are actively talking based on loudest speaker algorithm. The mission controllers are also able to monitor the audio from multiple rooms simultaneously and barge in to a given room simply by touching appropriate buttons on the screen.

The Benefits

There are several other benefits to the VoIP based mission critical conferencing solution.

Distributed Architecture — Scalable High Availability

With the monolithic approach, the high availability number is fixed and is a function of how redundant individual components are. With the VoIP based distributed approach, one can engineer the level of availability needed by adding multiple IP PBXs and multiple VoIP based bridges as required.

Lower Cost Of CAPEX

As the bridges use standard industrial grade hardware (with redundant PSUs, Disks and CPUs, etc.), and the operating system is **Linux**-based, the capital cost is significantly reduced, typically less by up to 50 percent when compared to legacy TDM solutions.

Lower OPEX

The legacy TDM-based approach requires an organization to have dedicated leased lines between their geographically dispersed CPE devices and their TDM-based Mission Critical Conference Bridge. Sometimes these lines are extended to different parts of the world. Given the mission critical nature of the usage, these lines are usually redundant. Since events needing use of mission critical conferencing, such *as* a satellite launch, do not occur on daily basis, this leased line approach becomes expensive quickly.

These days, most of the organizations that require mission critical conferencing have installed their private data networks (**MPLS**, **MetroE** etc.). Inherent within such packet networks is the ability to create virtual circuits and allow such circuits to be used for alternate routing. These virtual trunks obviate the need for redundant physical trunks, as is the case with legacy approach, and that leads to significant OPEX savings.

The bridge servers use power much more efficiently when compared to the monolithic switch counterpart — power is only used when needed, instead of keeping the spare modules powered up at all times. The power estimate for the two IP PBXs and two VoIP bridges as shown in *Figure 2* is approximately 1000 watts, as opposed to 5000 watts associated with the monolithic Mission Critical Conference Bridge. Reduced power also results in less cooling required to operate the equipment.

Vendor Agnostic

The network elements comprising the distributed Mission Critical Conference Bridge are standard products that are available from multiple vendors. These products follow the demand and supply cost curve that is typical of any standard product. As time progresses, this approach will yield an overall lower cost of ownership. Also, being standard products, there is no need for any proprietary signaling between them. This helps the organization as it is not dependent on a single vendor for the entire solution.

Redundant Deployment, Remote OAM&P

The IP PBXs and VoIP based Conference Bridges can be located at different geographical locations, further improving the overall availability of the network. The administrative web portal of any of the servers can be accessed from any PC (with proper authentication) connected to the Internet. This provides a lot more flexibility in managing *Operation, Administration, Maintenance and Provisioning* (**OAM&P**) functions associated with the equipment, compared to the legacy approach where the Mission Critical Conference Bridge can only be managed from a co-located administrative terminal.

Remote Troubleshooting + Network Assurance Testing

Even though the individual network elements support five 9's of availability, they need to be tested and re-tested to make certain that they are working optimally and are available when the actual need occurs. In the legacy TDM environment, test engineers make routine test calls to make sure network is operating end to end. In case of any issues, a lot of manual testing is used until the equipment is restored back into service.

With VoIP approach, the network tester can be more proactive. By using automated test tools network testers can learn about the health of the equipment and various interfaces before the equipment gets into a

XOP Networks™ — direct link to Digital Collaboration Bridge™ information

failed condition. Being able to take proactive action further improves the availability of the network.

PRESENCE

The VoIP network uses *Session Initiation Protocol* (**SIP**) for signaling between different network elements. This signaling format has built in processes that make use of 'presence' information. Incidentally same SIP signaling is used on Instant messengers that allow one to see if their buddy is online or not. Use of SIP allows VoIP based mission critical conference network operators to invite other operators and/or colleagues into a conference based on their 'presence' status.

PHYSICAL SIZE

Each one of the IP PBXs and the VoIP-based bridges as shown in *Figure 2* are built using **1RU** high servers. All four units comprising the VoIP based Mission Critical Conference Bridge can fit into a 4RU (about 7 inches) vertical shelf space. The equivalent monolithic Mission Critical Conference Bridge requires a 7 ft Telco cabinet. Therefore, the VoIP based approach provides equivalent functionality but in considerably less space.

PLAYING THE BETTER ROLE

Mission critical conferencing equipment plays an important role in situations where decisions made could affect the lives of thousands if not millions of people. It is extremely important that such equipment be always available when needed. So far, this need had been met by very expensive monolithic mission critical conference bridges that are TDM-based.

As most of the telecommunications networks are migrating from TDM to VoIP, the same holds true for the mission critical conferencing networks, as well. The VoIP solution has significant CAPEX and OPEX cost savings that can easily justify the network upgrade.

XOP Networks has broken new ground and has developed VoIP and TDM-based mission critical conference bridges that can be used with an organization's legacy TDM assets (keysets, PBXs, voice gateways etc.) and its VoIP resources, such as MPLS network, IP PBXs etc. The Company's mission critical conferencing gear is currently deployed in the world's largest commercial satellite launch services provider's network.

About the author

Sudhir Gupta is the CEO of XOP Networks and offers more than 26 years of strategic marketing and product development experience. Prior to founding XOP Networks, Sudhir was an Entrepreneur-in-Residence with Austin Ventures and, earlier, was the co-founder and VP of Marketing for Spatial Wireless, a venture capital backed manufacturer of soft-switching based GSM Mobile Switching Centers.

For further information, please select the following direct link to their website...

http://www.xopnetworks.com

MILSATMAGAZINE

Vol. 3, No. 6—November/December 2010

Authors

Colonel Keith Balts, USAF
Tiffany Chow
Sudhir Gupta
William Hafner
Jos Heyman
Sandy Johnson
Hartley Lesser
Pattie Lesser
Rick Lober
James Montgomery
James Ramsey
Martin Roesch

Published 6x per year by
Satnews Publishers
800 Siesta Way
Sonoma, CA 95476 USA
Phone: (707) 939-9306
Fax: (707) 838-9235

We reserve the right to edit all submitted materials to meet our content guidelines as well as for grammar and spelling consistency. Articles may be moved to an alternative issue to accommodate publication space requirements or removed due to space restrictions. Submission of content does not constitute acceptance of said material by SatNews Publishers. Edited materials may, or may not, be returned to author and/or company for review prior to publication. The views expressed in our various publications do not necessarily reflect the views or opinions of SatNews Publishers.

ADVERTISERS

AAE Systems	*19*
Advantech	*37*
Agile Communications Systems	*41*
AVL Technologies	*65*
Comtech EF Data	*47*
CPI	*61*
EM Solutions	*31*
Intelsat General	*FC + 03*
JD Events: SATCON	*61*
LDS Test & Measurement	*02*
MITEQ / MCL	*59*
Paradise Datacom	*13*
Wavestream	*35*
Xicom Technology	*53*
XipLink	*07*