SPACE EFFECTS IN OPERATION IRAQI FREEDOM

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The Gulf War of 1991, officially termed *Operation Desert Storm*, was the "first conflict in history to make comprehensive use of space systems support."[1] In particular, weather satellites, multi-spectral imaging satellites, Global Positioning System satellites, early warning satellites, and communications satellites supported the coalition's efforts. Though military leaders routinely used space functions to support warfighters during the first Gulf War, they did not integrate space functions into all phases of combat operations. For example, United States Central Command (USCENTCOM) did not include space functions in operational planning, nor did they appoint an individual to coordinate the use of space support. Equally important, direct space support for the warfighter was not widely available.

During the 12 years between Operation Desert Storm and the beginning of Operation Iraqi Freedom (OIF) in 2003, the support that space-based systems provided to U.S. military forces in theater became increasingly integral to operations. The systems themselves evolved little in a technical sense, but how troops on the ground, in the air, and at sea used them and relied on them changed tremendously. In Desert Storm, for the first time, virtually all U.S. military space systems and some nonmilitary assets had contributed directly to combat operations but, for the most part, in *ad hoc* fashion. For early warning of Iraqi Scud missile attacks, for example, a hastily assembled "Scud alert network" or Tactical Event Reporting System enabled command centers in Colorado Springs, Colorado, to pass Defense Support Program launch detection data via voice to troops in theater. For highly accurate Positioning, Navigation, and Timing (PNT), the Global Positioning System (GPS) contained an incomplete satellite constellation, and tactical units in theater had woefully few small lightweight GPS receivers. Shortcomings also existed in the availability of satellite communications (SATCOM), intelligence and surveillance information, and meteorological data.

By the time of OIF, sometimes called the Second Gulf War, space-based capabilities were far more integrated with service and joint doctrine, training, and force application. For example, the Army's transportable Joint Tactical Ground Station systems enabled direct receipt, processing, and distribution of DSP and other data on tactical ballistic missile launches in near real time to theater forces. GPS had achieved full operational status; procurement of tactical receiver equipment had accelerated; and GPS-based PNT applications had proliferated throughout the Department of Defense (DoD). Demand for SATCOM bandwidth per warrior was two orders of magnitude greater than in 1991, and the DoD had taken significant strides toward supplying tactical forces with timely, accurate weather and intelligence, surveillance, and reconnaissance (ISR) data from space systems. More than 50 Air Force, Navy, and National Reconnaissance Office satellites supported OIF; civil and commercial satellites augmented them. Despite these tremendous improvements in the provision of space support to theater forces, however, warfighting commanders and their forces in the field continually asked for more.

Space operations during OIF were complicated, because the sources of space capabilities were exceedingly diverse, global and theater space forces regularly depended on each other, and command and control of space assets was complex. Furthermore, as General Lance W. Lord, commander of Air Force Space Command (AFSPC) from 2002 to 2006, put it, "Space capabilities are inherently joint."[2] This truism became apparent during the years between the First and Second Gulf Wars, because force enhancement capabilities contributed to maximizing the effectiveness of military air, land, and sea forces, but also because there was no neat way to separate the contributions of the Air Force from those of the Army, Navy, Marines, or other federal agencies. The use of weather satellites during OIF illustrated this point. The Defense Meteorological Satellite Program weather satellites fell under United States Strategic Command, but were operated by the National Oceanic and Atmospheric Administration. However, the Air Force Weather Agency, which reported directly to the Deputy Chief of Staff Air and Space Operations, was responsible for tasking of onboard sensors. Weather satellites, in short, offered vital support to warfighters during OIF, and multiple organizations could take credit for their successful deployment.[3]

When Operation Iraqi Freedom (OIF) officially began in 2003, however, AFSPC was generally perceived as the primary provider of space support to forces in theater. United States Central Command designated the Combined Forces Air Component Commander as its theater space coordinating authority and that commander, then Lieutenant General T. Michael Moseley, called on Colonel Larry D. James, then commander of AFPSC's 50th Space Wing, to ensure that space assets were in place. As Lieutenant General Robert Dickman, deputy for Military Space in the Office of the Undersecretary of the Air Force, put it, "The way we planned our campaign" reflected a shift in thinking about what space capabilities brought to the fight; space assets were no longer sim-

A Boeing Delta IV, launched from Cape Canaveral on 11 March 2003, carried a new Defense Satellite Communications System III (DSCS-III) satellite into orbit. The 3rd Space Operations Squadron completed early-orbit checkout of the satellite in record time.

Source: The Boeing Company

ply an additional tool, they were "embedded in how we operated our forces." Consequently, as Colonel James later asserted, many observers came to see OIF as "the first real space war," because it became increasingly difficult to imagine conducting combat operations without space-enabled assets.[4]

Early Warning and Battlespace Characterization

Based on the Desert Storm experience, U.S. forces preparing for OIF anticipated Iraq would launch Scud missiles and, perhaps, smaller ones, such as Ababil-l00s. Defense Support Program infrared-detecting satellites operated by the 2nd Space Warning Squadron (2 SWS) at Buckley Air Force Base, Colorado, would detect the heat signatures from such launches, process the data at the Space-Based Infrared System (SBIRS) Master Control Station (MCS), and enable Air Force Space Command to warn forces in theater. On 10 November 2002, well before the beginning of OIF, the SBIRS MCS reconfigured its Space Operations Center (SOC) to include a Theater Support Cell (TSC). The latter adopted a new concept of operations for major theater war, with a dedicated point of contact—the TSC chief—to Combined Air Operations Center (CAOC) Space and experienced mission crew and intelligence analysts. Relying on a dedicated mission server and special-event tracker, the TSC would provide tailored DSP support operations—"Constant Vigilance"—and direct Secret Internet Protocol Network (SIPRNET) "chat" connectivity to the Iraqi theater of operations. Using a technique it implemented whenever events such as missile launches were likely, the 2 SWS began "focused monitoring" of infrared indications from the Kirkuk and Rumaila areas of Iraq on 3 March 2003. Nine days later, 2 SWS expanded that type of monitoring to the entire Southern Watch area of operations on a 24-hour basis. When OIF commenced on 19-March, Commander Space Air Forces (COMSPACEAF) directed 2 SWS and the 1st Space Operations Squadron (1 SOPS) to suspend non-mission-essential station keeping on certain DSP satellites crucial to detection of Iraqi theater ballistic missile launches. The first of many such launches and DSP detections occurred on 20-March when an Ababil-l00 rose from near Al Basrah toward Tactical Assembly Area Thunder in Kuwait, only to be intercepted and destroyed by three U.S. Army Patriot missiles about 10 kilometers from its expected impact point.[5]

Developing a robust detection capability and ensuring timely, effective warning throughout the theater became key issues. Robust detection required fusion of DSP data with information from airborne, ground-based, and seaborne sensors. Emplacement of those sensors and linking them satisfactorily to the CAOC prior to the beginning of combat operations proved chal-

lenging because of different sensor capabilities, different communications links, and different reporting screens on the CAOC computer system. Racing against the clock to complete the detection network before combat started, innovative Space Cell officers succeeded. The payoff was superb detection of 26 short-range missile launches from southern Iraq against coalition positions in Kuwait when OIF commenced on 19 March 2003, and nearly 1,500 events total by August 2005.[6]

Near real-time, theater-wide dissemination of warning notices to U.S. and coalition forces was a further challenge. Again, Space Cell officers, working closely with the director of communications staff, established all the communications links and procedures required to ensure timely, theater-wide warning notification. Their experience in doing this confirmed the importance of developing a robust missile warning architecture and an associated communications plan well before commencement of combat operations. Furthermore, it reinforced the lesson that those capabilities ought to be exercised thoroughly before being used in an actual conflict.[7]

Satellite Communications

It would be difficult to overestimate the importance of satellite communications (SATCOM) to the success of U.S. and coalition activities in OIF. The Joint Staff assembled a team of SATCOM experts in April 2002 to visit USCENTCOM and explore options for an invasion of Iraq. Among its recommendations, the team urged an upgrade of deployed tactical terminals, improved capabilities at Standard Tactical Entry Point sites, relocation of a Defense Satellite Communications System (DSCS) satellite, and use of commercial satellites to augment DSCS. The Defense Information Systems Agency (DISA) played a major role in providing SATCOM services, with Operation Enduring Freedom (OEF) in Afghanistan and OIF being the first time DoD put commercial bandwidth in place ahead of the warriors and weapon systems relying on it. Air Force Space Command, meanwhile, played a key role in maintaining the overall DoD Military Satellite Communications (MILSATCOM) architecture from procurement and launch of new satellites or related capabilities, to telemetry, tracking, and control of on-orbit assets, and development of innovative ways and means to employ SATCOM in combat. The Air Force, Army, Marines, and Navy relied on MILSATCOM provided by DSCS, Milstar, and the Global Broadcast System (GBS); commercial systems, which supplied 68-80 percent of the total capacity, included INTELSAT, INMARSAT, and Iridium. According to USAF Lieutenant General Harry D. Raduege, director of DISA, the average bandwidth requirement per individual soldier in OIF was 100 times greater than in Operation Desert Storm—13.8 kilobits per second (Kbps) in early 2004 compared to 0.14 Kbps in early 1991. Put another way, OIF used 42 times the SATCOM bandwidth of Operation Desert Storm while employing a force less than half the size.[8]

During the six months prior to OIF, the 50th Space Wing's 3rd Space Operations Squadron (3 SOPS) at Schriever AFB, Colorado, began moving military communications satellites to support anticipated requirements. On 20 September 2002, controllers at 3 SOPS responded to a United Kingdom (UK) decision to move the North Atlantic Treaty Organization (NATO) *Skynet 4D* satellite toward a position over the Middle East, ending support of that maneuver on 20-December.. Meanwhile, on 22-November, 3 SOPS began moving *DSCS III-B14* toward 10 degrees east, which would boost by 35 percent the bandwidth for super-high-frequency (SHF) wideband communications into USCENTCOM's Area of Responsibility (AOR). The squadron completed the *DSCS III-B14* maneuver on 15 January 2003. Per COMSPACEAF Space Tasking Order (STO) 03-017, the squadron commenced moving *DSCS III-B4* toward 42.5 degrees west on 24-January. The latter satellite reached its new orbital location on 30-March.[9]

The NATO Skynet ultra-high-frequency constellation, owned by the UK and controlled orbitally by 3 SOPS, included two NATO and five Skynet satellites that served NATO forces, the UK Ministry of Defence, British conventional and special forces, and certain U.S. forces, such as U.S.-operated NATO Airborne Warning and Control System aircraft. All of those users leveraged the constellation heavily during OIF. In addition to enabling head-of-state communications, the NATO Skynet constellation delivered MILSATCOM service for more than 30,000 British army, commando, armored, and artillery troops, plus air and naval forces.[10]

Total SHF wideband DSCS support for OIF far exceeded any prior operation and set a precedent for how operational plans were developed and communications provided. As warfighting requirements for data throughput surged to 350 megabits per second (Mbps) tactical and 150 Mbps fixed, the 3 SOPS reconfigured the DSCS satellite constellation to help meet the increasing demand. Working with the Space and Missile Systems Center at Los Angeles AFB, California, and satellite-builder Lockheed Martin Space Systems, AFSPC accelerated early on-orbit checkout of the last two DSCS Service Life Enhancement Program (SLEP) satellites that the 45th Space Wing had launched from Cape Canaveral Air Force Station, Florida, on 11-March and 29 August 2003. Altogether, four DSCS satellites—three DSCS III and one DSCS SLEP—supported OIF. The DSCS constellation provided approximately 20 percent of the SHF wideband communications employed by U.S. forces during OIF, with commercial and civil satellites supplying the remainder.[11]

To meet wideband requirements for ISR products, target sensing and