GLOBAL BROADCAST SERVICE (GBS)
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In this Information Age the key to the successful completion of any mission is ready access to information. Nowhere is this more critical than on the battlefield where information availability can mean the difference between victory and defeat. It is no wonder therefore, that Information Warfare, the ability to prevent an enemy from accessing information or disrupting your own information flow, has become an essential component of any modern battlefield. An important element in information access is the mechanism for distributing large amounts of useful information from source to user. Useful information, in the case of the Warfighter, includes imagery, maps, weather data, logistics files, air tasking orders, etc. In the military environment delivery of this information is not a trivial matter since most Warfighters, whether they are soldiers, sailors, marines or Air Force pilots. They are constantly moving and can not be easily connected to the sources of information they need.

Aware of the need, the Department of Defense (DoD) has, in recent years, initiated several research and development projects aimed at developing technologies needed to produce such an information distribution system. The basic requirements of the system were that it would be able to provide continuous, high speed, one-way flow of high volume multi-media, that is voice, data and video, information to various locations. One of these projects was the Battlefield Awareness and Data Dissemination (BADD) Advanced Concept Technology Demonstration (ACTD) in which the US Army CECOM RDEC played a key role. This project created the information management tools for the commanders and their staff to use in combining and tailoring the flow of information to their forces in the field. These R&D efforts and interaction with potential users helped define the system, known as Global Broadcast Service (GBS), which will satisfy the basic requirements and provide a solution that could be used by all branches of the US military. With this system users can be located on the ground, in a ship or on an airborne platform and still have access to high volumes of the information they need.

According to Mr. Paul J. Kirzow, Army Project Director for GBS, the development of GBS since its inception has followed a phased approach. Phase 1, known as the Joint Broadcast Service, lasted from FY96 through FY98. During that phase a concept of operations (CONOPS) was developed and limited operational testing was accomplished using leased satellites and COTS receivers. Phase 2, known as Interim System, was awarded to Raytheon as prime contractor in November 1997 and will continue to operate through FY06. During this phase, three Navy Ultra High Frequency (UHF) Follow-On
(UFO) satellites with GBS payloads and leased commercial satellites will be used to provide Warfighters with interim GBS support. The system will be used by the 4th ID warfighters as part of the upcoming First Digitized Division (FDD). Phase 3, known as the Objective System, will be deployed post-FY06. During that phase a satellite constellation will be used that will provide complete worldwide coverage to Warfighters in garrison, being deployed and on-the-move.

GBS exploits technological developments made in the commercial Direct-to-home Broadcast Service (DBS) industry. The main difference, however, is that whereas DBS, as represented by DirecTV, DirecPC, PrimeStar and other programming services provide many channels of entertainment to TV viewers at home, GBS provides many channels of essential information to commanders on the battlefield. Technically, the two systems are similar in that both use compressed digital video technology and high capacity satellite transponders to broadcast a large number of channels containing voice, data and video to small user terminals. Both systems employ large satellite earth stations with large dish antennas to transmit, that is "uplink", the wideband signals to their respective satellites. In the case of GBS, the capacity of the wideband signal is 23.5 Mbps per transponder. On each satellite, four transponders receive these signals in one frequency band and re-transmit them back to earth through three steerable spot beams, that is "downlink" them, in another frequency. In technical jargon the satellite is acting as a "bent pipe" transponder taking the signal in at one end and sending it out of the other. For GBS the uplink frequency band is between 30.0 GHz and 31.0 GHz and the downlink frequency band is between 20.2 GHz and 21.2 GHz. Both bands are part of what is known as the Ka Band of frequencies. When the signals arrive on the ground they are received by a user terminal that has a tracking dish antenna much smaller than the antenna of the transmitting terminal. The user then selects which channel he wants to receive and view, as in DirecTV, or what information he needs as a Warfighter on the battlefield.

One basic tenet of GBS is to maximize the use of Commercial Off The Shelf (COTS) technology. This applies to all items in the system including the space segment, that is, the satellite payload, the terminal segment which includes the uplinking terminals and the user receiving terminals, and the broadcast management segment. The latter segment is responsible for the integration, encryption and packaging of the multi-media information into a transmitted signal.

As shown in the accompanying figure, GBS has two types of uplinking terminals known as Uplink Injection Sites. One is called a Primary Injection Point (PIP) and the other a Theater Injection Point (TIP). As the name implies, the PIP is the primary source of global and theater information being delivered by the system. It receives the information to be transmitted from the GBS Broadcast Manager basically as a 23.5 Mbps bit-stream. It then encrypts the data and converts it to Radio Frequency (RF) to be transmitted over its 8.1 meter antenna for Ka band broadcast or 3.7 meter antenna for Ku band broadcast to the satellite. The TIP is a smaller version of the PIP. It resides in theater, at a Tactical Operations Center (TOC), and is used to distribute theater generated information to local forces. The TIP can send large theater generated information products such as local UAV
and satellite imagery, operation orders and overlays to theater users. This eliminates the need to send this information through backhall channels to the PIP for broadcast.

Additionally, the TIP is a transportable system element housed on two HMMWVs while the PIP is part of a fixed installation. The data rate of the signal transmitted by the TIP is 6 Mbps. Three PIPs will be produced and installed in Phase 2 of the GBS program. PIPs are installed in Hawaii and Norfolk and the Sigamella, Italy site is currently under construction. Three Army TIPs will also be produced during this phase. They will be located at Ft. Hood, Korea and Germany.

The GBS user terminal, known as the Transportable Receive Suite (TRS) is designed to be the least complicated and least costly part of the system. The reason for this is obvious. It is expected that there will be many TRSs in the system and therefore low cost would encourage wider use of the system. The TRS consists of an Integrated Receiver/Decoder (IRD), a Personal Computer (PC), a crypto and a 1 meter tracking dish antenna. It is capable of receiving and decoding the 23.5 Mbps signal from the Ka Band transponder or it may also be configured to be capable of receiving and decoding a 23.5 Mbps signal from a Ku Band transponder aboard a commercial satellite. These commercial satellites are needed in order to augment the gap in Ka Band satellite coverage that currently exists over central CONUS. This concept is also depicted in the accompanying figure.

The GBS space segment for the objective Phase 3, is based on a constellation of Ka satellites providing a complete worldwide coverage. For Phase 2, however, the system will rely on three Navy UFO satellites that contain GBS payloads and support a total of 12 transponders. These satellites, built by Hughes and designated UFO 8, 9 and 10, will provide a near-worldwide coverage with the gap over CONUS being filled by leased commercial satellite(s). Of the three satellites UFO 8 and UFO 9 have already been launched and are positioned over the Pacific Ocean and the Atlantic Ocean respectively. The third satellite, UFO 10, is scheduled for launch in 1999 and will be positioned over the Indian Ocean. These satellites provide a steerable spot beam with coverage of 65°n to 65°s, two 500 Nm steerable spot beams operating at 24 Mbps and one 2000 Nm steerable spot beam operating at 1.544 Mbps.

An important feature of GBS is its capability to tailor information being disseminated to the changing needs of the Warfighter. This is accomplished by allowing the users at each echelon to define the type of information they need and the time when they need it. Users can also submit queries/requests for specific data to be transmitted to them. These requests are sent over a “Reachback Channel” to the GBS Information Dissemination Server (IDS) located in CONUS. The Reachback Channel uses the Defense Information Systems Network (DISN) to carry the requests back to CONUS.

According to Mr. Kirzow, GBS is a joint program where all four branches of the service are involved in its implementation. The Air Force is the lead service on the program having the overall responsibility for its execution. The Air Force set up a GBS Joint Program Office located in the Washington D.C. area. The GBS JPO receives the majority of its
technical and logistics support from the Army, Air Force and Navy technical offices. The Navy is responsible for the Phase 2 space segment that consists of the UFO satellites. The Defense Information Systems Agency (DISA) is responsible for the information management.

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