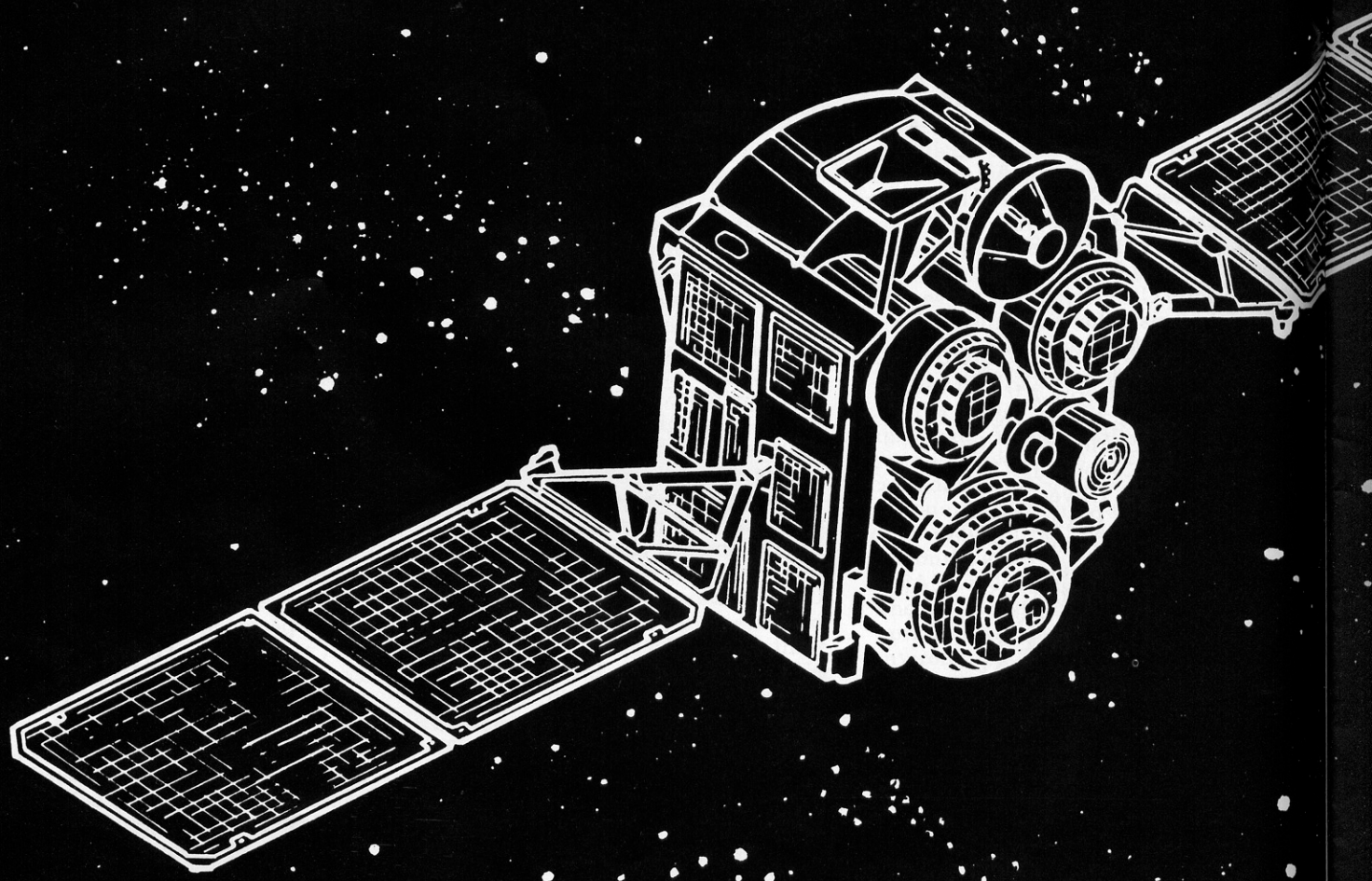
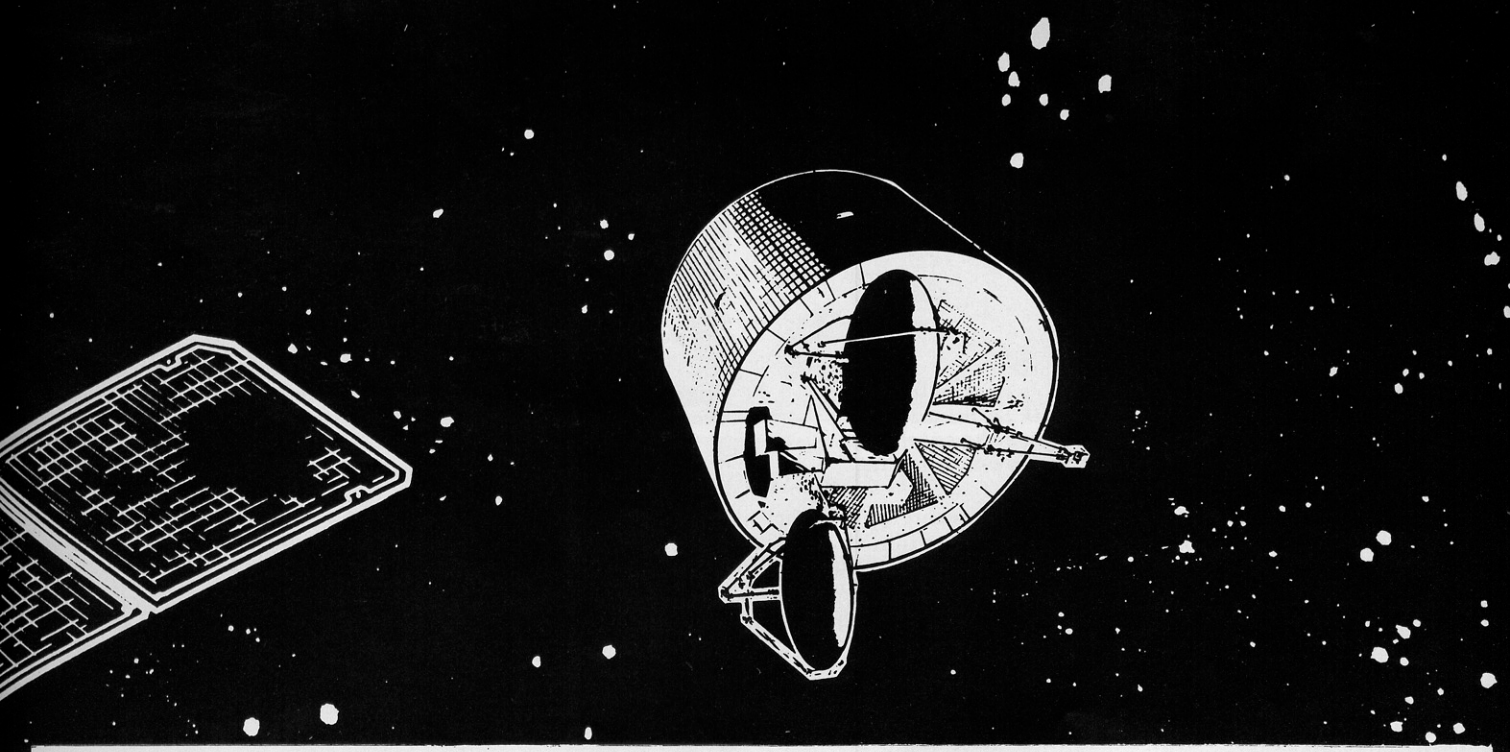


Satellite control via the DSCSOC



by Captain Keith D. Bombaugh

Satellite control within the Defense Satellite Communications System (DSCS) is not new. Yet most soldiers not familiar with DSCS probably don't understand the full extent of the Army's role in outer space. Though they may have been familiar with the Army's earth terminal responsibilities, they have probably dismissed satellite control as an Air Force function. However, with the development of the Defense Satellite Communications System Operations Center (DSCSOC), the United States Army has assumed a major role in the satellite control network. The purpose of this article is to explain what the DSCSOC is and what it does, and to generate a degree of interest that will inspire further inquiry.

Satellite control is divided into three main areas of responsibility: control of the spacecraft, control of the communications payload, and control of the communications network. Spacecraft control—which involves the total health of the satellite, station keeping, satellite positioning, and other services which ensure optimum operation of the satellite—has been and will continue to be the responsibility of the Air Force Satellite Control Facility (AFSCF) in Sunnyvale, California. However, the other two areas of responsibility, communications payload control and satellite communications network control, are functions of the DSCSOC. Communications payload control involves managing the satellite's communications subsystems, primarily by controlling antenna pointing directions, antenna coverage patterns, and antenna configurations for nulling jammers. Satellite communications network control is the technical management of the DSCS radio frequency spectrum—its power, bandwidth, and frequency allocation.

From 1974-1983, satellite communications control was provided by operators located at the Area Communications Operations Center (ACOC) of DCA Pacific or DCA Europe. They used a Hewlett-Packard HP-8580 computerized spectrum analyzer, which commonly took 45 minutes to complete a visual sweep of the 500 MHz satellite spectrum. And to maintain order wire control with the various earth terminals, they used a bank of teletypes which operated at 75 bps. Although this system met the requirements at the time, it was too slow and unresponsive to meet the requirements of the rapidly expanding DSCS network.

As a result, the DSCS Operations Center was set up to improve our control over the communications of these satellites and earth terminals. Today, it accomplishes its mission through the use of the integrated subsystems listed below:

DOSS - DSCS Operational Support System
DASA - DSCS Automatic Spectrum Analyzer
DFCS - DSCS FDMA (Frequency Division Multiple Access) Control System
(currently referred to as Pilot Control System Extension, PCS-X)
SMCT/TCCC - Smart Multi-Circuit Terminal/Terrestrial Critical Control Circuit
SCCE - Satellite Configuration Control Element

In the remainder of this article, we will briefly examine what each of these subsystems does and how it fits into the overall Defense Satellite Communications System.

The support system, DOSS, is the workhorse of the DSCSOC. It provides computational support to calculate DSCS parameters in response to changing requirements, changing network status, or changing environmental conditions. It has an operational data base which reflects current satellite operations, as well as accounts to help with planning and training.

The spectrum analyzer, DASA, is a monitoring tool which provides information to facilitate trouble-shooting. It accepts signal monitoring data from a Hewlett-Packard 8566B spectrum analyzer and compares the measured values with the expected values generated by the DOSS computer. These comparisons provide the SATCOM network controller with the required information to effectively

SFC Bernardo Perdomo communicates with satellite terminals on the SMART Multi-Circuit Terminal (SMCT), while Sp4 Sandra Maw reviews the satellite spectrum on the DSCS Automatic Spectrum Analyzer (DASA).

In the foreground are three disc drives; in the background is the SCCE/TT&C interface.

control critical aspects of the satellite network, such as the percentage of satellite channel power used by each terminal and the percentage of power radiated by the satellite.

While the spectrum analyzer is a monitoring tool which uses signal data generated from the earth terminal antenna at the DSCSOC location, the DFCS (currently referred to as the PCS-X) is a monitoring tool which uses signal data generated by the user terminals in the network; in other words, it polls the network terminals for performance and status. The data which is transmitted to the DSCSOC through the order wire (a circuit used for engineering purposes) is automatically compared to expected nominal values. Any actual readings which exceed these nominal values will generate an alarm for the operators and be corrected. The DFCS controls the earth terminals' transmit power, ensuring that an acceptable receive signal is available for all users in the network.

The primary means for the Operations Center controllers to communicate with various DSCS elements is with the SMCT/TCCC. If the lengthy abbreviation and even lengthier name of this subsystem seem a little imposing, try imagining the TCCC as a pipeline for data and the SMCT as a two-way faucet that can either send or receive information. The SMCT consists of two display keyboard terminals, a printer, and a console-mounted central processing unit which consolidates the numerous order wire teletype requirements. It provides reliable 9600 bps time-tagged communications, with message routing capabilities in a clear or encrypted environment, thus replacing the bank of teletypewriters that individually operated at 75 bps. The Operations Center uses the SMCT as a control order wire for troubleshooting, coordinating operations between terminals, and receiving network status reports. As mentioned above, SMCT and the various DSCS elements are linked by the TCCC, the "pipeline" which provides circuits that are routed through non-satellite communications systems or, if necessary, over satellite links not controlled by the TCCC.

The Operations Center uses the Satellite Configuration Control Element (SCCE) to monitor and control the communications payload of the new DSCS III satellites. The SCCE generates command sequences to establish the communication subsystem configuration (which affects antenna pointing, nulling patterns, jammer location equipment, etc.) and provides real-time control, monitoring, and data base maintenance for the satellite communications payload. It also provides backup to the Air Force Satellite Control Facility in performing satellite housekeeping or orbital adjustments. The soldier assigned as a DSCSOC Communications Payload Controller (CPC) is responsible for using the SCCE to monitor satellite health, status, and payload, as well as Telemetry, Tracking, and Control (TT&C) information. He or she also must control the payload configuration and report anomalies — a very challenging job.

Four DSCSOC facilities are currently in operation. The Army operates facilities at Fort Detrick, Maryland; Camp Roberts, California; and Landstuhl, Germany. It also plans to open one at Fort Meade, Maryland, by 1986. The Air Force operates one at Sunnyvale, California, and plans to operate one at Clarke Air Force Base in the Phillipines. And the Navy has plans to open a facility at Northwest Chesapeake, Virginia.

Army DSCSOC facilities are currently authorized a Signal Corps officer (captain, 27B) and approximately twenty-five soldiers trained as Satellite Communications Ground Station Equipment Repairers (MOS 26Y). Reports from the Army's facilities indicate that the competence of controllers is, to a great extent, related to their work experience at a satellite earth terminal. The best controllers are soldiers that use their technical expertise and judgement they gain working at earth terminals to provide effective troubleshooting guidance and proper operational instructions. The entire satellite network depends upon the proficiency and competence of each controller.

As we have seen, the Army has an important mission in satellite control, and as the use of satellite communications continues to expand, the role of the DSCSOC will grow. As a result, we have a growing demand for young Signal Corps officers and talented 26Y soldiers.

If you feel you fall into one of these categories and would like to pursue an assignment at DSCSOC, or if you would just like more detailed information about our operation, contact your branch assignments office.

SOURCES:

Technical Report No. DAAK80-79-D-0299
Technical Report No. DAAB07-84-D-J534
Final Payload Operations Handbook, Vol. I (General Electric)
DCA Circular 800-70-1

Captain Keith D. Bombaugh graduated from West Point in 1977 and later attended Airborne School, Ranger School, and the Officers Basic Course. He has served at Fort Hood, Texas, with the 142nd Signal Battalion, the 1st (Mechanized) 50th Infantry Battalion, and the 57th Signal Battalion. He has also served in Korea with the 304th Signal Battalion. After completing the Officers Advanced Course, he worked at COMSAT General Corporation in the Training With Industry Program and as the SATCOM Division OIC at Fort Detrick, Maryland. He currently is the satellite communications officer with USAISC — Operations Command, Fort McNair, Washington, D.C.