CODE 777: AUSTRALIA AND THE US DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS)

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ABSTRACT

There are currently installed in Australia eight satellite ground terminals that operate either as integral parts of or in connection with the US Defense Satellite Communications System (DSCS). One of these is at North West Cape, Western Australia; two are at Nurrungar, South Australia; two are at Pine Gap, Northern Territory; one is at the Weapons Research Establishment (WRE), Salisbury, South Australia; and two are at Watsonia Barracks in Melbourne. Despite the critical importance of this satellite system to US global military and intelligence operations, and the fact that Australian involvement in the system began more than two decades ago, there remains in Australia no public description of this system nor any discussion of the implications of Australia’s involvement in it for various aspects of Australia’s national security.

This monograph describes the US Defense Satellite Communications System (DSCS) and its various missions and discusses Australia’s role in the system. It concludes that Australia has had insufficient control over the DSCS deployments and operations in this country; that the Australian Government has been remiss in informing the public about the extent of Australia’s role in the DSCS system and the implications of this involvement; and that Australia should take advantage of the DSCS facilities to support our own defence communications requirements.
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Unless otherwise stated, publications of the Centre are presented without endorsement as contributions to the public record and debate. Authors are responsible for their own analysis and conclusions.
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CHAPTER 1

THE US DEFENSE SATELLITE COMMUNICATIONS SYSTEM

There are currently installed in Australia eight satellite ground terminals that operate either as integral parts of or in connection with the US Defense Satellite Communications System (DSCS). One of these is at North West Cape, Western Australia; two are at Nurrungar, South Australia; two are at Pine Gap, Northern Territory; one is at the Weapons Research Establishment (WRE), Salisbury, South Australia; and two are at Watsonia Barracks in Melbourne. Despite the critical importance of this satellite system to US global military and intelligence operations, and the fact that Australian involvement in the system began more than a decade and a half ago, there remains in Australia no public description of this system nor any discussion of the implications of Australia’s involvement in it for various aspects of Australia’s national security.

The Defense Satellite Communications System

The DSCS is perhaps the largest single US military satellite program. Although the number of satellites in the system operational at any given time is second to that of the GPS navigational satellite system, the DSCS program generally receives the largest annual budgetary appropriation, it involves the largest number of major satellite ground terminals around the world, and it supports an extremely wide range of US global military and intelligence missions.

Although the US maintains four other military and intelligence satellite communications programs for more particular or specialised purposes - the US Navy’s Fleet Satellite Communications (FLTSATCOM) system, the Air Force Satellite Communications (AFSATCOM) system, the Satellite Data System (SDS), and the CIA’s covert communications satellite system - the DSCS program provides a basic capability for virtually every type of strategic and tactical telecommunications requirement of the Department of Defense, the Services, and other Defense agencies.
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The most comprehensive but succinct description of the DSCS is given in Jane’s Military Communications:

The Defense Satellite Communications System (DSCS) has been designed and configured for presidential communications; to support the Worldwide Military Command and Control System (WWMCCS) by providing communications service between the National Command Authorities (NCA)/Defense Communications Agency (DCA) and the unified and specified commands, between the unified and specified commands and the general war combat forces, and by providing communication from peripheral early warning sites and from critical intelligence sites to provide a high-capacity, reliable, independent communications capability in support of contingency and limited war operations and to restore primary Defense Communication System (DSC) transmission sub-systems that may have become inoperative due to natural causes, sabotage or direct enemy action; to augment the DCS with a transmission sub-system capable of providing the wide-band channels required to handle high-quality secure voice, high-speed data between automated command and control centres, high-resolution graphics and imagery, and rapid transmission of sensor data; to provide DCS communications service to remote locations not adequately served by other means; to support Navy ship-to-shore communications and other authorised users; to support the voice channel requirements of the Ground Mobile Forces (GMF); and to support voice and data requirements of the Diplomatic Telecommunications System (DTS), the United Kingdom and NATO.

The DSCS provides communications services to components of the DoD, the National Security Agency, and special authorised users including the DTS, the White House Communications Agency (WHCA), the DCA, NATO and the United Kingdom. In addition to serving DoD components the DSCS
The US Defense Satellite Communications System directly supports the WWMCCS. This system provides high-priority communications to the JCS, unified and specified commands for the direction and control of forces, and for special intelligence and warning.

The DSCS provides analogue and digital transmission paths for virtually every type of telecommunications application. Its configuration can be readily changed to meet contingency requirements. Both strategic and tactical communications needs are met through the global DSCS. Telecommunications services to virtually every geographical area in the world can be established in the time required to deploy a transportable earth terminal. These capabilities make the DSCS an essential sub-system of the DCS for US telecommunications needs.

The DSCS users have the following priority:
- Presidential and national authorities
- JCS
- Unified and specified commands
- DCS
- Other DoD
- Non-DoD national
- NATO and allied governments as specified by international agreements.¹

The Space Segment

The DSCS program was initiated in 1962, at which time it was designated the Initial Defense Communications Satellite Program (IDCSP). The IDCSP, subsequently also known as the Initial Defense Satellite Communications System (IDSCS) and then DSCS Phase I, consisted of 26 satellites randomly-spaced in near-synchronous equatorial orbits (with perigees of about 33,700 km and apogees of about 34,000 km).

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</tr>
<tr>
<td>DSCS II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSCS 1 (1971-95A)</td>
<td>2 November 1971</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Failed to operate.</td>
</tr>
<tr>
<td>DSCS 2 (1971-95B)</td>
<td>2 November 1971</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Failed to operate.</td>
</tr>
<tr>
<td>DSCS 3 (1973-100A)</td>
<td>13 December 1973</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13°W. Provided coverage over the Atlantic Ocean.</td>
</tr>
<tr>
<td>Satellite Name and Designation</td>
<td>Launch Date</td>
<td>Launch Vehicle</td>
<td>Orbital Inclination (Degrees)</td>
<td>Orbital Period (Minutes)</td>
<td>Perigee Height (km)</td>
<td>Apogee Height (km)</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------</td>
<td>----------------</td>
<td>-------------------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>----------</td>
</tr>
<tr>
<td>DSCS 4</td>
<td>13 December 1973</td>
<td></td>
<td>3.7</td>
<td>35,797</td>
<td>35,801</td>
<td></td>
<td>60°E. Provided coverage over the Indian Ocean.</td>
</tr>
<tr>
<td>DSCS 5 (1975-40A)</td>
<td>20 May 1975</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Failed to reach equatorial synchronous orbit.</td>
</tr>
<tr>
<td>DSCS 6 (1975-40B)</td>
<td>20 May 1975</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Failed to reach equatorial synchronous orbit.</td>
</tr>
<tr>
<td>DSCS 8 (1977-34B)</td>
<td>12 May 1977</td>
<td></td>
<td>2.20</td>
<td>35,781</td>
<td>35,792</td>
<td></td>
<td>175°E. Provided coverage over the western Pacific Ocean (WPAC).</td>
</tr>
<tr>
<td>DSCS 9</td>
<td>25 March 1978</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Failed to orbit.</td>
</tr>
<tr>
<td>DSCS 10</td>
<td>25 March 1978</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Failed to orbit.</td>
</tr>
<tr>
<td>DSCS 11 (1978-113A)</td>
<td>13 December 1978</td>
<td></td>
<td>.60</td>
<td>35,796</td>
<td>36,412</td>
<td></td>
<td>124°W. Provided coverage over the eastern Pacific Ocean (EPAC).</td>
</tr>
<tr>
<td>DSCS 14 (1979-98B)</td>
<td>21 November 1979</td>
<td></td>
<td>1.00</td>
<td>35,792</td>
<td>36,357</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satellite Name and Designation</td>
<td>Launch Date</td>
<td>Launch Vehicle</td>
<td>Orbital Inclination (Degrees)</td>
<td>Orbital Period (Minutes)</td>
<td>Perigee Height (km)</td>
<td>Apogee Height (km)</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>----------------</td>
<td>------------------------------</td>
<td>--------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td>DSCS III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSCS 3-02</td>
<td>31 January 1984</td>
<td>Titan 34D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Transtage failure.</td>
</tr>
</tbody>
</table>
The US Defense Satellite Communications System

The satellites were built for the Department of Defense by the Western Development Laboratories Division of Philco-Ford Corporation under a contract managed by the US Air Force's Space and Missiles Systems Organization (SAMSO). They were 26-face polyhedrons, weighed 45 kg (100 lbs), and measured 0.8 metres in length and 0.9 metres in diameter. (Figure 1). They were spin-stabilized, and each contained a 7-8 GHz (i.e. X-band) multiple-access transponder with omnidirectional microwave antennae, a 400 MHz PCM telemetry sub-system, and a 42-watt solar array power sub-system mounted on a radial web structure.2

The first seven DSCS I satellites were launched by a single Titan 3C rocket from the Eastern Test Range (ETR) on 16 June 1966. A special dispenser structure was developed during the IDCSP which enabled a Titan 3C payload to support eight satellites and to eject them sequentially into orbit. (Figures 2 and 3). An attempt was made to launch a further eight satellites on 26 August 1966, but it failed due to a malfunction in the Titan 3C rocket. However, a successful launch of eight satellites occurred on 18 January 1967; three more were launched on 1 July 1967; and the final eight Phase I satellites were launched on 13 June 1968. At this time, the DSCS I system represented the world's first global satellite communications network. By international agreement, the DSCS I satellites were designed to be silenced automatically after six years, an action that began in mid-1972 and was completed in mid-19743 - except for one satellite (93-26) which was maintained until 1980 for the purposes of experiments concerning signal propagation, attenuation, and scintillation effects in the Super High Frequency (SHF) band.

In 1968, Phase II of the DSCS program was approved, and in March 1969 a contract was awarded to TRW Inc. for the design and development of the first six DSCS II satellites. In October 1974, TRW was awarded a contract for six additional DSCS II satellites (F7-F12);
Code 777: Australia and the US DSCS

FIGURE 1
DSCS I SATELLITE
FIGURE 2
CLUSTER OF EIGHT DSCS I SATELLITES CARRIED BY TITAN 3C TRANSTAGE
FIGURE 3
DSCS I SATELLITES BEING DISPERSED FROM TITAN 3C TRANSTAGE
and in July 1976 it received a contract for the final four satellites (F13-F16) in the Phase II program.4

The DSCS II satellites each weigh 590 kg (1,300 lbs), are 2.75 metres (9 feet) in diameter, and 3.95 metres (13 feet) tall with antennae extended. (Figures 4 and 5). The electrical power is supplied by solar arrays which provide an output of 535 watts at launch, decreasing to a minimum of 358 watts after five years.5

The antennae systems on the DSCS II satellites consist of an X-band multi-channel single-frequency conversion repeater with a bandwidth of 410 MHz and a capacity of 1,300 voice channels or up to 100 megabits per second of data; an Earth-coverage (ec) antenna with a transmit beamwidth of 18°, a gain of 16-18 dBi, and an effective radiated power of 28 dBw; a steerable narrow-coverage (nc) antenna, with a beamwidth of 2.6°, a gain of 33 dBi, and an effective radiated power of 43 dBw; and a steerable area coverage (ac) antenna, with a beamwidth of 6.5°, a gain of 22 dBi, and an effective radiated power of 32 dBw. The nc and ac antennae are each steerable to ±10°, and they are both capable of receiving and transmitting simultaneously. This arrangement provides four different channels of operation - Earth coverage to Earth coverage (ec - ec); Earth coverage to narrow coverage/area coverage (ec - nc/ac); narrow coverage/area coverage to Earth coverage (nc/ac - ec); and narrow coverage/area coverage to narrow coverage/area coverage (nc/ac - nc/ac). In addition, the satellites are equipped with an S-band biconical horn antenna with a torroidal beamwidth of 32° for the reception and transmission of telemetry and command data for satellite control.6

The first two DSCS II satellites were launched into geostationary orbit by a Titan 3C from the ETR on 3 November 1971, but both failed to operate. A second pair was launched on 13

FIGURE 4
DSCS II SATELLITE
FIGURE 5
DSCS II SATELLITE
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FIGURE 6
DSCS II STATIONS
The US Defense Satellite Communications System 17

FIGURE 7
DSCS II SATELLITE COVERAGE
FIGURE 8
DSCS II SATELLITE COVERAGE (NARROW BEAM ANTENNA PATTERNS)
FIGURE 9
DSCS II SATELLITE COVERAGE (EARTH, AREA AND NARROW COVERAGE)
December 1973, and after completion of a two-month orbital test period, were transferred to fixed positions over the equator on 24 February 1974. The first (1973-100A) was placed at 13°W longitude to provide coverage across the Atlantic Ocean. The second was originally positioned over the Western Pacific at 175°E longitude, but it was later moved to 60°E over the Indian Ocean. A third pair was launched on 20 May 1975, but the satellites failed to achieve a usable orbit because of a malfunction in the Titan 3C transtage, and decayed back to Earth on 26 May 1975. DSCS 7 and DSCS 8 were successfully launched into geostationary orbit on 12 May 1977, and the latter (1977-34B) was still operational at 175°E in 1982. DSCS 9 and DSCS 10 were launched on 25 March 1978, but the Titan 3C rocket was destroyed by range safety personnel before the satellites could be successfully released into orbit. DSCS II and DSCS 12 were launched on 13 December 1978 and placed into fixed orbits at 135°W and 66°E respectively. DSCS 13 and DSCS 14 were launched on 21 November 1979, and placed into orbits at 130°W and 12°W. DSCS 15 was launched on 30 October 1982 together with the first DSCS III satellite. The last of the Phase II satellites, DSCS 16, was launched on 31 January 1984, together with the second DSCS III satellite, but these satellites failed to reach orbit because of a transtage failure.

The DSCS II satellites currently positioned in geostationary orbit are maintained within ±1° of their nominal orbital positions. Each can be repositioned at least once during its five-year operational

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life to any other equatorial point at a maximum rate of 15° per day. More than one repositioning is possible if a slower drift rate is acceptable.8

On 2 February 1977, the Space Systems Division of General Electric was awarded the contract to produce two DSCS III Demonstration Flight Satellites and a Qualification Model. The first of these was successfully launched on 30 October 1982 (1982-106B), together with DSCS 15 (1982-106A), by the first Titan 34D rocket and Inertial Upper Stage.9 The second launch, on 31 January 1984, was evidently a failure. The first production models, DSCS 3-B4 (1985-92B) and DSCS 3-B5 (1985-92C), were launched aboard the Space Shuttle Atlantis (STS-51J, 1985-92A) on 3 October 1985.10 Contracts have been awarded to General Electric for the production of a further nine DSCS III satellites, the last of which are scheduled for delivery to the Air Force in 1991.11

The DSCS III satellites weigh some 1040 kg; the central structure is 110 inches in length, and extends to 457.7 inches with the solar array fully deployed; it is 76 inches wide and 77 inches deep. (Figures 10 and 11). The solar power system is capable of producing 1240 watts at the beginning of each mission and 980 watts at the end of the projected 10 year satellite lifetime. A monopropellant hydrazine propulsion sub-system, with 600 lbs of fuel, is used for attitude control and stationkeeping.

The DSCS III satellite communications system consists of a six-channel SHF transponder, with each channel powered by its own

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FIGURE 10
DSCS III SATELLITE
FIGURE 11
DSCS III SATELLITE
travelling wave-tube amplifier (TWTA) to allow the most efficient use of the available frequency spectrum and power, and ten flexibly interconnected antenna systems. Two of the channels (1 and 2) have a power output of 40 watts, while the other four (3-6) have a power output of 10 watts; one channel (No.6) has a bandwidth of 50 MHz, one (No.3) a bandwidth of 85 MHz, and the other four have bandwidths of 60 MHz. (Figures 12 and 13).

The 10 communications antennae consist of four Earth-coverage horn systems (two each for reception and transmission); a 61-beam waveguide lens reception antenna, with an associated beam-forming network, which provides anti-jamming protection and a selective coverage capability; two 19-beam waveguide lens transmission antennae with beam-forming networks to rapidly produce selective coverage patterns tailored to the network of ground receiving terminals; a high-gain (3° beam) gimbaled dish transmission antenna for spot-beam fixed coverage; and two UHF antennae, one a bow-tie reception system and the other a cross-dipole transmission system, for use by the Single Channel Transponder (SCT). The SCT is integrated into the spacecraft to provide secure and reliable dissemination of the Emergence Action Message (EAM) and Single Integrated Operational Plan (SIOP) communications for the US strategic nuclear forces and command systems. In addition, there is a dual-frequency (UHF/S-band and SHF/X-band) Telemetry, Tracking and Control (TT&C) system for spacecraft control, tracking, positioning, and housekeeping.12

The DSCS III program is one of the first US satellite programs in which survivability features have been included in the design and development criteria from the outset. The satellites have improved communications security (COMSEC), the most advanced anti-jamming capabilities currently available, and some hardening against exo-atmospheric nuclear effects. With respect to COMSEC, for example, features have been incorporated to prevent interception and monitoring of the communications by Soviet signals intelligence (SIGINT) agencies, as well as features to prevent spoofing - i.e. the

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12 Material on DSCS III satellites provided by Space Systems Division, General Electric, Valley Forge Space Center, Philadelphia, Pennsylvania.
FIGURE 13
DSCS III FREQUENCY ALLOCATION

FREQUENCY ALLOCATION FOR EFFICIENT SPECTRUM USE

<table>
<thead>
<tr>
<th>Spectrum</th>
<th>SHF from 7250–8400 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UHF (SCT) from 225 to 260 MHz Transmit</td>
</tr>
<tr>
<td></td>
<td>300 to 400 MHz Receive</td>
</tr>
<tr>
<td>Channels 1-5</td>
<td>725 MHz Up-Down Translation</td>
</tr>
<tr>
<td>Channel 6</td>
<td>200 MHz Up-Down Translation</td>
</tr>
<tr>
<td>Guard Bands</td>
<td>25 MHz Maximum</td>
</tr>
</tbody>
</table>

RECEIVE PLAN

<table>
<thead>
<tr>
<th>ANTENNA</th>
<th>MULTI BEAM</th>
<th>EARTH COVERAGE</th>
<th>UHF BOW TIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHANNEL</td>
<td>HORN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH 1</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 2</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 3</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 4</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 5</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 6</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>SCT</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

TRANSMIT PLAN

<table>
<thead>
<tr>
<th>ANTENNA</th>
<th>MULTI BEAM</th>
<th>EARTH COVERAGE</th>
<th>GIMBALLED DISH</th>
<th>UHF CROSS DIPOLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHANNEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH 1 (40W)</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 2 (40W)</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CH 3 (10W)</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CH 4 (10W)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>CH 5 (10W)</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CH 6 (10W)</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SCT</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
insertion into the system of false command signals or false communications traffic.

With respect to anti-jamming capabilities, the three steerable waveguide antennae are able to be pointed away from sources of hostile electronic interference, while the multiple waveguide lens systems allow any particular beam to be dropped out by switching off the appropriate feed element, thus creating a null in the antenna pattern to counter the effects of hostile jamming from any given direction. Spread-spectrum frequency-hopping techniques can also be used as an additional counter-measure. The dual-frequency TT&C system also enables the satellites to be controlled and operated in various jamming environments.\textsuperscript{13}

With respect to exo-atmospheric nuclear effects, the DSCS III satellites have been provided with some hardening to protect them against both transient radiation electronic effects (TREE) and electromagnetic pulse (EMP). The electrical power sub-systems are fully redundant and are able to isolate load faults and to rapidly respond to load changes caused by EMP.\textsuperscript{14}

The DSCS Ground Segment

The DSCS satellites are controlled by eight DSCS Network Control Facilities (NCFs) deployed around the world such that each satellite is under the control of two NCFs, as shown in Table 2.

In addition, the installation of dual-frequency UHF (S-band) and SHF (X-band) TT&C systems on the DSCS III satellites allows these satellites to be controlled by other US satellite ground stations if


TABLE 2
DSCS NET CONTROL FACILITY (NCF) ARCHITECTURE

Atlantic (LANT) DSCS
Fort Detrick, Maryland.
Northwest, Virginia.

West Pacific (WPAC) DSCS
Wahiawa, Hawaii.
Camp Roberts, California.

East Pacific (EPAC) DSCS
Sunnyvale, California.
Fort Meade, Maryland.

Indian Ocean (IND) DSCS
Landstuhl, West Germany.
Clark Air Force Base, Philippines.

necessary. Initially, the UHF S-band system is being used by the
ground terminal components of the US Air Force Satellite Control
Facility (SCF) for spacecraft control, tracking and housekeeping
purposes, while the SHF X-band system is being used by Defense
Communications Agency (DCA) ground stations to control
channelization and transponder and antennae system configurations.
The SCF system consists of the central control station at Onizuka Air
Force Base in Sunnyvale, California, and seven Remote Tracking
Stations (RTSs) at Vandenberg AFB, California; Manchester AFS, New
Hampshire; Kaena Point, Oahu, Hawaii; Thule AFB, Greenland; Mahe
Island in the Seychelles; Anderson AFB, Guam; and Oakhanger in the
UK. In addition, the Camp Parks Communications Annex of the SCF,
at Pleasanton, California, assists with the control of these satellites.

Although the UHF S-band and SHF X-band systems are used
for separate TT&C functions during normal operation, their functions
are interchangeable whenever conditions may warrant. This
introduces a great deal of flexibility into the system, since commands
can be transmitted and the satellites monitored through numerous
ground terminals. It also assures an immediate satellite response to
commands from terminals within view, rather than having to wait
until the SCF system accords these commands the top priority among
its numerous and various missions, thus enabling the DSCS III satellite
network to be rapidly reconfigured to meet changing communications
requirements and operational conditions. Finally, the redundancy
The US Defense Satellite Communications System

FIGURE 14
DSCS NET CONTROL STATION, CLARK AIR FORCE BASE, PHILIPPINES
FIGURE 15
DSCS NET CONTROL STATION, SUNNYVALE, CALIFORNIA
FIGURE 16
DSCS NET CONTROL STATION, SUNNYVALE, CALIFORNIA
FIGURE 17
DSCS NET CONTROL STATION, SUNNYVALE, CALIFORNIA
FIGURE 18
DSCS NET CONTROL STATION, FORT DETRICK, MARYLAND
FIGURE 19
DSCS NET CONTROL STATION, NSA HEADQUARTERS,
FORT MEADE, MARYLAND

The US Defense Satellite Communications System

FIGURE 20
CAMP PARKS COMMUNICATIONS ANNEX, PLEASANTON, CALIFORNIA

FIGURE 21
DSCS GROUND CONFIGURATION FOR PRECISE TIME AND TIME INTERVAL (PTTI) OPERATIONS, 1971

provided greatly enhances the survivability of the ground segment of the DSCS system.\textsuperscript{15}

Some 85 DSCS ground stations are currently operational. There are nine principal types of terminals operated at these stations (Table 3).

\textbf{TABLE 3}

\textbf{DSCS TERMINALS}

<table>
<thead>
<tr>
<th>Designation</th>
<th>Manufacturer</th>
<th>Type</th>
<th>Antenna Size (Diameter)</th>
<th>Number Produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 AN/FSC-9</td>
<td>Harris Corporation, Electronics Division, Melbourne, Florida.</td>
<td>Heavy</td>
<td>60 ft</td>
<td>2</td>
</tr>
<tr>
<td>2 AN/MSC-46</td>
<td>Hughes Aircraft Company, Ground Systems Group, Fullerton, California.</td>
<td>Medium</td>
<td>40 ft</td>
<td>15</td>
</tr>
<tr>
<td>3 AN/TSC-54</td>
<td>Harris Corporation, Electronics Division, Melbourne, Florida.</td>
<td>Light</td>
<td>Cloverleaf 18 ft equivalent</td>
<td>15</td>
</tr>
<tr>
<td>4 AN/FSC-78</td>
<td>Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California.</td>
<td>Heavy</td>
<td>60 ft</td>
<td>24</td>
</tr>
<tr>
<td>5 SCT-21</td>
<td>Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California.</td>
<td></td>
<td>21 ft</td>
<td>3</td>
</tr>
<tr>
<td>6 SCT-8/18</td>
<td>Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California.</td>
<td>Light</td>
<td>8 ft and 18 ft</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{15} Material supplied by Space Systems Division, General Electric. See also Barry Miller, ‘Expansion of Military Satcom Planned’, \textit{Aviation Week and Space Technology}, 5 January 1976, p.44-45.
The AN/FSC-9 terminal is a large 18.2 metre (60 feet) parabolic antenna, which is equipped with both frequency modulation (FM) and spread-spectrum modulation. It operates in the X-band, with a transmission frequency range of 7.9 to 8.15 GHz and a reception frequency range of 7.25 to 8.4 GHz and a bandwidth of 50 MHz. The maximum power output is 20 KW, and the power output in terms of effective isotropic radiated power (EIRP) is 133 dBm. The multiplex equipment can accept 12 incoming voice channels in the FM mode. Alternatively, it can provide four voice channels and a digital signal of up to 4800 bits.16 (Figure 24).

Two FSC-9 terminals were produced for the DSCS ground segment. One is installed at Fort Dix, Lakehurst, New Jersey, which is the major US Army satellite communications station on the US east coast for communications with US forces in Europe. The second is at Camp Roberts, California, which is a DSCS Network Control Facility (NCF) for the West Pacific (WPAC) DSCS satellite(s), and which serves as a ground relay station in the DSCS satellite communications link between the Code 647 DSP early-warning satellite ground station at Nurrungar, SA, and the DSP Data Distribution Centre (DDC) at Buckley Field, Colorado.17

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17 Ibid.; William M. Arkin and Richard W. Fieldhouse, Nuclear Battlefields: Global Links in the Arms Race, (Ballinger Publishing
The AN/MSC-46 terminal is a 12-metre (40-foot) parabolic antenna and was the first terminal specifically designed for the DSCS program. The complete system consists of the 12-metre antenna, a 95-foot radome, three 30-foot operations, maintenance and support vans, and three 100-kva diesel-powered generators. It transmits on frequencies between 7.9 and 8.4 GHz and receives on frequencies in the 7.25 to 7.75 GHz band. The power output of the system is 16 kw. The terminal provides 12 full-duplex voice channels, two full-duplex teletype circuits, and a voice order circuit.18 (Figures 25, 26, 27 and 28).

The first MSC-46 terminal was built for the US Army Satellite Communications Agency (USASATCOMA), and fourteen others were delivered to the Agency between 1966 and 1968.19 In 1971, these were operational at 11 sites around the world, with two at Wahiawa, Hawaii; Fort Monmouth, New Jersey; and Landstuhl, West Germany. Table 4 lists the locations of these stations.20

**TABLE 4**

**AN/MSC-46 STATIONS, 1971**

<table>
<thead>
<tr>
<th></th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>South Korea</td>
</tr>
<tr>
<td>2</td>
<td>Okinawa</td>
</tr>
<tr>
<td>3</td>
<td>Saigon, Vietnam</td>
</tr>
<tr>
<td>4</td>
<td>Guam</td>
</tr>
<tr>
<td>5</td>
<td>Clark AFB, Philippines</td>
</tr>
<tr>
<td>6</td>
<td>Wahiawa, Hawaii (2 terminals)</td>
</tr>
<tr>
<td>7</td>
<td>Brandywine, Maryland</td>
</tr>
<tr>
<td>8</td>
<td>Fort Monmouth, New Jersey (2 terminals)</td>
</tr>
<tr>
<td>9</td>
<td>Landstuhl, West Germany (2 terminals)</td>
</tr>
<tr>
<td>10</td>
<td>Asmara, Ethiopia</td>
</tr>
<tr>
<td>11</td>
<td>Diyarbakir, Turkey</td>
</tr>
</tbody>
</table>

FIGURE 25
AN/MSC-46 DSCS TERMINAL
FIGURE 26
AN/MSC-46 DSCS TERMINAL IN PART-CONSTRUCTED RADOME
FIGURE 27
AN/MSC-46 DSCS TERMINAL IN RADOME ON GUAM (THE TERMINAL IN THE FOREGROUND IS AN AN/SSC-3 SHIPBOARD SYSTEM)
FIGURE 28
AN/MSC-46 DSCS TERMINAL IN THE MIDDLE EAST

Source: US Defense Communications Agency (DCA).
Two of these (i.e. those at Asmara and Saigon) were subsequently relocated - one was installed at Clark Air Force Base (at which one was already located) and one was installed at Nurrungar, SA, in 1972-74, to support the Code 647 DSP early-warning satellite ground station there.²¹

In January 1985, AN/MSC-46 stations were also operational at Rosman in South Carolina, Howard Air Force Base in Panama, Camp Zama in Japan, and in Berlin, and at least one other AN/MSC-46 terminal was operational at an unidentified location. These have evidently been relocated from some of the previous sites.²²

The AN/TSC-54 terminal is a light-weight, air transportable follow-on to the MSC-46 system. It uses a cassegrain-type antenna, composed of four 3-metre parabolic reflectors in a clover leaf arrangement. (Figures 29, 30, 31 and 32). It is generally enclosed in a 40-foot radome, and is powered by a 4-5 kw generator.²³

Fifteen TSC-54 terminals (including two training units) were originally produced by Harris Corporation, Melbourne, Florida, but some of these (including one training unit) are no longer operational. Table 5 lists the locations at which the TSC-54 terminals are installed.²⁴

---

FIGURE 29
AN/TSC-54 DSCS TERMINAL
FIGURE 30
AN/TSC-54 DSCS TERMINAL
FIGURE 31
AN/TSC-54 DSCS TERMINAL
FIGURE 32
AN/TSC-54 DSCS TERMINAL
The AN/FSC-78 terminal is a fixed system that was designed specifically for operations with the DSCS Phase II satellites and to be compatible with the DSCS III satellites. (During the engineering development and prototype stages, the system was designated AN/MSC-60.) The antenna system weighs some 181,437 kg and consists of a high-efficiency 18.2-20 metre (60-foot) solid surface main reflector and a five-horn monopulse feed system supported on a pedestal structure. It is capable of operation under high winds and other adverse environmental conditions without a protective radome. The performance characteristics include a receive frequency band of 7.25 to 7.75 GHz and a transmit frequency band of 7.9 to 8.4 GHz; a 500 bandwidth; a Gain/Antenna Noise Temperature figure (G/T) of more than 39 dB; an effective isotropic radiated power of 124-127 dBm (i.e. up to 97 dBw); and an ability to simultaneously provide transmission and reception carrier operations with configurations up to 9 uplink and 15 downlink carriers.\(^\text{25}\) (Figures 33, 34, 35, 36 and 37).

\(^{25}\) Ford Aerospace and Communications Corporation, *AN/FSC-78(V) DSCS Satellite Communications Terminal*, (Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, October 1975).
### TABLE 6
AN/FSC-78 SYSTEM PERFORMANCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational availability</td>
<td>&gt;0.999</td>
</tr>
<tr>
<td>Receive frequency band</td>
<td>7.25–7.75 GHz</td>
</tr>
<tr>
<td>Transmit frequency band</td>
<td>7.9–8.4 GHz</td>
</tr>
<tr>
<td>Antenna</td>
<td>60 ft. High-Eff. Az-El</td>
</tr>
<tr>
<td>Receive Polarization</td>
<td>LHC</td>
</tr>
<tr>
<td>Transmit Polarization</td>
<td>RHC</td>
</tr>
<tr>
<td>G/T</td>
<td>&gt;39 dB</td>
</tr>
<tr>
<td>Normal Mode EIRP</td>
<td>+124 dB</td>
</tr>
<tr>
<td>Combined Mode EIRP</td>
<td>+127 dB</td>
</tr>
<tr>
<td>Intermediate frequencies</td>
<td>70 MHz, 700 MHz</td>
</tr>
<tr>
<td>Up/down converter BW</td>
<td>40 MHz, 125 MHz</td>
</tr>
<tr>
<td>Phase linearity:</td>
<td>±0.25 rad</td>
</tr>
<tr>
<td>Any 40 MHz BW</td>
<td>±0.4 rad</td>
</tr>
<tr>
<td>Any 125 MHz BW</td>
<td></td>
</tr>
<tr>
<td>Amplitude response:</td>
<td>±2 dB</td>
</tr>
<tr>
<td>Any 40 MHz BW</td>
<td>±2 dB</td>
</tr>
<tr>
<td>Any 125 MHz BW</td>
<td>±3.0 dB</td>
</tr>
<tr>
<td>Receive gain stability, 24 hr</td>
<td>Up to 15 receive, 9 transmit</td>
</tr>
<tr>
<td>Number of carriers</td>
<td>(one each designated as spare)</td>
</tr>
<tr>
<td>Modems (External)</td>
<td>FDMA, SSMA, TDMA</td>
</tr>
<tr>
<td>Fault location</td>
<td>Automatic</td>
</tr>
<tr>
<td>Frequency control</td>
<td>Cesium derived, synthesizer controlled</td>
</tr>
<tr>
<td></td>
<td>in 1 kHz increments</td>
</tr>
<tr>
<td>Frequency stability; accuracy</td>
<td>±3 \times 10^{-12}</td>
</tr>
<tr>
<td>Transmitters</td>
<td>Redundant 5 KW TWT (500 MHz BW)</td>
</tr>
<tr>
<td>Paramp</td>
<td>Redundant, cooled</td>
</tr>
<tr>
<td>Tracking receiver</td>
<td>Redundant</td>
</tr>
<tr>
<td>Redundancy switch-over:</td>
<td></td>
</tr>
<tr>
<td>Automatic</td>
<td>200 ms</td>
</tr>
<tr>
<td>Manual</td>
<td>3 min</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>15 years</td>
</tr>
</tbody>
</table>
FIGURE 33
AN/FSC-78 DSCS TERMINAL
FIGURE 34
AN/FSC-78 DSCS TERMINAL
FIGURE 35
AN/FSC-78 DSCS TERMINAL
FIGURE 36
AN/FSC-78 DSCS TERMINALS (CENTRE AND LEFT)
Source: US Defense Communications Agency (DCA).
A total of 25 FSC-78 terminals have been produced, including two prototypes. Table 6 lists the locations of the known FSC-78 ground stations.26

### TABLE 7

**AN/FSC-78 STATIONS**

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sunnyvale NCF, California (2 terminals)</td>
</tr>
<tr>
<td>2</td>
<td>Elmendorf AFB, Alaska</td>
</tr>
<tr>
<td>3</td>
<td>Manchester AFS, New Hampshire</td>
</tr>
<tr>
<td>4</td>
<td>Colorado</td>
</tr>
<tr>
<td>5</td>
<td>Finegayan, Guam</td>
</tr>
<tr>
<td>6</td>
<td>Kwajalein</td>
</tr>
<tr>
<td>7</td>
<td>Wahiawa, Hawaii (2 terminals)</td>
</tr>
<tr>
<td>8</td>
<td>Stockton, California</td>
</tr>
<tr>
<td>9</td>
<td>Camp Roberts, California</td>
</tr>
<tr>
<td>10</td>
<td>Offutt AFB, Nebraska</td>
</tr>
<tr>
<td>11</td>
<td>Northwest (Norfolk), Virginia</td>
</tr>
<tr>
<td>12</td>
<td>Fort Detrick, Maryland</td>
</tr>
<tr>
<td>13</td>
<td>Fort Meade, Maryland (2 terminals)</td>
</tr>
<tr>
<td>14</td>
<td>Landstuhl, West Germany</td>
</tr>
<tr>
<td>15</td>
<td>Menwith Hill, UK (2 terminals)</td>
</tr>
<tr>
<td>16</td>
<td>Croughton, UK</td>
</tr>
<tr>
<td>17</td>
<td>Diyarbakir, Turkey</td>
</tr>
<tr>
<td>18</td>
<td>Murkle, Thurso, Scotland</td>
</tr>
<tr>
<td>19</td>
<td>Italy</td>
</tr>
<tr>
<td>20</td>
<td>Watsonia Barracks, Melbourne, Australia</td>
</tr>
</tbody>
</table>

---

26 Letters to the author from Mr M.B. Gibson, Manager, Advanced Planning, Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, 24 November 1980; and from Mr B.B. Bellit, Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, 25 January 1982. According to the letter of 24 November 1980, ‘there were a total of twenty-four AN/FSC-78 terminals manufactured, including the [two AN/MSC-60] prototypes’. According to the letter of 25 January 1982, ‘Ford Aerospace [has] completed the installation of a 25th AN/FSC-78 terminal at [Watsonia Barracks, Melbourne]’.
The SCT-21 terminal consists of a 6-metre antenna with low noise parametric amplifiers and an automatic satellite tracking capability. Three of these terminals have been deployed in the DSCS program. The first of these, designated 'Mascot', was operational at Kwajalein Atoll in the Pacific Ocean in 1971. Another was operational at the Mahe Island SCF Remote Tracking Station (RTS) in the Seychelles in April 1983.

The SCT-8/18 terminals are light traffic, X-band adaptive systems designed for fixed ground-to-satellite communications applications. The SCT-8 terminal has an 8-foot (2.4 metre) antenna, and the SCT-18 has an 18-foot (5.5 metre) antenna. The standard terminal makes extensive use of microprocessors, which permit real-time adaption to meet varying traffic, network control, and operational requirements. It is easy to install, uses off-the-shelf hardware, requires a low initial investment, and provides digital voice, teletype, facsimile and data link networks. The terminal incorporates the WDL-1500 modem and WDL-8240 multiplexer which are capable of operating at data rates of between 45 baud and 19.2 k baud. It can be operated attended or unattended, with a local power source and manual traffic switching, or with remote power control and automatic power switching. The technical specifications of the system are described in Table 8. An SCT-8 system was installed at the CIA/NRO SIGINT satellite ground station at Pine Gap in Central Australia in 1980.

The SCT-35 terminal is an X-band system with a 35-foot (10-metre) antenna and a modular design able to be configured for a wide range of telecommunications purposes, including telephony, facsimile, or satellite tracking, telemetry and control (TT&C) functions. It has a G/T figure of 32 to 35 dB and an EIRP of dBw, and accommodates a

30 Ford Aerospace and Communications Corporation, SCT-8/18 X-Band Adaptive SATCOM Terminal, (Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, no date).
# The US Defense Satellite Communications System 61

## TABLE 8
### SCT-8/18 SPECIFICATIONS

<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive frequency</td>
<td>7250 to 7750 MHz</td>
</tr>
<tr>
<td>Transmit frequency</td>
<td>7900 to 8400 MHz</td>
</tr>
<tr>
<td>G/T Performance</td>
<td>8 ft antenna 18 ft antenna</td>
</tr>
<tr>
<td>Parametric amplifier</td>
<td>20 dB 26 dB</td>
</tr>
<tr>
<td>FET amplifier</td>
<td>18 dB 24 dB</td>
</tr>
<tr>
<td>EIRP</td>
<td>98.5 dBm 103.4 dBm</td>
</tr>
<tr>
<td>Data rates</td>
<td>45 baud to 19.2 kbaud</td>
</tr>
<tr>
<td>Data types</td>
<td>Synchronous, asynchronous, isochronous</td>
</tr>
<tr>
<td>Tunability</td>
<td>Any frequency between 7.25 and 7.75 GHz and between 7.9 and 8.4 GHz</td>
</tr>
<tr>
<td>Frequency resolution</td>
<td>1 kHz</td>
</tr>
<tr>
<td>Modulation type</td>
<td>PSK</td>
</tr>
<tr>
<td>Data channels</td>
<td>8</td>
</tr>
<tr>
<td>RF channels</td>
<td>Any number (equipped for two)</td>
</tr>
<tr>
<td>Availability</td>
<td>&gt; 0.997</td>
</tr>
</tbody>
</table>

### Power Requirements
<table>
<thead>
<tr>
<th>specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
</tr>
<tr>
<td>Input voltage range</td>
</tr>
<tr>
<td>Input frequency</td>
</tr>
</tbody>
</table>

### Environmental Characteristics

#### Antenna
- Air temperature: \(-40^\circ\) to \(120^\circ\)F
- Relative humidity: 100% at air temperatures above \(32^\circ\)F
- Rainfall up to 2 inches per hour

#### Wind velocities
- Operational: 45 mi/h
- Survive: 100 mi/h

#### Atmospheric conditions
- Blowing snow, hail, sand, and dust: Operational without damage following exposure in winds up to 45 mi/h
- Arid, coastal, tropical, and arctic

#### Rack-mounted equipment
- Air temperature: \(37^\circ\) to \(120^\circ\)F
- Relative humidity: 100% at air temperatures above \(37^\circ\)F
- Altitude: 13,000 ft (operational)
FIGURE 38
SCT-8 DSCS TERMINAL
FIGURE 39
SCT-8 DSCS TERMINAL
FIGURE 40
SCT-18 DSCS TERMINAL
modem which provides data rates of 75 baud to 50 k baud. The standard terminal is designed to survive winds of up to 90 mph (145 km/h), and a design option is available which can survive winds of up to 120 mph (193 km/h). It is generally installed in a radome to provide a controlled antenna environment.\(^\text{32}\) (Figures 41, 42, 43 and 44). An SCT-35 system was installed at Pine Gap in 1973.\(^\text{33}\) Another was operational at Brandywine in Maryland in 1985.\(^\text{34}\)

The AN/GSC-39(V) terminal, previously designated AN/MSC-61, is manufactured by Comtech Laboratories under the auspices and direction of the USASATCOMA. The antenna consists of a 38-foot (11.6 metre) reflector with a 5-horn pseudo-monopulse feed system, and operates in the X-band. It provides a full 500 MHz instantaneous bandwidth coverage, tunable in increments of 1 KHz, a G/T of more than 34 dB, and an EIRP of 119-122 dBm. The communications sub-systems have been designed for installation in both fixed-site and transportable configurations - designated AN/GSC-39(V)1 and AN/GSC-39(V)2 respectively.\(^\text{35}\) (Figures 45 and 46).

In August 1977, Comtech Laboratories was awarded a contract for the production of 21 GSC-39(V) terminals.\(^\text{36}\) Further contracts were awarded in the early 1980s, and some 25 terminals were operational in

\(^{32}\) Ford Aerospace and Communications Corporation, *SCT-35 X-Band Earth Stations*, (Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, no date).

\(^{33}\) *Hansard (House of Representatives)*, 20 October 1981, p.2249.

\(^{34}\) Defense Communications Agency (DCA), *Facilities Handbook (Areas 1, 2, and 9)*, (Defense Communications Agency, Scott Air Force Base, Illinois, January 1985), p.5B

\(^{35}\) Comtech Laboratories, *Satellite Communications Medium Terminal AN/GSC-39(V)*, (Comtech Telecommunications Corporation, Comtech Laboratories, Smithtown, New York, no date).

FIGURE 41
SCT-35 DSCS TERMINAL
FIGURE 42
SCT-35 DSCS TERMINAL
FIGURE 43
SCT-35 DSCS TERMINAL
FIGURE 44
SCT-35 DSCS TERMINAL
70 Code 777: Australia and the US DSCS

1985. The locations of these terminals, including that of the initial prototype (Fort Monmouth, New Jersey)\textsuperscript{37} are given in Table 9.

### Table 9

<table>
<thead>
<tr>
<th>Number</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fort Monmouth (USASATCOMA), New Jersey</td>
</tr>
<tr>
<td></td>
<td>(initial prototype)</td>
</tr>
<tr>
<td>2</td>
<td>Thurso (Murkle), Scotland</td>
</tr>
<tr>
<td>3</td>
<td>Shemya, Alaska</td>
</tr>
<tr>
<td>4</td>
<td>Coltano, Italy</td>
</tr>
<tr>
<td>5</td>
<td>Naples, Italy</td>
</tr>
<tr>
<td>6</td>
<td>Sigonella, Sicily, Italy</td>
</tr>
<tr>
<td>7</td>
<td>Lago di Patria, Italy</td>
</tr>
<tr>
<td>8</td>
<td>Berlin, West Germany</td>
</tr>
<tr>
<td>9</td>
<td>Landstuhl, West Germany</td>
</tr>
<tr>
<td>10</td>
<td>Gableningen, West Germany</td>
</tr>
<tr>
<td>11</td>
<td>Augsburg, West Germany</td>
</tr>
<tr>
<td>12</td>
<td>Puerto Rico</td>
</tr>
<tr>
<td>13</td>
<td>Lajes Field, Azores</td>
</tr>
<tr>
<td>14</td>
<td>Diego Garcia</td>
</tr>
<tr>
<td>15</td>
<td>Mahe Island, Seychelles</td>
</tr>
<tr>
<td>16</td>
<td>Guantanamo, Cuba</td>
</tr>
<tr>
<td>17</td>
<td>Clark AFB, Philippines (2 terminals)</td>
</tr>
<tr>
<td>18</td>
<td>Japan</td>
</tr>
<tr>
<td>19</td>
<td>Fort Kobbe, Canal Zone, Panama</td>
</tr>
<tr>
<td>20</td>
<td>Song So, South Korea</td>
</tr>
<tr>
<td>21</td>
<td>Humosa, Spain</td>
</tr>
<tr>
<td>22</td>
<td>Fort Buckner, Okinawa</td>
</tr>
<tr>
<td>23</td>
<td>Ascension Island</td>
</tr>
<tr>
<td>24</td>
<td>North West Cape, Western Australia</td>
</tr>
</tbody>
</table>

\textsuperscript{37} The location of the AN/MSC-61 prototype at Fort Monmouth, New Jersey, is given in letter to the author from Mr M.B. Gibson, Manager, Advanced Planning, Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, 24 November 1980.
FIGURE 45
AN/MSC-61 DSCS TERMINAL
FIGURE 46
AN/MSC-61 DSCS TERMINAL
The AN/GSC-52 terminal, also known as the State-of-the-Art Medium Terminal (SAMT), is produced jointly by the Development Laboratories Division of Ford Aerospace and Communications Corporation at Palo Alto in California and the Government Systems Division of Harris Corporation at Melbourne in Florida. (Figures 47, 48 and 49). It is a high-capacity, medium-sized (38-foot diameter) SHF terminal designed to operate in the DSCS, NATO and similar satellite networks. The antenna itself is essentially an up-graded 38-foot GSC-39 system, with a new modularised computer controlled electronics package which provides high communications performance, increased ease of operation, and improved reliability and maintainability. The terminal receives in the 7.25 to 7.75 GHz band, with a G/T of at least 33 dB; it transmits in the 7.9 to 8.4 GHz band, with an EIRP of at least 91 dBw; and it is able to simultaneously provide transmission and reception carrier operations, with up to 18 reception and 18 uplink channels. A key novel feature of the GSC-52 is its ability to operate and maintain communications traffic in electromagnetic pulse (EMP) environments, using a concentric three-zone shielding design with fibre optics. An AN/GSC-52 terminal was installed at the Overseas Ground Station (OGS) for the Code 647 DSP satellite early-warning system at Nurrungar, SA, in 1987-88.

Table 10 lists the known locations of DSCS ground stations of all (non-tactical) types.

---

38 Ford Aerospace and Communications Corporation, AN/GSG-52 State-of-the-Art Medium Terminal (SAMT), (Brochure provided by Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California, no date).

39 ‘Defence Terminals’, Hansard (Senate), 11 February 1986, p.77; and Desmond Ball, A Base for Debate: The US Satellite Station at Nurrungar, pp.45, 49.
FIGURE 47
AN/GSC-52 DSCS TERMINAL
FIGURE 48
AN/GSC-52 DSCS TERMINAL
FIGURE 49
AN/GSC-52 CONTROL, MONITOR AND ALARM (CMA) SUBSYSTEM
## TABLE 10
DSCS GROUND STATIONS

<table>
<thead>
<tr>
<th></th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ascension Island</td>
<td>AN/MSC-61 terminal. GPS NAVSTAR uplink and telemetry station. Joint NSA/GCHQ SIGINT site. SOSUS facility. P-3 Orion LRMP base. Important base for communications, ocean surveillance, and SIGINT operations during Falklands War.</td>
</tr>
<tr>
<td>2</td>
<td>Antigua Island, West Indies</td>
<td>DSCS II terminal installed to relay communications and data from SCF RTS at Mahe in the Seychelles to the SCF STC at Sunnyvale AFS, California.</td>
</tr>
<tr>
<td>4</td>
<td>Augsburg, West Germany</td>
<td>AN/MS6-61 terminal, replaced AN/MSC-46 installed in 1978. Located 300 km south-west of DSCS Network Control Facility (NCF) at Landstuhl. Augsburg is officially described as ‘the largest US communications intelligence [COMINT] complex in Europe’. Dedicated DSCS system provides wideband, bulk-encrypted, high data rate capability for transmission of COMINT to NSA HQ, Fort Meade, Maryland.</td>
</tr>
<tr>
<td>5</td>
<td>Bad Aibling, West Germany</td>
<td>Major NSA facility. AN/TSC-54. Terminal for DSCS II system installed in 1982.</td>
</tr>
</tbody>
</table>
Beale AFB, Maryland, California

DSCS terminal supports Pave Paws AN/FPS-115 SLBM early warning radar, and SAC 9th Strategic Reconnaissance Wing (with SR-71, U-2 and TR-1 aircraft).

Berlin, West Germany

AN/MSC-61 and AN/MSC-46 terminals. According to US Army testimony,

Berlin represents a unique communications requirement due to its remote location. All other existing communications cross land areas controlled by the Government of East Germany. These communications can be readily jammed or interrupted. The [AN/MSC-61] terminal will satisfy JCS [Joint Chiefs of Staff] validated communications between Berlin and the Washington area, and between Berlin and other areas in West Germany which support operations in the city.

Brandywine, Maryland

AN/MSC-46 and AN/TSC-54 terminals operational in 1971. SCT-35 terminal operational in 1985. Serves as input site for time signals from US Naval Observatory (USNO), Washington, DC, into DSCS/Precise Time and Time Interval (PTTI) system. Also designated DSCS 'special user terminal' for US contingency deployments worldwide.
Buckley Field, Colorado


[F]acilities are required to house a Defense Satellite Communications System (DSCS) Ground terminal.

The DSCS provides long distance communications with a Jam Resistant Secure Communications (JRSC) system to support critical command, control, intelligence, and warning activities, as well as the national command authorities. Currently, there is no DSCS terminal for this site. Existing long distance communications links to NORAD are now routed through various circuits via leased terrestrial links and commercial satellite links. These circuits do not provide essential JRSC features and do not provide an adequate, survivable, and non-vulnerable communications network.

This project will provide a new ground terminal to properly support NORAD operational requirements with missile warning data through the DSCS.
80 Code 777: Australia and the US DSCS

10 Camp Parks, Communications Annex to US Air Force Satellite
   Pleasanton, Control Facility (SCF).
   California

11 Camp Network Control Facility (NCF) for West Pacific
   Roberts, DSCS satellite. Two DSCS terminals, one
   California AN/FSC-78 system and one AN/FSC-9 system.
   One terminal AN/FSC-9 system. Two DSCS terminals, one
   AN/FSC-78 system and one AN/FSC-9 system. Linked to Wahiawa, Hawaii; Kwajalein; Camp
   Zama, Japan; Clark Air Force Base, Philippines;
   Misawa, Japan; and Fort Detrick, Maryland. Intermediate site in DSCS satellite communications
   link between Nurrungar DSP-E station and Buckley DDC, Colorado.

12 Camp Zama, HQ US Army Japan. Also HQ of NSA/CSS
   Tokyo, Japan Representative, Japan. AN/MSC-46. DSCS
   AN/FSC-78 system and one AN/FSC-9 system. Linked to Wahiawa, Hawaii; Kwajalein; Camp
   Zama, Japan; Clark Air Force Base, Philippines;
   Misawa, Japan; and Fort Detrick, Maryland. Intermediate site in DSCS satellite communications
   link between Nurrungar DSP-E station and Buckley DDC, Colorado.

13 Cavalier Air Force Detachment 5, 1st Space Wing, USAF. Site of
   Station, Perimeter Acquisition Raid Characterization
   North Dakota System (PARCS) for attack assessment and
   AN/FSC-78 system and one AN/FSC-9 system. Linked to Wahiawa, Hawaii; Kwajalein; Camp
   Zama, Japan; Clark Air Force Base, Philippines;
   Misawa, Japan; and Fort Detrick, Maryland. Intermediate site in DSCS satellite communications
   link between Nurrungar DSP-E station and Buckley DDC, Colorado.
   Site of Perimeter Acquisition Raid Characterization
   System (PARCS) for attack assessment and
   characterization of ballistic missile attacks against
   US. DSCS terminal installed in 1984.
14 Clark Air Force Base, Philippines


15 Clear Air Force Station, Anderson, Alaska

13th Missile Warning Squadron, USAF. One of three Ballistic Missile Early Warning System (BMEWS) stations. DSCS terminal installed in 1984.

16 Coltano, Italy

AN/GSC-39 terminal. Main US Army communications station in Italy.

17 Croughton, Buckinghamshire, United Kingdom

USAF Communications Station. Automated Data and Information Network (AUTODIN) Switching Center. Principal US defence communications station in UK. Three DSCS terminals, including an AN/FSC-78.

18 Dakar, Senegal
19 Diego Garcia
British Indian
Ocean
Territory (BIOT)

AN/TSC-54 and AN/GSC-39 (AN/MSC-61) terminals. Supports presence of a carrier battle group in the Indian Ocean and operations of the Rapid Deployment Force (RDF); two HF-DF SIGINT sites; Classic Wizard ELINT Ocean Surveillance Satellite System; GEODDS satellite tracking site; and NAVSTAR GPS tracking and control ground station.

20 Diyarbakir, Turkey

NSA SIGINT site. Support base for Pirinçlik radar tracking and SIGINT collection station. DSCS terminal in 1971 was AN/MSC-46. Terminal in 1985 was AN/FSC-78. Linked to DSCS station at Fort Dix, Lakehurst, New Jersey.

21 Elmendorf Air Force Base, Anchorage, Alaska

HQ Alaskan Air Command; 1931 Communications Group, US Air Force Communications Service (AFCS). DSCS terminal linked to SCF Sunnyvale, California; Offutt Air Force Base, Nebraska; and Fort Detrick, Maryland. Two AN/FSC-78 terminals.

22 Finegayan, Guam

Two AN/TSC-54 terminals operational in 1969. AN/MSC-46 and AN/TSC-54 terminals operational in 1971. AN/FSC-78 terminal operational in 1983. Linked to Wahiawa, Hawaii; Camp Zama, Japan; Fort Buckner, Okinawa; and Sunnyvale, California. Supports AUTODIN Switching Center; SCF tracking station; HQ 3rd Air Division of SAC; NAVSTAR GPS Monitor Station; SOSUS facility; Classic Wizard ELINT Ocean Surveillance Satellite System; and Naval Communications Area Master Station Western Pacific.
23 Fort Belvoir, Alexandria, Virginia

24 Fort Buckner, Okinawa
AN/MSC-46 and AN/GSC-39 terminals. Linked to Clark Air Force Base, Philippines; and Wahiawa, Hawaii.

25 Fort Detrick, Maryland
Network Control Facility (NCF) for Atlantic DSCS satellite. One of the largest communications facilities in US. Serves as primary hub for satellite communications to Washington, DC AUTODIN Switching Center. Terminal for Moscow-Washington Direct Communications Link ('hotline'). Three SATCOM terminals, including AN/MSC-60 (AN/FSC-78) installed 1973.

26 Fort Dix, Lakehurst, New Jersey
AN/FSC-9 60-foot (18.2m) system. Major SATCOM station on US east coast for communications with forces in Europe.

27 Fort Gordon, Georgia

28 Fort Huachuca, Sierra Vista, Arizona
AN/TSC-54 terminal. HQ Army Communications Command; US Army Intelligence Center and School (USAICS).

29 Fort Kobbe, Panama
AN/GSC-39 terminal.
30 Fort Meade, Maryland
HQ NSA/CSS, and HQ Army Intelligence and Security Command (INSCOM). Network Control Facility (NCF) for East Pacific DSCS satellite. Two DSCS terminals, at least one of which is an AN/FSC-78.

31 Fort Monmouth, Red Bank, New Jersey
HQ Army Communications and Electronics Materiel Readiness Activity. Army Satellite Communications Agency. DSCS terminals include two AN/TSC-54 systems, AN/MSC-46 system, and AN/MSC-61 prototype.

32 Fylingdales Moor, Yorkshire, UK
Ballistic Missile Early Warning System (BMEWS) Site III. SATCOM terminal installed 1984.

33 Gablingen, West Germany
AN/GSC-39.

34 Guantanamo, Leeward Point, Cuba
Naval Security Group Activity (NSGA) SIGINT site. AN/TSC-54 and AN/MSC-61 terminals.

35 Howard Air Force Base, Canal Zone, Panama

36 Humosa, Spain
AN/GSC-39 terminal.

37 Incirlik Air Base, Turkey
SATCOM station installed 1984.
38 Johnston Island, Pacific Ocean

39 Keflavik, Iceland.

40 Kester, Belgium  
NATO control terminal for DSCS and NATO communications satellites.

41 Kwajalein Atoll, Marshall Islands  
AN/FSC-78 and SCT-21 ('Mascot') terminals. Supports operations of Kwajalein Missile Range (KMR); NAVSTAR GPS tracking, telemetry and control ground station; and SIGINT collection activity.

42 Lackland AFB, Texas  
Terminal installed 1984.

43 Lago di Patria, Italy  
AN/GSC-39.

44 Lajes Field, Terceira Island, Azores  
AN/MSC-61 terminal. Supports ASW Operations Center; P-3 Orion LRMP operations; Azores Fixed Acoustic Range (AFAR) ASW system; and Naval Security Group Activity (NSGA) SIGINT operations.
86 Code 777: Australia and the US DSCS

45 Landstuhl, West Germany
Network Control Facility (NCF) for Indian Ocean DSCS satellite. Also control facility for Atlantic Ocean DSCS satellite. Two AN/MSC-46 terminals operational in 1971. AN/MSC-61 terminal delivered in 1980. Also AN/FSC-78 terminal. Main communications station for US forces in West Germany.

46 Lima, Peru

47 London, UK
HQ US Naval Forces Europe; WWMCCS terminal facilities; US Navy Fleet Ocean Surveillance Information Center (FOSIC).

48 Mahe Island, Seychelles, Indian Ocean

49 Manchester Air Force Station, New Boston, New Hampshire
AN/FSC-78 terminal. Supports New Hampshire Satellite Tracking Station USAF SCF.

50 McGuire AFB, New Jersey

51 Menwith Hill, Harrogate, Yorkshire, UK
Major NSA satellite ground station in UK. Projects ‘Steeplebush’, ‘Runway’ and ‘Moonpenny’. Two AN/FSC-78 DSCS terminals.

52 Mildenhall RAF Base, Suffolk, UK
SATCOM ground terminal installed in 1983.
53 Misawa Air Base, Honshu, Japan

Largest US SIGINT facility in Japan with AN/FLR-9 antenna. Project ‘Ladylove’. DCS terminal linked to Camp Roberts, California. AN/TSC-86.

54 Naples, Italy

AN/MSC-61 terminal. Supports HQ Allied Forces Southern Europe (AFSOUTH) and Sixth Fleet; also Naval Security Group (NSG) SIGINT operation.

55 Northwest, Chesapeake, Virginia

Network Control Facility (NCF) for Atlantic Ocean DCS Satellite. DCS terminals include at least one AN/FSC-78.

56 North West Cape, Western Australia


57 Nurrungar, Woomera, South Australia


58 Oakhanger, near Borden, Hampshire, UK

USAF Satellite Control Facility (SCF).

59 Offutt Air Force Base, Omaha, Nebraska

HQ, Strategic Air Command (SAC). AN/FSC-78 terminal. Linked to Elmendorf Air Force Base, Alaska; Fort Detrick, Maryland; and Wahiawa, Hawaii.
DSCS terminal supports Pave Paws AN/FPS-115 SLBM early-warning system.

HQ, USAF Space Command (SPACECOM); HQ, North American Aerospace Defense Command (NORAD); Space Defense Operations Center (SPADOC); and Consolidated Space Operations Center (CSOC). DSCS terminal serves as SATCOM link between Buckley Aerospace Data Facility and NORAD. Terminal was constructed in FY 1982. According to US Air Force testimony in 1981, this terminal will be the hub of a 14 terminal [ballistic missile] tactical warning and attack assessment network and will handle traffic in both voice and data modes to support NORAD.

Currently, there is no DSCS terminal in the Colorado Springs area. Existing long distance links to NORAD are now routed via leased terrestrial links and commercial satellite links..... This project will provide a new ground terminal to properly support NORAD with missile warning data through the DSCS.

Without this project, NORAD will be forced to continue to rely on the vulnerable leased circuits for critical warning and assessment communications.
63 Pine Gap, Alice Springs, NT, Australia


64 Pirincliik, Turkey


65 Pirmasens, West Germany

DSCS terminal linked to Fort Detrick, Maryland. Supports AUTODIN Switching Center and communications control of US Army and NATO nuclear weapons in Europe.

66 Puerto Rico


67 Rosman, North Carolina


68 Saigon, Vietnam

Located at Ba Queo. AN/MSC-46 terminal operational in 1971.

69 Ramstein Air Base, West Germany

SATCOM ground terminal installed in 1983.

70 Recife, Brazil
90 Code 777: Australia and the US DSCS

71 Rota, Spain  US Navy Fleet Ocean Surveillance Information Facility (FOSIF).

72 San Vito dei, Normanni Air Station, Brindisi, Italy  AN/TSC-86 terminal. AN/FLR-9 SIGINT facility.


74 Shemya AFB, Alaska  AN/TSC-54 and AN/GSC-39 terminals. Supports 16th Surveillance Squadron, which operates AN/FPS-108 ‘Cobra Dane’ phased array radar; and ‘Cobra Ball’ RC-135S ELINT aircraft operations. Linked to Offutt Air Force Base, Nebraska, and Fort Detrick, Maryland, via DSCS EPAC satellite.

75 Songnam, South Korea  ‘Tango’ Combined Communications Operations Center, underground command centre for US Forces Korea. DSCS terminal linked to Wahiawa, Hawaii.

76 Song So, South Korea  AN/GSG-39 terminal, provides main communications link with Japan and Hawaii.

77 Stockton, California  AN/FSC-78 terminal.

78 Stuttgart, West Germany
The US Defense Satellite Communications System

79 Sunnyvale, California
Network Control Center for USAF Satellite Control Facility (SCF) controls and tracks some 13 Department of Defense (DoD) satellite programs, involving some 40 satellites, from 7 world-wide locations. Network Control Facility (NCF) for East Pacific DSCS satellites. Two AN/FSC-78 terminals, one installed 1974 for West Pacific DSCS satellite and second installed 1975 for East Pacific DSCS satellite. Linked to Guam; Shemya, Alaska; Wahiawa, Hawaii; Offutt Air Force Base, Nebraska; Manchester, New Hampshire; and Fort Detrick, Maryland.

80 Teheran, Iran
DSCS II terminal, closed 1980.

81 Thurso, (Murkle), Scotland
AN/FSC-78 and AN/GSC-39 terminals.

82 Tinker AFB, Midwest City, Oklahoma
AN/TSC-54 terminal. Supports 552nd Airborne Warning and Control Wing, homebase for US E-3 Airborne Warning and Control System (AWACS) aircraft; and AUTODIN Switching Center.

83 Torrejon Air Base, Spain
Supports HQ 16th Air Force.

84 Travis AFB, California
Supports HQ 22nd Air Force Military Airlift Command (MAC) and 307th Aerial Refuelling Group, operating KC-135 tankers.

85 Utapao, Thailand
AN/TSC-54 terminal operational in 1971.
86 Vandenberg AFB, California

87 Wahiawa, Oahu, Hawaii

Network Control Facility (NCF) for West Pacific (WPAC) DSCS satellite. Two AN/MSC-46 terminals operational in 1971. Two ANM/FSC-78 terminals operational in 1985. One AN/TSC-54 maintained on contingency basis. Linked to Tango, South Korea; Song So, South Korea; Camp Zama, Japan; Fort Buckner, Okinawa; Clark Air Force Base, Philippines; Guam; Kwajalein; Fort Detrick, Maryland; Fort Meade, Maryland; Nurrungar, South Australia; Sunnyvale, California; and Camp Roberts, California. Supports Naval Communications Area Master Station Eastern Pacific; AUTODON/AUTOVON Switching Center; Transit NAVSAT tracking and data injection station; NAVSTAR GPS Monitor Station; and Navy Security Group (NSG) SIGINT operations.

88 Watsonia, Melbourne, Australia

AN/FSC-78 terminal (Project 'Sparrow') officially declared operational on 1 July 1981. Provides link between HQ of Australian Secret Intelligence Service (ASIS) and Defence Signals Directorate (DSD), Melbourne, and CIA and NSA HQ in US. Also provides SATCOM link between DSD HQ and DSD station in Hong Kong (Project 'Kittiwake').

89 Unknown location, Colorado

CHAPTER 2

DSCS MISSIONS

The communications capabilities of the DSCS are extremely extensive. It is the single most important US military communication system, and is designed and configured to satisfy the US national communications requirements in the areas of world-wide command and control, crisis management and early warning detection data relay, treaty monitoring and surveillance information relay, and diplomatic traffic. It is increasingly also used for tactical military communications.1 (Figure 50).

The DSCS is one of the major components of the US World Wide Military Command and Control System (WWMCCS), where it supplements the High Frequency (HF), long-haul ground cable, ground-based microwave, and undersea cable systems, each of which has limitations in terms of vulnerability to disruption either through deliberate hostile action or as a result of natural phenomena, such as solar flares disrupting the HF band or earthquakes affecting cable communications.2

The system provides unique transmission capabilities for the US DoD Automatic Digital Network (AUTODIN), and Automatic Secure Voice Communications (AUTOSEVOCOM) system, which comprise the largest military communications networks in existence. It also provides wide-band data transmission capabilities for the US Satellite Control facility (SCF) and the US intelligence community.3

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3 Ibid..
FIGURE 50
DSCS TERMINALS

The World Wide Military Command and Control System

The World Wide Military Command and Control System (WWWCCS) is defined in US Department of Defense Directive 5100.30 of 2 December 1971 as 'the world-wide command and control system that provides the means for operational direction and technical administrative support involved in the function of command and control of US Military Forces'. Directive 5100.30 also states that:

The WWWCCS serves two functions, listed below in their order of priority and emphasis:

1. Support of the NCA [National Command Authorities, i.e., the President and the Secretary of Defense] is the primary mission. The NMCS [National Military Command System] provides the means by which the President and the Secretary of Defense can: receive warning and intelligence upon which accurate and timely decisions can be made; apply the resources of the Military Departments; and assign Military Missions and provide direction to the Unified and Specified Commands. The NMCS must be capable of providing information so that appropriate and timely responses may be selected and directed by the NCA and implemented. In addition, the NMCS supports the Joint Chiefs of Staff in carrying out their responsibilities.

2. Support of the command and control systems of the Unified and Specified Commands and the WWWCCS related management/information systems of other DoD Components is the second mission. This function will be supported by the WWWCCS

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subordinate to and on the basis of non-interference with the primary mission.\textsuperscript{5}

Hence, the functional capabilities required of the WWMCCS are as follows:

- situation assessment
- tactical warning
- briefing of the NCA and selection of options
- execution of the selected options
- termination of a previously transmitted order.

Each of these functions requires extensive interface between the WWMCCS and a wide range of other systems and organisations, including the White House Communications Agency, the NATO Command and Control System, the Tactical Command and Control Systems, the North American Air Defense Command (NORAD), and various intelligence collection and assessment systems.\textsuperscript{6} This complex and diverse system is summarised in Figures 51 and 52.

Command and Control Communications with the US Strategic Nuclear Forces

The US strategic nuclear forces consist of 950 Minuteman II and III intercontinental ballistic missiles (ICBMs), 50 MX ICBMs, 624 submarine-launched ballistic missiles (SLBMs) deployed aboard 32 Poseidon and Trident (Ohio-class) Fleet Ballistic Missile (FBM) submarines, and 361 long-range strategic bombers (241 B-52s, 56 FB-111s, and 64 B-1Bs). These forces are equipped with more than 13,000 strategic nuclear warheads and bombs.\textsuperscript{7}

\textsuperscript{5} \textit{Ibid.}, pp.2-3.


\textsuperscript{7} Desmond Ball, \textit{Australia and the Global Strategic Balance}, (Canberra Papers on Strategy and Defence No.49, Strategic and Defence Studies Centre, Australian National University, Canberra, 1989), Table 3, p.45.
FIGURE 51
WWMCCS
These forces are allocated to a wide range of military, political and economic/industrial targets in the Soviet Union, the Non-Soviet Warsaw Pact (NSWP) countries, the People's Republic of China, Vietnam and Cuba in accordance with a series of Presidential memoranda, the most recent version of which is National Security Decision Directive (NSDD) - 13, signed by President Reagan in October 1981; guidance issued by the Secretary of Defense entitled Nuclear Weapons Employment Policy (NUWEP); and guidance issued by the Joint Chiefs of Staff (JCS) in Annex C (Nuclear) of the Joint Strategic Capabilities Plan (JSCP); and which is effected in the Single Integrated Operational Plan (SIOP) prepared by the Joint Strategic Target Planning Staff (JSTPS) at SAC Headquarters, Offutt Air Force Base, Nebraska. The most recent version of the SIOP is SIOP-6E, which came into effect on 1 October 1988.8

Overall control of the SIOP forces is exercised by the NCA, which is defined in Directive 5100.30 as consisting 'only of the President and the Secretary of Defense or their duly deputized alternates or successors'.9 Ultimate authority for the use of nuclear weapons rests with the President, but in practice it is exercised jointly by the President and the Secretary of Defense. The chain of command for the execution of the SIOP 'and other time sensitive operations' is defined in the Directive as being from the NCA through the Chairman of the JCS to the executing commanders.10 In other words, in those operations involving the use of strategic nuclear weapons or in intense crises, the President might in fact by-pass the Joint Chiefs and perhaps

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10 Ibid., pp.1-2.
even the senior commanders in the field and communicate directly with the commander on the spot.

The WWMCCS provides the means by which the NCA and the subordinate commands direct the US strategic nuclear - and all other military - forces. The most survivable portions of the WWMCCS, and hence the one utilised for communications involving the SIOP forces, have been designated the Minimum Essential Emergency Communication Network (MEECN).\textsuperscript{11}

Major components of the MEECN include communication satellites and a variety of land-based and airborne communication systems. In the former category, the key element is the Air Force Satellite Communications (AFSATCOM) System, which is designed to provide a survivable and reliable means of ensuring command and control communications between the NCA and the SIOP forces in the pre-, trans-, and post-nuclear war environments. The AFSATCOM system does not involve any dedicated satellites. Rather, it consists of special communications transponders and channels carried on board 'host' satellites (such as the US Navy's FLTSATCOM satellites, the Air Force SDS satellites, the GPS navigation satellites, and the DSCS satellites), together with numerous UHF ground and air terminals.

The AFSATCOM Single Channel Transponder (SCT) on the DSCS III satellites uses the UHF bow-tie antenna for reception and the cross-dipole antenna for transmission of Emergency Action Messages (EAMs) to the strategic nuclear forces. However, the DSCS III SCT system is less capable than and primarily intended as a back-up to the FLTSATCOM, SDS, and GPS AFSATCOM systems. The DSCS III SCT is designed only to ensure that EAMs can get through to the forces if the primary systems are jammed or destroyed. It does not provide any capability for the operational forces to report back to the command authorities.\textsuperscript{12}


Command and Control Communications with US Theatre and Tactical Nuclear Forces

The DSCS satellites are also used, through the WWMCCS, for the command and control of the US theatre and tactical nuclear forces. These forces cannot be used without receiving both a coded signal designed to unlock the Permissive Action Link (PAL) devices installed on these weapons to prevent unauthorised use of them, and a communication from the NCA permitting their employment.\(^\text{13}\)

DSCS terminals have been installed at most of the key US military bases responsible for the execution of orders to unlock the PALs and use these nuclear weapons. For example, Pirmasens in West Germany is the headquarters of the European Command and Control Console System (ECCCS), which is a system installed at fixed nuclear weapon storage and deployment sites and is ‘essentially used for managing the weapons in peacetime’; headquarters of the Cemetery Net, which is the normal primary means by which the US sends Emergency Action Messages (EAMs) to nuclear ‘field storage sites, delivery units, and mobile and fixed command headquarters; and the HQ of the 59th Ordnance Brigade, which is responsible for all US Army and NATO nuclear weapons in Europe, and which includes a Permissive Action Link (PAL) Detachment which controls these weapons. A DSCS terminal at Pirmasens provides a direct satellite communications link to the Army East Coast Telecommunications Center (ECTC) at Fort Detrick, Maryland, which is the primary hub for satellite communications in the Washington, DC area.\(^\text{14}\) Similarly, Songnam in South Korea is the site of the ‘Tango’ Combined Communications Operations Center, the underground command post

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\textbf{Communications Support for Other US Military Forces}

An increasingly important mission of the DSCS is the provision of communications support to the US general purpose forces, including the Ground Mobile Forces (GMF), in both crisis and contingency situations. The DSCS satellites and associated ground terminals allow the NCA to communicate directly with field commanders, as well as providing of means of voice communications between units in the field.

The DSCS was first used to provide communications between US command authorities and field commanders during the Vietnam War. In 1967, an AN/MSC-46 terminal was installed at Ba Queo, near Saigon, to provide a voice channel between the US forces in Vietnam and the Commander in Chief, Pacific (CINCPAC) in Hawaii, where two AN/MSC-46 terminals also provided a link between CINCPAC and Washington, DC (via the AN/FSC-9 terminal at Camp Roberts, California). In 1969, AN/TSC-54 terminals were operational in Honolulu, Guam (2) and at North West Cape, WA, to support CINCPAC in connection with military operations in Southeast Asia.\footnote{Major General Thomas Matthews Rienzi, \textit{Vietnam Studies: Communications - Electronics 1962-1970}, (U.S. Department of the Army, Washington, D.C., 1972), pp.94-95; and US Congress, House Appropriations Committee, \textit{Department of Defense Appropriations for 1970}, (U.S. Government Printing Office, Washington, D.C., 1969), Part 3, pp.686-689.}

Since 1980, numerous types of small, mobile DSCS terminals have been procured for the US GMF. These include the AN/TSC-86, AN/TSC-85, AN/TSC-93, AN/TSC-94, and AN/MSC-59 terminals,
each of which consists of 8 feet (2.4 metre) parabolic antenna and supporting equipment, which can be deployed on jeeps or other vehicles, can be transported by trucks, helicopters or transport aircraft, and can be made operational within 20-30 minutes of arrival on site. These terminals are designed to provide voice, data and teletype communications capabilities between military units in the field. They can be operated in a wide variety of temperature, humidity, shock and vibration environments. For example, the TSC-85, TSC-93 and TSC-94 terminals can operate in wind gusts up to 168 km/hour. Some 400 of these tactical terminals were scheduled for procurement for the GMF by 1985.17 (Figures 53, 54 and 55).

More recently, the Department of Defense has decided to employ the DSCS in support of the Rapid Deployment Force (RDF). A contract has been awarded to the Collins Communications Division of Rockwell International for the manufacture of seven AN/TSC-60 terminals for this purpose.18

Support for the US Air Force Satellite Control Facility (SCF)

As described above, the US Air Force Satellite Control Facility (SCF) network of S-band satellite ground stations is one of the principal means of controlling the DSCS satellites. Indeed, the SCF control centre at Onizuka Air Force Base in Sunnyvale, California, is also a DSCS Network Control Facility (NCF). In turn, however, the


FIGURE 53
AN/TSC-85 SMALL TACTICAL SHF SATELLITE TERMINAL
FIGURE 54
AN/TSC-86 TACTICAL SATELLITE TERMINAL
FIGURE 55
ANTSC-93A GROUND MOBILE FORCES SATCOM TERMINAL DEPLOYMENT

POWER UNITS
PU-753 OR PU-332

S-250 SHELTER

POWER TRANSFER SWITCH

ANTENNA PALLET TRANSIT FRAME

B-FOOT ANTENNA AN 3036/TSC

REMOTE CONTROL UNIT
DSCS satellites and associated ground terminals provide critical wide-band support for the SCF.19

The SCF is officially described as 'the principal means of supporting the DoD [Department of Defense] on-orbit satellites'.20 The headquarters at Onizuka Air Force Base in Sunnyvale, formally designated the Satellite Test Center (STC), is the control centre of the network, and is responsible for establishing the tracking, telemetry and control priorities for most US military and intelligence satellite programs, as well as for the mission planning and processing of orbital data required to maintain these satellites in operational orbital positions and configurations. The Sunnyvale station is supported by a world-wide network of Remote Tracking Stations (RTSs), a Communications Annex at Camp Parks, California, and a Recovery Group based at Hickam Air Force Base, Hawaii.21

The RTSs are responsible for tracking the satellites allocated to them by the STC whenever those satellites are within view, receiving telemetry signals from the satellites, transmitting command and control communications to them, and receiving mission data from them for relay to the STC or direct to ground terminals maintained by specific user agencies. The locations of some of the RTSs have changed considerably over the past two and a half decades. For example, an RTS was located at Edwards Air Force Base, California, from 1959 to 1973 and another was at Kodiak, Alaska, from 1959 to 1975. There are currently seven RTSs in the network-Vandenberg Tracking Station (VTS) at Vandenberg AFB, California; New Hampshire Station (HS) at Manchester AFS, New Boston, New Hampshire; Thule Tracking Station (TTS) at Thule AFB, Greenland; Indian Ocean Station (IOS) on Mahe Island in the Seychelles; Guam Tracking Station (GTS) at North West Field, Anderson AFB, Guam; Hawaii Tracking Station (HTS), at

Kaena Point on Oahu, Hawaii; and Oakhanger Tracking Station (OTS) at Bauden Hauts, Hampshire, England. Four of these (VTS, NHS, GTS and HTS) are dual stations, capable of tracking and otherwise supporting two satellites simultaneously. The Camp Parks Communications Annex (CPCA), at Pleasanton, California, is responsible for the operational testing and analysis of signals from communication and navigation satellites supported by the SCF. The Recovery Group at Hickam AFB, formally designated the 6594th Test Group, provides a support capability for air and surface recovery of re-entry vehicles deployed from orbiting spacecraft. In particular, it recovers the film capsules ejected from US photographic reconnaissance satellites operated by the National Reconnaissance Office (NRO) - i.e. the KH-8 close-look photographic satellites and the Code 467 KH-9 Big Bird (or Hexagon) multi-capsule area surveillance photographic satellites.

Table 11 summarises the system architecture of the SCF.

In February 1971 it was announced that a Wideband Communications System was under development for the SCF, which would use the DSCS as a relay between the STC and the RTSs, and which would eventually be capable of handling a data rate of up to 1.5 megabits per second. DSCS wideband support for the SCF officially began on 9 February 1974, when the Interim Wideband Communications System (IWCS) became operational using a DSCS II

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<table>
<thead>
<tr>
<th>Unit</th>
<th>Station</th>
<th>Location</th>
<th>Dual (D) or Single (S)</th>
<th>Call Sign</th>
<th>Ground Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>STC</td>
<td>Sunnyvale APS California</td>
<td></td>
<td></td>
<td>DICE</td>
<td>5 terminals, including two AN/FSC-78 DSCS systems.</td>
</tr>
<tr>
<td>APSCF Detachment 1.</td>
<td>Vandenberg AFB,</td>
<td>34° 49.4' N</td>
<td>D</td>
<td>COOK</td>
<td>4 terminals, including two 60-foot and one 46-foot antennae.</td>
</tr>
<tr>
<td></td>
<td>California</td>
<td>23° 29.9' E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APSCF Detachment 2.</td>
<td>Manchester APS, New Boston,</td>
<td>D</td>
<td></td>
<td>BOSS</td>
<td>Terminals include one 60-foot and 46-foot antennae, and one AN/FSC-78 DSCS system.</td>
</tr>
<tr>
<td></td>
<td>New Hampshire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APSCF Detachment 3.</td>
<td>Thule AFB, Greenland</td>
<td>S</td>
<td></td>
<td>POGO</td>
<td>4 terminals, including one 14-foot antenna.</td>
</tr>
<tr>
<td>APSCF Detachment 4.</td>
<td>Mahe, Seychelles</td>
<td>S</td>
<td></td>
<td>INDI</td>
<td>3 terminals, including an SCT-21 and an ANM/MSC-61 DSCS system.</td>
</tr>
<tr>
<td>APSCF Detachment 5.</td>
<td>Guam</td>
<td>D</td>
<td></td>
<td>GUAM</td>
<td>Terminals include one 60-foot SCF/RTS system, plus AN/MSC-46, AN/TSC-54, and AN/FSC-78 DSCS systems.</td>
</tr>
<tr>
<td>APSCF Detachment 6.</td>
<td>Kaena Point, Oahu, Hawaii</td>
<td>D</td>
<td></td>
<td>HULA</td>
<td>4 terminals, including 60-foot and one 46-foot SCF/RTS systems.</td>
</tr>
<tr>
<td>APSCF Detachment 7.</td>
<td>Oakhanger, Borden, Hants,</td>
<td>S</td>
<td></td>
<td>LION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPCAS</td>
<td>Camp Parks, Pleasanton,</td>
<td></td>
<td></td>
<td>PARK</td>
<td>4 terminals, including one 60-foot system.</td>
</tr>
<tr>
<td></td>
<td>California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6594th Test Group</td>
<td>Hickam AFB, Hawaii</td>
<td></td>
<td></td>
<td>HICK</td>
<td></td>
</tr>
</tbody>
</table>
satellite to link the Hawaii and Guam stations to the STC.\textsuperscript{25} IWCS capabilities were installed at the other RTSs over the next five years, and on a 1 February 1979 the DSCS/SCF Interface System (DSIS) was formally declared operational, providing wideband data links between all the stations in the SCF network.\textsuperscript{26}

In March 1979, the Air Force disclosed that the SCF was then supporting 13 satellite programs involving some 40 DoD and NATO satellites,\textsuperscript{27} but according to other reports it has on some occasions supported up to 55 satellites at the same time.\textsuperscript{28} Programs currently being supported by the SCF include the NROs KH-8 close-look photographic satellites, KH-9 Big Bird area-surveillance photographic satellites and KH-11 real-time imaging satellites; and NSA’s Code 711 electronic intelligence (ELINT) satellites; the Navy’s ocean surveillance satellites; the Transit and Global Positioning System (GPS) navigation satellites; the Defense Satellite Meteorological Program (DMSP) satellites; the SDS, FLTSATCOM and DSCS communications satellites; and the NATO II and NATO III communications satellites.\textsuperscript{29}

**DSCS Support for US Photographic Intelligence Operations**

The US intelligence community operates some half-dozen extremely sophisticated photographic intelligence systems, including both airborne and satellite systems, designed to provide photographic imagery of military installations and movements in the Soviet Union, Non-Soviet Warsaw Pact (NSWP) countries, China, North Korea, Vietnam, Cuba and other places of interest.

With respect to airborne systems, for example, the US Air Force operates three principal types of camera-equipped aircraft - the Lockheed U-2, known as Idealist when managed by the NRO; the

\textsuperscript{25} Ibid., p.91.
\textsuperscript{26} Ibid., p.105.
\textsuperscript{29} James B. Schultz, 'Inside the Blue Cube', pp.52-59.
Lockheed SR-71 Blackbird, known as Ox Cart when managed by the NRO; and the McDonnell Douglas RF-4 Phantom. In late 1967, following the installation of a DSCS ground terminal at Ba Queo, near Saigon, Dr John S. Foster, the Director of Defense Research and Engineering (DDR&E) in the DoD, revealed that the DSCS system was being used to relay high-resolution photographs, taken by reconnaissance aircraft, from Saigon to Washington. This system, known as Compass Link, involved the conversion of the photographs to electrical signals by means of an optical scanner produced by CBS Laboratories and signal processing equipment produced by Philco-Ford, and the transmission of these signals via DSCS satellites to a ground terminal in the Washington, DC area, from where they were delivered to the CIA’s National Photographic Interpretation Center (NPIC) for reconstitution and analysis.30

The US intelligence community has also developed three different types of photographic intelligence satellites. The first of these to become operational, subsequently designated KH-4, was developed by the CIA and involved the actual recovery of the photographic capsule. The first successful satellite in this program was Discoverer 14, launched on 19 August 1960 and recovered the next day. Satellites of this type have been used for relatively low-altitude, high-resolution ‘close-look missions’. Subsequent close-look programs have been designated KH-6 and KH-8.31

The second type of photographic intelligence satellite was developed by the US Air Force under the Satellite and Missile Observation System (SAMOS) program, and involved the conversion of photographs to electrical signals and the transmission of these signals by radio to ground stations, from which they were relayed to Washington for reconstitution and interpretation. The first of these radio-transmission satellites, SAMOS II, was successfully launched on 31 January 1961. The SAMOS program was retroactively designated KH-1. Subsequent programs utilising the radio-transmission technique were designated KH-5 and KH-7.32 These satellites were

32 Ibid., pp.129, 122, 134.
equipped with optical scanners produced by CBS Laboratories and signal processors produced by Philco-Ford, which were later used in the Compass Link program during the Vietnam War.33

Radio-transmission satellites were generally orbited at a slightly higher altitude than the recovery-type satellites, and hence were used for area surveillance missions. The last of these satellites was a KH-7 launched on 25 May 1972. The area surveillance mission was then taken over by the Code 467 KH-9 Big Bird (or Hexagon) satellites, which have perigees of about 150 km and apogees of about 270 km and orbital lifetimes of up to six months, and which contain several recoverable film capsules.34

The third type of photographic satellite, designated Code 1010 or KH-11 (Ikon), uses a television camera and involves the direct telecast of imagery in real-time - i.e. virtually instantaneously - to the NRO ground control station at Fort Belvoir, Virginia, via the DSCS and SDS satellites.35

The DSCS program is involved in the operations of these photographic intelligence satellite systems in several ways. First, DSCS satellites and ground terminals are used by the SCF for the transmission of command and control communications concerning these systems. Second, DSCS I satellites were used to relay imagery data transmitted to the SCF RTSs by the KH-7 radio-transmission photographic satellites. And, third, DSCS II and III satellites are used by the KH-11 satellites to relay imagery directly to the NRO and other users in the Washington area.

Signals Intelligence (SIGINT) Data Transmission

The DSCS satellites were designed from the outset to accommodate the wide-band data transmission requirements of the US intelligence community, and particularly the CIA and NSA. According to a report in 1977, for example, at which time only the DSCS Phase I satellites were operational,

33 Klass, Secret Sentries in Space, p.168.
35 Ibid., pp.136-137.
the [DSCS] spacecraft ... are used for wideband intelligence information that cannot be transmitted via commercial satellites [or narrow-band land-lines or undersea cables] and for bulk-encrypted secure voice/data communications that require bandwidths of 1.5 megabits/second.36

The data transmission requirements of the NSA are especially immense. The NSA, together with allied SIGINT agencies - the British Government Communications Headquarters (GCHQ), the Canadian Communications Security Establishment (CSE), the Australian Defence Signals Directorate (DSD), and the New Zealand Government Communications Security Bureau (GCSB) - operates some 400 SIGINT sites around the world, with the mechanics of data exchange and communications governed by the UKUSA arrangements of 1947. These 400 sites collect extraordinary amounts of military, diplomatic and commercial communications traffic, as well as non-communications electromagnetic emissions, which must be transmitted by secure means back to the headquarters of these UKUSA SIGINT agencies.37

Some two dozen DSCS terminals are located at major NSA SIGINT stations around the world. In some cases, these DSCS terminals are wholly dedicated to the support of SIGINT operations (including the transmission of the SIGINT data), while in cases where the SIGINT sites are co-located with other US military facilities, the terminals support both SIGINT operations as well as the other user requirements.

DSCS terminals which are essentially dedicated to SIGINT activities include those at Augsburg and Bad Aibling in West Germany, Diyarbakir in Turkey, Misawa in Japan, Menwith Hill in the UK, and Pine Gap and Watsonia in Australia.

Augsburg is located only about 300 km south-west of the DSCS Network Control Facility (NCF) at Landstuhl, but separate DSCS facilities were justified because of the particular wide-band requirements of the US Army Intelligence and Security Command (INSCOM) Field Station in Augsburg. As US Army officials testified on 28 February 1977,

This particular site at Augsburg is for a particular requirement at the location. It is a new wide band requirement.38

INSCOM is the US Army component of the NSA, and the Augsburg station is 'the largest of its eight field stations around the world'.39 Indeed, the facilities at Augsburg, which include an AN/FLR-9 HF and VHF SIGINT antenna (Figure 56),40 comprise ‘the largest US communications intelligence [COMINT] complex in Europe’.41 The DSCS terminal initially installed ‘to directly support communication requirements at Augsburg’ was an AN/MSC-46 antenna system, but this was only intended ‘to provide interim communications’ until installation of an AN/MSC-61 (AN/GSC-39) system was completed in 1979.42

Bad Aibling is another major NSA station in West Germany, at which a terminal was installed in 1984 ‘as part of the Phase II implementation of the world-wide DSCS which satisfies the DOD unique and vital communications needs’.43 (Figure 57). The facility at Diyarbakir, which is equipped with an AN/MSC-46 terminal, is one of

40 Ibid., p.12.
Figure 56
AN/FLR-9 SIGINT ARRAY AT AUGSBURG, WEST GERMANY

the most important NSA stations in Turkey.\textsuperscript{44} Misawa is the largest SIGINT site in Japan; it is manned by more than 1,800 personnel, operates an AN/FLR-9 HF and VHF Circularly-disposed Antenna Array (CDAA), and is the main operating site for the NSA’s Project LADYLOVE.\textsuperscript{45}

The NSA station at Menwith Hill, Yorkshire, has eight satellite terminals, making it one of the largest satellite ground stations in the world. Four of these terminals are enclosed in radomes and are evidently part of the NSA’s Project RUNWAY, which involves the control of CHALET, VORTEX and MAGNUM geostationary SIGINT satellites; two terminals are oriented to track and monitor satellites in highly elliptical (Molniya or SDS) orbits; while two are AN/FSC-78 DSCS terminals which evidently operate with the Atlantic Ocean and Indian Ocean DSCS satellites.\textsuperscript{46} (Figures 58, 59 and 60). The CIA/NRO SIGINT satellite ground station at Pine Gap in central Australia now also has eight satellite terminals, of which two are designed for communications through the DSCS system.\textsuperscript{47} The AN/FSC-78 terminal at Watsonia Barracks, Victoria, was installed to provide long-haul wide-band communications capability for DSD. Fort Meade Maryland, which is linked by DSCS satellites to each of these other stations, has six satellite ground terminals (including two AN/FSC-78 systems), and serves as the Network Control Facility for

\textsuperscript{44} Ibid., pp.188, 329; and Enright, ‘DSCS PTTI Transfer’ p.178.
\textsuperscript{45} Richelson and Ball, The Ties That Bind, p.326.
\textsuperscript{47} Hansard (House of Representatives), 20 October 1981, p.2255.
Code 777: Australia and the US DSCS

FIGURE 58

NSA/GCHQ STATION AT MENWITH HILL, YORKSHIRE, ENGLAND

Source: Duncan Campbell, New Statesman, London.
FIGURE 59
NSA/GCHQ STATION AT MENWITH HILL YORKSHIRE ENGLAND

FIGURE 60
NSA/GCHQ STATION AT MENWITH HILL, YORKSHIRE, ENGLAND
(THE TERMINAL FOR THE DSCS ATLANTIC OCEAN SATELLITE IS IN THE FOREGROUND)

Source: Duncan Campbell, New Statesman, London.
the East Pacific (EPAC) DSCS satellite in addition to being the headquarters of the NSA itself.\textsuperscript{48}

DSCS terminals which support both SIGINT operations and other military communications requirements include those at Wahiawa in Hawaii, Camp Zama in Japan, Clark Air Force Base in the Philippines, Diego Garcia in the Indian Ocean, Guam, Naples in Italy, Lajes Field in the Azores, Ascension Island in the Atlantic, and Guantanamo in Cuba. Wahiawa is the Network Control Facility for the West Pacific (WPAC) DSCS satellite and the Communication Area Master Station Eastern Pacific, and supports, \textit{inter alia}, the operations of the Naval Security Group (NSG) component of the NSA in Hawaii.\textsuperscript{49} Camp Zama is the Headquarters of the US Army Japan as well as the Headquarters of the NSA Representative Japan.\textsuperscript{50} Clark Air Force Base, which has at least three DSCS terminals, is the Headquarters of the 13th Air Force and the largest US Air Force base in Southeast Asia, and is also a major centre of SIGINT activity (including operation of an AN/FLR-9 SIGINT system).\textsuperscript{51} (Figure 61).


\textsuperscript{51} \textit{Air Force Magazine}, May 1977, p.55; Richelson and Ball, \textit{The Ties That Bind}, p.327; and Arkin and Fieldhouse, \textit{Nuclear Battlefields}, p.228.
FIGURE 61
AN/FLR-9 SIGINT ARRAY AT CLARK FIELD, PHILIPPINES

Source: US Defense Communications Agency (DCA).
The US facilities at Guam, Diego Garcia, Lajes Field and Ascension Island are, \textit{inter alia}, particularly important naval SIGINT stations.\footnote{Richelson and Ball, \textit{The Ties That Bind}, Chapter 9 and Appendix 1.}

In some instances, the DSCS SIGINT data links are components of more extensive NSA SIGINT data networks. For example, the NSA’s MAROON SHIELD network (which once also had the code-name DRAWSTRING) uses RCA communications satellites and ground-based communications systems in addition to the DSCS system.\footnote{Defense Marketing Services (DMS), \textit{Code Name Handbook}, (DMS Inc., Greenwich, Connecticut, 1979), p.207.} The MAROON SHIELD network is used by DSD to communicate between Watsonia Barracks and the major DSD/GCHQ operation, code-named Kittiwake, in Hong Kong.\footnote{Desmond Ball, \textit{Australia’s Secret Space Programs}, (Canberra Papers on Strategy and Defence No.43, Strategic and Defence Studies Centre, Australian National University, Canberra, 1988), pp.4-6, 13-17, and 57-65.}

\textbf{DSCS Support for the US Ocean Surveillance Information System (OSIS)}

The US Ocean Surveillance Information System (OSIS) consists of a world-wide network of facilities, data processing centres and communications links designed to collect, process, correlate, and disseminate ocean surveillance information by means of satellites, signals intercept and Direction Finding (DF) stations, underwater hydrophone arrays, and a variety of airborne devices.\footnote{Vice Admiral Samuel L. Gravely, Jr., ‘OSIS Extends Intelligence Coverage Beyond Radar Horizon’, \textit{Defense Electronics}, April 1982, pp.69-76.}

The US Navy’s ocean surveillance satellite system is known as Classic Wizard, and consists in turn of a number of White Cloud electronic intelligence (ELINT) satellites designed to monitor naval communications and electronic emissions from naval radars and fire control systems, together with five major ground stations at Guam, Diego Garcia, Adak (Alaska), Winter Harbor (Maine), and Edzell.
Coile 777: Australia and the US DSCS

(Scotland). (Figure 62). The signals intercept and DF systems include both ground-based HF and VHF DF stations, operated by the Naval Security Group (NSG) component of NSA, and located at some 40 sites around the world, as well as ship-based HF DF equipment, known as Classic Outboard. The underwater systems include both fixed hydrophone Sound Surveillance System (SOSUS) arrays and mobile Surveillance Towed Array Sensor System (SURTASS) arrays towed by specially designed ships. The airborne systems include infra-red detection devices, ELINT systems, magnetic anomaly detection (MAD) systems and sonobuoys deployed on Lockheed P-3 Orion aircraft and carrier-based SH-3 helicopters and S-3A anti-submarine aircraft. The Orions are based world-wide at some 16 major bases.56

Ocean surveillance intelligence collected by these various systems is transmitted to the Navy Operational Intelligence Center (NOIC) at Suitland in Maryland; three Fleet Ocean Surveillance Information Centres (FOSICs) at Makalapa in Hawaii, Norfolk in Virginia, and London, UK; two Fleet Ocean Surveillance Information Facilities (FOSIFs) at Rota in Spain and Kamiseya in Japan; and a Central Shore Station at Moffett Field, next to Onizuka Air Force Base in Sunnyvale, California.57 DSCS and FLTSATCOM satellites provide the principal means of communications in this system.58

Richelson and Ball, The Ties That Bind, Chapter 9.

FIGURE 62
CLASSIC WIZARD OSIS STATION, EDZELL, SCOTLAND

DSCS terminals which are particularly important in connection with OSIS include those at Guam, Diego Garcia, Rota in Spain, Lajes Field in the Azores, Ascension Island, Puerto Rico, Norfolk (Virginia), and the AN/FSC-78 terminal at Watsonia Barracks in Melbourne, which is used to transmit ocean surveillance intelligence collected by the DSD stations in Australia and Hong Kong to the United States.59

Ballistic Missile Early Warning Detection Data

The DSCS system is being increasingly used as a major communications link between the elements of the US ballistic missile early warning system, which is designed to detect Soviet and Chinese launches of intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs), and the North American Air Defense (NORAD) Combat Operations Center at Cheyenne Mountain, Colorado, Strategic Air Command (SAC) Headquarters at Offutt Air Force Base, Omaha, Nebraska, and the US National Command Authorities (NCA) in Washington, DC.

This ballistic missile early warning system consists of a network of Code 647 Defense Support Program (DSP) infra-red satellites in geostationary orbit controlled from two major satellite ground stations at Nurrungrar, South Australia, and Buckley Field, Colorado, and a Simplified Processing Station (SPS) at Kapaun Air Station, Vogelweh, West Germany; three Ballistic Missile Early Warning Systems (BMEWS) radars at Thule, in Greenland, Clear Air Force Station in Alaska, and Fylingdales Moor in Yorkshire, UK; the Cobra Dane large phased array radar (LPAR) at Shemya Air Force Base in the Aleutian Islands; the Perimeter Acquisition Raid Characterization System (PARCS) at Cavalier Air Force Station, Concrete, North Dakota; and two Pave Paws phased-array SLBM detection radars at Otis Air Force Base, Massachusetts, and Beale Air Force Base, California (with a further two currently under construction

at Robbins Air Force Base in Georgia and Goodfellow Air Force Base in Texas).

The BMEWS sites at Thule, Clear, and Fylingdales have been in operation since 1962 and, together with the DSP satellites, comprise the principal US means of warning of a ballistic missile attack. The station at Thule operates three AN/FPS-50 large static array scanning radars and an AN/FPS-49 tracking radar with a parabolic reflector (which is soon to be replaced by a new phased array radar) (Figure 63); the station at Clear operates four AN/FPS-50 radars and an AN/FPS-92 radar, which is a more modern version of the AN/FPS-49 system; and the station at Fylingdales operates three AN/FPS-49 radars. Satellite communications terminals were installed at each of these stations in 1984.

The Cobra Dane LPAR system at Shemya, formally designated USAF Program 633A, is a 30-metre diameter AN/FPS-108 radar designed to detect and track ICBMs and SLBMs and thus augment the BMEWS radars. (Figure 65).

The AN/TSC-54 DSCS terminal at Shemya provides communications support for this system as well as for NSA SIGINT activities conducted at Shemya. The PARCS at Cavalier (Figure 66) was originally designed as part of the US Safeguard Anti-Ballistic Missile (ABM) system; a satellite communications terminals was installed in 1984. The two Pave Paws SLBM detection and warning stations at Otis and Beale Air Force Bases operate LPAR AN/FPS-115 radars. (Figure 67).


FIGURE 63
BMEMS STATION, THULE, GREENLAND
FIGURE 64
AN/FPS-49 BMEWS RADAR AT FYLINGDALES, YORKSHIRE, ENGLAND
1.30 Code 777: Australia and the US DSCS

FIGURE 65
COBRA DANE RADAR, SHEMYA, ALASKA
FIGURE 66
PERIMETER ACQUISITION RAID CHARACTERISATION SYSTEM (PARCS),
Cavalier Air Force Station, Concrete, North Dakota
FIGURE 67
PAVE PAWS RADAR, OTIS AIR FORCE BASE, MASSACHUSETTS
DSCS terminals were installed at Beale and Otis in 1982. The US Air Force budgetary justification statement supporting the construction of the DSCS terminal at Otis, which is essentially identical to that concerning Beale, was as follows:

This terminal will be an essential link in the missile-warning network and will handle traffic in both voice and data modes.

The Code 647 DSP infra-red satellite system is the most important of all the elements in the US ballistic missile early warning system and, indeed, has been officially described as ‘the key element of the Worldwide Military Command and Control System (WWMCCS)’. (Figure 68). In January 1973, the US Air Force informed the Congress that the DSCS Phase II system ‘will provide an alternative communications route’ to the network of leased commercial satellite circuits, submarine cables and terrestrial systems initially employed, and that ‘an MSC-46 communications terminal has been installed at the Overseas Ground Station (OGS) [i.e. Nurrungar, South Australia] which will enable DSP data to be transmitted to the CONUS [Continental United States] via a Defense Satellite Communications System (DSCS) Phase II communications satellite, thereby providing an alternative communications mode’. (Figures 69

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63 Ibid., p.655.


FIGURE 68
DSP EARLY WARNING SATELLITE
DSCS Missions 135

FIGURE 69
US AIR FORCE DEFENSE SUPPORT PROGRAM (DSP) SATELLITE EARLY WARNING SYSTEM GROUND SEGMENT
FIGURE 70
SCHEMATIC OF DSP GROUND AND SPACE SEGMENTS, SHOWING BACK-UP GROUND SYSTEMS AND SATELLITE-TO-SATELLITE LASER COMMUNICATION CROSSLINK
In January 1980, the Congress was informed that the DSCS 'provides primary communications routing for DSP overseas data'.

The AN/MSC-46 DSCS terminal at Nurungar, SA, became operational in 1974. DSP data received at the Nurungar OGS is transmitted to the continental United States (CONUS) either through the DSCS satellite over the Western Pacific (DSCS WPAC) to the DSCS NCF at Wahiawa, Hawaii, and then via the eastern Pacific (EPAC) DSCS satellite to the CONUS Ground Station (CGS)/DSP Data Distribution Center (DDP) at Buckley Field, Colorado; or through the DSCS WPAC to the DSCS NCFs at Sunnyvale or Camp Roberts in California, and then via the DSCS EPAC to Buckley. (Figures 71 and 72). In 1982, the US Air Force informed the Congress of its intention to install a Satellite Communications Ground Terminal at Buckley, and in March 1982 provided Congress with a full justification for the terminal:

Facilities are required to house a Defense Satellite Communications System (DSCS) Ground terminal. The DSCS provides long distance communications with a Jam Resistant Secure Communications (JRSC) system to support critical command, control, intelligence, and warning activities, as well as the national command authorities.

Currently, there is no DSCS terminal for this site. Existing long distance communications links to NORAD are now routed through various circuits via

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FIGURE 71
DSCS ROUTES BETWEEN NURRUNGAR AND THE UNITED STATES
FIGURE 72
DSP GROUND STATION, AEROSPACE DATA FACILITY, BUCKLEY FIELD, COLORADO
leased terrestrial links and commercial satellite links. These circuits do not provide essential IRSC features and do not provide an adequate, survivable, and non-vulnerable communications network.

This project will provide a new ground terminal to properly support NORAD operational requirements with missile warning data through the DSCS.70

Installation of this DSCS terminal at Buckley began in December 1981 and was completed in 1984.71

In 1981, the Air Force also requested authorisation from Congress to construct a DSCS terminal at Peterson Air Force Base, near Colorado Springs, in order to receive missile warning data from the Buckley CGS/DDC and other early warning sites for direct transmission to the NORAD complex at nearby Cheyenne Mountain. According to the Air Force justification for this requirement;

[Flacilities are required to house a Defense Satellite Communications System (DSCS) ground terminal.

This terminal will be the hub of a 14 terminal tactical warning and attack assessment network and will handle traffic in both voice and data modes to support NORAD.

Currently, there is no DSCS terminal in the Colorado Springs area.

... This project will provide a new ground terminal to properly support NORAD with missile warning data through the DSCS.72

Construction of the DSCS terminal at Peterson Air Force Base was scheduled to begin in April 1982 and the terminal would have become

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71 Ibid., p.652.

operational in 1983. According to one source, the terminal is located ‘next to the Officers’ Club’ at the Base.

73 Ibid., p.1732.
CHAPTER 3

THE AUSTRALIAN CONNECTION

Australia’s involvement in the DSCS program began at North West Cape, Western Australia, in 1967, at the very outset of the program, when an AN/TSC-54 terminal was installed at the base. Together with sites at Guam, Wahiawa in Hawaii, and Ba Queo near Saigon in South Vietnam, North West Cape was one of the first sites to be equipped with a DSCS terminal.¹

Since 1967, some half dozen other terminals have been installed in Australia for the purpose of monitoring DSCS satellites or communicating through the DSCS system.

1. AN/TSC-54 DSCS Terminals at North West Cape, Western Australia

Despite the fact that the installation of an AN/TSC-54 terminal at North West Cape in 1967 represented the involvement of Australia in an entirely new and extremely important US defence satellite program, it was made without any public announcement. In fact, in what was to become a typical characteristic of developments at the US facilities in Australia, the first disclosure of the existence of a satellite communications terminal at North West Cape occurred in US Congressional Hearings, on 19 May 1969, when the US Navy testified that:

Today we are operating ... four TSC-54 terminals, one at Honolulu, two at Guam, [and] one at Naval Communications Station Harold E. Holt [at North West Cape, WA].²

² Ibid., p.686.
FIGURE 73
DSCS STATIONS IN AUSTRALIA
It was only following a number of press reports, prompted by this testimony, and a Question Without Notice asked in the House of Representatives by Mr Lance Barnard on 28 May 1969 - some 18 months after the terminal became operational - that the Minister for Defence, Mr Alan Fairhall, made the first official Australian Government statement concerning Australia’s involvement in the DSCS program. The Minister stated:

For the last 18 months there has been operating in Australia under the control of the interim defence communications satellite programme [IDSCP] a portable communications station .... It is installed at North West Cape. It forms part of the normal communications facility between North West Cape and continental United States for the communications organisation, and supplements the very high [sic!] frequency communications channels which have always been a part of the North West Cape project.3

The Minister’s statement was characteristic of the Government’s attitude to the right of the Australian public to be informed about developments of this sort. Not only was it made after the US Congress had been informed, but whereas the US Congress was given a full explanation of the reason for the installation, the capabilities of the TSC-54 terminal and the way it would operate with the other terminals at Hawaii and Guam, the Minister’s statement was quite uninformative. It eschewed detail, implied that the press reports and Mr Barnard’s question were perhaps mischievous in raising the matter, and revealed either ignorance or at least carelessness on the part of the Minister with respect to the primary communications systems at North West Cape - which are either Very Low Frequency (VLF) or High Frequency (HF), but not Very High Frequency (VHF) systems!

In November 1973, the TSC-54 terminal was removed from North West Cape.4 However, again without any public

3 Hansard (House of Representatives), 28 May 1969, p.2316.
announcement, another TSC-54 terminal was installed in 1977 and commenced operating in 1978 - a fact which again only became public knowledge in May 1978, and then inadvertently, when the Minister for Defence was questioned in Parliament about US Congressional testimony concerning the award of contracts for a third terminal - an AN/MSC-61 - at North West Cape. Being ignorant of the US plans with respect to the MSC-61, the Government thought that the Congressional testimony and the subsequent press reports must have been referring to the recent installation of this second TSC-54 terminal. As the Minister representing the Minister for Defence in the Senate mistakenly stated on 9 May 1978, in what was however the first disclosure of the re-installation of a TSC-54 terminal at North West Cape,

A [TSC-54] satellite terminal was in operation at the station until late 1973. A terminal of the same type was again installed late in 1977 and the contracts referred to ... were with companies manufacturing part of this equipment.5

It was a deplorable way for Parliament to learn of the re-installation of the TSC-54 system.

These AN/TSC-54 terminals were installed in the Area B communications complex at North West Cape. (Figure 74). Area A, which is located at the most northernmost tip of the Cape, is the site of the large VLF antenna array, used for communicating with US submarines in the Indian and Western Pacific Oceans. Area B, which is six miles south of Area A, contains the HF transmitter, the station headquarters, and the Communications Center in addition to the satellite terminals. Area C, which is located some 60 km south of Area

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FIGURE 74

MAP OF NORTH WEST CAPE, WA
B, is the main receiver site and contains both the HF and VLF receiving antennae systems.6

The AN/TSC-54 ground station configuration was a point-to-point network. According to the US Defense Communications Agency (DCA), the network was 'not very efficient. North West Cape cannot talk [for example] to Kwajalein, North West Cape talks [only] to Guam'.7

The initial purpose of the AN/TSC-54 facility at North West Cape was to supplement and enhance the communications capabilities available to the Commander-in-Chief Pacific (CINCPAC), particularly with respect to CINCPAC operations in the Vietnam War. However, as part of the US Defense Communications System (DCS), it was also used to relay communications of more general import. For example, the original TSC-54 terminal at North West Cape was used in October 1973, during the Yom Kippur War in the Middle East, to communicate the general US nuclear alert of 25 October to US military forces in the Western Pacific and Indian Oceans - without the Australian Government having been consulted or even informed!8

In 1974, the International Telecommunications Union (ITU), a UN agency located in Geneva and responsible for maintaining a list of all radio frequencies registered by member countries, was informed that the satellite terminal at North West Cape was communicating with a DSCS II satellite stationed over the West Pacific (WPAC). The frequencies registered for transmission were 7.97628, 7.97764 and 8.00718 GHz, and the frequencies for reception were 7.25128, 7.27319 and 7.28218 GHz. In 1977, the ITU was informed that North West

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8 See Ball, A Suitable Piece of Real Estate, pp.56, 145 and 154; Canberra Times, 9 November 1973, p.11; and Sydney Morning Herald, 22 November 1973, p.10.
FIGURE 75
AN/TSC-54 TERMINAL AT NORTH WEST CAPE, WA

Cape would also transmit on the additional frequency of 8.019253 GHz and receive on the additional frequencies of 7.2501, 7.3152 and 7.6751 GHz. In 1980, the ITU was notified that the frequencies of 8.047925 GHz would also be used for transmission and 7.32389 GHz for reception purposes.\(^9\)

In October 1981, the Minister for Defence, Mr D.J. Killen, confirmed in answer to a Question on Notice that the AN/TSC-54 terminal then operating at North West Cape was scheduled to be dismantled and removed when the new AN/GSC-39(V)I became operational.\(^10\) The GSC-39 formally became operational on 9 July 1984.\(^11\) The TSC-54 was decommissioned in August 1984 and was shipped by merchant ship to the US Army Satellite Communications Agency at Fort Monmouth, New Jersey, on 15 February 1985.\(^12\)

2. **The AN/GSC-39(V)I DSCS Terminal at North West Cape, Western Australia**

The AN/GSC-39(V) terminal is a 38-foot diameter X-band system, previously designated AN/MSC-61, designed to operate with DSCS II satellites but to also be compatible with DSCS III satellites.

The installation of an AN/GSC-39(V) terminal at North West Cape was the subject of a major political controversy in May 1978. In March 1977, the US Congress was informed by the Department of Defense that a contract was to be awarded in August 1977 for 21 AN/MSC-61 ground terminals for the DSCS II/III system, and that one of these terminals was to be installed at North West Cape. Construction of the new facility was to begin at North West Cape late

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11. 'Defence Terminals', *Hansard (Senate)*, 14 February 1986, p.402.

in 1978, and to be completed by the end of 1980, and the new terminal was to become operational in early 1981.13

However, the Australian Government was not fully appraised of this planned installation. Although certain senior military officers within the Australian Department of Defence (as well as the Australian Deputy Commander at North West Cape) had been informed by the Pentagon, the first the government and the Parliament knew of it was a report in the Australian Financial Review on 8 May 1978.14 Indeed, it took the Minister for Defence several days to determine that a new ground terminal was in fact destined for North West Cape. His initial response then was to indict the US for not treating Australia ‘with the proper courtesy’.15 The Minister later stated that ‘there exists a difference of opinion between the United States Government and the Australian Government as to the procedures to be observed’ in respect of US plans for new developments at North West Cape,16 and that Australia had (once again!) undertaken detailed discussions with the United States in an attempt to reach agreement on ‘improved procedures to meet the Australian Government’s needs’.17

The installation of the AN/GSC-39(V)1 terminal at North West Cape was, for reasons unexplained, an inordinately lengthy process. The US Congress had been originally informed that installation of the terminal would be completed by the end of 1980.18 In October 1981, however, the Australian Minister of Defence informed Parliament that installation was then scheduled ‘to be completed in August 1982’.19 And in February 1982, during the course of public controversy about revelations concerning the installation of a US Navy Fleet Satellite Communication (FLTSATCOM) satellite ground terminal at North

16 Hansard (House of Representatives), 25 May 1978, p.2463.
17 Ibid..
West Cape, the Director of Public Information in the Department of Defence stated:

It is true that the minister told Parliament last October that the GSC-39(V)1 terminal was scheduled for installation in August 1982, but this schedule has since slipped until sometime in 1983.\(^\text{20}\)

The GSC-39 was finally declared operational on 9 July 1984.\(^\text{21}\) (Figures 76 and 77).

The Government has been characteristically uninformative about the capabilities and missions of the AN/GSC-39(V)1 terminal. The fullest statements available to the Australian public are those made by the Minister for Defence, Mr D.J. Killen, during the public controversy in May 1978. On 16 May, the Minister issued a press statement which stated, *inter alia*, that

The AN/MSC-61 terminal envisaged for installation is the follow-on replacement for the obsolescent AN/TSC-54 terminal now at Harold E. Holt station. Its installation would provide greatly improved performance, enhanced maintainability and reliability. It is envisaged to perform the same function as the existing terminal but with much improved effectiveness.

The MSC-61 would enhance the capacity of Harold E. Holt Station to carry out its present role. No changes in that role are envisaged.\(^\text{22}\)

And on 25 May 1978, the Minister stated in Parliament that the proposed MSC-61 terminal was a ‘replacement for the obsolescent TSC-54 terminal’ and that it:

(a) would not have any facilities to command the positioning of satellites;


\(^{21}\) ‘Defence Terminals’, *Hansard (Senate)*, 14 February 1986, p.402.

Source: Australian Department of Defence.
FIGURE 77
AN/GSC-39 TERMINAL AT NORTH WEST CAPE, WA

Source: Owen Wilkes and Mark Delmege.
(b) would not have any facilities to control the allocation of Satellite Communications capacity to users of the Defence Satellite Communication System; 
(c) would not have telemetry and tracking functions other than those necessary in any satellite terminals including the present TSC54 terminals to keep it own antenna pointed at the communications satellite;
(d) would - as the existing terminal - be used purely for the transmission and reception of communication traffic; and
(e) this transmission and reception would be done by the MSC61 through the US Defence Satellite Communication System of which it, like the TSC54 terminal would be part.23

These statements were not really very helpful, since the capabilities and functions of the AN/TSC-54 terminal had never been officially described; and there was no mention whatsoever of the particular DSCS satellites with which the new terminal was designed to operate, or of the capabilities and functions of these satellites. Indeed, it was only in June 1981 - more than four years after the US Congress had been informed of the MSC-61 program - that the Minister for Defence confirmed that the MSC-61 terminal at North West Cape would be 'part of the ... DSCS III' program.24

In fact, the transition from the AN/TSC-54 terminal and the Phase I DSCS program to the AN/GSC-39(V) terminal and the Phase III DSCS program represents much more than a mere 'updating' or 'technical upgrading'. Rather, it involves a quantum increase in communication capabilities, with six SHF channels instead of only one and a voice data rate capability of 32 megabits instead of only 10 kilobits.25 Moreover, the new system configuration is much more a true global network, rather than a collection of point-to-point systems, thus enabling North West Cape to be used as a relay for communications concerning military operations in the Middle East or

the Atlantic Ocean (such as the Falklands/Malvinas War) as much as for those in the western Pacific and Indian Oceans. And, further, the new system is truly tri-Service, being used for communications concerning the whole range of US military activities rather than simply naval operations.

3. The MSC-46 Terminal at Nurrungar, SA

In January 1973, the US Air Force informed the Congress that an AN/MSC-46 satellite communications terminal had been installed at the Overseas Ground Station (OGS) for the Code 647 Defense Support Program (DSP) early-warning satellite system, and that this terminal would 'enable Defense Support Program (DSP) data to be transmitted to the CONUS [Continental United States] via a Defense Satellite Communications System (DSCS) Phase II communications satellite'. Although the location of the OGS was deleted from this 1973 testimony, it was already clear from other sources that this station was the so-called Joint Defence Space Communications Station (JDSCS) at Nurrungar, SA. However, it was not until November 1981 that the Australian Government admitted, again in response to a Question on Notice, that an AN/MSC-46 terminal had in fact been installed at Nurrungar.

In October 1988, the Australian Department of Defence released photographs of Nurrungar which showed four satellite terminals (Figures 78 and 79). These were the DSP satellite control terminal, which provides the link between the DSP-E satellites and the

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27 See Desmond Ball, A Suitable Piece of Real Estate, pp.66 and 71, for references to reports in 1970-73 which identified Nurrungar as the Overseas Ground Station (OGS) for the Code 646/DSP satellite early-warning system.


FIGURE 78

US AIR FORCE DEFENSE SUPPORT PROGRAM (DSP) OVERSEAS GROUND STATION (OGS), NURRUNGAR, SA

Source: Australian Department of Defence.
FIGURE 79
US AIR FORCE DEFENSE SUPPORT PROGRAM (DSP) OVERSEAS GROUND STATION (OGS), NURRUNGAR, SA

Source: Australian Department of Defence.
ground, and which is used to transmit commands to the satellites and to receive telemetry data as well as early-warning mission data from the satellites; a smaller antenna, planned for completion in early 1989, which provides 'a back-up when the main antenna is out of service through maintenance or breakdowns'; the AN/MSC-46 DSCS terminal, which was installed in 1972; and an AN/GSC-52 DSCS terminal, which was installed in 1987-88. The MSC-46 and GSC-52 DSCS terminals are operated by the 1970th Communications Squadron of the US Air Force Headquarters Strategic Communications Division in support of the DSP early-warning activity.

The AN/MSC-46 terminal has a 12-metre (40-foot) antenna, which is housed at Nurrungar in a 95-foot radome. According to data registered with the ITU in Geneva, the DSCS II satellite used by Nurrungar is the West Pacific (WPAC) satellite, which is located in geostationary orbit above the equator at approximately 175°E longitude. The ITU was also notified in 1977 and 1978 that the frequencies to be used for transmission would be 7.939929 GHz, 8.0 GHz, and 8.040526 GHz and the frequencies used for reception would be 7.2501 GHz, 7.49867 GHz, and 7.6751 GHz.

Data received from the DSP-E satellites are transmitted by the MSC-46 either directly to Sunnyvale or Camp Roberts in California via the WPAC DSCS satellite, or to the DSCS ground station at Wahiawa in Hawaii via the WPAC DSCS satellite and thence to Camp Roberts

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via the East Pacific (EPAC) DSCS satellite.\textsuperscript{33} Until 1982, it was then sent to Buckley Field DSP Data Distribution Center (DDC) in Colorado via either leased commercial satellite or terrestrial links, and from Buckley to the NORAD Combat Operations Center and Cheyenne Mountain near Colorado Springs by the same means. However, DSCS terminals were installed in 1982 at both Buckley Field and Peterson AFB, near NORAD, to enable the DSP data to be relayed all the way from Nurrungar to both NORAD and the US Air Force Space Command headquarters at Peterson by means of DSCS satellites.\textsuperscript{34}

In the early 1980s, the MSC-46 was refurbished to operate with the DSCS III satellites, and was expected to remain operational through to the mid-1980s.\textsuperscript{35} In February 1986, in response to a Question on Notice concerning the obsolescence of the MSC-46, the Minister for Defence stated that it would be replaced in 1987 by a GSC-52 terminal.\textsuperscript{36}

4. The AN/GSC-52 DSCS Terminal at Nurrungar, SA

The AN/GSC-52 terminal, which is 38-foot in diameter and housed in a large radome, was installed at Nurrungar in 1987-88 to replace the MSC-46.


\textsuperscript{36} ‘Defence Terminals’, \textit{Hansard (Senate)}, 11 February 1986, p.77.
5. The SCT-35 DSCS Terminal at Pine Gap, Northern Territory

As described elsewhere, the satellite ground station at the Joint Defence Space Research Facility (JDSRF) at Pine Gap, near Alice Springs, NT, code-named MERINO, is operated by the US Central Intelligence Agency (CIA) as a control station for geostationary signals intelligence (SIGINT) satellites designed to monitor signals emanating from selected areas in the eastern hemisphere.37

The station became operational in 1970, and currently consists of eight satellite terminals, ranging in size from about 100-feet in diameter to eight-feet in diameter. Six of these terminals are evidently concerned directly with the tracking and stationkeeping, command and control, telemetry reception and SIGINT read-out from the SIGINT satellites themselves. (Figures 80 and 81).

In October 1981, the Minister for Defence, Mr Killen, stated in response to a Question on Notice that

There are two DSCS terminals at the Joint Defence Space Research Facility [i.e. Pine Gap]. An SCT-35 terminal was installed in 1973 and an SCT-8 terminal in 1980.38

The SCT-35 terminal is a 10-metre (35-foot) X-band antenna installed in a 55-foot radome located at the north-east of the antenna complex. It is ‘custom tailored’ to suit the communications requirements of the station.39

The SCT-35 terminal is used to communicate via DSCS satellites with the communications centre (code-named PEDAL) in Building M-4 at TRW Defense and Space Systems Group at Redondo Beach, California, and thence with CIA headquarters in Langley, Virginia (code-named PILOT). It is used to send telemetry data concerning the status of the SIGINT satellites themselves as well

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39 See Ford Aerospace and Communications Corporation, SCT-35 X-Band Earth Station.
FIGURE 80
PINE GAP, NT, MID-1985
(THE SCT-35 TERMINAL IS IN THE RADOME AT THE LEFT; THE SCT-8 TERMINAL IS IN THE SMALL RADOME THIRD FROM LEFT)
Figure 81
PINE GAP, NT, 1986
(THE SCT-8 TERMINAL IS FOURTH FROM LEFT; THE SCT-35 TERMINAL IS SEVENTH FROM LEFT)

Source: Australian Department of Defence.
as selected samples of signals intercepts to design engineers at TRW, who use this information to improve the performance of the satellites; to transmit selected time-urgent intercepts to CIA headquarters, which may need to rapidly respond to particular developments revealed through those intercepts; and for general communications with TRW and CIA headquarters - including, for example, communications concerning the scheduling of the flight of Credible Dove C-141 Starlifter and C-5A Galaxy transport aircraft to and from Alice Springs airport, bringing in equipment for the facility and collecting the tapes of intercepted signals for further processing and analysis in the US.40

6. The SCT-8 DSCS Terminal at Pine Gap, Northern Territory

The SCT-8 is an eight-foot X-band antenna housed in a radome located on the roof of the main operations and control building. Installed in 1980, it was the seventh radome to be constructed at Pine Gap.

7. Project Sparrow: The AN/FSC-78 DSCS Terminal at Watsonia Barracks, Melbourne

The decision to install a DSCS terminal at Watsonia Barracks, near Melbourne, was announced on 7 August 1979 in a press release entitled ‘Defence Intelligence Communications Capability to be Improved’:

The Minister for Defence, Mr D.J. Killen, announced today that the Government had decided to improve Australia’s capability to communicate with allies on intelligence matters.

A modern satellite communications facility would be established within the Defence complex at Watsonia, near Melbourne, at an estimated cost of $9.4m.

The facility would use the US Defense Satellite Communications System. It would be operated and

maintained entirely by the Australian Defence Forces.\textsuperscript{41}

In February 1980, it was revealed in trade magazines in Britain and the US that a contract had been awarded to Ford Aerospace and Communications Corporation, Western Development Laboratories Division in Palo Alto, California, for an AN/FSC-78 60-foot diameter X-band terminal, which was scheduled, for delivery to Watsonia by June 1981.\textsuperscript{42}

Preparatory construction work was begun almost immediately, and the antenna pedestal, which required the pouring of 213 cubic metre of concrete around 15 tonnes of reinforcing steel, was completed in late 1980.\textsuperscript{43} (Figures 82 and 83).

In August 1980, a selected group of Australian Army technicians began a 9-month course in the US on operating and maintaining the FSC-78 terminal within the DSCS program. Most of the instruction and training took place at the US Army Communications Command (USACC) SATCOM Station at Fort Meade, Maryland - known locally as ‘the Daring Duo’ because of its two large antennae; and at the headquarters and training school of the US Army Signal Corps at Fort Gordon, near Augusta, Georgia. The group returned to Australia in May 1981.\textsuperscript{44}

The FSC-78 terminal, by now known as Project SPARROW, was officially declared operational at a ceremony at Watsonia Barracks


\textsuperscript{43} ‘Project Sparrow Satellite Terminal Progress’, \textit{Signalman}, No.6, 1980, p.49.

FIGURE 82
PROJECT SPARROW AN/FSC-78 DSCS SATELLITE GROUND TERMINAL UNDER CONSTRUCTION AT WATSONIA, VICTORIA

Source: *Signalman*, No.6, 1980, p.49.
FIGURE 83
PROJECT SPARROW AN/FSC-78 DSCS SATELLITE GROUND TERMINAL UNDER CONSTRUCTION AT WATSONIA, VICTORIA

on 1 July 1981, and soon after ‘commencing passing live traffic’.45 (Figures 84 and 85).

Watsonia is the signals centre for the Australian defence communications establishment. It houses the School of Signals, 126 Signal Squadron, 2 Signal Regiment, 127 Signal Squadron, 6 Signal Regiment, and 700 Signal Troop. The FSC-78 terminal is operated by the Satellite Terminal Troop of Communications Squadron, 6 Signal Regiment.46

Project Sparrow has three primary missions. First, it provides a communications link, via the DSCS system, between the headquarters of the Defence Signals Directorate (DSD) at Victoria Barracks in Melbourne and the headquarters of the NSA at Fort Meade in Maryland.

Second, it provides a secure and rapid means of transmitting SIGINT material collected by the DSD stations in Australia to NSA headquarters for further decryption, processing and analysis. These stations are located at Shoal Bay, near Darwin, NT; Pearce RAAF Base, near Perth, WA; Cabarlah, near Toowoomba, Queensland; HMAS Harman, near Canberra, ACT; and Rockbank, Victoria, which also serves as the receiver station for Watsonia.47

In 1973, DSD commenced participation in the US Ocean Surveillance Information System (OSIS), and over the past decade its ocean surveillance capabilities have been enhanced significantly. Most particularly, PlesseyCircularly Disposed Antenna Arrays (CDAAs), designed for High Frequency Direction Finding (HF-DF) operations have been installed at Shoal Bay, Pearce and Cabarlah, while the facilities at Harman also make a limited HF-DF contribution. This ocean surveillance intelligence is also transmitted to the US via Project Sparrow.48

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FIGURE 84
PROJECT SPARROW AN/FSC-78 DSCS SATELLITE GROUND TERMINAL,
WATSONIA, VICTORIA

Source: Corporal Ken Scott, Photographic Training Section, School of Signals, Watsonia Barracks, July 1981.
FIGURE 85
PROJECT SPARROW AN/FSC-78 DSCS SATELLITE GROUND TERMINAL, WATSONIA, VICTORIA

Source: Corporal Ken Scott, Photographic Training Section, School of Signals, Watsonia Barracks, July 1981.
And, third, Project Sparrow also provides a direct satellite communications link between DSD headquarters and the joint DSD/GCHQ facilities in Hong Kong. In particular, the link operates as part of the MAROON SHIELD program for relaying selected SIGINT material - including material collected through Project KITTIWAKE, which involves the operation of a satellite ground station designed to collect telemetry from Chinese missile and satellite launches and to monitor Chinese satellite communications.49 (Figure 86).

According to the answer to a Question on Notice provided to the Senate in February 1986:

The [AN/FSC-78] terminal [at Watsonia] operates into the United States Defense Satellite Communications System (DSCS) and accesses a DSCS satellite which was launched on 21 November 1979. Its international designation is 1979-98B [i.e. DSCS 14].50

More recently, a second, 11-metre ground terminal has also been installed at Watsonia.51 It was scheduled to become operational in 1988 and, like the 60-foot FSC-78 terminal, is also intended for secure communications with the US concerning intelligence matters.

8. DSCS Terminal at Salisbury, South Australia

In 1971, the Communications and Electronic Engineering Division of the Engineering Wing at the Weapons Research Establishment (WRE) at Salisbury, SA, began to design and construct a satellite communications facility, with capabilities in both UHF and SHF bands, for experimental purposes. This facility is now formally known as the Advanced Engineering Laboratory Satellite Communications Experimental Facility. The facility achieved an initial

49 Desmond Ball, Australia’s Secret Space Programs, pp.4-6, 13-17, and 57-65.
50 ‘Satellite Data System’, Hansard (Senate), 17 February 1986, p.478.
51 Ian Mackay, ‘Defence Links Put Australia on Top’, The Age, 23 December 1987, p.11.
FIGURE 86
ARCHITECTURE OF DSCS LINKS, WATSONIA, VICTORIA
The Australian Parliament and public were first informed of the involvement of the Salisbury facility with the DSCS program in October 1981, as a result of a Question on Notice placed on 24 February 1981. This question was, once again, prompted by information which had become publicly available in the United States. On 28 February 1980, Major-General William R. Yost, Director of Space Systems and Command, Control, Communications in the US Air Force, told a meeting of the US Air Force Association in Florida that:

The satellites of the Defense Satellite Communication System provide the bulk of our military space communications capability. DSCS began with 26 [DSCS I] satellites launched into near-synchronous orbit. The first satellites were launched in 1966.... Remarkably, one of these [DSCS I] satellites is still operational and is used periodically, when within view, by Australia.

The question asked in the House in February 1981 was designed to elicit details about the connection. The Minister answered the question on 20 October 1981:


The DSCS I satellite referred to is designated satellite 93-26 [1967-03F, launched on 18 January 1967]. The satellite occupies a sub-synchronous, near equatorial orbit at an altitude of approximately 33,800 kilometers. Australia made use of the satellite for experimental, but not for operational, purposes between 1976 and 1978. The ground station at Salisbury, South Australia operated by the Advanced Engineering Laboratory of the Defence Science and Technology Organisation was used to communicate with the satellite.

... since April 1980, Australia has conducted experiments using a DSCS II satellite for research and development purposes.55

The particular DSCS satellites with which the Salisbury facility has been involved are DSCS 1-10 (1967-03C), launched on 18 January 1967; DSCS 1-13 (1967-03F), also launched on 18 January 1967 and the one still being used by the Salisbury facility at least 11 years later; and DSCS 11-7 (1977-34A), launched on 12 May 1977. In addition, the Salisbury facility has used three US Navy UHF communications satellites - Gapfiller (1976-101A), launched on 14 October 1976; FLTSATCOM 4 (1980-87A), launched on 28 October 1980 and stationed at 172°E over the western Pacific Ocean; and FLTSATCOM 2 (1979-38A), launched on 4 May 1979 and now stationed at 72.5°E over the Indian Ocean.56

The Satellite Communications Experimental Facility at Salisbury is based on equipment acquired in 1971 from the former European Launcher Development Organisation (ELDO) Down Range Guidance and Tracking Station at Gove, NT, including two precision antenna mounts (UHF and SHF), an auto-tracking system, associated tracking receivers, a control console, generating plant, and control equipment.57 The static-split tracking feed assembly and Cassegrain

56 Hansard (Senate), 19 March 1986, p.1293.
FIGURE 87
UHF AND SHF TERMINALS, SATELLITE COMMUNICATIONS EXPERIMENTAL FACILITY, SALISBURY, SA

FIGURE 88
UHF AND SHF TERMINALS, SATELLITE COMMUNICATIONS EXPERIMENTAL FACILITY, SALISBURY, SA

FIGURE 89
SHF TERMINAL, SATELLITE COMMUNICATIONS EXPERIMENTAL FACILITY, SALISBURY, SA

FIGURE 90
BLOCK DIAGRAM OF SHF TERMINAL, SATELLITE COMMUNICATIONS EXPERIMENTAL FACILITY, SALISBURY, SA

TABLE 12
TECHNICAL SPECIFICATIONS OF SHF TERMINAL, SALISBURY, SA

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna</strong></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Cassegrain</td>
</tr>
<tr>
<td>Diameter</td>
<td>4.38 metres</td>
</tr>
<tr>
<td>Feed Type</td>
<td>5 Horn Static Split</td>
</tr>
<tr>
<td><strong>Receive System</strong></td>
<td></td>
</tr>
<tr>
<td>Preamplifier Type</td>
<td>TDA or Paramp</td>
</tr>
<tr>
<td>Preamplifier Bandwidth</td>
<td>500 MHz or 200 MHz</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>7.25 to 7.75 GHz</td>
</tr>
<tr>
<td><strong>Transmit System</strong></td>
<td></td>
</tr>
<tr>
<td>No. 1 Transmitter</td>
<td></td>
</tr>
<tr>
<td>Amplifier Type</td>
<td>Klystron</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>50 MHz (1 dB)</td>
</tr>
<tr>
<td>Power Output</td>
<td>1 KW</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>7.9 to 8.4 GHz</td>
</tr>
<tr>
<td>No. 2 Transmitter</td>
<td></td>
</tr>
<tr>
<td>Amplifier Type</td>
<td>Travelling Wave Tube</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>500 MHz (3 dB)</td>
</tr>
<tr>
<td>Power Output</td>
<td>10 W</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>7.9 to 8.4 GHz</td>
</tr>
<tr>
<td><strong>Tracking</strong></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Manual or Auto-track</td>
</tr>
<tr>
<td>Overall Accuracy</td>
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<tr>
<td>Search Modes</td>
<td>Frequency and Spatial (Raster Scan)</td>
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<tr>
<td><strong>Total Performance (Nominal Values)</strong></td>
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<tr>
<td>EIRP</td>
<td>+78 dBw or +58 dBW</td>
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<tr>
<td>G/T</td>
<td>22 dB/K or 19 dB/K</td>
</tr>
<tr>
<td><strong>Baseband</strong></td>
<td></td>
</tr>
<tr>
<td>Interfaces</td>
<td>70 MHz (40 MHz bandwidth)</td>
</tr>
<tr>
<td></td>
<td>700 MHz (125 MHz bandwidth)</td>
</tr>
</tbody>
</table>
FIGURE 92
PORTABLE SHF TERMINAL DEVELOPED AT THE ADVANCED ENGINEERING LABORATORY, SALISBURY, SA

sub-reflector for the SHF antenna mount was designed and developed at Salisbury.58

The SHF terminal at Salisbury consists of a 4.38 metre diameter parabolic antenna with a five-horn static-split feed assembly and Cassegrain sub-reflector; a transmitter hut located beside the antenna mount; and a control building some 150 metres away and connected to the antenna and transmitter hut by underground cable ducts. (Figures 87, 88, 89, 90 and 91). It operates in the 7.9 to 8.4 GHz frequency range for transmission and the 7.25 to 7.75 GHz frequency range for reception. Its technical characteristics are summarised in Table 12.59

The terminal commenced operations in a receive-only mode in August 1974, receiving signals from a cooperative satellite transmitting station at the US Naval Electronics Laboratory Center in San Diego, California.60

The facility has been used to conduct a variety of experiments relating to ‘the requirements of any future satellite component in Australia’s defence communications network’. These include experiments in multiple access; interference reduction; propagation problems, including the attenuation of SHF signals by rain; and the design of man-portable satellite communication terminals for operation in conjunction with the main terminal.61 (Figure 92).

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CHAPTER 4

CONCLUSION

Australia's involvement in the DSCS program is so extensive, and the DSCS program provides such comprehensive satellite communication capabilities, that Australia is inevitably involved in supporting a wide range of US military and intelligence operations.

The DSCS terminal at North West Cape commits Australia to involvement in US military operations - including those of US strategic and tactical nuclear forces as well as those of US conventional forces. With respect to operations involving US strategic nuclear (i.e. SIOP) forces, the satellite terminal provides one of some two or three means whereby North West Cape receives command and control signals from US military headquarters in Honolulu and Washington for re-broadcast to these forces - either directly, as in the case of signals retransmitted on VLF to US Fleet Ballistic Missile (FBM) submarines; or indirectly, by relaying the signals to other communication stations around the world for subsequent dissemination to the SIOP forces. These signals would include messages concerning the alert status of the SIOP forces and, in wartime, Emergency Action Messages (EAMs) directing the launch of these forces.

With the disbandment of the 15th Submarine Squadron at Guam and the cessation of FBM submarine patrols in the south and west Pacific Ocean in 1981, the direct connection between North West Cape and the US strategic nuclear forces was much reduced. However, the indirect connections remain extremely extensive. North West Cape would be involved, through the DSCS III system, in the dissemination of signals to increase the alert status or Defense Condition (DEFCON) of SIOP forces in any crisis or of EAMs to the SIOP forces in any nuclear war, regardless of whether that crisis or war occurred in the Indo-Pacific region or elsewhere around the world.

With respect to US conventional military operations, the satellite terminal at North West Cape provides a direct communications link from US military headquarters and Honolulu or Washington with forces in the western Pacific or Indian Oceans. Indeed, it must be expected that any US military operation in this region - whether involving vessels of the Seventh Fleet, aircraft based
at Anderson AFB in Guam or Clark AFB in the Philippines, or the activities of the Rapid Deployment Force (RDF) in the Indian Ocean or Persian Gulf - would involve utilisation of the satellite communication facilities at North West Cape.

Australia has no way of monitoring the content of signals transmitted through these facilities to the US nuclear and/or conventional forces - and hence of ascertaining the military activities which it is supporting. As noted above, the AN/TSC-54 terminal at North West Cape was used in October 1973, during the Yom Kippur War in the Middle East, to communicate the general US nuclear alert of 25 October to US military forces in the Western Pacific and Indian Oceans, without the Australian Government having been informed or consulted. As a result, the 1963 Agreement with the United States concerning North West Cape was renegotiated in January 1974 to ‘ensure that the Australian Government was kept fully informed of U.S. policy as circumstances developed’. However, Australia was unable to gain access to the actual content of the US signal traffic through the station. As Mr Barnard announced on 10 January 1974, at the conclusion of the negotiations in Washington,

The prospect of introducing a system whereby Australia could monitor particular messages had been investigated.

However, the station is a relay station and such intervention would be impracticable.

In 1978, Mr Bill Hayden, then the Leader of the Opposition, was briefed by officers of the Department of Defence on the arrangements for monitoring US signal traffic through North West Cape, and concluded that they were unsatisfactory. As he stated in a letter to the Minister for Defence, Mr Killen, on 25 May 1978,

In response to my questioning it was made clear by your Department officers that they were not aware of

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the nature of communications passing through North West Cape. It appears there is no overview of monitoring of U.S. communication traffic. That means simply that the Government is totally dependent on U.S. advice as to the nature of these communications. ... [T]he arrangement seems quite undesirable for it means that Australian authorities are blanketed out from any overview of what is transmitted through North West Cape by U.S. authorities.  

And in April 1981, following further briefings and a visit to the North West Cape station, Mr Hayden stated:

The fact is that key US communications from North West Cape cannot be monitored nor controlled by those Australians working there. Even the Americans at the station are unable to do this.

Key messages are relayed in code through North West Cape from US command centres elsewhere in the world. They are unintelligible to local US staff even if they wished to monitor their contents.

The most dramatic illustration of the use to which North West Cape could be put is the obvious one of relaying an order for a nuclear attack.

At a lower level, it could be a series of commands directing offensive military operations in an area, and of a nature, that compromised out national interest.

... Australia has a sovereign right to be in ultimate control of affairs on her own territory. In these circumstances, we find present arrangements covering North West Cape unsatisfactory.

We would seek to re-negotiate the North West Cape Agreement to provide: first, that Australia’s consent is mandatory for all orders to initiate military action which flows from the station; and second, that

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we be given firm and convincing assurances the station will not be used to send orders for a first strike nuclear attack nor to initiate a limited strike.

If the United States would not accept these reasonable provisions designed to protect our national sovereignty, then we would ask them to wind down the operations of North West Cape as rapidly as possible.4

The DSCS terminals at Pine Gap, Nurrungar, and Watsonia have to be assessed on a different basis to those at North West Cape. To begin with, they do not function as part of the general US defence communications system but, rather, serve much more particular purposes - supporting the satellite SIGINT and satellite early-warning operations at Pine Gap and Nurrungar respectively, and supporting the exchange of intelligence material between Australian and US agencies in the case of the Watsonia terminal. Hence, the implications of these terminals for Australian security and sovereignty derive from these more particular activities. If it is considered that it is in Australia's interests to cooperate in the collection of early-warning intelligence, SIGINT, and ocean surveillance information, then there can be no objection to satellite communications facilities designed to enhance the efficiency of these cooperative activities.

In the case of the DSCS terminals at Pine Gap, Nurrungar and Watsonia, it is also possible to delineate the parameters of Australian access to the content of the signal traffic. At both Pine Gap and Nurrungar there are national US cypher and communication rooms to which Australians are not admitted, but Australians have full access to the DSCS terminals and the operational areas at both facilities. Hence, unlike the situation at North West Cape, the operational substance of communications passing through the DSCS terminals at Pine Gap and Nurrungar, if not the content of 'administrative' signals designated for US authorities at the stations, would be known to Australian personnel.

In the case of Watsonia, the DSCS terminals are ‘operated and maintained entirely by the Australian Defence Force’. However, the system is used for communications between the Special US Liaison Office (SUSLO) at DSD headquarters at Victoria Barracks and NSA headquarters at Fort Meade, Maryland, as well as for communications between DSD headquarters and Australian liaison officers at Fort Meade and other US agencies in the Washington area. The content of NSA/SUSLO communications would not necessarily be known to Australian authorities.

The purpose of the satellite communications terminal at the Advanced Engineering Laboratory at Salisbury, South Australia, is entirely experimental. The facility was designed and developed by Australian defence engineers, is operated and maintained entirely by Australian personnel, and the experiments in which it is engaged are concerned with the possibility of incorporating satellite communications in Australia’s future defence communications network. This activity should be further encouraged.

Perhaps the most disturbing feature of Australia’s involvement in the DSCS program is the manner in which the Australian public has been appraised of this involvement. In only one instance - that of the FSC-78 terminal at Watsonia - was the Australian public informed before the relevant developments were disclosed in the United States. In the case of the TSC-54 terminals at North West Cape, the MSC-46 terminal at Nurrungar and the SCT-35 and SCT-8 terminals at Pine Gap, the terminals had been operational for periods from 18 months to 8 years before the Australian public was informed - and even then, the Australian Government only acknowledged these installations in response to Questions asked in Parliament or to public controversies following disclosures in the US. In the case of the MSC-61 (GSC-39) terminal at North West Cape, the Government itself was still unaware of the proposed installation some 15 months after the US Congress had been informed. And in the case of the use of DSCS I satellites by the station at Salisbury, a private body - the US Air Force Association - was told of the involvement 18 months before the Australian parliament and the Australian public!

The explanation which the Government has proffered for this state of affairs is quite illuminating. In February 1981, the Minister for Defence was asked in a Question on Notice:

Is he able to state whether it is general practice for the US Congress and private bodies such as the US Air Force Association to be informed of operational details and developments with respect to the DSCS system before Members of the Australian Parliament and the Australian public.\(^6\)

On 20 October 1981, the Minister provided the following answer:

As the DSCS system is a US system it is natural that operational details and developments with respect to the system should be made publicly available when the US so desires.\(^7\)

Given Australia's extensive involvement in the DSCS program, the fact that US military operations supported by DSCS terminals in Australia might not necessarily be supported by Australia and might not even be in Australia's national interests, and the likelihood that at least some of the terminals would be targeted in the event of any nuclear exchange, this explanation is clearly most unsatisfactory.

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\(^6\) Hansard (House of Representatives), 20 October 1981, p.2254.

\(^7\) Ibid., p.2255.
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There are currently installed in Australia eight satellite ground terminals that operate either as integral parts of or in connection with the US Defense Satellite Communications System (DSCS). One of these is at North West Cape, Western Australia; two are at Nurrungar, South Australia; two are at Pine Gap, Northern Territory; one is at the Weapons Research Establishment (WRE), Salisbury, South Australia; and two are at Watsonia Barracks in Melbourne. Despite the critical importance of this satellite system to US global military and intelligence operations, and the fact that Australian involvement in the system began more than two decades ago, there remains in Australia no public description of this system nor any discussion of the implications of Australia’s involvement in it for various aspects of Australia’s national security.

This monograph describes the US Defense Satellite Communications System (DSCS) and its various missions and discusses Australia’s role in the system. It concludes that Australia has had insufficient control over the DSCS deployments and operations in this country; that the Australian Government has been remiss in informing the public about the extent of Australia’s role in the DSCS system and the implications of this involvement; and that Australia should take advantage of the DSCS facilities to support our own defence communications requirements.