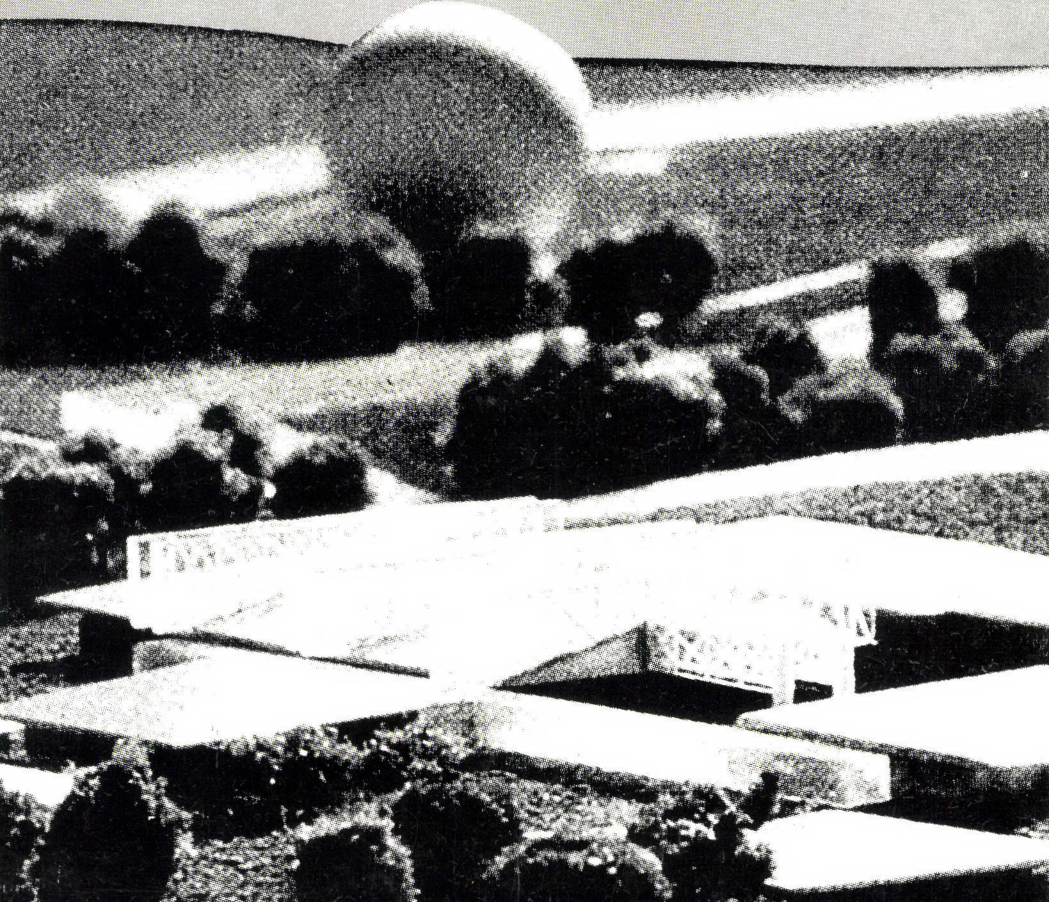
Canberra Papers on Strategy and Defence No.43

Australia's Secret Space Programs

by Desmond Ball



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Desmond Ball

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ABSTRACT

Australia's largest single space activity involves the Defence Signals Directorate (DSD) of the Department of Defence, and concerns the interception of satellite signals. DSD currently maintains satellite signals intelligence (SIGINT) facilities at Stanley Fort in Hong Kong and Shoal Bay near Darwin, and a third station is under construction at Kojarena, near Geraldton, Western Australia. A satellite facility for intelligence communications is also maintained at Watsonia Barracks, Victoria. This monograph describes these facilities and the satellites with which they are concerned. It concludes that DSD's expansion into satellite SIGINT operations requires oversight to ensure that there is no reduction in the overall effectiveness of the Directorate.

The monograph also includes a Note on the proposed New Zealand satellite SIGINT facility at Waihopai, near Blenheim, and cooperation between this facility and the DSD operations.

Professor Desmond Ball is Head of the Strategic and Defence Studies Centre at the Australian National University, Canberra. He has previously been a Lecturer in International Relations and Military Politics in the Department of Government at the University of Sydney, a Research Fellow in the Center for International Affairs at Harvard University, and a Research Associate at the International Institute for Strategic Studies in London. He is the author of more than 120 academic monographs and articles on nuclear strategy, nuclear weapons, national security decision-making, and Australia's defence policy. His major books include *Politics and Force Levels: The Strategic Missile Program of the Kennedy Administration* (University of California Press, Berkeley, 1980), *A Suitable Piece of Real Estate: American Installations in Australia* (Hale & Iremonger, Sydney, 1980), *A Base for Debate: The US Satellite Station at Nurrungar* (Allen & Unwin, Sydney, London and Boston, 1987), and *Pine Gap: Australia and the US Geostationary Signals Intelligence Satellite Program* (Allen & Unwin, Sydney, 1988). He is the co-author of *The Ties That Bind: Intelligence Cooperation Between the UKUSA Countries* (George Allen & Unwin, Sydney, London and Boston, 1985); co-author of *Defend the North: The Case for the Alice Springs-Darwin Railway* (George Allen & Unwin, Sydney 1985); co-author of *Crisis Stability and Nuclear War*, (American Academy of Arts and Sciences, and Cornell University Peace Studies Program, Ithaca, New York, 1987); editor of *The ANZAC Connection* (George Allen & Unwin, Sydney, 1985); editor of *Strategy & Defence: Australian Essays* (George Allen & Unwin, Sydney, 1982); editor of *The Future of Tactical Air Power in the Defence of Australia* (Australian National University, Canberra, 1976); co-editor of *Problems of Mobilisation in the Defence of Australia* (Phoenix Defence Publications, Canberra, 1980); co-editor of *Strategic Nuclear Targeting* (Cornell University Press, Ithaca, New York, 1986); co-editor of *A Vulnerable Country? Civil Resources in the Defence of Australia* (Australian National University Press, Canberra, 1986); co-editor of *The Future of Arms Control* (Australian National University Press, Sydney, 1986); and co-editor of *Civil Defence and Australia's Security in the Nuclear Age* (Strategic and Defence Studies Centre, Australian National University, Canberra, and George Allen & Unwin Australia Ltd., Sydney, 1983).

Canberra Papers on Strategy and Defence are a series of monograph publications which arise out of the work of the Strategic and Defence Studies Centre, Research School of Pacific Studies, The Australian National University. Previous *Canberra Papers* have covered topics such as the relationship of the superpowers, arms control at both the superpower and South-east Asian regional level, regional strategic relationships and major aspects of Australian defence policy. For a complete list refer to the last pages of this volume.

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

INTRODUCTION

The Defence Signals Directorate (DSD) is Australia's largest and most effective intelligence organisation.[1] The official description of DSD's general function is as follows:

> The Defence Signals Directorate is an organisation concerned with radio, radar and other electronic emissions from the standpoint both of the information and intelligence that they can provide and of the security of our own Government communications and electronic emissions.[2]

DSD has about 1,150 personnel, of whom about 350 work at the headquarters in Victoria Barracks in Melbourne. Signals intelligence (SIGINT) is collected by a variety of means, including large fixed high frequency (HF) arrays, mobile HF and very high frequency (VHF) systems, VHF and microwave intercept systems installed in several Australian Embassies in this region, and satellite communications (SATCOM) monitoring stations - two of which have been operating in Hong Kong (Project KITTIWAKE) and at Shoal Bay near Darwin (Project LARSWOOD) for nearly a decade, and the construction of a third is about to begin at Kojarena near Geraldton, W.A.. The three SATCOM monitoring stations will employ some 230 personnel, making DSD the largest single Australian governmental agency involved in space activities.

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1 For a more comprehensive discussion of DSD and its activities, see Jeffrey T. Richelson and Desmond Ball, *The Ties That Bind: Intelligence Cooperation Between the UKUSA Countries - the United Kingdom, the United States of America, Canada, Australia and New Zealand*, (George Allen & Unwin, Sydney, London and Boston, 1985), pp.36-42, 190-193, and 208-209.

2 *Hansard (House of Representatives)*, 25 October 1977, p.2339.

The history of DSD can be traced back to 1939-40, when three signals intercept stations were established - HMAS Harman, near Canberra; Coonawarra, near Darwin; and at Park Orchards in Melbourne.[3] A small cryptographic or 'special intelligence' organisation began operation in early 1940, and the establishment of a Special Intelligence Organisation was formally approved by the Defence Committee on 28 November 1941. This capability was greatly expanded during the Second World War. The number of signals intercept stations was increased to more than two dozen and a variety of new SIGINT and cryptographic organisations were established, the most important of which was Central Bureau, which was set up on 15 April 1942.[4] Central Bureau was officially disbanded in late 1945, but the capability was retained. According to Lieutenant Colonel A.W. Sandford, who was Assistant Director of Central Bureau, in a letter dated 16 November 1945,

> the affairs of this Unit are being wound up very satisfactorily... I am going to Melbourne in the near future to assist in the formation of the post-war organisation.[5]

Initially called the Defence Signals Bureau (DSB), it later became the Defence Signals Division (DSD). In October 1977, the Prime Minister disclosed that it was to be restyled as the Defence Signals Directorate 'in recognition of the enhanced status that the Royal Commission [on Intelligence and Security] recommends should be accorded to the agency'.[6]

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3 Commander J.B. Newman, 'Memorandum for Discussion at Singapore', (October 1940), Australian Archives Accession No. MP1185/8, File MP 1937/2/415. See also Ross Andrews, 'How Harman Got Its Name', *Canberra Times,* 21 April 1979, p.2; and '6 Signal Regiment', *Signalman,* No.5, 1980, p.19.

4 See Desmond Ball, *A Suitable Piece of Real Estate: American Installations in Australia,* (Hale and Iremonger, Sydney, 1979), pp.31-32, and p.153, note 7.

5 Letter from Lt.-Col. A.W. Sandford to General Berryman, 16 November 1945, in Berryman Papers, Personal Correspondence File, Australian War Memorial.

6 *Hansard (House of Representatives)*, 25 October 1977, p.2339.

The locations of the DSD stations have long been a matter of public record. The Directorate operates five major stations in Australia.[7] HMAS Harman, the only one remaining of the three stations originally established in 1939-40, is the smallest of these. Its equipment is obsolete, and plans are currently in preparation for its relocation somewhat further out of Canberra in the mid-1990s. Harman's principal mission is the interception of diplomatic traffic to and from foreign embassies in Canberra, although it is also involved in monitoring transmissions emanating from Southeast Asia. The station operates closely with Darwin on this - often being able to intercept transmissions that either skip over or are too weak to be monitored at Darwin. There is also an Adcock direction finding (DF) system at Harman for limited ocean surveillance activity.[8]

The station at Pearce Air Force Base, outside Perth, has been run by the Royal Australian Air Force's No.3 Telecommunications Unit since 1946. Its primary purpose is monitoring naval and air traffic over the Indian Ocean. The HF interception and direction finding (DF) capability at Pearce was upgraded in the mid 1970s with the installation of a Plessey Circularly-Disposed Antenna Array (CDAA), code-named PUSHER, which is designed for the interception, monitoring, direction finding and analysis of radio signals in the HF band from 1.5 to 30 MHz.[9]

The station at Cabarlah, near Toowoomba, Queensland, commenced operations on 3 February 1947 under 101 Wireless Regiment, which was redesignated 7 Signal Regiment on 22 December 1964.[10] Its primary mission is to monitor HF radio transmissions throughout the Southwest Pacific. As with the station at Pearce, the Cabarlah facility was upgraded in the mid-1970s with a Plessey CDAA for HF DF operations.[11]

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7 Richelson and Ball, *The Ties That Bind*, pp.39-40, 190-193, and 208-209.

8 Ball, *A Suitable Piece of Real Estate*, pp.42-4; 'Embassies Messages Taped', *Nation Review*, 20-26 April 1978, p.4.

9 *Ibid.*, p.192, 208-209.

10 'A Short History of the Seventh Signal Regiment and Borneo Barracks, Cabarlah', *Signalman*, Vol.1, No.2, 1978, p.62.

11 Richelson and Ball, *The Ties That Bind*, pp.192, 209.

The station at Shoal Bay, near Darwin, is run jointly by the Royal Australian Navy (RAN) and Darwin Detachment of 7 Signal Regiment (71 Signal Squadron). It is primarily responsible for monitoring transmissions throughout Southeast Asia, and is currently manned by some 200 personnel. The facility achieved an initial operational capability (IOC) in 1974,[12] replacing the Coonawarra station which had been operational since 18 September 1939 but which had been suffering an 'increasing level of electrical interference ... due to the growth of Darwin',[13] as well as a station at Singapore which had been operated by DSD until 1974.[14] The Shoal Bay station is equipped with a Plessey CDAA HF DF system which became operational in 1977, and a SATCOM monitoring capability, code-named LARSWOOD, which became operational in late 1979.

The station at Watsonia Barracks, northeast of Melbourne, was established in 1960 and is a direct descendant of the original Park Orchards station.[15] Watsonia is the site of a satellite communications terminal, designated Project SPARROW, which was officially declared

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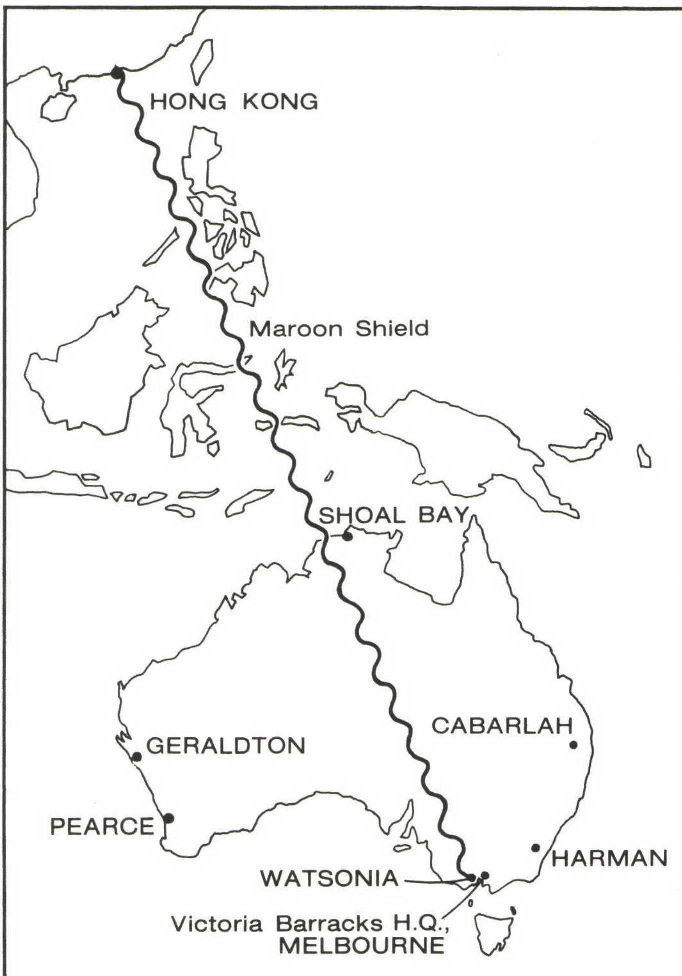
12 'New Shoal Bay Radio Base Ready This Year', *Northern Territory News*, 3 March 1973, p.4; 'Radio Station "Not for Spying"', *Northern Territory News*, 12 December 1973, p.3; 'RAN Ban on Shoal Landing', *Northern Territory News*, 14 December 1973, p.1; 'Move Begins on Beach Access', *Northern Territory News*, 19 December 1973, p.7; Joy Hooper, 'Beach Road Open to Some', *Northern Territory News*, 20 December 1973, p.5; and interviews with Shoal Bay personnel, June 1982.

13 R.N. Thompson (Director DSD), 'SIGINT Presence in Singapore and New Station at Darwin', (Memorandum to the Secretary, Department of Defence, 23 February, 1973).

14 *Ibid.*. See also for press references to the relocation of DSD personnel from Singapore to Darwin, Frank Cranston, 'Singapore "Aware" of Signals Base', *Canberra Times*, 15 February 1973, p.1; 'Top Two Slug it Out on Singapore "Spy" Unit', *Northern Territory News*, 16 February 1973, p.1; 'We Have to Stay in Singapore - Forbes', *The Australian*, 17 February 1973, p.2; and Allan Barnes, 'Whitlam Gets Two Birds With One Stone', *The Age*, 17 February 1973, p.15.

15 '6 Signal Regiment', *Signalman*, No.5, 1980, pp.19-20.

FIGURE 1
DSD STATIONS



operational on 1 July 1981[16] and which provides direct and secure communications between DSD headquarters in Melbourne and the headquarters of the US National Security Agency (NSA) at Fort Meade, Maryland, as well as with the DSD operations in Hong Kong.[17]

Hong Kong is the location of DSD's most important overseas facilities.[18] Originally established in 1949, in cooperation with the British Government Communications Headquarters (GCHQ), the joint DSD-GCHQ facilities now include HF receiving systems at Sek Kong and Tai Mo Shan in the New Territories[19] and the Stanley Fort Satellite Station on the south coast of Hong Kong Island.[20]

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16 *Ibid.*, p.22; 'Project Sparrow Satellite Terminal Progress', *Signalman*, No.6, 1980, p.49; 'Official Opening and Handover of the Watsonia Satellite [Terminal]', *Signalman*, No.8, 1981, p.31.

17 Richelson and Ball, *The Ties That Bind*, pp.40, 191-192.

18 For background on DSD's Hong Kong operations, see Hugh Armfield, 'We Spy in Hong Kong, Too', *The Age*, 16 February 1973, p.5; 'Why Australians Know Less Than The Chinese', *The National Times*, 25 February 1974, pp.8-9; and Richelson and Ball, *The Ties That Bind*, pp.40-190.

19 *Ibid.*. See also, on the Sek Kong and Tai Mo Shan facilities, John Lombard, 'More Facts About Our Spooks', *Nation Review*, 9-15 December 1976, p.171; Paul Cheung, 'Army to Expand "Spy Centre"', *Hong Kong Standard*, 14 May 1975; 'Hong Kong's Spy Radio Moves South', *Defense Electronics*, March 1982, p.30; and 'Regimental Partnership - Queen's Gurkha Signals and 6 Signal Regiment', *Signalman*, No.12, 1984, pp.42-43.

20 Duncan Campbell, 'GCHQ's Lost Secrets', *New Statesman*, 5 November 1982, p.5.

CHAPTER 2

PROJECT KITTIWAKE, HONG KONG

The Stanley Fort Satellite Station, code-named Project KITTIWAKE, was built by GCHQ and the Royal Air Force (RAF) in 1977.[1] DSD's participation in the project was also approved in 1977, at which time it was also agreed that the SIGINT collected at the station would be transmitted from Hong Kong via a special satellite link to a satellite terminal to be constructed at Watsonia, Melbourne.[2] The Stanley Fort Satellite Station has three large satellite terminals, two of which are dedicated to the SIGINT collection mission and the other responsible for the link with Watsonia.[3] (See Figures 2 and 3.)

Project Kittiwake is a 'state of the art' signals intercept operation designed to monitor communications from Chinese satellite communications and telemetry from Chinese nuclear weapon, missile and satellite test activities.[4] The particular intelligence collected at the Stanley Fort Satellite Station includes:

1. Telemetry from Chinese strategic ballistic missile tests. The two principal IRBM and ICBM test ranges are the Shuang Cheng Tzu Missile Range (SCTMR), also known as the Jiuquan launch site, located near 41°N, 100°E in the Gobi Desert some 1,500 km west of Beijing, and a 'site southwest of Beijing [which] has been used

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1 Duncan Campbell, 'GCHQ's Lost Secrets', *New Statesman*, 5 November 1982, p.5. The code-name KITTIWAKE is cited in Brian Toohey, 'The AUSTEO Papers. Part 3: Listening in on Pierre in Paris', *The National Times*, 6-12 May 1983, p.6; and Brian Toohey and Marian Wilkinson, *The Book of Leaks: Exposes in Defence of the Public's Right to Know*, (Angus and Robertson Publishers, Sydney, 1987), pp.137-138.

2 *Ibid.*, p.137.

3 Personal observation, June 1983.

4 Duncan Campbell, 'GCHQ's Lost Secrets', *New Statesman*, 5 November 1982, p.5.

FIGURE 2
STANLEY FORT SATELLITE STATION, HONG KONG

FIGURE 3
STANLEY FORT SATELLITE STATION, HONG KONG

for years for ballistic missile tests' - including tests of the DF-5 or CSS-X-4 ICBM.[5]

2. Telemetry from Chinese satellite launches.[6] China has launched 21 satellites - 18 from the Shuang Cheng Tzu site and, since 1984, three from Xichang, located in a mountain canyon some 1,300 km south of Shuang Cheng Tzu and 280 km east of the Burmese border in Sechuan province. The Shuang Cheng Tzu site has been used for eight successful launches of non-recoverable satellites by the FB-1 launch vehicle and 10 successful recoverable satellites by the CZ-2 launch vehicle.[7] (See Table 1.) These latter satellites, which typically return a 1,850 kg film capsule to earth after five days and then re-enter themselves after a further 10 days, generally transmit FM telemetry at a frequency of 393.675 MHz as well as a CW beacon at 179.985 and 479.970 MHz.[8]

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5 Craig Covault, 'Chinese Expand Launch Facilities to Attract Satellite Customers', *Aviation Week and Space Technology*, 13 July 1987, pp.120-126; and Craig Covault, 'Third Chinese Launch Pad Signals Aerospace Growth in Pacific Basin', *Aviation Week and Space Technology*, 15 June 1987, p.66.

6 The most useful recent discussions of the Chinese satellite program are Nicholas L. Johnson, *The Soviet Year in Space 1984*, (Teledyne Brown Engineering, Colorado Springs, Colorado, January 1985), Appendix C ('Chinese Space Programs'), pp.68-74; and Phillip S. Clark, 'China's Long March Into Space', in Tina D. Thompson (ed.), *TRW Space Log 1986*, (TRW Electronics and Defense Sector, Redondo Beach, California, 1987), pp.26-35.

7 *Ibid.*; 'China Orbits Satellite With French Payload', *Aviation Week and Space Technology*, 10 August 1987, p.21; and 'Long March 2 Launches Recoverable Spacecraft', *Aviation Week and Space Technology*, 14 September 1987, p.35. Details of Chinese satellites launched through 1986 (i.e. China-1 to China-19) are derived from Royal Aircraft Establishment (RAE), *The RAE Table of Earth Satellites 1957-1986*, (Macmillan Publishers, London, 1987).

8 Nicholas L. Johnson, *The Soviet Year in Space 1986*, (Teledyne Brown Engineering, Colorado Springs, Colorado, 1987), Appendix D ('Frequencies Used by Soviet- And Chinese-Launched Satellites in 1986 as Monitored by the Kettering Group'), pp.97-99.

TABLE 1: CHINESE SATELLITE LAUNCHES

Name and Designation	Launch Date	Launch Site	Launch Vehicle	Shape and Weight (kg)	Size (metres)	Perigee (km)	Apogee (km)	Period (mins)	Inclination (degrees)	Comments
1. China-1 SKW-1 (1970-34A)	24 April 1970	Shuang Cheng Tzu	CZ-1	Spheroid 173	1 dia.	441	2386	114.09	68.44	First successful Chinese satellite launch. SKW-1 (Shiyan Kexuedi Weixing: Space Physics Experiment). Later named Tungfanghung. Transmitted 'The East is Red' as well as housekeeping telemetry.
2. China-2 SKW-2 (1971-18A)	3 March 1971	Shuang Cheng Tzu	CZ-1	Spheroid 221	1 dia	262	1622	103.88	69.89	Second successful Chinese satellite. Also known as SKW-2. Decayed on 17 June 1979.
3. China-3 SKW-3 (1975-70A)	26 July 1975	Shuang Cheng Tzu	FB-1	3500	-	184	461	90.98	69.02	Decayed 14 September, 1975.
4. China-4 SKW-4 (1975-111A)	26 Nov 1975	Shuang Cheng Tzu	CZ-2	- 3500	-	179	479	91.09	62.95	Capsule was successfully recovered on 2 December 1975. Satellite decayed on 29 December 1975.
5. China-5 SKW-5 (1975-119A)	16 Dec 1975	Shuang Cheng Tzu	FB-1	- 3500	-	186	387	90.26	69.00	Decayed 27 January 1976.
6. China-6 SKW-6 (1976-87A)	30 August 1976	Shuang Cheng Tzu	FB-1	Spheroid 270	1.25dia	195	2145	108.77	69.16	Electronic Intelligence (ELINT) Ferret satellite. Decayed 25 November 1978.
7. China-7 SKW-7 (1976-117A)	7 December 1976	Shuang Cheng Tzu	CZ-2	Cylinder 3600	-	174	469	91.00	59.45	Photographic reconnaissance satellite. Capsule returned to earth on 9 or 10 December 1976. Satellite decayed 2 January 1977.
8. China-8 SKW-8 (1978-11A)	26 January 1978	Shuang Cheng Tzu	CZ-2	Cylinder 3600	-	161	479	90.90	57.03	Photographic reconnaissance satellite. Capsule returned to Earth on 30 January 1978. Satellite decayed 7 February 1978.
9. China-9	19 September 1981	Shuang Cheng Tzu	FB-1							China-9 placed three scientific satellites into eccentric orbits. One of the payloads, SKW-9A (1981-93A) was a metal sphere attached to a balloon; it rapidly decayed. The other payloads, SKW-9B (1981-93B) and SKW-9C (1981-93C) studied the earth's atmosphere, magnetic field, energetic particles and various parts of the electromagnetic spectrum.
SKW-9A (1981-93A)				Balloon and Sphere	1.2 dia 0.75dia	232	1598	103.27	59.47	
SKW-9B (1981-93B)				Truncated cone	1.65 high 0.65 to 1.65 dia	235	1615	103.49	59.47	
SKW-9C (1981-93C)				Octagonal prism and 4 vanes	1.1 high 1.2 max dia	234	1610	103.42	59.46	

TABLE 1 (CONTINUED)

	Name and Designation	Launch Date	Launch Site	Launch Vehicle	Shape and Weight (kg)	Size (metres)	Perigee (km)	Apogee (km)	Period (mins)	Inclination (degrees)	Comments
10.	China-12 SKW-10 (1982-90A)	9 September 1982	Shuang Cheng Tzu	CZ-2	Cylinder 3600	-	174	385	90.08	62.98	Capsule returned to Earth on 14 September 1982. Satellite decayed on 21 September 1982.
11.	China-13 (SKW-11) (1983-86A)	19 August 1983	Shuang Cheng Tzu	CZ-2	Cylinder 3600	-	173	382	90.05	63.31	Hemispherical capsule, with weight 1850 kg and radius 0.7m, returned to Earth on 24 August 1983. Satlellite decayed on 3 September 1983.
12.	China-14 STW- (1984-8A)	29 January 1984	Xichang	CZ-3	Cylinder 900 full 420 empty	2.4 long 2.0 dia	362	6481	160.70	36.03	Communications satellite. First launch from new site at Xichang, Sechuan Province (28.1°N; 102.3°E), using CZ-3 or Long March 3 rocket. Failed to place the payload into a geostationary transfer orbit.
13	China-15 STW-1 (1984-35A)	8 April 1984	Xichang	CZ-3	Cylinder 900 full 420 empty	2.4 long 2.0 dia	35520	36382	1444.55	0.72	First successful Chinese geostationary satellite launch. Experimental/developmental TV/communications satellite. Stationed at 125°E longitude.
14.	China-16 SKW-12 (1984-98A)	12 Sep 1984	Shuang Cheng Tzu	CZ-2	Cylinder 3600	-	175	399	90.24	67.94	Photographic reconnaissance satellite. Hemispherical capsule, weight 1850 kg and radius 0.7 m, returned to Earth on 17 September 1984. Satellite decayed 29 September 1974.
15.	China-17 SKW-13 (1985-96A)	21 October 1985	Shuang Cheng Tzu	CZ-2	Frustum and hemisphere	2.95 long 1.4 to 2.25 dia	171	386	90.08	62.98	Hemispherical capsule, weight 1850 kg and radius 0.7 m, returned to Earth 26 October 1985. Satellite decayed 7 November 1985.
16.	China-18 STW-2 (1986-10A)	1 February 1986	Xichang	CZ-3	Cylinder 900 full 420 empty	2.4 long 2.0 dia	35778	35790	1435.87	0.10	Domestic communications satellite. Stationed at 103°E longitude.
17.	China-19 SKW-14 (1986-76A)	6 October 1986	Shuang Cheng Tzu	CZ-2	Frustum and hemisphere	1.55 long 1.4 to 2.25 dia	172	387	90.07	56.96	Photographic reconnaissance satellite. Hemispherical film capsule, weight 1850 kg and radius 0.7 m, returned to Earth on 11 October 1986. Satellite transmitted until 14 October 1986. Satellite decayed 23 October 1986.
18.	China-20	5 August 1987	Shuang Cheng Tzu	CZ-2	-	-	172	397	-	-	Carried a French Matra experimental payload. Recovered about 10 August 1987.
19.	China-21	9 September 1987	Shuang Cheng Tzu	CZ-2	-	-	204	311	-	63	Recoverable photographic reconnaissance satellite.

The Xichang launch facility was initially built to launch communications satellites into geostationary orbit with the CZ-3 launch vehicle. In addition to the Xichang Command and Control Centre itself, which is located about 3 km from the CZ-3 launch pad and which has 'optical, radar and telemetry tracking responsibilities', there are two downrange telemetry and tracking control stations - at Yibin and Shamen - on the southeast coast.[9] (See Figures 4 and 5.)

(In addition to the satellite launch facilities at Shuang Cheng Tzu and Xichang, a third site - the ballistic missile test site southwest of Beijing - has recently been upgraded with new pad support facilities for launch of polar orbit satellite missions such as reconnaissance, Earth resources and weather satellites.[10] This will require the construction of additional satellite launch telemetry facilities.)

3. Mission data from Chinese intelligence satellites. The Chinese intelligence satellite program includes both electronic intelligence (ELINT) or Ferret satellites and photographic intelligence (PHOTINT) satellites. These satellites downlink mission data to a 7-station tracking, telemetry and control network, with the central station at Weinan, some 830 km southwest of Beijing.[11]

4. Chinese satellite communications. China has successfully launched two geostationary satellites for domestic telecommunications - China-15 (1984-35A), stationed at 125°E longitude; and China-18 (1986-10A), stationed at 103°E longitude. The downlink frequency is 4 GHz.[12]

Communications between the Stanley Fort Satellite Station and the Watsonia satellite terminal are transmitted via an intelligence communica-

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9 Craig Covault, 'Chinese Expand Launch Facilities to Attract Satellite Customers', *Aviation Week and Space Technology*, 13 July 1986, pp.120-126.

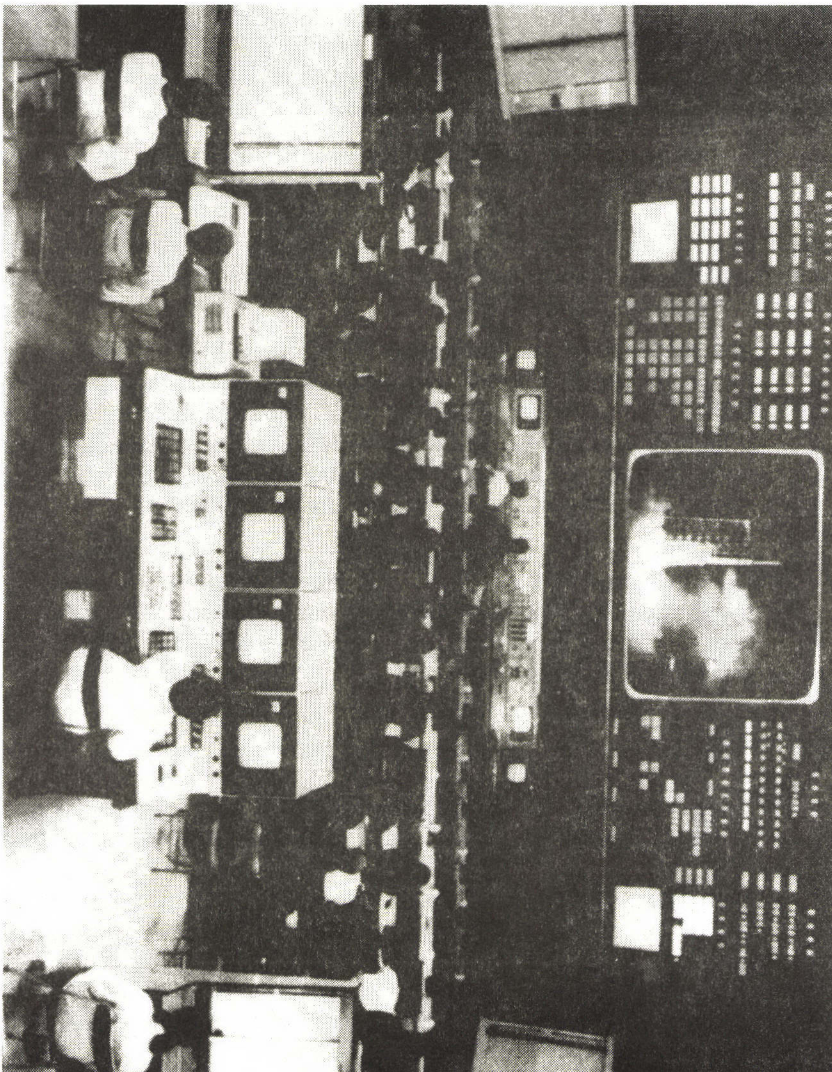
10 Craig Covault, 'Third Chinese Launch Pad Signals Aerospace Growth in Pacific Basin', *Aviation Week and Space Technology*, 15 June 1987, p.66.

11 Jim Bussert, 'China's C^3I Efforts Show Progress', in Fred D. Byers (Editorial Director), *The C^3I Handbook*, (EW Communications, Inc., Palo Alto, California, 1st Edition, 1986), p.178.

12 Nicholas L. Johnson, *The Soviet Year in Space 1984*, p.74.

FIGURE 4

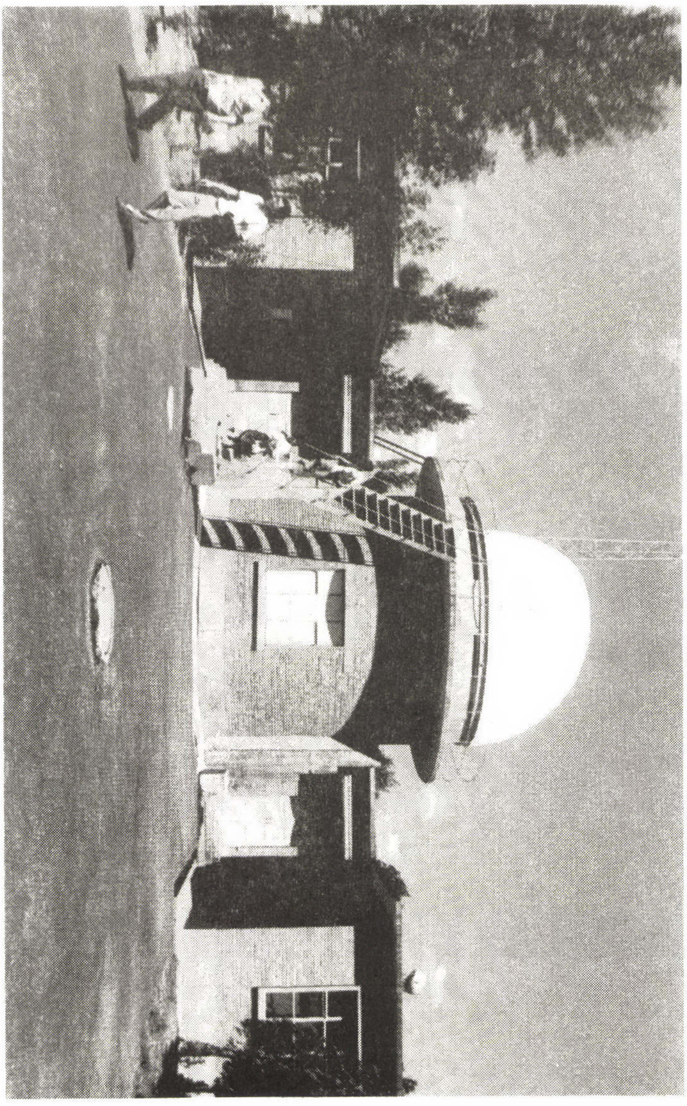
XICHANG COMMAND AND CONTROL CENTRE



Source: *Aviation Week & Space Technology*, 13 July 1987, p.121.

FIGURE 5

XICHANG TRACKING SITE



Source: *Aviation Week & Space Technology*, 13 July 1987, p.131.

FIGURE 6
CHINESE MILITARY RECONNAISSANCE SATELLITE RECOVERY

tions network code-named MAROON SHIELD (formerly DRAW-STRING).[13] Designed by RCA for the US National Security Agency (NSA), the network employs special wide-band transponders on RCA communications satellites (COMSATS) and Defense Satellite Communications System (DSCS) satellites capable of transmitting bulk-encrypted data and secure voice communications.

13 Defense Market Service (DMS), *Code Name Handbook,* (DMS Inc., Greenwich, Connecticut, 1979), p.207.

CHAPTER 3

PROJECT LARSWOOD, SHOAL BAY, NT

Project LARSWOOD consists of two satellite terminals which became operational at Shoal Bay in late 1979 and which are designed for the interception of Indonesian satellite communications. The larger Larswood antenna, which is about 33-feet in diameter, monitors the Palapa satellites stationed at 77°E and 83°E over the mid-Indian Ocean, while the smaller antenna is concerned with the Palapa satellites stationed over Indonesia itself. (See Figures 7 and 8.)

The Palapa communications satellite program was designed in the mid-1970s to provide a national telecommunications system across the whole of Indonesia, 'linking 130 million people in 3000 of the 13,000 islands in the 3,400-mile-long archipelago'.[1]

The first phase of the program consisted of the construction of the ground stations and procurement of the first two Palapa satellites. Two additional satellites were procured in the second phase.

The ground station network constructed in 1975-76 consisted of a master control station at Cibinong, some 35 km south of Jakarta, and 39 other terminals. The Cibinong master control station, built by Hughes Aircraft Services International, consists of a satellite control antenna, a 32-feet diameter satellite communications antenna, and a microwave tower.[2] (See Figures 9 and 10.) Nine other ground stations were also built by Hughes on Java, Bali, and Nusa Tenggara. Fifteen ground stations were built by International Telephone and Telegraph (IT&T) on Sulawesi, Maluku and Irian Jaya.[3] Aeronutronic Ford Corporation also built 15 stations, on Sumatra, Kalimantan and Sulawesi. These Aeronutronic Ford stations included eight 10-metre

1 'Second Indonesian Satellite Flies', *Flight International*, 2 April 1977, p.859. See also Richard G. O'Lone, 'Indonesia Poised for Satellite Launch', *Aviation Week and Space Technology*, 7 June 1976, pp.55-56.

2 *Ibid.*.

3 *Ibid.*, p.56.

FIGURE 7
DSD STATION, SHOAL BAY, NORTHERN TERRITORY

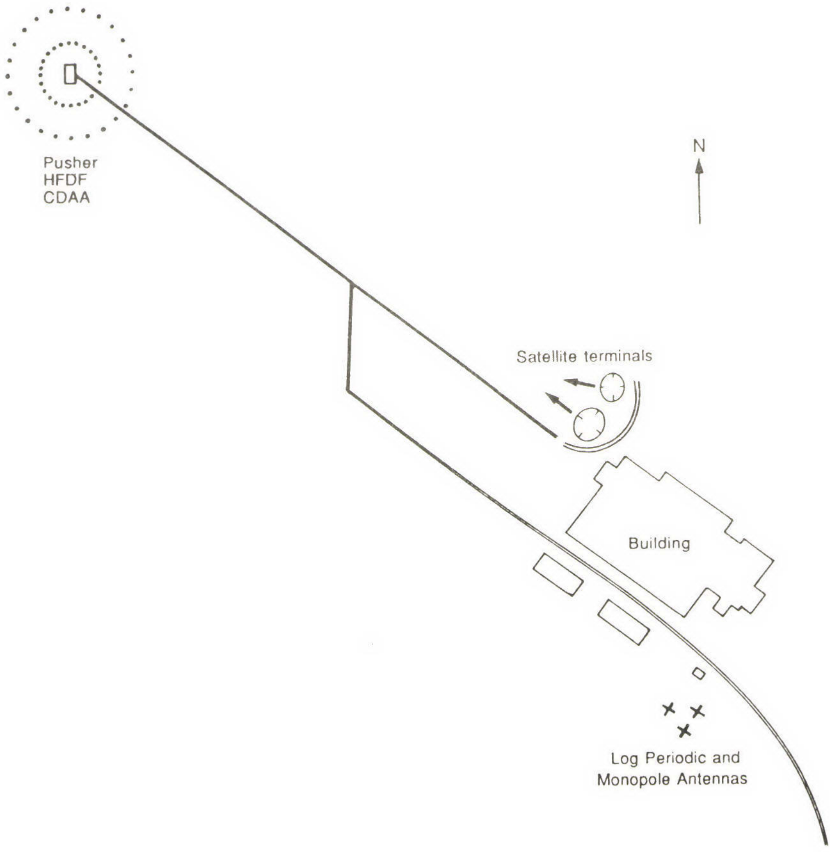
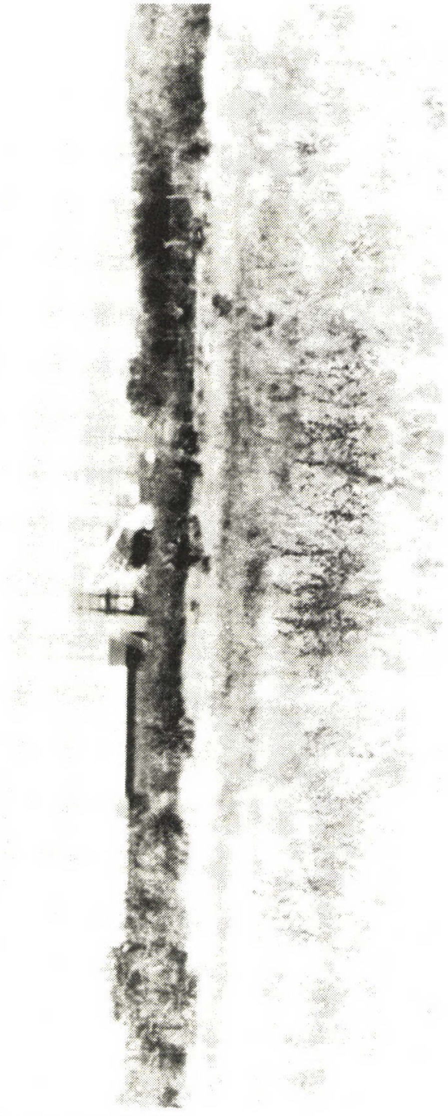


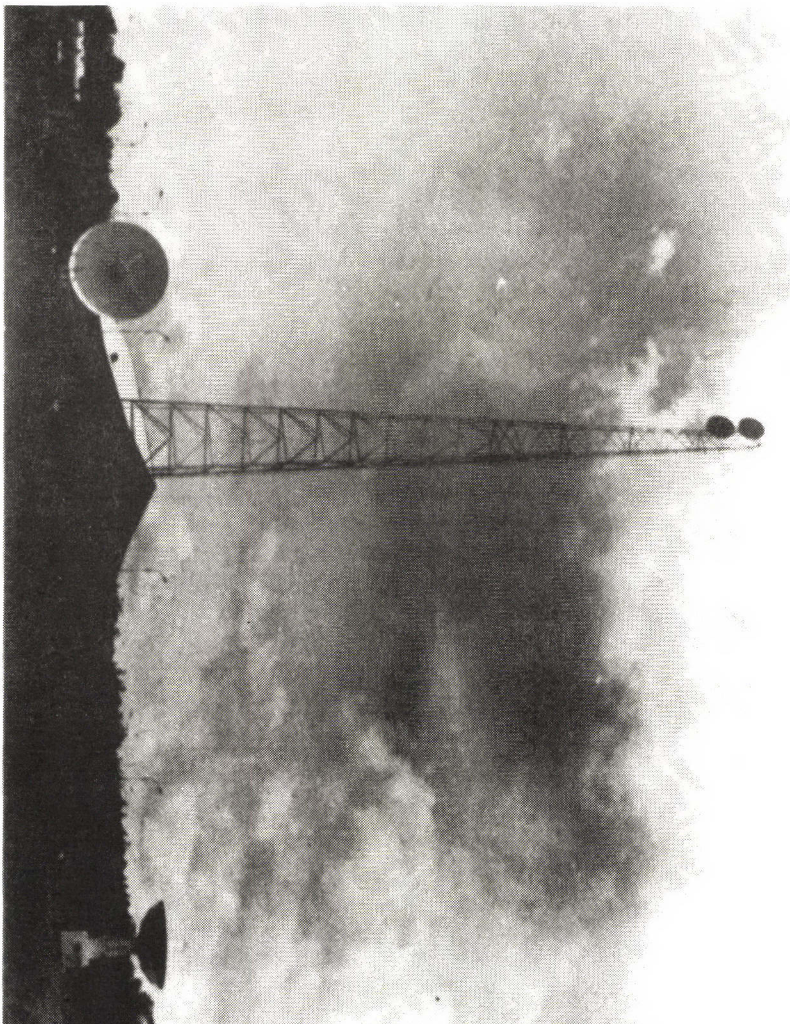
FIGURE 8
PROJECT LARSWOOD, SHOAL BAY, NORTHERN TERRITORY



Source: Peter Godbold, Darwin, September 1984.

FIGURE 9

MASTER CONTROL STATION AT CIBINONG, NEAR DJAKARTA, FOR INDONESIA'S COMMUNICATIONS SATELLITE SYSTEM. THE STATION INCLUDES COMMUNICATIONS ANTENNA (LEFT), MICROWAVE TOWER, AND SATELLITE CONTROL ANTENNA (RIGHT)



Source: *Aviation Week & Space Technology*, 7 June 1976, p.55.

FIGURE 10
32-FOOT DIAMETER PARABOLIC COMMUNICATIONS SATELLITE ANTENNA UNDER CONSTRUCTION AT CIBINONG MASTER CONTROL STATION

Source: *Aviation Week & Space Technology*, 7 June 1976, p.56.

medium traffic stations and seven 10-metre light traffic stations.[4] (See Figures 11 and 12.) Several additional ground stations have been built over the past decade.

The contract for the first two Palapa satellites (A1 and A2) was awarded to Hughes Aircraft Company in February 1975. These satellites, based on the Hughes HS333D design, are 3.41 metres (11'1.75") in height, including the antenna, and 1.9 metres (6'2.75") in diameter. The weight of the satellites was 574 kg (1,265 lbs) at launch and about 290 kg (640 lbs) in orbit. The shaped-beam antenna, which is 1.5 metres (4'11") in diameter, is specially designed to concentrate the signal power of the satellites on all the Indonesian islands, including the main islands of Java, Sumatra, Bali, Kalimantan, Sulawesi and Irian Jaya, as well as the surrounding Southeast Asia area, including Singapore, Malaysia, Thailand, the Philippines and Papua New Guinea.[5]

Each of the initial two Palapa satellites was equipped with 12 transponders designed to provide some 6,000 two-way telephone (voice) circuits or 12 simultaneous colour television channels, or any combination of these.[6] According to Indonesian officials, the system was designed to provide:

- minimum of 1,083 long-distance circuits for telephony, telegraphy and/or teletype throughout Indonesia;
- extension of the national television service into each of the nation's 26 provinces;
- introduction of educational television nationally; and

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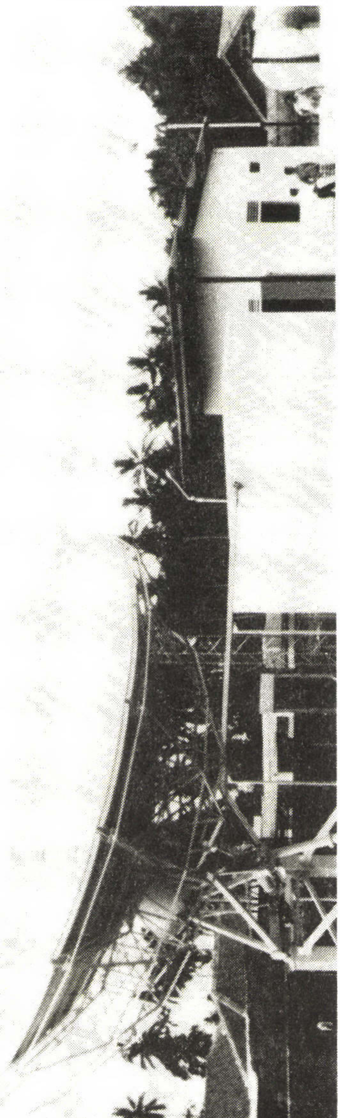
4 *Ibid.*, and *Small Earth Stations for Satellite Communications*, (Brochure published by Ford Aerospace and Communications Corporation, Western Development Laboratories Division, Palo Alto, California).

5 John W.R. Taylor (ed.), *Jane's All The World's Aircraft 1978-79*, (Macdonald and Jane's Publishers Limited, London, 1978), p.665.

6 *Ibid.*; and Richard G. O'Lone, 'Indonesia Poised for Satellite Launch', *Aviation Week and Space Technology*, 7 June 1976, p.56.

FIGURE 11

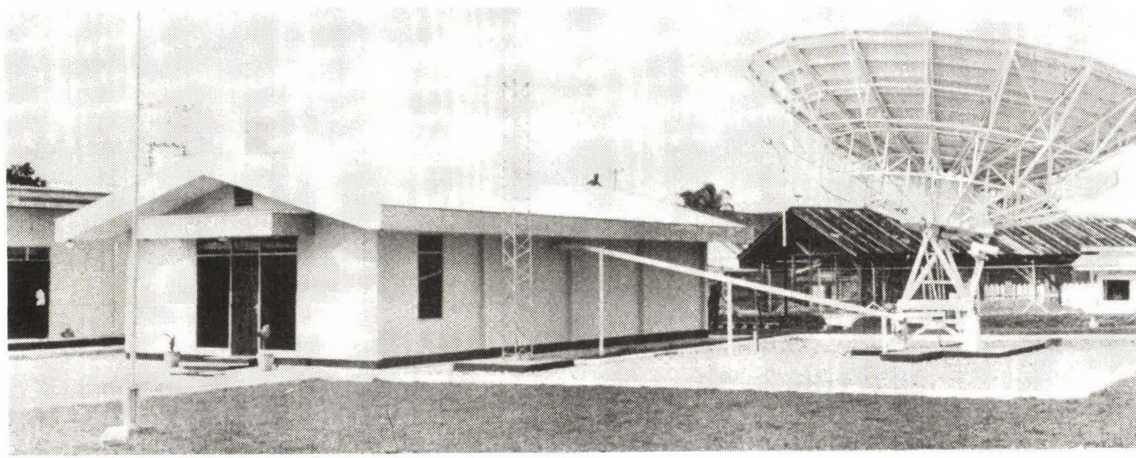


FORD AEROSPACE 10-METRE LIGHT TRAFFIC STATION AT TANJUNG KARANG, INDONESIA

Source: Ford Aerospace and Communications Corporation, Palo Alto, California.

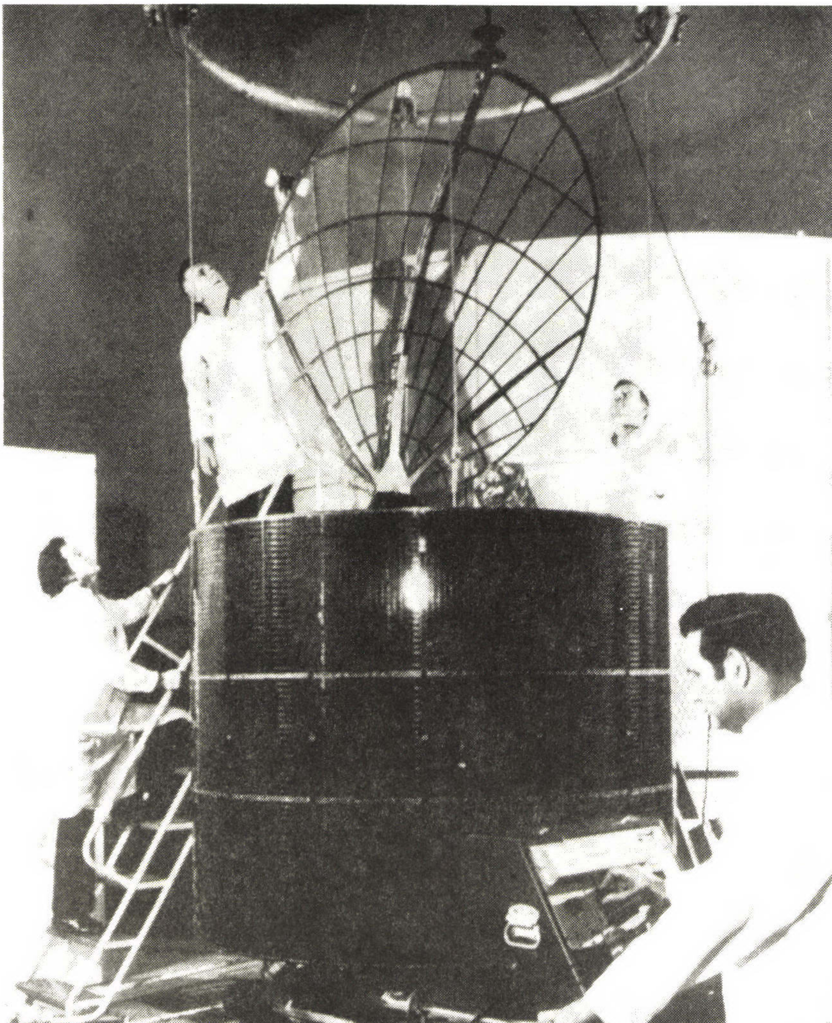
FIGURE 12

FORD AEROSPACE 10-METRE MEDIUM TRAFFIC STATION AT PAKENBARU, INDONESIA



Source: Ford Aerospace and Communications Corporation, Palo Alto, California.

FIGURE 13
PALAPA A2 COMMUNICATIONS SATELLITE
LAUNCHED 10 MARCH 1977

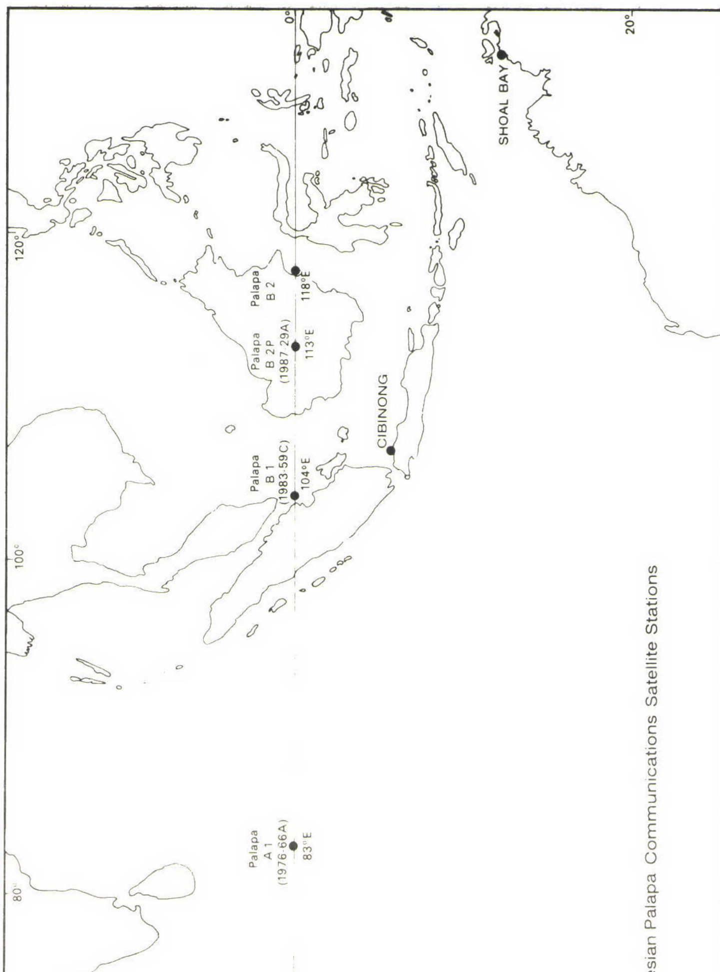


Source: Hughes Aircraft Company, Space and Communications Group, Los Angeles, California.

TABLE 2: INDONESIAN PALAPA COMMUNICATIONS SATELLITES

Satellite Name and Designation	Launch Date	Launch Site	Launch Vehicle	Shape and Size (metres)	Weight (kg)	Period (min)	Perigee (km)	Apogee (km)	Inclination (degrees)	Comments
1. Palapa A1 (1976-66A)	8 July 1976	ETR	Delta	Cylinder 1.56 to 3.41 long 1.90 diam.	574 (full) 282 (empty)	1436.1	35,764	35,809	0.05	Stationed at 83°E.
2. Palapa A2 (1977-18A)	10 March 1977	ETR	Delta	Cylinder 1.56 to 3.41 long 1.90 diam.	574 (full) 293 (empty)	1436.1	35,764	35,809	0.1	Stationed at 77°E.
3. Palapa B1 (1983-59C)	18 June 1983	ETR	Shuttle and IUS/PAM-D	Cylinder 2.82 to 6.83 long 2.16 diam.	1200 (full) 650 (empty)	1436.2	35,780	35,796	0.83	Launched aboard the Shuttle <u>Challenger</u> (STS-7). Stationed at 104°E.
4. Palapa B2 (1984-11D)	3 Feb. 1984	ETR		Cylinder 2.82 to 6.83 long 2.16 diam.	1200 (full) 650 (empty)	-	-	-	-	Launched aboard the Shuttle <u>Challenger</u> (STS-41B) on 3 February 1984. The attempt to place it into geostationary orbit, on 6 February, failed when the PAM-D misfired. It was later recovered from space by the Shuttle <u>Discovery</u> (STS-51A), on 16 November 1984, and has been refurbished for re-launch in 1990. It is to be stationed at 118°E.
5. Palapa B2P (1987-29A)	20 Mar. 1987	ETR	Delta	Cylinder 2.82 to 6.83 long 2.16 diam.	1200 (full) 650 (empty)	-	-	-	-	Stationed at 113°E. Serves as an in-orbit spare for Palapa B1 (1983-59C).

FIGURE 14
INDONESIAN PALAPA COMMUNICATIONS SATELLITE STATIONS



- for the military, the interconnection of all national security locations and the provision of voice, data and television services.[7]

Palapa A1 (1976-66A) was launched from the US Eastern Test Range (ETR) at Cape Canaveral by a McDonnell Douglas Delta 2914 launch vehicle on 8 July 1976. The satellite was placed in its synchronous station at 83°E on 25 July, and achieved its initial operating capability on 17 August 1976.[8]

Palapa A2 (1977-18A) was launched from the ETR by a Delta rocket on 10 March 1977 and stationed at 77°E to serve as a back-up to Palapa A1 (1976-66A).[9]

In 1980, Hughes was awarded a further contract to build two second-generation Palapa B communications satellites. The new satellites, based on the Hughes HS 376 spacecraft, are more than twice as large and four times as powerful as the previous Palapa satellites. They are 6.83 metres (22'5") in height (including fully deployed antenna) and 2.16 metres (7'1") in diameter, and weigh about 1,200 kg (2650 lbs) at launch and about 630-650 kg (1,400 lbs) in orbit. Each has 24 transponders (compared with 12 on the previous models) and each of the transponders has 10W power output (compared with 5W on the earlier spacecraft).[10] (See Figures 15 and 16.)

Palapa B1 (1983-59C) was launched aboard the Shuttle Challenger (STS-7) from the ETR at Cape Canaveral on 18 June 1983. The satellite was ejected at approximately 1.40 pm GMT on 19 June 1983 when the Shuttle was over the Atlantic Ocean at 2°N latitude and 29.9°W longitude. The apogee motor on the satellite was fired on 20 June 1983 to place it into a precise geostationary orbit at 104°E.[11]

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7 *Ibid.*.

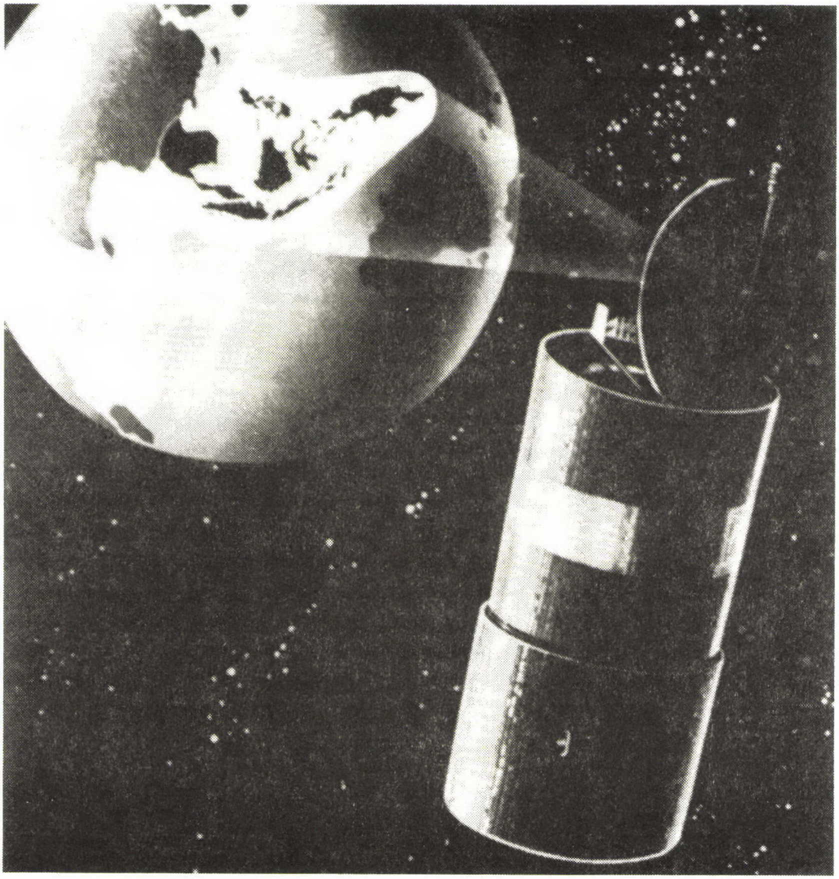
8 *Ibid.*; and *Aviation Week and Space Technology*, 19 July 1976, p.243.

9 'Second Indonesian Satellite Flies', *Flight International*, 2 April 1977, p.859.

10 John W.R. Taylor and Kenneth Munson (eds), *Jane's All The World's Aircraft 1981-82*, (Jane's Publishing Company Limited, London, 1981), p.703.

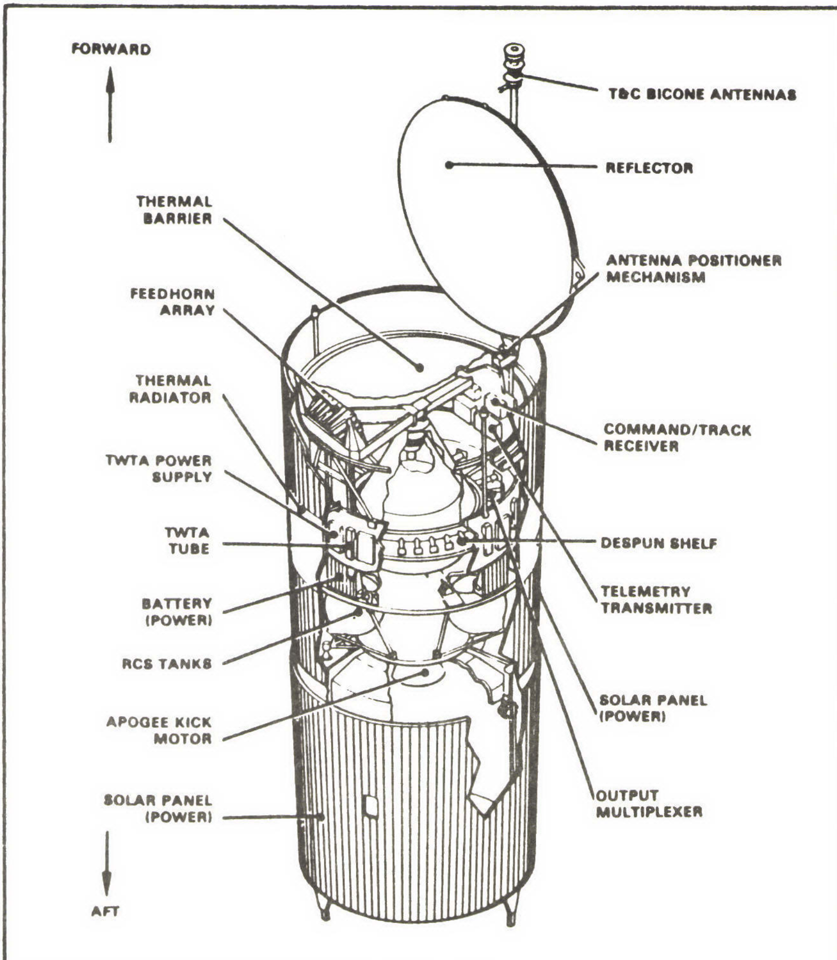
11 'Shuttle 7 Improves Precise Deployment of Satellites', *Aviation Week and Space Technology*, 27 June 1983, pp.18-19.

FIGURE 15
PALAPA B COMMUNICATIONS SATELLITE



Source: Hughes Aircraft Company, Space and Communications Group, Los Angeles, California.

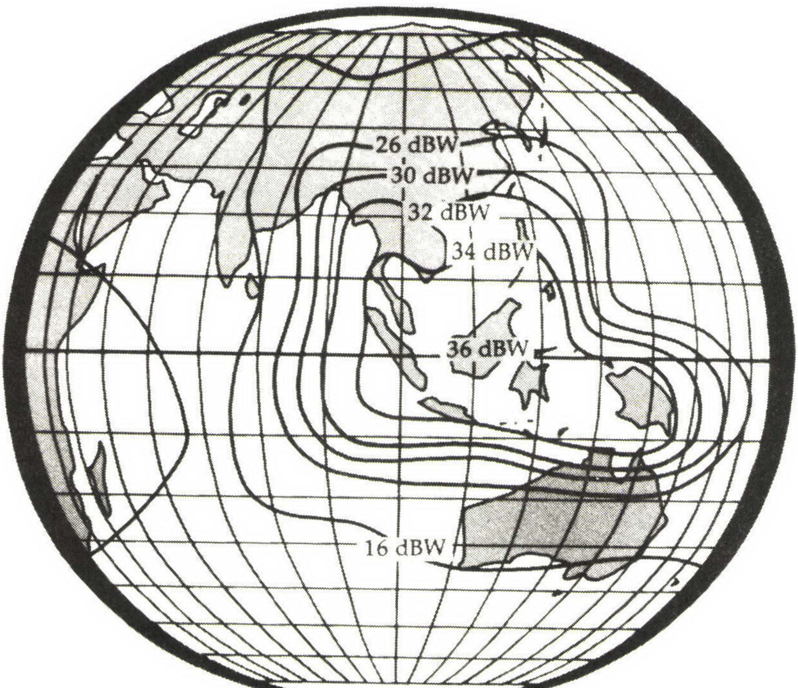
FIGURE 16
PALAPA B, THE INDONESIAN SATELLITE SERVING INDONESIA,THAILAND, THE PHILIPPINES, MALAYSIA, SINGAPORE, BRUNEI AND PAPUA NEW GUINEA



Source: Hughes Aircraft Company, Space and Communications Group, Los Angeles, California.

FIGURE 17

SHAPE AND SIGNAL STRENGTH OF SPOT BEAM OF PALAPA B1 (1983-59C) COMMUNICATIONS SATELLITE



Source: Mark Long, *World Satellite Almanac: The Complete Guide to Satellite Transmission and Technology,* (Howard W. Sams & Company, Indianapolis, Indiana, Second Edition, 1987), p.498.

Palapa B2 was launched aboard the Challenger (STS-41B) on 3 February 1984, and ejected from the Shuttle on 6 February. (See Figure 18.) However, the Payload Assist Module (PAM) malfunctioned and the Palapa failed to achieve a geostationary transfer orbit. The Palapa B2 satellite was retrieved by the Shuttle Discovery (STS-51A) on 16 November 1984 and has been refurbished for re-launch in 1990. It is to be stationed at 118°E.[12]

The third Palapa B satellite (i.e. Palapa B2P, 1987-29A) was launched from the ETR aboard a McDonnell Douglas Delta 182 launch vehicle on 20 March 1987. It was successfully boosted into geostationary orbit by a PAM, and stationed over Borneo at 113°E.[13]

The Larswood Project is designed to monitor the communications from these Palapa satellites. Given the critical importance of the Palapa program to communications throughout the Indonesian archipelago, this provides DSD with extraordinary access to Indonesia's communications, including local communications in Irian Jaya and the Papua New Guinea-Indonesia border area. Moreover, since Indonesia is leasing excess Palapa capacity to other countries in the region (including Thailand, Malaysia, Singapore, the Philippines, Brunei and Papua New Guinea[14]), DSD also has access to

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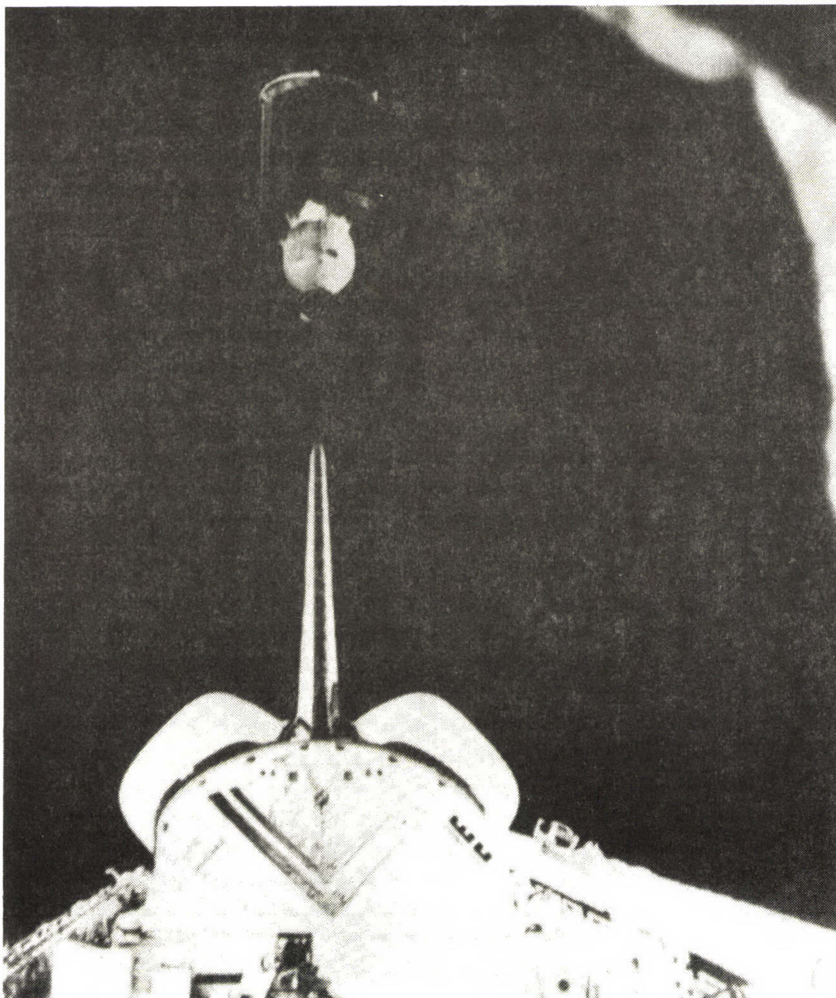
12 Tina D. Thompson (ed.), *TRW Space Log 1984-1985*, (TRW Electronics and Defense Sector, Redondo Beach, California, Vol.21, 1986), p.7; Bruce A Smith, 'Hughes Stations Will Aid Palapa Rescue', *Aviation Week and Space Technology*, 17 September 1984, pp.21-22; and Craig Covault, 'Satellite Rescue Made Possible by Detailed Contingency Plans', *Aviation Week and Space Technology*, 10 December 1984, pp.46-49.

13 'News Digest', *Aviation Week and Space Technology*, 30 March 1987, p.29; 'Palapa Goes Into Orbit', *Flight International*, 4 April 1987, p.20; and Mark Long, *World Satellite Almanac: The Complete Guide to Satellite Transmission and Technology*, (Howard W. Sams & Company, Indianapolis, Indiana, Second Edition, 1987), p.127, 491-492.

14 'Intelsat Faces Numerous Challenges', *Aviation Week and Space Technology*, 17 October 1977, p.75; Stan Prentiss, *Satellite Communications*, (Tab Books, Blue Ridge Summit, Pennsylvania, 1983), pp.10-22; and 'Indonesia Aims to Capitalise on Its Geography', *The Australian*, 14 March 1988, p.14.

FIGURE 18

PALAPA B2 (1984-11D) BEING EJECTED FROM THE SPACE SHUTTLE CHALLENGER, 6 FEBRUARY 1984



Source: US National Aeronautics and Space Administration.

these communications. Thus, the Director-General of the Office of National Assessments (ONA), Robert Furlonger, reported in 1978,

> The entry into operations of the *LARSWOOD* project in late 1979 should make a major contribution, not only in relation to the coverage of Indonesia (including Irian Jaya) but also, possibly, of other ASEAN countries as well.[15]

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15 Cited in Brian Toohey, 'The AUSTEO Papers. Part 3: Listening in on Pierre in Paris', *The National Times*, 6-12 May 1983, p.6; and Brian Toohey and Marian Wilkinson, *The Book of Leaks: Exposes in Defence of the Public's Right to Know*, (Angus and Robertson Publishers, Sydney, 1987), p.138.

CHAPTER 4

THE AUSTRALIAN DEFENCE SATELLITE COMMUNICATIONS STATION (ADSCS), KOJARENA, VIA GERALDTON, WA

The decision to establish a new DSD satellite communications station in Western Australia was disclosed by the Minister for Defence, Mr Beazley, in the White Paper, *The Defence of Australia 1987*, tabled in Parliament on 19 March 1987:

> The Government plans to enhance our independent intelligence capabilities by establishing a large satellite communications station in Western Australia. This will contribute to Australia's security in our area of strategic interest. The station will be totally Australian owned and will be manned and operated by the Defence Signals Directorate.[1]

The same day, the Minister also explained the decision to disclose the plans for the new station:

> There are many DSD sites around the country.
>
> But this one is of such substantial size and so obvious it would be impossible for us to conceal it, and I would be concerned about public misunderstanding about what it is ....
>
> The reason why I chose to declassify this particular DSD facility and not others is simply because it will be of substantial size and I don't want there to be any overt excitement, alarm or whatever in the community as it starts to be constructed.[2]

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1 The Hon. Kim C. Beazley, Minister for Defence, *The Defence of Australia 1987*, (Australian Government Publishing Service, Canberra, 1987), p.34.

2 John Arthur, 'Base in WA for "Sky Spy"', *Daily News*, 19 March 1987, p.2; and 'Beazley to Abandon "Fortress Australia"', *The Australian*, 20 March 1987, p.2.

According to the Director of DSD, Mr Tim James, 'the initial planning for the base began in November 1985, with preliminary discussions with Government early in 1986'.[3]

On 20 March 1987, the Minister announced that the station would be located near Geraldton, that construction was scheduled to commence in 1988 and construction activity was expected to peak in 1990-1992, that the station would become operational in the mid-1990s, and that 'station staff numbers were expected to be about 125'.[4]

In September 1987, the Department of Administrative Services informed local landowners that a specific site had been identified for the station, and negotiations were begun for the acquisition of the selected land.[5] The site is in the Greenough Shire, about 25 km east of Geraldton, and about 3.5 km north of the Telecom tower at Kojarena on the road to Mullewa.[6] (See Figure 19.) The station itself will occupy about 35 hectares in a compound surrounded by a 415 hectare buffer zone 'to safeguard the station from local electrical interferences'.[7]

On 17 November 1987, at a meeting with local government officials and business leaders in Geraldton, Mr Tim James provided a more detailed timetable for construction of the station:

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3 Tony Dean, 'British Personnel to Run Communication Base', *Geraldton Guardian*, 27 April 1988, p.3.

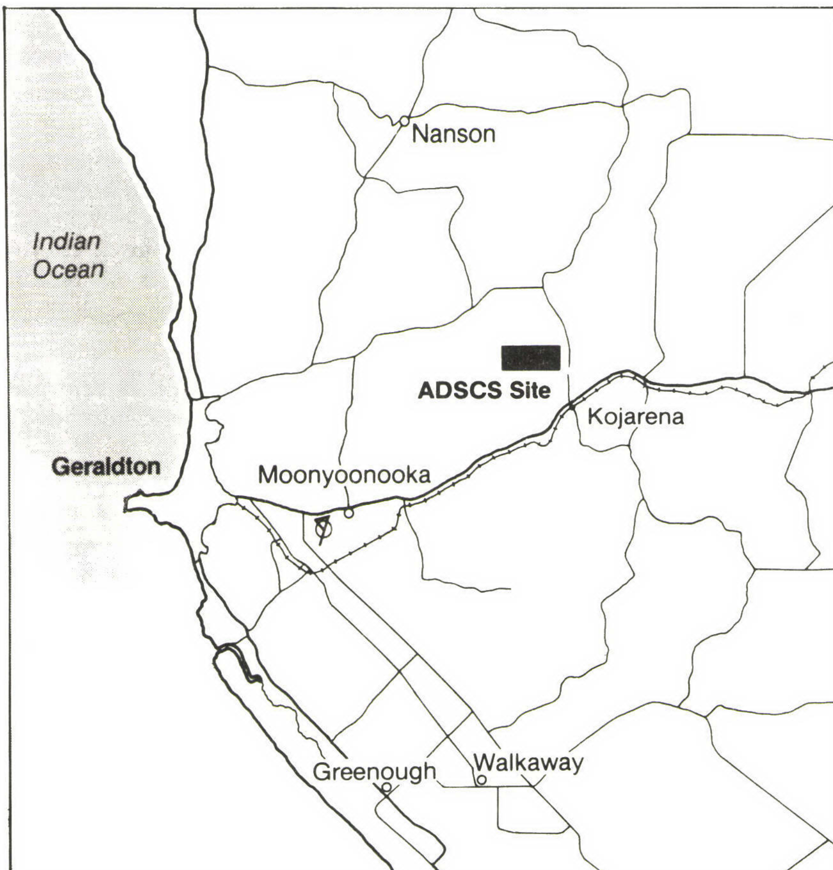
4 'Geraldton (WA) Chosen for New Defence Satellite Communications Station', Defence News Release No.39/87, 20 March 1987.

5 'Row Over Land Needed for Base', *West Australian*, 12 October 1987, p.14; and 'Farmers Fight New Spy Base', *Daily News*, 12 November 1987, p.8.

6 'Site Selected for New Defence Satellite Communications Station', Defence News Release No.17/87, 28 October 1987; and *The Australian Defence Satellite Communications Station, Geraldton, Western Australia*, (Brochure published by the Department of Defence, November 1987).

7 *Ibid.*.

FIGURE 19
LOCATION OF AUSTRALIAN DEFENCE SATELLITE COMMUNICATIONS STATION (ADSCS), KOJARENA, NEAR GERALDTON, WESTERN AUSTRALIA



Source: Department of Defence, November, 1987.

> The access road and services will be finished by mid-1988 and work will peak in 1990 with the buildings being completed by 1992.
>
> We expect the base to be operational by the middle of 1993.[8]

According to Mr James, ten British (i.e. GCHQ) personnel will be stationed at the ADSCS for three years to assist in the shake-down phase of the project and to 'transfer' certain 'skills' to their DSD counterparts.[9]

The operational configuration of the station remains to be fully determined. However, it is likely to consist of four or five satellite ground terminals (covered by radomes) and about 10 technical and support buildings. (See Figure 20.) The total project cost - including acquisition of the land and site preparation, procurement and installation of the satellite terminals, construction of the technical and support buildings, acquisition and installation of the electronic and computer equipment, the connection of water, power and communications services, and construction of about 70 houses in the Geraldton area as married quarters for the station's staff - has not been disclosed. According to the Minister for Defence, Mr Beazley,

> The figure is well over the $100 million mark, but to disclose the actual sum would give away some degree of the facility's capability to foreign intelligence.[10]

The Department of Defence has explained the selection of Geraldton as the site for the ADSCS as follows:

> Why Geraldton?
>
> The Department of Defence had to search long and carefully for a site that was exactly suitable for the satellite communications station. A number of

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8 Tony Dean, 'Defence Officials Clear the Way', *Geraldton Guardian*, 18 November 1987, p.1.

9 Tony Dean, 'British Personnel to Run Communication Base', *Geraldton Guardian*, 27 April 1988, p.3.

10 Diane Campbell, 'Minister Under Fire on Price of Spy-base Land', *Geraldton Guardian*, 5 February 1988, p.1.

technical and logistic conditions had to be met, including:

- freedom from electromagnetic interference
- accessibility to essential services, including water, power and communications
- readily accessible by road and air
- close to civilian infrastructure

Geraldton meets all these conditions.[11]

In fact, however, the primary consideration was to identify a site <u>on the extreme western coast of the continent</u> which met these conditions.

The general purpose and function of the ADSCS is to monitor communications and other signals transmitted from satellites stationed in geostationary orbits (i.e. approximately 36,000 km altitude) over the Indian Ocean and Southeast Asia. For satellites at this altitude, any site on the Earth's surface has a line-of-sight extending across some 162.6° longitude. Hence, a geostationary satellite can be seen from any point on the surface of the Earth which lies within a circle distance of 81.3° from the sub-satellite point. In practice, however, atmospheric attenuation on the circumference of the circle (or local horizon) limits the effective circle for signal reception to something less than 162.6°. In commercial communications satellite operations, the simple assumption is generally made that the area of attenuation extends across a radius of 10°, which gives the circle of effective reception a radius of about 71.45°.[12] In the case of sophisticated intelligence operations, however, employing the most sensitive receiver systems and signal processing techniques, the area of attenuation need not extend across more than 6° at the horizon - giving the circle of effective reception a radius of 75° or a diameter of 150°.

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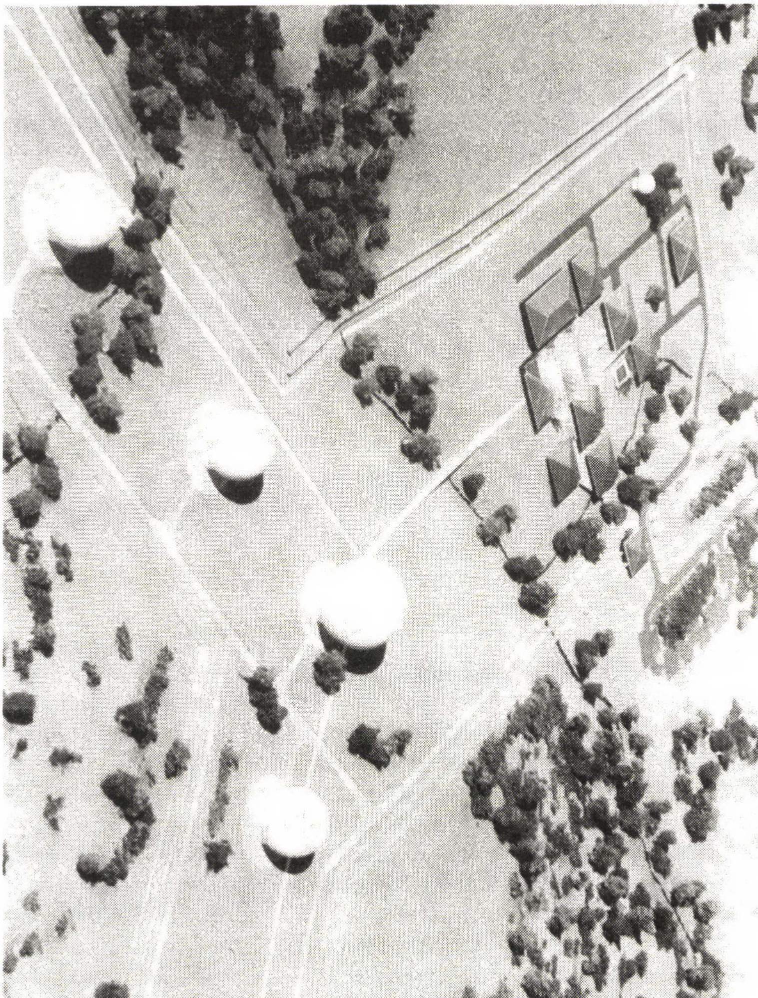
11 Department of Defence, *The Australian Defence Satellite Communications Station*.

12 See Donald M. Jansky and Michael C. Jeruchim, *Communication Satellites in the Geostationary Orbit*, (Artech House, Inc., Dedham, Massachusetts, 1983), pp.2-3.

FIGURE 20
SCHEMATIC OF AUSTRALIAN DEFENCE SATELLITE COMMUNICATIONS STATION (ADSCS), KOJARENA, NEAR GERALDTON, WESTERN AUSTRALIA



Source: Department of Defence, November 1987.

A site on the West coast of Australia (i.e. about 115°E longitude) therefore has an effective purview from about 40°E to about 170°W longitude. (See Figure 21.) As indicated in Table 3, there are presently some 93 geostationary satellites either operational or planned for launch by 1990 within this purview. Many of these are concentrated over the western Indian Ocean, while very few are stationed over the mid-Pacific Ocean. If, for example, the ADSCS had been located in the centre of Australia (at, say, 135°E or 20° further east of Geraldton), it would have lost access to some 14 satellites (including six Soviet Gorizont and Raduga communications satellites and five INTELSAT communications satellites) stationed between 40°E and 60°E longitude while gaining a coverage from 170°W to 150°W longitudes which contain no satellites!

The more particular purposes and functions of the Kojarena ADSCS can be ascertained from an examination of the 93 satellites listed in Table 3. At the time the Department of Defence accepted the DSD proposal for a west coast satellite intercept station, some 65 of these satellites were operational, while the International Telecommunications Union (ITU) had received requests for slots to be reserved for another 28 satellites across the relevant section of the geostationary band.

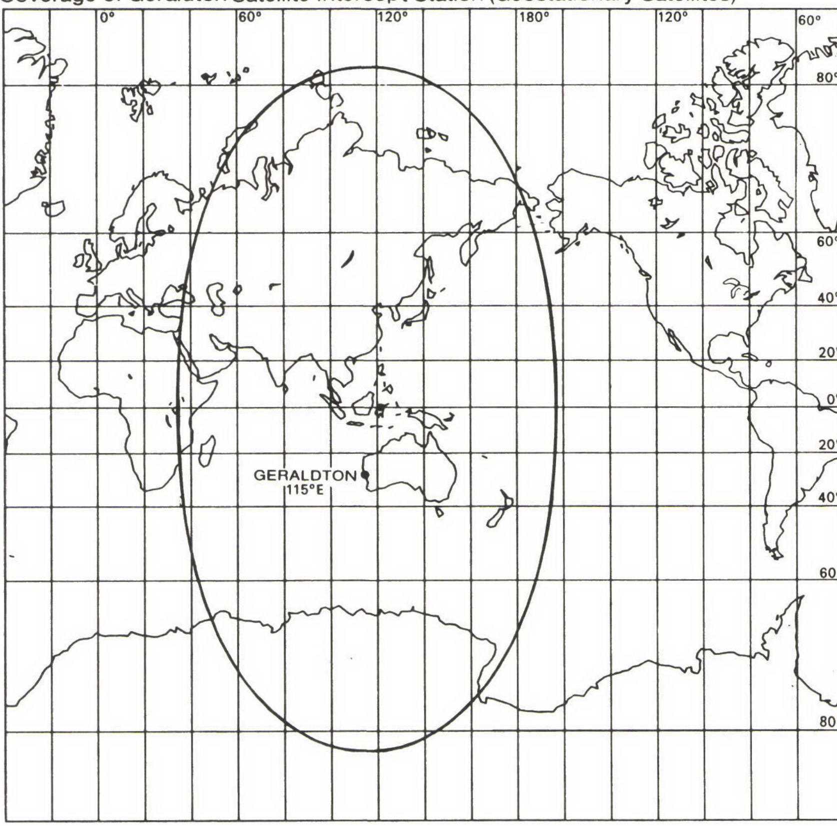
These satellites can be categorised as follows:

1. US Defence and Intelligence Satellites

The United States generally maintains about 15 defence communications and intelligence satellites in the relevant geostationary band - including 2-4 Defense Satellite Communications System (DSCS) satellites, stationed around either 60°E (DSCS IND) or 175°E (DSCS WPAC); two Code 647 Defense Support Program (DSP) ballistic missile early warning satellites, stationed around 69°E (DSP-E prime) and 75°E (DSP-E back-up); four signals intelligence (SIGINT) satellites (originally code-named Rhyolite and presently designated Chalet/Vortex and Magnum), stationed at around 45°E, 70°E and 115°E); and several US Navy Fleet Satellite Communications (FLTSATCOM) satellites and leased satellites (LEASATs), stationed at around 75.1°E (FLTSATCOM-IND), 100°E (FLTSATCOM-7), 172°E (FLTSATCOM-PAC), and 178°E (LEASATs).

FIGURE 21
COVERAGE OF GERALDTON SATELLITE INTERCEPT STATION (GEOSTATIONARY SATELLITES)

Coverage of Geraldton Satellite Intercept Station (Geostationary Satellites)



The ADSCS is, of course, not interested in signals from these satellites. In fact, most of them have dedicated ground facilities in Australia which are specifically designed for communications with them - the Joint Defence Space Research Facility (JSDRF) at Pine Gap is the command and control and signal processing station for the geostationary SIGINT satellites stationed at 70°E and 115°E; the Joint Space Defence Communications Station (JSDCS) at Nurrungar is the control and data processing station for the DSP-E early warning satellites stationed at 69°E and 75°E; there are DSCS ground terminals at Pine Gap, Nurrungar, North West Cape, and Watsonia; and there is a FLTSATCOM terminal at North West Cape.

2. Soviet Communications Satellites

The Soviet Union makes extensive use of the geostationary band from 40°E to 170°W for communications satellite purposes. As at December 1986, some 23 Soviet communications satellites were positioned in this band, while positions for 10 others had been reserved with the International Telecommunications Union (ITU). A slot at 76°E has also been reserved for a Geostationary Operational Meteorological Satellite (GOMS), the launch of which has been long delayed.[13] These 34 satellites/reserved positions represent some three-quarters of the 44 Soviet geostationary satellites existing and proposed as at December 1986, and more than a third of the total number of existing and proposed geostationary satellites within the purview of the Kojarena ADSCS.

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13 For more comprehensive discussion of the Soviet geostationary satellite programs, from which most of the material in this section is derived, see Nicholas L. Johnson, *Soviet Space Programs 1980-1985*, (Published for the American Astronautical Society by Univelt, Inc., San Diego, California, Vol.66, Science and Technology Series, 1987), pp.65-73; and the series by Nicholas L. Johnson, *The Soviet Year in Space*, (Published each year since 1981 by Teledyne Brown Engineering, Colorado Springs, Colorado), various pages.

TABLE 3: EXISTING AND PLANNED GEOSTATIONARY SATELLITES WITHIN PURVIEW OF DSD SATELLITE COMMUNICATIONS MONITORING STATION, GERALDTON, WESTERN AUSTRALIA TO DECEMBER 1986

	Satellite	Designation	Country	Date of Launch	Station Longitude	Comments
1	GORIZONT 3	1979-105A	USSR	28 Dec 1979	40°E	Communications
2	PAKSAT 2		PAKISTAN		41°E	Proposed
3	CHALET-2	1979-86A	US	1 Oct 1979	45°E	US geostationary SIGINT satellite, designed for both COMINT and telemetry interception
4	RADUGA 13	1983-88A	USSR	15 Aug 1983	45°E	Communications
5	RADUGA 16	1985-70A	USSR	8 Aug 1985	45°E	Domestic communications
6	RADUGA 19	1986-82A	USSR	25 Oct 1986	45°E	Communications
7	SKYNET-4C		UK		53°E	Cover for proposed (now cancelled) Zircon SIGINT Satellite
8	GORIZONT 5	1982-20A	USSR	15 Mar 1982	53°E	Communications
9	GORIZONT 9	1984-41A	USSR	22 Apr 1984	53°E	Communications
10	INTELSAT 4AF2	1976-10A	ITSO	29 Jan 1976	57°E	ITSO (International Telecommunications Satellite Organisation)
11	INTELSAT VI-A IND2		ITSO		57°E	Proposed
12	DSCS 3 IND	1985-92C	US	3 Oct 1985	60°E	DSCS 3 B5
13	DSCS 2 IND	1978-113B	US	13 Dec 1978	60°E	DSCS 12
14	INTELSAT 5F1	1981-50A	ITSO	23 May 1981	60°E	Intelsat communications
15	INTELSAT 5F7	1983-105A	ITSO	19 Oct 1983	60°E	Intelsat communications
16	INTELSAT 6 IND 1		ITSO		60°E	Proposed
17	INTELSAT 5F5	1982-97A	ITSO	28 Sep 1982	63°E	Provides 12,000 voice circuits 2 colour television channels simultaneously
18	MARECS-IND	1981-122A	ESA	20 Dec 1981	64.5°E	European maritime communications satellite
19	DSP-12	1984-37A	US	15 Apr 1984	69°E	US DSP-E ballistic missile early warning satellite
20	STW-3		CHINA		70°E	Proposed Chinese communications satellite
21	MAGNUM	1985-10B	US	24 Jan 1985	70°E	US geostationary SIGINT satellite, launched from Shuttle Discovery (Mission 51-C).
22	FLTSATCOM-IND	1979-38A	US	4 May 1979	71.5°E	FLTSATCOM-2. Originally at 23°W. Relocated after FLTSATCOM-3 launch of 17 January 1980
23	MARISAT-IND	1976-101A	US	14 Oct 1976	72.5°E	Maritime communications
24	MARECS-IND-2		ESA		73°E	Proposed
25	INSAT I-C		INDIA		74°E	Proposed
26	DSP-6	1976-59A	US	26 June 1976	75°E	US ballistic missile early warning satellite, back-up to DSP-12 (1984-37A)

TABLE 3 (CONTINUED)

	Satellite	Designation	Country	Date of Launch	Station Longitude	Comments
27	DSP-7	1977-7A	US	6 Feb 1977	75°E	US ballistic missile early warning satellite, back-up to DSP-12 (1984-37A)
28	GOMS		USSR		76°E	Proposed
29	PALAPA A2	1977-18A	INDONESIA	10 Mar 1977	77°E	Second Indonesian communications satellite
30	KOSMOS 1366	1982-44A	USSR	18 May 1982	80°F	Experimental relay satellite. New SHF transponders
31	RADUGA 5	1979-35A	USSR	25 Apr 1979	80°E	Communications
32	KOSMOS 1540	1984-22A	USSR	2 Mar 1984	80°E	Experimental relay satellite
33	KOSMOS 1546	1984-31A	USSR	29 Mar 1984	80°E	Moved from 25°W early 1986
34	GORIZONT 10	1984-78A	USSR	1 Aug 1984	80°E	Television, telephone, and telegraphic communications
35	PROGNOZ 4		USSR		80°E	
36	STATSIONAR 13		USSR		80°E	
37	ASC-1	1985-76C	US	27 Aug 1985	81°E	American Satellite Company. Commercial communications. Provides video conferencing, voice, data and facsimile services to US business and government agencies.
38	KOSMOS 1700	1985-102A	USSR	25 Oct 1985	82°E	Originally planned for 95°E Soviet Satellite Data Relay Network (SDRN) satellite, counterpart to US Tracking and Data Relay Satellite. Major malfunction. Drifting. Near 82°E end 1986
39	PALAPA-A1	1976-66A	INDONESIA	8 Jul 1976	83°E	First Indonesian communications satellite
40	RADUGA 10	1981-102A	USSR	9 Oct 1981	85°E	
41	RADUGA 14	1984-61A	USSR	15 Feb 1984	85°E	Television, radio, and telegraphic communications
42	GORIZONT 8	1983-118A	USSR	30 Nov 1983	90°E	Television, communications
43	GORIZONT 13	1986-90A	USSR	18 Nov 1986	90°E	Television, communications
44	INSAT 1B	1983-89B	INDIA	31 Aug 1983	94°E	Indian weather satellite ejected from Shuttle STS-8
45	KOSMOS		USSR		95°E	Proposed position for Soviet Satellite Data Relay Network (SDRN) satellite. See Kosmos 1700 (1985-102A) at 82°E.
46	EKRAN 11	1983-100A	USSR	29 Sep 1983	99°E	Television
47	EKRAN 14	1985-24A	USSR	22 Mar 1985	99°E	Television
48	EKRAN 15	1986-38A	USSR	24 May 1986	99°E	Television
49	FLTSATCOM 7	1986-96A	US	5 Dec 1986	100°E	Military communications
50	BS-2A	1874-5A	JAPAN	23 Jan 1984	100°E	Yuri 2A direct television signal broadcasting to remote areas Japan

TABLE 3 (CONTINUED)

	Satellite	Designation	Country	Date of Launch	Station Longitude	Comments
51	INSCOM 1		INDIA		102°E	
52	PRC 18 (STW)-2)	1986-10A	CHINA (PRC)	1 Feb 1986	103°E	Second Chinese geostationary satellite. Domestic communications.
53	PALAPA B1	1983-59C	INDONESIA	18 Jun 1983	104°E	Third Indonesian communications satellite. Ejected from Shuttle 19 June 1983.
54	BSE-2	1978-39A	JAPAN	7 Apr 1978	110°E	Yuri experimental broadcast communications satellite
55	BS-2B	1986-16A	JAPAN	12 Feb 1986	110°E	Yuri 2B domestic communications replacing BS-2A
56	PALAPA B2P	1987-29A	INDONESIA	20 Mar 1987	113°E	Fifth Indonesian communications satellite. Serves as in-orbit spare for Palapa B1 (1983-59C)
57	CHALET-3	1981-107A	US	31 Oct 1979	115°E	US geostationary SIGINT satellite, controlled from Pine Gap
58	CHALET-4	1984-129A	US	22 Dec 1984	115°E	US geostationary SIGINT satellite, controlled from Pine Gap
59	PALAPA B2	(1984-11D)	INDONESIA	(4 Feb 1984)	118°E	Fourth Indonesian communications satellite. Failed to reach proper orbit. Retrieved 16 November 1984. Awaiting relaunch in 1989
60	EKRAN 13	1984-90A	USSR	24 Aug 1984	120°E	Originally at 99°E. Drifted to 120°E in November 1986. Restabilized. ITU has no request for this spot so may be in standby spare mode
61	CHINA-15 (STW-1)	1984-35A	CHINA(PRC)	8 Apr 1984	125°E	First successful Chinese geostationary satellite. Experimental communications satellite.
62	RADUGA 15	1984-63A	USSR	22 Jun 1984	128°E	(Statsionar 15) domestic communications.
63	GALS 5		USSR		130°E	
64	CS-2A	1983-6A	JAPAN	4 Feb 1983	132°E	Sakura A2 communications satellite for business data, fax and video
65	CS-2B B2	1983-81A	JAPAN	5 Aug 1983	135°E	Sakura communications satellite
66	GORIZONT 6	1982-103A	USSR	20 Oct 1982	140°E	Originally stationed at 90°E. Moved to 140°E after being relieved by GORIZONT 8
67	GORIZONT 11	1985-7A	USSR	18 Jan 1985	140°E	Television, telephone and telegraph communications
68	GMS-1	1977-65A	JAPAN	14 Jul 1977	140°E	Meteorological satellite
69	GMS-2	1981-76A	JAPAN	10 Aug 1981	140°E	Himawari 2 meteorological satellite

TABLE 3 (CONTINUED)

	Satellite	Designation	Country	Date of Launch	Station Longitude	Comments
70	GMS-3	1984-80A	JAPAN	2 Aug 1984	140°E	Himawari 3 meteorological satellite
71	VOLNA-6		USSR		140°E	
72	STATSIONAR-16		USSR		146°E	
73	AUSSAT II	1985-109C	AUSTRALIA	28 Nov 1985	156°E	Domestic communications
74	AUSSAT I	1985-76B	AUSTRALIA	27 Aug 1985	158°E	Domestic communications
75	GMS		JAPAN		160°E	Proposed
76	AUSSAT III		AUSTRALIA		164°E	Proposed
77	STATSIONAR 10		USSR		170°E	
78	LUCH P4		USSR		170°E	
79	TDRS		US		171°E	Space-based satellite tracking and data relay system
80	FLTSATCOM-4 (PAC)	1980-87A	US	30 Oct 1985	172°E	Military communications
81	INTELSAT V		ITSO		173°E	Proposed commercial communications satellite
82	INTELSAT 4AF6	1978-35A	ITSO	31 Mar 1978	174°E	Commercial communications satellite
83	DSCS-2 W-PAC	1982-106A	US	30 Oct 1982	175°E	DSCS 15
84	DSCS-3 W-PAC		US		175°E	Proposed
85	INTELSAT V		ITSO		176°E	Proposed commercial communications satellite
86	MARISAT PAC	1976-53A	COMSAT	10 June 1976	176.5°E	Maritime communications satellite
87	MARECS B2	1984-114B	ESA	10 Nov 1984	177.5°E	Maritime communications
88	LEASAT 3	1985-28C	US	13 Apr 1985	178°E	Aka Syncom IV.3 military communications stranded in low earth orbit when PKM failed to fire after shuttle deployment; repaired in orbit 31 August/1 September 1985
89	LEASAT 4	1985-76D	US	29 Aug 1985	178°E	Military communications (UHF). Not transmitting
90	ECS 2	1980-18A	JAPAN	22 Feb 1980		Ayame. In orbit
91	INTELSAT 4AF3	1978-2A	ITSO	7 Jan 1978	179°E	Communications satellite
92	GALS 4		USSR		170°W	Proposed
93	VOLNA 7		USSR		170°W	Proposed

The Soviets maintain four major geostationary communications satellite programs - Ekran, Gorizont, Raduga and Kosmos.

The Ekran satellites are designed to provide television broadcast to an area of about 9,500,000 square kilometers (40%) of the Soviet Union, including Siberia, the Far East, and the extreme north of the country. All Ekran satellites have operated at about 99°E, although Ekran 13 (1984-90A), launched on 24 August 1984, has been positioned at 120°E. Since the Soviets have not requested the ITU for this slot, it is likely that the satellite is in a standby spare mode. The Ekrans transmit directly in the 0.7 GHz band. The high transmitter power (200W) permits the use of relatively simple ground receivers, more than 3,000 of which are currently operational.[14]

The Gorizont communications satellites are used for a variety of purposes. The Gorizont satellites stationed at 14°W, 53°E, 90°E and 140°E host Moskva television transponders, which transmit television services in the 3.65-3.95 band. Some 500 Moskva ground stations are now operational, including new receivers on the Kuril Islands and in Czechoslovakia. The satellites at 14°W and 53°E are also used for the Intersputnik international communications network - which is used by the Soviet Union, Algeria, Afghanistan, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Iraq, Laos, Mongolia, Nicaragua, North Korea, Poland, Romania, Vietnam, and South Yemen. In addition, the satellite at 14°W serves as a node in the 'hotline' between Washington and Moscow.[15] More recently, Gorizont satellites have been designed to serve as hosts for the new Luch general communications and Volna air and land mobile communications systems. The Gorizont-based Luch general communications system receives on an uplink frequency band of 14.0-14.5 GHz and transmits on a downlink frequency band of 10.95-11.70 GHz. The Gorizont-based Volna air mobile and sea mobile communications systems have a 1.636-1.660 GHz uplink and a 1.535-1.559 GHz downlink.[16] Two ground stations have been built specifically to service the Volna system - one near Odessa, which handles the

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14 Nicholas L. Johnson, *The Soviet Year in Space 1986,* (Teledyne Brown Engineering, Colorado Springs, Colorado, 1987), p.23.

15 *Ibid.*, p.24.

16 Nicholas L. Johnson, *The Soviet Year in Space 1985,* (Teledyne Brown Engineering, Colorado Springs, Colorado, 1986), p.25.

Atlantic and Indian Ocean traffic, and the other near Nakhodka, which handles Pacific and Indian Ocean traffic. The station at Odessa also links the Volna system to the MARECS European Maritime Communications System.[17]

The third major Soviet geostationary communications satellite system is Raduga, which serves domestic communications purposes. Raduga satellites are located at five slots around the geostationary band: 35°E, 45°E, 85°E, 128°E, and 25°W. A Raduga satellite stationed at 85°E is used to provide a direct telecommunications link between the Soviet Union and India.[18] The Raduga satellites also host the new Luch P general communications and Volna air and sea mobile communications systems, as well as the new Gals government and military communications system. The Raduga-based Luch P system operates in the uplink frequency band of 14.0-14.5 GHz and the downlink frequency band of 10.95-11.70 GHz; the Volna system has uplinks in the 0.335-0.4 GHz and 1.645-1.66 GHz bands, and downlinks in the 0.24-0.329 GHz and 1.544-1.559 GHz bands; and the Gals system uplinks in the 7.9-8.4 GHz band and downlinks in the 7.25-7.75 GHz band. (See Table 4.)[19] It is likely that the Gals system on the Raduga satellites stationed at 45°E, 85°E and 128°E, and proposed for 170°W, would be of particular interest to the Kojarena station.

The Kosmos geostationary satellites can be divided into two categories - those which the Soviet Union refers to as experimental communications or data relay satellites, and those for which it provides no mission characterisation. (See Table 5.)[20] It is reasonable to assume that the transmissions of the Kosmos satellites currently

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17 Nicholas L. Johnson, *The Soviet Year in Space 1982*, (Teledyne Brown Engineering, Colorado Springs, Colorado, 1983), p.12; and Nicholas L. Johnson, *The Soviet Year in Space 1983*, (Teledyne Brown Engineering, Colorado Springs, Colorado, 1984), p.19.

18 Johnson, *The Soviet Year in Space 1983*, p.19.

19 Johnson, *The Soviet Year in Space 1985*, p.25.

20 The geostationary Kosmos satellite program is discussed in Nicholas L. Johnson, *The Soviet Year in Space 1982*, p.12; *The Soviet Year in Space 1984*, p.22; *The Soviet Year in Space 1985*, pp.24-25; and *The Soviet Year in Space 1986*, pp.25-26.

stationed at 80°E and proposed for 95°E would be of major interest to the Kojarena station.

3. Regional Geostationary Satellites

There are some 22 deployed or planned geostationary satellites belonging to Asian countries within the purview of the Kojarena ADSCS. These include the five Indonesian Palapa communications satellites (three of which are operational) described above; the three Chinese communications satellites (two of which are operational) also described above; a Pakistani communications satellite, PAKSAT 2, proposed for placement at 41°E; three Indian satellites, two of which are meteorological satellites (INSAT 1B and INSAT 1C), and one of which is a communications satellite (INSCOM 1) proposed for placement at 102°E; and 10 Japanese satellites.

The ten Japanese satellites consist of four geostationary meteorological satellites (GMS-1, GMS-2 and GMS-3 at 140°E); three broadcast communications satellites (BSE-2, BS-2A and BS-2B at 110°E); and three CS-2 domestic communications satellites - the experimental ECS-2 (1980-18A), launched on 22 February 1980 to test the high-capacity K-band (30/20 GHz) frequencies, and the CS-2A and CS-2B spacecraft currently operational.

The CS-2A and CS-2B satellites are of significant interest to the Kojarena station. CS-2A, launched from the Tanegashima Space Center of the Japanese National Space Development Agency (NASDA) on 4 February 1983 (1983-6A) is stationed at 132°E; and CS-2B, launched from Tanegashima on 5 August 1983 (1983-81A) is stationed at 135°-136°E as a spare satellite. The satellites, designed and built by Mitsubishi Electric Corporation, are 220 cm (87") in diameter and 206 cm (81") in height and weigh 326 kg (719 lb) in orbit. Each CS-2 has six channels in the Ka-band and two channels in C-band. Each channel has 130 MHz and 180 MHz bandwidth, respectively, for telephone, colour television, and data transmission. The satellites were designed to provide communications with the remote islands of Japanese territory; to establish domestic public telecommunications services for

TABLE 4
SOVIET SECOND GENERATION GEOSTATIONARY SYSTEMS

PROGRAMS

	Gals	Luch	Luch P	Volna	Volna
Service	Government/ Military Communications	General Communications	General Communications	Air Mobile Sea Mobile	Air Mobile Land Mobile
Uplink (GHz)	7.90-8.40	14.0-14.5	14.0-14.5	1.636-1.660	0.335-0.400 1.645-1.660
Downlink (GHz)	7.25-7.75	10.95-11.70	10.95-11.70	1.535-1.559	0.240-0.329 1.544-1.559

SYSTEM DESIGNATORS

Geostationary Positions (°E)	Gals	Luch	Luch P	Volna	Volna
35	6				
45	2		2		3
53		2		4	
85	3		3		5
90		3		8	
128	5				
140		4		6	
190	4		4		7
335	1		1		1
346		1		2	
	RADUGA	GORIZONT	RADUGA	GORIZONT	RADUGA

APPPARENT HOST SATELLITE

Source: Nicholas L. Johnson, *The Soviet Year in Space 1985*, (Teledyne Brown Engineering, Colorado Springs, Colorado, 1986), p.25.

TABLE 5: GEOSTATIONARY KOSMOS SATELLITES

	Satellite	Date of Launch	Station (Degrees Longitude)	Comments
1.	Kosmos 13366 (1982-44A)	18 May 1982	80°E	To test unspecified SHF equipment
2.	Kosmos 1540	2 March 1984	80°E	According to the TASS announcement on 3 March 1994, Kosmos 1540 carried 'scientific equipment to continue the exploration of outer space and experimental equipment to relay telegraph and telephone communications in the centimeter waveband'
3.	Kosmos 1546 (1984-31A)	29 March 1984	25°W	No details provided
4.	Kosmos 1629 (1985-16A)	21 Feb 1985	25°W	No details provided
5.	Kosmos 1700 (1985-102A)	25 Oct 1985	82°E	According to the TASS announcement of 26 October 1985, Kosmos 1700 carried 'scientific apparatus for continuing the study of space and experimental apparatus for relaying information by telegraph and telephone. The latter operates in the centimeter waveband'. Initially stationed at 90°E. In 1981, the Soviets requested this slot for a Satellite Data Relay Network (SDRN) satellite. Suffered a major malfunction and now drifting. Was at 82°E at the end of 1986
6.	Kosmos 1738 (1986-27A)	4 April 1986	14°W	According to the TASS announcement, 'on board the satellite is installed scientific equipment designed to carry on outer space exploration and experimental equipment for relaying telegraph and telephone information operating in the one centimeter wavelength'

national disasters or emergencies; and to provide telecommunication networks for business corporations and government agencies.[21]

4. International Communications Satellites

There are some 14 existing and proposed international geostationary communications satellites within the purview of the Kojarena ADSCS - 10 INTELSAT satellites, three of which are INTELSAT 4 spacecraft launched in 1976-78 and probably no longer operational, five of which are INTELSAT 5 spacecraft (three operational and two proposed), and two of which are proposed INTELSAT 6 spacecraft; two MARISAT maritime communications satellites, launched in 1976; and two MARECS European maritime communications satellites, one launched on 20 December 1981 (1981-122A) and stationed over the Indian Ocean at 64.5°E and the other proposed for placement at 73°E.

The most recent INTELSAT 5 satellites weigh 2,936 kg full and 1,098 kg in orbit, and have a capacity of 15,000 two-way circuits plus two television channels. The antenna systems include a 4 GHz global horn, a 6 GHz global horn, a 4 GHz hemispheric zone reflector, a 6 GHz hemispheric zone reflector, two 14/11 GHz and two 14/12 GHz spot antennas, and a telemetry and command antenna. The proposed INTELSAT 6 satellites weigh 3,500 kg and will provide 33,000 two-way telephone circuits and four television channels using both the 6/4 and 11/14 GHz frequency bands.[22]

Both the US National Security Agency (NSA) and the British Government Communications Headquarters (GCHQ) have constructed extensive satellite communications facilities designed to monitor INTELSAT downlinks in the US and the UK. One of the largest NSA stations, for instance, is the Naval Security Group (NSG) station at Sugar Grove in West Virginia; it has numerous antenna systems, including four satellite ground terminals (with 30-foot, 60-foot, 105-foot and 150-foot diameters), and is designed to monitor the

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21 Madeline W. Sherman (ed.), *TRW Space Log 1982-1983*, (TRW Electronics and Defense Sector, Redondo Beach, California, 1984), p.5.

22 Reginald Turnill (ed.), *Jane's Spaceflight Directory 1987*, (Jane's Publishing Company Ltd, London, Third Edition, 1987), pp.316-317.

telecommunications traffic through the Communications Satellite Corporation (COMSAT) INTELSAT ground station at Etam, West Virginia, less than 60 miles away, through which passes more than half of the non-governmental international satellite communications entering and leaving the United States each day. Other NSA stations at Winter Harbor in Maine, Yakima in Washington, and Skaggs Island in California monitor the other half of the US INTELSAT traffic which passes through the COMSAT ground stations at Andover (Maine), Brewster (Washington) and Jamesburg (California) respectively.[23] In the UK, the GCHQ station at Morwenstow (near Bude in Cornwall), is designed to monitor the telecommunications traffic which passes through the COMSAT/INTELSAT ground station at Goonhilly Downs, some 60 miles to the south of Morwenstow.[24] The Soviet Union also maintains facilities for monitoring international communications satellite transmissions. The large Soviet SIGINT complex at Lourdes in Cuba has 'big dish satellite receiver terminals' designed to monitor the INTELSAT downlinks to the COMSAT ground stations at Etam and Andover as well as other commercial communications satellite systems within its purview.[25] Similar communications satellite monitoring stations are maintained within the Soviet Union itself. According to the US Department of Defense,

> The importance of the facility [at Lourdes] is that it provides the Soviets, together with similar facilities in the USSR, complete coverage of the global beams of all US geosynchronous communications satellites.[26]

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23 James Bamford, *The Puzzle Palace: Inside the National Security Agency, America's Most Secret Intelligence Organization,* (Penguin Books Ltd, Harmondsworth, Middlesex, 1983), pp.220-225.

24 *Ibid.*, pp.420-421.

25 For further discussion of the Soviet SIGINT complex at Lourdes, see Desmond Ball, 'Soviet Signals Intelligence' in Bruce L. Gumble (Executive Editor), *The International Countermeasures Handbook,* (EW Communications Inc., Palo Alto, California, 12th Edition, 1987), pp.78-80.

26 Department of Defense, *Soviet Military Power 1984,* (US Government Printing Office, Washington, D.C., Third Edition, 1984), p.126.

The Kojarena ADSCS, together with the stations in the US and the UK, provides the UKUSA SIGINT community with complete coverage of all international geostationary communications satellite systems.

CHAPTER 5

PROJECT SPARROW, WATSONIA BARRACKS

The decision to install a Defense Satellite Communications System (DSCS) satellite ground terminal at Watsonia Barracks, near Melbourne, was announced on 7 August 1979 in a Department of Defence 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 Force.[1]

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.[2] (See Figure 22.)

Preparatory construction work was begun almost immediately, and the antenna pedestal, which required the pouring of

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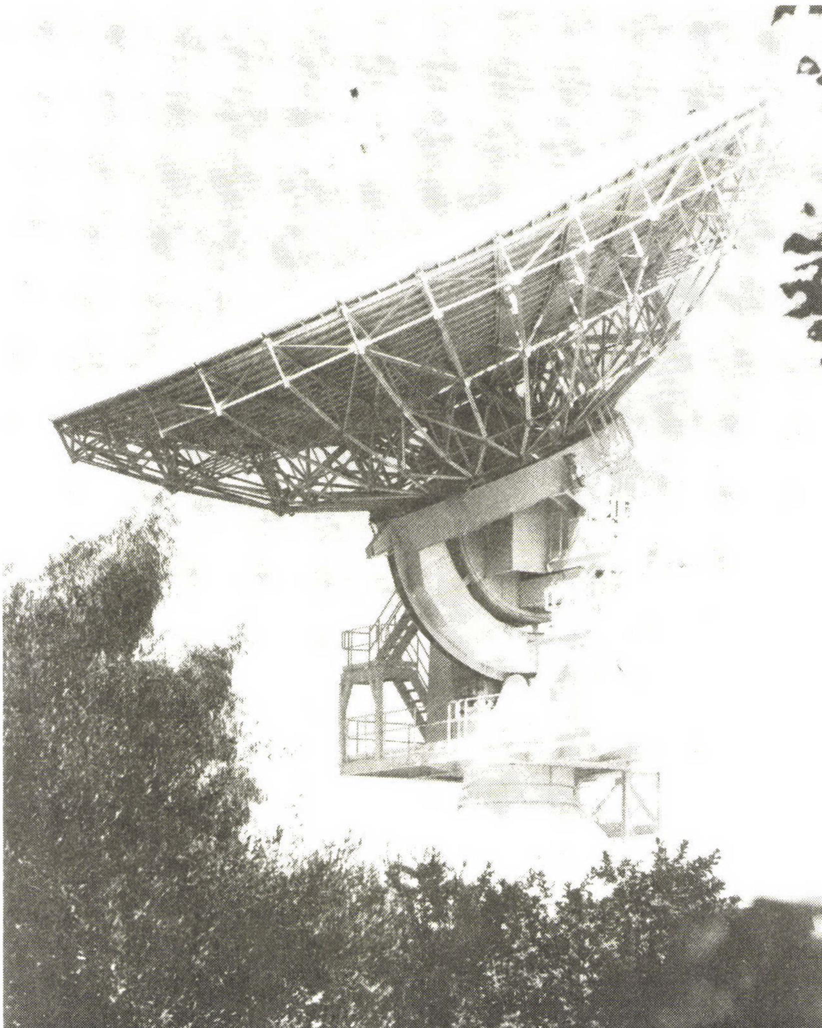
1 D.J. Killen, 'Defence Intelligence Communications Capability to be Improved', Department of Defence Press Release No.162/79, 7 August 1979. See also '$9.4m Satellite Centre for Spies', *Canberra Times*, 8 August 1979; and 'Direct Tap for US Satellites', *Australian Financial Review*, 8 August 1979.

2 See *Electronics Weekly*, 20 February 1980, p.11; and *Aviation Week and Space Technology*, 25 February 1980, p.65.

FIGURE 22
AN/FSC-78 60-FOOT DEFENSE SATELLITE COMMUNICATIONS SYTSTEM (DSCS) SATELLITE COMMUNICATIONS TERMINAL



Source: Ford Aerospace and Communications Corporation, Palo Alto, California.

213 cubic metres of concrete around 15 tonnes of reinforcing steel, was completed in late 1980.[3] (See Figures 23 and 24.)

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.[4]

The FSC-78 terminal, by now known as Project Sparrow, was officially declared operational at a ceremony at Watsonia Barracks on 1 July 1981, and soon after 'commenced passing live traffic'.[5] (See Figures 25 and 26.)

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-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 MHz 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

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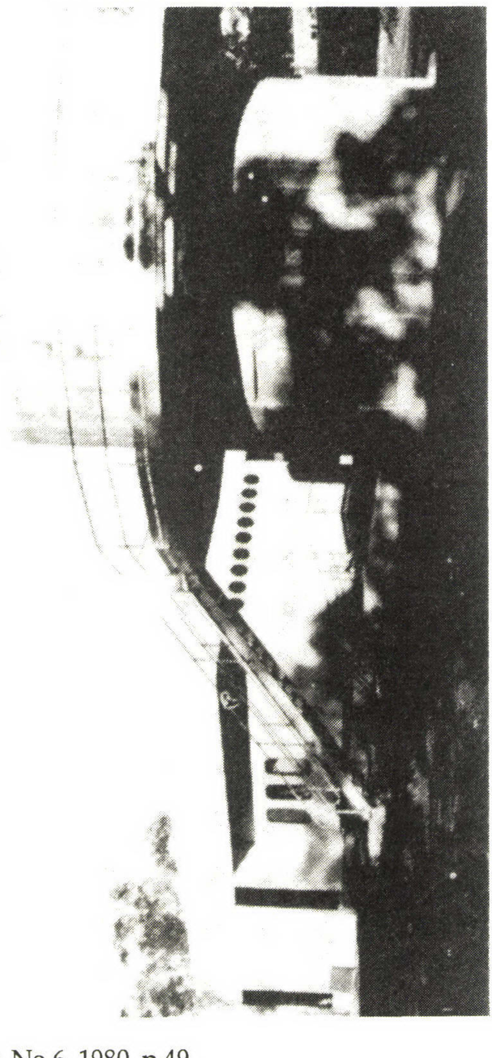
3 'Project Sparrow Satellite Terminal Progress', *Signalman*, No.6, 1980, p.49.

4 Peter Joel, 'SATCOM Training in the USA - 1980/81', *Signalman*, No.8, 1981, pp.41-42.

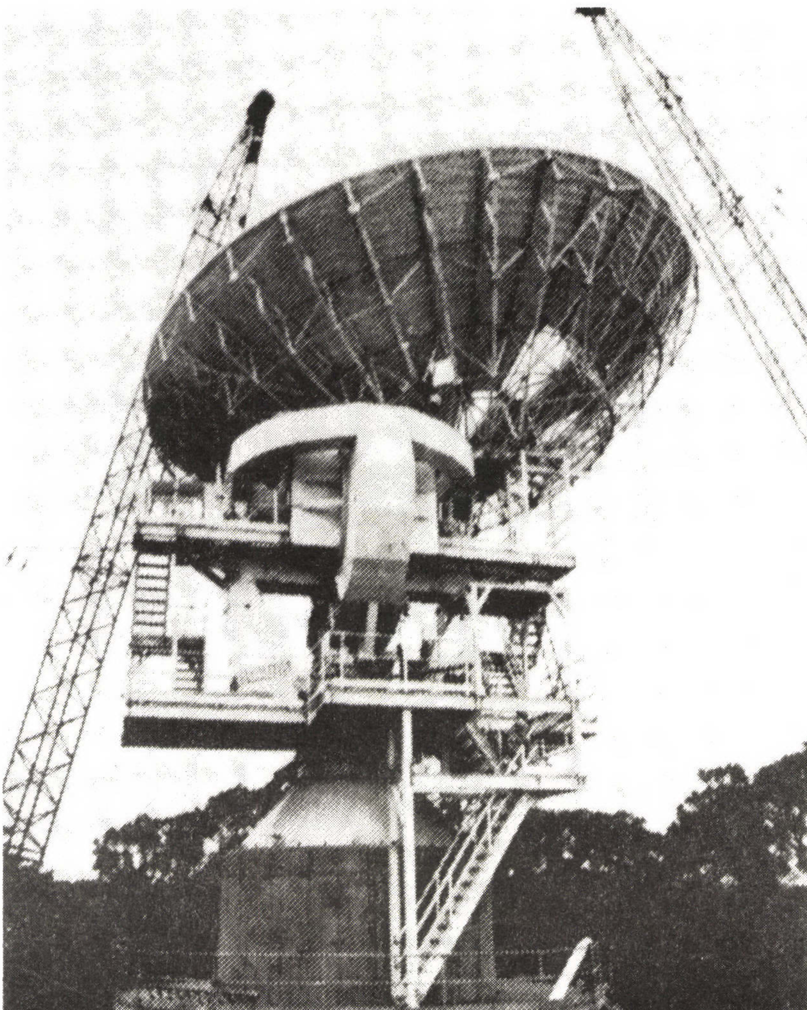
5 'Official Opening and Handover of the Watsonia Satellite [Terminal]', *Signalman*, No.8, 1981, p.30.

FIGURE 23
PROJECT SPARROW AN/FSC-78 DSCS SATELLITE GROUND TERMINAL UNDER CONSTRUCTION AT WATSONIA, VICTORIA



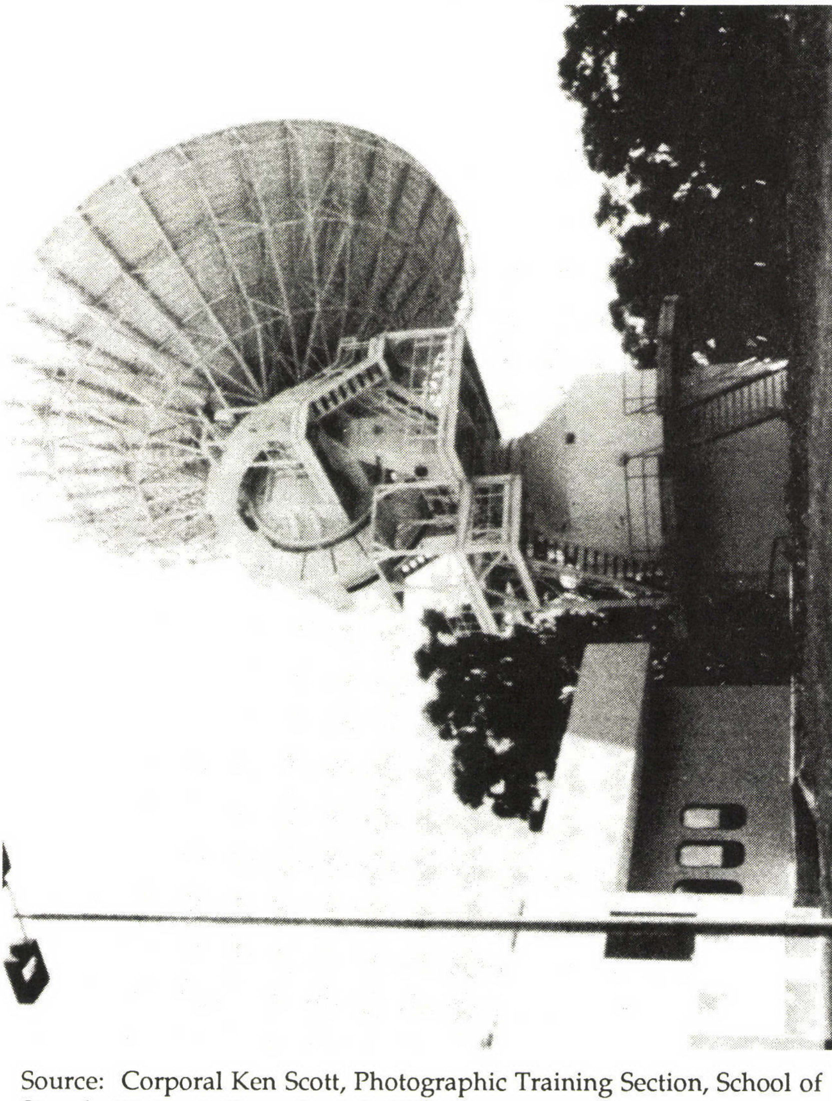
Source: *Signalman*, No.6, 1980, p.49.

FIGURE 24
PROJECT SPARROW AN/FSC-78 DSCS SATELLITE GROUND TERMINAL UNDER CONSTRUCTION AT WATSONIA, VICTORIA



Source: *Signalman*, No.7, 1981, p.66.

FIGURE 25
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 26
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.

transmission and reception carrier operations with configurations up to 9 uplink and 15 downlink carriers.[6]

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.[7]

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.

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, Plessey Circularly 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.[8]

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

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6 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).

7 *Signalman*, No.6, 1980, p.49; and No.8, 1981, p.31.

8 Desmond Ball, 'The US Naval Ocean Surveillance Information System (NOSIS) - Australia's Role', *Pacific Defence Reporter*, June 1982, pp.45-46.

as part of the MAROON SHIELD program for relaying selected SIGINT material - including material collected through Project KITTIWAKE.

More recently, a second, (11-metre) ground terminal has also been installed at Watsonia.[9] It is scheduled to become operational in early 1988 and, like the 60-foot FSC-78 terminal, is also intended for secure communications with the US concerning intelligence matters.

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9 Ian Mackay, 'Defence Links Put Australia On Top', *The Age*, 23 December 1987, p.11.

CHAPTER 6

THE PUBLIC DEBATE

The decision to establish the Kojarena ADSCS has generated considerable controversy - concerning both DSDs activities with respect to monitoring satellite communications in general and the establishment of the Kojarena station in particular. There is some controversy in the Geraldton area itself; there has been debate on the Kojarena project 'as a matter of urgency' in the Senate; and various issues have been raised by the peace movement.

Within the Geraldton area, which is presently suffering from depressed economic activity, the primary consideration has been the prospective economic benefits, including the enhancement of local employment opportunities.[1] However, considerable ill-feeling has resulted from the manner in which the government compulsorily acquired the site from the local landowners - under arrangements which are widely believed in the area to amount to unfair compensation.[2]

More generally, some of the critics of the Kojarena project have made assertions concerning strategic and defence policy aspects of the project - most of which have been ill-informed and some of which have been patently absurd! During the 'Matter of Urgency' debate in the Senate on 25 November 1987, for instance, Senator Robert Wood (NSW) asserted that the Kojarena/Geraldton facility will

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1 Gervase Greene and Lindsay Olney, 'Geraldton Base Seen as Bonanza: $100m Boost for Area', *West Australian,* 21 March 1987, p.5; and 'Mixed Reaction to WA Spy Base', *West Australian,* 21 March 1987, p.14.

2 'Row Over Land Needed for Base', *West Australian,* 12 October 1987, p.14; Tony Dean, '"Base Makes Farm Unviable"', *The Geraldton Guardinan,* 12 November 1987, p.1; John Arthur, 'Farmers Fight New Spy Base', *Daily News,* 12 November 1987, p.8; 'Tuckey Presses for "A Fair Deal"', *The Guardian Express,* 2 December 1987, p.1; '"We Feel Like Trespassers On Our Land"', *The Weekend Australian,* 5-6 December 1987, p.2; and Tony Robertson, 'Anger at Land Grab', *Sunday Times,* 6 December 1987, p.34.

allow Australia to 'collect in its own right the sort of strategic intelligence needed to be part of a nuclear war fighting game', that 'surely the opening of the Geraldton base will increase tensions in the region', and asked:

> Why does Australia need to monitor all the satellites operating in a whole third of the globe? Why do we need to get that information and what could we do with it?[3]

According to Senator Norm Sanders (Tas.), the decision to establish the Geraldton facility 'may be the first stage of the withdrawal of [the US geostationary SIGINT satellite ground station at] Pine Gap', which, according to Senator Sanders, has become politically too controversial to maintain. The United States has decided

> ... to eliminate this controversy by eliminating Pine Gap and letting the Australian Government take over all the functions of Pine Gap and take over all the functions at the new base at Geraldton....
>
> Geraldton ... is not going to be an Australian base at all; it will be run for the Americans by the Australians.[4]

It has also been asserted that, because the station will primarily serve US intelligence and nuclear war planning requirements, it will be a Soviet nuclear target![5]

Of course, the Kojarena project will involve substantial cooperation with Australia's UKUSA allies.[6] As the New Zealand Minister for Defence, Mr Bob Tizard, disclosed at a press conference in Canberra on 24 March 1988, there will be some cooperation between the Kojarena station and a similar (although smaller) facility being

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3 Senator Robert Wood, 'Proposed Satellite Facility: Geraldton', *Hansard (Senate)*, 25 November 1987, pp.2394-2397.

4 Senator Norm Sanders, *ibid.*, pp.2401-2402.

5 See, for example, 'WA Spy Base Worries Anti-Nuclear Group', *The Age*, 21 March 1987, p.15.

6 The UKUSA agreement is described in Richelson and Ball, *The Ties That Bind*, pp.4-8, 141-151.

built by the New Zealand Government Communications Security Bureau (GCSB) at Waihopai, near Blenheim.[7] Cooperation with the British Government Communications Headquarters (GCHQ) includes the posting to Geraldton of 10 GCHQ officers who will assist in establishing the ADSCS SIGINT operations and teaching certain satellite SIGINT skills to their DSD counterparts.[8] Cooperation with the United States will also be substantial. On the one hand, much of the sophisticated satellite monitoring and signal receiving and processing equipment will be procured from US aerospace and electronics companies under certified agreements with the US Department of Defense and the National Security Agency (NSA). And on the other hand, SIGINT collected at the station which is of interest to the United States will be passed to the NSA in accordance with procedures established under the UKUSA arrangements for SIGINT cooperation and exchange. It is also expected that signals which prove to be beyond the decryption capabilities of DSD will be sent to NSA and subjected to that Agency's superior capabilities.

From the point of view of the defence of Australia, the important issue is not the element of cooperation with the United States, but the extent to which the DSD satellite SIGINT facilities contribute to greater self-reliance. The fact that the Kojarena ADSCS can monitor satellites at an altitude of 22,300 miles across a horizon of some 150^{o} is nothing more than a fact common to any other point on the Earth's surface. The pertinent consideration is the nature of the satellite signals being monitored and the relevance of the SIGINT obtained for Australian intelligence assessments and defence planning.

DSD's satellite monitoring capabilities are unquestionably extensive, but the real question is whether or not they are excessive. The focus of the LARSWOOD project at Shoal Bay on Indonesian

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7 'Aust Plan to "Bug" Satellites', *Australian Financial Review*, 25 March 1988, p.5; Anna Grutzner, 'Spy Base to Swap Signals with NZ', *The Australian*, 25 March 1988, p.3; 'Station to Listen in on Foreign Satellites', *Sydney Morning Herald*, 25 March 1988, p.3; and 'NZ Minister Drops (Australian) Satellite Shock', *Canberra Times*, 25 March 1988, p.3.

8 Tony Dean, 'British Personnel to Run Communication Base', *Geraldton Guardian*, 27 April 1988, p.3.

satellite communications lies well within Australia's area of direct military interest. The Chinese satellite signals monitored by the KITTIWAKE project at Hong Kong are likely to be of less direct military relevance, but the Australian Government certainly has an interest in the intelligence about Chinese military, strategic and diplomatic developments provided by the project; and, moreover, the project is DSD's most important collaborative activity with the British GCHQ, and hence signifies the cooperative arrangements through which Australia receives an enormous volume of intelligence from the UK.

In the case of the Kojarena ADSCS, the coverage encompasses the satellite concentrations stationed over the mid-Indian Ocean and Southeast Asia and hence amounts to many dozen satellites - some 93 existing or proposed satellites in 1987. However, the great majority of these satellites would be ignored by the Kojarena station, and in many other cases the transmission beams are too narrow or are shaped so that they cannot be intercepted from Australia. (For example, the Soviet Luch communications system deployed on Gorizont 9 stationed at 53°E, well within the purview of the Kojarena station, has a shaped-beam coverage which excludes Australia.[9]) In fact, the Kojarena station is designed to monitor only 3-5 satellites at any given time, and these would be selected from the 12-15 existing and proposed Soviet, Japanese and INTELSAT communications satellites with which it is reckoned that DSD is likely to be concerned. Some of the SIGINT derived from monitoring these satellites is likely to be of direct significance to defence planning. However, the greater proportion of the SIGINT is likely to concern strategic, diplomatic and economic intelligence which would be important in the preparation of longer-term national assessments. Other SIGINT is likely to be of little direct relevance to the Australian Government but of value to other members of the UKUSA SIGINT community.

Given Australia's resources and geostrategic circumstances, the pursuit of self-reliance cannot be unqualified. There is nothing more than a superficial irony in the fact that greater self-reliance requires access to advanced US defence technologies and the extensive US intelligence capabilities. There is simply no way that Australia

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9 See 'Intelsat Faces Numerous Challenges', *Aviation Week and Space Technology*, 17 October 1977, p.75.

could develop these technologies and capabilities itself. Cooperation and exchange is especially fruitful with respect to SIGINT - and, indeed, it is probably necessary if the full strategic potential of SIGINT is to be realised.[10]

A final issue concerns the allocation of resources and effort within DSD. The Directorate has achieved an enviable reputation for its coverage of foreign signals in the Indo-Pacific region. As the countries in this region have increasingly supplemented or even replaced their high frequency (HF) communications systems with satellite communications systems, DSD has increasingly supplemented its HF with SATCOM monitoring systems. The satellite ground stations at Shoal Bay and Hong Kong, and the proposed Kojarena station, are among the largest DSD facilities. When the Kojarena ADSCS becomes operational, some 230 DSD personnel will be engaged in SATCOM monitoring activities - or some 30 per cent of the 800 DSD personnel employed outside the headquarters. The estab-lishment, operation and maintenance of satellite ground stations is expensive. It will be important to ensure that the attraction of involvement in state-of-the-art SATCOM monitoring operations and the undoubted value of some of the satellite SIGINT collected does not distort the overall priorities of DSD's activities and reduce the effectiveness of its more conventional operations.

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10 Richelson and Ball, *The Ties That Bind*, pp.301-302.

A NOTE ON THE NEW ZEALAND SATELLITE SIGINT STATION

On 2 December 1987, the New Zealand Prime Minister, David Lange, announced that New Zealand would also establish a satellite SIGINT station:

> To further enhance our own intelligence capabilities a defence satellite communication station will be constructed in the Waihopai Valley, near Blenheim.
>
> A site in the Waihopai Valley of about 77 acres has been purchased. It was selected for technical reasons, including lack of radio interference, climate and freedom from salt corrosion, and for the availability of support from RNZAF Woodbourne nearby. A satellite dish will be erected there. There will in addition be an operations building and workshop and the usual security fences. Construction will begin in 1988 and the station is expected to be operational in 1989.
>
> The station will be staffed and operated by the Government Communications Security Bureau. It will be wholly New Zealand owned and controlled.... The station will mark a new level of sophistication in our independent intelligence capability.[1]

The Government Communications Security Bureau (GCSB) was set up in 1977.[2] Its functions are similar to those of DSD - to ensure the security of official New Zealand communications (the COMSEC mission) and to collect foreign signals intelligence (the SIGINT mission) - and it cooperates closely with DSD. Cooperation

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1 Prime Minister David Lange, 'Defence Satellite Communications Station', Press Statement, 2 December 1987. See also 'Satellite Station Exposes Big Loss', *Evening Post*, 3 December 1987, p.1; 'Intelligence Project Revealed', *Evening Post*, 3 December 1987, p.5; and 'NZ Spy Base Plan Gives Self-Reliance', *The Australian*, 7 December 1987, p.15.

2 Richelson and Ball, *The Ties That Bind*, pp.76-78.

between Australia and New Zealand in SIGINT activities began during the Second World War. For example, New Zealand naval authorities intercepted Japanese radio transmissions on 26 and 30 May 1942 concerning Japanese submarine operations close to Sydney, which were passed to the Australian Naval Board by the New Zealand Naval Board.[3] Ten New Zealanders were stationed at the DSD station at Singapore in 1973, prior to the relocation of the station to Shoal Bay in 1974.[4] DSD assisted with the establishment of GCSB, as well as with the design and establishment of GCSB's single intercept station at Tangimoana, and DSD headquarters continues to maintain a significant degree of operational control over the Tangimoana facility. There are reportedly some 30 New Zealanders at DSD headquarters;[5] and according to a report in *Janes's Defence Weekly* in April 1987, it had been suggested that 'there might also be a New Zealand input into the Geraldton base'.[6] DSD has provided GCSB with considerable technical assistance with the planning and design of the Waihopai station, and several DSD officers will be posted to the station.

The relationship between the Kojarena and Waihopai stations was described in general terms by the New Zealand Minister for Defence, Mr Bob Tizard, at a press conference in Canberra on 24 March 1988:

> We are building satellite interception equipment in the South Island of New Zealand [i.e. Waihopai] and I understand that will be compatible with what the Australians are establishing [at Kojarena]...

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3 *Ibid.*, p.77.

4 'Five Power and ANZUK Arrangements and Withdrawal of Australian Battalion and Battery', Minute of Defence Committee Meeting Held On 11 January 1973, (Defence Committee Minute No.2/1973), p.3. See also Fred Brenchley, 'Why Our Troops Are Staying in Singapore', *National Times*, 12-17 February 1973, p.1; and *Hansard (House of Representatives)*, 1 March 1973, p.111.

5 John Edwards, 'Australia Will Stick to Links With NZ', *The Bulletin*, 12 March 1985, p.33.

6 Frank Cranston, 'Australia's Plans for New Listening Post', *Jane's Defence Weekly*, (Vol.7, No.13), 4 April 1987, p.582.

> Obviously, we're both interested in the same area and the intelligence that is applicable to Australian activity is applicable to ours...
>
> I don't say that we're overlapping. I'm saying that we're putting in our own independent source.
>
> But then when you've got it, you've got something to exchange if you want to.[7]

The connection between the Kojarena and Waihopai stations will not involve the automatic transmission of information between them, but will 'conform to normal voluntary exchange arrangements' between DSD and GCSB.[8]

The most comprehensive description of the planned station at Waihopai was given by Mr Colin Hanson, Director of GCSB from its inception in 1977 until his retirement on 29 January 1988, at a public meeting of residents of the Waihopai Valley area on 25 January 1988. According to reports of the meeting in *The Marlborough Express*, Mr Hanson stated that the station (to be known as Delta Station) will consist of a single 18-metre diameter dish mounted on a 6-metre high concrete pedestal, together with 'two low level buildings, one a workshop and the other the operations centre which will house the station's computers'.[9] It is expected that 'site works would be finished by about April', that basic construction should be completed by August or September and that the station should become operational by July 1989. About 30 people are to be employed at the station.

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7 'Aust Plan to "Bug" Satellites', *Australian Financial Review*, 25 March 1988, p.5; Anna Grutzner, 'Spy Base to Swap Signals with NZ', *The Australian*, 25 March 1988, p.3; 'Station to Listen in on Foreign Satellites', *Sydney Morning Herald*, 25 March 1988, p.3; and 'NZ Minister Drops (Australian) Satellite Shock', *Canberra Times*, 25 March 1988, p.3.

8 Anna Grutzner, 'Spy Base to Swap Signals With NZ', *The Australian*, 25 March 1988, p.3.

9 'Waihopai Spy Post Size Shocks Locals', *The Marlborough Express*, 27 January 1988, p.1; and 'Two Earlier Spy Stations Operated in Province', *The Marlborough Express*, 27 January 1988, p.3.

FIGURE 27
LOCATION OF GCSB SATELLITE COMMUNICATIONS INTERCEPT STATION, WAIHOPAI, NEAR BLENHEIM, NEW ZEALAND

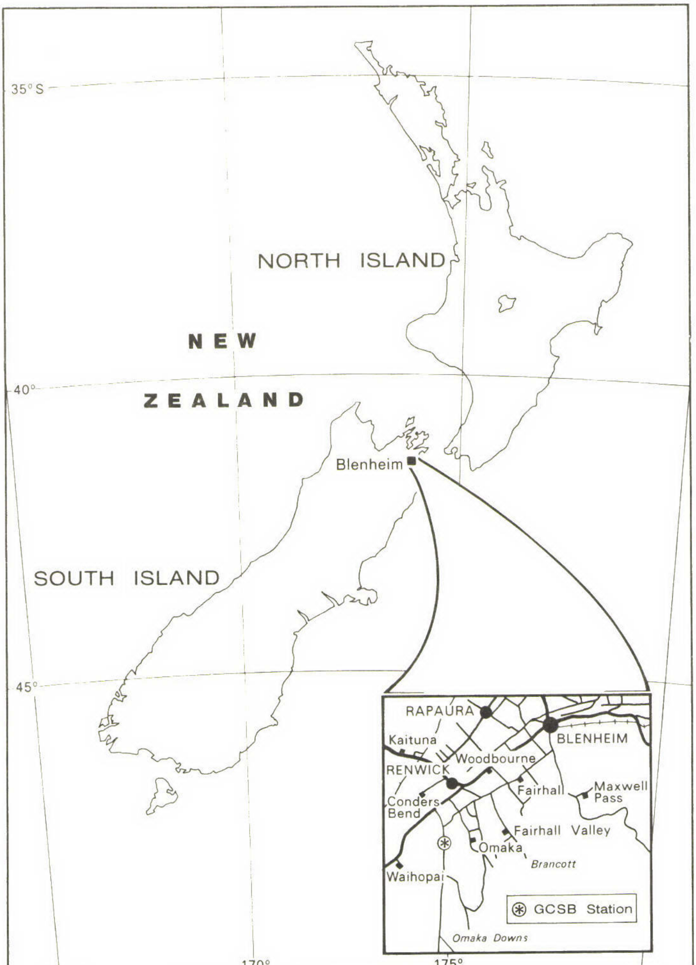
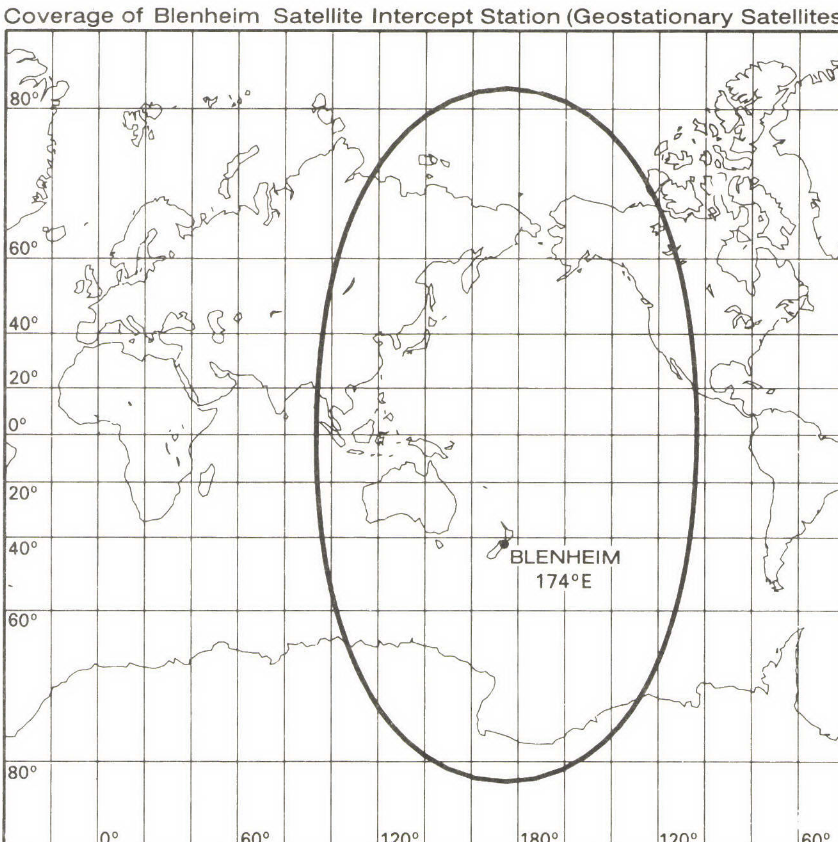


FIGURE 28
COVERAGE OF BLENHEIM SATELLITE INTERCEPT STATION
(GEOSTATIONARY SATELLITES)



According to Mr Hanson, it would not be unreasonable to expect a second dish to be added to the facility at some stage:

> If we're going to stay in the game in the years ahead then in all probability there will be another dish.[10]

Although the New Zealand Government has consistently refused to disclose the cost of the Waihopai project, a reasonable estimate would be about $30m.

Given that the Waihopai station will be located at about 174°E, its purview with respect to geostationary satellites will extend from about 100°E to about 110°W - i.e. from above Singapore to above the mid-United States. This will provide coverage of some 72 existing or proposed satellites. (See Figures 27 and 28.)

Of course, the coverage from 100°E to 170°W duplicates that of the Kojarena ADSCS, and includes some 44 satellites (see Table 3). Between 170°W and 110°W are some 28 existing and proposed satellites. These include three Mexican Ilhuicahua communications satellites, two Canadian communications satellites and two Canadian meteorological satellites, and 21 US satellites - two Defense Satellite Communications System (DSCS) satellites; two US Navy Fleet Satellite Communications (FLTSATCOM) satellites; a Geostationary Operational Environmental Satellite (GEOS) meteorological satellite; a Defense Support Program (DSP) western hemisphere missile early warning satellite; and 15 US commercial communications satellites. It is reasonable to presume that the principal purpose of the Waihopai station is the collection of military, diplomatic, economic and security intelligence by monitoring selected transmissions to New Zealand from national and international COMSATs.

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10 'Waihopai Spy Post Size Shocks Locals', *The Marlborough Express*, 27 January 1988, p.1.

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The aim of the Strategic and Defence Studies Centre, which was set up in the Research School of Pacific Studies in The Australian National University, is to advance the study of strategic problems, particularly those relating to the general region of the Indian and Pacific Oceans and South-east Asia. Participation in the Centre's activities is not limited to members of the University, but includes other interested professional and Parliamentary groups. Research includes not only military, but political, economic, scientific and technological aspects. Strategy, for the purpose of the Centre, is defined in the broadest sense of embracing not only the control and application of military force, but also the peaceful settlement of disputes which could cause violence.

This is the only academic body in Australia which specialises in these studies. Centre members give frequent lectures and seminars for other departments within the ANU and other universities. Regular seminars and conferences on topics of current importance to the Centre's research are held, and the major defence training institutions, the Joint Services Staff College and the Navy, Army and RAAF Staff Colleges, are heavily dependent upon SDSC assistance with the strategic studies sections of their courses.

Since its inception in 1966, the Centre has supported a number of Visiting and Research Fellows, who have undertaken a wide variety of investigations. Recently the emphasis of the Centre's work has been on problems posed for the peace and stability of Australia's neighbourhood; the defence of Australia; arms proliferation and arms control; decision making processes of the higher levels of the Australian Defence Department; management studies and the role of the Minister in Australia's defence policy making; and the strategic implications of developments in South-east Asia, the Indian Ocean and the South West Pacific Area.

The Centre contributes to the work of the Department of International Relations through its graduate studies programme; and the Department reciprocates by assisting the Centre in its research. A comprehensive collection of reference materials on strategic issues, particularly from the press, learned journals and government publications, is maintained by the Centre.

The Centre also conducts seminars and conferences which have led to several volumes of published proceedings.

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The monograph also includes a Note on the proposed New Zealand satellite SIGINT facility at Waihopai, near Blenheim, and cooperation between this facility and the DSD operations.