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VII

DEPUTY FOR SYSTEMS MANAGEMENT

[redacted] The Air Force developed program 461 as a satellite early warning system capable of detecting missile flights by infrared radiation. A 1963 series of tests, employing satellite sensors, demonstrated validity of the infrared detection concept by reporting Atlas and Titan flights. Further sensor development permitted 461 launches in 1966 and 1967.

[redacted] Meanwhile, on 1 November 1966, Air Force headquarters designated program 949 as a follow-on to program 461, possessing a wider range of capabilities described as:

> . . .development and demonstration of a technological base from which cost effective multipurpose satellite systems may be evolved during the 1970 time period having progressively enhanced world-wide early warning, surveillance and detection capabilities.

The Department of Defense saw these capabilities as particularly relevant to Soviet development of a

on 14 August 1967, an Air Force headquarters request directed to the program office to immediately investigate possible acceleration of the 949 program. Prompt study revealed the program could be accelerated to provide FOBS warning as early as July 1969. This could be accomplished by developing and producing one research and development satellite, less pacing sensor elements not essential to the tactical warning mission, yet capable of providing real time data to a station located in the eastern hemisphere.[2]

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[redacted] On 22 August an important mission was added to the 949 program. A contract change notice gave TRW Inc., overall responsibility for mission IIIB--Space Nuclear Detonation Detection--". . . including the design and development of the hardware and analysis of the data from the AGC (Aerojet General Corporation) Sensor Data Processing Laboratory." This decision imposed a requirement to develop satellite sensor equipment equal to its demanding mission.[3]

[redacted] On 8 November 1967 Systems Command directed program 949 return to its original plan of preparing three development satellites for Titan IIIC launches in June, September and December 1970. Command headquarters instructed SAMSO to activate, by June 1970, a single overseas readout station to provide real time warning of hostile missile/spacecraft launches. Further, the command advised that the ground station, a key element in the operational system, be constructed to assure optimum survivability.[4]

[redacted] Though the program was not formally accelerated, development of crucial program technical elements proceeded at a generally satisfactory rate. TRW Inc., scheduled a satellite preliminary design review, 30 October-17 November 1967. Engineering work on an acceptable infrared sensor continued without major problems or significant changes. Thus by the end of December Aerojet General had completed preliminary design review of all sensor elements except the visible light sensor (VLS). International Telephone and Telegraph designed sensor hardware and Aerojet General worked on its electronics but near the end of the year". . . it became obvious that the most general interpretation of the top specifications could not be satisfied." At a 30 November 1967 briefing on VLS progress, "Aerojet General presented a cohesive picture of end-to-end

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VLS performance . . .

The contractor anticipated his star sensor design would experience difficulty only during solar flares. Thus harassed by technical problems Aerojet delayed formal VLS preliminary design review until January 1968.[5]

[redacted] The 949 program office began planning selection of a suitable overseas ground station site and submitted a formal request for foreign operating rights in Australia. The program office scheduled completion of ground system and overseas station designs by 1 August 1968, the date for award of a contract to construct the ground elements of the 949 system.[6]

[redacted] As engineers defined the basic technical elements of the program strategic planning continued apace at SAMSO and Washington decision levels. The Air Force, during the last half of the fiscal year, broadened objectives of the 949 program to include warning and data collection functions also applicable to the Army's Sentinel program. As future elements of 949 became clear the program office and the Deputy for Development Plans prepared a Concept Formulation Package/Technical Development Plan for submission to Systems Command by 3 June 1968.

Each satellite would contain infrared, nuclear detection and horizon/star sensors plus real time data transmission capability to a ground readout station. Block II, scheduled for deployment in mid-1972,

improved sensor equipment capable of diagnosing nuclear detonations

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As of June 1968 the program office had a well developed contractual program underway based on an approved funding level of $52.3 million for the fiscal year. The period of performance on Aerojet General's sensor development contract (FO4695-67-C-0034) extended to 31 October 1970 with an increase in target cost and fee of $2.9 million. The program office extended TRW Inc., contract (FO4695-67-C-0035) at an increase in target cost and fee of $3.3 million.[8]

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[redacted] While 949 system design and hardware generally developed satisfactorily the Air Force and Department of Defense decision makers gradually defined the program's operational mission--early warning of attack by long range continental missiles, submarine launched missiles, and

level of sensory development, and rate of development and deployment of the operational system. Though the basic concept of the program rested on sound experimental experience complex elements of data collection and transmission from the satellite to ultimate user thousands of miles distant pressed the state of optical and electrical arts. Nevertheless, development of sophisticated sensory equipment would enable 949 satellites to determine the flight path of incoming vehicles

[redacted] Guided by these decisions the program office mapped the crucial elements of the 949 system. A satellite(s) covering the eastern hemisphere from a synchronous altitude required an eastern

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hemisphere readout station. Readout station data would then be reduced and transmitted via cable or relay satellite to a United States data processing facility for relay to user operation room screen displays, a nearly instantaneous process.[32]

[redacted] Though an Australian readout station site had been tentatively selected in fiscal 1968, site options remained open.

In any event, the Department of Defense and the Air Force considered the program's first phase (Block I), whose technical dimensions remained somewhat imprecise, essentially a test of the follow-on operational system (Block II), slated to begin in mid-1972. Block II would provide nearly global coverage, sophisticated sensors to detect and diagnose enemy actions, enhanced reliability, increased survivability, a 36 month operational life and one readout station in each hemisphere.[33]

[redacted] Acceleration of program decisions through the mid-fiscal year resolved some of the more pressing uncertainties in the overall program plan. In December 1968 the Air Force decided to locate the eastern hemisphere readout facility at Woomera, Australia. Hence, the program office asked TRW Systems, Inc. and Philco-Ford, competitive contractors in planning the 949 ground system, to resubmit their Phase I data acquisition and communications studies, completed 2 December, to include technical and cost proposals reflecting an Australian located readout station in a government built facility equipped to provide partial data reduction prior to final processing in the United States. In addition to this action the Secretary of Defense, on 3 January 1969, issued a Program Change Decision (PCD) that scheduled the first 949 R&D Phase I launch in June 1970, provided for an improved system (Phase II), and kept open the option of developing

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and deploying an operational series of satellites (Phase III). Moreover, the PCD approved procurement of the Australian ground station and a United States based data processing facility in fiscal 1969 and 1970, procurement of a United States ground readout station in fiscal 1970 and 1971, refurbishment of the Phase I qualification satellite for flight, procurement of four Phase II satellites and four Titan IIIC boosters, two each in fiscal 1971 and fiscal 1972, and reprogramming of fiscal 1969 funds to make up deficits in the program. Interestingly, the PCD directed phase out of BMEWS and SLBM radar warning systems in fiscal 1972 and the bomb alarm system in fiscal 1974 if the 949 program deployment proved successful.[34]

[redacted] A program office briefing to the Assistant Secretary of the Air Force in early March 1969 advised an additional program change, formally announced on 10 March, that scheduled the first eastern hemisphere launch in December 1970 and completion of the first ground station on the same date. The program office also pointed out, and the Secretary agreed, that more money would be needed for setting up both the eastern and western ground stations

[redacted] Development of the ground data system, based on mid-year directives, included selection of a United States readout station. The program office worked closely with Aerospace Defense Command (ADC), designated operator of the hemisphere readout stations, in technical aspects of station planning and site selection. A site selection team's thorough review of prospective sites resulted in selection of as the best United States 949 station site. Following selection of the two hemisphere station sites

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the program office contracted with C. F. Braun and Company, architect/ engineer, to establish design criteria essential for facility design and construction. The Australian site, about 15 miles from the nearest town, required complete facilities. A second survey of the Woomera area, in March 1969, examined communications, water, roads, and base-life support requirements. C. F. Braun engineers again visited the Australian site in late May 1969 for additional engineering data. Also, in May 1969, C. F. Braun engineers prepared specific readout station design criteria based on their survey of existing Waverly AFS facilities.[36]

[redacted] The program office source selection board, on 15 March 1969, selected Philco-Ford's Western Development Laboratories (WDL) to design and produce the "Data Acquisition and Communication Segment" of the 949 program. The contract required single hemisphere coverage and split of the ground data system between Australia and the United States. On 2 June 1969 the program office awarded Western Development Laboratories a contract to integrate all segments of ground data operations into a single system. Aerojet General, under a Phase I contract, had defined the data reduction center function of the system which, essentially, would be performed by a single IBM 360/75 computer collocated with the readout station. By the end of June 1969, Aerojet General had advanced this phase of the program under a letter contract undergoing definition. Meanwhile, development of user data displays, originally a part of the Aerojet General data reduction center contract, had been established as a separate contractual task awarded to Philco-Ford.[37]

[redacted] Generally, the Air Force and SAMSO assessed 949 technical development through fiscal 1969 as hopeful if not completely satisfactory.

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communications contract F04701-69-C-0051, extending from 15 March 1969 to 31 August 1969, with options to extend through August 1971. The Air Force established the target price at $5 million and option price at $11.3 million for a fixed price incentive contract. In April 1969 Aerojet General received a letter contract, F04701-69-C-0049, slated for definition by 27 September 1969, to design and develop the 949 data reduction center. The Air Force priced the contract at $11.4 million with a $30 million option for a cost plus incentive fee contract. In addition the program office awarded a number of study contracts. Two $100 thousand contracts awarded to Lockheed Missiles and Space Company and General Electric Company studied a target and background measurement program from September 1968 through May 1969. The program office also awarded Lockheed, TRW Systems, and Hughes Aircraft contracts to study conceptual satellite surveillance systems. These contracts cost the Air Force about $350 thousand each for work from 1 May 1969 through August 1969. These studies defined the best means of adapting the 949 program to the quick response requirements

At the beginning of the fiscal year the 949 program had a funding total of $94.3 million; allocated at $92.3 million for Block I development and $2 million for study of the follow-on program. Obviously costs were high and the program office became concerned over Aerojet General's rapidly mounting costs. In November Aerojet's rate of expenditure ". . . mushroomed from about $38 million, for which we had budgeted, to almost $57 million, for which we hadn't." It became necessary for SAMSO and the program office to take strong action to quickly control the problem and yet retain a viable development program. Program adjustments included elimination of certain tests, improved Aerojet management, and assignment of a qualification test satellite as a flight satellite. Within these various pressures the program office had to hold overall rate

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An Aerojet General sensor critical design review, 2-11 December 1968, suffered from an absence of completed hardware and it did not include the visible light sensor subsystem and data processing electronics subsystem. TRW Systems held a satisfactory spacecraft critical design review, 17-19 December 1968. Spacecraft development encountered thruster problems and within the attitude control system reaction wheel electronics gave some difficulty--problems amenable to solution within the development schedule.

The star sensor and infrared sensor developed successfully. The latter indicated improved detection of both submarine launched missiles as well as larger intercontinental ballistic missiles. But continued application of time and resources revealed that nearly "insurmountable development problems beset the VLS (visible light sensor)." These problems, in fact, placed development of the VLS about 10 months behind schedule and development costs 400 percent over original cost estimates to completion.[38]

Thus the 949 system evolved from a contractual effort that began in December 1966 with spacecraft development and integration by TRW Systems, and development of satellite sensors and data processing by Aerojet General. As the Department of Defense and the Air Force advanced the program the program office extended TRW Systems contract F04695-67-C-0035 and Aerojet General contract F04695-67-C-0034 period of performance to 31 March 1971. In addition to extension of the above contracts the Air Force awarded Philco-Ford a data acquisition and

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of expenditures to an approved funding level of [redacted] million for fiscal 1969 and $114.4 million for fiscal 1970.*[40]

Thus the program office fashioned the 949 contractual program through fiscal 1969 to develop, produce, test and launch the first eastern hemisphere 949 satellite in December 1970. Thereafter, as planned, three more launches providing satellites for both hemispheres by September 1971 would complete the first phase or Block I of the 949 system. This schedule required complex phasing of myriad details of engineering design, construction, launch planning, data transmission and personnel training--approximately 250 people would be required to man each readout station. Surveillance and warning data would then appear, thousands of miles distant, on screens in command and control rooms across the nation.** As planned the system would be contractor operated for a year before Aerospace Defense Command military manning took over.[41]

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	FY 1969	FY 1970
RDT&E	$ 94.3	$ 62.7
Booster	15.6	15.6
1st Ground Station	17.6	14.2
2nd Ground Station Support	.2	3.6
MCP	2.6	3.7
Operations		2.1
	$130.3	$114.4

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NOTES

1. History Report (HR), Dep for Sys Mgt, Engrg Div, Jul-Dec 67; Rpt, Program 949--Block II, prep by AFRDS, 24 Sept 68.

2. SAMSO, Dep for Sys Mgt (SMU), Prog Control Div Prog Change Request, Prog 949, 8 Oct 67; msg, MSF 1182, Hq AFSC to all AFSC, 1 Nov 66.

3. HR, Dep for Sys Mgt, Prog Control Div, Jul-Dec 67.

4. Ibid.

5. Ibid.

6. Ibid.

7. Msg, SMUM 26133, SAMSO to ADC, SAC, CSAF and AFSC, 28 Nov 67; ltr, Col F.X. Kane, SAMSO Dir of Dev Plans to SAMSO Comdr LtGen J.W. O'Neill, subj: 949 Operational Planning, 11 Mar 68, in Hist Ofc files; ltr, MajGen G.A. Kent, AFSC DCS/Dev Plans, to Hq USAF, BrigGen Hedrick, subj: CFP/TDP for a Follow-on to Program 949, 25 Mar 68; ltr, MajGen G.A. Kent, to LtGen J.W. O'Neill, subj: CFP/TDP for a Follow-on to Program 949, 26 Mar 68.

8. Rpt, Prog 949 and 461, Proc and Prod Div, Jul-31 Dec 67; HR, Prog Control Div, Jul-Dec 67.

Plan (PSPP) For Program 949, 1 May 69,

IR, 949 SPO, Jan-Jun 69.

AFSC Dir of Prog and Budget, to
ansmittal of Program Change Request,
22, Prog 949.

C. Moot, Asst Sec of Def, to Air Force,

Prog Control Div, Jan-Jun 69.

36. HR, Dep for Space Systems, Dir of Operations, Jan-Jun 69.

37. Ibid.

38. HR, 949 SPO, Engrg Div, Jul-Dec 68; HR, Engrg Div, Jan-Jun 69.

39. HR, 949 SPO, Dep Dir for Test and Deployment, Jul-Dec 68; HR, Proc and Prod Div, Jul-Dec 68; HR, Proc and Prod Div, Jan-Jun 69.

40. HR, Dep for Defense Sys, Prog Control Div, Jan-Jun 69; quotation from PRESCA Guidelines, draft prep by Prog Ofc, dtd 10 Mar 69; ltr, Col R.H. Lengnick, 949 SPD, to TRW Systems, subj: Program 949 Direction, dtd 14 Feb 69.

41. Proposed System Package Plan (PSPP) For Program 949, 1 May 69.