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Report 10340
Final
September 1994

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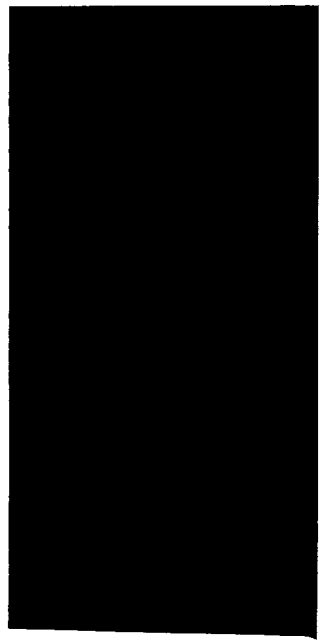
Earth Observing System (EOS) Advanced Microwave Sounding Unit-A (AMSU-A) Spares Program Plan



Contract No: NAS 5-32314
CDRL: 035

Submitted to:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Submitted by:

Aerojet
1100 West Hollyvale Street
Azusa, California 91702

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TABLES

Section 1

SPARES PROGRAM PLAN

1.1 Scope

This plan specifies the spare components to be provided for the EOS/AMSU-A instrument and the general spares philosophy to be adopted for their procurement. It also addresses those key components not recommended for spares, as well as the schedule and method for obtaining the spares. The selected spares list has been generated based on component criticality, reliability, repairability, and availability and is based primarily on historical findings evinced by the NOAA/AMSU-A program. An alternate spares list is also proposed based on more stringent fiscal constraints.

This Spares Program Plan is submitted in response to Contract NAS5-32314, CDRL 035. This is the second and final submittal.

Section 2

RECOMMENDATIONS

2.1 Recommended Spares

The spare quantities recommended assume that one AMSU-A instrument, consisting of one AMSU-A1 module and one AMSU-A2 module, is delivered. They do not take into account provisions for optional flight models not under contract at this time. Table I shows the recommended spare components and quantities to be provided, as well as the total number of components required in each module.

Rationale for the recommended quantities is as follows. Those components requiring one spare are generally reliable or repairable, but their criticality to the instrument is such that a catastrophic failure to any one of them, without a spare component available, would significantly affect instrument delivery schedule.

Regarding ground support equipment, a spare for the hard drive used in the AMSU-A special test equipment (STE) is recommended because of the potential for obsolescence. The STE was developed for use on the current NOAA/AMSU-A program, and replacement parts will eventually be unavailable.

Table II includes those key instrument components considered sufficiently reliable or readily available that spares are not recommended. These devices are all passive and thus much less susceptible to failure.

2.2 Alternate Spares Recommendation

A modified spares list, based on potential fiscal constraints, is provided in Table III as an alternate approach. It does not offer as robust a spares program as that presented above.

Specifically, the phase-locked oscillator, to be built by Aerojet, can be trouble-shot and quickly repaired if the Gunn Diode voltage-controlled oscillator used in it is spared. Historically, failures to the low-noise mixer/IF amplifiers on the NOAA/AMSU-A program were repaired in three weeks by responsive supplier (SPACEK), and they can be eliminated at modest schedule risk assuming the supplier is directed to maintain spare diodes, parts critical to the components, and remains responsive. IF amplifiers also experienced failures, but they can generally be repaired in a few days. Finally, the motors and resolver have never failed on the existing program, providing a high degree of confidence.

2.3 General Usage Inventory

Table IV lists components that are not recommended to be spared, but rather augmented by a general usage inventory. Usage inventory is not deliverable and thus remains available for subsequent transition to additional flight instruments should options be exercised. However, should a failure of one of these components occur after delivery, replacement from the usage inventory could be done rapidly and without affecting any optional follow-on instrument effort that might be under way at

that time. Usage inventories of 20 percent, with a minimum of one component, is planned for those components.

Note that a general usage inventory is provided for RF detectors in addition to those provided as spares. Whereas two complete sets of detectors are considered necessary, it is recommended that only one set be delivered in order to retain a portion of the detectors for flight options.

Table I Recommended Spares List

Component	Quantity Required		Qty of Spares
	AMSU-A1	AMSU-A2	
Dielectric Resonator Oscillator, Channel 1		1	1
Dielectric Resonator Oscillator, Channel 2		1	1
Dielectric Resonator Oscillator, Channel 3	1		1
Dielectric Resonator Oscillator, Channel 4	1		1
Dielectric Resonator Oscillator, Channel 5	1		1
Dielectric Resonator Oscillator, Channel 6	1		1
Dielectric Resonator Oscillator, Channel 7	1		1
Dielectric Resonator Oscillator, Channel 8	1		1
Phase-Locked Oscillator, Channels 9-14	2		1
Crystal Oscillator Unit (for Phase-Locked Oscillator, Channels 9-14	1		1
Dielectric Resonator Oscillator, Channel 15	1		1
Low-Noise Mixer/IF Amplifier, Channel 1		1	1
Low-Noise Mixer/IF Amplifier, Channel 2		1	1
Low-Noise Mixer/IF Amplifier, Channel 3	1		1
Low-Noise Mixer/IF Amplifier, Channel 4	1		1
Low-Noise Mixer/IF Amplifier, Channel 5	1		1
Low-Noise Mixer/IF Amplifier, Channel 6	1		1
Low-Noise Mixer/IF Amplifier, Channel 7	1		1
Low-Noise Mixer/IF Amplifier, Channel 8	1		1
Low-Noise Mixer/IF Amplifier, Channel 9-14	1		1
Low-Noise Mixer/IF Amplifier, Channel 15	1		1
IF Amplifier, Channel 9	1		1
IF Amplifier, Channel 10	1		1
IF Amplifier, Channel 11-14	1		1
IF Amplifier, Channel 11	1		1
IF Amplifier, Channel 12	1		1
IF Amplifier, Channel 13	1		1
IF Amplifier, Channel 14	1		1
Surface Acoustic Wave Filter, Channel 11	1		1
Surface Acoustic Wave Filter, Channel 12	1		1
Surface Acoustic Wave Filter, Channel 13	1		1
Surface Acoustic Wave Filter, Channel 14	1		1
RF Detector, 10-400 MHz	13	2	7
RF Detector, 500-1500 MHz	1		1
Analog-to-Digital Converter	1	1	1
Resolver-to-Digital Converter	2	1	1
MIL-STD-1553 Transceiver	1	1	1
Motor, AMSU-A1	2		2
Motor, AMSU-A2		1	1
Resolver	2	1	1
DC/DC Converter	1	1	1
Platinum Resistive Transducer No. 1	32	11	5
Platinum Resistive Transducer No. 2	10	7	5
Hard Drive, 71 Mbyte	1 (used in STE)		1

Table II Key Components Not Recommended for Sparing

Component	Quantity Required		Qty of Spares
	AMSU-A1	AMSU-A2	
Feedhorn, A1-1	1		
Feedhorn, A1-2	1		
Feedhorn, A2		1	
Multiplexer, 5-Port	1		
Multiplexer, 3-Port	1		
Diplexer		1	
IF Bandpass Filter, Channel 1		1	
IF Bandpass Filter, Channel 2		1	
IF Bandpass Filter, Channel 3	1		
IF Bandpass Filter, Channel 4	1		
IF Bandpass Filter, Channel 5	1		
IF Bandpass Filter, Channel 6	1		
IF Bandpass Filter, Channel 7	1		
IF Bandpass Filter, Channel 8	1		
IF Bandpass Filter, Channel 9	1		
IF Bandpass Filter, Channel 10	1		
IF Bandpass Filter, Channel 15	1		

Table III Alternate Recommended Spares List

Component	Quantity Required		Qty of Spares
	AMSU-A1	AMSU-A2	
Dielectric Resonator Oscillator, Channel 1		1	1
Dielectric Resonator Oscillator, Channel 2		1	1
Dielectric Resonator Oscillator, Channel 3	1		1
Dielectric Resonator Oscillator, Channel 4	1		1
Dielectric Resonator Oscillator, Channel 5	1		1
Dielectric Resonator Oscillator, Channel 6	1		1
Dielectric Resonator Oscillator, Channel 7	1		1
Dielectric Resonator Oscillator, Channel 8	1		1
Gunn Diode Voltage Controlled (for Phase -Locked Oscillator), 9-14	2		1
Crystal Oscillator Unit (for Phase-Locked Oscillator), Channels 9-14	1		1
Dielectric Resonator Oscillator, Channel 15	1		1
RF Detector, AMSU-A1	13		5
RF Detector, AMSU-A2		2	2
Analog-to Digital Converter	1	1	1
Resolver-to-Digital Converter	2	1	1
DC/DC Converter	1	1	1
Platinum Resistive Transducer, No. 1	32	11	5
Platinum Resistive Transducer, No. 2	10	7	5

(continued)

Table III Alternate Recommended Spares List (Cont.)

Component	Quantity Required		Qty of Spares
	AMSU-A1	AMSU-A2	
Low-Noise Mixer/IF Amplifier, Channel 1		1	1
Low-Noise Mixer/IF Amplifier, Channel 2		1	1
Low-Noise Mixer/IF Amplifier, Channel 3	1		1
Low-Noise Mixer/IF Amplifier, Channel 4	1		1
Low-Noise Mixer/IF Amplifier, Channel 5	1		1
Low-Noise Mixer/IF Amplifier, Channel 6	1		1
Low-Noise Mixer/IF Amplifier, Channel 7	1		1
Low-Noise Mixer/IF Amplifier, Channel 8	1		1
Low-Noise Mixer/IF Amplifier, Channel 9-14	1		1
Low-Noise Mixer/IF Amplifier, Channel 15	1		1

Table IV Key Components To Be Covered With General Usage Inventory

Component	Quantity Required	
	AMSU-A1	AMSU-A2
Waveguide Isolators (10 Types)	8	2
IF Attenuators (8 Types)	6	2
Power Dividers (2 Types)	2	
Printed Wiring Boards (20 Types)	23	19
Microcircuits (21 types)	Numerous	Numerous
Scan Drive Motor Bearings	2	1
RF Detectors (Complete Set)	13	2

2.4 Spares Schedule

The spares inventory is recommended to be procured at the same time as flight units. This approach offers two advantages: (1) Cost can generally be maintained at a lower level when quantity buys are made simultaneously rather than spaced in time; (2) simultaneous delivery allows a spare component to be available immediately during system assembly and integration in case of a failure during integration, avoiding delivery delays; or, conversely, the component suppliers could be allowed some latitude in delivering spare units if a problem with one unit occurred, allowing them to expedite qualified units for instrument integration while delaying the noncritical problem unit.

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