

MIL-R-85693/2(AS)

31 October 1986

MILITARY SPECIFICATION SHEET

Receiver, Advanced Sonobuoy Communication Link
AN/ARR-78(V)(2) S-3B CONFIGURATION

(U) The requirements for acquiring the sonobuoy receiver described herein shall consist of this specification and the latest issue of MIL-R-85693.

(U) This specification is approved for use within the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

(U) REFERENCES: References to numbers in parentheses following primary topics indicate paragraphs in the main body of the specification where that material is discussed.

(U) REQUIREMENTS:

(U) Total weight (see 3.4.1): The total weight of the sonobuoy receiver, excluding cables, shall be not greater than the following unit weights:

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TABLE I. (U) Total weight

Item	Unit Weight in Pounds
Receiver Assembly R2266/ARR-76	105
RF Amplifier AM-6875/ARR-78	3
Total System Weight	108

(U) Weapon replaceable assembly (WRA) types (see 3.4.7.3.1.1): The equipment shall consist of two WRAs, one of which shall be of the light replaceable assembly (LRA) type. Each must be replaceable at the organizational ("O") level. No special tools shall be required for removal or replacement. The non-LRA type WRA shall be composed of SRAs of the quick replaceable assembly (QRA) type, which shall include but not be limited to the following, and must be replaceable at the organizational level:

(U) 12 ea acoustic receivers (analog only)

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- (U) 4 ea acoustic receivers
- (U) 4 ea acoustic receivers
- (U) 4 ea auxiliary receivers
- (U) 1 ea power supply
- (U) 1 ea computer I/O
(Manchester Type I)
- (U) 1 ea built-in-test equipment
(BITE) module
- (U) 1 ea RF amplifier/multi-coupler/
ADF preamplifier
- (U) 1 ea reference generator
- (U) 1 ea clock generator
- (U) 1 ea I/O processor

(U) Backplane wiring: Backplane wiring may be of the shop replaceable assembly (SRA) type.

(U) Electrical power (see 3.4.12):

(U) Operating power (see 3.4.12.1): The sonobuoy receiver shall meet all specified performance requirements when energized from a power source having characteristics and limits as defined in MIL-STD-704, 3-phase, 4-wire, 400 Hz, 115 Vac power. The ac power required for normal operation shall not exceed 400 watts.

(U) Lighting power (see 3.4.12.2): This requirement has no application in the (V)(2) configuration.

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(U) Cooling: The equipment shall operate within the specified limits using ambient cooling air. Cooling air shall not pass directly over any internal components, with the exception of certain power supply component outer cases. Ambient cooling air shall be supplied by the aircraft and drawn through the equipment at a rate of 58 CFM minimum of 0.5 inch of water and +55°C at sea level.

(U) Thermal overload protection (see 3.4.13.1): An overtemperature sensor shall be provided to protect the equipment within 5°C of maximum permissible internal operating temperature. Operation of the overtemperature sensor shall result in automatic equipment turn off.

(U) Outputs:

(C) RF monitor outputs: Each auxiliary receiver shall be capable of interrogating each of the above RF channels in 20 ms (10 ms acquisition time, and 10 ms dwell time) and provide A/D output to computer I/O defined into levels of RF signal as specified in take II.

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TABLE II. (U) Three-bit code definitions of signal levels.

<u>Bit Code</u>	<u>RF Level (uvolt)</u>
0 0 0	<1.3
0 0 1	0.8-2.5
0 1 0	1.5-5.0
0 1 1	3.1-10.0
1 0 0	6.3-20.0
1 0 1	12.0-40.0
1 1 0	>25.0

(U) Computer I/O interface (see 3.7.2.5):

(U) Digital interface - general: Communication with the ASW receiving set on S-3B aircraft shall be carried out via a Manchester Type 1 Interface Channel with the AN/AYK-10 general purpose digital computer (GPDC). Thus, the AN/ARR-78(V)(2) configuration will operate only in the automatic mode. The manual mode will not be utilized on the S-3B.

(U) Input-output communication: The receiver shall interface directly with a control processor via a Manchester type 1 interface channel pair as defined in appendix B. Included within this appendix are the functions and flow that define each of the channel sequences that are implemented with the advanced sonobuoy communications link sonobuoy receiver. The receiver and interface logic shall be required to perform all functions defined for implementation of the four sequence types (interrupt word, input word, output word, and forced output word). An exact definition of the sequence flow of the control processor is provided in section 5 of appendix B.

(U) Computer control interface: The receiver shall interface with a system control computer via a Manchester type 1 channel. The control computer will transfer control information and test requests to the receiver. Control commands will include selection of all operating modes and parameters which the receiver shall interpret and execute. Test requests shall be capable of exercising built-in test functions. The receiver shall transfer status information and equipment failure/error conditions to the control computer via the Manchester interface channel. Sonobuoy receiver failure or error conditions shall be transmitted to the control computer upon request. The transmission requirements, data content, and word formats shall be as described herein.

(U) Receiver-computer communication word structure: The communication word structure used to control and monitor the receiver operation has been designed to accommodate 30-bit and 32-bit word length control computers. Although the receiver shall communicate via 32-bit word lengths, certain compromises in the data field boundaries have been imposed in order to facilitate hardware/software interface testing on

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- (U) either word length computer. The word formats and data field boundaries for both word types are shown on figure 1. Data fields applicable to each type of command or status word type is specified in table III.
- (U) Control computer (AN/AYK-10(V)-to-receiver communications:
- (U) General formats: The control computer shall command the receiver via command words sent on a Manchester interface channel. The commands defined and the required fields for each are shown on figure 1 and specified in table III. Detailed field definition for the command words is specified in table IV. Every command will not be used on the S-3B, as noted in tables III and IV. Restrictions on the fields and the command sequences that are utilized on the S-3B are detailed below. The command field shall always be checked to ensure that a valid command has been issued. Any undefined commands shall be detected and classified as illegal commands and a command error status word shall be generated as defined below. The sonobuoy receiver shall not execute commands containing errors or illegal field values.
 - (U) Receiver control command with return status: This command is used to tune any of the 16 acoustic receivers or three auxiliary receivers to a desired mode and RF channel. This command (010) requires the selection of a Control Mode in field B for a desired operating mode defined for field F. Auto Mode 1 is the only valid mode on the S-3B. Subassembly Selection in field C shall be limited to specify receivers 1 to 19. Any other codes placed in this field shall be detected as an illegal command and a command error status word shall be generated. The RF Channel desired shall be specified in field H. A status word is returned to the computer following a successful execution of a command.
 - (U) Test (BIT INITIATE): This command shall cause the sonobuoy receiver or a subassembly to perform an internal test sequence. Upon completion of the test, the appropriate test status shall be returned to the control computer. The GPDC on board the S-3B will not initiate any individual receiver tests. Thus the subassembly specified in field C will not be a receiver (1-19). If the subassembly specified by field C is not a receiver, the equipment shall perform a test sequence on the selected subassembly. In these cases, field E shall be ignored and GO-NO GO status shall be returned as specified below. The tests specified herein have been defined as valid tests on S-3B.

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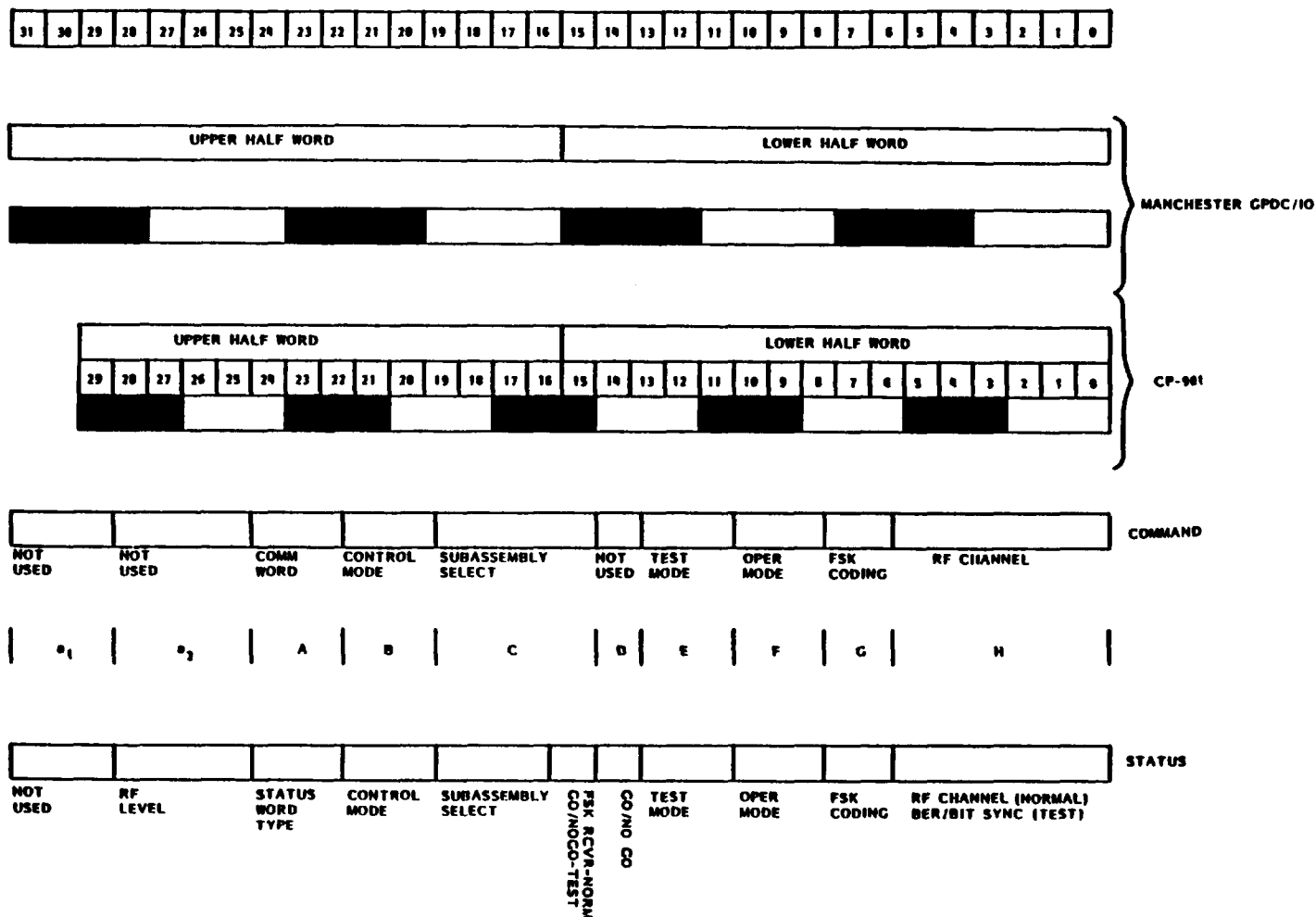


FIGURE 1. (U) Word formats and data field boundaries, S-3B configuration.

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TABLE III. (U) Data field requirements for command and status words.

	A	B	C	D	E	F	G	H	A2
Receiver Control <u>2/</u>	X	X	X			X	X	X	
Receiver Control Rtn Status	X	X	X			X	X	X	
Status Request <u>2/</u>	X		X						
Test	X	X	X		X	X	X	X	
Equipment Master Clear	X								
Subassembly Master Clear <u>2/</u>	X		X						
Normal Status	X	X	X	X	X	X	X	X	X
Test Status	X		X	X	X			<u>1/</u>	X
Command Error	X	X							
Clear Complete <u>2/</u>	X		X						
Mode Change	X	X	X			X	X	X	X
Power ON	X								
Power OFF	X								

NOTES:

1/ Bit Error Rate

2/ These are legal data words, but are not used on the S-3B

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TABLE IV. (U) Command word formats.

<u>FIELD A - COMMANDS</u>	
0 0 0	ILLEGAL
0 0 1 <u>1</u> /	RECEIVER CONTROL
0 1 0	RECEIVER CONTROL WITH RETURN STATUS
0 1 1 <u>1</u> /	STATUS REQUEST (RECEIVERS ONLY)
1 0 0	TEST (BIT INITIATE)
1 0 1	EQUIPMENT MASTER CLEAR
1 1 0 <u>1</u> /	SUBASSEMBLY CLEAR
1 1 1	ILLEGAL
<u>FIELD B - CONTROL MODE</u> (specifies range of field F)	
0 0 0	ILLEGAL
0 0 1	AUTO MODE 1
0 1 0	ILLEGAL
0 1 1 <u>1</u> /	AUTO MODE 2
1 0 0	ILLEGAL
1 0 1 <u>1</u> /	AUTO MODE 3
1 1 0	ILLEGAL
1 1 1	ILLEGAL
<u>FIELD C - SUBASSEMBLY SELECT</u>	
0 0 0 0 0	NO COMMAND
0 0 0 0 1	FM/FSK RECEIVER NO. 1
0 0 0 1 0	FM/FSK RECEIVER NO. 2
through	
1 0 0 0 0	FM/FSK RECEIVER NO. 16
1 0 0 0 1	AUXILIARY RECEIVER NO. 1

1/ Legal commands though not normally issued by the GPDC.

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TABLE IV. (U) Command word formats - Continued.

1 0 0 1 0	AUXILIARY RECEIVER NO. 2
1 0 0 1 1	AUXILIARY RECEIVER NO. 3
1 0 1 0 0 <u>2/</u>	AUXILIARY RECEIVER NO. 4
1 0 1 0 1 <u>2/</u>	RF STATUS
1 0 1 1 0	POWER SUPPLY
1 0 1 1 1	MASTER OSCILLATOR
1 1 0 0 0 <u>2/</u>	OTPI
1 1 0 0 1	I/O PROCESSOR (CHECKSUM TEST ONLY)
1 1 0 1 0 <u>2/</u>	ICU ACIA (ICU INITIATED TEST ONLY)
1 1 0 1 1 <u>2/</u>	EXTERNAL TEST RELAY (ENABLE)
1 1 1 0 0 <u>2/</u>	EXTERNAL TEST RELAY (DISABLE)
1 1 1 0 1	PREFLIGHT BITE (TERMINATE)
1 1 1 1 0	PREFLIGHT BITE (START)
1 1 1 1 1	PREFLIGHT BITE (RESUME)
<u>FIELD D</u>	NOT USED
<u>FIELD E - TEST MODE</u>	
0 0 0	OFF
0 0 1 <u>1/</u>	FM SENSITIVITY - (RCVR 1 THROUGH 19 ONLY)
0 1 0 <u>1/</u>	FM FUNCTIONAL TEST - (RCVR 1 - 19 ONLY)
0 1 1 <u>1/</u>	FSK SENSITIVITY TEST (RCVR 1 - 16 ONLY)
1 0 1 <u>1/</u>	AM FUNCTIONAL TEST (OTPI RCVR ONLY)
1 0 0	PREAMP TEST - (RCVR 1 - 19 ONLY)
1 1 0 <u>1/</u>	FSK FUNCTIONAL TEST (RCVR 1 - 16 ONLY)
1 1 1	LOOP TEST (B, C, D, F, G, H = X)

1/ Legal commands though not normally issued by GPDC.2/ Not used on S-3B.

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TABLE IV. (U) Command word formats - Continued

<u>FIELD F - RECEIVER OPERATING MODE</u>	
0 0 0	FM NARROW
0 0 1 <u>2/</u>	FM WIDE
0 1 0 <u>2/</u>	FSK 4.8 kbps
0 1 1 <u>2/</u>	ILLEGAL
1 0 0 <u>2/</u>	FSK 32 kbps
1 0 1 <u>2/</u>	FSK 64 kbps
1 1 0 <u>2/</u>	FSK 96 kbps
1 1 1 <u>2/</u>	FSK 128 kbps
<u>FIELD G - FSK CODING</u> (if field is FSK)	
0 0 <u>2/</u>	NRZ
0 1 <u>2/</u>	MILLER
1 0 <u>2/</u>	MANCHESTER
1 1 <u>2/</u>	ILLEGAL
<u>FIELD H - RF CHANNEL SELECT</u>	
0 0 0 0 0 0 1	RF CHANNEL NO. 1
through	
1 1 0 0 0 1 1	RF CHANNEL NO. 99
0 0 0 0 0 0 0	
and	
1 1 0 0 1 0 0	
through	
1 1 1 1 1 1 1	ILLEGAL CODES

NOTES:

1/ Legal commands not normally issued by GPDC.

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- (U) Power Supply: All voltages tested for out-of-tolerance conditions
- (U) Loop: Tests Manchester Interface
- (U) Preflight Sequence: Tests P.S., Master Osc., Preamp., FSK and FM Analog Receiver Operation of Receivers 1-19
- (U) Reference Generator: Tests frequency and output level of master oscillator.
- (U) Upon completion of the selected test, a test status word shall be returned to the control computer.
- (U) Equipment master clear: The purpose of this command (101) shall be to initialize the sonobuoy receiver and all subassemblies. This command shall be used especially at the beginning of a mission, following a power transient greater than 50 milliseconds or following a fault condition. At the completion of a power ON sequence or a master clear command, the receivers (1-19) shall assume the following initial states:
 - a. (U) RF Channel: all receivers to initial condition (channel 16)
 - b. (U) Operating Mode: FM narrow
 - c. (U) Control Mode: auto mode No. 1
 - d. (U) Digital Clocks. off

The equipment master clear command shall always be sent as a forced output on the S-3B. Since this command is the only command to use the forced output sequence, the control frame, as described in appendix B, will be hardware decoded by the Manchester interface module which will generate a power on reset pulse for the sonobuoy receivers. Thus, on the S-3B, any forced output request sequence will automatically initialize the sonobuoy receiver and all subassemblies and all fields in the command word will be ignored. A successful transmission shall require a power on initialization response from the receiver.
- (U) Subassembly master clear: Not applicable.
- (U) Receiver-to-control computer communications: Communications from the receiving set to the control computer is initiated in response to input or interrupt request commands. For all receiver to computer communications, field A_1 (bits 0 and 1) are not used and shall be set to zero.

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- (U) The valid status word types are identified by the field A contents. The field A values are as follows:

(U) Field A - Status Word Type Status to GPDC

a. (U) 0 0 0	SPARE
b. (U) 0 0 1	NORMAL STATUS
c. (U) 0 1 0 <u>1</u> /	CLEAR COMPLETE
d. (U) 0 1 1	COMMAND ERROR
e. (U) 1 0 0	TEST STATUS
f. (U) 1 0 1	MODE CHANGE
g. (U) 1 1 0	POWER ON
h. (U) 1 1 1	POWER OFF

1/ Legal response, though not normally sent to GPDC.

- (U) Normal status words: The receiver Normal Status Word (NSW) shall be generated in response to a receiver control with return status command. In no case shall the status word generation require greater than 50 millisecond to complete. Upon completion, the receiver shall transfer the status word to the control computer during either an Input or Interrupt Request Sequence.
- (U) The associated data fields for the NSW are A₂, B, C, D, F, G and H. Fields C, F, G and H are identical to those defined for the receiver control command word and table IV. Field D is set to a logical one for acoustic receivers, and a logical zero for acoustic (analog only) and auxiliary receivers.
- (U) Field B contains status information indicating the control mode of the sonobuoy receiver for which status has been requested. Code 001 signifying Auto Mode 1 is the only valid control mode used on the S-3B.
- (U) Field A₂ contains the status information indicating the RF level of the selected receiver at the input to the preamplifier. The A₂ field values are interpreted as specified in table V.

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TABLE V. (U) Field A₂ bit codes and signal levels.

<u>Field A₂</u> Bit Code	<u>RF Level (uvolt)</u>
0 0 0	<1.3
0 0 1	0.8-2.5
0 1 0	1.5-5.0
0 1 1	3.1-10.0
1 0 0	6.3-20.0
1 0 1	12.0-40.0
1 1 0	>25.0

- (U) Test status word: The receiver test status word shall be generated in response to a test command word from the control computer. The test status word shall be formulated upon the completion of the requested test by the subassembly specified in the test command word. When the test status word has been constructed, the receiver shall transfer the status word to the control computer during the next input or interrupt sequence. The associated data fields for the test status word are C, D, and E. All fields except D are identical to those contained in the test command word. Field D contains the result of the test on the specified unit with a one bit GO-NO GO status 0 - GO, 1 - NO GO or unit failed test). Since there will be no individual receiver tests performed on the S-3B, no other fields are used in the test status response.
- (U) The results of the preflight tests shall be sent to the control computer as normal test status words at the completion of each test in the preflight sequence in which a failure is detected.
- (U) Command error status word: This status word indicates that a command word from the control computer contained a fault (undefined value) data field or illegal code. This type of status word would be an applicable response following receipt of erroneous receiver control with return status or test command words.

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- (U) Clear complete status word: Not applicable.
- (U) Mode change status word: The mode change status word is used to report the status of all 19 receivers at the conclusion of the preflight BIT test. It will be followed immediately by a test status response word. All fields are identical to the normal status word except field A.
- (U) Power-ON status word: The power-ON status word indicates that the Forced Output Master Clear sequence has been completed and the receiver has assumed its initialization state.
- (U) BITE subassembly (see 3.7.2.6):
 - (U) Function: The BITE module shall contain circuits for generating RF signals, analog and digital baseband signals, detectors and correlators as necessary to generate and compare looped and sampled test data as necessary to provide fault isolation to the SRA level. BIT may be controlled and monitored via the computer I/O under a computer software program.
 - (U) System diagnostics: Upon initiation of BIT, the diagnostic testing shall include but not be limited to the following functions and tests:
 - a. (U) Frequency: Provide for the generation of RF frequencies between 136 and 174 MHz.
 - b. (U) Modulation characteristics: Provide for FM and FSK modulation of the selected RF carrier by an internal modulation source.
 - c. (U) Preflight BIT: Provide for automatic end-to-end testing of all acoustic receivers at one RF frequency, one FSK data rate and in the analog mode; the auxiliary receivers at one RF frequency in the analog mode. Provide for automatic testing of the reference oscillator, the power supply, and the I/O interface to the GPDC. Provide a status word to the GPDC to disclose the test results.
 - d. (U) Sensitivity tests: Provide for a sensitivity check of the receiving system.
 - e. (U) External distribution: Provide the selected attenuated/modulated BITE signal to output connectors for external distribution.

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- f. (U) FSK sync and BER: While in the digital BITE mode, determination of bit sync and error rate will be indicated on the ICU with a GO-NO GO indication to the computer for any one of 16 acoustical channels. FSK Functional Test shall detect BIT SYNC only.
- (U) Intended use (see 6.1): The equipment covered by this specification is designed to operate with the general purpose digital computer AN/AYK-10 and to receive, demodulate, and amplify sonobuoy analog and digital transmissions in the VHF band. The equipment shall provide the demodulated outputs to analysis, recording, and display equipment and shall consist of the necessary controls and interfaces consistent with the S-3B aircraft.

Preparing Activity

Navy AS

(Project 5845-M088-02

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