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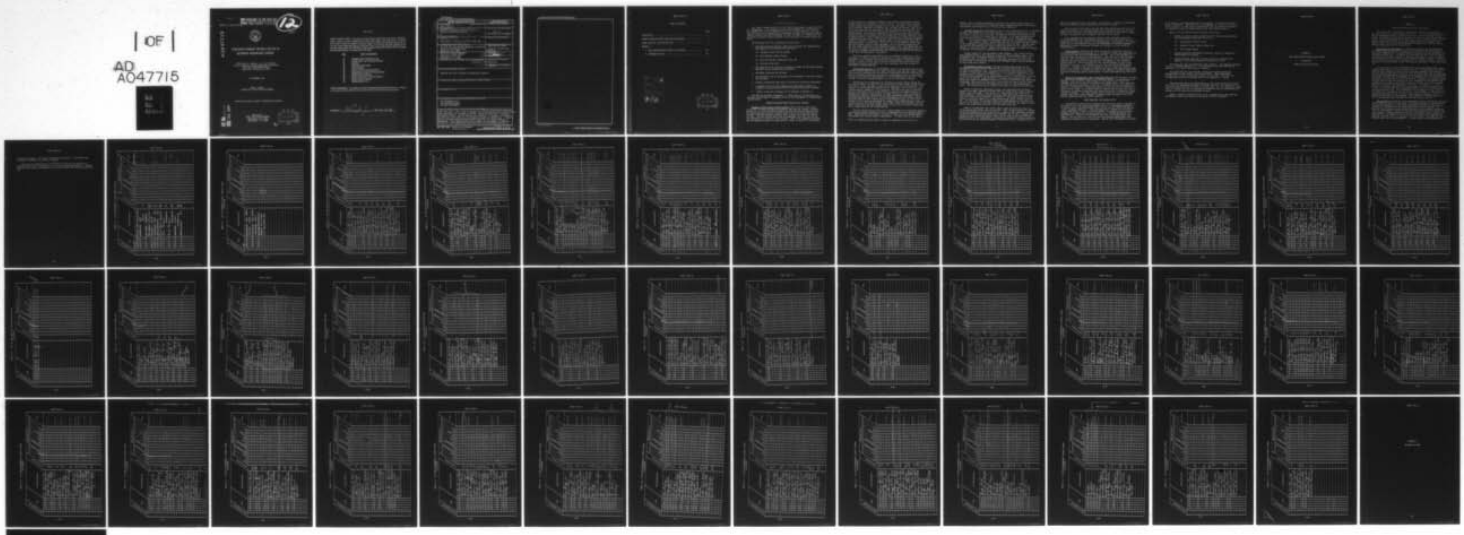

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REPORT NO. NADC-77291-60

DEVELOPING TRADEOFF CRITERIA FOR USE IN REVIEWING MAINTENANCE TRAINER

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Task Identification Matrices (TIMs) were used in this study to document the tasks associated with organizational level maintenance of 4 systems on the S3A. These TIMs were used to evaluate maintenance trainers used in training S3A technicans. In general, the trainers provided very little practice in the skills required for maintenance. A Phase II study to develop training system specifications for the systems studied, is recommended. These specifications would support the development of effective trainers at costs significantly below the costs of the existing trainers.

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INTRODUCTION

This report documents Phase I of this AIRTASK and presents a plan for Phase II. During Phase I, discussions were held with NAMTRAGRU H.Q., COMNAVAIRPAC, and COMASWWINGPAC Staffs, NAMTRADET 1036 and VS-41 FRAMP personnel. Each of these provided useful suggestions and meaningful insights which helped guide the conduct of Phase I and the development of plans for Phase II. Specifically the discussants provided valuable guidance on the selection of aircraft systems for study.

The following items were accomplished during Phase I:

1. Task Identification Matrices (TIMs) were developed for organizational maintenance of the following S3A subsystems:

   (a) Automated Flight Control System,

   (b) Environmental Control System,

   (c) Fuel and Inflight Refueling System, and

   (d) Auxiliary Power Unit.

2. The capabilities of existing maintenance trainers for the above systems and their use in teaching were documented.

3. The FRAMP curriculum was reviewed.

4. The procedures used by Lockheed for the development of existing courses were reviewed.

5. Detailed observations were made of technicians performing maintenance.

6. A complete library of S3A organizational maintenance manuals was assembled and those dealing with the selected systems were reviewed.

7. A Phase II plan was developed and is presented in appendix B.

The TIMs are included in appendix A. These tasks will be provided as a baseline for the Phase II contractor to use in the development of trainer/media specifications.

CURRENT NAMTRADET/FRAMP TRAINING AND TRAINERS

Automatic Flight Control System Training - Most of the two weeks spent in the AFCS training involves using handouts and technical manuals, primarily schematics, to review interfaces between the AFCS and other aircraft systems. The instructors feel that the trainees need to know more about interfaces to be able to identify problems caused by other systems, but reflected through the AFCS. The AFCS trainer shows what the components look like, but not how the components are installed in the aircraft. Most of the components indicate failure symptoms through the flight control system, so there is a "silhouette"

of the aircraft on a pedestal attached to the trainer with miniature control surfaces that move in response to control inputs. The trainer has a partial cockpit mockup that permits trainees to "fly" the silhouette. Both trainees and instructors expressed the feeling that, although the trainer is fun to fly, it is of little value as it relates to the job of maintaining the AFCS. The instructors wish that the AFCS trainer were connected to the Flight Control System trainer, so that the trainees could see the real flight controls move instead of just the silhouette, but they agreed that even this additional level of sophistication in the trainer would not substantially affect the learning of troubleshooting and repair. Most of the flight line level troubleshooting performed on the AFCS is achieved through a built-in test panel in the pilot's instrument panel. For the past 1-1/2 years, all of the aircraft systems have had this automatic built-in test equipment, but the "autobite" modification was just being installed in the trainer during our visit. This means that for the last 1-1/2 years, the trainer has been incapable of supporting practice of the primary automated troubleshooting task that forms the bulk of the organizational level troubleshooters' activities.

While more detailed task analysis will be required to arrive at a firm conclusion, it seems reasonable to assume that a trainer using actual aircraft components can be replaced using less costly media and/or a simulation based trainer. Avionics systems such as the S3A AFCS with effective BIT and good maintenance manuals would seem to be likely candidates for cost savings in maintenance training hardware.

Fuel System Training - At the NAMTRADET, about 2-1/2 days are spent on Fuel System, of which about 5 hours are spent standing around the Fuel System trainer. The instructor indicated that the trainer is used exclusively for "show and tell." There is no hands-on practice with any of its components, since it would leak a lot and require excessive maintenance if it were manipulated in this way. The trainer is the only training equipment in use for Fuel System training.

The trainer has a capability for insertion of several faults through the instructor's panel, but the faults do not produce the same symptom in the trainer that they do in the aircraft, so none of the instructors use this feature. The trainer is a scale model using mostly actual components, but it also uses some trainer-peculiar components. The instructor said that principles of operation and the traditional kind of troubleshooting discussion are supported mostly by handouts and technical publications, and that little or no time is devoted to discussion of removal, installation, or other maintenance procedures.[1] The instructor expressed admiration of the ECS Environmental Control System trainer, and wished that he had a similar means of depicting what goes on in the Fuel System to aid in teaching principles of operation and troubleshooting. Since the trainer conceals most of the things that it does, other than filling up various cells (which can be watched through windows in the cells) it doesn't really help much in describing how the system operates.

The Fuel System trainer seems to be a prime example of a traditional approach, via existing Military Standards, which is inappropriate to the teaching requirement. More detailed task analysis in Phase II should allow the determination of more appropriate training support requirements. It seems clear at this point,

[1]This is a hardwired panel which is similar in appearance to the EC II LP.

however, that any future procurement of similar fuel system trainers should be scrutinized to insure there is a specific need to support identified instructional requirements which cannot be met with less costly approaches.

Auxiliary Power Unit - Maintenance of the APU at organizational level is extremely limited. The service in the aircraft consists of tightening connections if leaks are observed, refilling the oil tank, and removing and installing the entire APU. If an APU is removed, it is taken back to the shop. If it needs anything other than cleaning of filters, it is generally sent back to the intermediate-level shop. The only hands-on practice associated with the APU is removal and installation in the aircraft, using a trainer that consists of an actual APU and a mockup of the compartment in which the APU is installed in the aircraft. Two-man teams can practice disconnecting the lines, sliding the APU out on its tracks, and removing it from the trainer. Handouts and technical manuals are used for limited discussions of principles of operation and troubleshooting.

Trainer support for APU maintenance seems adequate. Only limited savings seem promised through a more detailed analysis of APU maintenance tasks. It is recommended that, if adequate funding is available, the "O" level power plant maintenance tasks be analyzed, since it seems that requirements for hands-on practice might be achieved in the FRAMP with NAMTRADET theory training supported by media other than trainers.

Environmental Control System - Existing technical publications for the Environmental Control System assume the use at organizational level of a test set that no one actually uses. It was discovered that the tester did not test a number of things that it was supposed to, and it was nearly impossible to use because of space limitations in the aircraft. As a result, almost all of the troubleshooting performed at the organizational level is "shot-gunning," (without the use of the tester) a term offered by the people interviewed in the shop. Rather than expand the NAMTRADET course to try to give troubleshooters additional background to make up for the failure of the tester, the course was cut almost in half when they found that the tester was not usable at the organizational level. The students were given handouts consisting of workbooks with questions.

Theory of operation, operational checks, and troubleshooting (deriving symptoms from known component failures) were all taught using a large training device called "the panel." This device is a large graphic depiction of the system schematic, with back-lighted data flow lines and little rotating valves that can be used to show sequences of operation. The panel responds like the system to instructor inputs on a mockup of the flight cruise controls for the ECS. The instructors are extremely fond of and complimentary to the panel, but several of the people in the shop volunteered that they felt they hadn't learned much in the course that turned out to be of value on the job.

There is an additional ECS trainer that is used for hands-on practice of certain remove-and-install tasks for the ECS. This trainer consists of a mockup of the ECS compartment in the aircraft with a number of ECS components installed. The mockup includes fuselage formers and stringers, but no skin. Two-man teams practice several remove-and-install tasks, but for some of the more difficult operations one of the team members is occasionally permitted to stand outside the trainer and assist by reaching through the aircraft's skin, a condition that is

physically impossible in the real world. Nevertheless, a number of transferable skills are probably learned during practice with this device.

The instructor could recall only one ECS system modification that had to be installed in both of the training devices, and he indicated that this was done without much difficulty, requiring approximately one day to modify both trainers. The panel accommodates minor changes in data flow fairly easily.

It is expected that the detailed analysis of ECS maintenance tasks will yield specifications for a maintenance trainer which will use a great deal of simulation and allow the practice of troubleshooting. Additionally, this trainer should serve as an evaluation tool for the development of revised maintenance procedures to reduce the current reliance on "shot-gun" or trial-and-error troubleshooting.

Troubleshooting - Some time was spent talking with instructors about the distinction between troubleshooting as it is presently taught and troubleshooting as an activity that has to be performed on the job. All of the NAMTRADET instructors take essentially the same approach: they teach the system thoroughly, then talk their way through the system one component at a time, failing each component and showing how to figure out what the symptom of that component failure would be. This writer believes that troubleshooting, as an activity performed on the job, is a different activity that involves different mental processes: a symptom, that could be caused by any of a number of different failures, is brought to the man's attention and he must apply some process, hopefully a logical one, to isolate the cause of the symptom. Trainers incorporating simulation technology provide opportunities to teach troubleshooting viewed this way.

Review of Existing Task, Skill, Knowledge (TSK) Data - The TSK data from which the original S3A NAMTRADET courses were developed seems to be comprehensive and thorough. This was due in large measure to the assignment of four of the NAMTRADET Chief Petty Officers to Lockheed for several months. They instructed the Lockheed course developers in the use of NAMTRAGRU 1540.B and reviewed the products. Unfortunately, increasing pressure has been put upon the NAMTRADET to reduce course length. In revising courses to reduce training time, the course objectives, so carefully developed, have been revised into less specific, theory-oriented statements. For those systems studied in Phase II, task and training analyses will assist course managers in making courses job-specific and will provide supporting logic for course duration.

FRAMP PRACTICAL JOB TRAINING (PJT)

The FRAMP PJT curriculum was developed from the basic concept, expressed by CWO3 Larson, that they were training men to work in a maintenance department. To achieve this, a mini-maintenance office was set up with VIDS/MAF boards and a work assignment supervisor. Parts salvaged from a crashed S3A were used to create "bad" parts. A part, with known defects, was inserted in an aircraft assigned to the FRAMP and a gripe was entered on a VIDS/MAF NAVMACLANT TEST FORM 4790/41E. A total of 386 JOB PLANS, each with a different gripe, was created. On the face of it, this PJT looks like the most appropriate, well-thought-out training plan for maintainers. Because this PJT package is believed

to be unique in its completeness and in its approach, a thorough evaluation should be conducted. This evaluation is recommended as a follow-on to Phase II of this project. In many cases, an augmented FRAMP, using this PJT approach, can adequately handle all organizational level maintenance training.

Phase II of this effort has the following three goals:

1. Develop a training system specification for training organizational level maintenance technicians for the S3A:

   (a) Environmental Control System,

   (b) Automatic Flight Control System, and

   (c) Fuel Control System.

2. Develop maintainer performance evaluation criteria to measure the effectiveness of training.

3. Develop decision logic and criterion values for evaluating the adequacy of existing maintenance training units (MTUs).

The first goal will be accomplished under contract. The proposed statement of work is attached (appendix B). It is anticipated that this work can be completed 3 to 5 months after award of contract.

The second goal will be developed, using data developed during the accomplishment of the contract, by in-house effort. These performance criteria will be used as acceptance criteria for the MTUs. This task will be coordinated with the first goal and will be completed in 7 months.

The third goal would be accomplished as a joint in-house contractor effort with NAVAIR 413 designated personnel, NAVTRAGRU, and NTEC. The third goal will be pursued concurrent with the first and second goals, will be completed in draft form in 7 months, and will be validated and finalized after the procurement and evaluation of the specified maintenance trainers.

Phase II should be undertaken only if it is planned to buy the specified maintenance trainers and conduct an evaluation of their usefulness.

APPENDIX A

TASK IDENTIFICATION MATRIX (TIM) REPORT

prepared by

Applied Science Associates

APPENDIX A

TASK IDENTIFICATION MATRIX (TIM) REPORT

This report and its attachments document ASA's efforts in constructing and validating a Task Identification Matrix (TIM). The four subsystems selected for TIM development were the Auxiliary Power Unit, the Environmental Control System, the Automatic Flight Control System, and the Fuel and In-Flight Refueling System. Technical publications available to use here in Valencia were used to develop preliminary TIMs for all of the systems except the Automatic Flight Control System, for which we had insufficient documentation. The TIM for the AFCS was constructed at NAS, North Island.

Preliminary TIM Development - In constructing the TIM for each subsystem, we began by going through the Illustrated Parts Breakdown and identifying all functional components in the system that were authorized for any maintenance at the organizational level. We specifically excluded from the TIM such things as electrical and hydraulic connectors, hydraulic and pneumatic lines, and attaching hardware such as nuts, bolts, screws, washers, gaskets, brackets. Whenever it was unclear from the IPB or from associated work packages whether a particular hardware item was functional or not, the item was included as a line item in the TIM.

All line entries in the TIM qualified for remove-and-install tasks at the organizational level, at least, and were so noted. The maintenance and troubleshooting work packages for each of the systems were examined, and additional TIM cell entries were made to cover all tasks for which there were work packages or for which instructions were provided in work packages for other hardware items. When items were specifically mentioned at the terminal points of troubleshooting procedures, that fact was also noted in the TIM. Whenever work packages existed for more than one task for a given line item, references to the specific work packages were included in the "Notes" column in the TIM, and the cell entries were given subscripts corresponding to the notes. The letter "O" in a cell denotes the judgment that such a task is performed at the organizational level. A dash (-) in a cell indicates the judgment that no such task is performed at the organizational level. A "W" denotes both the existence of such a task and the presence of instructions for the task in a work package. As mentioned above, numerical subscripts to the "W" entries were used when a hardware item was covered by more than one work package. Page numbers and callout numbers from IPB or work packages were included with the line items in the TIM.

TIM Validation - Validation of the preliminary TIM was conducted at the North Island Naval Air Station in San Diego. The process followed in validating the TIM involved spending time with senior maintenance personnel in the shops responsible for maintenance of the systems with which we were concerned. We assembled the relevant technical publications and, as we proceeded through the TIM , we simultaneously tracked the IPB and the maintenance and troubleshooting work packages. Whenever questions arose that our experts couldn't answer, they would call in other people or we would resolve the question by examining the hardware involved, either in the shop or on the aircraft. For each line item in the TIM, every cell was investigated. In cases where we had inappropriately

included or excluded a cell entry (according to the expert), the entries were corrected to conform to the expert's judgment.

Note that the construction of the TIM for the AFCS did not identify any troubleshooting tasks in connection with 0-level replaceable components. Troubleshooting of the AFCS is accomplished at the whole system level using comprehensive BIT.

TABLE A-I - TIM FOR AUTOMATIC FLIGHT CONTROL SYSTEM

Found in Troubleshooting	Code (Work Pack.)	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes (IPB 02200)
	02200	FLIGHT DATA COMPUTER	1	-	-	-	-	-	-	-	-	-	-	-	-		
	02200	ELECTRICAL TEST PANEL	3	-	-	-	-	-	-	-	-	O	-	-	-		
	02200	ATTITUDE HEADING REFERANCE SELECTOR	2B	-	-	-	-	-	-	-	-	O	O	-	-		
	02200	CONTROL STICK	4														
	02200	GYROSCOPE ASSY. (2)	5	-	-	-	-	-	-	O	-	-	-	-	-		
	02200	ACCELEROMETER (2)	7														
	02200	PITCH RATE SENSOR	8A	-	-	-	-	-	-	O	-	-	-	-	-		
	02200	ROLL POSITION TRANSDUCER	17	-	-	-	-	-	-	-	-	-	-	-	-		
	02200	PITCH POSITION TRANSDUCER	22	-	-	-	-	-	-	-	-	-	-	-	-		
	02200	AUTOMATIC FLIGHT CONTROLLER	29	-	-	-	-	-	-	-	-	-	-	-	O		
	02200	ANNUNCIATOR (2)	32	-	-	-	-	-	-	-	-	-	O	-	-		

TABLE A-I - TIM FOR AUTOMATIC FLIGHT CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code (IPB)	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	02200	ELECTRICAL TEST PANEL SWITCH LAMP		-	-	-	-	-	-	-	-	-	o	-	-		
	02200	ELECTRICAL TEST PANEL INDICATOR LAMP		-	-	-	-	-	-	-	-	-	o	-	-		
	02200	ELECTRO/MECHANICAL ROTORY ACCTUATOR (TG-209/ASW 33)		-	-	[-]	-	-	-	-	-	-	o	-	-		

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM

Found in Troubleshooting	Code (Paragraph 1.3)	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
✓	06600	Valve, Drain, Water	11	-	-	-	W	-	-			O	W	-	-					1) WP 00300 2) WP 00402
✓	06600	Valve, Drain, Fuel Tank	15	-	-	-	W	-	-			O	W	-	-					1) WP 00300 2) WP 00403
	00700	Control Assy, Dual																		
		Beam, 2500 Series,																		
		Fuel Transfer System	2										O	-	-					
	00700	Adapter, Control, Fuel																		
		Transfer System	29	-	-	-	-	-	-	-	-	O	-	-						
✓	00700	Lever, Manual Control,																		
		Fuel Transfer Valve	14	O	-	-	W	-	-	-	-	W	W	W	W					1) WP 00 [illegible]
	00700	Lever, Remote Control,																		
		Fuel Transfer Valve	18	O	-	-	-	-	-	-	-	O	W	-	-					2) WP 00404
	00700	Connecting Link, Rigid,																		
		Fuel Transfer Valve	24	-	-	-	-	-	-	-	-	-	-	-	-					
	00700	Control Assy, Push-Pull,																		
		Flexible, Fuel Interconnect	28	-	-	-	-	-	-	-	-	W	-	-	-					2) WP 00404
	00700	Adapter, Support, Push-Pull																		
		Control, Fuel Tank																		
		Interconnect Valve	39	-	-	-	-	-	-	-	-	W	-	-	-					2) WP 00404

C = Refer to Work Package on Troubleshooting
W = Refer to Work Package on Repair System Maintenance

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Calibrate	2 Checkout/Troubleshoot	3 Clean	4 Disassemble/Assemble	5 Inspect	6 Lubricate	7 Operate	8 Remove/Install	9 Repair	10 Service	11	12	13	Notes
✓	00700	Valve, Butterfly, Tank															
		Interconnect, Fuel	47	-	W	-	-	W	-	W	-	-					D4TP00304 D4TP00404
	00800	Adapter, Straight, Flange & Tube, Bulkhead															
		Engine Fuel Shutoff Valve	1	-	-	-	-	-	-	O	-	-	-				
	00800	Clevis Assy, Rod End, Hexg LE Cable, Forward Shutoff	6	O	-	-	-	O	-	O	-	-	-				
✓	00800	Valve, Shut, Aircraft Engine Feed	16	O	-	-	W	-	-	W	-	-	-				D4TP00304 D4TP00405
	00900	Clip, [illegible]	25	-	-	-	-	-	-	-	-	-	-				CT)
	00900	Control Assy, Flexible, Push-Pull, Rolling Friction	61	O	-	-	-	-	-	-	W	-	-	-			D4TP00405
✓	01200	Valve, Check, High Pressure, Fuel	5	W	-	-	-	-	-	-	W	-	-				D4TP00304 D4TP00504
✓	01300	Pump, Ejector, Fuel Transfer	4	W	-	-	-	-	-	-	W	-	-				D4TP00402

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13 Notes
	01300	Filter, Particulate, Fuel														
		Ejector Pump	5													
✓	01400	Pump, Ejector, Fuel Fuel	18													
	01500	Switch	2													
	01500	Switch	3													
	01500	Switch	6													
	01500	Switch	7													
	01500	Receptacle	11													
	01500	Indicator, Liquid Quantity Transfer Tank	12													
	01500	Indicator, Liquid Quantity Fuel Tank	20													
✓	01600	Valve, Fuel Check, Flapper	5													
✓	01600	Valve, Fuel Check, Flapper	12													
✓	01700	Valve, Fuel Check, Flapper	10													
✓	01900	Adapter and Cap Assy, Pressure Refueling 2½ Tube Size	20													

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot	Clean	Disassemble/Assemble	Inspect	Lubricate	Operate	Remove/Install	Repair	Service	Notes
✓	02000	Valve, Drain, Fuel	3									W				WP 00500
	02100	Gage, Air Pressure	1													WP 00500
✓	02200	Valve, Syphon Breaker, Ground Fueling	4													WP 00400 WP 00500
✓	02300	Valve, Plug, Precheck Fuel	10									W				WP 00400 WP 00500
✓	02300	Valve, Plug, Precheck Fuel	20									W				WP 00400 WP 00500
✓	02500	Valve, Float, Fuel	17									W				WP 00400 WP 00500
✓	02600	Valve, Fuel Shutoff Control Sys.	7									W				WP 00400 WP 00500
	02900	Control Assy. Flexible Push-Pull, Rolling Fracture	1													WP 00600
	02900	Connecting Link Assy., Rigid, Fuel Pump Control	11													WP 00600
	02900	Clevis, Rod End, Fuel Pump Valve	12									W				WP 00600
✓	02900	Bellcrank, Aft, Fuel Pump Control	17									W				WP 00500
	02700	HANDLE MANUAL CONTROL	4													

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	02900	Control Assy., Flexible Push-Pull, Rolling Friction	29										2							1) WP 00600
✓	03000	Valve, Jettison, Fuel	36				1						2							1) WP 00500 2) WP 00600
	03000	Coupling Half, Tube, Fwd, Fuel, Seal	37										2							1) WP 00600
	03000	Coupling, Half, Fuel Vent, Fwd	47										2							1) WP 00600
	03100	Adapter, Bulkhead, Jettison, Fuel Transfer Tank	19										2							1) WP 00600
✓	03100	Valve, Check, Fuel Jettison	30				1						2	3						1) WP 00500 2) WP 00600
	03100	Valve, Check, Fuel Jettison	42				1						2	3						1) WP 00600
✓	03200	Flame Arrestor Assy., Fuel Dump	33				1						2							1) WP 00500 2) WP 00600
	03300	Arrester, Flame Vent Tank	32										2							1) WP 00600
✓	03400	Valve, Float, Fuel Vent Tank	7				1						2							1) WP 00500 2) WP 00600

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot	Clean	Disassemble/Assemble	Inspect	Lubricate	Operate	Remove/Install	Repair	Service	Notes
				1	2	3	4	5	6	7	8	9	10	11	12	13
✓	035600	Valve, Solenoid, Fuel Shutoff	2							O						WP 00600 WP 00700
	035000	Valve	30							O						
	036000	Heat Exchanger Assy., Air Pressure Sys, External Fuel Tank	1							O						
✓	036000	Valve, Check, Air	14			O				O						WP 00600 WP 00700
	036000	Filter	19							O						WP 00700
✓	036000	Valve	20			O				O						WP 00700 WP 00600
	036000	Valve Assy., Regulating, Pressure, Fuel Tank Pressurization	34							O						WP 00700
✓	036000	Valve, Check, Air	26			O				O						WP 00700 WP 00600
✓	036000	Valve, Selector, Two-Position, Thru-Way, Solenoid Operated	33			O				O						WP 00700 WP 00600

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Adjust	Align	Calibrate	Maintenance Function 1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	03800	Plate, Retaining, Electrical Connector, Front Spar	1																	
	03800	Plate, Retaining, Electrical Connector, Front Spar	2																	
	03800	Tubing, Heat, Shrinkable, Electrical Conduit	13																	
	03800	Wiring Harness, Bracket	15																	
	03800	Transmitter Assy, Liquid Fuel Level and Fuel Quantity Gaging	16																	
	03900	Tubing, Heat, Shrinkable, Electrical Conduit	5																	
	03900	Tubing, Heat, Shrinkable, Electrical Conduit	27																	
	03900	Tubing, Heat, Shrinkable, Electrical Conduit	40																	

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
✓	03900	Transmitter, Liquid Quantity, Fuel Gaging System	41																	
✓	03900	Transmitter, Liquid Quantity, Fuel Gaging System	42																	
✓	03900	Transmitter, Liquid Quantity, Fuel Gaging System	43																	
	03925	Tubing, Heat Shrinkable, Electrical Conduit	5																	
✓	03925	Transmitter, Liquid Quantity, Fuel Gaging System	40																	
✓	03925	Transmitter, Liquid Quantity, Fuel Gaging System	41																	
✓	03925	Transmitter, Liquid Quantity, Fuel Gaging System	42																	
✓	04000	Amplifier, Power Supply Group	1																	
✓	04100	Simulator, Fuel Quantity, External Fuel Tank Capacitance	8																	

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TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
✓	04300	Probe Assy., Air Refueling	1				C		C	O	O	R	-	-						WP 00500 D WP 00404
	04350	Light Set Assy, Indicator																		
		Fracture	2									R								Electrical
	04350	Lamp	4									C								
✓	04400	Nozzle	1							O		R	O							WP 00800 D WP 00404
✓	04400	Base Assy, Fwd Bearing, Air Refueling Probe	15									R								WP 00800 D WP 00404
✓	04400	Gearhead	16									R								WP 00800 D WP 00404
	04400	~~Locking~~ Motor	17				O					O								
✓	04400	Aft Base Assy., Air Refueling Probe	28									R								WP 00800 D WP 00404
✓	04450	Power Unit Assy., Air Refueling Ref Probe	1									R								WP 00800 D WP 00402
✓	04450	Shaft, Flexible	19									R								D WP 01001
	04450	Universal Joint Assy	21									R								D WP 01001
	04450	Shaft, Input	25									R								D WP 01001
	04450	Shaft, Output	35									R								D WP 01001

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	04450	Shaft, Flexible	36										W							D WP 01001
	04450	Universal Joint	40										W							D WP 01001
✓	04500	Base, Fwd Bearing, Air Refueling Probe	5				W						W							D WP 00930 D WP 00404
✓	04500	Base, Aft Bearing, Air Refueling Probe	13				W						W							WP 00930 D WP 00404
✓	04700	Valve, Check, Aerial Refueling	8				W						W							D WP 00930 D WP 00404
	04800	Tension Tie, Probe Cap	11										W							D WP 00403
	04800	Latch, Open Refueling Probe Door	22										W							D WP 01003
	04800	Spring, Door Linkage, Refueling Probe	23										W							D WP 01003
	04800	Push-Pull Rod, Door Linkage, Refueling Probe	27										W							D WP 01003
	04800	Latch, Manual, Refueling Probe Door	28										W							D WP 01003

TABLE A-II - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	04800	Rod End, Door Linkage, Refueling Probe	30A	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Clevis, Refueling Probe Door	36	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Link Assy, Inflight Refueling Door	36A	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Link Assy, Inflight Refueling Door	36B	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Spring Assy, Inflight Refueling Door	41	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Plunger, Spring, Inflight Refueling Door	46	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Slide, Spring, Inflight Refueling Door	47	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003
	04800	Spring, Compression, Inflight Refueling Door	48	–	–	–	–	–	–	–	–	2	2	–	–		DWP 01003

TABLE A-11 - TIM FOR FUEL AND IN-FLIGHT REFUELING SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function												Notes
				Adjust	Align	Calibrate	Checkout/Troubleshoot	Clean	Disassemble/Assemble	Inspect	Lubricate	Operate	Remove/Install	Repair	Service	
✓	04900	Switch, Proximity	4													DWP00800 DWP00104
✓	04900	Switch, Proximity	8													DWP00800 DWP00104

Electricians

TABLE A-III - TIM FOR AUXILIARY POWER UNIT

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	0041011	Auxiliary Power Unit, APU		-	-	-	C	-	-	C	-	-	C	C	C					
	0041011	Auxiliary Power Unit, Coupling		-	-	-	-	-	-	-	-	-	-	-	-					
	0041011	Auxiliary Power Unit, Center Mount		C	-	-	-	-	-	-	-	-	C	-	-					
	0041021	APU System Rigging, Control Lf	2	C	-	-	-	-	-	-	-	-	C	-	-					
	0041021	APU System Rigging Switch	4	C	-	-	-	-	-	-	-	-	C	-	-					
	0041021	APU System Rigging, Assembly, LH	5	C	-	-	-	-	-	-	-	-	C	-	-					
	0041021	APU System Rigging, Control Lf	8	C	-	-	-	-	-	-	-	-	C	-	-					
	0041021	APU System Rigging, Door Actuator	—	-	-	-	-	-	-	-	-	-	-	-	-					Airframe
	0041021	APU System Rigging, Bellcrank	—																	

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	0040211	Aft Wing Rigging, Steel Package															Airframe
	0040216	Aft Wing Rigging, Shutoff Valve															
	0040216	Aft Wing Rigging, Divider Replacement															
	0040222	Aft Inlet Door Rigging, Link	1														Airframe
	0040222	Aft Inlet Door Rigging, Bellcrank	2														
	0040222	Aft Inlet Door Rigging, Link	3														
	0040222	Aft Inlet Door Rigging, Link	4														
	0040222	Aft Inlet Door Rigging, Bellcrank	6														
	0040222	Aft Inlet Door Rigging, Actuator															
	0040311	Aft Control Removal and Installation, Door Actuator															
	0040316	Aft Control Removal and Installation, Handle Control															

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13 Connect/Disconnect	Notes
	004031	APU Control Removal and Installation Fuel Valve		C	-	-	-	-	-	-	-	-	O	-	-		
✓	004031	APU Control Removal and Installation	14.	-	-	-	-	-	-	-	-	-	O	-	-		
	004032	Manual Push-Pull Control Assembly		-	-	-	-	-	-	-	-	-	O	-	-		
	004041	APU Door Actuator Removal and Installation, Actuator	—	/	/	/	/	/	/	/	/	/	/	/	/	/	Airframe
	004041	APU Door Actuator Removal and Installation, Electrical Connector		-	-	-	-	-	-	-	-	-	-	-	-	C	
	004041	APU Door Actuator Removal and Installation, Link	—	/	/	/	/	/	/	/	/	/	/	/	/	/	Airframe
	004041	APU Door Actuator Removal and Installation, Control	—	/	/	/	/	/	/	/	/	/	/	/	/	/	Airframe

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	004042	C/S A Air Inlet Bellcrank Removal & Installation, Connecting Link											O							
	004042	C/S A Air Inlet Bellcrank Removal & Installation, Bellcrank	—										O							
	004042	C/S A Air Inlet Bellcrank Removal & Installation, Actuator Link	—										O							Airframe
	004051	Start Package and Accumulator Removal & Installation, Accumulator	—										O							
	004061	C/S A Divider Mechanism Removal & Installation, Handle Control		O	O	—	—	O	—	—	—	—	O	—	—					
	004061	C/S A Divider Mechanism Removal & Installation, Fuel Valve Control		O	O	—	—	O	—	—	—	—	O	—	—					

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot	Clean	Disassemble/Assemble	Inspect	Lubricate	Operate	Remove/Install	Repair	Service	Notes
	0 0 4 0 6 1	Lift Nozzle Mechanism Removal & Installation, Nozzle Actuator Controlled		-	-	-	-	-	○	-	-	-	-	-	-	
	0 0 5 0 0 1	Electrical Components Removal & Installation, Over temperature Switch		-	-	-	-	-	-	-	-	-	○	-	-	
	0 0 5 0 0 1	Electrical Components Removal & Installation, Thermocouple		-	-	-	-	-	-	-	○	-	○	-	-	
	0 0 5 0 0 1	Electrical Components Removal & Installation, Fault Indicator Set Assy		-	-	-	-	-	-	-	-	-	○	-	-	
	0 0 5 0 0 1	Electrical Components Removal & Installation, Ignitor/Exciter		-	-	-	-	-	-	-	-	-	○	-	-	

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	006001	Manual Fuel Shutoff Valve Removal & Installation, Adapter															
	006001	Manual Fuel Shutoff Valve Removal & Installation, Shut-off Valve															
	006001	Manual Fuel Shutoff Valve Removal & Installation, Fuel Assembly															
	006002	APU Fuel Filter Element & Fuel Pressure Switch Removal & Installation, APU															
	006002	APU Fuel Filter Element & Fuel Pressure Switch Removal & Installation, Fuel Pressure Switch															
	006001	Manual Fuel Shutoff Valve, Adapter															Nothing Original
	006002	APU Filter Element & Fuel Pressure Switch, Filter Assembly															"

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	006002	APU Fuel Filter Element and Fuel Pressure Switch Removal & Installation, Filter Element		-	-	-	-	-	-	-	-	-	C	-	-		
	007001	Oil Cooler & Filter Element Removal & Installation, Oil Filter Assembly		-	-	-	-	-	-	-	-	-	C	-	-		
	007001	Oil Cooler & Filter Element Removal & Installation, Element		-	-	-	-	-	-	-	-	-	C	-	-		
	007001	Oil Cooler & Filter Element Removal & Installation, Oil Cooler		-	-	-	-	-	-	-	-	-	C	-	-		
	008012	APU Fire Detection Control Unit, Control Unit															Nothing Coded

TABLE A-III - TIM FOR AUXILIARY POWER UNIT
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	008021	APU Control Panel, APU Run Indicator																		
	008021	APU Control Panel, Disarmed Indicator																		
	008022	Sequence & Safety Unit, APU Sequence and Safety Unit		-	-	-	-	-	-	-	-	-	O	-	-					
	008022	Sequence & Safety Unit, APU Generator Control		-	-	-	-	-	-	-	-	-	O	-	-					

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	00100	Valve, Check, Low-Stage Bleed Air	1.																	
	00100	Coupling, Sheet Metal	2																	
	00200	Coupling, Sheet Metal	3																	
	00200	Turnbuckle Body, 14" Stage Valve	5																	
	00200	Valve, Regulating, High-Stage Bleed Air	10																	
	00200	Coupling, Sheet Metal	30																	
	00300	Coupling, Sheet Metal	4																	
	00300	Valve, Bleed Air Shutoff	13																	
	00400	Valve, Bleed Air Shutoff and Flow Control	4																	
	00400	Post, Bleed Air Duct	13																	
	00500	Valve, Pressure Control Regulator	26																	

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	00500	Filter	34	-	-	-	-	-	-	-	-	-	C	-	-	-				UF
	00500	Valve	64	-	-	-	-	-	-	-	-	-	L	-	-					WP [illegible]
	00600	Nipple Assy, Pneumatic																		
		Duct, Check Std	8	-	-	-	-	-	-	-	-	-	-	-	-	-				WP [illegible] AND (MECH)
	00600	Union	20	-	-	-	O	-	-	-	-	-	O	-	-					
	00700	Nipple, Engine Ground																		
		Start, Bleed Air	9	-	-	-	-	-	-	-	-	-	W	-	-					WP 0046)
	00700	Coupling, Sheet Metal	12	-	-	-	-	-	-	-	-	-	-	-	-					[illegible]
	00700	Valve, Check, Engine																		
		Bleed Air, Ground Start	14	-	-	-	-	-	-	-	-	-	-	-	-					[illegible]
	00700	Vibrecker Assy, Power,																		
		Engine Ground Start Duct	15	-	-	-	-	-	-	-	-	-	-	-	-					WP 5010
	00700	Cable	18	-	-	-	-	-	-	-	-	-	-	-	-					WP [illegible]
	00750	Port, Electrical Mechanical																		
		Equipment, Bleed Air Duct	33	-	-	-	-	-	-	-	-	-	-	-	-					
	00750	Glass, Sight Port,																		
		Auxiliary Power Unit Check																		
		Valve	54	-	-	-	-	-	-	-	-	-	O	-	-	-				IA MECH

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	00750	Coupling, Shell Metal	57										O							
	00800	Valve, Shutoff, Pressure																		
		Operated, Butterfly, 3 inch																		
		Solenoid, Pilot Controlled	1																	(illegible)
	00900	Transmitter, Pressure	7																	(illegible)
	00950	Switch	1																	(illegible)
	00950	Switch	2									O								
	00950	Indicator	4									O								
	00950	Selector, Position, Valve																		
		Ram Air	6									O								
	00950	Switch	7									O								
	00950	Switch	8									O								
	00950	Selector, Temperature Cabin																		
		and Suit Air	10									O								
	00950	Receptacle	11																	NA (illegible)
	00950	Switch	12									O								
	00950	Indicator, Blend Air	13									O								
	00900	Filter											O							(illegible)

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot	Clean	Disassemble/Assemble	Inspect	Lubricate	Operate	Remove/Install	Repair	Service	Notes
	01000	Valve, Temperature Control Bleed Regulator	11	-	-	-	-	-	-	-	-	-	O	-	-	
	01100	Coupling, Shut Metal	2	-	-	-	-	-	-	-	-	-	O	-	-	
	01200	Coupling, Shut Metal	1	-	-	-	-	-	-	-	-	-	O	-	-	
	01200	Coupling, Shut Metal	13	-	-	-	-	-	-	-	-	-	O	-	-	
	01200	Coupling, Shut Metal	15	-	-	-	-	-	-	-	-	-	O	-	-	
	01200	Coupling, Shut Metal	22	-	-	-	-	-	-	-	-	-	O	-	-	
	01300	Coupling, Shut Metal	3	-	-	-	-	-	-	-	-	-	O	-	-	
	01300	Insulation, Flexible Joint Duct	4	-	-	-	-	-	-	-	-	-	O	-	-	WP00415
	01400	Thermostat, Temperature Control Bleed Air	4	-	-	-	-	-	-	-	-	-	O	-	-	WP00415
	01400	Anticipator, Bleed Air Temperature Control	10	-	-	-	-	-	-	-	-	-	O	-	-	WP00415
	01500	Refrigeration Unit, Aircraft Pressurization and Air Conditioning	2			-	O			O	O	O	-	O		WP00501
	01400	Gasket	5	-	-	-	-	-	-	O	-	-	O	-	-	
	01400	Gasket	11	-	-	-	-	-	-	O	-	-	O	-	-	

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	01500	Cable, Flexible	6									O								
	01600	Refrigeration Unit, Aircraft Pressurization & Air Conditioning	2									O								
	01600	Clamp	9A									O								
	01600	Coupling	10									O								
	01600	Coupling	28									O								
	01700	Coupling	1									O								
	01700	Control, Low Limit Refrigeration Pack	3			O														
	01700	Cable, Flexible	8																	
	01700	Coupling, Clamp	19																	
	01700	Valve Assy, Bypass	23									O								
	01700	Coalescer Assy, Conical Water Separator	26																	
	01700	Screen Assy, Water Separator Inlet-Heavy	28				O		O			O								

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	01800	Valve, Cabin Temperature Control Modulating	2			-	-	-	-		-		W	-	-					
	01800	Coupling, Shut Metal	16			-	-	-	-	-	-	-	O	-	-					
	01900	Valve, Shutoff, Air Recirculated	3			-	-	-	-	-	-	-	W	-	-					WP00801
	01900	Switch, Thermal Recirculating Air	5			-	-	-	-	-	-	-	W	-	-					WP00805
	01900	Sensor, Temperature Control, Cabin Recirculating Air	6			-	-	-	-	-	-	-	W	-	-					WP00806
	01900	Thermostat, Suit Air High Temperature Limit	8			-	-	-	-	-	-	-	W	-	-					WP00801
	01900	Control, Suit Air Temperature	11			-	-	-	-	-	-	-	W	-	-					WP00801
	02000	Coupling, Shut Metal	4			-	-	-	-	-	-	-	O	-	-					
	02000	Valve, Ram Air Shutoff	14			-	-	-	-	-	-	-	W	-	-					WP00805
	02000	Valve, Check, Ram Air Recirculating Air Supply	20			-	-	-	-	-	-	-	W	-	-					WP00806

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	02000	Housing	21	-	-	-	-	-	-	-	-	-	W	-	-					WP 00606
	02100	Valve, Ground, Air Supply Check	4			-	-	-	-	-	-	-	W	-	-					WP 00601
	02100	Adapter, Air Conditioning Ground Service	5			-	-	-	-	-	-	-	W	-	-					WP 00601
	02100	Clamp, Duct	8	O	O	-	-	-	-	-	-	-	O	-	-					
	02100	Clamp, Band, Light Weight	8a	-	-	-	-	-	-	-	-	-	O	-	-					
	02200	Coupling, Sheet Metal	2	-	O	-	-	-	-	-	-	-	O	-	-					
	02200	Valve, Control, Suit Air Temperature	3	-	-	-	-	-	-	-	-	-	O	-	-					
	02200	Coupling, Sheet Metal	4	-	O	-	-	-	-	-	-	-	O	-	-					
	02300	Thermostat, Cabin, Air High Temperature Limit	4	-	-	-	-	-	-	-	-	-	W	-	-					WP 00603
	02300	Control, Cabin Air Temperature	7	-	-	-	-	-	-	-	-	-	W	-	-					WP 00601
	02400	Detector, Temperature, Cabin	27	-	-	-	-	-	-	-	-	O	-	-	-					
	02500	Fan, Centrifugal, 883 Standard Electrical Rating, Unpressurized Areas	12																	WP 00601
	02100	Bypass Air Valve	11	-	-	-	-	-	-	-	-	-	-	-	-					

Fleet

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	02500	Valve, Control, Air Temperature, Pressurized Avionics	15									W								WP 00301
	02500	Switch, Pressure, Differential	25									W								WP 00401
	02500	Thermostat, Temperature Control, Avionics Air	31									W								WP 00801
	02600	Switch, Thermal	6									W								WP 00801
	02600	Actuator, Linear Communication Equipment Cooling Door	17						9			O								
	02600	Fan, Vaneaxial, 880 Standard Cubic Feet Per Minute, Pressurized Avionics	26																	Elect
	02600	Thermostat, Temperature Control, Avionics Air	29									W								WP 00802
	02600	Valve, Control Air Temperature, Pressurized Avionics	38									W								WP 00902
	02600	Switch, Pressure, Differential	39									W								WP 00902

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	02700	Restrictor, Air Flow Infrared Compt.	5	-	-	-	-	-	-	-	-	-	-	-	-					Nothing
	02700	Switch, Pressure, Differential	27	-	-	-	-	-	-	-	-	-	C	-	-					
	02700	Fan, Vaneaxial, 880 Standard Cubic Feet Per Minute, Unpressurized Avionics	30	-	-	-	-	-	-	-	-	-	-	-	-					Elect
	02700	Restrictor, Air Flow, Camera Bay	40	-	-	-	-	-	-	-	-	-	O	-	-					
	02800	Fan, Vaneaxial, 250 Standard Cubic Feet Per Minute, Internal Avionics	29	-	-	-	-	-	-	-	-	-	-	-	-					WP 00804 Elect
	02800	Switch, Pressure, Differential	47	-	-	-	-	-	-	-	-	-	W	-	-					WP 00804
	02900	Switch, Pressure, Differential	14	-	-	-	-	-	-	-	-	-	W	-	-					WP 00804
	02900	Fan, Vaneaxial, 250 Standard Cubic Feet Per Minute, Internal Avionics	44	-	-	-	-	-	-	-	-	-	-	-	-					WP 00804 Elect

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	03000	Fan, Vaneaxial, 250 Standard Cubic Feet Per Minute, Internal Avionics	3	•													Elect WP 00207
	03000	Switch, Pressure Differential	40									W					WP 00207
	03100	Switch, Pressure Differential	2									W					WP 00805
	03100	Coupling, Sheet Metal	5									O					
	03100	Coupling, Sheet Metal	6									O					
	03100	Valve, Regulator, Cabin	13							O		W					WP 00805
	03100	Coupling, Component to	8									O					
	03100	Coupling, Sheet Metal	14									O					
	03100	Coupling, Sheet Metal	16									O					
	03100	Fan, Vaneaxial, 1300 CFM, Brush, 400 Hz, 115-200 Volt	17						C			W					WP 00805
	03200	Valve, Temperature Control, Cabin Recirculating Air	2									W					WP 00806
	03200	Coupling, Sheet Metal	6									O					
	03300	Coupling, Sheet Metal	1									O					

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	03300	Valve, Shutoff Air Recirculating	4									W					WP 00107
	03300	Cooling, Sheet Metal	5									O					
	03400	Switch, Thermal, Recirculating Air	2									W					WP 00508
	03400	Sensor, Temperature Control, Cabin Recirculating Air	3									W					WP 00508
	03400	Valve, Check, Ram Air Recirculating Air Supply	6						S			W					WP 00107
	03500	Signal Lamp	3														WP 00507
	03500	Fan, Cooling	4														WP 00507
	03500	Intercommunication System	6														WP 00507
	03500	Signal Lamp	11														WP 00507
	03500	Fan, Cooling	13														WP 00507
	03525	Switch	1								W	O					
	03600	Intercommunication System	1														WP 00507
	03600	Fan, Cooling	7														WP 00507
	03600	Signal Lamp	19														WP 00507

Elect

Elect

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13 Notes
	03600	Fan, Cooling	21													WP00829
	03700	Clamp, Synchro	4													WP00810
	03700	Fan, Cooling	5													WP00810
	03700	Synclamp	7													WP00810
	04100	Connecting Link, Rigid Lonobloy Compt Heating	10									R				WP01001
	04100	Connecting Link, Rigid Lonobloy Compt Heating	11									R				
	04100	Connecting Link, Rigid Lonobloy Compt Heating	12									R				
	04100	Coupling, Sheet Metal	16									R				
	04100	Valve, Regulator, Cabin Pressure	17									R				WP01001
	04100	Cradle, Valve 75483	23									R				WP01001
	04100	Coupling, Sheet Metal	26													Notes
	04200	Filter, Air Pressure Regulator Control	24B									R				

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TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot	Clean	Disassemble/Assemble	Inspect	Lubricate	Operate	Remove/Install	Repair	Service	Notes
	04200	Control, Regulator, Cabin Pressure	35									O	R			WP 01002
	04400	Coupling, Sheet Metal	9									O				
	04400	Valve, Regulator, Cabin Pressure Safety	10									O	R			WP 01004
	04500	Coupling, Sheet Metal	5									O				
	04500	Valve, Regulating, Fluid Pressure, Device System	6									O	R			WP 01101
	04600	Coupling, Sheet Metal	2									O				
	04600	Valve, Regulating, Fluid Pressure, Duct System	4									O	R			WP 01101
	04600	Sept, Elec Mechanical Equipment, Bleed Air	6									O	R			WP 01101
	04700	Coupling, Sheet Metal	7									O				
	04700	Coupling, Sheet Metal	28									O				
	04700	Coupling, Sheet Metal	53									O				
	04700	Valve, Solenoid, Bleed Air Device System	55			C						O	R			WP 01102

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	04700	Coupling, Sheet Metal	57	-	-	-	-	-	I	-	I	-	O	-	I					
	04725	Coupling, Sheet Metal	3	-	-	-	-	-	-	-	-	-	O	-	-					
	04725	Valve, Solenoid, Bleed Air Device System	4	-	-	-	-	-	-	-	-	-	W	-	-					WP01102
	04750	Timing Control, Ring and Pinion Drive	1	-	-	-	-	-	-	-	-	-	-	-	-					WP01103 Elec
	04900	Coupling, Sheet Metal	19	-	-	-	-	-	-	-	-	-	O	-	-					
	04900	Plug, Elec Connector	26	-	-	-	-	-	-	-	-	-	-	-	-					WP01105 Elec
	04900	Valve, Solenoid, Bleed Air Device System	27	-	-	-	-	-	-	-	-	-	W	-	-					WP01105
	05000	Coupling, Sheet Metal	28	-	-	-	-	-	-	-	-	-	O	-	-					
	05000	Valve, Regulating, Fluid Pressure Bleike System	7	-	-	-	-	-	I	-	-	-	W	-	-					WP01107
	05000	Coupling, Sheet Metal	86	-	-	-	-	-	-	-	-	-	O	-	-					
	05000	Hinge, Half	16	-	-	-	-	-	-	-	-	-	W	-	-					WP01104
	05000	Hinge, Half	21	-	-	-	-	-	I	-	-	I	W	-	-					WP01104
	05000	Hinge, Half	24	-	-	-	-	-	-	-	-	-	W	-	-					WP01104
	04700	Coupling, Sheet Metal	59	-	-	-	-	-	-	-	-	-	O	-	-					
	05000	Hinge, Half	13	-	-	-	-	-	-	-	-	-	W	-	-					WP01104

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	05000	Hinge, Half	33	-	-	-	-	-	-	-	-	W	-	-	-		WP 01101
	05000	Pin, Hinge, Straight	35	-	-	-	-	-	-	-	-	W	-	-	-		WP 01101
	05100	Coupling	8	-	-	-	-	-	-	-	-	-	-	-	-		Nothing
	05100	Converter, Oxygen	12	-	-	-	-	-	O	-	-	W	-	-	-		WP 01201
	05100	Coupling	13	-	-	-	-	-	-	-	-	O	-	-	-		
	05100	Coupling	14	-	-	-	-	-	-	-	-	O	-	-	-		
	05100	Coupling	15	-	-	-	-	-	-	-	-	O	-	-	-		
	05100	Heat Exchanger, Air-Craft, Liquid Oxygen	36	-	-	-	-	-	-	-	-	W	-	-	-		WP 01201
	05100	Receptacle	40	-	-	-	-	-	-	-	-	-	-	-	-		WP 01201 Elect
	05150	Indicator	2	-	-	-	-	-	-	-	O	-	-	-	-		WP 01202
	05200	Switch, Pressure	12	-	-	-	-	-	-	-	-	O	-	-	-		
	05250	Diode	1	-	-	-	-	-	-	-	-	-	-	-	-		Elect
	05250	Receptacle	4	-	-	-	-	-	-	-	-	-	-	-	-		Elect
	05250	Switch (Bleed Air Leak Detect-Test)	5	-	-	-	-	-	-	-	-	-	-	-	-		Elect
	05250	Resistor	6	-	-	-	-	-	-	-	-	-	-	-	-		Elect

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	1 Checkout/Troubleshoot	2 Clean	3 Disassemble/Assemble	4 Inspect	5 Lubricate	6 Operate	7 Remove/Install	8 Repair	9 Service	10	11	12	13	Notes
	05275	Resistor	1																	Elect
	05275	Receptacle	4																	
	05275	Switch	5																	WP01202
	05275	Diode	6																	
	05300	Hose Assy, Oxygen Communication and Ventilation Quick Disconnect	10										W							WP01204
	05300	Valve, Oxygen Control, Manual	12									O	W							WP01204
	05300	Hose Assy, Oxygen, Communication and Ventilation Quick Disconnect	22										W							WP01204
	05300	Valve, Oxygen Control, Manual	24									O	W							WP01204
	05300	Valve, Oxygen Control, Manual	40									O	W							WP01204

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function 1 Adjust	2 Align	3 Calibrate	4 Checkout/Troubleshoot	5 Clean	6 Disassemble/Assemble	7 Inspect	8 Lubricate	9 Operate	10 Remove/Install	11 Repair	12 Service	13	Notes
	05300	Hose Assy, Oxygen, Communication and Ventilation Aircraft to Crew Disconnect	50	-	-	-	-	-	-	-	-	W	-	-			WP01204
	05300	Hose Assy, Oxygen, Communication and Ventilation Aircraft to Crew Disconnect	66	-	-	-	-	-	-	-	-	W	-	-			WP01204
	05300	Valve, Oxygen Control, Manual	84	-	-	-	-	-	-	-	O	W	-	-			WP01204
	05500	Synolamp	3														Nothing
	05600	Switch, Thermostatic	1	-	-	-	-	-	-	-	-	O	-	-			
	05600	Thermometer, Temperature, Electrical Resistance, Thermister Probe Sensor	4	-	-	-	-	-	-	-	-	O	-	-			
	05700	Switch, Thermostatic	2	-	-	-	-	-	-	-	-	O	-	-			
	05700	Transmitter, Temperature, Electrical Resistance, Thermister Probe Sensor	5	-	-	-	-	-	-	-	-	O	-	-			

TABLE A-IV - TIM FOR ENVIRONMENTAL CONTROL SYSTEM
(continued)

Found in Troubleshooting	Code	System Hardware Item	Reference Designator	Maintenance Function: Adjust	Align	Calibrate	Checkout/Troubleshoot (1)	Clean (2)	Disassemble/Assemble (3)	Inspect (4)	Lubricate (5)	Operate (6)	Remove/Install (7)	Repair (8)	Service (9)	(10)	(11)	(12)	(13)	Notes
	05700	Switch, Thermostatic	11	–	–	–	–	–	–	–	–	–	W	–	–					WP01105
	05700	Transmitter, Temperature, Electrical Resistance, Thermistor Probe Sensor	12	–	–	–	–	–	–	–	–	–	W	–	–					WP01108
	05700	Switch, Thermostatic	16	–	–	–	–	–	–	–	–	–	W	–	–					WP01108
	05700	Transmitter, Temperature, Electrical Resistance, Thermistor Probe Sensor	17	–	–	–	–	–	–	–	–	–	W	–	–					WP01105
	bbbbbb																			
	bbbbbbb																			

APPENDIX B

STATEMENT OF WORK

APPENDIX B

STATEMENT OF WORK

Develop, using Navy-provided task identification list (augmented by on-site contractor observations), a training system specification for organizational level maintenance training for the following systems of the S3A:

1. Environmental Control System.
2. Automatic Flight Control System.
3. Fuel Control System.

The following sub-products must be developed and delivered, after approval:

1. Skills and knowledges analysis - identifying S&K required for performing described tasks:
   (a) S&K in students repertoire and
   (b) S&K to be acquired in training.
2. Specific Behavioral/Performance Objectives for training system graduates.
3. Curriculum Outline.
4. Media/Method selections.
5. Functional and, where possible, material specifications for required MTUs.
6. Suggested entry level and completion tests to determine whether SBOs have been achieved.