JP43350

ON-THE-JOB TRAINING PACKAGE

MISSILE MECHANIC

JULY 1960

DEPARTMENT OF THE AIR FORCE

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MISSILE MECHANIC

PREPARED BY SHEPPARD TECHNICAL TRAINING CENTER, TEXAS

AIR TRAINING COMMAND

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OJT PACKAGE
NUMBER JP43350

DEPARTMENT OF THE AIR FORCE
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FOREWORD

1. Purpose. This publication will be used by Air Force activities as a guide for the supervised on-the-job training of a Missile Mechanic. Directives and responsibilities for this type of training are contained in Air Force Regulation 52-2, "On-the-Job Training" and Air Force Manual 50-23, "Guide for Planning and Conducting On-the-Job Training." This OJT package provides a job orientation for the Missile Mechanic, and furnishes information on job hazards, use of technical orders and maintenance forms; how to perform inspections, troubleshoot malfunctions, and supervise personnel.

2. Recommendations. Recommendations for the improvement of this package should be forwarded through channels to Air Training Command, Randolph Air Force Base, Texas.

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BY ORDER OF THE SECRETARY OF THE AIR FORCE:

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INTRODUCTION

Just what is meant by the term "on-the-job" training? The following official definition is from AFR 52-2: "On-the-Job Training is that planned training program designed to qualify a person, through supervised instruction, in the performance of the duties of a given AFS while he is working in a duty assignment of the career field ladder. The training is not on-the-job training unless the airman spends a portion of his time in a productive capacity on the job." This definition, in a few words, sums up the overall mission of the Air Force on-the-job training program.

You must keep certain principles in mind in order to get the most out of this program. Some of these principles are:

Air Force Training will never end; therefore, on-the-job training will always be required.

Training is your business, my business, everybody's business.

Your unit mission is paramount. However, your unit mission stands a much better chance of being accomplished efficiently if training is given its proper importance.

A training program must include the trainer as well as the trainee.

You cannot apply rigid formulas to different people, different types of training, or different levels of training. A successful program must be flexible.

Flexibility in this sense means that you must be prepared to use combinations of training methods depending on the nature of the subject, time available, and the capabilities of the trainee. The following methods of training are basic to any well-planned unit training program.

DIRECT SUPERVISION (Apprentice or coach-pupil). No other method of training is as effective as intelligent, interested, coach-pupil instruction. In addition to being the quickest way of fitting a new worker into the operation of a unit, it serves as one of the best methods of training. Without specific directions and guidance in learning to perform the necessary duties, a worker is likely to waste time and material, and form bad habits of work.

Many organizations in industry have apprenticeship courses which are designed to train workers in a trade or skill. Their training consists of coach-pupil supervision under skilled workers with periodic group instruction when it is advantageous.

SELF-STUDY. Skilled and semi-skilled jobs require a considerable amount of job knowledge and judgment ability. Even in simple jobs there is much basic job information that the worker must acquire. The more complicated technical jobs involve both basic and highly specialized technical knowledges and related skills, which must be taught. In skilled jobs, the training given through direct supervision is seldom complete within itself in developing basic airmen into skilled workers. In such cases, formal technical training courses should be utilized to the fullest extent. Workers who come to the job with a fair technical background and some experience can acquire much of the needed job knowledge information through self-study and other self-improvement methods.

GROUP INSTRUCTION is a practical adjunct to direct supervision and self-study. It is a time saver when several workers are to be instructed in the same job knowledge or procedures. It provides opportunity for frank discussions and group problem-solving. It develops good judgment characteristics, provides time to motivate the trainee, and leads to better cooperation among the workers. It affords an opportunity for the supervisor or trainer to check training progress and clarify matters which are difficult for the trainees to understand.

Do not confuse group instruction with classroom or so-called "academic type" instruction. The two are not the same. Academic-type instruction will certainly hinder production; while group instruction, intelligently used, can expedite production. For example, suppose you have six trainees learning the same job. Four of the trainees are having trouble with a certain job element, while the other two have it "cold." The four men having trouble can be brought over to the other two, and in a short time, the difficulties will probably be solved. In on-the-job training, this is what we mean by group instruction.

Let us now consider the key steps in implementing an on-the-job training program.

Step 1 - Survey unit assignments and insure that each assignment is in the best possible accord with the individual's classification and his specific skills background.

Step 2 - Determine the exact need for training. To determine this need, two things must be established:
a. The specific job requirements.
b. The individual skills of the trainee.
When a and b are known, the on-the-job training required can be stated in a simple formula:
a - b = c (on-the-job training required)

Step 3 - Determine the method or methods of training which will be most effective. Number of people, time available, facilities required, nature of training, and individual capabilities are factors which will affect this decision.

Step 4 - Select the people who will actually conduct the training, remembering that the end product will be no better than those who conduct the program.

Step 5 - Procure all available materials which may be helpful (such as this package) to supplement the program.

Step 6 - Follow-up. This should be a continuous monitoring job to insure that the program does not lag, that training records are kept current, and that proper utilization of newly-developed skills is being made.

This is truly a large order. But now, more than ever before, our Air Force is dependent upon quality training. It is an important job and it is one that never ends.

OJT PACKAGE OUTLINE & TRAINING STANDARD

1. Purpose. The purpose of this OJT Program Outline and Training Standard is to:

a. State the common knowledges and tasks necessary for an airman to perform duties in the Missile Mechanic Ladder of the Aircraft and Missile Maintenance Career Field (Column A). This JTS is used in conjunction with the JTS supplements listed in Note 2 to provide complete coverage of the Air Force Specialty. These knowledges and tasks are based on the Specialty Description outlined in AFM 35-1, 1 December 1959.

b. Indicate the proficiency recommended for each common job element for qualification at the three level AFSC (Column B).

c. Indicates the proficiency recommended for each common job element for qualification at the five level AFSC as provided by OJT Package JP43350 and Supplemental Packages (Column C).

d. Show chapter reference for job elements (Column D).

e. Provide the basis on which supervisors can plan and conduct individual OJT programs.

2. Explanation of Coding: The numbers and/or letters appearing in Columns B, and C are based on the following code key:

CODE KEY

Scale Value	Performance Definition	Scale Value	Knowledge Definition
1	Extremely Limited. Requires detailed guidance and close supervision in using correct procedures and techniques.	a	Introductory Knowledge - possesses knowledge of nomenclature and/or facts.
2	Partially Proficient. Requires some guidance and supervision mainly on involved and complicated steps of the operation.	b	Basic Understanding - possesses an understanding of basic principles and procedures.
3	Competent. Can perform "on his own" unless special problems are encountered; only a general check of the work is required by the supervisor.	c	Working Knowledge - thoroughly understands the application of principles and procedures to operational situations.

Scale Value	Performance Definition	Scale Value	Knowledge Definition
4	Highly Skilled. Performs skillfully and efficiently: considered capable of supervising others and applying correct procedures and techniques to new and related tasks.		

No training offered because of lack of equipment or facilities: X

No training required at this level:

The code key for a job element (knowledge or performance task) consists of a number or letter scale value, or an appropriate number/letter combination thereof.

REQUIRED KNOWLEDGE OR TASK (A)	PROFICIENCY LEVEL (3) Lvl (B)	(5) Lvl (C)	Chap. Ref. (D)
1. MISSILE ORIENTATION:			
a. Knows history of missiles	a	a	
b. Knows classification of missiles	b	b	
c. Knows use of missiles	b	b	
2. DEMONSTRATES AN UNDERSTANDING OF THE AIR FORCE SECURITY REGULATIONS AND DIRECTIVES AS OUTLINED IN THE AFR 205 SERIES	2b	3c	
3. SAFETY			
a. Applies safety principles when working around missile electronic equipment	2c	3c	2
b. Practices safety principles as applied to missile handling equipment	2c	3c	2
c. Understands and applies safe operating procedures when using hand and special tools	2c	3c	2
d. Understands radiation hazards associated with electronic equipment and nuclear warheads	b	c	2
e. Knows and observes safety precautions for handling fuels under pressure	b	c	2

(A)	(B)	(C)	(D)
4. UNDERSTANDS AND USES TECHNICAL PUBLICATIONS, MANUALS, AND RELATED PUBLICATIONS PERTAINING TO:			
a. The Air Force technical order system	2b	3c	3
b. The Maintenance Data Collection System	2b	3c	5
c. Applicable supply procedures	1a	3b	
d. T.O. 00-20E-1 Inspection System and records for missiles and direct support equipment	2b	3c	4
e. The specialized maintenance concept as outlined in AFM 66-1	1b	2b	5
f. Drawings and schematic diagrams	2b	3c	6
g. Hi-value concept	1a	2b	
5. UNDERSTANDS THE STRUCTURE OF MISSILES AND MATERIALS TO INCLUDE:			
a. Types of structures	b	b	
b. Use and composition of metals, alloys, and other structural materials	a	b	
c. Methods used in fabrication of missiles and their related components	a	b	
d. Effects and procedures for control of corrosion	b	c	
6. MISSILE HARDWARE			
a. Identifies missile hardware	2b	3c	
b. Uses and cares for missile hardware	2b	3c	
c. Applies locking and/or safetying methods	3c	4c	
7. CARES FOR AND USES HAND AND SPECIAL TOOLS PROPERLY	2b	3c	2
8. UNDERSTANDS BASIC PHYSICS AND MECHANICS TO INCLUDE:	b	b	
a. Principles of matter and energy			
b. Principles of forces at rest and in motion			
c. Application of simple machines			
d. Fundamentals of work and power			

	(A)	(B)	(C)	(D)
9.	UNDERSTANDS BASIC PRINCIPLES OF AERODYNAMICS TO INCLUDE:	b	b	
	a. Atmospheric properties			
	b. Flight characteristics			
	c. Basic missile configurations			
10.	UNDERSTANDS FUNCTIONS OF MISSILE PROPULSION SYSTEMS TO INCLUDE	b	b	
	a. Air breathing jets			
	b. Liquid rockets			
	c. Solid rockets			
11.	BASIC FUEL SYSTEMS			
	a. Understands operating principles	b	c	
	b. Identifies components	2b	3c	
12.	UNDERSTANDS CHARACTERISTICS OF			
	a. Solid propellants	a	b	
	b. Liquid fuels	a	b	
	c. Oxidizers	a	b	
	d. Lubricants	b	c	
	e. Desiccants	a	b	
13.	UNDERSTANDS THE BASIC PRINCIPLES OF MISSILE HYDRAULIC SYSTEMS TO INCLUDE:	b	c	
	a. Basic laws of hydraulics			
	b. Physical characteristics			
	c. Types of hydraulic systems			
	d. Functions of hydraulic components			
14.	KNOWS COLOR CODING SYSTEMS FOR FLUID CARRYING LINES	b	c	
15.	HAS AN UNDERSTANDING OF BASIC ELECTRICITY TO INCLUDE:			
	a. Laws and application of simple direct current circuits	b	c	
	b. Laws and application of simple alternating current circuits	a	b	

	(A)	(B)	(C)	(D)
	c. Use of measurement devices	2b	3c	
	d. Purpose and function of missile electrical system components	b	c	
16.	SUPERVISES OJT PROGRAM	-	2b	1
	a. Understands and complies with OJT directives			
	b. Obtains OJT materials			
	c. Assures that missile maintenance personnel are in proper OJT status			
	d. Orients missile maintenance personnel to OJT program			
	e. Assigns subordinate personnel areas of responsibility for conducting the OJT program			
17.	SUPERVISES MISSILE MAINTENANCE PERSONNEL:		2b	1, 2
	a. Plans and schedules work assignments			
	b. Establishes work methods, production controls, and performance standards			
	c. Insures availability of required maintenance equipment, tools, and spare parts			
	d. Assigns operation and maintenance functions to subordinates			
	e. Establishes priorities for work accomplishment			
	f. Evaluates performance for work accomplishment			
	g. Insures that subordinates comply with operational policies, preventive maintenance directives, and technical orders			
	h. Orients newly assigned personnel and assigns individuals to unit positions			
18.	KNOWS THE DUTIES OF THE GUIDED MISSILES MAINTENANCE SUPERINTENDENT	a	b	1

	(A)	(B)	(C)	(D)
19.	KNOWS THE DUTIES OF THE MISSILE TECHNICIAN	a	c	1
20.	KNOWS THE DUTIES OF THE MISSILE MECHANIC	b	c	1
21.	KNOWS THE DUTIES OF THE APPRENTICE MISSILE MECHANIC	b	c	1
22.	UNDERSTANDS MISSILE INSPECTION SYSTEMS TO INCLUDE:	b	b	4, 5
	a. Levels of maintenance			
	b. Types of inspections			
	c. Inspection methods			

CHAPTER 1

YOUR JOB

You have recently been awarded a semiskilled missile mechanic specialty (AFSC 43330) and are assigned to a guided missile organization. In the course of your schooling you have learned the basic fundamentals of missiles. Now you are ready to apply this knowledge to work experiences on operational equipment. Your immediate objective is to attain the 5 skill level within the next year. The only way in which this can be done is through On-the-Job Training. This OJT package and its supplements have been prepared to help you reach this objective.

Before we discuss just how these packages are to be used in your training, let's see how your career pattern shapes up. Notice the illustration on page 1-2. This is a career progression chart of the missile maintenance career field subdivision. Notice that as you progress from one skill level to the next, your duties and responsibilities also increase. Likewise (and this is important to you), as your duties and responsibilities increase, your pay is adjusted accordingly by promotions to higher grades. Chief Master Sergeant stripes are waiting for you at the top of the ladder. Your pay, therefore, is linked directly to your ability to increase your skill level.

REQUIREMENTS FOR UPGRADING

At this time, however, your main interest is centered on getting yourself upgraded to the 5 skill level. What are the requirements? To answer this question, let's see what Air Force Manual 35-1, "Airman Classification Manual" outlines as the mandatory requirements.

* * *

"31. Award of Skilled and Advanced (5 and 7 Levels) AFS's.

Award of AFS's at the skilled and advanced levels will be predicated upon the following facts:

a. Fulfillment of the requirements contained in the specialty description.

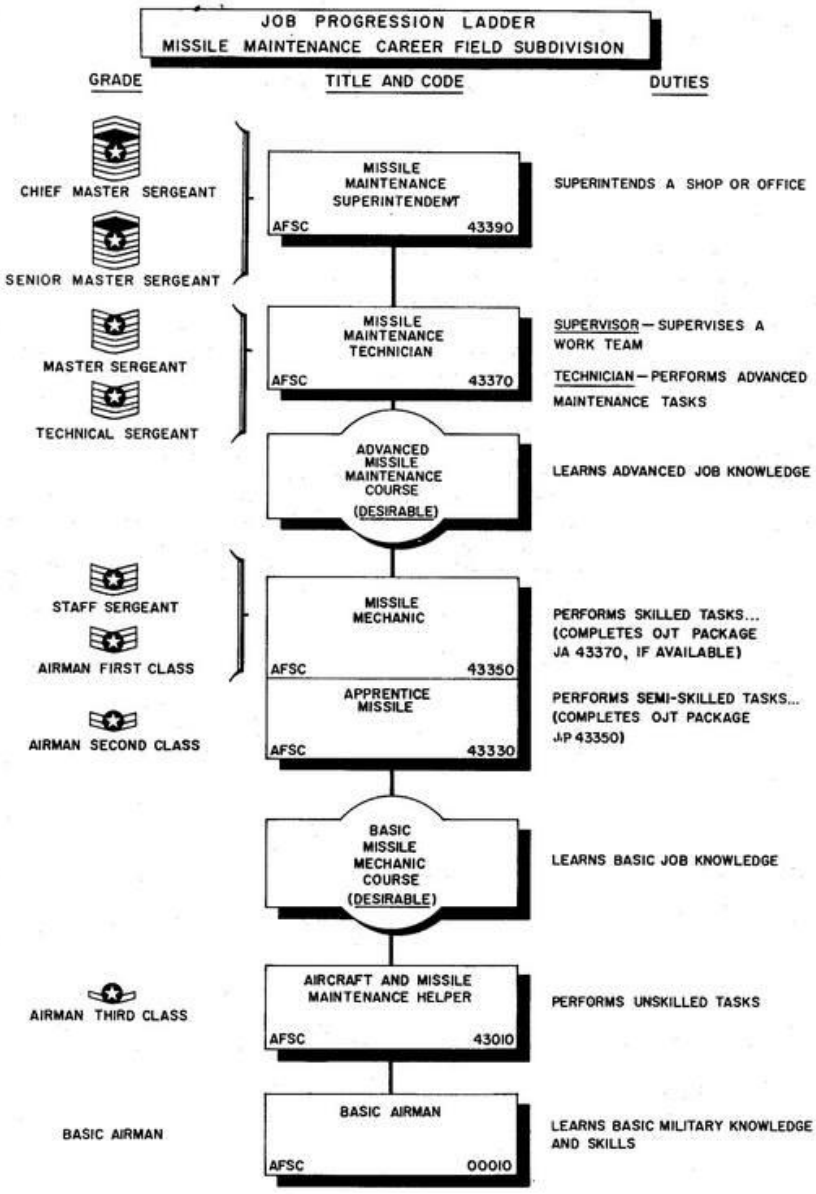
b. Current demonstration of qualifying proficiency.

c. Attainment of a qualifying score on the appropriate APT.

d. Recommendation of the Supervisor."

* * *

There they are - four simple steps required for upgrading. Let's discuss each one briefly to be sure you know just what is expected of you.


JOB PROGRESSION LADDER
MISSILE MAINTENANCE CAREER FIELD SUBDIVISION
GRADE
TITLE AND CODE
DUTIES
CHIEF MASTER SERGEANT
SENIOR MASTER SERGEANT
MISSILE MAINTENANCE SUPERINTENDENT
AFSC 43390
SUPERINTENDS A SHOP OR OFFICE
MASTER SERGEANT
TECHNICAL SERGEANT
MISSILE MAINTENANCE TECHNICIAN
AFSC 43370
SUPERVISOR — SUPERVISES A WORK TEAM
TECHNICIAN — PERFORMS ADVANCED MAINTENANCE TASKS
ADVANCED MISSILE MAINTENANCE COURSE (DESIRABLE)
LEARNS ADVANCED JOB KNOWLEDGE
STAFF SERGEANT
AIRMAN FIRST CLASS
MISSILE MECHANIC
AFSC 43350
PERFORMS SKILLED TASKS... (COMPLETES OJT PACKAGE JA 43370, IF AVAILABLE)
AIRMAN SECOND CLASS
APPRENTICE MISSILE
AFSC 43330
PERFORMS SEMI-SKILLED TASKS... (COMPLETES OJT PACKAGE JP 43350)
BASIC MISSILE MECHANIC COURSE (DESIRABLE)
LEARNS BASIC JOB KNOWLEDGE
AIRMAN THIRD CLASS
AIRCRAFT AND MISSILE MAINTENANCE HELPER
AFSC 43010
PERFORMS UNSKILLED TASKS
BASIC AIRMAN
BASIC AIRMAN
AFSC 00010
LEARNS BASIC MILITARY KNOWLEDGE AND SKILLS

The Specialty Description

Turn to the specialty description on page 1-4. This is the missile mechanic specialty description exactly as found in AFM 35-1. Study these requirements, especially in the "Duties and Responsibilities" area. These are the jobs a missile mechanic is required to do. A thorough understanding of your job description is the first step to becoming a qualified mechanic. As a self-check, see if you can pick out all the duties of a missile mechanic from the following list. If you miss even one, you need more study on your job description.

A Missile Mechanic:

1. inspects missile subsystems.
2. establishes work methods.
3. mates missile to launch pad.
4. operates launch emplacement support systems.
5. evaluates inspection results.
6. monitors servicing of missile with fuel.
7. initiates failure reports.
8. requisitions fuel.
9. maintains inspection records.
10. assigns personnel to unit positions.

The Job Training Standard

As you may have noticed, the duties in the specialty description are very broad. These broad duties are broken down into more specific jobs and knowledges by the Job-Training Standard. A modified version of the JTS is found on pages vii thru xii, this package. It is used as a reference to determine just how proficient you should be in each element of the specialty description. Naturally you will be required to become more proficient in the simpler tasks than in the more complex ones. A copy of the job training standard must be kept with your training records to provide a means of keeping track of your progress. This is where your supervisor certifies that you have demonstrated your proficiency in each job element. See illustration on page 1-6.

The Airman Proficiency Test

Sometime during your OJT period you will be scheduled to take the Airman Proficiency Test. This is your third requirement for upgrading. You must pass this test in addition to being proficient on the job in order to be eligible for upgrading. You will no doubt have to do much studying in order to satisfactorily meet this requirement. Reference Study Lists are available from your Base Education Office. You should secure this list at the beginning of your training period, which is right now, and study the materials on which the test questions are based. A number of references and questions will be found throughout this package which will also help you pass the APT

This leaves only the supervisor's recommendation to consider as a mandatory requirement for upgrading. When he decides that you are fully qualified by observing your proficiency on the job, and after you have satisfactorily completed the APT, he will recommend you for upgrading by submitting an Air Force Form 1098, "Request for Classification Action."

By the time you have read to here, you should have a good picture of your career field subdivision, how you fit into it, what you must do to perform as a missile mechanic, and the requirements for upgrading to the 5 skill level.

AIRMAN AIR FORCE SPECIALTY

MISSILE MECHANIC

1. SPECIALTY SUMMARY

Assembles, repairs, maintains, modifies, inspects and services missiles, subsystems, and missile launch emplacement support equipment.

2. DUTIES AND RESPONSIBILITIES

a. *Performs missile transport, assembly, and inspection functions:* Loads, transports by special vehicle, unloads, and hoists missile into operation or maintenance position. Prepares launch emplacement area for mating with missile. Uncrates, inspects and assembles missile and missile subsystems at launch emplacement or storage areas. Removes or applies preservatives, desiccants, and covers. Removes and installs test lines, cables, plates, and fixtures. Joins missile sections and joins missile to launch pad. Performs scheduled preventive maintenance inspections. Services, maintains, checks, tests, and operates missile emplacement support systems such as water, pneumatic, and fire extinguisher system. Inspects, repairs, maintains, and checks mechanical ground support equipment associated with launch emplacement area.

b. *Services missiles with fuels, gases, and lubricants:* Insures that an adequate supply of fuels, gases and lubricants are available at launch emplacement area. Monitors servicing of missile with fuel and gases. Monitors and evaluates instruments and gages during fueling and countdown operations. Monitors and interprets mechanical console panels to locate and isolate malfunctions. Determines scope and complexity of malfunctions by consulting technical publications, mechanical drawings, or engineering instructions. Removes, tests, and replaces mechanical console components. Possesses thorough knowledge of safety procedures associated with handling of liquid oxygen, helium, nitrogen, and hydrocarbon fuels under exteremely high pressures.

c. *Records and maintains missile and missile component historical data:* Maintains accurate historical record of inspections, repairs, replacements, tests, and malfunctions of missile, missile engine, missile engine components, and missile ground support equipment using prescribed forms and methods of recording. Requisitions and records deliveries of gases, fuels, and lubricants to missile and adjacent storage tanks.

d. *Supervises missile personnel:* Assigns maintenance, repair, and replacement functions to subordinates. Observes subordinates performance to insure compliance with standing operating procedures or technical publications. Instructs subordinates in techniques of assembly, repair, inspection, test, and replacement of missile and components using diagrams, blueprints, and technical directives.

3. SPECIALTY QUALIFICATIONS

a. *Education:*

(1) Knowledge of hydraulics, electricity, and principles of propulsion as applied to missiles is *mandatory.* Knowledge of the use of blueprints, diagrams, and technical publications is *mandatory.* Attaining a qualifying score on the APT applicable to the specialty described herein satisfies these mandatory knowledge qualifications.

(2) Knowledge of inspection techniques and supply procedures is desirable.

(3) High school level course in physics or mechanical drawing is desirable.

b. *Experience:* Experience in assembly, repair, servicing and inspection of missiles, components, and mechanical support equipment is *mandatory.*

c. *Training:* Completion of a basic missile repair course is desirable.

d. *Other:*

(1) Physical profile serial 222111 is desirable for field or base assignment.

(2) Normal color vision as defined in AFM 160-1 is *mandatory.*

(3) Only male airmen will be awarded this AFS.

4. SPECIALTY DATA

a. *Grade Spread:* Airman second class through staff sergeant.

b. *Source Jobs (D.O.T.):* None.

THE OJT PACKAGE

Now let's see how this package and its supplements fit into the picture. AN OJT PACKAGE IS DESIGNED TO DIRECT THE EFFORTS OF YOU AND YOUR SUPERVISOR, SO THAT YOU CAN ACCUMULATE EXPERIENCE AND SKILL AS RAPIDLY AS POSSIBLE. Why the supervisor? Without planned supervision, you (or any other trainee) are likely to waste time and material and form bad work habits. OJT packages must be used in conjunction with operational equipment essential to the unit mission. They are not suitable for classroom or "academic type" instruction.

This is a basic package for the missile mechanic specialty. Its subject matter is limited to that which is broad enough to cover the entire specialty. Subjects which deal with specific missiles are covered in the weapon systems supplements. For example if you are assigned to an Atlas Squadron, you should use this package (JP43350, Missile Mechanic) and its Atlas supplement (JP43350-S3, Missile Mechanic, SM-65D).

Use of these OJT packages in the prescribed manner will result in a well directed training program which will allow you to develop the necessary skills in a minimum of time.

HOW TO TRAIN ON THE JOB

To be effective, training on the job must be carried out intelligently. It's easy to see that a person who spends too much time in one shop, or doing one job will not be in a position to fully qualify in his specialty. To become fully qualified in your specialty, it is mandatory that you be rotated from one shop or job within a shop as soon as you become proficient in that particular job. Shortage of personnel and mission commitments are often given as reasons for not rotating men. These are merely excuses, not valid reasons. Personnel must be rotated! The overall unit effectiveness depends on it.

How long then, should you remain on one particular job? The answer lies partly in the job training standard, and partly with your trainer or supervisor. The JTS specifies the nature of the job, and through use of a code number, and/or letter, how well you should be able to perform that job. Notice the illustration on page 1-6. It contains an extract from your JTS. The job, "Applies safety principles when working around missile electronic equipment" has the code 3b in Column D. Referring back to the Code Key on page vii, notice that the number "3" means that you must be able to do this job well enough that only a general check of your work by the supervisor is required. Now notice the definition of the letter "C." To meet the level of knowledge required by this JTS item you must have a thorough understanding of how the principles and procedures apply to operational situations. These are the minimum standards for the specialty.

A copy of the approved JTS must be included in your training folder. When you have satisfactorily demonstrated to your trainer or supervisor that you can perform each task to the degree required, he will place his initial in the applicable column for that item. (See illustration on page 1-6.) Once you have reached this desired level of proficiency, you should be rotated to another task listed on the JTS. When all items have been accomplished and signed off, you will have reached the minimum proficiency level required for upgrading.

In the process of gaining this proficiency you will also have gained a considerable amount of background knowledge. Knowledge is gained each time you research a publication in connection with a particular job to which you are assigned. Knowledge gained in this manner, however, may not be sufficient to enable you to make a satisfactory mark on your proficiency test. But these experiences, together with diligent study of the publications listed in the Reference Study List, will be sufficient to enable you to make the grade with flying colors.

(A)	PROFICIENCY LEVEL AND PROGRESS RECORD											
	(B)	(C)	(D)						(E)	(F)		
REQUIRED KNOWLEDGE OR TASK	Crs (3) Lvl	AFSC (3) Lvl	Date OJT Started	Date Compl & Trainer's Initials	AFSC (5) Lvl	Date OJT Started	Date Compl & Trainer's Initials		Crs (7) Lvl	AFSC (7) Lvl	Date OJT Started	Date Compl & Trainer's Initials
3. Safety												
a. Applies safety principles when working around missile electronic equipment	2b	2b			3b	1 Jul 60	29 Jul 60			4c		

Trainee's initials (optional)

Trainer or supervisor's initials

Code level reflecting your recommended current proficiency.

These columns applicable to 3 level training only and will be left blank unless you attained a 3 level AFSC through OJT.

Code level reflecting the recommended proficiency for attainment of the 5 skill level.

Entries will be made in these columns only for 5 level training.

Applicable to 7 level training only. Will be left blank until you are awarded a 5 level AFSC and are entered into 7 level upgrade training.

ATC FORM 302, APR 59

Typical Entries for Job Training Standards

CHAPTER 2

SAFETY

During your upgrade training you will be expected to demonstrate safe practices in the performance of your daily tasks. This is necessary to prevent serious injury to yourself and to fellow workers, to say nothing of the large amount of money involved in needless damage to equipment. You must be a safe worker to be an effective member of your organization.

With this in mind, start thinking today of the possible hazards involved in the job to which you are assigned. In addition to learning how to do a job you must also demonstrate that you know how to do it safely.

This section is not intended as a textbook on the safe practices that should be observed in every job you may be expected to do. There are many publications available to you on the hazards involved in the maintenance of guided missiles. These publications are listed at the end of this chapter. This section will attempt to point out to you the basic principles involved in the safe performance of any job; yes even the one to which you are presently assigned.

During your assignment to a missile organization you may be exposed to such hazardous materials as Unsymmetrical Dimethyl Hydrazine (an ingredient of JP-X fuel), Inhibited Red Fuming Nitric Acid, Liquid Oxygen, various types of Igniter charges, and many other equally dangerous materials. However, a common hand tool dropped from a tower onto someone's head can cause as much damage as a whiff of nitric acid. Or the same tool dropped onto a missile structure can have the same damaging effect as a well placed rifle shot.

For these reasons you must attach the greatest importance to safely performing even the simplest jobs.

Some tips on increasing your job safety proficiency are outlined here. Start today by applying them to every job assigned you.

THE JOB

The first item of concern is the current job itself. Every job has a specified procedure to be followed. These procedures will be found either in current technical orders or in written procedures bulletins published by your own organization, or a higher headquarters. In either case, they were written for a purpose, by people thoroughly acquainted with the technical aspects of the job; the purpose being to insure that the job will be performed as quickly and as efficiently as possible. Any special hazards encountered or safety precautions to be observed in doing the job will usually be set forth in these publications.

4-123. OXIDIZER OVERPRESSURE SWITCH REMOVAL.

NOTE

Oxidizer (IRFNA) may be trapped in pressure switch line. Place a natural sponge (DO NOT USE CELLULOSE SPONGE) over line opening to absorb any fuel trapped in line.

a. Disconnect electrical connector (1, figure 4-19) from pressure switch (3).
b. Disconnect pressure switch line (6) from oxidizer tank elbow (5).
c. Remove two screws (2) and nuts (4) attaching pressure switch to missile structure.
d. Remove pressure switch and line.
e. Disconnect pressure switch from line and place line in decontamination container.
f. Place the pressure switch in a special container.

WARNING

Do not place oxidizer pressure switch in the same container with JP-X pressure switch.

g. Screw cap AN929-4 (7) on elbow.

4-124. ROCKET FUEL HELIUM CHECK VALVE AND INLET REMOVAL.

a. Disconnect regulated pressure flexible hose (1, figure 4-20) from check valve (2).
b. Unscrew and remove check valve and O-ring (3), and place O-ring in decontamination container.
c. Loosen locknut (6) on fitting (5).
d. Unscrew and remove helium inlet elbow (4) and fitting as a unit and place in disassembly container.
e. Remove O-ring (7) and place in decontamination container.

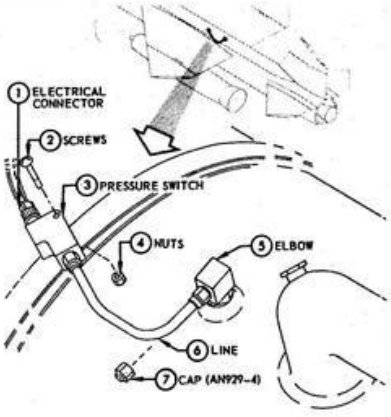


Figure 4-19. Removing Oxidizer Overpressure Switch

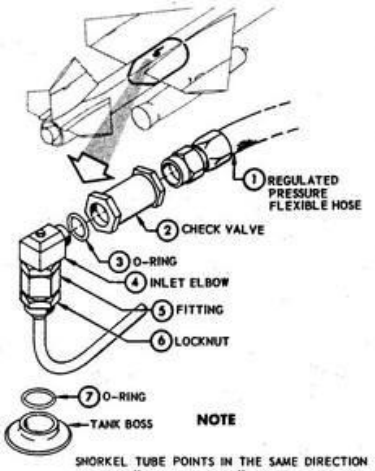


Figure 4-20. Removing Rocket Fuel Helium Check Valve and Inlet

NOTE

Snorkel tube points in the same direction as the "indexing slot" on the forward face of the fitting. To remove the inlet and fitting, tip the assembly toward the slot and lift up.

4-125. Deleted

4-126. ROCKET FUEL TANK EMERGENCY VENT ASSEMBLY, TUBING AND VALVE REMOVAL.

a. Disconnect vent line (3, figure 4-22) from emergency vent valve outlet elbow (6).
b. Disconnect vent line from emergency vent assembly (1).
c. Remove clamp (4) from vent line.
d. Remove vent line, and place in decontamination container.
e. Disconnect emergency vent actuating line "d" (5) from emergency vent valve (7).
f. Loosen locknut (9).
g. Unscrew and remove emergency vent valve and O-ring (8) and place both in decontamination container.
h. Screw cap AN929-8 (10) on vent assembly fitting (11).
i. Remove locknut (2).
j. Remove emergency vent assembly (1) from bracket (12) and place in decontamination container.

Notice the illustration on page 2-2. It is a typical technical order page from a missile publication; in this instance from a Bomarc T.O. Here is a good example of a step-by-step maintenance procedure, "removal of an oxidizer overpressure switch." Notice also the "Warning" between steps f and g. This warning is necessary for two reasons, the first being that each and every mechanic called upon to do this job may not have the necessary background knowledge to realize the dangers of mixing fuels and oxidizers. Secondly, even though the mechanic may be aware of the dangers involved, the possibility exists that he may still inadvertently place the two switches in the same container. In this case the warning merely serves as a reminder that the possibility of a dangerous condition exists while performing this particular job.

The illustrations on pages 2-4 and 2-5 are examples of missile technical orders that have special sections on safety, as well as having the "Warnings" and "Cautions" incorporated within the texts. Reading the technical orders in your spare time on the job or in your off duty time will greatly improve your safety consciousness.

The ideal job situation would require you to first read the job procedure to thoroughly acquaint yourself with the job you are about to do. This in itself would greatly increase your ability to do the job safely on your first attempt.

The ideal job situation, however, doesn't present itself each time one is assigned a different job. Many times your trainer will be able to show you how to do the job, with little time available for the special precautions involved. This presents no great handicap to your performing the job safely however, as safety is primarily a case of applying common sense.

The important thing here is that if the job is unfamiliar to you, either have your trainer show you how to do it, or research the applicable publications, before you attempt to tackle it. Knowledge of correct procedures is a very large factor in the prevention of accidents.

As a practical exercise, perform your next job in accordance with the written procedures outlined in the applicable technical order. If you have difficulty in locating the information, ask your trainer for assistance. Once located, follow the step-by-step procedure, observing the necessary safety precautions. This will enable your trainer to evaluate your ability to follow instructions; the first and most important lesson in safety.

WORK AREAS

There are many potentially hazardous conditions in the areas in which you are required to work. These may range from an improperly guarded piece of operating machinery to a defective hand tool. As a part of your training you must be able to recognize these possible sources of accidents and take the action necessary to eliminate them. In every case you won't be able to correct the situation personally. Safety is also a function of management; and the correction of certain discrepancies, such as the previously mentioned improperly guarded machinery, fall within the responsibility of management. It is your responsibility however, in such a case, to bring the hazard to the attention of your supervisor.

Housekeeping is one of the most important factors in accident prevention. Housekeeping is more than cleanliness; it is cleanliness and order. A place is in order when there are no unnecessary things about and those that are necessary are in their proper places. Good housekeeping is indicated by floors free from grease and oil spillage; properly marked aisles; clean windows; neat and orderly machinery and equipment; adequate lighting; and no excessive material, waste, or debris in the work area.

HAZARDS AND CONTROLS. . . . . Section III

3-1. DESCRIPTION AND LEADING PARTICULARS

3-2. This section provides hazards and control information on YIM-99A missiles, AF56-4027 and on.

3-3. The YIM-99A interceptor missile by its nature has a number of hazards due to the type of fuels being used and high gas pressures.

3-4. The missile has two fuel systems, the rocket and cruise systems. The rocket system.is a constant thrust, pressure-fed system with relate components. The cruise system consists of two ramjet engines mounted longitudinally under the fuselage, and are operated by the introduction of 80 octane gasoline into the combustion chamber of each engine.

3-5. The propellants used in the rocket system are inhibited red fuming nitric acid (IRFNA) and JP-X fuel. The JP-X fuel is a mixture of JP-4 jet engine fuel and unsymmetrical dimethyl hydrazine (UDMH) by weight. A starting fuel slug (ANFA) consisting of a mixture of aniline and furfuryl alcohol by weight is used to ini - tiate combustion.

3-6. These propellants are extremely hazardous even when the necessary precautions are taken. The inhibited red fuming nitric acid (IRFNA) is a powerful oxidizer and readily attacks most organic materials, and is extremely toxic. Its characteristic for attacking organic material presents a terrific fire hazard should leakage or spillage occur. The JP-X fuel and starting fuel slug (ANFA) are hypergolic fuels and also present serious health and fire hazards. They react violently with acids and other oxidizing agents and are extremely inflammable.

CAUTION

To prevent serious injury and possible loss of life and serious property damage, personnel involved in the handling of these propellants should be thoroughly acquainted with the characteristics of each propellant, the protective measures to be followed, and the remedial action to be taken in the event of an accident.

NOTE

No attempt has been made in this handbook to outline prescribed protective measures, or medical treatment for personnel involved in the handling of these propellants. These instructions will be furnished by the USAF base medical and ground safety personnel who are responsible for the safety of personnel at the activity.

3-7. The high gas pressures encountered in this missile are found in the helium and nose pressurization systems. The helium system has pressures as high as 4400 psig, and the nose pressurization system has air pressures as high as 3000 psig.

3-8. The high gas pressures involved in these systems require that certain precautions must be taken when the systems are activated.

T.O. 21-SM65D-2J-2-3
VOL II of III

PRELIMINARY
TECHNICAL MANUAL

OPERATION-MAINTENANCE

USAF MODEL
SM-65D
MISSILE WEAPON SYSTEM

JOB MANUAL

SUSTAINER ROCKET ENGINE XLR105-NA-3 MAINTENANCE ENGINE MAINTENANCE AREA

VOL II

COMPONENT REMOVAL AND INSTALLATION

THIS PUBLICATION REPLACES T.O. 21-SM65D-2J-2-3 VOL II DATED 12 JUNE 1959.

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9/18/59 —400 (Rocketdyne Div. of N.A.A.) **1 SEPT. 1959**

SAFETY PRECAUTIONS

SCOPE. The following safety precautions have been prepared for the personnel accomplishing the tasks presented in this manual. These safety precautions list specific precautions to take when the task involves working with potentially dangerous materials or conditions. Warnings and cautions are used in the text to indicate potentially dangerous steps; these warnings and cautions must be strictly observed and acted upon in accordance with the safety information contained in this section. The following examples are an explanation of the warnings and cautions:

WARNING

The warning note indicates a procedure or practice which, if not followed correctly, can result in personal injury or loss of life.

CAUTION

The caution note indicates a procedure or practice which, if not observed, can result in damage to equipment.

PRECAUTIONS TO TAKE WITH SPECIFIC EQUIPMENT AND MATERIALS.

ELECTRICAL SYSTEM PRECAUTIONS.

The following precautions must be taken by personnel working on electrical equipment:

a. Deenergize circuits before working on electrical equipment.

Here are two lists of items you should look for around your work area. These lists are by no means complete but are provided merely to start you thinking in the proper direction. The first covers some objects that may (if defective) contribute to accidents. The second pertains to some defects that could make any one of the objects dangerous.

	Object or Substance	Examples
*	Machine	welder, drill press, lathe
*	Pumps	hydraulic, fuel, and vacuum pumps, gas compressors, engines, blowers
*	Elevators	service tower, truck mounted
*	Hoisting apparatus	crane, derrick, pulley
*	Boilers and pressure vessels	steam boiler, compressed gas cylinders, storage tanks
*	Motor vehicles and trailers	prime mover, transportation trailers
*	Mechanical power transmission apparatus	shafts, bearings, pulleys, chains
*	Electrical units	motors, generators, wires, switches. lamps
*	Chemicals	explosives, vapors, fumes, corrosives, combustibles
*	Miscellaneous	bars, metal scraps, wood or other substances

The above objects or substances may possess one or more of the following faults:

*	Defective	rough, slippery, sharp, inferior in composition
*	Hazardous arrangements	unsafe storage, improper location
*	Hazardous procedures	overloading, congestion, unqualified personnel, inadequate instructions
*	Improper illumination	insufficient light, glare
*	Improper ventilation	insufficient air change, impure air source
*	Miscellaneous	dirty work areas, etc.

To check your ability for recognizing hazards, look around your work area each time you report for duty or when you move from one area to another. Make a list of all the items you think might be a potential accident cause. Submit this list to your trainer for his comments. Or the trainer may require you to make a verbal report to him on the conditions observed. Either way, he will be able to evaluate your ability to recognize these dangers.

TOOLS

Improper use of tools is another major cause of personnel and equipment damage. This includes both the improper use of serviceable tools and the use of unserviceable tools. For every job, no matter how simple, there are specified tools that must be used. If you attempt a job with tools that don't fit the job, the probability of your successful completion of the job is very remote. It's an even better bet that you will damage the equipment or injure yourself in some way before you complete the job.

Before the first job of the day you should inspect your tools for damage. Such things to look for are:

* Cleanliness - freedom from grease, oil, dirt or other organic matter.
* Breaks and cracks in sockets, end wrenches, pliers, screwdriver blades.
* Wear of sockets, drills, end wrenches, pliers, screwdrivers.
* Loose handles on hammers, files, screwdrivers.
* Calibration of special measuring tools such as meters and gages.

Before your next assignment, inspect your tools in the presence of your trainer. Examine each tool and point out to the trainer the points requiring inspection on each tool. Do not return defective tools to your toolbox. Follow prescribed procedures to replace them with serviceable ones.

Aside from the obvious hazard of using defective tools, other hazards are presented when tools are carelessly laid aside upon completion of a job. Tools should be placed in toolboxes or other designated places after use. Many accidents are caused by people stepping on or tripping over tools left in a walkway, on a ladder, on steps, or in other places used as passageways.

In addition to the hazards of using defective tools or not returning them to their proper place, injury may result from using the improper tool to do a particular job. As an example, only non-conducting tools should be used to remove igniters. If you should ignore this, and attempt to remove an igniter with a pair of common pliers, a stray voltage may fire the igniter. The resulting damage is not hard to imagine. The time required to select the right tool is generously repaid by quicker, more efficient, and safer accomplishment of the job.

PERSONAL PROTECTIVE EQUIPMENT

The hazardous nature of missile maintenance requires that personnel wear a certain amount of protective clothing, especially when engaged in particularly dangerous jobs. There is a long list of men who have lost their lives or have become permanently injured for failure to wear the protective clothing available. Protective suits, gloves, boots, face shields, and safety helmets should be available near any hazardous area.

The importance of inspection of protective clothing prior to wearing cannot be overemphasized. Make a thorough inspection of each item. If it is defective, exchange it for one which is serviceable. Also, check each item for proper fit.

A glove worn in such a manner as to leave the wrist exposed will furnish little protection against a liquid oxygen or acid burn. The same would hold true for a glove containing a ripped seam or other defect. Also, for your own safety, do not wear protective clothing unless you are certain the clothing has been thoroughly decontaminated since its last exposure to hazardous materials. Protective clothing should be regarded and handled as any other life-saving equipment.

On your next job requiring the wearing of protective clothing, demonstrate to your trainer the method of inspecting the various items. Also demonstrate the proper method of donning the items, and the checks you would make for proper fit.

UNSAFE ACTS

According to many safety studies, 15% of all accidents are caused by physical hazards (such as unsafe machinery), and 85% are caused by unsafe acts. We can safely assume that if all physical hazards in a given location were eliminated, the accident rate would be considerably lower than it would be if the hazards were not eliminated. Removal of all hazardous conditions would not, however, guarantee an accident-free situation.

Accidents may be caused by unsafe acts even though no other dangerous condition is present. You must not engage in any of the unsafe acts listed below if you are to become a safe worker.

* Operating equipment without authority
* Operating equipment at unsafe speeds
* Working at unsafe speeds
* Removing or disconnecting safety devices
* Using unsafe equipment
* Taking unsafe position or posture
* Working on moving equipment
* Distracting or teasing other personnel (horseplay)
* Failing to wear personal protective equipment
* Using improper or unsafe tools

SAFETY SUPERVISION

You will be expected to exercise a certain amount of supervision as your training progresses. Perhaps no other area requires more supervision than the area of safety. Though each individual must perform the job safely to the best of his ability, it remains management's function to provide the safest possible working conditions. This will include locating and removing any unsafe equipment or other physical hazards, performing a continuous inspection for physical hazards, planning safe operating procedures, training subordinate personnel in safe practices, and performing follow-up inspections to see that safe practices are followed.

Physical Hazards

Personnel must have a clean, unlittered, adequately lighted and ventilated place to work. Operational equipment must be in good condition and properly guarded. "No Smoking" and other warning signs must be posted where required. Safety showers and eye wash fountains must be available in the vicinity of liquid propellant handling areas. Personal protective clothing and equipment should be available and in serviceable condition. Medical personnel must be summoned during particularly hazardous operations. Maintenance personnel must be qualified in their assigned jobs.

Inspection

Daily inspections of the work areas will be made, using a check list as a guide. Most physical hazards such as defective equipment, improper ventilation, and insufficient lighting, will be found on these inspections. Other conditions which contribute heavily to accidents, such as improper procedures may not be noticed until after an accident happens. An unsafe act can happen at any time.

Therefore, even though a check-list inspection can be expected to reduce accidents, the elimination of accidents involving people and procedures requires a continuous vigilance. You must develop an awareness of everything going on around you. As you gain experience, your awareness should increase accordingly.

When you have done a particular job often enough to become thoroughly familiar with it, you will know certain things about that job, such as:

* the correct procedure
* safety precautions necessary
* special equipment needed
* personnel required
* frequency
* time required

Knowledge of these items will give you a good overall picture of the job. Once you have the picture in your mind,you can easily detect any deviation from the normal pattern. When you see the job being performed by someone else,you would quickly notice any of the following discrepancies.

* wrong procedure used
* safety precautions not observed
* required equipment not available
* unqualified personnel
* job done at wrong time
* too much or too little time required

Use this knowledge you have gained through experience to promote the safety program in your organization. Constant watchfulness and attention to detail are necessary to eliminate equipment damage and personnel injuries.

Planning

Many accidents happen as a result of poor planning. It is up to you to see that all jobs over which you have supervision are properly planned. Most jobs performed around missile installations have written instructions available which specify safe work methods and practices. These instructions represent good planning on management's part. The more complex the job, the more likely written procedures will be available. You must become familiar with these instructions and see that they are followed.

Simple tasks such as painting, greasing, and oiling can also develop into hazardous operations. It is in this type of job that proper planning can be easily overlooked. Oiling a fitting is a simple operation in itself, but that same oil applied to an oxygen fitting may cause a fierce fire or explosion. A drop of grease, aside from providing a slippery surface, could never hurt anyone. Or could it? Saturate it with liquid oxygen and it can blow your foot off! No job can be considered so simple that it does not require adequate planning.

Good housekeeping cannot be attained by an occasional grand cleanup and setting in order. It must be planned for and continuously pushed. When you undertake to secure improvement in housekeeping, the first thing to obtain is a thorough cleanup; but unless you accept the idea of getting a reasonable amount of order and system into all operations, conditions will soon be as bad as before. Lasting improvement will result only if, in addition to a cleanup, you adopt a policy of searching out and correcting the conditions that produce the dust and disorder, and plan all operations systematically. Some items necessary to good planning are listed below.

* Schedule the workload so as to properly space and sequence the jobs or steps. This will allow orderly progression from one job or step to another, and provide effective use of personnel.

* Make certain personnel are thoroughly qualified to perform the job to which they are assigned. If some people are training on the job, assign qualified trainees to direct their activities.

* Provide written instructions for performing each job, regardless of its simplicity.

* See that all necessary tools and equipment are available to properly perform the job.

Training

Safety training is the process of developing one's skill in the use of safe work methods and in the application of safe practices to work activities. Training is an essential part of conducting safe operations. You must see that personnel under your supervision are properly trained in the safety aspects of their assigned job. This can best be accomplished by instruction, demonstration, and repetition.

Describe the safe methods of performing each job operation, or sequence of operations, in simple but adequate detail. Point out the various hazards, together with their relationship to the steps of the job operation. Show the trainee how to accomplish any hazardous steps of the job. After a thorough orientation the trainee is ready to actually perform the job himself, but only under direct supervision. Little or no supervision is needed after he has demonstrated his ability to do the job satisfactorily. Personnel must be checked out on each unfamiliar job in this manner for you to maintain a satisfactory accident prevention record. Training of this nature does not take the man off the job; it merely guides his training, on the job.

So that your ability to plan a job may be evaluated have your supervisor assign you to supervise a job in which you are thoroughly qualified. In the presence of your trainer, instruct the trainee in the job procedure. If written instructions are needed, show the trainee how to locate them, and demonstrate their use. Impress on them the value of safety precautions and safe working habits.

REFERENCES

Your job proficiency can be considerably increased by broadening your safety knowledge. You will find a wealth of ideas and items of information in the following publications. By studying them in your spare time, you will be better able to recognize and correct conditions and practices that might lead to an accident or injury.

Air Force Manuals

32-3	Accident Prevention Handbook
32-4	Ground Safety Manual
92-1	Fire Protection Program - Operational Procedures

Air Force Pamphlets

160-1-1	Respiratory Protective Devices
160-6-3	Health Hazards From Propellant Fuels and Oxidizers -- Outlines the essential features of a preventive program and presents information on the physical and chemical properties of these materials, their toxicity and potential dangers, and the control measures indicated for health protection when these chemicals are stored, handled, or used.
160-6-11	Toxicology of Trichlorethylene
160-8-405	Hazards Involved in Using Trichloroethylene, USP

Air Force Technical Orders

00-25-172	Ground Servicing of Aircraft and Repositioning of Equipment -- Instructions and precautions to minimize fire and accident hazards while ground servicing aircraft and repositioning equipment. Applies primarily to aircraft but many items are applicable to missiles.
1-1-309	Aircraft Ground Safety -- Guide for the prevention of injury to personnel engaged in ground operation, service, and maintenance of aircraft. Many sections are applicable to missiles.
11A-1-34	Military Explosives -- A basic source of general and technical information concerning explosives.
11C-1-6	General Safety Precautions for Chemical Guided Missile Propellants -- Contains the things to do and not to do to obtain reasonable and adequate safety in the handling, storage, transportation and use of highly reactive chemicals.
11C-1-6C	Title same as 11C-1-6 -- Pertains to liquid oxygen only.

42A1-1-3 Solvent, General Purpose -- Prescribes precautionary measures to be observed when using general purpose solvent.

42B-1-17 Field Handling of Concentrated Hydrogen Peroxide -- Provides a uniform policy for the safe and intelligent field handling of concentrated hydrogen peroxide.

42B1-1-1 Use and Disposition of Fuels -- Precautions to be observed when handling fuels. Much of this information is applicable to missiles.

42B1-1-6 Drum Storage, Handling, and Transportation of Liquid Rocket Propellants, Nitric Acid, Aniline, Furfuryl Alcohol, and Xylidine -- Tells how to store, receive, handle, transport, and inspect liquid rocket oxidizers and fuels. Also prescribes methods for safe disposal, decontamination, and fire protection of these materials.

42B5-1-2 Gas Cylinders, Use, Handling and Maintenance -- Information and procedures in the use, inspection, and maintenance of storage type compressed gas cylinders and cylinder valves.

42B6-1-1 Storage and Handling of Liquid Oxygen -- Specifies the precautions necessary to protect personnel handling liquid oxygen. Also contains instructions necessary to maintain the purity of liquid oxygen.

Air Force Regulations

32-1 Air Force Ground Safety Program -- Establishes the Air Force Ground Safety Program to increase Air Force combat capability by reducing ground accidents.

32-3 USAF Ground Safety Digest -- Authorizes the USAF Ground Accident Digest and explains its purpose, distribution, and other features.

32-4 Identifying Unsafe Materials and Equipment -- Establishes procedures for the use of AF Form 1492, Danger Tag.

32-6 Unsafe Practices in Handling Volatile Liquids -- Prescribes responsibilities and procedures for preserving the health and safety of personnel and for reducing materiel damage when using flammable solvents in the cleaning and testing of AF equipment.

92-1 The Air Force Fire Protection Program -- Describes the Air Force Fire Protection Program and states policies and responsibilities for its accomplishments.

136-6 Ammunition and Explosive Materiel Surveillance and Safety -- Establishes policies and assigns responsibilities for safety, surveillance, renovation, preservation, repair, modification, reconditioning, manufacture and destruction of ammunition and explosive materiel.

160-59 Precautionary Measures for Handling Solvents -- Describes the need for and methods of employing precautionary measures for the prevention of illness and injury to personnel who are exposed to solvent cleaning materials.

CHAPTER 3

TECHNICAL ORDERS

One of the first things a mechanic must acquire is the ability to follow instructions. Locating the instructions in AF publications is a skill which must also be developed. By the time your training period has ended, you should have accomplished the projects outlined in this chapter. Don't try to do them all at once. Take them one at a time, and as they occur in your routine day-to-day operations. At the end of your OJT you should be able to look up nearly any item of information for which you have a need.

USE OF TECHNICAL ORDER INDEXES

The technical order indexes are primarily a list of all current Air Force technical orders. They are the keys to the entire T.O. file. A marking system is used to indicate whether certain T.O.'s are in your file, complete, etc. There is a numerical index for each major category of AF equipment. These numerical indexes are all numbered in the 0-1 series of technical orders. The alphabetical index to T.O.'s is numbered 0-2-1. There is even an index to the indexes. Let's take a look at these indexes and see what they can do for you. Select T.O. 0-1-01 from your T.O. file. It will be the first T.O. in the first volume.

Technical Order 0-1-01

The title tells you this is a "Numerical Index (of) Indexes and Publications Requirement Tables." You will be interested only in the Indexes portion at this time. Publication Requirement Tables will be covered later in your training to the 7 level.

Read the Preface carefully. This is something you must do to use any publication effectively. It may seem time consuming, but it is time well spent. All Prefaces may look alike, but each is different, and must be read before using each publication.

After you have read the Preface, scan the next few pages of the list of numerical indexes. Locate the T.O. number for the following indexes, and write them down so your trainer may evaluate your ability to use this T.O.

* Indexes and Publications Requirement Tables
* General Publications
* Aircraft and Missile Engines and Associated Equipment Publications
* Aircraft and Missile Fuel Systems and Equipment Publications
* Missile Publications

Also, find, and list, the title of the T.O. indexes as shown on the following page.

0-1-8	0-1-35	0-1-37
0-1-9	0-1-11	0-1-42

Marking Indexes

So much for T. O. 0-1-01. You may have noticed some penciled entries in the left hand column of the list of indexes. These markings are put there by the file clerk so that you will know whether or not the complete publication is in the file; the publication is in the file, but incomplete; and whether an authorized publication is not in your file. Knowing these symbols will save you valuable time when using any numerical index.

Using T. O. 00-5-1, find the symbol that would be entered in the index for each of the following conditions.

* The basic publication is in the file and complete
* The basic publication of current issue is not in the file
* The basic publication is in the file but is not complete

To learn more about how numerical indexes are used, locate T. O. 0-1-02. Like the -01 index, it will also be in the first book of the file. This is the index to General Publications; that is, tech orders and manuals which are general in nature and do not logically fit into any of the other special categories.

After reading the Preface, turn the page to the Table of Contents. Notice that Part 1 is a list, by groups, of the active T. O.'s that are listed in this index. Part II is a list of the rescinded and reclassified publications. Part III is a cross reference of Department of the Army to Air Force publications, and Part IV is a new publications listing. Turn to the page referenced in the Table of Contents for each of these last 3 parts, and read the explanation for them. You will find them self-explanatory.

Most indexes are assembled in this manner, so if you are familiar with the lay out of 0-1-02, you won't have any trouble with the others.

Now let's find the T. O. number for a particular tech order. Going back to the problem mentioned earlier concerning index markings, what procedure would you use to arrive at the conclusion that T. O. 00-5-1 would probably have the needed information? It's really very simple if you use the indexes in the manner for which they are designed.

First, open T. O. 0-1-01. It should be researched to locate the T. O. number for the proper index. The second listing in the active Technical Publications section shows T. O. 0-1-02 as the General Publications Index. The next logical step is to turn to T. O. 0-1-02, and read the Preface.

Turn to the Table of Contents, and locate a logical subdivision of General Publications which may contain something on marking T. O. indexes. The 00-5 series T. O.'s, "Technical Publications System" has possibilities, as well as the 00-25 series "Miscellaneous Publications." But let's try 00-5 first, as it sounds more logical. Turn to the page referenced in the Table of Contents. Here you will find the list of active T. O.'s of the 00-5 series.

The first T. O. listed is 00-5 "AF T. O. System." This is a likely looking title for our subject. Now locate the Volume which contains T. O. 00-5-1. After locating

the T.O., turn to the Table of Contents. To use the Contents effectively you should scan the entire table for the most likely looking heading and sub-heading. There is no guarantee that the first one you pick will be correct. In this case, you simply return to the Table of Contents and pick out the next most likely heading. In this particular case however, the Section containing the information on how to mark indexes is found under the heading "Technical Order Publication Files, and the sub-heading "Checking Files."

The following questions are provided to help develop your skill in use of the numerical indexes and Table of Contents of Tech Orders. In your spare time, locate the answers, write them out, and submit them to your trainer for evaluation. Describe to him the method you used to locate the information.

Is the status of a particular technical order shown in the ALPHABETICAL INDEX?

How are changed pages of a T.O. identified?

Which publications are authorized in a "limited" T.O. file?

Can worn-out copies of T.O.'s be removed from the file and destroyed?

List all the current T.O.'s available on your particular missile, indicate the status of each and whether they are present and complete in your file. Limit this problem to the coverage provided by T.O. 0-1-21.

In your spare time read T.O. 00-5-1. This is not a requirement of OJT, but will expand your knowledge of the AF Technical Order System. The greater background knowledge you acquire the more satisfactorily your OJT will progress.

USE OF TECHNICAL ORDERS

Now that you have become familiar with the proper use of the indexes, let's turn our attention to the other tech orders in the file. You have already developed some degree of skill in locating T.O.'s. The next step is to become proficient in the use of tech orders which govern your everyday work.

As you already know from the study of 00-5-1, there are several types of T.O.'s. Those you will use most frequently in your OJT will be Missile Technical Manuals, therefore it is upon these manuals that we will concentrate at this time. A glance at your Specialty Summary on page 1-4 will show that you will normally be required to use a limited number of the available manuals to perform your job. For example, you will be interested in manuals pertaining to launch operations, assembly, servicing, and inspection of the missile airframe, and operation and maintenance of some ground support equipment. (Ground support equipment will not be listed in the 21 series T.O.'s.)

To check the number and types of tech manuals available on your missile, select T.O. 0-1-21, and scan the list of active publications. Here you can see the great number and variety of manuals, all highly specialized.

Use of these manuals is relatively simple if you use correct procedures. Let's take a typical problem that could occur on any missile, and use the TM-76A T.O.'s to solve it. The procedure may vary slightly if you are assigned to another missile.

0-1-8	0-1-35	0-1-37
0-1-9	0-1-11	0-1-42

Marking Indexes

So much for T. O. 0-1-01. You may have noticed some penciled entries in the left hand column of the list of indexes. These markings are put there by the file clerk so that you will know whether or not the complete publication is in the file; the publication is in the file, but incomplete; and whether an authorized publication is not in your file. Knowing these symbols will save you valuable time when using any numerical index.

Using T. O. 00-5-1, find the symbol that would be entered in the index for each of the following conditions.

* The basic publication is in the file and complete

* The basic publication of current issue is not in the file

* The basic publication is in the file but is not complete

To learn more about how numerical indexes are used, locate T. O. 0-1-02. Like the -01 index, it will also be in the first book of the file. This is the index to General Publications; that is, tech orders and manuals which are general in nature and do not logically fit into any of the other special categories.

After reading the Preface, turn the page to the Table of Contents. Notice that Part I is a list, by groups, of the active T. O.'s that are listed in this index. Part II is a list of the rescinded and reclassified publications. Part III is a cross reference of Department of the Army to Air Force publications, and Part IV is a new publications listing. Turn to the page referenced in the Table of Contents for each of these last 3 parts, and read the explanation for them. You will find them self-explanatory.

Most indexes are assembled in this manner, so if you are familiar with the lay out of 0-1-02, you won't have any trouble with the others.

Now let's find the T. O. number for a particular tech order. Going back to the problem mentioned earlier concerning index markings, what procedure would you use to arrive at the conclusion that T. O. 00-5-1 would probably have the needed information? It's really very simple if you use the indexes in the manner for which they are designed.

First, open T. O. 0-1-01. It should be researched to locate the T. O. number for the proper index. The second listing in the active Technical Publications section shows T. O. 0-1-02 as the General Publications Index. The next logical step is to turn to T. O. 0-1-02, and read the Preface.

Turn to the Table of Contents, and locate a logical subdivision of General Publications which may contain something on marking T. O. indexes. The 00-5 series T. O.'s, "Technical Publications System" has possibilities, as well as the 00-25 series "Miscellaneous Publications." But let's try 00-5 first, as it sounds more logical. Turn to the page referenced in the Table of Contents. Here you will find the list of active T. O.'s of the 00-5 series.

The first T. O. listed is 00-5 "AF T. O. System." This is a likely looking title for our subject. Now locate the Volume which contains T. O. 00-5-1. After locating

the T.O., turn to the Table of Contents. To use the Contents effectively you should scan the entire table for the most likely looking heading and sub-heading. There is no guarantee that the first one you pick will be correct. In this case, you simply return to the Table of Contents and pick out the next most likely heading. In this particular case however, the Section containing the information on how to mark indexes is found under the heading "Technical Order Publication Files, and the sub-heading "Checking Files."

The following questions are provided to help develop your skill in use of the numerical indexes and Table of Contents of Tech Orders. In your spare time, locate the answers, write them out, and submit them to your trainer for evaluation. Describe to him the method you used to locate the information.

Is the status of a particular technical order shown in the ALPHABETICAL INDEX?

How are changed pages of a T.O. identified?

Which publications are authorized in a "limited" T.O. file?

Can worn-out copies of T.O.'s be removed from the file and destroyed?

List all the current T.O.'s available on your particular missile, indicate the status of each and whether they are present and complete in your file. Limit this problem to the coverage provided by T.O. 0-1-21.

In your spare time read T.O. 00-5-1. This is not a requirement of OJT, but will expand your knowledge of the AF Technical Order System. The greater background knowledge you acquire the more satisfactorily your OJT will progress.

USE OF TECHNICAL ORDERS

Now that you have become familiar with the proper use of the indexes, let's turn our attention to the other tech orders in the file. You have already developed some degree of skill in locating T.O.'s. The next step is to become proficient in the use of tech orders which govern your everyday work.

As you already know from the study of 00-5-1, there are several types of T.O.'s. Those you will use most frequently in your OJT will be Missile Technical Manuals, therefore it is upon these manuals that we will concentrate at this time. A glance at your Specialty Summary on page 1-4 will show that you will normally be required to use a limited number of the available manuals to perform your job. For example, you will be interested in manuals pertaining to launch operations, assembly, servicing, and inspection of the missile airframe, and operation and maintenance of some ground support equipment. (Ground support equipment will not be listed in the 21 series T.O.'s.)

To check the number and types of tech manuals available on your missile, select T.O. 0-1-21, and scan the list of active publications. Here you can see the great number and variety of manuals, all highly specialized.

Use of these manuals is relatively simple if you use correct procedures. Let's take a typical problem that could occur on any missile, and use the TM-76A T.O.'s to solve it. The procedure may vary slightly if you are assigned to another missile.

Problem: You are assigned to a TM-76A Launch team as mechanic number 4. Part of your job is to make the necessary static ground connections after the Translauncher has been positioned. The following steps should be used to locate this information.

Step 1 Consult T. O. 0-1-01, if necessary, to determine which numerical index contains missile publications. This step can be eliminated if you are already certain of the category of the equipment. At any rate, the index required is T. O. 0-1-21.

Step 2 Open 0-1-21 and read the Preface. This is particularly important if you are uncertain as to how missile T. O. numbers are made up. Each category contains variations to the numbering system.

Step 3 Use the Table of Contents to determine the page on which the TM-76A T. O. 's begin.

Step 4 Turn to the page referenced in the Table of Contents. Here you find a list of the TM-76A tech orders. Start at the beginning of the list and read the titles until you find one whose title indicates it contains the desired information.

The title that fits our problem is "Operating Instructions -- Launch Team, Mechanic No. 4 Missile Specialist, (AFSC 433) -- TM-76A." The numbers to the left of the title (-1-5), added to the numbers at the top of the list (21-TM76A) make up the number of the tech order you need, T. O. 21-TM76A-1-5.

Step 5 Locate T. O. 21-TM76A-1-5 in the file. If you are not assigned to a TM-76A organization, this T. O. won't be in your file. In this case follow the steps involved in locating this information by referring to the illustrations on page 3-5.

Step 6 Open T. O. 21-TM76A-1-5 to the Table of Contents (see illustration). The problem is how to make the necessary static ground connections. It is fairly obvious that Section I "Description and Leading Particulars," Section II "Equipment Required," and Section III "Countdown," will not contain grounding instructions. But what about Section IV, "Operating Instructions"? Here again, you have to read the subheadings to find the exact page you want. Notice under the subheading "Operation 2," the sub-subheading" Static Ground Connections," referenced to page 4-4. This seems to be exactly the heading we need.

Step 7 Turn to page 4-4 and read the information in paragraph 4-12. It is only at this point that you can be sure you were on the right track. Many times you may be misled in your research by vague or unclear headings in the indexes and in the tables of contents. When this happens the only alternative is to turn back to the index (in the case of locating the desired T. O.) or to the table of contents, and pick out another title or heading and begin again. You can see from the illustration that our deductions in this problem were correct.

Of course you can't expect to find in one technical manual all the information you will need to perform your job. Each missile weapon system requires many manuals; the more complex the system, the more manuals required. Also, many of the manuals on your missile will be of little value to you. Some that directly concern you are:

T.O. 21-TM76A-1-5

TECHNICAL MANUAL
OPERATING INSTRUCTIONS

LAUNCH TEAM MECHANIC NO. 4 MISSILE SPECIALIST

(AFSC 433 _ _)

USAF SERIES

TM76A

GUIDED MISSILE

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

CHANGE NOTICE

LATEST CHANGED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE

Insert changed pages into basic publication. Destroy superseded pages.

FEBRUARY 1959

TABLE OF CONTENTS

4-11. OPERATION 2.

4-12 STATIC GROUND CONNECTIONS.

a. Remove static ground cable from translauncher equipment box and ground rod from behind the Power Pack.

b. Locate ground rod halfway between power pack ground stud, and grounding stud at center of Translauncher.

c. Remove ground rod driver from power pack storage compartment, and drive grounding rod 4-1/2 feet into ground.

d. Connect ground cable from ground stud on center of Translauncher to ground rod.

e. Sandbag cable between Translauncher and ground rod.

f. Remove ground cable from Power Pack; attach cable between truck bed and ground rod.

g. Connect ground cable between ground stud on Test Pack and ground jack on Missile at station 160.312.

h. Connect ground cable between ground stud on aft left side of Translauncher and engine tailpipe.

i. Insure that ground cable GAC is installed between Power Pack and MM-1 truck bed.

4-13. ADJUSTING POWER PACK OUTPUT.

a. Insure that EMERGENCY POWER OFF switch (6, figure 4-3) on 28 Volts DC Power panel is OFF.

WARNING

To shut down power of power pack in an emergency, place EMERGENCY POWER OFF switch ON.

b. Place 28 VOLTS GEN switch (8) ON.

c. Rotate 28 VOLT DC VOLTAGE ADJ control (5) clockwise INC until VOLTS DC meter ADJ indicates between 28 and 28.5 volts.

d. Place POWER switch (7) ON.

POWER ON indicator lamp (10) must go on.

CAUTION

If POWER ON indicator lamp goes off during power pack operation, immediately place POWER switch OFF; then, check for possible overload condition.

e. Place 60 CYCLE GEN switch (7, figure 4-4) ON.

* Operating instructions for the missile and some ground support equipment (GSE).

* Erection, maintenance and servicing instructions for the missile.

* Illustrated parts breakdowns for the missile and GSE.

* Inspection requirements for the missile and GSE.

Using the specialty summary on page 1-4, screen 00-1-21 for T.O.'s which pertain to your specialty on your particular missile. Write them down on a slip of paper and let your trainer evaluate your selection. This may also serve as a handy reference list for future use.

To increase your proficiency in researching T.O.'s locate the answers to the following questions. The questions deal directly with your job and therefore the research will also increase your overall job proficiency. Write out the answers, together with the T.O., page, and paragraph numbers where the information is found. Use the procedures previously outlined in this chapter.

1. Can general purpose solvent, specification XAE-107, be used when moisture or water is present?

2. When using thread compound, specification MIL-T-5542B on male oxygen fittings, to how many threads should the compound be applied?

3. Which grade of lubricating oil, specification MIL-L-6086 is intended for use under extreme low temperatures.

4. What is the military specification for liquid oxygen used for propellants?

5. For what purpose should distilled or de-ionized water be available in a hydrogen peroxide storage area?

6. Within how many feet of an operating ground radar transmitter are fuel handling operations prohibited?

7. Does inhalation of fuming nitric acid cause immediate personal discomfort?

8. What method of testing is used to determine whether a high-pressure gas cylinder is unsafe for future use?

9. Which has the highest degree of purity, nitrogen in a compressed gas cylinder marked "water-pumped," or nitrogen in a cylinder marked "oil-pumped"?

10. What types of desiccant are used to prevent corrosion in missiles and missile systems?

USE OF ILLUSTRATED PARTS BREAKDOWNS

Another type of technical manual you will be required to use frequently is the Illustrated Parts Breakdown. Every major piece of equipment has its own IPB. IPB's are usually identified by a -4 suffix to the T.O. series number. Example: IPB for the TM-76A is T.O. 21-TM76A-4. Other numbers reserved for IPB's are -14, -24, -34, etc.

The primary function of IPB's is to furnish part numbers, stock numbers and names of the various parts. These part numbers are required on forms, records, and parts tags. IPB's may also serve as an aid in determining the sequence of assembly or disassembly of the items.

You may have already noticed that all parts breakdowns are not exactly alike. They are all similar however, in the respect that all contain a Group Assembly Parts List and a Numerical Index, which are the main sections you should know how to use.

To be sure you know the procedure for using IPB's, follow the solution of the problem stated below. Refer to the accompanying illustrations as they are referenced.

Problem: You are assigned to an SM-78 (Jupiter) organization. To prepare the missile for flight you are assigned to replace the dummy screws, which attach the nose section to the thrust section, with explosive screws. The normal procedure for accomplishing this job is to use instructions contained in the Erection and Maintenance technical manual.

Several problems however, could develop at this point which could require use of the IPB:

* One or more of the explosive screws may be missing: in which case you may need the part number to re-order.

* You may not be sure you have the correct type screw; in which case you can compare the actual screw with the illustration and/or part number for positive identification.

* You may be unsure of the exact location of the screws on the missile, in which case you can use the illustrations to positively locate the screws.

Other problems could arise in addition to these, all of which could be solved by correct use of the IPB.

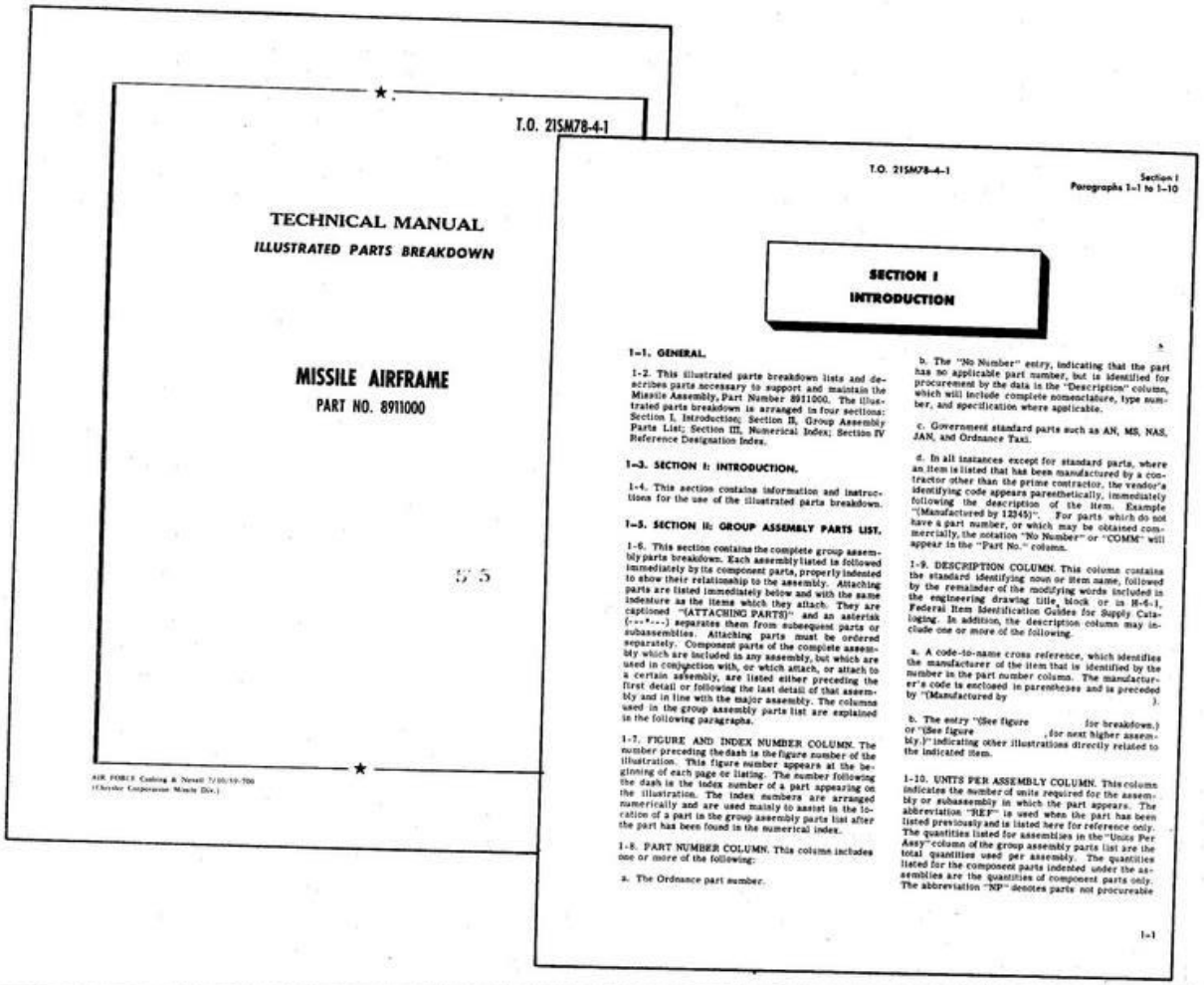
Step 1 Locate the T.O. number for the required IPB in the appropriate T.O. numerical index. In this case it is T.O. 21-SM78-4-1 "Technical Manual, Illustrated Parts Breakdown, Missile Airframe, Part Number 8911000." (See illustration, page 3-8).

Step 2 Read the Introduction carefully.

Step 3 Consult the Table of Contents for the assembly, system, or section of the missile which contains the item you need. In this case "Explosive Screw Assembly" is listed. (See illustration, page 3-9).

Step 4 Turn to the page referenced in the Table of Contents, and locate the item on the illustration. Here you have a drawing of the part, which may aid in identification. In this case the item we are looking for happens to be a major assembly. Notice however, that each part on the drawing is referenced to a number. This is called the "index" number. If you only wanted a washer for the explosive screw, you can see its index number is 5.

Notice the "figure number" below the drawing. Combine the index number for the washer (5) with the figure number (4) and you have a "Figure and Index Number" (4-5). There is no figure number for the explosive screw assembly itself, as it is the major assembly of the illustration.



T.O. 21SM78-4-1

TECHNICAL MANUAL

ILLUSTRATED PARTS BREAKDOWN

MISSILE AIRFRAME

PART NO. 8911000

AIR FORCE Cushing & Nemati 7/10/59-700
(Chrysler Corporation Missile Div.)

SECTION I
INTRODUCTION

1-1. GENERAL.

1-2. This illustrated parts breakdown lists and describes parts necessary to support and maintain the Missile Assembly, Part Number 8911000. The illustrated parts breakdown is arranged in four sections: Section I, Introduction; Section II, Group Assembly Parts List; Section III, Numerical Index; Section IV Reference Designation Index.

1-3. SECTION I: INTRODUCTION.

1-4. This section contains information and instructions for the use of the illustrated parts breakdown.

1-5. SECTION II: GROUP ASSEMBLY PARTS LIST.

1-6. This section contains the complete group assembly parts breakdown. Each assembly listed is followed immediately by its component parts, properly indented to show their relationship to the assembly. Attaching parts are listed immediately below and with the same indenture as the items which they attach. They are captioned "(ATTACHING PARTS)" and an asterisk (-**-) separates them from subsequent parts or subassemblies. Attaching parts must be ordered separately. Component parts of the complete assembly which are included in any assembly, but which are used in conjuction with, or which attach, or attach to a certain assembly, are listed either preceding the first detail or following the last detail of that assembly and in line with the major assembly. The columns used in the group assembly parts list are explained in the following paragraphs.

1-7. FIGURE AND INDEX NUMBER COLUMN. The number preceding the dash is the figure number of the illustration. This figure number appears at the beginning of each page or listing. The number following the dash is the index number of a part appearing on the illustration. The index numbers are arranged numerically and are used mainly to assist in the location of a part in the group assembly parts list after the part has been found in the numerical index.

1-8. PART NUMBER COLUMN. This column includes one or more of the following:

a. The Ordnance part number.

b. The "No Number" entry, indicating that the part has no applicable part number, but is identified for procurement by the data in the "Description" column, which will include complete nomenclature, type number, and specification where applicable.

c. Government standard parts such as AN, MS, NAS, JAN, and Ordnance Tass.

d. In all instances except for standard parts, where an item is listed that has been manufactured by a contractor other than the prime contractor, the vendor's identifying code appears parenthetically, immediately following the description of the item. Example "(Manufactured by 12345)". For parts which do not have a part number, or which may be obtained commercially, the notation "No Number" or "COMM" will appear in the "Part No." column.

1-9. DESCRIPTION COLUMN. This column contains the standard identifying noun or item name, followed by the remainder of the modifying words included in the engineering drawing title, block or in H-6-1, Federal Item Identification Guides for Supply Cataloging. In addition, the description column may include one or more of the following.

a. A code-to-name cross reference, which identifies the manufacturer of the item that is identified by the number in the part number column. The manufacturer's code is enclosed in parentheses and is preceded by "(Manufactured by).

b. The entry "(See figure for breakdown.) or "(See figure , for next higher assembly.)" indicating other illustrations directly related to the indicated item.

1-10. UNITS PER ASSEMBLY COLUMN. This column indicates the number of units required for the assembly or subassembly in which the part appears. The abbreviation "REF" is used when the part has been listed previously and is listed here for reference only. The quantities listed for assemblies in the "Units Per Assy" column of the group assembly parts list are the total quantities used per assembly. The quantities listed for the component parts indented under the assemblies are the quantities of component parts only. The abbreviation "NP" denotes parts not procureable

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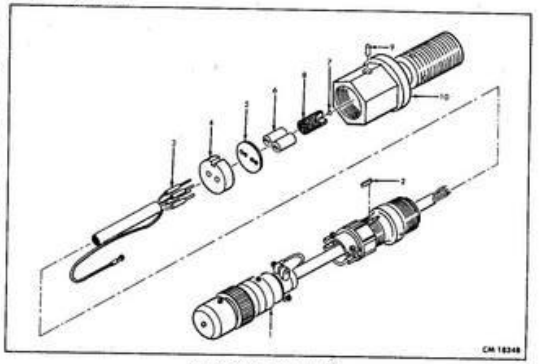


Figure 4. Explosive Screw Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
4-	8923300	SCREW ASSY, Explosive (See figure 2-7 for next higher assembly)	REF	
4-1	8923308	. CABLE ASSY	1	
	8920542	. . PLUG ASSY, Shorting	1	
	NO NUMBER	. . CAP AND LUG, Riveted	NP	
	WK-4-21C	. . PLUG (MFD by 71468)	1	
	WK-4-22C-5/8	. . CONNECTOR, Electrical plug (MFD by 71468) (ORD DWG NO. 8046799)	1	
	34119	. . TERMINAL (MFD by 00779) (ORD DWG NO. 8046797)	2	
	2255-20	. . CLAMP, Cable (MFD by 71468) (ORD DWG NO. 8046820)	1	
	8923309	. HOUSING, Retainer	1	
-2	8923307	. KEY	1	
-3	34131	. CONNECTOR, Parallel (MFD by 00779) (ORD DWG NO. 8046821)	1	
-4	8920544	. SLEEVE, Explosive screw	1	
-5	8920545	. WASHER, Explosive screw	1	
-6	73-2-250	. DETONATOR	1	
-7	COMM	. PELLET, Lead No. 6 shot, 0.090 ±0.005 DIA	1	
-8	8920548	. CHARGE	1	

2-6

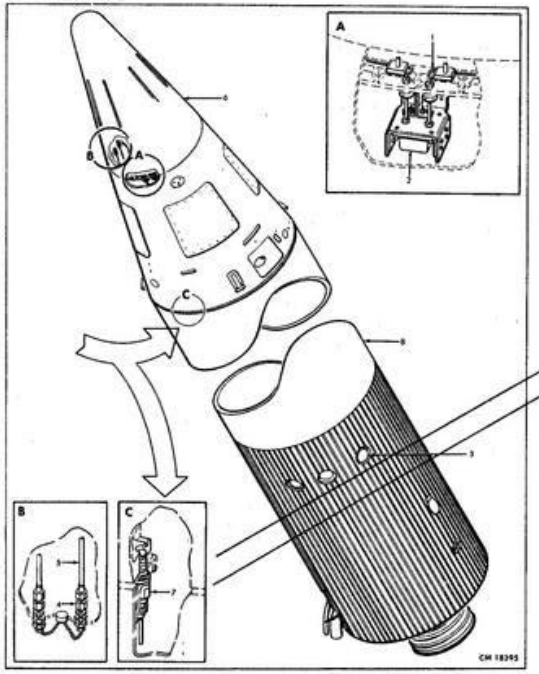


Figure 2. Tactical Missile Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
2-	8911000	MISSILE ASSY, Tactical	1	
-1	8920871	. PRIMACORD, Nose aft separation	AR	
-2	10305-15	. ARMING UNIT (MFD by 95146) (ORD DWG NO. 8910460)	1	
		(ATTACHING PARTS)		
	MS35234-9	. SCREW, MACH	4	
	AN363C1032	. NUT, Self-locking	4	
-3	8944243	. COVER, Fuel and LOX fill	2	
	8911681	. KIT, Field pressure test	1	
-4	AN832-4D	. . UNION, Flared tube	2	
-5	AN6270-4-70	. . HOSE ASSY	2	
-6	8933900	. NOSE SECTION ASSY (See figure 3 for breakdown)	1	
-7	8933300	. SCREW ASSY, Explosive (Remove dummy screws 8911318 to install explosive screws) (See figure 4 for breakdown)	6	
-8	8911005	. THRUST UNIT ASSY (See figure 5 for breakdown)	1	

Step 5 Locate the list of items shown in the figure. This list will be on the same page as the figure, or on an adjacent page. In this case it's on the lower half of the page containing the figure.

Step 6 In the left hand column locate the figure and index number that corresponds to the numbers referenced on the illustration. In the case of the screw assembly only the figure number (4) is listed.

Step 7 Locate the part number. This will be found in the column so designated. Our part number is 8923300.

Step 8 Locate the description of the part in the next column. Screw assembly, Explosive is the one we are interested in.

Step 9 In the column headed "Units Per Assembly" locate the number of explosive screws used on the missile. Notice here the letters REF. This means the information will be found on another figure. To find out which figure, check the description column again. Notice that it refers us to figure 2-7.

Step 10 Turn to figure 2 and locate the area in which the screws are used. (See illustration on page 3-10). Here we see the area indicated by the letter "C." This means a larger view of the inset (represented by the circle) is shown elsewhere on the illustration. The enlarged view of C at the bottom of the illustration shows the relative position of the screws on the missile. This still has not shown the number of screws though.

Step 11 Locate figure 2-7 on the Group Assembly Parts List opposite Figure 2. Here we once again find the Part Number and Description. In the column "Units per Assembly" we find that 6 explosive screws are required. This completes the research of the IPB as far as locating an item when its name or location is known.

NOTE

A part can be located much quicker and easier however, when its part number is known. In this case you simply refer to the numerical index section of the IPB and locate the part number. (See illustration on page 3-12). Here you will find various items of information, including the Figure and Index number for the part in the Group Assembly Parts List. Once you have this number it is a simple matter to locate the part in the Group Assembly Section.

Using the numerical indexes, find the T.O. number for an IPB on your missile or its related equipment. Select the T.O. from the file and open to the Introduction and spend a few minutes studying it. This will give you a general idea of how to use that particular parts breakdown. Answer the following questions after you have read the Introduction.

1. What type parts are listed in the Group Assembly Parts List?

2. What is the meaning of the numbers 1 through 7 in the Description block of the Group Assembly Parts List?

3. What do the letters NHA mean in the Group Assembly Parts List?

PART NO.	STOCK NO. CLASS CODE	STOCK NO. SERIAL OR PART NO.	FIG. AND INDEX NO.	QTY. PER ART.	SOURCE CODE
8921441	1420		29- 18	6	P2
8921442	1420		29- 19	6	P2
8921474	1420		29- 3	1	X2
8921500			27- 12	1	X1
			28-	REF	X1
8921503	5306		5- 11	6	P1
8921525	1420		29- 23	6	
8921546	5930		29- 6	1	P
8921561			27- 5	2	
8921563			27- 4	4	
8921597	1420		27- 8	1	X2
8921598	1420		27- 9	1	X2
8921600	1420		28- 15	1	X2D
	1420		30-	REF	X2D
8921636	1420		30- 32	3	X1
8921638	1420		30- 25	3	X1
8921671	1420		30- 1	3	X1
8921691	1420		30- 15	3	X1
8921699	1420		30- 33	3	X1
8921700			27-	1	
			9-322	1	
8921770	1420		6- 9	1	X1
8923034	5307		3- 7	52	P1
8923061	1420		3- 1	38	P2
8923063	1420		3- 2	5	P2
8923064	1420		3- 3	5	P2
8923065	1420		3- 4	4	P2
8923129			3- 9	92	
8923148	1420		3- 14	1	P1
8923232			27- 6	2	
8923238	1420		29- 11	2	M
8923246	1420		29-	3	X1
8923251	1420		29- 9	1	X1
8923252	1420		29- 10	1	X1
8923253	1420		29- 8	NP	X1
8923254	1420		29- 7	1	M
8923255	1420		29-	4	X1
8923300			2- 7	1	
			4-	REF	
8923301			4-	1	
8923302			4- 10	1	
8923306			29- 25	6	
8923307			4- 2	1	
8923308			4- 1	1	
8923309			4-	1	
8923314			(SEE 4426-418-M)		
8923323	1420		28-	1	X2
8923336			28- 10	1	
8923400			30- 8	3	
8923448	1420		38- 9	32	X1
8923462	1420		30- 2	3	X2
8923474	1420		30- 28	1	X2
8923475	1420		5- 1	1	X2
	1420		6-	REF	X2
8923477			(SEE BLANKET)		
8923478			(SEE BLANKET)		
8923479			(SEE BLANKET)		
8923480			(SEE BLANKET)		
8923481			(SEE BLANKET)		
8923482			(SEE BLANKET)		
8923507	1420		30-	1	X2
8923510	1420		30-	1	X2
8923513	1420		30- 13	1	M
8923514			30- 11	1	
8923524	1420		7- 2	3	
	1420		7- 6		X1
8923525	1420		7- 10	1	X1
8923528	1420		30- 27	3	X2
8923534	1420		9-	1	X2
8923535	5315		9-133	1	P1
8923536	1420		9-138	1	X2
8923537	5315		9-135	1	P1
8923538	1420		9-137	1	X1
8923540	1420		7- 1	8	P1
8923548	1420		7-	1	X1
8923549	1420		5- 6	1	P2
	1420		7-	REF	P2
8923557	1420		7-	1	P2
8923559	5340		7- 9	8	X1
8923560	4030		5- 9	1	P2

PART NO.	STOCK NO. CLASS CODE	STOCK NO. SERIAL OR PART NO.	FIG. AND INDEX NO.	QTY. PER ART.	SOURCE CODE
8923561			(SEE BLANKET)		
8923563	1420		7-	1	P2
8923564	1420		7- 4	1	X2
8923575	1420		30- 26	3	
8923576			8-	6	
8923582	1420		9-204	AR	P1
8923600	1420		2- 6	1	X2D
	1420		5-	REF	X2D
8923601	1420		3- 15	1	X
8923602	1420		3-	1	P2
8923603	1420		3- 12	1	X2D
8923621			3- 11	1	
8923629	1420		3- 10	1	X2D
8923672	1420		3- 16	1	X
8923728			6- 10	1	
8923931	1420		31-134	1	X2
8923946			38- 10	32	
8924062			7- 17	1	
8924624	1420		5- 5	2	X2
8924625	1420		5- 4	7	X2
8924650	1420		5- 7	2	P1
8924651			32-	24	
8924657	1420		7- 11	1	X1
8924658	4220		7- 5	1	X1
8924660	5330		7- 7	37	M
8940007			(SEE 4369-419-M)		
8940010			14- 1	1	
8940012			(SEE 315350A)		
8940053	5310		25- 3	136	
			8-		
			9-303		
	5310		26- 3		P1
	5310		20-		P1
8940069	1420		9-235	1	
8940071	1420		12- 7	1	X2
8940072	1420		12-	1	A
	1420		9- 25		A
8940098	1420		9-289	1	
8940174			(SEE HOSE)		
8940224			(SEE HOSE)		
8940225			(SEE HOSE)		
8940285	1420		19-	2	P1
8940329	1420		19- 30	1	P
8940330	1420		19- 29	2	P
8940331	5330		19- 38	4	P
8940332	1420		19- 31	1	X1
8940333	1420		19- 32	1	X1
8940340	1420		19- 36	1	X1
8940347	5315		32- 1	8	X2
	5315		19- 37		
8940381			32- 3	1	
8940384	1420		19- 28	1	
8940385	5330		32- 2	2	X1
	5330		16- 27		
8940386	1420		32-	2	X2
	1420		19-		
8940535	1420		32- 5	2	M
8940560			(SEE HOSE)		
8940680	1420		9-216	1	P1
8940681			(SEE SPHERE)		
8940797			(SEE GASKET)		
8940995	1420		28- 2	1	X2
8941012	1420		12-	1	A
8941013	4730		9- 95	1	P1
8941014	4730		6- 85	3	P1
	4730		6- 97		P1
8941015	4730		6- 93	1	P1
8941016	4730		6- 94	2	P1
8941017			6- 96	1	
8941022			12- 6	1	
8941033			31- 88	2	
	1420		16- 25		
8941034			9-244	1	
8941119			(SEE MU56-A)		
8941130			9- 61	2	
			9- 72		
			6- 65	1	
8941159			19- 14	1	
8941256			19-	1	P1
8941358	1420		(SEE 29891-1)		
8941359					

4. Explain the "Usable on Code" column in the Group Assembly Parts List.

5. Can Air Force Stock Numbers sometimes be found in IPB's?

So that you may be evaluated on your ability to use IPB's, demonstrate to your trainer the procedure used to research a part. Do this each time you have the opportunity, until your trainer is satisfied with your proficiency as indicated on the Job Training Standard.

CHANGES TO TECHNICAL ORDERS

Now that you have learned how to use some of the more common technical orders you should be ready for one last important item. Once you have located a T.O., can you be sure you have the latest information? The answer of course is "yes." You not only can be sure, but you must be sure you have the latest version of the T.O. It's absolutely essential.

T.O. 00-5-1 "AF Technical Order System" contains complete information as to how and why changes and additions to T.O.'s are made and how these changes are indicated.

At this point in your training it will be sufficient for you to learn how to check a T.O. for the latest date. How is this done? Its really a very simple procedure. Open T.O. 0-1-21. Using the table of contents, locate the List of Active Publications for your missile. Notice the date immediately to the right of the T.O. title. This is the date of the current T.O. of that title and number. Now check any T.O. of that series. The same date listed in the index should appear on the lower right hand corner of the Title Page of the T.O. (See illustration, page 3-14).

Now look at the list in 0-1-21 again. Notice some T.O.'s have a date in parentheses immediately below the "basic" date. This indicates the date of the latest change to the basic T.O. In this case, both the basic date and the change date will appear on the Title Page of the T.O. If the change dated in the index does not agree with the change date on the T.O. Title Page, you should not use the T.O. as you have no way of knowing just which information has been changed.

The next time you have the occasion to research a T.O., demonstrate to your trainer the manner in which you check the T.O. date against the numerical index.

REFERENCES

Here are some references on this subject. You should study them at your leisure to increase your knowledge of the AF Technical Order System.

T.O. 00-5-1 "AF Technical Order System"

T.O. 00-5-2 "Distribution and Storage of AF Technical Order System Publications"

T.O. 00-5-3 "Technical Orders, How to Get Them"

T.O. 00-5-4 "Explanation of Distribution and Numbering System for Microfilm Indexes"

T.O. 00-5-7 "Commercial Technical Publications"

T.O. 00-25-15 "T.O. Compliance"

NUMBER	TITLE	BASIC DATE	STG & MGMT
21-SM	STRATEGIC MISSILES (CONT)		
21-SM65D	MODEL SM-65 SERIES D (CONT)		
*L -1J-2-9	Job Manual--Ground Elec System Maint, Power Distribution System, Launch Instl, (Volume 2, Parts I and II), 576-B Squadron Complex, SM-65D (Convair)	26 Sep 59 (Chg 28 Dec 59)	SB
*L -1J-2-9	Job Manual--Ground Elec System Maint, P...	30 S...	SB
*L -1J-2-13	Job Manual--Water Distribution System, Pump House and Power House, (Volume 1), 576-A, -B Squadron Complex, SM-65D (Convair) (Repl AZI-27-085A)	30 Sep 59	SB
*L -1J-2-13	Job Manual--Water Distribution System Opr-Maint, (Chg 30 Dec 59) Distribution and Subsystems, (Volume 2), 576-A Squadron Complex, SM-65D (Convair) (Repl AZI-27-086)	30 Sep 59	SB
*L -1J-2-13	Job Manual--Water Distribution System, Distribution and Subsystems, (Volume 3), 576-B Squadron Complex, SM-65D (Convair) (Repl AZI-27-350)	2 Nov 59	SB
L -1J-2-14	Job Manual--Pneu System, Maint--SM-65D (576-A Squadron Complex) (Convair)	20 Oct 59	SB
*L -1J-2-15	Job Manual--Propellant Utilization System Maint, 576-A, -B, 564-A and -B Squadron Complex, SM-65D (Convair)	30 Dec 59	SB
*L -1J-2-16	Job Manual--Missile Elec System, Launch Instl, (Volume 1, Parts I and II), 576-A Squadron Complex, SM-65D (Convair) (CONF) (Title Uncl)	5 Nov 59	SB
*L -1J-2-16	Job Manual--Missile Elec System Maint, Squadron Maint Area, (Volume 2), 576-A -B, 564-A, -B Squadron Complex, SM-65D (Convair)	11 Nov 59	SB
*L -1J-2-17	Job Manual--Air Conditioning, Heating and Ventilating Systems, 576-A and -B Squadron Complex, SM-65D (Convair) (Repl AZI-27-093)	30 Sep 59	SB
*L -1J-2-18	Job Manual--Launch and Svc Instl Maint Svc Tower, 576-A Squadron Complex (Convair) (Repl AZI-27-109)	30 Sep 59	SB
*L -1J-2-19	Job Manual--Missile Transportation and Handling, Ground Transportation, (Volume 1), 576-B, 564-A and -B Squadron Complex, SM-65D (Convair)	31 Dec 59	SB
*L -1J-2-19	Job Manual--Missile Airframe and Booster Section, Transportation and Handling, Erection and Removal, (Volume 3), 576-B, ... Complexes, SM-65D (C...	14 Aug 59 (Chg 14 Nov 59)	SB
-1J-2-19	Volume 4 (Repl by V 21-SM65D-1J-2-19 ...		
-1J-2-20	Job Manual--Cor... Automatic Pro... 576-B, 564- ... (Convair)	...ov 59 ...out Equip Maint, ... Complex, SM-65D ...-039)	SB
-1J-2-21	Job M... Instl ... C...	...and Svc ..., -B and 576-B Squadron (Repl AZI-27-076) (Convair)	1 Dec 59 SB
1J-2-22	...issile Airframe ..., 564-A, -B Squadron Complexes, (Convair)		1 Feb 60 SB
	...ual--Weapon System ...out Equip, Squadron Maint Area, Opr, ...olume 1), 576-B Squadron Complex, SM-65D		4 Jan 60 SB
	... Manual--Propellant Loading System Maint, 576-B, 564-A, -B Squadron Complex, SM-65D		28 Nov 59 SB

T.O. 21-SM65D-1J-2-19
Volume 3 of 4
(Replaces AZI-27-074-3)

PRELIMINARY TECHNICAL MANUAL

OPERATION - MAINTENANCE

USAF MODEL
SM-65D
MISSILE WEAPON SYSTEM

576-B, 564-A, AND 564-B SQUADRON COMPLEXES

JOB MANUAL
MISSILE AIRFRAME AND BOOSTER SECTION TRANSPORTATION AND HANDLING

VOL. 3 ERECTION AND REMOVAL

CHANGE NOTICE
LATEST CHANGED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE
Insert changed pages into basic publication. Destroy superseded pages.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

Kerr Litho—11/30/59—550—(CONV.-ASTRO.)

14 AUGUST 1959
CHANGED 14 NOVEMBER 1959

Check these dates before using T.O.

RESEARCH QUESTIONS

The following questions are based on information contained in T.O. 00-5-1, "AF Technical Order System."

1. Which Command has been delegated the authority to determine whether certain Army or Navy technical publications should be integrated into the AF Technical Order System?
2. To whom should suggestions for improvements to the technical order system be submitted?
3. List the types of information included in Technical Manuals.
4. Are commercial publications required by the Air Force given technical order numbers?
5. Which T.O. explains the Joint Special Weapons Publications system?
6. What type of T.O. provides instructions for one-time changes to aeronautical equipment?
7. What type T.O. indicates a "degree of urgency" in its instructions?
8. In what forms are "interim" T.O.'s issued?
9. When are interim T.O.'s normally replaced by formal T.O.'s?
10. Are Routine Action T.O.'s released before the T.O. compliance kits are available?
11. What are the limitations of the Alphabetical Index, T.O. 0-2-1, in regard to requisitioning technical orders?
12. What is the function of Publications Requirements Tables? How are they numbered?
13. What T.O.'s are used to determine the contents of a "limited" T.O. file?
14. Are Inspection Work Cards assigned technical order numbers?
15. Does the term "revision" have more than one meaning in the present technical order system?
16. Under what circumstances would T.O. pages be issued with letters following the page numbers, such as 20A, 20B, etc?
17. What is the purpose of the "A" page in a tech order?
18. How is a changed T.O. page identified?
19. Are black line symbols used to indicate changes in the text of technical manual revisions?
20. What type of T.O. supplement includes all data contained in supplements previously issued, and supersedes the preceding supplements?

21. How are T. O. supplements identified?

22. Under what circumstances is an appendix issued separately from the basic publications?

23. Give three reasons for rescinding technical orders.

24. Which T. O. supplement is issued weekly?

25. Is there a relationship between the present T. O. numbering system and the AF supply classification of the equipment?

26. Do T. O. numbers reflect the security classification of the publication?

27. What type publication would bear the number MF21-TM61C-2?

28. What type publication would bear the number WC-21-TM76A-6-DA?

29. What type publication would bear the number SC-21-SM65-D(1)-6-1AS?

30. Could the letter suffix to a number of a classified supplement to a technical manual reflect its security classification?

31. What is the highest security classification assigned to technical orders?

32. Under what circumstances can the custodian of a classified technical order change its security classification?

33. What determines the number of T. O. 's in a "limited" file?

34. Are commercial missile manufacturers authorized T. O. files?

35. Can copies of technical orders be assigned to individuals?

36. Where should T. O. files be located?

37. Are publications received in flexible binders filed as received, or removed and filed in standard binders.?

38. Where are interim technical orders filed?

39. Where are T. O. supplements filed?

40. How are inspection work cards and sequence charts filed?

41. What is the disposition of tech orders which become mutilated beyond use?

CHAPTER 4

INSPECTIONS

The missile inspection system was established to assist using organizations in maintaining the highest possible percentage of missiles and ground support equipment in a state of readiness at all times. It does this by providing for the accomplishment of thorough and repetitious inspections. These inspections may be required at certain time intervals or by other special conditions.

By the end of your upgrade training to the (5) skilled level you must be able to perform an inspection in the missile mechanic position (43350) with only limited supervision. This means you must have done the job enough times that you are sure you can do it even though you may need more practice. This is the minimum requirements in this area for upgrading.

To be able to adequately perform an inspection you must:

* become familiar with the publications governing the inspection system.

* develop sound basic inspection techniques.

* be able to accurately accomplish the required inspection forms.

Each of these areas will be presented separately in this chapter for ease of both presentation and learning.

INSPECTION METHODS AND PROCEDURES

The inspection system is implemented by several publications which describe the system, state the equipment to be inspected, when and by whom it is to be inspected, and the functions to be performed during an inspection, including the procedures for accomplishment of the required forms. Some of these publications are discussed in the following paragraphs. From these discussions you will be able to see the part each plays in the inspection system.

Technical Order 00-20E-1

The title of this T.O. is "Inspection System and Records for Missiles and Direct Support Equipment." This is the primary instrument governing the inspection system for missiles. In the course of this chapter you will be required to read certain sections of this T.O. in connection with the subject being presented. At this point select it from your file, read paragraphs 1-1 through 1-5, and be prepared to answer the following questions.

1. Which of the following is not a purpose of this T.O. ?

To prescribe for missile weapon systems:

a. historical and inspection forms
b. a planned inspection system
c. a replacement schedule for missile components
d. a system of recording basic information

2. To which of the following missiles does this T.O. apply?

a. GAM-72
b. IM-99B
c. TM-76A
d. GAR-8
e. SM-68
f. GAM-77

3. What is the purpose of the Inspection System?

4. Which T.O. specifies the inspections to be performed on a missile?

5. Can destruction action on certain forms be determined by a using organization?

6. What is the purpose of the historical and inspection records?

7. What is the purpose of the maintenance data collection forms?

8. What other T.O.'s in the 00-20 series are required in the missile inspection system?

Technical Order 00-20A-1

This T.O. is titled "Aircraft, GAR, GAM, and Drone Inspection and Maintenance System and Records Administration." It sets up the inspection systems for Guided Aircraft Rockets, Guided Aircraft Missiles and Drones. It also contains the necessary instructions required to accomplish the DD 829 series forms and AFTO Form 44 which are required for missile jet engines. DD Form 829-1 is also used on all missile airframes, engines and major items of GSE.

Technical Order 00-20C-1

The T.O. "Ground Equipment Inspection System" provides the basic means for maintaining the highest possible percentage of both powered and non-powered ground equipment in a serviceable condition for immediate use. The ground equipment covered by this T.O. is that equipment which as AF wide usage. Special GSE for weapon systems is covered by T.O. 00-20E-1. Read sections I, II, and III of T.O. 00-20C-1 and answer the following questions.

1. The provisions of T.O. 00-20C-1 are binding upon all organizations of the Air Force within the ZI and overseas

a. without exception
b. that have assigned or possess ground support equipment, without exception
c. that support missile weapon systems
d. excepting those that support missile weapon systems

2. Base activities are provided with information regarding their assigned or possessed GSE by

a. personal reports from maintenance personnel
b. historical and inspection records

c. Technical Order Compliance Work Records
d. Ground Equipment Condition Inspection Records

3. If your organization should receive reassigned equipment without the related forms, the first step it should take is to

a. return the equipment
b. request the missing forms
c. inspect the equipment for possible sabotage
d. prepare substitute forms

4. What publication contains detailed definitions for Ground Equipment?

5. Which forms are not used to implement the Ground Equipment Inspection System?

a. AFTO Form 11C
b. AF Form 646
c. DD Form 829-1
d. AFTO Form 11
e. AFTO Form 44
f. AFTO Form 11A
g. AFTO Form 130C
h. AFTO Form 11B

6. Which T.O. specifies the maximum repair allowances for Ground Equipment?

7. Your organization receives an "Urgent Action" time compliance technical order which specifies that action must be taken within a specified number of days. On which AFTO Form is an entry required?

8. What types of inspections are required for Ground Equipment?

9. Which publication specifies the intervals between Ground Equipment periodic inspections?

10. Are these maximum or minimum intervals?

11. Can maintenance officers increase the frequency of inspections?

12. Who can perform the daily inspection on an item of Ground Equipment?

13. What is the maximum time interval between periodic inspections of non-powered Ground Equipment?

14. Which Ground Equipment Workcards list Special Inspections?

15. Name one circumstance that might alter a special inspection interval?

16. Receiving inspections on Ground Equipment are performed in accordance with which T.O. ?

17. Which form is prepared when damage caused by faulty packaging is discovered on a Receiving Inspection?

18. On which form is a mechanical defect found on a Receiving Inspection reported; if the defect was not due to faulty packaging or handling?

19. Which forms must accompany an item of Ground Equipment when such items are being shipped?

INSPECTION REQUIREMENTS TECHNICAL MANUAL

There will be one or more Inspection Requirements technical manuals published for your weapon system. These are usually identified by a -6 suffix to the T.O. series number. Example: The Inspection Requirements manual for an SM-75 is numbered T.O. 21-SM75-6. These manuals state what equipment is to be inspected, when such equipment is to be inspected, and what conditions are to be sought. A page from T.O. 21-SM75-6 is shown on page 4-5 to illustrate the manner in which this information is presented. Compare item number 4 with the following:

* Equipment to be inspected - exterior surface of the missile.
* When such equipment is to be inspected - on first periodic inspection.
* Conditions to be sought - damage, corrosion condition of paint, and legibility of stenciling.

The Inspection Requirements manual will also list the inspections required on the missile and its support equipment. Each inspection will be referenced to its applicable set of work cards. This serves as a handy reference for determining the proper set of cards for a particular inspection. For example, if you were going to checkout the explosives on an SM-75, you would use the card set W.C. 21-SM75-6-ECSP-13. See illustration, page 4-6.

Component Replacement Schedule

The Inspection Requirements manual also contains a Replacement Schedule and a Calibration Schedule. The Replacement Schedule lists the items which require replacement with a serviceable like item at certain intervals. This may occur at a given number of calendar days, months, or years or at a predetermined number of operating seconds, minutes, hours, or cycles. The form entry, and the appropriate man-minutes required to do the job is also shown in this schedule. Notice the illustration on page 4-7. The two vernier engine igniter assemblies, part number 650291, must be replaced every six months if they are installed on the missile. Information concerning the amount of time required to replace the igniters was not available when this T.O. was published, as noted by the asterisks in the "time" column. The igniter replacement information must be recorded on AFTO Form 2B, as indicated in the appropriate column.

Calibration Schedule

The Calibration Schedule includes a list of all items which require a periodic calibration check to insure their accuracy. This list includes such items as gages, meters, timers, switches, and many other similar items too numerous to list here.

This schedule specifies only the intervals at which the item is to be calibrated. Actual calibration procedures will be found in other technical publications such as the 33 series T.O.'s, and Inspection Work Cards.

Locate, in your T.O. file, an Inspection Requirements technical manual on your equipment. Check the T.O. date against the date listed in the T.O. index to be certain the manual is up-to-date. Read the Introduction. After having done this, locate the section which lists the steps necessary to prepare the missile for a periodic inspection. (In some instances the -6 manual will refer you to a work card set, which will contain this information). List these steps and submit them to your

INSPECTION REQUIREMENTS SM75 MISSILE	TYPE OF INSPECTION								SPECIAL	TIME MAN-MIN
	ASSEMBLY	INSTALLATION	DAILY	WEEKLY	PERIODIC					
					1	3	6	12		
1. Guidance cabling between the missile and the ground support equipment for condition.	X	X	X		X				15 Day	20
2. Main fuel and liquid oxygen tank vents for opening and closing operation.									15 Day	1
3. Fuel mast nozzle for cleanliness and security of attachment to the missile tank.					X					9
4. Exterior surface of the missile for damage, corrosion, condition of paint, and legibility of stenciling.					X					19
5. Liquid oxygen mast nozzle for cleanliness and security of attachment to the missile tank.					X					4
6. Forward umbilical carrier for proper connection.			X		X				15 Day	1
7. Battery overflow vent open and access door closed.			X		X					1
8. Clamshells closed and switch manually actuated.			X		X					2
9. Liquid oxygen tank vent for corrosion and obstruction; flexible hose for corrosion, breaks, general condition and proper installation of the vent hose.			X		X					3
10. Short range theodolite door open and rigged.			X		X					22

INTRODUCTION (Continued)

Major End Item Number	Equipment	Type of Inspection	Workcard Sets
13.	SM75 MISSILE (Continued)		
	SECTION II: WITH MISSILE CHECKOUT STATION FROM MISSILE		
	SECTION III: MANUAL OPERATION		
	READY CONDITION	SPECIAL	WC 21-SM75-6-RCSP-13
	LIVE DRY EXERCISE COUNTDOWN	SPECIAL	WC 21-SM75-6-DCSP-13
	DECONTAMINATION	SPECIAL	WC 21-SM75-6-DESP-13
	EXPLOSIVE COMPONENT CHECKOUT	SPECIAL	WC 21-SM75-6-ECSP-13
	REENTRY VEHICLE	SPECIAL	'SP-13
	SECTION I		

WC 21-SM75-6-ECSP-13

ONE SET
(43 CARDS)

SPECIAL INSPECTION WORKCARDS

SM-75 MISSILE – EXPLOSIVE COMPONENT CHECKOUT

3P-13
14
14
4
4

REPLACEMENT SCHEDULE SM75 MISSILE -- AIRFRAME, CONTROL, AND PROPULSION

REPL. FREQ.	SYS	ITEM 1 2 3 4	OPER. CODE	VENDOR	QUAN.	AFTO FORM 2A	AFTO FORM 2B	AFTO FORM 2C	AFTO FORM 2E	TIME MAN-MIN.
30 mo	06	Valve Assembly, Liquid Oxvgen Bleed, P/N 304563, 300903		02602	2		O			30
1000 cyc 30 mo	06	Valve, Propellant Poppet, P/N 302066	203 204 220	02602	2		O		X	54
2500 sec 30 mo	06	Chamber Assembly, Thrust, P/N 350247, 350284	220	02602	2		O		X	**
6 mo (Installed)	06	Igniter Assembly, Vernier Engine, P/N 650291		02602	2		O			**

GENERAL NOTE

X = AFTO form required.

O = Item identification required on existing AFTO form.

* = Calendar time to be measured from date of initial DD250.

**To be added when available.

trainer for evaluation. Show him the procedure you used to locate this information.

So much for the Inspection Requirements Technical Manual. Let's turn our attention now to another phase of the inspection system: use of Inspection Work Cards.

INSPECTION WORK CARDS

As you already know, the -6 technical manual specifies what to inspect, when to inspect it, and the conditions to look for. It does not tell you HOW to inspect. Nor does it give any particular sequence in which the items must be inspected. Why is sequence important? For the answer to that, we must go back to the stated purpose of the inspection system: "to provide the highest possible percentage of missiles in a state of readiness at all times." It's fairly obvious that to do this, inspections cannot be conducted in a haphazard manner, or stretched out over an excessive period of time. Hence the sequence requirement. This then basically is the purpose of the work cards: to provide mechanics and technicians with sequenced guides for inspections or operational checkouts.

At this point it will be well to see what T.O. 00-20E-1 has to say about work cards. Locate this T.O. and read Section III, para. 3-18 thru 3-31. Omit the information pertaining to Sequence Charts at this time. After reading the section on work cards you should be able to answer the following questions.

1. A work card publication number is prefixed by the letters "WC." From what source is the publication number derived?

2. To what does the letter suffix to a work card publication number refer?

3. Where can a list of the revised or changed work cards in a set be found?

4. Is a work area diagram included in a work card set?

5. Which work card gives instructions on the use of the card set?

6. The entry in the "card time" block indicates the amount of time needed by the

   a. highly skilled mechanic

   b. trainee

   c. average skilled mechanic

   d. maintenance technician

7. What action is taken when a work card inspection item pertains to equipment which is not installed on your missile?

8. Can items on work cards be relocated by the using organization?

9. For what purpose are work cards issued in blank form?

10. What action is authorized if one card of a set becomes unserviceable?

Let's examine a work card set more closely. Notice again the illustration on page 4-6. To check out the explosives on an SM-75 you would select the work card set WC21-SM75-6-ECSP-13.

The purpose of the illustrations on pages 4-10 and 4-11 is to show the orderliness of an inspection conducted with work cards. Notice the work cards numbered 13-1 and 13-2 on page 4-10. Here are lists of all the equipment needed to conduct this inspection. To attempt this inspection without having all of these items available is contrary to the inspection concept. The time spent gathering these necessary items (in this case, 20 minutes) represents a small fraction of the time which can be lost if one or more of the items are missing. The times allotted on the other cards of the set are based on the assumption that all items listed are available as needed.

Notice on card 13-1 that T. O. 21-SM75-1J-2-35 is required. You might wonder why a T. O. is necessary if all the steps of the inspection are listed on the work cards. Further research shows the title of this T. O. to be "Explosive Components Checkout, Troubleshooting and Maintenance." Now we can see why both the cards and the T. O. are needed; the cards give the steps in sequence, and the T. O. shows how to correct any malfunctions that are found during the sequence.

Notice on card 13-3, page 4-11, how the notes and warnings to be observed during the inspection or checkout are also included on the work cards. No effort has been spared to prevent unnecessary damage to personnel and equipment.

Notice also on card 13-4, how the operational steps are clearly sequenced. This arrangement reflects time and motion economy by insuring that all necessary steps are included in their proper sequence. It also serves to eliminate steps which serve no useful purpose.

Other useful information included in the work card set is shown on page 4-12. The upper card shows the number of personnel, their job titles and AFSC's, which are needed to perform the inspection or checkout. It also indicates which work cards are used by each technician. The lower card shows the work areas of the missile, and designates them with a letter which is used in the "Work Area" column on the work card.

After you have assisted in the performance of a few inspections in which you were required to use the inspection work cards, you should be able to demonstrate your proficiency to your trainer. Do this on the next inspection by pointing out where the following information is found in the card set.

* Date of basic publication
* Date of change to basic publication
* Type of inspection
* Card numbers for changed cards
* Location of work areas
* Mechanic type, AFSC position number, and card numbers needed for the inspection
* Equipment required
* Other preparatory steps

INSPECTION SEQUENCE CHARTS

Another publication used in the inspection system is the Sequence Chart. It is used to plan and direct the sequence of an inspection and the unscheduled maintenance

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECHANIC NUMBER	CARD TIME
13-1		Missile Fitter (P)	1	10

MAN MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY: SYS	SUB SYS AND COMP	SPECIAL INSPECTION REQUIREMENTS	ELECTRICAL POWER
				PREPARATION - 15 DAY	[X] OFF [ ] ON
10				SM-75 MISSILE - EXPLOSIVE COMPONENT CHECKOUT	

1. Make certain that the following equipment and manual are available at the designated test site, prior to starting test:

One	Main engine igniter Part No. 650580
Two	Vernier engine igniters Part No. 650291
Two	Gas generator igniters Part No. 650183E
One	Ignition detector link Part No. 650340-41
Two	Retro-rocket igniters Part No. C20538-B
Three	Re-entry vehicle latch squibs Part No. 7832371
One	Igniter squib set case CNU-14/E
One	Igniter and igniter circuitry test set. TTU-40/E
One	Can opener.
One	4-inch common slot screwdriver.
One	Adapter cable 500712-11B(MTC)
Two	Adapter cable kit 350426(VE)
One	In-Flight disconnect squib Part No. 33819-2
	T.O. 21-SM75-1J-2-35

CARD NO.	WORK AREA(S)	TYPE MECH RQR	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHANGE DATE
13-1		43350/70	1	10	WC 21-SM75-6-ECSP-13	15 December 1959	

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECHANIC NUMBER	CARD TIME
13-2		Missile Fitter (P)	1	10

MAN MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY: SYS	SUB SYS AND COMP	SPECIAL INSPECTION REQUIREMENTS	ELECTRICAL POWER
				PREPARATION - 15 DAY	[X] OFF [ ] ON
10				SM-75 MISSILE - EXPLOSIVE COMPONENT CHECKOUT	

2. Make certain that the following equipment is available at the launch emplacement:

Two	Retro-rocket assemblies Part No. 5602321.
One	3/8-inch-sq. drive 0-25 foot-pounds torque wrench.
One	3/8-inch-sq. drive 3/4-inch-deep hexagon socket wrench.
One	Trailer-Mounted Ballistic Missile Systems Checkout Station, TTU-36/M.
One	Small tube of Fluorolube.
One	Pin spanner wrench 1-1/2 to 2-1/2-inch.
One	Wrench, open end, 1-7/8-inch-thin type.
One	Pliers, safety wire
One	Felt pad, 4 by 6-foot by 1/4-inch.
One	Pliers, diagonal cutting
One	Screwdriver, phillips head
One	Ratchet, 3/8-inch drive
One	7/16-inch socket, 3/8-inch drive
One	13/16-inch socket, 3/8-inch drive
Eight	Bolts, AN 4C7A
Eight	Washers, AN960D416L
Three	Gaskets, AN6290-8
One	Wrench, 3/8-inch open end

CARD NO.	WORK AREA(S)	TYPE MECH RQR	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHANGE DATE
13-2		43350/70	1	10	WC 21-SM75-6-ECSP-13	15 December 1959	

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECHANIC NUMBER	CARD TIME
13-3		Missile Fitter (P)	1	—

MAN MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY SYS	SUB SYS AND COMP	SPECIAL INSPECTION REQUIREMENTS	ELECTRICAL POWER
				15 DAY	[X] OFF [ ] ON
—				SM-75 MISSILE - EXPLOSIVE COMPONENT CHECKOUT Checkout of Igniters, Squibs, and Ignition Detector Link. 1. Mechanic No. 1 direct all operations for this portion of check. Note Igniters, squibs, and ignition link should be checked within a maximum of three hours before anticipated installation time. WARNING Always disconnect test set cable from test set before attaching cable to an igniter. Place igniter behind barricade and re-attach cable to test set before proceeding or injury to personnel can result due to the explosive nature of the igniters.	

CARD NO.	WORK AREA(S)	TYPE MECH RQR	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHANGE DATE
13-3		43350/70	1	—	WC 21-SM75-6-ECSP-13	15 December 1959	

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECHANIC NUMBER	CARD TIME
13-4		Missile Fitter (P)	1	20

MAN MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY SYS	SUB SYS AND COMP	SPECIAL INSPECTION REQUIREMENTS	ELECTRICAL POWER
				15 DAY	[X] OFF [ ] ON
20		62		SM-75 MISSILE - EXPLOSIVE COMPONENT CHECKOUT Calibration Check of TTU-40/E Test Set 1. Check Test Set for calibration as follows: a. FUNCTION SELECTOR switch OFF b. POLARITY SWITCH NORMAL c. INPUT SWITCH to IGNITER 1 d. Connect signal cable Part No. 3695797 connector P2401 to J2401 of test set. e. FUNCTION SELECTOR switch to LOW IGNITER 1R f. Depress OHM TEST button momentarily. VOLT-OHM meter should indicate infinity. If it does not, adjust LOW MID-SCALE potentiometer. Note If LOW MID-SCALE potentiometer adjustment will not bring the meter needle to infinity adjust LOW R INFINITY knob also. These potentiometers interact within the circuit. g. Connect signal cable connector J2402 to P2402-8 of adapter Part No. 3695791.	

CARD NO.	WORK AREA(S)	TYPE MECH RQR	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHANGE DATE
13-4		43350/70	1	20	WC 21-SM75-6-ECSP-13	15 December 1959	

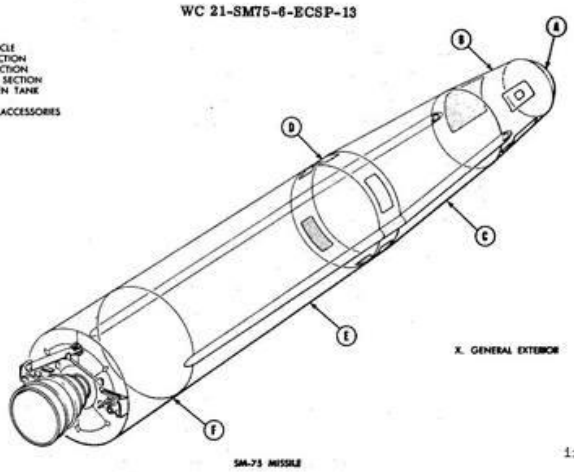
WC 21-SM75-6-ECSP-13

INDEX

SPECIAL INSPECTION

WC 21-SM75-6-ECSP-13

A. RE-ENTRY VEHICLE
B. GUIDANCE SECTION
C. FUEL TANK SECTION
D. CENTER BODY SECTION
E. LIQUID OXYGEN TANK SECTION
F. ENGINE AND ACCESSORIES SECTION



X. GENERAL EXTERIOR

SM-75 MISSILE

018032C

generated as a result of the inspection. The work cards provide an orderly sequence to a particular operation or phase of an inspection, but a sequence chart is necessary to sequence the work cards for time and motion economy.

For example: Suppose an engine gimbal check is due on a particular inspection. On this same inspection the engine is due to be replaced. Suppose also your supervisor hands you the necessary work cards to perform the gimbal check without telling you when to perform it. It's easy to see that time would be wasted by checking the engine gimbaling before the engine is replaced. Of course, it would be impossible to perform the check while the engine is removed.

In addition to preventing this sort of thing, sequence charts allow the mechanics to be scheduled into the various work areas with minimum interference.

Sequence charts are primarily a management function; therefore, you are not required at this stage of your training to be proficient in their use. You should, however, know the part they play in an inspection. Answer the following questions after reading the section on Sequence Charts in T.O. 00-20E-1.

1. What is the form number of blank sequence charts?
2. What identifying letters prefix the sequence chart publication number?
3. From what source is a sequence chart publication number derived?
4. To what does the letter suffix to a sequence chart publication number refer?
5. In what size are sequence charts published?
6. In what size are blank sequence charts published?
7. What is the purpose of columns 8 and 9 of the sequence chart?
8. What is the purpose of columns 10 and 11 of the sequence chart?

INSPECTION CONCEPT

In order to get an overall picture of the missile inspection system, you must at this time read paragraphs 3-1 through 3-17 of T.O. 00-20E-1. After this assignment answer the following questions.

1. For which types of maintenance activites are these policies and procedures prescribed?
2. What management tools are provided by this T.O.?
3. What is the result of uninterrupted job accomplishment during an inspection?
4. Which forms are used to determine and control the progress of an inspection?
5. Which form establishes credit and fixes responsibility for an inspection?
6. Which form is used to record defects found by the mechanics?
7. Which form provides scheduling of time compliance technical orders?

8. Who prepares and maintains work cards and sequence charts?

9. Can existing inspection forms be re-designed for local usage?

10. Who is responsible for the administration of the planned inspection concept?

11. Are specific inspection procedures defined in this T. O. ?

12. May a using command issue procedural directives to amplify the provisions of this section of the T. O. ?

13. Can variations in crew strength have an adverse affect on the planned inspection concept?

14. What is the logical alternative to operating with several inspection crews which are short one or more men each?

15. Can inspection and unscheduled repair be combined into a single operation?

16. What is the purpose of a pre-inspection meeting between the maintenance and supply personnel?

17. Which forms are accomplished after this inspection planning meeting?

18. How can a launch crew furnish assistance to maintenance personnel during an inspection.

19. How is the progress of the inspection noted on the sequence chart?

20. What is done with the inspection forms after they have been completed?

21. What is done with the inspection work cards at the completion of the inspection?

22. Upon what two things does the efficiency of this inspection system depend?

Now that you have a good overall picture of the missile and ground equipment inspection systems and their related publications, let's take a look at how you fit into the picture.

It will be some time before you are able to inspect a missile without supervision, even though inspection work cards are available to you. As detailed as work cards are, they are not comprehensive enough to give complete instructions necessary to properly perform the inspection items. These detailed instructions are found in other publications such as technical manuals. You will have to research these publications individually as the need for the information arises. In some cases your trainer or supervisor will be able to tell you all that is required for you to accomplish the job. This is particularly true of the simpler tasks.

For example, notice inspection item number 1 on the work card illustrated on page 4-15. It tells you to check the lacquer coating of the reentry vehicle for scratches, abrasions, or chipped areas. That's a pretty clear statement, as far as it goes. It tells you what to look for but it doesn't answer the questions of how deep, wide, or long a scratch, dent, or abrasion must be to render the reentry vehicle unserviceable. You must secure this information either from technical orders or from your trainer or supervisor.

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECHANIC NUMBER	CARD TIME
13-2	A, X, B	Missile Fitter (P)		3

MAN MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY SYS	SUB SYS AND COMP	DAILY INSPECTION REQUIREMENTS	ELECTRICAL POWER [X] OFF [ ] ON
				SM-75 MISSILE	
2	A	16		1. Check lacquer coating of reentry vehicle for scratches, abrasions, or chipped areas.	
1	A	16		2. Nose cone access doors (four) closed.	
-	X	02		3. Right side of the missile for dents, and scratches.	
-	B	22		4. Forward umbilical carrier for proper connection.	
-	B	14		5. Battery overflow vent open and access door closed.	
-	B	22		6. Right clamshell closed and switch actuated.	
-	B	12		7. Short range theodolite door open and rigged.	
-	B	12		8. Upper right guidance section access door closed and latched.	
-	B	12		9. Long range theodolite viewing door OPEN.	

CARD NO.	WORK AREA(S)	TYPE MECH RQR	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHANGE DATE
13-2	A, X, B	43350/70		3	WC 21-SM75-6-DA-13	15 December 1959	

Let's check a few more items on the same work card. Item 2 is fairly self-explanatory. The only information required to accomplish this is a knowledge of where the doors are located and how to determine whether or not they are closed. Item 3 however, requires considerable background knowledge, similar to that of item 1. You might think at this point that you can simply make a note of all the scratches and dents and let the supervisors and inspectors worry about whether or not it will affect the missile. This is not true for three reasons. First, a mountain of paper work would be required to list all the minor discrepancies found on an inspection. This is particularly true of equipment that has seen some use.

Secondly, the time required to perform the daily (in this case) inspection would be greatly lengthened. Notice the "Card Time" block. You are allowed only 3 minutes to inspect all the items on the card. It's obvious then, that to properly perform all these items, you must possess a considerable knowledge of the system or unit being inspected.

Lastly, there are not enough supervisors and inspectors assigned to a unit to be able to check every minor discrepancy on every daily inspection to determine whether or not the equipment is serviceable. That's the reason you are inspecting it. Of course, there are times when difficult problems arise that require the advice and assistance of your supervisor or an inspector; but generally speaking, you are the person required to decide on the "go" or "no go" condition.

After you have familiarized yourself with what to look for, and know the tolerances allowed, you are ready to perform one or more items on a work card. You must be extremely careful to avoid overlooking any discrepancies while inspecting any unit or system. In addition to the visible portion of a wire, tube, surface, or unit, you must also be sure to inspect the portions that are not readily visible. This may mean removing additional inspection plates, doors, or cowls. In some cases it may be necessary to use a small mirror in order to observe the hidden portion of a system. Also

be sure adequate lighting is available. It would be foolish to inspect a missile compartment whose interior was too dark to discern possible discrepancies. A flashlight, therefore, is a very useful inspection item.

As the inspection progresses you will undoubtedly find one or more defects which require correction. As previously pointed out, the time allowed for each item, or card, allows only for the "look" operation. If a defect is found, it will usually be scheduled for repair at a later period of inspection.

INSPECTION FORMS

Defects found during the "look" phase of the inspection are entered on a Maintenance Discrepancy/Production Credit Record, AFTO Form 130C. A separate form must be accomplished for each defect. These forms are turned in to your supervisor when the work cards are returned.

If an unserviceable item is removed from a weapon or GSE, a Form 130C-4 is initiated. This form is identical to the 130C, except that it is in four copies.

As you complete the work cards you will indicate this fact on an Inspection Certification Record, AFTO Form 26B. These forms are also turned in to the supervisor at the time the work cards are returned.

At this point in the inspection you will probably come in contact once again with AFTO Form 130C. After they are originally turned in, the supervisor schedules the repair work indicated by these forms. Consequently you will be required to make additional entries on this form as you complete the work.

A third inspection form used is the Technical Order Compliance Record, AFTO Form 130E. You will be required to make entries on this form as you complete the T.O. Compliance.

For information on how to accomplish the inspection forms see Section V of T.O. 00-20E-1 and Chapter 5 of this publication.

Before your OJT period has ended you should be able to perform the tasks listed on inspection work cards with only limited supervision. You should also be able to accurately accomplish the previously discussed forms.

So that your progress can be checked, each time you master a work card item, demonstrate your proficiency to your trainer. When you have learned to accomplish all the items on one work card, have your trainer check your procedure for the entire card. If your progress proves satisfactory, you should then proceed to check out on the other work cards one at a time until you complete all the missile mechanic work cards in a particular set.

CHAPTER 5

FORMS

The purpose of this chapter is to help you develop proficiency in the element of your Specialty Description (see page 1-4) which reads "Maintains accurate historical records of inspections, repairs, replacements, tests, and malfunctions of missile, missile engine, missile engine components, and missile ground support equipment, using prescribed forms and methods of recording."

For each job you perform, regardless of its size or complexity, there are certain form entries required by the person performing the maintenance. Some entries are standardized by T.O. 00-20E-1 and AFM 66-1, however certain entries are governed by the using Command. To show the necessity of accurate form entries, let's take a look at what AFM 66-1 says about the collection of maintenance data, which is the prime reason for accurate form entries.

"The maintenance data collection system provides maintenance management with information as to what production jobs were performed by the manpower charged to direct labor in each organization or work center. In addition to what was done, the system further provides data as to how many direct manhours were expended on each job (unit of work); why each repair was required (how malfunctioned); when the malfunction was discovered; and who accomplished the work. All maintenance jobs are recorded in such a manner that comprehensive data is available for (1) analysis of failure rates vs airframe and engine time; (2) malfunctions as related to inspection period: (3) reliability expectancies for systems and components; and (4) frequency and volume of malfunctions as related to when discovered. * * * Summary data accumulated over a period of time can be realistically used for overall manpower planning, labor distribution, tooling and equipment needs, budget computations, and cost analysis."

In simpler terms, the information you enter on the forms is fed into the maintenance data collection system, where it is compiled and analyzed. The results are used to promote better management, planning, efficiency, and effectiveness. This benefits the entire organization. Therefore, it is for your own indirect benefit that the form entries you make be correct, clear, and concise.

All maintenance work is recorded on AFTO Forms 2, 130C, 130C-4, and 130E. You will also be required to make entries on AFTO Form 26B to certify for inspections. This chapter will show you how to record the maintenance work you perform and how to certify for inspections. The maintenance of operational, status, historical, and other related forms will be presented in your 7-level training program.

A certain amount of background knowledge is necessary to assure correct form entries. The areas with which you must become familiar include definition of terms, general maintenance of forms, symbols used on forms, and form heading entries. Each of these areas are presented in this chapter.

DEFINITIONS OF TERMS

To acquaint yourself with the terms used in connection with missile forms, read paragraph 1-6 of T.O. 00-20E-1. This will enable you to match the following terms and definitions. Write them out on a separate sheet of paper and let your trainer evaluate them. For example, the best definition for item No. 1 "Sequence Chart," is item p. "Visual schedule for accomplishment of an inspection." Your first answer therefore is 1.p.

Terms

1. Sequence Chart
2. Work Unit Code
3. Bench Check
4. Operation Code
5. Reference Symbol
6. When Discovered Code
7. Conversion Factor
8. Exceptional Release
9. Operation Control Level
10. Replacement Schedule
11. Exceptional Item
12. Work Unit Code
13. How Malfunctioned Code
14. Time Change Item
15. Shop Time
16. Inspection Requirements Manual

Definitions

a. level of hardware used for a control point for operational time on AFTO Form 2A.

b. indicates that the senior maintenance officer has personnaly determined that the unaccomplished maintenance will not jeopardize the mission.

c. segregates manners of operations and types of usage.

d. contains action taken, when discovered, and how malfunctioned codes.

e. used on AFTO Form 2E when an item is removed from one OCL and installed on another OCL.

f. listing of systems requiring replacement at specific intervals.

g. maintenance action to determine the condition status of an item.

h. item that must be replaced at specific intervals.

i. number of operating hours on an item not installed in its OCL assembly.

j. specifies what equipment is to be inspected.

k. identifies the inspection in which a discrepancy was found.

l. describes how an item failed.

m. accumulates usage at a different rate than its OCL assembly.

n. identifies individual components on electronic schematic diagrams.

o. identifies the item worked on and the work done on the item.

p. visual schedule for accomplishment of an inspection.

FORMS MAINTENANCE

Paragraphs 2-1 through 2-25 of T.O. 00-20E-1 contain instructions on the disposition of forms and the use of certain symbols and characters. Read these paragraphs and then determine whether the following statements are true or false.

1. "J. J. Jones" may be an acceptable signature on a form.
2. Hand-printed characters must be in ink.
3. When room is no longer available for additional entries on a form, a substitute form is prepared.
4. When equipment is received minus the forms, the shipping organization will prepare substitute forms.
5. Record files will be shipped along with transferred equipment.
6. Symbols are used on forms to show the equipments' readiness for use.
7. The red X symbol is more serious than a circled red X.
8. The red horizontal dash is more serious than a red diagonal.
9. The circled red X is less serious than a red dash.
10. When a red X condition has been remedied, it will be inspected and signed off by the organization inspector.
11. A circled red X symbol will be used when an urgent action T.O. is received.
12. A red dash indicates that a red X condition may exist.
13. A red diagonal slopes from the upper-left hand corner downward to the lower-right hand corner of the status symbol block.
14. A red diagonal symbol is cleared by an Exceptional Release.
15. A red symbol can be cleared by initiating the next open block below the symbol.
16. A mechanic can be directed by the chief of maintenance to change a symbol which he has entered in a status block.

MAINTENANCE CERTIFICATION AND FAILURE RECORDS

When you are assigned to an inspection team, you are expected to record the results of your inspection on certain forms. These forms, their purpose, the manner in which they are used, and the entries to be made on them, are covered in Section V of T.O. 00-20E-1. Read paragraphs 5-1 through 5-17 and be prepared to answer the following questions.

AFTO Form 26B-Inspection Certification Record

1. Can this form be used to certify a Special Inspection?
2. When does a mechanic prepare an inspection certification record?

3. Can additional inspection certification records be prepared? Under what circumstances?

4. Inspection certification records also serve as a cross-check of what other AFTO forms?

5. What action is taken if all items on an inspection work card are not accomplished at the end of your shift?

6. From what source would you locate information for entries in the "Mechanic Type" and "Mech No." blocks?

7. What entry is made in the "Position" block?

8. Are entries in the "Card No." block always made on the next lower open line?

9. Is "1:30" a legitimate entry in the "Time Started" or "Time Completed" blocks?

10. Does an entry in the "Time Completed" block mean that the work was actually completed?

11. What entry is made in the "Time Expended" block if the work took an hour and a half? An hour and 15 minutes? 10 minutes?

12. You are performing inspection items listed on the work card illustrated on page 4-15. You notice a dent in the right side of the missile. What entry would you make under "Card and Item" in the "Unscheduled Maintenance Discovered" block?

13. Is a red dash symbol permitted in the "Unscheduled Maintenance Discovered" block?

14. Is "10 Jul" a legitimate entry in the "Date" block?

15. Which blocks are intended primarily for analysis purposes? Is it mandatory that entries be made in these blocks?

16. How long must inspection certification records be kept in the files?

Secure a blank AFTO Form 26B and make all the entries required to record the following maintenance data. At 10:15 hours on 16 May, 1960 you start inspecting the missile in accordance with Inspection Work Cards No. 25 and 26 illustrated on page 5-5. You complete the required items at 11:10 hours the same day; but, in the process of inspecting the missile, you find the following discrepancies - both red X conditions:

A crack in the equipment pod skin at station 960, Quadrant IV.
A pink humidity indicator on the inverter canister.

You begin Card No. 26 at 13:00 hours and complete it at 13:47 hours. The only discrepancy found was too little clearance on the upper equipment pod door when the door is closed, another red cross condition. Due to unforeseen work area congestion, however, you were unable to inspect the intermediate bulkhead drain boss at the time you completed the other items. After you have made the required entries, submit the completed AFTO Form 26B to your trainer for evaluation.

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECH NO.	CARD TIME	SCHED START TIME
25	4	Missile Mechanic	1	00:45	

MAN-MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY		2nd Periodic **INSPECTION REQUIREMENTS**	Electrical Power	☒ OFF ☐ ON
		SYS	SUBSYS AND COMP	Missile Assembly Building Area, Missile		
				Inspection		
				MISSILE AIRFRAME: REF: T.O. 21-SM65D-1J-2-22		
25	4	02		1. Inside of pods for dents, holes, cracks, and damage; equipment for security, corrosion, loose tubing and electrical harness, loose connections, and loose nuts, and bolts.		
15	4	02		2. Exterior pod surfaces for dents, holes, cracks, and security; hinges for damage, cracks, broken rivets, and corrosion.		
05	4	02		3. Canister humidity indicators (if installed) for safe indication.		

CARD NO.	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHANGE DATE
25	4	Missile Mechanic	1	00:45	WC 21-SM65D-6-2-13-PE	15 April 1960	

CARD NO	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECH NO.	CARD TIME	SCHED START TIME
26	4, 6	Missile Mechanic	1	00:53	

MAN-MIN	WORK AREA	WORK UNIT CODE FOR DISCREPANCY		2nd Periodic **INSPECTION REQUIREMENTS**	Electrical Power	☒ OFF ☐ ON
		SYS	SUBSYS AND COMP	Missile Assembly Building Area, Missile		
				Inspection		
				MISSILE AIRFRAME: T.O. 21-SM65D-1J-2-22		
10	4	02		1. Equipment pod for loose tools and hardware.		
30	4	02		2. Pod mounted equipment for security, electrical connectors for proper attachment and security: tubing and unions for security of mounting.		
10	4	02		3. Equipment pod doors for binding and specified gap when closed.		
3	6	02		4. Intermediate bulkhead drain boss for security, corrosion, and damage.		

CARD NO	WORK AREA(S)	TYPE MECHANIC REQUIRED	MECH NO.	CARD TIME	CARD SET NO.	CARD SET DATE	CARD CHA DATE
26	4, 6	Missile Mechanic	1	00:53	WC 21-SM65D-6-2-13-PE	15 April 1960	

AFTO Forms 130C and 130C-4
Maintenance Discrepancy/Production Credit Record

You will also be required to make certain entries on the AFTO Form 130C and 130C-4. The procedures for initiating these forms are found in Section V of T.O. 00-20E-1. At this time read paragraphs 5-18 through 5-64 Test your knowledge by answering the following questions.

1. In what respect are AFTO Forms 130C and 130C-4 alike? How do they differ?

2. Which of the listed conditions would most likely require a 3-level missile mechanic to initiate an AFTO Form 130C?

3. When is the AFTO Form 130C-4 initiated?

4. Explain the use of each copy of the AFTO Form 130C-4.

5. You replace the Vernier Engine Igniters in accordance with the Replacement Schedule illustrated on page 4-7. Is an AFTO Form 130C required?

6. How are blocks which contain information for machine processing identified?

7. The AFTO Form 130C and 130C-4 blocks listed below may require information from other forms or publications. Match each block number with its information source.

Block No.	Source of Information
10	Cataloging Handbook H4-1
4	AFTO Form 2E
14	Work Unit Code Manual
D	AF Form 50B
18	AFTO Form 2A
23	Illustrated Parts Breakdown
17	AFTO Form 2B
20	Appendix III, T.O. 00-20E-1
21	AFM 66-1

8. Entries in which blocks must be transferred to AFTO Form 2B?

9. Why must all blocks on AFTO Form 130C be filled in?

10. What action is required in the event that data to complete a block on AFTO Form 130C is not available?

11. What action is required if a block on AFTO Form 130C is not applicable?

To check your understanding of AFTO Forms 130C and 130C-4 perform the following project. Secure sufficient blank forms from your trainer and have him check them for accuracy when you complete the project. Fill out a form 130C or 130C-4 for each discrepancy recorded on the AFTO Form 26B required by the project on page 5-4. Use all information available from the 26B and the work cards on page 5-5. Secure other necessary information from your own weapon system. In the "corrective action" columns, enter any action you think appropriate to correct the discrepancy.

CHAPTER 6

TROUBLE SHOOTING

No other area of maintenance serves to separate the men from the boys as effectively as does the area of troubleshooting. Here is where a cool head, extensive knowledge of the job, and the ability to locate and sort items of necessary information really pay off. You won't be expected to solve unusual or complex problems this early in your training. You can, however, establish a firm foundation for troubleshooting efficiency now, by learning and applying basic troubleshooting procedures. This foundation, together with your accumulated experiences, will enable you to gradually become proficient in handling complex maintenance problems.

Just what is troubleshooting? It is nothing more than the use of your knowledge and skill to analyze and isolate troubles in missile and ground support systems. The more knowledge you accumulate about your particular weapons system, and the more experience you gain, the more effective troubleshooter you will become.

There are certain basic fundamental steps involved in solving any problem. First, you must accurately recognize the trouble and gather all information pertinent to that trouble. Next, you must list the possible troubles and check them off systematically. After checking the possible troubles, you must then arrive at a conclusion. The accuracy of your decision will be in direct proportion to how well you perform the preliminary steps. Snap judgments almost always result in erroneous conclusions, with its resultant waste of manpower and needless replacement of serviceable units. Let's discuss each of these steps in more detail, and see how each applies to effective troubleshooting.

RECOGNIZE THE TROUBLE

Although this step may seem extremely simple, it is the key to good troubleshooting. A wrong analysis at this point can send you off on a fruitless search in the wrong direction. Careful inspections and operational checks are essential if you are to accurately recognize the trouble. Perform an operational check that is as complete as possible and notice all indications given by the unit operated, the pressure gages, and warning lights. Place selector valves, control valves, metering valves, and switches in all positions individually. Allow each valve or switch to remain in each position long enough for you to notice all the effects upon the system being checked. If a malfunction or potential trouble is present in a unit or system, it will be spotlighted by a thorough inspection and/or operational checkout.

GATHER INFORMATION

If a malfunction is found during the inspection and/or operational checkout, you must gather all the information possible about the system or unit in which the trouble appears. This information can be gained from one or more sources: crews which previously operated the equipment, technical orders, and maintenance forms.

Technical Orders

The primary source of information concerning a system or unit malfunction is Technical Orders. Here you will find complete descriptions of the systems as well as all necessary drawings and illustrations. Study the function, description, and schematic diagrams of the system in question. This allows you to look at the complete system or subsystem, with all its units in their correct relationship to one another. Shown on page 6-3 is a typical schematic. It is a page from an Atlas launcher T.O., showing the auxiliary support systems. How you would use a diagram of this type is the subject of a later discussion in this chapter.

In some instances troubleshooting charts are included in these T.O.'s for quick reference. These charts can sometimes be of great help in isolating troubles, as evidenced by the illustration on page 6-4. Notice that the trouble indication, probable cause, action required to protect the missile, and time required for analysis and correction are all clearly stated. Though all troubleshooting charts are not as comprehensive as this, they will furnish some helpful information and should be used if available.

Maintenance Records

The missile and GSE operational and maintenance records can also be valuable aids in trouble analysis. This source of information should be screened for recent repairs, adjustments, or component replacements that could have a bearing on the problem at hand. Careful screening may show a pattern which, if correctly analyzed, will point out a particular unit. For example, the system in which the trouble occurs contains a hydraulic actuator which requires replacement every 500 operating cycles. The records show only 300 cycles, but they also show that all previous actuators in this system either failed or developed serious troubles at 200 cycles. Here then you have a unit which, compared with its normal replacement schedule, is not due replacement for another 200 cycles; yet when compared with its past performance standards, is overdue replacement by 100 cycles. A situation such as this would cast a suspicious finger in the direction of the actuator.

Another type of form entry which can spotlight a trouble area is a record of repeated adjustments to a component. Many times an inherent weakness is "tuned out" by external adjustments rather than correcting the weakness itself. Over a period of time these frequent adjustments usually indicate a serious basic deficiency which should be corrected at its source. This will usually require removal of the unit for shop maintenance. A component with such a history would at least warrant a thorough checkout.

These are just two of the many items of information that can be furnished by a thorough review of the maintenance and operational records. Any information you may secure in this manner may easily be the major factor in a correct analysis and quick solution of the trouble.

Interviews

Another source of information that should not be overlooked is the crews that have recently operated the equipment. Interviews with these people may turn up facts which have a relationship to the current problem. Suspicious symptoms may have been observed or adjustments made. These interviews may help establish a trend or pattern which may be significant, or at least indicative of a pending malfunction.

All of these sources must be fully utilized if you are to become an efficient troubleshooter.

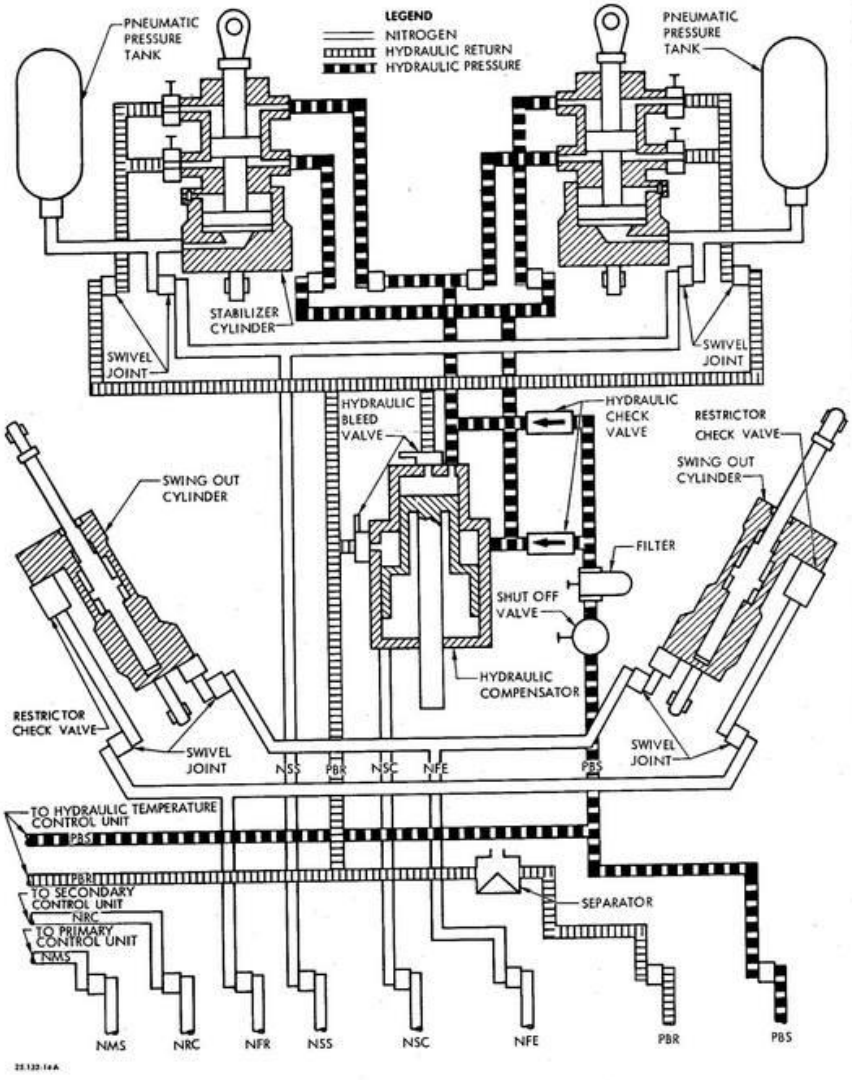


Figure 4-5. Auxiliary Support Hydraulic and Pneumatic System, Schematic Diagram

Table 5-10. Liquid Oxygen Countdown Malfunction Analysis Procedures (Cont)

ITEM	ABNORMAL IND	EFFECT ON COUNTDOWN & SYSTEMS	PROBABLE CAUSE	ACTION REQUIRED	ANALYSIS TIME	CORRECTION TIME
31	LA Panel MISSILE BOIL-OFF indicator flashing orange.	Missile in danger.	Missile boiloff valve failed to open.	Report malfunction to LCO and recommend that the LO recycle to LAUNCHER OFF and replace missile.	30 min	2 hrs
32	LA Panel MISSILE BOIL-OFF indicator flashing white	Missile in danger. Sequencer stops. Temporary hold. Possible abort. NOTE Missile may lose structural in-tegrity due to low tank pressure. NOTE See following sheet if missile is equipped with auxiliary boiloff valve.	Missile liquid oxygen boiloff valve fails to close. Valve actuator, or control sensor malfunction.	1. Report malfunction to LCO and recommend that the LCO depress commit sequence STOP button and then restart commit sequencer to attempt to clear system. If system clears continue countdown.	1 min	1 min
				2. If failure re-occurs, recycle to LAUNCHER OFF, repair missile, and return to STANDBY.	-	2-4 hrs

LIST POSSIBLE TROUBLES

After all information which might have a bearing on the trouble has been gathered and sorted, you should make a list of the possible troubles. This step is necessary for effective troubleshooting because it enables you to think more clearly without the danger of forgetting one or more items during the analyzing process.

Here is where a schematic diagram of the system is invaluable. As previously mentioned, this type drawing shows the entire system, with its parts situated in their relationship to one another. It isn't impossible to list all possible troubles without a schematic, but why neglect such a valuable tool when it is available? Notice again the illustration on page 6-3. Consider a trouble in the stabilizer hydraulic system.

Locate the faulty system or subsystem on the schematic. Most troubles will be located somewhere between the source of operating pressure and the operating unit. Start by listing the source from which the power or pressure originates. List also all units located in the line, pipe, or wire, including the operating unit itself. If the faulty system is affected by other parallel systems, be sure to list these also. A note should be made of any foreign elements that could possibly have been introduced to the system, such as air in a hydraulic system. The list then for the stabilizer hydraulic system illustrated would resemble this:

Source of pressure (not shown)
Shutoff valve
Filter
Hydraulic check valves (2)
Hydraulic compensator
Hydraulic bleed valves
Stabilizer cylinders (2)
Lines
Swivel joints (4)
Air in system

After making a list of the items which could cause trouble, you are ready for the next step in troubleshooting.

CHECK POSSIBLE TROUBLES

You are now ready to start eliminating items from the list systematically. Analyzing the system in the light of information recorded during the operational checkout will usually eliminate a few items. For example, if a pressure gage located in the system registered correct pressure during the checkout, you can safely assume that adequate pressure is available at least from the source to the pressure gage location. You cannot assume, however, that adequate pressure is available downstream of the gage. This same reasoning will apply equally well to meters in electrical circuits.

You could, therefore in a problem of this type, scratch all items from the list which are located between the pressure source and the gage, including both the source and the gage. After you have checked off as many items as possible based only on known facts, you should apply another basic troubleshooting principle, "Never Imagine Double Troubles". Intelligent application of this principle will usually eliminate a few more possible troubles from your list. Double troubles rarely, if ever, occur. Consequently much time and effort can be saved by not imagining that because two like units show abnormal indications; they are both defective. For example, the pressure gages, in two parallel systems which are furnished pressure from the same source have zero or low

readings. Application of this principle will eliminate both gages, and focus attention to the source which supplies both systems.

Likewise, if a single system was furnished pressure by two parallel pumps, a reading of zero on the system pressure gage would not indicate that both pumps were defective; but rather that some element common to both pumps is inadequate, such as a common source of fluid or some defect between the pumps and the gage, such as an open line.

After eliminating as many items as possible through reasoning and deduction, you are ready to begin checking the list against the actual equipment. At this point another important principle comes into play, "Check the Easiest Thing First". Application of this principle may save many manhours of wasted effort.

The wide variation in types of troubles and complexity of equipment make it difficult to furnish an example having an application broad enough to cover all troubles and equipment. Generally speaking however, the easiest thing to check will be those items which are close at hand. Also, external items are easier to check than those in remote locations. For example, if a leaking line is suspected you should check all external lines, fittings, etc., before proceeding to those which cannot be easily inspected.

The third principle involved in troubleshooting is "Never Disassemble Units or Disconnect Lines Unless Absolutely Necessary". Snap judgments invariably lead to needless replacement of serviceable parts. Under no circumstances should you remove or disassemble a component unless it can be absolutely proved that it is defective. Nothing can possibly be gained from unwarranted replacements, and you always wind up right back where you started. For this reason, further checkouts of the suspected unit may be warranted before removal or disassembly.

REACH A CONCLUSION

Reaching a conclusion can be a cinch if the simple steps and rules outlined in this chapter are followed. You can be certain that such a conclusion is correct because it is based on sound troubleshooting principles rather than a snap judgment.

After all items on your list have been eliminated to the point where you can decide which item is actually malfunctioning, you must then decide what action is desirable to correct the trouble. Here is another point at which knowledge of the equipment pays off. Should the unit or assembly be replaced, repaired, or simply adjusted?

As previously stated, you won't at this time be expected to solve complex troubleshooting problems; but you can start applying the correct techniques to simple problems you will encounter during your training period. Once you have mastered these steps and have gained experience on your equipment, you will be well along the road to becoming an efficient troubleshooter.

Demonstrate your knowledge of correct troubleshooting procedures to your trainer by using the steps outlined here to solve as many maintenance problems as possible on actual equipment during your OJT. Have your progress checked at each step by the trainer before you proceed to the next.
