MODULE 09A

FOR A CERTIFICATION

HUMAN FACTORS

Aviation Maintenance Technician Certification Series

AIRCRAFT TECHNICAL BOOK COMPANY

72413 U.S. Hwy 40
Tabernash, CO 80478-0270 USA

www.actechbooks.com

+1 970 726-5111

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REVISION LOG

VERSION	EFFECTIVE DATE	DESCRIPTION OF CHANGE
001	2018 11	Module Creation and Release

HUMAN FACTORS

CONTENTS

SUB-MODULE 04
FACTORS AFFECTING PERFORMANCE

SUB-MODULE 05
PHYSICAL ENVIRONMENT

SUB-MODULE 06
TASKS

SUB-MODULE 07
COMMUNICATION

SUB-MODULE 08
HUMAN ERROR

SUB-MODULE 09
HAZARDS IN THE WORKPLACE

HUMAN FACTORS

GENERAL

SUB-MODULE 01

PART-66 SYLLABUS LEVELS

CERTIFICATION CATEGORY → A

Sub-Module 01

GENERAL

Knowledge Requirements

9.1 - General

	A
The need to take human factors into account; Incidents attributable to human factors/human error; "Murphy's" law.	1

9.1 - GENERAL

INTRODUCTION

Why are human conditions such as fatigue, complacency, and stress, so important in aviation maintenance? These conditions, along with many others, are called human factors. Human factors directly cause or contribute to many aviation accidents. It is universally agreed that at least 80 percent of maintenance related incidents involve human factors. If they are not prevented, and their causes detected, they can cause injuries, wasted time, and even accidents. (***Figure 1-1***)

THE NEED TO TAKE HUMAN FACTORS INTO ACCOUNT

Aviation safety relies heavily on maintenance. When it is not done correctly, it contributes to a significant proportion of accidents and incidents. Some examples of maintenance errors may include; parts installed incorrectly, missing parts, or necessary checks not being performed. In comparison to many other threats to aviation safety, the mistakes of an Aviation Maintenance Technician (AMT) can be more difficult to detect.

Often times, these mistakes are present but not visible and have the potential to remain latent, affecting the safe operation of aircraft for long periods of time. AMTs are confronted with a set of human factors unique within aviation. Often times, AMTs are working in the evening or early morning hours, in confined spaces, on platforms that are up high, or in a variety of adverse temperature/humidity conditions. The work can be physically strenuous, yet also requiring a high degree of attention to detail. (***Figure 1-2***)

Because of the nature of maintenance tasks, AMTs commonly spend more time preparing for a task than actually carrying it out. Proper documentation of all maintenance work is a key element, and AMTs also typically spend as much time updating maintenance logs as they do performing the work.

Human factors and how they affect people are very important to aviation maintenance. Such awareness can lead to improved quality, an environment that ensures continuing worker and aircraft safety, and a more involved and responsible work force. More specifically, the reduction of even minor errors can provide measurable benefits including cost reductions, fewer missed deadlines, reduction in work related injuries, reduction of warranty claims, and reduction in more significant events that can be traced back to maintenance error.

It is apparent that anticipated or abnormal medical conditions influence the AMTs work. Reduction in vision is a signpost of aging that is anticipated in all AMTs over the age of 50 years. It compromises the visual

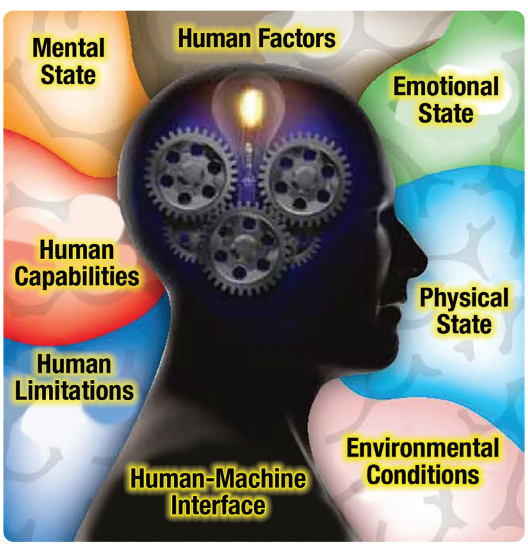

Figure 1-1. The above human factors and how they affect people are very important. Awareness of their influence can help control possible accidents

Figure 1-2. Aviation maintenance technicians have many distractions and must focus on detail.

inspection of aircraft. Obesity is an abnormal medical condition that leads to multiple metabolic changes. It produces behaviors described by The Dirty Dozen of human factors. These consequences from normal aging or abnormal medical conditions are classified as Latent Medical or Environmental Conditions (LMEC).

THE ORGANIZATIONAL ENVIRONMENT

HOW DOES YOUR ORGANIZATION STACK UP?		
POSITIVE ORGANIZATIONAL CHARACTERISTICS		
There are sufficient staff appropriately licensed to cover the workload.	Yes	No
The organization never encourages shortcuts or procedure violations.	Yes	No
Management acts quickly to fix unsafe situations.	Yes	No
Staff are encouraged to report errors and unsafe situations.	Yes	No
The company has a 'just culture' policy. Incidents are investigated to identify why they occurred, not whom to blame.	Yes	No
Staff receive human factors training.	Yes	No
NEGATIVE ORGANIZATIONAL CHARACTERISTICS		
There is an extreme 'can-do' culture. Staff do whatever it takes to get a job done on time.	Yes	No
Tasks are routinely performed according to 'norms' (informal work practices), rather than documented procedures.	Yes	No
Staff are often required to work excessive hours.	Yes	No
Work is done differently when there is time pressure.	Yes	No
Shortages of spares or equipment often lead to workarounds.	Yes	No
There is rapid staff turnover, or many inexperienced personnel.	Yes	No

INCIDENTS RELATED TO HUMAN FACTORS

The following are major incidents that have been directly attributed to human factors.

CASE STUDY: ALOHA AIRLINES FLIGHT 243

Complacency is identified as one of "The Dirty Dozen" of aircraft maintenance human factors. (Discussed in full detail in Sub-Module 09, along with other error models). The Dirty Dozen are 12 identified human factors that lead to maintenance errors. Complacency is at the top of this list and is the deadliest of the 12 factors. This is demonstrated by the tragic Aloha Flight 243, which took place on April 28, 1988. Complacency with the state of aging aircraft was exposed as the cause of the accident and this event became the watershed accident that would bring much needed change.

Aloha Airlines Flight 243 (AQ 243, AAH 243) was a scheduled Aloha Airlines flight between Hilo and Honolulu in Hawaii. On April 28, 1988, a Boeing 737-297 serving the flight suffered extensive damage after an explosive decompression in flight, but was able to land safely at Kahului Airport on Maui. There was one fatality, a member of the flight crew who was swept overboard from the airplane. Another 65 passengers and crew were injured. The safe landing of the aircraft despite the substantial damage inflicted by the decompression established Aloha Airlines Flight 243 as a significant event in the history of aviation, with far reaching effects on aviation safety policies and procedures. (***Figure 1-3***)

The flight departed Hilo at 13:25 HST on April 28, 1988 with six crew members and 89 passengers, bound for Honolulu. No unusual occurrences were noticed during the predeparture inspection of the aircraft. The aircraft had previously completed three round trip flights from Honolulu to Hilo, Maui, and Kauai that day, all which were uneventful. Meteorological conditions were checked but no advisories for weather phenomenon occurred along the air route, per Airman's meteorological information or significant meteorological information. The captain was an experienced pilot with 8 500 flight hours; 6 700 of those were in Boeing 737s. The first officer had significant experience flying 737s, having logged 3 500 of her total 8 000 flight hours in them.

No unusual occurrences were reported during the takeoff and ascent. Around 13:48, as the aircraft reached its normal flight altitude of 24 000 feet (7 300 m) about 23 nautical miles (43 km) south southeast of Kahului, Maui, a small section on the left side of the roof ruptured with a "whooshing" sound. The captain felt the aircraft roll left and right, and the controls went

Figure 1-3. Aloha Airlines Flight 243; A watershed moment in aviation maintenance history that brought about much needed change in aviation maintenance. It was recognized that complacency in the state of aging aircraft was the main contributing factor to this accident.

loose. The first officer noticed pieces of gray insulation floating over the cabin. The door to the cockpit was gone so the captain could look behind him and see blue sky. The resulting explosive decompression tore off a large section of the roof, consisting of the entire top half of the aircraft skin extending from just behind the cockpit to the forewing area.

The first officer was flying the plane at the time of the incident. After discovering the damage, the captain took over and steered the plane to the closest airport, on Maui Island. Thirteen minutes later, the crew performed an emergency landing on Kahului Airport's Runway 02. Upon landing, the crew deployed the aircraft's emergency evacuation slides and evacuated passengers from the aircraft quickly. In all, 65 people were reported injured, eight seriously.

Investigation

The main factor was the failure of the Aloha Airlines maintenance program to detect the presence of significant disbonding and fatigue damage.

Contributing causes were the failure of Aloha Airlines management to supervise properly its maintenance forces. The failure of the Federal Aviation Administration (FAA) to properly evaluate the Aloha Airlines maintenance program, and to assess the airlines inspection and quality control deficiencies. The failure of the FAA to require Airworthiness Directive AD 87.21-08 inspection of all the lap joints proposed by Boeing Alert Service Bulletin SB 737.53A1039; and the lack of a complete terminating action (neither generated by Boeing nor required by the FAA) after the discovery of early production difficulties in the Boeing 737 cold bond lap joint which resulted in low bond durability, corrosion, and premature fatigue cracking.

Safety Recommendations

Investigator's made eighteen *Safety Recommendations*.

FAA Recommendations

- Provide specific guidance and proper engineering support to principal maintenance inspectors to evaluate modifications of airline maintenance programs and operations specifications, which propose segmenting major maintenance inspections.
- Revise the regulation governing the certification of aviation maintenance technical schools and licensing of airframe and power plant mechanics to require that curriculum and testing requirements include modern aviation industry technology.
- Require formal certification and recurrent training of aviation maintenance inspectors performing nondestructive inspection functions. Formal training should include apprenticeship and periodic skill demonstration.