COMMANDER NAVAL AIR FORCES
DAMAGE DUE TO MAINTENANCE ANALYSIS

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AIRFOR DAMAGE DUE TO MAINTENANCE

Damage due to maintenance are mishaps that result when a component of the aircraft is damaged during routine maintenance, turnaround or scheduled inspections, or any other maintenance activity. For the purpose of this study only class C or more severe events were included. Five years (FY2004-FY2009) were analyzed. In the five years of this study, CNATRA only reported four mishaps as a result of maintenance. Due to the low number, CNATRA is not included in this report.

Figure 1 displays the number and rate of mishaps for AIRFOR aircraft for the time period from FY2005 to FY2009. The rate is per million maintenance man-hours. The source of maintenance man-hours for each aircraft is the Naval Air Systems Command Deckplate query tool. P-Values lower than .05 means that the rate is significantly different from the average rate at the 95% confidence level.

T/M/S	MISHAPS	MAINT MAN-HRS	MISHAP RATE*	P_VALUE
F-16	1	252,277.7	3.96	0.422
EP-3	2	561,598.2	3.56	0.195
MH-53E	3	1,162,324.5	2.58	0.191
E-2	7	2,994,867.9	2.34	0.042
P-3	5	4,886,513.2	1.02	0.976
H-60F/H/R/S	6	6,716,880.9	0.89	1.000
F/A-18	16	21,242,768.3	0.75	0.328
EA-6B	6	8,312,312.5	0.72	0.641
C-2	1	1,594,940.1	0.63	1.000
H-60B	4	6,700,327.8	0.60	0.463
Total	51	54,424,811.1	0.94	

*rate per million maintenance man-hrs

Fig 1: Damage Due To Maintenance Rate

Only the E-2 has a rate that is significantly higher than the other aircraft. E-2 specifics will be discussed later in this report.

DAMAGED COMPONENTS

The following section details the components that were damaged during maintenance.

F/A-18	E-2/C-2	P-3/EP-3
Canopy/Canopy Frame (4)	Inboard and Outboard Flaps (2)	Compressor Rotor
Port Aileron (2)	Landing Gear Door	AQH-4 Recording/Playback System
M61A1 20 mm Gun (2)	Starboard Aileron	EFDS/MFDS
Trailing Edge Flaps (2)	Antenna Fiberglass Shell	Engine
Horizontal Stabilizer (2)	Center and Outer Wing Panels	Aft Radome
ATFLIR (2)	Engines	Reduction Gear Box and Propellor
External Fuel Tank	Hydraulic Reservoir	

Fig 2: Damaged Components During Maintenance

EA-6B	H-60F/H/R/S	H-60B
ALQ-99 Pod (2)	Main Rotor Blade (3)	Main Rotor Blade
Canopy (2)	Avionics Shorted Out	Rotor Head
Engine	Primary Flight Computer	Main Transmission System
WRA-6 Outer Housing	Swashplate Assembly	TBD

Fig 3: Damaged Components During Maintenance

H-53	F-16
Tail Rotor	Canopy Frame
Swashplate	
Engine	

Fig 4: Damaged Components During Maintenance

INVOLVED FACTORS

Aviation "What" factors are described in three levels with each level providing more detail. Figure 5 displays the level one factors.

WHAT FACTOR LEVEL 1	
MAINTENANCE	40
SUPERVISORY	14
AIRCREW	1
FACILITIES	1

Fig 5: Level 1 Factors

Not surprisingly, maintenance factors were involved most often. Level two and three factors provide more detail. Figure 6 lists the top level three factors and their number of occurrences.

DAMAGE DUE TO MAINTENANCE "WHAT" FACTORS			
MAINTENANCE	SUPERVISORY	FAILED TO MANAGE/SUPERVISE PERSONNEL/ASSETS	16
MAINTENANCE	PRODUCTION	FAILED TO FOLLOW TECHNICAL PROCEDURE; STEP BY STEP	16
SUPERVISORY	FAILURE TO PROVIDE	TECHNICAL DATA/PROCEDURE	10
MAINTENANCE	SUPERVISORY	INADEQUATELY INSPECTED	8
MAINTENANCE	SUPERVISORY	FAILED TO DEMAND ADHERENCE TO TECHNICAL DOCTRINE	8
MAINTENANCE	SUPERVISORY	OTHER	8
MAINTENANCE	PRODUCTION	FAILED TO IDENTIFY/DETECT FLAW/HAZARDOUS CONDITION	8
MAINTENANCE	PRODUCTION	FAILED TO FOLLOW SAFETY PROCEDURES	7
MAINTENANCE	SUPERVISORY	FAILED TO PROVIDE ADEQUATE TRAINING	5
MAINTENANCE	PRODUCTION	OTHER	5
MAINTENANCE	PRODUCTION	FAILED TO OPERATE EQUIPMENT PROPERLY	4
MAINTENANCE	PRODUCTION	IMPROPERLY INSTALLED	3
MAINTENANCE	PRODUCTION	USED MATERIAL/TOOLS IMPROPERLY	3
MAINTENANCE	PRODUCTION	OPERATED EQUIPMENT WITHOUT LICENSE/QUALIFICATION	3

Fig 6: Level 2/3 Factors

An attempt was made to analyze the top three in detail by reading the safety investigation reports. With respect to "failed to manage/supervise personnel/assets" there was a lack of specific examples of this factor in many reports. It appeared that in some instances, this factor was assigned as a result of the tradition in the military that a supervisor is responsible for the actions of his subordinates. However failure to ensure adequate rest was specifically mentioned twice in the reports. Also listed were failures to manage work schedules and to manage personnel assignments.

For "failed to follow technical procedure step by step", there were no specific reasons given such as lack of training, command OPTEMPO, etc. The reasons for the failure were lack of attention, poor judgment and poor decision making.

With respect to "failure to provide technical data/procedure", this was directed at Naval Air Systems Command. All ten of the mishaps cited a failure of NAVAIR to provide, or NAVAIR provided unclear instructions/ warnings/procedures.

Since the E-2 was the only aircraft that had a significant rate of mishaps, the chart below shows all of the level three factors that occurred more than once.

DAMAGE DUE TO MAINTENANCE "WHAT" FACTORS			
SUPERVISORY	FAILURE TO PROVIDE	TECHNICAL DATA/PROCEDURE	4
MAINTENANCE	SUPERVISORY	FAILED TO MANAGE/SUPERVISE PERSONNEL/ASSETS	4
MAINTENANCE	PRODUCTION	FAILED TO FOLLOW TECHNICAL PROCEDURE; STEP BY STEP	2

Fig 7: E-2 Level 3 Factors

The E-2 has the same top three as AIRFOR; however the "failure to provide technical data/procedure" is tied for number one and represents 40% (4 of 10) of this factor. It was number three for AIRFOR.

There was no commonality in E-2 damaged components for this factor. The four components were inboard/outboard flaps, center/outer wing panels, starboard aileron, and antenna fiberglass shell.

CONCLUSIONS

- Damage due to maintenance is an AIRFOR-wide issue. No aircraft has a mishap rate that is significantly lower than the average. Only the E-2 has a rate that is significantly higher.
- The leading cause of damage due to maintenance is the failure to follow established procedures/instructions. Inadequate supervision and insufficient instructions were also factors.