



Ergonomics Case Study: EA-6B Prowler Aircraft Maintainer

Alexander G. Pepin, John L. Kleber; Beth Blickensderfer, Ph.D.
Embry-Riddle Aeronautical University

Introduction

Aircraft maintainers are vital to the effectiveness of the USMC. The purpose of this study was to perform an ergonomic assessment on an EA-6B Prowler maintainer performing some of their most strenuous/repetitive tasks. Four tasks were evaluated using either the REBA (Cockpit Preflight inspection, Compressor Blade inspection, Engine Bay Door installation) or the WAC (Constant Speed Drive). The results of this evaluation indicated all four tasks put the participant at an elevated risk of developing musculoskeletal disorders (MSDs).

Methods

Participant:

- Caucasian male, 29 yrs. old
- USMC Aircraft Mechanic
- Physically fit

Research Methods:

- Interviews with participant about work tasks and habits
- Description of participant's injury & its circumstances

Ergonomic Assessment Tools:

- Rapid Entire Body Assessment (REBA)
 - Cockpit Preflight inspection
The participant released & climbed a stairwell to access the cockpits, opened their canopies, and climbed inside each.
 - Compressor Blade inspection
The participant jumped inside an engine inlet, lay on his side, and visually inspected each compressor blade while rotating them with his fingers.
 - Engine Bay Door installation (Figure 2)
The participant lifted the door on his back, braced it against the airplane, and fastened it in with a screwdriver.
- Washington State Risk Assessment Checklist (WAC)
 - Constant Speed Drive (CSD) removal (Figure 3)
The participant knelt below the CSD, braced it against his right shoulder, released it, and lowered it to a cart beside him.



Figure 1. A mechanic accesses the cockpit of an EA-6B

Ergonomic Assessment Tools

Above: Fig. 2, One of three REBAs performed on the participant.
Right: Fig. 3, The WAC used to determine a weight limit for the CSD.

Results

REBA

- All the tasks analyzed in this study put the participant at a **HIGH** or greater risk of both immediate injury (Table 1) and long-term risk of MSDs later in life.

WAC

- The Constant Speed Drive was found to weigh 32.75 lbs. over the recommended limit for the CSD removal task.

Task:	REBA		
	Table A:	Table B:	Final Score:
Cockpit Preflight Inspection	9	8	11
Compressor Blade Inspection	5	10	11
Engine Bay Door Installation	8	6	12

Task:	WAC	
	Recommended Weight:	Object Weight:
CSD Removal	55.25 lbs.	88 lbs.

Table 1: Results of Ergonomic Assessments.

Discussion

The participant demonstrated two of the most strenuous or repetitive tasks that maintainers perform on the airplanes.

Common Tasks:

- **Cockpit Preflight inspections**
 - Accessing the four flight stations of the EA-6B forced the participant to assume a variety of awkward postures (Figure 1).
- **Compressor Blade inspections**
 - Lying in the confines of the engine inlet was tiring on the subject's upper back and arms.
 - Rotating the compressor blades significantly strained the participant's wrists and fingers.

Discussion cont.

Strenuous Tasks:

- **CSD removal**
 - The CSD exceeded the WAC's recommended weight limit by over 30lbs.
 - The risk from its weight was exacerbated by the awkward lifting position the participant assumed.
- **Engine Bay Door installation**
 - Bracing the 60 lbs. door against the side of the aircraft using only the upper back is extremely strenuous.
 - The participant sustained a lumbosacral strain between three vertebrae while performing this task.

Contributing Factors:

- The participant noted that his 12-hour shift, 7 days per week did not allow adequate time for muscle recovery.

Recommendations

There are several ways the USMC can reduce the strain placed upon their aircraft maintainers.

- Providing mechanic crews with movable stairwells for rapid & easy access to airplane cockpits.
- Refining & implementing preexisting and less-strenuous borescope compressor blade inspections.
- Reducing door and panel sizes to enable easy handling.
- Using jacks or pulleys to assist in the removal of heavy or awkward objects like the CSD.

Conclusion

Four tasks were evaluated using the REBA (Cockpit inspections, Compressor Blade inspection, and Engine Bay Door installation) and WAC (CSD). All four tasks exhibited an elevated risk of the participant developing MSDs. This risk was exacerbated by working long hours that did not allow enough time to rest. Changes to the tasks were recommended in order to reduce future risk of musculoskeletal disorders.

References

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