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THE F/A-18 F404 ENGINE: GETTING LEAN (A)

It was June 2000, and Navy Commander C. J. Jaynes had just settled into her new assignment as Officer-In-Charge of the Aircraft Intermediate Maintenance Detachment (AIMD) at Lemoore, California. Since graduating from Officer Candidate School in Newport, Rhode Island in 1983, Jaynes had spent most of her time in aviation maintenance and program management. Previous AIMD assignments had included Mayport and Diego Garcia. In other prior assignments, Jaynes had worked on various aspects of F-14, F/A-18, P-3C, and H-60 aircraft.

There were six production divisions at AIMD Lemoore, all in trouble in one way or another, but the Power Plants Division (F404 engine maintenance) was a particular mess. Not-Ready-For-Issue parts were everywhere. Division thru-put was poor with 35 engines and 190 modules awaiting maintenance and 30 F/A-18 aircraft with bare firewalls (no engines). The maintenance crews were working 12-hour days. Manning was at 61% of authorized levels. Reenlistment rates were an abysmal 50%. Crew morale was lousy. And more parts and engines arrived daily. "It's always been that way" was a typical response Jaynes got when she asked questions, and it was a shock as she had just come from a Northrop Grumman F/A-18 E/F Super Hornet aircraft project where everything was in order.

Jaynes took a deep breath. She had distinguished herself in prior assignments by facing challenges head on but none as big as this one. After pondering the situation, she knew she had to get the "house" in order. She could see that the experience she had had, at Northrop Grumman, could set the stage for success at AIMD. It was at Northrop Grumman that she had seen Lean manufacturing at work, and she decided to apply Lean principles to tackle the challenge she faced at Lemoore. It would be the first application of the Lean concept to Naval Aviation.

This case was prepared by Tom Cross, Senior Director of Executive Education, Darden School Foundation, with the assistance of Jeff Pottinger, CAPT, SC, USN (Retired) and Darden alumnus, Bob Osterhoudt, CAPT, USN (Retired) and SAIC Navy Financial Management, and Captain C. J. Jaynes, USN, PMA-202 Aircrew Systems Program Manager, under the supervision of Professor Richard Brownlee.

AIMD Lemoore

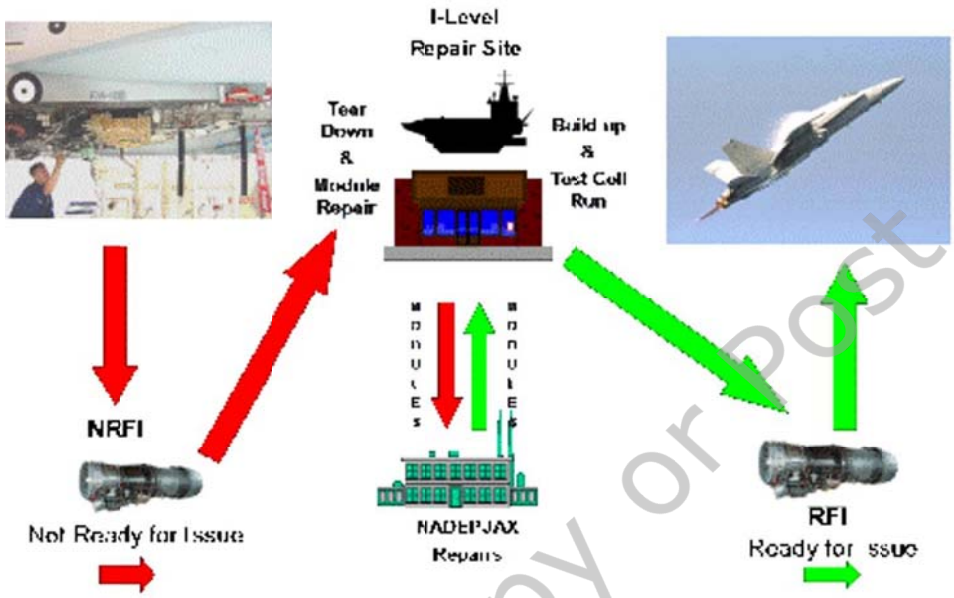
Aircraft maintenance was divided into three predetermined levels:

- Organizational-Level Maintenance (O-Level)—least complex level of maintenance performed by military personnel in the actual organization (air squadron or ship).
- Intermediate-Level Maintenance (I-Level)—maintenance performed by military personnel at an intermediate maintenance activity (an Aircraft Intermediate Maintenance Activity—AIMD for aircraft or Shore Intermediate Maintenance Activity—SIMA for ships). AIMDs were at Naval Air Stations or onboard aircraft carriers and helicopter carriers.
- Depot-Level Maintenance (D-Level)—most complex level of maintenance performed at a depot (Naval Aviation Depot—NADEP for aircraft or Naval Shipyard—NSYD for ships).

AIMD Lemoore was an I-Level facility located within the Naval Air Station Lemoore. Organizationally, it was part of the Strike Fighter Wing Pacific that included 18 operational fleet squadrons (14 Lemoore-based, 4 in Atsugi, Japan), 2 F/A-18 fleet replacement squadrons, the Strike Fighter Weapons School, AIMD Lemoore, and two other AIMDs (Fallon, Nevada, and El Centro, California). The AIMD work force consisted of 816 people, 11 officers, 751 enlisted personnel, and 54 civilians, who worked on F/A-18 aircraft components, systems, engines, hydraulics, and life-support equipment, and was organized into 63 production work centers. The F404 engine-production work center had authorized manning a total of 165 personnel with on-board manning of 101 (61% of authorized). There had been little progress for some time in the increase of onboard manning in of the AIMD divisions.

The I-Level engine-repair process procedure comprised breaking the engine down into six modules, repairing the modules, and reassembling them (**Figure 1**).

Figure 1. I-Level engine-repair process.



Source: Created by C. J. Jaynes.

F/A-18 Aircraft

The F/A-18 was a twin-engine, all-weather fighter and attack aircraft that was the core of the Navy's carrier-based strike force. It had entered service in 1983, replacing the A-7 and F-4 Phantom II aircraft. There were about 1,300 in service at a cost of $35 million each. The F/A-18 A/C was a single seat, and the F/A-18 B/D was a dual seat. The F/A-18 A/B was expected to be in service until 2015, and the F/A-18 C/D until 2020. The F/A-18 A/B/C/D Hornet would eventually be replaced by the F/A-18 E/F Super Hornet (first operational cruise in 2002) and the F-35 Joint Strike Fighter.

The F/A-18 A/B/C/D was powered by the GE F404-400/402 jet engine while the F/A-18 E/F used a newer GE F414 jet engine. Thus, projected F404 engine maintenance would decrease over time as the F/A-18 E/F came into service. Typical flight time on wing (TOW) before service intervals for the F404 engine was 180 hours. (When the engines were under development, it was understood that the Mean Engine Flight Hours Between Repair [MEFHBR] would be 300 hours.) In nonwartime, F/A-18 aircraft averaged 35 hours of flight time per month. In wartime, flight time per month increased to 90 hours. Thus, the F404 engines were serviced about every five to six months during nonwartime.