

(Photo courtesy of Canada Department of National Defence.)



SECRETS TO A LONG LIFE

The Lockheed P-3 Orion's Half-Century in Service

By Randall Brink

In 1957, the U.S. Navy announced a tender to replace P2V Neptune and Martin P5V Marlin reconnaissance and patrol aircraft. Believing that the fastest and least expensive route to deployment was modification of an existing model, the Lockheed Aircraft Company proposed a military version of the L-188 Electra, which was then in advanced stages of development. In May 1958, the Lockheed Aircraft Company received a research and development contract from the Navy to proceed with the design.

The P-3 Orion achieved operational status in 1962. The P-3C Orion, first delivered to the U.S. Navy in July 1970, still provides anti-submarine and patrol service. There are many other military operators. Today, the worldwide operational Lockheed P-3 fleet numbers 241 aircraft flown by twenty-four operators in seventeen countries on five continents (*see sidebar*).

Canada operates the CP140/140A Aurora, which is based on the P-3 airframe but features the electronics suite of the S-3 Viking. Japan's



Kawasaki Heavy Industries has built P-3 derivative aircraft under license from Lockheed Martin.

Of the active Lockheed P-3/CA140 operators worldwide, the majority operate the aircraft in the military roles of anti-submarine and land patrol. The remaining operators utilize their P-3s in missions involving research, analysis, and law enforcement/interdiction.

EARLY DESIGN TROUBLE

Lockheed's engineers equipped the U.S. Navy design with four Allison T56 turbine engines, coupled with four-bladed propellers designed by the Aeroproducts division of General Motors. As early as 1963, the U.S. Naval Bureau of Weapons initiated a contract with the Univac division of avionics manufacturer Sperry-Rand to design and implement a digital computer system for the P-3 Orion.

The launch of the U.S. Navy P-3 program occurred before Lockheed had completed engineering and testing processes on the aircraft's

CURRENT WORLDWIDE OPERATORS

Following is a list of P-3 models operated by nations worldwide, totaling 241 aircraft, at the time of this writing. Total P-3 production, including license-built aircraft, is 757. There are 272 Lockheed P-3 aircraft currently in storage, and 244 aircraft have been destroyed or scrapped.

COUNTRY	FORCE/ORGANIZATION	P-3 FLEET
NATIONAL/GOVERNMENT FLEETS		
Argentina	Argentine Air Force	2
Australia	Historical Aircraft Restoration Society (HARS)	1
Australia	Royal Australian Air Force	2
Brazil	Brazilian Air Force	9
Canada	Royal Canadian Air Force	15
Chile	Chilean Navy	2
Germany	German Navy	3
Greece	Hellenic Air Force	2
Iran	Islamic Republic of Iran Air Force	5
Japan	Japan Maritime Self-Defense Force	80
New Zealand	Royal New Zealand Air Force	6
Norway	Royal Norwegian Air Force	6
Pakistan	Pakistan Naval Air Army	6
Portugal	Portuguese Air Force	5
South Korea	Republic of Korea Navy	16
Spain	Spanish Air Force	3
Taiwan	Republic of China Navy	12
United States	U.S. Department of Homeland Security/Customs and Border Protection	14
United States	U.S. National Aeronautics and Space Administration (NASA)	1
United States	U.S. National Oceanographic and Atmospheric Administration(NOAA)	2
United States	U.S. Navy	40
OTHER U.S. OPERATORS		
United States	Airstrike Firefighters, LLC	3
United States	Buffalo Airways	1
United States	MHD Rockland, Inc.	5

root design, the L-188 Electra civilian airliner. The high-performance turboprop's performance pushed into aerodynamics and flight realms where no transport aircraft had gone before, leading to some unforeseen problems.

One such issue was the stress imposed by the Allison T56 turbine combined with the Aeroproducts propellers. The sophisticated propellers

improvements, along with a continuous series of original equipment manufacturer (OEM) upgrades, have been a key reason why the Lockheed P-3 Orion and its derivatives have enjoyed such a long, successful run in service.

OEM SERVICE UPGRADES

The P-3C model entered military service in 1970. Since then, Lockheed Martin has

September 1981 and completed in January 1982.

Noteworthy additions and changes in Update III included enhanced acoustic data processing capabilities and an improved sonobuoy communications suite, including the Single Advanced Signal Processor (SASP) system and the Advanced Sonobuoy Communications Link Receiver, plus Adaptive Controlled Phased



produced complex airflow that was more stress-producing than the powerplants and engine mounts were designed to handle, and under aerodynamic load, the aircraft wing structure was subjected to in-flight motion and high torque. Though it was unknown to Lockheed engineers at the time, the so-called "whirl mode" induced by the propellers would result in rapid fatigue and, ultimately, failure of the rigid wing.

Following two in-flight failures of the civilian L-188 Electra in 1959 and a third in 1960, Lockheed reengineered the L-188's engine mount structures. In place of the "lord" mounts, engineers substituted a V-shaped attachment far more resistant to the propeller-induced bending forces.

The engine mount and wing redesign was applied to the military P-3. From this airframe's earliest years, such

introduced several upgrades to improve mission-specific configuration and update aircraft systems. These changes generally have been organized and packaged into a series of what the manufacturer refers to as "updates."

The initial **Update I** package was introduced in 1975, incorporating new digital avionics and data processing software. In 1977, **Update II** included installing an infrared detection system, a sonobuoy reference system, the Harpoon anti-ship missile, and a twenty-eight-channel magnetic tape recorder.

The last and most recent redesign was created by **Update III**, resulting in the P-3C configuration. The U.S. Navy Force Warfare Test Directorate conducted an Aircraft Technical Evaluation (TECHEVAL) beginning in March 1981. The Operational Testing and Evaluation (OT&E) of the P-3C Update III Aircraft was conducted from

Array System, Electronic Support Measure (ESM) Set, Acoustic Test Signal Generator, CP-2044 Digital Data Computer, and changes to environmental control and other systems.

After Follow-on Operational Test and Evaluation (FOT&E), production of Update III commenced in January 1986. The U.S. Navy began integrating the P-3C Update III aircraft into the fleet and achieved Aircraft Initial Operating Capability (IOC) later that year.

Beginning in 1983, an enhancement of the Update III Program was introduced. A Channel Expansion (CHEX) Program doubled the number of sonobuoy channels processed. The U.S. Navy took delivery of an operationally tested aircraft at IOC in April 1986, and the CHEX TECHEVAL was completed in June 1988. The Pentagon further approved funding for a total of twenty-three Block