P-8A POSEIDON:

A NEW MODEL FOR MILITARY PROCUREMENT

LOREN THOMPSON

EXECUTIVE SUMMARY

The Navy is developing a military version of the widely used Boeing 737 airliner to serve as its next-generation maritime patrol aircraft. Designated the P-8A Poseidon, the land-based jet will perform anti-submarine, anti-surface and intelligence-gathering missions for the joint force once it becomes operational in 2013.

Poseidon will replace the propeller-driven P-3 Orion, which is rapidly approaching the end of its service life. The new plane will be considerably more capable than its Cold War predecessor, enabling the Navy to cover more ocean faster with a smaller fleet of aircraft. Poseidon's onboard combat capabilities are the most advanced in the world, combining state-of-the-art sensing with precision weapons and comprehensive connectivity to the rest of the joint force.

The Poseidon program has made steady progress through development and testing into low-rate production. The plane is being built using an innovative acquisition strategy that facilitates continuous upgrades to capabilities as threats evolve. Because Poseidon is based on the most popular commercial airframe-engine combination in the world, it is easier to operate and maintain around the world than a purely military plane would be.

In 2009, the government of India committed to buying eight of the planes to protect its 5,000-mile coastline and littoral waters. Other countries likely to consider purchases include Australia, Canada, Germany, Italy, Japan, New Zealand, Norway, Spain and South Korea. Variants of Poseidon may also be adapted to other military missions by the United States, since the aircraft is intrinsically versatile and is well-suited to many overland missions beyond its primary maritime role.

This report was written by Dr. Loren Thompson of the Lexington Institute staff as part of the institute's continuing inquiry into technology and industrial trends bearing upon national security.

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POSEIDON INAUGURATES A NEW ERA IN NAVAL WARFARE

In Greek mythology, Poseidon was the god of the sea and protector of all waters. That makes the ancient god's name a fitting designation for the U.S. Navy's new P-8A maritime patrol aircraft. The P-8A Poseidon promises to be the most versatile, cost-effective patrol plane ever bought by any navy, capable of defeating hostile submarines and surface vessels while collecting diverse intelligence over sea and land. It is a key part of the U.S. Navy's plan to assure access to all the world's oceans and coastal areas through mid-century, and unlike some other parts of that plan, it is making steady progress towards its introduction into the fleet in 2013.

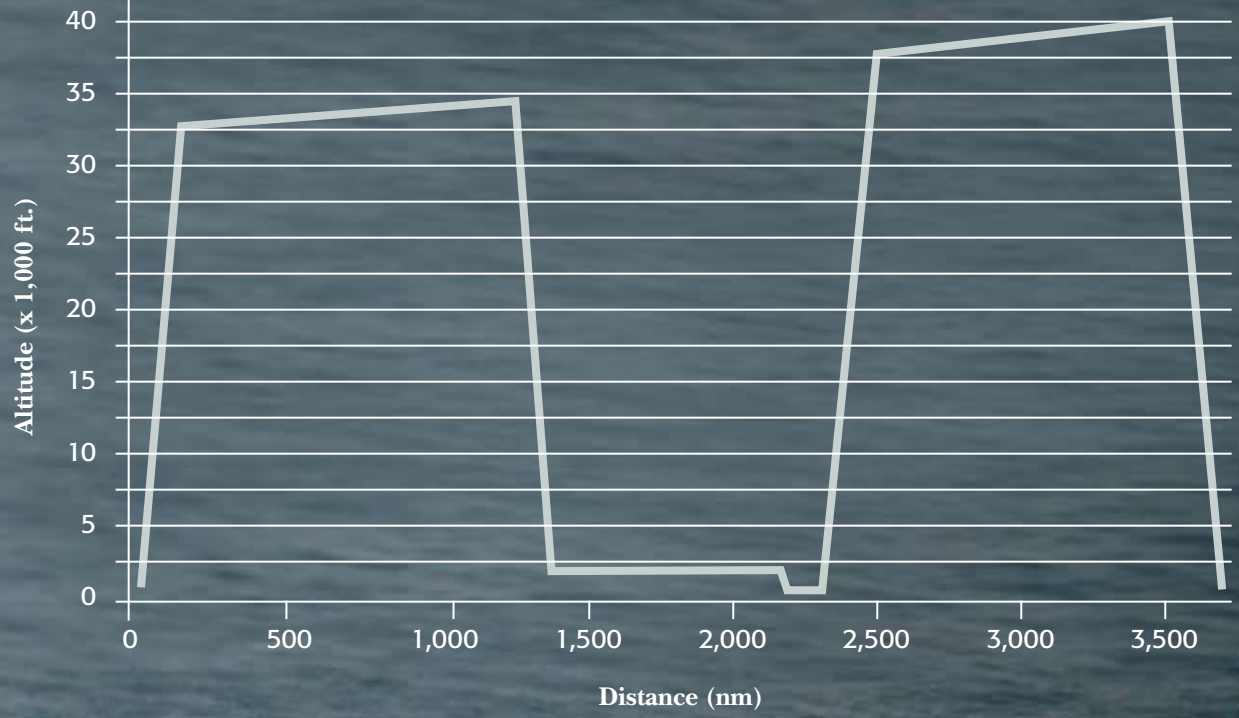
The land-based Poseidon is a modified version of the most popular commercial transport in the world, the Boeing twin-engine 737. It was conceived to replace the aging P-3 Orion patrol plane, a propeller-driven plane that has been in service for half a century. But although the P-8A will execute all of the missions currently performed by Orion, it is a very different plane developed according to a very different design philosophy. First of all, it is a jet that can cover much more ocean in an allotted period of time. Second, it is equipped with a sophisticated array of sensors, weapons and communications links that did not exist when the Orion was developed. Third, it leverages the global infrastructure and support system of the world's most popular airliner. And fourth, it was designed from day one to mesh effectively with the human beings who use it.

Because the P-8A design is intrinsically more capable than that of the legacy plane, the U.S. Navy plans to replace its fleet of 200 Orions with only 117 Poseidons. The smaller Poseidon fleet will be less expensive to maintain while affording greater potential for future modifications as threats evolve – modifications that are already part of the program's planned evolution. And the research done to develop the Poseidon will give the joint force a head start in finding successors to a number of other Cold War reconnaissance aircraft, including the E-3 Airborne Warning and Control System (AWACS) and the E-8 Joint Surveillance and Target Attack Radar System (JSTARS). Poseidon thus inaugurates a new era in naval warfare while also providing the foundation for revitalization of the nation's entire airborne sensor fleet.

The purpose of this report is to capture the potential of the Poseidon program for enhancing the future performance of the joint force. The report begins by explaining the importance of the missions Poseidon must accomplish, and describing the innovative acquisition strategy that the U.S. Navy fashioned to assure its next maritime patrol plane would be able to cope with future threats in the most cost-effective manner. The report then turns to the plane's technology, focusing on the sensor systems that enable Poseidon to track and target a wide array of potential foes. It also assesses the export potential of Poseidon, which is considerable given the military needs of other maritime powers and the focus of U.S. security strategy on partnering. Finally, the report details how the versatility of the Boeing 737 permits the military to derive a whole family of reconnaissance and intelligence-gathering aircraft from a single airframe-engine combination, thereby maximizing the economy and interoperability of the future joint fleet.

P-8A

ANTI-SUBMARINE FLIGHT PROFILE



Stealthy diesel-electric submarines such as this Russian-designed Kilo are a potential threat to shipping in the littoral areas of the Western Pacific and Indian Ocean.

MARITIME AWARENESS AND CONTROL ARE VITAL TO SECURITY

The United States is separated from most of the world's great land masses and population centers by vast expanses of ocean. From the earliest days of the republic, America's leaders understood that the ability to monitor and secure waters adjacent to U.S. territory was essential to national security. As the nation's trade relations with other countries grew, so did the need to protect shipping lanes further and further from U.S. shores. The challenge of maritime awareness and control was eased by the advent of aircraft at the beginning of the last century, but it also was complicated by three other developments later in the century:

• The increasingly widespread use of submarines, which were harder to detect and track than surface shipping.

• The expansion of routine U.S. naval presence beyond the North Atlantic, to the Western Pacific and Indian Oceans.

• The growing need to posture naval forces so they could support ground combat operations unfolding ashore.

All three of these trends converged during the Cold War to create the requirement for aircraft that could continuously sustain maritime awareness and control over vast expanses of ocean. The main focus initially was on "blue water" operations in the open ocean, but as the need to monitor the movements of Russian and Chinese submarines grew, increased emphasis was placed on "chokepoints" and other littoral areas that communist navies needed to transit in order to reach the open sea. The advent of nuclear-powered submarines in the 1950s made the mission much harder, because unlike earlier diesel-electric submarines, nuclear subs did not need to come to the surface frequently for air and had almost unlimited range.

America's main airborne submarine hunter during the Cold War was the P-3 Orion, a four-engine turboprop derived from the Lockheed Electra commercial transport. The P-3 carried acoustic buoys, magnetic sensors and radar for detecting signs of undersea and surface shipping, along with weapons for attacking whatever hostile targets were found. Orion later was adapted to using radar and other sensors over land to support U.S. Marines engaged in ground combat.

Although Orion is still the Navy's principal land-based anti-submarine plane, metal fatigue and corrosion caused by decades of continuous operation have taken their toll. The Navy therefore must field a successor that is less costly to maintain and can fully leverage the many new technologies that have appeared since the P-3 received its last major upgrade. In particular, the service needs an aircraft that can function more effectively in littoral regions as part of a comprehensively networked force operating both at sea and ashore.

POSEIDON DEVELOPMENT TIMELINE

2004	System development contract awarded
2007	Critical design review passed
2008	Assembly of first test aircraft
2009	Flight tests begin
2013	Initial operational capability
2015	Increment 2 fleet introduction
2018	Increment 3 fleet introduction

The Navy's decision to use a modified version of the popular 737 commercial transport as its future maritime patrol plane makes it easier to operate and maintain a global force.

POSEIDON EVOLVED TO BE A NEW KIND OF MULTI-MISSION PLANE

By the time the Cold War ended, the P-3 Orion had already been operating for 30 years. That fact, plus the surge in new missions and technologies that appeared during the closing years of the 20th Century, inspired the Navy to rethink its approach to meeting maritime patrol requirements. A series of studies in the 1990s led to the establishment of a Multi-Mission Maritime Aircraft (MMA) program, which in turn evolved into the Poseidon effort. Boeing won the competition to develop the plane in 2004, securing a $4 billion contract to design and test five prototype aircraft. The Navy initially planned to buy 108 production aircraft, a number later raised to 117, with a total procurement value of $20 billion.

The most noticeable difference between the P-3 and what became the P-8A was that the Poseidon was a jet-powered plane rather than a turboprop. The basic idea was to combine a modified version of the mature and widely used 737 commercial transport with the rugged, reliable CFM-56 engine to create a fleet of patrol planes that could fly farther and faster than Orion while carrying a bigger payload of combat equipment and incurring lower operating costs. Because each P-8A would be so much more capable than legacy aircraft, the Navy planned to accomplish all necessary missions with 40 percent fewer planes in the fleet, saving money both in the construction phase and during the plane's service life.

A key feature of the Poseidon acquisition plan was to build the airframe in-line at the Boeing 737 production facility in Renton, Washington. The traditional approach to modifying commercial transports for military use had been to acquire a completed commercial airframe and then make changes – for example, reinforcing wing structures and cutting necessary openings into the fuselage. The P-8A approach is completely different, manufacturing airframe sections that have already been modified for military missions and then mating them together on the same production line that assembles 737 airliners. This approach maximizes the commonality of products and processes while minimizing the customization activities that drive up costs during and after assembly.

Two other non-traditional features of the Poseidon acquisition plan were the decision to design a plane that could be easily upgraded as new missions and technologies emerged, and that would mesh seamlessly with the demands of human operators. The ability to accept continuous enhancements is facilitated by an open architecture for all on-board equipment that allows new innovations to be quickly integrated as they become available. The human-centric design philosophy was dictated from day one by the Naval Air Systems Command, which was determined to fashion an airframe in which Navy personnel could accomplish on-board tasks with maximum ease and effectiveness. The cumulative effect of these and other measures was, in the words of the Poseidon's Navy program manager, to create "an acquisition approach unlike any other."

POSEIDON DESIGN SPECIFICATIONS

Wingspan:	124 feet (38 meters)
Length:	130 feet (40 meters)
Height:	42 feet (13 meters)
Speed:	490 nautical miles per hour (907 kilometers, 564 miles)
Range:	1,200 nautical miles (2,200 kilometers)
Ceiling:	41,000 feet (12,500 meters)
Airframe:	Modified Boeing 737-800
Engine:	2 CFM56-7B (27,300 lbs. thrust)
Crew:	9 people
Weapons:	Torpedoes, depth charges, antiship missiles
Sensors:	Sonar, radar, electronic intercept and geolocation
Communications:	HF, VHF, UHF, CDL, SATCOM, INMARSAT

Poseidon is expected to play a crucial role in securing U.S. access to coastal areas, where threats are becoming more diverse and political sensitivities limit warfighting options.

POSEIDON COMBAT CAPABILITIES ARE THE BEST IN THE WORLD

Poseidon was approved for low-rate initial production by the Pentagon's top acquisition body in August of 2010, capping a highly successful development effort that generated all necessary hardware, software and training systems. The combat systems carried by the P-8A will make it the most advanced long-range maritime patrol and reconnaissance aircraft in the world – a status the U.S. Navy intends to preserve for decades to come through frequent technology upgrades. The plane's readiness and reliability are bolstered by use of the most popular airframe-engine combination in commercial transport history, and its utility to the joint force is maximized by an array of communications links that span the radio frequency spectrum (making it the most comprehensively networked aircraft in naval history).

At the heart of Poseidon's combat capabilities is its acoustic signal detection and processing system, which enables the plane to track hostile submarines with great precision. On a typical mission, each P-8A will carry nearly a hundred passive and active sonar buoys ("sonobuoys") that create a highly sensitive network of listening devices when dropped into the sea. The signals collected from these expendable nodes will be continuously fused and analyzed using high-speed computers that then display threats on high-resolution monitors for on-board operators. The information thereby obtained will often be sufficient to justify releasing missiles, torpedoes or depth charges carried inside the plane and on external weapons stations.

A second major sensor system carried on Poseidon is the Raytheon AN/APY-10 radar, which can precisely track surface targets in the open sea, in cluttered coastal areas, and on land. The multi-function radar is designed to accomplish several surveillance and reconnaissance activities at the same time, so that broad areas can be searched even as on-board operators track and image objects of interest. For example, the telltale radar return of a hostile submarine's periscope breaking the water's surface can be followed from considerable distance without any sacrifice of capability for seeking out other threats.

A third sensing capability resides in Poseidon's Northrop Grumman-built "electronic support measures," which enable 360-degree monitoring of all radio frequencies potentially used by hostile forces, along with the ability to rapidly determine the direction and location from which signals are originating. As in the case of the acoustic and radar sensing systems, the electronic intelligence equipment on Poseidon is designed to separate signals of interest from background noise and then clearly display them for operators. Northrop Grumman also provides much of the P-8A's defensive equipment for protecting the plane against radar-guided and heat-seeking missiles, and many of the on-board data links that facilitate joint force connectivity.

Although configured primarily as a maritime patrol aircraft, Poseidon is readily adapted to a variety of overland missions such as tracking insurgents in rugged terrain.

POSEIDON EXPORTS SUPPORT GLOBAL PARTNERING

The national security strategy of the United States assigns considerable importance to the role that overseas friends and allies play in helping America maintain global stability. It is an explicit goal of the strategy to help trusted partners develop the capacity to meet regional security needs, and Washington has recently taken steps to streamline export controls so that military systems can reach those partners in a timely fashion. The Poseidon program is well-suited to a partnering strategy, because it provides a cost-effective way of accomplishing military missions that are vital to the security of many maritime nations.

Evidence of Poseidon's overseas appeal appeared even before the plane entered production. In January of 2009, India became the first international customer to order the P-8A, signing an agreement to buy eight of the planes in a special regional configuration for about $2 billion. Designated the P-8I, the Indian planes will replace aging Russian patrol aircraft and help the United States develop closer security ties with one of Asia's most important powers. The extended range, advanced combat systems, and commonality with commercial transport fleets that Poseidon provides will greatly enhance India's capacity to police its 5,000-mile coastline and adjacent waters.

Several other nations have an urgent need to replace Cold War patrol planes in the near future, including Australia, Canada, Germany, Italy, Japan, New Zealand, Norway, Spain and South Korea. Several of these countries operate P-3 Orions subject to the same age-related metal fatigue and corrosion seen in the U.S. fleet. In March of 2009, the chief of the Royal Australian Air Force stated a desire to begin replacing his service's Orions with Poseidons in 2016, and other countries such as Canada and Italy have formally expressed an interest. Japan may license production of the P-8 in much the same way that it acquired its fleet of 100 indigenously-built Orions.

The early overseas popularity of Poseidon reflects both the importance of the missions it is designed to accomplish and the appeal of using an aircraft based on the world's most popular commercial transport. Over 250 customers around the world have ordered the 737 airliner, so many countries are familiar with the plane and possess the infrastructure needed to support it. For those countries, the fact that Poseidon has extensive parts commonality with the commercial transport is an attractive feature, because it will cost much less to support during its service life than a purely military aircraft would. It appears that the industry-leading reliability and low life-cycle costs of the 737 have already done much of the selling job required to assure a robust export market for Poseidon.

The multi-mission versatility of the Poseidon design is well-suited to dealing with both conventional threats and non-traditional adversaries in places like Southwest Asia.

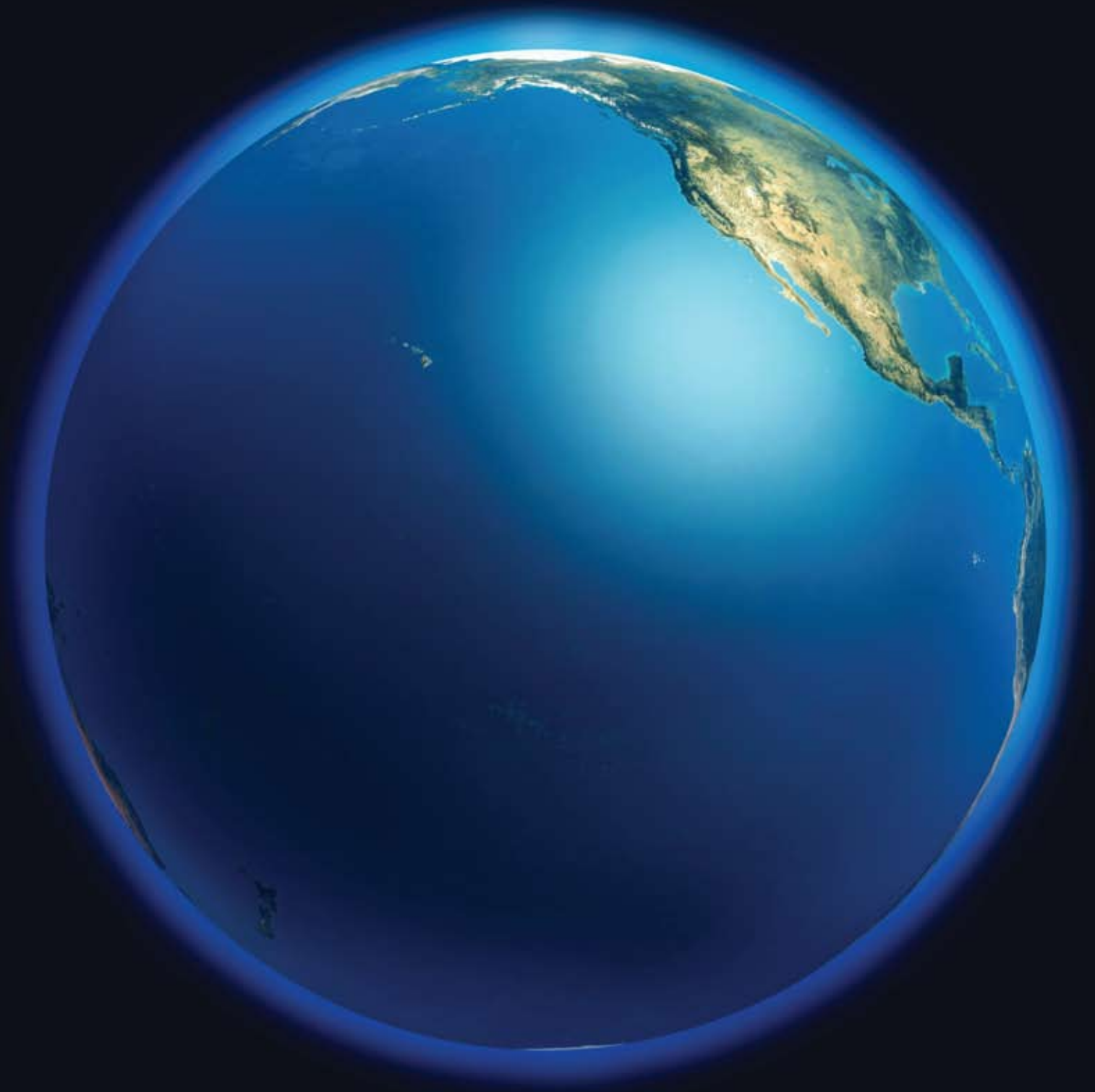
THE POSEIDON MODEL FITS OTHER MISSION AREAS

The U.S. Navy has spent over $6 billion developing the P-8A, and that appears to be money well spent given the steady progress the plane has made towards initial operational capability in 2013. No other maritime patrol and reconnaissance plane in the world is likely to match the capabilities of Poseidon before mid-century. However, maritime patrol may be just the beginning of the Poseidon story, because the United States and its allies own a number of other airborne sensor systems that must be replaced in the near future due to aging. The aircraft and acquisition strategy developed for the Poseidon program can be readily applied to the other mission areas at much lower cost than competing solutions, leveraging investments the Navy has already made.

The most immediate need beyond planned P-8A missions is to find a successor to the Navy's EP-3 Ares electronic eavesdropping ("signals intelligence") plane. The EP-3 is based on the same airframe as the Orion, and is facing similar age-related safety and readiness concerns. Its mission of collecting and analyzing radio-frequency intelligence is vital to both the Navy and national intelligence agencies, because at present there is no other way of reliably obtaining such intercepts when the emitter is a hostile maritime power such as North Korea. The Navy's plan to operate Poseidon in conjunction with long-endurance unmanned aircraft offers the possibility of new ways to collect signals intelligence, but unmanned aircraft lack the flexibility, carrying capacity and self-defense features of the P-8A. Poseidon thus appears to be the logical candidate to replace the EP-3, a solution that would maximize naval fleet commonality and economies.

In addition to meeting other naval needs, Poseidon is well-suited to satisfying a host of emerging modernization requirements in the U.S. Air Force. Over the next two decades, the service has an urgent need to find successors to its Joint Surveillance and Target Attack Radar System (JSTARS) used for tracking moving ground targets, its Airborne Warning and Control System (AWACS) used for tracking airborne targets, and other specialized reconnaissance aircraft. All of these Air Force planes are based on the old Boeing 707 airframe, which has served the joint force well but is experiencing age-related readiness problems. A fleet of next-generation sensor aircraft based on the same Boeing 737 airframe used for Poseidon would be the most cost-effective approach to fleet recapitalization, replacing the current four-engine jets with more fuel-efficient and maintainable twin-engine jets.

The E-8C JSTARS fleet of 18 specialized radar planes provides an especially good example of the Poseidon model's relevance to Air Force needs, because the service must make decisions in the near term on how to preserve the capability of that fleet to track and image moving ground targets such as armored vehicles. The JSTARS fleet of previously-owned 707's is so diverse in its origins that each plane must be assessed individually in determining remaining service life, and the engines used on the planes are no longer in production. The Air Force is understandably reluctant to spend many billions of dollars upgrading a handful of aircraft already well past their prime, so the possibility of buying a variant of Poseidon is being seriously considered. Poseidon not only would provide a more fuel-efficient engine and airframe earlier than competing solutions, but it is configured to host a next-generation surface-tracking radar that is more capable and versatile than the radar carried on current JSTARS planes.



This view of Earth from above the Pacific Ocean illustrates the fact that most of the world is covered by water, making maritime surveillance and control vital to U.S. security.

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