



## A Fresh Look at Maritime Surveillance: Guest Editor's Introduction

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**I**t is somehow fitting that we publish this issue of the *Technical Digest* on the Multi-mission Maritime Aircraft (MMA) at the same time that the world celebrates the 100th anniversary of powered flight. The events that took place at Kitty Hawk a century ago have had profound influences on warfare, and none more profound than the influence on maritime patrol. Indeed, as noted in the historical review by Keane and Easterling, this issue, the first maritime surveillance application of a heavier-than-air vehicle was in 1914, a mere 11 years after the Wright brothers' first flight!

No doubt the most familiar contemporary symbol of maritime surveillance is the ubiquitous P-3 *Orion*, a military derivative of the venerable Lockheed Electra. My own first experience with the P-3 was in 1965 as a young midshipman undergoing an orientation/familiarization flight from the Naval Air Station in Jacksonville. I still remember vividly my five minutes in the cockpit's left seat—left hand on the 1950s-design yoke, right hand wrapped around the four massive throttles, and a Walter Mitty-like grin across my face. The astonishing fact is that the very same airframe may still be in service today, as there are a few remaining that were manufactured in the early 1960s. If ever a force needed recapitalization, this is it.

### THE TECHNICAL TEAM

It has been over a decade since the Naval Air Systems Command (NAVAIR) embraced the Integrated Process Team (IPT) model as its preferred approach to technical coordination for program execution. Under this concept, NAVAIR program managers, warfare centers, prime and support contractors, and involved Federally Funded Research and Development Centers and University Affiliated Research Centers each bring their specialized talents to the table in a collegial way, with the common goal of program success. Fleet operators are brought into the team at appropriate junctures, and a hierarchical taxonomy of IPTs provides the management structure to ensure effective communication and collaboration.

It is within this context that APL has made its contributions to the MMA program (indeed, to all of its endeavors for NAVAIR sponsors). Although the articles in this issue of the *Digest* are authored principally by APL staff members, it should go without saying that the efforts of many talented professionals, both inside and outside of the government, were essential to success.

## SYSTEMS ENGINEERING: THE KEY

The design of a new aircraft such as the MMA gives a clean perspective on an old problem with new wrinkles. It is clearly a nontrivial undertaking—an opportunity for the practice of the art of systems engineering at its most basic and yet its most elegant level. It is appropriate to remind ourselves of H. L. Mencken's Metalaw: "For every human problem, there is a neat, simple solution; and it is always wrong." The solution to the design of the MMA is neither neat nor simple. Today, we have new threats, new technology, and new challenges, but we also have limited resources and legacy systems that must be accommodated. The need for competent systems engineering has never been more evident.

The systems approach is to begin with a comprehensive understanding of payload requirements that are principally driven by two factors: the mission of the aircraft and the environment in which it will operate. The mission is driven by extant military doctrine, but that doctrine must then be projected through the expected operating life of the aircraft. The environment defines the physics of the problem: What are the expected winds aloft, and how do they influence transit time? What is the expected cloud cover, and how will that impact sensor performance? What is the enemy air defense threat, and how does it affect standoff range? Where in the world will this aircraft operate, desert or polar regions? All of these questions have one thing in common: uncertainty. As this issue of the *Digest* unfolds, the reader will see a methodical analysis of the elements of the MMA mission and environment that will quantify the uncertainty and lead to a definable set of requirements. The reader will also see the evolution of the technical management framework that will support the complex activities associated with a multibillion-dollar acquisition program.

## THE ARTICLES

We are certainly indebted to RADM Dick Brooks, former Commander of the Atlantic Fleet Patrol and Reconnaissance Force, for taking the time to write the leadoff article framing the MMA in the context of military transformation from an operational perspective. His long and distinguished service in the maritime patrol community lends special weight to his views of the challenges that lie ahead.

We follow the Admiral's introduction with a look in the rear-view mirror, so to speak, beginning with the earliest days of the maritime patrol community. Here, Jack Keane and CAPT Al Easterling give us an extensively referenced, fascinating, and comprehensive history of maritime patrol aviation. The chronicled exploits of the earliest patrol aviators are truly the "stuff of legends," and the photographs of the early aircraft are marvelous to see.

As noted earlier, a key driver in requirements generation is the mission of the platform. In DoD programs, the vehicle for communicating this is the Design Reference Mission. In the article by Trena Lilly and Bruce Russell we see how multiple performance parameters, operating environments, and platform attributes are combined into a tractable set of tactical vignettes. A degree of abstraction was applied to this work to present it here at the unclassified level.

The development of a methodology for bounding MMA performance parameters to establish the analytical foundation for alternatives and force-level assessments is the subject of the article by Jack Guarneri. Leveraging the Design Reference Mission work described in the previous article, each of a number of operational missions is meticulously dissected, and the key issues and observations are extracted.

All military platforms perform tasks that are relative to national security objectives. This hierarchical flow-down is called "Strategy-to-Task," and it frequently employs an analytical technique called "Quality-Function-Deployment." For the MMA, a pre-existing QFD analysis with a strong pedigree needed to be updated without introducing any new bias. The article by Bill Kroshl and Scott Osborne describes the approach taken and the results obtained.

RADM Brooks' discussion of the transformation of Maritime Patrol and Reconnaissance is next expanded upon by Scott Osborne and CAPT Brian Prindle. Here, we are given a conceptual look at the way ahead through the prism of the Chief of Naval Operations' "Sea Power 21" paradigm, measured by the criteria of the DoD Office of Force Transformation.

"Simulation Based Acquisition" is a term for an evolving concept that applies advanced modeling and simulation techniques toward the development of common tools and collaborative analyses that streamline defense system procurement. To be effective, Simulation Based Acquisition must be instituted *ab initio*. The article by Bob Lutz, a nationally recognized leader in the field, demonstrates how this is being accomplished for the MMA.

Previous articles in this issue have spoken extensively about developing MMA requirements, but it must be recognized that requirements development is not a one-step process; it is intrinsically iterative. "Requirements maturation" is the term of art that refers to this spiral evolution, and Chris Evans' article discusses the strategy

that defines the process for the MMA acquisition, along with the need to maintain traceability.

Any new system must, of course, fit into the existing physical environment. Failure to do so could result in infrastructure costs that dwarf aircraft development and acquisition costs. One key constraint for the MMA is that it must be able to operate from the worldwide network of airfields that are owned by (or made available to) U.S. forces. In the penultimate article, Rich Miller, Fred Newman, and Bruce Russell examine 43 potential operating bases for their suitability to host the MMA.

Last, but most assuredly not least, Jean Garber and Art Williamson address the issue of air vehicle survivability. We know that a maritime patrol aircraft will certainly be, relative to other military aircraft, neither small nor fast nor nimble. As a consequence, survivability is a critical concern. The authors show that the quantification of survivability and vulnerability is a complex

process involving an understanding of the worldwide air defense threat as well as the technologies of self-protection.

## A FINAL THOUGHT

Three years ago, a core group of professionals at APL (Chip Dudderar, Jack Guarneri, Jack Keane, Scott Osborne, and Ron Vauk) joined the NAVAIR community that was shaping the future of maritime patrol aviation. One of our key members, Ron Vauk, was on reserve duty in the Pentagon on 11 September 2001 when an aircraft piloted by a terrorist struck the Navy Command Center in which he was working. It is in Ron's memory that we dedicate this issue.

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