The Commodity Approach to Aircraft Protection Systems

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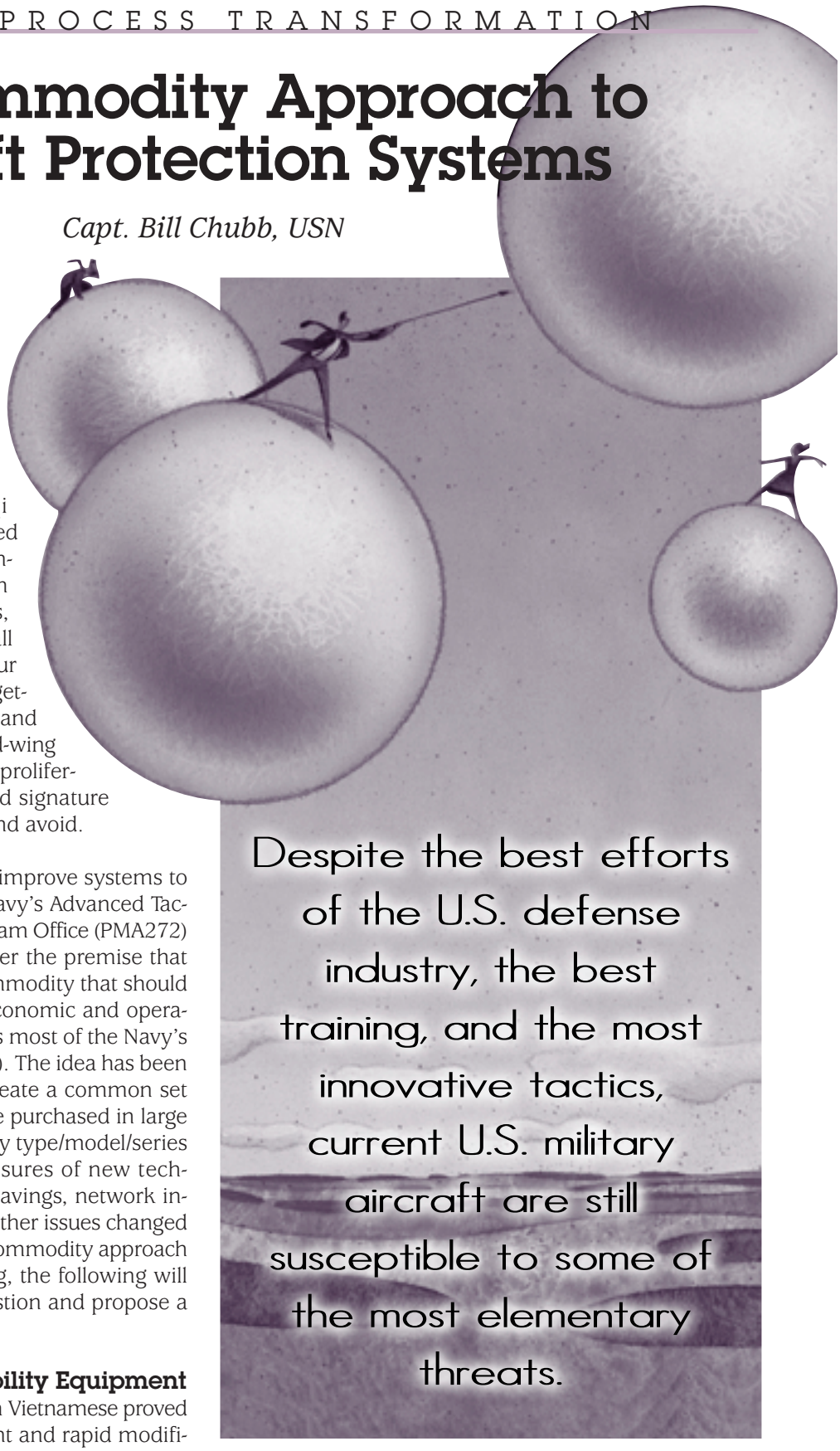

It is a sobering phenomenon: Despite the best efforts of the U.S. defense industry, the best training, and the most innovative tactics, current U.S. military aircraft are still susceptible to some of the most elementary threats. Over the past three years, rotary-wing forces operating in Operations Iraqi and Enduring Freedom have suffered combat-related losses as a result of unsophisticated air defense systems such as infrared surface-to-air missiles, rocket-propelled grenades, and small arms fire. With advancements by our adversaries in laser and infrared targeting systems, high-speed weaponry, and component miniaturization, our fixed-wing assets are also susceptible to widely proliferated missiles whose size, speed, and signature make them very difficult to detect and avoid.

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How does the U.S. Navy create and improve systems to defend against these threats? The Navy's Advanced Tactical Aircraft Protection Systems Program Office (PMA272) was established to do just that. Under the premise that aircraft protection systems are a commodity that should be centrally developed to provide economic and operational advantages, PMA272 manages most of the Navy's aircraft survivability equipment (ASE). The idea has been to have a single acquisition office create a common set of self-defense systems that could be purchased in large quantities, and deployed across many type/model/series of naval aircraft. But have the pressures of new technologies, industry partnering, cost savings, network integration, joint interoperability, and other issues changed the underpinning assumptions of a commodity approach to ASE? While the debate is ongoing, the following will highlight the key points for this question and propose a way ahead.

The Roots of Aircraft Survivability Equipment

During the Vietnam conflict, the North Vietnamese proved to be very adept in their employment and rapid modifi-

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cation of surface-to-air missiles and anti-aircraft artillery. To counter this threat, Naval Air Systems Command (NAVAIR) took responsibility for aircraft-related electronic warfare (EW) efforts in 1966 and established the Reconnaissance, Electronic Warfare, Special Operations, Navy (REWSON) Office, whose objective was to centrally develop EW systems to counter the threat and then rapidly integrate them on the right platforms. Since the conflict was ongoing, speed was the primary issue. This office was designated as Program Manager, Aircraft (PMA)253 in 1968.

Defeating the North Vietnamese integrated air defense system was addressed through a multi-phase approach that involved developing a dedicated EW aircraft (the EA-6A and later EA-6B), developing tactics, techniques, and procedures at Naval Fighter Weapons School (Topgun) schoolhouse, and commodity-based development of EW systems in PMA253. Through these actions, significant progress was made that radically decreased aircraft attrition.

As EW systems matured, a new PMA was established in 1979 to manage the airborne self-protection jammer program. Designated the Advanced Tactical Aircraft (TACAIR) Protection System Program Office, PMA272 took on the role of developing common, integrated aircraft survivability equipment. By 1991, Operation Desert Storm demonstrated how far we had come in defeating an integrated air defense system and in our ability to enhance the survivability of our aircraft. As a further move toward integration and commonality, in 1993, PMA253 was formally disestablished and all of its TACAIR components were assimilated into PMA272. Then, in 1996, the Training and Expendables Branch of PMA222 (located at Naval Air Station Jacksonville, Fla.) became part of the PMA272 team, creating the current command structure that includes ASE management, advanced technology development, foreign military sales, training, and expendables development. From the rudimentary "fuzzbuster" devices of the 1960s to the three-prong approach of EA-6B, TTPs, and commodity coordination of today, aircraft survivability equipment has come a long way toward insuring our ability to operate safely in an increasingly complex threat environment. Even so, we still have a way to go.

Operational Environment

Imagine the task of an Al Qaeda terrorist developing weapons in the Al-Anbar province of western Iraq. The goal is to develop systems and tactics to kill Americans, namely man-portable air defense system munitions. His assembly plant is a 20-by-20-foot garage, his materials arrive daily by truck or car, and his test range is somewhere in the open desert. The best part of his operation is quick knowledge of results in the weapon's operational environment. With every attack on a helicopter or cargo aircraft that he and the other terrorists survive, he receives feedback of success or failure in aircraft damage and casualties. If necessary, he can quickly make changes to his design and the associated tactics, techniques, and procedures; and within 24 to 48 hours conduct another real-world operational test.

This is an extreme of the enemy's acquisition environment that our deployed armed forces currently experience on a daily basis, and this is why the January 2006 Defense Acquisition Process Assessment considers revamping the DoD's acquisition system a matter of national security rather than one of trivial expediency. It demonstrates how our enemies are operating inside our decision cycle and fully underscores how agile and adaptable PMA272 must become if it is to fulfill its mission of enhancing aircraft survivability.

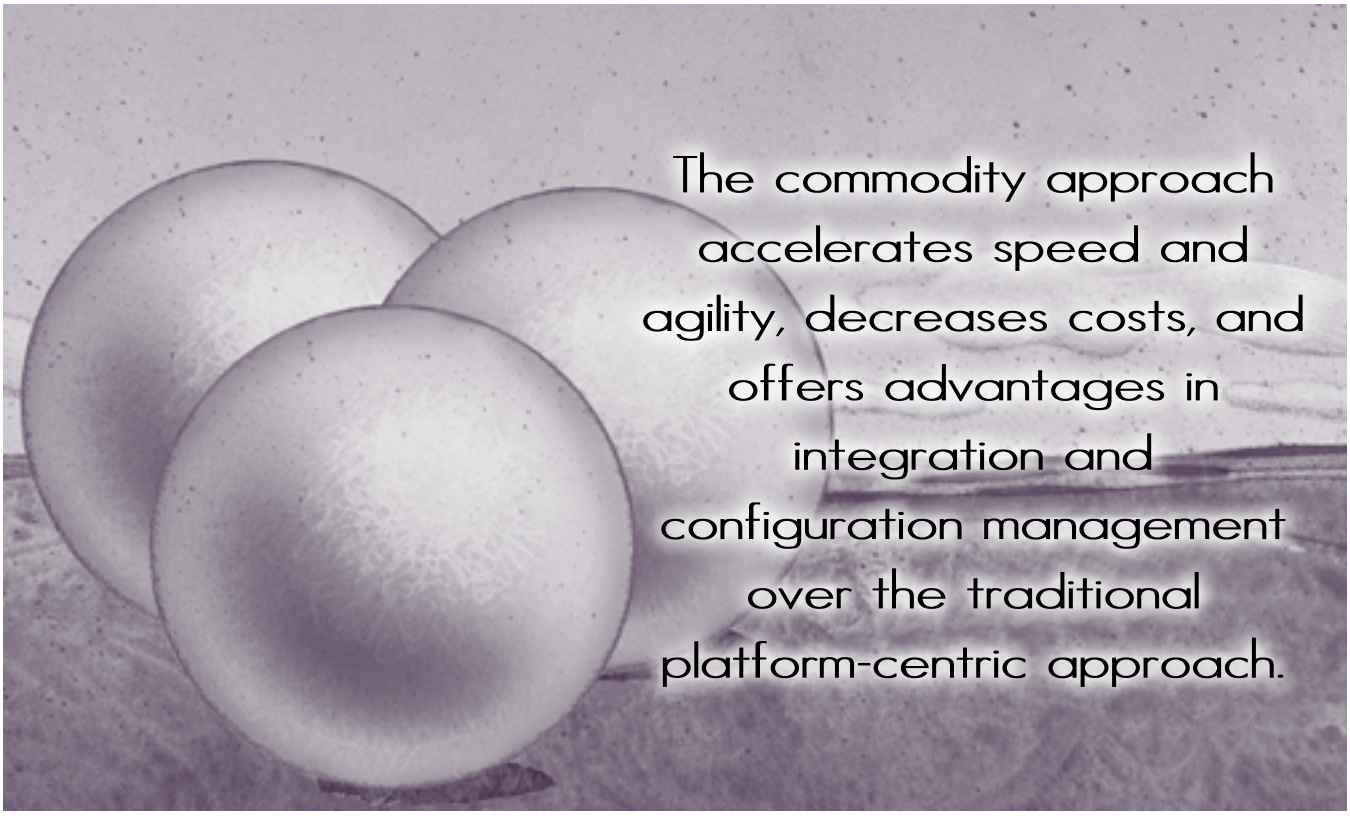
Attributes of Commodity-based ASE

- Speed and agility
- Overall cost savings through commonality
- Integration interoperability
- Configuration management
- Coordinated technology development
- Platform integration cost
- Coordination challenges

The Commodity-based Approach to EW Self Protection

PMA253 and later PMA272 were envisioned as "commodity PMAs"—organizations that provided an integral capability to the platform PMs who were charged with providing an end-to-end weapons system. In the 1960s the ALQ-100 defensive electronic countermeasures set was developed for the F-4 to deceive and jam Vietnamese radars. It was found to be extremely effective and was subsequently integrated into other platforms (such as the A-4, A-6, A-7, RA-5C, F-8, F-111, F-14A, and EA-6B). The ALE-39 countermeasures dispensing system and its successor the ALE-47 are currently deployed on numerous fixed- and rotary-wing aircraft. Widespread use of these common dispensers has generated benefits in cost savings, interoperability, logistic improvements, and configuration management. There are many other historic examples of successful commodity ASE programs—but have the operational and acquisition environments changed such that the attributes of a commodity approach are no longer as important today? The sidebar above identifies the key attributes of this commodity approach that will be explored in the subsequent paragraphs.

Speed was the primary characteristic in the 1960s. Speed and agility in the ASE acquisition process allowed Viet-



nam-era warriors to get inside the OODA (observe, orient, decide, act) Loop of their enemy, not only in the F-4 but also in numerous other aircraft that benefited from the new technology. As more advanced ASE systems were developed, PMA272's commodity approach allowed rapid integration of systems such as the ALE-39, ALE-47, ALQ-165, and advanced chaff and flares into multiple platforms. In recent conflicts, that OODA Loop has been shortened considerably. To address this decision-cycle change, the Defense Acquisition Process Assessment commissioned by then-Acting Deputy Secretary of Defense Gordon England, highlighted numerous problems in the DoD's archaic acquisition systems and made sweeping recommendations for change. The clear theme was that acquisition reform was not just a matter of cost savings, but also a matter of national security as we stand on the brink of allowing our enemies to get inside our OODA Loop. Acquisition speed and agility are vital metrics for warfighting success that are strongly enabled by common, modular systems that a commodity approach to ASE brings.

Cost savings is another key attribute of the commodity approach. It is difficult to document the precise amount of savings, because we would never create two separate platform-centric ASE systems while simultaneously developing a common system against which to compare them. But it is clear that by developing a common system such as the ALE-47 Countermeasures Dispensing System and applying it to numerous platforms, the Navy can avoid the increased development costs of multiple stove-piped systems. Huge savings can also be realized with common spares in the supply system, storage aboard ship, configuration management and upgrades, non-recurring engineering, repair facilities, flightline interoperability, and so on. But the commodity approach to ASE also demands that platform programs assume the costs of integrating the common ASE system with their unique subsystems. The one-size-fits-all approach can actually add costs and time to an individual platform's development, while creating savings across the Naval Aviation Enterprise (NAE). Thus, cost savings is a positive attribute only when viewed from the broad enterprise perspective.

Another significant attribute of the commodity approach lies in integration interoperability. Rapidly growing in importance, this attribute creates advantages in both the internal integration of ASE into multiple platforms and the external integration of ASE into broader communication networks like the global information grid. The commodity approach inherently drives a certain level of standardization in both of these interfaces. Facing a similar challenge, the air-launched weapons community is developing a universal armament interface. Through standardization of this interface, both weapons and weapons systems will speak the same language, allowing them to be seamlessly integrated on multiple platforms. By applying this approach to commodity ASE, PMA272 can significantly ease internal and external integration issues and costs facing a platform manager.

Configuration management is a byproduct of the commodity approach. As ASE systems, modules, and inter-

faces become more standardized, it will become significantly easier to apply hardware and software configuration upgrades and theater-specific operational adjustments that stay ahead of the threat. This translates to a reduction in the operational time to market, increased agility and operational effectiveness, and cost savings. A potential risk, however, is that a technological vulnerability could be exploited across a larger fleet of platforms.

Commodity management of ASE also creates an opportunity for the planned leveraging of technology across multiple future platforms. Under a strategic roadmap concept, PMA272 uses the benefits of this attribute to develop waypoints in time to initiate development of future ASE systems that will mitigate an evolving threat. By looking further and more broadly across the entire future threat environment, rather than being constrained by a single platform's schedule or mission set, these waypoints can enable spiraled solutions to a continuum of threats across time. But this leveraging of technology is possible only when the commodity manager can influence ASE development across the spectrum of the Naval Aviation enterprise. By approaching ASE solutions in this manner, there is potential for the commodity PMA to achieve substantial savings over a platform-centric approach.

A final attribute for discussion in the commodity-based approach to ASE is one of coordination, trust, and accountability. We hold the platform PMA responsible for the key performance metrics of the program: cost, schedule, and performance. The commodity approach forces a relationship of trust and accountability among the PMAs such that ASE development does not adversely affect the platform's performance or schedule. And in this era of increasing jointness, the responsibility for coordination extends across Service lines. In a recent example, PMA272 is coordinating with the U.S. Army's Advanced Threat Infrared Countermeasures program for possible integration as a commodity into current and future Navy helicopter programs.

Sharpening the Focus: Alignment to Strategic Plans

The attributes of a commodity approach support the key tenets of survivability, joint development and interoperability, and networked systems. The recent 2006 Quadrennial Defense Review addresses the importance of aircraft survivability, the continuing global war on terror, defense of the homeland, the primacy of joint operations, and the importance of domain awareness.

But the QDR and other joint concepts are more than just general guidance on DoD priorities and how the U.S. armed forces will conduct warfare for the next four years. They set a course for continued transformation and underscore the need for altering the fundamental ways we do business.

The commodity-based approach to ASE also supports the guidance contained in the *Naval Aviation Vision* (available at <www.cnaf.navy.mil/nae/>) by reducing cost, enhancing agility through improved responsiveness and adaptability, and improving alignment both within and outside of the Naval Aviation Enterprise.

Vision for the Future

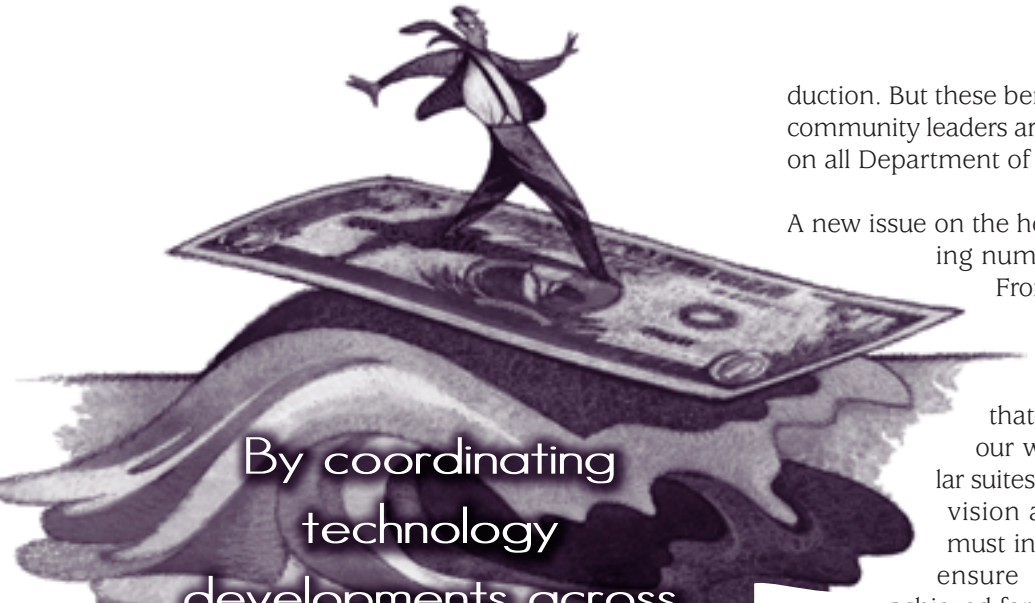
With its roots in the Vietnam-era PMA253 and advantages in agility, effectiveness, and cost savings, the future of commodity-based ASE is centered on movement toward common, modular ASE suites that leverage technology across platforms and operational environments. PMA272's vision for this future is that "All Naval aircraft are equipped with self-protection systems that are modular, integrated, and optimized to ensure survivability across the range of operations." This will be accomplished by:

- Moving toward common, modular self-protection suites
- Developing technologies that integrate into FORCENet and emerging operational concepts
- Developing future joint EW self-protection systems and capabilities and leveraging technological developments across time
- Maintaining balanced investments for in-service and future platforms.

The EW Self-Protection Roadmap: Achieving the Vision

The EW Self-Protection Roadmap is a guide to achieve the commodity benefits of the PMA272 vision. It is centered on requirements for EW self-protection capability, rather than requirements for platforms. It formulates ideas and informs decisions for the long term, while providing key insights to programs within the current fiscal period. Furthermore, it guides PMA272 internally and provides a means for informing other stakeholders in the EW self-protection community about the programs upon which they rely.

The Roadmap process followed a Joint Capabilities Integration and Development System (JCIDS)-like process that involved requirements definition, gap analysis, and recommendations for alternatives. But at this simplistic level the similarity ends. Unlike JCIDS, the Roadmap includes the EW self-protection vision as a long-term guidepost and develops a series of operational vignettes to describe the context of EW self-protection in the future environment. Also unlike JCIDS, the Roadmap results in a series of waypoints in time where action is required. These waypoints pace the development of materiel and non-materiel solutions (doctrine, organizational, training, leadership, personnel, or facilities changes—DOTLPF) to mitigate capability gaps. One of the great benefits of the Roadmap process is that these waypoints can address capability gaps across the full spectrum of naval aviation platforms, from old to new, rotary- to fixed-wing, and sup-



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port to strike, as well as across time from the present until 2020. By maintaining focus on the EW self-protection vision as the guidepost and on the operational vignettes as the context, the Roadmap helps us to leverage technological development between programs and platforms to best serve the self-defense needs of naval aviation.

Current Issues for EW Self-protection Stakeholders

The Roadmap process identifies several critical issues for PMA272 and the EW self-protection community, foremost of which is our acquisition and technical "sphere of influence." Leaders in the EW self-protection community have less influence over future programs than in the past, because of the increasing emphasis on commercial off-the-shelf technology and EW systems developed and integrated by a platform's contractor. This issue is important because a reduced sphere of influence weakens the scope of the commodity approach and results in a proliferation of platform-centric ASE systems. Our vision paints a future with a very limited number of EW self-protection suites composed of common, modular, and joint components for radio frequency, electro-optical/infrared, and laser threats. These suites will provide huge benefits in operational flexibility, interoperability, supportability, speed and simplicity of upgrades, and cost reduction. But these benefits will never be achieved if ASE community leaders are unable to influence ASE decisions on all Department of the Navy aircraft.

A new issue on the horizon is self-defense for our growing number of unmanned aerial systems. From the original concept of cheap, expendable platforms, unmanned aerial systems are rapidly becoming a significant investment that will contribute a critical portion of our warfighting capabilities. The modular suites portrayed in the EW self-protection vision and being developed by PMA272 must include UAS requirements and must ensure adequate protection levels are achieved for the missions they will fulfill.

From the rudimentary days of REWSON with the ALE-29, ALR-45, and ALQ-100 on limited numbers of aircraft, to today's ALE-47, ALQ-165, integrated defensive electronic countermeasures, and directed infrared countermeasures programs, aircraft survivability has come a long way in supporting virtually all Navy fixed- and rotary-wing aircraft. This article began with the question "Have the pressures of new technologies, industry partnering, cost savings, network integration, joint interoperability, and other issues changed the underpinning assumptions of a commodity approach to ASE?"

The clear answer is "No," and the commodity approach is even more vital today because of these issues. It accelerates speed and agility, decreases costs, and offers advantages in integration and configuration management over the traditional platform-centric approach. But most important, by coordinating technology developments across multiple platforms, it provides the right systems, at the right time, for the right cost.

As operational, fiscal, and industrial pressures have evolved over time, it has become increasingly clear that to provide the best ASE solutions for naval aircraft, PMA272 must maintain its commodity approach to ASE development, and expand its role to a broader spectrum of platforms and ASE systems. We must improve coordination across all ASE users and stakeholders and be held accountable for providing the right equipment, at the right time, for the right cost, to outpace our adversaries in any environment. We must continually achieve our vision of providing effective survivability options for manned and unmanned Navy aircraft in the face of current and emerging threats.

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