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Building 21st Century Weapons for 21st Century Operations: Key Attributes of the New Weapons Enterprise

by Robbin Laird and Ed Timperlake

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In a wide ranging discussion with Dr. Mark Lewis about hypersonic cruise missiles, former Chief Scientist of the USAF and now head of IDA's Science and Technology Policy Institute, Dr. Lewis simply stopped and said:

"Why are we putting 3rd and 4th generation weapons on 5th generation aircraft?"

What Dr. Lewis was highlighting was the disconnect between what the 5th generation aircraft could enable and what it was being handed from the past to use.

With a new weapons approach, the fifth generation aircraft could new distributed operations so central to 21st century strategies and approaches.

We have referred to the impact of the 5th generation aircraft as leading to a "re-norming" of aircraft.

We did this to highlight the central impact of the aircraft in re-crafting how you do operations, and not only air operations.

For this "re-norming" to have its full impact, one needs a shift in the weapons provided for these aircraft, either directly on the aircraft or enabled by the aircraft in a broader weapons employment space.

The Nature of the Challenge and Opportunity

General Hostage, the Air Combat Commander, has emphasized the shift as well.

He refers to the need to shape what he calls the "air combat cloud" to underwrite the air dominance approach of the future. Clearly, effective weaponization for a distributed air force is crucial as well.

Rather than simply focusing on the airframe, one needs to think about the weaponization of a distributed battlespace or a weaponized "air combat cloud."

http://www.sldinfo.com/shaping-the-way-ahead-for-airpower-general-hostage-focuses-on-the-future/

http://defense.aol.com/2013/01/10/why-the-air-force-needs-a-lot-of-f-35s-gen-hostage-on-the-com/

We have highlighted in our discussion of the Pacific and our focus on building a deployment honeycomb – with forward presence, scalability and reachback as key elements – the need for what we then called "6th generation weapons."

What we were trying to get at is simply shifting the focus upon the 6th generation aircraft issue to the weaponization of the honeycomb enabled by the new 5th generation aircraft.

Support for this position came as well from General Hostage during our interview with him.

As Hostage put the problem:

Rather than thinking of 6th generation aircraft in form factor terms, we can operate the new air combat cloud and leverage that moving forward.

The key elements of what could constitute the next weapons revolution were identified in our assessment of pathways to craft a new Pacific strategy.

http://www.sldinfo.com/special-report-on-crafting-a-new-pacific-strategy/

We will highlight those here and then break out the key components in the next section.

It is our position that the real achievable "sixth gen" revolution should focus on weapons and not be platform centric. With that viewpoint driving funding weapons can be developed, improved and fielded prior to prematurely locking in funding for any future "sixth gen aircraft" or "Strategic Strike Platform" study yes but commit to a specific type of platform –not yet.

This approach has the benefit of capturing the evolving con-ops across the spectrum of US and allied platforms embracing the revolutionary F-35 initiated concept that no platform fights alone. So now weapons first should be the focus to improve the warfighting capabilities of platforms in the inventory and soon to arrive F-35s.

The scalable force built around diverse basing and F-35 enabled C4ISRD needs a new weaponization effort to build out the capabilities of the deployed force. The current weapons enterprise builds on older technology and innovations have been driven to support the ground warrior by reducing collateral damage and shaping greater capability for close proximity weapons.

http://www.sldinfo.com/the-308th-armament-systems-wing-at-eglin-air-force-base-weapons-development-and-the-case-of-the-small-diameter-bomb-i-block-9/

The internal weapons bays of the F-22 and F-35 need new weapons. The internal bays will be especially important to the B as it can then deploy across the fleet rather than just operating on ships that are able to arm the aircraft.

The F-35 also has a core advantage as one builds out the new weapons enterprise. Common software allows for savings and capabilities across a FLEET, rather than building to a specific aircraft or even a specific model of that aircraft.SLD: Single configuration has a major impact on weapons development as well. The current situation is a software Tower of Babel whereby weapons are integrated with a type of aircraft or even a model of a type of aircraft. Software commonality across the fleet will mean that I can save time, effort and money on inserting weapons onto that single configuration F-35A.

Malone: Ultimately it comes down to what weapons are qualified by development test and then also operational test and evaluation. Which airplane? What weapons are what they call "seek eagle tested" and approved for carry and employment off the weapon system? The F-16 has now been around for quite a while and over the last 25 or 30 years, and has been modernized, upgraded, and it can carry a plethora of weapons that are out in the field today.

The F-35 will go through the same flight test requirement. Initially there'll be a set of weapons that are very specifically driven toward precision and non-precision GPS type weapons and it's a very

limited scope. . Eventually the F-35 platform will end up growing and broadening to many more weapons, but that ends up taking time with more testing and flights to ensure the seek eagle process is accomplished.

Initially when the airplane goes operational for each of the variants, there will be a very specific list of weapons that the airplane can carry. It's been designed and agreed to qualify the airplane with Block 3 and then ultimately that number of weapons that can be employed off each variant will grow like the number of weapons have grown on the F16, the F-15E, the F-18 and A-10 and other aircraft, Tornado, Typhoon, but each one of those platforms that were just mentioned all went through a growing curve where initially they qualified one weapon and they just continued to grow the number of weapons, but it's a process they had to go through for safety and to ensure safe separation and safe weapons' effects and the F-35 will go through that same process.

SLD: But the difference is this: what we saw down at Air Armaments Command (AAC) at Eglin was they qualify each weapon up against the platform as you just described which costs a lot of money, and takes a lot of time. The big advantage here is one can qualify a new missile across a fleet.

Malone: What it does is reduce ultimately the number of test flights that you have to do across all three variants, but there will probably be a requirement to drop each individual weapon off each variant just to confirm safe separation. But there'll be a lot of synergy; especially with the software that drives the avionics' processes of stores' management, radar handoffs and all the interfaces. And this should represent a significant savings of time and money within the testing and evaluation cycle.

http://www.sldinfo.com/moving-from-the-f-16-to-the-f-35a/

In addition, leveraging the connectivity across the scalable force means that designing new weapons for the sub-surface as well as surface force makes sense. Now with "Aegis as my Wingman" and the "SSGN as my fire support," one can focus on building weapons that are cost effective to the support mission.

Rather than using expensive Tomahawks for the strike mission, weapons designers can now look at what to insert into the subsurface fleet or put aboard the surface fleet that fit a broader range of needs at a more effective price point.

By shaping a new weapons enterprise, which can enable a SCALABLE force, rather than being platform centric, weapons planners can shape in effect the 6th generation capabilities.

Rather than focusing upon new platforms – long range strike, next generation tactical aircraft or the like – the US would have a moratorium on building new air platforms for the next 15 years as R and D is invested into what then best works with the re-normed air elements shaped by the F-35 cultural revolution.

The F-22 needs to be back fitted with relevant capabilities from the F-15 and the MADL data systems can then be able to shape a broader spectrum strike and defensive capability within the entire 5th generation fleet.

http://www.sldinfo.com/pacific-strategy-xvi-weaponizing-the-honeycomb/

Finally, we should hover over the concept developed by Ed Timperlake and presented at the annual conference of the Air Force Association of "Aegis as my wingman."

This is a concept which challenged traditional thinking but pointed to the central reality of the "off boarding" concept associated with the F-35 with regard to weapons use.

With the combination of Aegis with F-35, the sensors are combined into wide area coverage. With a new generation of weapons on the F-35, and the ability to operate a broad wolfpack of air and sea capabilities, the F-35 can perform as the directing point for combat action. With the Aegis and its new SM-3 missiles, the F-35s can leverage a sea-based missile to expand its area of strike. With a combination of the F-35 and the Aegis, the defense of land-bases and sea-bases is expanded significantly.

http://www.sldinfo.com/pacific-strategy-vii-"aegis-is-my-wingman"/

(Many of these themes were developed in our Joint Forces Quarterly article on the F-35 and the future of power projection and signed off by the Chairman of the Joint Chiefs of Staff, http://www.ndu.edu/press/the-f-35.html).

Key Elements of the Weapons Revolution

The perspective presented above suggests a number of key elements for weapons in the next phase of air combat development.

In this section, these elements will be identified and some cross-cutting interactions suggested.

First, the key capabilities of the 5th generation aircraft should define the weapons and not the other way around.

For example, the F-22 is the finest SEAD aircraft ever built and is likely to be used in this way by US and coalition forces. Yet the F-22 does not have internal bay weapons optimized for these missions.

The F-35 poses even more problems for legacy weapons.

The range of the sensor systems of the fusion engine of the F-35 reaches more than 200 miles out, yet the airplane is to be hobbled with an AMRAAM, which has a much smaller range.

What is the aircraft supposed to do: what till the enemy gets closer to kill him?

Second, offloading of weapons will be a fundamental opportunity posed by the 5th generation aircraft.

The Chief of Staff Schwartz spoke prior to his departure of F-22s training to guide Tomahawk missiles off of surface ships to their targets.

Our testing last year of an F22 in-flight, retargeting a tomahawk cruise missile that was launched from a U.S. Navy submarine, is an example of how we are moving closer to this joint pre-integration under our Air-Sea Battle concept.

http://www.sldinfo.com/the-air-sea-battle-concept-and-pacific-operations/

This is simply the hint of things to come.

The aircraft has a 360-degree situational awareness and data delivery capability.

This poses the possibility of leveraging the 360-degree space to guide weapons to their targets.

Target acquisition onboard does not have to be married to weapons CARRIED on board.

This means as well that classic distinctions between tactical fighters doing close air support, or air superiority missions or air defense missions are clearly blurred. The fleet flies and identifies targets for the various mission sets and can guide weapons to a diversity of target sets.

Third, the ability to craft synergy across a legacy fleet enabled by 5th generation fighters will be a significant aspect of combat capability.

As 5th generation fighters enter the fleet, older fighters will be retired, but there will several in mid-life. The 5th generation fighters can provide a new life to the older fighters by providing them with a very significant weapons carrying role.

As General Hostage put it:

The fifth generation aircraft will enable the air combat cloud and allow me to use my legacy assets differently.

Many of my 4th Generation fighters can be used to extend the network of linked systems providing reinforcing fires, and I can focus on the fifth generation assets as the core nodes shaping distributed joint capabilities. And when we come to the evolution of "next" generation systems, the form factor could stay quite similar as we evolve the capabilities within the planes or in terms of how the flying systems can interact and operate together.

As the 5th generation fighters shape the "combat cloud" and identify targets and do the kind of information warfare that a forward deployed fighter can do, there will be a significant role for the weapons deployed on legacy fighters.

Shaping connectivity among the fighter force will be a key enabler for using a broad diversity of weapons.

Fourth, one USMC aviation thinker has suggested that the F-35 might best be armed internally with defensive weapons, and leverage other platforms for offensive and strike purposes.

These weapons could be on the surface ships of the Expeditionary Strike Group; they could be deployed ashore with missile batteries, or on unmanned surface ship systems or airborne unmanned systems.

This means that cheaper weapons could be developed aboard surface platforms.

They could then be deployed across the different types of platforms, and an ability to operate off a diversity of platforms might favor weapons, which could have a long production run.

Fifth, weapons themselves could be redesigned to take into account the operational impact of the fusion engine of the F-35.

How could new weapons be designed differently to take advantage of the F-35 sensor suites?

Sixth, another key aspect of the next phase of weapons development is the cross-fertilization of the performance of the F-35 cockpit with the robotics revolution.

The F-35 cockpit is built on a revolutionary man-machine interface. The fusion engine which emerges from this marriage allows not just situational awareness but situational decision making by the pilots deployed in an F-35 fleet. This means that the F-35 is a key anchor for the further evolution of distributed operations.

The robotic revolution intersects with this cockpit and fusion engine development.

What weapons, RPAs, underwater and surface vehicles and land based IED killing robots all have in common is the evolution of robots and over time capabilities for greater loiter time and "defined" autonomous behavior. Over time, weapons will be deployed as wolfpack tools enabled by the situational decision makers to strike their targets.

As "Tron Warfare" becomes an increasingly important element of operations, various robotic elements will be deployed "organically" aboard tactical aircraft or enabled by them.

EW was designed inherently into the F-35 airframe and C5ISR-D Cockpit.

EW can include offensive operations to identify an opponents emissions in order to and fry spoof or jam their systems. In successful "tron" war, often-kinetic kill weapons can be fired. An F-35 can be a single sensor/shooter or off load it's track to other platforms such as; planes, ships and subs and eventually UCAS-Unmanned Aerial Combat Systems.

The kinetic kill shot is usually a high speed missile designed to HOJ (home on jam). It has been said on the modern battlefield — air, sea or land — if not done correctly, "you emit and you die."

http://www.sldinfo.com/the-f-35-as-a-%E2%80%9Cflying-sensor-fusion-engine%E2%80%9D-positioning-the-fleet-for-%E2%80%9Ctron%E2%80%9D-warfare/

Will the F-35 in its internal bay carry classic weapons or clusters of weapons and RPAs? The answer to this question will be determined by the intersection of developments associated with 5th generation aircraft and robotics evolutions and revolutions.

Seventh, software upgradeability will be a key aspect of how to evolve the weapons revolution.

The F-35 itself is a software upgradeable aircraft.

The weapons that will grow with it either will be simply disposables not really designed for upgradeability, or upgradeable weapons built around the new software upgradeable paradigm.

The core advantage of software upgradeability is that the weapons and the aircraft can evolve based on demand from users. Indeed, a shift from a fairly sterile engineer-driven block upgrade approach to a user's group approach.

Eighth, the weapons integration approach of the F-35 if exercised properly could revolutionize not only integration but the ability of a global coalition to develop economies of scale and diversity of choice never open before.

Historically, a national selection of an aircraft and a decision to integrate a missile on that aircraft would be largely for that country or whoever else chose that aircraft and the series variant of that aircraft. This would not likely be a large natural market.

With the F-35 the situation is totally different. The F-35s to be purchased by a particular country has the same software as every other global F-35, and so integration on that country's F-35 provides

an instant global marketplace for the weapons manufacturer that gets "its" weapon on its national champion's plane. But of course, weapons integrated on one variant will not automatically be cleared for all. Further testing will be required to do so.

It is not hard therefore to understand why companies would like their weapons on this plane, notably as new 21st century weapons are developed.

http://www.sldinfo.com/the-norwegian-f-35-decision-understanding-the-impact-of-weapons-integration/

But the consequences for the global partners are even more significant than simply weapons integration.

It is about maximizing global investment. It is also about plugging in a diversity of global experiences into a much more capable fleet of aircraft.

Each country will shape its integration of the F-35 with its national forces a bit differently and in so doing may well seek weapons, which fit its core requirements. With a global approach, subsets of countries could buy similar weapons to deal with convergent con-ops requirements.

A 360-degree aircraft deserves a global weapons development and diversity approach.

The Impact

In short, even though the US has been the core architect for the aircraft, the implementation of the fleet will not be solely and perhaps primarily American. The diversity of global weapon suppliers – European, Israeli, and Asian – will seek to integrate their products onto the F-35.

This means that for the United States, there will be a significant opportunity not to repeat investment being made by others. Put simply, why waste US dollars when others are investing in key capabilities, which are available to the global coalition?

It would be smarter to invest in key areas others are not likely to do so.

Such an approach will be crucial to the viability of the American and coalition air enterprise – quite literally.

A central case in point is the pressing need to develop a hypersonic cruise missile, and to design the con-ops to use this missile and to defend against it. If the US does not invest wisely in a time of financial stringency such a core asset will not be developed, for money will simply be spent on legacy weapons or their incremental upgrades.

http://www.sldinfo.com/hypersonics-special-report/

The F-35 can enable a bold break from the past, and significant growth in capability.

The new weapons approach can then be a key part of re-shaping how defensive and offensive operations are re-designed.

We have argued earlier that evolving the weapons approach will be a key contributor to what Secretary Wynne called the attack and defense enterprise.

With the new multi-mission systems, the key is presence and integration able to support strike or defense in a single operational presence capability. Now the adversary cannot be certain that you are simply putting down a marker.

The strategic thrust of integrating modern systems is to create a grid that can operate in an area as a seamless whole, able to strike or defend simultaneously.

This is enabled by the evolution of C5ISR (Command, Control, Communications, Computers, Combat Systems, Intelligence, Surveillance, and Reconnaissance), and it is why Wynne has underscored for more than a decade that fifth generation aircraft are not merely replacements for existing tactical systems but a whole new approach to integrating defense and offense….

By shaping a C5ISR system inextricably intertwined with platforms and assets, which can honeycomb an area of operation, an attack and defense enterprise can operate to deter aggressors and adversaries or to conduct successful military operations.

http://www.sldinfo.com/crafting-an-attack-and-defense-enterprise-for-the-pacific/

Shaping an appropriate weapons revolution to go along with the 5th generation aircraft is not simply about arming particularly platforms, it is about re-thinking the entire approach to combat.

It is about how to build combat synergy across a fleet – joint and allied.

As Secretary Wynne recently noted:

Now, there is an opportunity to recover to a position of strategic strength; and make not expensive choices to create a long range, command and control fleet trained and ready for the future fight.

Admiral Mullen once talked of the 'Thousand Ship Navy' as he extolled the virtue of the interoperational allied fleet. The Air Force should do the same in the Air, for the future fight will not be 'mano-a-mano'; but fleet on fleet; and tactics and strategies that more mimic old ground strategies may yield big dividends.

Leveraging distant fires, creating opportunities for fourth gen success in a fifth gen engagement will be central to mission success. The Air Force role in the future fight looks to be Air Combat Manager, recalling the mission to Fly, Fight and Win. But this will be done through the Fifth Generation-led revolution not by older systems such as AWACS.

http://www.sldinfo.com/the-role-of-the-us-air-force-in-the-future-fight/