

The Emergence of a 21st Century Concept of Air and Military Operations: The Impact of the “Forcing Function” of the 5th Generation Aircraft

The evolution of 21st century air operations is unfolding under the impact of a new generation of aircraft and a significant shift in the role of air operations in support of ground and maritime forces. The “5th generation” aircraft have largely been viewed as simply a next iteration of airframes whereby “legacy” or “4th generation aircraft” will be replaced by new stealth airframes. And aircraft have been largely viewed as operating within the classic domain of air operations, largely playing the role of air superiority, air dominance, air defense, strike and support roles seen as separable sequences of tasks.

While it is clear that expeditionary military operations cannot succeed without control of the skies, the fifth generation aircraft will be able to contribute to a significant change in the role of manned aircraft within air, ground and maritime operations. The change is significant enough that one can speak of the challenge of crafting a concept of 21st century air operations transformed by the introduction and use of the new aircraft. The transformation is underway as the 5th generation aircraft are being introduced, affecting employment concepts and roles of legacy air elements as well. Rather than anticipating change only with a significant replacement of one class of aircraft by another, changes in operations of “legacy” aircraft are already anticipating the changes to be accelerated by the new aircraft, and these changes will be accelerated as the new aircraft enter in larger numbers. The new “5th generation” aircraft will generate significantly greater “integrated” capability for the non-kinetic use of aircraft and an expanded use of connectivity, ISR, communications, and computational capabilities built around a man-machine interface which will, in turn, shape the robotics and precision revolutions already underway.

21st century air operations are a significant building block for overall U.S. and allied joint and coalition operations. Capability to connect air, ground, and maritime forces throughout the battlespace via air assets can support the decision-making of the ground and maritime command elements. Indeed, the C⁴ISR envisaged in network operations is becoming re-shaped into C⁴ISR/D whereby decision-making is shared across the battlespace. Distributed information and distributed decision-making will be enhanced as air operations become much more capable of providing information in support of the deployed decision-maker, and kinetic and non-kinetic support elements can be cued in support of air, ground, and maritime combat requirements.

Considerations for a 21st Century Con-Ops: Reflections on the Controversial RAND Air Combat Briefing

Earlier this year, a RAND brief on Air Combat issued in August, generated significant debate and controversy about the future of U.S. air capabilities in confronting difficult combat scenarios in the future.¹ In particular, the F-35 came under scrutiny in much of the political and analytical coverage. This brief and the reactions to it provides a good shorthand to start the discussion of the changing nature of concepts of operations induced by the introduction of the new manned aircraft.

The Project Air Force analysts in “Air Combat: Past, Present and Future,” focused on a core challenge facing the U.S. Air Force for the 21st century, namely the evolving capabilities of competitor air systems and counter-air capabilities. In particular, the RAND study focused on a 2020 scenario over the Taiwan straits in which the Chinese forces sought to deny U.S. air superiority.

The study was based on three key building blocks for U.S. superiority -- the use of nearby bases or seas, the use of stealth advantages and the use of beyond visual range (BVR) missiles – to counter Chinese capabilities. The study argued that all three advantages could be countered by an overall combined Chinese strategy. This strategy would combine significant Chinese numbers, anti-access denial strategies, counter-stealth innovations, and counter measures and operations with attrition of BVR missiles. The Chinese innovated; the U.S. did not in its concept of operations.

The study underscored realistic concerns. Numbers do matter; anti-access strategies are rapidly evolving; and defensive measures to stealth and against BVR missiles as well as the proliferation of numbers and of capabilities of Chinese missiles are growing. Simply building new platforms, and at relatively low numbers is not an effective strategy for the U.S. Air Force or the U.S. military.

That is the bad news; the good news is that the U.S. by leveraging the capabilities of its new systems, crafting a 21st century approach to a concept of air operations, and more effectively combining legacy and new U.S. Air Force and Naval forces and, equally significantly, by evolving combined and allied operations can counter the evolution of a competitor like China. One can also add that the proliferation of capabilities being developed by China and Russia globally to U.S. and allied competitors is enhancing the need for a rapidly evolving concept of operations for U.S. and allied forces informed by the “forcing function of fifth generation aircraft” and associated air and naval systems.

¹ Wendell Minnick, “RAND Study Suggest U.S. Loses War With China,” *Defense News* (October 16, 2008), Stephen Trimble, “Under Attack,” *Flight International* (14-20 October 2008), “The F-35’s Air-to-Air Capability Controversy,” *Defense Industrial Daily* (October 12, 2008). The brief can be found on the web provided by Steve Trimble and can be found here <http://www.flightglobal.com/cgi-bin/mt/mt-search.cgi?search=baby+seals+brief&IncludeBlogs=108>.

Before returning to the analysis of the RAND brief, I want to develop an understanding of 21st century air operations and the role of 5th generation aircraft and unmanned systems within the con-ops. I will then apply the 21st century con-ops approach to the RAND analysis and suggest how the outcome might look quite different.

Emergence of 21st Century Air Operations Con-Ops

21st century air operations is characterized by a significant capability to connect air, ground, and maritime forces and whereby air assets can support the decision-making of the ground and maritime command elements. In the older con-ops, the air assets were largely self-contained and needed to bring their own assets to support their operations, notably AWACS and separate electronic warfare specialized air assets. Air combat power was measured by a self-defined combat capability and strike assets carried by the combat aircraft ITSELF and those of its nearby wingmen. In the new concept of operations driven by the 5th generation aircraft, the combat and strike power of a single aircraft within the operation is not defined by what it carries itself but by its ability to direct and rely upon network partners. Any assets within range of an identified target, which carries weapons, can be directed to strike by the 5th generation aircraft, whether this weaponry is carried by air, ground or maritime platforms.

In traditional con-ops, credit for combat power could only be given for internal storage of weapons; no credit could be given for external strike assets or weaponry directed from outside of the lethal zone. For the 5th generation aircraft, a core ability to direct strikes from outside itself is a core competence for the aircraft and a key element enabling 21st century air operations.

Air battle management becomes networked as well, and not simply reliant on AWACs, which potential adversaries will seek to destroy early in an air battle. The USAF considers the combined air operations center or CAOC as a weapon system in and of itself.

But until the advent of the 5th generation aircraft, CAOCs are physically located on the ground or [directed by] dependent on AWACS, which presents a large profile for available air-to-air missiles. With the advent of the 5th generation aircraft, first by the F-22 and then by the much more numerous and allied anchored F-35, the CAOC will be become enabled by the flying ISR and C2 systems which constitute the 5th generation. The combination of sensors and stealth allows the new aircraft to operate at altitudes (in the case of the F-22) or over adversary air space (in the case of both aircraft) that allow the aircraft to serve as nodes in a dispersed or distribution air battle management system. In this way, they act as an extension for the CAOC.

The key “forcing function” of the 5th generation aircraft is to create a distributed air operations across the air, sea and ground platforms within which unmanned assets and networked information and strike assets become central to the overall capability of the air force itself. The F-22 is evolving into a battle management

system able to fly at substantially higher altitude than the F-35. After performing its air dominance missions, the F-22 can transition into a battle management and strike management aircraft. Indeed, with Block 35, the F-22 can be conceived of as the brain of the overall strike force of air and naval strike assets.

This connectivity focus has received a new boost from a recent Joint Requirements Oversight Council (JROC) decision. In July, the JROC approved the F-35 data link as the new standard for integrating airborne assets. Specifically, the Multifunction Advanced Data Link (MADL) is to be used by both the F-22 and F-35 as the centerpiece for their data transfer and, because, the 5th generation aircraft will be transferring data to robotic airborne radars, the MADL will be important for the next generation UAVs as well. The JSF MADL system includes six phased Array Antenna Assemblies (AAAs) and three Antenna Interface Units (AIUs). The system allows aircraft to communicate within and between flights in order to share a common view of the battle space. USAF and senior officials in the JSF program office view MADL as the centerpiece of elaborating a new relationship between manned and robotic aircraft. Currently, UAVs are built with little regard to their connectivity with manned systems. With the F-35 coming on line as a “flying combat system,” to use the phrase favored by the USMC, the computer systems of the F-35 will manage new robotic systems. And those robotic systems will become part of the airborne air battle management system. As General Davis has recently underscored, “We will change processing systems twice within the next four years. We will do this by simply taking out the chip and replacing it. The F-35 is a flying computer able to manage the battlespace.”

In turn, a 21st century con-ops enables the operating characteristics of the 5th generation aircraft to be optimized. The RAND brief underscored that the Chinese air capability circa 2020 would prevail, in part, because of the numbers of aircraft and numbers of weapons. Too few USAF platforms with too few weapons would allow for a decisive Chinese advantage. To quote Douglas Barrie of *Aviation Week and Space Technology*, “in the Rand study’s combat scenario, while the exchange ratio is hugely in favor of the F-22, weight of numbers (of a capable combat platform) coupled with weapons load-out still mean key “Blue” assets—tankers, airborne warning and control, maritime patrol and surveillance unmanned aerial vehicles—would be lost.”²

The study evaluated F-22s and F-35s only in their stealth mode, which requires and counts only missiles contained in the internal bay. But the 5th generation aircraft will not operate only in a stealth mode; indeed, the advantage of this aircraft is that it can be loaded heavily with external missiles operate outside of the “stealth operational” range, launch missiles which are in turn guided by 5th generation aircraft or unmanned systems operating within the “stealth operational range.” After firing the external weapons or fuel tanks, the 5th generation aircraft can return

² Douglas Barrie, “Quantity and Quality,” *Aviation Week and Space Technology* (11/3/08), p. 66.

to the tanker, return to the fight and then operate in stealth mode, enter the combat zone and operate as forward air controllers, ISR, or C2 assets with the internal bay still loaded with missiles.

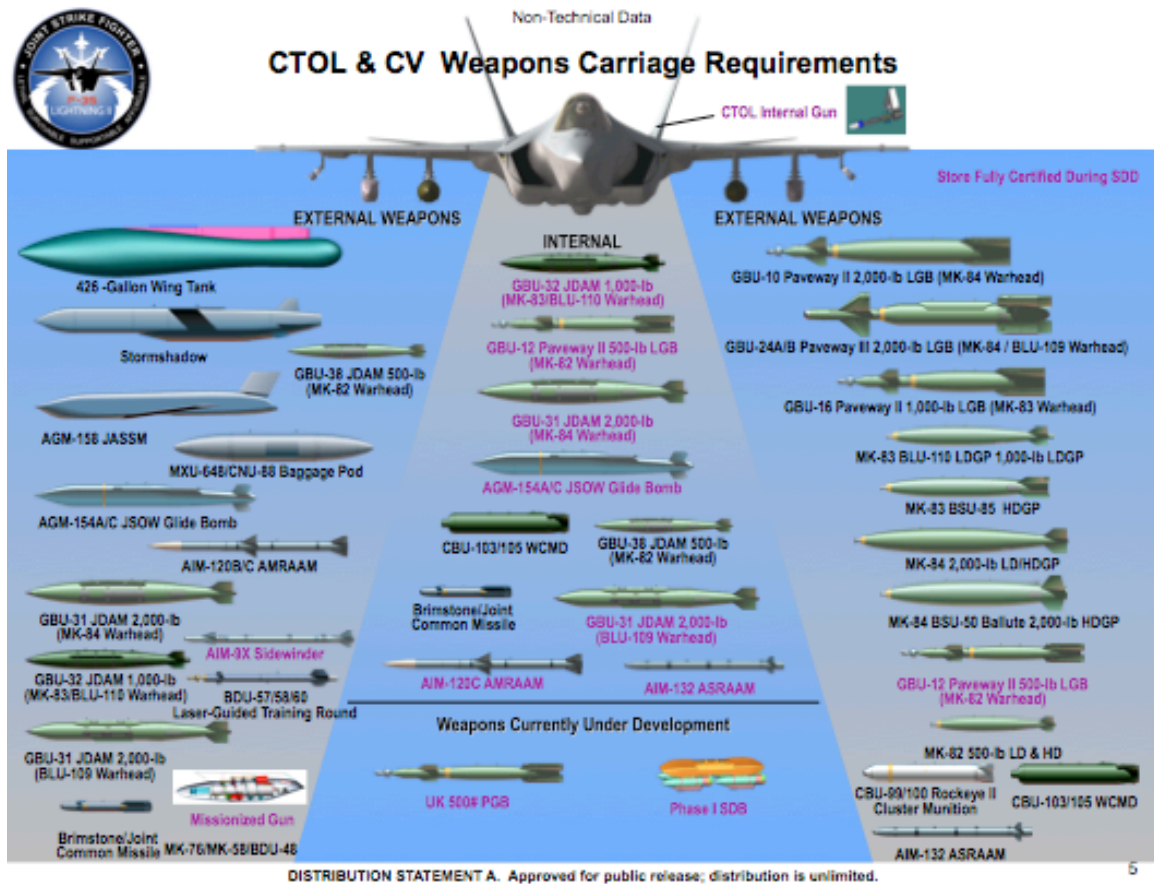


Figure 1 From Major General Davis, "Mission Critical Enterprise Symposium," October 28, 2008.

In other words, the 5th generation aircraft assumed to operate in the study have vastly greater missile load capacity than assumed by making calculations of operating only in a stealth mode. The authors assumed the 5th generation aircraft were going to operate as if they were combat aircraft operational in a 1991 air operations con-ops.

5th Generation Aircraft: Core Capabilities

For the novice, the shift from "legacy" aircraft to 5th generation aircraft is largely about the airframe or that the aircraft is stealthy. For this point of view, the first stealth aircrafts, the F-117 and the B-2, demonstrated the utility of stealth to support strike operations and to be able to dominate air defenses.

Stealth is important but is the *conjunction* of stealth with a number of other capabilities, which create a different capability for a flying force.

First, it is stealth plus integrated sensors, which are especially important. Stealth allows the aircraft to operate over enemy positions and, with the sensors on board,

they are able to target mobile as well as fixed targets. Indeed, a major threat to air superiority in the 21st century are the growing capabilities of mobile air defenses, because “legacy” aircraft rely on target data obtained outside of the aircraft itself to launch strikes. With stealth and sensors integrated on the aircraft mobile targets, an increasingly important element of adversarial systems, are within the scope of effective strike actions.

Second, the aircraft are built around integrated capabilities. When pricing 4th versus 5th generation aircraft, the price for 4th generation aircraft often quoted do not include the add-on systems, which are placed on these aircraft to make them more effective. The C⁴ISR capabilities of the new aircraft are built into the aircraft itself. The integration factor then allows the aircraft to process data and to make informed decisions much more rapidly than a fleet of 4th generation aircraft. These aircraft need AWACS, electronic attack aircraft and a variety of specialized assets to accompany them to work effectively in a 21st century threat environment.

Third, the processing capabilities of the new aircraft are significantly greater than “legacy” aircraft. The F-35 has an advanced distributed computer system on board which can be upgraded simply by changing the chips empowering the system.

Fourth, the processing power and integration of the aircraft facilitate a man-machine relationship on the aircraft. The aircraft can process data and assist pilot decision-making. But more fundamentally, the pilot will not make many of the decisions, which makes the aircraft useful to 21st century air operations. The man-machine relationship on the 5th generation aircraft is essential to using airborne robotic systems in an integrated fashion for 21st century air operations.

The new 5th generation aircraft create an inherent capability to broaden a connected battlespace, whereby the manned aircraft becomes a node on the airborne network, that can support other assets, direct other assets or combine with air, ground and maritime assets into flexible military force packages. The inherent flexibility of the 5th generation aircraft built around on board C⁴ISR capabilities robust automation capabilities via the man-machine interfaces is what makes this aircraft the centerpiece of transition in 21st century air operations.

Working through enhanced collaboration is an evolving effort as 5th generation aircraft are introduced and a “collaborative workspace” is shaped with other aircraft and between air and surface elements. The potential is significant because of the core capabilities of the new aircraft; for the potential to be fully realized will require shaping collaborative tools and concepts of operations which leverage the elements of a national or allied force structure. Platforms are significant; but working through effective concepts of operations in using those platforms is central as well. And providing for the tools, which allow for a concept of operations to be implemented is an important element as well. This is why one should speak of the “forcing function of 5th generation aircraft,” rather than assuming simply by introducing these aircraft into the inventory is a platform magic wand.

The F-22

The first of the new aircraft is the F-22.³ The aircraft has gone through nearly 30 years of evolution from its anticipated role as the replacement for the F-15 and to provide for air dominance. Originally conceived of as an air superiority fighter against the Soviet Union, the focus was largely upon shaping the F-22s capabilities to generate multiple kills of enemy aircraft.

And while air dominance remains the sine qua non of successful air operations and the entry of power projection forces into denied territory, the F-22 story has largely remained understood in terms counter-air operations. But the aircraft is evolving and its evolution is important as F-35 is introduced in the next few years. Some of the key lessons learned from F-22 deployments will be transferred to the F-35 fleet, but, above all, the air dominance capabilities of the F-22 allow the F-35 to focus on its synergistic role for air, ground and maritime platforms.

The F-22 has been deployed now for three years and its evolution is having a significant impact on rethinking air operations. The decade or more of deployment prior to F-35 will provide a significant impact on the F-35 and its concept of operations.

Additionally, the F-22 as a dedicated air superiority aircraft relieves the F-35 of the task of being redesigned for this mission set. The primary task of the F-22 is air-to-air dominance followed by core competence in counter-air defense missions. This latter task is increasingly difficult given the evolution of mobile air defense systems.

For example, the SA-10s and SA-20s can be dismantled, moved and ready for action in a very short period of time. The trend line is towards rapid mobility in the adversary's air defenses, and mobility in this domain means that the incoming strike aircraft must be able to do target identification, target acquisition and strike missions virtually simultaneously. A key aspect of the new fifth generation aircraft is its machine processing capability on-board, which allows the pilot to do simultaneously operations, which historically required several platforms operating sequentially.

But the most significant evolution of the F-22 is in its ISR and C2 capabilities, both associated with its unique AESA radars.⁴ The F-22 is evolving into a battle management system able to fly at substantially higher altitude than the F-35. After performing its air dominance missions, the F-22 can transition into a battle

³ Michael Sirak, "F-22A: The Next Stage-Raptor Rapture," *Jane's Defence Weekly* (January 18, 2006).

⁴ "F-22 Demonstrates Sensor Data Transfer," *Defence Systems Daily* (May 6, 2008); "F22s May Deploy to Middle East," *Aviation Week and Space Technology* (March 31, 2008), p.21; "Not just Fighters," *Aviation Week and Space Technology* (June 25, 2007), p. 27.

management and strike management aircraft. Indeed, with Block 35 the F-22 can be conceived of as the brain of the overall strike force for air and naval strike assets.⁵

F-22 and F-35 Dynamics

But the limited numbers of the F-22 will ensure that the F-35 will be the dominant 5th generation aircraft both in terms of numbers and availability in a coalition environment.⁶ From the standpoint of thinking through 21st century air operations, the ability of the F-22 and F-35 to work together and to lead a strike force will be central to U.S. core capabilities for projecting power. And it is to be remembered that the F-35 is coming off of USAF airfields, allied airfields, USN carriers, and, in the case of the F-35B, virtually anywhere close to the action.



Figure 2 Graphic by Robbin F. Laird Based on Discussion with the USF, USMC, Lockheed Martin and Northrop Grumman

⁵ David Fulghum, "F-35 EW System Redefines Combat," *Aviation Week and Space Technology* (January 21, 2008), p. 50. David Fulghum and Graham Warwick, "New Missions for the F-35," *Aviation Week and Space Technology*, July 23, 2008, p. 13.

⁶ Graham Warwick, "USAF Plots Path from F-22 to F-35," *Aviation Week and Space Technology* (September 29, 2008), p. 36.

The graphic above conceptualizes how the F-22 and F-35 might work together in supporting air dominance, kick in the door, and support for the insertion of a joint power projection force. Here the F-22 largely provides the initial strike and guides the initial air dominance operations; 4th generation aircraft as well as the F-35 support the effort, with the F-35, because of its stealth and sensor capabilities, able to operate in a distributed network to provide strike and ISR and capabilities to suppress enemy air defenses as well attack shore defenses against maritime projection forces.

The “Forcing Function” of the F-35: Shaping the “Wolfpack” for 21st Century Air Operations

The F-35 is less a fifth generation fighter than a first generation flying combat system.⁷ F-35 is far more than a replacement for aging aircraft inventories, because the effects that the F-35 can deliver on the battlespace are flexible, synergistic and multi-dimensional (air, ground, maritime).⁸

This is due to two core developments – new technologies associated with the aircraft and the evolution of military doctrine by the nations acquiring the F-35. It has been characterized as 5th Gen by the impact of stealth and the advanced capabilities associated with a multi functional sensor suite, which includes network, communications, sensors, electronic warfare, and reconnaissance capacities.

The F-35’s open architecture allows this “flying combat system” to become the focal point of three core activities: air-to-air, air-to ground, and air-to-maritime roles and missions. The F-35 will be defined by how its open architecture is customized by national militaries in meeting their perceived priority needs and mix of air, ground, and maritime mission sets. Its combat capabilities will be defined in part by *con-ops customization*.

One example of an opportunity for conops customization derives from the F-35’s multi-modal/multi-mission capability, which includes the ability to deliver both kinetic and non-kinetic (information and cyber warfare, electronic attack, ISR and C2 contributions to ground forces, management of robotic ISR elements, processing of information to support shared decision-making between the air and the ground forces) effects, offering decision makers many more potential options. The nature of conflict places increasing demands on military planners to provide options for the delivery of non-kinetic effects – demands that the F-35 is well suited to handle.

⁷ The USMC clearly argues for the F-35B as a “flying combat system.” The USMC aviation command focuses upon the F-35B as a “key enabler for distributed operations lethality” with “unprecedented situational awareness and connectivity with ground forces providing organic high-end ISR and electronic warfare capabilities.” Also see, Gareth Jennings, “Above and Beyond: F-35 technology offers a new vision of future combat,” *International Defence Review* (June 2008).

⁸ See General Davis comments in Douglas Barrie, et. al., “Industrial Dogfight,” *Aviation Week and Space Technology* (July 21, 2008), p. 24.

The F-35 is central to operationalizing the netted or connected battle management environment. It can provide services (communications, intelligence, and electronic support) to others in the battlespace in ways that are transparent to the pilot operating the F-35. Large platforms that are used to provide battle management can be augmented by a reduced force mix of the F-35 and unmanned vehicles shaping a 21st century approach to air operations.

Conops customization is why the F-35 STOVL version is of special interest. The USMC, the Royal Air Force, the Italian Navy, and others will use the STOVL variant differently than today's non-vertical lift aircraft. As a result, ground-air integration and conops will be performed differently than with that of the F-35 conventional take-off version. And almost certainly weaponization and ISR requirements will be modified to work with the STOVL-enabled con-ops.⁹

An additional aspect in developing joint or coalition concepts of operations for the F-35 will revolve around its interaction with other manned and unmanned assets. With regard to manned assets, a key challenge will be to work an effective "connectivity" battle space with other manned aircraft, like the Typhoon or "legacy" U.S. aircraft. Here the advantages of each platform in contributing to the air battle and to the type of flexible military force packages, which 21st century air capabilities contribute, will be the focus of a joint concept of operations.

In addition to the core dynamic of working with a variety of manned aircraft across the joint and coalition battlespace, the F-35 will be highly interactive with the evolution of robotic elements as well. UAVs are not well designed for self-defense. For early entry UAVs to stay alive, they need to be part of a wolfpack built around the protective functions of the manned aircraft. As air dominance and air superiority operations succeed, their significance can recede during a particular operation, which then allows the role of the unmanned aircraft can go up significantly and over the duration of the operation supplant manned aircraft in an ISR and C2 role.

But the man-machine and computational capabilities of the F-35 provide a significant opportunity to evolve the robotic elements within airspace to provide for data storage, transmission, collection, weapon emplacement, loitering strike elements, all of which can be directed by the manned aircraft as the centerpiece of a manned-robotic strike or situational awareness wolfpack. Rather than focusing on robotic vehicles as self-contained units with proprietary interfaces and ground stations, the F-35 can be useful in generating common linkages and solutions to combine into a core wolfpack capability.

Placing the 21st Air Con-ops "Grid" onto the RAND Scenario

Unlike the authors of the RAND study, I am assuming that the U.S. is innovating as well and is applying a 21st century approach to a concept of operations which will complicate Chinese planning and effectiveness. The Chinese will attack U.S. air power with counter air assets, including fighters in number and in force, and with significant missile strike assets. The Chinese will assume as do the RAND authors that the USAF will fight alone

⁹ Robbin Laird, "Recovering the Strategic Context for JSF," *Defense News* (September 4, 2006), p. 21.

and following 20th century air battle management and attack con-ops. This assumption will be an important contribution to the Chinese defeat in this scenario.

First, the USAF and the USN can operate as an integrated strike and defense approach. The 5th generation aircraft will be used as forward air assets to support co-coordinated strike and defense operations. As the Chinese reach out to strike U.S. air assets, the distributed operations of the air and naval forces will use unmanned, 5th generation air assets, legacy air assets, integration with Aegis systems, and reliance on USN strike missiles to provide a comprehensive capability. Allies who can contribute weapons to the fight whether land-based, sea-based or air-based can contribute. It is important to remember here that the 5th generation forward air controllers can call for missile strikes from virtually any asset – US bombers, missiles from any US Naval asset (or allied asset for that matter). By providing a significant and complicated set of vectors of attack and defense, the Chinese strike assets will be exposed to counter-strikes as they seek to reach out to assets they think they can see in the forward area.

Second, the 5th generation fighters will draw on lethal assets outside of the forward area to attack approaching Chinese forces. The distribution over the battlespace, including operating simply as nodes in the strike determination network, will allow the 5th generation aircraft to guide strikes and to determine core targets for a counter-offensive.

Third, the vertical lift F-35Bs can be distributed throughout the battlespace on dispersed launch points to contribute to the diversity of vectors of attack and defense against the Chinese. For the STOVL F-35, their ability to penetrate the battlespace in a stealth mode, land in a remote area and then wait to deploy against a primary target is an additional capability, which this 5th generation aircraft contributes to the new con-ops.

Fourth, allies will be available to contribute ISR and other nodes in the attack and defense network, which can contribute to a further enhancement of the distributed network. Australian F-35s can participate in the fight or their Wedgetail and Global Hawk assets deployed to provide further battle management capabilities.

Fifth, the introduction of UAVs, like the USN's new UCAS systems can provide important strike assets which can be directed by the F-22s and F-35s functioning as forward air controllers.

Sixth, the movement away from AWACs to the use of the 5th generation fighters as air battle management assets will significantly reduce the ability of the Chinese to shut down the force multiplier aspects of a air battle management directed force. Indeed, the RAND study provides an important warning for why the US needs 5th generation aircraft. Simply continuing to rely on the AWACS provides an increasingly easy target for a force like China.

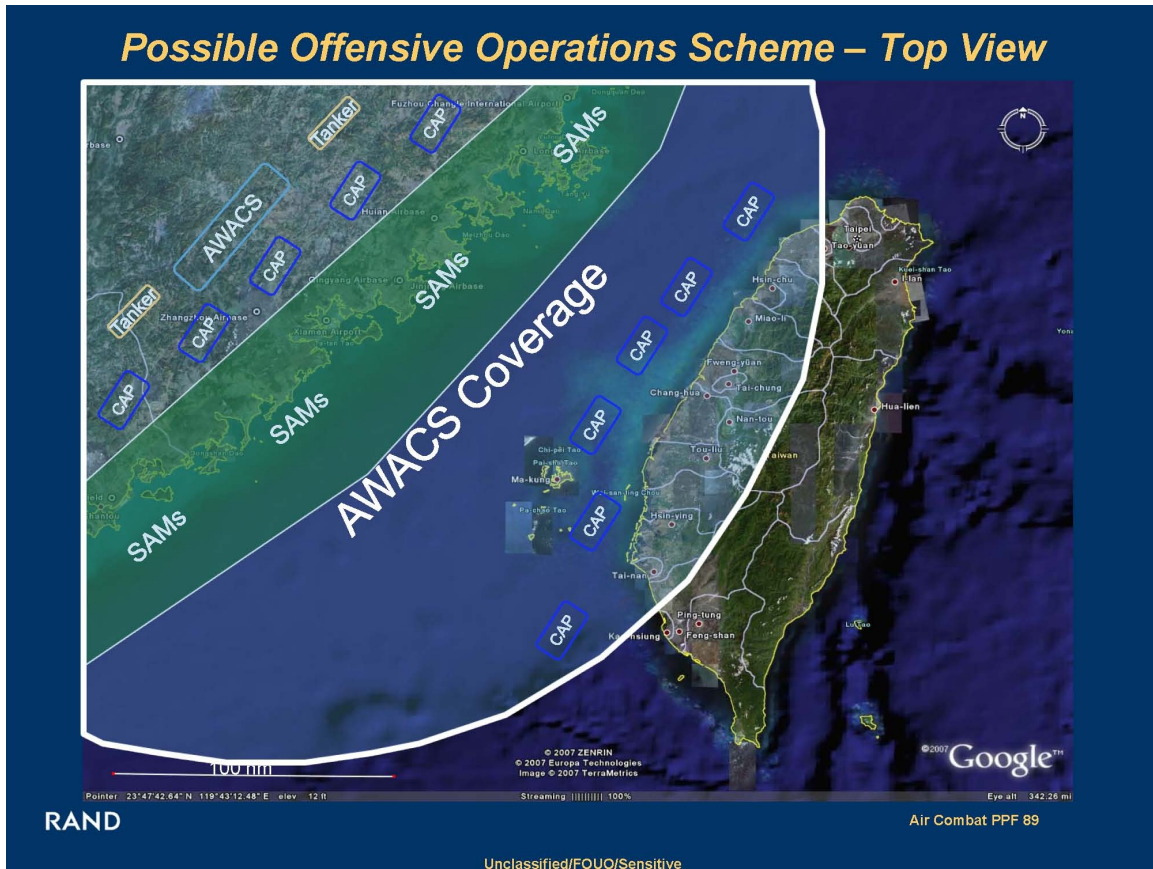
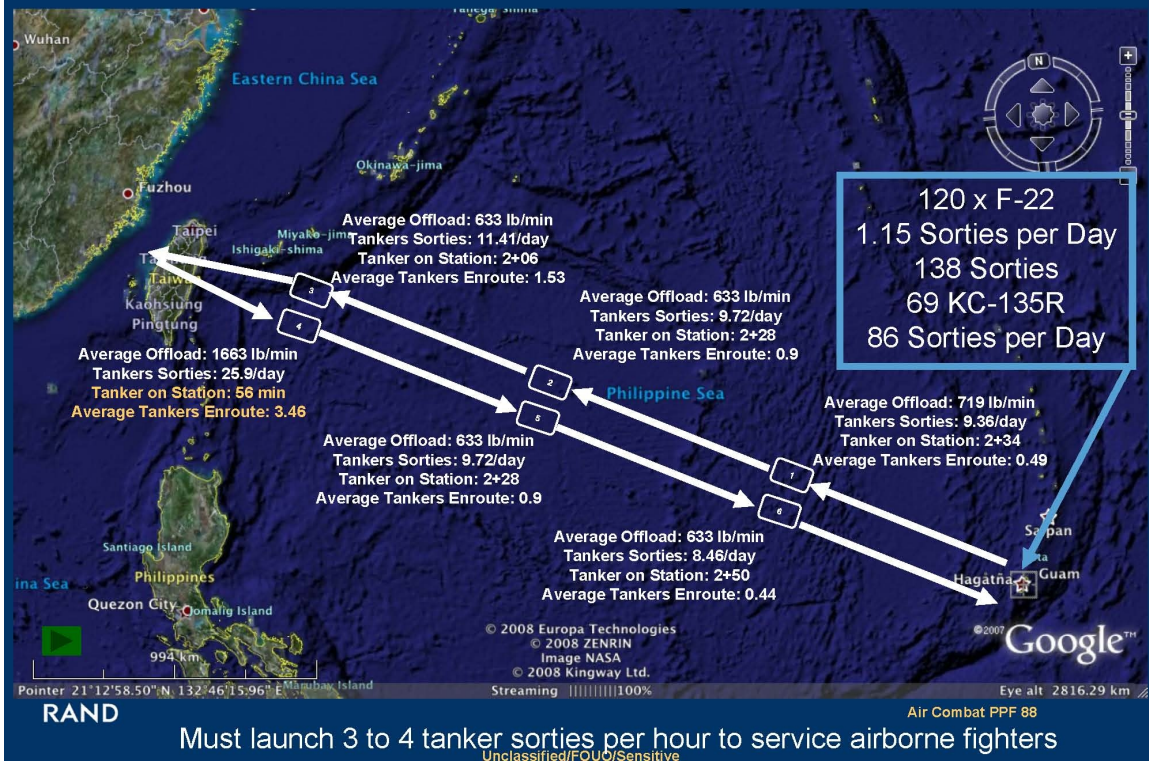


Figure 3 Both this and the following slide are taken from the brief placed on the web by Steve Trimble

Seventh, the tanker vulnerability identified in the study is a very good argument for the next generation tanker. The tanker selected by the USAF in 2008 (the NG A330) would deploy further from the strike area, be able to remain aloft indefinitely (with crew rest areas) and capability to be re-fueled while deployed, and would provide an important force multiplier for the 5th generation fleet. This fleet operates as a combined strike, ISR and communications asset and as such needs to stay on deployment as long as the pilot's duration allows, not simply with regard to how large the plane's weapons load is.

Fuel consumption to support F-22s 2.6 million gallons per day vs. 2.2 million gallon per day long term constraint



In short, by confronting the Chinese with a distributed 21st century concept of air operations, the US and its allies can prevail. If the USAF operates alone and follows 20th century air concepts of operations and relies on the limitations of legacy aircraft, the US loses. Surely, the US if it followed such a strategy would lose. That is why it is imperative to focus on a 21st century con-ops and to build, buy and deploy joint and combined assets, which enables such a con-ops.

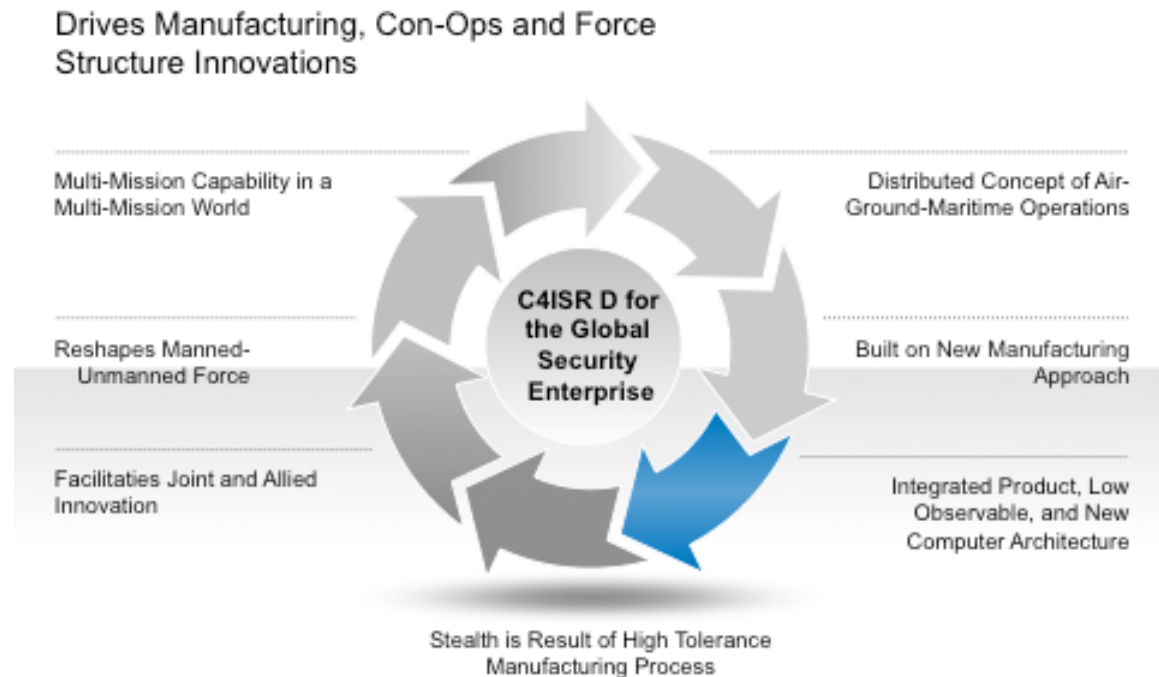
Conclusion: Moving Forward on Acquiring the Pieces for the 21st Century Con-ops Puzzle

Obviously, acquiring 5th generation aircraft in sufficient numbers to enable 21st century air operations is crucial. The termination of the F-22 now poses fundamental questions of how the USAF will use the remaining F-22s as a special asset in shaping capabilities and concepts of operations. By reducing numbers, the F-22 might well be configured to be used as special assets somewhat similar to the F-117. And the termination might well lead to the need to slow down the possibility of eliminating several legacy systems, which was possible if F-22s had been acquired in greater numbers. If acquired in greater numbers, one could have eliminated several legacy systems, e.g., AWACS and dedicated electronic warfare assets, which saves money in terms of acquisition and logistics as well as enhances the capability of U.S. operations.

Leveraging legacy fleets is equally important. The F-35 and its relationship to legacy aircraft will be central to shaping the evolution of 21st century air capabilities. The F-35 as a “flying combat system” will have an immediate impact on air capability with its

initial deployment. The first squadron(s) of aircraft will bring a C4ISR platform into the air combat domain and with it a major contributor to air-surface operations. But beyond the core capability of the new fighter comes its ability to force multiple legacy assets.

F-35 As Enabler of 21st Century Con-Ops



How will the F-35 work with legacy air assets and in an air-to-surface environment? The key way to think about the F-35 as shaping a transition in capability is its ability to process data in the air, using its revolutionary man-machine capabilities, and then its transfer of processed data into Link 16 message sets. Surface assets suffer from a significant bandwidth problem: F-35 processors can assist by processing data and sending appropriate results to the ground forces.

And organizing air combat operations is significant as well. The later generation aircraft such as Eurofighter and upgraded F-15s and F-16s can be optimally organized for operations by F-35. The older aircraft can be organized more efficiently as well by F-35 processing and stealth capacities.

And rolling out of capability as squadrons are added to the fleet will transform operations as numbers of F-35s are augmented in the fleet. Each new squadron will allow the F-35 to become a more significant player in shaping the operations of air and surface forces. A way to think about the insertion of F-35s in the fleet is to conceptualize a sliding scale of capability, which grows as F-35s supplant legacy. But the great thing about the F-35 is that you do not have to wait for the legacy fleet to be completely replaced to get significant enhancements of overall fleet capabilities.

The F-35 has the further advantage of being a joint and coalition aircraft. This means that the integration of a significant part of U.S. power projection forces – USAF, USN and USMC – is built-in to the acquisition of the aircraft. And as coalition partners acquire the aircraft worldwide, working joint concepts of operations with those allies allows the US to enable both allies and the US to operate in a 21st century concept of operations approach.

Indeed, integration of the USN and the USAF within an overall power projection force is suggested by such an approach. As the USN deploys its first 21st century carrier, it will carry F-35s and hopefully UCAS on board. This will allow the USN to configure the carrier as a significant contributor to joint con-ops. And the UCAS will precede any new bomber for the USAF and, as such, can contribute an important technological and operational step towards defining how a new bomber can contribute to the joint battlespace.

And the USN by becoming much more closely integrated with the USAF can make intelligent decisions about the future of its surface fleet. The F-22 will play a key role as the lead element of a USN or USAF strike force. But the RAND analysis underscores the need for the US to have a significant increase in the number of “bullets” which it can bring to the fight. The USN can provide these bullets in terms of missiles carried and launched from the surface fleet.

And, the further developed of the unmanned contributors to the joint fight should be defined by their ability to work with the 5th generation aircraft. Some simply need to operate as decoys against threats like China whereby the Chinese fire against what they think are deployed US strike assets only to discover that they are striking decoys and by so striking open themselves to a powerful counter strike from distributed assets. Some will operate as airborne routers operating in the battlespace to receive data from 5th generation fighters machine systems and then distribute that data to the relevant assets in the proximate battlespace. Airborne routers and other assets would as well dump data to ships for further processing and distribution in determining strike and defense positions which can then be provided to the shooters available to strike key targets.

In short, a 21st century concept of air operations opens the way to an overall 21st century concept of power projection con-ops. And shaping such an approach is crucial to defeating an adversary such as that sketched in the RAND report, or to the general ability to link U.S. and allied capabilities into a collaborative force able to provide for a global security enterprise.