Forward Arming and Refueling Points for Fighter Aircraft

Power Projection in an Antiaccess Environment

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The United States depends upon effective power projection to advance its national interests abroad. A section of the Department of Defense's strategic guidance for 2012 describes one of the primary missions of the US armed forces as "Project[ing] Power Despite Anti-Access/Area Denial Challenges."[1] The US Air Force plays a central role in power projection by providing air and space superiority; intelligence, surveillance, and reconnaissance (ISR); rapid global mobility; global strike; and command and control.[2] The US military faces significant challenges to its power projection capabilities, particularly in the Western Pacific theater of operations (WPTO). The People's Republic of China has invested substantial resources in the modernization of its military forces and continues to expand its antiaccess/area-denial (A2/AD) capabilities, largely designed to prevent opposing forces from gaining access to the WPTO.[3] Consequently, as the Air Force attempts to solve today's A2/AD problems, it should first reduce the vulnerabilities of forward-deployed forces to A2 threats, thereby allowing them to project force into a contested theater. The rapid movement and employment of fighter aircraft by means of mobile forward arming and refueling points (FARP) support this priority.

Fighter FARP, an innovative concept, combines sortie-generation capabilities and mobility support to enable more expeditionary and dispersed operations. It uses existing airfields throughout an area of responsibility to increase the range and tempo of fighter operations. Fighter FARP includes rearming, refueling, and swapping pilots without the use of airfield infrastructure—usually in 90 to 120 minutes. Benefits include strategic deterrence, crisis stability, greater range of fighter aircraft, and sustained fighter operations in an A2/AD environment. Currently, this affordable, feasible concept can be executed on a small scale, but the Air Force should develop it into an operational capability for application in a variety of scenarios using current and future aircraft.

Although other nations such as Iran and North Korea have A2/AD capabilities, this article focuses on issues in the WPTO. China's capacity for A2 has increased to the point that it fundamentally confronts one of the basic concepts of US power projection—the massing of forces at forward bases. Thus, the article first describes A2/AD in the WPTO, offers a brief history of FARP in the US military, and examines this concept, including its three critical elements, operational and strategic benefits, and known challenges.

Antiaccess / Area Denial

In an effort to hinder America's ability to project combat power and conduct operations in the WPTO, China has developed a robust A2/AD system that includes both defensive and offensive capabilities. *A2* refers to actions and capabilities intended to deny adversary forces entry to a theater of operations. *AD* denotes actions and capabilities intended to limit an enemy's freedom of action within an operational area.[4] China's A2 strategy calls for deterring US military action in support of its allies by increasing the difficulty and costs associated with projecting power in the WPTO.[5] China plans to attain its A2/AD objectives through the coordinated use of air defenses, antisatellite/cyber weapons, and both ballistic and cruise missiles to target operating bases and maritime forces in the region.[6] Fighter FARP addresses the projection and sustainment of fighter forces in a contested environment.

Threats to US and allied bases include Chinese ballistic and cruise missiles that can strike bases throughout the WPTO. The Department of Defense estimates that China could target approximately 1,100 of its short-range ballistic missiles (SRBM) and 500 ground-launched cruise missiles (GLCM) against bases within the first island chain, which encompasses the East and South China Seas. Additionally, more than 500 medium-range ballistic missiles (MRBM) and air-launched cruise missiles (ALCM) can reach bases as far away as Guam and the second island chain (figs. 1 and 2).[7]

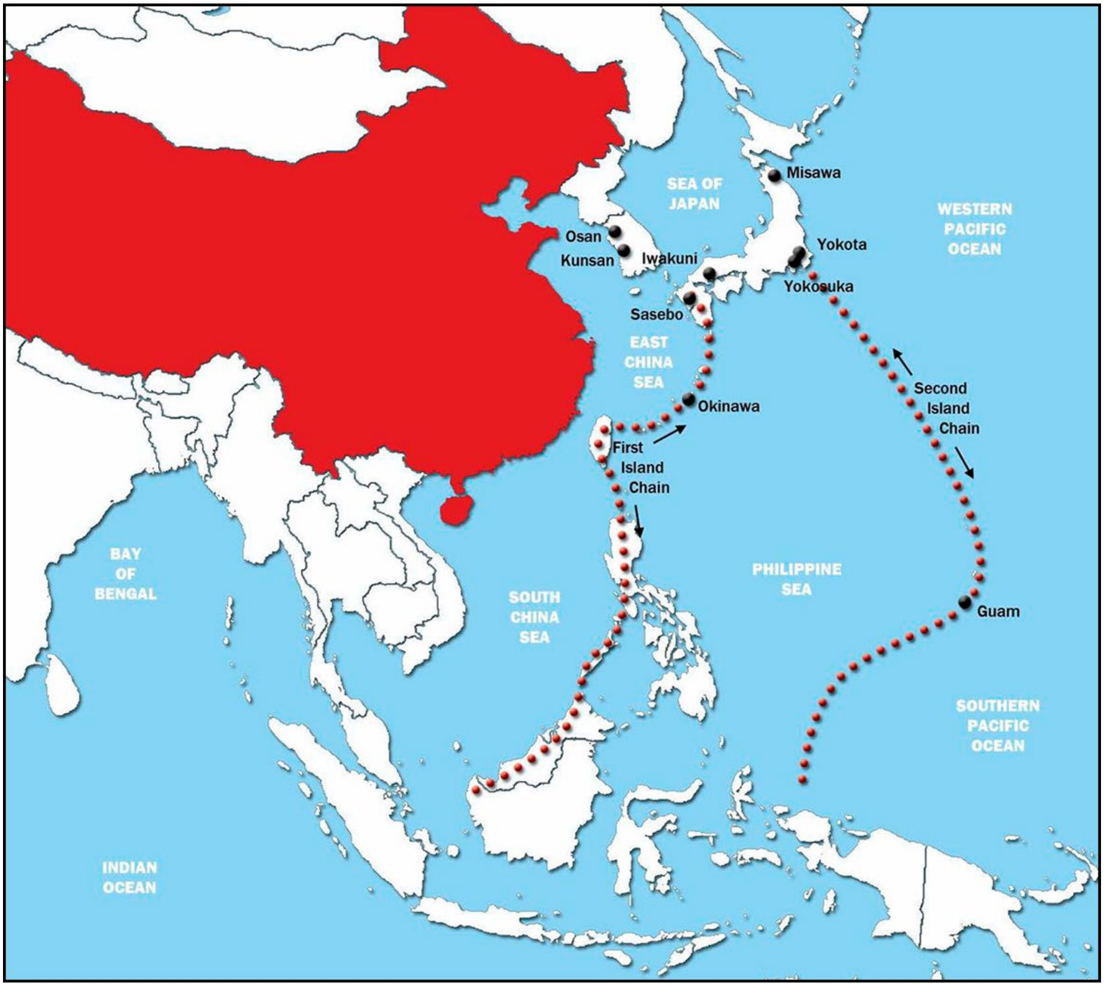

Figure 1. The first and second island chains. (From Jan van Tol et al., *AirSea Battle: A Point-of-Departure Operational Concept* [Washington, DC: Center for Strategic and Budgetary Assessments, 2010], 13, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/. Reprinted with permission from the Center for Strategic and Budgetary Assessments.)

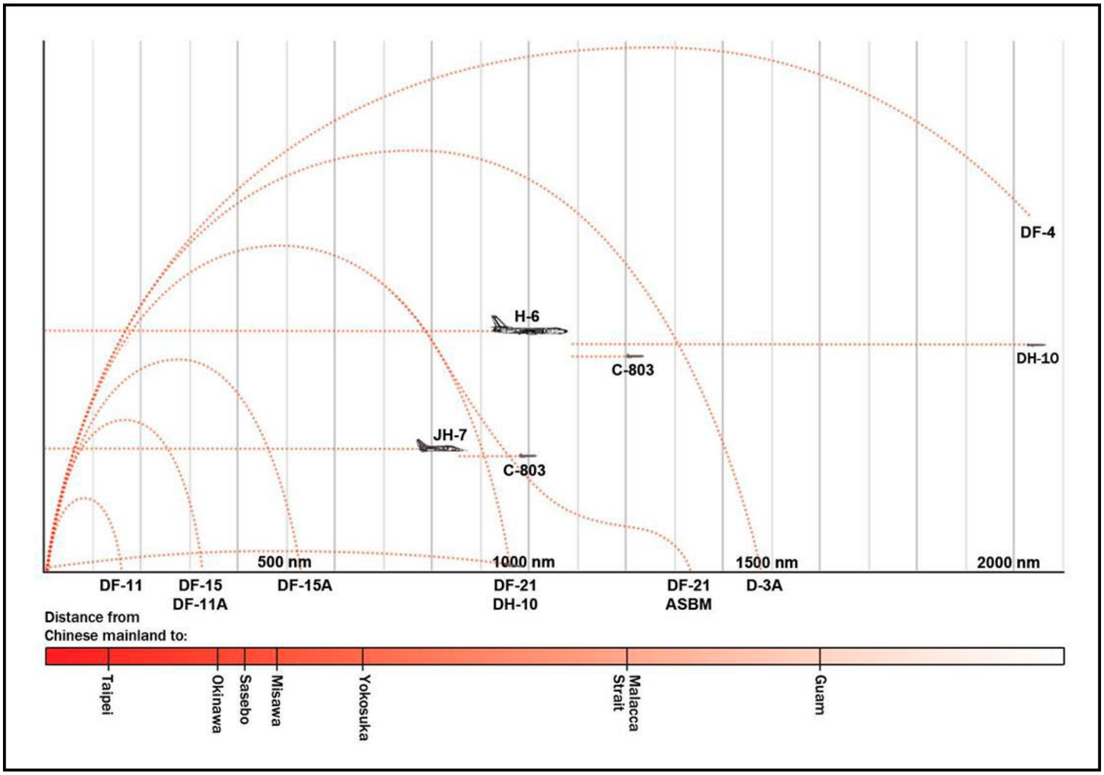

Figure 2. Ranges of Chinese weapon systems. SRBMs include the DF-11, DF-11A, and DF-15A; MRBMs, the DF-21 and D-3A; and cruise missiles, the DH-10 and C-803. (From Jan van Tol et al., *AirSea Battle: A Point-of-Departure Operational Concept* [Washington, DC: Center for Strategic and Budgetary Assessments, 2010], 18, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/. Reprinted with permission from the Center for Strategic and Budgetary Assessments.)

The inability to operate from bases in the WPTO would threaten US power projection in the region. Over the past 60 years, the "American way of power projection" has included rapidly deploying a large number of forces to a small number of secure forward bases, generating many sorties, and freely initiating combat operations as the United States chooses.[8] If China expects US military intervention, then it is reasonable to assume that Chinese military forces would seize the initiative by executing a campaign to deny US forward basing, thereby limiting access to the region.[9] In light of China's A2 capabilities, massing forces at main operations bases (MOB) actually projects *vulnerability* rather than *power*.

A Brief History of Dispersed Operations and FARP

The Air Force defines FARP as "fuel's [*sic*] operations used to hot refuel aircraft in areas where fuel is otherwise not available. Fuel is transferred from a source aircraft's (C-130, C-17, or C-5) internal tanks to receiver aircraft."[10] The Army's and Marine Corps's definitions differ slightly, resembling that of Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*: "a temporary facility . . . to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat."[11] This article uses the latter definition since it incorporates the *arming* of aircraft in addition to refueling.

The utilization of FARP and dispersed air operations is not new. Throughout the Cold War, the threat of Soviet attacks on North Atlantic Treaty Organization (NATO) air bases led to different forms of dispersed operations. NATO developed plans to use host-country civilian airfields and large sections of the German autobahn as emergency landing strips.[12] In March 1984, that organization practiced this capability during Exercise "Highway 84," during which NATO aircraft operated for three weeks from a section of the autobahn. Continued concern about the security of forward bases led to the multiweek Salty Demo exercise in 1985 at Spangdahlem Air Base, Germany. Salty Demo showed the effect of sustained attacks against a modern air base and helped guide Air Force investments in Europe through the end of the Cold War.[13]

As the threat to US overseas bases decreased during the two decades following the Cold War, the need to disperse quickly from MOBs also decreased. Nevertheless, FARP remains a reliable method of enhancing flexibility and combat effectiveness. For example, Air Force, Marine, and Army helicopter units regularly execute FARP operations with pre-positioned fuel supplies. Some Air Force C-17 crews receive training to conduct these operations with aircraft from Air Force Special Operations Command. Rescue units in the Alaska Air National Guard employ HC-130s to extend the range of their HH-60 Pave Hawk helicopters by means of FARP. Numerous military operations since the 1960s, including those in Vietnam, Panama, Iraq, and Afghanistan, have used FARP.[14] Recent advances in Chinese A2 have elevated the threat to US operating bases, leading to development of a new application of FARP.

Rapid Fighter Movements: A New Concept for Dispersed Operations

No "silver bullet" will solve the A2/AD dilemma. An effective strategy will likely include standoff weapons, disabling technologies, and operational resilience. Typical elements of the latter include improved indicators and warning, ballistic missile defense, cruise missile defense, redundancy, selective hardening, rapid infrastructure repair, and distributed basing.[15] This type of basing entails deploying aircraft squadrons to larger numbers of bases with sufficient ramp space, weapons-storage areas, and infrastructure for high-volume fuel delivery. The fighter FARP concept adds to operational resilience by taking distributed basing to an entirely new level.

This concept combines current Air Force capabilities in new ways, resulting in significant strategic, operational, and tactical advantages. It pairs a four-ship of fighters with a transport aircraft, making use of FARP to rearm, refuel, and swap pilots quickly at over 250 possible locations throughout the WPTO. The transport aircraft contains a prioritized parts kit, munitions for rearming, a forward area manifold (FAM) cart to regulate fuel pressure from its internal tanks to the fighters, additional pilots to rotate into the fighter cockpits, and trained personnel to conduct fuel, weapons, and maintenance functions. The fact that the weapons, fuel, equipment, and personnel necessary to conduct

FARP are all contained in the transport aircraft precludes the need for fuel and logistics support at FARP locations. Successful implementation of the fighter FARP concept depends upon three key elements: (1) generation of fighter and transport aircraft from bases outside the A2 environment and projection of that power over long distances in a coordinated fashion; (2) the availability of acceptable runways throughout the joint operations area (JOA) where FARP operations can occur with reduced risk of enemy attack; and (3) successful regeneration of combat sorties using FARP in a time-constrained environment without depending on fuel or logistics support from the dispersed airfield.

Generation and Power Projection of FARP Forces

Fighter FARP relies on effective combat generation of paired fighter and transport aircraft that can project combat power over long distances into an A2 environment, a capability demonstrated and exercised at Joint Base Elmendorf–Richardson (JBER), Alaska.[16] Since 2009 that base's F-22 and C-17 units (fig. 3) have exercised long-range strike and escort (LRS/E) training missions in which they rapidly deploy a formation of F-22s and one C-17 on an eight-hour-plus mission, receive mission updates airborne, generate (or receive) target-quality coordinates, defeat air-to-air adversaries, deliver air-to-ground ordnance in a dense surface-to-air-missile environment, and land at a forward location.[17] These exercises are representative of the long distances involved if combat operations in the WPTO are supported by fighters outside the second island chain; moreover, they show the synergistic effect of combining fifth-generation platforms with a tailored support package on a C-17. Figure 4 indicates the distances from Alaska and Hawaii to the WPTO.

Figure 3. F-22 FARP site layout. Four F-22s and a C-17 line up in preparation of FARP operations during an operational unit evaluation at JBER in August 2013. (Photo courtesy of TSgt Dana Rosso, USAFR, 477th Fighter Group Public Affairs, JBER, Alaska.)

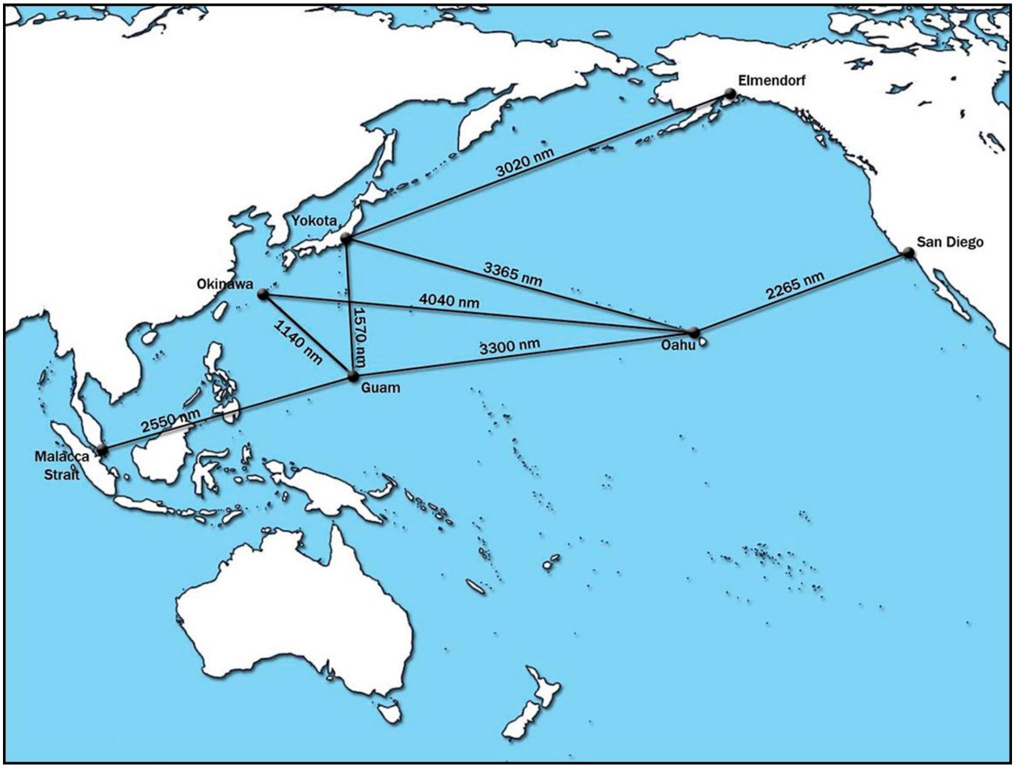

Figure 4. Distances in the Pacific theater. (From Jan van Tol et al., *AirSea Battle: A Point-of-Departure Operational Concept* [Washington, DC: Center for Strategic and Budgetary Assessments, 2010], 12, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/. Reprinted with permission from the Center for Strategic and Budgetary Assessments.)

Suitable Airfields and Freedom from Enemy Attack

Once the F-22s execute an LRS/E mission into the JOA, they will need a suitable airfield unlikely to be attacked by enemy ballistic or cruise missiles for a useful period of time. Typically, these fighters require runways at least 8,000 feet long and 75 feet wide although operations group commanders can allow shorter ones if the computed takeoff and landing distances do not exceed 80 percent of the available runway.[18] Depending on fuel and weapon loads, an F-22 will likely operate from runways 6,000 feet long, at a minimum. The C-17, which has excellent short-field takeoff and landing capabilities, can in most situations operate with such a runway. The pavement classification number, an additional consideration for the C-17, represents the weight-bearing capacity of the runway. The WPTO has at least 163 airfields that are 8,000 x 75 feet, and reducing the required length to 6,000 feet increases the total to 258. Table 1 summarizes the possible FARP locations in the WPTO that lie within the second island chain.

Table 1. FARP airfields by runway length and location (in the WPTO)

	8,000 ft. +	7,000–7,999 ft.	6,000–6,999 ft.	Totals
From PRC to First Chain	117	14	43	174
Between Chains Including the Second)	46	14	24	84
Totals	163	28	67	
Grand Total	258			

Source: "Worldwide Airport Database," Airport Nav Finder, accessed 8 February 2014, http://airportnavfinder.com/index.php. For a list of all 258 airfields, see Lt Col Robert D. Davis, "Fighter FARP: An Affordable and Feasible Concept for Power Projection in an A2/AD Environment" (Maxwell AFB, AL: Air War College, 2014). These numbers do not include airfields beyond the second island chain although several in Papua New Guinea and northern Australia are close enough for consideration. All of the runways noted in the table are asphalt, but the pavement classification number did not enter into the equation. Locations demand a certified FARP survey in accordance with Air Force Instruction 11-235, *Forward Area Refueling Point (FARP) Operations*, 15 December 2000, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-235/afi11-235.pdf.

Maintaining a survivable fighter force is a central feature of the FARP concept since it complicates China's efforts to deny forward bases to US forces. To increase the survivability of FARP forces, the US military should deny the People's Liberation Army's (PLA) real-time *awareness* of the FARP locations currently in use, deny its *ability* to strike these locations in a timely manner, or lower its *willingness* to target a particular airfield.[19] Depending on China's ability to monitor potential FARP locations, FARP operations could probably be conducted during times of reduced awareness. During a major military operation, it is also plausible that US forces will attempt to disrupt or deny PLA ISR through kinetic or nonkinetic means. FARP planners should coordinate closely with intelligence personnel to know when certain locations are available and for how long.

China's ballistic and cruise missiles pose the greatest risk to FARP operations. Given that country's scientific approach to warfare, one can realistically assume that it will dedicate most of those missiles to a small number of high-priority targets such as US and allied MOBs. However, targeting fighter FARP locations will require significantly more missiles as well as Chinese willingness to launch at bases in many nearby countries (including Japan, South Korea, Indonesia, Singapore, Malaysia, Thailand, and Palau). The uncertainty of FARP locations and the tremendous ill will created by targeting its neighbors will likely affect China's willingness to use ballistic or cruise missiles against those sites.[20]

Although choosing a FARP location further from the Chinese coastline may reduce the risk of missile attack, doing so may prove unnecessary because of China's reduced awareness or willingness to target FARP airfields. (It would also lessen the effectiveness of the concept.) Nevertheless, a FARP location greater than 486 nautical miles (nm) from the Chinese coast will lie outside SRBM range, leaving only MRBMs as the primary ballistic missile threat.[21] Choosing a site 540 or 810 nm from the coast will provide 60 or 90 minutes of protection from GLCMs, respectively.[22] In the WPTO, at least 174 potential FARP locations are 540 nm from China, 130 of them beyond 810 nm. To thwart an attack by ALCMs, US forces should prevent Chinese bombers (H-6s and JH-7s) from reaching the maximum launch range of their most likely weapons—323 nm.[23] Air-to-air fighters or other joint counterair capabilities could supply this protection.

Conducting Fighter FARP

The fighter FARP concept, a natural extension of the LRS/E mission, allows fighters to resume operations quickly after a mission without returning to a base far from the JOA. Besides a suitable runway, other minimum requirements for fighter FARP include certified maintenance, weapons, and fuels personnel; a FARP-certified C-17 crew; a FAM cart; supporting fuels equipment; ammunition; maintenance equipment; beyond line-of-sight (BLOS) communications; additional F-22 and C-17 aircrews with crew-rest quarters; one to two mission planners with a mission-planning computer; and air-refueling (AR) tanker support.[24] The length of time on the ground depends upon the amount of fuel and munitions needed by the fighters. If it needs few munitions, a four-ship of F-22s can be back in the air 60 minutes after landing. In most situations, arming/refueling the fighters takes 60 to 120 minutes (fig. 5).[25]

Figure 5. F-22 arming and refueling operations during an F-22 FARP evaluation at JBER, Alaska. (Courtesy of TSgt Dana Rosso, USAFR, 477th Fighter Group Public Affairs, JBER, Alaska.)

Several factors affect the number of days that F-22s can sustain FARP operations away from a base having robust maintenance capability, but the typical number is three days.[26] The C-17s and associated personnel must rotate more frequently because of fatigue and ammunition considerations. Although this concept requires additional analysis before it can be developed into an operational capability, enough information exists to highlight the most significant benefits and issues associated with fighter FARP operations.

Strategic Benefits

The most significant strategic benefit of the fighter FARP concept is its potential deterrent value. Possession of a credible capability to conduct fighter operations despite an adversary's attempt to deny forward basing would likely have a deterrent effect and might prevent the need for lethal military force. This is particularly true for China, whose military planning is characterized by a scientific approach to warfare. The United States should publicly announce and exercise its ability to conduct fighter FARP. If Chinese military leaders lack confidence that their antiair campaign will achieve its desired aims, then America can likely deter them.

The concept also imposes significant costs on China (or any adversary) if it attempts to deny FARP locations by increasing its number of missiles or ISR capabilities. Given the many possible sites in the WPTO and the likelihood that China would have to target an airfield with multiple missiles, the PLA would need to augment its stockpile of weapons substantially. Additional space-based or airborne ISR platforms are also very expensive. Compared to the low cost of executing fighter FARP, China's outlay for denying such a capability would be extremely high.

Furthermore, the United States would enjoy the benefit of conducting conventional "strategic strike" missions with fifth-generation fighters. By utilizing FARP, F-22s can launch from their home base, fly more than 4,500 miles (with AR tanker support) during one flight duty period, swap pilots, continue to the desired location, and operate in an advanced threat environment while delivering their munitions. After striking multiple targets, the aircraft can return to their home base or other suitable airfields. The employment of F-22s over long distances also allows them to escort other strategic platforms and/or strike high-value targets on their own, producing strategic effects.

Moreover, fighter FARP offers responsive, flexible, and scalable options for stabilizing a crisis and thus exerts a significant strategic impact. A plausible future crisis might involve a territorial dispute between China and Japan or renewed aggression by North Korea. In such situations, a package of stealth fighters and specifically paired transport aircraft can be generated and deployed on a long-range mission to demonstrate American resolve and reassure US allies in the region. In less than 24 hours, a four-ship of stealth fighters can fly thousands of miles using FARP to extend their range, deliver precision-guided munitions (if needed), and land at a forward base as a stabilizing presence. The aircraft can continue local operations or move to another base in the region, using FARP as necessary. If the situation demands more forces, then the Air Force can generate additional packages and quickly deploy them to the theater. Upon resolution of the crisis, it can redeploy them within hours. Flexible and rapid power projection (especially in an A2 environment) gives US leaders more options for effective crisis stability and helps advance America's interests abroad.

Sortie Generation

The concept offers the significant operational benefit of sustaining fifth-generation airpower operations when MOBs become unusable. The estimated number of sorties that a squadron can generate each day using FARP is an important planning factor and helps in evaluations of the utility of the concept. Even under the best FARP conditions and high availability of platforms, the sortie generation rate will be lower than that of forward bases because of efficiencies gained through consolidated maintenance and supply resources. The operational value of fighter FARP, though, is not its efficiency but its lack of vulnerability to A2 measures. Fighter FARP is more than a good idea—it is a necessity.

For example, an F-22 fighter squadron and aircraft maintenance unit based at JBER with 21 primary aircraft authorized could employ up to three four-ship cells concurrently.[27] If three cells are employed simultaneously, then 12 of the 21 jets (57 percent) will conduct FARP operations while the remaining nine aircraft remain at home station. As the three four-ships rotate back to JBER for maintenance, up to two additional four-ships can replace them. If several aircraft are undergoing long-term maintenance, the fighter squadron might be able to employ a maximum of only two four-ships concurrently.[28]

The number of sorties flown by a four-ship each day depends upon several factors. If the tasked mission is defensive counterair with few air-to-air engagements, it could remain on station for an extended period of time (eight to 10 hours), producing two missions (eight sorties) per day for the four-ship. Other missions such as offensive counterair or air-to-ground strike would likely call for a higher rate of weapons expenditures and an earlier return to a FARP location. In this situation, a four-ship could reasonably fly three or four missions (12 or 16 sorties) in 24 hours. In light of the assumptions above, one F-22 squadron can generate at least 480 sorties over a continuous 30-day flying period (two four-ships, each flying two missions per day). When MOBs are unusable, 480 sorties per month flown by eight fifth-generation, continuously present fighters represent a substantial amount of combat power.

Fighter FARP operations may prove necessary only during the opening weeks or months of a major combat operation. In a hypothetical WPTO scenario, this concept would likely be combined with other distributed basing and resiliency efforts. As the military operation unfolds, the ballistic and cruise missile threat to MOBs is likely to attenuate, and damage to those bases will be repaired. The lesser threat will allow fighter and maintenance units to move forward to MOBs where they can take advantage of consolidated resources. Although it is difficult to predict the time required to reduce such a threat, one can reasonably assume that a squadron tasking to conduct FARP operations would last one to two months.

Other Operational and Tactical Benefits

The affordability of the fighter FARP concept compared to that of other operational resiliency efforts is an important benefit that has operational implications. On the one hand, typical base-dispersal efforts require costly infrastructure investments at multiple bases throughout the region. These construction projects are not only expensive but lengthy. On the other hand, expenses associated with FARP operations are relatively small since investments are limited to the purchase of additional FAM carts, fuel hoses, modified in-transit crew-rest bunks, and additional training to certify FARP personnel. Although other dispersal and resiliency efforts should continue, fighter FARP—a feasible, proven concept—offers affordable dispersion that can be implemented immediately.

Moreover, fighter FARP is transferrable. This article concentrates on the WPTO, but fighter FARP is applicable to any theater with acceptable landing surfaces. Alaska's geographic position permits LRS/E and FARP missions over the North Pole to reach other areas of responsibility quickly. New fifth- and sixth-generation aircraft should be designed with the flexibility to operate from dispersed locations using a FARP concept. Future technologies and capabilities will amplify the utility of FARP by adding improved sensors, weapons, and integrated networks into joint operating concepts that exploit multiple domains (air, space, cyber, surface, and subsurface).

Known Challenges

The rapid generation and movement of fighter airpower will challenge many of the Air Force's established ways of "doing business." Although initial evaluation of the concept has highlighted some issues, none of them are insurmountable. The first set concerns the sustainment of FARP operations through the continuous use of C-17 aircraft (fig. 6).

Fatigue and limitations of the flight duty period prevent a C-17 from supporting these operations for more than about 24 hours. Sustaining a steady supply of fuel, munitions, personnel, and equipment on these platforms presents a logistical problem that demands creative solutions. The added risk of an aircraft malfunction requiring extensive maintenance at a FARP location poses another set of potential obstacles. For the most part, the solutions are affordable and feasible; moreover, they can be implemented immediately with acceptable levels of risk. The list of challenges and solutions in table 2 is not exhaustive, and further analysis of these and others should continue. In the end, the significance of the strategic and operational benefits greatly outweighs the hindrances.

Figure 6. C-17 loaded for F-22 FARP practice. (Courtesy of TSgt Dana Rosso, USAFR, 477th Fighter Group Public Affairs, JBER, Alaska.)

Table 2. Known challenges and possible solutions for fighter FARP

Known Challenges	*Possible Solutions*

Crew fatigue	• Rotate transport aircraft approximately every 24 hours.
	• Augment transport aircrews.
	• Provide in-transit rest for nontransport crews.
	  • Install bunks on the side of cargo bay (current capability).
	  • Modify "Tortoise"—secure debrief modules (currently possessed by fighter squadrons).
	  • Modify Senior Leader in-Transit Conference Capsule.

Munitions requirements	• Anticipate munitions based on air tasking order. • Position munitions at airfields with munitions-storage capabilities. • Swap transport aircraft more frequently.
High C-17 demand	• Increase the types of FARP transport aircraft (C-130, C-5, etc.). • Lower the demand to move units to MOBs until threat levels decrease. • Establish priorities between supported/supporting commanders.
Fuel requirements	• Coordinate tankers for both fighter and transport AR.
Aircraft malfunctions	• Carry spare parts kit on transport aircraft. • Fly non-mission-capable aircraft if safe to do so. • Leave grounded aircraft and fly remaining platforms (degraded mission with two- or three-ship). • Launch additional transport with parts and personnel to fix aircraft.
Long-term fleet health	• Take advantage of higher-quality low observable maintenance facilities at established stealth fighter bases (Alaska and Hawaii).
Command and control	• Establish a dedicated mission planner with communication link to air and space operations center. • Develop robust lost-communication contingency plans. • Use current BLOS communications on transport aircraft. • Invest in future BLOS communications for fighter aircraft.

Fifth-Generation Doolittle Raid

> *If we should have to fight, we should be prepared to do so from the neck up instead of from the neck down.*
>
> —Gen Jimmy Doolittle

The famous Doolittle Raid during World War II offers a superb example of how an innovative concept can lead to strategic effects. On 18 April 1942, just four months after the Japanese attack on Pearl Harbor, Lt Col Jimmy Doolittle led 16 aircraft and 80 men on a bombing raid over Tokyo. The Japanese believed that the "tyranny of distance" in the Pacific and their defensive capabilities would prevent American forces from reaching the homeland.[29] However, the Doolittle Raid increased the operational reach of airpower by placing B-25 bombers on the US aircraft carrier *Hornet*. Doolittle's unorthodox concept had the support of Lt Gen Henry H. "Hap" Arnold, chief of the Army Air Forces. Launching B-25s off a Navy carrier required special modifications to the bombers and a robust training program for the aircrews.

The raid over Tokyo achieved nearly complete surprise and bolstered US public support for the war enormously. Although the physical destruction was relatively small, the fact that American military power had penetrated the Japanese "A2" perimeter caused devastating psychological damage.[30] Consequently Japan's leaders changed their strategy, leading to ruinous defeat at the Battle of Midway.[31]

The fighter FARP concept has several parallels to the Doolittle Raid. Both deal with the tyranny of distance and the A2 environment in the Western Pacific. Further, like the raid, fighter FARP extends the operational reach of airpower. Most importantly, it too can have a demoralizing effect on an adversary, causing him to question his strategy, and can create both operational and strategic effects that advance US objectives.

Conclusion

Projection of power around the world is an important military capability that contributes to America's national security strategy. China's A2/AD strategy seeks to challenge US force projection in the WPTO and deter American involvement in the event of China's military action against its neighbors. To project and sustain airpower in an A2 environment, the Air Force must overcome the threat to its forward operating locations from enemy ballistic and cruise missiles. The Fighter FARP concept addresses this issue by providing flexible and dispersed sortie generation that does not depend upon the use of MOBs.

Rarely does a single concept address strategic, operational, and tactical operations simultaneously. The generation of fighter FARP sorties provides increased deterrence, rapid stabilization of a crisis, long-range power projection into contested environments to conduct counterair or strike missions, and the production of strategic effects via surprise raids or extended combat operations. By these means, the United States can impose costs on the adversary, offer options to national leaders for the effective projection of airpower in a supposedly denied environment, and do so quickly at relatively low expense and with existing forces. This collection of strategic, operational, and tactical advantages makes the associated risk acceptable. Demonstration and exercise of this capability, regardless of whether or not America actually uses it, greatly complicate the adversary's planning process and cost. Under these circumstances, the Air Force cannot ignore the concept of fighter FARP in the WPTO and should invest in it now. ✪

Notes

1. US Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: Office of the Secretary of Defense, January 2012), 4, http://www.defense.gov/news/defense_strategic_guidance.pdf.

2. Department of the Air Force, *Global Vigilance, Global Reach, Global Power for America: The World's Greatest Air Force—Powered by Airmen, Fueled by Innovation* (Washington, DC:

Department of the Air Force, January 2013), 4–9, http://www.af.mil/Portals/1/images/airpower/GV_GR_GP_300DPI.pdf.

3. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China, 2013* (Washington, DC: Office of the Secretary of Defense, 2013), i, http://www.defense.gov/pubs/2013_china_report_final.pdf.

4. Department of Defense, *Joint Operational Access Concept (JOAC)*, version 1.0 (Washington, DC: Department of Defense, 17 January 2012), 6, http://www.defense.gov/pubs/pdfs/joac_jan%202012_signed.pdf.

5. Ye Zicheng, *Inside China's Grand Strategy: The Perspective from the People's Republic*, ed. and trans. Steven I. Levine and Guoli Liu (Lexington: University Press of Kentucky, 2011), 3. See also John A. Shaud, *Air Force Strategy Study, 2020–2030* (Maxwell AFB, AL: Air University Press, Air Force Research Institute, January 2011), 130, http://www.dtic.mil/dtic/tr/fulltext/u2/a540345.pdf. Although China does not seek a large-scale military conflict with the United States, its leaders expect America to intervene if China acts aggressively in a regional dispute.

6. Andrew F. Krepinevich, *Why AirSea Battle?* (Washington, DC: Center for Strategic and Budgetary Assessments, 2010), 13–24, http://www.csbaonline.org/wp-content/uploads/2010/02/2010.02.19-Why-AirSea-Battle.pdf. See also Department of Defense, *Annual Report to Congress*, 5–11; and Jan van Tol et al., *AirSea Battle: A Point-of-Departure Operational Concept* (Washington, DC: Center for Strategic and Budgetary Assessments, 2010), 18–20, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/.

7. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China, 2012* (Washington, DC: Office of the Secretary of Defense, May 2012), 29, http://www.defense.gov/pubs/pdfs/2012_CMPR_Final.pdf. Furthermore, China has approximately 500 combat aircraft within unrefueled distance of Taiwan and the ability to deploy substantially more (a total of 2,300 combat aircraft), many of which can employ ALCMs. Future capabilities of the People's Liberation Army will include larger numbers of missiles with increased range, advanced stealth fighters such as the J-20 and J-31, and new air defense systems. See Krepinevich, *Why AirSea Battle?*, 32, 35.

8. Van Tol et al., *AirSea Battle*, 23.

9. Ibid., 51.

10. Air Force Instruction (AFI) 23-201, *Fuels Management*, 23 January 2012, 71, http://static.e-publishing.af.mil/production/1/af_a4_7/publication/afi23-201/afi23-201.pdf. For additional Air Force FARP guidance, see AFI 11-235, *Forward Area Refueling Point (FARP) Operations*, 15 December 2000, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-235/afi11-235.pdf.

11. Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 8 November 2010 (as amended through 15 March 2014), 104, http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf. See also Army Techniques Publication 3-04.94 (FM 3-04.104), *Army Techniques Publication for Forward Arming and Refueling Points*, January 2012, 1-1, http://armypubs.army.mil/doctrine/DR_pubs/dr_a/pdf/atp3_04x94.pdf.

12. Donald E. Lewis et al., *A Perspective on the USAFE Collocated Operating Base System*, RAND Note N-2366-AF (Santa Monica, CA: RAND Corporation, July 1986), 3, http://www.rand.org/content/dam/rand/pubs/notes/2007/N2366.pdf.

13. Christopher J. Bowie, "The Lessons of Salty Demo," *Air Force Magazine* 92, no. 3 (March 2009): 54, http://www.airforcemag.com/MagazineArchive/Documents/2009/March%202009/0309salty.pdf.

14. Capt Jeremy R. Lewis, "Performance Evaluation of a Forward Arming and Refueling Point (FARP) Using Discrete Event Simulation," Graduate Research Project AFIT/MLM/ENS/05-08 (Wright-Patterson AFB, OH: Air Force Institute of Technology, 2005), 8–9, http://www.dtic.mil/dtic/tr/fulltext/u2/a442595.pdf.

15. Roger Cliff et al., *Shaking the Heavens and Splitting the Earth: Chinese Air Force Employment Concepts in the 21st Century* (Santa Monica, CA: RAND Corporation, 2011), 239.

16. The fighter FARP concept can be applied to any fighter and transport combination capable of conducting FARP. So far, it has been applied only to F-22s and C-17s at JBER, AK. Application to other transport aircraft and future fighters will increase the concept's utility.

17. Lt Col Robert D. Davis, commander, 525th Fighter Squadron, to commander, 3rd Wing, and commander, 477th Fighter Group, trip report memorandum, 21 December 2012. See also Capt Ashley Conner, "Innovation Advances F-22 as Strategic Force in the Pacific," 477th Fighter Group Public Affairs, 9 October 2013, http://www.477fg.afrc.af.mil/news/story.asp?id=123366570.

18. AFI 11-2F-22A, vol. 3, *F-22A—Operations Procedures*, 8 December 2009, 11, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-2f-22av3/afi11-2f-22av3.pdf. If poor weather is expected, the airfield will also require an approved instrument approach and departure procedure.

19. Additional threats to air operations include enemy surface-to-air-missile systems and air-to-air fighters that might disrupt US attempts to move freely within the JOA.

20. FARP operations can be conducted at MOBs and civilian/military airfields with robust infrastructure, but choosing a location without such infrastructure may lower the risk of a missile attack because of its (perceived) lack of military utility.

21. Duncan S. Lennox, ed., *Jane's Strategic Weapon Systems*, issue 55 (Alexandria, VA: Jane's Information Group, 2011), 24. The DF-15A, the longest-range SRBM, has a range of 486 nm. Other SRBMs include the DF-11 (151 nm), DF-11A (189 nm), and DF-15 (324 nm). China's MRBMs include the DF-21, which has a range between 945 and 1,350 nm, depending upon the variant; the D-3A, with a range of 1,512 nm; and the DF-4, with a range of 2,565 nm (beyond Guam).

22. Ibid., 9. This assumes that GLCMs are launched when the first aircraft lands. China's most capable GLCM, the C-602/H-3, is also known as the DH-10. This cruise missile has a maximum range of 1,620 nm, flies at a speed of Mach 0.9, and can be launched from multiple locations along the Chinese coast.

23. Ibid., 8. See also Noam Eshel, "Chinese Air Force Gets More H-6K Strategic Bombers," *Defense Update*, 25 June 2013, http://defense-update.com/20130625_h-6k-bombers-delivered-to-pla-air-force.html. China probably will use its most capable ALCM, the DH-10, only for high-value targets. The C-602/HN-1 has a maximum range of 323 nm, flies at a speed of Mach 0.8, and can be launched only from the H-6 aircraft. Other operational ALCMs include the YJ-63 (108 nm / Mach 0.7) and the C-803 (135 nm / Mach 1.3–1.5).

24. Lt Col Kevin Sutterfield, FARP OUE test director, 477th Fighter Group, JBER, AK, to the author, e-mail, 27 January 2014. The 3rd Wing and 477th Fighter Group at JBER continue to develop and exercise the fighter FARP concept. F-22 and C-17 units performed the

first operational unit evaluation of the concept in August 2013 during which FARP operations were successfully conducted on a JBER runway with four F-22s and one C-17.

25. Ibid. See also Marc V. Schanz, "The Pacific Abhors a Vacuum," *Air Force Magazine* 97, no. 1 (January 2014): 23, http://www.airforcemag.com/MagazineArchive/Documents/2014/January%202014/0114pacific.pdf; and Schanz, "Rapid Raptors: A New PACAF Concept Gets F-22s to the Fight Fast," *Air Force Magazine* 96, no. 11 (November 2013): 57, http://www.airforcemag.com/MagazineArchive/Documents/2013/November%202013/1113raptors.pdf.

26. Some of the determining factors include maintenance inspection requirements, number of weapons expended and available, crew fatigue, and unforeseen F-22 and/or C-17 maintenance problems.

27. Both of the two F-22 squadrons at JBER, AK, have 21 primary aircraft authorized (PAA). There is also one permanently assigned F-22 squadron at Joint Base Pearl Harbor–Hickam (JBPHH), HI, with 18 PAAs. Three other combat-coded F-22 squadrons, all with 21 PAAs, are assigned to bases in the continental United States (CONUS).

28. For a large military operation in the Pacific area of responsibility, the Air Force may choose to add additional CONUS-based F-22 units to the two F-22 squadrons at JBER and the one F-22 squadron at JBPHH.

29. Winston Groom, *The Aviators: Eddie Rickenbacker, Jimmy Doolittle, Charles Lindbergh, and the Epic Age of Flight* (Washington, DC: National Geographic Society, 2013), 325.

30. Ibid., 324.

31. Ibid., 339.

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