Tools of Change

Tactical C4ISR and Conflicts—Past, Present, and Future

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The United States does not have a single aircraft capable of performing tactical reconnaissance. Understanding this claim as it applies to irregular warfare (IW) requires defining the terms *tactical* and *reconnaissance*. In IW, *tactical* refers to the activities and actions of small units. It applies to tactical reconnaissance units themselves as well as the units they support and the enemy units they are trying to find. Tactical reconnaissance units can also support larger friendly forces and detect larger enemy forces, but their capabilities emphasize the small-unit level. In IW, *reconnaissance* means searching for enemy forces and their trails, campsites, supply routes, border access points, depots, and cross-border training camps. In essence, it means detecting the enemy's presence and gathering relevant data about terrain and weather. In IW, combining these two terms, *tactical reconnaissance*, secures a wide variety of information about the enemy, terrain, and weather for immediate use on the battlefield or for exploitation as an intelligence or surveillance task that would begin right away and generally remain with the tactical personnel covering the assigned area. The level of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) integration between tactical units and those at the operational and theatre levels could expand rap-

idly, depending on the importance and exploitability of initial detection of the enemy. In Afghanistan, ground units detect the enemy first, most of the time. Airpower could contribute much more to the fight if the United States had a dedicated, manned tactical reconnaissance airplane.

The US Air Force is at least somewhat aware of its deficiency in tactical reconnaissance. A careful reading of *The 21st Century Air Force: Irregular Warfare Strategy* shows that the failure to provide a true tactical reconnaissance platform informs much of the document.[1] The "Purpose" section of this white paper speaks of the "Long War" and the need to initiate "new approaches and synchronize Air Force actions" by "fielding appropriate capabilities."[2] In "Strategic Context: The Challenges of 'Irregular Warfare,'" the document notes that the Air Force expects to be part of a "Joint Force" as well as "[work] by, with, and through partner nations . . . to establish a secure environment in which partner nations can flourish—ultimately without direct assistance"; however, it leaves open the means, particularly the aircraft, by which to realize this expectation.[3] The "Indirect Methods" portion of the section "Airpower in the Irregular Warfare Environment" virtually outlines the roles and missions of a manned, tactical-level C4ISR aircraft, and the "Direct Methods" portion of that section identifies mobility and intelligence, surveillance, and reconnaissance (ISR) as often "the most important elements" in counterinsurgency operations.[4] The section "Ends: Organize, Train, and Equip to Win the Long War" implies that we have not yet attained the essential capability to fight IW with our conventional warfare capabilities.[5] Next, "Ways: Five Pillars of Global Shaping" again outlines the need for a tactical-level C4ISR aircraft without specifically identifying it.[6] Further, "Means: Airpower for the 21st Century Irregular Environment" speaks of "'right-sizing' our enabling capabilities—such as ISR, cyber, and command and control—to meet joint requirements across the spectrum of conflict."[7] Finally, the sections "Risk: Failure to Anticipate, Adapt, and Learn" and "Conclusion" speak of adopting "new, relevant operational concepts," "learning from our own . . . experience," and applying "proven airpower principles in new and innovative ways to the environment we fight in today—and will continue to fight in tomorrow."[8] In this document, we probably have never had a more comprehensive outline of the need for an aircraft that the Air Force does not have. No other platform, current or proposed, comes close to addressing such a huge part of the Air Force's own strategy for the future as would a properly designed, dedicated, manned tactical C4ISR aircraft. The service should designate such a dedicated aircraft O/A (observation/attack) but have it function primarily as a C4ISR platform.

Far too many people in the Air Force and government believe in using slightly modified civilian aircraft and converted trainers to perform tactical reconnaissance. Traditionally the service has turned to such aircraft, but these planes are not adequate for this important and dangerous combat role. As discussed below, the history of aircraft used by the Air Force to perform tactical reconnaissance demonstrates a consistent shortfall in capabilities for dealing with the type of enemy forces typically encountered in IW.

A Brief History of Tactical Reconnaissance Aircraft

Today's deficit in tactical reconnaissance aircraft has deep historical roots. The first airplanes used in combat, the observation/spotter aircraft of World War I, accounted for the "O" designation that has stuck with that set of roles and missions ever since.

These planes soon became armed in order to survive, and any such aircraft today must have appropriate, effective armament. *Tactical reconnaissance*, from a German term, emerged in the 1930s to reflect the ability of aircraft to provide a light attack capability and much more information than simply observing and spotting for artillery. There followed an unfortunate split between what eventually became known as command, control, communications, and intelligence (C3I) roles/missions and observation/spotting, as if the two did not significantly overlap. The split, however, often resulted in using *tactical reconnaissance* to refer to any mission that sought out enemy troop movements. The term thus might apply to an O-1 flying at 1,500 feet and calling in an air strike or artillery barrage or to a TR-1 doing high-altitude photo reconnaissance for the regional combat commander. The first of those missions would be truly tactical, but the other would use a theatre-level asset for operational purposes. More recently, a set of tactical missions defined as find, fix, track, target, engage, and assess has emerged. Currently we assume that each of these tasks requires different aircraft. Finally, available technology has so expanded the range of possible roles and missions at all levels of war that a broader abbreviation—C4ISR—has emerged, which links the observation/spotting and C3I roles. Unfortunately, the Air Force has focused on integrating theatre-level assets into a complex C4ISR network, based on the incorrect assumption that they could also perform tactical-level C4ISR tasks. The very serious negative consequences of this misplaced emphasis inform much of this article.

Irregular wars are fought almost exclusively at the tactical level over an extended period of time, often upwards of 10 years. The United States has fought many such wars throughout its history. The military has learned how to fight those wars and has developed tools to do so, but the regular military services have quickly dismissed, discarded, and forgotten those things after each war. In particular, the Air Force has consistently resisted the development of aircraft dedicated to ground attack or true tactical-level reconnaissance. Its opposition to the development, procurement, and retention of the A-10 as a dedicated ground-attack aircraft is legendary.[9] Far less noticed has been the Air Force's reluctance to fund development of a true, dedicated, manned tactical reconnaissance aircraft. The institutional disregard for this capability goes all the way back to World War II.

During that war, Aeronca L-3s and Piper L-4s—unarmed, unarmored, and underpowered conversions of civilian aircraft—performed most American tactical reconnaissance. Enemy forces greatly feared these airplanes because of the destruction they could direct with high precision and effectiveness.[10] Notably, the crews received no stars on their shoulders during or after the war as a reward for their incredible bravery.

In contrast, the Germans designed and developed a dedicated tactical reconnaissance aircraft, the FW-189 Uhu.[11] A twin-engine aircraft with a pilot, navigator / radio operator, and observer/gunner, it offered an excellent field of view, a superb communications suite, more than twice the performance of the L-3 and L-4, ruggedness and maneuverability, and light offensive and defensive weapons. The FW-189 was a key element in German blitzkrieg tactics, proving very effective on the Eastern Front.

After World War II, the United States thoroughly evaluated Axis weapons, especially aircraft, except for the FW-189. Because it could not survive—much less perform tactical reconnaissance—anywhere near the American front lines, it received only a cursory review. In fact, *no* German aircraft—including the FW-190, widely considered one of the best propeller-driven fighters of the war—could survive 10 minutes over our front lines. The United States had suffered over 50,000 casualties to gain such total air dominance. Subsequently, the question of whether the Germans could have effectively used the FW-189 on the Western Front was irrelevant. The relevant question would have asked what American

forces might have accomplished with an equivalent aircraft operating over and behind the German front lines under cover of such air dominance. We will never know definitively, but a couple of speculations might be useful. Would the Battle of the Bulge ever have occurred? Might American units have advanced well across the Rhine by late 1944, even under the diplomatic constraints that limited Gen Dwight Eisenhower's options? Still, the die was cast, and we have paid the price ever since.

In the first months of the Korean War, the shortage of tactical reconnaissance available to United Nations forces made the North Korean assault more rapid and effective than it might have been. After the Inchon landing, the Cessna L-19 saw extensive service but offered little significant improvement over the L-3 and L-4 of World War II, falling far short of the old FW-189. When the Chinese crossed the Yalu River, their troops and supplies traveled primarily on foot. The ill-equipped L-19 completely lacked the performance to track this massive movement. Eventually the Air Force had to employ old T-6 Texan training aircraft, which performed much better than the L-19 and proved more useful for tactical reconnaissance than any of the US or United Nations jet- or propeller-driven fighters. The Air Force's tendency to use modified trainers as combat aircraft thus began in Korea, and the United States has lacked a true tactical reconnaissance capability ever since. A Rand Corporation paper published in 1963 addressed the absence of effective tactical-level reconnaissance, or "A-frame detectors," beyond our front lines in that war, noting that the shortfall appeared to have become institutionalized, with dire prospects for the future.[12]

Despite the proven inadequacy of the L-19, now designated the O-1, it was still the only tactical reconnaissance aircraft initially available in Vietnam.[13] Its shortcomings led to employment of another slightly modified civilian aircraft, the Cessna 337, designated the O-2. Both of these aircraft had major deficiencies. Arguably a better observation/spotter aircraft, the O-1 was grossly underpowered and vulnerable, while the O-2 had a limited view from the cockpit, lacked armor, and carried little weaponry. The O-2 is important, however, because of what it might have led to and because of the Air Force's reaction to it. Cessna listened to critiques by O-1 and O-2 crews and designed the O-2TT to reflect their input.[14] The Air Force reacted so harshly that the O-2T test mule and the O-2TT mockup were dismantled and destroyed, their existence erased from Cessna's corporate memory.[15]

Meanwhile, the Air Force purchased and employed the OV-10 Bronco, which offered a significant improvement in performance, provided the crew a clear view forward and to the side, and carried a variety of weapons but failed to deliver as a consummate tactical reconnaissance aircraft. Designed to be all things to IW, it was master of none. The original design did not include a specific reconnaissance suite, and the rear seat had little instrumentation and none related to the reconnaissance role. Hence, the OV-10 simply became a light attack aircraft fitted with whatever equipment suite the Air Force decided to install. The service eventually fitted some of them with the Pave Nail suite while the Marines employed the Night Observation / Gunship System. Both suites failed to meet expectations because designers inadequately considered the aircraft's sound, visual, and other signature characteristics required for tactical reconnaissance in IW.[16]

Interestingly, the Army was studying one of those signature characteristics, sound reduction, through Lockheed's Q-Star and YO-3A aircraft.[17] According to reports, these highly modified, experimental powered gliders proved strikingly successful at night reconnaissance in Vietnam, but they had no other combat capability.[18] The Air Force did not participate in the YO-3A's development, evidently viewing it as competition for its own programs. Meanwhile, the service continued using modified trainers for combat duty by employing the T-28 in

Lockheed YO-3A. Reproduced by permission from Lockheed Martin Aeronautics Company

Laos and the A-37B (a highly modified T-37) in Vietnam. It later decommissioned the OV-10s, doubting they could continue to perform tactical reconnaissance duties without unacceptable losses. The Air Force then transferred the OV-10s and A-37Bs to various countries such as the Philippines and Thailand, which have used them extensively for counterinsurgency.

The Vietnam War supplied a treasure trove of tactical reconnaissance lessons; however, it is unlikely that any active duty Air Force officer can properly identify either the O-2TT or the YO-3A, or has read about the crews who flew light aircraft over Laos. Loss rates of different types of aircraft in the ground-attack role represent another Vietnam War lesson. An Air Force major wrote a study of aircraft loss rates that heavily favored using jet over propeller-driven aircraft in low-altitude ground attack. The significantly higher loss rates of propeller aircraft compared to those of jets, particularly in the case of the A-37B, are not reflected either in the Light Attack Armed Reconnaissance-Capabilities Request for Information (LAAR-CRFI) program's preference for a turboprop aircraft or in the sibling OA-X program.[19] Requirements that restrict candidates to versions of aircraft already in production limit both programs to current turboprop trainers.[20] The potential of a light, manned combat aircraft powered by small Pratt and Whitney or Williams turbofan engines for performing critical missions such as tactical C4ISR and light attack in both IW and conventional warfare remains unstudied. The Air Force should have learned the tactical reconnaissance lesson from Vietnam that converting civilian aircraft or trainers for combat duty seems acceptable in an office but seldom works well in combat.

Rather than study what might be required to fulfill tactical reconnaissance requirements, the service brought in a number of two-seat OA-10s for the first Gulf War, outfitting the observer with a pair of hand-held binoculars, some night vision goggles, and a slightly better set of radios. Those planes also featured some changes in their weapons payload to reflect tactical reconnaissance demands. The Iraqis learned quickly not to shoot at a passing A-10 lest it attack, thus solving the issue of unacceptable loss. The Air Force does not appear to have seriously studied the positive and negative lessons available from the use of the two-seat A-10s. Instead, those planes proved to be an ad hoc solution.

When the Air Force participated in the initial invasion of Afghanistan in 2001, it brought no tactical reconnaissance capability to supplement theatre-level C4ISR assets. Fortunately, the allied Afghan forces had been battling the Taliban for years and easily made up for that shortfall. The price of having no real tactical-level reconnaissance capability came later during the battle for Tora Bora when the Taliban and al-Qaeda reportedly moved as many as 4,000 men plus 50 to 80 leaders unhindered through an unguarded pass to northeast Pakistan.[21] The failure to detect and stop these movements has greatly contributed to ongoing conflicts in Afghanistan and Pakistan.

The initial stage of the subsequent Iraq War was such an operational and strategic success that no one paid much attention to alarmed American unit commanders who reported that large numbers of Iraqi soldiers were leaving the battle areas still carrying their weapons. Nor did anyone pay attention to Saddam Hussein's claim that irregular units would carry on the fight long after the conventional war ended. The failure to understand and prepare for the possibilities of IW would cost us far more casualties

than all the battles leading up to the collapse of Saddam's regime. Like their predecessors, the leaders of the Air Force—the service least prepared for this eventuality—turned to converted civilian aircraft such as the Hawker Beech King Air and the Cessna 208 to provide critical tactical reconnaissance in lieu of military aircraft specifically designed for IW missions.

Today, with the need for equipment more suitable to IW in Afghanistan having become undeniable, the Army and Marines are already receiving a second generation of weapons and vehicles designed to meet these requirements. The Air Force has done nothing other than install various ISR suites in various civilian aircraft, issue a CRFI for a LAAR aircraft, initiate an OA-X program, and use more remotely piloted aircraft (RPA). Once again, the leading LAAR/OA-X candidates are converted trainers, including the modified Brazilian Super Tucano A-29 under the Navy's "Imminent Fury" program and the AT-6B, a Swiss Pilatus PC-9 built under license by Hawker Beech as the T-6 "Texan II" and highly modified to compete with the Super Tucano. The Air Force was so uninterested in the inadequacies of the OV-10 that it did not keep even one plane it could modify to investigate ISR suites such as the one that has gone into the AT-6B prototype. Provision of even a baseline capability using the OV-10 would quickly have shown the total inappropriateness of the conventional configurations of the two trainers for armed reconnaissance. That inappropriateness has apparently become evident insofar as the original "OA" designation has been shortened to "A," and the "O" designation has been dropped altogether for both the A-29 and the AT-6B.[22] This highlights the primacy of attack in the eyes of the Air Force and its continuing disinterest in true tactical-level reconnaissance. However, noise and visibility signatures of conventional turboprop aircraft in IW and their radar signature in conventional warfare make their employment, even in light attack, extremely suboptimal.

Implications for Today

The Air Force has been so indifferent to tactical reconnaissance for so long that it can no longer even properly define the roles and missions.[23] The rapid development of technology has allowed tactical reconnaissance to take on the full range of C4ISR missions. Nevertheless, the modern Air Force, deeply committed to RPA development, has no real understanding of the necessity of a manned aircraft, no idea of the potential man/system synergies, no grasp of the required performance and critical aircraft signature parameters in IW, no analysis of a proper onboard weapons fit, and no study of how such an aircraft could fit into the overall C4ISR network. Nor does it have an awareness of the importance of a properly designed tactical C4ISR aircraft for the future effectiveness of its fifth- and upgraded fourth-generation aircraft at all levels of conflict intensity short of nuclear war. As an institution, the Air Force has shown little serious interest in the political and budgetary issues of long-term American involvement in foreign nations' unconventional wars, let alone the demands of a viable exit strategy in terms of equipping and training a developing nation's military—all of this despite some very good studies of many of these issues by Air Force personnel.[24] Ironically, the service has so distanced itself from the realities and demands of IW that it has no awareness—much less understanding—of the critical role that airpower must play in IW.

American and German experiences with tactical reconnaissance in World War II showed that it plays an important part in conventional warfare. But in IW, tactical reconnaissance—particularly the aerial variety—is the sine qua non of successful suppression and defeat of irregular forces. The key piece this capability rests upon a manned tactical reconnaissance aircraft that is dedicated, properly designed and equipped, and capable of carrying out the full C4ISR spectrum of tasks at the tactical level while providing full linkage to any available C4ISR

net elements at the theatre level. This conceptual, advanced tactical C4ISR aircraft would be the modern American equivalent of the FW-189 mentioned earlier, although comparing the two would be like equating an F-22 and a P-51.

If irregular forces could effectively apply sufficient firepower against conventional forces of the sitting government, they would already be in power. The fact that they do not possess such firepower dictates the surreptitious movements of small units. These insurgent groups are difficult to detect when they disperse or move from one area to another. History shows that insurgent units are usually so small that they evade detection until they gather to attack. Despite all the advances in technology, finding these small units continues to rely on simple visual observation; everything else just supplements the latter, however useful the technology. In view of these realities, a true tactical-level C4ISR aircraft could offer initial detection, identification of a hostile force, eyes-on direction of a strike, confirmation of strike results, mobility, payload capacity and flexibility (both weapons and systems suites), options for viewing angle and viewing range, and a wide variety of communications capabilities.

Studies, articles, and exercises support these claims. A study that included Air National Guard responsibilities (the Air Force has traditionally given the Guard responsibility for "O" class aircraft) practically begged for a new forward air controller aircraft that offered more of these capabilities.[25] The October 1985 edition of *Air Force Magazine* included an interview with Lt Col Thomas A. Lanum, chief of the Ground Attack Division in Fighter Requirements at Headquarters Tactical Air Command, who said that "Tactical Air Forces have 235 forward air control aircraft. . . . We are working hard to get more and better ones."[26] A year later, the command decided that the program was too low a priority and cancelled it. Exercises at Fort Irwin, California, have consistently shown that an "O" class manned aircraft is absolutely necessary to carry out what used to be called "maneuver" warfare due to limitations that surface conditions impose upon ground reconnaissance units.[27] Because the constraints on surface tactical-reconnaissance units are the same in IW, the mandatory need for an aircraft designed to carry out tactical reconnaissance separately or in coordination with ground units, any available attack assets, or a C4ISR net thus remains unmet.

The Inadequacy of Modified Civilian Aircraft, Trainers, RPAs, and Theatre-Level ISR Aircraft for Tactical Reconnaissance

The implications discussed above highlight the need for a manned aircraft specifically designed for tactical reconnaissance. Slightly modified civilian aircraft or trainers are too detectable by enemy forces and vulnerable to enemy defenses.[28] Consequently, they must operate at such high altitudes that they offer little functional advantage over the theatre-level aircraft comprising the C4ISR net. However, modified civilian aircraft or trainers do have two distinct advantages: (1) their considerable cost savings over manned and remotely piloted military combat aircraft, and (2) the paucity of security and export barriers to transferring them to a developing country.

The latest favored trend, RPAs, is even less effective at C4ISR offensive operations against irregular forces.[29] Currently (and far into the future if we do not develop a manned tactical C4ISR aircraft) RPAs continue to rely on vulnerable, relatively immobile ground units for initial detection of irregular forces. Plagued by the "soda straw" phenomenon (the very narrow angle of view at mid-to-high powers of magnification), limitations in situational awareness, relative slowness to engage targets, and complete dependence on a very extended communications network, RPAs are far more expensive as a system than any comparable manned aircraft. Furthermore, they

experience higher loss rates and require a phenomenal number of skilled personnel to carry out a single surveillance mission.[30] Basically, RPAs are remotely piloted strike platforms. In terms of the C4ISR mission, they excel only at surveillance, yet their employment in any C4ISR role may now have become counterproductive.

The Air Force's dependence on RPAs raises four main concerns. Ignoring them would amount to turning a blind eye to the shortcomings and vulnerabilities of a purely technological solution. First, Boeing has had a contract to provide RPA surveillance along the US-Mexico border for years but cannot make it operationally effective. This relatively simple program involves a static, linear, thoroughly mapped, uncontested area backed up by a stationary video surveillance system and a barrier fence system.[31] Due to ineffectiveness and high cost, program funds are now frozen, except for work along the Arizona border.[32] Second, the National Aeronautics and Space Administration has discovered a number of counterfeit computer chips in its satellites and space probes.[33] Since its systems checks are far more extensive and focused on far fewer pieces of equipment than the military's, one wonders how many weapons, communications suites, and other electronics-based systems such as RPAs contain counterfeit chips. Furthermore, might such chips compromise these devices? Third, hackers have deeply penetrated both the Pentagon and Congress, transferring a great deal of very sensitive information to mainland China, thus illustrating that our entire C4ISR net is vulnerable and subject to compromise.[34] The idea that new encryption will solve the myriad problems involved in such a deep penetration is illusory. Any aircraft or systems suite not capable of completely autonomous operations is unacceptably vulnerable.[35] Finally, any real-time RPA operation must use continuous communications and video feeds. We now know that the Taliban and al-Qaeda have been downloading RPA video feeds for some time.[36] Although their ability to download RPA video may be embarrassing, the greater problem is that irregular forces can now *detect* RPA feeds. It takes only a couple of relatively simple portable signal receivers to alert the enemy that an RPA is searching for them and to reveal both the aircraft's position and the nature of its scanning system. Small units don't need to download encrypted videos to know when to disappear by dispersing or hiding.

Despite the importance of these four concerns, another equally important fact pertains to RPA use in tactical C4ISR roles. After American forces leave, the allied government's military must continue to operate some sort of effective tactical C4ISR capability independently of US systems and support. There is little chance that the United States would ever give a developing nation a fully operational, highly advanced RPA squadron along with its codes and satellite access. There is even less chance that such a nation could operate it effectively at the tactical or even operational level, maintain the squadron over an extended period with any degree of effectiveness, afford it financially, or fully staff the unit with highly trained personnel. Furthermore, there is no chance at all that the access and control codes or operational manuals would remain secure for even a month.

By only lightly touching on the inadequacies of RPAs in tactical C4ISR, this article highlights the fact that the Air Force is so committed to RPAs for every role and mission that not even their demonstrated vulnerabilities can break the service's "target fixation." Thus, with every passing month the Air Force has less and less relevance to the real-time, real-life needs of developing nations now engaged in IW all over the world.

Aircraft used for theatre-level ISR are no better suited to tactical reconnaissance than modified civilian aircraft, trainers, or RPAs. A desire to make up for the shortfall in tactical reconnaissance motivated a request to upgrade the E-8Cs operating over Afghanistan so they could detect small units moving on the ground. This proposal has now grown to include Boeing's modernizing the Air Force's airborne ground-surveillance

fleet with a P-8A-based design, or Northrop Grumman's significantly upgrading the E-8C fleet to enable these very large, scarce, and expensive aircraft to perform tactical-level reconnaissance searches for small, irregular units.[37] Unfortunately, these searches would be effective only when the irregular units move. The fact that a serious proposal exists for using a theatre-level 707- or 737-class aircraft for tactical reconnaissance reveals the complete indifference of Air Force culture to developing an effective manned tactical-reconnaissance aircraft. It also demonstrates how little the current Air Force leadership understands about tactical reconnaissance in IW. The service's entire approach is so far removed from the realities and demands of IW that it utterly negates the *21st Century Air Force: Irregular Warfare Strategy* mentioned previously.

In sum, not even the United States can afford to operate such a huge panoply of ISR assets that are only marginally effective, at best, in this kind of war. Nor can we afford to waste more time.

Characteristics of the Light Tactical C4ISR Aircraft That We Need

The C4ISR aircraft's three categories of detectable signatures are critical to its effectiveness. First, inherent signatures include sound generation, visibility (ease of seeing the aircraft), and infrared (IR) generation. The Air Force has paid no attention at all to sound generation, minimal attention to ease of visual acquisition (i.e., passive or active camouflage), and considerable attention to IR signatures. Second, externally generated signatures primarily involve the radar return from an aircraft to enemy receivers. In this area, the United States leads in stealth technology and jamming. Third, though not inherent to the operation of the aircraft, self-generated signatures entail the optional employment of its equipment such as onboard radar, communications gear, and lasers. The Air Force has worked very hard to reduce the signature of its aircraft radars but has been shocked at its communications suites' (including its video feeds') vulnerability to detection and has seldom even thought about the detectability of its lasers.

These signature categories affect the design characteristics of the aircraft and the effectiveness of its systems in both IW scenarios and conventional warfare. In the IW arena, radar signatures are unimportant. Irregular units cannot carry "mobile" radars with them and would not dare use them even if they had them because doing so would reveal their position. The Air Force needs to put personnel who write tactical C4ISR requirements not only into real tactical reconnaissance aircraft in actual combat but also with ground units so they can learn which aircraft signatures really matter to a terrorist or guerilla. Those personnel would immediately discover that sound is the primary signature recognized by people on the ground, whether encamped or moving across terrain. That signature becomes critical when a tactical reconnaissance aircraft is searching for encamped enemies who have hidden antiaircraft weapons (they therefore have a limited view and field of fire but can set up an ambush, based on the approaching sound). The Army has certainly become aware of this fact since its helicopters have come under increasingly effective fire.[38] However, we can passively ameliorate the sound generation of a purpose-designed tactical C4ISR aircraft to a very useful degree. Employment of active counternoise technologies could further reduce the sound signature to a level that would critically threaten irregular units. We need a platform that possesses such characteristics and permits such applications.

Susceptibility of an aircraft to visual detection from the ground represents the next most important signature in IW. We see images by contrast, movement, color variation, and shape. Movement and shape are inherent to an aircraft and afford minimal potential for reduction, but we can do a great deal to affect contrast and color variation. Several options are available, ranging

from the simple and direct to the technologically advanced. The preferred option for now is a simple and inexpensive system involving underside illumination by directed, variable-color lighting from light-emitting diodes. A tactical C4ISR aircraft featuring reduced sound generation and low visibility poses serious threats to irregular forces that are tied to the inherent characteristics of those forces, making them very difficult to counteract.

The third most important signature, IR, mostly associated with engine exhausts, is not in itself a critical element in IW. Irregular forces have no IR search-and-track system to alert them to an otherwise undetected aircraft, but because we have made little effort to suppress the sound and visual signatures of our aircraft, their IR signatures have become a serious concern. Some irregular units already carry SA-14 and SA-18 man-portable air defense systems and may soon obtain an even later model, the SA-24. When sound alerts foot-mobile irregular units to an approaching aircraft, followed by visual acquisition, they generally have sufficient time to employ these IR missiles quite effectively.

In conventional conflicts, the reverse is true. The war zone contains a wide range of ground-based and airborne radars as well as numerous IR search-and-track systems, all directing a deadly variety of antiaircraft missiles and guns. Aircraft must have radically reduced radar and IR signatures if they wish to survive more than a couple of missions.

Interestingly, the seemingly disparate requirements for effectiveness and survivability in IW and conventional conflicts actually overlap significantly. Design characteristics that reduce sound and IR signatures in the IW arena can also diminish radar signatures. Additionally, the general configuration of stealth aircraft lends itself to enhancing a tactical C4ISR aircraft's crew performance. It also provides a clean underside that simplifies illumination efforts to reduce visual acquisition. Additionally, reduction of IR signatures is useful, regardless of conflict intensity.

The Air Force needs to take a serious, committed approach to the design requirements of tactical reconnaissance aircraft, hold the program to the most elegant approach (i.e., the simplest design that offers the largest margin of mission performance above the minimum requirements), avoid compromising the aircraft design by adding unrelated missions (armed tactical reconnaissance and the light attack capability inherent to any such design, as well as advanced training for such roles and missions, are quite enough), and, finally, prohibit the "gold plating" that major aircraft corporations agree to because they cannot afford to jeopardize their other bids and contracts with the government. (That type of acquiescence has distorted or killed many promising projects whose basic mission requirements now go unmet, or are met at too high a cost to acquire the numbers of aircraft needed.)[39]

Another important issue has contributed to the Air Force's reluctance to develop an aircraft capable of performing tactical reconnaissance: the apparent need for more than one type of platform to carry out the full range of such missions in low-, mid-, and high-intensity combat, particularly after the advent of powerful mobile radars. The author conducted a study in 1987–88 (as an outside contractor to the Air Force) that defined requirements for an "Advanced Manned Aerial Scout" based on input from aviators who had actually flown such missions in combat, as well as input from Army, Marine, and Air National Guard personnel involved in forward air controller exercises and tests.[40] Moreover, Eidetics International conducted an engineering feasibility study, demonstrating that a single aircraft meeting all requirements was well within then-current technology.[41]

Today's challenge regarding an evolved design lies in the cost of meeting the Air Force's stealth requirements while also designing for IW conflicts. As noted previously, a number of features meet the demands of

both IW and conventional conflict. One requirement, the Air Force's demand for a very low radar signature, triggers a need for two variations of the same airframe. Cost and technology-security issues concerning the very sophisticated surface treatments that meet this specification make any export or transfer of such an aircraft very unlikely for all but our major allies. Still, production of an airframe in two versions, the sole difference being the surface treatment (the composition of the aircraft's exterior skin and canopy), may have a practical solution.

Domestic and foreign markets for such an aircraft are much larger than most studies have indicated since the latter are blinkered by policy constraints. The *VISTA 1999* study estimated a total global market of 800 airframes, but with the worldwide proliferation of IW, a much larger projected production run now seems reasonable.[42] The need for versions with and without such advanced surfaces might justify two production lines, one in the high-tech factory of a major defense contractor and the other operated by an innovative manufacturer of light aircraft. This solution also would allow for the different weapons and systems suites dictated by American and foreign demands. The potential markets should make such an aircraft program very cost-effective and fully justified even though it would add a new aircraft and engine(s) to the inventory. However, when one considers the number of modified trainers and civilian aircraft that these platforms would replace, the total inventory might actually see a reduction, as might the manpower requirements. The fact that the aircraft would be designed in America, built by American workers, and fitted with American weapons and systems suites might also represent a significant consideration.

Doctrinal and Personnel Implications of a C4ISR Plane

The Air Force would need to consider the doctrinal and personnel implications of any new aircraft it introduced. The use of modified civilian aircraft and converted trainers has imposed significant limits on C4ISR operational doctrine as it applies to manned aircraft. Because its capabilities affect virtually the entire current range of American military aircraft programs, a properly designed, highly capable, tactical C4ISR aircraft would necessitate rewriting the Air Force's IW doctrine. ISR shortfalls have forced the Air Force to use scarce E-8Cs for explicitly tactical-level reconnaissance, to have concerns about extending the service life of its F-15Es equipped with Sniper pods due to their heavy use in Iraq and Afghanistan, and to consider a whole range of transport aircraft modifications (including AC- and MC-130 variations, as well as, perhaps, C-27 variants) to provide fire support to ground units. After considering all of these issues, one begins to grasp the scope of doctrinal revisions that a true tactical C4ISR aircraft would allow and require.[43]

Operational doctrine for tactical reconnaissance itself must undergo a radical rewrite. Changing the current doctrinal floor of 1,500 feet (or 15,000 feet for the OA-X) for tactical operations to leaving the altitude flown and the decision to engage small units up to the crew members, based on their tactical judgment, reflects the extreme nature of the revision. However, every service's doctrines will need a significant rewrite as they apply to and are affected by a true tactical C4ISR capability. When one considers the level of authority that a single tactical C4ISR aircraft crew might have in implementing the intent of the operational commander in combat, the extent of change begins to boggle the mind. To paraphrase Napoleon, the aircrew truly would be carrying a "marshal's baton" in its kit.

Finally, with regard to career paths, pilots with "O" class flight time in their logbooks have traditionally had slim chances of promotion beyond the rank of colonel. The Air Force seems to think that such pilots must have regressed in some way since they fly the equivalent of basic or, at best, midlevel trainers. The service's promotion

selection boards do not seem to value the fact that such missions are critical and that trainers and civilian aircraft are the only ones available to perform them.

The unique domain of tactical C4ISR aircraft has been called the "Indian territories," a historical allusion to the great expanses of the American "Old West" and, by inference, the scouts that made the US cavalry effective and ultimately victorious. In today's conventional warfare, the term refers to the ever-increasing space required between highly mobile and lethal major opposing forces prior to engagement. In IW it refers to all the territory not under direct control of friendly forces. In either case, the Indian territories are hardly empty or neutral; primarily they make up the domain of tactical reconnaissance on both sides. A properly designed, manned tactical C4ISR aircraft would be the top predator in these territories.

People who think of piloting an F-15, F-16, F-22, or F-35 as the ultimate in combat flying should consider the fact that in IW the crew of a tactical reconnaissance aircraft is likely to find itself more often engaged in different combat scenarios than any fighter or attack aircraft awaiting target assignments. If the United States ever again joins in a major conventional war, the tactical C4ISR aircraft will likely produce more aces than any fighter, other than the F-22, simply by virtue of opportunity. A properly designed tactical C4ISR aircraft is a true predator—a very high-performance aircraft within its domain and a very difficult opponent for fighters.

As an institution, the Air Force should also consider the fact that the crew of a true tactical C4ISR aircraft (the tactical reconnaissance platform properly fitted out with C4 equipment and an ISR suite) would often become the on-scene commander when involved in an engagement. The range of knowledge required, and the experience gained, might better prepare an officer to be chief of staff than would any other career in the military.

Conclusion

The twenty-first-century Air Force has options to quickly meet most of the Long War's demands with an effective and affordable light tactical C4ISR aircraft. It merely has to find a place in its culture to allow adoption of the innovative thinking that the service itself has sponsored. It could then follow up by rapidly implementing an innovative development and production program, perhaps by a small company consortium with combat experience in the IW arena and world-class design capabilities, rather than trying to persuade a big corporation to step out of its preferred pattern of corporate evaluation, bidding, and development. By doing so, the Air Force would avoid the normal minimum of three years to fly a prototype, an additional three years for initial deployment, at least a tripling of program costs, and delivery of a product too late to have any effect in Afghanistan.

We need a modern American analogue to the World War II–era FW-189. The Rutan 151 ARES—of the same weight, size, and thrust-to-weight class as the conceptual model of a modern tactical C4ISR aircraft—met all of the performance parameters required for the roles and missions over 20 years ago.[44] In particular, the ARES, powered by a JT-15D turbofan, meets the endurance and range standards on internal fuel alone. A dedicated tactical C4ISR design that meets all roles and missions demands as well as modern stealth requirements can be developed

Rutan 151 ARES. Reproduced by permission from Scaled Composites

relatively easily with demonstrated technical and engineering capabilities. We could quickly introduce an aircraft that would radically improve our ability to fight modern wars, particularly irregular ones. If the Air Force wants to implement its strategy for the twenty-first century, it has no other tactically effective or cost-effective option available today. We should have acquired such an aircraft 20 years ago, and we desperately need one now. ✪

Notes

1. *The 21st Century Air Force: Irregular Warfare Strategy*, Irregular Warfare White Paper (Washington, DC: Headquarters US Air Force, January 2009), https://www.nshq.nato.int/NSTEP/GetFile/?File_ID = 108&Rank = 0.

2. Ibid., 3.

3. Ibid., 4, 5.

4. Ibid., 5, 6.

5. Ibid., 6, 7.

6. Ibid., 7–9, especially the "Find, Fix, Finish, or Isolate Insurgents and Terrorists" portion.

7. Ibid., 9.

8. Ibid., 11.

9. Robert Coram, *Boyd: The Fighter Pilot Who Changed the Art of War* (Boston: Little, Brown, 2002), 232–37.

10. "Perhaps the greatest praise for their service came from a German prisoner of war: 'When the Cub flies over, all things cease. All we move are our eyeballs.'" Jan Bos, "The Flying Eyes of the Artillery," *WWII Quarterly: Journal of the Second World War* 2, no. 1 (Fall 2010): 97.

11. Leonard Bridgman, ed., *Jane's All the World's Aircraft, 1942* (New York: Macmillan, 1943), 79c–80c.

12. A-frames are the simplest type of shelter or storage structure, denoting the level of tactical reconnaissance required to detect not only the almost exclusively foot-mobile Chinese army of that time but also the type of reconnaissance necessary in virtually all variations of irregular warfare. Amrom H. Katz, *Some Ramblings and Musings on Tactical Reconnaissance* (Santa Monica, CA: Rand Corporation, 1963), http://www.rand.org/content/dam/rand/pubs/papers/2008/P2722.pdf.

13. Leonard Bridgman, ed., *Jane's All the World's Aircraft, 1956–57* (London: Jane's All the World's Aircraft Publishing Co., 1956), 248. Cessna developed the OE-2 for the Marine Corps. It had a more powerful engine and better performance as well as light armor, self-sealing fuel tanks, and specialized communications gear. Further, the OE-2 could carry either a 250-pound bomb or three rockets on each wing. The Air Force never purchased or used this aircraft.

14. John W. R. Taylor, ed., *Jane's All the World's Aircraft, 1969–70* (New York: McGraw-Hill Book Co., 1969), 304.

15. Cessna public relations executive, interview by the author, 1987. According to this executive, Cessna had never built such an aircraft. He could find no reference to it in the company's library or official history.

16. The number produced of either version never went beyond a test sample. The services retained neither the Pave Nail nor the Night Observation / Gunship System version nor made any attempt to upgrade the initial versions of these two suites for the OV-10.

17. John W. R. Taylor, ed., *Jane's All the World's Aircraft, 1971–72* (London: Sampson Low, 1971), 341–42.

18. See "Lockheed YO-3A Quiet Star," Western Museum of Flight, accessed 10 December 2010, http://www.wmof.com/yo-3a.htm; and *Wikipedia: The Free Encyclopedia*, s.v. "Lockheed YO-3," http://en.wikipedia.org/wiki/Lockheed_YO-3.

19. Maj Steven J. Tittel, "Cost, Capability, and the Hunt for a Lightweight Ground Attack Aircraft" (thesis, US Army Command and General Staff College, 2009), http://www.dtic.mil/cgi-bin/GetTRDoc?Location = U2&doc = GetTRDoc.pdf&AD = ADA510947. Major Tittel did not differentiate the A-37B from the other jet fighters, an unfortunate omission because the former flew missions far more similar to those flown by the A-1, OV-10, O-1, and O-2 than any other jet but had an astoundingly low loss rate. This fact should have generated much more interest. See also Fred George, "Low-Cost CAS COIN Candidate," *Aviation Week and Space Technology* 172, no. 28 (26 July 2010): 59–62.

20. "The USAF . . . wants its OA-X aircraft to cost no more than $10 million per airframe, to have an hourly operating cost of under $1,000, and to be built around a proven airframe, engine, and avionics with a demonstrable track record of service. The USAF is not specifying a powerplant for OA-X but circumstances seem to rule out anything except a small turboprop engine such as the 1,600 shp [shaft

horsepower] Pratt & Whitney PT6A-68 that powers both the Texan II and Super Tucano." Robert F. Dorr, "Special Report: Light Attack Comeback," *Combat Aircraft* 11, no. 4 (April 2010): 24–25.

21. Philip Smucker, "How bin Laden Got Away," *Christian Science Monitor* 94, no. 68 (4 March 2002): 1, 12, http://www.csmonitor.com/2002/0304/p01s03-wosc.html.

22. George, "CAS COIN Candidate," 57–62.

23. Two examples illustrate this indifference. According to Christopher Robbins, "Greg Wilson asked for a fighter assignment on his return. He was told over the phone by the officer in charge of military personnel control, 'We're trying to purge the Vietnam FAC [forward air controller] experience from the fighter corps because we have moved into an era of air combat where the low-threat, low-speed, close air support you did in Southeast Asia is no longer valid. And we don't want these habits or these memories in our fighter force.'" Christopher Robbins, *The Ravens* (New York: Crown Publishers, 1987), 339. As Marshall Harrison notes, "I was steadily learning my trade. I knew how many villagers should be in the rice fields surrounding each village. Too many might mean they had visitors. Too few could mean a VC [Vietcong] recruitment campaign was under way and the villagers decided to stay home until it was over. New footbridges had to be analyzed to determine what sort of traffic was using them, for the farmers seldom strayed away from their local village. A comparative surveillance of the bridges and trails would almost always show the amount of foot traffic in the area. It was impossible to hide movement in the wet season since tracks would show in the mud and elephant grass. I was starting to feel like something out of James Fenimore Cooper." Marshall Harrison, *A Lonely Kind of War* (Novato, CA: Presidio Press, 1989), 125. Compare this to what passes for tactical reconnaissance in the Afghan war, where an RPA flies at 15,000 feet or an E-8C flies at 25,000–30,000 feet.

24. See, for example, Maj William Brian Downs, "Unconventional Airpower," *Air and Space Power Journal* 19, no. 1 (Spring 2005): 20–25, http://www.airpower.au.af.mil/airchronicles/apj/apj05/spr05/spr05.pdf; Capt Vance C. Bateman, "Tactical Air Power in Low-Intensity Conflict," *Airpower Journal* 5, no. 1 (Spring 1991): 72–80, http://www.airpower.au.af.mil/airchronicles/apj/apj91/spr91/6spr91.htm; Col John D. Jogerst, "Preparing for Irregular Warfare: The Future Ain't What It Used to Be," *Air and Space Power Journal* 23, no. 4 (Winter 2009): 68–79, http://www.airpower.au.af.mil/airchronicles/apj/apj09/win09/win09.pdf; and Maj Richard D. Newton, "A US Air Force Role in Counterinsurgency Support," *Airpower Journal* 3, no. 3 (Fall 1989): 62–72, http://www.airpower.au.af.mil/airchronicles/apj/apj89/fal89/newton.html.

25. US National Guard Bureau, *VISTA 1999: A Long Look at the Future of the Army and Air National Guard* (Washington, DC: National Guard Bureau, 8 March 1982). (Pentagon Library, call no. UA42. A584). See the "Forward Air Controllers" section.

26. James P. Coyne, "Coordinating the Air-Ground Battle," *Air Force Magazine* 68, no. 10 (October 1985): 57, http://www.airforce-magazine.com/MagazineArchive/Documents/1985/October%201985/1085air-ground.pdf.

27. US National Guard Bureau, *VISTA 1999*; and US Army personnel, Fort Irwin, CA, interview by the author, 1987.

28. Captain Higgins, Headquarters Tactical Air Command, DFRG, interview by the author, October 1987. The command also dropped the program because of the vulnerability of any existing aircraft (e.g., conversion of a civilian airplane) trying to perform the forward air controller mission.

29. The latest RPA system, "Gorgon Stare," failed to meet numerous test criteria yet may still see deployment, a possibility that demonstrates the desperate shortfall in tactical level reconnaissance. See "Drone Spy System Fails Tests, Draft Report Says," *Los Angeles Times*, 25 January 2011, A9.

30. "Of the 195 Predators it has purchased, the Pentagon says 55 have been lost in Class A mishaps, meaning damage costing more than $1 million." Amy Butler, "Grim Reaper Rate," *Aviation Week and Space Technology* 170, no. 18 (4 May 2009): 24–26. See also Sandra Erwin, "Air Force Chief: We Will Double the Size of the UAV Fleet," *National Defense*, 6 October 2010, accessed 3 December 2010, http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?List=7c996cd7%2Dcbb4%2D4018%2Dbaf8%2D8825eada7aa2&ID=213. The article notes that the RPAs are "so labor intensive that each 'orbit' of aircraft requires 120 personnel per 24-hour shift."

31. "Even a relatively benign ISR curtain may not prove practical. 'Since the U. S. is unable to provide a "curtain" along our own southern border—even with fences to help—flying a few dozen or even a few hundred [RPAs] over foreign ground is unlikely to do better,' says David Rockwell, [an RPA] expert with the Teal Group, a Washington consultancy." John M. Doyle, "Boundary Issues," *Aviation Week and Space Technology* 169, no. 18 (10 November 2008): 57–58.

32. "Border Project," *Los Angeles Times*, 22 October 2010, A1, A20.

33. Jeff Bliss, "NASA Discovers More Counterfeit Spacecraft Parts (Update 2)," Bloomberg, 5 March

2009, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=akUwVbu507m4.

34. Julian E. Barnes, "Pentagon Computer Networks Attacked," *Los Angeles Times*, 28 November 2008, A-1, A-30.

35. David A. Fulghum, "Digital Goes Viral," *Aviation Week and Space Technology* 171, no. 17 (9 November 2009): 74–76.

36. Siobhan Gorman, Yochi J. Dreazen, and August Cole, "Insurgents Hack U.S. Drones," *Wall Street Journal*, 17 December 2009, A1, A21.

37. Amy Butler, "Intelligence Choices," *Aviation Week and Space Technology* 172, no. 34 (13 September 2010): 44–48.

38. The same was true in Vietnam, as related by Major Harrison when he was shot down in an OV-10: "They'd probably been tracking my engine noise throughout the turn after I made the first pass, and they were lined up and ready. . . . I hadn't realized how loud the Bronco engines were." Harrison, *Lonely Kind of War*, 244.

39. For such projects, see, for example, Bettina H. Chavanne, "Humpty Dumpty," *Aviation Week and Space Technology* 170, no. 18 (4 May 2009): 28. The floundering Armed Reconnaissance Program is an attempt to replace the Army's gold-standard, gold-plated, and cancelled RAH-66 Comanche program with a helicopter that is not capable of meeting the ever-increasing requirements despite its skyrocketing costs. Robert Dorr writes, "It may prove difficult to develop a small, simple warplane that can fulfill a burgeoning roster of needs on the USAF's shopping list . . . some observers believe the list of requirements may defeat the purpose of seeking the lightweight qualities a Texan II or Tucano could offer, to say nothing of the flexibility and agility needed over the battlefield." Dorr, "Special Report," 24.

40. Thomas J. Rath, Robert Parker, and James R. Stevens, "A Study Identifying the Requirements for, and the Feasibility of, an Advanced Manned Aerial Scout," contract no. F33657-87-C-2161 (Wright-Patterson AFB, OH: Aeronautical Systems Division, USAF/AFSC, March 1988).

41. "A Study to Determine the Feasibility of an Advanced Manned Aerial Scout Airplane" (engineering study conducted by Eidetics International and attached to Rath, Parker, and Stevens, "Study Identifying").

42. US National Guard Bureau, *VISTA 1999*.

43. Marcus Weisgerber, "The Light Attack Aircraft," *Air Force Magazine* 93, no. 1 (January 2010): 56–58, http://www.airforce-magazine.com/MagazineArchive/Documents/2010/January%202010/0110aircraft.pdf.

44. Scaled Composites, http://www.scaled.com. Two releases detailing the history, design approach, dimensions, and weights as well as tested performance are available upon request.

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Mr. Rath (BA, University of California–Berkeley) flew support missions to Guantanamo during the Cuban missile crisis and United Nations support missions during the rebellion in the Congo as a Navy officer and pilot. He earned his degree from the University of California during the Free Speech Movement. He then flew missions in South Vietnam, Laos, and Cambodia for six and one-half years as a pilot with Air America. After observing the lack of progress in tactical reconnaissance, he wrote an extensive study and analysis of tactical reconnaissance requirements under a US Air Force contract. Mr. Rath is now a retired planner and has kept contact with the tactical reconnaissance community since writing the study.