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Benjamin S. Lambeth¹

Air superiority operations took place throughout the entire six weeks of the 1991 Persian Gulf war. Allied control of the air over Iraq was achieved, however, for all practical purposes during the earliest hours--and even minutes--of combat. This article considers the main characteristics of the multinational coalition's campaign for air superiority; the campaign's effect on the subsequent course and outcome of the war; aspects of the campaign that were unique to the Gulf; aspects that may be generalizable to future wars; and the question of whether the prompt achievement of air superiority--and the air war more generally--heralded the arrival of a new "military-technological revolution."

I

During the final countdown, many allied fighters slated to fly in the initial attack waves were placed on ground alert. The declared reason was to insure against an Iraqi preemptive attack against Saudi Arabia before the UN-imposed January 15 deadline for Iraq to evacuate Kuwait. The actual reason was to allow adequate flight crew rest and aircraft stores reconfigurations without telegraphing the coalition's operational intentions to Saddam Hussein. F-15s continued to fly defensive combat air patrols (CAPs) as they had throughout the Desert

¹This paper is an edited version of a talk given by the author at the Zhukovskii Air Force Engineering Academy in Moscow on October 12, 1992. It is based on information contained in *Conduct of the Persian Gulf Conflict: Final Report to Congress*, Washington, D.C., Office of the Secretary of Defense, April 1992; James P. Coyne, *Airpower in the Gulf*, Arlington, Virginia, Aerospace Educational Foundation, 1992; and Wing Commander Gary Waters, *Gulf Lesson One--The Value of Air Power*, Canberra, Australia, RAAF Air Power Studies Center, 1992. It will appear in a forthcoming issue of the Russian Air Force's monthly journal *Aviatsiia i kosmonavtika*. I am grateful to Lieutenant General Buster C. Glosson, Deputy Chief of Staff for Plans and Operations, Headquarters United States Air Force, for his helpful comments on an earlier draft.

Shield buildup. Some F-16s not assigned combat missions the first day stood in for those F-15s being prepared for opening night.

Earlier, coalition aircrews had conducted repeated large-force employment rehearsals (with up to 80 aircraft) beyond the view of Iraqi and Jordanian radar. Almost from the beginning of Desert Shield, the coalition had flown daily sortie surges, complete with airborne tanker tracks, AWACS orbits, and fighter CAPs. Iraqi intelligence became habituated to this pattern, and that contributed heavily to the allied achievement of tactical surprise. The coalition's chief air planner and fighter operations commander, USAF Brigadier General Buster Glosson, later stated that the allies maintained "total tactical surprise" until the first bombs landed on Baghdad.

The opening shots in the war, 21 minutes prior to H-hour, were Hellfire missiles fired from Army Apache helicopters against Iraqi acquisition radars controlling four fighter bases. This cleared a penetration corridor enabling F-15Es to fan out in search of Iraqi mobile surface-to-surface missiles. Twelve minutes later, a single F-117 (one of twelve in this initial attack) took out an interceptor operations center, proceeding thereafter to hit a second target in western Iraq 20 minutes later. These attacks helped blind Iraq's air defenses and cripple key control nodes.

H-hour was 0300 local time. The second attack waves consisted of F-15E, F-16, F-111, B-52G, F-117, Tornado GR1, A-4, A-6, and F-18 aircraft and Tomahawk cruise missiles. Initial defense suppression was provided by EF-111, EA-6B, and F-4G aircraft. The combined attack force was backed by 160 airborne tankers, three E-3A AWACS aircraft, and two E-2Cs. Its goal was to paralyze Iraq strategically in the opening moments of the war without causing undue civilian casualties or collateral damage.

Iraq had an impressive integrated air defense system (IADS). It featured hardened, redundant, internettted, and buried communications links, with some 16,000 surface-to-air missiles (SAMS) and 7000 antiaircraft artillery (AAA) guns. The U.S. government estimated before the war that the most critical Iraqi targets were more heavily defended than any in Eastern Europe even during the height of the Cold War.

Over 100 coalition fighters flew defense suppression and offensive counterair missions against Iraqi targets the first night, with F-4Gs and LANTIRN-equipped F-16Cs concentrated against enemy SAM and AAA sites and the F-111F and Tornado GR1 against enemy surface-to-surface missile shelters and airfields. B-52Gs, launched from bases in the continental United States many hours earlier, fired cruise missiles against Iraqi communications and electrical power targets. EF-111s and EA-6Bs were used for close-in and standoff jamming of Iraqi early warning, acquisition, and ground-controlled intercept (GCI) radars. The EC-130 jammed GCI voice communications, data link, and aircraft navigation systems.

High-speed antiradiation missiles (HARMs) were fired for lethal suppression and destruction of Iraqi acquisition, GCI, and target tracking radars. These missiles were carried by the F-4G, A-6, F-18, and EA-6B. At one point during the initial attacks, more than 200 HARMs were in flight simultaneously. Altogether, 812 combat sorties were flown in the first 24 hours. That made the opening round of Operation Desert Storm the largest single air offensive to have been conducted anywhere in the world since the end of World War II.

Iraq's IADS was completely dependent on centralized control. Once that control was eliminated, Iraqi defenses were forced to conduct autonomous operations in a heavily degraded mode. General Glosson's stated goal was the effective neutralization of Iraq's command and control within 24 hours of the start of combat operations. The coalition actually achieved that objective in the first eight hours. Later in the war, initial warning of impending attack was often acquired by individual SAM battery radars, which had no way of transmitting an alert to central agencies. With little or no early warning and with no central direction, SAMS were typically forced into ineffective salvo firing.

Air defense of Saudi Arabia remained a serious concern only during the earliest days of Desert Shield, when the threat of an Iraqi invasion was both credible and real. Once the war began, repeated coalition attacks against Iraqi air bases and the prompt downing of any fighters that made it into the air assured that the Iraqi Air Force's ability to

threaten coalition targets was neutralized almost from the outset. Freed of concern over any serious danger of enemy air attack, the coalition was able to determine at will the timing and tempo of subsequent air operations.

Because Iraqi fighters never intruded into Saudi airspace, the coalition's early warning, reaction time, and interception capabilities were never truly put to the test--even though the coalition's commander, General H. Norman Schwarzkopf, expressed high confidence in those capabilities. Nevertheless, defensive fighter patrols were flown around the clock along the Saudi border as insurance. These operations were heavily resource-intensive. Although they would have been flown in any event, they were made easier by the large number of coalition fighters deployed in the war zone.

In the end, the Iraqi Air Force was an inconsequential player in the war. Before the beginning of hostilities, it was averaging around 55 shooter and 40 support sorties a day. Once the war started, it launched 25 fighters the first night, and eight got shot down. It averaged 30 combat sorties a day during first week, and fourteen more got shot down.

Altogether, the coalition achieved 35 air-to-air kills during Operation Desert Storm. No air-to-air losses were confirmed, although there was one possible (a Navy F-18 the first night). After the 25th day, the Iraqi Air Force stopped flight operations entirely, aside from the five aircraft that escaped to Iran the day the ground war commenced. All in all, 109 Iraqi aircraft fled to Iran, another 151 were destroyed on the ground, and 33 were captured by ground forces in addition to the 35 that were shot down. USAF Chief of Staff General Tony McPeak later observed: "The Iraqi Air Force never recovered from the opening attack. We took the initiative at the beginning, and we held it throughout the war."

Initial airfield attacks concentrated on suppressing the generation of enemy fighter sorties so as to prevent or disrupt any Iraqi air reaction to the opening strikes. At the outset, B-52s dropped area-denial weapons with time-delay fuses, and RAF Tornados used JP233 munitions to mine and crater runways and taxiways, with the stated goal

of keeping targeted airfields closed for 24 hours. These attacks were only marginally effective in the longer run because the Iraqis used high-pressure firehoses to sweep time-delayed weapons from runways and taxiways. They also showed a skillful use of decoys and rapid runway repair capabilities.

By the beginning of Week Two, the coalition shifted from airfield suppression to the systematic destruction of enemy aircraft in their shelters. This had been planned from the outset but was moved forward five days when the Iraqi Air Force essentially quit flying and hunkered down. A typical massed airfield attack featured 20 F-111s, each carrying four 2000-lb Mk 84 laser-guided bombs (LGBs), making two passes each in an operation spanning some seven minutes in the target area. This meant a weapon impact on the average of every five seconds. More than 80 percent of the LGBs dropped on enemy shelters scored direct hits.

F-117 stealth attack aircraft were also major players in the shelter campaign. On Day Nine, the Iraqi Air Force began its flight to Iran after F-117s destroyed 23 hardened shelters at an airfield northwest of Baghdad that contained Iraq's best and most capable shelters. Altogether, 80 Iraqi aircraft fled in three days. By this point, the Iraqi Air Force had become totally ineffective, and the allied command declared the achievement of air supremacy.

By the U.S. government's estimate, the heart of the Iraqi IADS was taken out within the first hour, and the entire system was "virtually destroyed" in 36 hours. Hardened SAM and interceptor operations centers were destroyed within four days. After that, individual air defense sectors were forced into autonomous operations. Throughout the air campaign, the E-3 AWACS, E-8 Joint Surveillance Targeting and Attack Radar System (JSTARS), and effective communications and radar jamming yielded a winning combination by expanding the coalition's situation awareness while denying it to the enemy. For this reason, Desert Storm has been rightly described by both Russian and Western experts as the first "information war"---and one in which electronic countermeasures moved decisively from a supporting role to a direct combat role.

II

What was the net effect of the coalition's early achievement of uncontested control of the air? Perhaps the clearest indication lay in the relative rate of allied fighter losses over the course of the war. Allied sortie rates remained roughly constant throughout the six weeks of fighting. Yet the coalition incurred nearly *half* its aircraft losses (17) during the first week of Desert Storm, before Iraq's defenses had been fully neutralized and when low-level operations were required in order for coalition aircraft to penetrate them. Another eight aircraft were downed during the final week of the war, when coalition aircrews resumed low-altitude operations in order to support the ground campaign. These losses were due mainly to random fire by optically-tracked AAA and IR SAMs whose existence and locations could not be detected from the air.

The E-3 AWACS was initially used almost entirely as an airborne GCI site in support of the air superiority campaign. Once air supremacy was established, the role of AWACS was broadened to include providing a general overview of the air situation for the coalition's commanders. Throughout the war, it was expressly tasked with preventing any inadvertent blue-on-blue engagements--although in at least one case it erroneously committed an F-15 against his wingman, with a resultant fratricidal loss averted only thanks to the superior situation awareness of the F-15 flight lead. Eventually, the coalition's attainment of air supremacy allowed AWACS and tanker tracks to be moved 100 nautical miles northward into Iraq.

The success of the initial defense suppression campaign enabled coalition fighters to employ medium-altitude tactics beginning on January 23. Initially, a medium-altitude floor of 15,000 ft was established. Only the F-15E, F-111F, F-16C, and Tornado GR1 with automatic terrain-following radar were cleared down to lower altitudes as mission demands required. Later, the hard deck was lowered to 8,000 ft, and finally as low as necessary for mission needs when the ground campaign started. Throughout the war the coalition maintained unchallenged air supremacy above 15,000 ft and air superiority above 5000 ft.

This resort to medium-altitude operations was not a forced move but a matter of conscious choice. Low-altitude tactics have always been heavily driven by surface-to-air threats in the target area. Although largely unavoidable in the case of well-defended targets, they have been considered highly undesirable because of the risk of inadvertently flying into the ground during exceptionally task-loaded mission segments. Fighter pilots have long sought better ways of accomplishing this mission. As a former commander of the USAF's Tactical Air Command, General Robert Russ, said six years ago in this respect: "Don't count on us flying in forever at 200 ft or 100 ft. There's too much regime above that that we're not using, and we may decide to use it all." In the Gulf war, effective neutralization of radar-directed SAMs finally made medium-altitude fighter employment possible, although at considerable cost in the accuracy of computer-aided free-fall weapons delivery due to the increased release distances from the target.

Coalition air operations did not follow the pattern prescribed in the U.S. Army's "AirLand Battle" doctrine. Colonel General Anatoly Malyukov, chief of the Russian Air Force's headquarters staff, hit the nail on the head when he remarked: "There was no classical AirLand Battle in Desert Storm. Why? The point is that this war ... was obviously conceived from the outset as an air war to wear out the opponent by means of air strikes, disorganize his command systems, destroy his air defenses, and weaken the ground forces' striking power. And these objectives were achieved. Broadly speaking, this is the first time we have seen a war in which aviation took care almost entirely of all the main tasks."

The intent of the coalition's military leaders all along was to destroy Iraq's warfighting capability *before* any ground offensive took place. This was a unique approach that envisaged a long preparation phase. It also called for the simultaneous commencement of strategic and operational-level attacks. The coalition's technological assets, notably stealthy F-117s and precision-delivered conventional weapons, made Iraqi strategic targets vulnerable to attack from the outset.

Giulio Douhet's theory of air power (that strategic bombing can win wars singlehandedly) was not confirmed in the Persian Gulf. However,

General Billy Mitchell's very different theory was vindicated by the final merging of technology and doctrine into a seamless web in Desert Storm. General Mitchell had argued that what really mattered was not strategic bombing against economic targets in the enemy's rear, but rather the centralized integration and coordination of all air assets under the control of an autonomous air commander, freed from dependency on the army. If this goal could be achieved, he argued, everything else would fall into its proper place. The Desert Storm experience amply bore that prediction out.

III

What aspects of the operational setting were unique to Desert Storm? For one thing, the coalition generally possessed good threat and target information, which is essential for effective suppression of enemy air defenses. Such a luxury is highly contingent and may or may not be available in future combat situations.

Second, the base infrastructure in the Gulf region was ideal. Saudi Arabia and other Gulf allies were configured to receive thousands of coalition aircraft, and the coalition enjoyed more than five months of time to get itself positioned and ready for combat. The desert environment also offered air power an unrestricted operating arena--although distances to target and recurrent foul weather added offsetting complications.

Other factors further helped the coalition exploit the full range of its air power. These included an absence of political sanctuaries; a regional balance that made possible the favorable basing options; widespread domestic support among the principal coalition partners; and a formal UN Security Council mandate. Of especially great importance, the improved Russian-American relationship was, for the first time since the end of World War II, part of the solution rather than part of the problem in international crisis management.

Finally, it is hard to improve on the advantage that comes from having a strategically and tactically inept opponent. As USAF Lieutenant General Charles Horner, the coalition's air component commander, noted after the war, Saddam Hussein simply "had no idea what

air power is. Any of my captains could have run his air force and caused much more trouble than he did." To cite but one example, the Iraqi Air Force could have launched massed or even suicide attacks against high-value coalition targets like AWACS and tankers. This would not have altered the *military* outcome, but it could have produced a greatly disproportionate *political* effect.

Of course, the coalition was prepared for such an event and took appropriate preventive measures. But if Iraqi air commanders ever gave serious thought to such an attempt, they were unable to pull it off because of the coalition's determined effort to keep Iraqi fighters on the ground and to prevent communication between units. It would be risky to count on similar enemy incapacity in future conflicts.

Great care is warranted in seeking to extract enduring "lessons" from successful wars like this one where the temptation is often overwhelming to find "proof" for any and every favored theory. For one thing, the "facts" rarely speak for themselves. They require meticulous, detached, and historically literate analysis. This is not easy, especially when objectivity is threatened by the urge to find answers that support previous biases.

Second, the record of combat data from Desert Storm remains far from complete. Initial impressions are still being revised based on new and better information. Instant history is invariably shallow history.

Third, and perhaps most dangerous of all, seeking "lessons" from experiences like Desert Storm can quickly lead to the temptation to think of such events as literal scripts for *all* future contingencies.

IV

Having said that, what can we conclude about aspects of the air superiority campaign that might have relevance to future conflicts? And what can we say of a more generalizable nature beyond that?

First of all, *stealth works*. The F-117 stealth attack aircraft was the only piloted vehicle to operate directly over Baghdad throughout the war. F-117 pilots flew as singles. Although they frequently benefited from rampant confusion in the combat zone, they fought without direct support other than from tankers. After the war was over, General Horner

frankly stated: "We had some initial uncertainties. We had a lot of technical data about stealth technology, but I had no way of knowing that we wouldn't lose the entire fleet on the first night. Those boys were going in there naked, all alone. We were betting everything on the data. As it turned out, they flew every night, and we did not suffer battle damage to any of the F-117 aircraft."

Having a reliable low-observable capability ends the need for complex force packaging for many missions. Consider, for example, four F-117s working independently against the more conventional strike package that would be required to achieve comparable results against a well-defended target. The more conventional package would typically include eight strikers protected by four defense suppressors, five jammers, and 20 fighters, resulting in a "gorilla" of up to 37 combat aircraft to put two four-ship flights against a target with any expectation of success. By way of contrast, during the first night of Desert Storm, 21 F-117s hit 37 targets autonomously. In light of this experience, General McPeak has said that "it will be difficult for the U.S. Air Force ever again to buy combat aircraft that do not incorporate low observables."

Lethal defense suppression also works. Over 500 HARM missiles were fired, with great effect, during the first 24 hours of the Gulf war alone. Iraqi air defenders quickly learned that to activate their radars meant to invite a deadly attack. By the sixth day of the war, Iraqi SAM, AAA, and early-warning radar emissions were down 95 percent. Later in the war, once Iraqi early-warning and SAM radars went permanently down, coalition defense-suppression operations shifted from preemptive to reactive HARM launches to economize on HARM expenditure.

Even as so effectively demonstrated in Operation Desert Storm, however, advances in defense suppression capability have hardly made air warfare a picnic. Twenty-two out of the 38 coalition aircraft lost to hostile fire were downed by enemy IR SAMs and AAA, with the rest attributable to radar SAMs and unknown causes. Defense suppression can reduce, but not eradicate, these threats. Better threat warning and protection systems are still needed.

Beyond visual-range (BVR) aerial combat has now become practical,

thanks to an astute combination of AWACS, reliable IFF (identification friend or foe) systems, and stringent rules of engagement. Two-thirds of the coalition's air-to-air kills, including some at night, were accomplished by the BVR-capable AIM-7 Sparrow missile.

Shelter protection of aircraft is due for a new look. It has not yet been proven for sure that shelter hardening of combat aircraft has become a losing proposition. One must completely dominate the middle and upper air to accomplish with impunity what the coalition did against Iraqi airfields in Desert Storm. Furthermore, the first week of the war indicated that suppression attacks alone can be ineffective in closing down air bases. The enemy can reopen them in a short time if he has sustained only damage to runways and taxiways. If the enemy can deny an attacker the middle and upper air while maintaining effective terminal defenses, then air bases are far more difficult and costly to take out. Nevertheless, the results of the coalition's shelter campaign in Desert Storm clearly indicated that the days of passive hardening as a high-confidence hedge against air attack are numbered.

Pilot initiative must be given free rein within tactical confines to get the most out of modern fighter equipment. Of course, top-down battle management by AWACS or other offboard command and control is essential for maintaining big-picture situation awareness and making the most effective air-to-air force committals in real time. However, as a number of the Desert Storm aerial engagements established, there has to be a provision for decentralization in execution. Often the flight lead will have the best picture of his immediate operational situation. He must be free to act without awaiting directives or guidance.

Long-duration fighter sorties can be sustained. A typical peacetime USAF fighter training mission lasts 1-1.5 hours. Most combat sorties in Desert Storm lasted 4-5 hours because of the great distances between the coalition's bases deep in Saudi Arabia and critical targets in central Iraq. Some missions featuring multiple refuelings and multiple attacks against targets of opportunity lasted up to 7-9 hours. This depended critically on ample tanker support.

High technology proved itself across the board. It showed that strategic goals can be achieved promptly in high-intensity warfare

against a determined adversary with a minimal loss of friendly life. However, this statement requires an important qualification. Two points expressed by then-Congressman and now U.S. Secretary of Defense Les Aspin warrant special mention in this regard: "One, the equipment worked and was vindicated against its critics. Two, we know how to orchestrate its use in a way that makes the sum bigger than all the parts."

The second point in that statement is no less important than the first. It would be difficult, if not practically impossible, to say which allied weapon or platform was single-handedly the most influential in shaping the outcome of Desert Storm. Indeed, even looking for such an answer to begin with would entail asking the wrong question. Although by all accounts the F-117 was pivotal in achieving tactical surprise and in minimizing the coalition's losses to enemy ground fire, the real force-multiplication leverage that swung the final outcome in Desert Storm came from the way the coalition's diverse assets were brought together in synergistic combination by allied planners.

Air power finally matured in Desert Storm. Almost by acclamation, it showed itself to be the dominant form of military power. This does not mean that air power can win wars by itself; or that air power in each and every situation will invariably be more important than land or sea power. Nor does it mean that air power now commands a natural and automatic claim to a disproportionate share of resources in the annual budget battles. These are points often missed by the most ardent air power enthusiasts. What it does mean is a strong presumption in favor of air power as the instrument of choice for shaping the complexion of war in most circumstances. As Air Marshal Ray Funnell, the recently-retired Royal Australian Air Force chief of staff, has noted in this regard, "air power has transformed the way in which wars are fought.... Control of the air is crucial to success in modern conventional warfare. With it, almost anything is feasible; without it, everything is difficult."

Some of the most insightful comments on the newly emergent dominance of air power have come from Russian defense professionals. One of the best characterizations anywhere was put forward by retired

Russian Army Major General I. Vorobyev: "For the first time in history, we observed a case in which a very large grouping of ground troops (more than a million men) suddenly found itself unable to do its business." General Vorobyev added that Desert Storm underscored "the decisive role of firepower"--he may as well have said air power--"in destroying the enemy. This has never been demonstrated so clearly in any operation in the past. The fire phase became a prolonged strike, as a result of which Iraq's defenses were so shattered that there was no need to execute an assault to break through fortified positions."

Major General Vladimir Slipchenko of the General Staff Academy was even more adamant on the pivotal role of air power. In a lecture at the U.S. National Defense University in Washington shortly after the war ended, he said: "The Gulf war supports the fact that air strikes can, by themselves, form the basis of victory. Such attacks can now achieve both political and strategic goals." He added that the coalition would likely have won anyway using more traditional tactics, but that this would have come at a much higher price. In Desert Storm, he said, "air power was responsible for the victory because air superiority altered the complexion of the war from the very outset."

As a result of the Desert Storm experience, it may now be possible to begin thinking seriously about the autonomous employment of air power, separating air operations from planning for ground maneuver and giving up the idea that air operations must necessarily take place over the main axes of a ground attack into enemy territory. Clearly the Gulf war indicated that there are alternative--and better--ways to resolve this problem, as attested by the success of an air campaign that continued for more than a month before ground troops even made their initial combat move.

A final point is especially important for potential future conflicts. The successful air campaign in Operation Desert Storm took place in an unprecedentedly cooperative international political setting. UN Resolution 678 authorizing allied forces to use "all means necessary" to eject Iraq from Kuwait, the existence of a broad-based multinational coalition, and Soviet diplomatic support were essential to the campaign's successful outcome. The major powers cannot always count on

such allied cooperation in future crises. But we can surely hope, and take all needed measures to ensure, that never again will such a crisis occur within the context of a Russian-American confrontation.

V

Was a "military-technological revolution" reflected in the success of allied air operations in Desert Storm? This concept was first suggested by Soviet military theorists in the early 1960s, when the face of war was transformed by nuclear weapons and intercontinental delivery systems. It gained renewed prominence in the early 1980s, when Marshal Nikolai Ogarkov, then-chief of the Soviet General Staff, voiced his concern that high-accuracy conventional munitions would eventually be able to produce effects comparable to those of tactical nuclear weapons. Today, a serious debate has taken root among Western defense professionals over the question of whether Desert Storm constituted clear proof that such a military-technological revolution has finally occurred.

Without question, the coalition's considerable technological edge over Iraq made an important difference in shaping the course and outcome of the war. Without it, the war would have proved far more costly for the allies. As matters turned out, the coalition suffered fewer casualties to enemy fire during the six weeks of fighting in Desert Storm than it did to training accidents during the preceding five months of preparations during Desert Shield.

Nevertheless, it remains unclear whether Iraq would have done substantially better even had it possessed the latest-generation military equipment. As Russian defense experts have been among the first to remind us, the factor that matters most is not the hardware but how it is used. To offer just one example, Iraqi pilots showed little situation awareness or tactical insight in aerial combat and rarely attempted any counteroffensive maneuvering worthy of the name once they were aware they were being engaged by coalition fighters. They had far more capability in their aircraft and in their command and control system than they were able to exploit because of poor training and proficiency.

To sum up, then, high technology was a significant but not determining factor in the coalition's overall success in Desert Storm. Superior training, motivation, proficiency, leadership, tactical cleverness, and boldness in execution were no less important in producing the final outcome. One need only consider the immensely difficult balancing act of getting 400 coalition fighters airborne and marshalled at night in radio silence, refueled often several times, and working under tight time lines without a missed tanker connection or midair collision, let alone a ragged and ineffectual attack, to appreciate how aircrew skill and the ability to adapt under stress were critically important. Without these and other intangibles, all the technology in the world would have been for naught.

Another important point was made by General Slipchenko of the Russian General Staff Academy: *High technology becomes pivotal only when it exists in enough numbers to make its influence felt.* Precision munitions were effective because the coalition had a large supply of them. Yet the multinational force did not have enough to meet all mission needs. One lesson learned was that "smart" airplanes like the F-16 and F-18 dropping unguided bombs from medium altitude yield little payoff when high delivery accuracy is needed to achieve desired mission results. This indicates a need for more laser-guided bomb kits for conventional munitions if the fullest value is to be gained from medium-altitude tactics.

Perhaps the most insightful comment on the relative weight of technological sophistication and human prowess was made after the Gulf war by former USAF Chief of Staff General Mike Dugan in a lecture to the Royal United Services Institute in London. General Dugan said: "I do not know whether we are on the verge of a military-technological revolution or not. I do believe that air forces are postured, more so than other forces, to take advantage of emerging technical developments, if airmen can envision new operational concepts to exploit them."

The Desert Storm experience taught every fair-minded observer what high-technology weapons, coupled with good leadership and training, can do against less well-endowed forces. Yet the war was ultimately not about weapons systems or "technology," even though certain weapons and

other combat-support systems were indeed star performers. The war was more fundamentally about consensus building and the orderly formation of national goals; about diplomacy and leadership in the pursuit of those goals; and about astute strategy and coordinated action by skilled professionals in the employment of combined-arms power, notably air power, to achieve them once diplomacy and economic sanctions failed to carry the day. Insofar as the success of Desert Storm heralded a "revolution" in warfare, the revolution was in the fusion of all these ingredients into a winning combination.

The U.S. Air Force has summed up this point very nicely. It was not merely top-notch equipment that determined the final outcome in the Gulf war. Rather, an appropriate mix of "quality people, quality equipment, quality training, and quality leadership assured Air Force success in Desert Storm." In the end, the coalition discovered that air power, properly fielded and utilized, was capable of substituting for land power for many important strategic functions. The Iraqis, for their part, learned that no amount of land power can substitute for air power.

