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PREDATOR'S BIG SAFARI

By Richard Whittle

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Brig. Gen. Billy Mitchell

On September 12, 1918 at St. Mihiel in France, Col. William Mitchell became the first person ever to command a major force of allied aircraft in a combined-arms operation. This battle was the debut of the US Army fighting under a single American commander on European soil. Under Mitchell's control, more than 1,100 allied aircraft worked in unison with ground forces in a broad offensive—one encompassing not only the advance of ground troops but also direct air attacks on enemy strategic targets, aircraft, communications, logistics, and forces beyond the front lines.



Mitchell was promoted to Brigadier General by order of Gen. John J. Pershing, commander of the American Expeditionary Force, in recognition of his command accomplishments during the St. Mihiel offensive and the subsequent Meuse-Argonne offensive.

After World War I, General Mitchell served in Washington and then became Commander, First Provisional Air Brigade, in 1921. That summer, he led joint Army and Navy demonstration attacks as bombs delivered from aircraft sank several captured German vessels, including the SS *Ostfriesland*.

His determination to speak the truth about airpower and its importance to America led to a court-martial trial in 1925. Mitchell was convicted and resigned from the service in February 1926.

Mitchell, through personal example and through his writing, inspired and encouraged a cadre of younger airmen. These included future General of the Air Force Henry H. Arnold, who led the two million-man Army Air Forces in World War II; Gen. Ira C. Eaker, who commanded the first bomber forces in Europe in 1942; and Gen. Carl A. Spaatz, who became the first Chief of Staff of the United States Air Force upon its charter of independence in 1947.

Mitchell died in 1936. One of the pallbearers at his funeral in Wisconsin was George Catlett Marshall, who was the chief ground-force planner for the St. Mihiel offensive.

ABOUT THE MITCHELL INSTITUTE: The General Billy Mitchell Institute for Airpower Studies, founded by the Air Force Association, seeks to honor the leadership of Brig. Gen. William Mitchell through timely and high-quality research and writing on airpower and its role in the security of this nation.

Published by Mitchell Institute Press

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Design by Darcy Lewis

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August 2011

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PREFACE

Think back to April 1999: NATO was ramping up its air war in Kosovo, and Predator was a little-known unmanned air vehicle with a great video scanning suite and not much else. Senior Air Force officials recognized it had greater potential and directed addition of a laser designator—in just three weeks. It worked.

Today the Predator is a known hunter-killer. It's become so identified with operations in Afghanistan and Iraq, it's hard to imagine there were ever doubts about whether the unmanned plane would make it as a warbird.

Richard Whittle takes us back to the beginning of this exciting journey with his new report, *Predator's Big Safari*. It's the story of how the Air Force transformed a light remotely piloted aircraft into a hunter-killer weapons platform.

Whittle has already told the story of another of military aviation's ugly ducklings made good. His 2010 book *The Dream Machine: The Untold History of the Notorious V-22 Osprey* laid bare the difficulties of developing advanced technology military aircraft. Nathan Hodge in *Wired Magazine* called Whittle's book "a parable of defense procurement."

Here Whittle embarks on another quest. His focus is on the arming of the Predator from spring 1999 through its use in Afghanistan at the beginning of Operation Enduring Freedom in October 2001.

Early Predators had already been deployed to the Balkans for intelligence, surveillance, and reconnaissance missions. The RQ-1 was the latest in a long line of Air Force unmanned aircraft programs—as described in Dr. Thomas Ehrhard's *Air Force UAVs: The Secret History*, published by the Mitchell Institute Press in July 2010.

The major leap for Predator came as a result of the 1999 NATO air war sparked by the Kosovo crisis. The problem with Kosovo was that the war

quickly turned from a three-day series of bombing raids into a full-scale air campaign. Serbian forces had spread through Kosovo pushing out 600,000 refugees. Locating and targeting Serb forces on the ground was essential. The Predator had a wonderful ability to apply video scanning to a target area. What it couldn't do was deliver target-quality mensurated coordinates or designate targets for other aircraft to strike.

The stories were famous. Air commanders at the Combined Air Operations Center at Vicenza, Italy, could see the Predator video feed. They'd try to direct pilots on to targets like a Serbian tank by describing terrain and buildings—to the immense frustration of both sides. “You would have Predator up there looking at targets, but you had no way to get that information, other than verbally, to the airplanes that were going to attack those tanks,” Gen. John P. Jumper, USAF Commander at the time, said in a CBS news interview several years later.¹

As Whittle tells it, Gen. Michael E. Ryan, Air Force Chief of Staff, quickly took Predator to the next level. Thus it was that on April 14, 1999, the Air Force acquisition office, SAF/AQ, directed Big Safari to install a laser designator on the Predator—within three weeks.

Predator was also becoming a player in countering terrorism. Whittle's fast-paced history includes a gripping account of how the Predator was tracking Osama bin Laden in Afghanistan—well before September 11, 2001. Air Force-developed Predators became one of the CIA's favorite tools as the hunt for Bin Laden increased after attacks on embassies in Kenya and Tanzania in August 1998. Twice in the fall of 2000 the unarmed Predators thought they had Bin Laden in view but authorities could not organize a strike in time.

Whittle relates the story—including conversations between Jumper and General Atomics President Tom Cassidy—behind the Air Force's work to combine Predator and Hellfire, which was of particular interest to the CIA.

A change in administrations brought a change in emphasis, but the Air Force continued with its weaponization tests, still eagerly followed by CIA officials. And, fortunately, the George W. Bush Administration directed DOD and the CIA to get armed Predators on the Bin Laden hunt by early fall 2001, so, as Whittle relates, three days after 9/11, armed Predators were in Uzbekistan and on the job when Operation Enduring Freedom began on Oct. 7, 2001.

The theory goes that innovation has to have champions within an organization to be successful. Predator had a roster of them. The story told by Whittle sheds light on these champions and the little-known Air Force program office known as Big Safari. Whittle's interviews with key players at Big Safari show an Air Force adept at rapid acquisition—to use today's vernacular.

It's a theme that stands out in Whittle's study. Innovation with Predator was not happening by accident or in some backwater. The Air Force was able to move swiftly to generate a new type of capability because key leaders defined the need clearly based on their operational experience and knew where to place responsibility for getting the job done, fast. Nor did they hesitate over dedicating resources to an "unmanned" plane. On the contrary, the best of the best worked to bring Predator's combat capabilities up to speed. "Because it began as an Air Force effort, intra-service dynamics were primarily responsible for opening the innovation window," noted Col. Sean Frisbee, who wrote his School of Advanced Airpower Studies master's thesis in 2004 on the weaponization of Predator.

Air Force energy and investment applied to the Predator had enormous implications. "In only a decade," Whittle points out, "the UAV revolution has reshaped the Air Force and the Army's aviation branch, revised US military tactics and doctrine for air and ground forces, and revamped plans, budgets, and corporate structures in the defense and aviation industries."

Predator's Big Safari stands as a reminder that innovation is not a task that can be delegated to joint processes alone or to other parts of the Department of Defense. The tale of arming the Predator reminds us again that the Air Force must continually exercise its abilities to stretch new weapons systems and their applications.

After all, it was airmen who made Predator a success.

*Rebecca Grant, Director
Mitchell Institute for Airpower Studies
July 2011*

AUTHOR'S NOTE

This paper is based on research and interviews conducted over more than two years as part of a project that continues. I am deeply grateful to those players in the Predator story who have shared their time, recollections and, in some cases, documents to help me construct an accurate historical record of a technological revolution still little understood outside the inner circles of those who took part in it. I also owe a special debt of gratitude to Col. Sean Frisbee, USAF, who graciously loaned me a treasure trove of briefing papers and other documents he amassed in 2004 while working on his master's thesis at the School of Advanced Air and Space Studies at the Air University at Maxwell AFB, Ala. In "Predator's Big Safari," I have been able to add quite a few facts, details, and narrative context to what Sean wrote, but his "Weaponizing the Predator UAV: Toward a New Theory of Weapon System Innovation," remains a seminal and extremely valuable work on the subject.

Richard Whittle
July 2011

PREDATOR'S BIG SAFARI

“Before the war, the Predator had skeptics, because it did not fit the old ways. Now it is clear the military does not have enough unmanned vehicles.”

—President George W. Bush, Address to the Corps of Cadets, The Citadel, Charleston, S.C., Dec. 11, 2001

When the war in Afghanistan began on Oct. 7, 2001, among the aircraft at the disposal of Army Gen. Tommy R. Franks, head of US Central Command and Operation Enduring Freedom, was a strike weapon that had never before been used. That night, it inaugurated a new age in warfare—and soon sparked a technological revolution. The aircraft’s name was “Predator.”

Despite its menacing moniker, the Predator was a small, slow, and rather flimsy unmanned aerial vehicle (UAV) that had been developed in a hurry seven years earlier and used since then all but exclusively for intelligence, surveillance, and reconnaissance (ISR). Designated the RQ-1 in its ISR-only configuration, the Predator had impressed top commanders with its streaming daylight and infrared video of the ground during deployments over Bosnia, Kosovo, and Iraq during the 1990s. Skeptics, however, discounted its future.

“This \$600 million program has so many combat limitations that its long-term viability remains in question,” Air Force Col. Thomas P. Ehrhard, a leading expert on UAVs, concluded in a Ph.D. dissertation published in June 2000.¹

That very month, however, an Air Force officer with a different vision of the Predator’s promise—Gen. John P. Jumper—took a decision that would transform the little UAV into a weapon constituting a true revolution in military affairs. Jumper, Commander of Air Combat Command at the time and soon to become Chief of Staff of the Air Force, ordered the 645th Aeronautical Systems Group, a rapid acquisition office known as “Big Safari,” to arm the Predator with the AGM-114 Hellfire, an Army “tank-buster” missile carried by

helicopters. Jumper issued that order on June 21, 2000.² Over the next 16 months, Big Safari and its contractor partners not only armed the Predator but also devised an ingenious communications system that let a crew sitting in a ground control station (GCS) in the United States fly the UAV over Afghanistan and guide its missiles to their targets with a laser beam.

Franks ordered the first Hellfire strike launched by a Predator in combat the first night of the Afghan war—a shot fired by a crew flying the newly armed UAV from a GCS in the parking lot of CIA headquarters in Langley, Va.³ The Hellfire shot was ordered after the Predator crew followed Taliban leader Mullah Mohammed Omar and some followers from his residence in Kandahar to a compound of buildings in the countryside. While the damage done in that first Predator strike was limited—the missile destroyed a vehicle and killed a couple of men assumed to be Omar’s bodyguards—the shot was historic. The ability to target individuals or fleeting targets with precision from an aircraft flown from total safety on the other side of the globe was a phenomenal capability—and a technological tipping point.

The idea of using remote-control aircraft to deliver ordnance had been attempted off and on since World War I, though never satisfactorily achieved.⁴ The US military had developed a variety of unarmed UAVs for ISR over the decades, however, and at the turn of the 21st century was using several types. Even so, until the armed Predator’s use was revealed in the media a few weeks into the Afghan war, even leading experts were unaware that the hapless history of UAVs was taking a dramatic turn toward success. “Until UAVs can demonstrate reliability ratings on par with manned platforms, and they have not even come close, they cannot hope to make inroads into the force application role,” Ehrhard had asserted in his Ph.D. dissertation 16 months earlier.⁵

The Predator’s reliability as an airframe had always been shaky, and in the view of DOD testers would remain so for years to come.⁶ Even so, as President Bush’s comment at The Citadel less than two months after the Predator fired its first missile at an enemy illustrates, the armed version of the UAV—soon designated the MQ-1—quickly captured the imaginations of policymakers. Moreover, in the decade since its debut in Afghanistan, the MQ-1 has not only disproved the skeptics but fueled an explosion in the development of unmanned aircraft of all kinds.

The Predator’s success as a strike weapon, as an ISR platform that can spot or lase targets for other aircraft, and as an eye in the sky whose video can be seen by ground troops—all capabilities added to the aircraft under Big Safari’s special acquisition methods—has inspired an enthusiasm for UAVs within the military and industry whose absence in the past had made unmanned aircraft a niche technology. Since the MQ-1 went into service,

the type and number of UAVs flown by or being offered to the US and other militaries have multiplied exponentially. In only a decade, moreover, the UAV revolution has reshaped the Air Force and the Army's aviation branch, revised US military tactics and doctrine for air and ground forces, and revamped plans, budgets, and corporate structures in the defense and aviation industries. The emergence of armed UAVs has had profound effects on US national security and foreign policy as well. For these reasons, the MQ-1 Predator is arguably the most important new military technology since the nuclear-armed intercontinental ballistic missile.

Examining the many implications of the new age of UAVs is a task that goes far beyond the scope of this paper, a chronicle of how Big Safari and its contractor partners—especially the Predator's maker, General Atomics Aeronautical Systems Inc.—transformed an ISR platform of limited utility into a revolutionary weapon. Technologically, this is an Air Force success story, despite inaccurate assertions published elsewhere.⁷ The armed Predator was first used for a CIA mission and has flown many more since, but it was conceived and developed solely by the Air Force and primarily because of the vision of one Air Force leader, Gen. John P. Jumper. What follows is the story of how the revolution began.

PREDATOR FINDS A HOME

A few months after he became Air Force Chief of Staff in October 1994, Gen. Ronald R. Fogleman concluded that his service needed to take charge of the RQ-1 Predator.⁸ General Atomics Aeronautical Systems Inc. (GA-ASI), a privately held company headquartered at the time in Rancho Bernardo, Calif., had derived the Predator from its Gnat 750 UAV and first flown it on July 3, 1994, as an Advanced Concept Technology Demonstration (ACTD), a Defense Department program created in 1993 to generate new technologies quickly.⁹ The Naval Air Systems Command, which led a UAV Joint Program Office (JPO) created by Congress in 1988, had run the Predator ACTD, but it was funded by the Defense Airborne Reconnaissance Office (DARO), a DOD organization created by civilian reformers in Congress and the Pentagon out of frustration with the military services' lack of success in fielding UAVs.¹⁰ The DARO's director, Air Force Maj. Gen. Kenneth R. Israel, visited Fogleman early in the new Chief of Staff's tenure and told him that, with the ACTD over, the Office of Secretary of Defense (OSD) wanted a military service to take over Predator operations.¹¹ "The Army wanted it, but they weren't passionate about it," Fogleman said. "On the other hand, the Air Force really hadn't looked at it in much detail."¹²

No wonder. As an aircraft, the Predator wasn't very sexy. Constructed of graphite epoxy composites and lighter than an economy car, the RQ-1 was powered by a

four-cylinder Rotax 912 piston engine turning a small, two-bladed propeller on the UAV's tail that pushed it through the air at a sluggish top speed of 120 knots or a cruising speed of 80. Resembling a glider more than a powered aircraft, the Predator had thin, tapered wings that stretched 49 feet from tip to tip—nearly twice the length of its 27-foot fuselage, which was eight feet shorter than a Piper Cub's. Two rectangular stabilizers jutted downward from the Predator's tail in a distinctive inverted V, while forward of the wings, where a manned aircraft's cockpit might be, the fuselage swelled into a bulbous lump. That bulge housed a satellite dish and a flight control computer. Beneath the fuselage and just forward of the wings was another protuberance—a sensor turret containing electro-optical and infrared cameras for shooting video in daylight or darkness. In 1995, the tiny new UAV's real utility was far from clear. Fogleman, though, saw it as a potential part of the answer to a problem that was much on his mind in those days.¹³

As an F-100 Super Sabre pilot, Fogleman had flown Misty Fast Forward Air Controller (FAC) missions in the Vietnam War, escorting RF-4 Phantom reconnaissance jets and leading them to targets. As Chief of Staff, Fogleman now saw a worrisome gap looming in the nation's airborne reconnaissance capabilities. The last active-duty RF-4 flight had occurred earlier in 1994. The last Air National Guard RF-4C was slated to retire in 1995. Congress had just voted to reactivate the SR-71 Blackbird, but that would take a couple of years.¹⁴ With defense budgets declining following the Soviet Union's collapse, some Pentagon officials were arguing that satellites could fill the airborne reconnaissance void. "We were slowly denuding ourselves of air-breathing reconnaissance capability," Fogleman said, but then, "all of a sudden, as a result of this ACTD, there appears to be something on the horizon that might be helpful."

As Pentagon leaders considered which service should get the RQ-1, Fogleman moved to encourage them by creating the Air Force's first Predator squadron. He designated it the 11th Reconnaissance Squadron, reviving the name of a decommissioned RF-4 unit he had flown with on Misty Fast FAC missions in Vietnam.¹⁵ The 11th RS activated July 29, 1995, at Indian Springs Air Force Auxiliary Field, Nev., 45 miles northwest of Nellis Air Force Base.¹⁶

Five months later, on Dec. 16, 1995, Adm. William A. Owens, Vice Chairman of the Joint Chiefs of Staff and Chairman of the Joint Requirements Oversight Council (JROC), signed a memo recommending the Air Force become the lead service for Predator operations, but "with significant participation by the other services."¹⁷ Four months after that, on April 9, 1996, Defense Secretary William J. Perry signed a memo designating the Air Force "the lead service for operating and maintaining the Predator UAV" but leaving "responsibility for system development and procurement" with the Navy.¹⁸

The next year, Fogleman's campaign to gain total control of the Predator succeeded with help from Rep. Jerry Lewis, a California Republican who had been one of

Predator's strongest supporters in Congress since GA-ASI developed the RQ-1 in 1994. Lewis, a member of the House Appropriations Defense Subcommittee (HAC-D) and at the time Vice Chairman of the House Permanent Select Committee on Intelligence (HPSCI), put a provision in the House version of the fiscal 1998 intelligence authorization act requiring that all authority over the Predator still held by the Navy-led UAV JPO, and all funding as well, be transferred to the Air Force.¹⁹ At the suggestion of HPSCI Professional Staff Member Michael Meermans, the House intelligence authorization bill report also said: "The Committee has been keenly interested in the rapid, flexible, and innovative acquisition approaches that hallmark Big Safari, and it strongly urges the Assistant Secretary of the Air Force (Acquisition) to consider using the Big Safari streamlined acquisition and management program for Predator."²⁰ Meermans, who had joined the HPSCI staff in 1995 after retiring as an Air Force chief master sergeant, had spent the last five of his 22 years in uniform on the Air Staff as chief of airborne reconnaissance operations. He was well-versed in the history and work of Big Safari and friendly with its director, William Grimes, who had commanded the unit as a colonel since 1986 and remained as its director following his retirement from the Air Force in 1990.

Since the 1950s, Big Safari had specialized in acquiring, modifying, managing, and operating special purpose weapons and communications systems—often classified—for the Air Force and other government agencies.²¹ Big Safari's success over the years lay partly in its extraordinary methods and acquisition authority. The organization was largely exempt from the usual steps in the normal acquisition process—lengthy operational requirements analyses, technology trade and risk assessment studies, preliminary design, full scale development, and developmental and operational testing, all punctuated by formal "milestone" reviews. Big Safari existed to get new technology into the hands of operational users fast. It did that by aiming for "the 80 percent solution"—rather than perfection—and by ignoring what Big Safari insiders disdained as "administrivia."

Lewis's legislation to give the Predator wholly to the Air Force, along with the HPSCI report language urging the Air Force to give the Predator to Big Safari, were dropped by a House-Senate conference committee on the intelligence authorization bill, but Lewis achieved his goals anyway. The intelligence bill conference only deleted his amendment because a separate House-Senate Armed Services conference on that year's defense authorization bill—a conference that included Lewis—carried a broader provision that abolished DARO and ordered OSD to give control of the various UAV programs back to the armed services. In 1998, the Air Force took full control of Predator. Air Combat Command (ACC) assumed management of the program and began writing an Operational Requirements Document (ORD) for the aircraft, a step not required for the ACTD, as well as creating a formal logistics chain for the system.²² Predator acquisition authority, however, went to Big Safari. In August 1998, Big Safari opened an office at GA-ASI's facility in Rancho Bernardo designated Operating Location Detachment 4 (OL Det. 4) and began figuring out ways to make the Predator better.

FROM ISR PLATFORM TO FAC

Seven months after Big Safari became the Predator System Program Office (SPO), the United States and its NATO allies began Operation Allied Force, the air war NATO waged from March 24 to June 10, 1999, to stop Serbia's military from conquering and committing atrocities in the breakaway province of Kosovo. Three days into the operation, one of several Serb SA-3 anti-aircraft missiles launched at an F-117 brought the stealth fighter down. The pilot was rescued, but the loss of the F-117 reinforced for allied commanders what a difficult set of problems they faced in trying to find and hit targets in Serbia and Kosovo—problems that led to Big Safari's first major step toward transforming the Predator into a weapon.

Political leaders in Washington and other NATO capitals wanted to avoid allied losses if at all possible in Allied Force. For that reason, NATO imposed a 15,000-foot “hard deck” on allied warplanes for most flights over the combat zone to keep them out of range of Serb surface-to-air missiles.²³ The politicians also wanted the military to avoid civilian casualties at all costs, which made it imperative to verify targets thoroughly before striking them. From 15,000 feet, and with mountainous Kosovo frequently blanketed by clouds and fog, that was easier said than done. The Predator's ability to fly below cloud cover to spot targets without putting air crews at risk made it a possible solution, but pilots of manned aircraft had no way to see the Predator's video, and controllers who could see it in the Combined Air Operations Center (CAOC) at Vicenza, Italy, quickly found it was nearly impossible to talk pilots onto targets the RQ-1 spotted. Even a pilot who could see the Predator itself had no way of knowing where its camera was pointing.

Nine days into the war, Gen. Michael E. Ryan, Air Force Chief of Staff, sent an officer he liked to rely on for special assignments, Air Staff modeling and simulation expert Col. James G. “Snake” Clark, to Vicenza to talk to the allied air forces commander, USAF Lt. Gen. Michael C. Short, about ways the Predator might be better used to cross-cue manned aircraft to targets.²⁴ Clark had been a player in the campaign to gain Air Force control over the Predator in 1996, going on a mission to inspect Predator operations in Bosnia for Fogleman that year and writing a report that helped wrest control of the RQ-1 from the other services.²⁵ As a result of Clark's trip to Vicenza in the early days of 1999's Allied Force, two steps were taken. First, a Big Safari consultant sent to Tuzla created a system that, on a separate screen in the CAOC, would overlay on a digital terrain map a trapezoid showing the Predator's precise sensor footprint and a symbol representing the location of the Predator itself, both in real time, making it far easier for CAOC controllers to direct manned aircraft pilots to targets spotted on the UAV's video. This “Exploitation Support Data” (ESD) was an innovation the consultant had created in an earlier experiment to link Predator video with images from the

synthetic aperture radar carried on E-8C Joint STARS surveillance aircraft.²⁶ Second, on April 14, the Secretary of the Air Force acquisition office (SAF/AQ) directed Big Safari to install a laser designator on the Predator—within three weeks.²⁷

The idea wasn't new. Three years earlier, the House version of the fiscal 1997 defense authorization bill had included a provision authorizing \$10 million for "advanced concepts technology demonstration of air-to-surface precision guided munitions employment using a Predator, Hunter, or Pioneer unmanned aerial vehicle and a nondevelopmental laser target designator."²⁸ Rep. Curt Weldon (R-Pa.), who sponsored the provision, argued at the time that weaponizing UAVs was "the next logical step" for the technology. DARO and DOD, however, opposed the provision and a House-Senate conference on the bill dropped it.²⁹ During the Kosovo campaign, though, Jumper, Commander of US Air Forces Europe at the time, suggested adding a laser designator to the Predator. "I talked to General Ryan about it and Ryan got Snake [Clark] on it, and I think Ryan talked to Short about it," Jumper recalled years later.³⁰

Big Safari wasted no time responding to SAF/AQ's order. As officers at Big Safari's headquarters in Dayton began researching technologies that might work, Capt. Brian D. Raduenz, Commander of Big Safari's OL Det. 4, alerted GA-ASI's engineers to the task. Over the next two days, they considered, but rejected for technical reasons, a modified version of Lockheed Martin's "Sniper" laser targeting pod, developed for the Navy and new at the time, and an Air Force Research Laboratory man-portable laser designator being developed for special operations ground forces.³¹ On Saturday April 17, the third day after Big Safari got the assignment, four Raytheon engineers arrived at GA-ASI with what proved to be the solution—Raytheon's AN/AAS-44(V) laser designator turret. A Big Safari officer at Wright-Patterson had learned about the AN/AAS-44(V), which the Navy was buying for its SH-60B and HH-60H Seahawk helicopters, in a phone call to Crane Naval Depot in Indiana.

The Raytheon engineers propped their laser ball up on a stand atop a conference room table and explained it to Raduenz's team and GA-ASI's top systems and software engineers. By day's end, they were agreed that while the Raytheon ball had no daylight video camera, only infrared, it was a fairly elegant solution, for they could simply substitute the 162-pound AN/AAS-44(V) for the Predator's standard Wescam EO/IR turret. There would be a lot to do in the short time they had to work. They would have to modify some hardware and more software in a GCS and a Predator. Air Force crews would have to be trained to use the laser designator, and GA-ASI and Raytheon would have to provide maintainers. ACC had initially balked at sending to Kosovo even the newest version of the Predator, which incorporated de-icing

gear, because GA-ASI had yet to deliver technical manuals to go with them when the war began.³² Big Safari would also need help from higher-ups to get enough Raytheon turrets to outfit a complete system of four Predators. Raytheon had produced more than 70, but the Navy owned them and was scheduled to put them on its helicopters.³³

“We looked at the whole thing very rapidly and said, ‘We see nothing that can’t be done here; this is a good fit, a good solution,’ “ recalled Raduenz. “So we called back to Grimes and we briefed him on the whole thing and he said, ‘Go. Do it. Now.’ “³⁴

The Raytheon and GA-ASI engineers spent the next three days working on their own, then reconvened at Rancho Bernardo to integrate the first AN/AAS-44(V) with the Predator’s subsystems. Four days later, at GA-ASI’s El Mirage, Calif., flight facility, the engineers installed the Raytheon ball on a Predator built for but not yet delivered to ACC. Two days after that, a GA-ASI crew flew the Predator with the Raytheon ball for the first time to test its aerodynamic and other qualities. On May 4, a day less than three weeks after Big Safari got the assignment, an ACC pilot detailed to the project flew the newly laser-equipped Predator from Indian Springs over a Nellis Air Force Base test range with a sensor operator lasing targets for F-15E and A-10 aircraft. No bombs were dropped, but an A-10’s Pave Penny laser tracker verified that the Predator’s laser spot was on target.

The Big Safari and contractor teams were elated—until the Predator landed. When it did, its front landing gear collapsed. The Predator’s nose and the Raytheon ball smacked into the runway and bounced several times as the aircraft rolled to a stop. The ball was intact but damaged beyond immediate repair.³⁵

The accident set the project back eight days, the time required to obtain a new Raytheon ball and integrate it onto a new Predator. The second ball was available because Snake Clark, alerted to the need by Big Safari, had explained the situation to Ryan, who arranged for the Navy to release four more Raytheon turrets to Big Safari.³⁶ The Navy did, and on May 12, the new laser-designator-equipped Predator flew a second test at Nellis, this time lasing targets for actual bomb drops by F-15Es. Three of four bombs hit their targets. The fourth missed because of a weapon malfunction.

By this time, the project had acquired a name—Project WILD Predator. MSgt. Jeff A. Guay, a former imagery analyst who had become a Predator sensor operator and been recruited by Grimes to join Big Safari, coined the name. WILD, Guay told others on the team, stood for Wartime Integrated Laser Designator.³⁷ He liked “WILD” because it described the ride they were on.

At Snake Clark's request, Ryan ordered Air Mobility Command to assign two C-17s to fly to Tuzla carrying two of the new WILD Predators, a GCS equipped for employing the laser designator, the RQ-1's mobile satellite antenna, and the combined Big Safari/contractor team needed to operate and maintain the system.³⁸ ACC was unwilling to take responsibility for operating the two WILD Predators itself, so Big Safari kept the aircraft in depot status, retaining financial liability for them, and arranged to borrow a handful of pilots and sensor operators to fly them over Kosovo from the 11th RS and the 15th RS, which had been activated in August 1997.³⁹ The C-17s departed May 22 and arrived by direct flight the next day.

Mechanical and other problems with the Predators and the AN/AAS-44(V) kept the team from flying a CAOC-directed operational mission for the next 10 days, but, during what were logged as training sorties, they tested the laser designator.⁴⁰ On June 2, though, sensor operator Guay used the Predator's IR camera to follow a Serb military vehicle as its crew drove it into a garage or barn to hide.⁴¹ Guay lased the building for a Pave Penny-equipped A-10, which dropped a 500-pound bomb on it. The next day—by coincidence—Serbia agreed to peace terms and NATO's air campaign effectively ended. The WILD Predators departed Tuzla on July 2.

THE NEXT LOGICAL STEP

Even before the war in Kosovo began, Maj. Gen. Michael C. Kostelnik, who had become Commander of the Air Armament Center (AAC) at Eglin AFB, Fla., in 1998, had been thinking about another way to use the Predator. He wanted to arm it with a weapon so new it didn't exist yet, a 250-pound, GPS-guided, nine-inch-diameter munition called the Small Smart Bomb, (later renamed the Small Diameter Bomb). In 1999, Kostelnik starting trying to make that happen.⁴²

Kostelnik had been impressed with the Predator ever since 1995, when as director of special programs in the Office of the Undersecretary of Defense for Acquisition and Technology and executive secretary to OSD's Special Access Program Oversight Committee, he watched Predator video beamed to the Pentagon from an exercise at Fort Huachuca, Ariz. During a visit to California on other business later that year, he stopped by GA-ASI's flight center at El Mirage, where he met the company's president, former Navy fighter pilot and retired Rear Adm. Thomas J. Cassidy, and got to see a Predator fly in person. Four years later, as Commander of AAC, a product development arm of Air Force Materiel Command (AFMC), Kostelnik's top priority was to persuade others in the Air Force that the service truly needed the Small Smart Bomb, which his command was developing. As Kostelnik saw it, the SSB was vitally needed

in an age of stealth aircraft like the F-22 Raptor and the nascent Joint Strike Fighter, which would need to carry munitions internally to stay stealthy. He was finding little support for the SSB elsewhere in the service, though. “Trying to push the concept that a new weapon would be something we would need at the expense of resources going to airframes was dead on arrival,” Kostelnik said.⁴³ But one day he had an inspiration and telephoned GA-ASI’s Cassidy.

“I’ve got an idea about using your aircraft,” Kostelnik told Cassidy. “I think it can carry a small bomb. What do you think?”

“You’ll hardly believe your good fortune,” replied Cassidy, always eager to promote new uses for the Predator. “We’ve already been working on this.”⁴⁴

From the Predator’s earliest days, Cassidy and others at GA-ASI had envisioned arming the aircraft at some point.⁴⁵ Earlier UAVs had failed, Cassidy thought, because they’d been more like model aircraft than real airplanes. “We had to make it act like an airplane, and we had to have a pilot involved so that he or the payload operator could operate the payload or, if we were able to get weapons on, they would fire the weapons, too,” Cassidy recalled. “So early on, the idea was, make it act like an airplane. What do airplanes do? They carry sensors, video, electronics; they carry weapons; they can jam things. These are all the thoughts we had when we started the effort.” For that reason, the Predator already had hardpoints in its wings to carry payloads that might include weapons, though the munitions would have to be extremely light.

Sometime after Kostelnik’s call to Cassidy, AAC announced it would hold its second annual Air Armament Summit from March 14-16, 2000, at the Hilton Sandestin Beach Resort & Spa in Destin, Fla., a 45-minute drive from Eglin. The event’s purpose would be for Air Force leaders and senior industry figures—“company presidents, directors of research, or major division chiefs”—to discuss the service’s armament plans and needs.⁴⁶ It would also be a chance for Kostelnik to promote his pet project, so among the briefings scheduled for the second day of the event was a presentation by his deputy, Brig. Gen. Kevin J. Sullivan, on how the Predator would be a great vehicle for a Small Smart Bomb demonstration.

The Air Armament Summit attendees included Jumper, who had assumed command of ACC the previous month. Jumper spoke to a black-tie dinner on the event’s opening night. He was scheduled to leave the next morning before Sullivan did his Predator-SSB briefing, but Jumper’s departure was delayed by a thunderstorm, so Sullivan gave him the briefing privately, in a small room outside the conference.⁴⁷ When Sullivan finished, Jumper told Kostelnik he liked the idea, and AAC was welcome to pursue it, but only with funding already available.⁴⁸

Jumper himself had been thinking along similar lines since Kosovo. A month before he attended Kostelnik's Air Armament Summit, Jumper had asked his own staff about the status of the WILD Predators, only to learn that after their return to Indian Springs from Bosnia, ACC had removed and stored the AN/AAS-44(V) laser designator turrets and reinstalled Wescam sensor balls on the aircraft because the laser designator wasn't an official Predator requirement. He was furious.⁴⁹ A few weeks after the summit, Jumper's thinking on the subject jelled. Headquarters ACC sent a message to Headquarters Air Force, the office of Air Force Secretary F. Whitten Peters, AFMC, and other relevant commands.

"Chief, ACC has internalized the Predator lessons learned from Operation Allied Force and is changing the direction for the Predator program," the May 1 message began. "The original construct of the Predator as just a reconnaissance surveillance target acquisition asset no longer applies. ACC will employ Predator as a FAC-like resource, with look-out, target identification, and target acquisition roles using the inherent and proposed EO/IR/laser targeting/designation capabilities and upgrades. Also, ACC, AFMC, and the Air Armament Center (Eglin) are moving out on the next logical step for USAF UAVs using Predator—weaponizing UAVs."⁵⁰

Spurred by that, Kostelnik's staff drafted a briefing that proposed creating a "Combined Development Force"—a multi-command, multi-service team with members from industry and academia as well—whose goal would be to drop a live Small Smart Bomb from a Predator by May 2001. The estimated cost was \$3.43 million.⁵¹ Kostelnik intended the briefing for Jumper, but because Big Safari was the Predator SPO, he first sent it there for review. Soon afterward, he learned that the commander of ASC, Lt. Gen. Robert F. Raggio, thought Kostelnik was "a little bit out of his sand box."⁵²

Maj. Raymond F. Pry, an acquisition officer who had joined Big Safari in April, wrote a memo pointing out weaknesses in AAC's plan and recommending further discussion.⁵³ Pry's memo didn't say so, but Big Safari's experts viewed the SSB as a bad choice of munitions for the Predator, in part because only one test article SSB existed at the time.⁵⁴ Moreover, while Kostelnik's staff had been preparing the Combined Development Force briefing, Big Safari had been told that Jumper now wanted the Predator armed within four months, though Pry and many others weren't sure why.⁵⁵ Even Raggio himself had no idea why the project was suddenly taking on such urgency.⁵⁶

The urgency was likely coming from the White House. President Bill Clinton had been pressing the National Security Council (NSC) and the Joint Chiefs of Staff (JCS) for months to find a way to capture or kill Al Qaeda leader Osama bin Laden following the terrorist group's Aug. 7, 1998, bombings of the US embassies in Kenya and Tanzania.⁵⁷ On April 25, 2000, the NSC's

counterterrorism coordinator, Richard A. Clarke, had sent a memo to members of an inter-agency Counterterrorism Security Group (CSG) proposing to fly the Predator over Afghanistan to aid the CIA's search for Bin Laden.⁵⁸ If the Predator found the terrorist leader, the hope was that submarines in the north Arabian Sea could attack with cruise missiles. Clarke called the proposal "Afghan Eyes."⁵⁹ Sometime after penning that memo, Clarke learned that the Air Force was considering arming the Predator.⁶⁰

By the time Pry reviewed Kostelnik's briefing on the Small Smart Bomb, Big Safari was already working on the project informally and had come up with a different choice of weapon for the Predator. The Navy, it turned out, had modified some of its SH-60 helicopters to carry the Army's laser-guided AGM-114 Hellfire missile using the same AN/AAS-44(V) laser designator Big Safari had used on the WILD Predator in Kosovo.⁶¹ Though an Army weapon, the Hellfire appealed to Big Safari both because of its weight, which at 100 pounds was less than half the heft of the SSB, and because the Lockheed Martin AGM-114 was operational, had been used in combat, and already had been built in the thousands. Big Safari's interest in the Hellfire only increased after experts from the Army's Redstone Arsenal in Alabama visited Dayton and briefed them on the AGM-114 in detail.⁶²

Apprised of Big Safari's view, Raggio summoned Kostelnik to Dayton to discuss the project. Kostelnik would always remember the June 15, 2000, session as a "shitstorm of a meeting," with Raggio telling him off for invading ASC's turf.⁶³ Raggio recalled only, "I said that 'this is an Aeronautical Systems Center lead,' so we led it." Raggio concluded the meeting by giving Big Safari its first formal direction to take charge of arming the Predator.⁶⁴

On June 21, at ACC headquarters, Col. Robert E. Dehnert Jr., director of the Reconnaissance SPO at ASC, briefed Jumper on three options.⁶⁵ The first was the SSB. The second was the Low Cost Autonomous Attack System (LOCAAS), a 100-pound cruise missile still being developed at the time by Lockheed as an Air Force Research Laboratory project. Dehnert's briefing, which cast the purpose of the project as merely to demonstrate that a Predator could be armed, clearly pointed toward the Hellfire as the quickest option. The SSB would be ready for production in quantity, the briefing noted, only in six or seven years. The slides portrayed the LOCAAS as an even less desirable candidate, more technically risky and expected to go into production no earlier than 2007. Hellfire, the briefing said, was available "immediately" and could be integrated onto the Predator for an estimated \$485,000. The major technical risk lay in the fact that no one knew how the Hellfire's rocket plume would affect the fragile UAV. Despite all that, the briefing ended with a slide saying "we propose" the SSB as the solution that would be cheapest, carry the least technical risk, and avoid the Hellfire's need for Army involvement.

Dehnert's briefing also noted two potential political obstacles. First, to proceed with arming the Predator, the Air Force might need to get congressional approval of a "New Start Notification," a legal requirement for changes in DOD programs unmentioned in previous written justifications for appropriations. Air Force leaders were especially sensitive to this issue in 2000 because members of Congress and the media had severely criticized them in 1999 for failing to get such approvals.⁶⁶ The Air Force would also need approval from the Compliance Review Group (CRG), a DOD committee responsible for making sure new weapons systems were permissible under existing arms control treaties. If the CRG decided an armed Predator would count as a ground-launched cruise missile (GLCM) under the US-Soviet Intermediate Nuclear Forces Treaty of 1987, the project would be halted.

Jumper listened to the options, then concluded the briefing by telling Big Safari to come up with a detailed plan for arming the Predator with Hellfire. Four days later, NSC counterterrorism advisor Clarke sent CIA Director George J. Tenet a memo that said other agencies with representatives on the Counterterrorism Security Group "are unanimous that the Predator project"—meaning the plan to use the UAV to look for Bin Laden—"is our highest near-term priority and that funding should be shifted to it."⁶⁷ The CIA had been resisting the proposal partly because agency officials didn't want to help pay for it, but on June 29, the so-called Small Group—a special interagency committee of top officials cleared to see the most sensitive information concerning Bin Laden—approved the plan. The CIA later agreed to contribute \$2 million for a 60-day series of Predator flights over Afghanistan. The assignment to conduct them went to Big Safari, where it became known as "The Summer Project."⁶⁸

Just over two weeks later, on July 13, Dehnert briefed Jumper at ACC headquarters on two options for arming the Predator with Hellfire. One was an "accelerated" three-month effort for \$1.5 million that would entail "high technical risk" and disrupt both Big Safari's other Predator projects and ACC's plans for operational test and evaluation of the RQ-1.⁶⁹ The second was a nine-month effort for \$1.3 million with "medium technical risk."

Sitting in the meeting next to Jumper was GA-ASI President Cassidy. Dehnert was about three-quarters of the way through his briefing when Jumper turned to Cassidy and said, "What do you think about all this?"⁷⁰

"Let's go in your office," Cassidy said, which they did.

"You give us two million bucks and two months and it'll be a done deal," Cassidy told Jumper when they were alone.

"Done," Jumper replied.

Cassidy went back to the meeting, leaving Jumper in his office. When Jumper returned to the conference room, he told the gathering he had just phoned General Ryan, the Air Force Chief of Staff, and Lt. Gen. William J. Begert, Assistant Vice Chief of Staff. Then he gave the Big Safari team a surprise. He said they could have \$3 million to arm the Predator with Hellfire—and were to do *both* options Dehnert had presented. Ryan would find the funding and Begert would get New Start Justification approval. The Air Force, Jumper explained, “wants to make rapid progress on weaponizing UAVs.”⁷¹

PREDATOR MEETS HELLFIRE

A week after getting Jumper’s order, Big Safari hosted a meeting at its headquarters to discuss technical and other issues with Hellfire experts from Redstone Arsenal, engineers from GA-ASI, Big Safari’s OL Det. 4 and others from ACC and ASC.⁷² “My first question is, can I fire your missile off Predator without knocking it out of the sky?” Big Safari Director Grimes told the Army experts.⁷³

Whether the torque from the Hellfire’s rocket plume would throw the Predator into a spin when fired, or whether the plume’s pressure and temperature—1,050 degrees at its hottest⁷⁴—would damage the aircraft’s wing, tail, or fuselage, was a question that required engineering analysis, the team decided. GA-ASI already knew the wing would need to be beefed up to withstand the strain of a missile launch. The company also said hardpoints already built into each wing to carry payloads of up to 100 pounds apiece would have to be strengthened to put a 100-pound Hellfire and launch rails on each wing. The Army experts said they might have to borrow an M-299 launcher from the Navy because those bought for the Army’s AH-64 attack helicopters were in short supply. Once they had a launcher, they would have to find a way to reduce the thrust needed to trigger a release spring on the launcher’s rails, which holds the missile until fired, from the standard 600 pounds of resistance to about 235. Otherwise, a launch might rip off the wing.

Beyond that, they would have to integrate the missile’s circuitry and software with the Predator’s flight control computer and a new AN/AAS-52 Multi-Spectral Targeting System sensor turret, or “modified Kosovo ball,” Raytheon was developing to combine EO/IR cameras with a laser designator/rangefinder. The Hellfire’s software also would need to be modified to allow the missile, designed to be launched by helicopters at less than 2,000 feet, to be fired from the Predator’s normal operating altitude of about 15,000 feet. Then they would need to do test firings—first from the ground, then in the air—to make sure everything worked. They also had to try to meet Jumper’s instruction to test launch a Hellfire from a Predator within 120 days.

On July 28, Big Safari received official tasking to proceed from the Air Force acquisition office, SAF/AQ, but was instructed to confine its work to engineering and analysis and refrain from modifying any aircraft pending New Start and INF treaty compliance approval.⁷⁵ Over the next few weeks, GA-ASI and Big Safari, reinforced by engineers from other parts of ASC, got as ready as they could to actually put a Hellfire on a Predator. The Aeronautical Systems Center Engineering Directorate at Wright-Patterson did an analysis finding that the Hellfire's plume would be away from the aircraft so fast—the missile would be 16 feet past the Predator's nose within 250 milliseconds—and would be so compact that the Predator's tail would only “see” a high temperature of 440 degrees Fahrenheit as the missile departed, while the wing and fuselage would see only 170 degrees. The air pressure change would be no problem at all.⁷⁶ GA-ASI did analyses showing that a Hellfire indeed could be launched from a Predator without breaking the aircraft or throwing it into a spin. At Rancho Bernardo, meanwhile, the contractors began writing the necessary software and designing new ribs and cross brackets to go into the Predator's wings at their hardpoints to hold a single-rail launcher derived from the M-299.

As the work they could do without New Start and treaty approval went on, two other small Big Safari/GA-ASI teams headed overseas to fly the Predator over Afghanistan in search of Osama bin Laden—the Afghan Eyes program initiated by the National Security Council. One team was a Launch and Recovery Element that would take off, land, and maintain the RQ-1 from an airfield in Uzbekistan, next door to Afghanistan.⁷⁷ The other team deployed with a GCS to yet another country that was located within the beam footprint of a satellite in orbit over Southwest Asia. Using a new communications system devised by a Big Safari consultant, the crew would be able to fly the Predator over Afghanistan from more than 3,000 miles away, a practice the inventor dubbed “Split Operations.”⁷⁸ From there, Big Safari began flying Afghan Eyes missions over Afghanistan on Sept. 7, 2000. On its first flight over Bin Laden's Tarnak Farms compound outside Kandahar, the Predator's camera spotted a man intelligence analysts believed to be the Al Qaeda leader himself.⁷⁹ On Sept. 28, the Predator saw him again, but no submarines were in position to launch cruise missiles.⁸⁰

The second apparent Bin Laden sighting came a week to the day after the Air Force received New Start approval from congressional leaders to arm the Predator, releasing funds to pay for the project. Big Safari had been forced to stop all work on it for 10 days after AFMC's Judge Advocate General office had issued a legal opinion on Aug. 30 forbidding all “touch labor” prior to getting New Start approval.⁸¹ Now the team could start installing some hardware. They were still barred, though, from actually attaching a missile to a complete Predator airframe without a decision on whether the modified aircraft would constitute a cruise missile under the INF treaty.⁸² To get around

that stricture, the engineers took a Predator's wings off and propped them on saw horses. Then they ran wires from the Hellfire launcher and a ground test missile on one wing to the flight control computer in the disassembled Predator's fuselage to check whether the systems would work together once the wings were re-attached. By Oct. 17, the team had done all the work it could pending a resolution of the treaty issue. They were also waiting for Raytheon to deliver the new sensor ball, which was expected by Dec. 15.

In the meantime, as the CIA Director at the time, George Tenet, later testified to the 9/11 Commission, "Air Force and CIA officers began to discuss the possibility of capitalizing on an Air Force program to arm the Predator by adapting it to carry and fire Hellfire missiles. These officers, and later the leadership of CIA, reasoned that if we could develop the capability to reliably hit a target with a Hellfire missile and could develop the enabling policy and legal framework, we would have a capability to accurately and promptly respond to future sightings of high value targets."⁸³

Despite that development, with the treaty issue still unresolved, the project remained in limbo for nine and a half weeks. On Dec. 22, though, Grimes got a call from Lawrence J. Delaney, Assistant Secretary of the Air Force for Acquisition, giving Big Safari a green light.⁸⁴ The DOD Compliance Review Group had finally decided an armed Predator wouldn't constitute a GLCM under the INF treaty. By now, Pry and others on the Big Safari team were chafing at the bit, but GA-ASI had closed its plants for the holidays. On Jan. 2, 2001, though, the Predator/Hellfire team went to work at top speed to complete the project.

FROM CHINA LAKE TO AFGHANISTAN

On Jan. 23, the team gathered at Naval Air Weapons Station China Lake in California for the first test of their work. From Predator No. 3034, the airframe they had modified at GA-ASI and now had chained to a concrete pad atop a small mountain at China Lake, the team launched an inert Hellfire at a target tank in the desert three miles away. The new sensor ball wasn't ready yet, but the test's main purpose was to see what effect a missile launch would have on the Predator, so the team used an Army ground laser designator positioned a half mile from the target to spot the tank for the Hellfire. The inert missile hit the tank square in the turret.⁸⁵

Three days before that test, President George W. Bush had taken the oath of office, and with him came a new national security team with starkly different priorities from those of their predecessors. NSC counterterrorism advisor Clarke, deeply convinced that Al Qaeda was the greatest imminent

threat to the United States, had been the driving force behind the Predator missions flown over Afghanistan before Bush was elected. In December, Clarke had prepared a strategy paper for his new boss, National Security Adviser Condoleezza Rice, aimed at getting the Bush administration to share his views. Clarke's paper laid out an "agenda for urgent action" that included "Going forward with new Predator reconnaissance missions in the spring and preparation of an armed version of the aircraft."⁸⁶ Two days after the Predator's first Hellfire test launch at China Lake, Clarke sent his strategy paper to Rice.

By then, the Big Safari team had packed up Predator 3034 and other equipment and moved everything to Indian Springs to start flight tests. On Feb. 16, flying 3034 from a GCS in a Conex container parked on one of nearby Nellis Air Force Base's test ranges, the team made history by launching the first missile ever fired from a Predator in flight, though not a live missile. To guard against a runaway missile mishap, the Nellis range operators had assigned the Predator to an area bounded on three sides by mountains, though the precaution proved unnecessary. With the Predator flying at low altitude and a target tank illuminated once again with a ground laser designator, the inert Hellfire performed just as the one fired from the ground at China Lake had done. It hit the target tank's turret about six inches right of center, spinning the turret around about 30 degrees. GA-ASI was so pleased it issued a news release quoting Big Safari's Maj. Ray Pry describing the results.⁸⁷

Five days later, again on the Nellis range, the team made military history by firing the first live missile ever launched from a Predator, this time lasing the target with the modified Kosovo sensor ball and hitting it from 2,000 feet above ground level (AGL). The missile was an AGM-114C Hellfire, an older model limited to lower altitudes but cheaper and more readily available than the AGM-114K the team planned to use during Phase II of the project, when the flight tests would move to higher altitudes.⁸⁸

On March 16, after briefings to senior leaders on the project's success so far, Big Safari received an instruction from SAF/AQ to go ahead with Phase II.⁸⁹ There were a variety of software and other adjustments to be made in the system, and the new MTS ball was still being integrated with the Predator and Hellfire systems.⁹⁰

There was a new set of tests to organize, too, because of decisions being made at the NSC and CIA. The head of the CIA's Counterterrorism Center (CTC), J. Cofer Black, and the head of the CTC's Bin Laden unit had begun pressing higher-ups to accelerate the Air Force's development of the armed Predator so it could be flown over Afghanistan and possibly used to attack Bin Laden.⁹¹ To be sure a Predator-launched Hellfire could kill the Al Qa-

eda leader if fired into his residence at Tarnak Farm, the CIA provided Big Safari with specifications and funding to construct a simple adobe building at China Lake to conduct test shots against. The structure was built that spring—far too sturdily, it turned out—and a Big Safari crew conducted a series of test shots, using plywood silhouettes and a variety of other “soft targets” inside the adobe building and testing Hellfires against a variety of vehicles on the range to gauge the missile’s lethality.⁹²

The initial results were unsatisfactory, for the Hellfire, designed as an anti-tank missile, contained a precision shaped charge optimized for penetration rather than fragmentation. When fired into the test building, it would punch through the wall and burrow into the ground. Unless an individual was hit directly or was very close to where the charge went off, the loud bang and concussion might unnerve him, but he was unlikely to be killed or even seriously wounded. As the tests went on, the team began consulting with Redstone about whether the Hellfire could be modified to make it a fragmentation weapon with a larger lethal radius.

As the lethality tests were being conducted, Phase II of the Air Force’s part of the project proceeded. From May 22-31 at China Lake, the Big Safari team conducted a series of Hellfire-K test firings at succeeding higher altitudes up to 15,000 feet AGL. Big Safari was still working on another aspect of the project as well: devising a way for the Predator’s crew to operate the aircraft from a GCS in the United States. Even with the CIA’s new interest in using the armed Predator to go after Bin Laden, it was still unclear whether the Bush administration would take that step. At the White House that spring, counterterrorism advisor Clarke had found it impossible to get the new national security team to even focus on the issue. If the armed Predator ever were to be used to go after Bin Laden, though, there were a host of reasons it would be best if it could be operated without putting the GCS in a third country, as had been done for the unarmed Predator flights over Afghanistan.⁹³ Consequently, as Phase II of the project to arm the Predator proceeded, Big Safari had the scientist consultant who had created the “Split Operations” communications setup used during the Summer Project working on what would come to be called “Remote Split Operations”—the ability to fly the Predator over a country on the other side of the globe from the United States.⁹⁴ The solution the consultant came up with was complex—other experts insisted it would never work—but essentially consisted of routing the Predator’s signal to a satellite over Southwest Asia, then to a second antenna on the satellite, then to an antenna on the ground in Europe, and then feeding it across the Atlantic via fiber optic cable.⁹⁵

On July 11, as Big Safari continued its Hellfire tests, Stephen J. Hadley, Deputy National Security Adviser, sent the CIA and DOD a memo directing them to have armed Predators ready to fly over Afghanistan no lat-

er than Sept. 1.⁹⁶ As the summer unfolded, crews were still developing tactics, techniques, and procedures (TTPs) and testing the Remote Split Operations system. Policymakers, meanwhile, were debating whether the CIA could legally use such a weapon. They were still divided on that point by Sept. 4, when National Security Adviser Rice reported to a meeting of NSC principals that the armed Predator wasn't quite ready. The principals agreed to renew unarmed Predator flights over Afghanistan while the Air Force finished its work on the armed version.⁹⁷

A week later to the day, shortly after the second of two airliners hijacked by Al Qaeda terrorists crashed into the World Trade Center towers, members of the Big Safari team began getting phone calls from Grimes. Pack a bag, he told them, and get to the airfield at Palmdale, Calif., site of a Big Safari detachment at Lockheed Martin's famous Skunk Works facility. A C-17 would be there soon to pick up three Predators modified to carry Hellfires and those needed to operate them.

Three days later, a Big Safari-led team was in Uzbekistan with the three armed Predators, and a few days after that, a Big Safari-led crew began flying them over Afghanistan from a GCS in the CIA's parking lot.⁹⁸ On Oct. 7, they fired their first missile.⁹⁹

PREDATOR GETS POPULAR

There were two Predators in the air over Afghanistan when the war there began on Oct. 7, 2001. One was the armed version, flown for the CIA by Big Safari's team. The second was an unarmed Predator, launched from Pakistan and flown by a regular ACC crew.¹⁰⁰ As the war unfolded, the Predator was used often against "high value targets" because of the accuracy and low collateral damage of its Hellfires.¹⁰¹ The Predator's video, meanwhile, proved especially valuable in the UAV's role as an airborne FAC—and led to Big Safari's next assignment.

On Nov. 8, Lt. Col. R. Kevin Hoffmann, commander of Big Safari's detachment at Palmdale, which mainly worked on projects other than the Predator, got a call from Grimes. "I don't care what you guys are doing, I want you to drop everything," Grimes said.¹⁰² He continued: "On Monday morning you will have an AC-130U gunship show up on your ramp, as well as all the Predator guys. I want you to do everything you can to support them."

The Air Force Special Operations Command AC-130U, the heavily armed ground attack aircraft known as "Spooky," was coming because Big Safari had been asked to solve a problem the gunship's crews were having in

sparsely populated and mountainous Afghanistan, where sound carries greatly at night. During orbits required to line up their targets, Spooky crews would often see enemy fighters scatter, alerted to the AC-130U's arrival by its engine noise. Predators in Afghanistan were being used to direct AC-130Us to their targets, with the crews of the two aircraft communicating by radio. At some point, someone realized that if AC-130Us could see Predator video as they flew, their crews would be able to calculate their firing solutions before getting close enough to tip off their targets that Spooky was on the way.

Big Safari's answer to the problem was relatively simple in the end, and achieved quickly. A Predator uses a C-band line-of-sight data link to take off and land. The aircraft is controlled through a Ku-band beyond-line-of-sight satellite data link once it flies 150 miles or so from where it was launched, but the C-band data link can continue to transmit the Predator's video. By the time the AC-130U arrived at Palmdale, Big Safari's favorite scientist consultant—the one who had created ESD overlays for the Predator's video at Tuzla in 1999 and devised the Remote Split Operations system of operating the Predator, among other innovations—had spent four days considering about a dozen possible ways to get Predator video to Spooky crews in flight.

The solution the scientist decided on was based on a system GA-ASI had spent six months or so developing as part of an unsuccessful effort to win a contract to provide the Army a small Tactical Unmanned Aerial Vehicle able to stream ISR video to ground troops. (GA-ASI's entry, a 700-pound UAV called Prowler II, lost the competition to the AAI Corp. Shadow 200.¹⁰³) When the AC-130U arrived at Palmdale, personnel from the Big Safari detachment there, from GA-ASI, and from Lockheed attached a C-band antenna to the top of the gunship's crew escape hatch, above and just behind the cockpit. The Big Safari scientist and GA-ASI's lead hardware engineer, Jesse Stence, meanwhile, fastened to the bottom of the crew hatch an assembly of hardware they had devised that included an electrical power unit, a C-band receiver, and a digital decoder. They wired that system's power unit to the AC-130U's power system, then ran coaxial cables from their device to two 15-inch video display terminals (VDT)—bought off-the-shelf at a local store—attached to the top of the AC-130U's two sensor operator stations. That work was done Monday night and Tuesday. On Wednesday, the AC-130U and a Predator flew a test. With the Predator sending its video through its omnidirectional C-band antenna from over El Mirage, the AC-130U could receive its imagery from up to 25 miles away, and when the video was sent through the Predator's directional C-band antenna, the gunship crew could see it on their new VDTs from more than 100 miles. By Tuesday of the next week, after the Big Safari/GA-ASI team refined the engineering a bit, two AC-130U gunships equipped with the new system had departed for Afghanistan.

“It was done quick and dirty,” Grimes recalled, but AC-130U crews said it dramatically increased their effectiveness.¹⁰⁴

The new Predator-AC-130U link had no name at first, but it got one not long after an Army Special Forces soldier, Chief Warrant Officer 2 Christopher Manuel, appeared at Big Safari’s door one day late that December.¹⁰⁵ Born in Springfield, Ohio, a mere 20 miles from Wright-Patterson Air Force Base, Manuel was home for the Christmas holidays after having spent four and a half months in Stuttgart, Germany, and an additional month in Kuwait as 3rd Special Forces Group liaison to Special Operations Command Europe. Prior to his time at Stuttgart, Manuel had become familiar with Predator operations over Bosnia, where ACC crews were still flying ISR missions with RQ-1s. He found himself thinking how great it would be if troops on the ground could see that kind of imagery when going into a fight, as he was now preparing to do.

Manuel was preparing to deploy to Afghanistan with C Company, 3rd Battalion, 3rd Special Forces Group, and one of their missions would be the dangerous task of going into caves to look for Al Qaeda and Taliban militants. Before his unit went, Manuel wanted to see if the Predator SPO could come up with a way for his unit to receive Predator video of their target areas on the ground in real time, perhaps by feeding it to a device Special Forces used for intelligence and reconnaissance, the Special Operations Tactical Video System (SOTVS). Before coming home for the holidays, Manuel had made an appointment to visit the Predator program manager at Wright-Patterson while he was in the area.

Bearded and in civilian clothes, Manuel arrived at the appointed hour, with an SOTVS in the back of his SUV, but the officer he’d made an appointment to see wasn’t there. The security guard at the front desk, though, called Big Safari’s offices and Manuel was quickly invited in, where a couple of the unit’s experts and director Grimes sat down with him in a conference room. After establishing to their satisfaction that he was in fact a Special Forces soldier, Manuel explained that C Company was on its way to Afghanistan and cave clearing would be one of its missions.

“I know these guys are flying up there,” he said of the Predator. “I just want to see the video before I get there so I know what I’m getting into, what my team’s getting into, when we go in.” Ideally, Manuel said, he would like to be able to see Predator video of a target area from as far as 100 miles away. “We want to help,” said Grimes. “How long can you stay?”

The next day, Manuel came back to explain his idea to the Big Safari consultant who, with GA-ASI’s Stence, had created the system now being used by AC-130Us to receive Predator video. After a long talk with Manuel, the scien-

tist said he would need to go to GA-ASI to consult with Stence but thought they could put together a system that would let troops receive Predator video on the ground—and have it ready to use within about two weeks.

In early January, Manuel was invited to California to help test a shoebox-sized receiver/transmitter with a small video screen and a six-inch-by-six-inch C-band antenna attached to it, a system much akin to the one now streaming Predator video to AC-130Us. Soon it would become Big Safari's latest Predator innovation.

With a Predator flying over El Mirage, Manuel, the Big Safari scientist, and Stence climbed into an SUV and started driving toward Las Vegas on Interstate 15, the scientist holding the “shoebox” as they drove. They were in a mountain pass near the Nevada border, 117 miles from El Mirage, when the scientist proudly reported, “We’ve got it.” Looking at the video screen on the “shoebox,” Manuel could clearly see hangars and other buildings around El Mirage as viewed through the Predator’s camera.

The next week, Manuel came back to California to work with Stence on refining the software in the device, which Manuel wanted to be simple enough that any soldier could be trained to use it in about 15 minutes. Stence was now calling the new piece of equipment “ROVER.” Big Safari OL Det. 4 engineer Bob Miller had come up with the name, saying the device could best be thought of as a “Remotely Operated Video Enhanced Receiver.”¹⁰⁶

When Manuel went to Afghanistan in February, he took the prototype ROVER with him, and it wasn’t long before it proved its value. In a raid mounted to capture a suspected Al Qaeda facilitator, Manuel’s ability to see Predator video let him warn Special Forces troops of two potential ambushes, then prevent them from firing on people running from the target location. Manuel could see from the Predator video on his ROVER that they were women and children.

After Manuel began using the prototype in Afghanistan and word of it spread among the special operations community, GA-ASI received orders for a refined version and ultimately supplied 147 ROVERs to special operations forces and US Air Forces Central, air component of US Central Command.¹⁰⁷ Later on, Big Safari began calling the system used on AC-130U gunships ROVER I and the ground troop version ROVER II. Later still, the military contracted with L-3 Communications Corp. for a series of increasingly smaller and more capable derivatives that could receive video not just from Predators but a variety of UAVs. L-3 started with ROVER III and within a couple of years was making the handheld ROVER 6. Thousands are in use by US troops today.

PREDATOR FIGHTS AIR-TO-AIR

Even before Big Safari created ROVER II, policymakers had become enamored with the Predator's utility in Afghanistan, from launching Hellfire strikes to serving as an airborne FAC for AC-130Us and other attack aircraft, to providing ISR for ground commanders. As the war began, among the locations Predator video was being streamed to was the White House Situation Room, and one of its most interested viewers was President Bush.¹⁰⁸ On Dec. 11, 2001, less than two months after the armed Predator debuted in Afghanistan, Bush spoke at The Citadel in Charleston, S.C., where he said that since the war's beginning less than two months earlier, the Predator had made it "clear the military does not have enough unmanned vehicles."

The next day, the new Air Force Chief of Staff—Jumper, who had taken over as the service's leader on Sept. 6—approved a US Central Command Combat Mission Needs Statement establishing a requirement to retrofit all Predators with Hellfire missiles.¹⁰⁹ In 1999, as commander of US Air Forces Europe, Jumper had suggested Big Safari's first innovation with the Predator, the laser designator added for Kosovo. In 2000, as ACC commander, he had been the pivotal player in the decision to arm the Predator with the Hellfire. Now, as Chief of Staff, and with the Predator proving its value in Afghanistan, Jumper was ready to take the revolutionary weapon he had helped create out of the niche it still occupied and give it the prominent role in Air Force operations he felt it deserved.

Congress was enthusiastic, too. Before the war in Afghanistan, the Air Force had bought 12 Predator systems of four aircraft and a GCS each, and the service's pre-war fiscal 2002 budget request had asked for only six Predator aircraft, as attrition replacements, at a cost of \$19.6 million.¹¹⁰ After the war began, as part of the Defense Emergency Relief Fund supplemental appropriations for fiscal 2002, Congress approved Air Force requests for \$167.6 million to add MTS sensor balls and Hellfire missiles to the existing fleet and add four Predators to it.¹¹¹ The amended fiscal 2002 defense appropriations bill, meanwhile, included additional funds that brought the total Predator buy that year to 16, with another 22 requested in fiscal 2003.¹¹²

By late 2002, as the first of those aircraft were still being built, Predators operated from Kuwait by ACC crews were flying ISR missions over Iraq, where they had first been sent in 1999 to help enforce the no-fly zones the United States and its allies had imposed on dictator Saddam Hussein's country since the 1991 Gulf War. With the Bush administration making it increasingly clear that the United States might soon invade to remove Hussein, the dictator's air force began to get aggressive against the Predator—the only US plane its pilots dared go up against—by launching fighter aircraft to try to shoot it down. Jumper didn't like that, and if a war began, the Air Force was

planning to use its newly armed Predators to try to find and kill perhaps the most worrisome weapon Iraq had used in 1991, Scud missiles mounted on mobile launchers. Given the importance of that prospective mission, and as the Predator's godfather within the Air Force, Jumper didn't hesitate when Snake Clark—now retired from the Air Force but still director of quick reaction combat support on the Air Staff—came to him with an idea for how to make the Iraqi fighters back off.

One way to protect the Predators over Iraq, Clark told Jumper, might be to mount Stinger missiles on them in place of Hellfires. Small enough to be man-portable but also used on Army and Marine Corps helicopters, the Stinger would be light enough for the Predator to carry. A Predator crew would find it hard, if not impossible, to spot an Iraqi fighter and launch a Stinger quickly enough to have a chance of hitting it, given the speed of a jet. At the very least, though, giving the Predator a way to shoot back might spook Hussein's pilots, Jumper and Clark agreed.

On Sept. 25, 2002, Big Safari gave GA-ASI a contract to integrate the Stinger onto the Predator.¹¹³ By Oct. 15, software integration was complete, a new MTS sensor ball was in hand and a supply of Stingers was on the way to China Lake, where a Big Safari crew began flying tests in early November.¹¹⁴ First the crew flew some "captive carry" tests with Stingers mounted on the Predator's hard points. Then they flew mock engagements against a Cessna 206 and an F-16 to develop a concept of operations. Finally, they launched eight Stingers, four of them live rounds, at ground targets. The targets included an array of stovetop burners rigged on stands and electrically heated to give the missile's infrared seeker something to seek. The results were less than impressive, with one of the four live-round shots hitting the ground between two targets and one missile self-destructing in flight. The new system was deemed good enough for its purpose, though, and 56 days after GA-ASI got the contract, it was deployed to Kuwait.

The Stinger-armed Predator got into several inconclusive engagements with Iraqi fighter planes over the no-fly zones at first, then did genuine air-to-air combat with a MiG-25 Foxbat that came up to meet it over Iraq on Dec. 23, 2002.¹¹⁵ In an incident whose Predator video was later broadcast by CBS News and can still be found on the Internet, the engagement began when the MiG turned to attack head-on and fired a missile. The Predator crew fired a Stinger back. The video shows the smoke trails of the missiles crossing, then the Stinger starting to dive, coming nowhere close to the MiG. Then the Predator video suddenly ends. In the CBS broadcast, as footage of Predator wreckage lying in the desert is shown, correspondent David Martin explains that only the MiG's missile found its mark.

The engagement with the MiG-25, though, had precisely the effect Jumper

had hoped it would. From that time through the US invasion of Iraq that began the following March, no Iraqi fighter plane ever attacked a Predator again.

“Although the chances of hitting him were miniscule, we knew it would scare the hell out of them to have somebody shoot back,” Jumper said. “And that’s exactly the effect it had.”¹¹⁶

CONCLUSION

In 2002, the Air Force changed the Predator’s designation to MQ-1—changing the R for reconnaissance to M for multi-role—to reflect the aircraft’s new status. GA-ASI would soon offer the Air Force a larger Predator derivative able to carry bombs as well as Hellfire missiles, an aircraft the service bought and later designated the MQ-9 Reaper. For the next seven years, though, the Air Force continued to order MQ-1s as well, and the Predator played an important role—at times pivotal—in military operations in Afghanistan, Iraq, and elsewhere in the world. Only on March 1, 2005, though, did ACC declare that the Predator had reached “initial operational capability”—a decade after its first deployment over Bosnia.¹¹⁷

Big Safari remained the Predator SPO as the Air Force fleet of MQ-1s grew, but with IOC in 2005, the program began to be “normalized.” On March 18 of that year, the Air Force announced plans to expand its MQ-1 fleet to as many as 15 squadrons and create a new office to take over from Big Safari as the SPO and manage the Predator under all the attendant regulations and milestones of the regular defense acquisition process.¹¹⁸ The next year that office was designated the 658th Aeronautical Systems Squadron (658th AESS).

On Nov. 1, 2005, well before the 658th AESS stood up, the officer who had led the Air Force into a new age of warfare by steering the Predator’s transformation, Gen. John P. Jumper, retired after 39 years in uniform. The revolution Jumper and Big Safari had spearheaded by turning the Predator from an ISR platform whose future seemed dubious into a technological tipping point, however, was only gaining steam. In March 2008, the Predator was designated an Acquisition Category 1D program. Shortly after that, a new 703rd Aeronautical Systems Group was activated to take over both Predator and Reaper program management, while the 658th Aeronautical Systems Squadron was deactivated. By 2009, the Air Force would announce that in the coming year it would train more pilots for remotely piloted aircraft than manned fighters and bombers.¹¹⁹ Earlier that year, the service had released an 82-page Unmanned Aircraft Systems Flight Plan 2009-2047 that

said the Air Force would expand its use of UAVs of all kinds, from moth-sized nano-drones able to flit through windows and spy inside buildings to large automated bombers and fighters controlled from ground stations.¹²⁰ The plan predicted that by the Air Force's 100th anniversary in 2047, the service would have UAVs equipped with artificial intelligence and able to decide on their own—without human intervention—when and whether to attack a target.¹²¹

That day was still far in the future on March 3, 2011, when a crowd of Air Force and other dignitaries gathered at GA-ASI's Gray Butte Flight Operations Center for a ceremony to mark the delivery of the Air Force's 268th and last Predator.¹²² Over the years, more than 90 Predators had been lost to crashes or, like the one used to launch the first Hellfire missile in Afghanistan in 2001, retired.¹²³ That particular Predator, tail number 3034, was now hanging in the National Air and Space Museum in Washington. Even so, Predators were still flying over Iraq, Afghanistan, and elsewhere in the world. Air Force crews were flying most of them from active duty, Air National Guard, and Air Force Reserve Command bases in Arizona, California, Nevada, New Mexico, North Dakota, and Texas using the revolutionary Remote Split Operations communications system Big Safari had pioneered to control them, providing often crucial ISR to other aircraft and ground troops, using their laser designators to spot targets for strike aircraft, and launching Hellfire missiles at enemy targets.¹²⁴ Before the Predator's big safari began in 1998, few could have imagined it. ■

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