AIR & SPACE POWER History

WINTER 2022 - Volume 69, Number 4
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.....*Shape the Future*

The Air Force *Historical* Foundation

Founded on May 27, 1953 by Gen Carl A. "Tooey" Spaatz and other air power pioneers, the Air Force Historical Foundation (AFHF) is a nonprofit tax exempt organization. It is dedicated to the preservation, perpetuation and appropriate publication of the history and traditions of American aviation, with emphasis on the U.S. Air Force, its predecessor organizations, and the men and women whose lives and dreams were devoted to flight. The Foundation serves all components of the United States Air Force—Active, Reserve and Air National Guard.

AFHF strives to make available to the public and today's government planners and decision makers information that is relevant and informative about all aspects of air and space power. By doing so, the Foundation hopes to assure the nation profits from past experiences as it helps keep the U.S. Air Force the most modern and effective military force in the world.

The Foundation's four primary activities include a quarterly journal Air Power History, a book program, a biennial symposium, and an awards program.

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COVER: F–111F aircraft and an EF–111A Raven aircraft, rear, fly in formation over the desert during Operation Desert Shield. *(USAF Photo.)*

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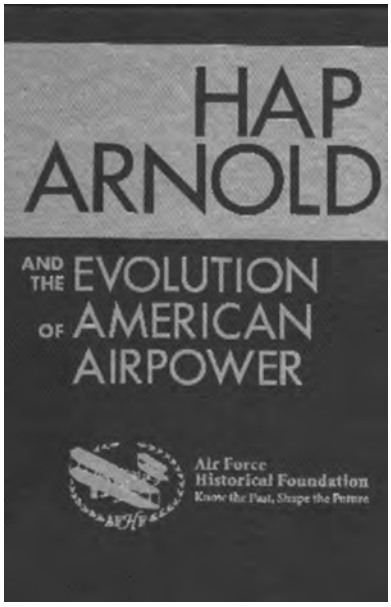
Biography as History



General of the Air Force Hap Arnold, was born during American industrialization. The airplane had not yet been invented. He entered the "Old Army" after graduation from West Point in a time when the horse cavalry provided mobility, reconnaissance, and offensive shock combat capability—functions of today's Air and Space forces. Arnold learned the technical aspects of flight and experienced both the thrill and the terror of piloting the first military flying machines. Much of his career focused on the development of the aircraft as an air weapon but also the process of creating an air force from the ground up. Research, testing, fabrication, logistics, manpower, airfield infrastructure, leadership and command were all part of the process of technological change that has remained at the heart of the modern U.S. Air and Space Force. After World War I, Arnold was the only Army officer that understood it all.

During his 44-year military career, Arnold met America's greatest aeronautical minds, engaged industrialists and manufacturers, trained with future military commanders, and flew every plane developed from 1910 through 1940. After retirement, Arnold wrote a letter offering timeless advice to younger Airmen listing several qualities required for a successful military career. Yet none of Arnold's requisites explained more about Arnold himself than integrity.

> *Personal integrity: This covers a very wide field. It means, for example, maintaining the courage of one's convictions. By no means should this be confused with stubborn thinking. Stubborn thinking is as outmoded as the ox cart. Its exact opposite, resilient thinking, is Today's Must—a man must be able to accommodate his thinking quickly and accurately to his rapidly changing world; nevertheless, it must be his thinking—not someone's else's. Personal integrity also means moral integrity…The man who is genuinely respected is the man who keeps his moral integrity sound; who is trustworthy in every respect. To be successful, a man must trust others; and a man cannot trust others, who does not trust himself.*

Those Arnold trusted enjoyed free and independent authority to accomplish given missions and tasks with relatively little interference. Larry Bell's XP–59A jet project, "Jimmy" Doolittle's Tokyo Raid, Curtis LeMay's strategic bombing of Japan, Kármán's study of future technologies, Spaatz, Eaker, and Jackie Cochran, were some of the most well-known illustrations of this trust. In the end however, Arnold realized that he, among a fortunate few, had one other quality that could not be learned or taught. Arnold described it as "the intangible—the spirit of a man."

Hap Arnold was the first modern "Commander in Chief" of America's strategic air forces. His legacy is the creation of a scientific and technological foundation of a force of complex weapons systems and highly trained Airmen, Guardians, and civilians that operate and support America's Air and Space Force around the world.

Know the Past…Shape the Future!

Pick up a copy as a gift for the holidays at: **www.afhistory.org/programs/books/**

This Air Force Historical Foundation, Special Edition, was released in 2012 as part of a joint publication effort with the USAF, Air Command and Staff College located at Maxwell AFB, Alabama. This beautiful award-winning, hardbound, limited-edition volume will thrill any biography-lover on your gift list.

Air Force Historical Foundation "Shows the Flag" at the Air, Space, Cyber Conference — National Harbor Convention Center

To celebrate the 75th anniversary of the creation of the US Air Force, Foundation leadership attended the single largest air, space, and cyber tech event in America. From September 17 through September 21, hundreds of organizations, commercial and military, packed the convention halls of the Gaylord at National Harbor. AFHF had a small (10X10) booth amongst the massive displays of technology and cyber-products.

Small but mighty, the AFHF staff introduced thousands of floor-walkers to the benefits of Foundation membership, described the many projects and programs currently underway with Foundation support.

Unfortunately, the trend away from "Knowing the Past" seems pervasive among Airmen and Guardians alike. Such a trend only highlights the purpose of our Foundation and the importance we must place upon studying USAF history, including that history related to the newly established Space Force, so that we have the tools to intelligently "Shape the Future."

Providing tools to that end is our mission, pure and simple. We need your help.

The Foundation has established a program to archive historic documents and papers through a partnership with the Information Technology school at the University of Alabama. We are seeking funding to place interns to work on the Hap Arnold Project—the first concrete effort to preserve and make available the personal records of the founding father of the USAF. Robert Arnold, Gen. Arnold's grandson, has given us access and permission to archive all of the papers and images from the general's personal collection. With your help, the $20,000 needed for the project will ensure its completion during the next calendar year. This is only one of several initiatives underway at AFHF Headquarters.

The executive staff at AFHF charges each and every AFHF member to set a simple Foundation-related goal for the end of the year. Seek out ONE new member. Show them the benefits the Foundation offers. Convince them to join. Purchase a membership for someone you know or an organization that would love it as a holiday gift. Or, if you prefer, make a pledge to donate to the Foundation during "giving Tuesday"—or on any other day this fall. Purchase *Hap Arnold* from the AFHF website. It makes a great gift and there are even some autographed volumes available. Every gift or membership is greatly appreciated and is put to good use helping us "Know the Past" and " Shape the Future."

Visit the Air Force Historical Foundation website at:

https://www.afhistory.org

Air Force Historical Foundation
Know the Past, Shape the Future

Project Phoenix

The Air Force Historical Foundation (AFHF) was established by our first Airmen. The list of those who attended the AFHF Organizational Meeting on May 27, 1953 is astonishing! Among the notable attendees were:Gen. Carl A. "Tooey" Spaatz, first USAF Chief of Staff; Gen. Hoyt Vandenberg, second USAF Chief of Staff ; Gen. Nathan Twining, third USAF Chief of Staff and first Airman named Chairman of the Joint Chiefs; Lt. Gen. Thomas D. White, fourth USAF Chief of Staff; Maj. Gen. Benjamin Foulois, the first Army Air Service pilot (1909-1911). Chief of the Air Service (AEF) Mexican Punitive Expedition (1916), Chief of the Air Corps during 1934 Mail Fiasco; Brig. Gen. Thomas DeW. Milling, holder of Military Aviator Certificate No.1 (1912); Gen. Laurence Kuter, one of the WW II architects of AWPD-1, and Deputy Chief of Air Staff under Hap Arnold; and John Victory, first employee and only Executive Secretary the NACA ever had.

YOU, as a member of AFHF, are part of the vision that they had in 1953. Imagine if, today, such a meeting took place in the Pentagon. You are right! It could never happen. But it did happen in 1953 and together these Airmen established the initial guidelines and programs for the Air Force Historical Foundation. That is how important preserving USAF history was to our early leadership. That is why AFHF matters. That is why we created OPERATION PHOENIX, the rebirth of the AFHF as envisioned by the founding members of both the USAF and the AFHF.

These Airmen established the Foundation with a specific purpose in mind. I am going to reprint a portion of the founding document here because it is critical to understanding who we are and what we stand for. Even after seventy years have passed, the ideals that these Airmen established for the Foundation are alive and well today.
They said:

1. OBJECTIVE: To preserve and perpetuate the annals of American air power, especially the annals of the United States Air Force and its predecessor organizations and of the individuals composing those organizations; to disseminate to the men and women of the air force, to the public, and to posterity accurate and complete historical information on air subjects; and to preserve in suitable repositories significant materials depicting the history, culture, and traditions of the United States Air Force.

For our Guardians, Air Force history IS your history and always has been. The founders believed that was true. From Goddard to McCall and Schriever to Raymond, Space history has been included in the history of the USAF. The early issues of the AFHF journal: *The Airpower Historian (originally Air Power)* covered Dr Goddard's early rocketry efforts, as well as NASA space efforts such as Gemini. AFHF has always understood and included Space history as part of its legacy.

Last year, the AFHF began a revitalization effort to boost membership, expand history-related programs, update an outmoded website, host a bi-monthly Book Club (which has been wildly popular), broaden outreach to the national air museum community, and partnered with the USAF to produce children's coloring books featuring WW II airpower artwork donated by Disney for distribution at airshows and other public events. These education efforts and others will continue as funding allows.

This coming year, we are going to build our programing with a focus on the end of the War in Vietnam, improve access to our already excellent journal, re-enter the academic publishing world, and expand our awards program in a nationwide effort to highlight the best and the brightest in performance and in practice. We are defining our working committee structure to focus these efforts. The AFHF fall membership meeting is being thematically planned to highlight the end of the War in Vietnam. Although we do not yet have a location finalized, the event will combine traditional symposium events with exhibit tours, and as many members as we can convince to attend (there will also be a ZOOM option for symposium talks and events). We are honored that you are a member of AFHF and hope that you are enriched by the Foundation's contributions to preserving the history of the USAF—both air and space branches. We could not offer these programs and resources without your generous donations and membership.

How can you help? We hope you will consider increasing your membership level or giving a membership to another air and space history enthusiast. If each member gifted just one membership…well, you know what could happen. Purchase a book for holiday giving from our website like the AFHF Special Edition of *Hap Arnold and the Evolution of American Airpower*, or the beautiful coffee-table book, *The Air Force*. Sponsor one of the Foundation's annual awards celebrating excellence, determination, and service—for one year or for ten years. Celebrate the AFHF's commitment to the preservation of USAF history by sponsoring the Hap Arnold Project or the 9/11 Project under development in partnership with the University of Alabama. Help the Foundation to provide a research grant to draft important new books documenting the history of the service. Sponsor the Foundation's annual literary prizes for significant, newly published books and articles that examine air and space history.

Host the Foundation's Book Club Zoom Meeting or Warrior Stories Night including web advertising and a brief appearance to introduce the meeting. We are also looking for members willing to tell their personal "Nam War Stories"

during a one-hour zoom session in 2023. Be one of the first to purchase "info/adds" in the Foundation's journal—one page, one image, and five hundred words that describe your company's history with the USAF over the years. There are many opportunities for any donor or sponsor. Contact us for details.

If you are one of the Foundation's members who have published air and space history works, consider donating one of your books or a case of your books (autographed, of course) that we can feature on our book sale web page. The proceeds from sales of those books would boost your visibility and assist the Foundation in its work. Ship them to the foundation address and we will do the rest. Let us amaze the membership with the number of gifted authors we have in our ranks. We welcome all feedback and suggestions during our effort to make AFHF the "go to" for historical issues within USAF and our expanding SF circles. For AFHF, every day is "Giving Tuesday!"

THANK YOU for all you have done for AFHF. It is my privilege to serve as the President of the Board,

Jonna Doolittle Hoppes
President

General James M. Holmes, USAF (Ret.)
Chairman of the Board

From the Editor

This issue, we run the chronology from World War II through the first Gulf War. We hope you enjoy the variety and the interesting topics.

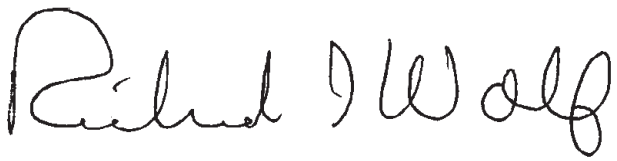
We start with an article by return contributor Theo van Geffen, who continues his series on USAF operations in Desert Shield/Desert Storm with Part 3.

Our second article is by first-time contributor Mike Croissant, recently retired from the CIA, who tells the story of a Top Secret emergency landing field in Yugoslavia during World War II.

Our third article is by a long-time member and multiple contributor David Stumpf, with another fine article on USAF ballistic missiles.

Our fourth article is by another repeat contributor, as Daniel Haulman provides a wealth of statistics on fighter escort units and missions in the Fifteenth Air Force in 1944 and 1945.

The Leadership's Message begins on page 5. It's worthy of the reading. Don't miss Upcoming Events on page 62, although I fear you must continue to take many dates in that section as still uncertain at this point, but more firm than during the last two years. And the issue closes with the Mystery. Enjoy!



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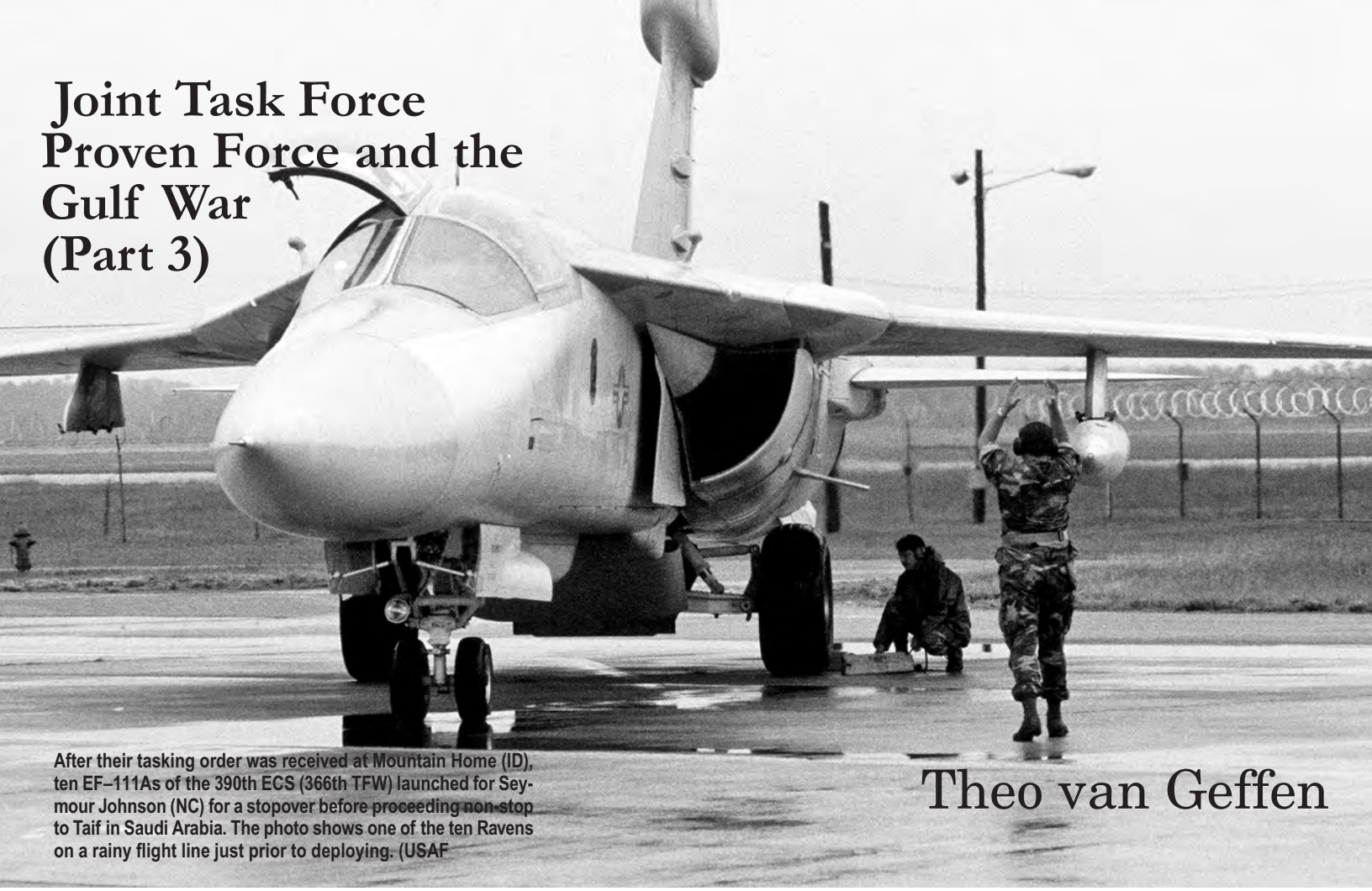
Joint Task Force Proven Force and the Gulf War (Part 3)



After their tasking order was received at Mountain Home (ID), ten EF–111As of the 390th ECS (366th TFW) launched for Seymour Johnson (NC) for a stopover before proceeding non-stop to Taif in Saudi Arabia. The photo shows one of the ten Ravens on a rainy flight line just prior to deploying. (USAF

Theo van Geffen

When in early August 1990 the U.S. Air Force was called upon to deploy personnel, aircraft and equipment to the Gulf Region to persuade Iraq's Saddam Hussein to give up Kuwait, a score of aircraft types were involved, including the EF–111A. When the Gulf War ended, all Ravens redeployed from Incirlik (Turkey), but a number remained at Taif (Saudi Arabia). They would return to Incirlik however, and even assume an additional mission when they deployed to Aviano (Italy). In this part we will have a closer look at those deployments and the resulting combat operations.

On July 31, 1990, the EF–111A Raven inventory numbered 42, with 29 assigned to Mountain Home (ID) and 13 to RAF Upper Heyford (UK). When on August 7, C-Day, the initial deployment of USAF aircraft began to Saudi Arabia, EF–111As were not included. One day later, USCINCCENT (Commander, U.S. Central Command) requested additional forces, including an EF–111A squadron. On 9/1345Z Aug, the deployment order was given for a number of aircraft, including six Ravens.

Importance

In DESERT STORM and PROVEN FORCE, electronic warfare aircraft like the EF–111A and Navy/Marine Corps EA–6B Prowler played a central role in the neutralization of Iraq's Integrated Air Defense System (IADS). As it was important to keep Coalition aircraft attrition low, Electronic Warfare (EW) aircraft were of greater importance to overall air operations than ever before. Unavailability of these aircraft was in fact reason to abort a mission. While in stand-off and close-in orbits, EF–111A/EA–6B aircrews provided high-powered, directional, electronic jamming, directed at detection, sorting and identifying Iraqi GCI (Ground Control Intercept), early warning, acquisition and height finder radars and IFF (Identification Friend or Foe).

A Raven aircrew consisted of an Aircraft Commander (AC, pilot) and an Electronic Warfare Officer (EWO) in respectively the left and right seat. As close coordination between the two was important, they formed a 'hard' crew more or less permanently. The EWO was responsible for navigation, terrain-following flight and EW operations. He planned and programmed jamming tactics in advance. Available was the ISS, Intelligence Support System, which was a computerized program that provided information about radars in the area where the aircraft's crew would be working. ISS data were fed into the MDG, Mission Data Generator, before the beginning of the mission and then loaded into the aircraft via a Raymond cassette, which plugged directly into the aircraft, and taking some five minutes. While airborne, the EWO op-

erated and monitored the jamming system. When threats were identified, appropriate countermeasures were initiated. Jamming could be done in two ways, (1) automatically by the computer, or (2) manually by the EWO. Information about new threats, which were not yet in the computer's memory, could be fed into the system by the EWO through entries on his cockpit keyboard. He could test the information, and in case corrections had to be made, he used the keyboard and cockpit display unit. In comparison to the Douglas EB–66C, which had a crew of six, including four EWOs, the Raven's mission was performed by a crew of two with just one EWO because its jamming system was much more automated.

Tactical forces were supported in three ways, (1) penetration: flying along with the strike force through critical phases of the mission, providing countermeasures as required to protect the force from acquisition and surveillance radars; (2) close-in jamming: calling for the EF–111A to jam GCI, early warning and acquisition radars, while the force delivered its weapons on Iraqi targets; and (3) standoff jamming: orbiting outside Iraqi territory and from there, safe from Iraqi ground-based weapons, the aircraft's jamming systems screened the routes of the strike force. Raven and Prowler aircrews proved to be highly effective in jamming Iraqi low-frequency early warning and higher frequency target-track and acquisition radars throughout the early campaign, providing an umbrella for strikers. Due to the success of, for example, AGM-88 HARMs, this jamming tactic was reduced as the war evolved.

48th TFW

When EF–111As, F–15E Strike Eagles and F–111F Aardvarks (initially non-PGM-capable F–111Ds were on the deployment list, but were replaced by USAFE Precision-Guided Munitions-capable F–111Fs after release from their NATO commitment) were called upon to deploy to the Gulf Region for Phase I of the DESERT SHIELD buildup, the initial plan was to send them to Seeb (Oman), as that is where USCENTAF (United States Air Forces Central) had stored their ordnance. As Oman did not want U.S. strike aircraft being displayed prominently at its international airport, USCENTAF decided to send the F–111s to Taif and the F–15Es to Thumrait (Oman) before eventually moving the latter to Al Kharj (Saudi Arabia).

Theo van Geffen has been an aviation journalist and historian since 1977. He is from Utrecht, The Netherlands. His focus is the history of the F–105 Thunderchief and the units it flew with, and of the Air War in Southeast Asia. Mr. van Geffen has flown in USAF aircraft like the B–1B Lancer, EC–130E ABCCC, Century fighters F–101B Voodoo, F–105F, and F–106B Delta Dart, F–15B / D Eagle and the F–16B Fighting Falcon. He was the first program speaker at the THUD-OUT at Hill AFB on February 25, 1984 and one week later he became the last F–105 back seater ever while flying the next to last flyable F–105F to Little Rock AFB.

An EF–111A of the 390th ECS and an F–111F of the 492nd TFS (74-0182, blue) taxiing back to the flight line after flying training sorties during DESERT SHIELD. ***(USAF, TSgt Rose Reynolds)***

On August 21, a 28-person ADVON deployed from RAF Lakenheath (UK) to Taif.

48th TFW Forward Deployed (FD) was the designation initially used as the generally recognized designation of the Wing's deployed assets. Basically, the organization functioned as a detachment of the 48th TFW, since Wing headquarters and many of its forces remained at Lakenheath. As it became evident DESERT SHIELD would last several months, 48th TFW (FD) eventually had three F–111F squadrons (492nd, 493rd and 494th), which had been reconstituted from the four 'rainbowed' units (the fourth was 495th). The many personnel from other home stations, like TAC's 390th ECS (which included 42nd Electronic Combat Squadron assets), generally continued to use their home unit designations, even though they functioned as components of 48th TFW (FD).

On December 5, Air Division Provisional, 14 and 15 were activated at Riyadh (Saudi Arabia) and Doha (Qatar) respectively and attached to 9th Air Force. They would exercise operational control of forward deployed USCENTAF–assigned TFWs (ADP 14) and combat support aircraft, like EF–111A, E–3B and EC–130H aircraft (ADP 15). Both were inactivated on April 20, 1991.

To standardize and stabilize its organizational structure, USCENTAF, on December 20, 1990, designated, activated and organized provisional wings and established provisional Combat Support Groups under each wing. The 48th became Tactical Fighter Wing Provisional, 48 (TFWP 48) and was assigned to ADP 14, with the F–111F squadrons retaining their designations. However, according to the 366th Wing history, the 390th detachment became assigned to a new unit, Electronic Combat Squadron Provisional, 390 (ECSP 390) and assigned to ADP 15, becoming a tenant unit of TFWP 48.

As the first USAFE Wing, it deployed the initial 18 F–111Fs (493rd) to Taif on August 25. Nearly 500 personnel departed in this first group with the final C–130 departing Lakenheath on September 4. Two days earlier, an additional 14 F–111Fs (494th) had deployed, also in Phase I. In Phase II, 32 F–111Fs were deployed. By December 11, 64 of the Wing's 70 F–111Fs with 100 pilots and 104 Weapons Systems Officers, WSOs, were deployed to Taif.

Three F–111Fs of the 48th Tactical Fighter Wing Forward Deployed and an EF–111A of the 390th ECS during a DESERT SHIELD training mission in Saudi Arabia. ***(USAF, TSgt Rose Reynolds)***

Altogether, the base was host to some 100 jets and 3,000 personnel from 243 different units, 74 different bases and from all U.S. military services, making the 48th the largest single Wing deployed in Saudi Arabia. Lakenheath's share was 1,235 and Mountain Home's some 400 personnel.

The 48th Wing history stated this variety created very little fraction. Also, that its F–111 fleet flew 13,973 hours in 3,328 combat sorties. For 42 days, the 48th averaged 60 F–111F and 20 EF–111A sorties daily without a single non-delivery. No combat losses were suffered, although a 495th TFS crew and F–111F 40183 were lost on October 10 during a training mission. The first 18 F–111Fs returned to Lakenheath on March 11, 1992. However, not all aircraft returned home from the theater then as the final 12 F–111Fs were redeployed on May 10. When ADP 14 was inactivated on April 20, the Wing was reassigned to USCENTAF, Forward and attached to TFWP 4404. Its inactivation followed on August 2.

390th ECS

After receipt of the tasking order to deploy, ten EF–111As were launched on August 22 from Mountain Home, staging through Seymour Johnson (NC) for ancillary support by the 4th TFW . The next day, the aircraft were to fly non-stop to Taif. This was true for eight of them, as they, led by its Commander, Lt Col Dennis Hardziej, arrived on 24/1230Z August. Only fuel and ramp space had been guaranteed. According to Maj Delbert Parker, 366th TFW/MA Deployed, the decision to bring in 'the teeth before the tail' proved to be an awesome logistics challenge, which dictated innovative leadership and management actions at all levels. Within 12 hours after arrival, all eight Ravens were fully mission capable with two aircraft placed on 30-minute alert. On the 27th, the 390th ECS/AMU (Aircraft Maintenance Unit) began flying 2-3 training sorties per day. The two other aircraft diverted to Lajes (Azores) and Torrejon (Spain) for in-flight emergencies and arrived at Taif on August 29.

In the first week of September, seven C–141B Starlifters arrived from Mountain Home, bringing 120 additional personnel, WRSK (War Reserve Spares Kit), engines, AGE (Aerospace Ground Equipment) and 204 ECM (Electronic Countermeasures) test stations and their NAV-Air shelters. The test stations, providing intermediate support for the EF–111A's jamming systems, were set up and running within 48 hours of arrival.

Eventually, the aircraft were moved from an open air environment on the RSAF (Royal Saudi Air Force) flight line to protected aircraft shelters within an area that would be totally controlled by U.S. forces. In this way, maintenance, operations, billeting and Wing command functions were concentrated fully within this area, enabling a more effective accomplishment of its mission.

With the improved supply capability, flying was increased to five-turn-three sorties daily, with an average sortie duration of four hours. In the latter part of September, the number of Ravens was increased to 14. During October, back shops and support fully integrated with the 48th TFW FD. In the next month, the 390th was tasked with a no-notice alert scramble with aircraft being airborne in less than 20 minutes. COMUSCENTAF (Commander, United States Air Force, Central Command), on February 9, 1991, requested deployment of an additional three EF–111As, which arrived at Taif on the 11th, increasing the total to twenty-one, including the four 42nd ECS Ravens.

Combat

The first DESERT STORM sorties by ECSP 390 aircrews were flown on the night of January 16 (see later). The final two sorties were flown by Socket 77-78, taking off at 0137L on February 27 and landing at 0917L. According to the 366th history, the 390th flew a total of 1,365 training/combat sorties at Taif, collecting 5,188 flying hours. These numbers are excluding the 42nd ECS ones.

Emblem of the ECSP 390. The flag remained at Mountain Home, ID, where the 390th ECS was part of the 366th Tactical Fighter Wing. (*Via André Wilderdijk)*

Aircrews of two EF–111A Ravens of ECSP 390 waiting at Taif for takeoff clearance prior to a mission in support of Operation DESERT STORM. ***(USAF, TSgt Perry Heimer)***

The (combat) numbers for February were 473 and 2,453. In sharp contrast were the Mountain Home numbers for that month, 54 and 136 respectively. (In the February 28-March 4 period, the 390th flew an additional 40 and the 42nd ten sorties from Taif, while 23 sorties were canceled.) ECSP 390 used 22 different Ravens, including the four 42nd ECS examples. One, 60048, was returned to CONUS for depot repairs before DESERT STORM began and 60023 was lost (see later).

According to Maj Parker, the EF–111A, under austere working conditions and supported by cumbersome supply lines, sustained a 85+ percent Mission Capable (MC) and a 31.2 utilization rate during the 42 days of active hostilities, the highest utilization rate ever achieved throughout the history of the F–111. 'Teamwork' orchestrated the maintenance planning, scheduling and execution of all actions necessary to generate in excess of 704 combat sorties and 3,524 flying hours, and without a single maintenance non-delivery.

In January, SSgt Godsmen's EF–111A at Taif, 60033, flew 31 training/combat sorties for 130.4 hours. In February, SSgt Garcia succeeded in getting his Raven, 70038, airborne to fly 42 combat sorties for 209.4 hours.

42nd ECS

On November 16, JCS issued the Phase II deployment order for another 283 aircraft. To support CENTCOM, USCINCEUR (U.S. Commander in Chief, European Command), on November 19, ordered the Phase II deployment of 114 additional USAFE aircraft, including four EF–111As and 32 F–111Fs. As a result, the 42nd ECS deployed four aircraft to Taif on December 21. They left Upper Heyford at four o'clock in the morning. The aircraft, 80 personnel, including eight aircrews, and equipment joined the 390th ECS. Through January 16, 1991, the 42nd flew 153 hours in 59 training sorties.

Aircrews flew four sorties on the opening day from Taif as Wrench 71-74. All took off at 0240L, but return was between 0659L and 0901L. The last day of DESERT STORM saw five crews flying a sortie, of which Ratchet 73-74 were the final ones with a 2115L take off and a 0240L landing. The longest sortie from Taif was 8.4 hours and flown on February 13 as Sander 77 by 42nd crewmembers Griffin/Smith in 67-0038. According to the 20th TFW (the Squadron was reassigned on January 25, 1991 from the 66th Electronic Combat Wing to the 20th), the 42nd ECS flew 219 combat sorties during DESERT STORM, collecting 1,159 flying hours.

The EF–111A that was lost on February 13, 60023, was assigned to the 42nd and flown as Ratchet 75 by a 390th crew, Capts Douglas Bradt and Paul Eichenlaub, who were both killed. They were part of a three-ship with a 2107L takeoff time for a night electronic combat mission. At 0139L, Ratchet 75 was reported overdue (the other two crews had already landed). A search resulted in finding both deceased crewmembers and the wreckage 26 nautical miles (NM) northwest of Badanah (Saudi Arabia). According to GWAPS, cause was reported as 'direct enemy action, other' (supposedly, the crew took evasive action when they believed an Iraqi aircraft was behind them and then crashed). The combat loss rate was 0.9 per 1,000 sorties. However, the 366th TFW history stated that 'while the loss occurred during a combat mission, it did not happen due to hostile fire. Instead the loss was judged a Class A flight mishap. Following a prestrike aerial refueling, the aircraft crashed about eight miles south of the Iraqi border in Saudi Arabia. The aircrew had been in Iraqi airspace and was returning to Saudi Arabia at the time of the crash. Apparently, 023's crew perceived a threat and initiated evasive actions, with three low-level evasion maneuvers leading to impact with the ground.' Since 023 was a 42nd ECS aircraft, it became part of the 20th TFW safety record. Only a limited on-scene investigation was conducted due to the short distance to the Iraqi border.

Incirlik

After the Turkish government authorized the U.S. on January 17 to use Incirlik for strikes against Iraq (Operation PROVEN FORCE), reinforcement of Composite Wing Provisional, 7440 (CWP 7440) with additional aircraft was initiated.

The 42nd ECS was tasked to supply six Ravens. They arrived on the 17th and by 1400L, four were MC. Orbits north of the border were established with EF–111As, COMPASS CALL EC–130Hs (jamming radio communications, data links and navigation systems) and KC–135E/R Stratotankers, supported by CAP (Combat Air Patrol) F–15C Eagles.

One hundred mission packages were flown from Incirlik and only the first one was flown without EF–111A support for the simple reason the aircraft had not yet arrived in Turkey. The targets for the 20-aircraft strike package, including twelve F–111Es, were therefore changed to lower threat areas. The first two sorties were flown by KK-01 flight, taking off at 0147L on January 17 and returning at 0430L (67-0035) and 0450L (67-0034). As of January 22, 'normal' call signs were used, like Fliers 11-12. On the last day of PROVEN FORCE, EF–111As flew seven sorties with Trap 1-3 as the final flight, taking off at 2241L and landing at 0202-22L. The 42nd had an average of six aircraft assigned. The total combat sorties flown totaled 252

TFWP 48, which had 'rainbowed' three squadrons (492nd, 493rd, 494th) from its four squadrons of F–111Fs assigned, the 495th TFS being the fourth, would ultimately have some 70 aircraft to fly combat sorties. With the F–117As, the F–111Fs were the only aircraft with an LGB-capability. The photo shows 72-1443 of the 494th TFS (red) taxiing at Taif prior to a combat sortie. ***(USAF, TSgt Perry Heimer)***

with 704 flying hours, for an average sortie duration of 2.8 hours. The average MC rate was 68.6. The grand total for the 42nd (Taif and Incirlik) was 530 sorties, including 471 combat and 59 training sorties with 2,016 flying hours. Grand totaled, the 28 EF–111A Ravens at Taif (22, of which four assigned to the 42nd ECS) and Incirlik (six) flew 1,895 training/combat sorties, amassing 7,204 flying hours. Taif EF–111As were air refueled 1,262 times and Incirlik Ravens, 152.

Bed-down of EF–111As in Gulf War

Sep 1	Oct 1	Jan 1	Jan 17	Feb 27	Base
10+	14*	18**	18	20***	Taif
-	-	-	6	6	Incirlik

\+ arrival August 24-29
* plus four latter part of September (Phase I)
** plus four (42nd ECS), December 21 (Phase II)
*** by February 9 USCENTAF request, an additional three Ravens arrived on the 11th, increasing the total to twenty-one. The next day, eighteen of them were MC, 85.7 percent. One EF–111A was lost on the 13th.

Training

It became apparent soon after their arrival in the KTO, Kuwait Theater of Operations, that aircrews of the Coalition Air Forces would lose proficiency if training programs were not reinstated. Development of the operational concept and plan for overall training was USCENTAF's responsibility. In response, USCENTAF initiated a Coalition staff to define and set training priorities, and arrange host nation training facilities. Two of USCENTAF's priorities were, (1) to maintain a deterrent and defensive posture; and (2) to practice mission profiles that would be expected during combat ops. Training sorties were of a wide variety to become familiar with the desert flying environment, local-area orientation and mission preparation. Initially, training was affected by bare base operating conditions, unfamiliar meteorological conditions and the gradual availability of (Saudi) airspace and weapon ranges. Aircrews also trained to carry out specific roles. This meant in some cases refining medium altitude tactics and practicing multiple weapons deliveries.

Minimum sortie rates were established to ensure minimum combat capability. EF–111A aircrews, for instance, were to fly two sorties/week and eight/month. In this way Raven aircrews were to establish combat readiness and proficiency at the highest possible level. Night or instrument Terrain Following Radar (TFR) training at Mountain Home knew certain restrictions, preventing adequate training in its use in poor visibility. To ensure aircrews would have adequate practice before combat began, relevant night TFR training sorties were flown. As the Raven flew well over half of its combat sorties at night, this training proved to be very useful. Most training sorties were flown in the local area and in northern Saudi Arabia, just south of the Kuwaiti border. The latter required aerial refueling, further adding to aircrew training.

Weekly package training exercises were instituted by USCENTAF in September to promote interoperability and integrated training. They familiarized pilots and controllers with local terrain and meteorological conditions in possible combat areas and to demonstrate to Coalition land forces that air support could be used safely close to their positions. Each launch package was progressively larger and getting more complex with timing more severe. The final exercise, which potentially mirrored a day-one tasking order, went flawlessly for the 390th, with 20 consecutive aircraft being launched on time.

Unique

DESERT SHIELD training included unique and recurring exercises. Examples of the former were, (1) INITIAL HACK, conducting 48-hour continuous operations with an airspace control plan on October 24-26. Coalition forces practiced pre- and post-strike air refueling, airfield attacks, airfield defense, Close Air Support (CAS) and C2 (Command and Control) procedures against a simulated D-day Air Tasking Order (ATO). On the 25th, mock attacks were made on Al Dhafra, Taif and Al Ahso airfields by strike packages, which included 40 F–16Cs, two RF–4Cs, two EA–6Bs, eight Italian Tornados, and two French Mirage 2000s. A night strike against airfields was flown by two F–117A, four F–15E, two B–52G, two EF–111A, two F–4G, and one EC–130H aircraft, plus six RSAF and eight RAF Tornados. The *USS Kennedy* and *Saratoga* conducted dual-carrier operations. A total of eighteen air packages were flown, involving about forty coalition air units. The number of sorties totaled 431, including 88 tanker and 13 AWACS (Airborne Warning and Control System) sorties; (2) Exercise IMMINENT THUNDER was a fully-integrated, combined exercise, which was accomplished in five Phases in the November 15-20 period and included an amphibious operation. Phase 1 was flown throughout the Exercise. Its Concept of Operations included offensive air operations and CAS/AI (Air Interdiction). As to the former, alert notice was performed and aircrew/aircraft generation simulated, and D-Day simulated (coalition flight operations were planned to closely simulate the actual ATOs). As to the latter, the

TACS (Tactical Air Control System) C2 was exercised in a limited jamming environment, and integrated AC–130/A–10 night anti-armor operations were conducted. D-Day (dress rehearsal) on November 15 involved 12 composite force packages, 273 sorties, and six airfield attacks. For the first time, the Mission Commander (MC) operations order was exercised. On Day 2, the 16th, actual ATOs for D-Day+1 were simulated in CENTCOM/ Coalition flight operations. Twelve combined strike packages and a single CAS exercise were flown. The potential D-Day+2 ATO was closely simulated on November 17 by five combined strike packages and a CAS exercise. F–117As conducted a simulated night airfield attack. B–52Gs flew 11 sorties in support of the exercise on the 18th. A 296-sortie CAS exercise was conducted on November 19. On the final day of IMMINENT THUNDER, four strike packages were flown by U.S., Saudi, British, French and Canadian forces, plus a CAS package with U.S., Saudi and Kuwaiti forces. Thirty composite force packages flew 2,300 sorties. Phases 2 through 5 included amphibious operations, reinforcement, and redeployment, and SAR/CSAR (Search and Rescue/Combat Search and Rescue). In the former, an amphibious operating area was established and Navy and Marine operations supported. Missions included DCA (ground alert), CAS, air-to-air CAP, and air refueling. In the latter, USSOCCENT/USCENTAF exercised helicopters and A–10s with two preplanned pickups and an immediate launch. Combined U.S., Saudi and French forces participated on November 16 in CSAR exercises. The 4th Marine Expeditionary Brigade conducted a heli-borne assault in the vicinity of Ras Al Ghar, about 75 miles below Kuwait on the Persian Gulf. USSOCCENT/USCENTAF forces completed over 35 unannounced CSAR scenarios. A total of 4,150 sorties were flown by eventually 1,000 coalition aircraft; and

Emblem of the 42nd ECS. The Squadron was involved in JTF PROVEN FORCE from Incirlik, Turkey and Operation DESERT STORM from Taif, Saudi Arabia. ***(Via André Wilderdijk)***

EF–111A 60016 of ECSP 390 on the light line at Taif in January 1991. On the first day of DESERT STORM, its crew, Capts Jim Denton and Brent Brandon, as Ratchet 52, claimed the kill of an Iraqi Mirage F1. The crew felt their jamming efforts had fooled the F1's pilot into thinking their Raven was a fighter aircraft, and in trying to evade, the pilot flew his aircraft into the ground. ***(via USAF)***

(3) Exercise FISH BARREL, January 7-9, 1991. Concept of operations included the performance of CAS and AI, using friendly ground forces, to fly dedicated AWACS/opposing air and concentrate package training. Missions were flown both day and night to test air-to-ground TACAIR procedures. The exercise began with 266 simulated CAS and AI sorties, flown by Coalition aircraft. For the first time, six B–52Gs completed a strike training mission in northeast Saudi Arabia. In addition, a USCENTAF/USMC/Italian Air Force package conducted simulated strikes against Al Dhafra airfield and an industrial complex in the UAE (United Arab Emirates). On FISH BARREL's final day, package training was flown by five Coalition partners, including the USAF with, among others, EF–111As, F–4Gs, B–52Gs and F–111Fs, and the FAF with Jaguar, Mirage 2000 and Mirage F–1CR aircraft. Navy package training was flown by four Coalition partners, including the Navy with, for instance, A–6Es, EA–6Bs, and KA–6Ds, and the USAF with EF–111As and F–4Gs. A total of 1,824 sorties were flown.

Recurring

Recurring and training exercises included (1) air defense, weekly with 178 sorties over fourteen vulnerability periods (to exercise C3, practice detection, identification and reaction; USAF fakers included EF–111A and F–4G aircraft); and (2) day and night package training, weekly in the September-January period. Its objective was to promote interoperability of friendly forces, conduct of integrated training, and to exercise actual operations and procedures, planning, tactics and C3, Command, Control and Communications. For instance, the execution of package coordination on September 12, included two EF–111As, four F–4Gs, four F–15Cs, and four F–15Es. Over 4,000 sorties were flown in which all aspects of the integrated air campaign were exercised. In addition, electronic combat integration of joint assets on UHF, HF, and VPN exercises were held with, for instance on September 25, EF–111A, F–4G and EC–130E aircraft.

While most pre-war training had centered on area and corridor support, a large majority of the combat sorties in-

EF–111A Ravens at Taif were adorned with two distinctive markings. One was an EF–111E silhouette with three lightning bolts emanating its nose area. Above this appeared the words 'DESERT STORM', while below were the words 'ROCKIN IRAQ'. Also, a marking was used to indicate the number of combat sorties flown by each aircraft. Aircrews flew 37 combat sorties with this Raven. ***(USAF, TSgt Fernando Serna)***

volved package support. Although Raven aircrews had received some training in this area, Col Hardziej felt future training should include more package support missions. Through January 16, EF–111A aircrews at Taif flew 923 training sorties, resulting in 2,079 flying hours. In that period, the 390th also maintained aircraft on alert status. Initially, two aircraft were involved on a 30-minute alert, but the number was doubled to four when the probability of war increased. All four stood ready to launch within two hours, although two of them had the additional commitment of remaining on 30-minute alert.

D-Day

On the night of January 17, before the first strikes, two groups of aircraft penetrated Iraqi airspace. This occurred in conjunction with 52 BGM-109 TLAM (Tomahawk Land Attack Missile) strikes from Navy ships in the Red Sea and Persian Gulf against targets in and around Baghdad, with Time over Targets (TOTs) between 0306 and 0311L, followed shortly thereafter by 35 AGM-86B ALCMs (Air-Launched Cruise Missile), expanded by aircrews of seven Barksdale B–52Gs. The first group to cross Iraqi's early warning line, at H-40 (0220L), included nine U.S. Army AH-64A Apache attack helicopters (101st Airborne Division [Air Assault]), and four pathfinder USAF MH-53J PAVE LOW III helicopters (20th Special Operations Squadron) of Task Force NORMANDY. They had taken off from their Forward Operating Location (FOL) at Al Jouf. Their targets were two border early warning radar sites about 50 NM north and north northeast of Ar'Ar in Iraq. Although the attack at H-21 (0239) with 27 AGM-114 Hellfire missiles, 100 2.75-inch Hydra rockets and 4,000 rounds from the Apache's 30-mm gun was regarded successful, resulting in the creation of a 'hole' in Iraq's early warning coverage for several aircraft packages with early missions, sites personnel must have issued some warning as the AAA batteries in Baghdad began firing immediately before H-hour. Supposedly, this was the only time that Army air assets were included in the Master Attack Plans (MAP) or ATOs. The second group included nine F–117As of the 415th TFS (TFWP 37), which took off from King Khalid RSAB near Khamis Mushait (Saudi Arabia) at 0022L (the distance to the Iraqi border was 665 NM). After being refueled, they crossed the border. At H-9 (0251L) one of the aircrews dropped the first bomb of the war, a 2,000-lb GBU-27 PAVEWAY II, striking the hardened air defense Nukhayb Intercept Operations Center (IOC). It was the central air defense node in southern Iraq with the best chance to detect the F–15E strike package (see later) by directing Iraqi fighters in that region. In addition, the Center was best positioned to coordinate Iraqi defensive efforts against succeeding allied SEAD (Suppression of Enemy Air Defenses) attacks. Nine minutes later, at 0300, aircrews of two F–117As dropped the first bombs, four GBU-27s, on crucial installations in central Baghdad, including the AT&T Building and the Telecommunications Center. By 0315L, pilots of the other six F–117As had struck targets in and around Baghdad, including the Iraqi AF headquarters, the Tallil SOC (Sector Operations Center) and the ADOC, Air Defense Operating Center.

In the meantime, more than 160 tanker aircraft had taken their place in their assigned refueling orbits outside the Iraqi early warning radar range and were refueling Coalition aircraft; were RC–135, TR-1 and U-2R aircraft providing intelligence coverage of Iraq and Kuwait; were radars of AWACS E–3Bs and Navy E–2C Hawkeyes orbiting over Saudi Arabia probing deep into Iraq to look for any Iraqi reactions; and were initial strike packages marshalling south of the Iraqi early warning and GCI coverage, all being CAP-ed by F–15Cs and Navy F–14A Tomcats. That first night, 668 combat sorties were flown by Coalition aircraft, of which 530 by USAF and 138 by UK, France and Saudi Arabia. The start of the second wave attacks roughly coincided with sunrise. Of the 530 AF sorties, 30 were flown by F–117A pilots, who struck 37 high-value targets.

EF–111A Sorties

As the first group of F–117As was withdrawing and returning to base, an aircraft package consisting of two Taif-based ECSP 390 EF–111As, Ratchet 51-52, and 22 Al Kharj-based LANTIRN-equipped F–15Es, supported by KC–135s, approached their targets, western fixed and mobile Scud launch areas in the vicinity of H-2 and H-3 airfields. The first Lockheed Martin LANTIRN (Low Altitude Navigation and Targeting Infrared for Night) at Seymour Johnson was received on September 17, 1990. According to Squadron information, Ratchet 51 (60046) launched at 0042L and 52 (60016) at 0110L. The Ravens provided jam-

ming of Iraqi radars. After final air refueling, the package formed south of Iraqi's early warning line and then headed north, penetrating Iraqi territory through the gap. F–15C Eagles had moved up ready to pick up any Iraqi fighters which their controllers might have scrambled. While the Raven crews, using their TFR capability to fly low enough to elude Iraqi defenses, provided jamming support, Strike Eagle crews struck Scud sites with a combination of free-fall bombs and Mk-20 cluster weapons, with the first bombs hitting at 0305L. At about the same time, Iraqi fighters were launched.

An E–3B AWACS picked up bandits moving south in the general direction of the F–15Es as Penzoil and Citgo flights (F–15Cs of the 58th TFS, 33rd TFW, Eglin) were still refueling. Penzoil 63 and 64 then swept northward at .95 Mach at 30,000 feet. The first group of bandits turned back north, a single MiG-29, however, made its appearance 30 miles to the north at 11,000 feet and climbing. Final lock-on occurred at 20-22 NM. When the F–15C pilot of Penzoil 63, 50119, Capt John Kelk, was certain the aircraft involved was a bandit, he fired an AIM-7M at 16 miles and shot it down, becoming the first USAF pilot to be credited with a kill in the F–15.

After the Citgo four-ship had dropped off the tankers and rapidly entering Iraqi airspace, its aircrews picked up two trailing groups of Iraqi fighters, which were tracking F–15Es coming off their targets. However, these fighters turned north and out of range, but another group took off from the FOL at Mudaysis. An E–3B AWACS controller called "bandits airborne", Mirage F1s heading towards supposedly the two EF–111As. After the controller had declared the aircraft as hostile, the pilot of Citgo 65, Capt Rob Graeter, at 8.5 NM fired an AIM-7M at a Mirage F1 and seconds later the aircraft turned into a large fireball. As to Graeter's second Mirage F1 kill that day, the 366th Wing history told a different story: a single Mirage F1, picked up visually, was locked-on to a trailing Raven, 60016 of the 42nd ECS, Ratchet 52. Its aircrew, Capts Jim Denton and Brent Brandon of the 390th ECS, then countered by slicing down to the earth, while expending chaff and flares, and still being followed by the Mirage pilot. His firing a missile was unsuccessful. Presumably the Iraqi pilot was so busy trying to get his kill, he got too low and flew into the ground. According to the history, the EF–111A crew felt their jamming efforts had fooled the F1's pilot into thinking their Raven was a fighter aircraft, and in trying to evade, the pilot flew into the ground. Also, this would have constituted the first and only aerial victory ever earned by an unarmed EF–111A, if confirmed. A subsequent higher headquarters investigation disallowed the claim. Instead, the credit was also given to Capt Graeter.

This Raven's 42nd ECS crew chief talks with Capt Askew, aircraft commander, and 1Lt Shintaku, EWO, as they sit in their cockpit in the HAS at Incirlik, prior to takeoff in September 1991 for a mission in support of PROVIDE COMFORT II. ***(USAF, SSgt Cynthia Alderson)***

The 37th had requested jamming support for its first missions over Baghdad as being regarded the most difficult as Iraqi air defenses would still be undamaged. AFSAA, the Air Force Studies and Analysis, reconstructed aircraft mission profiles after the Gulf War. GWAPS stated in this respect about the mission the two Raven aircrews were later supposed to jam into the Baghdad area, but never supported the first F–117A strikes on the Iraqi capital. By the time the Raven crews were to have turned on their jammers at H-2 (0258L) at Baghdad, the first two F–117s would already be within range of acquisition and targeting radars from Baghdad's SAM defenses, as well as within the range of the missiles themselves. The F–117s returned safely to their temporary base at Khamis Mushait. The Ravens landed at 0525L (016) and 0537L (046).

Third F–117 Strike

Ratchet 51-52 were not the very first EF–111As to launch from Taif. At 0029L, 390th ECS EF–111As Wedge 21-23, 66-0044, -057, and -027 respectively took off. The flight was led by Col Hardziej. After takeoff they headed for an area southwest of Baghdad to provide electronic jamming for the second group of 12 F–117As, nine 416th TFS and three 415th TFS birds, and led by the TFWP 37 commander. The flying distance to the Iraqi border was 525 NM for EF–111A aircrews and 665 NM for F–117A pilots. The Ravens were CAP-ed by four F–15Cs of the 71st TFS (1st TFW, Langley) at about 50 NM west of Al Jarrah Airfield. Mirage F1s tried to disrupt the mission. After Capt Steve Tate, flight lead, had identified his target as hostile, he used an AIM-7M to down it. F–117A pilots struck 16 targets and scored ten hits. According to the book 'On Target', the F–117As gained little from the support by the EF–111As, as one crew departed before setting up jamming because they detected an Iraqi aircraft closing in, while the two other aircrews appeared to have set up jamming at a range so far from Baghdad they might have accomplished little.

Concurrently with the F–117As striking Sector and Intercept Operations Centers, C2 nodes in the air defense system and leadership targets, SEAD attacks on Baghdad were carried out by two large packages in the 0348L-0355L period. Navy aircraft launched from carriers in the Red Sea flying in from the west, while USAF F–4Gs came in from the south, heading straight for Baghdad and then just short of the capital swinging northeast. Three EF–111As, each in a separate orbit southwest-southeast of Baghdad, jammed Iraqi radars to further the confusion. In addition,

six USAF BQM-74 drones and TALDs (Tactical Air-Launched Decoys) dropped from A–6E Intruders increased the numbers on the Iraqi radar screens. During the mission, a Navy F/A–18C and its pilot (USS Saratoga) were lost, the first Coalition pilot to be killed.

After supporting the SEAD mission, the three Ravens supported six TFWP 48 F–111Fs which, between 0400L-0420L, struck Balad SE Airfield, northeast of Baghdad. In the meantime, at 0340L, a strike package of 11 F–111Fs and four Tornado GR. Mk1s struck runways, Scud shelters and storage bunkers at Al Jarrah and Jalibah Airfields with GBU-24s and CBU-89s (F–111F) and JP-233 munitions (GR.Mk1). The package was supported by two EF–111As and four F–4Gs.

The third F–117A strike on the first night took place between 0500L and 0510L. The eight F–117As were each configured with two GBU-27s. Targets included SOCs, and chemical and biological bunkers. However, due to bad weather only five out of the 16 bombs expended were reported as hits. Just subsequent to the F–117 strike, four F–111Fs struck biological weapons bunkers at Salman Pak just south of Baghdad with CBU-87 and CBU-89 munitions. The package was supported by four EF–111As and eight F–4Gs. This was large in relation to the flight of four strike aircraft, as planners had anticipated opposition.

Daylight

Two-hundred-and-ten Coalition attack aircraft participated in day strikes on D-day, including 140 F–16Cs, 30 F/A–18s, eight B–52Gs and four RAF Tornado GR.Mk1s. For instance, around 1500L and preceded by four BQM-74 drones, a strike package consisting of 32 F–16Cs of TFWP 363 (no PGM-capability) struck the Habbaniya Petroleum Storage Facility and Al-Taqaddum airfield in Iraq. The Fighting Falcons were supported by four 42nd ECS EF–111As (Wrench 71-74*)* to provide jamming support, 16 CAP F–15Cs, and eight F–4Gs, meaning the 32 F–16Cs were supported by 28 aircraft. In addition, E–3B AWACS on the central orbit, and Navy E–2C Hawkeye aircraft over the Persian Gulf and Red Sea provided surveillance and control with their search and height-finding radar and communications equipment, to, for example, identify who was friendly. E–3B controllers alerted F–15C aircrews that two Iraqi MiG-29 Fulcrums were active in the area, which were shot down in the ensuing action by pilots of the 58th TFS, Marine Corps Capt Chuck Magill and AF Capt Rhory Draeger, using AIM-7F Sparrows. The first day's effort ended with heavy attacks in the early evening. For instance, seven B–52Gs struck the Republican Guard's Tawakalna Division and aircrews of 12 F–111Fs and eight Navy A–6E Intruders struck Iraqi airfields, using their laser-designator systems.

Coalition aircraft did not only strike targets in Iraq itself, but also in occupied Kuwait, with two groups of aircraft striking targets in the 0835L-0850L period. Sixteen F–16C of TFWP 401 attacked two Scud sites at Ali al Saleem and Ahmed Al Jaber Airfields with Mk-84 general-purpose bombs and CBU-89s. An additional 36 F–16Cs

An EF–111A of the 42nd ECS, deployed from RAF Upper Heyford (England), takes off from Incirlik in September 1991 to support PROVIDE COMFORT II. ***(USAF, SSgt Cynthia Alderson)***

struck nine missile sites, including two at Kuwait IAP, with Mk-82s and Mk-84s. However, some of the attacks were broken off due to SAM launches. The F–16Cs were supported by two EF–111As and ten F–4Gs.

Day 1, second night

One more F–117A strike was flown on the second night of Day 1. The 12 aircraft of the 415th TFS were supported by two Ravens. Due to an air abort, pilots of 11 F–117As reached a score of targets between 2015L and 2030L, including C2 bunkers, the headquarters of the intelligence service and Baghdad's nuclear reactor. Ten hits were reported out of 18 attempts. This brought the number of F–117A strikes for Day 1 to 41.

A few minutes after the F–117As departed the Baghdad area, four F–111Fs, supported by two Ravens, were approaching Saddam Hussein's residence in his home town Tikrit, north of Baghdad. To reach a target so deep in Iraq, the aircraft were refueled over south-central Iraq by KC–135Rs, which were CAP-ed by F–15Cs. At 2040L, his leadership bunker was hit by PGMs. The same two EF–111As then supported two B–52Gs which penetrated into northern Iraq a few minutes before 2100L. The bombers struck the Al Sahra undergraduate pilot training base, some 100 miles north of Baghdad. As the Stratofortresses flew north of Baghdad, two EF–111As, four F–4Gs, and four Eagles supported eight F–111Fs and four RAF Tornado GR.Mk1s. The strike aircraft bombed the runways and base facilities at Al Jarrah to the south of Baghdad. At 2315L, six F–111Fs attacked Scud shelters at Qalat Salih. They were supported by two EF–111As.

On Day 1, EF–111A aircrews flew 29 support sorties in Iraq and Kuwait. The Coalition lost six aircraft on D-Day, an F–15E, one Navy A–6E and one F/A–18C, two RAF Tornado GR.Mk1s and a Kuwaiti A–4KU, while the Iraqis lost three Mirage F1s, two MiG-21s and three MiG-29s, of which six by F–15C and two by Navy F/A–18C pilots. Thirteen Coalition aircraft were damaged.

Early days

Especially in the first three days of the Campaign it was clear that not all of the deployed Raven aircrews had received adequate training in threat avoidance as training

guides at Mountain Home did not include enough practice to avoid air-to-air threats. This caused problems as many aircrews had brief engagements with Iraqi aircraft, especially at low and medium altitudes. However, none of these engagements resulted in a loss. Col Hardziej stated this was attributed to a lack of skill on the part of the Iraqis and not to effective avoidance by EF–111A aircrews. Hence his suggestion to also increase training requirements in this area after redeployment.

Also, aircrews of, for instance, EF–111As, B–52Gs, RAF Tornados and some Navy units conducted their attacks from low level, the way they trained at home. However, the intense AAA, the inability of the Iraqi Air Force, and the fact the SAM threat was reduced due to Coalition SEAD, led those units to conduct operations at medium-altitude.

A 42nd ECS EF–111A Raven is approaching a KC–135 Stratotanker to get refueled during a PROVIDE COMFORT II sortie from Incirlik. ***(USAF, SrA Gudrun Cook)***

Gorilla

LFE, Large Force Employment, also called 'Gorilla' packages, were typical for DESERT STORM operations. Such a package consisted of up to 90 aircraft, a dedicated SEAD package of F–4G WILD WEASEL and EF–111A aircraft preceding it. The tactic was to exploit the principles of mass and economy of force. LFE suppressed and overwhelmed defenses, while providing greater destructive energy on targets. It was easier to coordinate EC assets in support of a limited number of large forces than employing such limited assets in support of numerous smaller strike packages. LFEs demanded a great deal of coordination, increasing greatly with the size of the package, plus needed dedicated CAP. As to EC assets, the designated Mission Commander, the overall commander of the entire strike package, planned, integrated and executed coordinated tactics. With regard to EF–111As, their orbits would put them in a position to jam Iraqi radars, which would pose the highest threat as had been determined by pre-mission target area study.

Package Q

The Master Attack Plan called for three large daylight strikes against targets in the Baghdad area on day three, January 19, but due to weather only one was flown, Package Q, the largest of DESERT STORM. The major target was the nuclear research facilities southeast of Baghdad. Depending on the target, each mission cell would consist of up to eight aircraft. However, overnight crucial changes were made to the Air Tasking Order. For instance, the target for the F–16C pilots of the 614th TFS (TFWP 401) was changed to include three major sites in downtown Baghdad, one of which was the Iraqi Air Force (IAF) headquarters. In addition, the ATO was received late, preventing the mission's coordination and planning.

The MAP called for 72 F–16Cs, of which 56 of TFWP 388 (Al Minad, UAE and also supplying the Package commander) and 16 of the 614th TFS (Doha, Qatar) to strike targets lying on the axis from southeast to northwest across Baghdad. Support would be provided by two EF–111As, eight F–15Cs for CAP (Tabuk, Saudi Arabia), and eight F–4Gs (Shaikh Isa, Bahrain). The Phantoms were configured with two AGM-88s each because of distances and fuel consumption (they could carry four). Yet, this meant their crews would not have much time in the target area.

Orbits

The first aircraft, F–15Cs, began rolling at approximately 1346L (although the Iraqi border was only 250 NM away, it would take the aircrews one hour and 21 minutes to fly the 665 NM to their tanker rendezvous point), followed by the EF–111As at 1408 (415 NM, 59 minutes), and by the last, the F–4Gs, at 1443L (165 NM, 24 minutes). Support aircraft included KC–135E/R and KC–10A (each refueling track had 5-8 tankers), E–3B (to, among others, provide warnings of Iraqi aircraft threats and for airspace control), EC–130E ABCCC (coordination and giving updates before the force entered Iraq), EC–130H (jamming Iraqi communications centers) and RC–135V/W (monitoring Iraqi electronic signals) aircraft. The strike force took off from five different bases and at different times before they rendezvoused with their tankers, already being in their *Railroad* and *Weasel* orbits, south of the Iraqi border. TOT of 1630L meant the strike force would have to begin dropping off the Seeb tankers (it would take them approximately one hour and twenty four minutes to fly the 590 NM to their refueling tracks) at approximately 1547 to cross the Iraqi border eight minutes later. It would then take 35 minutes to reach the Baghdad area.

Ballistic

From the moment Package Q approached Baghdad and its air defenses, the Weasels engaged Iraqi SAM sites. However, according to MG Buster Glosson, in an April 1992 interview with GWAPS personnel, there was a problem with the Weasels allocated to the mission. Either because of fuel, timing, or the decision of the package commander, not all appeared to have made it to the Baghdad area. The GWAPS Database showed that only six HARMs were fired. Maj John Nichols stated in his July 1992 interview that up

to the Weasel call they were leaving, SAMs had been fired by the Iraqis the ballistic way. Following this, many SAMs were guided, forcing his flight members to take evasive action and jettison ordnance and fuel tanks.

Like the other F–16Cs, the 16 of the 614th were each configured with two Mk-84s, two external fuel tanks, two AIM-9s, fifteen flares and ninety bundles of chaff. The target for eight of them, led by Maj Jeffrey Tice, was a large oil refinery on the Tigris River. As the IAF headquarters was obscured by a cloud cover, the second group of eight F–16Cs, led by Nichols, rolled off to turn and strike the refinery. As the last Mk-84s were hitting the refinery, a SA-3 hit F–16C 87-0228, flown by Capt Harry Roberts. As the F–16s egressed Baghdad, a SA-6 impacted near another F–16C, 87-0257, flown by Tice. Both pilots ejected successfully, taken POW, and released on March 6, 1991. One of the F–16Cs was so low on fuel that it would have crashed short of Coalition territory, had a crew of a Kansas ANG KC–135E (190th Air Refueling Group) not crossed over in enemy territory to refuel the Fighting Falcon. F–16C pilots of the 388th struck the nuclear facilities.

Smaller

The conclusion of the Package Q mission commander was that a series of frictions -the ATO reaching late, certain crucial changes, not enough coordination time, a tactical approach that provided the Iraqis considerable warning and fuel problems for the Weasels and others, bad weather, and insufficient attrition of Iraqi defenses- combined contributed to a less satisfactory outcome: the loss of two pilots with their F–16Cs.

One of the lessons was that Iraqi defenses in the Baghdad area remained lethal and that it was not worth the risk sending conventional packages into the heart of those defenses, especially having F–117s around with their PGM capability. Also, for the remainder of DESERT STORM F–16 packages were smaller, so more manageable and easier to coordinate and fly.

Special Mission

The last time 15,000-pound BLU-82 *Daisy Cutters* were used, was in South Vietnam to create landing zones for helicopters. Around January 20, Lt Col Thomas Beres, the 8th SOS commander, introduced the concept of using it as a psychological weapon. It was capable of destroying everything in a three-mile radius within the flat type of terrain provided by the desert. Due to the threat, target assessment determined that the best tactic was to drop the BLU-82 from between 16,000 and 21,000 feet AGL, versus the normal 6,000 feet. AFSOC also decided to drop more than one BLU-82 at a time in order to increase the psychological impact. In addition, and as a final precaution, each of the drops was to be given a force package comprising of EF–111As, F–4Gs and EC–130Hs, to suppress radars and jam communications if threats appeared. Gen Norman Schwarzkopf, CENTCOM commander, was briefed on January 28 by AFSOCCENT (deployed) and showed interest in using the bomb to clear minefields. A requirement for eight bombs was anticipated. On February 3, the first two of ultimately 18 BLU-82s arrived from Hill. The first *Daisy Cutter* was dropped on a mine field by the MC–130E COMBAT TALON crew of Maj Skip Davenport during the late night/early morning hours of February 6-7. The blast created a safe passage through Iraqi defenses for U.S. Marines to start the ground offensive. The fifth and final BLU-82 mission was on the 22nd, one day prior to G-Day. Two bombs were dropped by MC–130Es, split by two hours. Both were on target. The first was the deepest into the area and came under radar threats. There was no response by SAMs or AAA. MC–130Es of the 8th SOS expended a total of 11 BLU-82s. The remaining seven BLU-82s were destroyed by EOD (Explosive Ordnance Disposal) personnel.

Ground

Pre-G-Day operations were initiated by XVIII Airborne Corps on February 15 with a series of cross-border reconnaissance missions. That evening, two teams of two AH-64s (1-101st Aviation) crossed the Iraqi border on a route recce. Other Apaches screened the mission along the corps line of departure. They were supported by Army EH-60A QUICKFIX and EF–111A aircraft.

The U.S. Army was also supported by coalition aircraft conducting SEAD. For instance, on February 20, EF–111A, F–4G and EC–130H aircraft provided SEAD support for an Army AH-64 attack battalion, which conducted a deep strike in the rear area of Iraqi's 45th Infantry Division.
Although air operations in direct support of the four-day Offensive Ground Campaign were initiated on D+38, February 24, the Strategic Air Campaign continued. For instance, CWP 7440 at Incirlik sent a large force package to the Al Mawsil military research and production facility near Mosul in northern Iraq. The package consisted of F–

When the EF–111As of the 429th ECS departed Incirlik for good in June 1997 to return to home base Cannon, Marine Corps and Navy EA-6Bs assumed the Raven's mission. One of the squadrons was Electronic Attack Squadron (VAQ) 209, a Naval Reserve squadron from NAS Whidbey Island (WA). A ground crew carefully monitors their Prowler 161118 (AF–502), as the pilot lowers its folded wings into the launch position. An EA-6B crew consists of a pilot and three Electronic Countermeasure Officers, ECMOs. (USAF, TSgt Anna Hayman)

Maj J.B. Bobbitt, a pilot assigned to the 429th ECS, pre-flights his EF–111A, 60020, before redeploying on April 3, 1998 from Prince Sultan Air Bases to Cannon, NM. It meant the end of Raven operations in Operation SOUTHERN WATCH. ***(USAF, TSgt James Mossman)***

16Cs and F–4Es and was supported by EF–111As, F–15Cs and F–4Gs.

Analysis

The overall performance results of the Raven crews indicated they were quite effective in neutralizing the Iraqi early warning system. Coupled with the total EW capability of the Coalition forces, the Raven and its crews were a major contributor to the low allied aircraft loss rate and the general breakdown of Iraqi's IADS. An analysis by USAF's Electronic Warfare Center concluded that when EF–111As were supporting Coalition aircraft, Iraqi abilities to detect, track and pass target information were seriously impaired and in some cases completely denied.

Redeployment

On March 9, USCENTAF verbally approved JTF–PF's redeployment flow plan. The redeployment period was called Operation DESERT CALM. In what was termed a 'Joint Task Force/Proven Force retrograde ceremonial flow', the first USAFE units to return home from Incirlik were five of the six EF–111As and 22 F–111Es of the 20th TFW. In addition, one 42nd ECS EF–111A returned from Taif in company of one F–111F. Due to maintenance, the sixth Incirlik Raven returned to Upper Heyford on the 13th.

Aircraft and aircrews of the 390th ECS departed Taif on March 25, arriving three days later. Four KC–10A Extenders supported the redeployment, being configured to carry passengers in addition to fuel. Redeployment of support personnel was initiated earlier, with relatively small numbers of people returning when airlift would allow. Most personnel had returned to Mountain Home by early April. April was the 'great recovery month' for the 390th AMU with a reconditioning of its EF–111A fleet. This included full paints and complying with any overdue inspection. More scheduled maintenance was accomplished than in the previous six months. This trend continued in May (the Squadron's first Avionics Modernization Program-modified EF–111A, 60020, arrived for the 390th that month).

As to paints, policy from TAC, Tactical Air Command, directed all units to remove any unauthorized artwork from their aircraft. After DESERT STORM combat ops began, 390th maintenance added two markings. One was an EF–111A silhouette with three lightning bolts emanating its nose area. The center and largest of the lightning bolts intersected a radar dish. Above this appeared the words 'DESERT STORM', while below were the words 'ROCKIN IRAQ'. The symbol appeared on both sides of the aircraft just below the front windscreens. Also, a marking was used to indicate the number of combat sorties flown by each aircraft. This symbol consisted of a radar dish with a lightning bolt through its base and appeared under the canopy opening on both sides of the Raven. These markings were also used by the Upper Heyford contingent.

Turkey

When the Gulf War came to an end, the involvement of the Raven did not, not at Incirlik, nor in the Gulf Region. After the UN Security Council authorized a humanitarian relief effort for the Iraqi Kurds on April 3, 1991, U.S. European Command (USEUCOM) organized a Combined Task Force (CTF), Operation PROVIDE COMFORT (OPC), which deployed to Incirlik on the 5th. MG James Jamerson became its first commander, but when LG John Shalikasvili took over, Jamerson became his air component commander. In Phase I, U.S. and coalition fighter aircraft provided air cover for cargo aircraft like C–130s (air-dropping relief supplies), and C–5s and C–141s (moving relief supplies from CONUS into Turkey). USAFE fighter units that participated included Upper Heyford's 42nd ECS and Spangdahlem's 52nd (T)FW. To support OPC, the 42nd deployed EF–111As, personnel and equipment on April 6, 1991. They were welcomed back on August 14. Coalition forces flew 700 fixed-wing sorties in Phase I, including 500 by U.S. aircraft.

In Phase II, beginning on July 15, an established no-fly zone, north of 36°N, was enforced by British, French, Turkish and U.S. aircraft. On September 26, 1991 the 42nd ECS sent three Ravens, aircrews and support personnel to Incirlik. The number of aircraft was increased to five on April 4, 1992, remaining unchanged until the detachment returned to Upper Heyford on July 3. Two days earlier, the 390th ECS had taken over the commitment. With 19+ months of continuously being deployed (see later), the Squadron was the most deployed unit in USAFE. As the 42nd had already formally inactivated on July 1, as described in USAFE Programming Plan (PP) 20-1 of April 1, 1992, the 42nd ECS held an informal inactivation ceremony on July 10.

In December 1992 and January 1993, the northern no-fly zone was tested by Iraqi aircraft. On January 17, a MiG-23 was downed by 1Lt Craig 'Trigger' Stevenson of the 23rd FS (Spangdahlem), flying F–16C Fighting Falcon 86-0262 and using an AIM-120 AMRAAM. In the first eight months of 1993, USAF aircraft would strike Iraqi AAA and radar sites in both no-fly zones in five separate occasions after the Iraqis locked onto or fired at Coalition aircraft.

After the 42nd's inactivation, TAC's two EF–111A squadrons became responsible for OPC and support in the Gulf Region: the 390th ECS at Mountain Home (replaced by the newly activated 429th ECS on September 11, 1992) and the 430th ECS at Cannon, which was activated on August 1, 1992 to accept the Ravens and personnel of the inactivated 42nd ECS. In December 1992, the 430th deployed to Incirlik for the first time to provide support in OPC with three EF–111As. This number would not change during the Raven's presence at Incirlik. The number of EF–111A squadrons was decreased to just one after the PCS of the 429th from Mountain Home to Cannon on June 22, 1993 and the inactivation of the 430th ECS one week later. This meant the 429th became responsible to support both Operations, PROVIDE COMFORT/NORTHERN WATCH at Incirlik and SOUTHERN WATCH at Dhahran. Hence its deployment to Incirlik in July 1993.

On February 21, 1996, EF–111s reached a permanent milestone when they passed 2,000 days of continuous deployment to both Incirlik and Al Kharj/Dhahran. It occurred while the Raven, then assigned to the 429th ECS, was in its 21st rotation. At that time, the USAF still had 24 Combat Coded (CC) Ravens in its inventory. PROVIDE COMFORT II was ended on December 31, 1996 and replaced the next day by Operation NORTHERN WATCH (ONW). The U.S. flew over 42,000 fixed-wing sorties in OPC II.

EF–111As were involved in ONW until their departure from Incirlik, June 25, 1997. They were relieved by EA–6B Prowlers of Marine Tactical Electronic Warfare Squadron (VMAQ) 1, which deployed for six months from MCAS Cherry Point (NC).

PERIOD	UNIT/ NUMBER	SORTIES	FLYING HOURS	REMARK
CY91	42ECS			Apr 6-Aug 14, 1991
CY91/2	42/3*			Sep 26, 1991-Jul 3, 1992
CY92/3	390ECS**/3			Jul 1-
CY93	430ECS=/3			Mar 1993-
CY94	429ECS/3	487	1770	
CY95	429ECS/3	476	1659	
CY96	429ECS/3	406	1366	
CY97	429ECS/3	297	939	-June 25+

* increased to five on Apr 4, 1992; later decreased to three.
** aircrews only; 390ECS re-designated as Fighter Squadron at Mountain Home on Sep 11, 1992 and replaced by newly activated 429ECS.
= after PCS of 429ECS from Mountain Home to Cannon on Jun 22, 1993, the 430th was inactivated there on the 29th.
+ replaced by EA–6Bs of Marine Tactical Warfare Squadron (VMAQ) 1.

Saudi Arabia

The redeployment of personnel and equipment to Mountain Home did not result in the inactivation of ECSP 390. Nor, that no EF–111As remained, as four Ravens and

429th ECS maintenance personnel line-up at the flight line at Prince Sultan to bid farewell to their EF–111As, which are taxiing to the runway to begin their redeployment to Cannon. ***(USAF, A1C Greg Davis)***

aircrews of the 42nd ECS and personnel of the 42nd AMU stayed behind as part of TFWP 48. As part of USAF's residual assets in the Gulf Region during the ceasefire period with Iraq the Ravens would provide an ECM capability to U.S. forces in case hostilities would begin again. To support flight operations, the 390th left its WRSK. It was returned to Mountain Home in July, although it was no longer 100 percent complete. Plans called for eventual rotation of the 42nd contingent with a small portion of the 390th ECS tasked to provide assets early in 1992 (see later).

On March 13, 1991 TFWP 4404 was activated at Al Kharj, replacing TFWP 4, assuming its mission, personnel and equipment. Assets initially assigned to its subordinate units were F–15C and E, F–16A and C–130H aircraft. Plans were in place to include EF–111As, F–4Gs and A–10As. As a result, maintenance representatives of the 42nd ECS visited Al Kharj on March 27 as part of an inspection of base facilities in connection with the upcoming move from Taif. The next day, F–4G Phantoms arrived, joining the 4404th. The four 42nd EF–111As, personnel and equipment arrived at their new home on April 11 and were attached to the 4404th, adding, as the Wing stated, "a new dimension and more versatility". When ADP 15 was inactivated on April 20, ECSP 390 was reassigned to USCENTAF, Forward, but stayed attached to the 4404th. 42nd AMU personnel returned to Upper Heyford in May and were replaced by other 42nd AMU personnel.

In the week of June 9, 1991, plans were revealed regarding, among others, the re-designation of the Wing, a realignment of six groups under it, the extension of Wing control from Al Kharj and Riyadh to Dhahran (King Abdul Aziz AB), and the move of Hq USCENTAF (Forward) from Riyadh to Dhahran. On June 15, the Wing initiated its official move to Dhahran with the departure of EF–111As and F–4Gs. Two days later, re-designation to Composite Wing Provisional 4404 (CWP 4404) was effected.

All scheduled normal flying operation sorties were temporarily cancelled on April 17, 1992 due to a sandstorm. This must have come as an unpleasant surprise for personnel of the 390th ECS, which had arrived in Dhahran eight days earlier with four EF–111As from Mountain

Home to replace the 42nd ECS detachment. On the 22nd, CWP 4404 organized a static display on its flight line, representing each type of fighter aircraft assigned.

SOUTHERN WATCH

After the UN Security Council (UNSC) adopted Resolution 688, designed to protect the Kurdish minority in Iraq, President George Bush announced on August 26, 1992 the establishment of a no-fly in Iraq south of 32°N to support '688', initiating Operation SOUTHERN WATCH (OSW), which complemented OPC and later ONW. Its duration was not determined at that time. The no-fly zone would be enforced by Coalition forces from the U.S., UK, Saudi Arabia, France (and later) Kuwait. In the meantime, Joint Task Force Southwest Asia (JTF–SWA) had been established on August 13 with the mission to support in-theater forces by provision of operational planning and tactical command. The first operational sorties were flown on the 27th, less than 24 hours after Bush's announcement. On September 2, the number of 390th ECS EF–111As was increased by two to six. Nine days later, the aircrews took off their 390th ECS patches and replaced them with new 429th ECS ones as back home, at Mountain Home, their unit had been re-designated as a Fighter Squadron and replaced by the 429th ECS. September also saw the arrival of personnel and equipment of the French Air Force. In October, the Wing conducted its first composite training exercise since the beginning of OSW, SANDSTORM. Participants included USAF fighters, aircraft from the carrier USS Ranger, and RAF Tornado GR.Mk1s.

Like in the north, Iraqi aircraft also tested the no-fly zone in the south. This resulted on December 27, 1992 in the loss of a MiG-25 Foxbat, which was downed by Lt Col Gary North, commander of the 33rd FS (Shaw), flying F–16D 90-0078 and using an AIM-120A AMRAAM. Four F–16Cs and two Iraqi MiGs were involved in the engagement. It was the first aerial victory ever scored by a U.S. F–16 pilot. A further re-designation, to Wing Provisional 4404 (WP 4404), occurred on January 1, 1993. Twelve days later, Coalition forces destroyed SAM sites in southern Iraq.

January saw the number of Ravens being decreased by two to four. This would continue to be the number through the remainder of the rotations. While in Dhahran, the detachment's parent unit, the 429th ECS, PCS-ed on June 22, 1993 from Mountain Home to Cannon and was reassigned from the 366th Wing to the 27th FW.

After Iraq had moved elements of its Republican Guards to Kuwait's border by October 1994, the U.S., on the 11th, began reinforcement of their in-theater forces in Operation VIGILANT WARRIOR by deploying almost 3,000 additional personnel (total 25,000+) and 100 aircraft (270+). Surveillance over the no-fly zone was increased with, for instance, on the 22nd, 165 sorties flown. In a November 5 message, USCINCCENT recommended redeployment of the VIGILANT WARRIOR forces, which was initiated on the 19th.

In October 1995, the Air Expeditionary Force (AEF) concept was introduced. The AEF provided forces with the same or greater capability than the units being replaced. AEF I deployed to Shaikh Isa with F–16s in the October 28-December 18 period.

When EF–111As ended their involvement in SOUTHERN WATCH and redeployed from Prince Sultan to CONUS, the US Navy took over the commitment from the 429th ECS with EA-6Bs. Their first unit to deploy was VAQ-142 from NAS Whidbey Island. On the photo, Prowler 162936 (NL-621), configured with two AN/ALQ-99 Tactical Jamming System (TJS) pods, cruising over the Saudi Arabian desert after in-flight refueling. ***(USAF, A1C Greg Davis)***

In February 1996, WP 4404 operated from nine geographically separated locations in three countries. It received mission tasking from JTF–SWA.

Khobar Towers

On June 25, 1996 Khobar Towers, which was used as living quarters for SOUTHERN WATCH coalition personnel, was hit by terrorists, resulting in 19 personnel killed and almost 500 wounded. A Task Force, the Downing Commission, was appointed to review the situation and assess force protection measures at other Wing locations within the AOR (Area of Responsibility). The Commission suggested Prince Sultan AB near Al Kharj. The first Wing units relocated in August. The EF–111A detachment of the 429th ECS followed suit on September 11.

After Iraqi tanks took Irbil in the northern no-fly zone in August 1996, President Bill Clinton expanded the southern no-fly zone to 33°N. To clear the additional territory of crucial air defenses, B–52Hs and U.S. Navy ships fired 44 cruise missiles on September 2-3 in an operation called DESERT STRIKE. The B–52s were supported by, among others, eight 909th ARS KC–135Rs (Kadena). Forces in the Gulf Region were increased to support SOUTHERN WATCH with eight F–117s (to Al Jaber AB in Kuwait), and F–16Cs of the 68th and 78th FS (to Al Kharj). Also, Air Mobility Command (AMC) transported Patriot-ready batteries to CENTCOM's AOR. By February 1997, Wing aircrews had flown 133,000+ operational sorties.

Implementation of the expeditionary nomenclature for the SWA AOR was adopted by Air Combat Command (ACC) in May 1997 through a two-phase approach. In Phase I, the organizational nomenclature for operational units rotating into SWA were modified, adopting the Expeditionary organizational nomenclature. For instance, 77th FS became 77th Air Expeditionary Squadron (AES). In an August 4, 1998 letter, USAF approved the Phase II changes of the numbers of provisional in-place SWA units from 44XX to other unit numbers. In this way the WP 4404

was inactivated at Prince Sultan on October 1, 1998 and replaced by the newly activated 363rd Air Expeditionary Wing (AEW).

Prowlers

On March 30, 1998, SWA's curtain started falling for the EF–111A Raven as well, when 429th ECS aircrews flew the final two OSW sorties. They flew two EF–111As, which, in 1968, had participated in COMBAT LANCER, the initial combat evaluation of the F–111A in Southeast Asia. On April 8, some 60 Squadron/Wing personnel redeployed. By the 11th, all four Ravens had returned to Cannon. This was for a total of 2,780 days in 32 continuous rotations in SWA, enforcing a no-fly zone over Southern Iraq. According to WP 4404, "the Squadron departed with distinction of providing the Area of Responsibility with the longest, continuous United Nations support in enforcing no-fly, no-drive zones in both Operation Southern and Northern Watch."

In the meantime, in February, an advanced U.S. Navy echelon (ADVON) team had visited Prince Sultan AB for a site inspection and to discuss details concerning the replacement of EF–111As with EA–6Bs. Naval personnel and equipment then arrived at the base to begin construction of the Expanded Mission Mobile Maintenance Facility, known as EMMMF2. Its mission was to maintain ALQ-99 jamming transmitter equipment of the Prowler and was under the command of Lt Cdr Don Patterson. During their final deployment, Raven aircrews worked especially close with their Navy counterparts of Electronic Attack Squadron (VAQ) 142 from NAS Whidbey Island (WA) to ensure a smooth transition from the Raven to its replacement, the Prowler. The official transition ceremony took place on March 31.

PERIOD	UNIT/ NUMBER	SORTIES	FLYING HOURS	REMARK
Mar 25, 1991	42ECS/4			
Apr 9, 1992	390ECS/4			+2, Sep 2, 1992
Sep 11, 1992*	429ECS/6			
FY93	429ECS**/4	646	1953	
FY93	27FW/4	619	1952	430***/429ECS
CY94	429ECS/4	713	1974	
CY95	429ECS/4	823	2150	
CY96	429ECS/4	790	2052	
CY97	429ECS/4	766	2435	
CY98	429ECS/4	403	1730	-March 30+

* 390ECS re-designated as Fighter Squadron at Mountain Home on Sep 11, 1992 and replaced by newly activated 429ECS.
** Jun 22, 1993, PCS from Mountain Home to Cannon and reassigned from 366 to 27FW.
*** Aug 1, 1992, activated at Cannon and assigned to 27(T)FW; Jun 29, 1993, inactivated.
+ replaced by Electronic Attack Squadron (VAQ) 142.

DENY FLIGHT

EF–111A Ravens did not only support operations in Southwest Asia, but also in Europe: Operation DENY FLIGHT. The passing on March 31, 1993 of UNSC Resolution 816, authorized NATO to enforce a ban on military flights over Bosnia and Herzegovina by shooting down any violators. Coalition members included the U.S., UK, Italy, Holland, France, Spain, Turkey and Germany. Aviano became the most important of DENY FLIGHT bases, with at one time 140 aircraft. The Operation was initiated on April 12.

An EF–111A Raven of the 429th ECS on 'last chance' at Aviano AB, Italy, prior to a September 12, 1995 takeoff to support a NATO air strike against Bosnian Serbs in Operation DENY FLIGHT. ***(USAF, TSgt Bruce Sherwood)***

The first aerial victories were scored on February 28, 1994 when four of the six Serb Bosnian jets were shot down after being intercepted by two flights of F–16Cs of the 526th FS. Capt Robert Wright begged three of them. On March 25, 1995, the 429th ECS got involved when it deployed six EF–111As with personnel and equipment from Cannon to Aviano. This meant the Squadron was active on three fronts, Italy, Saudi Arabia and Turkey with personnel, equipment and a total of 13 Ravens. A truly imposing challenge, which was tackled successfully.

Through April 30, 1995, participating aircraft flew 72,000 sorties, including 58,920 operational and 13,080 training sorties.

However, the UN was very reluctant in authorizing close air support missions for the fear of the Serbs retaliating against UN peacekeepers on the ground. The Serbs did seize hostages after a strike against an airfield at Udbina and an ammunition depot at Pale and as a result the UN vetoed further NATO air strikes. After the Srebrenica debacle (July 6-11, 1995), during which urgent Dutch requests for direct air support had not materialized and some 8,000 Moslem men and boys were massacred by Bosnian Serbs, a bold new air campaign, called DELIBERATE FORCE, was ready by the end of July. It began on August 29 and ended on September 21. Overall, 3,515 sorties (including 2,470 sorties like SEAD, CAS, recce and SAR/CSAR) were flown in the August 29-September 14 period by some 400 aircraft, which operated from Italian bases and from two Navy and two French carriers. The U.S. flew 2,318 sorties, 66 percent of the total. The EF–111A detachment returned to Cannon on September 25, 1995.
In December, a peace agreement between Bosnia, Croatia and Serbia was formally signed at Wright-Patterson AFB. This ended DENY FLIGHT, which was replaced by Operation JOINT ENDEAVOUR to implement the agreements.

Its air aspect was named Operation DECISIVE ENDEAVOUR.

PERIOD	UNIT/ NUMBER	SORTIES	FLYING HOURS	REMARK
CY95	429ECS/6	498	1964	Mar25-Sep28

PDM

As to an interesting insight into the relation between an Air Logistics Center (ALC) and a Major Command after the latter cancelled a previously negotiated workload, the following.

PDM, Periodic Depot Maintenance, of an EF–111A, by Sacramento ALC (SM-ALC) at McClellan AFB, was accomplished after every 1,500 flying hours, in general, every four years. The work encompassed 24,000 man-hours in 342 calendar days at a cost of $3.2M. In FY96, ACC contracted SM-ALC for six EF–111As to go through PDM and for FY97, five aircraft.

Although ACC had contracted 'Sacramento' for PDM of five EF–111As in FY97, it later decided to terminate work on three aircraft. According to SM-ALC this would cause an estimated $6M loss to its Depot Maintenance Activity Group (DMAG). Referring to AFMCI 21-111, SM-ALC stated in an August 12, 1997 letter to ACC that "charges for cost due to cancellations of previously negotiated workload or reductions in quantities of previously negotiated workload were reasonable and businesslike expenses, which had to be borne by the customer who negotiated, but then cancelled the workload or part of the workload". Hence, SM-ALC's request to ACC for recoupment of the losses resulting from the termination of the EF–111 depot work.

ACC, through Col Ramon Luina, Chief, Resources, Requirements, Integration and Execution Division, responded by letter of September 19, stating that SM-ALC's request had been reviewed and was denied. The only reason consideration was given to performing these PDMs was to prepare for an Air Force decision extending the EF–111 retirement date. As that decision had not been made, ACC had no requirement to perform PDM on those aircraft in FY97. Doing so would have been a gross waste of money. ACC regretted the fact losses were incurred as result of the decision, but believed it was not obligated to pay 'penalty' costs in the current Fiscal Year.

At that time, there were three EF–111As going through PDM at McClellan with 60051 scheduled for completion on January 16, 1998 (FY96), 60046 on the 21st and the final Raven, 60015, on March 11.

Inactivation

On January 28, 1997, the 429th ECS had a total of seven aircraft with personnel deployed, four in SWA and three at Incirlik.

TAC Programming Plan (PP) 97-07 dealt with the inactivation of the 429th. Although an ACC Site Action Task Force (SATAF), 429th ECS inactivation/EF–111 retirement was already held at Cannon on June 3-6, 1997, it would take more than a year to realize the action. The SATAF was performed by five different working groups in the area of, for instance, Operations and Manpower/Personnel. The in-brief was presented by the 27th Fighter Wing commander, Col Michael Koerner, who presented all aspects of the Team's objectives and addressed particular concern for taking care of the personnel and identifying closure costs and funding sources.

EF–111A 60051 in flight over the Italian Alps while on deployment to Aviano to support Operation DENY FLIGHT, the NATO enforcement of the no-fly zone over Bosnia. The photo was taken on May 1, 1995. ***(USAF, SrA Tama Hamilton)***

As to Operations, the 429th ECS, by the end of June, still had personnel and four of its 37 EF–111As on rotation to SWA with a scheduled return to Cannon on April 15, 1998. A plan for the return had to be developed. The Squadron was attempting to send eight aircraft and personnel to the first period of GREEN FLAG in FY98. As to personnel, new assignments would have to be found for 683 mission and 69 base operating support manpower authorizations, which were identified for reduction. The milestones showed, among others, that the transfer of EF–111As to AMARC, Aerospace Maintenance and Regeneration Center, at Davis-Monthan was scheduled to begin on June 11, 1997 and to be completed on June 12, 1998. ACC was to publish the order to inactivate the 429th ECS by May 29 for a June 26 inactivation. The unit was to be removed from the UMD on June 30.

Some two months after returning from SWA, USAF's final EF–111A Electronic Combat Squadron, the 429th, was inactivated (June 19), after the EF–111A Raven had been retired in a May 2 ceremony. Thirty-five EF–111As were flown to AMARC with the final two on June 19. ■

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With special thanks to my photo man Sandor Kocsis, and Guy Aceto, Michael Dugre (ACC Historian), Peter Lay (USAFE acting Historian), Tammy Horton, Sly Jackson and Jim Musser (AF Historical Research Agency).

A Top Secret Yugoslavian Emergency Landing Field in World War II

RAF Supermarine Spitfires taxi to the runway at Prkos for a sortie against German forces as an RAF anti-aircraft gun crew looks on. *(Photo credit: The Imperial War Museums.)*

Mike Croissant

In the waning days of World War II, Second Lieutenant Louis Head sat in the copilot seat of a damaged B–24 Liberator as it limped deep into Yugoslavia. "The cockpit aerial maps show an emergency landing field on the Dalmatian coast, Zara," he later wrote. "Lodged mainly in our imaginations, this target turns out to have imaginary aspects. This is the destination we talk about, hold our compass heading for, but never think of as a place we would choose to visit."[1] By the time the war ended, thousands more airmen would share the same sentiment. The remote airfield outside Zara—known today by its Croatian name, Zadar—was a well-kept secret of World War II, and its story has been untold until now.

Allied war planners originally conceived of the idea of establishing an emergency landing field on the mainland of Yugoslavia in the fall of 1944 as an element of Operation FAIRFAX. A downgraded version of a shelved British plan, code-named GELIGNITE, to conduct a major amphibious assault on the western part of German-occupied Yugoslavia, FAIRFAX envisioned the opening of one or more advance landing grounds for Royal Air Force (RAF) air interdiction operations against German forces in Croatia.[2] At minimum, it required one airfield with two landing strips—one for use by British fighters and fighter-bombers for combat operations, and a second for emergency use by Italy-based US Fifteenth Air Force aircraft in distress.[3] FAIRFAX sought an ultimate footprint of 15,000 combat and administrative troops and 2,600 vehicles, almost all of them British.[4]

On November 9, 1944, Fifteenth Air Force engineering officer Colonel A.E. Harris led a small Allied reconnaissance party that landed on the Dalmatian coast and, partnering with local Yugoslav Partisans serving under Marshall Josip Broz Tito, spent a week surveying two potential sites for the operations proposed in the FAIRFAX plan. One was a hard clay airstrip located near the village of Zemunik, six miles east of Zara, and the other a smaller field located near Prkos, a village five miles east of Zemunik.[5] Harris authored a report, dated November 17, declaring that Zemunik was "the only airfield in the . . . area worth considering." The site had two hangars, an operations tower, housing for a garrison of five hundred men, a nearby water supply, and excellent road access from Zara and its port. Although the field and its facilities had been severely damaged during British raids against Italian forces occupying the area earlier in the war, the report estimated that they could be repaired and opened to emergency landings within seven days of the arrival on site of the necessary troops and equipment.

Making the field suitable for all-weather offensive operations of the kind intended for Operation FAIRFAX, however, would take at least six weeks of work following the arrival of the requisite personnel, equipment, and material, including three thousand tons of pierced steel planking (PSP) with which to surface the main runway. "Due to the critical shortage

Churchill's special envoy, Brigadier Fitzroy Maclean, negotiated an agreement with Tito that paved the way for the opening of an emergency landing field at Prkos, near the Dalmatian coast of Yugoslavia. ***(Photo credit: Imperial War Museums.)***

of engineer troops, heavy equipment, and PSP," the report stated, "it is reasonable to expect that such a field could not be completed in less than two to three months from this date."[6]

The report made no mention of the Prkos site, but a later communication from the RAF's Balkan Air Force (BAF) to the Mediterranean Allied Air Forces stated, "Prkos (is) not capable of development (as an all-weather field) and is suitable for two squadrons (of) fighters at most. (We) do not consider there is (a) likely prospect of (a) separate airfield for (the) Fifteenth Air Force." [7] The BAF dispatched a reconnaissance party of its own to Dalmatia at the end of 1944 and found that the Prkos airfield was "situated in veritable wilderness with no chance of provision of amenities." The road from Zara was also single-track and in very poor state, complicating resupply, but the airstrip itself could be made operational within less than a week.[8]

Planning for FAIRFAX moved forward, but the operation, and particularly the large deployment of British forces it envisioned, became a further sticking point in Anglo-Yugoslav relations that, at this point in the war, were already under significant stress. The official British history of the Second World War stated:[9]

The Allies wished to trap and destroy the German forces in the Balkans so that they could not reappear on the Eastern and Western fronts as soon as Hitler deemed it expedient to abandon the Balkans. The Partisans wanted merely to hustle the Germans out of their country so that they could consolidate Communist power in post-war Yugoslavia . . . While they wished to push the Germans out, they had no desire to see the British troops come in because such arrivals might encourage unwelcome hopes in the minds of non-Communist Yugoslavs.

These differences took center stage when Churchill's special envoy to Tito, Brigadier Fitzroy Maclean, took two draft agreements related to Operation FAIRFAX to the Yugoslav leader in December 1944.

The first accord proposed the establishment of a base in the Zara area from which to "extend and intensify air action against the enemy" and to deploy six fighter/bomber squadrons, including two from the Yugoslav Army of National Liberation (YANL), with a possible future addition of another fighter/bomber squadron and a night fighter squadron. The agreement capped the air force contingent at approximately four thousand RAF officers and men, who would be subject to the operational command of an RAF officer acting "under the general direction of Marshall Tito." Separately, the accord declared that the British would send a detachment of up to twenty thousand land forces personnel to the Zara area to establish, maintain, and defend the air base and to "carry out offensive operations, in conjunction with the YANL Forces, if required." The operation of these forces "will be carried out in consultation with and in support of the appropriate YANL Commanders."[10]

A second, more broadly worded accord sought to grant the Royal Navy temporary use of any port or anchorage on the Dalmatian coast that the British deemed operationally necessary to prosecute the war in the Adriatic.[11] The naval and air agreements were interconnected in that open shipping routes from Italy to Yugoslavia were a prerequisite to keeping the Zara-area forces supplied. Both agreements stated that British forces would be withdrawn from Yugoslavia as soon as their presence was no longer required.

Tito appeared willing to accede to British wishes

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Field Marshal Harold Alexander, Supreme Allied Commander, Mediterranean (left), meets with Marshall Josip Broz Tito, leader of the Yugoslav Partisans (right), in Belgrade in February 1945. ***(Photo credit: Imperial War Museums.)***

regarding the operation of naval forces, but he objected to the size of the force proposed under the air-land agreement. Field Marshal Harold Alexander, Supreme Allied Commander, Mediterranean, proposed putting off further discussions on the matter for his upcoming visit to Belgrade to meet Tito personally,[12] but the British chiefs of staff noted their "gravest objection," echoing Prime Minister Churchill's recent message to Tito insisting on "complete freedom to move sea, land, and air forces to any part of Yugoslavia where they could best kill the most Germans."[13]

When tensions in Greece forced Alexander to cancel his trip to Belgrade, he advised Maclean to, if possible, leave out exact personnel numbers during his presentation of the agreement to Tito, seeking to avoid "any restrictions which will cramp our style in any way in the future."[14] Maclean replied that any accord without codified limits on the British presence in the Zara area would be dead on arrival.[15] Defeated, Alexander argued in a December 29 communique to the British chiefs of staff:

The early establishment of an Air Base in the Zara area is of primary operational importance if we are to deal effectively with the German forces withdrawing through Yugoslavia. I feel . . . that we must make allowances in this case for the particular circumstance obtaining here . . . I consider it expedient for us to forego principles to some extent in order to obtain the results we require.

Alexander thus informed the chiefs that he had given Maclean the green light to sign an agreement with specified troop limits in place.[16]

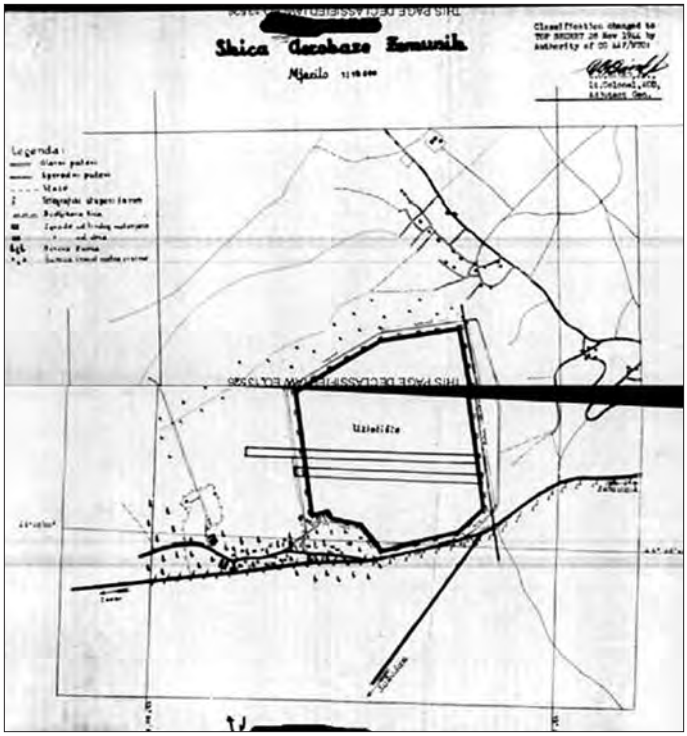
War planners made the resulting change in policy official with the announcement of Operation BAFFLE, a much-reduced version of FAIRFAX. The new plan sought to land an initial force of 2,500 troops, including airfield construction and aircraft servicing personnel, to get the Zara-area air bases up and running, with a later expansion to six thousand.[17]

At the end of December, Maclean presented Tito with an updated draft of the air-land agreement. In a clear capitulation to the Yugoslav Communist leader, it capped the air and land forces contingents at 3,700 and 3,000 officers and men, respectively. The agreement also specified that the land forces contingent would be limited to aircraft maintenance and airfield construction and defense, thus marking the abandonment—for now—of the British plan for large-scale offensive army operations in Yugoslavia. The new draft also decreed that Zemunik and Prkos would be the focus of Allied efforts in the region. The air base would fall under the command of a Yugoslav air force officer, but the forces functioning there would be subject to the operational control of an RAF officer.[18] As expected, Tito reacted favorably to the new draft, and he signed it on January 7, 1945.[19]

In the end, the enemy made the wrangling over the size of the British footprint in Dalmatia rather moot. As the negotiations with Tito over the air-land and naval agreements were reaching their climax, intelligence pointing to a resurgence of German land and naval forces in the area came to light. Fearing that, even in scaled-back form, the base at Zemunik risked inviting a concerted German attack that its British and Partisan defenders had little hope of repelling, war planners postponed BAFFLE indefinitely.

On January 17, 1945, the same day Tito signed the naval agreement, Operation ACCOMPLISH was unveiled as a temporary measure until military conditions became favorable for BAFFLE's reinstatement.[20] ACCOMPLISH set plans for Zemunik aside in favor of Prkos. A party of 750 men and 150 vehicles, plus a small Fifteenth Air Force servicing unit, would be sent, relying on Partisan forces and a small detachment of RAF personnel to provide defense against small German raiding parties.

The BAF, clearly hopeful that BAFFLE would still be mounted as originally planned, stressed that Prkos would "meet our operational needs for the time being,"[21] and an initial deployment of four RAF Spitfire fighters for defense was planned. It was a far cry from earlier British plans for aggressive air interdiction of German forces in Croatia, and the BAF tried to put the best possible spin on the outcome. In a communique to Nathan Twining, the Commanding General of the Fifteenth Air Force, BAF headquarters made it clear that "the immediate intention is to establish an Advanced Landing Ground at Prkos for use by aircraft of the Balkan Air Force, and which can also be used as an Emergency Landing Ground by Fifteenth Air Force aircraft which cannot safely attempt to reach . . . the mainland of Italy." As if to discourage Twining's bomber boys from using Prkos, the communique emphasized that medical facilities and the capacity to refuel and repair heavy bombers at the



A November 1944 map of Zemunik airfield, Yugoslavia. Ultimately, Allied planners determined that a large troop presence at Zemunik risked provoking a concerted German attack, so they abandoned plans to use the field. ***(Photo credit: US National Archives.)***

field would both be very limited, so landing there should only be done as a last resort.[22]

Operation ACCOMPLISH got underway on the night of February 2-3, with the arrival of five landing craft with destroyer escort at the port of Zara. The entire force was ashore by February 6, with RAF Wing Commander L.H. Bartlett in charge,[23] and the field opened to RAF air operations two days later.[24] The only thing missing was an American unit to tend to the aircraft that would soon begin landing there.

Captain S. Reed Keator, chief engineering officer for the Fifteenth Air Force's 81st Air Service Squadron, had distinguished himself as a standout problem solver when sent to establish the emergency airfield on the Yugoslav Isle of Vis in the spring of 1944. Assuming the role of commanding officer, operations officer, and engineering officer for the 81st's detachment at the base, which was sometimes known within the squadron as "Project A," Keator got the field up and running quickly, earning the Legion of Merit for his "tireless energy, devotion to duty . . . enormous capabilities . . . (and) outstanding efficiency."[25] When Keator learned of the existence of "Project B," the opening of an airfield on the Yugoslav mainland, he wanted in on the action.

According to the 81st's squadron history, Keator "moved heaven and earth" to become a member of the joint British-American scouting party sent into Yugoslavia in November 1944 in search of suitable airfields to replace the operation on Vis. After days of surveying sites with their Partisan hosts, Keator's group returned to Italy, minus three British officers killed in action against the enemy. On January 19, 1945, Keator was put in command of the 81st at Bari, Italy, and bringing "Project B" to fruition consumed his attention.

On the night of February 4, Keator led a party of twenty of his men with equipment and supplies in a convoy of four LCTs—Landing Craft, Tank—that departed Bari for the Dalmatian coast. Upon arrival at Prkos three days later, the captain and his men set to establishing an American outpost, the only one of its kind on the mainland of Yugoslavia. Within seventy-two hours, a complete camp had sprung up, replete with aircraft maintenance and refueling facilities, a field hospital, a transient area for overnight air crew guests, supply and communications units, an operations office, and a transportation department equipped with the heavy-duty vehicles required for such tasks as changing out engines on bombers.[26]

From the start, the base was within striking distance by the enemy. Initially, German ground forces were believed to be as close as eighteen miles away, and artillery fire and the sound of reconnaissance planes overhead could be heard nightly.[27] Louis Head, who was forced to bail out of his damaged 451st Bomb Group Liberator about fifty miles from Prkos on March 16, 1945, observed firsthand how murky the situation on the ground actually was. Perched in a vantage point near a major road, attempting to evade capture and reach the sanctuary of Prkos, he noted:

(T)he demarcation lines between the Germans and the Partisans . . . are not battle lines, but rather lines of territorial control. My map depicts this stretch of road as a main route stretching across southern Croatia. German armed forces occupying the major towns control it militarily, that is, their troops use it whenever needed to go from here to there. They do not really hold it or own it. Threatening reprisals, they use it for the most part without opposition. Therefore, it is not territory held by the enemy. It and a railroad are the means the enemy uses to move between cities. The Partisans, situated in adjacent hills, isolate the road so as to prevent enemy forces from admission to the surrounding countryside. The terms "enemy-held territory" and "battle lines" can describe the situation once you realize it is the Partisan forces that restrict the German troops to the confines of the road and it is the Partisans who form the lines beyond which the enemy cannot move without opposition.

This translated into a somewhat surreal situation. Despite hearing small-arms and artillery fire, Head wrote that "no one seems to be shot, killed, or even wounded."[28]

* * *

Veteran pilot First Lieutenant William Bonnifield of the 98th Bomb Group was at the controls of a battered B–24 nicknamed *Watt's Cookin'?* when, over the Adriatic, an explosion suddenly tore open the Number Four engine, sending two cylinder heads, half of the cowling, and a viscous trail of oil tumbling into the slipstream. The Number Three engine also soon gave out, and Bonnifield knew he wouldn't be able to complete the mission to

1Lt William Bonnifield, 98th Bomb Group, 344th Bomb Squadron. ***(Photo credit: The William Bonnifield family.)***

Vienna with the rest of the Fifteenth Air Force.[29] It was February 15, 1945, barely a week after the 81st Air Service Squadron had completed its preparations to receive damaged aircraft at Prkos.[30]

Bonnifield and his copilot feathered the damaged engines, dumped the bombload, and ordered the crew to toss out all unnecessary equipment. By now, the bomber was over the mountains of western Yugoslavia, steadily losing altitude, its continued airworthiness still in doubt. "There ensued what was probably one of the fastest and most effective staff conferences in history," Bonnifield recounted. He apprised the crew of the situation over the interphone, stating that the land below their feet was still at least partially occupied by the Germans, making bailing out a risky prospect. As he began laying out their options, the navigator broke into the briefing with unexpected news.

First Lieutenant Louis Gillette announced that, in a pre-mission briefing three or four days earlier, he had been informed of the existence of an emergency landing field in the Zara area that damaged bombers could utilize if necessary. It had not been mentioned in this morning's briefing, but he recalled the general location of the field from memory and thought the Liberator could reach it without great difficulty.[31] Gillette was an unknown quantity to Bonnifield, having been inserted into the patchwork crew of airmen under the pilot's command that day, but Bonnifield decided to trust Gillette's information. The navigator gave him a course heading for the field, and Bonnifield turned the stricken aircraft toward the hoped-for refuge.[32]

"Continuing on down and circling around, indeed, we saw a field of sorts," the pilot recollected. He spied a couple

The William Bonnifield crew after landing in their damaged B-24 Liberator bomber *Watt's Cookin'?* at Prkos emergency landing field. Standing, left to right: SSgt Richard Marsden, SSgt Raymond Duquette, SSgt Don Burkett, Cpl Thomas Crehan, TSgt John Klisenbauer, SSgt Frank Voci. Kneeling, left to right: Adams, 1Lt William Bonnifield, 2Lt Richard Pfeiffer, 1Lt Milton Erdman. ***(Photo credit: The William Bonnifield family.)***

Members of the US Army Air Force's 81st Air Service Squadron repair flak damage to the nose of a B-24 Liberator at Prkos. ***(Photo credit: US Air Force Historical Research Agency.)***

of wooden buildings, three fighter aircraft, a handful of tractors, and a C–47 transport with the red star of Tito's Partisans painted on one wing. As the bomber got ever lower, Bonnifield saw what he thought were swastikas on the fighters, and he feared the worst. *This was a German field*, he recalled thinking. Perhaps Gillette was right about there being a friendly field in the area, but maybe the Germans had retaken it, which was why the pre-mission briefing that morning had made no mention of it.

The pilot quickly hatched a plan and briefed the crew. They would land and roll to a stop as close as possible to the end of the runway, drain the fuel tanks onto the ground under the bomb bay, quickly disembark, and fire a flare into the gas to set it alight. This would both keep the aircraft out of enemy hands and potentially buy the crew time to make a break for it.[33]

Bonnifield set *Watt's Cookin'?* down with consummate skill, and the men prepared to set their plan in motion. They exited the bomber, however, to the sight of a Union Jack fluttering from a mast,[34] and a handful of American-made jeeps quickly pulled up beside the aircraft. The first individual out of the lead jeep, whom Bonnifield described as a "wiry, crusty-looking lieutenant colonel," unleashed a verbal tirade on the surprised airmen. "I'd never heard such a completely extemporaneous and volatile and imaginative and creative string of swear words in my life, before or after," the pilot recalled. The men in the jeeps spirited the crew off to a building, where they faced questioning.

Bonnifield later claimed that personnel told him the airfield was a newly operational joint endeavor between the British and the Americans, and its existence was still considered "top secret." The pilot surmised that his unannounced landing threatened to destroy the tiny base's anonymity, and he had the impression that its commander wanted them all arrested. This, of course, did not explain why, a few days before, Gillette had been briefed that bombers could land at the field if necessary.

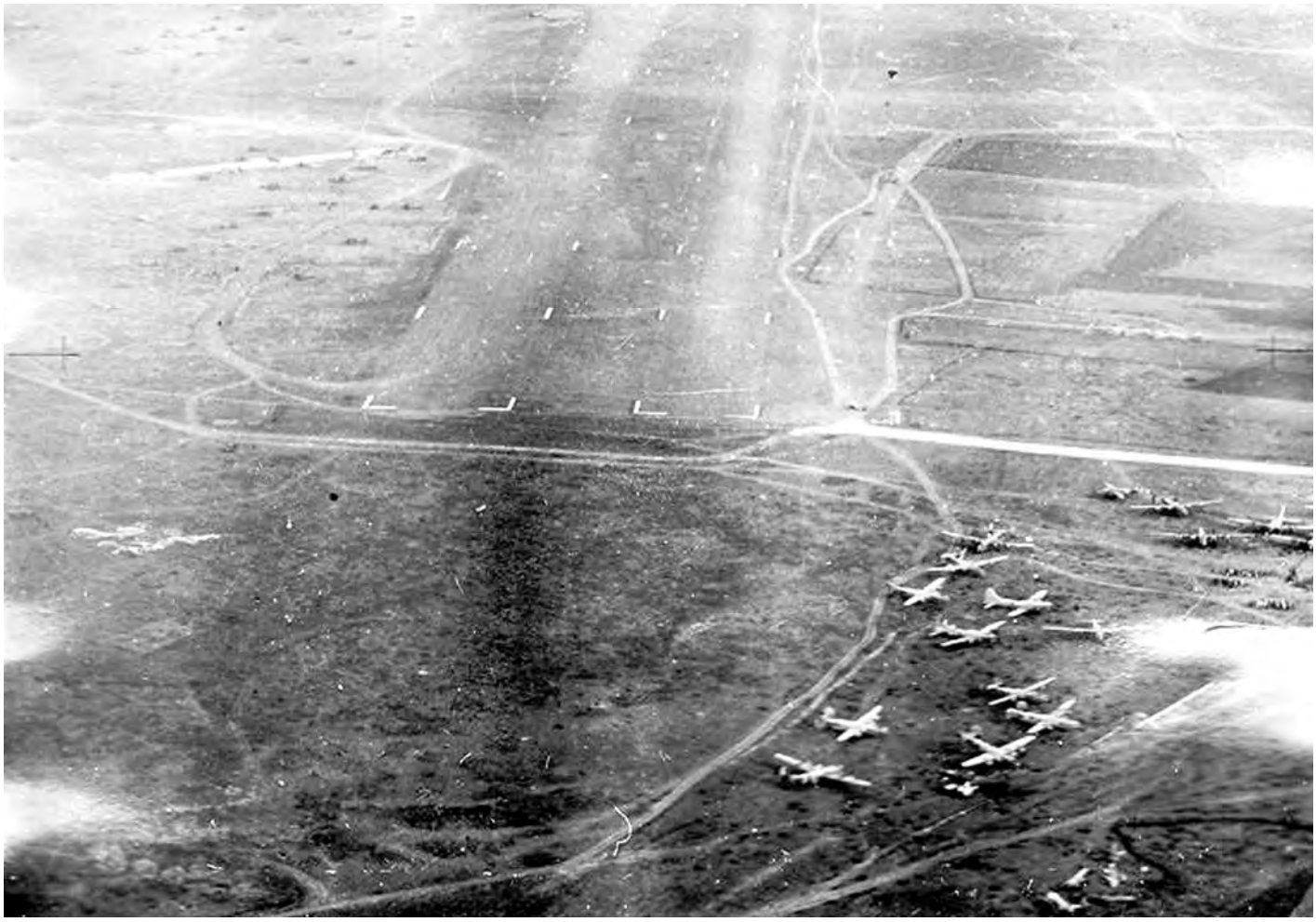
According to Bonnifield, attitudes toward the crew quickly thawed, and, after providing a meal and asking the men to maintain secrecy about the affair, base personnel allowed them to mill about the area while they awaited the arrival of a C–47 to return them to Italy. For three hours, Bonnifield and his men hung out, chatting, to the extent possible, with Yugoslav Partisans detailed to protect the base, and posing for photos next to *Watt's Cookin'?* with a camera one of his crewmen had brought along.[35] When the C–47 arrived, the airmen bid their new friends farewell and headed home, unaware they had made the historic first emergency landing at the Prkos airfield.[36]

With the Bonnifield crew's arrival, the genie was out of the bottle. In the last two weeks of February 1945, forty-one aircraft made emergency landings at Prkos, three of which ended in crashes, and the medical staff cared for sixteen wounded or injured crewmen.[37] This number exploded the following month to 491 landings, including three crashes, and forty-two wounded airmen treated. Personnel manning the airfield poured some 197,550 gallons of one-hundred octane gas, 2,875 gallons of eighty octane, and 4,800 gallons of oil into planes and vehicles, and kitchen staff served approximately thirty-five thousand meals.

Demand for aviation gasoline quickly outpaced the Royal Navy's ability to supply Prkos via the port of Zara, so Captain Keator arranged for six B–24s no longer considered combat-worthy to be stripped of all but the most critical equipment and fitted with large gas tanks mounted in their bomb bays. The Liberators each made dozens of flights to Prkos, where ground crews drained every drop from the bomb-bay and auxiliary wing tanks and most of the gas in the main wing tanks, leaving just enough for the venerable birds to return to Italy.

By the middle of March, there was more work than the men of the 81st's Prkos detachment could keep up with. The squadron at Bari relinquished a cook, a driver, a supply officer, two clerks, six sheet metal specialists, and ten aircraft mechanics to the remote outpost, and the unit on the Isle of Vis sent a half dozen personnel. An additional sixty mechanics were reassigned to Prkos from the 451st, 454th, 455th, 456th, and 459th bomb groups.[38] Fortunately, the 81st was in capable hands.

Keator had relinquished command of the squadron's Prkos element to his chief test pilot and newly assigned engineering officer, First Lieutenant Floyd R. Creasman, on March 8. A native of Asheville, North Carolina, Creasman had enlisted in the Army in 1937 and earned his commission in 1941, going on to complete 26 combat missions as a Liberator pilot with the 484th Bomb Group before transferring to the 81st.[39] There, Creasman recalled,



The dual airstrips of Prkos emergency landing field with several American B-24 and B-17 bombers in the foreground. ***(Photo credit: UK National Archives.)***

Few visible signs of human activity remained at the site of the airfield as of 2019. ***(Photo credit: Mike Croissant.)***

he flew "everything, all of the bombers, all of the fighters, all of the transports, all the aircraft that were in the Air Force inventory at that time."[40]

In addition to being a hotshot pilot with an affinity for buzzing the airfield in whatever aircraft he happened to be flying at the time, Creasman was also a fearless leader of men. On February 28, a P–38 fighter crashed onto the Prkos airstrip during an abortive landing attempt, breaking apart and catching on fire. Creasman and two sergeants rushed to the scene and, with flames licking at them from all around, pulled the pilot from the wreckage of the cockpit. The flier soon succumbed to his injuries, but Creasman and the two enlisted men received the Soldier's Medal, the US Army's highest honor for valor in a non-combat situation.[41]

Today, Zara is once again known by its Croatian name, Zadar, and the city has rebounded from the devastation of not only World War II, but also the war that accompanied the breakup of Yugoslavia and Croatia's emergence as an independent country in 1991. The village of Prkos, with a population of 363 in the 2011 census, probably looks much the same as it did in the 1940s. The site of Prkos emergency airfield is a large open area, and rows of trees trace the general outline of parts of the two former landing strips. The area where airmen parked their aircraft is an open-air landfill strewn with trash, discarded furniture and appliances, and tires. A passerby would never know that, in three months of operation in 1945, 373 heavy bombers, one medium bomber, and 194 fighters landed at Prkos airfield for fuel, repairs, or both.[42] ■

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26. Eighty-First Air Service Squadron History, February 1945, in *Ibid*.
27. Eighty-First Air Service Squadron History, April 1945, in *Ibid*.
28. Head, *Dancing in the Dark*, 73.
29. William Bonnifield audio recording, cassette number ten, recorded 8 February 1977.
30. Eighty-First Air Service Squadron History, February 1945.
31. Bonnifield audio.
32. William Bonnifield, "Visit to Bosnia, February 15, 1945, Down Behind Enemy Lines," accessed 15 May 2020, https://medium.com/william-bonnifield/visit-to-bosnia-1945-d78849fa4317.
33. Bonnifield audio.
34. Raymond Duquette letter to William Bonnifield, 1957, accessed 15 May 2020, https://medium.com/william-bonnifield/visit-to-bosnia-1945-d78849fa4317.
35. Bonnifield audio.
36. William Bonnifield interview with the author, 8 October 2013.
37. Eighty-First Air Service Squadron History, February 1945, AFHRA, reel A0944.
38. Eighty-First Air Service Squadron History, March 1945, in ibd.
39. Lisa Neidinger, "Former Fairchild AFB Commander Remembered," Fairchild Air Force Base Public Affairs Release #010125-4, 25 January 2001, accessed 11 February 2013, http://www.transcom.mil/news/print_news.cfm?id=1822.
40. Quoted in Kim Crompton, "Airport Director Floyd Creasman to Retire," *Spokane Chronicle*, 20 July 1983, 5.
41. Eighty-First Air Service Squadron History, February 1945, AFHRA, reel A0944.
42. The figures were: 335 B-24s, 38 B-17s, 127 P-38s, 67 P-51s, and one B-25; 29 C-47s also landed at the field to deliver personnel and supplies and transfer downed crews back to Italy. Eighty-First Air Service Squadron History, February-May 1945, AFHRA, reel A0944.

Ballistic Missile Shock Isolation Systems

Atlas D undergoing a propellant transfer exercise at Offutt Air Force Base, Nebraska. The above ground coffin did not use a missile suspension system, the missile was held in the stretched position using the erecting boom visible to the left of the missile. The reentry vehicle is a General Electric Mark 3. *(Library of Congress)*

David K. Stumpf

In late 1950s, designers of intercontinental ballistic missile launch facilities had to juggle hardening the facilities against nuclear weapon blast effects while maximizing reaction time and rapid force expenditure without excessive exposure time. First and foremost, however, was the need for the earliest operational capability.

The resulting designs progressed from: (1) the three Atlas D gantry launch facilities (no protection) at Vandenberg Air Force Base; (2) the above ground coffin system used with Atlas D (2 psi overpressure); (3) the buried coffin system used with Atlas E (25 psi); (4), in-silo storage combined with above-ground launch, as deployed with Atlas F and Titan I (100 psi); and ultimately in-silo storage and launch with Titan II (300 psi), Minuteman (300 psi, launch facility as-built) and Peacekeeper (1000 psi, launch facility).[1]

The Atlas F and Titan I launch facilities did not utilize missile suspension systems per se, as the missiles were stored on their rigid launch platform within the silo crib structure and the entire structure shock isolated. This article describes the design evolution of ballistic missile shock isolation systems used with Atlas F, Titan I, Titan II, Minuteman, and Peacekeeper .

Decisions, Decisions

On April 30, 1958, the Office of the Secretary of Defense requested the Air Force to report on the operational, logistical, engineering, construction, and cost factors anticipated for protecting ballistic missiles by hardening and dispersal of the launch facilities. After two months of study, the Ballistic Missile Hardening Committee Report concluded:

1. Hardening is required in combination with dispersal, low exposure time, fast reaction, and rapid force expenditure.

2. Methods of hardening with quick response are known and are feasible.

a. Now – to 25 psi above ground

b. Now – to 100 psi underground

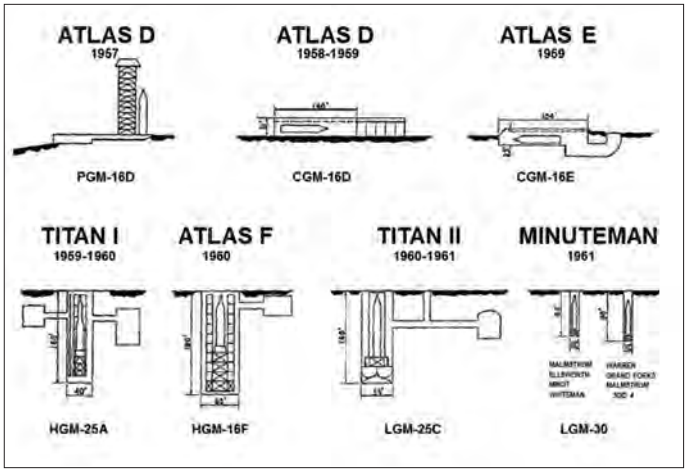
c. After R&D – to higher psi underground

d. After R&D – to survive direct hits with slow response (superhard)

3. Hardening to 200 psi. appears feasible and attractive.

4. The construction costs of hardening can be estimated with reasonable accuracy.

The committee recommended that the Atlas E program be continued at the 25-psi level to obtain operational capability at an early date. Atlas F and Titan I could be hardened to 100 psi and studied for hardening beyond 100 psi. As Soviet accuracy improved, resistance to blast effects above 25 psi overpressure meant the missile sites needed to be located under-



Evolution of ICBM Basing Modes: Launch Environment Symbol: C – coffin stored for ground launch; H – silo stored, launch from surface; L – silo stored and launched; P – soft pad, surface launch. Mission Symbol: G – surface attack. Type Symbol: M – guided missile. ***(Missileer's Heritage)***

ground. Ground shock and ground motion studies from the nuclear weapons tests at the National Test Site indicated the design of the underground facilities was relatively straightforward.[2]

A follow-up report, the Air Force's Missile Site Separation study of 1959, took two approaches to determine the required level of hardening. The basis was a general Soviet threat with: (1) a warhead yield of 5 to 30 Mt; (2) a CEP of 1 to 2 nautical miles; (3) 80 percent reliability; and (4) an enemy-to-US missile ratio of from 1 to 10.

The first approach was if the attack was completed before missiles were launched, i.e., still protected in their silos. Site separation distance in this case was a matter of cratering and crater ejecta dispersal; cratering resulting in physical disruption of the silo and ejecta dispersal preventing the opening of the silo closure door.

The second approach concerned exposure time, defined as "that time during a missile's launch sequence and initial flight trajectory that is soft, herein considered to be vulnerable to 2 psi over pressure." An additional consideration in determining vulnerability during the exposure period was the sensitivity of the guidance system to thermal energy. The study found that exposure time for 2 psi overpressure or a thermal pulse of 100 calories/per centimeter^2 was about the same. This became more of an issue in the case of Atlas F and Titan I during elevation to the surface

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Table I. Characteristics of Basing Systems With Recommended Separation Distances[a]

System	Site Hardness (psi)	Missiles/Site	Sites/Squadron	Exposure Time (minutes)	Separation Distance (nautical miles)
Atlas-Titan Silo Lift	100	1	9	5 to 7	14 to18
Titan-Ia Silo[b]	100	1	9	2 to 3	7 to 10
Minuteman[b]	100	1	50-100	0.5 to 1.5	3

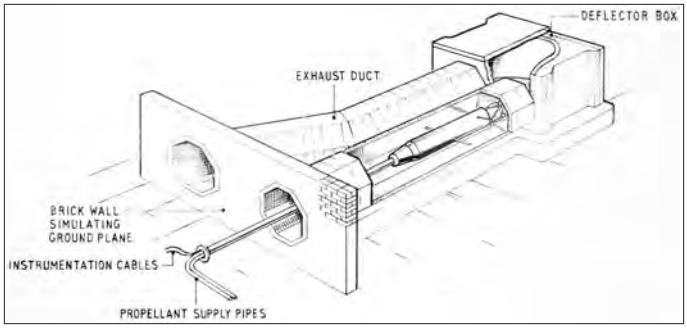
a) Adapted from "Missile Site Separation, October 1959," (Air Force Materiel Center History Office, Wright-Patterson AFB, Ohio) page vi; b) Original estimate was 100 psi, actual construction was to 300 psi hardening.

and the subsequent pause until launch. Titan II and Minuteman would be only briefly exposed when the silo closure door was open prior to liftoff. In any case, once launched, missiles were still vulnerable during the early part of their trajectory (Table I).

The report concluded the survival potential of a hardened missile system was independent of site separation distance, if that separation distance was at least 4 to 5 nautical miles, as long as no limitations were placed on force expenditure time.[3] Implicit within the report was that underground basing offered the best and most cost-effective protection against air blast and ground shock. Silo-lift, surface launch, was the interim solution for Atlas F and Titan I, since neither airframe had been designed to withstand the severe acoustical energy environment of in-silo launch. Was in-silo launch even feasible?

In May 1956, a preliminary study by Aerojet General Corporation engineers determined that underground basing combined with in-silo launch was theoretically possible, but further investigation was dropped due to costs. Parallel research as part of the Blue Streak IRBM program in Great Britain confirmed, in a September 1958 report, the

Construction of the 1/6th scale Titan II in-silo launch test facilities at Aerojet, Azusa, California. The facility was built and the testing completed in a 60 day period. Aerojet opted for a W-shaped deflector with cascade vanes to direct exhaust away from the silo opening, preventing entrainment of exhaust products. ***(Courtesy of Rollo Pickford)***



British in-silo launch test facility, circa 1958, which validated the feasibility of basing the Royal Air Force Blue Streak intermediate range ballistic missile in underground silos. The British opted for a J-shaped deflector. Blue Streak was not deployed. ***(British National Archives)***

validity of Aerojet's theory. Both the British scientists and the Aerojet engineers used 1/6th scale models to demonstrate the feasibility of in-silo launch. Work resumed on the Aerojet study with the first test firing conducted on June 6, 1959. Thirty-six tests later, on March 7, 1961, a modified Titan I missile, VS-1, strengthened to withstand the acoustical energy environment of in-silo launch, completed a fully successful captive fire test at Vandenberg Air Force Base. The same missile, VS-1, flew successfully on May 3, 1961, verifying the in-silo launch concept.[4]

Ballistic Missile Shock Isolation Systems

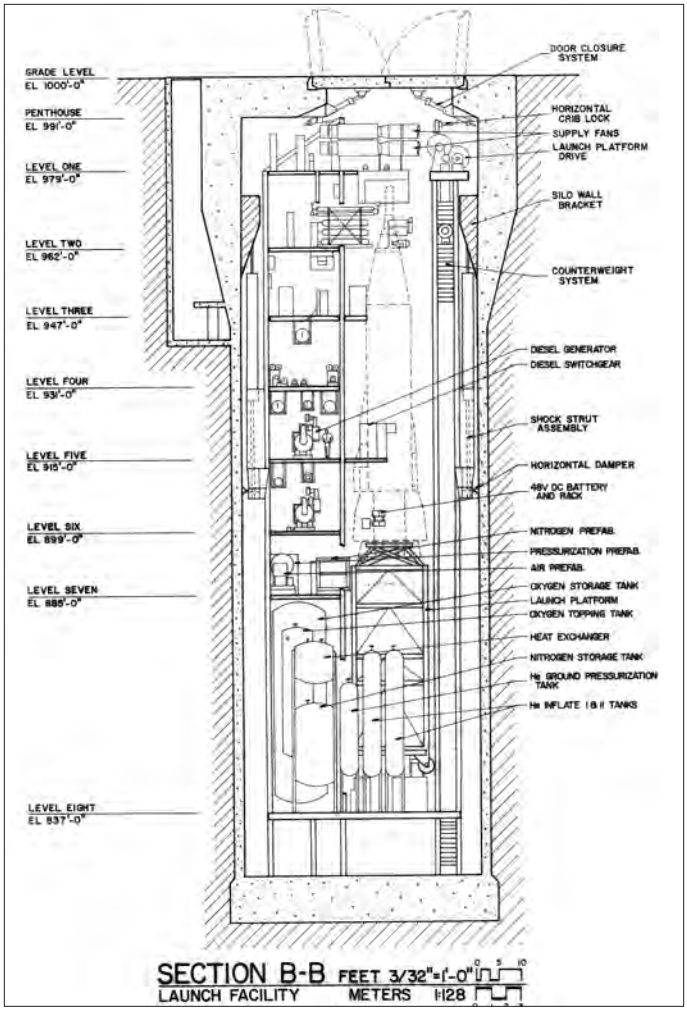
While the Atlas F and Titan I shock isolation systems did not directly support the missile airframe, the lessons learned in the silo-lift design contributed to the true missile shock isolation systems used with Titan II, Minuteman, and Peacekeeper.

Silo-Lift: Atlas F (1962-1965)

The Atlas F silo, measuring 52 feet in diameter and 173.5 feet deep, housed an octagonal steel structure called the crib, which measured 150 feet tall, 49 feet point-to-point, with eight floor levels. The crib housed the missile lift system, the liquid oxygen plant, propellant storage tanks, environmental control systems, guidance alignment, generators, and hydraulic systems. The crib also stored missile test, checkout, countdown, and launch equipment. The missile itself rested vertically on the silo launcher platform housed in the 21-foot square missile enclosure.

The shock isolation system protected the entire crib structure, which weighed approximately 900 tons.[5] Shock isolation of individual pieces of equipment was considered but discarded because of the large amount of rattle space required between the pieces of equipment. Isolating the entire crib structure facilitated use of standard equipment. Developing new equipment that could be hard mounted and withstand the anticipated shock was deemed too costly and time-consuming.

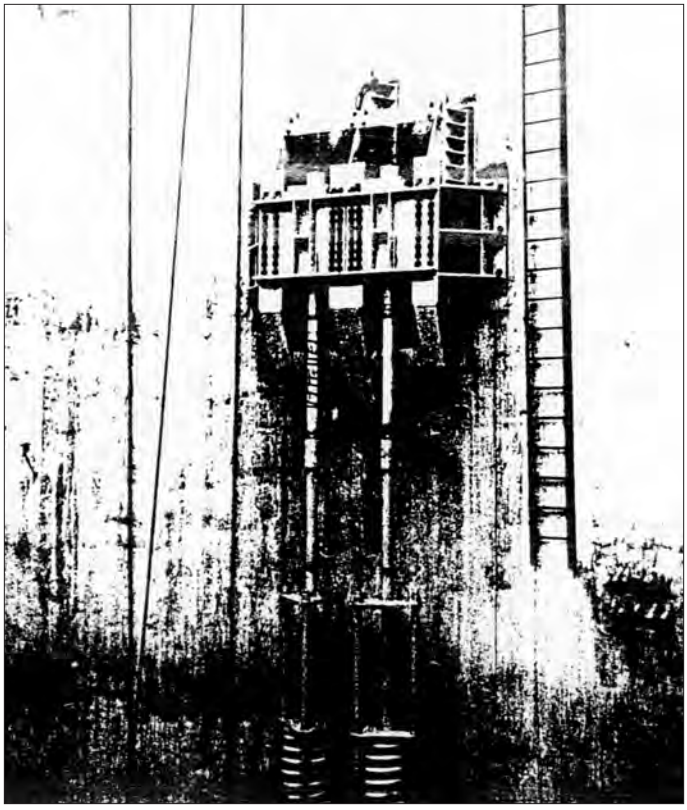
The crib was supported, and shock isolated, by four pairs of pendulous, 64-foot-long springs, known as shock isolation struts, equally spaced on the periphery of the octagonal crib.[6] The lower end of each strut was attached to the crib at Level 6, a few feet below the crib's center of gravity. The upper end was attached to the silo wall at Level 2, approximately 15 feet below the silo roof. Each strut spring element was composed of seven decks of springs, three sets of springs per deck, mounted in series around a common compression rod. The outer spring, approximately 2 feet in diameter, was made from 3 ½ inch diameter chrome molybdenum spring steel stock.



Atlas F silo cross-section. The shock isolation system was installed upon completion of fabrication of Level 6 structural steel. ***(Historical American Engineering Record)***

The spring element provided vertical shock attenuation of approximately 6 inches in response to a peak vertical acceleration of 0.4g, as dictated by the missile structure. Horizontal attenuation of a peak horizontal acceleration of 0.4g was provided by the pendulum action of the shock struts. Vertical dampers were located on each strut near the top coil spring, and horizontal dampers were located between the silo crib and silo wall at the lower point of attachment for the shock struts. Although the RP-1 fuel was stored on board the missile, a horizontal rattle space of 18 inches allowed for the anticipated pitch motion and shift of the center of gravity when loading the oxidizer. Hydraulically operated positioning and locking mechanisms enabled alignment of the crib prior to elevating the missile to the surface for launch.

This design made it difficult to increase the system weight or shift the center of gravity, because the load ca-

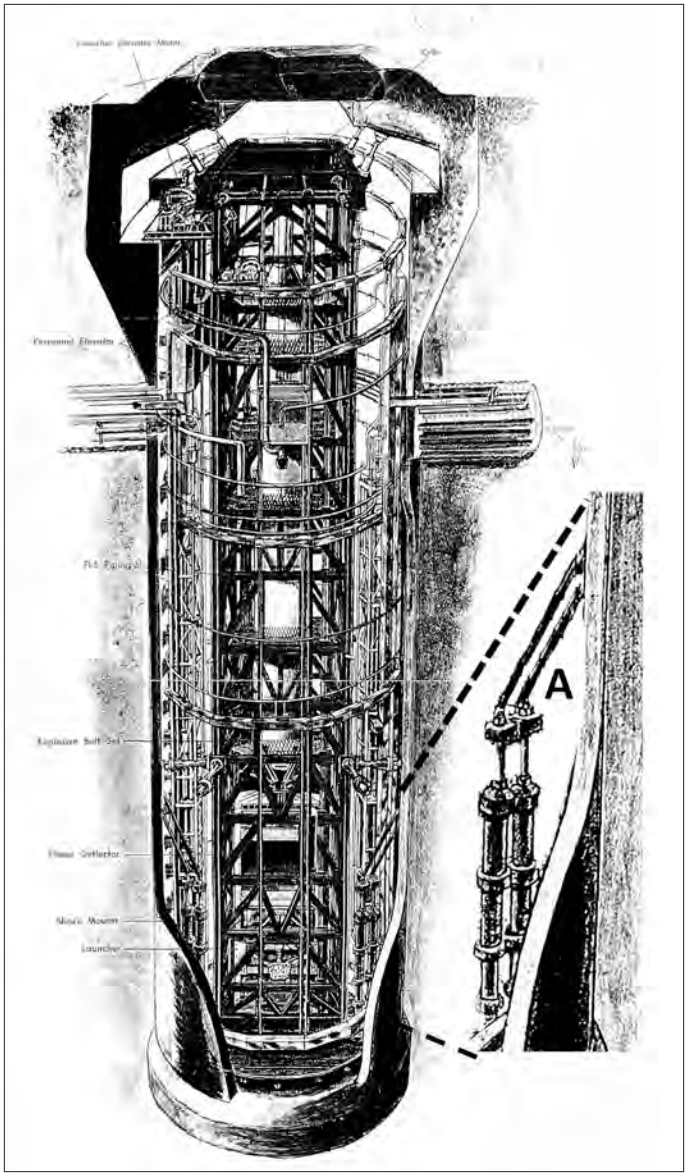


(Above) Atlas F: Upper wall bracket for crib shock isolation system. The point of attachment was at Level 2. The bracket was over 6 feet tall *(Atlas-missilesilo.com)* (Below) Atlas F: Lower crib shock isolation system bracket attachment to crib structure at Level 6. Note the workers on the beam below the leftmost spring set. *(Defense Visual Information Distribution Service)*

pacity of the springs was fully utilized. Seemingly minor changes, such as a lighter weight alloy for fuel storage tanks, necessitated the addition of ballast to maintain the crib's center-of-gravity position. Spring failures occurred in some of the first installations due to poor quality control during manufacture.[7]

Silo-Lift: Titan I (1962-1965)

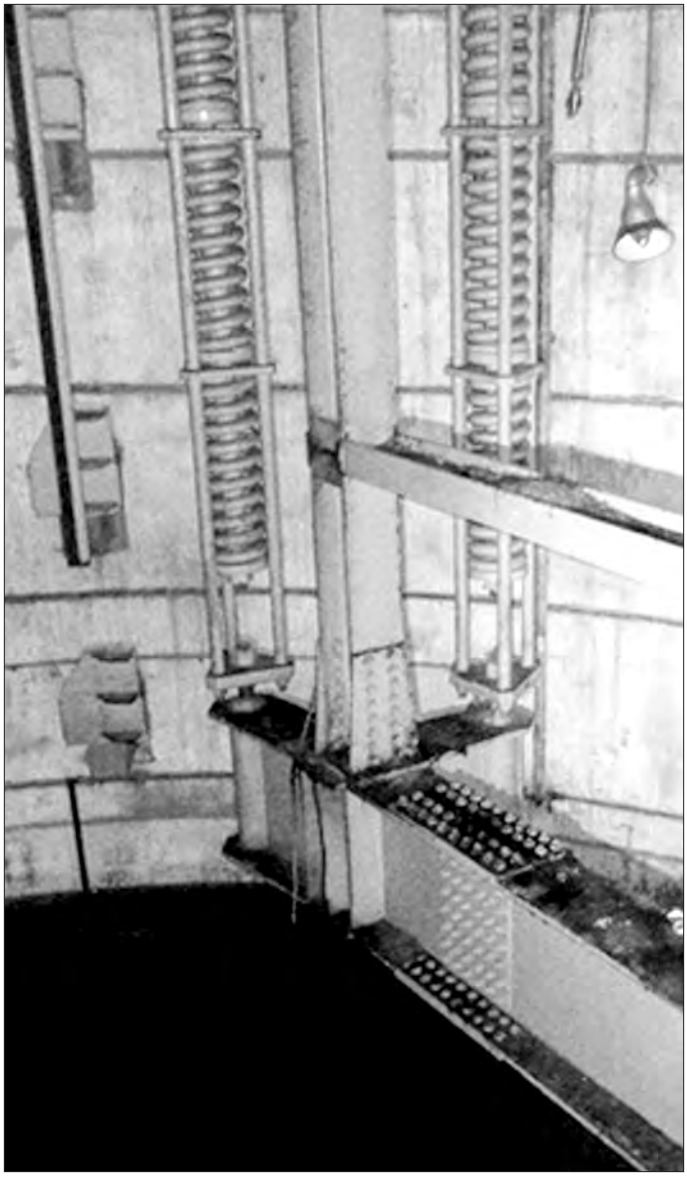
The Titan I silo was 161 feet deep, including a 6-foot-thick foundation, with an interior diameter of 40 feet. Like



Isometric illustration of a Titan I silo. Unlike Atlas F, the shock isolation system was located in the lower half of the silo and connected to the base of the crib structure. The illustration is somewhat misleading, the brackets (A) are also attached to the silo wall. *(Courtesy of Lee O'Connor)*

Atlas F, the silo housed a crib structure, 132 feet tall and 21 feet wide, weighing 490 tons including the missile on the elevator launch platform. Like Atlas F, the crib structure housed the support equipment for the missile and the silo. Engineers evaluated several shock isolation systems for the crib, such as base- or side-mounted spring assemblies for improved pitch stability. Both systems had the drawback of requiring a re-leveling system to compensate for any permanent tilt of the silo following a ground shock.

A pendulous spring system was again used. It consisted of eight 16-foot springs (four 49-inch-long, 22-inch-diameter subassemblies) attached at the corners of the crib base and to a silo wall bracket 32 feet off the silo floor. The vertical center of gravity was above the spring attachment level on the crib but well below the missile center of gravity because of the elevator weight. When the vertical center of gravity of the missile and crib structure is higher than the shock isolation system's point of attachment on the crib, pitch sta-

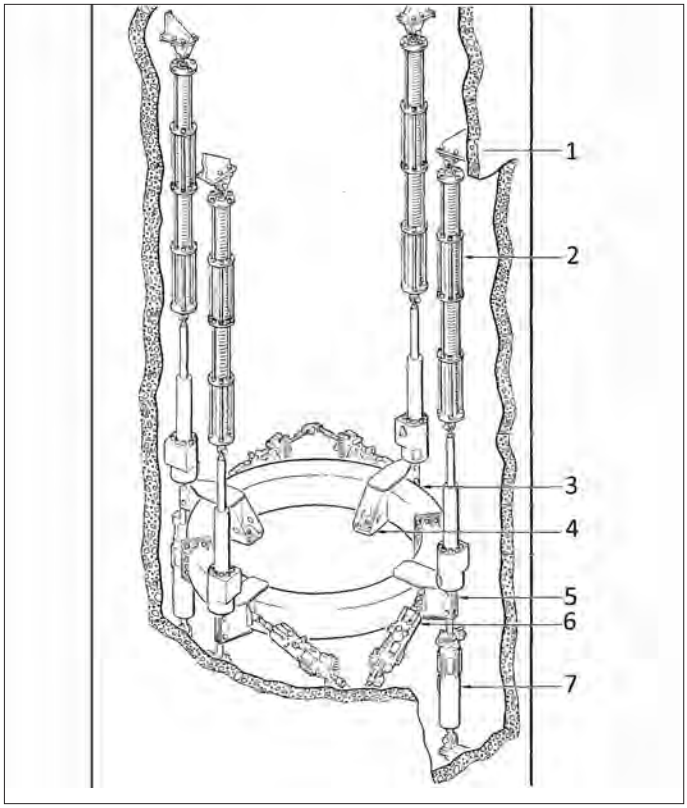


Shock isolation springs attached to the base of Titan 1 crib structure. The rest of the platform has been salvaged. ***(Courtesy of Groundskeeper Pete at www.chromehooves.net)***

bility is more often difficult to attain. Initial studies indicated it would be necessary to cross-couple the vertical springs to manage pitch stability. When the ground shock criteria were reduced, the spring elements were made stiffer which eliminated the need for a coupling mechanism. Coil spring elements were chosen over pneumatic springs because of their high reliability. Hydraulically operated crib locking mechanisms at the top of the crib securely positioned the crib prior to raising the missile to the surface.[8]

In-Silo Launch: Titan II (1963-1987)

The Titan II launch concept differed significantly from Atlas F and Titan I in that the missile was launched from inside the silo. This eliminated the need for the silo crib and its shock isolation system. The silo, 55 feet in diameter and 145 feet deep, housed the equipment area between the silo wall and the launch duct, which was a cylinder 26.5 feet in diameter. The missile rested inside the launch duct on the



Titan II shock isolation system components: 1) attachment to the launch duct wall at silo Level 4, 4 places; 2) spring suspension strut assembly, 4 places; 3) thrust mount, 4) missile support arm and attachment point, 4 places; 5) thrust mount suspension arm, 4 places; 6) horizontal damper assembly, 4 places; 7) vertical damper assembly, 4 places. ***(Courtesy of Titan Missile Museum)***

11.5-ton thrust mount which was shock isolated using four 35-foot pendulous springs. Each spring assembly consisted of four coil springs, 20 inches in diameter, mounted in series. The top of the spring assemblies attached to the launch duct wall at the midpoint of the Stage I airframe and, at the bottom, to the thrust mount.

The fully fueled missile's center of gravity was 10 feet above the shock isolation system's point of attachment to the launch duct wall.[9] Use of the horizontal dampers at the thrust mount eliminated the potential for pitch instability. Vertical and horizontal dampers were attached to the launch duct wall and the thrust mount, respectively, and also locked the thrust mount into the launch position.

The peak acceleration limits were 0.8 g vertically and 0.1 g horizontally. Predicted vertical motion was 12 inches maximum and 4 inches horizontally. Oscillations due to a nearby blast were damped within 60 seconds to allow for thrust mount lockup and launch. The shock isolation system design was such that the missile was returned to within plus or minus 0.25 inch of vertical neutral position, plus or minus 0.4 inch of neutral horizontal position, and 0.25 degree of verticality for the missile axis.[10] Requirements of the optical azimuth alignment system for aligning the missile guidance inertial platform necessitated those exacting specifications.

The Titan II first stage engine took approximately one second to reach 77 percent thrust at which time two 1.8-second timers started. When they timed out, four explosive

hold-down bolts fired, and the missile lifted off of the thrust mount. Aerojet engineers knew from extensive testing that if the first stage engines reached 77 percent thrust, they would go on to reach full thrust. To provide a stable platform for launch, the shock isolation system was locked prior to engine ignition. In the locked condition it was considered "soft" because it no longer provided protection against nearby blast.

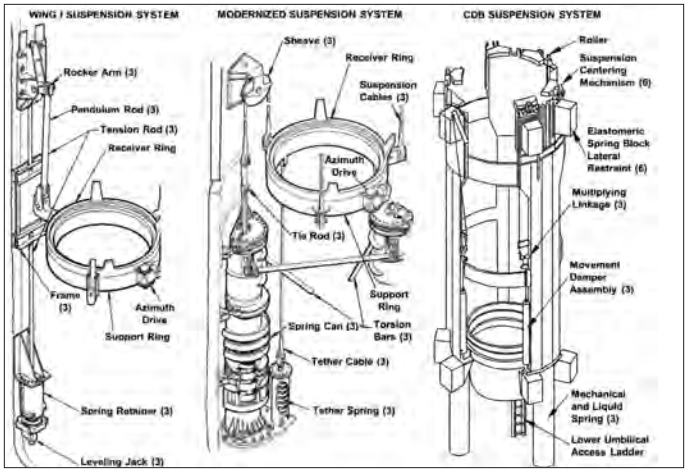
One of the more interesting tests involving a complete Titan II airframe was the "twang" test conducted on February 11, 1963 at Launch Complex 395-D, Vandenberg Air Force Base. Airframe N-3 (60-6810) had been installed in the silo on November 29, 1962. After completion of full-scale propellant transfer system design verification tests, which lasted from December 12 to December 27, 1962, the missile propellant tanks were purged and filled with water. On February 11, a series of tests, nicknamed "twang" tests, began evaluating the missile shock isolation system under dynamic conditions. The missile shock isolation system thrust mount, with the water-filled missile in place as if ready to launch, was pulled down or to the side of the silo with chains held by explosive bolts. The bolts were fired, quickly releasing the missile, simulating ground shock conditions from a nearby explosion being mitigated by the missile shock isolation system.

Elmer Dunn, the Martin Marietta Company engineer in charge of the "twang" tests, found that while the tests verified the ability of the missile shock isolation system to dampen thrust mount movement and then lock up for launch, a mechanical means of spring centering was needed. In addition, the spreader jack for unlocking the dampers—the mechanisms that locked the thrust mount into a rigid configuration to support actual launch—proved to be structurally insufficient. Dunn reported that adjustments to permit load equalization were difficult and that refurbishment after launch, at the Vandenberg sites, would be time consuming and costly unless components were better protected from the effects of the engine exhaust.

The "twang" testing resulted in major system changes to all sites, including spring centering devices and new spreader jacks for unlocking the dampers. Engineers designed ratchet-type positive shuttle lock mechanisms to prevent the dampers from unlocking due to vibration during the time between engine ignition and lift-off. A special lubricant was found to facilitate damper unlocking and inhibit corrosion. Since the original protective devices for the thrust mount shock suppression system springs were inadequate, Dunn's team built reusable fiberglass cocoons that proved to require little maintenance. These cocoons were only used at the three Vandenberg sites.[11]

In-Silo Launch: Minuteman IA 1961-1969

Minuteman IA was only deployed the at Malmstrom Air Force Base, Montana. The Minuteman IA suspension system (MSS, also referred to as Figure A 1204) used the pendulum system but in a significantly different design. The original design had 50-inch-long pendulum rods with the launch tube wall attachment point below the missile's



Comparison of the general features of the three Minuteman MSS. ***(Courtesy of Boeing Corporation)***

center of gravity. Tests showed coupling of horizontal and vertical movement, which was largely negated by moving the point of attachment nearer to the missile center of gravity. Three 100-inch-long pendulum rods connected the missile support ring to three rocker arms. The other ends of the rocker arms were connected by tension rods to three vertical coil springs housed in cans anchored to the launch duct wall 300 inches below the rocker arms. The three pendulous rods had universal joints at each end and were spaced at 120-degree intervals around the missile.

Unlike Titan II, the Minuteman IA MSS did not have horizontal or vertical dampers nor hold down bolts. Vertical oscillations were damped out in approximately six seconds while lateral oscillations took considerably longer, but within the five-minute limit requirement, limiting the ability to launch immediately after an attack. Hold down bolts were not needed because the missile literally leapt off the support ring at 0.34 seconds after ignition due to the much more rapid acceleration found in solid propellant motors compared to liquid propellant engines.[12]

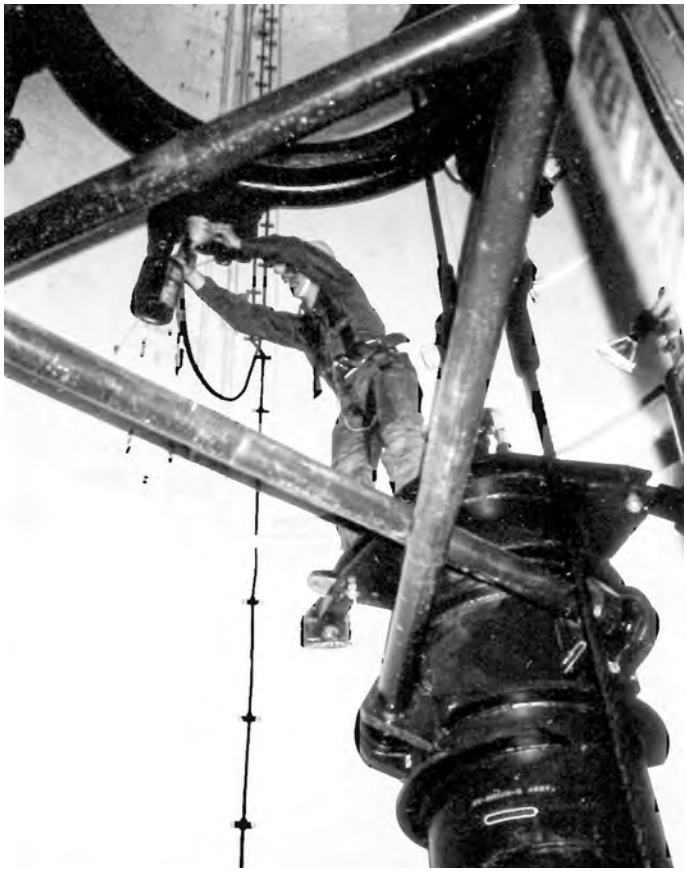
The peak acceleration limits were 0.8g vertically and 0.1g horizontally, with a vertical displacement limited to 4.3 inches below the rocker arm and snubber block assembly. Horizontal motion was limited to 6 inches by the rattlespace. Snubbers were added to prevent the base support ring lofting after missile liftoff and contacting the first stage motor nozzles.[13]

The MSS was designed to return the missile, after a ground shock, to within a 15-minute angle from the vertical—within 0.5 inches of the launch tube centerline in the plane of the missile base—and the missile elevation was to be maintained within plus or minus 0.25 inches. As with Titan II, these impressive specifications were required to keep the light beam from the optical azimuth alignment system, located in the Launcher Equipment Room Level 1, centered on the alignment window in the missile guidance system section.

In-Silo Launch: Minuteman IB, II and III (1963-1975)

The original hardening specification of October 1959 for the Minuteman launch facility was 100 psi. In April

Overhead view of Wing II-VI and 564th Strategic Missile Squadron MSS. Note the crisscrossing torsion bars. ***(Library of Congress)***



The torsion bars and spring cans for the Wing II MSS. The airman is servicing the Azimuth Alignment Drive motor. The spring cans were 2 feet in diameter and 12.5 feet tall. The crisscrossing torsion bars were 3.86 inches in diameter. ***(Library of Congress)***

1960, the Air Force changed the hardening specification to 300 psi. The launcher closure thickness was increased from 24 to 40 inches and a shock mounted floor added in part of Level 1 of the Launcher Equipment Room while still maintaining the deployment schedule for Wing I but the MSS was not modified. Evaluation of the geological formations in the Malmstrom area indicated the original MSS was sufficient, but the design for the remaining wings was modified and identified as Figure A 1322.[14]

A cable and pulley system, while retaining the same vertical dimension, replaced the pendulous rods, rocker arms, and snubbers (see **left** and **above**). The vertical spring stiffness was reduced to 4,500 pounds per inch to meet the new hardness specifications. Torsion bars were added between the vertical compression spring cans to increase pitch stability. The bars were mounted on the suspension spring cans and joined to tie-rod connecting assemblies in such a way that the bars furnished no resistance to vertical motion if the three suspension cans were moving in unison. Ground movement, which would tilt the base ring and thus the missile, would also exert a twisting moment on the torsion bars (**above right**). The bars resisted that force, providing pitch stiffness and stability.

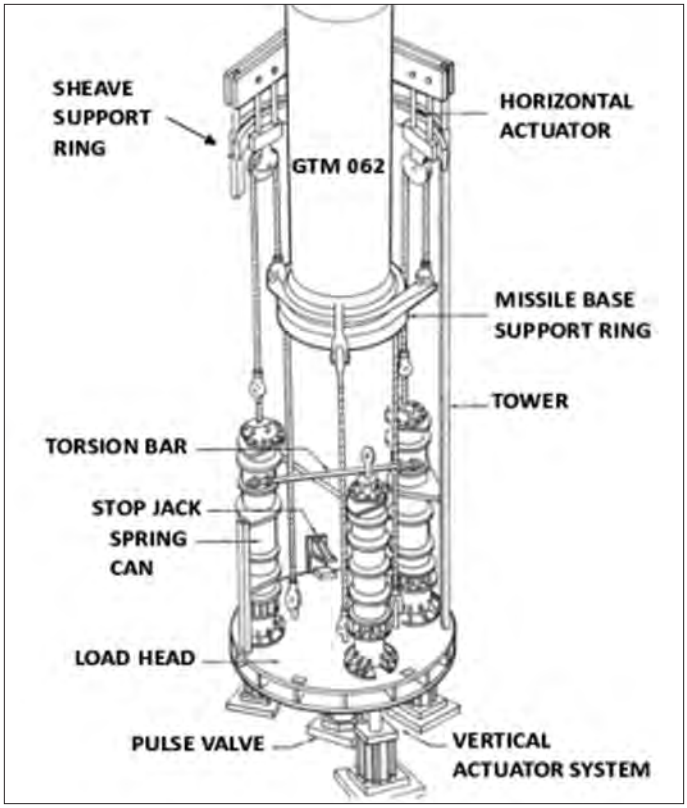
The vertical displacement was limited to 12.5 inches and the horizontal rattle space was limited to 6 inches. The change in the vertical spring stiffness also required addition of three tether cables and springs to prevent lofting of the base support ring at launch.[15]

Although the dynamic responses of the MSS had been determined mathematically, physical verification was needed. From June to August 1967, the development of equipment for the tests took place using a Wing VI Figure A 1322 MSS, minimally modified to fit in the confines of the Boeing Engineering Development Laboratory in Seattle. Three 12-inch-bore hydraulic actuators were used at the base of the simulated launch tube to generate vertical ground shock motion. Horizontal side shock was similarly applied at the top of the launch tube. Once the techniques were worked out, testing moved to the full-scale launch tube facilities at the Seattle Test Program III test building, where testing was completed, and performance verified in May 1968.[16]

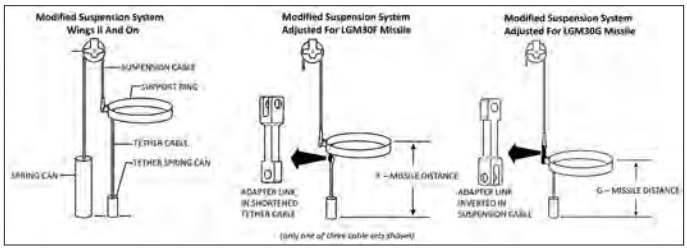
To accommodate the longer Minuteman III missiles (LGM30G) using the launchers built for the earlier and shorter Minuteman IA, IB and II airframes, the MSS had to be lowered from its original position. Rather than use new, longer suspension cables and shorter tether cables, a forged steel link was used to either extend suspension cable length for Minuteman III installations or extend the tether cable for Minuteman II (LGM30F) emplacement. [17]

In-Silo Launch: Minuteman II, III Upgrade Silo Program (1973-Present)

On April 21, 1967, the Minuteman program reached its 1,000-missile force level when the 564th Strategic Missile Squadron achieved combat readiness. Six months later,



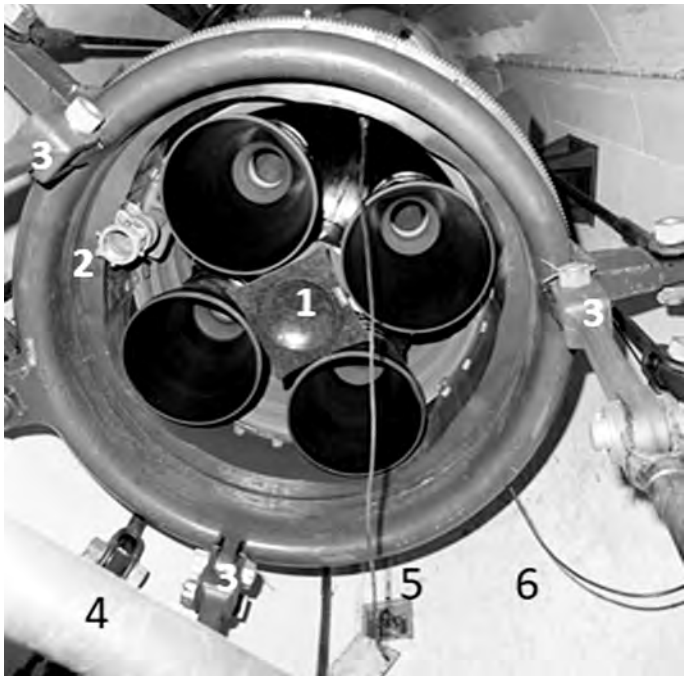
(Above) Dynamic response equipment arrangement for testing the Wing II MSS in 1968. ***(Courtesy of Boeing Corp.)*** **(Below) The simple solution for accommodating Minuteman II and Minuteman III in the Wing II MSS. The use of the link meant that only the tether cable had to be exchanged to accommodate either missile.** ***(Courtesy of Boeing Corp.)***



on October 4, Secretary of Defense Robert McNamara, concerned with the threat posed by the new Soviet SS-9 ICBM, directed the Air Force to explore development of a Hard Rock Silo system for Minuteman III. On October 30, the Hard Rock Silo development program was approved.[18]

The Air Force wanted a launch facility that could withstand a 3,000-psi ground shock as well as protect against higher levels of radiation and electromagnetic interference. The new facilities would be designed to accommodate both Minuteman III and its eventual replacement, initially designated as WS-120A. In June 1970, after three years of debate within both the Pentagon and Congress, the Hard Rock Silo concept, which had reached the subscale and full-scale test stage with favorable results, was abandoned due to escalating costs and resulting delays. Instead, the Upgrade Silo program would improve the hardness of the existing "soil silo" facilities.[19]

Boeing, Strategic Air Command, and other Air Force records from that period conflict on the actual genesis of the current MSS. On June 22, 1971, Boeing was notified of its selection to provide the new MSS as part of Upgrade



Details of Wing II missile suspension system and Minuteman II Stage I: 1) base heat deflector, 2) lower umbilical connection, 3) forged cable adapter links, 4) torsion bar, 5) grounding cable, 6) work cage control cable. The presence of the forged steel links in the tether cable visible on the left and right indicates that this is a Minuteman II installation. ***(Library of Congress)***

Silo.[20] Whether the design was from the Hard Rock Silo experiments is unclear because Boeing had been given a contract for the Hard Rock Silo MSS a year earlier.

The new system, commonly referred to as the Command Data Buffer (CDB) MSS and still in use today, has the missile installed in the Missile Support suspended in the launch facility. The Missile Support consists of five major components:

1. Three attachment bracket assemblies suspend the isolator and missile support structure's assemblies from the launch tube wall.

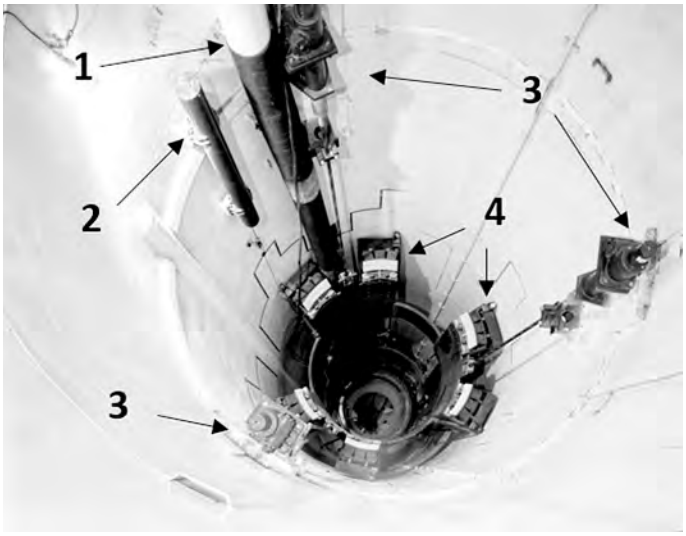
2. Three isolator assemblies support the missile support structure assembly and provide attenuation during attack induced ground shock environment.

3. The missile support structure assembly supports the missile assembly at the missile skirt through the Adapter Ring, Missile Support (ARMS)[also known as the missile base adapter ring], and with lateral restraint devices at the forward "Y" joint of the Stage I motor.

4. The lateral restraint devices are released prior to launch using explosive devices and position the missile for fly out. Missile support structure assembly to launch tube restraints are provided to attenuate the horizontal ground shock environment.

5. A tether assembly is attached between the launch tube floor and the bottom of the missile support structure assembly to prevent interference of the missile support with the missile fly out.

The MSS, a steel cage structure, weighs approximately 40,000 pounds, supports a load of between 74,000 to 79,600 pounds, and measures 8 feet in diameter and 38 feet in length, exclusive of the suspension and tether cables.[21]



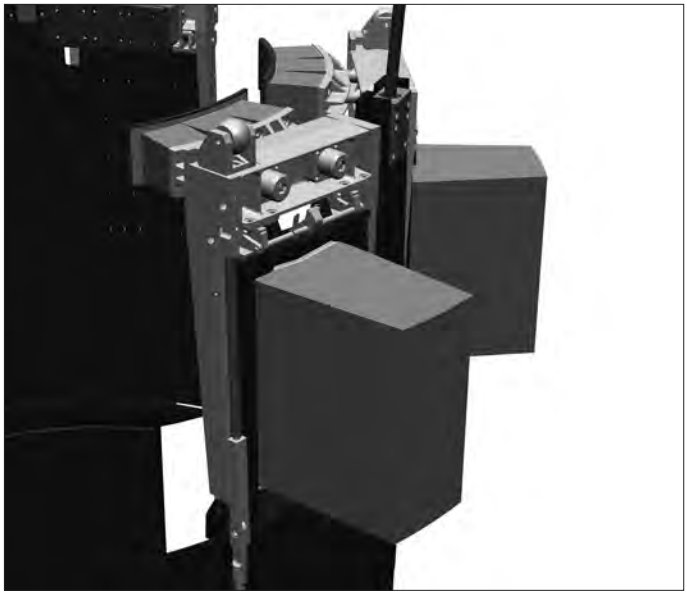
CDB MSS: 1) NCU lower umbilical snubber, 2) launch tube heater conduit, 3) MSS attachment points to launch tube wall, 4) upper lateral restraints, six places. ***(Library of Congress)***

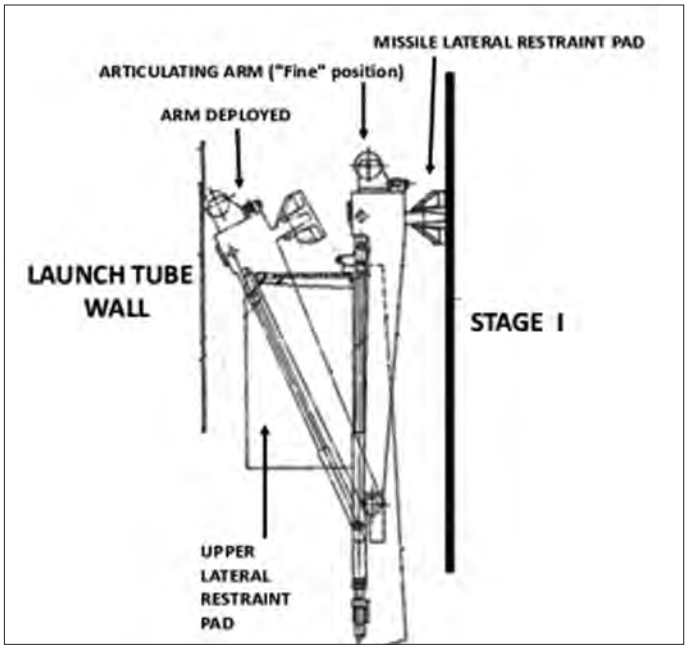
Three vertical legs spaced 120 degrees apart are connected at the top and middle by ring elements. The legs are bolted at the bottom to the base support assembly, which retained the receiver ring and azimuth alignment drive from earlier MSS designs. At the top of each vertical leg, the suspension cable slides through a cable guide. The upper end of the 1.5-inch-diameter steel cable attaches to the launch tube wall at the level of the lower Launcher Equipment Room floor. The lower end of the cable attaches to a shock isolator consisting of an actuator connected to a mechanical spring in series with a liquid spring. The isolators are attached to the base of the cage.

Under nuclear attack or seismic disturbance conditions, the liquid spring responds much more quickly to downward ground motion than the mechanical spring. When the system experiences a vertical downward shock, such as the vertical air induced shock from a nuclear blast, the suspension cables tend to become slack. The liquid spring exerts immediate downward force on the suspension cable to prevent any slack from developing. The mechanical spring recovers and again places its force on the suspension cable.[22] Tether cables are also attached to the base of the cage to prevent lofting of the MSS and uses a crushable honeycomb material to reduce shock as the tether cables come under tension during missile launch.

The missile is emplaced within the steel cage structure, resting on the ARMS, like the base support ring used in the earlier system.[23] Six polyurethane foam blocks attach circumferentially to the outside of the structure at the upper and lower ring levels to control lateral movement of the MSS during ground shock response and missile launch. These blocks do not fit tightly; a nominal launch tube clearance of 1.5 inches exists between the outer face of the upper blocks and the launch tube wall, and 2.25 inches between the lower blocks and the wall. The outer surface of the block have a Teflon face to reduce friction upon contact with the launch tube wall.

Hinged at the top of the cage structure are six articulating arms, also known as the lateral restraint system. In



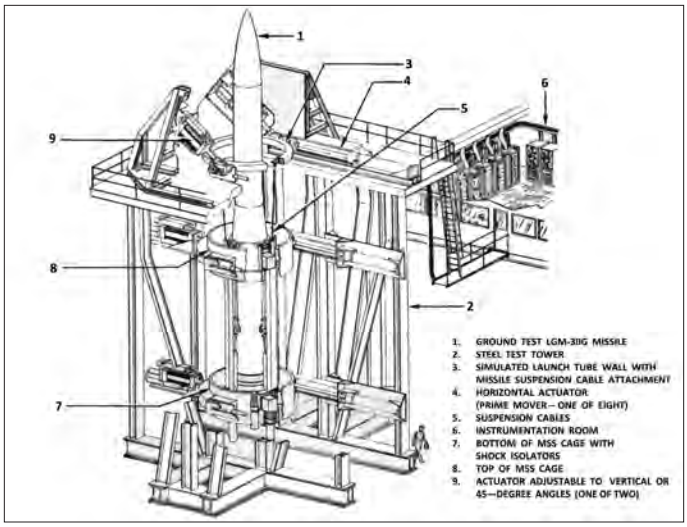


(Top) Upper lateral restraint pads and articulating arm mechanism. The upper lateral restraint pads would only be in this position if a missile was emplaced. ***(Courtesy of Harold Klingensmith)*** **(Above) Detail of articulating arm mode of action.** ***(Courtesy Harold Klingensmith)***

the non-deployed position, the polyurethane foam blocks on the inner side of the articulating arms provide lateral restraint to the missile within the cage. The arms are deployed just prior to a missile launch to reposition the MSS in the center of the launch tube. In the deployed position, the articulating arms also provide lateral restraint to the MSS during launch.

The frustum below the base support ring reduces pressure in the base region of the missile during launch.[24]

Dynamic testing of the full-scale CDB MSS began at the Boeing Developmental Center in Seattle in 1971, with completion in 1972. The 62.5-feet-tall test structure weighed 1.8 million pounds. A 2-million-pound concrete slab on top of 45 pilings supported it. The structure included three drive rings: the top ring located at the height of the MSS support cable attachment point in the launch



(Top) Upper lateral restraint in deployed position against launch tube wall after a successful launch. The pads are replaced after each launch. *(Boeing Corporation)* (Above) Wing V MSS Dynamic Response Facility. Extensive testing was done prior to the first launch from the new MSS in January 1973. *(Courtesy of Boeing Corporation)*

tube wall; the middle ring at the point of the top of the articulating arms which restrain the missile at the forward "Y" joint of the Stage I motor; and the lower ring at the point of the lower restraint blocks. The upper ring had two hydraulic actuators that could be set at 0, 45, or 90 degrees to the horizontal. The middle and lower rings each had one actuator. Acceleration at the top ring could be as high as 160 Gs and a velocity as high as 450 in/sec. Shock pulses could be positive or negative or cyclic.[25]

Prior to ignition, the missile is supported by the MSS. The missile is held to the MSS by gravitational forces (vertical) only, and lateral relative motion is inhibited by skirt index pins (effectively about 2.67 inches long). Clearance is about 2.25 inches between the lower foam blocks and the launch tube (LT) wall.

At ignition, the missile starts to rise as thrust builds. The first and consequent motion are essentially vertical. Missile exhaust gases are turned by the LT bottom and flow back up alongside the missile, generating lateral forces and tilt moments on the missile mount. An upward gas flow is also applied to the mount. The thrust buildup transient causes a pressure wave that is reflected by the LT bottom and continues up the LT. The frustum was added to the MSS to prevent a large pressure transient at the nozzle exit plane (thereby preventing catastrophic asymmetric flow separation in the nozzle).

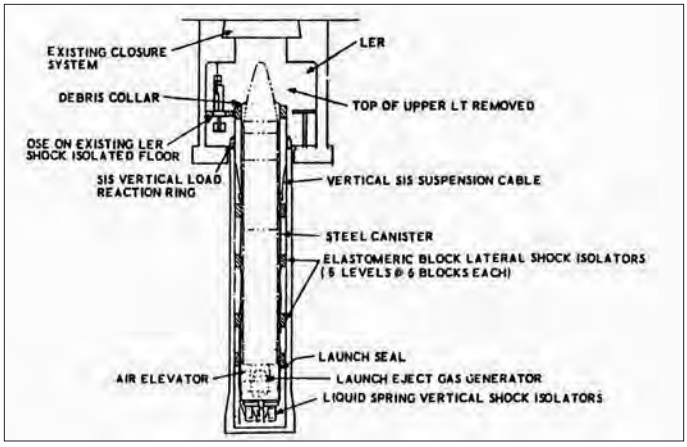
As thrust continues to develop, the missile in the MSS continues to gain vertical velocity. At about 0.34 seconds after ignition, the missile skirt lifts off the mount, but the vertical separation rate is quite small (and lateral motion is inhibited by the pins) until about 0.43 seconds after ignition (vertical travel 23.5 inches) when the tether system comes into play. The tether system imparts an essentially vertical (downward) impulse to the MSS, causing its velocity to decrease rapidly. The nozzles exit the base support ring at about 0.57 seconds after ignition. The effective dwell time, from the time the skirt lifts off the pins until the nozzles exit the ring, is about 0.12 seconds.

The missile continues to accelerate upward while the MSS is held at a nearly constant elevation by the tether system. Gas dynamic forces and moments, plus the structural forces arising when the lower foam blocks impact the LT wall and/or when the upper centering arms contact the LT wall, cause significant lateral motions of the MSS. After the nozzles exit the MSS, the missile continues to accelerate upward. The nozzles will rise above all LT hardware at about 1.85 seconds after ignition.[26]

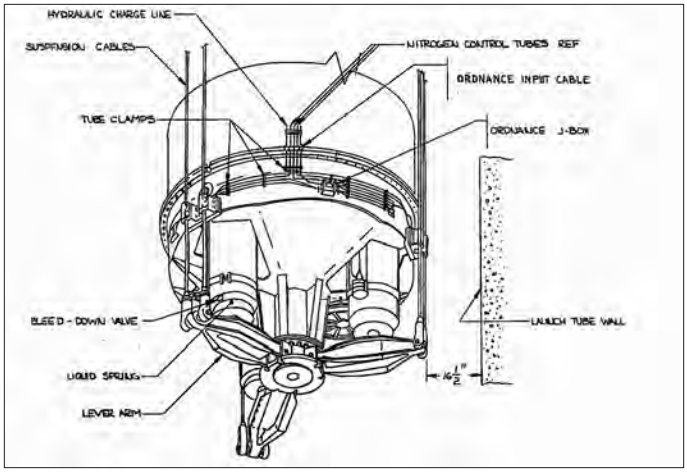
In-Silo Launch: Peacekeeper (1985-2005)

Peacekeeper missile development began in 1971 as the MX follow-on missile to replace Minuteman III. Concerns about the vulnerability of Minuteman launch facilities to increasingly accurate Soviet ICBMs led to investigation of a multitude of basing options during MX development. On November 22, 1982, the Reagan administration announced selection of the "dense pack" deployment mode and formal naming of the program as Peacekeeper. The administration asked for deployment of 100 missiles. Facing strong congressional resistance, President Reagan formed the President's Commission on Strategic Forces, known as the Scowcroft Commission, to review the US strategic modernization program. Focusing on possible alternatives for the future of ICBM forces, the commission published its findings on April 6. 1983. It recommended basing 100 Peacekeepers in modified Minuteman launch facilities at F. E. Warren Air Force Base, Wyoming. Warren AFB was selected for two reasons: (1) the soil structure was the best of all the wings and (2) the launch tubes at Warren were 10 feet deeper than at Wings I-IV, as was the case at Grand Forks (Wing VI) and the 564th Strategic Missile Squadron at Malmstrom AFB, and able to accommodate the longer missile. Congress, still unsatisfied about the need for Peacekeeper, authorized deployment of just 50 missiles at F. E. Warren AFB.[27]

The Peacekeeper missile measured 70.9 feet long, 92 inches in diameter, and weighed 196,000 pounds. Given the Minuteman launch tube diameter of 144 inches, that left an annulus of 26 inches, compared to 39 inches with Minuteman, which was insufficient for hot launch. The solution was a technique called cold launch, where the missile was



Cutaway view of a Peacekeeper Launch Facility at F. E. Warren Air Force Base, Wyoming. ***(Courtesy Westinghouse Electric Corporation)***



Details of the liquid spring actuators at the external base of the canister. ***(Author's Collection.)***

ejected from a steel canister suspended in the launch tube and ignited approximately 100 feet above the ground. The canister system supported the missile in the launcher, provided environmental protection, lateral and vertical shock protection, provided a means of launching the missile, guided it during launch, and enabled lowering or raising the missile for maintenance. The canister had an outer diameter of 108 inches and length of 68.2 feet.

The vertical shock isolation system design for Peacekeeper was on the surface quite similar to the current Minuteman III MSS with the canister replacing the cage structure. However, in the decade since the design of the latest Minuteman III MSS, Soviet advances in accuracy and throw-weight meant a more severe ground shock environment coupled with probable multiple attacks. The ground shock that the system is protected against consists of two components, the vertical air induced (AI) component and a horizontal ground induced (DI) seismic component. For close detonations, the AI will arrive first, for distant detonations the DI will outrun AI. The AI is the most severe of the two. The heavy steel canister and much heavier missile (196,000 pounds versus the 79,000 pound Minuteman III) coupled with the constraint of installing this system in the existing Minuteman launch tube further complicated the issue.[28]

The early studies showed that optimizing MSS response around a single set of ground motion parameters, as in past practice, would provide insufficient protection. The current state-of-the-art liquid spring/damper systems were not designed for multiple ground shock protection. What was needed was a liquid spring/damper that could produce a constant damping force, regardless of ground shock velocity, above the selected velocity threshold. Fortunately, engineers at Boeing were able to develop a liquid spring passive load control damper and full-scale drop load testing verified the design.[29]

Unlike the complex crib structure used with Atlas F and Titan I, the MSS for Peacekeeper was simply the canister and its vertical shock isolation system (VSIS). The MSS was not a pendulous system. The VSIS had two external components, one vertical and the other lateral. The vertical component protected both the canister and missile from vertical shock. The canister was supported inside the modified Minuteman launch tube at the base of the lower level of the Launcher Equipment Room (LER) by six 1 7/8th-inch-diameter suspension cables (the upper launch tube was removed as part of the modifications). These cables, mounted in pairs at 120° intervals, were secured through the launch tube wall at the lower-level LER floor. Cable guides on the outside of the canister routed the cable pairs to three lever arms located at the base of the canister, two cables per lever arm. These lever arms were hinged at a center plate at the base of the canister and rested beneath three liquid spring isolators for vertical shock isolation of the canister. Prior to launch, a bleed down initiator triggered by squibs opened a valve in the liquid springs, lowering the canister to the launch tube floor to provide a massive base to support lofting the 196,000 pound missile during launch.

The second external system, the lateral shock isolation system, consisted of five levels of concentric ring's s of elastomeric foam blocks, six blocks per level. These isolators also stabilized the canister during missile launch ejection. A low-friction surface was affixed to the blocks at the launch tube wall interface to minimize resistance to sliding.

The Peacekeeper missile was further shock isolated within the canister by a longitudinal support assembly (LSA) and a lateral support group (LSG). The LSA supported and held the missile at the required axial position relative to the canister tube center line. Consisting of two mechanical structures—an axial load structure containing a gimbaled-torsion subassembly—the LSA provided lateral translation of the missile in any radial direction relative to the canister. The axial load structure was the load path for tension and compression loads during axial shock loading. The gimbaled-torsion subassembly provided torsion stability of the LSA.[30]

The second internal shock isolation system, the lateral support group (LSG), consisted of nine rows of 12 pads per row on the first (5) and second stage (4) and nine pads in a single row on the deployment module. The pads served as shock isolation devices to prevent missile contact with the canister wall but were used primarily to stabilize the missile during launch as well as guides during the assembly of the missile at the launch facility. Cable assemblies secured the pads in position as the missile was assembled in the canister and served to keep the pads in place during

ground shock. The LSG cable assemblies were fitted with two delayed-release mechanisms to automatically release the pad rows in a predetermined sequence after the missile emerged from the launcher and before first stage ignition.[31]

Summary

The urgent need for initial operational capacity led to the highly vulnerable above-ground options for ICBM basing. Next best was underground storage and surface launch, but the missile exposure time for loading the liquid oxygen on the surface caused concern. The ultimate solution was underground storage and silo launch.

Missile suspension system design came full circle, starting with the massive spring sets supporting the crib structure and missile launch platform for Atlas F and Titan I, to a high-tech version of the crib structure with the Peacekeeper canister system. ■

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Measuring Up: A Comparison of the Mustang Fighter Escort Groups of the Fifteenth Air Force, June 1944-April 1945

Daniel L. Haulman

A group of Tuskegee Airmen in World War II.

For almost sixty years, a false claim circulated regarding the Tuskegee Airmen, the first black pilots in American military history. That claim asserted that no bomber escorted by the Tuskegee Airmen pilots was ever shot down by enemy aircraft. Only in the twenty-first century, by research conducted by Tuskegee Airmen Incorporated historian William Holton, certain Tuskegee Airmen combat pilots who were members of a Tuskegee Airmen Incorporated committee to investigate the issue, and my own research, was the claim conclusively refuted. At its 2010 national convention in San Antonio, Texas, the Tuskegee Airmen Incorporated passed a resolution that recognized that sometimes bombers under Tuskegee Airmen escort had been shot down by enemy pilots. The resolution did not specify how many Tuskegee Airmen-escorted bombers had been shot down by enemy airplanes.[1]

In the years between 2006-2010, I researched fighter and bombardment group daily narrative mission reports and reports on missing air crews in an attempt to discover the number, and I was able to confirm that at least 27 Tuskegee Airmen-escorted bombers were shot down by enemy fighters.[2] At the time, I did not research how many bombers escorted by the other Fifteenth Air Force fighter escort groups were shot down by enemy fighters, but from other statistical sources I knew that the Tuskegee Airmen had lost considerably fewer enemy aircraft than the other groups. I have now researched each of the other P–51 fighter groups, and I have the numbers.

I have applied the same stringent research methods to the study of the other fighter groups with which the Tuskegee Airmen's 332d Fighter Group served as I had done earlier for that group. First, I determined, for each of the fighter group's missions, which of them were bomber escort missions, and which bombardment wing and groups the fighter group was assigned to escort for each of those missions. If I discovered missions in which the group daily narrative mission reports mentioned encountering enemy aircraft, and seeing escorted bombers being shot down, I recorded the date of the mission. Next, I consulted the index of reports of missing aircraft, which indicate which report numbers corresponded to a downed bomber that day. Finally, I searched the reports of the missing air crews themselves, because each of them states not only when and where the escorted bomber went down, and to which bombardment group it belonged, and what type of bomber it was, but also whether it was lost to enemy aircraft fire, enemy anti-aircraft fire, or flak, from the ground, or some other cause, such as mechanical problems, collisions, fuel shortages, or an unknown cause. I counted only the bombers that went down because of enemy aircraft fire. In pursuit of these numbers, I researched more than 500 missing air crew reports (MACRs), which are available at the Air Force Historical Research Agency on microfiche.[3]

Revealing those numbers is one purpose of this article, but there is another purpose. I also wanted to test the hypothesis, often raised by the Tuskegee Airmen themselves, that the reason they lost fewer bombers than the other fighter

escort groups in the same time period, flying the same types of missions, is that they flew closer to the bombers they were assigned to protect, as ordered, and did not chase after distant enemy fighters that were not directly threatening their bombers. Many of the Tuskegee Airmen claimed that the white fighter groups had many pilots who were so interested in shooting down enemy airplanes that they sometimes went chasing after those in the distance, which left the bombers more vulnerable to other enemy fighters. If a fighter group's fighters were more eager to shoot down enemy airplanes in the distance than in staying close to the bombers to protect them from other enemy fighters, it could be expected to have higher numbers of aces and aerial victories, but also higher numbers of escorted bombers lost to enemy aircraft.

I reasoned that if I could compare the Tuskegee Airmen's group with the other fighter escort groups, not only in terms of number of escorted bombers lost to enemy aircraft, but also in terms of how many enemy fighters each of the groups shot down, there would be strong evidence that the Tuskegee Airmen's general hypothesis was correct. If I could prove that the white fighter groups shot down considerably more enemy fighters than the black fighter group, but that the black fighter group lost significantly fewer escorted bombers to enemy aircraft, the Tuskegee Airmen brought more escorted bombers home safely because they were less prone to abandon the bombers to chase after distant enemy fighters in order to shoot down more enemy aircraft, even those that were not threatening the bombers. Thus, I have numbers not only of bombers lost to enemy aircraft, but numbers of enemy fighters shot down by each of the fighter groups in the same Fifteenth Air Force.

From the beginning of June 1944 through the end of April 1945, the Fifteenth Air Force, based in Italy, managed 21 bombardment groups. They flew four-engine B–17 and B–24 heavy bombers, each of which with a crew that averaged 10 but sometimes had 9 or 11. The bombers were sent on long range missions to bomb Axis targets, some deep within Nazi Germany, some in countries Germany occupied, and some in countries allied to Germany. To escort those bombers, to protect them against enemy fighters, the Fifteenth Air Force also managed seven fighter escort groups, three of which flew P–38 Lightning twin-engine fighters, and four of which flew P–51 Mustang fighters for most of the period. While the Lightnings were very good escort fighters, they were generally inferior to the Mustang, which was faster, more maneuverable, and had a longer range.[4]

The four P–51 groups were the 31st, 52d, 325th, and 332d Fighter Groups. The first three of these were white organizations, but the 332d Fighter Group was black. Its pilots had trained at Tuskegee, and later came to be known as the Tuskegee Airmen. The Tuskegee Airmen's 332d Fighter Group had a disadvantage during the month of June, because if flew P–47 aircraft instead of P–51s, but in July the group began flying P–51 Mustangs like the others, although some of their Mustangs were inherited from the 325th Fighter Group, which received newer models. For those reasons, the 332d Fighter Group had a disadvantage, compared to the other three P–51 groups. Not only did they not fly P–51s until a month after the other groups, the ones they did fly, at first, were hand-me-down Mustangs. In addition, the 332d Fighter Group also had to fly transition missions to learn how to fly the newer type of aircraft. Moreover, the Tuskegee Airmen began to fly bomber escort missions later than the white fighter groups, and did not have as much experience as the other groups. Yet the period for comparison covers only that time during which all the groups were flying the same kinds of missions for the Fifteenth Air Force.[5]

The 332d Fighter Group also had an advantage over the three white P–51 fighter groups. It had four squadrons instead of three. One reason is that the 99th Fighter Squadron, the first black fighter squadron, and the first one to deploy and enter combat, was not at first assigned to the black 332d Fighter Group, which was activated later. The Fifteenth Air Force wanted all the black fighter squadrons assigned to the same fighter group, the only one that was black. Because it had a fourth fighter squadron, from the beginning of the period to early March 1945, the Tuskegee Airmen's 332d Fighter Group had more aircraft and pilots than the white Mustang groups. A typical fighter squadron in World War II had 25 aircraft, and more than 25 pilots to fly them. Most fighter groups therefore, with three fighter squadrons, had 75 fighter aircraft, but the 332d Fighter Group, with four squadrons, had approximately 100 fighter aircraft, and correspondingly more pilots. When one considers the advantages of the white fighter groups and of the black fighter group, they tend to balance.[6]

Daniel L. Haulman recently retired as Chief, Organizational Histories, at the Air Force Historical Research Agency, Maxwell AFB, Alabama. After earning a BA from the University of Southwestern Louisiana and an ME (Master of Education) from the University of New Orleans, he earned a Ph.D. in history from Auburn University. Dr. Haulman has authored several books, including Air Force Aerial Victory Credits, The USAF and Humanitarian Airlift Operations, *and* One Hundred Years of Flight: USAF Chronology of Significant Air and Space Events, 1903-2002. *He has written several pamphlets, composed sections of several other USAF publications, and compiled the list of official USAF aerial victories appearing on the AFHRA's web page. He wrote the Air Force chapter in supplement IV of* A Guide to the Sources of United States Military History *and completed six studies on aspects of recent USAF operations that have been used by the Air Staff and Air University. He has also authored* The Tuskegee Airmen Chronology. *The author of thirty-one published articles in various journals, Dr. Haulman has presented more than twenty historical papers at historical conferences and taught history courses at Huntingdon College, Auburn University at Montgomery, and Faulkner University. He co-authored, with Joseph Caver and Jerome Ennels, the book* The Tuskegee Airmen: An Illustrated History, *published by New South Books in 2011.*

Table 1: Comparing The Four P–51 Fighter Escort Groups Of The Fifteenth Air Force June 1944-April 1945

Fighter Group	31st	52nd	325th	332nd
Number of Squadrons	Three	Three	Three	Four
Aircraft Type Flown	P–51	P–51	P–51	P–47 P–51
Tail Color	Striped Red	Solid Yellow	Yellow and black Checkerboard	Solid Red
Base in Italy	San Severo Mondolfo	Madna Piagiolino	Lesina, Rimini Mondolfo	Ramitelli
Number of Aerial Victories	278	224.5	252	94
Aces	10	10	11	0
Victories per Aircraft Lost in Combat	2.49	2.08	2.22	.66
Average Number of Enemy Aircraft Shot Down per Mission	.7335	.6432	.7019	.3012
Number of Missions Flown	379	349	359	312
Number of Bomber Escort Missions Flown	184	193	192	179
Number of Such Missions Encountering Enemy Aircraft	53	66	53	35
Number of Missions Escorted Bombers Were Lost to Enemy Aircraft	16	18	18	7
Number of Escorted Bombers Shot Down By Enemy Aircraft	49	88	68	27
Average Number of Bombers Lost to Enemy Aircraft per Mission	.2663	.4559	.3541	.1508

*for nine of the eleven months considered, the 332d Fighter Group had four squadrons
**for ten of the eleven months studied, the 332d Fighter Group flew P–51s

In general, the four P–51 fighter groups of the Fifteenth Air Force were flying the same kinds of missions in the same months, from early June 1944 through the end of April 1945, and were all keeping diligent records of the missions they flew per day. By July 1944, the 332d Fighter Group was flying P–51s like the others. Eventually all the P–51 groups were flying with later-model Mustangs with bubble canopies, although each group still had some of the older models.[7]

Before looking at the statistics, let me describe some of the unique features of each of the four Mustang groups. While the Tuskegee Airmen's 332d Fighter Group flew P–51s with solid red tails, each of the other groups also flew Mustangs with distinctively colored tails, so that the bombardment formations could determine which group was escorting them, and also could better distinguish friendly aircraft from enemy fighters. The distinctive tails also helped the fighters and the bombers rendezvous before flying to the targets, in accordance with orders specifying which fighter groups would escort which bombardment groups. On some of the missions, more than one fighter group was on the same escort mission, with one fighter group escorting for part of the mission and another fighter group taking over later, or with one fighter group flying above the bomber formations, and other fighter group flying on the side, or in front, or in the back, or below. The 31st

Table 2: 31st Fighter Group–Escorted Bombers Shot Down By Enemy Aircraft

Date	Number of Bombers Shot Down	Bombardment Group or Groups	Numbers of Missing Aircrew Reports
5 June 1944	1 B–24	464th	5845
6 June 1944	5 B–24s	464th (4), 465th (1)	5431, 5455, 5840 6098, 6125
14 June 1944	1 B–17	2nd	6015
23 June 1944	3 B–17s	97th	6406,6407. 6951
26 June 1944	2 B–24s	460th	6177, 6430
28 June 1944	3 B–24s	485th	6411, 6820, 8339
8 July 1944	2 B–24s	464th	6819, 6960
18 July 1944	15 B–17s	483rd (14) 301st (1)	6856. 6953, 6954, 6975, 6976, 6977, 6978, 6979, 6980, 6981, 7097, 7098, 7099, 7153, 7310
21 July 1944	2 B–17s	2nd	6684, 6685
22 July 1944	1 B–24	99th	7054
7 August 1944	2 B–24s	460th(1), 485th(1)	7294, 7533
22 August 1944	1 B–24, 1 B–17	454th(1), 2nd(1)	8004, 11270
29 August 1944	1 B–17	2nd	8763
22 November 1944	1 B–24	459th	10013
22 March 1945	5 B–17s	483rd(3), 97th(1)	12244, 13249, 13253, 13254, 13265
24 March 1945	3 B–17s	463rd	13274, 13278, 13375

Fighter Group flew P–51 Mustangs with striped red tails. The tails of the 52d Fighter Group were painted a solid yellow color, and the tails of the 325th Fighter Group's Mustangs were painted a black and yellow checkerboard pattern. On a mission, fighter pilots and bomber pilots could usually tell, in the air, which fighter came from which group. That was especially important for the gunners on board the bombardment aircraft, the B–17s and B–24s, because they did not want to shoot down fighters sent to protect them by mistaking them for enemy airplanes. Who was escorting whom was classified information so that the Germans and their allies would be less likely to paint the tails of their own aircraft to look like the Allied aircraft.[8]

Each of the Fifteenth Air Force P–51 fighter escort groups also flew from its own base. The 332d Fighter Group flew from Ramitelli, the 31st from San Severo, then Mondolfo, the 52d from Madna and then Piagiolino, and the 325th From Lesina, then Rimini, then Mondolfo.[9]

In terms of shooting down enemy airplanes, the Tuskegee Airmen's 332d Fighter Group shot down far fewer enemy aircraft in the June 1944-April 1945 period than the white fighter groups. The Tuskegee Airmen shot down 94, the 31st Fighter Group shot down 278, the 52d Fighter Group shot down 224.5, and the 325th Fighter Group shot down 252. In other words, the 332d Fighter Group shot down less than 100 enemy aircraft, while each of the other P–51 fighter groups shot down well over 200. The 332d Fighter Group had no aces, or pilots who shot down at least five enemy airplanes, while the 31st Fighter Group had 10 aces, the 52d Fighter Group had 10 aces, and the 325th Fighter Group had 11 aces, in the same time period. A post-World War II study by the War Department also determined that the 332d Fighter Group shot down .66 enemy aircraft for every aircraft it lost in aerial combat. The 31st Fighter Group shot down 2.49 enemy aircraft for every aircraft it lost in dogfights. The 52d Fighter Group shot down 2.08 enemy aircraft for every aircraft it lost in aerial combat, while the 325th Fighter Group shot down 2.22 enemy aircraft for each aircraft it lost in dogfights. In other words, a comparison of the four P–51 fighter groups in the same time period shows that each of the white fighter groups shot down far more enemy aircraft than the black fighter group did.[10]

Part of the reason is that the 332 Fighter Group flew fewer bomber escort missions than the other Mustang fighter groups. The Tuskegee Airmen flew 179 bomber escort missions, while the 31st Fighter Group flew 184, the 52d Fighter Group flew 193, and the 325th Fighter Group flew 192. One can conclude that the more bomber escort missions a group flew the more chance it had to shoot down

Table 3: 52nd Fighter Group–Escorted Bombers Shot Down By Enemy Aircraft

Date	Number of Bombers Shot Down	Bombardment Group or Groups	Numbers of Missing Aircrew Reports
13 June 1944	5 B–24s	484th	6097, 6305, 6306, 6389 6416
14 June 1944	1 B–17	2nd	6015
16 June 1944	3 B–24s	376th(2), 450th(1)	6033, 6312, 5773
24 June 1944	4 B–24s	450th(2), 376th(1), 98th(1)	6365, 6760, 6071, 6437
26 June 1944	12 B–24s	455th(7), 456th(2), 454th(2), 459th(1)	6400, 6401, 6402, 6404 6405, 6433, 6516, 6427 6435, 6432, 6434, 6431
30 June 1944	5 B–24s	460th(4), 465th(1)	6394, 6395, 6396, 6809, 6335
6 July 1944	1 B–17	2nd	6376
8 July 1944	2 B–24s	464th	6819, 6960
9 July 1944	1 B–24	98th	6865
14 July 1944	2 B–24s	449th, 376th	6823, 6958
18 July 1944	15 B–17s	483rd(14), 301st(1)	6856, 6953, 6954, 6975 6976, 6977, 6978, 6979 6980, 6981, 7097, 7098 7099, 7153, 7310
26 July 1944	11 B–17s	301st	7000, 7123, 7124, 7127 7129, 7135, 7136, 7138 7141, 7142, 7143
20 August 1944	1 B–17	2nd	11699
22 August 1944	1 B–24	454th	8004
23 August 1944	6 B–24s	451st	7956, 7958, 7965, 7966, 8253, 8326
24 August 1944	6 B–24s	464th(4), 465th(1), 485th(1)	7967, 7968, 8392, 11967, 8085, 8394
17 Dec 1944	9 B–24s	461st(8), 484th	10636, 10650, 10651, 10652, 10677, 10680, 10701, 10742, 10492,
24 March 1945	3 B–17s	463rd	13274, 13278, 13375

enemy aircraft (and to lose escorted bombers to enemy aircraft).[11]

Another factor to consider is the number of bomber escort missions each of the fighter groups reported encountering enemy aircraft. The Tuskegee Airmen's 332d Fighter Group daily narrative mission reports show only 35 of the bomber escort missions encountered enemy aircraft. The 31st and 325th Fighter Groups each reported encountering enemy aircraft on 53 of their bomber escort missions, while the 52d Fighter Group encountered enemy aircraft on 55 of its bomber escort missions. If a fighter group encountered fewer enemy airplanes, it could be expected to shoot down fewer enemy fighters, and to lose fewer escorted bombers to those enemy airplanes.[12]

It might be helpful at this point to provide statistics showing the average number of enemy aircraft shot down by each of the groups per bomber escort mission. For the 31st Fighter Group the average was .73, for the 52d Fighter Group the average was .64 and for the 325th Fighter Group, the average was .70. For the 332d Fighter Group, the average number of enemy aircraft shot down per bomber escort mission was .30. The Tuskegee Airmen shot down fewer enemy airplanes than the white fighter groups partly because they flew fewer bomber escort missions, but the number of enemy aircraft they shot down per bomber escort mission was also lower.

Table 4: 325th Fighter Group–Escorted Bombers Shot Down By Enemy Aircraft

Date	Number of Bombers Shot Down	Bombardment Group or Groups	Numbers of Missing Aircrew Reports
11 June 1944	1 B–17	97th	6425
16 June 1944	3 B–24s	456th, 457th, 376th)	6038, 6128, 6312
23 June 1944	3 B–17s	97th	6406, 6507, 6951
24 June 1944	5 B–24s	376th(1), 450th(3), 98th(1)	6071, 6365, 6367, 6437, 6760
3 July 1944	3 B–24s	376th	6339, 6754, 6762
6 July 1944	1 B–17	2nd	6376
12 July 1944	1 B–24	465th	6891
20 July 1944	2 B–24s	485th	6914, 6919
22 July 1944	1 B–24	98th	7054
24 July 1944	2 B–24s	459th	6998, 9833
26 July 1944	11 B–17s	301st	7000,7123, 7124, 7127 7129, 7135, 7136, 7138 7141, 7142, 7143
27 July 1944	5 B–24s	455th	6999, 7031, 7140, 7527, 12390
3 August 1944	8 B–24s	465th	7334, 7529, 7530, 7532 7535, 7537, 7538, 7539
22 August 1944	1 B–17	2nd	11270
23 August 1944	6 B–24s	451st	7956, 7958, 7965 7966, 8253, 8326
24 August 1944	6 B–24s, 1 B–17	464th(4), 465th(1), 485th(1), 97th(1)	7967, 7968, 7971, 8085 8392, 8394, 11967
22 March 1945	5 B–17s	483rd(3), 2nd(1), 97th(1)	13244, 13249, 13253 13254, 13265
24 March 1945	3 B–17s	463rd	13274, 13278, 13375

One may reasonably ask why the Tuskegee Airmen reported far fewer missions encountering enemy aircraft than the other P–51 fighter groups. It is also reasonable to answer that one reason is that the Tuskegee Airmen were less eager to leave the bombers they were escorting to go after enemy aircraft and therefore have encounters. If other fighter groups had more encounters with enemy aircraft, it could be that they were more likely to chase after distant fighters, that resulted in encounters or aerial combat with them.

When one compares the four P–51 Mustang groups of the Fifteenth Air Force for the period June 1944 through April 1945, the documents show clearly that the Tuskegee Airmen lost far fewer escorted bombers to enemy aircraft than the others. Twenty-seven bombers under 332d Fighter Group escort were shot down by enemy aircraft. For the 31st Fighter Group the number was 49. For the 325th Fighter Group, the number was 68. For the 52d Fighter Group, the number was 88. The Tuskegee Airmen lost far fewer bombers to enemy aircraft than the white Mustang groups of the Fifteenth Air Force. In other words, two of the three white P–51 fighter groups lost more than twice as many escorted bombers to enemy aircraft than the Tuskegee Airmen's 332d Fighter Group did.[13] The average number of escorted bombers lost to enemy aircraft by each of the three white Mustang groups was 68.33, while the Tuskegee Airmen's 332d Fighter Group lost only 27. I did not research the number of escorted bombers lost to enemy aircraft by each of the three P–38 groups of the Fifteenth Air Force. It is possible that the average number of escorted bombers each of the P–38 fighter groups lost to enemy fighters was less than 68.33. My research focused on the P–51 Mustang groups of the Fifteenth Air Force.

The Tuskegee Airmen also flew fewer missions on which its escorted bombers were shot down. Tuskegee Airmen-escorted bombers were shot down by enemy aircraft on only 7 of its 179 bomber escort missions. 31st Fighter Group-escorted bombers were shot down by enemy fighters on 16 of its 184 bomber escort missions. For the 52d Fighter Group and the 325th Fighter Group, which flew 193 and 192 bomber escort missions respectively, in the same period, the number of missions on which they lost bombers was the same: 18. Each of the white fighter escort groups lost bombers on more than

Table 5: 332nd Fighter Group–Escorted Bombers Shot Down By Enemy Aircraft

Date	Number of Bombers Shot Down	Bombardment Group or Groups	Numbers of Missing Aircrew Reports
9 June 1944	2 B–24s	457th	6317, 6179
13 June 1944	1 B–24	484th	6097
12 July 1944	3 B–24s	49th	6894, 6895, 7034
18 July 1944	15 B–17s	483rd(14), 301st(1)	6856, 6953, 6954, 6975 6976, 6977, 6978, 6979 6980, 6981, 7097, 7098 7099, 7153, 7310
20 July 1944	2 B–24s	485th	6914, 6919
24 August 1944	1 B–17	97th	7971
24 March 1945	3 B–17s	463rd	13274, 13278, 13375

twice as many of its bomber escort missions than the black fighter escort group did.[14]

Sometimes the same bombardment wing and its bombardment groups were escorted by more than one of the fighter escort groups. For example, on July 18, 1944, the 5th Bombardment Wing, which included the 483d and 301st Bombardment Groups, among others, lost 15 bombers to enemy aircraft. When reading the mission reports of the fighter escort groups, one learns that the 31st, 52nd, and 332nd Fighter Groups were all involved in protecting those bombers in the vicinity of Memmingen, where there was a huge air battle. I have counted those bombers lost for all three of the fighter escort groups. Another example is July 26, 1944, when eleven B–17s of the 5th Bombardment Wing's 301st Bombardment Group were shot down by enemy aircraft. Both the 52d and 325th Fighter Groups were escorting the 5th Bombardment Wing's bombers that day, so I have counted those bombers lost by both of the fighter groups. A third example is the Berlin mission, when all four P–51 fighter groups of the Fifteenth Air Force were escorting the 5th Bombardment Wing to Berlin. I have counted the three B–17s shot down by enemy aircraft over Berlin that day, all belonging to the 5th Bombardment Wing's 463d Bombardment Group, as losses for the 31st, 52d, 325th, and 332nd Fighter Groups. All the Mustang groups shared the glory of escorting the Flying Fortresses all the way to Berlin, and therefore also shared the losses of some of those bombers to enemy aircraft that day. Incidentally, the enemy fighters were Me-262 jets.

It appears that all of the Mustang fighter groups escorting bombers for the Fifteenth Air Force between the beginning of June 1944 and the end of April 1945 had similar months of heavy losses of escorted bombers to enemy airplanes. Most of the losses were in the summer of 1944. There were relatively few losses of escorted bombers to enemy aircraft in the fall and winter of 1944-1945. The losses increased in March of 1945 partly because the escorted bombers were flying deeper into Germany, around Berlin, and the Germans there were using jet-powered Me-262 jets, which were much faster than the P–51s. That is not to say that the Mustangs could not down the jets, which they did because of the Mustang's maneuverability, and the experience of the pilots, but several bombers were shot down by German jets in March 1945.

Since the white Mustang groups of the Fifteenth Air Force flew more bomber escort missions than the black one, it might be helpful to compare the average number of bombers lost to enemy aircraft per mission for each of the groups. For every bomber escort mission it flew, the 31st Fighter Group lost an average of .27 bombers, the 52d Fighter Group lost an average of .45 bombers, and the 325th Fighter Group lost an average of .35 bombers. For every bomber escort mission it flew, the Tuskegee Airmen's 332d Fighter Group lost an average of .15 bombers. Even considering that the 332d Fighter Group flew fewer bombardment escort bomber missions than the other Mustang fighter escort groups, it lost significantly fewer bombers, on average, per mission.

The evidence is in, and the message is clear. The Tuskegee Airmen lost significantly fewer bombers to enemy aircraft fire than any of the other fighter groups, and lost bombers on far fewer of its bombardment escort missions. The reason is somewhat circumstantial, but the far greater numbers of enemy aircraft shot down by the other fighter groups suggests that one reason they lost more bombers is because they were indeed chasing after enemy fighters, and shooting many more of them down than the Tuskegee Airmen, who were sticking closer to the bombers in order to not leave them unprotected.

When one compares the Tuskegee Airmen's P–51 fighter escort group with the other four Mustang fighter escort groups, the 332d Fighter Group did a better job of bringing back the bombers home safely, while each of the other fighter escort groups did a better job of shooting down enemy airplanes. It might seem like comparing apples and oranges, but I am led to the conclusion that the Tuskegee Airmen were correct when they claimed that the reason they lost fewer escorted bombers to enemy aircraft is because they flew closer to the bombers and were less willing

Thuskegee Airmen receive their pre-operation briefing for the day.

to leave them in pursuit of more aerial victories and ace status for themselves.

Most of this article contrasts the 332d Fighter Group with the other three P–51 groups of the Fifteenth Air Force, but there is also some interesting commonality among them. When one subtracts the number of bombardment escort missions during which escorted bombers were shot down by enemy aircraft from the total number of its bomber missions, for each group, the numbers are remarkably similar. The 31st Fighter Group flew 168 bomber escort missions without losing an escorted bomber to enemy aircraft. The numbers for the 52d, 325th, and 332d Fighter Groups are 175, 174, and 172, respectively. In other words, all four of the Mustang fighter groups of the Fifteenth Air Force flew almost the same number of bomber escort missions that did not lose any bombers. For each of the groups, the number of escort missions the groups lost bombers to enemy aircraft was far exceeded by the number of such missions that lost no bombers to enemy fighter pilots. Moreover, the number of bomber escort missions that each group did not encounter enemy aircraft far exceeded the number of bomber escort missions that did encounter enemy aircraft. In other words, most of the bomber escort missions, for each of the P–51 fighter escort groups of the Fifteenth Air Force, did not face any enemy fighter opposition. The reason is that the German air force, the Luftwaffe, by June 1944, was not nearly the threat it had been for the Eighth Air Force, and for the Fifteenth Air Force, before the month the 332d Fighter Group began escorting heavy bombers. Naturally, without enemy fighter opposition on a typical bomber escort mission, there was no opportunity to shoot down aircraft, but also no opportunity for enemy aircraft to shoot down escorted bombers.

One word of caution. There will always be those who argue that by shooting down enemy fighters, even fighters that were far away from the bombers, the fighter escort groups reduced the future threat of those fighters to future bomber escort missions. The groups that shot down more enemy aircraft were protecting future bomber missions by reducing the number of enemy aircraft that might shoot them down. The first commander of the Fifteenth Air Force, during November and December 1943, was Major General James Doolittle. In early January 1944, when he assumed command of the Eighth Air Force in England, then Lieu-

The Tuskegee Airmen flew P–51s like this one.

tenant General Doolittle entered the office of Major General William Kepner, commander of the VIII Fighter Command, and ordered him to take down the sign that said the first mission of the command was to bring the bombers back safely. Doolittle insisted the first duty of the fighter escort groups was to shoot down enemy fighters.[15] Although Doolittle was no longer in command of the Fifteenth Air Force by the time the Tuskegee Airmen started escorting Fifteenth Air Force bombers, in June 1944, his policy of prioritizing the shooting down of enemy airplanes over protecting the bombers might have been the de facto policy of the white P–51 fighter groups that shot down more enemy fighters than the black fighter group, but that lost more bombers in the process. If the other fighter groups had not shot down so many enemy fighters, perhaps the number of bombers they lost might have been even greater.

The accompanying tables contain the statistics on the four P–51 fighter escort groups of the Fifteenth Air Force and tables that show how many bombers escorted by each group were shot down by enemy aircraft, and when, with numbers of the reports on missing air crews. The numbers are telling, and should be useful for future reference whenever historians consider the question about whether it was better to prioritize destroying enemy aircraft or to protect bombers, or whether doing one was actually doing the other. ■

NOTES

1. The author attended eight of the Tuskegee Airmen Incorporated national conventions, including those of 2007, 2008, 2009, and 2010, when the Harry Sheppard historical research team (or committee) reported it discovered that sometimes bombers under Tuskegee Airmen escort were shot down by enemy aircraft. The convention approved a resolution to that effect at the San Antonio convention in 2010.
2. Daniel Haulman, *Eleven Myths About the Tuskegee Airmen* (Montgomery, Ala.: NewSouth Books, 2012), pp. 17-22.
3. To give you an example, I looked at well over 200 missing air crew reports for each of the bombers that went down under the escort of the 52d or 325th Fighter Groups, to see how many of those bombers was shot down by enemy aircraft, according to witness statements accompanying each of the reports. The Air Force Historical Research Agency has thousands of such reports on missing air crews, one for each aircraft that did not return. Each report has three boxes, with one checked. One option is enemy aircraft as the cause of the loss.
4. Mauer Maurer, *Air Force Combat Units of World War II* (Wash., D.C.: Office of Air Force History, 1983), pp. 83-85, 113-15, 206-08. 212-13, 470; Martin W. Bowman, *USAAF Handbook, 1939-1945* (Mechanicsburg, PA: Stackpole Books, 1997), p. 76.
5. *Ibid*.
6. *Ibid*.
7. Monthly histories of the 332d Fighter Group at the Air Force Historical Research Agency, under call number GP–332-HI.
8. Histories of the 31st, 52d, 325th, and 332d Fighter Groups, filed by month, at the Air Force Historical Research Agency, under call numbers GP–31-HI, GP–52-HI, GP–325-HI, GP–332-HI.
9. Mauer Maurer, *Air Force Combat Units of World War II* (Wash., D.C.: Office of Air Force History, 1983), 83-85, 113-15, 206-08. 212-13.
10. USAF Historical Study No. 85, *USAF Credits for the Destruction of Enemy Aircraft, World War II* (Wash., D.C.: Office of Air Force History, 1978) which lists aerial victory credits by individual, by date, and by unit, at the Air Force Historical Research Agency for the Army Air Forces in World War II; "Policy for Utilization of Negro Manpower in the Post-War Army," Report of War Department Special Board on Negro Manpower, November 1945, section on historical evaluation of the Negro's Military Service, subsection 9, evaluation of combat performance of the Negro in World War II, under g., "combat aviation,", p. 15.
11. Daily narrative mission reports of each of the following fighter groups: 31st, 52d, 325th, and 332d, for the period June 1944 through April 1945, filed with the histories of each of those groups, under call numbers GP–31-HI, GP–52-HI, GP–325-HI, and GP–332-HI, by month, except for June 1944, when such reports are filed under the supporting documents for each group for that month.
12. Daily narrative mission reports of each of the following fighter groups: 31st, 52d, 325th, and 332d, for the period June 1944 through April 1945, filed with the histories of each of those groups, under call numbers GP–31-HI, GP–52-HI, GP–325-HI, and GP–332-HI, by month, except for June 1944, when such reports are filed under the supporting documents for each group for that month.
13. Daily narrative mission reports of the 31st, 52d, 325th, and 332d Fighter Groups, under call numbers GP–31-HI by month, GP–52-HI by month, GP–325-HI by month, and GP–332-HI, by month, and, for the month of June, GP–31-SU, GP–52-SU, GP–325-SU, at the Air Force Historical Research Agency; Index of Missing Air Crew Reports at the Air Force Historical Research Agency, and corresponding Missing Air Crew Reports on microfiche, also at the Air Force Historical Research Agency.
14. Daily narrative mission reports of the 31st, 52d, 325th, and 332d Fighter Groups, under call numbers GP–31-HI by month, GP–52-HI by month, GP–325-HI by month, and GP–332-HI, by month, and, for the month of June, GP–31-SU, GP–52-SU, GP–325-SU, at the Air Force Historical Research Agency; Index of Missing Air Crew Reports at the Air Force Historical Research Agency, and corresponding Missing Air Crew Reports on microfiche, also at the Air Force Historical Research Agency.
15. James H. Doolittle and Carroll V. Glines, *"I Could Never Be So Lucky Again: An Autobiography of General James H "Jimmy" Doolittle* (Atglen, Penn.: Schiffer Military/Aviation History, 1991), p. 380.

Paths of Dissent: Soldiers Speak Out Against America's Misguided Wars. By Andrew J. Bacevich and Daniel A. Sjursen, eds. New York: Metropolitan Books, 2022. Pp. 290. $27.00 ISBN: 978-125087017-9

The two editors are both combat experienced; one served multiple tours in Iraq and Afghanistan. This book, however, is not about their experiences. It is about wars as seen by young professionals who served in them and became disillusioned by what they witnessed.

There is no doubt that the authors of the 15 essays are critical of the Iraq and Afghanistan wars. They look beyond the conflicts to the flawed political culture that led the US down a misguided path to tragic wars of choice and not ones fought out of necessity. From the first essay by a hard charging West Point graduate to the final chapter, the reader is confronted with the life changing experiences of those who served and why they became disillusioned. We learn about the day-to-day casualties suffered in meaningless incidents that were of no lasting value. Equally disturbing were the countless civilian casualties that, in the end, had led to ever growing numbers of insurgents fighting to expel the intruders. General McChrystal called this insurgent math: for every innocent person you kill, you create ten new enemies. In another essay a young Army journalist deployed to Baghdad describes how she quickly became disenchanted with the falsehoods she was instructed to write about a war going badly. The common thread woven into all the essays is what the American public was being told differed greatly from the reality for troops on the ground.

Generally acknowledged today is that the initial effort to destroy al Qaida in Afghanistan was squandered as the war soon changed course into an unwinnable 20-year campaign of so called nation-building—one that wasted lives and treasury. Errors in judgement at the senior leadership level had real consequences and prolonged a war that was going nowhere. Besides the dangers faced, many soldiers were also disappointed by the incredible waste of American taxpayer's money as it flowed into the hands of unscrupulous contractors and corrupt local war lords. After a while they came to believe that they were the only ones with eyes on the truth—a truth they felt compelled to share with the American people.

The dissidence expressed takes different forms from essay to essay. A young Marine on his first Iraq deployment quickly saw the mindlessness of the war and extended his criticism to include his fellow Marines and anyone in authority. To prevent a return on a subsequent tour, he turned himself in for drug addiction and alcoholism and speculated that he would kill his superior officers once in Iraq. A more reasoned essay captured in a simple assessment the dichotomy between what America was doing and the awareness that it was wrong: "The entire US government was and is full of people who don't believe in America's endless wars, don't believe in the supposed reasons for fighting them, and don't believe that the sacrifices and costs are worthwhile."

This anthology highlights issues that all Americans should be concerned about and discussing. As an Iraq War veteran, I needed little convincing that the conflict was a huge error from the very beginning and from the tactical to the strategic levels. President Biden has stated that the US is no longer in the nation-building business. That is a big step in not repeating the errors of the past.

John Cirafici, Milford Deleware

Silent Invaders: Combat Gliders of the Second World War. By Gary A. Best. Croydon UK: Fonthill Media, 2022. Illustrations. Photographs. Notes. Appendix. Bibliography. Index. Pp. 247. $34.95 paperback. ISBN: 978-1-78155-853-9

This is a good book! Best has really plowed some new ground with this work. Combat gliders have been used in only one war (World War II), and they have seldom had much coverage. The Orne River Bridge operation on D-Day was covered in *The Longest Day*. *Saving Private Ryan* well related the incident in which the assistant division commander of the 101st Airborne was killed in a glider. And the end of Errol Flynn's *Objective Burma!* showed some of the glider operations in that theater. Other than those few examples, movie and book coverage of glider operations has been scant.

Best covers every operation (both planned and executed) where gliders were involved in combat operations—German, British, French, and American. From their first use in capturing Fort Eben Emael from the Belgians in May 1940, to their last, relatively useless, operations in the Philippines in the summer of 1945, Best has included them.

What were these things good for? The simple answer is that they could bring in the heavier equipment that paratroops couldn't carry: Jeeps, smaller artillery pieces, heavy communications equipment, crates of ammunition and food, and even a light airborne tank. And more troops, ideally better and more-precisely concentrated, came as well. John Howard's entire *Pegasus* force came in by gliders right next to the bridge he was assigned to capture at the outset of D-Day. They could, as shown in the final scenes of *Operation Burma!* take out wounded and other personnel when airfields for conventional aircraft hadn't yet been prepared. All of this shows why they fought in one war: their role was soon taken over by the helicopter.

But Best covers far more of the story than just their operations—the relatively complete story of these interesting weapons of war. He well presents all of the combat glider designs of the war (even those of the Soviets and Japanese). He also discusses the various tow planes that

were used. However, it is the people part of the story that I found most interesting. There has been little written about the men who piloted these machines of war—what were they like, how were they trained, how did they live, and what did they do after they brought their gliders into the battlefield?

The best known of the gliders was probably the Waco CG-4. Of the nearly 14,000 built, only a dozen-plus survive today. Likewise, only a couple of the 3600 larger British Horsa gliders survive. Through his excellent research involving a great deal of documentation and many interviews with participants, Best has ensured that the legacy of these little-known and little-understood aircraft has finally been made available to a large audience. The substantial collection of black-and-white photos included adds greatly to the excellent text. Read this one. It's first-person accounts are often riveting.

Col Scott A. Willey, USAF (Ret), Book Review Editor, and former National Air and Space Museum docent

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The Men Who Flew the Heavy Bombers: USAAF Four-Engine Heavies in the Second World War. By Martin W. Bowman. Philadelphia: Pen & Sword, 2022. Photographs. Notes. Index. Pp. vii, 219. $42.95. ISBN: 978-1-52674-631-3

Bowman has authored more than 100 books, mostly on World War II aviation. This output makes him among the most prolific writers of his generation. In this recent book, he shares his compilation of conversations with, and reminiscences from, Eighth Air Force crewmembers (mostly pilots) collected over the years. The index lists more than 250 individuals who appear in the narrative.

For reasons known only to Bowman, his description of various missions begins in February 1944, by which time the Eighth had already flown 226 missions from England against German-occupied Europe. Most of the early missions that were flown into Germany were accomplished without fighter escort, leading to devastating losses inflicted by *Luftwaffe* fighters. But Bowman covers none of this early period of operations.

By the spring of 1944, the North American P-51 Mustang possessed the range to escort the bombers and counter the German aircraft. Nevertheless, the enemy planes proved to be a dangerous adversary. Radar-directed antiaircraft guns posed an enormous challenge.

Many of the missions covered were deep attacks against Berlin. The campaign against the French transportation network before the Allied invasion in June receives limited attention. Operation *Crossbow*, the effort to reduce the number of attacks by the V-1 "buzz bombs" and the V-2 rockets is barely mentioned. With the invasion's success, the target emphasis switched to Germany's synthetic oil plants—facilities typically protected by dozens, if not hundreds, of antiaircraft guns.

In most instances, Bowman includes comments from surviving crewmembers of how their aircraft were damaged. Sometimes he provides background biographical information. Some stories involve those who were captured and imprisoned, while others describe the challenge of nursing a barely flyable Boeing B–17 or Consolidated B–24 back to England.

Even though Bowman includes no bibliography, the reader gains an appreciation for the sources he used based on each chapter's end notes. Far from comprehensive, the notes suggest that he has culled much of his material from secondary sources such as unit histories and personal memoirs. In some cases, he cites correspondence with certain individuals, most of whom have since passed on.

The narrative's repetitive nature makes this a difficult read. Subheadings would have helped immensely in differentiating between the various missions presented. An alternative a reader can use is to consult an appropriate website listing all of the Eighth Air Force missions. Context, analysis, and discussion of the Eighth Air Force's impact on the war are all lacking. This book is best suited for younger readers who, perhaps, would like to learn how their grandfathers and great-grandfathers attacked Germany and survived.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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At the Dawn of Airpower: The U.S. Army, Navy, and Marine Corps' Approach to the Airplane, 1907-1917. By Laurence M. Burke II. Annapolis MD: Naval Institute Press, 2022. Photographs. Notes. Bibliography. Index. Pp. xxvii, 339. $49.95. ISBN: 978-168247729-8

Burke, the aviation curator at the National Museum of the Marine Corps, formerly held a similar position as curator of naval aviation at the National Air and Space Museum. He received his doctorate from Carnegie Mellon University in history and public policy. This volume draws on research for his dissertation and is part of the Naval Institute Press' History of Military Aviation series intended to examine lesser-known aspects of aviation history.

Originally intended for an academic audience, Burke's writing introduces the concept of "advocate" and "patron." These types of personalities played a crucial role in influencing the perception and use of aircraft by the military in the years leading up to the United States' entry into World War I in April 1917.

Proceeding in chronological order, he shuffles back and forth between the services. By doing so, he presents an interesting contrast as to how they differed in their approaches. He emphasizes how, in some ways, the Navy had

an advantage in that it was far more technically oriented at the time, especially regarding engines.

Not surprisingly, most high-ranking officers were skeptical of the airplane's influence on operations. Of course, that began to change slightly after the outbreak of World War I in Europe in 1914. Along the way, the Army had to resolve the issue of the difference in control systems between the Wright and Curtiss machines. There was also the issue of pusher-versus-tractor-mounted engines. The latter eventually dominated because of the higher fatality rate with pushers in the event of a crash landing.

The Navy initially emphasized float planes and flying boats. To expedite the launching of aircraft from naval vessels, it developed the catapult.

Burke devotes a couple of chapters to interservice relations. Surprisingly cooperative in the beginning, the services became increasingly competitive as time passed. Acquiring funding was a factor in the changing attitude.

All of the services dealt with developing adequate infrastructures, including training bases. The Navy finally settled on Pensacola, Florida; with the Army focusing on San Antonio, Texas.

The use of aircraft supporting the Army's Mexican Expedition in 1916 and 1917 demonstrated the limits of American military aviation when tested in the field. However, it impacted operations positively when available.

Both the Army and Navy dabbled in lighter-than-air balloons and dirigibles. Both explored the potential of wireless communication between air and ground.

In his conclusion, Burke returns to his concept of "advocates" and "patrons." This idea would have been much more meaningful if he identified the various players as one or the other when he introduced them into the narrative. Some readers may find this concession to academia unnecessary in a work targeting a broader audience. Overall, however, this book reflects a very thorough research effort. It is highly recommended to anyone with an interest in this aspect of aviation history.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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F9F Panther vs Communist AAA: Korea 1950-53 and **F–86A Sabre: Korea 1950-51**. Both by Peter E. Davies. Oxford UK: Osprey. 2022. Photographs. Illustrations. 80Pp. $22.00 paperback. ISBN: 978-147285064-5 and 978-147285035-5 respectively.

Osprey and Peter Davies have given us a unique two-volume introduction to the jet-powered conflict in the skies of Korea. Both books follow the Osprey formula rigidly—heavy on illustrations and imagery, detailed research drawing on personal narratives from both combatants, and a high-level summary which encourages further reading on the subject. Interestingly the books are published in two of Osprey's series: "Dogfight" for the *F–86A* and "Duel" for the *F9F*, rather than offering both in the same series.

The premise of both books is similar. The introduction of jet-powered aircraft dramatically expanded the combat envelope but did not really change the nature of aerial warfare from that experienced by aviators in World War II. The jets still relied on line-of-sight guns and ballistic ordnance. The weapons were just employed at higher speeds and higher altitudes. Since there was no fundamental change in aerial warfare, aviators who enjoyed success in the Second World War continued to enjoy success in Korea. Davies notes that the USAF modified tactical formations to provide experienced "shooters" with every opportunity to shoot, while everyone else supported them.

In terms of the air-to-ground war, strike aircraft were still forced to fly close to the ground to improve their chances of hitting the target. As a result, the aircraft flew well within the range of small-caliber, anti-aircraft artillery. Just as happened earlier in World War II and later in Viet Nam, these cheap, simple, small-caliber weapons claimed a disproportionate number of attack aircraft.

While the experienced armchair historian might complain that there is little "new" in these works, careful reading uncovers nuggets of knowledge that add to the reading experience. Davies points out that the MiG 15 was in many ways superior to early F 86 variants, but that poor production and even poorer quality control found it difficult to manufacture symmetrical wings with a resultant lack of stability. The weapons suite installed in the MiG was designed to destroy heavy bombers. Lack of range and a poor rate of fire made the MiG ill suited to serve as a dogfighter. Similarly, the .50-cal weapons of the F–86 were lethal only if UN pilots scored hits in the cockpit or fuselage area. Experienced Russian pilots brought home MiGs with hundreds of bullet holes. US Navy pilots praised the weapon suite and gunsight installed in the Panther. But strafing necessitated flying within the lethal AAA zone with disproportionately high losses.

While I thoroughly enjoyed these books, they were far from perfect. The F–86 work relied on several complex "ribbon diagrams" with associated narratives to explain the 3-dimensional aerial maneuvers of multiple combatants. The F9F work did not fall into that trap but did present numerous pictures and drawings of AAA of many sizes and calibers. The nuances of AAA design and employment were lost on an aviator such as me.

That said, Davies has given us two particularly good introductory works on the air war over Korea—a technological transition that laid the groundwork for aerial combat in the 21st century.

Gary Connor, docent, Smithsonian National Air and Space Museum's Udvar Hazy Center

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Republic F–105 Thunderchief: Peacetime Operations. By Theo Van Geffen and Gerald Arruda. Stamford UK: Key Books, 2021. Table. Photographs. Bibliography. Pp. 96. $24.95 paperback. ISBN: 978-1-913870-66-9

Air and Space Power History readers will recognize Van Geffen as the author of numerous articles appearing in the journal over the past few years. Based in Utrecht, The Netherlands, he has been studying aviation history since the late 1970s. His articles have appeared in numerous magazines. Over the years, he has focused on the F–105, particularly its impact on the air war in southeast Asia. He has conducted dozens of interviews with Air Force personnel familiar with the aircraft.

This book is Key Publishing's sixth in its Historic Military Aircraft Series. Van Geffen has included a note indicating that this work will be followed by a second one covering combat operations. He points out that the F–105 story is a complex one and concedes that there is much more to be said than can be found here. In fact, this is a small-format picture book with about 150 images, many of which appear in print for the first time.

After introducing the Air Force's decision to proceed with production of the Thunderchief, he uses photographs to examine how the aircraft entered service with Tactical Air Command. From there he proceeds to Europe and the F–105's assignment to wings within the US Air Forces Europe.

One chapter is devoted to the Thunderchief's participation in the annual combat competition, William Tell, with an emphasis on 1962. He details how F–105-equipped wings prepared and competed that year. That was the final year for William Tell competitions until 1981.

Other chapters cover F–105s in the Pacific, an F–105 wing coping with an operational readiness inspection, and the eventual transfer of Thunderchiefs to Air National Guard and Air Force Reserve units.

Much of the limited text discusses the challenges of transitioning from North American F–100 Super Sabres and establishing the necessary training units. F–105s played a significant role in supporting the Single Integrated Operational Plan when operating in the Pacific and Europe.

Lengthy captions complement the photographs. However, the small images make it almost impossible to see some details. This book is best suited for F–105 specialists and those personally associated with this legendary aircraft.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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Harvest of the Grim Reapers: The Illustrated History of the 3rd and 27th Bombardment Groups During World War Two. By Lawrence J Hickey, Edward M Rogers, Ossamu Tagaya and Madison D Jonas. Boulder CO: International Historical Research Associates, 2021. Maps. Photographs. Drawings. 528Pp. $85.00. ISBN: 978-091351111-4

Before reviewing this book, I reread Walter Edmonds excellent *They Fought With What They Had* and John Bruning's *Indestructible*. *Harvest* is such a massive work, that I needed to get up to speed on the subject matter before reading it critically. The story of the US Army's operations in the Pacific are usually told in fits and starts—first focusing on lack of pre-war preparations; then transitioning to the almost unimaginable leap in technical and tactical innovation in the face of immeasurable hardship; and, finally, addressing the Pacific endgame and victory. The writers, researchers, and artists who contributed to *Harvest* do the subject justice by focusing on two US Army units, the 3rd and 27th Bomb Groups.

The experiences of these two units mirror those of other Allied units and personnel in the theater. But the authors include very personal stories that bring the actors to life. Special acknowledgement is owed to the decision to include equal detail on the Grim Reapers' Japanese opposition personified by the Tainan Kokutai, a unit at the peak of its strength and capability. The book builds a case for the turning point in the theater being the Royce Raid, featuring the combat debut of the B–25C Mitchell. The raid was a series of missions flown in the days immediately prior to the Doolittle Tokyo Raid. Collectively, both missions clearly marked a turning point in the war in the Pacific. The narrative describing the Royce Raid is tight and smooth flowing. It is personalized by including first-person accounts of the missions and personal life in theater. Some anecdotes are difficult for a 21st century historian to grasp. For example, while on a mission, an aircraft commander learned his navigator did not know how to use a sextant, so he pulled out a National Geographic map and map-read his way to the target.

Perhaps the greatest tactical innovation fielded by the Grim Reapers was skip-bombing—flying very low and very fast and skipping bombs off the water into the side of the target ship. In his book *Beaufighters: Over Sea, Sand and Steaming Jungles*, Jack Colman talks about using skip bombing against German targets in the same period thousands of miles away. Perhaps an RAAF crewman was transferred to the European theater and brought the tactic with him as an example of tactical cross-pollination. Or maybe the tactic evolved simultaneously in both theaters.

Harvest is somewhat unique in its organization and structure. Seven-hundred photographs spread over its five-hundred pages, and numerous profile illustrations and paintings make for a very visual book. At times *Harvest* feels like a typical modelling magazine on steroids. But the characteristic that sets *Harvest* apart is the sheer volume of information it offers. The four appendices, glossary, and

bibliography could be stand-alone volumes. The book is in a large format with heavy binding and high-quality paper which shows the illustrations to great effect. At 2-3 pounds, it is not a book to be taken lightly—literally or figuratively.

The survivors of the 3rd and 27th Bomb Groups and their families will be justifiably proud of the story told. The book (and a promised volume 2) tells a story of bravery, heroism, and innovation during a time of great hardship. The sheer number of personal stories makes it feel much like a post-war unit history rather than an historical research effort. *Harvest* tells a powerful story that is well worth reading.

Gary Connor, docent, Smithsonian National Air and Space Museum's Udvar Hazy Center

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Operation Jericho: Freeing the French Resistance from Gestapo jail, Amiens 1944. By Robert Lyman. Oxford UK: Osprey Publishing, 2022. Illustrations, Maps, Photographs. Bibliography. Index. Pp. 80. $22.00. ISBN: 978-1-4728-5206-9

As did many of my generation, I grew up watching war movies. World War II film classics such as *Twelve O'Clock High* and *The Longest Day* were among the best known of the day.

Lesser known among those post-war era productions is *13 Rue Madeleine*, a fictional account of an American agent, Bob Sharkey (portrayed by James Cagney), captured by the Gestapo shortly before Operation *Overlord*. Sharkey was privy to the coming invasion, and its secrecy hung in the balance as he endured ruthless interrogation. Escape was impossible. The only option was a low-level precision bombing raid to destroy the headquarters—and Sharkey. The bomber crews were informed of the target's importance and of the courageous American agent and did their duty. The film ended with Sharkey defiantly laughing at his cowering captors as bombs rain on their heads. It was an entertaining fictional account of individual courage.

In later years, I read accounts of daring World War II raids not unlike the fictional raid in *13 Rue Madeleine*. Among them, were raids targeting enemy headquarters and one against a prison. This book covers the raid on Amiens Prison in German-occupied France—Operation *Jericho*.

On 18 February 1944, less than four months before D-Day, a force of Commonwealth airmen embarked on an extraordinary mission in which success demanded courage, teamwork, and precision. Their mission was to liberate 120 Free French resistance fighters condemned to death within the next 48 hours for assisting the allies. There was little time to execute the mission, and weather conditions at their base limited visibility to near zero. In spite of the poor weather, the mission commander, Group Captain Pickard, declared, "This is one raid where cancellation is unthinkable . . . So, let's get going and make a good job of it." They did, but not without complications and losses.

Departing at 1100, 19 Mosquito fighter-bombers sped to Amiens. Estimated time on target was 1200. Flying at treetop-level and armed with 4 x 500-pound bombs, the aircraft attacked in three waves—the first two to breach the prison's walls, and the third to bomb the prison garrison and open the cells. The newly freed patriots would escape through the breached walls into the care of prepositioned French Resistance members who would spirit them away to safety.

Lyman is a veteran author with over 15 bestselling books. He is also a 20-year veteran of the British Army. In *Jericho*, he meticulously and concisely discusses the mission and its objective, introduces main characters and their roles, describes the Mosquito fighter-bombers, and deftly outlines the sequencing of the mission's execution. He also addresses some controversy regarding why the mission was ordered.

To expand the reader's perspective, Lyman adroitly weaves the accounts and interviews of participating aircrew and eye-witnesses to the attack into his narrative. Employing period images, mission photos, and superb illustrations, Lyman methodically describes each phase of the attack and the ensuing effects. He then takes the reader on the attackers' bittersweet journey to their home station.

This history has sufficient details and descriptive narrative to convey a powerful story of heroism and teamwork. It is a wonderful tribute to the airmen, and those supporting them, who bravely took the fight over the Channel before the June invasion.

COL Anthony J. MacDonald, USA (Ret)

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An Incipient Mutiny: The Story of the U.S. Army Signal Corps Pilot Revolt. By Dwight R. Messimer. Lincoln NE: Potomac Books (imprint of the University of Nebraska Press), 2020. Photographs. Notes. Bibliography. Index. Pp. ix, 283. $34.95. ISBN: 978-1-64012212-3

Messimer, a former lecturer in history at San Jose State University, has published 11 books on military and naval history. Most of these works dealt with either submarine warfare, World War I, or both. This is his first effort that focuses on the history of military aviation.

The title (which should, perhaps, be rephrased as the beginning of an open rebellion) deftly summarizes the events that transpired before, during, and after the earliest Army pilots objected to what they perceived as the Signal Corps' inability to appreciate the challenges they faced while attempting to master the skill of flying in totally inadequate aircraft.

For the most part, Messimer proceeds in chronological order. He does, however, make a few exceptions as he examines the personalities of key individuals. Among these are Benjamin Foulois, who commanded the Army Air Corps from 1931 to 1935, and Paul Beck. Both men had definite ideas about how Army aviation should proceed; and, consequently, they vied for the favor of those with influence.

In the early years, the training of Army aviators centered on North Island, in San Diego. North Island was a favorite spot for Glenn Curtiss' emerging operation, since the year-round weather was superior to that in upstate New York. The Curtiss firm's presence on North Island contributed to the friction that developed between Army pilots who flew Wright aircraft and those flying Curtiss aircraft. Besides the high fatality rate, the flyers lacked confidence in the school commander, Arthur Cowan. Furthermore, they came to resent Cowan for receiving flight pay when he could barely fly.

Creating a narrative that unfolds like a mystery novel, Messimer shows how the hard feelings led to a 1915 court-martial—not of the pilots but of Lewis Goodier, a judge advocate who bypassed the chain of command in advising the flyers. As it turned out, newspaper coverage emphasized the inadequacies of Army aviation revealed in the pilots' trial testimony. This reporting accelerated the public awareness of how deficient military aviation was in the peacetime United States; much of this was shown to be true the next year as Army aviation struggled to support Gen Pershing's incursion into Mexico. The situation had vastly improved by the time of aerial operations in 1918 on World War I's Western Front.

Behind the scenes, various factions argued for and against creating a separate branch for aviation. In May 1918, the US Army Air Service was established by presidential order, officially separating it from the Signal Corps.

Messimer concludes with an epilogue that examines the careers of the key characters, almost all of whom were spared any negative consequences by the Army.

This book is highly recommended for anyone with an interest in the beginning of Army aviation. It also offers insight into how a tradition-bound institution struggled to optimize a revolutionary technology and incorporate it into existing doctrine.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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Allied Air Operations 1939-1940: The War over France and the Low Countries. By Jerry Murland. Philadelphia: Pen & Sword, 2022. Table. Photographs. Appendix. Bibliography. Index. Pp. vii, 168. $34.95. ISBN: 978-1-39908-771-1

With more than two dozen books to his credit, Murland has focused on World War I and II land battles involving British forces in northern France and Belgium. He has produced numerous battlefield guides. Murland's father served as a fighter pilot during World War II and continued in that role after the war. Given his interest in the Battle of France, Murland chose to examine the aerial operations conducted by the Allies.

Setting the scene, he reviews the status of Allied air power in 1939 and how the Royal Air Force (RAF) would support the British Expeditionary Force in France. His description of the aerial campaign parallels the situation on the ground. The next two chapters examine the so-called Phoney War during which the German *Wehrmacht* conquered Poland, Denmark and Norway. With the exception of Norway, British troops remained on the sidelines, but the RAF was busy ineffectively bombing Germany. Like the United States in 1942 and 1943, Britain attempted to take the war to Germany through the air.

Before discussing the air campaign's impact on the Battle of France, Murland briefly looks at air combat over the Netherlands and Belgium. The Germans simultaneously attacked those two countries as well as France. In the next chapter, he examines Allied reconnaissance efforts from the outbreak of the war to the British withdrawal from France.

Murland divides the remainder of the book into four chapters: the German breakthrough at Sedan up to the isolation of British forces at Dunkirk; the air battles over Dunkirk; the retreat of British and French forces to the west and south until France surrendered, and the limited aerial activity on the French-Italian frontier. He wraps up the book with a brief summary of the German strengths and Allied weaknesses.

In each chapter, he proceeds day-by-day. He summarizes claims and losses (when available). In some instances, he details air-to-air engagements specifically mentioning individual pilots. If those mentioned failed to survive the war, he notes the date of their loss.

Murland based his research on Royal Air Force unit histories and numerous secondary sources, of which there is only one French and no German listed.

This book is best suited for those curious about the Battle of France. It should be used as an adjunct to one of the histories of the land war which, presumably, would include adequate maps. Students of the campaign may be disappointed because of the lack of analysis and the follow-on impact on the Battle of Britain. The absence of citations mars this effort.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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Flashpoints: Air Warfare in the Cold War. By Michael Napier. Oxford UK: Osprey Publishing, 2022. Glossary. Bibliography. Index. Photographs. Maps. Tables. Pp. 368. $45.00. ISBN: 978-1-4728-5357-8

Michael Napier studied aeronautical engineering at the Imperial College, London. He is an ex-RAF Tornado pilot who saw frontline service during the Cold War, including combat operations over Iraq after the Gulf War. He left the RAF in 1997 and joined British Airways as a First Officer, progressing to Captain. He is an experienced author with ten published titles including *In Cold War Skies, Korean Air War,* and *RAF Tornado Units of Gulf War I*—all in the Osprey Combat Aircraft series. He has authored articles for aviation magazines including *Aircraft Illustrated, Flypast, Aeroplane Monthly, and Cross & Cockade*.

The Cold War years saw a number of localized, but nonetheless intense, wars throughout the world. In these conflicts, air power played a vital role. The years following World War II also saw a steady revolution in aviation technology and design. The Korean war transitioned aircraft from piston engine and propellor design to jet propulsion. The period immediately following the war highlighted the importance of missile development and technologies facilitating electronic warfare. Conflicts during these years employed some of the most modern technology that the NATO and Warsaw Pact forces had in their arsenals. The campaigns were also practical demonstrations of the effectiveness of the tactics of the day. While air power is a vital component of modern warfare, aircraft proved vulnerable to both ground-based air defenses and enemy fighter aircraft with well-trained pilots.

Napier presents eight chapters dealing with these localized engagements: Suez crisis, Congo crisis, First Indo-Pakistan war, Six Day war, Second Indo-Pakistan war, October war, Iran-Iraq war, and South Atlantic war. He ends the book with a debriefing on the results of the wars he describes. Napier begins each chapter with a short description of the political background leading to the conflict, and briefly describes the ground war. He then moves to the air war, starting with the air order of battle and describing the campaign. For each campaign, he basically covers a day-by-day account of the air action by describing sorties and the wide range of aircraft and pilots involved. There is a brief paragraph at the end of each chapter describing the conflict outcome. At the end of the book, Napier covers the lessons learned from the eight campaigns in areas such as offensive and defensive counter-air operations, offensive support interdiction, reconnaissance, air transport, and combat effectiveness. Applying lessons learned to potential wars of the future, he covers effective and competent leadership, good training, suitable equipment, intelligence, and luck.

Napier has written a good book! I found the description of daily sorties, including pilot names, a bit repetitive, but plowing through them gives the reader a better perspective of how the battle progressed against the problems of enemy action and sometimes inept training and political incompetence. It is a well-researched source.

Frank Willingham, NASM docent

Flight Badges of the Central Powers, 1914-1918, Volume II: The Imperial German Naval, Austro-Hungarian, Bulgarian, and Ottoman Turkish Air Services.
By CDR Robert S. Pandis USNR (Ret). St. Petersburg FL: Imperial House Antiques, 2021. Photographs. Bibliography. Pp. 384. $95.00. *ISBN:* 978-179234435-0

This is Pandis' fourth and final book in a series on early flight badges. As with the other books in the series [reviewed in A&SPH], it is an exceptional work. This notable reference work examines the remaining Central Powers services for the period prior to and through World War I.

It covers in detail the changes of insignia worn as well as the related command orders for their creation. Of the emblems' details, Pandis provides information on the nature of when, how, and by whom each could be worn. These particulars provide an interesting record in the advance of early military aviation, and gives insight into the foundations of the various air services.

Pandis has produced a variety of excellent works on early flight badges covering the various combatants engaged in the World War I period. This updated edition completes the sweep of the combatants who stood against the Allies. The sections on Bulgarian and Turkish air services are breakthrough and alone make this volume a very important contribution. Very little has been described previously in English-language publications. As in his previous works, this is easily the go-to source for information and details on the particular nature of those insignia worn in the early years of military aviation.

Excellent examples of the various group of manufactures who produced the badges that were awarded during the war are covered in depth. The book is heavily illustrated with excellent close-ups of the various pieces front and back. Such details help to identify and to distinguish the genuine article from the fakes. The book is divided into seven sections, covering the various badge manufactures and styles developed.

Of particular interest are the German *Ehrenpreis*, or Naval Honor Prize, a distinctive award that is not as well-known as the *Ehrebecher*, or Honor Goblet. The details and examples provide insight into a hitherto obscure award presented to German Naval aircrews.

Overall, it is a comprehensive look at the badges, emblems and commemorative awards along with a historical view of those men who battled a century ago in the skies

over Europe. Indeed, the images of the pieces depicted are excellent and for that alone it is a worthwhile book to own. It is a well-researched book providing a clear concise understanding of the particular nature of these badges, making it a distinctive work.

Carl J. Bobrow, Research Associate, National Air and Space Museum

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Rearming the RAF for the Second World War: Poor Strategy and Miscalculation. By Adrian Phillips. Philadelphia: Pen & Sword History, 2022. Photographs. Notes. Bibliography. Index. Pp. xviii, 350. $49.95. ISBN: 978-1-39900-624-8.

Before earning a postgraduate degree in history, Phillips worked as a financial analyst focusing on how politics influence the markets. This experience prompted him to examine the inner workings of British government and its various ministries. His two previous books covered the abdication of King Edward VIII in 1936 and British foreign policy in the late 1930s as London tried to avoid war with Nazi Germany. In this volume, he examines the personalities that shaped the Royal Air Force (RAF) between the World Wars.

Phillips lays the foundation for the RAF's commitment to strategic bombing by reviewing the influence of Sir Hugh Trenchard. The "father of the RAF" advocated attacking enemy cities, crushing civilian morale, and forcing the defending nation to capitulate. Whether such a doctrine could succeed remained to be seen.

Once this doctrine dominated the thinking of the Air Ministry, the decision makers needed to acquire aircraft that could achieve their objective of smashing cities. Much of the book looks at the various procurement plans. Phillips details the machinations of various high-ranking RAF officers as well as their civilian counterparts. He introduces key figures among the aircraft manufacturers and how their influence may have prompted the purchase of significant numbers of deficient bombers such as the Fairey Battle, when superior designs should have received greater emphasis.

Throughout the 1930s, the RAF and Air Ministry advanced numerous successive "schemes" for acquiring aircraft. The pro-bomber argument frequently rested on a questionable assessment of Germany's strength. Fighters, for the most part, were ignored. Among those advocating a strong fighter force was Sir Hugh Dowding, Fighter Command commander, who insisted on the need for developing a comprehensive air-defense network. This network, along with the capable Hawker Hurricane and Supermarine Spitfire fighters, would prove decisive in the Battle of Britain in the summer of 1940.

Of course, money was always tight. Dowding found it almost impossible to convince those holding the purse strings how essential paved runways were if Fighter Command was to operate in wet conditions. And while the Hurricane and Spitfire proved successful, Dowding had to overcome the burden of operating cheap Gloucester Gladiator biplanes and the virtually useless Boulton Paul Defiant, whose armament consisted of a powered turret mounted behind the pilot.

Even as Bomber Command's inventory increased with additions of the Bristol Blenheim and the much superior Vickers Wellington, the personnel to maintain and operate the aircraft were woefully inexperienced. Bomber Command leaders emphasized this shortcoming, but their superiors pressed ahead with the rapid increase in bombers to support their strategic vision.

Readers familiar with the history of the US Army Air Corps in the 1930s will see obvious parallels with RAF thinking, although the geopolitical situation for the United States was considerably different from that of Great Britain. This book is highly recommended to those interested in the how personalities affect doctrine and technology.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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Imperial Japan's Allied Prisoners of War in the South Pacific: Surviving Paradise. By C. Kenneth Quinones. Newcastle-on-Tyne UK: Cambridge Scholars Publishing, 2021. Photographs. Tables. Notes. Appendices. Bibliography. Glossary. Maps. Index. Pp. xvii, 667. $99.95. ISBN: 1-5275-7096-7

This volume opens a window on allied POW experiences in the Southwest Pacific Area (SWPA) during the Second World War. After earning a Ph.D. in history, Quinones taught but then became a Foreign Service Officer specializing on northeast Asia. After retirement from the State Department, he returned to academe at Japan's leading international university.

His father was a P-38 pilot when he was downed by Japanese anti-aircraft fire on November 7, 1943. He became one of the 161 USAAF, Navy, and USMC POWs held by the Japanese in the SWPA. Other POWs (47 Australian and five New Zealand aviators, and 599 British soldiers) were moved to New Britain after the surrender of Singapore. A few, including USMC Maj "Pappy" Boyington, were transported to Japan. Of the total of 812 POWs, 672 were executed by the Japanese, and 86 more died in camps. Lt Quinones was one of only eight American POWs who survived executions, torture, beatings, disease, and malnutrition in Rabaul. Some POWs died when injected with malaria-infected blood by a member of Japan's infamous Unit 731.

The Japanese also held soldiers of the Indian and Chinese armies, along with Koreans, Taiwanese, Malays, and Indonesians as forced laborers. Alas, the immediate destruction of POW records before allies took control of various headquarters did not allow telling more of their stories. But Quinones does add details and context to the Japanese use of comfort women, mostly from Korea and Taiwan.

Quinones' prodigious research examined published and unpublished memoirs, official histories, and archival records. He untangled contradictory records and provided tables listing all allied POWs, plumbed records of war crimes investigations and trials, and integrated many details provided by the Pacific Wrecks project. All this research and the book's personal testimonies make it exceptional. Here and there are some errors: LeMay did not command the Fifth Air Force; Claire Chennault retired from the Air Corps as a major; Australia was no longer a colony; and gremlins apparently prowled the spell check. These are, however, small stuff .

Quinones also went on to address two larger issues. First, to assess why the Japanese armed forces were so brutal, he traced how, over the decades, Japan's leadership fashioned warped narratives of Bushido (the way of the samurai), suicide, Shinto, and "national essence" to motivate soldiers to be "human bullets." The extreme emphasis on fighting spirit and sacrifice caused Japan's leaders to slight medical and logistics support, weakening their war effort and increasing the butcher's bill. Today, Japan's Liberal Democratic Party continues to distort Japanese understanding of the war. Second, he examines how racial attitudes in Japan, the US, Australia, and the UK led both sides to plan campaigns based on racist misjudgments, with soldiers (including Allied soldiers) paying in blood for their commanders' prejudices.

In the final chapter of the volume, Quinones plainly summarized his views on the racism factor in the Pacific War. "[A]ny group of people who blend a sense of racial superiority with preferences for authoritarianism, militarism, and nationalism to promote their self interests can be expected to act inhumanely. Elements of Imperial Japan's military and political leadership were responsible for the horror that was the Great Pacific War, not the Japanese people."

Donald M. Bishop, The Krulak Center, Marine Corps University

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Aircraft of Red Flag: The Ultimate Air-to-Air Combat Exercise. By Scott Cuong Tran and Nick Tran. Stamford UK: Key Books, 2020. Photographs. Notes. Pp. 128. $22.98 paperback. ISBN: 978-1-913870-11-9.

Scott and Nick Tran specialize in books featuring aircraft photos. In this volume, they focus on Red Flag exercises in 2019 and 2020. Inaugurated by the Air Force at Nellis Air Force Base, Nevada, in 1975, Red Flag has developed into the world's most sophisticated test of aviation-based warfare outside of actual hostilities.

The introduction provides a summary of Red Flag's legacy. The Trans then share tips on how to best photograph aircraft outside the perimeter boundary of Nellis.

The chapters are organized mostly by type of aircraft. The text is limited but provides basic identification of all the aircraft pictured. Readers unfamiliar with the scope of Red Flag may be surprised at the variety of aircraft types and units visiting Nellis.

The first chapter, *Support Aircraft*, includes US Air Force tankers and surveillance and rescue aircraft. Chapter Two features the B–1 and B–52 bombers. The third chapter, labeled *Blue Force Fighters*, includes aircraft other than fighters such as the A–10 and AH–64.

The Air Force started Red Flag to promote dissimilar aircraft combat training. Initially, T–38s and Soviet-built aircraft were used. The *Red Forces* chapter features aggressor F–16s boasting a variety of paint schemes to mimic what US forces might encounter in air-to-air combat.

Several companies serve as aggressor contractors—the topic of Chapter Five. Among the aircraft pictured are the Douglas A–4, Czech-built Aero L–159 and the French-built Dassault Mirage F1. International participants vary from exercise to exercise. Represented in Chapter Six are aircraft from Australia, Britain, Canada, Germany, Italy, and Spain. Since Nellis is the home of the Thunderbirds, the Trans chose to include a few photos of the Air Force's aerobatic team as Chapter 7.

Some photographs show considerable detail. That aspect and some of the lavish paint schemes might be of use to modelers. Otherwise, this book is best suited as a guide for individuals interested in taking their own photos at Red Flag.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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Mosquito Intruder Pilot: A Young Pilot's WW2 Experiences in Europe and the Far East. By Jeremy Walsh. Philadelphia: Air World, 2022. Maps. Table. Photographs. Bibliography. Notes. Index. Pp. xiii, 341. $49.95. ISBN: 978-1-39908-477-2

Jeremy Walsh, a successful businessman and private pilot, has written a thoughtful and insightful biography of his late father, Ben Walsh. Like many veterans, Walsh's father seldom discussed his wartime experiences. Only in his later years (he passed in 2008) did his dad share his wartime memories. Walsh reviewed his father's logbook and photo album. Using those documents, he reconstructed his father's career.

Walsh enlisted in the Royal Air Force (RAF) as a 17-year-old in 1941. As a sergeant pilot, his first operational

assignment took him to No. 418 (Royal Canadian Air Force) Squadron. That unit became one of the best-known intruder squadrons. When Walsh joined 418 Squadron, the unit was flying Douglas DB–7 Bostons, a twin-engine bomber. Missions consisted mostly of harassing airfields in German-occupied France at night. Walsh and his crew would orbit in the vicinity of an airbase hoping to intercept aircraft. This seldom happened. They then would bomb the airfield, sometimes more than one, and return to base.

After about six months, 418 Squadron transitioned to the de Havilland Mosquito in the spring of 1943. Aside from a brief interlude, Walsh would fly the Mosquito (primarily the FB.VI version) for the remainder of the war.

In September 1943, Walsh received orders assigning him to the China-Burma-India (CBI) theater, where he would spend the rest of the war. To get there, he flew a new Mosquito. At this point, he had completed 18 of the required 30 missions to earn a transfer from a combat unit. Arriving in India, he learned that none of that counted; he would start over, but at additional cost. Given that news, combined with the stress of numerous difficult night missions, he physically collapsed in April 1944. Only that event and structural defects with the Mosquitos in the harsh tropical climate briefly prevented him from flying the twin-engine wooden wonder. The Mosquitos were grounded for most of December. However, Walsh kept flying. That month he completed 10 missions as a medevac pilot in Stinson Sentinels and de Havilland Tiger Moths. Flying into clearings next to the front lines, he would rush litter cases to the nearest medical facility.

After the war, he returned to England where he was diagnosed with a mental-health condition (today a form of post-traumatic stress disorder). With his wife's support, he recovered and went on to found two corporations later listed on the NASDAQ.

Far fewer personal flying accounts exist concerning the CBI compared to Europe. Readers curious about the CBI, or specialists in that theater of war, will find this read worth the time.

Steven D. Ellis, Lt Col, USAFR (Ret), docent, Museum of Flight, Seattle

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Fleet Air Arm Air Legends 2: Fairey Swordfish. By Matthew Willis. Horncastle, UK: Tempest Books, 2022. Illustrations. Photographs. Notes. Bibliography. Index. Pp. 130. $24.50 paperback. ISBN: 978-191165849-8

The name Matthew Willis didn't ring any bells for me, but while looking at his list of publications, I discovered I'd been reading his work for years. He's written numerous articles for *Aeroplane*, *FlyPast*, and *The Aviation Historian*, primarily on naval aviation. He has also written a number of books on Royal Navy aircraft, and even a few on German World War II aircraft, among other topics. He's also the author of the well-received *Mustang, The Untold Story*.

For an aircraft that was slated to go out of production in 1939, the Fairey Swordfish TSR (Torpedo/Spotter/Reconnaissance) had a remarkable history during World War II, seeing duty in the Atlantic, Europe, the Mediterranean, and the Indian Ocean. Only the realization that it was no match for the Mitsubishi Zero kept it from being used in the Pacific as well. Scheduled to be phased out in 1939 in favor of the Fairey Albacore, it outlasted the latter in active service, remaining on active duty until the end of the war in the ETO.

Its longevity can be attributed to its versatility, which earned it the nickname *Stringbag*, after the British housewife's string mesh shopping bag. Although Willis uses *Stringbag* only once (in a photo caption), this versatility is borne out by his account. The Swordfish carried torpedoes, depth charges, mines, bombs, and rockets. It flew from fleet carriers, the new escort carriers introduced for convoy protection, cruisers and battleships (on floats), MAC ships (merchant marine ships with added flight deck), and even from land. It could be equipped with radar, and laid smoke screens during the D-Day invasion. When RATOG (rocket-assisted takeoff) came along, the aircraft became a realistic escort carrier weapon against the U-Boats. Only its lack of speed kept it from operation against the Japanese.

All in all this, is a valuable introduction to the aircraft for those new to it. The 16 color profiles, many photos, and crew accounts will make it of interest even to those who are already familiar with the aircraft.

Jon Barrett, volunteer photographer/researcher, National Air and Space Museum

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PROSPECTIVE REVIEWERS

Anyone who believes he or she is qualified to substantively assess books for the journal should contact our Book Review Editor for a list of books available and instructions. The Editor can be contacted at:

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Compiled by
George W. Cully

In light of the coronavirus pandemic, events listed here may not happen on the dates listed here, or at all. Be sure to check the schedules listed on the individual organization's web sites for the latest information.

January 5-8, 2023
The **American Historical Association** will hold its 136th annual meeting at the Philadelphia Marriott Downtown in Philadelphia, PA. Details remain to be determined; see the Society's website at Future Annual Meetings | AHA (historians.org) for more information.

March 2-4, 2023
The **Vietnam Center & Sam Johnson Vietnam Archive** at Texas Tech University in Lubbock, Texas will hold a symposium entitled "1973: The Paris Peace Accords and the Allied Withdrawal from South Vietnam". For details, including registration and a call for papers, see the Center's website at The Vietnam Center and Sam Johnson Vietnam Archive: Events (ttu.edu).

March 8-10, 2023
The **American Astronautical Society** will host its annual Robert H. Goddard Memorial Symposium at the Johns Hopkins University's Applied Physics Laboratory in Laurel, Maryland. For details, see the Society's website at Robert H. Goddard Memorial Symposium | American Astronautical Society.

March 23-26, 2023
The **Society for Military History** will hold its 89th Annual Meeting at the Hilton San Diego Bayfront hotel in San Diego, California. For registration and other details as they become available, see the Society's website at Call for Papers | The Society for Military History (smh-hq.org).

March 30 – April 2, 2023
The **Organization of American Historians** will gather for the first, in-person portion of its annual conference at the Westin Bonaventure Hotel in Los Angeles, California. A second, virtual session will take place on April 13-4 May. The theme of this year's event is "Confronting Crises: History for Uncertain Times." For registration and other attendance information, see the Organization's website at 2023 OAH Call for Proposals | OAH.

April 12-15, 2023
The **National Council on Public History** will hold its first in-person gathering since 2019 in Atlanta, Georgia. For more information as it becomes available, see the Council's website at 2023 Annual Meeting | National Council on Public History (ncph.org)

April 17-20, 2023
The **Space Foundation** will hold its annual Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado. For registration and other details, see the Foundation's website at 38th Space Symposium – April 17 – 20, 2023 – Join Us April 17 – 20, 2023.

April 26-28, 2023
The **Army Aviation Association of America** will hold its annual convention and symposium in Nashville, Tennessee. For more information as it becomes available, see the Association's website at Home (quad-a.org).

May 6-8, 2023
The **Association for Uncrewed Vehicle Systems International** will present Xponential 2023, its premier annual event. The theme of this year's gathering is "the Blueprint for Autonomy", and it will be held in Denver, Colorado. For details as they are announced, see the Association's website at Association for Uncrewed Vehicle Systems International - XPONENTIAL 2023: Call for Presentations (secureplatform.com).

Readers are invited to submit listings of upcoming events Please include the name of the organization, title of the event, dates and location of where it will be held, as well as contact information. Send listings to:

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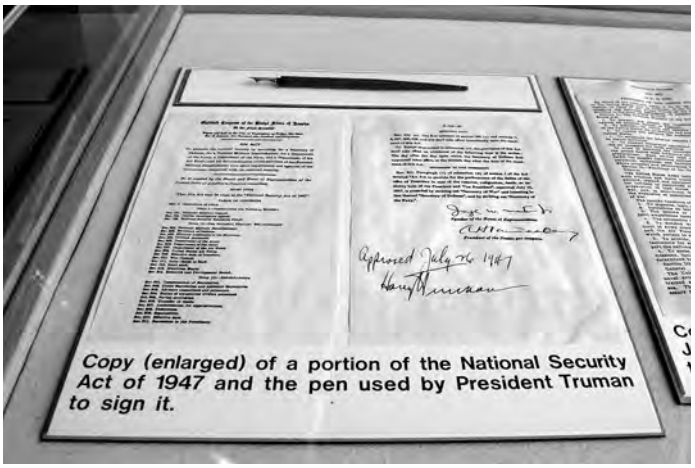
History Mystery Answer



Copy (enlarged) of a portion of the National Security Act of 1947 and the pen used by President Truman to sign it.

On July 26th, 1947 President Harry Truman signed the National Security of Act of 1947 while on board the VC–54C "Sacred Cow." The VC–54 was a heavily modified C–54. As a side note, the C–54 would serve as the backbone during the Berlin AirliftThe "Sacred Cow" was the first presidential aircraft and was the only VC–54C built. The "Sacred Cow" began its presidential service flying President Franklin D Roosevelt beginning in 1945. FDR only used "Sacred Cow" for one presidential trip. "Sacred Cow" would briefly serve President Truman before being replaced by the VC–118 "Spirit of Independence."

The National Security Act of 1947 not only established the Air Force, but it also represented a monumental shift in the United States' National Defense construct. The act created the National Security Council, the Joint Chiefs of Staff, and the Central Intelligence Agency. The Act established the Department of Defense with the merger of the War Department (renamed the Department of the Army) and the Department of the Navy into a single cabinet level department comprised of three departments: Departments of the Army, Department of Navy (USMC included within), Department of the Air Force.

Section 209 specified that "Each transfer, assignment, or change in status under section 207 or section 208 shall take effect upon such date or dates as may be prescribed by the Secretary of Defense." In the case of the Air Force, that date was September 18th, 1947 when Stuart Symington took office as the first Secretary of the Air Force.

To learn more:

VC–54C: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/195813/douglas-vc-54c-sacred-cow/
Birth of the Air Force: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/195791/usaf-established/
Efforts (1943-1947) leading up to the creation of the Air Force: https://media.defense.gov/2010/Sep/28/20013-29803/-1/-1/0/planning_and_organizing_the_postwar_af.pdf
National Security Act: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197560/national-security-act-sections-207-209/
U.S. Air Force 75th Anniversary: https://www.af.mil/About-Us/AF-75th-Anniversary/

New History Mystery

by Dan Simonsen

This Issue's Quiz: In 2022, the Air Force celebrated its 75th anniversary as an independent department. Specifically, "Sec 207. (a) Within the National Military Establishment there is hereby established an executive department to be known as the Department of the Air Force, and a Secretary of the Air Force, who shall be the head thereof." The document creating the U.S. Air Force also included several other significant changes to the United States' military construct. For this quarter's multipart question. What was the name of the document? Where was it signed? For an extra challenge, if the document was signed in July, why is the Air Force's birthday two months later?

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