

AIR POWER

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Set forty-five years ago, our lead article, “Misadventure of a Student Pilot,” by Rodney Rogers, details the author’s harrowing experience in Naval flight training. Rogers places the reader alongside him in the cockpit as he survives a near-death experience and learns that life is fragile, but sweet.

Every nation, it appears, has its “eggheads” or “Whiz kids” — scientists who assist the military in solving operational problems. The British had their “boffins.” In the second article, “Boffins at Bomber Command: The Role of Operations Research in Decision-Making,” Colonel Randy Wakelam, a Canadian soldier-scholar, demonstrates that Sir Arthur “Bomber” Harris was not the loner depicted in most histories, but depended greatly upon his boffins.

Chris Burton, in the third article, “The Eureka-Rebecca Compromises,” suggests that during World War II German manipulation of the Allies’ radar system not only produced effective counter-measures, but compromised Allied drop zone security as well. This exploitation of the radar system’s vulnerabilities enabled the Germans to infiltrate Allied special operations.

In the fourth article, “Those Were the Days,” Ken Werrell, a former WB-50 pilot turned history professor, examines the U.S. Air Force’s safety record as it transitioned from propeller-driven planes to jets. Dr. Werrell notes that the improvements in safety resulted less from direct action than they did from better equipment, techniques, training, and more mature attitudes.

We are pleased to announce that Brig. Gen. Alfred F. Hurley, USAF (Ret.) has agreed to serve as the publisher of this journal. Dr. Hurley has a Ph.D. in history from Princeton University. His best known publication is the biography, *Billy Mitchell: Crusader for Air Power* (1964, 1975). He served in the U.S. Air Force from 1950-1980, with extended assignments in Texas, Colorado, and Germany and briefer periods in Washington, D.C. and Vietnam. A faculty member at the Air Force Academy since 1958 in 1980 he was named department head and chairman of the humanities division. He held various positions at the University of North Texas, including Chancellor/President Emeritus.

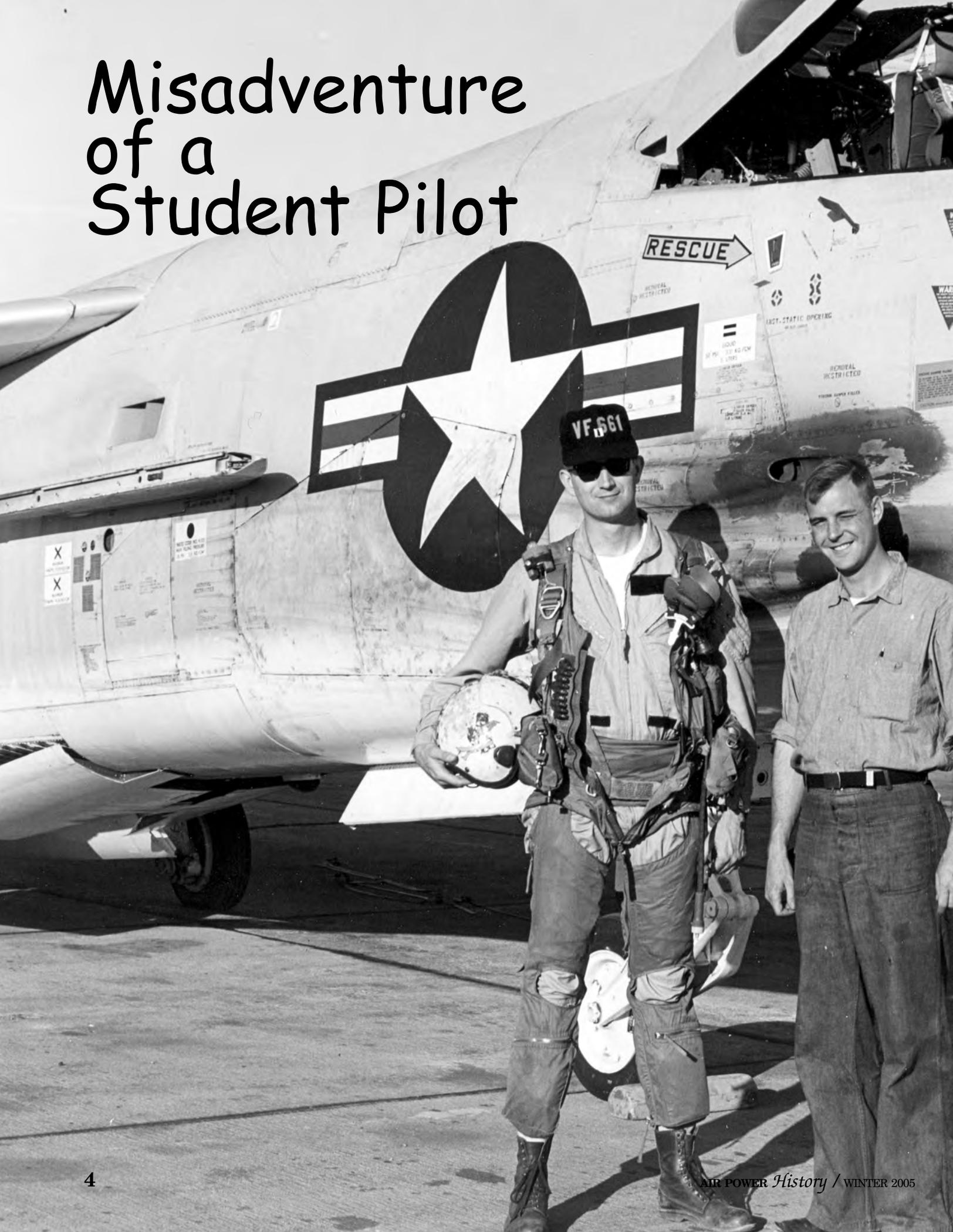
In this issue there are thirteen book reviews (see pages 54-61) and a long list of new books received, in search of reviewers (see pages 62-63). It is our custom to acknowledge and thank the individuals who reviewed the articles published during the year. The referees listed on page 66 greatly helped determine which articles would be published and helped to validate, improve, and refine the final versions. The departments section includes letters to the editor, upcoming events, news, notices, reunions, and the solution to the “History Mystery.” Also, be sure to read (page 65) the “Message from the President,” Lt. Gen. Michael A. Nelson, on the exciting changes occurring in the Air Force Historical Foundation.

Finally, on behalf of all the staff and contributors to *Air Power History* we wish you all the best for the holidays and the new year. “Happiness, long life, and prosperity.”



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Misadventure of a Student Pilot





Rodney O. Rogers



(Overleaf) Author Rodney Rogers, Plane Captain, F8H Crusader. (All photos, unless otherwise indicated courtesy of the author.)

(Above) The roster portrait of the author at Cecil Field, Florida, in 1961.

I HAD A CLOSE ENCOUNTER WITH DEATH

Many years ago when I was a young man—barely twenty-four years old—in flight training with the United States Navy, I had a close encounter with death while flying a jet trainer. Anyone familiar with naval aviation knows such an experience is far from unique. Nevertheless, for reasons I cannot fully explain, this particular flight has seldom been long out of my mind in the forty-five years since it took place.

An academic for the past thirty-six years at a number of different universities and in three different disciplines, I currently teach aspiring professional pilots at Embry-Riddle Aeronautical University about aerodynamics, aircraft performance, and upset recovery. Recently our College of Aviation faculty in Daytona Beach, Florida, received an

unexpected e-mail from Kara Oehler at National Public Radio. Ms. Oehler is investigating the hypothesis that brain activity stimulated by intense flying situations might result in aviators undergoing “out-of-body” experiences. She wondered if anyone on our faculty—many of whom have logged thousands of hours flying high performance swept-wing airplanes—could comment on this idea from the perspective of a professional pilot.

My initial response was that the idea is interesting but unutterably New Age. At first, I couldn't recall having experienced anything of this sort in my fourteen years of flying Navy airplanes on active duty and in the Naval Reserve. After further consideration, however, I realized that my brush with death in flight training might have involved something like the kind of experience Steven Kotler reports on in an article in *Discovery* that Kara had attached to her e-mail.

I don't know if what I *saw* in my misadventurous flight was an out-of-body experience. Most of the pilots with whom I flew in the Navy, and those I work with at Embry-Riddle today, would probably say that an out-of-body experience starts sometime after a fifth or sixth silver bullet on the rocks. I do know, however, that Ms. Oehler's e-mail is what catalyzed me to write down the story of what happened—and what almost happened—to me so many years ago. The undertaking has brought back many interesting details and memories. And for that I thank Kara Oehler.

Friday Night

It's eleven o'clock on a hot Friday evening in early October 1960, and I am having a drink with my flight instructor Jack Gunter at the bar of the Officers Club at Biggs Air Force Base in El Paso. We flew here from Naval Air Station Kingsville, Texas in a Grumman F9F-8T Cougar, a single-engine swept-wing jet trainer derived from the next generation of the F9F-2 Panther, a champion fighter featured in the 1955 Korean War film *The Bridges at Toko-Ri*. Film buffs may recall that this movie was made from the James Michener book of the same title starred William Holden, Grace Kelly, and Mickey Rooney, and received a Special Effects Oscar.

Jack and I had no intention of remaining overnight in El Paso. About two hours ago we

In a long, varied, and completely unconventional academic career, Rodney O. Rogers has taught literature, aeronautics, and computer science at a number of American universities, including Clemson, the University of North Carolina at Asheville, the University of Florida, and the Citadel. He holds the Ph.D. degree in Computer Science from the University of Central Florida, and the Ph.D. degree in English and American Literature from the University of Virginia. As a former Navy jet carrier pilot with six years active duty and eight years reserve flying, he has logged 247 carrier landings and 2,500 hours of single engine flight time, including 1,500 hours in the F8 Crusader and 500 hours in the A-4 Skyhawk. Currently he is a faculty member in the Department of Aeronautical Science at Embry-Riddle Aeronautical University in Daytona Beach, Florida, where he teaches aerodynamics, aircraft performance, and simulator-based upset recovery to aspiring airline pilots. He recently was awarded a \$200,000 research grant by the FAA to study training transfer in upset recovery training conducted using low cost desktop computer simulation.

The author's 1954 MG-TD at NAS Pensacola, Florida, with USS Antietam in the background.



THE T-28 LOOKED AND PERFORMED VERY MUCH LIKE A TYPICAL WORLD WAR II CARRIER BASED FIGHTER AIRPLANE

should have been landing in Phoenix after a refueling stop at Biggs. The two legs of the flight from Kingsville to Arizona were the planned conclusion of my advanced instrument flight training, a formidable hurdle on the way to winning coveted Navy Wings of Gold and being designated a Naval Aviator. However after we land at Biggs—at that time a Strategic Air Command base—a B-52 bomber touches down on the field's single runway with locked wheel brakes on the right main landing gear. The result is eight blown tires, a huge airplane stranded in the middle of a very long runway, and a closed airfield. After an hour or so the field is still closed, night has descended, and Jack decides we should wait until tomorrow morning to fly to Phoenix. We call base transportation, take rooms in the Bachelor Officers Quarters, and eventually end up here at the Officers Club for drinks, dinner, and adventure.

Will the Engine Fail?

I came to Kingsville Naval Air Station from basic flight training at Whiting Field in Milton, Florida, where I flew the North American T-28C Trojan, a hefty single-engine prop-driven trainer. Except for its high visibility yellow paint job and the fact that it had a nose wheel rather than a tail wheel, the T-28 looked and performed very much like a typical World War II carrier based fighter airplane. To lubricate itself, the Trojan's very healthy Curtiss-Wright nine-cylinder radial engine consumed oil at about the same rate that my little black MG-TD roadster used gas. Flying the plane was a pure open cockpit, white scarf adventure. I

never tired of the thrill of advancing the throttle at the end of the runway for takeoff. The engine's raucous 1,425 horsepower sank a pilot back in the seat hard, and the plane with its high lift straight wing leaped into the air as though it despised the prospect of remaining earthbound even one second longer than necessary.

The Trojan, however, had one characteristic that challenged a student pilot's mind. At low engine revolutions, the engine's supercharger was capable of ramming far more air/fuel mixture into the cylinders than their design strength could tolerate. It is no exaggeration to say that one could literally blow a cylinder off an engine by applying full throttle with the propeller control set for low revolutions. As a consequence, a pilot had to be very careful about throttle and propeller speed management to avoid damaging the engine by overpressurizing the cylinders—a situation known as *overboost*.

Overboost of an airplane's radial engine is an insidious kind of cumulative mistake that typically is paid for by someone other than the pilot who caused it. Imagine repeatedly over inflating and deflating a balloon until it eventually explodes during the ultimate inflation. This is the situation with cumulative overboost. An engine subjected to repeated abuse of this kind suffers gradual metal fatigue until one day a cylinder disintegrates and the engine fails. Standard operating procedures at Whiting Field required pilots to log accidental overboost situations so that inadvertently abused engines could be inspected to determine the extent of the damage, if any. However, since reporting an overboost was equivalent to declaring an act of



The author after his first solo in T34 Mentor, NAS Saufley Field, Pensacola, Florida, 1960.

JET AIRCRAFT ENGINES ARE VERY MUCH MORE RELIABLE THAN RADIAL RECIPROCATING ENGINES

unprofessionalism, some pilots wondered if every such occurrence eventually found its way into aircraft logs.

Apparently Naval aircraft maintenance officials had a similar concern. By the time I arrived at Whiting, the T-28 had been outfitted with a sensing system capable of giving a pilot advanced warning of an incipient engine failure. Long before a radial engine disintegrates from repeated overboosts or other anomalies, metal fatigue begins to show up as microscopic iron particles in the oil that lubricates the engine. Indeed, oil samples from the T-28 were routinely analyzed during periodic maintenance for the presence of such particles as a measure of engine wear. If engine fatigue becomes acute, larger pieces of iron may be picked up in the oil flow and carried to a portion of the lower engine called the oil sump. Some clever engineer dedicated to saving hapless pilots' lives conceived the idea of placing a magnetic collector in the oil sump to pick up any pieces of metal that might appear there. When sufficient metal accumulates at the magnet, an electrical circuit is closed and a red warning light comes on in the cockpit.

This red cockpit warning light in the T-28 was officially called the *sump plug warning light*. Pilots however invariably referred to it as the *Oh f_k! light*, no doubt because of the verbal response the light's illumination was likely to solicit. When the light lit up, it was time to land, and soon—very soon. Student pilots at Whiting rarely acknowl-

edged worrying about an engine failure, but I suspect many of them shared my concern about a threat that seemed to lurk in a shadowy guise somewhere behind us in the cockpit. God knows we were taught to keep the Oh f_k! light in our instrument panel scan and were repeatedly briefed on the procedures to follow should the light illuminate. In addition, in the familiarization stage of T-28 training, our flight instructors routinely required us to conduct simulated power out approaches to farmers' plowed fields. We practiced the maneuver down to 500 feet above the ground until we successfully demonstrated the ability to land safely in case an engine quit out of gliding distance of an airfield. We were also taught to have a suitable landing site constantly in mind. "Where would you land if the engine quit right now?" was a question an instructor pilot frequently put to a student pilot during the process of a training flight. One had better be able to answer authoritatively and without delay.

At Whiting Field—in addition to perfecting landing techniques after an engine failure—I learned how to perform precision aerobatics, operate and land an airplane solely on instruments, fly formation, shoot gunnery, and execute approaches to landing on an aircraft carrier. At the end of my basic training, I made six solo arrested landings in the T-28 on the Navy's training carrier *USS Antietam*, and in June 1960 received orders to report to advanced jet training in Kingsville, Texas. At the time, I had 165 hours of flight time—most of it in a high performance fighter-type propeller driven airplane—and I suppose I was as pleased with myself as most student Naval aviators at that stage of their pilot training. After all, many of our classmates had already left flight training by this point, usually from failure to perform rather than by choice. Moreover, I had been selected to fly not helicopters or multi-engine transport type aircraft but carrier-based jets, a choice assignment yearned for by virtually every aspiring naval aviator.

Another thing I remember being especially happy about was completing basic training without experiencing an engine failure. I knew jet aircraft engines are very much more reliable than radial reciprocating engines. Moreover, jet fighters—unlike the T-28—have emergency egress systems allowing a pilot to bail out successfully at low altitude in the unlikely event that the engine quits on takeoff or landing. Under the circumstances, I naively imagined that my upcoming transfer to Texas meant constant concerns about engine failures were now pretty much behind me. It turned out, however, that I was mistaken. Although I had graduated from an engineering school and had a good background in mathematics, I had a lot to learn about probability in the real world. Even the most unlikely event ultimately presents itself to a chosen few. Flying—especially military flying—is one of the best reinforcers of this incontrovertible truth, as implied by the wonderfully insightful title of Ernest Gann's book about aviation mishaps, *Fate is the Hunter*.



I FEEL LIKE A SCUBA DIVER SUBMERGED DEEP IN A THERMAL POOL WITH A FAULTY PRESSURE REGULATOR

Jets, Props, and a First Flight

When I arrived in Kingsville, I had never in my life flown in or even sat in a jet, much less piloted one. It was a time in aviation history when many people still knew little or nothing firsthand about turbine propelled airplanes. Moreover, puffed up by my successes in basic training, I was unprepared to examine beforehand the difficulties inherent in transitioning from slow moving propeller driven airplanes to high performance jets, where everything happens about five times as fast, and where there are many, many more potential mistakes that one is not graced to make twice.

I vividly recall my first flight in the F9F-8T Cougar. Encapsulated in thirty-five pounds of flight gear—flight suit, crash helmet with full face visor, oxygen mask, torso harness, G-suit, knife, parachute shroud cutter, hard toed boots—I am crammed into the very cozy front cockpit of the airplane, strapped tight at shoulder and hip like a turtle stuffed inside too small a shell. Jack Gunter is in the rear cockpit. Jet fighters are pressurized and air-conditioned, but the climate control system does not work during low thrust ground operations. The canopy is open, the tortuous Texas summer sun is blazing down, and I am soaking in sweat as I try with limited success to keep the plane pointed straight down the taxiway while completing the pre-takeoff checklist. I have occasionally worn an oxygen mask before, but never under such constrained circumstances. I feel like a scuba diver submerged deep in a thermal pool with a faulty pressure regulator delivering only a minimal fraction of the air needed to breathe comfortably.

Approaching the end of the runway, Jack tells me over the intercom that I will make the takeoff. This was not something we explicitly briefed, and I had naively assumed he would demonstrate the takeoff to me on this my first jet flight. However, Jack's announcement is not a request but an

implicit order from a senior officer and a designated Naval Aviator. I quash a strong impulse to say I would rather observe a successful takeoff before trying one myself. Closing the canopy, I call the tower controller for clearance and taxi onto the runway into takeoff position. Advancing the throttle lever while my feet firmly hold the brakes locked, I watch the engine revolution indicator slowly spool up to one hundred percent. An ineffectual hint of cool air emerges from the cockpit air conditioning outlets. A quick glance shows that the remaining engine instruments—pressure ratio, exhaust gas temperature, fuel flow, oil pressure—are within limits. It appears that we are developing full thrust. "Instruments look good," I say to Jack. "Cleared to roll," he replies, "let's go." I release the brakes with an existential fear and trembling I have from time to time experienced and learned to tolerate—if not control—since beginning flight training. The plane begins to accelerate down the runway.

The evolution I have now to perform is conceptually very simple. I am accustomed to doing it during every takeoff I have ever made in my previous flight training. Using differential braking, I will keep the accelerating airplane pointed straight down the runway. As the speed increases and control surfaces become effective, I will use rudder rather than brakes to maintain runway alignment. Shortly before the airplane reaches takeoff speed, I will smoothly rotate the nose upward to the takeoff attitude. Very soon thereafter the airplane will leave the ground and begin to climb. From my experiences in the Cougar flight simulator, I know this should happen four or five thousand feet down the eight thousand foot runway at a speed of 135 knots (155 miles per hour). As the airplane very quickly reaches a point where a safe landing on the remaining runway is no longer feasible, I will raise the landing gear, retract the wing flaps as the airspeed increases, and effect a transition to climbing

The author leads a flight of four F8H Crusaders over Cecil Field, Florida, in 1968 during the Vietnam Naval Reserve recall.



flight, taking care to observe standard procedures for departing the vicinity of the airfield.

Despite my intimate familiarity with these simple steps, the takeoff I am executing now is unlike any I have ever experienced. The differences register as those of a kind, not of degree. Flying a propeller driven airplane like the T-28 is something like driving a family car. The cockpit is capacious and relatively uncomplicated, compared to a jet fighter's cockpit. One has the sense of *riding* in a machine, a sense reinforced by the roar of the engine and propeller and by restricted visibility due to low mounted wings, a huge engine cowling, and an iron cage sort of canopy structure. A mechanical presence is everywhere manifest.

By contrast, one does not ride in a jet fighter as much as *become an integral part of it*. The engine in a jet is well behind the pilots, its immense blast scarcely audible in the cockpit, which is situated far forward on the fuselage of the airplane. Then there is the sense of being cocooned inside a vastly more compact space where only a soft whirr of the pressurization system disturbs silence. The few undertones of sound one hears seem reminiscent of the audible hush of parishioners in a religious ceremony. Moreover, flight is not only much quieter but also much smoother in a jet fighter than in a prop because the weight of the much heavier jet damps out most air turbulence. Finally, the swept wings of a jet are far behind a pilot—visible only in rear looking mirrors—and provide no impediment to vision. With the canopy's clear Plexiglas bowed unobstructed around one's head, there is an almost full circle line of sight at or above the horizon. Only directly aft is a small pie slice of a pilot's vision obscured. Except for the minimal area directly beneath the streamlined fuselage, the view of the world below is similarly unobstructed.

The result of all this is a keen sense that a jet fighter is an extension of the pilot's body, that *the airplane and the human body are one*. The extreme maneuverability of the airplane strongly reinforces this sense. Want to see the ground right underneath you right now, for example? Move the control stick very slightly left or right and you will rapidly roll upside down. Now look "up" into the top of the canopy and see the ground still "underneath" you as clearly as you previously saw the limitless sky. Flying in a high performance jet is indeed flying without an airplane. In six degrees of freedom, one maneuvers not a so much a machine as one's powerfully extended body. Human and aircraft merge into an unexpected cyborg. To borrow a favorite pilot's irony, one becomes *el hombre supremo*, a childhood comic book hero reincarnated.

The sense of freedom one experiences maneuvering a jet fighter is immense. Ultimately it becomes the basis of a thoroughly sensuous and highly pleasurable experience. One's introductory flights, however, can be alarming if not indeed frightening. As the takeoff evolution unfolds rapidly, I experience an ever keener sense of my mind's inability to keep up with my body, with the airplane. Moment by moment I am rushing inexorably ahead of myself, each second leaving my cognitive portion farther and farther behind. Compared to the muscular, thousand mile per hour F8 Crusader I will operated in the fleet, or even to the supersonic, afterburner powered Grumman F11F Tiger I will fly at the very end of my training at Kingsville, the Cougar will come to seem something of a kitty cat. Compared to the T-28 Trojan, however, it is a volcanic eruption, and right now I am being baked in its mountainous crucible.

The Cougar I am nominally piloting has become airborne and is crossing the upwind run-

ONE DOES NOT RIDE IN A JET FIGHTER AS MUCH AS BECOME AN INTEGRAL PART OF IT

MY UNFETTERED BODY IS SOARING INTO A QUIET, SERENE SKY, BUT MY MIND IS STILL BACK ON THE STEAMING RUNWAY ... A CIRCUMSTANCE WHICH PILOTS CALL BEING "BEHIND THE AIRPLANE"

way threshold with its landing gear up. The wing flaps are retracted, and the plane, now aerodynamically clean, is gaining airspeed and climbing very rapidly. How can this be? I recall nothing about how the plane has arrived here. My unfettered body is soaring into a quiet, serene sky, but my mind is still back on the steaming runway, somewhere between brake release and rotation for take-off. This is a circumstance which pilots call being "behind the airplane." It constitutes a loss of situational awareness that, unremedied, can quickly lead to disaster. Nothing bad *has* happened yet, but why? Is the airplane flying itself? Whatever the explanation, I am behind the airplane—far behind the airplane, the distance increasing exponentially with every unfolding moment. Thank God, Jack Gunter is aboard to pray me through this situation. To this day I recall with chagrin the shameless realization that overwhelmed my mind at that dark moment: "I will never be able to fly this feline beast by myself. It's way too much for me."

Prelude to a Misadventure

Fortunately, I was wrong in this desperate judgment. I say fortunate not simply because flying Navy jets off aircraft carriers in the Mediterranean Sea was one of the great pleasures of my life, but because what I learned as a Naval Aviator constitutes the most important educational experience of my life—a life devoted to academe and incidentally to earning two doctoral degrees at residential institutions of higher learning.

By the time I had seven familiarization flights in the Cougar—two of them solo—and fifteen hours of flight time, I felt as comfortable in the airplane as I ever had when flying the T-28. More comfortable, in fact, since I had much more faith in the Cougar's engine than in the Trojan's. After completing familiarization stage, I began the advanced instrument flight stage. In this phase, I flew in the back seat of the airplane with a large canvas hood—called a "bag"—pulled up over my head against the canopy to obscure vision outside the cockpit. While the instructor pilot observed from the front cockpit, I received and copied flight clearances from air traffic controllers, flew instrument departures, practiced high altitude enroute navigation, filed changes in flight plans to avoid threatening weather or other eventualities, circled in holding patterns, and executed various kinds of landing approach patterns to field minimums with missed approaches at the minimum descent altitude—all solely by reference to aircraft instruments.

At the end of instrument phase, I even learned how to recover from an unusual attitude on instruments. The rules of this intriguing game are simple. I am flying "under the bag." At a safe altitude, Jack takes control of the airplane. He asks me to close my eyes, whereupon he commences a series of aerobatic maneuvers to ensure I will have no idea about the attitude of the airplane when I reassume control of it. At some point in the maneuvers Jack announces, "You have the airplane; open your eyes

and recover to straight and level flight." The airplane may be in any conceivable pitch attitude—straight up, straight down, or anything between; at any bank angle—completely upright to completely inverted; and at any thrust setting—idle to full throttle. I must bring the plane under control referring only to its instruments—after all, I can't see outside the cockpit. Ordinarily I have no trouble doing this. In the few cases where I do, Jack graciously takes charge and—after the plane is under control again—helps me understand what I have done incorrectly. Recovery from unusual attitudes on instruments sounds difficult, but it really isn't. Moreover, this kind of training is a great confidence builder and a cheap form of life insurance, given the fact that if you experience a serious unexpected attitude in a jet—it happens, both in military and in civilian airplanes—and don't recover from it successfully, you aren't ever again going to have to face the same eventuality, or any other eventuality for that matter.

The last two flights in the instrument training phase at Kingsville are a two leg cross country with a night landing at a distant air base and return home the next day. I will fly the airplane under the bag from the back cockpit, with Jack watching me from the front. The flight I plan is from Kingsville to Phoenix, which explains how Jack and I came to be sitting in the Officers Club at Biggs Air Force Base in October 1960, our Cougar parked on the transient flight line and a slightly sick B-52 still in the process of being removed from the runway we consequently can't use to take off for our planned destination.

Saturday Morning

At six o'clock on Saturday morning, Jack and I meet as previously agreed at the flight line to continue our trip to Phoenix. Dawn is breaking. I wish I could say I arrived—to borrow a naval cliché—"bright-eyed and bushy-tailed." However, I seem to be suffering from too many libations and too little sleep, a common pilot's malady in that distant day of naval aviation. As it appears to my bleary eyes, Jack's diagnosis is about the same. We check the weather, file our flight plan in base operations, and—after gaining the attention of the crew at the transient flight line—walk out to man our airplane.

I am surprised to learn from Jack that I will be occupying the front cockpit. Perhaps he wishes to observe me from the back seat with eyes wide shut—after all, yesterday was a long day followed by a short night. The news about the front cockpit comes as a very mixed blessing. On the one hand, I am relieved that I will not have to fly under the bag on this leg of our cross country. I graciously take his determination to mean that my instrument training in the Cougar is complete, that I can now go on to the more exciting phases of advanced jet training—formation, gunnery, tactics, and carrier landings. I am also flattered that Jack trusts me to fly the airplane under the circumstances we find ourselves in. On the other hand, I am now presented



The author receiving Navy Wings of Gold at NAS Kingsville, Texas, February 1961.

**WE
COLLAPSE
ONTO THE
RUNWAY
LIKE A
SKEWERED
ALBATROSS**

with a challenge not unlike the one I faced on my first flight in the Cougar. I have spent my last forty flight hours in the back seat, where I have not had to be responsible for starting the airplane, performing post-start and pre-takeoff checks, and taxiing to the end of the runway. Moreover, I have logged merely fifteen hours of flight time in the front seat. Will I be able to perform front seat duties satisfactorily after so long an absence and with so little previous experience? For that matter, will I even be able to find the end of the runway—I have never flown the Cougar before from any airfield other than Kingsville?

Other salient considerations wander restlessly in my mind as we man the airplane. El Paso lies at 2,000 feet elevation, whereas the runway in Kingsville resides almost at sea level. A jet airplane's takeoff performance at 2,000 feet is significantly diminished compared to its performance at lower elevations. Not only does the engine produce less thrust at the higher elevation, the thinner air also means that our Cougar will have to achieve a higher ground speed before it develops enough lift to fly. Thus our takeoff roll at Biggs will last much longer and consume much more runway than a takeoff at Kingsville. Moreover, the Cougar—because of diminished thrust—will accelerate and climb more slowly after takeoff in El Paso than it does in Kingsville. I know all this academically, of course, but I have never experienced a high elevation takeoff. No worry, I tell myself, the bird will still fly. Moreover, Biggs is a bomber base. Airfield designers have given the B-52 pilots stationed here 13,500 feet of runway length, with 1,000 feet of paved overrun at either end in the event of a high speed rejected takeoff. That's as compared to 8,000 feet of runway in Kingsville, with no overrun other than the soft sands of the south Texas desert. We

have more than ample runway in El Paso to get airborne safely.

I start the airplane, perform the post-start checks with assistance from the ground crew, and obtain approval of our flight plan to Phoenix from air traffic control. We leave the transient line with a taxi clearance, and I find our way easily to the takeoff end of the only runway at Biggs. After completing the pre-takeoff checklist, I receive clearance from the tower and taxi into position for takeoff. Engine run-up is normal, and with concurrence from Jack I commence the takeoff roll. The Cougar accelerates slowly—very slowly it seems to me. Approaching rotation speed, we are eating up real estate rapidly. I ease the nose up and the airplane, breaking ground, begins to labor upward. A second or two later, the plane stops climbing and accelerating. This seems quite abnormal to me, but I am a student pilot—what do I know? Reluctantly, but with significant concern, I alert Jack to what I perceive as a problem. Is my hangover-enhanced inexperience tricking me, or is something actually wrong with our bird? Jack replies grumpily to the effect that there's no problem, it's just the high elevation, and takes control with the words, "I have the airplane." We are about 8,000 feet down the runway flying level 50 feet above the ground at 150 knots, not much above stall speed, with the landing gear and flaps still down.

As the echo of Jack's words dies out in the intercom, my question is answered. The engine of the Cougar quits. In a silent instant we collapse onto the runway like a skewered albatross. The impact is immense—harder by far than the hardest carrier landing I will ever experience, though carrier landings are often aptly described as controlled crashes. Amazingly, the landing gear on the Cougar holds together. Thank God we are flying a plane manufactured by the Iron Works, as Grumman Aviation is affectionately known to carrier aviators grateful to a company that designs airplanes strong enough to bear up under monumental structural abuse. A Cougar on takeoff holds a thousand gallons of highly inflammable jet fuel. If the landing gear had collapsed upon impact, the next thing tower controllers would have noticed is a huge fireball as fuel from ruptured tanks is torched off by the diamond heat of a jet engine. And that would have been the end of my flying career, and of Jack's as well, of course.

A flameout on takeoff! I have seen and responded to this scenario in virtually every simulator flight I have ever flown in advanced flight training—and I have completed many such flights. As a consequence, the procedures for this emergency are imprinted in my lower brain functions. To this day I can still clearly see and feel the cockpit controls used to remedy such an emergency—still remember how these controls must be manipulated, and in what order. Instinctively, without having to look, I ensure that the throttle lever is at the full thrust setting, then quickly move my left hand to a small toggle switch located midway and outboard on the cockpit console beside my left leg. Lifting its safety



The author in the cockpit of an F9F-8B Cougar fighter.

WE ARE SPINNING CLOCKWISE OUT OF CONTROL

cover, I reposition the switch to activate the engine's emergency fuel control, then hasten the same hand to a T-handle control located on the lower left portion of the instrument panel in front of me. I break the safety wire on the T-handle by rotating the handle one-quarter turn to the left, then pull the handle out to fire the engine's emergency igniters. This measured flurry of activity, highly rehearsed, takes not much longer than a second to complete, shorter by orders of magnitude than the time required to describe it.

The engine of our ailing Cougar surges to life and the airplane begins to accelerate down the runway. We still have about a mile of hard surface in front of us, and are not much below takeoff speed. If we keep going, we will easily get airborne before running off into the desert. In this actual emergency, things are evolving just as they have previously in my flight simulator rehearsals. But I have neglected to remember something crucial—I am no longer piloting the airplane! There is a cardinal rule about aircrew coordination—an airplane can be controlled by only one pilot at a time, and right now I am not that pilot. Jack has assumed command. I feel him hard on the brakes of the Cougar as he retards the throttle to idle. But he cannot shut down the engine from the back seat, a questionable limitation engineers incorporated presumably to protect hapless flight instructors from panicked students. But the student pilot here is in the wrong cockpit. "Secure the goddam engine, Rogers," Jack shouts from the back seat so loud I can almost hear him without the intercom. I retard the front seat throttle to the engine shut off position.

The few seconds since our engine quit seem in retrospect an eternity. During this brief time, I have apparently had not one conscious thought. Every response has been akin to a reflex. Now however I am returned to the conscious world, and what I see out the front windscreen strikes terror in my soul. Our speed is in excess of 100 knots—more than 115 miles per hour—and the end of the

runway has already passed under the nose of the aircraft. If we don't get stopped on the remaining hard surface of the overrun, the sands that lie beyond will grip our landing gear with claws of death, spinning us out of control. As if from above, I see a marvelously detailed image of our funeral pyre—the Cougar breaking up and burning in the soft desert sand off the end of the runway.

Need I say that the mind rejects such a prospect with enthusiastic rigor? My thoughts turn immediately to the possibility of emergency egress. At sea level, the Martin-Baker ejection seat in an F9F-8T is advertised to work at 80 knots or above, assuming only that the aircraft has no rate of descent when ejection occurs. However, we are not at sea level, and ejection seats are well known to malfunction. Pushing a seat's advertised capability is something no one in a right state of mind does willingly. As I reach above my head to grasp the ejection handle and pull the face curtain down smartly, initiating an ejection, I glance at the air-speed indicator and observe a speed just over 80 knots. The end of the overrun is coming up fast. Suddenly, a second stark graphic overwhelms my unhinging mind. Again as from above, I see myself after the contemplated ejection still strapped in the ejection seat and tipped forward onto the overrun in front of me, my crushed head sandwiched between the black metal hull of the seat and the concrete's abrasive hardness. The vision concentrates my mind wonderfully. I lower my raised hands and accept the absolute certainty that I must now ride the Cougar with Jack into the sands of the desert.

As we leave the hard surface of the overrun, a huge cloud of dust and sand envelops the airplane. We are spinning clockwise out of control, and I expect any moment that the aircraft will break up and that fumes from a ruptured fuel tank will ignite and torch us into eternity. But not so, of course! The airplane skids slowly to a stop, and one of us—I have no idea which one—activates the emergency air bottle that blows the canopy of the Cougar open. Jack and I are rapidly unstrapping from our seats as the dust settles around the airplane. Within perhaps twenty seconds we are both on the ground. The airplane has stopped no more than a basketball throw away from a chain link fence defining the field boundary. A quick perusal of the bird reveals something I have always considered to be miraculous. Beyond two blown tires and the need of a good wash down, our trusty Cougar appears to be undamaged—another testimonial to the damned fine work of the Grumman Iron Work engineers.

Nevertheless, Jack and I move away from the airplane quickly in consideration of the outside chance it might still go on fire. Within a minute or two of our departing the airplane, we see emergency crash vehicles and a pickup truck plowing through the desert toward us. The pickup driver turns out to be the commanding general of the Air Force base, who has come out to see what the hell two renegade Navy pilots are doing disturbing his

I CONSIDERED WITHDRAWING FROM FLIGHT TRAINING



real estate. After hearing a short version of our story, he gives us a ride back to base operations. Later our Cougar—fitted with two new tires—will be towed back to the flight line. Jack calls Kingsville to give them a report of our mishap, and a maintenance officer from our squadron arrives in El Paso in a second Cougar, which Jack and I then fly back to Kingsville. Over the weekend, the maintenance officer sees to it that the fuel control in our ailing Cougar is replaced and—after appropriate ground and flight testing—returns the plane to Kingsville. Our close encounter with death was caused by the malfunction of an engine part about the size of a shoebox—the jet engine equivalent of a carburetor or fuel injection system on an automobile engine.

That next week, my naval flight training continues as scheduled. I am never required to complete the cross country flight I had planned to Phoenix.

A Last Little Irony

So many pilots are memorable characters. I recall a hard-charging southern country-boy Delta Airline captain who commanded a reserve squadron I flew in. John Barnes—a likeable, take-no-prisoners sort of chap—had a favorite saying about the hazards of Naval Aviation: “If you can’t take a joke, you hadn’t oughta signed up.” That’s true—one needs a good sense of humor and strong defenses to fly Navy airplanes. And as it turned out, the cosmic trickster had one more little irony in store for Jack and me that long ago Saturday.

I suppose we must have looked a little bedraggled by the time the maintenance officer from our squadron in Kingsville landed in El Paso that Saturday afternoon. For sure, I felt much more than a little hung over and wrung out. I was just dog tired and relieved to be alive. Nothing else much mattered, or so I thought, until this Marine Corps captain maintenance officer—who had a certain son-of-a-bitch reputation anyway and who in

any event was clearly pissed off at having had his weekend interrupted by our mishap—took one look at us and assumed the worst. He never said as much, but beyond a doubt I know he assumed that there was nothing actually wrong with our airplane—that we had somehow screwed up the high elevation takeoff evolution and ended up lost out in the middle of the desert.

To make his point, the first thing Mr. Captain does is climb in the cockpit of our Cougar and attempt to start the engine. I’m sure he thought he would succeed. Jack and I—just as sure that he would fail—stand by observing this frivolous, highly insulting endeavor. In utter amazement, we watch as the Cougar’s engine surges to life and accelerates to idle thrust.

I never actually asked Jack how he felt when the engine lighted up, but I imagine it was akin to my own response. My heart sank in my chest as if weighed down by anchor chains. But then the trickster kindly turns the joke against our adversary the maintenance officer. When Mr. Captain advances the Cougar’s throttle out of the idle thrust setting, nothing happens. The engine, when operating in normal—as opposed to emergency—fuel control mode is incapable of responding to throttle movement. The Cougar’s power plant has indeed failed.

Later that afternoon Jack and I returned to Kingsville with unburdened hearts. A good night’s sleep that Saturday evening cured much of the rest of what was wrong with us.

Reflections

After such a close call with death, of course I considered withdrawing from flight training—DOR, it’s called, “drop on request.” I suspect most student aviators would have contemplated the same thing. Quite obviously I didn’t DOR, and in retrospect I have always considered that decision to be a good one. How could it be otherwise?

In my basic training at Whiting Field in

**NAVAL
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WORTH THE
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ENTAILS...
THE MISAD-
VENTURE AT
EL PASO
WAS A
WATERSHED
IN MY FLYING
CAREER**

Milton, Florida, and before that at Saufley Field in Pensacola for primary training, no student or instructor pilot had been killed while I was resident at either location. In the seven months I in was in advanced training, however, six or seven dramatic fatal crashes occurred at Kingsville or at its sister jet training base 80 miles north in Beeville, Texas. To fly military high performance jets, one must be able to accept the fact that some significant risk is involved. That is true today, and it was even truer in the 1960s. The Chance-Vought F8 Crusader—the plane I flew off carriers in the Mediterranean—suffered over 47 major accidents per 100,000 flight hours during its service life in the fleet. (The corresponding statistic for airliners today is way, way below 1.0.) The chances of being killed in a peacetime six-month cruise in the Mediterranean were about one in 50—that's about the same odds that Shuttle astronauts face today. Of 30 cadets in my Aviation Officer Candidate Pre-Flight class at Pensacola, at least two died in aircraft accidents before their five-year active-duty obligation expired. Not really bad odds perhaps, but not odds for everybody.

Somehow I was able to buy off on the idea that Naval Aviation is worth the risks it entails. In this respect, the misadventure at El Paso was a watershed in my flying career. Before El Paso, I had never really come to terms with the hazards of the occupation for which I had volunteered. Afterwards—to borrow a nice idea from the Irish poet W. B. Yeats—I learned to cast a cold eye on death. Perhaps it's a valuable lesson, perhaps not. I just don't know. I don't even know if it's a lesson teaching a truth or some kind of innocent lie. "Any fool," Samuel Beckett observes in his monograph on *Proust*, "can turn the blind eye. But who knows what the ostrich sees in the sand?"

What I find most interesting about what happened at El Paso is the improbably lucky sequence of eventualities that saved Jack and me, gracing us to fly another day. Suppose a B-52 with a malfunctioning brake had not closed the runway that Friday evening? Headed for Phoenix, we would have taken off from Biggs after dark. Would the engine have failed during that departure? If so, would our responses have been equally appropriate? Would we have ejected successfully? If we didn't eject, would we have survived a nighttime excursion off the runway? I don't know, of course, but realistically I have to think that's unlikely. A whimsical old saying about night flying seems worth mentioning: "Night flying is just like flying in the day except that you can't see anything at night." How true! And how infinitely more challenging at night to deal with aircraft emergencies than during the day!

The Cougar Jack and I flew from Kingsville to El Paso was three flights out of a major check and an engine change. It had passed a test flight coming out of check, but was written up for surging engine speed by the pilot who flew it next, immediately prior to our flight. Subsequently the aircraft was taken back to the high power engine run up

area, and the fuel control was retrimmed. Jack and I were the next pilots of the airplane. After we got airborne, and before we could depart for El Paso, Jack had to conduct an in-flight test on our airplane and radio the results back to our squadron operations. If the engine had not behaved itself, we would have had to land at Kingsville and wait for another plane to become available.

In retrospect, it seems clear that our bird had a fuel control just waiting for an opportune time to fail. What if the failure had occurred not at El Paso but at Kingsville, where the runway is only 8,000 feet long? When the engine quit, the outcome would have been a fireball in unprepared desert terrain. The odds of surviving such an impact are not one in a hundred, probably not one in a thousand or even in ten thousand. Of course, that doesn't mean things wouldn't have been resolved in our favor. Again, however, I have seriously to doubt it.

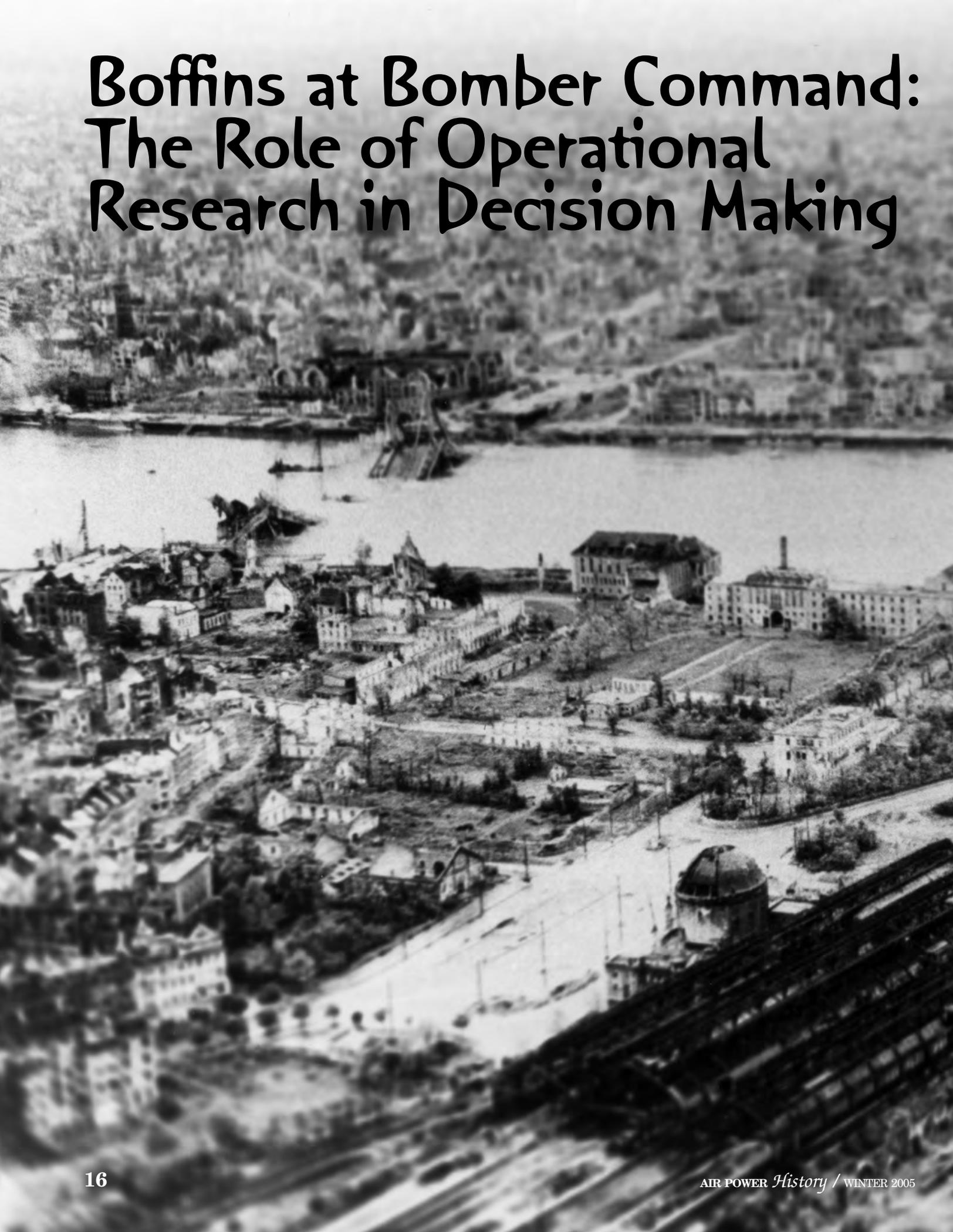
There is just one more idea to mention, and I am too old and petulant not to suggest that the question it raises is pregnant with a meaning beyond our current understanding. I experienced a vision of my body crushed between the Cougar's ejection seat and the runway, and this vision is what kept me from ejecting from the aircraft. From what I know of ejection seats of that era, coupled with our low airspeed and the fact that the ejection would have occurred at 2000 feet elevation rather than at sea level, I have always believed that I would have died if I had left the Cougar as it was decelerating to an ultimately safe stop. Yet I came close—very, very close—to ejecting. Why did I see myself dead on the runway? Did some kind of unconscious—a neuro-scientist might say paranormal—brain activity save my life? Who knows? The human mind is an incredible enigma.

Why did events work out as well as they did for Jack and me? So many eventualities could have led to a far different outcome of our misadventure. Why did I survive my flying career when so many of my friends in Naval aviation—and even after all these years I could easily name a dozen or fifteen without thinking very hard—did not? Such questions have no answers, but that doesn't keep them from continuing to crowd their way into one's imagination.

As everyone courageous enough to endure the truth knows, death is a mystery and life its unfathomable prelude. When we are young, we mostly like to live in the mystery. When we are old, we more and more are content merely to remember it, to talk about it, to try to parse some small portion of life's undecipherable text. But what do our meager efforts come to—just words that echo in the void. Were the seemingly heroic actions of our youth any more meaningful?

When pilots can no longer fly, they love to remember, to talk. When a pilot can no longer remember, no longer talk, who will care? Maybe someone, maybe no one. What difference does it make anyway? Flying teaches most pilots a poignant lesson—life is worth living. The rest, as Shakespeare reminds us, is silence. ■

Boffins at Bomber Command: The Role of Operational Research in Decision Making





Randall Wakelam

Most studies of Bomber Command leave one with the impression that Sir Arthur Harris managed operations almost single-handedly. Yet, those with an understanding of how large and complex organizations work will recognize that Harris could not have gathered, organized and acted on the plethora of data and factors that influenced daily and long term decisions. In fairness to those writing about Harris, this sort of description of commanders and headquarters is not unique to Bomber Command — it's just the way we tend to write about them.

This study will argue that the Operational Research (OR) Section of Bomber Command Headquarters provided scientifically derived conclusions and advice to Harris, as well as his predecessor and their key subordinates, to assist them with making technical and tactical decisions. Additionally it is hoped to illustrate that command is not the unitary activity that we might imagine, and perhaps even to suggest that Harris was not the donkeyesque Luddite that some might believe.

The study uses many of the usual Bomber Command sources, but is based largely on the Bomber Command ORS manuscript history and a number of AIR 14 files from the PRO. The paper begins with a broad review of concepts, issues and people before examining the some key events of 1941 and 1942.

What is OR?

Generically, OR has been described as “the use of scientific method in providing executive departments with a quantitative basis for decisions regarding the operations under their control.” In solving problems scientists and executives do not work in isolation; rather, “[t]he good planner, the good executive with imagination, has to be fully informed about ... capabilities and limitations [And] The good operational research worker will inevitably find himself drawn (given a not too hostile environment) into the planning.”¹

During the Second World War: “Past operations were studied to determine facts, theories were elaborated to explain the facts, and finally the facts and theories were used to make predictions about future operations.” The value of a quantitative assessment of particular circumstances was in the opportunity, frequently, to confirm the commander's intuitive conclusion with statistical analysis.²

Sir Robert Watson-Watt, pioneer of radar, saw a role for OR in confirming tactical efficiency. One needed, he was quoted:

to examine quantitatively whether the user organi-

*zation is getting from the operation of its equipment the best attainable contribution to its overall objective, what are the predominant factors governing the results attained, what changes in equipment or method can be reasonably expected to improve these results at a minimal cost in effort and in time, and the degree to which variations in the tactical objectives are likely to contribute to a more economical and timely attainment of the overall strategic objective.*³

Watson-Watt also formulated a short definition of OR stating simply that it sought: “maximum effect from available resources.”⁴

RAF OR before Bomber Command

Official sources indicate that the RAF first used OR during the development and fielding of air defense radar in Britain. It was not just the equipment that was invented, but also the modalities of employing the system and in this latter task OR played a central role. So valuable were these and other contributions that at the end of 1940 Air Chief Marshal Lord Hugh Dowding asked for the first permanent OR section (ORS) to be created in support of Fighter Command.⁵

In Coastal Command, scientists, first attached to integrate Air Detection of Surface Vessel (ASV) radar, also investigated the command's very low rate of U-boat sinkings. In what is considered among the “classics of operational research” (cited in many OR monographs) the boffins* were able to point out that both tactics and weapons were flawed. The resulting changes to depth charge settings and explosives resulted in an increase in sinking of near surface subs from 2-3 percent in 1941 to 40 percent in 1944.⁶

The Bombers' Problem

Sir Charles Webster and Noble Frankland, the official historians of Bomber Command, have explained that the “operational requirements of a strategic bombing force are easy to express and difficult to attain.” First, the force has to successfully penetrate enemy defenses and navigate to the target area. Then, it must be able to pinpoint and effectively bomb the objective and finally, “return to base without suffering more than a bearable casu-

* Boffin: a scientist working with the military who understands and contributes to the resolution of problems facing the operators. The term has its origins in the RAF of the 1930s. From “The Etymology of ‘Boffin’” in Ronald W. Clark *The Rise of the Boffins* (London: Phoenix House, 1963), pp vii-viii.

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PAST OPERATIONS WERE STUDIED TO DETERMINE FACTS, THEORIES WERE ELABORATED TO EXPLAIN THE FACTS, AND FINALLY THE FACTS AND THEORIES WERE USED TO MAKE PREDICTIONS



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alty rate.” “The bearable casualty rate is a variable and a relative factor which is influenced by the rate of destruction that can be achieved. The greater the rate of destruction, the greater is the casualty rate that can be sustained on each operation, for the fewer will be the number of operations which are required.”⁷ In other words, efficiency, “maximum effect from available resources” as Watson-Watt would say, was linked to success.

Initially problems were not recognized. For example, Harris, who commanded No 5 Group early in the war, said in his Memoirs that there was no reason to suspect the well trained pre-war crews were not getting to and bombing the target. Only with the introduction of bombing cameras did sufficient evidence finally begin to accumulate, he admitted, and this pointed to “the enormous possibilities of error in navigation by night.”⁸ Thus, in the summer of 1941, the Chief of the Air Staff, and former Air Officer Commanding-in-Chief (AOCinC) of Bomber Command, Sir Charles Portal, welcomed a review of air photos undertaken by the staff of Winston Churchill’s own scientific advisor, Lord Cherwell. Mr. D. M. Butt of the War Cabinet Secretariat reviewed available air photos and concluded that on nights without clear weather or moonlight of those aircraft claiming to have attacked their targets (thus leaving out those which made no such claim) only one third bombed within five miles of the aiming point; that is, somewhere in a 75 square mile area. When those aircraft that did not claim to have attacked were added the effective rate was estimated at one sixth.⁹ On September 11, Portal minuted the PM suggesting among other remedies the establishment of an ORS at Bomber Command headquarters in High Wycombe.¹⁰

Bomber Command ORS Mandate

In August, perhaps coincidentally, Harris’ predecessor, Sir Richard Peirse, had requested the creation of an OR section. In defining its mandate Peirse had said that: “Broadly speaking, [research should cover] the general study of operations with a view to *determining how the efficiency of operations in terms of bombs on target per aircraft lost could be increased.*”¹¹ [emphasis added]

Dr. Basil Dickins, working for the Ministry of Aircraft Production, but since the previous year tasked with producing monthly analyses known as “Report[s] on Losses and Interceptions of Bomber Command Aircraft”,¹² was named section head. In describing their role he said that while the scientists would from time to time receive high priority tasks from their seniors, “normally the items for research originated in the section itself. A detailed research program was prepared occasionally and submitted to the Commander-in-Chief and the Senior Air Staff Officer for approval and guidance as to priorities.”¹³

Initially there was some trial and error in defining functions, but by early 1942 the organization had been arranged into three sections: “Research into success of Night Operations; Research into losses in Night Operations; Research into Day Operations.” An ORS 4 was created in mid-1942 with a broad mandate including the extremely important production of the Bomber Command Quarterly Review and the Bomber Command Raid Reports – publications which got the word out to the stations and ultimately the crews. Radar and manpower sections were soon added.¹⁴ By August 1943, the organization had grown from an initial complement of just seven researchers to 55 scientists and 10 “laboratory assistants.”¹⁵

Research Processes

Chapter 2 of the ORS manuscript describes the collection and analysis of data. The placement of this discussion early in the body of the history is significant, for arguably the legitimacy of the Section’s conclusions and recommendations had everything to do with the soundness of its collection and interpretation of data. Amassing, sorting and analysing information on both successful and failed raids was a considerable task rendered more difficult by the fact that Bomber Command was involved in a major raid – the equivalent to a land or sea battle – several times a month. But the task was worth the effort, for it could reveal whether tactics and techniques were working or not. “The problem is to reconstruct the raid, compare it with the plan, and (if possible) to account for major discrepancies between them.”¹⁶ Initially, data, particularly bomb release photos, was insufficient to offer valid conclusions, but by the beginning of 1943 Dickins was satisfied with the sample sizes being achieved¹⁷ and, by later in the year, with the analysis processes.



I REALIZED THAT HE WAS NOT UNCOOPERATIVE, [AND ONCE COMMITTED TO AN IDEA] EVEN IF HE OPPOSED ITS INCEPTION, HE GAVE HIS FULL SUPPORT...

There were two types of analyses. Qualitative analysis permitted the rapid estimation of tactical successes or failures and the results were published as soon as possible in ORS reports which were distributed within the headquarters and to the Groups involved. The product of quantitative analysis, on the other hand, was a set of numerical conclusions, descriptive in nature, and not all that well suited for publication. Yet it was the quantitative data which permitted comparison of different techniques and of the accuracy of attacks under different conditions, while also permitting estimates of “the weight of attack required in future operations.”¹⁸

Dickins

Basil Dickins had received his Ph.D. in 1929 from the Royal College of Science¹⁹ and soon joined the staff at RAE Farnborough. In 1936, he was recruited by Sir Henry Tizard to work on the integration of radar into the air defense system—specifically the control of ground based interceptors.²⁰ By 1939, he was employed in research on atomic weapons.²¹ Given the import of these projects, Dickins was seen by some of his seniors within the scientific world as an up and coming researcher. The official historians seem to confirm this, indicating that: “The appointment of Dr. Dickins as head of the ... Operational Research Section of Bomber Command was an event of scarcely less importance than the widespread introduction of night photography.”²²

Sir Solly Zuckerman, himself a rising defense scientist who went on to important posts after the war, had a different view of Dickins however. Zuckerman implicitly questioned Dickins independence, when the latter’s recommendations on bombing requirements for the pre-Overload “Transportation Plan” (a creation of Zuckerman’s

own thinking one should remember) seemed to crumble under scrutiny.

*This was the first, but unfortunately not the last time that it became apparent to me that not all scientists who during the war had been drawn into Service posts were as questioning and as independent in their judgements as they could have been. On occasion, they were constrained by assumptions which uncannily fitted their masters’ preconceived ideas.*²³

Other writers have come to similar conclusions, seeing Dickins as a good scientist but one lacking the seniority to deal with his service chiefs.²⁴ In his memoirs, Harris, Dickins’ master, refers to the scientist only once, calling the him both “brilliant” and “young”.²⁵

Harris

“Butcher” Harris is often mythologized as the cold, distant Bomber Baron who would dully throw his crews, attrition style, against the German defenses. Max Hastings is typical of critics who believe that Harris did not have a quick intellect: “A good case can be made that he was slow to grasp the possibilities and limitations of the new generation of radar technology.”²⁶ Hastings further feels that Harris’ staff were toadies: “There appears to have been a chronic lack of open, critical debate. ... [with] too many weak men and sycophants around the throne...”²⁷

A different view was held by Charles Carrington, the Army LO in Bomber Command HQ during most of the war. Carrington had served in the Great War with Harris’ Senior Air Staff Officer, Robert Saundby, and was well connected in academe and publishing circles between the wars. He assessed Harris through the eyes of a contemporary: “Bert’ Harris ... was the most dominating personality with whom I became acquainted in the Second World War.”²⁸ “No one doubted that he was a master of his trade and had been so since [the last war] when he was a young pioneer of night-fighting. With his power of concentration on the aim, while excluding the irrelevant, he retained a rugged common-sense.... As I came to know him better... I realized that he was not uncooperative, [and once committed to an idea] even if he opposed its inception, he gave his full support....”²⁹

Henry Probert, Harris’ most recent biographer, says that while Harris might be abrasive, he had “an intensively [sic] active and fertile mind eager to leave no stone unturned in the effort to prepare ... for the concentrated operations that lay ahead.”³⁰

We might well conclude that, while passionate, Harris would have been open to sound counsel, even that which might have run contrary to intuition or past practice.

Boffins and Bombers

Given these pieces of the puzzle one is then left

AT THIS POINT DICKINS PROPOSED EXPERIMENTS TO VARY CONCENTRATIONS FROM AS MANY AS 200 AIRCRAFT PER HOUR TO AS FEW AS 50, AND ALSO TO VARY PENETRATIONS OF DEFENDED BELTS BETWEEN CROSS SECTIONS OF 20 TO 50 MILES IN WIDTH

to ask how exactly the RAF officers would get on with the scientists and vice versa. It was Carrington's general impression that: "the warriors, generals and marshals, were, in their hearts, a little afraid of these master-minds."³¹ Yet aviators like Coastal Command's Air Marshal Sir Jack Slessor³² and Dowding were most appreciative of the contribution of their boffins. The latter, as he departed from Fighter Command, sent his scientists a note saying: "Thanks. This war will be won by science thoughtfully applied to operational needs."³³

In addition to continuous support from the AOCinC and SASO Dickins indicated a close working relationship between the scientists and the uniformed staff.

*It is important to stress that the Section functioned as an integral part of the Command and worked in the closest collaboration with the other branches of the Headquarters. In fact, it is not too much to say that such success as was achieved by the Section was as much due to the receptiveness of the Service as to the efforts of the Scientists.*³⁴

*The incursion of the scientist into the field of operations, was, after all, an innovation insofar as most of the service staff was concerned and in a large headquarters opposition in some quarters was to be expected. Most of it was short lived and the remainder removed by postings occurring in the normal course of events.*³⁵

Dickins added that once the scientists had learned the ropes "no proposal made by the O.R.S. was ever turned down by the command on the grounds of impracticability."³⁶

The First Year

Within days of their arrival the boffins were asked by the AOCinC to sort out poor results, but they were reluctant, stating insufficient and "scanty" evidence.³⁷ By the end of September, however, they were able to make a definite connection between the condition of the moon and a raid's success. They were still clearly concerned by the reliability of the data, however, signalling "the inherent unreliability of crews' reports and the danger of basing any conclusions as to the success of the attack on these alone."³⁸ December saw the conclusion of a large trial which attempted to gain a better understanding of what crews actually thought they were seeing at night. The scientists gauged from this that there was a "big difference in the reliability of various ground features." Lakes and rivers, although very popular, had proved to be particularly unreliable, while coastal features including docks were relatively "trustworthy."³⁹ The boffins' report was circulated to all command organizations and emphasized the requirement to focus on mapreading skills, both in theory and in practice.⁴⁰ They were evidently not shy of offering criticism, but as importantly the Service officers did not

shy away from getting the scientific views out to the flying stations.

Navigating to the target area, and finding the target could both be addressed to some extent, it was generally accepted, by the operational use of the navigation device T.R. 1335, or Gee as it had been dubbed. After they had recommended that research be conducted to find the best means of using Gee, the AOCinC "entrusted" the scientists "with the task of drawing up detailed plans for such experiments." A plan was developed and two experimental attacks, code named Crackers I and II, were conducted on February 13 and 20, to confirm the soundness of the nascent 'Shaker' attack protocol.⁴¹ A 'Shaker' attack would consist of three waves: Gee-equipped flare dropping 'Illuminators', incendiary dropping 'Target markers' and finally the 'Followers' bombing with high explosives. Just days after Harris took command the procedure was tested during the very successful attack on Renault factory at Billancourt near Paris on 3 March 1942.⁴² It is fascinating to note is that it had been the scientists — not the flyers on staff — who were given the task of sorting out the operational use of Gee.

Meanwhile, the boffins had been drawn into the debate over the concentration of bombers in space and time. It appears from minutes in Bomber Command files that at the beginning of 1941 a concentration of 60 to 100 aircraft per hour over the target was about all the senior staffs felt comfortable with.⁴³ Then, on August 30, a skeptical G/C Ops minuted Saundby reporting that a No 4 Group study had surprisingly indicated that losses seemed to decrease proportionally with concentration. Dickins too was unconvinced and said that he would be investigating the matter in some depth. "In the meantime," he said, "I would endorse the proposal to concentrate aircraft in time and place so that while in enemy territory as many aircraft as possible are in the same 'room' at the same time."⁴⁴ Within sixty days the ORS had analysed raids on Cologne and Frankfurt and felt that: "From the very flimsy evidence available it would thus appear that for attacks on these towns there is something to be gained by concentration."⁴⁵ Despite attempts to increase concentration and having received related criticism from the Deputy CAS, the Ops staff pointed out that there were no effective data for measuring the "efficacy of concentration in time and space." At this point Dickins proposed experiments to vary concentrations from as many as 200 aircraft per hour to as few as 50, and also to vary penetrations of defended belts between cross sections of 20 to 50 miles in width.⁴⁶

The results were back by the end of March 1942. The conclusion of the study on time was that concentrations of less than 50 raiders per hour had measurably higher loss rates than those of greater density. The scientists admitted that their results were not conclusive, but "confirm, however, the suggestion that high concentration will help reduce the losses and raids are being planned accordingly. The effect of higher concentration will be watched



HARRIS ADMITTED THAT WHILE THERE WAS ROOM TO REDUCE THESE IMPACTS THE VALUE OF A REAL MISSION TO AIRCREW NEARING THE END OF THEIR TRAINING WAS MUCH GREATER THAN THE USUAL LEAFLET OR MINELAYING SORTIES

with a view to confirmation of this present trend.” They recommended as well the use of larger raids as the loss rate appeared to be lower for the bigger ops.⁴⁷ Once again it was the scientists who had sorted through the issues and if we may read between the lines we can surmise that the Ops staff were acting on their recommendations.

Experiments continued and by the end of May the section tabled a report showing inverse correlation between concentrations in both time and space and losses.⁴⁸ Days later, on June 4, 1942, A/Cdre Harrison, the DSASO, asked Dickins for an abridged version of this report as he wanted to circulate it to the stations for presentation to the crews.⁴⁹ Here again was clear indication that the scientists’ conclusions were being heard and accepted.

Concentration and the ability to use Gee to actually get the raid to the target had been key elements in Harris’ big raid on Cologne—the 1,000-plane raid—which had taken place just days before, on the night of May 30.

Prior to target selection the ORS had done a detailed review of the past year’s raids and Dickins was called in to brief Harris on their findings. Ralph Barker, author of *The Thousand Plan*, describes how the scientist went toe to toe with his commander. Dickins was firm that the attack should take place within Gee range and repeatedly recommended Cologne, despite Harris’ desire to attack Hamburg, which, as a port, Dickins agreed would be easy to find. “At the end Harris said ‘I still want to take on Hamburg.’ ‘Stay within Gee coverage,’ advised Dickins. ‘Go to Cologne.’” The Op Order for the raid continued to show Hamburg as the primary target,⁵⁰ with Cologne as the alternate, but according to Barker, Harris had actually heard and accepted Dickins counsel. “He had come to rely on Dickins’s flair for finding out before a raid what

to expect from it.”⁵¹

Harris wanted the raid to be a big one because, as the boffins had previously concluded, this was the only way to saturate the defenses. Yet, he remained concerned because there was no prior experience with concentrations of 10 or more per minute. After receiving ORS advice about the minimal chance of collision he concluded that: “It was obviously much better to accept such a risk, which would mean that two or three aircraft were lost in a really heavy attack, if by doing so we could prevent the loss of 40 or 50 aircraft from night fighters and flak.”⁵² In a letter to AOCinC Coastal Command he wrote: “... the risk of collision is, in my opinion, more than counterbalanced by the complete confusion which will be caused to the enemy’s locator system and gunnery.”⁵³

Another concern in mounting the raid had been the potential impact on the OTUs which would have to temporarily stop training in order to make up the numbers for the attack and would also risk lost production due to casualties. In a meeting with the CAS after the raid Harris admitted that while there was room to reduce these impacts the value of a real mission to aircrew nearing the end of their training was much greater than the usual leaflet or minelaying sorties. And aircraft losses, he said, had been “compensated for by the increased keenness and efficiency of the maintenance personnel, which resulted in a higher rate of serviceability. He was convinced that the intangible advantages of using OTU’s in operations far outweighed the tangible losses...”⁵⁴

At the end of October, the ORS reported on their analysis of OTU participation in the major raids of the summer. They had concluded that OTU crews contributed significantly where raids were conducted in good weather, but not so in poor conditions. As well, they determined that impacts on production could be avoided and that: “increased keenness will make good for the loss of flying incurred.” But they also cautioned, “When, as at present, there is a shortage of crews in the heavy squadrons, Conversion Units and Flights [as opposed to OTUs] should not be used.”⁵⁵ Thus, while their quantitative examination generally confirmed Harris’ intuition they had not rubber stamped his views.

Did OR influence decisions, and so what?

The existing discourse on Sir Arthur Harris and Bomber Command tells us much about the bombing campaign. But what we do not yet adequately understand is how Harris came to make his tactical and technical decisions, the decisions that affected the day to day efficiency and effectiveness of operations and that might ultimately make his operational goals attainable. This paper has attempted to illuminate one element of this issue, and to show that while Harris was undoubtedly the decision maker he had access to and accepted the advice of his Operational Research staff. Indeed, Harris was certainly effusive about

his boffins: "An Operational Research Section is indispensable....[and]... the work of the large research section of my Command saved thousands of lives and hundreds of aircraft."⁵⁶ He might have added that it rendered the work of the Command more efficient at the same time.

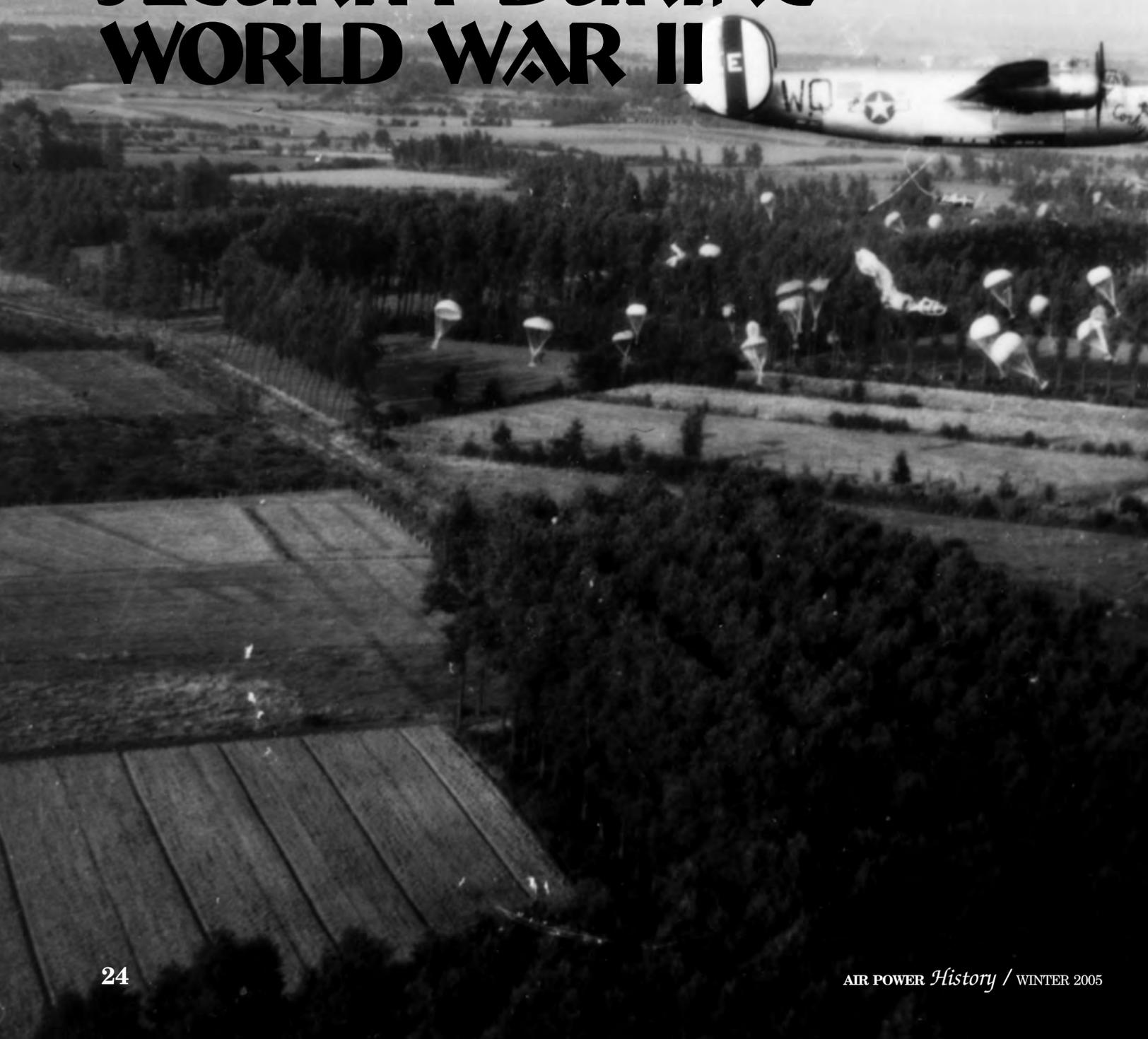
Arguably, both air historians and aviators still have room to better understand the notions of senior level command. The case of Harris and his

ORS staff shows us that there are facets of command at the operational and strategic level, and even the high tactical level that we have not yet fully grasped. Indeed, as contemporary military operations draw more and more on the expertise of the staff in advising commanders, it is incumbent on historians to provide the most complete insight possible of how these relationships have functioned in the past. ■

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25. Harris, *Bomber Offensive*, p.133.
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27. Hastings, *Bomber Command*, p. 247.
28. Charles Carrington, *Soldier at Bomber Command* (London: Leo Cooper, 1987), pp. 85-86.
29. Carrington, *Soldier at Bomber Command*, p. 131.
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44. Minute 113 BC G/C Ops to SASO, Aug 30,1941; Minute 117 BC OiC ORS to SASO, Sep 4, 1941, PRO AIR 14/396
45. BC ORS Memorandum No 9, Nov 1, 1941. PRO AIR 14/363.
46. Minutes 25, 26, 27, 34 and 35, PRO AIR 14/396.
47. In sending this report to the Ministry the SASO was able to report that the study had led to increases in concentration on recent raids and that staffs were actually planning concentrations of 150-200 aircraft per hour with the use of TR 1335 (Gee). Letter Saundby to Under Secretary of State, Mar 28, 1942, covering BC ORS Report 29, Mar 11, 1942, PRO AIR 14/396.
48. BC ORS Report No 34, May 30, 1942, PRO AIR 14/396.
49. Minute from A/C Harrison to Dickins, Jun 4 1942, PRO AIR 14/396.
50. The operation order for the raid did list Hamburg as the primary target, with Cologne as the alternate. Of note the attack at Hamburg was planned for 60 minutes (16.7 aircraft per minute for 1,000 raiders) while Cologne was scheduled for 90 minutes (11 aircraft per minute). BC Op Order No 148, May 26,1942, PRO AIR 14/276.
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THE *EUREKA-REBECCA* COMPROMISE: ANOTHER LOOK AT SPECIAL OPERATIONS SECURITY DURING WORLD WAR II





Chris Burton



(Overleaf) Paratroops plunge toward the drop zone. (USAF Photo.)

(Above) Rebecca aircraft on approach diagram. (Except where otherwise noted the images are taken from a training film co-produced by the OSS and the U.S. AAF, titled, "Blind Bombing," [undated but produced in December 1944], OSS no. PO-86, motion picture, 16mm, 14 minutes, control number NWDM(m)-226-B-6249, accession number NN 376-10. RG 226, Series B, Item 6249, rolls 1 & 2, NARA.)

DEPLOYING THE HIGHLY CLASSIFIED BEACONS IN ENEMY TERRITORY HELD SUBSTANTIAL RISK

One month after World War II, Major General Sir Colin Gubbins, the Chief of the British Special Operations Executive (SOE), requested that the Washington Headquarters of the American Office of Strategic Services (OSS) search its captured German document collection for information regarding German wartime knowledge of SOE or OSS secret operations. Both the SOE and the Special Operations Branch of the OSS ran hundreds of clandestine operations during the war, parachuting agents far behind enemy lines. Yet, SOE's discovery in 1944 of the German security services' infiltration of SOE's Holland agent network, together with the beginning of acrimonious postwar debates about SOE's failure in Holland, necessitated Gubbins' investigation into German records.¹

OSS Washington forwarded Gubbins' request to the OSS London office, then in the process of consolidating its operational files with the war now over. The London office produced four captured documents that dealt with Allied special operations, but none of the items proved pertinent to Gubbins' specific inquiries. One of these documents, however, would have interested any of the clandestine services during the war had it been forwarded to their air operations personnel. The document indicated that German army intelligence had issued a secret directive on the British Special Air Service (SAS).² Although the directive consisted only of a general, two-page narrative on SAS tactics, it indicated German familiarity with a special piece of electronic equipment carried by SAS, SOE, and OSS

teams—a compact radar navigation homing beacon which those groups had considered a closely held secret. The Allies nicknamed this radar set *Eureka*, a Greek term meaning, "I have found it."

Recently declassified OSS records show the regular employment of Eureka radar beacons in clandestine drop zone (DZ) operations.³ Allied special operations groups—the SAS, SOE, and the OSS—relied upon portable Eureka sets in all theaters because the ground-based, pre-positioned radar beacons enabled Allied aircraft, equipped with the *Rebecca* counterpart, to locate agent and supply DZs far behind enemy lines. Yet, deploying the highly classified beacons in enemy territory held substantial risk because these sets, if captured, could be activated to lure unsuspecting airborne agents and commando teams to certain capture. Although OSS documentation discloses the training, employment, and extreme secrecy surrounding Eureka-Rebecca system, these records also reveal that Allied special operations commands neglected to weigh the possible consequences whenever agents lost Eureka sets either accidentally during nighttime airdrops, or directly to the enemy.⁴ Furthermore, the postwar inquiries into SOE's Holland disaster confirmed what may have been suspected—yet not circulated throughout the special operations community—that as early as 1942 the Germans had captured and activated Eureka beacons in order to manipulate Allied DZs. Due to these gaps in operational security, Allied commands continued to issue Eureka beacons throughout the war without modifications that would limit their vulnerability to further enemy exploitation.

More than sixty years later, historical assessments of enemy technical countermeasures to Allied special operations tend to concentrate on German *Funkspiele* or "radio games," that often deceived Allied special operations headquarters through the playback of captured agent radio transmitters. This paper builds upon that premise and suggests that, in certain cases, German manipulation of the Allies' Eureka-Rebecca system could not only in theory produce an effective countermeasure, but could also compromise an important layer of Allied security and provide Berlin the initial, technical capability to infiltrate Allied special operations. German manipulation of Eureka-Rebecca could theoretically simulate special operations DZs to establish a trap for the capture of Allied personnel, and to help provide a foundation for the subsequent radio games whose devastating impact ended so many clandestine operations.⁵

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OSS agent with Eureka.

Early Compromises of the Eureka-Rebecca System

TO AVOID COMPROMISE OF EUREKA BEACONS, BRITAIN'S TRE ENGINEERED SECURITY FEATURES INTO THE BEACON DESIGN

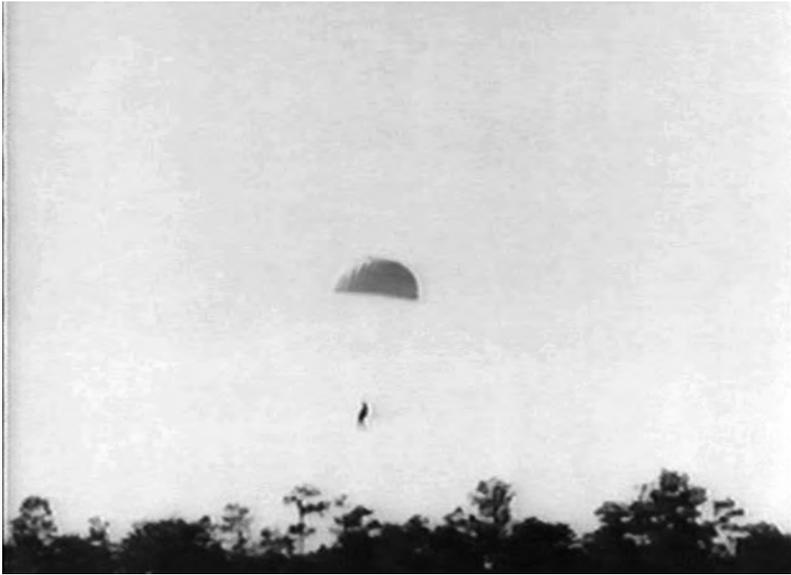
After the fall of France in 1940, London gradually introduced clandestine operations into the European Theater to destabilize the German occupation. Operations by air, however, had delivered only a few agents by 1942. This modest start reflected not only the beginnings of a new type of warfare, but also the constraints of successfully delivering agents by air during the limited full-moon period available each month. In 1941, following the Air Ministry's substantial success with defensive radar development and employment during the Battle of Britain, the British Telecommunications Research Establishment (TRE) developed a concept employing a small ground-based radar beacon that enhanced clandestine air navigation, particularly at night. TRE personnel nicknamed the ground portion *Eureka*, and the airborne counterpart *Rebecca*, and began developing test sets for some of the first British special operations.⁶

London fielded preliminary versions of an "Mk I" Eureka radar beacon in Holland and Czechoslovakia, where the devices first fell into German hands. In March 1942, the British Royal Air Force (RAF) dropped three SOE-trained Czech agents into German-occupied Czechoslovakia. This team, code-named *Out Distance*, carried one of these beacons. *Out Distance's* unique mission required the placement of the Eureka beside the Czech Skoda steel works, at that time producing weaponry for the German armed forces. The RAF planned to send bombers to home-in on the beacon, and destroy the factory. Like a number of the Czech teams dropped into Czechoslovakia in 1942, however, *Out Distance* found conditions there extremely hostile, and two of its three members quickly fell victim to the *Gestapo* (German Secret State Police). A Czech farmer subsequently found their Eureka beacon hidden on his farm and turned it over to the *Gestapo*.⁷ Shortly after the neutral-

ization of *Out Distance*, SS Lt. Gen. Reinhard Heydrich, the former *Gestapo* chief recently appointed acting *Reichsprotektor* of Czechoslovakia, wrote Adolf Hitler's aide, Martin Bormann. In his memo, Heydrich reviewed the recent capture of clandestine equipment in Czechoslovakia, and drew a link to reports he had read about similar "modern equipment" German intelligence recently discovered in Holland.⁸

In March 1942, the counterintelligence service of the German armed forces high command, the *Abwehr*, began Operation "North Pole," a long-term penetration and manipulation of SOE's Holland agent network. By 1944 the *Abwehr* in Holland, under the direction of Maj. H. J. Giskes, would capture more than fifty British agents, most of Dutch nationality, which London had sent back into the Netherlands for sabotage operations. In one of the longest and most disastrous radio games of the War, the *Abwehr* teamed with the German SS Security Service (SD), to force captured agents to radio false messages to SOE's Dutch section in London. They intended to deceive SOE into continuing additional DZ operations that would also fall under German control. Berlin could then neutralize or manipulate Allied clandestine operations in the country.⁹ In May 1942, Giskes' team, with the assistance of Dutch police impersonating resistance agents, captured SOE's *Beetroot* team on their own DZ, along with the team's Eureka beacon. SOE had recently trained the two Dutch operatives of *Beetroot* on the Eureka system, in order that they could then instruct other agents in Holland on its use. German radio experts, when they first analyzed *Beetroot's* Eureka, concluded the set was some type of aircraft beacon device; but the *Abwehr* did not understand its true use until told by *Beetroot's* agents under interrogation. The German *Abwehr* essentially received a description of the Eureka's operation by experts specifically trained to teach Eureka use to Allied agents.¹⁰

The Eureka beacon presented a unique problem for Allied designers, because the secret system had to be employed behind enemy lines. While the range and frequencies of the Eureka system remained classified until the end of the war, the Allies considered the *fact* that their agents used such a device, *secret* through most of 1943. To avoid compromise of Eureka beacons, therefore, Britain's TRE engineered security features into the beacon design. Yet these protective measures failed in both Czechoslovakia and Holland. The Eureka's passive frequency design (the beacons activated only when prompted by friendly aircraft emitting Rebecca's interrogating frequency), intended to deny enemy electronic "direction-finding" operations against active beacons, could prove irrelevant. For instance, the *Gestapo* captured intact *Out Distance's* Eureka hidden away at a farm; and the *Abwehr's* radio game with SOE put *Beetroot's* DZ (and their Eureka) directly in German hands. In both cases, the assumed electronic countermeasure difficulties against a passive system like the Eureka never materialized. In addition, the lack of an agent's



OSS agent parachutes in.

**GERMAN
COUNTERIN-
TELLIGENCE
MANAGED AS
MANY AS
THIRTY
FALSE DZs IN
HOLLAND TO
ENTRAP
PARACHUT-
ING AGENTS**

supplemental flashlight signal, typically required to assure approaching Allied aircraft that the beacon was in friendly hands, proved irrelevant in Holland. On his first attempt to use the Eureka in Holland, Giskes took the beacon to a known Allied DZ, and waited until late evening to activate the set. Giskes' team heard an approaching RAF aircraft, but never sighted the plane in the pitch-black sky and never attempted a supplemental flashlight signal; but Giskes did receive a drop of six Allied equipment containers intended for Dutch resistance. Giskes' first employment of his captured Eureka required no supplemental security whatsoever.¹¹

Giskes continued to capture additional Eureka radar beacons until 1944, when London had deduced the German penetration of its Holland agent network.¹² During this period German counterintelligence managed as many as thirty false DZs in Holland to entrap parachuting agents. The *Abwehr's* correct employment of captured Eureka at many of these DZs permitted the continued deception of SOE's Dutch section in London. Eureka manipulation became a ruse critical to the success of Berlin's main deception effort against Allied special operations—the subsequent playback of captured radio sets, the disastrous impact of which is widely acknowledged today. After London's postwar investigation into the Holland debacle, British intelligence could certainly conclude that the Eureka was compromised. But during the War, there appears to have been no recommendation to change the frequencies of new Eureka production models, and Eureka technology carried no warning about its potential compromise when in early 1943 design plans for the British Eureka-Rebecca system arrived in Washington for mass production by American industry.¹³

In early 1943, Britain's TRE briefed U.S. Army Signal Corps officers on the operation of the Eureka-Rebecca system. The Signal Corps saw immediate use for the Eureka beacon in U.S. airborne operations, and arranged priority shipment

to the War Department of design plans and samples of the British Eureka beacon and the airborne interrogating component, Rebecca.¹⁴ But the War Department had already tested the Eureka-Rebecca system. A few months earlier the Signal Corps had ordered one of its TRE-trained Signal Corps officers to fly from London to Gibraltar to brief the OSS, which planned to employ the Eureka beacon for the impending November 1942 Allied landings in Algeria, North Africa, codenamed Torch. In late October, as Capt. Gordon Browne of the OSS, sat at his communications post in Gibraltar, he received orders to attend a secret meeting at the British governor's Gibraltar residence. Upon his arrival, a Signal Corps officer laid out an Mk I Eureka beacon on the governor's living-room floor and instructed Browne on its use. Browne's mission was strategic: he was to courier the Eureka to Morocco and, shortly before the November 8 invasion, smuggle the secret device into Algeria and activate the beacon near airfields just outside of Oran. U.S. Army Air Forces (AAF) C-47 transport aircraft originating from England were then to home-in on the Eureka beacon, and drop American paratroopers to capture the airfields from Vichy French forces.¹⁵

One month after the Torch landings, Browne sent a copy of his after-action report to the OSS chief, Col. (later General) William A. Donovan. Browne recommended immediate adoption of the Eureka beacon for OSS clandestine DZ operations. In Washington, Donovan forwarded Browne's report to his communications branch. These officers also recommended OSS acquisition of the Eureka system, and warned that "Because of the extreme secrecy surrounding this apparatus," OSS procurement should be handled only at the highest channels. Eureka secrecy explains why OSS Washington had not previously learned of the device, but its inquires soon found that the Signal Corps was already examining British Eureka sets obtained through a highly classified procurement project. Donovan's staff subsequently recommended against duplication of effort, leaving the Signal Corps with sole responsibility for procurement.¹⁶

The Torch landings, however, introduced to the Americans the difficulties they too would experience attempting to ensure Eureka security. Browne's after-action report described the near-capture of his Eureka by Vichy French forces. An unfortunate risk, since bad weather over the Bay of Biscay had already dispersed the C-47 paratroop transports; most aircraft became lost, and none came close enough to trigger the Eureka beacon and establish a radar link to the Oran DZ.¹⁷ Lost pilots diverted their C-47s to emergency landing fields across much of the North African coast. A few aircraft landed farther west in neutral Spanish Morocco, where Spanish authorities interned the planes and their crews. The crew of one of these C-47s failed to destroy the aircraft's instruments before internment—instruments that probably included an early version of Rebecca. Neither the



OSS agent prepares Eureka.

U.S. AND BRITISH EUREKAS WOULD SHARE FIVE FREQUENCIES FOR STANDARDIZATION

Signal Corps nor presumably Britain's TRE learned of the possible compromise.¹⁸ Nevertheless, German intelligence soon afterward captured a Rebecca set in Europe. Allied bombers based in England conducted numerous special operations and agent supply operations over Holland and, according to the *Abwehr's* Major Giskes, in early 1943 *Luftwaffe* (German airforce) technicians pulled a Rebecca set from a crashed British bomber. Moreover, by mid-1943 Allied ground crews received orders to outfit conventional bombers with the Rebecca radar set. While this addition increased operational efficiency—aircraft pulled from scheduled bombing missions to support agent supply operations would not require time-consuming Rebecca retrofitting—it also increased the odds of Rebecca compromise in emergency landings behind enemy lines.¹⁹

These early-war compromises continued. During the July 1943 Allied landings in Sicily, American airborne and British airborne and SAS units employed early forms of radar beacon technology. Whereas the British employed early models of their Eureka beacons, the Americans modified existing versions of the U.S. AAF's Mk III IFF ("identification, friend or foe") radar system because American-produced Eureka beacons were not yet available. Allied fighter and bomber units normally fitted the IFF system in the forward sections of their aircraft, so that airfields and ships could identify friendly aircraft. Since the IFF and Eureka beacon shared similar operating principles, American airborne units in Sicily used existing IFF sets as interim ground navigation beacons. But the security of this system was in doubt too. By the end of 1943, Allied intelligence reports from both the European and Pacific theaters indicated that German and Japanese forces had captured the Mk III IFF system. Worse, they were mimicking the system in order to deceive Allied forces.²⁰ These examples suggest that by the early stages of U.S. Eureka production the enemy had already developed an ability to manipulate not only the early

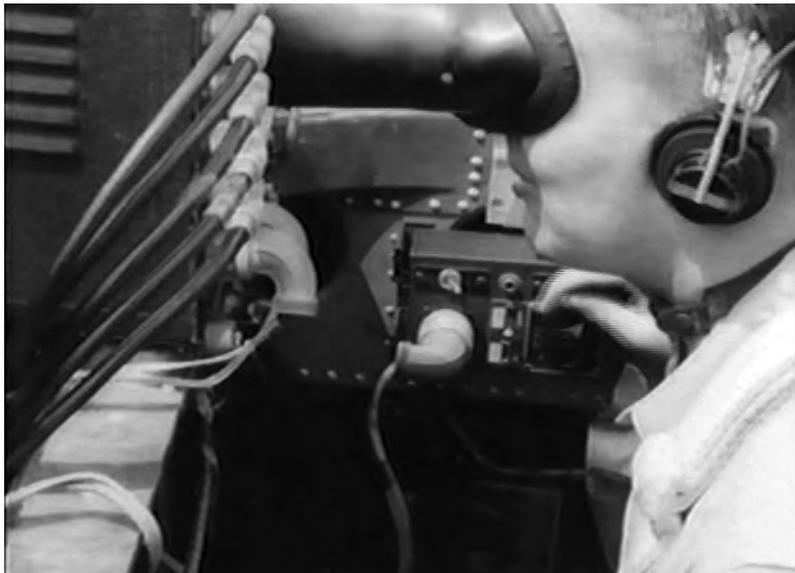
British Eureka models captured in Czechoslovakia and Holland, but other types of emerging radar beacon technology as well. If so, even short-term security may have been impossible to maintain for classified radar systems meant for use inside, or over, enemy territory.

U.S. Eureka Beacon Development and Employment

In early 1943, London forwarded the design plans and samples of the British Eureka-Rebecca system to the U.S. War Department, which then ordered the Signal Corps to procure the same design manufactured with the latest U.S. technology. But the momentum for a U.S. Eureka-Rebecca system also came from another source. Secretary of War Henry Stimson was a proponent for the fastest possible design and fielding of new radar systems. Moreover, Stimson's cousin had recently established the new radiation laboratory, or "Rad Lab," at the Massachusetts Institute of Technology (MIT). The Rad Lab worked with the Signal Corps and its contractors to review the feasibility of emerging radar technology, and one of Rad Lab's projects dealt with the conversion of the British Eureka beacon to U.S. specifications.²¹ Stimson's link with the Rad Lab provided support for a U.S. Eureka from the highest level, and on at least one occasion the Secretary of War personally promoted the Eureka beacon at a 1943 Thanksgiving dinner with the top OSS operations executive.²²

U.S. and British Eureka beacons would share five frequencies for standardization. Transmitter and receiver frequencies of both models (including their Rebecca counterparts) began at 214 megacycles per second (Mc/sec), and increased at five Mc/sec increments to 234 Mc/sec. Although the early Mk I Eureka featured only one frequency, the newer Eureka and Rebecca sets could transmit or receive on any one of the five predetermined frequencies as long as the transmitting and receiving frequencies differed by at least a five Mc/sec increment. The total frequency mix provided twenty possible transmitting-receiving modes, thereby offering a modicum of security.²³ But most military radios of the time, including the clandestine "suitcase" radios carried by agents, would accept numerous removable "crystals," or frequencies, that offered many more frequency choices—the Eureka radar beacon did not. But in April 1943 an Allied Combined Communications Board, or CCB, found that the security limitations of Eureka's five fixed frequencies posed no long-term security vulnerability by concluding, incorrectly, that the Eureka would only be employed "until something better is available."²⁴

The following month, a joint U.S. Army-Navy radio frequency coordination meeting essentially agreed with the CCB, but for a different reason. When a U.S. Navy representative found that two of the Eureka's frequencies overlapped those allocated to a future communications system, he dismissed the issue stating, the "Eureka would be abandoned in about a year because of the advan-



Rebecca interrogates Eureka.

U.S. EUREKAS ADOPTED THE BRITISH INCLUSION OF A SELF-DESTRUCT DETONATION SYSTEM TO INSURE AGAINST THE BEACON'S CAPTURE

tage with which it can be used by the enemy.”²⁵ The implication was that either a Eureka beacon could be too easily captured and turned back against Allied forces, or that the Eureka’s fixed frequency allocation would be soon discovered and emitted back on enemy countermeasure systems, thereby confusing the Eureka or Rebecca components. A weakness in OSS and SOE security policy would later compound this problem. In December 1944, OSS air operations personnel adopted a British practice employed in Italy and Yugoslavia that used only two of the Eureka-Rebecca frequencies (214 Mc/Sec & 219 Mc/Sec). It was thought these two channels worked the best, and nearly twenty OSS teams sent into northern Italy carried Eureka beacons confined to these two frequencies. If German intelligence captured one of these sets (as they did, to be discussed later) they could deduce the Eureka frequencies used by most of the OSS teams in Italy.²⁶

Perhaps to minimize the vulnerability of the Eureka’s fixed frequencies, the U.S. Eureka did feature a “Morse” key. The key interrupted Eureka transmissions in short bursts that visually simulated international Morse code on the Rebecca’s radar screen. War Department manuals issued with each Eureka set officially advocated use of the Morse key feature so that aircrew monitoring the Rebecca screen could discern different Eureka sets that might be in close proximity. After the war, however, MIT suggested that the Signal Corps added the Morse key feature to prevent enemy manipulation of the Eureka; for the enemy to credibly playback a captured Eureka, they would need to know a one or two letter Morse code assigned to that particular mission. Perhaps lending weight to the latter concern, all U.S. Eureka adopted the British inclusion of a self-destruct detonation system to insure against the beacon’s capture.²⁷

In 1943 the OSS sent their first Eureka-Rebecca shipments overseas. Early on, these shipments accompanied classified cipher equipment, transported by air and protected by armed guard.

By 1944, however, trucks delivered Eureka beacons from the OSS Northern Virginia warehouse to Baltimore Harbor, and paper receipts alone tracked Eureka shipments by sea to Europe, the Mediterranean, and India. The OSS continued to track Eureka within these theaters, including their use behind enemy lines.²⁸ Once Eureka sets arrived in theater, special operations training policy required that OSS, SOE, and SAS teams receive training on their use. By June 1944, SOE determined that whereas the new and more simply designed Eureka models required only a one-hour lecture, agents also needed practical field instruction.²⁹ That year SOE instituted a ten-day DZ “reception committee” school in England. Among other topics, the school covered the clandestine “S-Phone” for ground to air voice communication, DZ ground lighting patterns and Morse flashlight signals to aid navigation and provide security confirmation for approaching aircraft, and it allocated three days for Eureka instruction and hands-on operation. Security instruction for the beacon took forty-five minutes, and presumably covered Eureka’s low-probability of intercept, Morse key feature, and the set’s self-destruction mechanism.³⁰ OSS personnel in England also attended this school, but OSS commands elsewhere had to develop their own DZ training for both American OSS and foreign national agents. OSS radio experts in Italy, for example, found the Eureka beacon to be a simple device upon which to train American students, but they had little guidance about the appropriateness of instructing their Italian agents on the classified beacon. Nevertheless, they correctly assumed that training foreign agents to use the Eureka would correspond with any existing policy on the matter. As a final precaution, the OSS issued a certificate to each team receiving a Eureka beacon. The certificate required that “precautions be taken to prevent compromise of the beacon,” and if a team had to destroy their beacon, they were to radio the event to their OSS base.³¹

OSS DZ policy based the operational security of the Eureka upon the safety of the DZ perimeter, and this policy required what was in practice an optimistic ten mile Eureka operating distance from known enemy positions.³² But a promising new concept called “blind use” of the Eureka soon complicated this conservative approach to DZ security. In December 1944, an OSS air operations officer in Italy found that the pinpoint accuracy of the Eureka at night often did not require supplemental navigational assistance for an approaching aircraft, typically in the form of DZ ground fire patterns or Morse code flashlight signals, practices that could draw enemy attention. Eliminating these visual aides gave greater cover to clandestine DZ operations, but also sacrificed important visual signals that gave final security confirmation that the DZ was in friendly hands. Yet word of “blind use” accuracy arrived in London, where SOE expressed interest in the procedure as late as April 1945.³³ During this same period, however, the U.S.



OSS agent's Eureka receives prompt.

AAF informed OSS air operations personnel that AAF navigators monitoring their Rebecca radar screens were having difficulty deciphering the Eureka's Morse code transmissions. Unlike audible Morse radio transmissions, Morse codes keyed through the Eureka beacon had to be viewed as pulses on the Rebecca's three-inch diameter radar screen, where transmission speed on the Eureka key compounded the navigators' sight limitations using the small screen. Difficulties monitoring Morse transmissions on Rebecca, together with mounting reports that Eureka operators on the ground were apparently tiring of the beacon's Morse keying requirement, may explain why Morse key security for the Eureka-Rebecca system fell into disuse on both ends of the system; and this

at a time when "blind use," having already dispensed with the ground fire patterns and Morse flashlight signal security checks, would seem to demand its use.³⁴

An agent could jump with a Eureka beacon attached to his parachute harness or, as was often the case, special operations commands could parachute Eureka's in supply containers to agent teams upon request by radio. The most common cause of lost Eureka's occurred during night DZ supply drops. Mis-dropped containers and high winds routinely dispersed supplies, and references to accidental Eureka losses are prevalent in OSS, SOE, and SAS radio messages and after-action reports.³⁵ Radio messages also show the efforts made to keep the Eureka-Rebecca system out of German hands. One French resistance group had no choice but to search for hours, only 1,000 yards from a large German encampment, for their miss-dropped Eureka.³⁶ Almost a year later in Norway, after OSS Major William Colby searched the wreckage of a crashed OSS transport aircraft, he radioed his report to England and, at the end of the message, confirmed that the aircraft's Rebecca had been destroyed in the crash, an observation apparently made to ensure that the Rebecca was of no use to the Germans.³⁷ Despite these precautions, apparent examples of late-war losses of Eureka beacons to the enemy resulted from the capture of OSS Team *Dawes* by the SS in Czechoslovakia; from the capture of OSS Operational Group *Tacoma* by the SS in northern Italy; and from the apparent discovery of OSS Operational Group *Battle's* hidden radio equipment and Eureka by Cossacks on the Italian-Slovenian border.³⁸ At the same time these teams were operational, U.S. AAF navigators on OSS supply missions to northern Italy carried spe-

Paratroops and gliders land in Holland during Operation Market Garden. (USAF Photo.)





Eureka replies to Rebecca.

cial pre-printed forms to record Eureka-Rebecca performance. In late February, one particular navigator could not find the Eureka “blip” on his Rebecca screen when expected. He noted on his Eureka-Rebecca form, however, that during the mission he “picked up several [blips] but they all run up & down the trace line.” He appeared to be receiving multiple Eureka signals from the ground where there should have been none.³⁹

German Intelligence and the Eureka-Rebecca System

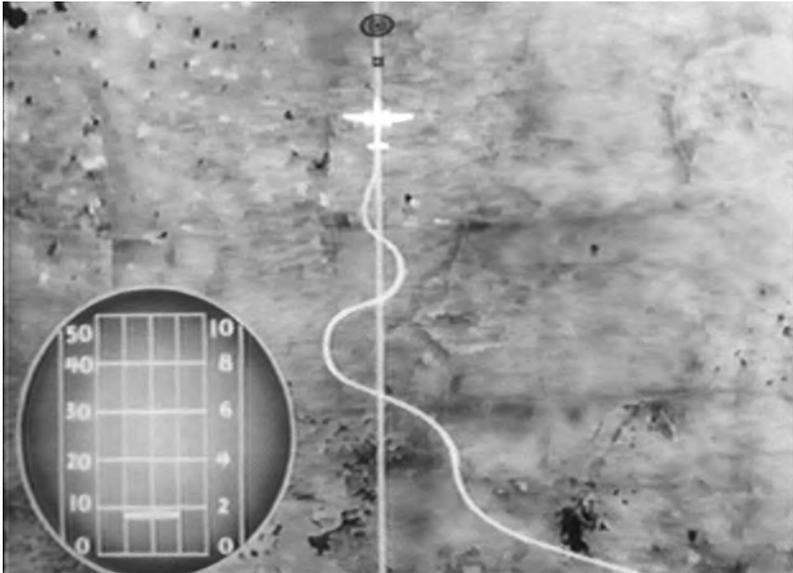
OSS debriefs filed after the war by members of a captured OSS Operational Group team reveal that their German interrogators knew much about the OSS command structure in Italy. As Operational Group *Tacoma*'s radio operator later said of his interrogation by an SS officer, “they knew more than I did about the outfit.” He added that before his interrogation, the SS officer placed his two OSS radios and Eureka radar beacon on a table in front of him, in an apparent mocking gesture.⁴⁰ Berlin destroyed a large portion of its intelligence records at the end of the war, but those remaining documents suggest that German intelligence organizations possessed a sound understanding of Allied special operations. For example, Berlin knew the location of many OSS training schools and bases in England and Italy, the names of pertinent OSS officers and instructors, and even understood the basic operation of the OSS special operations airbase in Harrington, England.⁴¹ The Germans also captured large numbers of Allied equipment containers parachuted behind their lines. The loss of equipment was seemingly so extensive that one SOE agent captured in Paris noted, in his postwar memoir, a pile of captured parachuted equipment containers so large it was impossible to ignore as he was led into the *Abwehr*'s Paris headquarters.⁴²

Once German counterintelligence located special operations DZs, they would either monitor

agent and reception committee activities at those sites, or destroy the DZs immediately. One method employed to eliminate DZs, and at the same time spread skepticism within the ranks of the local resistance forces, was to parachute German agents onto known DZs. In July 1944, the local French resistance informed Operational Group *Louise* that only a few days earlier Germans, dressed in American uniforms, had jumped on *Louise*'s DZ in an attempt to surprise and destroy the French reception committee.⁴³ And in Italy, OSS teams radioed their commands that Germans were manning false DZs using routine ground signals, and possibly using captured agent radios to arrange the drops.⁴⁴ Berlin employed other methods as well. The *Abwehr* attempted to track special operations flights from England to western Europe in order to estimate the location of Allied DZs, and the amount of supplies and agent teams dropped in those areas. Through a combination of radio intercepts and radar intercepts of lone aircraft, to routine flight sightings passed to the pertinent *Abwehr* offices, they could extrapolate special operations flight data.⁴⁵

German policy directed that captured “novel or technically improved” radio devices be forwarded to the appropriate technical intelligence office, unless an impending radio game required their use. *Luftwaffe* intelligence (OKL Ic) remained the primary authority for the collection and dissemination of information associated with Allied aircraft, and this included the Eureka-Rebecca system.⁴⁶ The first German publication informing front-line intelligence units of Eureka beacon specifications was an OKL Ic weekly intelligence newsletter, titled *Einzelnachrichten des Ic Dienstes West* (“Special Intelligence of Intelligence Service West,” hereafter referred to as *Einzelnachrichten*). The first edition of *Einzelnachrichten* to include the Eureka appeared on June 19, 1944, only two weeks after Allied airborne units used the Eureka to guide paratroopers to their DZs behind the Normandy beaches. The newsletter described the Eureka's purpose, range, and details such as its Morse key feature. *Einzelnachrichten* added the following month that OKL Ic had not observed the use of a Eureka by “regular” airborne units until the Normandy landings.⁴⁷ In August 1944, the newsletter carried a special edition on Allied special forces operating on the European continent, and repeated the Eureka's purpose as a key special operations device; it included a diagram of the Eureka, and closely associated the device with the SAS, an observation perhaps driven by previously referenced SAS Eureka losses in France during June 1944.⁴⁸ In October, *Einzelachrichten* included the specifications of the overall Eureka-Rebecca system, and summarized that “up until now, the total assessment of this system had not been settled.” Perhaps the exploitation of the early Eureka-Rebecca devices captured by the *Abwehr*'s Major Giskes during 1942 and 1943 remained incomplete; or perhaps the alleged inability of Berlin's many intelligence services to effectively exchange infor-

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Rebecca aircraft on approach diagram.

mation is at fault.⁴⁹

Nevertheless, radio messages sent between a Eureka-equipped special operations team in France and its London headquarters appear to indicate an instance where the *Luftwaffe* assisted German intelligence to counter the Eureka-Rebecca system. On June 5, 1944 an Allied special forces “Jedburgh” team, codenamed *Hugh* parachuted into the Indre region of France. Special Forces Headquarters (SFHQ) in London conceived of the three-man Jedburgh teams to serve as a joint American, British and Free French liaison to the French resistance, and to work with other special forces units, such as the SAS and the OSS Operational Groups. Jedburgh team *Hugh* was to work closely with SAS team *Bullbasket*. *Bullbasket*

had parachuted into the same area on June 7, having lost their Eureka container during the jump. Three weeks later, Jedburgh team *Hugh* radioed SFHQ to inquire about what *Hugh* assumed were Allied planes circling in the proximity of its DZ. SFHQ, however, had not send any supply aircraft to the area, and responded in radio code to *Hugh*:

*Have no idea whose planes circled . . . night 25/6 but believe Boche may have Eureka's and have located these areas in this way Hugh to advise immediately if he would prefer to postpone operation until he finds another ground.*⁵⁰

SAS Eureka container losses in June 1944 could have found their way into German hands. The Eureka's preset frequencies would have allowed *Luftwaffe* aircraft to patrol suspected areas, emit those frequencies on German radio systems modified to mimic the Rebecca component, and possibly prompt Eureka beacons in the area to identify the direction to enemy DZs.

About two months following the September 1944 Allied airborne landings in Holland, *Einzelnachrichten* contained a special feature subtitled “New Discoveries about the Employment of Allied Parachute and Air-Landing Troops.” In this issue, OKL Ic charted known Eureka beacon locations used during the airborne operation in Holland, and also suspected Eureka beacon locations in England, where the beacons aided conventional air traffic control for the hundreds of Allied C-47 aircraft flying towards Holland from their English airbases.⁵¹ It was during this period that Berlin considered an unusual countermeasure to Allied radar beacon sites. Before the Normandy landings, the Allies had delivered Eureka beacons to European

C-47s deliver a large-scale airborne assault. (USAF Photo.)





OSS agent signals for drop.

IF DIRECTION-FINDING PROVED SUCCESSFUL AGAINST SAS RADIOS, EUREKA BEACONS IN SAS POSSESSION WOULD BE CAPTURED ALONG WITH THE RADIO SETS

resistance groups with instructions to align the beacons in a direction that would provide discrete navigation tracks for Allied bombers heading to their targets in Germany.⁵² After the invasion, the Allies were able to move larger and more powerful conventional radar navigation systems to liberated regions of France and Belgium for the same purpose. In October 1944, OKL Ic met with its own reconnaissance liaison officers and with representatives of SS Lt. Colonel Otto Skorzeny's commando organization. They apparently reached an agreement for the OKL Ic to determine the location of Allied radar navigation beacons in France and Belgium, and pass those locations to Skorzeny's unit. The commandos would then, as they termed it, "clean out" the located beacon sites, possibly giving German cities and military facilities a respite from Allied bombings. Apparently, nothing came of the meeting, but by the standards reached there, any known Eureka beacon sites would have been included on Skorzeny's target list.⁵³ The SS also distributed a directive that included countermeasures against the Eureka. In January 1945, the *Gestapo* issued detailed instructions to SS police and SS radio intelligence technicians regarding radio countermeasures to SAS operations. Recommended countermeasures to SAS radios centered upon employing electronic direction-finding tactics against the radios; the thinking here, it appears, was that if direction-finding proved successful against SAS radios, Eureka beacons in SAS possession would be captured along with the radio sets.⁵⁴

By the end of 1944, Berlin had consolidated all Allied radar information of interest within the *Reichsluftfahrtministerium* (RLM, or National Air Ministry). The RLM served as Germany's central office for aviation matters, and it collected information on many Allied radar systems, including details on the Eureka-Rebecca frequency spectrum. It concluded that the success of using captured Eureka beacons to deceive Allied special operations, while possible, could not be "guaranteed"

because of the Eureka's Morse key security feature. The RLM suggested instead that the continuous interrogation of Rebecca, by ground-based German radio jammers emitting known Eureka frequencies, could flood the Rebecca receiver with false signals. Under these conditions, airborne Rebecca systems could be rendered incapable of establishing a navigation link to the proper Eureka beacon. Because of this vulnerability, the RLM concluded that Rebecca was "jammable."⁵⁵

Conclusion

In December 1944, the OSS officer responsible for managing all U.S. Eureka sent into northern Italy summed up the beacon's security against electronic countermeasures this way:

*The Eureka is not subject to DF [direction finding] operations by the enemy insofar as is known. Its ultrahigh frequency makes such measures impractical by other than exact simulation of the Rebecca equipment of the plane, which while possible is not considered to be within the enemy's capabilities at present.*⁵⁶

There is anecdotal evidence that the *Luftwaffe* did attempt to locate Allied special operations DZs by using German aircraft systems to simulate Eureka-Rebecca frequencies to trigger Eureka beacons; or, at least, the suspicious activity of German patrol aircraft caused SFHQ in London to radio special operations personnel in France that the Germans were somehow exploiting captured Eureka. Berlin also identified methods to counter the Eureka, outside of traditional direction-finding techniques. German radar experts determined that, by flooding the skies over known areas of Allied special operations with the proper frequencies, they could in theory prevent Rebecca-equipped aircraft from establishing the correct navigation link to their DZs, thereby denying Allied reinforcement and resupply for special operations.

German intelligence for the most part, however, may have approached this task in a more practical manner. As early as 1942, the *Abwehr's* direct manipulation of captured Eureka beacons helped to build a foundation for the capture of substantial numbers of special operations personnel.⁵⁷ Whether or not the assumption of Berlin's continued manipulation of the Eureka until the end of the war is accepted, this one method of deception could claim its place as a ruse used in the wider deception against Allied intelligence—the capture and exploitation of special operations teams and clandestine agents. The playback of captured radio transmitters could seriously mislead Allied commands into believing that their special operations were secure and active, when in fact many of the radio messages received by Allied headquarters were deceptive radio games managed by German counterintelligence. The compromise of the Eureka-Rebecca system sometimes played an integral part in this deception. ■

1. A short summary of the postwar investigation of SOE's Holland compromises can be found Nigel West, *Secret War: The Story of SOE, Britain's Wartime Sabotage Organization* (London: Hodder & Stoughton, 1992), 99-101.
2. Armeoberkommando I/Ic, *Appearance of S.A.S. Troops in the Army Area* [OSS translation], November 1944, RG 226, Entry 190, Box 292, Folder 1350. This folder contains correspondence relating to Gubbins' inquiry.
3. This paper draws from three main sources in the US National Archives & Records Administration (NARA): Record Group (RG) 226—Records of the Office of Strategic Services; RG 111—Records of the Office of the Chief Signal Officer (US Army); and the Captured German Records Collection on microfilm. OSS and Signal Corps record locations are cited by RG #, Entry #, Box #, and Folder # or title. German records are identified by "T" microfilm series #, Roll #, and Frame #. RG 226 and RG 111 also contain related British reports received by the OSS and U.S. Signal Corps. The growing volume of WW II special operations literature often cites the extensive use of the Eureka beacon. Examples are Ian Wellsted, *SAS With the Maquis* (London: Greenhill Books, 1994); Bruce Heimark, *The OSS Norwegian Special Operations Group in WW II* (Westport, Ct.: Praeger, 1994); Gerald Schwab, *OSS Agents in Hitler's Heartland* (Westport, Ct.: Praeger, 1996); Paul McCue, *SAS Operation Bulbasket* (London: Leo Cooper, 1996); Freddie Clark, *Agents by Moonlight: The Secret History of RAF Tempsford During World War II* (Charleston, S.C.: Tempus Publishing Inc., 1999); Thomas Nielsen, *Inside Fortress Norway: Bjorn West—Norwegian Guerilla Base, 1944-1945* (Kansas: Sunflower University Press, 2000); M.R.D. Foot, *SOE in the Low Countries* (London: St. Ermin's Press, 2001); and William Mackenzie, *The Secret History of SOE: The Special Operations Executive 1940-1945* (2000; reprint, with a foreword by M. R. D. Foot, London: St. Ermin's Press, 2002).
4. For example, in January 1945 the OSS London office only made local distribution of the aforementioned German directive, and the document apparently failed to draw attention to German familiarity with the Eureka radar beacon.
5. The impact of successful German radio games in Western Europe can be found in many histories of WW II special operations. One detailed account is in West, *Secret War: The Story of SOE, Britain's Wartime Sabotage Organization*, 88-104.
6. Arthur Roberts, ed., *Radar Beacons* (New York: McGraw-Hill, 1947), 10-11. "Radar" is an acronym for radio detection and ranging, as it allows the determination of both location and distance. The word "radar" remained restricted until June 1943, when the Allies released the term to the public. See Louis Brown, *A Radar History of World War II: Technical and Military Imperatives* (Bristol: Institute of Physics Publishing, 1999), 381.
7. Callum MacDonald, *The Killing of SS Obergruppenfuhrer Reinhard Heydrich* (New York: The Free Press, 1989), 151-52, 154. SOE-trained Czech teams such as *Out Distance* represented Czech President Benes' exiled government in London.
8. Heydrich to Reichsleiter Martin Bormann, *Ereignismeldung an den Fuehrer ueber Herrn Reichsleiter Bormann*, 4 May 1942, T-84, Roll 437, Frames 122-25. Also see MacDonald, *The Killing of SS Obergruppenfuhrer Reinhard Heydrich*, 154. One surviving member of *Out Distance* went on to contact another Czech team, *Anthropoid*, which on 27 May 1942 assassinated Reinhard Heydrich.
9. H. J. Giskes, *London Calling North Pole* (London: William Kimber, 1953), passim. The collapse of the Holland network is found in the official secret history of SOE, recently declassified. See Mackenzie, *The Secret History of SOE*.
10. Giskes, *London Calling North Pole*, 102.
11. *Ibid.*, 102.
12. In October 1943, two Dutch agents escaped German captivity and informed SOE of the German deception. One of their autobiographies is by Pieter Dourlein, *Inside North Pole: A Secret Agent's Story* (London: William Kimber, 1954). Regarding the Czech teams, London deduced their end through lack of initial radio contact, failed German "radio games" with captured radio sets, and through German propaganda. For example, see MacDonald, *The Killing of SS Obergruppenfuhrer Reinhard Heydrich*, 196, 207.
13. SOE compartmentalized its operations for security reasons. So, for example, the French section did not know of compromises within the Dutch section. See M. R. D. Foot, *SOE in France: An Account of the Work of the British Special Operations Executive in France 1940-1944* (London: Her Majesties Stationary Office, 1966), 343-44. Security compartmentalization also disallowed the exchange of London's intercepted and deciphered *Abwehr* and SD radio traffic—transmissions that might have suggested *Abwehr* or SD penetration of Allied clandestine operations. See the official history by John Curry, *The Security Service 1908-1945: An Official History*, with an introduction by Christopher Andrew (Kew: Public Record Office, 1999), 209.
14. Lt. Col. Magee, US Army Signal Corps, *Procurement of British Rebecca Equipment*, 23 October 1942, RG 111, Entry 1024, Box 1533, Folder "AN/PPN-2, Part 2 of 2." TRE training is cited in TRE Great Malvern, *Progress Report for the Period 16th September to 15th October 1942* [British report], Secret, 19 November 1942, RG 111, Entry 1024, Box 1743, Folder "Br. Equipment Reports."
15. Carleton S. Coon, *A North Africa Story: The Anthropologist as OSS Agent 1941-1943* (Ipswich, Mass.: Gambit, 1980), 39.
16. Capt. Browne to Col. Donovan, Memo w/attachment, Secret, 15 December 1942; Maj. Lowman to Lt. Graveson, Memo, Secret, 11 January 1943; and Maj. Lowman to Col. Donovan, Memo, Secret, 11 January 1943, RG 226, Entry 146, Box 163, Folder 2414.
17. Capt. Browne to Lt. Col. Roberts, 12th Air Force, Memo, Secret, 14 December 1942, RG 226, Entry 146, Box 163, Folder 2414.
18. Undated OSS cable # 101750, RG 226, Entry 136, Box 1, Folder 8. This cable shows that Washington asked the Spanish government to "guard" the interned American aircraft. This was a dubious precaution, as the Allies would later take advantage of Madrid's known links with the German *Abwehr* in a Top Secret operation called *Mincemeat*. In 1943, Operation *Mincemeat* planted misleading information about Allied Mediterranean strategy into the hands of Spanish intelligence officers who, as expected, forwarded it to the *Abwehr*. This deception successfully diverted Berlin's attention away from the Allies' planned objective of Sicily. See Ewen Montagu, *The Man Who Never Was* (Philadelphia: J.B. Lippencott Co., 1954).
19. Giskes, *London Calling North Pole*, 121. Accounts of even earlier compromises of a baseline Rebecca system can be found in Brown, *A Radar History of World War II*, 338. Brown's text covers the overall radar countermeasures "war" between the Allies and Axis. TRE's admitted risk in adding what it called "the special secrecy" of the Rebecca counterpart to conventional bomber navigation suites is in *TRE Report, No. 1486* [British Report], Most Secret, 27 June 1943, p. 3, RG 111, Entry 1024, Box 1725, Folder "RB-413.44 RB-1891 IFF MK V."
20. Capt. Ogas, IFF Section, US Signal Corps,

Performance Tests of AN/APN-2 and AN/PPN-1, Secret, 5 February 1944, RG 111, Entry 1024, Box 1735, Folder "Beacons." Compromises of Mk III IFF are found in Office of the Chief Signal Officer, *Airborne Monthly Report for November and December 1943*, Secret, 10 February 1944, and Col. Unruh, Air Corps, *I.F.F. Triggering by Japanese Night Fighters*, Secret, 30 October 1943, RG 111, Entry 1024, Box 1542, Folder "RB 413.44, Ident. #13, part 2 of 2." See also New Zealand intelligence report on Japanese electronic countermeasures against Allied radar in the Northern Solomons, in Maj. Watson-Munro, *Report on R.C.M. in Bougainville Area*, Secret, 29 January 1944, RG 111, Entry 1024, Box 1542, Folder "RB 413.44, Ident. #13, part 3 of 3."

21. Jennet Conant, *Tuxedo Park: A Wall Street Tycoon and the Secret Palace of Science That Changed the Course of World War II* (New York: Simon & Schuster, 2002), passim. Stimson's cousin, Alfred Loomis, established the Rad Lab at MIT. MIT, under the direction of the U.S. National Defense Research Committee, helped the War Department assess the feasibility of integrating the British Eureka design with U.S. radar production technology. The Signal Corps' Camp Evans Signal Laboratory in New Jersey then contracted with U.S. industry for the manufacture of thousands of "AN/PPN-1" and "AN/PPN-2" Eureka radar beacons. "AN/PPN" was standardized U.S. nomenclature for "Army-Navy/Man Portable-Radar-Navigation." The AN/PPN-1 & 2 would be employed by regular airborne divisions and the OSS. The United Kingdom, through international aid, received nearly 50% of total U.S. production. Signal Corps correspondence for the initial Eureka procurement phase (January-April 1943) is found in RG 111, Entry 1024, Boxes 1533, 1732, & 1770.

22. Thomas F. Troy, ed., *Wartime Washington: The Secret OSS Journal of James Grafton Rogers 1942-1943* (Frederick, Md.: University Publications of America, Inc., 1987), 180.

23. An AAF transcript for a training film on the Eureka stated that the five assigned frequencies were "enough for security." See 18th AAF Base Unit, *Rebecca-Eureka Project 1931*, Confidential, 19 December 1944, RG 226, Microfilm Series 1642, Roll 47, Frame 848.

24. The Allied Combined Chiefs of Staff Combined Communications Board coordinated the frequency allocation of Allied radio and radar systems to avoid frequency overlap and system interference. The CCB also assessed the Eureka's frequencies. See the Combined Chiefs of Staff, Combined Communications Board (CCB), Minutes, 9 April 1943, RG 111, Entry 1024, Box 1119, Folder 334.

25. E. M. Roberts, Airborne Section, Office of the Chief Signal Officer, *Proposed Radio Spectrum Allocations*, Secret, 5 May 1943, RG 111, Entry 1024, Box 1769, Folder "RB413.44 RB-2032 Airborne Radar Equipment #2 (2 of 2)."

26. See Lt. J. J. Orlan, 2677th Regiment, OSS, *Eureka Operations*, Secret, 2 December 1944; Lt. Orlan, 2677th Regiment, OSS, Untitled Eureka Morse Code Plan, Secret, 4 December 1944; and Lt. B. M. Cave to Maj. J. Duncan, 2677th Regiment, OSS, *Eurekas in the Field*, 11 January 1945. All three documents are located in RG 226, Entry 190, Box 96, Folder 91.

27. War Department operating manuals for the U.S. Eureka models are TM 11-1140, *Responder-Beacon AN/PPN-1*, Confidential, 12 July 1943; TM 11-1140A, *Beacon Transmitter-Receiver AN/PPN-1A*, Confidential, 10 May 1944; and TM 11-1145, *Beacon Transmitter-Receiver AN/PPN-2*, Confidential, 19 August 1944. MIT assessment of the Morse key feature is in Roberts, ed., *Radar Beacons*, 11. Regarding the Eureka's self-destruct system, see G. H. McClurg, Office of the Chief Signal Officer, *Conference on Eureka Mk III*, Secret, 22 February 1943, RG 111, Entry 1024, Box 1533, Folder "AN/PPN-1 Part 2 of 2." London recommended detonators for the new

Eureka models, and first considered installation of detonators in November 1942, about six months after the first compromises in Czechoslovakia and Holland. See TRE Great Malvern, *Progress Report for the Period 16th September to 15th October 1942* [British report], Secret, 19 November 1942, RG 111, Entry 1024, Box 1743, Folder "Br. Equipment Reports."

28. OSS Message, 12 August 1943, RG 226, Entry 134, Box 211, Folder 1319. Some Eurekas, nevertheless, were lost in shipment. See List, *Boxes Missing-Algiers Shipment*, 26 October 1944, RG 226, Entry 135, Box 50, Folder 543. Routine OSS shipping receipts from Baltimore to overseas commands are in RG 226, Entry 135, Boxes 543 & 555. Records of the 2677th Regiment, OSS, (Italy) tracking by serial number their Eurekas behind enemy lines are found in RG 226, Entry 1190, Box 96, Folder 91. OSS London also tracked Eurekas in France. For example, see OSS Jedburgh Team *Hugh*, Radio Message to London, 14 June 1944, RG 226, Entry 103, Box 3, Folder 82.

29. Minutes of Special Forces Headquarters, Secret, 8 June 1944, RG 226, Entry 190, Box 357, Folder 357.

30. OSS also used SOE's ten-day reception committee school. See Maj. C. A. Pitre, Chief, Training Program, OSS/SO Branch, *Final Progress Report for period 1-9 December 1944*, RG 226, Entry 92, Box 549, Folder 19.

31. Lt. Orlan, 2677th Regiment, OSS, Memo, *Eureka Operations*, 17 November 1944, RG 226, Entry 190, Box 96, Folder 91; and OSS Communications Office, to Lt. Cave, 2677th Regiment, OSS, Message, 17 December 1944, RG 226, Entry 190, Box 96, Folder 91. OSS commands remained unaware that in September 1944 the CCB had approved the release of all radar beacon technology to each member of the Alliance including resistance groups. See Maj. Gen. J. A. Ulio, *Policy on Release of Radar Equipment and Information*, Secret, 22 September 1944, RG 111, Entry 1024, Box 1528, Folder "Radar Equipment # 9, Part 2 of 2." Eureka destruction certificates for the 2677th Regiment, OSS, are located in RG 226, Entry 190, Box 96, Folder 91.

32. Lt. F. McDonough, 2677th Regiment, OSS, *Request for Eureka Equipment*, Secret, 16 November 1944, RG 226, Entry 190, Box 96, Folder 91, and Lt. H. H. Proctor, OSS SI Branch London to Lt. Col. K. T. Downs, Air Dispatch, Secret, 17 May 1944, RG 226, Entry 190, Box 290, Folder 1283.

33. Lt. Cave to Maj. V. A. Abrignani, 2677th Regiment, OSS, Memo, 18 December 1944, RG 226, Entry 190, Box 96, Folder 91; Lt. Cave, 2677th Regiment, OSS, *Special Operations Memorandum: Air Supply Operations*, Secret, 25 February 1945, RG 226, Entry 190, Box 93, Folder 66; Lt. Cave to Maj. C. J. Eubank, 2677th Regiment, OSS, *Eurekas*, Secret, 2 March 1945, RG 226, Entry 190, Box 96, Folder 91; and SOE report, *D/BT's Progress Report for April, 1945*, RG 226, Entry 148, Box 84, Folder 1220.

34. In August 1944, TM11-1145, *Beacon Transmitter-Receiver AN/PPN-2*, 37, first highlighted the lack of Eureka Morse key use. The problem also surfaced in late-War Italy. See Lt. Cave to Maj. Eubank, 2677th Regiment, OSS, *Eurekas*, 2 March 1945, RG 226, Entry 190, Box 96, Folder 91.

35. Lost container reports are found throughout special forces Jedburgh after-action reports located in RG 226, Entry 103, Boxes 1-4. SAS Eureka container losses in France during June 1944 are cited in Maj. O. A. Elwes, *Report on Operation Lost*, Secret, June 1944, RG 226, Entry 190, Box 328, Folder 7; Wellsted, *SAS With the Maquis*, 50; and McCue, *SAS Operation Bulbasket*, 25.

36. Jedburgh Team *Gerald* After-Action Report, 18 July 1944, RG 226, Entry 103, Box 3, Folder 46.

37. Maj. William E. Colby, Norso Operational Group, OSS to Lt. Col. H. H. Skabo, Scandinavian Section, OSS/SO, *Burial of Personnel of Plane Jones*, Secret, 30 April 1945, RG 226, Entry 115, Box 51, Folder 654.

During the 1970's, Colby would head the Central Intelligence Agency (CIA).

38. Reference to *Dawes'* capture and their use of a Eureka is in *Dawes* to OSS Base Caserta, Radio Message, 22 October 1944, RG 226, Entry 154, Box 42, Folder 642; and OSS Base Bari to OSS Base Caserta, Radio Message, Secret, 2 February 1945, RG 226, Entry 154, Box 42, Folder 642. *Tacoma's* loss of their Eureka to the SS is in a postwar debrief by *Tacoma's* radio operator. See Cpl. O. M. Silsby, Company A, 2671st Special Reconnaissance Battalion, OSS, *Report of the Tacoma Mission*, n.d. [approximately July 1945], RG 226, Entry 143, Box 11, Folder 145. Loss of *Battle's* equipment is in G. M. Proctor, 2677th Regiment, OSS, to Commanding General, HQ, MATAF, *Eureka*, Secret, 19 March 1945, RG 226, Entry 190, Box 96, Folder 91; and in OSS Operational Group *Battle* to 2677th Regiment, OSS, Radio Message, 7 April 1945, RG 226, Entry 190, Box 160, Folder 1109.

39. Lt. Shanklin, 35th Squadron, 51st Troop Carrier Wing, U.S. AAF, *Radar Report for Missions*, Secret, 26 February 1945, RG 226, Entry 190, Box 96, Folder 91.

40. Cpl. Silsby, *Report of the Tacoma Mission*, RG 226, Entry 143, Box 11, Folder 145.

41. Der Reichsfuehrer SS Reichssicherheitshauptamt, Amt IV Gr. 4 B, *Agenten u Sabotageschulen Der Feindlaender*, Geheim, 13 June 1944 [reissue of Oberkommando der Wehrmacht (OKW) Amt Abwehr, Abt. Abw. III, 19 April 1944], T-77, Roll 1503, frames 14-38; and Oberkommando des Heeres, Fremde Heere West, *Organisation die amerikanischen N.D.*, 5 December 1944, T-78, Roll 705 Frames 43-58. After the war an OSS report stated, "the Germans knew all about the Harrington Group and what it was doing." See OSS Operations Report, DIP, SI, ETO, Division of Intelligence Procurement, *Air Operations Section Final Report*, 7 June 1945, Secret, RG 226, Entry 146, Box 230, Folder 3245.

42. Guido Zembsch-Schrieve, *Pierre Lalande: Special Agent*, trans. John Brownjohn (London: Leo Cooper, 1996), 120. An OSS-compiled history estimated that Germans captured 15-20% of supplies dropped into France. See *OSS Aid to the French Resistance in World War II*, undated, RG 226, Entry 190, Box 241, Folder 1. Many of the captured containers contained radio equipment. See Abwehr III F West, *Increased dropping of enemy agents, arms, ammunition, and explosives on occupied French territory* [OSS translation], Secret, 8 March 1944, RG 226, Entry 190, Box 292, Folder 1350.

43. Operational Group *Louise* Operational Report, Company "B" 2671st Special Reconnaissance Battalion Separate, (Prov.), Grenoble, France, 20 September 1944, Secret, RG 226, Entry 154, Box 162, Folder 2770.

44. OSS Team *Lobo* to OSS Base Florence, Radio Message, Secret, 5 March 1945, RG 226, Entry 190, Box 158, Folder 1089; OSS Operational Group *Battle* to 2677th Regiment, OSS, Radio Message, Secret, 18 April 1945, RG 226, Entry 190, Box 160, Folder 1109; and OSS Capt. Jules Konig to HQ Co. A 2677th Regiment, OSS, *Interrogation of Johann Sanitzer*, Confidential, 30 June 1945, RG 226, Entry 124, Box 26, Folder 194. By 1944, German intelligence recognized established Signal Corps ground to air signal patterns, and other supply procedures down to the color-codes of supply parachutes. See the series of 1943 and 1944 German Airforce intelligence reports by Fuehrungsstabe Ic, Fremde Luftwaffen West, *Einzelnachrichten des Ic Dienstes West* and *G.B.-U.S.A. Fallschirm-und Luftlandetruppen*, in T-321, Rolls 98-102.

45. Oberstleutnant Reile, OKW, Leitstelle Abwehr III West an Verteiler, *Einfluege feindlicher Spezialistenflugzeuge im Monat Maerz 44*, Geheim, 3 May 1944 and *Einfluege feindlicher Spezialistenflugzeuge im Monat April 44*, Geheim, 4 June 1944, T-77, Roll 1515, No Frame #s. This paper cites those few pertinent intelligence documents that escaped destruction by Berlin's intelligence

services. A review of the subject indices of intercepted Abwehr message traffic, located in the United Kingdom's Public Records Office, does not suggest the presence of deciphered *Abwehr* messages on details such as the Eureka beacon.

46. OKW, WFST/A. Ausl. Abw./Abt. Abw. III/I/Ag WNV/Fu, *Behandlung vor erbeutetem Agenten-Funkgeraet und Funkbetriebsunterlagen*, Geheime Kommandosache, 14 April 1943, T-175, Roll 404, Frames 2926931-940. The SS issued similar instructions. See Chef der Sicherheitspolizei, *Sichergestellte Waffen, Munition und Sabotagemittel*, Geheim, 15 September 1943, T-175, Roll 254, Frames 2746880-882; and SS Pz. Div. "Das Reich," *Agenten-Kleinfunkgeraete*, 26 June 1944 [reissue of "Panzergruppe West" 22 April 1944 directive], T-354, Roll 129, Frames 3765843-844. For *Luftwaffe* authority, see OKL, Fuehrungsstabe IC, *Vorschrift fuer die Sicherung von Luftwaffengefangenen Beutepapieren und Beutegeraet*, 31 October 1944, T-283, Roll 75, Frames 4575237-254.

47. OKL Ic, *Einzelnachrichten des Ic Dienstes West der Luftwaffe*, Nr 55, Geheim, 19 June 1944, T-321, Roll 1001, Frame 651; and *Einzelnachrichten des Ic Dienstes West der Luftwaffe*, Nr 60, Geheim, 7 July 1944, T-321, Roll 101, Frame 737.

48. *Einzelnachrichten*, Nr. 62, Geheim, 15 August 1944, T-321, Roll 101, Frames 767-790.

49. *Einzelnachrichten*, Nr. 76, Geheim, 8 October 1944, T-321, Roll 101, Frame 1074. On Berlin's many competing intelligence services, see David Kahn, *Hitler's Spies: German Military Intelligence in World War II* (New York: Macmillan Publishing Company, 1978), passim. Kahn also addresses intelligence exchanges between Berlin and Tokyo, and it is possible that Japan received routine radio and radar countermeasure information collected by Berlin. Examples of German radar technology passed to Tokyo are in Brown, *A Radar History of World War II*, 135-40.

50. SFHQ Staff Report, Cipher, 28 June 1944, Vol. I, June 6th-30th 1944, 45-50, RG 226, Entry 103, Box 2, Folder 5. *Bullbasket's* lost Eureka is in McCue, *SAS Operation Bullbasket*, 25.

51. *Einzelnachrichten*, Nr. 80, Geheim, 18 November 1944, T-321, Roll 225, No Frame #s.

52. For an example of the use of "fixed" Eureka sites, see Clark, *Agents By Moonlight: The Secret History of RAF Tempsford During World War II*, 221. Clark refers to the ground-based Eureka as "Rebecca."

53. OKL Ic, *Vernichtung von besonders wichtigen Bodenstellen feindlicher UKW Navigations-und Zielfindungsverfahren durch Sabotage-Trupps des RSHA*, Geheime Kommandosache, 24 October 1944, T-321, Roll 100, Frames 195-202. Among the Allied radio and radar beacon systems Berlin targeted were the larger "Gee" and "Oboe" stations moved to Europe after the Normandy landings. These powerful systems provided navigation aid for Allied bombers. See Brown, *A Radar History of World War II*, 322.

54. SS-Gruppenfuehrer Mueller, Reichssicherheitshauptamt, *Einsatz von Einheiten des britishchen Special Air Service (SAS)*, Geheim, 23 January 1945, T-175, Roll 649, No Frame #s.

55. Reichsluftfahrtministerium, Leitstelle der Funkaufklaerung, *Zusammenstellung bisher aufgetretener Feindstoerungen an deutschen Boden-und Bord-FuMG*, Geheime Kommandosache, 7 February 1945, T-177, Roll 20, Frames 3706102, 3706112 & 3706115.

56. Lt. Cave to Maj. Abrignani, 2677th Regiment, OSS, Memo, 18 December 1944, RG 226, Entry 190, Box 96, Folder 91.

57. Numbers of captured personnel in Holland and France can be found in Giskes, *London Calling North Pole*, 122; McCue, *SAS Operation Bulbasket*, 215-16; and West, *Secret War: The Story of SOE, Britain's Wartime Sabotage Organization*, 126-30.

*Those Were the Days:
Flying safety during
the Transition to Jets,
1944-53*





Kenneth P. Werrell

The World War II army airmen went through a crucial period during the second half of the 1940s.¹ During this timeframe they gained their independence (the World War II Army Air Forces became the United States Air Force in 1947), began to transition from prop to jet power, reduced from the huge World War II establishment to a much smaller force, and started their engagement in the four-decade long Cold War. In the first years of the next decade the new service found itself fighting a different, difficult, and frustrating war in Korea. Throughout this period, flying performance was the primary concern. Compared to these issues, flying safety was of much lower priority.

Flying safety is an important, yet neglected, aspect of aviation history. The romance, the daring, the spectacle, the records, the performance of flying and fliers are the focus of attention, not the ordinary or the negative. Since 1921, the first year the army airmen kept comprehensive records, their flying accident rate has declined. This has not been a straight-line trend, however, as the rate shot upward in a number of years, notably in 1941, when America began the buildup for World War II and in 1946 during the rapid demobilization following that conflict. It then resumed its downward movement even during the hectic Korean War expansion. By the end of that conflict in 1953, the airmen had cut in half the rate of major accidents from the prewar low in 1940 to the lowest yet registered.² (figure 1³) This dramatic drop in the accident rate suggests that the airman adapted well in the conversion to jet power. Does this observation hold up under closer scrutiny? How much credit does the USAF deserve for this improvement?

Hardware

Jet propulsion offered the airmen several advantages in addition to higher performance. For example, tricycle landing gear, which quickly became the standard configuration on jets, enhanced aircraft safety as it eliminated ground loops on landing and gave the pilot better visibility during ground operations. Jet engines simplified flying with torque-less power, less complex engines, and an absence of propellers. Jet engines had only a throttle, while piston engines had controls for the throttle, mixture, and prop.

Of course, there were, trade-offs. Performance was higher, as were takeoff, approach, and landing speeds.⁴ Higher speeds meant not only less time for pilots to react, but due to faster vertical change,

increased altimeter lag, which gave the pilot erroneous altitude information.⁵ Jet engines were new to Air Force pilots and ground crews. Flying characteristics were different, for example, compared with prop aircraft, jet aircraft decelerated relatively slowly when the throttle was retarded. (Speed brakes were added to provide additional drag to slow jet aircraft more rapidly.) On the other hand, a particularly dangerous aspect of flying jets was that it took some time for jet engines to deliver increased power (“spool up”) unlike prop engines that delivered power almost immediately on demand. One early (1948) jet flight manual emphasized: “The acceleration characteristics of a jet-propelled airplane are definitely inferior to those of a propeller-driven airplane.”⁶ Another peril was that advancing the throttle too rapidly could cause a jet engine to “flame out” and lose all power. In addition, jet engines were prone to suck up foreign objects and damage their internal workings.⁷ Tricycle landing gear was novel to most pilots and posed the possibility of dragging the tail when landing.⁸

U.S airmen transitioned quickly to jet aircraft. The first American jet, the P-59, flew in October 1942 and the first jet fighter introduced into service (P-80) made its maiden flight in January 1944.⁹ In the last half of 1949 jet fighter flying hours in the USAF exceeded prop fighter flying hours for the first time and in 1953 87 percent of USAF fighter flying hours were logged in jets. (The switch to jet bombers was somewhat slower; as only 7 percent of USAF bomber flying hours in 1953 was in jets; and it wasn't until the last quarter of 1957 that jet bomber flying hours exceeded prop bomber flying hours.)¹⁰

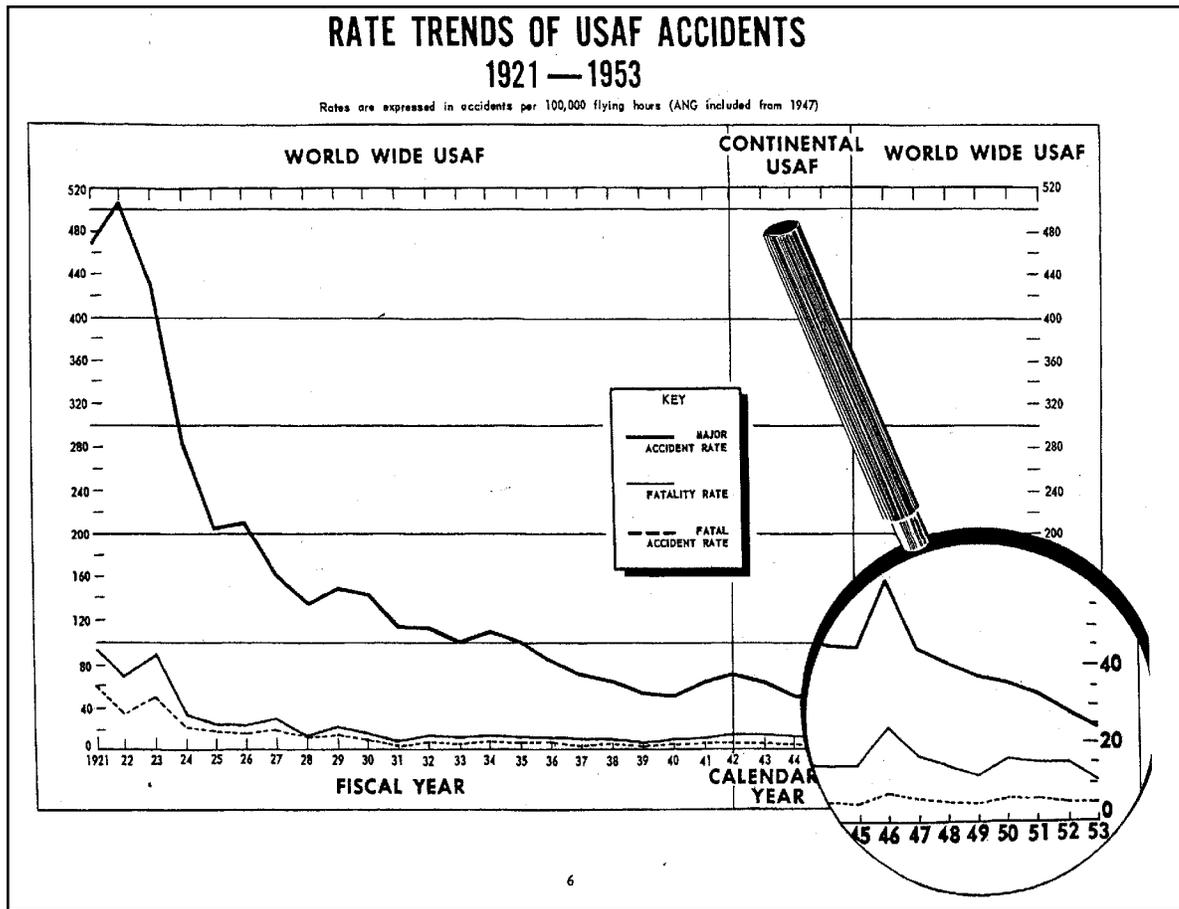
The Air Force put three jet fighters into service following World War II and into combat in Korea (1950-53). America's first jet fighter, the P-59, was not one of these. With a top speed less than that for piston powered fighters of the day, Bell built only 66 of the planes and none equipped operational units. Instead the better performing Lockheed P-80 Shooting Star became the Air Force's first service jet fighter. The USAF accepted about 1,600 of the fighter and reconnaissance versions and employed it in combat almost until the end of the Korean War. Meanwhile, the Republic P-84 Thunderjet made its maiden flight in February 1946, while the North American P-86 Sabre first flew in October 1947.¹¹

Was this transition to jet power a revolution or evolution, were the jets something entirely new or

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Kenneth P. Werrell graduated from the USAF Academy in 1960 and served five years on active duty, mostly as a WB-50 pilot flying weather reconnaissance missions over the northwest Pacific, before resigning his commission. He went on to earn his history Ph.D. at Duke University and teach history at Radford University before retiring in 1996. He has authored seven books on aviation history, the most recent of which are Blankets of Fire: U.S. Bombers over Japan during World War II (Smithsonian, 1996); Chasing the Silver Bullet: U.S. Air Force Weapons Development from Vietnam to Desert Storm (Smithsonian, 2003); and Sabres over MiG Alley: The F-86 and the Battle for Air Superiority in Korea (Naval Institute, 2005). Currently he is working on a book on the development of strategic bombing and strategic bombers.

Figure 1.



CHUCK YEAGER, ... STATED ... IT WAS "LIKE TRYING TO LEARN HOW TO RIDE A RACE HORSE AFTER RIDING ONLY ON ELEPHANTS"

just another aircraft, albeit with higher performance? Chuck Yeager, the renowned test pilot, stated after first flying a jet that it was "like trying to learn how to ride a race horse after riding only on elephants."¹² Nevertheless the Air Force adopted the evolutionary view and as a consequence took few additional efforts to integrate the new technology. In any case, jet fighters had problems.

Aircraft Problems: F-80

The first major issue with the Shooting Star involved the power boosted aileron controls. (Controls in previous aircraft were unboosted, but the jets' higher speeds required greater control forces which meant that pilots needed additional help.) When operating normally the F-80's system permitted a roll rate of 135 degrees per second, however, when inoperative the fighter's roll rate was reduced to less than 12 degrees a second; put another way, without aileron boost stick forces increased fifteen fold. In September 1947 the service attributed four major accidents to loss of lateral control and suspected this as the cause in five other accidents. Three of the first 29 fatal F-80 accidents were caused by loss of control. The problem was that the F-80's hydraulic system could not provide adequate pressure for aileron boost when other hydraulic systems were operating (such as the landing gear or speed brakes). Lockheed's design was flawed and the USAF response was worse. When a crew chief in one RF-80 unit found

that a larger hydraulic accumulator from an RB-26 would fit nicely on the Shooting Star and solve the problem, the responsible Air Force agency, Air Materiel Command, would not authorize the "fix." Instead it told the unit to "proceed at their own risk" and did not circulate the information to other F-80 outfits. Only belatedly did the Air Force begin modifying the system in 1948 by substituting a larger accumulator to provide more hydraulic pressure, but this modification took some time.¹³

Another F-80 vulnerability was a weak horizontal stabilizer. An Air Force communication in fall 1950 stated that the "F-80 fatal crash at Nellis AFB 9 October [19]50 has conclusively established this is a repetition of the same type of structural failure which has caused 8 crashes and is the probable cause of 3 additional crashes this year."¹⁴ The message went on to note that tail failure might account for the loss of three F-80s that did not pull out of dives in Korean combat, crashes the USAF had blamed on enemy ground fire. The authors of the message vented their frustration as they urged immediate and rapid testing of the problem, otherwise "This directorate feels unable to contribute further to the reduction of this type of F-80 crashes beyond maintaining a bookkeeping record of wrecks and fatalities until repeat until active interest and cooperation by responsible agencies is demonstrated by immediate remedial action."¹⁵ In January 1952, an F-80 turning onto final approach went out of control, crashed, and killed the pilot. The accident board concluded the fatal accident

The Army airmen endured high accident rates between the wars. Capt. Norbert Carolin (in helmet) survived this crash on the mud flats of the Elizabeth River in New Jersey, without injury on March 10, 1919. (Photo courtesy of the National Museum of the U.S. Air Force.)



AIR MATERIEL COMMAND ... CONCLUDED THAT WING FAILURE WAS CAUSED BY HIGH SPEED PULL-UP IN EXCESS OF SPECIFIC LIMITS NOTED IN THE TECHNICAL ORDER, IN SHORT, PILOT ERROR

was caused by either pilot error or the failure of the horizontal stabilizer, for at this time not all F-80 tails had been reinforced.¹⁶ Lockheed had failed to meet the greater demands on the aircraft's airframe and control system and, along with the Air Force, was slow to react to these shortcomings.

Aircraft Problems: F-84

Perhaps the most disconcerting of the F-84's problems was losing wings. This flew in the face of the aircraft's rugged appearance and the reputation of its manufacturer (Republic) that built the P-47, undoubtedly the toughest fighter of World War II. The Air Force knew of this situation as early as 1948, when tests revealed that the wing construction was "the main source of difficulty with the airplane."¹⁷ The fifth fatal broken wing accident (August 1950) prompted the accident board to write, "Although this type aircraft has a history indicating [that] wing failures in flight are not uncommon, it is felt that this trouble does not exist until the 'g' limits are exceeded." Nevertheless, the report ended with the damning recommendation that "future fighter aircraft [should] be designed in such a manner that ordinary gunnery passes can be made with a high degree of safety and confidence and with a minimum possibility of shedding wings."¹⁸ Following the ninth fatal accident caused by a wing ripping off the aircraft, Air Materiel Command tested the structural strength of "war weary" F-84s and concluded that wing failure was caused by high speed pull-up in excess of specific limits noted in the technical order, in short, pilot error. Therefore, it recommended that "No further engineering action is indicated."¹⁹ After the twelfth

fatal accident attributed to wing failure, the 86th Fighter-Bomber Wing examined its Thunderjets and found that 60 to 70 percent had various wing cracks around the wheel well area, some of which required replacement.²⁰ Air Training Command took action after two more fatal wing failure accidents by restricting F-84B, C, and D fighters from flying air-to-ground and aerobatic missions or other maneuvers that would have a high probability of exceeding the aircraft's specified flight limits. In all there were fifteen known accidents caused by wing failure that killed the pilot.²¹ While 15 out of 250 fatal accidents (6 percent) seems rather small, there may have been other fatal accidents, and certainly non-fatal accidents, in which wing failure played a role. In any event this situation was poorly handled and this problem understandably gave the aircraft a bad reputation.

The Thunderjet encountered other difficulties. A defective part in the elevator control system caused several accidents malfunctions in the elevator trim system. Nine of the fatal F-84 accidents were attributed to control failure, however surely some of the fatal accidents listed as "unknown" probably were caused by control malfunctions as well. Nevertheless, the largest cause of fatal F-84 accidents was engine failure, 46 in all.²²

Aircraft Problems: F-86

Like all new aircraft, the F-86 experienced early problems, but no serious or lasting ones. Chronologically the first involved the landing gear. This was somewhat surprising as that system was neither new nor exotic. North American test pilot George Welch struggled with the gear on the

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ARMY'S TANK
DRIVERS

plane's maiden flight in October 1947 and four of the Sabre's first five major accidents involved the nose gear. This problem resulted from both design and manufacturing deficiencies.²³ As late as November 1950 the Air Force complained of an excessive number of accidents involving the nose gear. Almost 10 percent of the F-86 major accidents through July 1953 were connected with the landing gear, two-thirds of these with the nose gear. The Air Force worked out these problems in successive Sabre versions. Whereas 12 percent of the F-86A major accidents involved the landing gear, this figure fell to 5 percent for the later F-86E and 7 percent for the F-86F.²⁴

The F-86 instruments also posed problems. An early 1950 survey noted that the Sabre's airspeed indicator read 15 kts low at the aircraft's high-speed limitation. More serious were non-standardized attitude indicators. For example, in early 1951 the 33d Fighter Interceptor Wing was using four different types of attitude indicators, and as late as August 1951 at least three different types. The hazard was that two of these gave opposite presentations, a situation that was confusing at best, and dangerous when flying at night, and in emergency or bad weather conditions.²⁵ No one seriously considered human factors until later.

Another problem involved the fighter's control stick. Accident investigators attributed a fatal accident in which the pilot flew into the ground at Nellis in January 1953 to the stick grip separating from the control column. A review of the records and inspection of F-86s at the base revealed three other incidents involving separated stick grips and four cases of loosened grips. The USAF discovered that since January 1952 a dozen undetermined fatal accidents might have been caused by the control stick failure. Clearly there were manufacturing and quality control deficiencies.²⁶ This situation highlights the Air Force's inability to quickly circulate and act on critical flying safety information.

Engine failure was the greatest cause of F-86 accidents accounting for 15 percent of the fighter's major accidents.²⁷ Some of these failures could not be further pinpointed, for both rapid throttle movement (pilot induced) and system malfunction (material or maintenance failure) could cause flameouts.

One cause of flameouts was the F-86's emergency fuel system. It could supply fuel to the engine in the event the main system regulator or switch failed. But if the automatic feature malfunctioned, it could pump excessive fuel to the engine and flame it out. In the twelve months following March 1949, the 1st Fighter Wing suffered 17 flameouts, 15 with the older of two types of emergency fuel regulators. (One pilot survived two flameouts in one day, another, two flameouts in one month.) In early 1950, an accident board recommended that F-86s equipped with this device be restricted to flying below 25,000 feet and that fall an engineering officer in one unit suggested that these Sabres be used only as lead aircraft and flown by experienced pilots. While the USAF replaced the early emer-

gency fuel regulator with another, this did not completely solve the problem.²⁸ Three separate accident boards in 1952 and 1953 recommended that the USAF study whether the device should be removed from the F-86. One officer observed that "This system might possibly cause more accidents than it prevents."²⁹ Air Materiel Command, responsible for the system, recommended that the device be engaged only if the main fuel system failed. Despite these criticisms, the system was retained.³⁰

Associated Equipment: Mostly Escape Systems

The introduction of jets brought with it new equipment. "Crash helmets," later renamed "flight helmets," were slow to enter the system and forced the first jet pilots to do without or use expedients such as football type headgear borrowed from the Army's tank drivers.³¹

Escape systems presented more serious problem. Escape from a crippled jet fighter in flight was more difficult than from a prop-powered fighter due to increased speeds and "g" forces. Not only was there a problem getting out of the cockpit because of greater "g" loads on the pilot and air loads on the canopy, it was also more difficult to clear the tail. Complicating the problem was the ability of the human body to withstand the high acceleration forces of ejection.³²

The Air Force was slow to provide jet pilots with a reliable and effective escape system. The F-80A went into service without ejection seats. Later Lockheed fitted the escape device into the "B" model that entered the inventory in 1947, and then retrofitted them into the earlier "A" and "B" versions. However ejection seat installation was slow: two years later the Air Force was still retrofitting F-80Bs with ejection seats and as late as September 1952 the Air Force was operating F-80As without ejection seats. Having the seats installed was not enough, as some were not operational. In March 1950 one unit reported that propulsion charges for the system were not available and another in August that it had received and installed charges in only 27 of its 76 aircraft. This problem with ejection seat propellants, especially years after the seat's introduction, indicates a serious lapse in the system. The airmen commented on problems with the design of the F-80 escape system in 1951 and malfunctioning of the canopy release the next year.³³

The Air Force also encountered problems with ejection seats in the F-84. It entered service in December 1947, yet as late as mid 1949 there were Thunderjets lacking ejection seats, seats not connected, and seats without propellant charges. Another difficulty was that Republic fitted different canopies in successive models that required different ejection procedures, which if not properly followed, could prevent the canopy from jettisoning. An accident report in early 1951 concluded that the company needed to modify the escape system for it was impossible to escape from the F-84C when the

Capt. Clifford Thompson of the 4th Fighter Group had his engine fail as he attempted a go-around on Sept. 7, 1951, in Korea. He suffered minor injuries, although the Sabre did not fare as well. (Photo courtesy of the Air Force Historical Research Agency.)



**OF 26
EJECTIONS
THROUGH
THE CANOPY
IN ALL TYPES
OF
AIRCRAFT,
42 PERCENT
PROVED
FATAL
COMPARED
WITH THE
USAF
EJECTION
FATALITY
RATE OF 17
PERCENT**

aircraft was operating under heavy “g” loads.³⁴ A June 1951 accident report noted that of 29 F-84 bailouts, 8 pilots had experienced difficulties, and in 4 additional cases bailout was prohibited.³⁵ A recommendation following a fatal Thunderjet accident two years later was “That the entire bail out ejection system on F-84B and C type aircraft [should] be redesigned or modified so that in an emergency the pilot can safely get out of the aircraft.”³⁶ The later “G” model, the last of the straight wing Thunderjets, was no better. Of 23 ejections prior to February 1953, 12 were fatal and another 4 resulted in major injuries. An F-84 group commander wrote in December 1953, “In the F-84G, the decision [to eject] must be made even more quickly in that if control is lost and high speed is reached a successful escape from the aircraft is most unlikely.”³⁷

Of the three Air Force jet fighters, the F-86 had the lowest ejection fatality rate.³⁸ Of 85 bailout attempts from F-86s up through the end of July 1953, 15 percent were fatal. In comparison the USAF noted a 23 percent fatal ejection rate during the 1949-1953 period.³⁹

The F-86 illustrated some of the difficulties and peculiarities of ejection seat use. The fighter’s 1948 flight manual instructed the pilot not to eject in low speed bailouts (speeds not specified) “As seat ejection subjects the pilot to extremely high forces, this method of exit should be used only when normal bail-out is impossible (at extremely high speeds or when [the] airplane is uncontrollable).”⁴⁰ No wonder pilots distrusted the system and as a result some deactivated the ejection seat! (Sitting atop a live 37 mm. cannon charge gave others

pause as well.) Second, in the early F-86A models the canopy jettison handle was mounted on the lower forward cockpit panel between the pilot’s legs forcing the pilot to reach forward and extend his arm to activate the canopy jettison, not an easy task if the aircraft was violently maneuvering or experiencing heavy “g” loads.⁴¹ Third, in the early models the ejection seat would only work if the canopy jettisoned. It was not until 1953, beginning with the F-86F-20, that the seat could be fired through the canopy. (This was a last resort maneuver. Of 26 ejections through the canopy in all types of aircraft, 42 percent proved fatal compared with the USAF ejection fatality rate of 17 percent for that period.⁴²) Another potential problem in the F-86 was that the departing canopy had the tendency to “dish down,” and therefore the flight manual warned ejecting pilots to “keep head and body as low as possible.”⁴³

In summary, although the Air Force knew there was a problem of pilots safely abandoning jet fighters in flight, it took slow and minimal action. While it fixed small problems with the escape systems, it made no overall, focused effort to deal with the issue. Meanwhile, the U.S. Navy and the British Royal Air Force pushed toward a zero altitude, zero air speed, escape system, which the Air Force considered unrealistic. (The USAF instead pushed for a 500 foot altitude requirement.) Such a system took time to develop and it was not deployed until the mid-1960s. One possible explanation of why the Air Force trailed in fielding a better ejection seats is that it relied on the aircraft companies to develop the seats while the Navy and British relied on companies devoted only to ejection seats.⁴⁴

The F-86 encountered landing gear problems throughout its early years. On its first flight on Oct. 1, 1947, test pilot George "Wheaties" Welch had difficulties with the nose gear. As seen here, the nose wheel failed to fully extend and give a safe indication when Welch attempted to land. It finally locked at the last moment before touching down. (Photo courtesy of the Boeing Aircraft Company.)



**ON JUNE 8,
1951, ...
16 F-84s
ENCOUNTERED ICING
... THE COST
WAS EIGHT
THUNDER-
JETS
DESTROYED
AND THREE
PILOTS
KILLED**

Weather

There were other flying safety problems in addition to those associated with hardware. For example, the cause of the worst accidents on a single day was not midair collisions, the cause of the most multiple aircraft accidents, but poor weather. Weather forecasting was less accurate than today, but even more significant, Air Force training gave fighter pilots limited and inadequate skills for flying in non-visual (instrument) conditions.

The USAF of the 1940s and 1950s was clearly not an all-weather flying force as three examples from the early 1950s make clear. On June 8, 1951 a formation of 16 F-84s climbed out from Wright-Patterson Air Force Base in Ohio and flew into a cloud at 12,000 feet. They encountered icing that forced 2 pilots to abort the mission, 4 others to crash land, 3 to bail out, and 1 to crash. The cost was eight Thunderjets destroyed and three pilots killed.⁴⁵ F-86s ran into a similar weather disaster a year and a half later when seven Sabres took off from Traux Field, Wisconsin on a practice intercept. While they were completing their training mission the weather closed in, and only three aircraft landed safely. Two pilots died in the four aircraft that were destroyed. Weather was certainly a factor in the December 6, 1953, F-84 accident that killed four F-84 pilots who flew into the ground on an instrument approach.⁴⁶ These were just the most dramatic of the weather related accidents. For between January 1949 and June 1953, the USAF cited weather as an accident cause in 14 percent of its major fighter accidents.⁴⁷ This highlights training as a major issue in flying safety training.

Training

Training is a vital element of flying safety. During World War II the AAF produced approximately 200,000 pilots, 40 percent of whom flew single engine aircraft.⁴⁸ This great number along with the drastic draw down in the military after the end of the war, led the AAF to stop all pilot training until October 1946. The classes that followed were not as large as those during the war, therefore the majority of USAF fighter pilots in the early 1950s were trained prior to 1946. In the period July 1949 to June 1950, 62 percent of the USAF's 1,100 active duty jet fighter pilots, had earned their wings prior to 1946. (The numbers of World War II trained pilots would be bolstered by the recall of reservists during the Korean War.) At first glance this did not seem to be a problem due to the young age of the men who earned their wings during World War II. However, the introduction of the jet challenged the conventional wisdom that total flying time was the key to flying safety. More important was the amount of jet flying time, especially the first few hundred hours. Pilots who had flown less than 100 jet hours had the highest rate of jet accidents, regardless of total flying time. One study showed that pilots with less than 300 hours total flying time had 1.5 times more accidents than the entire group, while pilots with fewer than 100 jet hours had an accident rate almost three times that of the entire group. In the period January 1951 through June 1953 pilots with fewer than 150 jet-flying hours accounted for 45 percent of jet accidents.

A case in point concerning inadequate training of jet fighter pilots involves those pilots who pinned



Joe McConnell was the top American ace of the Korean War with 16 credits. Following the war, the USAF assigned him to test pilot duties at Edwards AFB. On August 25, 1954, the F-86H he was testing had elevator problems. He attempted to land using the trim controls and throttle, but crashed and was killed. (Photo courtesy of the Air Force Historical Research Agency.)

on their wings in 1949. During the period July 1949 until June 1950, the 290 pilots who had earned their wings in 1949 comprised 25 percent of the fighter pilots, flew 27 percent of the jet time, and accounted for 37 percent of the jet accidents. Their major accident rate was more than twice the USAF average.⁴⁹ The class of 49C that graduated in September 1949 was a particular problem. Between December 1 1949 and the end of April 1950 six of sixteen fatal F-80 accidents, three of eight fatal F-84 accidents, and neither of the two F-86 fatal accidents involved graduates of 49C. Five of the F-80 accidents occurred in the Far East prompting the commander of Fifth Air Force to restrict pilots of that flying class from flying jet fighters until they were reevaluated. That command gave these pilots a training program that included 20 hours flying (in the T-6 and T-33) before they were returned to operations.⁵⁰ Obviously new pilots were not receiving adequate training to prepare them to fly jet fighters.

The situation with operational units was similar; limited jet flying experience led to accidents. The first unit that transitioned to the F-86, received the fighters in February 1949 and suffered its first major Sabre accident in April. During its initial quarter of operations, the 1st Fighter Group suffered five major accidents (including two fatalities and three total wrecks), had five more major accidents in its second quarter (with two write offs), and then two major accidents during the last quarter of the year.⁵¹

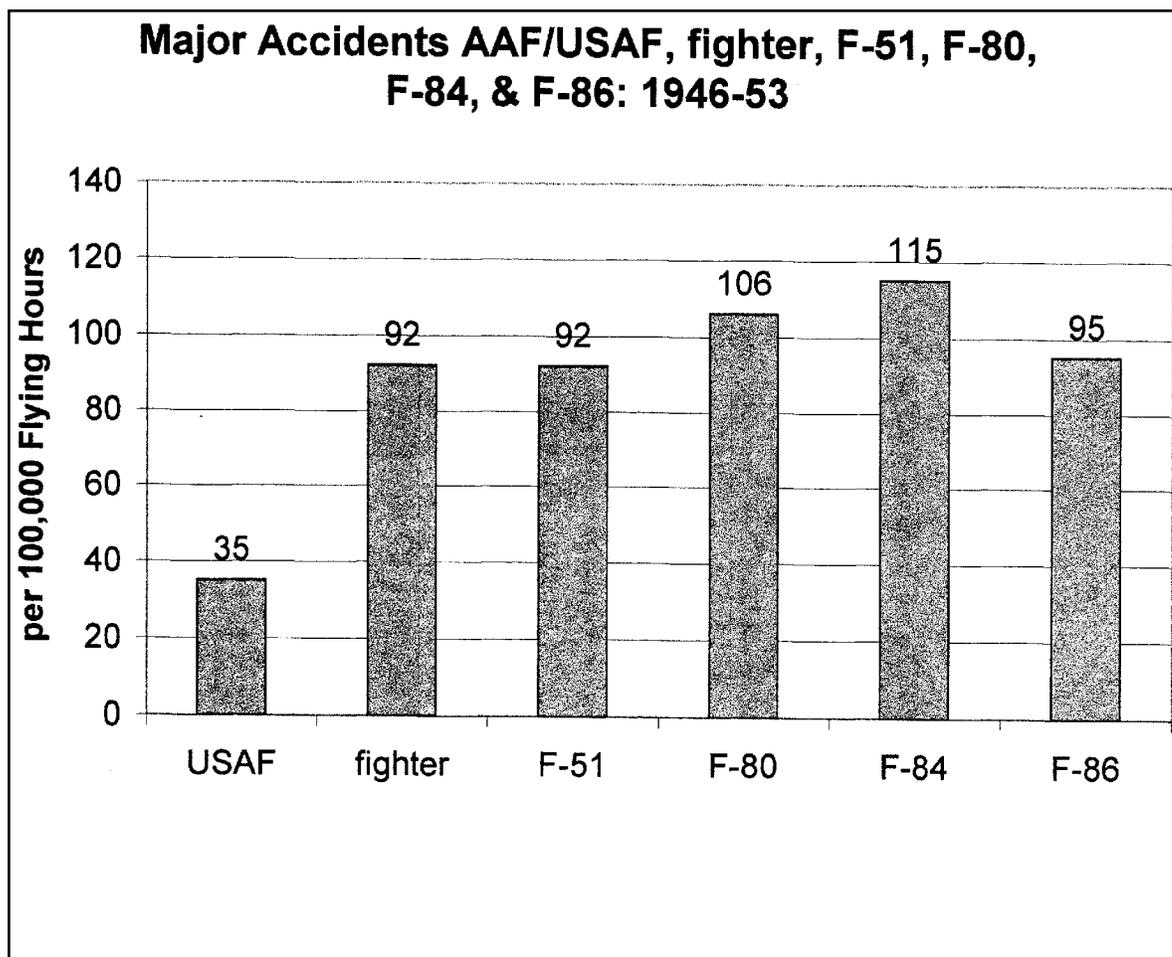
An early 1950 report blamed neither Air

Training Command nor the tactical units for the inadequate training. It diplomatically explained, "[t]he phrase 'inadequate training' must be considered to be due to several factors, chief among which are the urgency of international affairs, the reduced budget of the Air Force, and the state of the arts."⁵² A later report was harsher, noting the "inept flying on the part of pilots recently graduated from the Air Force flying schools."⁵³ If the specific problems described therein were widespread, as implied, this is an accurate summation. It stated that new pilots were not getting enough fighter flying time, the F-51 was unsuitable for jet fighter training, instrument and night flying training were inadequate, and the curriculum was lacking important elements. In brief "[g]raduates therefore are not proficient fighter pilots."⁵⁴ This report went on to criticize the lack of standardized USAF flight instruments. The USAF was using three different types of attitude indicators, some jet fighters and trainers had airspeed indicators graduated in miles per hour while others were using knots, and these instruments were located in different positions on the instrument panel of the various jet fighter types.⁵⁵ The Air Force's failure to standardize these items was a serious lapse.

Another major problem with USAF training was the lack of a two-seat jet trainer. In the prop era, fighter pilot trainees progressed from lower powered and performing two-seat trainers to higher powered and performing ones, and then to a more powerful and more complex operational fighter. From the first day of jet training, however, the jet trainee had to fly solo with at best an instructor flying in an accompanying aircraft. This arrangement worked when there were no problems, but proved very difficult and sometimes fatal if there were difficulties.⁵⁶ In mid-1947 Lockheed added three feet to the fuselage of an F-80C to accommodate a second pilot in tandem. The two-seat trainer first flew in March 1948 and went into service as the T-33A in May 1949. The T-bird proved to be an excellent trainer, greatly enhanced pilot training, and trained many pilots throughout the world.⁵⁷

The Korean War forced changes within the Air Force, which was already in turmoil as it transitioned from prop to jet aircraft. The war's demand for large numbers of pilots was met by increasing the production from training schools (I suspect it was done in part by lowering standards), reassigning pilots from desk jobs, and recalling reserve pilots to active duty. This resulted in an influx of what an Air Training Command historian called "notoriously unqualified" individuals going through jet training. Many of the recalled reservists had been out of the cockpit for years, as had those regular air force officers who had been serving in administrative positions.⁵⁸ A retraining program in the F-80 at Nellis began in mid-July 1950 and closed down in January 1951. In June 1951 the USAF established two jet fighter schools, labeled "fighter-bomber/escort," at Luke and Nellis Air Force Bases where students flew F-51s, F-80s, and

Figure 2.



**ONE FACT
REQUIRES
EMPHASIS:
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F-84s. The USAF established a training program for the F-86 day fighter by the end of 1951 and by 1953 there was a program for both the F-86 day fighter and fighter-bombers at Nellis.⁵⁹

For all of the shortcomings and criticisms of the USAF pilot training program, one fact requires emphasis: the Air Force program produced far better trained pilots than did its foes. For in the air battle over Korea these men performed in a spectacular fashion. Sabre pilots won and maintained air superiority and ran up a high victory to loss ratio against MiG-15s despite the fact that the F-86 had at best equivalent performance compared with the Soviet fighter, operated at the limits of its range against larger numbers of Communist fighters, and operated under restrictive rules of engagement. The major American advantage in the air-to-air battle was the skill, aggressiveness, and experience of the Sabre pilots, certainly much of which is attributable to superior training.⁶⁰

Air Force Attitude Concerning Flying Safety

The Air Force attitude toward flying safety deserves comment. Overall, it appears that during this period the Air Force accepted aircraft accidents as the cost of flying and made changes only on the margins. This attitude, perhaps acceptable in a total war—when America was producing hundreds of thousands of pilots and planes—was inappropri-

ate in the period following World War II as the numbers of both aircraft and pilots decreased, while the cost of turning out both increased. While difficult, if not impossible, to document, we do have anecdotal evidence and glimpses of this attitude. Some of this attitude resulted from the presence and influence of World War II veterans. They exhibited what one pilot of that era called the “bullet proof syndrome,” that is, if the enemy could not get them in wartime, nothing could happen to them in peacetime. In this pilot’s words, the Air Force “suffered from [a] terrible post-war lack of real discipline and leadership” and a “lack of professional approach to our flying.”⁶¹ In this period, checkouts were minimal, technical information was very poor, and buzzing and hassles were the order of the day. “Those days were a lot of fun,” he recalls, “but the cost was high.”⁶² Another pilot recalled that checklists were not required during the 1950s, and that “Most real fighter pilots did not carry a checklist with them.” He went on to note that “[a] lot of our accidents were [a result of] trying to prove our manhood.”⁶³ A more specific example is that of a World War II ace with over 1,800 flying hours. He lied that he had Sabre flying experience and asked for no help on his first flight other than for the crew chief to start the engine. He did not use a check list, and after ten flying hours in the F-86 survived a crash when he ran out of fuel because he was unable to use the drop tanks.⁶⁴

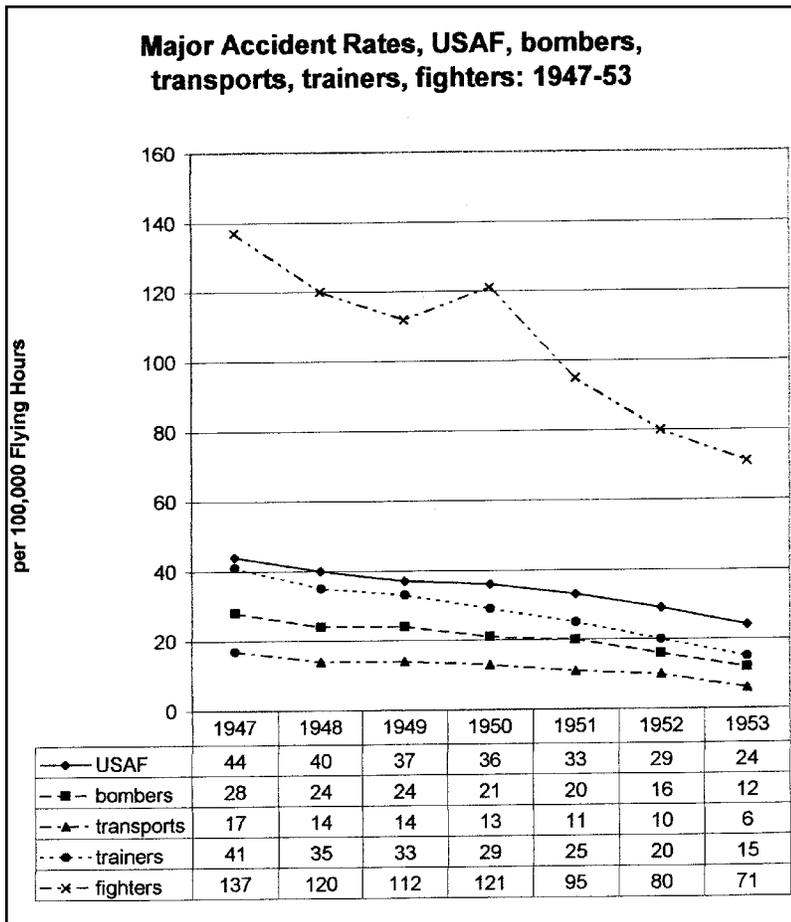


Figure 3.

Flying Safety Statistics

What does this mean in terms of flying safety: what was the AAF/USAF jet fighters record? Some may question the analysis of such statistics, for there are potential problems with the standard of measurement. First, these figures for the AAF and USAF (figure 1), lump together all aircraft, obscuring the fact that there was a great difference in the accident rates between aircraft types. During World War II, for example, the major accident rate for fighters was about 3 times the AAF average, almost 5 times that of four-engine bombers, and over 7 times that of transports.⁶⁵ Between the prop era (World War II) and the transition to jet power (1946-53) the accident ratios between aircraft types narrowed, but remained essentially the same.⁶⁶ Second, there were also differences between specific aircraft models. During World War II AAF fighter accidents rates varied from the safest AAF fighter (the P-51 with an accident rate twice the AAF average), to the worst (the P-39 with an accident rate over four times the AAF average rate.⁶⁷ The accident rates of jet fighters displayed similar characteristics: higher than other USAF aircraft types, with a spread, albeit considerably smaller, between specific fighter types. (figure 2⁶⁸) The accident rate of the entire USAF decreased as did that of fighters, and they fell at about the same rate. (figure 3⁶⁹) Especially noteworthy is that a greater percentage of fighter flying hours were in

DURING THE PERIOD 1947 THROUGH 1953, THE ACCIDENT RATES OF BOTH PROP AND JET FIGHTERS DECLINED AND WERE ESSENTIALLY THE SAME

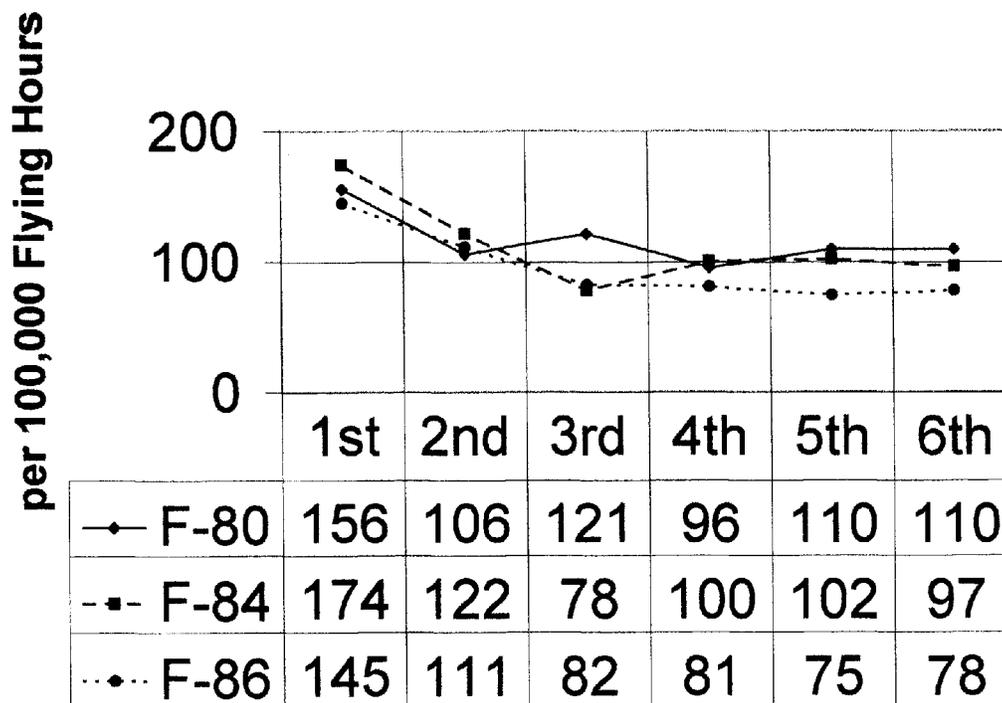
jets compared to the rest of the Air Force. (In 1947 only 19 percent of the fighter flying hours were in jets; in 1953 it rose to 85 percent.)

One problem with this chronological comparison is that the aircraft were in different parts of their life cycle. In an attempt to compare the various fighters at similar stages of their life cycle I have used 100,000 flying hour increments. The major accident rates for all three jet fighters declined sharply over time.⁷⁰ (figure 4⁷¹) A comparison between fighter models is difficult and requires considerable judgment for different fighters were employed in different ways. (There were even substantial differences between the various models of the same fighters.) The F-80 and F-84 were primarily used as fighter-bombers and thus carried heavier loads and operated closer to their design limits than did the F-86 that was initially fielded as an air defense fighter (interceptor), although used mainly as an air superiority fighter until 1953 when a fighter-bomber version went into action. Bombing and strafing runs took place close to the ground where a small miscalculation or mechanical problem could cause an accident while the same situation at altitude, where most air-to-air training was conducted and where air-to-air battles began, gave a greater margin for recovery. In addition, the F-80, as the first operational jet fighter, was extensively used in pilot training, both for those learning to fly and those who would fly the Shooting Star in combat. Through 1953 38 percent of the fatalities in F-80s occurred in flight training units compared with 25 percent of the F-86 fatalities.⁷² Another comparison of the three jet fighters indicates their similarities, more than their differences. A November 1958 study of what caused pilot ejection (by five causes) indicates that only major differences were greater number of ejections in the F-80 due to collisions and the much greater propensity of Sabre pilots to eject due to fuel starvation.⁷³

Comparing the jet and prop powered fighters was another matter. During the period 1947 through 1953, the accident rates of both prop and jet fighters declined and were essentially the same.⁷⁴ (figure 5⁷⁵) One way is to compare two specific aircraft. Probably the closest match for our purposes can be made between the F-51, the last, best, and safest American prop fighter and the F-80 the first operational American jet fighter. The F-80 was closest in chronology to the F-51 as their first flights were separated by a little over three years, their service overlapped, and they went out of action at about the same time. Between 1946 and 1953 the Mustang's major accident rates were lower than the Shooting Star's in all but two of the eight years.⁷⁶ But such a chronological comparison does not take into account the learning curve. This is more difficult to calculate because of the way the AAF published its statistics (by year) and complicated by the huge number of flying hours the Mustang amassed during World War II (773,000 flying hours within the US).⁷⁷ Therefore a comparison of the two fighters' initial record pits the P-51's

Figure 4.

Jet Fighters: Major Accident Rate by 100,000 Flying Hours



USAF'S ... FLYING SAFETY RECORD IN THE FIRST DECADE OF THE JET ERA CAN BE CRITICIZED IN THREE AREAS: EQUIPMENT, TRAINING, AND ATTITUDE

World War II service (its first 800,000 flying hours) against the F-80's first 800,000 flying hours that was reached in the first half of 1951. This reveals that while the jet had the advantage in terms of a lower major accident rate in the first 100,000 flying hours (for which I can only speculate that during the World War II period there were poorer training and laxer operational standards), the prop fighter's accident rate was lower thereon and at the 800,000 flying hour mark.⁷⁸

A comparison of the cause of accidents for these two fighters over the period 1948-53 shows some differences. Pilot error was the largest cause of aircraft accidents, about the same in the two fighters, below 50 percent. There was a difference in materiel failure, however, with the F-80 having a lower percentage attributed to this cause in all but one of six years.⁷⁹ Beginning in 1952 the Air Force broke these figures down further revealing some additional differences. During 1952-53 the F-51 powerplant comprised a greater percentage of materiel failure than did the F-80's engine and the causes of pilot error were markedly different. Whereas the proportion of pilot error in the F-51 attributed to "poor technique in ground operations" was considerably higher than the F-80, the situation was reversed for inflight techniques. Undoubtedly the jet's superior visibility on the ground due to its landing gear configuration (tail

wheel in the F-51 and nose wheel in the F-80) was the significant factor here.⁸⁰

The landing gear configuration theory is reinforced by Air Force figures which detail the phase of flight in which accidents occurred. The F-80 had half the percentage of taxi accidents as did the F-51. The Shooting Star also had a lower percentage of approach and landing accidents than the Mustang, the scene of about half of all the accidents for both fighters.⁸¹

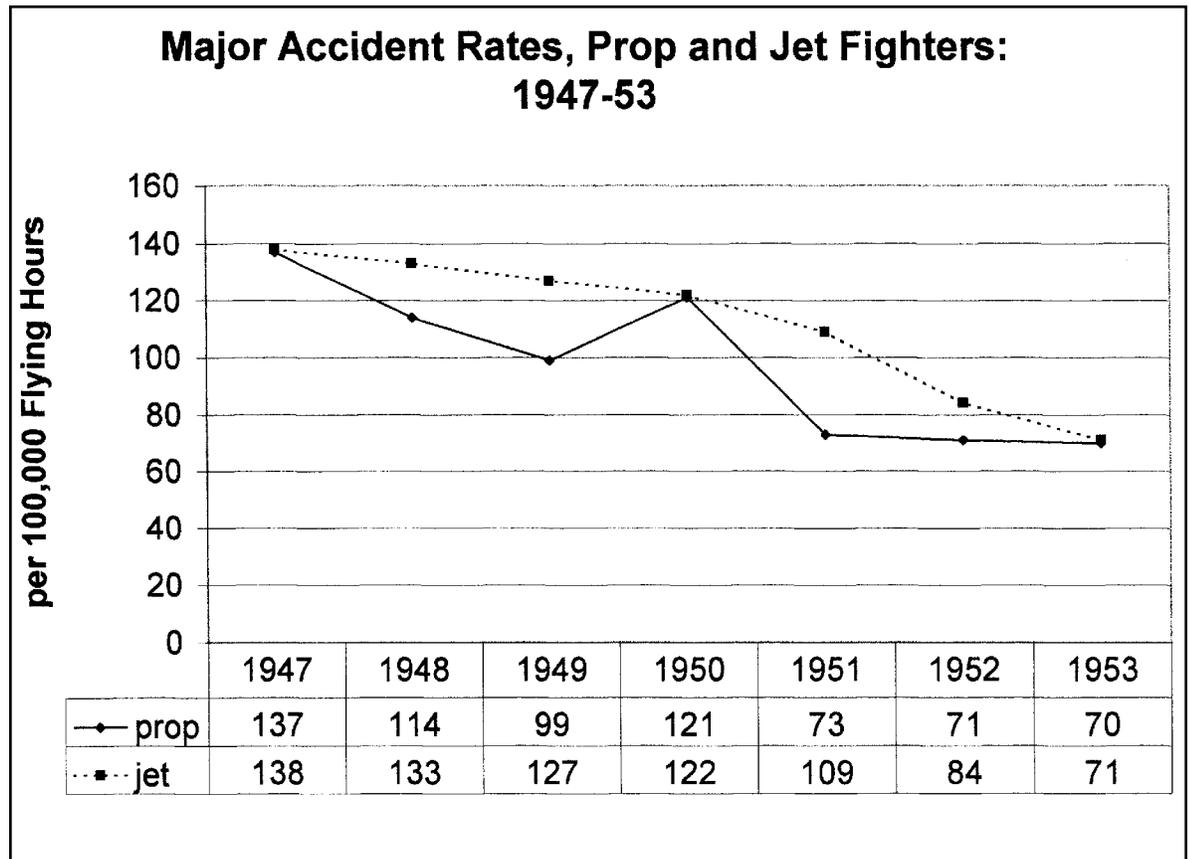
Conclusion

But to answer the original question: how well did the USAF do in its transition to jet fighters? At first glance and as defined by statistics it would seem quite well. Closer examination, however, reveals a different story. Although the overall Air Force accident rate declined during the transition to jets, the USAF's performance regarding flying safety record in the first decade of the jet era can be criticized in three areas: equipment, training, and attitude.

Certainly the Air Force paid inadequate attention to equipment. The initial aircraft were flawed as the F-80 had an inadequate hydraulic system and a defective tail, the F-84 deficient wings, and the F-86 weak landing gear and a dangerous emergency fuel system. In fairness, all new aircraft have teething problems. But the new powerplant and

Figure 5.

FLYING SAFETY WAS NOT SEEN AS A MAJOR PROBLEM AS THE ACCIDENT RATES WERE FALLING AFTER 1946



greater performance of jets brought a new set of difficulties unappreciated by the system. The early jet engines were unreliable and required different techniques and skills in both maintenance and flying. The Air Force only slowly introduced escape systems into service, and these were flawed in design and operation. Likewise the USAF did not make satisfactory steps in training. The USAF did not field a two seat jet trainer until 1949. The service may have recognized, but certainly did not adequately respond to the fact that jets were fundamentally different than prop-powered aircraft requiring different training and procedures, instead the Air Force accepted gradual change, treating jet aircraft as just another aircraft, not a different kind. The Air Force did not provide an adequate program for transitioning prop-trained pilots into jets or preparing new pilots for operational service flying jets. Night and instrument training were also unsatisfactory. The airmen's attitude about flying safety was also deficient from the pilot trainee up through the top leadership. The USAF was slow to put into effect a positive flying safety system. In brief, during this time frame the Air Force neglected flying safety, playing little more than lip service to the concept, collecting statistics but taking little corrective action.

Why this lapse? As there is no documentation on this point, I can only speculate on what played a role in this situation. Air Force leaders had other matters on their minds during this period, which they considered more important: demobilization, independence, transition to jets, the Cold War, and the Korean War. Flying safety was well below other

concerns such as flying performance, funding, research and development, and procurement. Flying safety was not seen as a major problem as the accident rates were falling after 1946, and the rates were considerably lower than those experienced by these leaders (high and low) when the had trained and flown.⁸² Finally, there was no prime mover, organization or leader, to push flying safety as later did Strategic Air Command (SAC) and Gen. Curtis LeMay.

It would appear that the improved flying safety record was due less to direct Air Force action than to other influences. Aviation technology—to include hardware, techniques, training, and attitudes—matured.

The Air Force's shortcomings in this era are highlighted by its subsequent record, for the USAF has come a long way in flying safety since the days when these early jets ruled the skies. A number of factors account for this progress after 1953: for sure new and better equipment, probably improved training, but perhaps most of all, a different attitude about flying safety. Designers and manufacturers fielded better aircraft with more capable and reliable engines, airframes, and instruments. In 1957, the USAF introduced the T-37, a side-by-side, twin seat jet trainer, and in the early 1960s the T-38, a twin-seat supersonic jet trainer. Training improved, molded by the rigid standards set by Strategic Air Command. That command had a check list and procedure for everything and did not tolerate errors, mistakes, or accidents. SAC, and the SAC way, dominated the Air Force from the 1950s for at least two decades pushing the service's



Maj. Richard I. Bong, leading ace of World War II, in front of his P-38 Lightning. On August 6, 1945, while the Enola Gay dropped the bomb on Hiroshima, Bong's P-80 that he was testing malfunctioned just after take-off, and he bailed out too close to the ground and was killed.

flying culture toward an attitude of zero mistakes. While an aircraft accident was not held against a pilot in the early years of the service, in the past two or three decades, such an incident could spell the end to a promising career. Further, the replacement of pilots trained during World War II by pilots trained later, also changed the atmosphere. A counterpoint, however, should be noted. In making flying safety paramount, realistic, "on the edge,"

fighter training was curtailed, certainly frowned upon, as it was more dangerous and accident prone. Thus, USAF pilots who flew in Vietnam probably were safer than both their predecessors and foes in non-combat situations, but at the same time they had less of an advantage in fighting skills than in the past. While the USAF has made significant changes over the past half century, none are clearer than those in the area of flying safety. Today, in an era of multi-million dollar aircraft and aircrew training, the U.S. cannot afford to lose either aircraft or airmen in accidents.

The Air Force can document the significant progress it has made in flying safety since the 1950s. Compared to a rate of 24 major accidents per 100,000 flying hours in 1953, the lowest to that point, since fiscal year 1983 the USAF major accident rate has been less than 2 per 100,000 flying hours.⁸³ To be more specific, while the F-86 Sabre was the best performing and safest of the USAF's three major jet fighters of this period (1945-53), its safety record is overshadowed by the USAF fighters that followed it. Even the much maligned F-100 and F-104 had superior safety records. Bringing the story up to date, comparing the F-86's safety record with the F-15 is breathtaking. The F-86 had 22 times the Eagle's major accident rate, 13 times its wrecked accident rate, and 20 times its fatal accident rate.⁸⁴ This certainly is progress. ■

NOTES

1. An earlier, shorter, more F-86 centric view of flying safety is in this author's *Sabres over the Yalu: The F-86 and the Battle for Air Superiority in Korea* (Washington: Naval Institute, 2005).
2. USAF Flying Accident Bulletin, 1953, 7 HRA K259.3-3 1953. HRA is the Historical Research Agency, Maxwell AFB and the number following is their call number. Figures for 1942 through 1945 are for accidents in the continental US. The airmen calculated flying safety in terms of major accidents per 100,000 flying hours, with subsets of fatal accidents and wrecked aircraft on that scale. Comparing the preceding period with 1953 the fatal accident rate was only better in one year (1939); and the rate of wrecked aircraft was only better in two other years, fiscal 1950 and calendar 1952. *Ibid.*, 6.
3. *Ibid.*, 6.
4. Compared to the 70 to 85 kt touchdown speed of the F-51, jet fighters touchdown speeds were between 110 and 150 kts. (Knots are nautical miles per hour. A nautical mile is 6,076 feet.) Office of the Inspector General [Flying Safety], "Human Factors in Jet Fighter Accidents: Period 1 Jan 1950-30 Jun 1952," 8 HRA K259.2.
5. "Human Factors in Jet Fighter Accidents," 37-38.
6. Handbook: Flight Operating Instructions USAF Model P-86 Airplane, Apr 1948, 25. Hereafter cited as [model] Pilot's Manual, [date].
7. An inspection of 153 engine failures in 1953 found that one third had foreign object damage. Syring Accident Report, 1 Sep 1953 HRA. Reports on individual accidents can be found at HRA and the National Archives. Individual reports are cited as [name] Accident Report, [date]. I have researched all major F-86 accidents through July 1953, and all fatal F-80, F-84, and F-86 accidents through December 1953. This source is cited as Accident Data Base.

8. History AAF Training Command, Jul-Dec 1946, 157-58,258 HRA K220.01.
9. Gordon Swanborough and Peter Bowers, *United States Military Aircraft since 1908* (London: Putnam, 1971), 62,334. "P" was the Army Air Forces (AAF) designation for pursuit, this was officially changed in June 1948 to "F" for fighter. Hereafter I will use the simpler, albeit less accurate, "F" designation to describe the generic aircraft over the 1940s and 1950s timeframe. Marcelle Knaack, *Encyclopedia of U.S. Air Force Aircraft and Missile Systems*, vol. 1, *Post-World War II Fighters 1945-1973* (Washington: Office of Air Force History, 1978), 1n2.
10. The vagueness of this crossover date is due to (1) statistics presented by quarter and (2) that for the period July 1949 through June 1950 the USAF combined F-80 and T-33 statistics. United States Air Force Statistical Digest, Jan 1949-Jun 1950 HRA 134.11-6; USAF Flying Accident Bulletin, 1953, 10-11.
11. America built 3,515 F-84s for foreign governments and 4,009 for the Air Force, the largest jet fighter buy. The USAF accepted 6,353 F-86s of which 5,893 served in US colors. Knaack, *Post-World War II Fighters 1945-1973*, 1,1n2,11,25,49,53,79.
12. Aeronautical Systems Center History Office, *Splendid Vision, Unswerving Purpose: Developing Air Power for the United States Air Force during the First Century of Powered Flight* (Wright-Paterson AFB: Aeronautical Systems Center, Air Force History and Museums Program, 2002), 112.
13. Chapin Accident Report, 26 Sep 1947; Croughan Accident Report, 26 Sep 1947; Chase Accident Report, 27 Feb 1948; Accident Data Base; Bryce Poe, "Early Jet Flying," *Air Power History* (spg 1989), 44.
14. TWX to IG, Reference AFCFS-6A-10-C-15 regarding

- F-80 Tail Failures, 13 Oct 50 in Rudd Accident Report, 9 Oct 1950.
15. The tests had been recommended the previous July. *Ibid.*
16. Perraudin Accident Report, 9 Jan 1952 and 1st Indorsement, LTC Clement K. Miller, Chief, Operations Office, Maintenance Engineering Division to The Deputy Inspector General for Technical Inspection and Flight Safety Research, 1 May 1952, *Ibid.*
17. Air Proving Ground Command, "Operational Suitability Test of the F-84B Airplane," reproduced in Donald Lopez, *Fighter Pilot's Heaven: Flight Testing the Early Jets* (Washington: Smithsonian, 1995), 172.
18. Haupt Accident Report, 5 Aug 1950.
19. Maj Roka Pamperien, Chief, Plans and Operations Office, Aircraft and Equipment Division to The Deputy Inspector General for Technical Inspection and Flight Safety Research, Norton Air Force Base, San Bernardino, California, 1st Indorsement, 15 Sep 1952 in O'Brien Accident Report, 21 May 1952.
20. Capt Robert Iles, Engineering Officer's Report in Hendron Accident Report, 27 Oct 1952.
21. Col Paul Douglas, Memorandum for Chief, Records and Statistics Division, sub: "Report of Special Investigation of Major Aircraft Accident Involving F-84C, Serial No. 47-1471A, near Gila Bend, Arizona, on 17 January 1953," 27 Jan 1955 in Adang Accident Report, 17 Jan 1953; Accident Data Base.
22. Accident Data Base; Carpenter Accident Report, 20 Apr 1951; Luther Accident Report, 21 Jun 1951; Roberts Accident Report, 1 Oct 1952.
23. The cylinder rod specifications called for a hardness of 140,000 psi, but the older ones tested out at 46,000 psi. When the Air Force inspected rods on 75 aircraft for a stamp that indicated that the part had been heat treated, only 38 were found. And of 32 rods in stock, only 15 had heat treatment stamps. 1st Ind. Maj John Walker, Maintenance Staff Officer to CG Air Materiel Command, 16 Jul 1952 in Comey Accident Report, 8 Jul 1952.
24. This does not include 14 accidents caused by pilots landing with their landing gear up and some others caused by a failure of the gear indicator system. "Nose Gear—F-86," *Flying Safety* (Jul 1949), 27; "Who Towed That F-86?" *Flying Safety* (Jul 1950), 9; Fighter Accident Review: Jan-May 1950, 8 HRA K239.2-13; Nash Accident Report, 13 Dec 1949; 6th Indorsement Col. E.L. Tucker, Acting Vice Commander Eastern Defense Force to CG, Continental Air Command, 14 Nov 1950 in Larsh Accident Report, 14 Oct 1950; 5th Indorsement BG Herbert Thatcher, Air Defense Command to Director of Flight Safety Research, 31 Jan 1951 in Hearin Accident Report, 29 Oct 1950; Accident Data Base.
25. 3rd Indorsement LTC Harrison Thyng, Commander 33rd Fighter Interceptor Group to Commanding Officer 33rd Fighter Interceptor Wing, 4 Jan 1951 in Cutler Accident Report, 18 Dec 1950; 2nd Indorsement. LTC Norman Christensen, Chief Aircraft Section to Commander Otis AFB, 2 May 1951 in Newell Accident Report, 11 Aug 1951.
26. TWX Inspector General Norton to CG Air Materiel Command, 4 Feb 1953 in Jocylen Accident Report, 20 Jan 1953.
27. Accident Data Base.
28. F-86E Pilot's Manual, Oct 1950, revised Mar 1951, 8; Christenson Accident Report, 18 Nov 1949; Pasqualicchio Accident Report, 8 Feb 1950; Ramsby Accident Report, 15 Jun 1950; 2nd Indorsement, 334th Fighter Squadron, Dunton Accident Report, 17 Sep 1950.
29. George Goertz, UR [unsatisfactory report] #52-733, 7 Oct 1952 in Richards Accident Report, 30 Sep 1952. Also see Peterson Accident Report, 15 Sep 1952.
30. Col. Norman Appold, Chief Power Plant Laboratory (WCKPG-2) to WCOWF-1, sub: "Effect of Removing Emergency Fuel Controls from F86A, E, and F, Type Aircraft," 27 Apr 1953, Item #348 F-86 Correspondence HRA K202.1-57; History of Fifth Air Force, Jan-Jun 1953, vol. 1, 144 HRA K730.01; 5th Indorsement, Maj Gen Glenn Barcus, Hq Air Training Command, 1 Oct 1953, Reed Accident Report, 3 Aug 1953.
31. History AAF Training Command, Jan-Jun 1946, 105; Larry Davis, *The 4th Fighter Wing in the Korean War* (Atglen, PA: Schiffer, 2001), 21.
32. The first propellants (cannon charges, compressed air, and springs) the airmen used gave a high initial push for a short period of time; later rocket propellants gave a more sustained push over a longer period of time.
33. Moore Accident Report, 6 Mar 1950; Kubelka Accident Report, 7 Aug 1950; Costello Accident Report, 5 Sep 1951; Guinther Accident Report, 9 Jul 1952; Headquarters Air Training Command to Office of the Inspector General, 2nd Indorsement, sub: "Report of Major Aircraft Accident, F-80, 45-8674, 7 Aug 1952," 4 Oct 1952 in Ward Accident Report, 7 Aug 1952; Sharp Accident Report, 12 Aug 1952; Hatch Accident Report, 8 Sep 1952; Mitchell Accident Report, 12 Nov 1952; Knaack, *Encyclopedia, Post World War II Fighters*, 7; Poe, "Early Jet Flying," 45.
34. Dodge Accident Report, 9 Jul 1949; Hefferman Accident Report, 22 Aug 1949; Richardson Accident Report, 13 May 1950; Wilson Accident Report, 14 Sep 1950; Welch Accident Report, 23 Mar 1951.
35. Accident Data Base; Maj Gen Victor Bertrandias, Deputy Inspector General to Vice Chief of Staff, USAF, sub: "Report of Special Investigation-F-84E Accidents of 12th Fighter Escort Wing," 18 Jun 1951, 2-3,13-14 in Horne Accident Report, 8 Jun 1951.
36. Martin Accident Report, 16 May 1953.
37. Col Donald Baccus, Commander 405th Fighter Bomber Group to Commander, 405th Fighter Bomber Wing, 2nd Indorsement, 31 Dec 1951 in McHugh Accident Report, 24 Nov 1953; BG Richard O'Keefe, Director Flight Safety Research to Commander in Chief, United States Air Forces in Europe, sub: "Type Parachute to be Used in F-84G Aircraft," 23 Apr 1953 in Owen Accident Report, 4 Dec 1952.
38. The Canadians had a similar experience; their F-86s had a lower fatality rate than the RCAF's other two jets, CF-100s and T-33s. C. D. Smiley, "RCAF Ejection Experience, 1952-1961," n.d., 39,41 Defense Technical Information Center AO-465171.
39. Regarding the F-86, there were at least five cases when the seat failed to operate, two of which proved fatal. In three other F-86 fatalities there is a question of whether or not the pilot attempted to bail out. Of the fatal F-80 and F-84 accidents, at least 24 F-80 and 55 F-84 pilots attempted to bail out. Accident Data Base. Fatal accidents are for the period prior to 31 Dec 1953. Christopher Carey, "A Brief History of the Development of Western Aircraft Ejection Seat Systems," <http://webs.lanset.com/aeolusareo/Articles/seat/history.htm>.
40. P-86A Pilot's Manual, Apr 1948, 27.
41. This system was changed in the F-86A-5 so that the pilot could jettison the canopy by raising the right seat handle, a system that became the Air Force norm.
42. Ambrose Nutt, Chief Special Projects Branch, Aircraft Laboratory to Mr. Carmichael [sub:] "F-86F Pilot Ejection System," 8 Nov 1957 # 809 in F-86 Correspondence.
43. P-86A Pilot's Manual, Apr 1948, 28,3,15; F-86A Pilot's Manual, Jan 1949 revised May 1949, 19; F-86A Pilot's Manual, Jun 1950; F-86F Pilot's Manual, Feb 1953, 73; North American Aviation memo to Commanding General, Air Materiel Command, sub: "Escape System, F-86A, F-86E, and F-86F Airplanes," 23 Apr 1953, item #346 in F-86 Correspondence; Robert Dorr, *F-86 Sabre* (Osceola, WI: Motorbooks, 1993), 12.
44. Carey, "Brief History of Western Ejection Seat Systems"; R. F. Sadler and E. B. Skinner, "History of Aircraft Escape System Propulsion" showcase.netins.net/

web/herker/ejection/history.html.

45. Memo for Chief of Staff, USAF, sub: "Accidents Involving 8 F-84E Aircraft near Richmond, Indiana, 8 June 1951," 20 Jun 1951; To Vice Chief of Staff, USAF, "Report of Special Investigation—F-84E Accidents of 12th Fighter Escort Wing," 18 Jun 1951 both in Horne Accident Report, 8 Jun 1951. The worst single fighter accident in AAF/USAF history occurred on 1 June 1945. A formation of 184 P-51s dispatched from Iwo Jima encountered bad weather en route to Japan and as a result 27 fighters and 25 pilots were lost. Kenneth Werrell, *Blankets of Fire: U.S. Bombers over Japan during World War II* (Washington: Smithsonian, 1996), 184-85.

46. Headquarters USAF, "Report of Special Investigation of Major Aircraft Accidents Involving F-86s. . . at Traux Field, Madison, Wisconsin, 31 Jan 1953," 3 Apr 1953 in Kemp Accident Report, 31 Jan 1953; Hodge Accident Report, 6 Dec 1953.

47. USAF Statistical Digest, Jan 1949-Jun 1950, 151-53; *Ibid.*, fy 1951, 132-33; *Ibid.*, fy 1952, 132-34; *Ibid.*, fy 1953, 166-68.

48. Rebecca Cameron, *Training to Fly: Military Flight Training, 1907-1945* (Washington: Air Force History and Museums Program, 1999), 388,400.

49. Another study covering the first half of 1950 noted that classes 49A through C had an accident rate three times that of the USAF USAF Fighter Accident Review, 1 Jan-31 May 1950; Directorate of Flight Safety Research, "Jet Fighter Accidents Related to Pilot Flying Experience" HRA K259.2-13 Jan-Nov 1950; Brief History of ATC, 1939-53, 21 HRA K220.01; "A Study of Jet Fighter Accidents and Their Relations to Flying Experience, 1 Jan 1951-30 Jun 1953," Nov 1953, 6 Air University Library M38368 1953 #27.

50. Accident Data Base; Moore Accident Report, 6 Mar 1950. Training Command's semi-annual history noted that the class of 49C was substandard with problems of morale, motivation, and discipline. ATC History, Jul-Dec 1949.

51. Accident Data Base.

52. Fighter Accident Review, 1 Jan-31 May 1950, 132.

53. Fighter Accident Review, Aug 1950, 5.

54. Fighter Accident Review, 1 Jan-31 May 1950, 15, 14. A F-80 training accident prompted the comment that "The flying experience level of the newly graduated pilots is inadequate to enter combat crew training. . ." Robinson Accident Report, 24 Jan 1951.

55. Fighter Accident Review, 1 Jan-31 May 1950, 16; ATC History, Jul 1950-Jun 1951, vol.1, 185.

56. In fact, through 31 July 1953 20 pilots were involved in a major accident during their first F-86 flight. One of these was fatal and five of these resulted in destroyed Sabres. To confirm the point made above, half of these pilots had more than 1,000 total flying hours. Through December 1953, five F-80 and three F-84 pilots were killed during their first flight in those respective fighter. Accident Data Base.

57. Swanborough and Bowers, *US Military Aircraft since 1908*, 338.

58. ATC History, Jul 1950-Jun 1951, vol.1, 268.

59. ATC History, Jul-Dec 1951, 56; ATC History, Jan-Jun 1952, 61-62; ATC History, Jan-Jun 1953, 57.

60. The USAF credited F-86 pilots with 800 MiG-15s destroyed while losing 100 Sabres in air-to-air combat. (More precisely, the Air Force listed 78 F-86s lost in air-to-air combat and 13 to unknown causes.) The Communists admit losing 566 MiGs and claimed to have destroyed 832 F-86s. USAF Credits for the Destruction of Enemy Aircraft Korean War, USAF Historical Study No. 81, 1975; USAF Statistical Digest, fy 1953, 28; Yefim Gordon, *Mikoyan-Gurevich MiG-15: The Soviet Union's Long-lived Korean War Fighter* (Hinckley, UK: Aerofax, 2001), 66. See Werrell, *Sabres over MiG Alley*.

61. Poe, "Early Jet Flying," 43.

62. *Ibid.*, 43,45.

63. USAF Oral History Interview, Lt Gen William Campbell, 17,18,19 Dec 1985, 16,22 HRA K239.0512-1689.

64. James Salter, *Burning the Day: Recollections* (NY: Random House, 1997), 142. The accident investigation put the blame on a possibly faulty fuel gauge. Coman Accident Report, 25 Jan 1952. My three and a half years experience with an operational Air Force unit in the early 1960s (albeit not in fighters) supports this view. I perceived that the older pilots, mostly trained during World War II, had a more cavalier attitude about flying and flying safety than did those of us trained in the late 1950s and early 1960s. I believe that this was even more true in the fighter units.

65. Army Air Forces Statistical Digest, World War II, 310.

66. AAF/USAF Statistical Digest, 1946-53.

67. AAF Statistical Digest WWII, 310.

68. AAF/USAF Statistical Digest, 1946-53.

69. *Ibid.*

70. AAF Statistical Digest WWII, 310; AAF/USAF Statistical Digest, 1946-53.

71. AAF/USAF Statistical Digest, 1946-53.

72. While 21 of the 256 F-80 fatalities were of students learning to fly (unrated) there were no unrated pilots killed in F-86s. Accident Data Base.

73. The sample size of the F-80 ejections is probably too small for analysis (23) compared with those of the F-84 (336) and F-86 (444). Directorate of Flight Safety Research, OTIG, USAF, Norton AFB, CA, USAF Ejection Escape Experience: 29 Aug 1949, 30 Jun 1958, table 17 HRA K237.163-27.

74. The more precise numbers for the period are 95.8 major accidents per 100,000 flying hours for jet and 96.3 for prop fighters. USAF Statistical Digest 1947-51; USAF Flying Accident Bulletin, 1952-53.

75. The sharp eyed reader will note the apparent discrepancy between these numbers and the appearance of the figure. The explanation is that there were many more prop accidents (and flying hours) in the early years than later, with the converse true with the jet fighters. USAF Statistical Digest, 1947-53.

76. USAF Statistical Digest, 1947-53

77. Again, the World War II accident statistics are only for continental US. AAF Statistical Digest, WWII, 310. A further complication is that for four quarters (fiscal year 1950) T-33 statistics were included with the F-80's numbers.

78. These figures are based on the P-51's World War II record (779,000 flying hours) and the F-80 at the end of June 1951 (781,000). AAF Statistical Digest, World War II, 310; AAF/USAF Statistical Digest, 1946-53.

79. USAF Statistical Digest, 1948-53.

80. *Ibid.*, 1952, 38; USAF Accident Bulletin, 1953, 21,23.

81. USAF Statistical Digest, 1948-53.

82. The major accident rate in the 1920s was 230 per 100,000 flying hours, in the 1930s 79 per 100,000 flying hours, in 1940-45 55 per 100,000 flying hours, and in 1946-53 period 35 per 100,000 flying hours. USAF Flying Accident Bulletin, 1953, 7.

83. USAF Statistical Digest, fy 1953, 173; USAF Flying Accident Bulletin, 1953, 7; James Kitfield, "Flying Safety: The Real Story," *Air Force Magazine* (Jun 1996), 57; USAF History, FY75-FY00, www.kirtland.af.mil, AAF Statistical Digest WWII, 310; AAF/USAF Statistical Digest, 1946-1953. I could not find comparable data on the US Navy and only fragmentary accident data from the Royal Air Force. The latter shows a major accident rate of 85 per 100,000 flying hours in 1947; 41 in 1957, 7 in 1967, 3.4 in 1977, and 2.8 in 1987. Andrew Brookes, *Crash!: Military Aircraft Disasters, Accidents and Incidents* (London: Allan, 1991), 38.

84. Individual aircraft histories: www-afsc.saia.af.mil/AFSC/RDBMS/Flight/Statisticalistics/f86mds.html.

The Regulars: The American Army 1898-1941. By Edward M. Coffman. Cambridge: Belknap Press of Harvard University Press, 2004. Notes. Index. Pp. vi, 519. \$35.00 ISBN 0-674012-992

This is the second book in Professor Coffman's two-volume history of the United States Army. Volume one was *The Old Army: A Portrait of the American Army in Peacetime, 1784-1898*. Together they are a history of the first century and a half of the U.S. Army. Each book is self-contained and can be read independently. They are not military histories, but rather histories of one specific military organization. Battles, campaigns, and wars are secondary to the personalities and the demographic, social, educational, organizational, and financial aspects of the Army. It covers the change from a small federal constabulary keeping the peace in the Far West through an expansion to global responsibilities and a modern Army, by World War II standards. Along the way, it successfully fought an insurrection and a major war and changed from horses and sabers to aircraft and tanks. In between, the expansive years were very lean. Because of the period covered, early Air Force history is also discussed.

The book is arranged chronologically. It is based mainly on War Department Annual Reports and official Army registers supplemented by various biographical sources (including questionnaires and interviews). The main theme, management of the Army, is examined by studying a number of questions: How do you go from a small constabulary to a global army for the Spanish-American War, then ramp down while fighting the Philippine-American War, drop further in strength, then have three million men under arms for World War I, drop to less than 138,000 in the Depression, and go back up to the millions of World War II? What are the proper role, doctrine, and organization, if any, for new weapons, such as tanks and aircraft? When and how do you decide to phase out old weapons like coast artillery or cavalry? How do you select and train senior staff officers and commanders for army groups, armies, or numbered air forces when the entire combat forces could be seated in Soldier's Field, Chicago? These and many more questions are answered. Needless to say, it is not a story of perfect solutions. The effects of personalities and mistaken ideas are told, as are the successes.

Another theme is that of the Army and society. Both the internal societies of officers, enlisted men, and dependents and the effects of the American people and the Army upon each other are described. The life of an Army dependent gets more treatment than I have seen before. Life in the Pacific outposts (China, the Philippines, and Hawaii) during the '20s and '30s is described. In the Depression, more than 25 percent of the Army was stationed overseas; Hawaiian

duty was mainly considered "Heaven on Earth." Promotions were either glacial or extremely rapid. For a new second lieutenant, it would take 36 years, on average, to make colonel (an improvement from the 1820s when the time was 58 years).

The racial and religious bigotry of American society was reflected in the Army. The segregated units, the careers of the father and son Generals Benjamin O. Davis, and the race riots involving Army personnel are covered. Class distinctions also applied. Enlisted men were considered second- or third-class people. Yet, blacks enlisted because the Army provided better jobs and security than the civilian world could.

If you remember this period, this book will remind you honestly about how we were and how far we have come. If this is ancient history, this book is a good depiction of a life and time of long ago and far away.

James A. Painter, commissioned as a second lieutenant, Coast Artillery



Ding Hao: America's Air War in China, 1937-1945. By Wanda Cornelius and Thayne Short. Gretna, La. Pelican Publishing, 2004. Map. Photographs. Appendices. Bibliography. Index. Pp. x, 505. \$19.95 Paperback ISBN: 1- 56554-523-0.

Countless stories of heroic wartime actions appear within libraries, bookstores, and personal collections across the U.S. World War II spawned thousands of such literary works, written by both scholarly historians or by those who actually participated. Such is not the case here, however. Dr. Short is a Louisiana-based veterinarian with a life-long admiration of Gen. Claire Chennault. A chance encounter with a former P-40 pilot, named Charlie Olsen, led to numerous discussions about combat aviation and American experiences in China. By teaming with freelance writer Wanda Cornelius, Short was able to bring the story of Chennault's "Flying Tigers" to life. He has gone on to write two more aviation-focused works.

Ding Hao is a detailed narrative describing the American aviation experience in China led by Chennault. The first two chapters, "The Burma Road: Back Door to China," and "Claire Chennault: From Louisiana Swamps to China Skies, 1890-1938," detail both the tenacity and industriousness of the Chinese people as well as the frustration experienced by Chennault in the years following World War I. The reader will see that the American Volunteer Group (AVG) provided Chennault a way to prove that his aviation strategies and tactics were sound, practical, and appropriate. The book maintains that Chennault was maligned during his military service and sought vindi-

cation for his efforts. To a certain extent, proof of this is provided in the third chapter, "Chennault and the American Volunteer Group, 1938-1942," which depicts Chennault's implementation of his training, strategies, and tactics as he built the capabilities of both the AVG and China's air force to help counter Japanese aggression.

With the fourth chapter, "The Making of a China Pilot: Charlie Olsen in Panama," Chennault fades into the background as the focus shifts from the AVG and its volunteers to Fourteenth Air Force and the active-duty Army pilots and crews who fought in China until Japan's surrender in 1945. The next three chapters describe in excruciating detail the daily activities of these brave men as they fought alongside Chinese allies against the persistent Japanese. Frequently, the daily recap tends to become monotonous and redundant as the authors strive to use a variety of verbs and adjectives to describe nearly endless aerial engagements and ground attacks. Fortunately, inclusion of first-hand accounts of select incidents from actual pilots adds a much-needed color commentary. However, this provides only partial relief.

The final chapter, "Victory in the Far East, 1945," covers the final eight months of World War II in China. After daily mission summaries for the previous three years, activity during this year seems somewhat glossed over. The authors state that most combat operations for Fourteenth Air Force units dwindled after May, and combat records were not kept over that time. This chapter also marks Chennault's return to the story, long enough for a sorrowful departure from China and the Army Air Forces. As the general's C-47 rumbles down the runway and away from his beloved China, the saga of the "Flying Tigers" draws to a close.

Ding Hao is a well-researched depiction of American wartime operations in China. It is the story of courageous young men who risked their lives daily to defend a sovereign nation from aggression. It is also the story of a man with a vision who fell victim to bad timing and was ultimately provided a second chance. In the end, Chennault was again denied the opportunity to see the final results of his efforts, forced into retirement for a second time. As the signatures on the surrender document were drying aboard the *USS Missouri*, General MacArthur was quoted as asking, "Where's Chennault?" This is the question the reader is also left asking as the final page is turned. In all fairness, however, the book does live up to its title—"Ding Hao" can be roughly translated into the English phrase, "it is good."

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Airpower in Small Wars: Fighting Insurgents and Terrorists. By James S. Corum and Wray R. Johnson. Lawrence: University Press of Kansas, 2003. Maps. Illustrations. Index. Notes. Pp xiv, 507. \$24.95 Paperback ISBN: 0-7006-1240-8

This book is a result of the authors' course on "Airpower and Small Wars," which they taught at the USAF School of Advanced Airpower Studies. Facing a dearth of both theoretical studies as well as historical case studies, they produced a series of case studies for their students. This book is the result. The studies start with Gen. John J. Pershing's use of the First Aero Squadron in his chase of Pancho Villa. They continue with several pre-World War II small wars, and on through the post-World War II era with its many anti-colonial, Marxist, nationalistic, and drug-related small wars. Not every small war is covered, but an impressive number are.

"Small wars" are defined as combat against a non-state entity. They are not an attractive object for theoretical study. The best two references date from 1896 and 1940. Small wars are essentially violent politics, and the political aspect overwhelms the military. Acceptable compromise is a very good political result, while victory is the military objective. The classic air power theory assumes a strategic center of power which, if threatened or destroyed, can produce victory. Non-state entities do not have a strategic infrastructure and, thus, do not present an objective. They are much more about ideas; thus the "information

war" model is probably more germane. Ideas, personalities, and propaganda are more useful targets. This book does not break any new ground in this area. However, we are promised another book which may examine this question more closely.

The strength of the book is the case studies. They cover everything from cases where the government wins the battles and the war to cases where the non-state entity wins the battles and the war. Variations abound. France in Algeria won the battles and most of the people and lost the war. Great Britain in Malaysia won the battles and most of the people and won the war. Prior to World War II, air power was touted as a cheap method of controlling restless populations. A theme of the book is that air power must be supportive of ground military elements, and both must support political and security efforts. The RAF espoused "air control," especially in Iraq, as a cheap way of maintaining control. It was partially an accounting gimmick. There were large ground forces; but they came from India and, thus, were not charged to the British Treasury. Only the RAF units were.

Another theme is the brutality employed by both sides. Even rebels who do not start out as terrorists rather quickly turn to such methods, while the government forces either historically are brutal or turn brutal in retaliation. Civil wars are historically more violent than "regular" wars. In the case where there is a great discrepancy between the military power of the combatants, there

is a natural inclination to fight "outside the box," which quickly leads to brutality. "Brutality" by them—"necessity" by us.

The book concludes with a set of eleven lessons. Although written before the war in Iraq, these lessons seem very germane. However, there does not appear to be much progress in implementing them. I hope this is due more to my limited vision than reality.

I recommend this book for anyone interested in what will probably be our future wars.

*James A Painter, Lt. Col., USAR (Ret.),
Washington, D.C.*



Brüderlein. By Mr. Dee (Irving Distenfeld). New York: Vantage Press, 2004. Pp. 114. \$11.95 paperback. ISBN:0-533- 14824-3.

Brüderlein is a novel of the air war in World War I. Set on the Western Front in 1917-18, the book imagines twin brothers, separated as small children and unaware of each other's existence, flying fighters for opposing air forces. This story line allows the author to touch on all elements of the air war, from life at frontline airfields and the rigors of air combat in primitive fighting machines to morale and conditions on the respective home fronts.

Those unfamiliar with World War I aviation might find this story a good introduction to a deeper study of the subject. The author sketches reasonably accurate descriptions of the aircraft and tactics employed in Western Front air battles in a format that renders accessible what is for many of us now almost ancient history. Unfortunately, readers looking for the kind of "you are there" feeling offered by the best historic fiction will likely be disappointed. The dialogue and inner thoughts of the protagonists are mostly recitations of clichéd phrases. And while the author avoids the ultimate cliché of having the two brothers engage in a climactic air battle, he does incorporate virtually every other well-worn war novel convention. Thus, the stress of combat is always quickly washed away with a stiff after-action drink in the canteen; the heroes easily garner medals (including a Victoria Cross!); and one of the brothers finds the love of his life by exchanging a single glance with a nurse while on leave.

The jacket notes suggest that Brüderlein may have been intended as a tribute to the author's father who flew as an observer in the Great War. If so, the book succeeds in drawing a picture of decent, honorable men serving their respective countries as well as they knew how. Readers seeking vicarious thrills may want to look elsewhere, however.

Larry Richmond, attorney for the federal government and a NASM docent



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FAC History Book. By Forward Air Controllers Association. 2004. Maps. Diagrams. Illustrations. Photographs. Appendices. Glossary. Search. \$15.00 ISBN: 0-9703068-1-4 Contact: citabriair@yahoo.com

This CD is a wonderful substitute for a book—and somewhat cheaper as well, given the amount of content included. It was developed by the Forward Air Controllers (FAC) Association with their members in mind. That does not, however, preclude anyone with an interest in the air war in Vietnam from buying the disc and learning more about the less well-known part of the war. Many books have been written about the F-105s and F-4s up north, but this fills in a great deal of the history of the war from the perspective of the fliers in the small FAC aircraft.

FACs were in Vietnam from the beginning of the U.S. involvement until the end—1961 through 1973. Over 4,000 pilots served under call signs such as Ravens, Vipers, Sundogs, and Rustics during those twelve years; and more than 200 paid the ultimate price. Five Tactical Air Support Squadrons (TASS) operated throughout Vietnam, Laos, and Cambodia, flying nothing more substantial than the widely used Cessna O-1, Cessna O-2, and North American OV-10 aircraft, and smaller numbers of Pilatus Porters, Cessna U-17s, and North American T-28s. The real beauty of this CD is that it is comprised solely of stories written by many of the men who flew the diverse FAC mission in these aircraft.

The CD is organized into ten sections along with a number of other items that would serve as appendices in a book. A convenient pull-out menu makes it easy to navigate through the material. Inside each of the stories, where required, are highlighted words that lead to maps or pictures. Through the menu, all of the pictures, maps, and other ancillary data are available at any time.

The first section deals with ancestry—the advent of the FAC from the Civil War (the balloon observers used by both sides) through World War II and Korea. “Butterflies and Ravens,” the second section, deals with the war in Laos (a non-existent war) where the Air Commando enlisted “Butterfly” controllers were later replaced by the officer FAC “Ravens.” The next five sections deal with one of the TASS units, 19th-23d. Each of these starts off with an overview of the unit and its history which is then followed by a number of first-person accounts of various operations (for example, there are 64 of these under 19th TASS).

“Gone Brothers,” Section 8, deals with the FACs who were lost during the war. “Legacy” has four stories of the changing world of the FAC since the fall of Saigon. The final section, “Propwash,” contains a glossary, list of FACs who became general officers, FAC poems, trivia, and songs (with appropriate camouflage for the more colorful terms, and a call-sign directory.

The only complaint I have with this otherwise excellent CD is the same one found with many websites: the backgrounds used (lots of clouds and flag banners) really makes some of the text difficult to read. Yellow lettering on clouds just doesn’t cut it! Other than that, however, this is a good buy that contains some really rip-roaring tales and superb history.

Col. Scott A. Willey, USAF (Ret.), NASM Docent and Volunteer



The Martin B-26 Marauder. By J. K. Havener. St. Petersburg, Fla.: Southern Heritage Press, 1998. Tables. Diagram. Photographs. Bibliography. Index. Pp. viii, 264. \$18.95 paperback. ISBN: 0-941072-27-4

Former B-26 pilot Havener has given us a wonderful history of the development and operations of the famous Martin Marauder. A veteran of over fifty combat missions in Europe as well as a transition instruction in the aircraft, he provides one of the best overall histories of the aircraft written.

This is an important point. There are a number of good books about the B-26. In 1980, veteran pilot, Carl Moore, wrote an excellent short book, *Flying the B-26 Marauder over Europe*. This is more of the typical “here’s the story of my experiences during the War” kind of book. It is also far richer in technical content than Havener’s volume. But Havener has assembled stories of literally hundreds of missions, crews, and aircraft from the four major theaters in which the B-26 engaged in combat: the southwest Pacific, Alaska, the Mediterranean, and—most importantly—western Europe.

One of the most important parts of the story has to be how the B-26 was “saved” from being cancelled. Most readers are probably aware of the Marauder’s early problems that led to such epithets as the “Widow Maker,” “One a day in Tampa Bay,” and the “B Dash Crash.” The hero of the story is always Brig. Gen. Jimmy Doolittle. Well, yes, partly. Hap Arnold gave Doolittle responsibility for getting the B-26 weapon system’s problems squared away. But most of the work was done by Doolittle’s hand-picked man, 1st Lt. (later Colonel) Vincent “Squeek” Burnett. The demo flights around the U.S., development of operating procedures, and work with Martin were mostly Burnett’s doing and saved what became one of the great combat aircraft in Europe.

After discussing the origins and claims to fame of the Marauder, Havener devotes the next three chapters to operations. The Pacific and Alaska come across for what they were: training grounds for what the aircraft would later become in Europe. The living conditions and logistics in both theaters were miserable, and the Army really hadn’t

figured out how it wanted to use the aircraft. A superb medium bomber didn’t do as well dropping torpedoes or doing low-level bombing and strafing, and many crews paid the price of these tough early operations. After some initial difficulties in the Med, Doolittle and Burnett finally established how the Marauder should be used; and, despite the also austere field conditions in that theater, the aircraft started showing some impressive results.

But Europe was where Martin’s dream proved its worth. The B-26 had the lowest loss rate of any combat aircraft in the theater. One, *Flak Bait* (in the National Air and Space Museum collection) racked up 202 combat missions—a record for any aircraft in Europe. B-26s were first to hit beach targets on D-Day and hit everything from airfields to strategic targets to bridges and gun emplacements all the way to V-E Day. The eight groups flew from 239 missions (the newest outfit) to 428 (the first group, starting in May 1943).

Martin built more than 5,200 aircraft, but when the war ended these were quickly sent to reclamation sites and, for the most part, melted down for their aluminum. Today only about five of these bombers remain, but they are fitting tributes to an excellent combat aircraft and the men who flew them in combat. Havener has ensured that the Marauder story will not be forgotten.

Col. Scott A. Willey, USAF (Ret.), NASM Docent and Volunteer



Winning My Wings: A Woman Airforce Service Pilot in World War II. By Marion Stegeman Hodgson. Albany Tex.: Bright Sky Press, 2004 (Originally, Naval Institute Press, 1996). Photographs. Pp. xi, 286. \$24.95 ISBN: 1-931721-47-5

I was prepared not to like this book. Having spent 15 years reading WASP books and 10 writing them, I have read the good, the bad, and the ho hum on the subject. I’m a tough critic. To my surprise and gratification, I liked *Winning My Wings* very much.

Marion Stegeman was a WASP (Women Airforce Service Pilots) in World War II, Class 43-5. Her book is based on letters she wrote to her mother while in service (dated March 1943 to May 1944) and to the man who would become her husband, Maj. Ned Hodgson, U.S. Marine Corps. To these, Marion adds her recollection of life at Avenger Field, Sweetwater, Texas, where she trained from March to September 1943, and her duty assignments thereafter.

We enter the cockpit of every trainer right along with Marion—with apprehension and excitement duly described—as well as the airplanes in which she checked out at her duty stations and flew as a member of

the women's squadron of the 5th Ferrying Group at Love Field in Dallas. We live with her through the deaths of three classmates, two in a dual training accident just days before 43-5's graduation. We are privy to the letter Marion writes to her mother following that crash. She is honest about the tragic turn of events and describes the routine of the flight her friends were on. Finally, she—from a pilot's fatalistic viewpoint—reassures Mrs. Stegeman that her daughter will try not to end up the same way. We learn about the reactions of other WASPs to such accidents, to training and flying, to friends washing out and duty assignments around the country. Marion is refreshingly candid in her telling. Her descriptions of life at Avenger are both revealing and enlightening.

One of her best friends was Shirley Slade, the lovely WASP who was photographed sitting on the horizontal stabilizer of a BT-13 she had just soloed. The photo graced the cover of *Life* magazine July 19, 1943. Marion tells the inside story of the photo shoot.

The first half of the book portrays Marion's love affair with airplanes and her training and duty as a WASP—a must read for those seeking documentation on how these remarkable women flyers of World War II actually lived and worked day to day. She describes the routine at Avenger as well as anyone in print.

The second half of the book is a real-life love story of the more traditional kind as she and Major Hodgson "find each other" after months of letter writing. Their families are old friends in Athens, Georgia, and Marion, several years younger than Ned, takes up writing to him during his long recovery after he is nearly killed in a crash in early 1943.

The WASP author spins her tale and in the process makes it both informative and fun to read. Her prose is fresh and her style unencumbered; she doesn't try to impress the reader, but tells it like it was. She was there!

For those who like a good love story, the book is a straightforward description of a 1940s romance. Marion portrays, through letters, the agonies of wartime courtship, of separation, of uncertainty, and of all-too-brief reunions in a time more inhibited by morals and societal influences than today. Everybody likes a happy ending and that is what WASP Stegeman gives us, all the while telling a darn good story.

Sarah Byrn Rickman, author of The Originals: The Women's Auxiliary Ferrying Squadron of World War II (the history of the first 28 WASPs) and the award-winning WASP novel Flight from Fear.



Fairchild C-82 Packet and C-119 Flying Boxcar. By Alwyn T. Lloyd. Leicester, England: Midland Press, 2005. Tables. Dia-

grams. Illustrations. Photographs. Glossary. Pp 176. \$36.95 ISBN: 1-8578-0201-2

Some subjects cry out for the careful touch of the expert. Particularly with regard to highly complex and technical topics, cool guidance and thorough, methodical explanation often benefit a reader more than passionate advocacy or intense prose. Lloyd provides just such a reasoned, detailed examination of the Fairchild C-82 Packet and its derivative, the C-119 Flying Boxcar. He clearly chronicles the way in which these planes, although "underpowered and flying overgrossed," nevertheless not only contributed to victory in World War II (the C-82) but also cleared the way for further crucial developments in heavy military airlift. Through the story of these two aircraft, the reader clearly sees the challenges facing the U.S. military as it struggled to provide adequate airlift for World War II and the Cold War, and some of the ways in which the Army Air Forces and later the USAF rose to the challenge.

The depth of technical detail is astonishing. Lloyd provides in-depth information on design, construction, avionics, and flight testing. His sure grasp of the engineering of these airplanes allows a relatively concise and clear presentation of the important features of the C-82 and C-119 without losing the reader in a bog of minutiae. I was particularly impressed with the way in which Lloyd deftly relates such details as hull construction, landing gear design, and the specifications of the cargo-loading equipment to the operational requirements of the aircraft.

Beyond the engineering aspects, Lloyd clearly chronicles the operational history of both types. Surveying more than two decades of activity, he ably illustrates the usefulness of these airplanes to not only the Army Air Forces and the USAF, but also to the Army, Navy, and Marine Corps. Looking at missions ranging from cargo hauling to personnel transport to medical evacuation, Lloyd follows the aircraft through such important eras as World War II, the Korean War, and the Vietnam Conflict. His discussion of the modification of the C-119 as a gunship (the AC-119) is surely one of the clearest and most readable short treatments of gunships currently available.

Unlike many authors, Lloyd does not forget that American planes often see extensive service outside of U.S. forces. He extensively discusses use of the C-119 in particular by air forces of India, Brazil, China, and many Western European countries. Lloyd also deals extensively with the C-119's long service in the Air National Guard and USAF Reserve.

One should not look to this book for a detailed explanation of the way in which the C-82 and C-119 fared in the political and policy arenas. If the book has a weakness, it would be that the place of these planes in the politics of acquisition and force-shaping needs to be explored more clearly and thor-

oughly. However, no book can cover all possible topics, and Lloyd's relatively tight focus on operational and technical history is well-conceived and defensible.

In all, this is a valuable addition to the history of American aircraft and military airlift. It would be a very useful addition to the library of anyone interested in the development of cargo and transport aircraft in the mid-to-late twentieth century, as well as the various ways in which those aircraft have been employed.

Robert Oliver, Air Combat Command History Office, Langley AFB, Virginia



Military Aircraft Markings 2005 (Revised 26th Ed.). By Peter R. March and Howard J. Curtis. Hersham, Surrey, UK: Ian Allan, 2005. Tables. Photographs. Notes. Glossary. Bibliography. Pp. 224. \$14.95 paperback. ISBN: 0-71103052-9

Let's first look at what this book is not. While the title might lead the modeler to think he has just found a great source of color plates and diagrams showing detailed insignia and markings of worldwide military aircraft, he would be wrong. There are only 43 pictures of aircraft, and only the ones on the front and back covers are in color. The remainder are in typical paperback black and white quality. And there aren't any pictures or diagrams of the detailed markings that really make models come alive. Further, a researcher thinking he'd found a book showing markings, serials, and unit codes of worldwide military aircraft will also be disappointed.

Instead, this book is designed to satisfy the insatiable curiosity of the British—probably the most airplane-crazy people in the world! It's kind of like an aeronautical version of a birdwatcher's guide, starting with the location of every military facility in the UK where operational aircraft are based. Nearly half of the book is a table listing the serial number of every military aircraft (active or retired) in the UK forces, the type of aircraft, and the owner/operator. These range from No. 168, a Sopwith Tabloid Scout, now in the RAF Museum in Hendon; through XT630, a Westland Scout helicopter privately owned in Ipswich; to ZZ175, a Boeing C-17 scheduled for delivery to the RAF in 2009.

There is a listing of all of the civil-registered aircraft in UK military service along with some cross-reference tables of mundane data (e.g., RAF Maintenance Command, Support Command, and Logistics Command "M" numbers)! About eight pages describe the squadron markings for both the RAF and Fleet Air Arm—written descriptions, not pictures or drawings (e.g., for No. 22 Squadron, "Badge: A black pi symbol in front of a white Maltese cross on a red cir-

cle.”) There is also a table of historic aircraft in foreign markings (generally museum artifacts).

Finally, the last 40 percent of the book is a listing, by country, of serial number of European and U.S. aircraft based in or likely to be seen in the UK as they come through on TDY for various operational deployments, air shows, and the like. Special attention is given to USAF/USN C-130, C-17, E-3, F-117, B-2, B-52, P-3, E-6, and similar aircraft by all their serial numbers!

In short, if any reader is taking a trip to the UK and planning to spend it hanging out by the fences around military airfields with a pair of binoculars and a camera, this is the book to have!

Col. Scott A. Willey, USAF (Ret.), NASM Docent and Volunteer



The Polish Underground Army, the Western Allies, and the Failure of Strategic Unity in World War II. By Michael Alfred Peszke. Jefferson, N.C. and London: McFarland & Co, 2005. Photographs. Notes. Appendices. Bibliography. Index. Pp. x, 294. \$45.00 ISBN: 0-7864-2009-X

Americans have obtained only limited information about what Poland did in World War II. If nation-centric U.S. or British authors mentioned the Poles at all, it was in passing or in footnotes. They were often portrayed as having a minor, supporting role without covering the background, motivations, and aspirations that brought them there. We knew of the rebirth of Poland after World War I and were intrigued that Paderewski was Prime Minister. The secrets of Enigma/Ultra were not completely revealed until 1977, so we had a belated awareness of (and appreciation for) Polish contributions there. All the world had an image (right or wrong) of gallant mounted lancers attacking panzers in 1939. Those of us who slogged through the mountains of Italy were aware of Ander's tough II Corps at Cassino, without knowing how they got there. The Polish 1st Armored Division was superb in the Falaise Pocket, but Le Clerc's French division inevitably got more attention in the sweep from Normandy. The Polish Parachute Brigade received part of the attention and controversy that surrounded the bridge too far (Market Garden). U.S. fliers in Europe and Italy may have known that Poland was one of the nations-in-exile to have squadrons flying with the RAF using equipment provided by the U.S. and U.K.

Peszke does not make the purpose of this book clear, though the back cover succinctly summarizes the contents. While he offers several disclaimers about what the work is not, use of this device doesn't absolve him of giving inadequate information about his subjects. His title is misleading. Composition and operations of the Polish Underground Army (also known as the Home Army and Secret Army) are covered very lightly (especially the Warsaw Uprising, which is the major, tragic event of their existence). Western allies collectively get some attention, but Great Britain was the primary patron—with her own agenda and willing to sell out the Poles to influence the Soviets on other matters. "Failure of Strategic Unity" is not well explained. It's no secret that the Great Powers had their own national interests, but the Western Allies were able to find some common ground in pursuing these and achieving the synergistic power of alliance. This may have been a failure from the Polish point of view. As the old proverb says, when sheep dance with elephants, someone may get trampled!

It seems an unprofessional evasion not to have mentioned the six Polish rifle divisions who fought with the Soviets all the way to the capture of Berlin or the 3,500 who deserted from II Corps in Palestine, many of

CALL FOR PAPERS 2006 CONFERENCE OF ARMY HISTORIANS

The U.S. Army Center of Military History is soliciting papers for the 25 - 27 July 2006 biennial Conference of Army Historians, to be held in the Washington, D.C., area. This biennial conference has traditionally featured presentations on joint and combined military history as well as papers presented by civilian historians from government and academia. As such, we are very pleased to invite members of the international and academic communities to both attend and present papers on the 2006 theme of "Terrorists, Partisans, and Guerillas: The U.S. Army and Irregular Warfare, 1775-2005."

Papers may deal with any aspect of the U.S. Army's role in irregular warfare and may range from panels on the American Revolution through the current and ongoing Global War on Terror. Such topics may include U.S. Army experiences in the Mexican War, Civil War and Reconstruction, the Philippine Insurrection, Vietnam, Somalia, and Bosnia and Kosovo. Papers that focus on structuring the Army to fight irregular conflicts, the development of doctrine and training necessary to engage in these types of operations, and the American experience in Vietnam are especially welcome. Additional topics of particular interest include logistical and medical support for irregular conflicts, integrating intelligence assets, rebuilding infrastructure, and special operations. Other special studies may include the role of missile defense, drug interdiction missions, the Army's role in occupation and nation building, and a host of other topics that may be presented upon.

Presenters should be prepared to speak for 20 minutes. Should the Center of Military History decide to publish the conference papers, the presenters will have an opportunity to submit a formal paper for consideration.

Further information on the conference location will be forthcoming on the Center of Military History website at <http://www.army.mil/cmh/>

Prospective participants should send their proposed topics no later than 30 December 2005 to 2006 CAH, U.S. Army Center of Military History, ATTN: DAMH-FPF, 103 Third Avenue, Fort McNair, DC 20319-5058 or via e-mail to 2006CAH@hqda.army.mil

whom became terrorists against British rule. The 400 who deserted from the so-called I Corps in Scotland put posed less of a threat. This is Peszke's third book, and he may have covered such matters elsewhere, but it is desirable for each work to stand alone. The appendices are largely padding, although the chronology is useful. In an attempt at serious history, it is inexcusable to have only one map.

Despite all this, there are bright spots. It is always useful to get a different perspective, conveniently in the English language. Certain details about Sikorski's death and the Katyn Forest Massacre may be new to some. Obviously not included, is that Maj. Gen. Clayton Bissell (who had been both A-2 USAAF and G-2 US Army) testified before Congress in 1950 that he had helped cover up the Soviet guilt at Katyn. For those of us in the Services, this had been an ill-kept secret for years but was a short-lived shock to the public.

For anyone who wants part of the Polish story from a fresh angle, this book doesn't take long to read.

Brig. Gen. Curtis H. O'Sullivan, USANG (Ret.), Salida, California



Into the Wild Blue Yonder: My Life in the Air Force. By Allan T. Stein. College Station: Texas A&M University Press, 2005. Photographs. Maps. Index. Pp. xi, 185. \$29.95 ISBN: 1-58544-386-7.

In this thoroughly enjoyable book, retired Air Force Lieutenant Colonel Stein documents his twenty-six year career. Beginning with his uncle, Robert Anderson, who had flown in France in 1918 and been commended by General Pershing, Stein winds us through his life until his retirement as the Civil Air Patrol Inspector General at Maxwell AFB, Alabama, in 1969. He takes us through his training to be a B-24 pilot and subsequent action in the southwest Pacific, through the rise of the Strategic Air Command (SAC) as a force of unimaginable power, and to his experiences in Vietnam. Throughout it all Stein is humble in speaking of the role that he played, while not shying away from giving praise to maintenance and personnel troops, other operators, his wife, or whomever he feels deserved it.

This is not a scholarly work, and those who approach it as such will be disappointed. It is written in a somewhat rambling manner that is almost conversational in delivery. The reader will occasionally get lost, because there are no transitions from subject to subject; but in the long run this "conversation" is very effective. The book really boils down to an unpretentious account of Stein's life that gives both the casual reader and the scholar a look at the

author's thoughts, fears, feelings, and naïveté as he goes from a twenty-year-old pilot trainee preparing for World War II to a seasoned group operations officer in Vietnam. Stein spent the majority of his career in training young pilots to fly multi-engine aircraft and in SAC. While in SAC, he served as an aircraft commander, flight commander, squadron operations officer, and standardization and evaluation officer. With those experiences in his background, Stein has given us a book that can serve well as a primary source for those wanting to conduct research in both Air Force pilot training and SAC.

The book is also a good record of events that occurred in the Air Force during the author's time in the service and can, therefore, serve as both a social history as well as a history of the Air Force during three wars (World War II, Vietnam, and the Cold War). With the exception of a few factual errors, such as the date when President George H. W. Bush took SAC off of alert (in one place he says it was 1990 and in another, 1994), it is fairly accurate. It should remain a valuable source for the researcher and an enjoyable read for the casual reader for a long time to come.

MSgt. Dennis Berger, USAF (Ret.), history teacher, Lubbock TX



Supporting Air and Space Expeditionary Forces: Lessons from Operation Enduring Freedom. By Robert S. Tripp et al. Santa Barbara CA: RAND, 2004. Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. xlvii, 119. \$20.00 paperback ISBN: 0-8330-3517-7

This monograph is intended for the professional and serious student who is interested in the development of an Agile Combat Support (ACS) system to support the Air and Expeditionary Force (AEF) concept. It is not for the casual reader or general public with only slight interest in the Air Force affairs. It does not deal with dogfights or deeds of daring-do. It does, however, have tight-packed information requiring close attention and a certain level of knowledge of arcane material.

RAND (Research and Development) was created by the Air Force as a contract institution to conduct studies to improve policy and decision-making through such tools as operations research, systems analysis, and game theory. The four authors have not yet acquired the reputation of such predecessors as Herman Kahn, Bernard Brodie, or Daniel Ellsberg, but appear to be competent journey persons in the field. Tripp has nine credits in the bibliography going back to 1983. The figures and tables help to illuminate the text. They range from bar and pie charts to

pictures of restroom facilities and raw open sewage at a forward operating location (FOL). There is an excellent glossary which helps to clarify the narrative. An index would have been useful. Short footnotes are located at useful points.

Operation Enduring Freedom in Afghanistan provided the opportunity to evaluate the ACS system in an operational environment. "Lessons Learned" are too often an assemblage of ideas on how to fight the last war a bit better. However, history doesn't really repeat itself. This report is forward-looking in the sense that it suggests improvements that seem adaptable to a variety of circumstances. Both AEF and ACS have not fully proven themselves; it is encouraging that studies such as this are being subsidized.

This study is one of a series by RAND on ACS sponsored by the Strategic Planning Division, Directorate of Plans, Headquarters USAF, in case anyone wishes to pursue the topic further.

Brig. Gen. Curtis H. O'Sullivan, USANG (Ret.), Salida, California



Eisenhower, the Air Force, and National Security

by Herman S. Wolk, Senior Historian, Air Force Historical Studies Office, Bolling AFB, D.C.

In January 2005, the Dwight D. Eisenhower Memorial Commission and the Industrial College of the Armed Forces sponsored a symposium at the National Defense University on Eisenhower and National Security for the 21st Century. *Forging the Shield*, edited by Dennis E. Showalter [Imprint Publications, Chicago, 2005, 235 pages, \$24.95], consists of papers delivered at the symposium along with an introduction by Dennis Showalter and an epilogue by Ernest May.

The symposium was built around the following sessions:

Eisenhower and the Changing National Security Environment;
Eisenhower, Science and National Security;
Eisenhower's Organization of the Intelligence Community;
International Perspectives of the 34th President and his Legacy as Commander in Chief, and
A roundtable discussion by Brent Scowcroft, Andrew Goodpaster, Montgomery Meigs, and Louis Galambos.

The presenters demonstrated that the historiography of Eisenhower and his two administrations has reached a new level. It has been almost a quarter century since professor Fred Greenstein's *The Hidden-Hand Presidency: Eisenhower as Leader*, punctured the picture of President Eisenhower as a lightweight who achieved little and was

primarily interested in his golf game. Greenstein showed Eisenhower as a literate, substantive chief executive who proved to be unusually competent in foreign policy and organizing the government for national security affairs.

In his introduction, Dennis Showalter paints a picture of Eisenhower as a confident leader who knew how to marshal all resources to foster the national security. Sergei Khrushchev, who considers the relationship between his father and Eisenhower, points out that in dealing with Eisenhower his father wanted to be recognized as an equal. Premier Khrushchev however, was well aware that America was much stronger than the Soviet Union, militarily and economically. Khrushchev's defense minister, Marshal Georgi Zhukov, emphasized that should war break out between the United States and the USSR, the Americans would win. The U-2 incident in May 1960 poisoned relations between the two countries. Sergei Khrushchev continues to be somewhat baffled over the timing of the flight, during the Paris Summit and sensitive negotiations over nuclear testing. In Sergei Khrushchev's view however, Eisenhower and Khrushchev built a foundation for peaceful coexistence.

Alex Roland attempts to show that Eisenhower's concern with excessive defense spending and its concomitant effect on American society mirrored the views of critics like C. Wright Mills [the "power elite"], Seymour Melman [the "war economy"], and Harold Lasswell [the "garrison state"]. Saki Dockrill explains that Eisenhower's

approach to intervention was guided by pragmatism and his own innate confidence in his judgment. The result was a basically successful approach to the foreign policy problems of the 1950s.

Alan Millett emphasizes that the Korean War influenced the Eisenhower administration's foreign and defense policies and fostered regional defense arrangements. Professor Qiang Zhai notes that establishment of the Peoples Republic of China amounted to a transforming event that resulted in Eisenhower taking a hard line toward Communist China, which "locked the two countries in a state of bitter hostility and separation for two decades."

Gregg Herken describes the growth of the nuclear arsenal under Eisenhower and pays tribute to Ike's success in keeping America at peace. Clayton Laurie, in considering Eisenhower and the CIA, emphasizes that the agency enjoyed a "golden age" during Eisenhower's terms and that the President "was arguably the most astute, knowledgeable, and prudent consumer of intelligence, and probably the President most willing to utilize the Agency to the fullest extent of its charter powers." David Hatch discusses Eisenhower's support and initiatives for the National Security Agency in the 1950's.

In one of the most insightful papers, Cargill Hall probes the "relatively unknown" topic of overhead reconnaissance, which played a significant role in the Cold War and in ultimately toppling the Soviet regime. Roger Launius discusses the birth and evo-

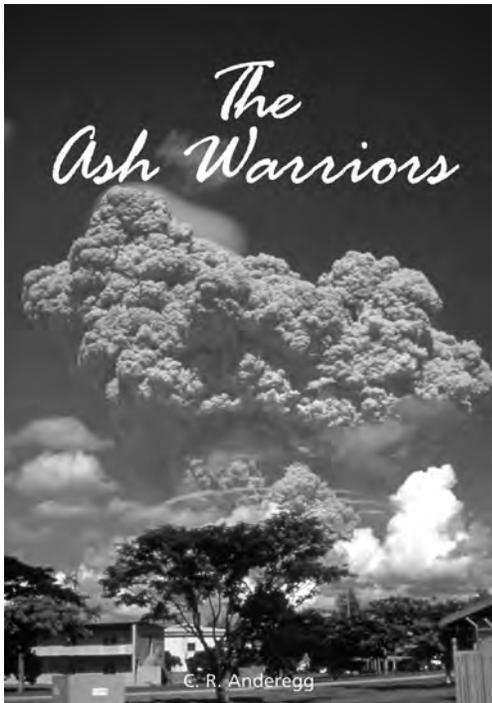
lution of NASA and how Eisenhower was forced to create the space agency. With the formation of NASA, Eisenhower was able to head off a much larger and more expensive space program. John Yaeger emphasizes Eisenhower's role in the development of joint professional military education. His strong support for the Industrial College of the Armed Forces, the National War College and the Joint Forces Staff College was instrumental in the evolution of the National Defense University.

A roundtable discussion featuring Generals Andrew Goodpaster and Brent Scowcroft emphasized Eisenhower's insistence upon being informed and having his advisers fully knowledgeable and informed. The President insisted also that his people at all times step up to their responsibilities. Professor Louis Galambos pointed out that Eisenhower got the really big decisions right. And, he observed, "the more presidents we have, the better Eisenhower looks."

Ernest May, professor of history at Harvard, and in a former life, a historian in the Office of the Joint Chiefs of Staff, describes in his epilogue, the importance of process. Eisenhower always cast a wide and deep net in search of facts prior to making a decision. Briefings, papers, and intelligence, all went into the mix. Eisenhower, May emphasizes, was one of the very few presidents "to follow the example developed by Washington, insisting on knowing the judgments of every constitutional officer before he, and he alone, took responsibility for a decision and its consequences." Prudence, May notes, was the distinguishing characteristic of Eisenhower's Presidency.

These essays emphasize that Gen. Dwight D. Eisenhower's views on a broad range of national security matters have had enormous impact in the United States from the end of World War II to the present day. His legacy in this regard will continue well into the 21st century.

With to military matters, organizational and operational, Eisenhower's experience in World War II was seminal to his thinking. His experience in commanding the great allied coalition convinced him of the necessity of unified command and the mutual dependency of the military services—ground, sea and air. Today we call this "jointness." Eisenhower was one of the earliest and most effective advocates of jointness. He called it the principle of "the three-legged stool." Operationally, this meant the services working together under unified command. It also meant that in the requirements process, no one service could be considered independently; the nation's military requirements needed to be weighed as a whole, an integrated process. The United States required an efficient and effective military establishment, but strict economy was also the watchword—maximum security at minimum cost. Although competition between the services was a good thing, Eisenhower emphasized that "competition is like some of the habits



*The
Ash Warriors*

C. R. Andereg

Available at
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PROGRAM

we have – in small amounts they are very, very desirable; carried too far they are ruinous.”²¹ Parochialism was the enemy, leading to narrowness in thought and policy.

This volume does not consider Eisenhower’s key role in the evolution of the National Security Act of 1947 and concomitantly, his strong support for the establishment of the United States Air Force. With the end of the war, he returned to Washington to succeed Gen. George Marshall as Army Chief of Staff and to participate in the on-going congressional hearings on unification. By his own admission, Eisenhower was disappointed at the intense controversy over postwar defense reorganization. He thought that the war experience clearly pointed to the need for a single defense department and creation of an independent Air Force. So he jumped into the debate and worked with Air Force Maj. Gen. Lauris Norstad to help craft legislation for the National Security Act of 1947. Eisenhower was instrumental in keeping the framers of the 1947 Act from getting bogged down in the roles and missions swamp. He insisted, and the Truman administration agreed, that roles and missions should be addressed in a separate executive order.

Norstad always considered Eisenhower as one of his two mentors, General Henry H. “Hap” Arnold, commander of the Army Air Forces in World War II, being the other. Eisenhower’s postwar support for defense reorganization provided Norstad the backing he required in working with Adm. Forrest Sherman to craft draft legislation for the 1947 Act and the landmark Unified Command Plan. Moreover, in all the postwar testimony to Congress on the subject of defense reorganization, Eisenhower’s carried the most weight.

Eisenhower felt strongly about the necessity of teamwork and unified command. In November 1945, in testimony before the Senate Military Affairs Committee, he noted how the responsibility for combined arms tended to break down the lines between the services: “At one time I was an Infantryman, but I have long since forgotten that fact under the responsibility of commanding combined arms In the press of events of the last three and one-half years I believe it is honest to say that I have forgotten that I came originally from the Ground Forces, and I believe that my associates of the Air and of the Navy in that Command came to regard me really as one of their own service rather than one of the opposite.”²²

I have always considered General Eisenhower as one of the founders of the Air Force. He learned to fly in 1937 in the Philippines and he maintained an affinity for airmen, strengthened during the war. His high regard for the air forces was fostered by the performance of tactical and strategic air forces in Europe. The Normandy invasion, he emphasized “was based on a deep-seated faith in the power of the Air Forces in over-

whelming number to intervene in the land battle.... without that Air Force, without its independent power, entirely aside from its ability to sweep air forces out of the sky....that invasion would have been fantastic.”²³

Eisenhower took a broad view of the question of postwar defense organization. He advocated a national security structure for the modern world -new ways of looking at defense, intelligence, and foreign policy. Part of this new thinking, as he viewed it, was formation of an independent Air Force. “No sane officer of any arm,” he stressed, would contest that thinking.”²⁴ Succeeding Marshall as Army Chief of Staff, in December 1945 he addressed the Army headquarters staff, emphasizing that the Air Forces deserved independence: “That seems to me to be so logical from all of our experiences in this war – such an inescapable conclusion that I for one can’t even entertain any longer any doubt as to its wisdom.”²⁵

Historians have long mused about whether Eisenhower strongly supported a separate Air Force because he wanted the airmen out of the Army, lest they eat up the postwar budget. I have never been persuaded by this argument as it goes against everything we know about Eisenhower’s character and integrity. This was simply a judgment that he made because in his mind it was what the country required; it was the right thing to do.

In line with his thinking on jointness, Eisenhower stressed that future wars would be waged as a single effort. Military planning and organization would be completely unified, combat forces under unified command, “singly led and prepared to fight as one, regardless of service.”

During his second term, it should be noted that Congress followed key recommendations proposed by Eisenhower in framing the Department of Defense reorganization Act of 1958. This legislation marked a turning point in American military organization by removing the military departments and their service secretaries from the operational chain of command. Directives would flow from the Secretary of Defense through the Joint Chiefs to the unified and specific commands. The 1958 Act—the Eisenhower reorganization—gave the unified and specified commanders control and direction of combat forces.

Thus, in the defense reorganizations of 1947 and 1958, Eisenhower’s views played a major role in shaping legislation. He was an architect of the modern American national security establishment. Despite revisions to the national security structure since the 1950’s, the main lines of Eisenhower’s reorganization remain in place today.

As we look back from today’s perspective, we can appreciate the initiatives and programs that the Eisenhower administration structured to foster the national security. These are considered by the authors of

this Eisenhower symposium volume. Above and beyond these policies, processes, programs, and achievements, stands the man himself.

In staff meetings when Eisenhower would ask, “what is best for America?” he was requesting his people to summon their best judgment. This was something that he always maintained deep within himself. In discussing Eisenhower, Gen. Ira Eaker, a thoughtful airman who knew Ike well, always pointed to Eisenhower’s innate fairness, modesty, and integrity. For example, in September 1947, on the eve of Air Force independence, Eisenhower addressed the Army staff: “I am particularly anxious that the existing pleasant and friendly relations between ground and air personnel continue, and that every possible means be adopted to insure that legal recognition of the autonomy of the Air Force will serve only to bring us closer together in friendship and in performance of duty.”²⁶ These comments were characteristic of Ike’s thinking. Eaker, who also knew most of the British commanders in World War II, noted that Eisenhower was that rarity among great leaders and commanders—eminently fair, exuding decency and integrity.

These are qualities America requires of its leaders in the 21st century. Therein lies the value of this volume, for in presenting the character of Eisenhower’s two terms, it offers us guideposts for the future of our country.

End Notes

1. Hearings before the Committee on Military Affairs, Senate, *Department of Armed Forces and Military Security: Hearing on S.84 and S.1482*, Statement of General Dwight D. Eisenhower, 79th Congress, 1st Session, Washington, D.C., November 16, 1945, p. 363.
2. *Ibid.*
3. *Ibid.*, p. 360
4. Memo, General Dwight D. Eisenhower to ACS, G-1, *et al.*, subj: Responsibilities of Staff Officers, Scope, Approach and Execution [Comments of Chief of Staff before Staff Officers, 5 Dec 1945], Dec 10, 1945, RG 165, Records of War Dept. Gen'l and Special Staffs, ACS, Patch-Simpson Bd Minutes and Comments, Box 922, Modern Military Branch, Nat'l Archives.
5. *Ibid.*
6. Memo, General Eisenhower to All Members of the Army, July 26, 1947, RG 165, Records of the War Dept General and Special Staff, 320, Book 1, Cases 1-15, Modern Military Branch, National Archives.



Books Received

Amir, Amos. Trans. By Ruvik Danieli. *Fire in the Sky: Flying in Defence of Israel*. UK: Pen & Sword, 2005. Photographs. Index. Pp. 292 £19.99 ISBN: 1-84415-156-5

Boyne, Walter J. *Today's Best Military Writing: The Finest Articles on the Past, Present, and Future of the U.S. Military*. New York: Tom Doherty Associates, 2004. Notes. Index. Pp. 397. \$15.95 Paperback ISBN: 0-765-30888-6

Chickering, Roger, Stig Forster and Bernd Greiner, Eds. *A World at War: Global Conflict and the Politics of Destruction, 1937-1945*. Washington, D.C.: German Historical Institute and Cambridge University Press, 2005. Notes. Index. Pp. vii, 392. \$70.00 ISBN: 0-521-83432-5

Clark, A. P. *33 Months as a POW in Stalag Luft III: A World War II Airman Tells His Story*. Boulder, Colo.: Fulcrum Publishing, 2004. Photographs. Bibliography. Index. Pp. xvi, 207. \$17.95 Paperback ISBN: 1-55591-536-1

Dorr, Robert F. *Chopper: Firsthand Accounts of Helicopter Warfare, World War II to Iraq*. New York: Berkley Books, 2005. Photographs. Index. Pp. 328. \$24.95 ISBN: 0-425-20273-9

Harris, Arthur. *Bomber Offensive* [Pen & Sword Military Classics] UK: Pen & Sword, 2005. [originally, 1947] Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. 288. \$15.00 Paperback ISBN: 1-84415-210-3

Irwin. Will. *The Jedburghs: France, 1944, and the Secret Untold History of the First Special Forces*. New York: Public Affairs, 2005. Notes. Appendices. Bibliography. Index. Pp. xxiv, 328. \$26.95 Paperback ISBN: 1-58648-307-2

Jackson, Robert. *Hit & Run during Air Attacks in World War II*. UK: Pen & Sword, 2005. Maps.

Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. 202 £19.99 ISBN: 1-84415-162X

The Joint Chiefs of Staff and the First Indochina War, 1947-1959. [History of the Joint Chiefs of Staff] Washington, D.C.: Office of Joint History, JCS, 2004. Maps. Photographs. Notes. Appendices. Glossary. Index. Pp. xi, 285. ISBN: 0-16-072430-9

Knott, Richard C. *Fire from the Sky: Seawolf Gunships in the Mekong Delta*. Annapolis, Md.: Naval Institute Press, Maps. Photographs. Notes. Glossary. Bibliography. Index. Pp. xx, 260. \$29.95 ISBN: 1-59114-447-7

Lane, Peter B. and Ronald E. Marcello., Eds. *Warriors and Scholars: A Modern War Reader*. Denton: University of North Texas Press, 2005. Maps. Notes. Index. Pp. vi, 288 \$24.95 ISBN: 1-57441-197-7

Lundstrom, John B. *The First Team: Pacific Naval Air Combat from Pearl Harbor to Midway*. Annapolis, Md.: Naval Institute Press, 2005. [Copyright, 1984.] Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. xiii, 547. \$28.95 Paperback ISBN: 1-59114-471-X

Lundstrom, John B. *The First Team and the Guadalcanal Campaign Naval Fighter Combat from August to November 1942*. Annapolis, Md.: Naval Institute Press, 2005. [Copyright, 1994.] Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. xx, 626. \$28.95 Paperback ISBN: 1-59114-472-8

Murphy, Justin D. *Military Aircraft, Origins to 1918: An Illustrated History of Their Impact*. Santa Barbara, Calif.: ABC-CLIO, 2005. Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. xiii, 319. \$85.00 ISBN: 1-85109-488-1

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Nolan, Bernard Thomas. *Isaiah's Eagles Rising: A Generation of Airmen*. Alexandria, Va.: Bernard T. Nolan, 2002. Photographs. Appendices. Pp. 268. \$27.00 ISBN: 1-4010-5309-2

Nutter, Ralph H. *With the Possum and the Eagle: The Memoir of a Navigator's War over Germany and Japan*. Denton: University of North Texas Press, 2005. Maps. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. xiv, 327. \$29.95 Paperback ISBN: 1-57441-198-5

Parker, Geoffrey, Ed. *The Cambridge History of Warfare*. UK: Cambridge University Press, 2005. Maps. Notes. Appendices. Glossary. Bibliography. Index. Pp. viii, 515. \$22.99 Paperback ISBN: 0-521-61895-9

Philpott, Ian M. *The Royal Air Force: An Encyclopedia of the War Years*. [Vol. I "The Trenchard Years". UK: Pen & Sword, 2005. Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. xvi, 492. £L35.00 ISBN: 1-84415-154-9

Robinson, Linda. *Masters of Chaos: The Secret History of the Special Forces*. New York: Public Affairs, 2004. Maps. Photographs. Index. Pp. xxii, 388 \$14.00 Paperback ISBN: 1-58648-352-8

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Samson, Jack. *The Flying Tiger: The True Story of General Claire Chennault and the U.S. 14th Air Force in China*. Guilford, Ct.: The Lyons Press, 2005. [Copyright 1987] Photographs. Pp. xiv, 365. \$16.95 Paperback ISBN: 1-59228-711-5

Seamans, Robert C., Jr. *Project Apollo: The Tough Decisions* [NASA SP 2005-4537] Washington, D.C.: NASA History Division, 2005. Illustrations. Photographs. Appendices. Glossary. Index. Pp. xi, 159. ISBN: 0-16-074954-9

Sears, David. *The Last Epic Naval Battle: Voices from Leyte Gulf*. Westport, Ct.: Praeger, 2005. Index. Pp. 264. \$39.95 ISBN: 0-275 -98529-2

Showalter, Dennis E., Ed. *Forging the Shield: Eisenhower and National Security for the 21st Century*. Chicago: Imprint Publications, 2005. Notes. Index. Pp 235. \$24.95 Paperback ISBN: 1-879176-44-0

Shores, Christopher. *Air War for Burma: The Allied Air Forces Fight Back in South-East Asia, 1942-1945*. London: Grubb Street, 2005. Maps. Tables. Diagrams. Illustrations. Photographs. Notes. Appendices. Bibliography. Index. Pp. 448. \$59.95 ISBN: 1-90401095-4

Smith, Richard Harris. *OSS The Secret History of America's First Central Intelligence Agency*, Guilford, Ct.: The Lyons Press, 2005. [Copyright 1972] Photographs. Notes. Bibliography. Index. Pp. xxx, 413. \$16.95 Paperback ISBN: 1-59228-729-8

Sutherland, Jonathan and Diane Canwell. *THE RAF Air Sea Rescue Service, 1918-1986*. UK: Pen & Sword, 2005. Photographs. Index. Pp. x, 244. £19.99 ISBN: 1-84415-155-7

Werrell, Kenneth P. *Sabres over MiG Alley: The F-86 and the Battle for Air Superiority in Korea*. Annapolis, Md.: Naval Institute Press, 2005. Photographs. Notes. Bibliography. Index. Pp. x, 318. \$29.95 ISBN: 1-59114-933-9

Wright, James C. *The Flying Circus: Pacific War 1943, as Seen through a Bombsight*. Guilford, Ct.: The Lyons Press, 2005. Photographs. Pp. x, 214. \$22.95 ISBN: 1-59228-656-9

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Coming Up



Compiled by George Cully

Jan 5-8

The annual meeting of the **American Historical Association** will include "Social Shaping of Weaponry: The History of Military Technology in Context," a session co-sponsored by the U.S. Commission on Military History and the Society for the History of Technology. Contact:

Barton C. Hacker
Smithsonian Institution
NMAH-4013 / MRC 620 POB 37012
Washington, D.C. 20013-7012
e-mail: hackerb@si.edu
www.h-net.org/announce/show.cgi?ID=145793

Mar 2-4

The **University of Nebraska at Omaha** will host the 49th Missouri Valley History Conference at the Embassy Suites Hotel in downtown Omaha, Nebraska. Contact:

Moshe Gershovich, Program Chair
Missouri Valley History Conference
Department of History (ASH 287E)
University of Nebraska at Omaha
Omaha, NE 68182
(402) 554-3175, Fax -2794
e-mail: mgershovich@mail.unomaha.edu
website: www.unomaha.edu/mvhc/index.html

Mar 22-25

The **Intelligence Studies Section of the International Studies Association (ISA)** invites paper and panel proposals for the next ISA annual convention, to be held at the Town & Country Resort and Conference Center in San Diego, California. Contact:

Stephen Marrin
Woodrow Wilson Department of Politics
University of Virginia
e-mail: spm8p@virginia.edu or spm8p@yahoo.com
website: www.people.virginia.edu/~spm8p/
or http://iss.loyola.edu/call2006.html

Apr 3-6

The **Space Foundation** will host its 22d National Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado. Contact:

The Space Foundation
310 S. 14th Street
Colorado Springs, CO 80904
(719) 576-8000, Fax x8801
www.spacesymposium.org

Apr 19-22

The annual meeting of the **Organization of American Historians** will be held in Washington, D.C. This year's theme is "Our America." Contact:

Organization of American Historians
P.O. Box 5457
Bloomington IN 47408-5457
(812) 855-9851, Fax x9872
website: www.oah.org

May 5-7

The 9th Biennial Women in French conference, "**French and Francophone Women and War**," will be held at Hinsley Hall in Leeds, England. Contact:

Alison Fell
DELIC, Lancaster University
Lancaster, LA1 4YN United Kingdom
e-mail: a.s.fell@lancaster.ac.uk
www.h-net.org/announce/show.cgi?ID= 145442

May 17-20

The **Hamburg Institute for Social Research** will host "Crises in the Cold War," its third in an annual conference series entitled "Between 'Total War' and 'Small Wars': Studies in the Societal History of the Cold War". Contact:

Dr. Christian Th. Mueller
Hamburger Institut fuer Sozialforschung
Mittelweg 36 20148 Hamburg Germany
e-mail: christian.mueller@his-online.de
www.h-net.org/announce/show.cgi?ID=145706

May 18-21

The **Society for Military History** will hold its 73d annual meeting in Manhattan, Kansas. This year's theme is "The Construction, Reconstruction, and Consumption of Military History." Contact:

Prof. Michael Ramsay
Dept. of History
Kansas State University
Eisenhower Hall
Manhattan KS 66506-1002
e-mail: mramsay@ksu.edu
www.ksu.edu/history/

Jun 1-4

The **Journal of Policy History** will host a Conference on Policy History at the University of Virginia in Charlottesville, Virginia. Contact:

Policy Conference
Journal of Policy History
Saint Louis University
P. O. Box 56907
St. Louis MO 63156-0907
e-mail: jpolhist@slu.edu
www.slu.edu/departments/jph

Jul 17-19

The **University of Bristol's Group for War and Cultural Studies** will host a conference entitled "War Without Limits: Spain, 1936-1939 and Beyond." Its goal is to explore the international social, political, military and cultural history of this conflict from 1936 to the present. Contact:

Dr Martin Hurcombe
Department of French
University of Bristol
19 Woodland Road
Bristol BS8 1TE
United Kingdom
e-mail: M.J.Hurcombe@bristol.ac.uk
/www.bris.ac.uk/arts/birtha/centres/
war_withoutlimitsconference.html

If you wish to have your event listed, contact:

George W. Cully
10505 Mercado Way
Montgomery Village, MD 20886-3910
e-mail: warty@comcast.net



A Message from the President

From time to time, our executive director, Colonel George Williams, USAF (Ret.), likes to remind me, however gently, that it's fine to have a good plan, but having one doesn't make it come true.

He is, of course, correct. We do have an excellent strategic plan as well as an annual "roadmap" for near-term action. And we do measure our progress against our goals. So, how are we doing? I judge that we're doing pretty well, or, more accurately, as well as resources will permit.

We have this great magazine, which, thanks to Jack Neufeld, Richard Wolf, Scott Willey, Bob Dorr, and others, keeps getting better. We have a capable but modest two-person office staff. We now have an official liaison with the Air Force, a happy step forward. We have a new motto, "***Know the past, shape the future,***" and a new logo, which appears on page two. We are on the cusp of presenting an exciting and useful new website. And we are redrafting our bylaws to make our governance more inclusive (e.g., appointing Directors from the enlisted ranks, the Guard, Reserves, active duty, and younger retirees). Things are happening!

But we could do so much more towards our goal of raising the level of appreciation for Air Force heritage and history if we had some more energy to expend. We can get more energy in three ways: we can increase our membership, we can get volunteers to help, and we can get more contributions.

The first of these, membership, is very important: If you're not getting this magazine regularly and you're enjoying reading it, here's an idea: Become a member and enjoy every issue!

Of course, we would be delighted to have your contribution of any amount, but, even more important perhaps, we'd be delighted to have you aboard one of our committees or working on our Air Power Symposium in 2006. Some of our work—for instance, reviewing books for this magazine—doesn't require geographic proximity. Some does. But why not call or e-mail George Williams [(301) 736-1959 or afhf@earthlink.net] and discuss how you might help. You will feel good about doing something useful, we'll be able to turn up the gain, and you'll make George smile, too. Not a bad outcome.

Lt. Gen. Michael A. Nelson, USAF (Ret.)
President, Air Force Historical Foundation



Letters

Air Force Secretary John McLucas on the Shuttle

L. Parker Temple's article, "Committing to the Shuttle Without Ever Having a National Policy" (Vol. 52, No. 3) is a very informative account of how NASA used Department of Defense satellite launch requirements to help justify and sustain the early Space Shuttle program. A forthcoming book by the late John L. McLucas, a former secretary of the Air Force, will add some more details on this subject.

From the time McLucas became director of the National Reconnaissance Office (NRO) in 1969 until his later years as chairman of the NASA Advisory Council and a consultant on space policy in the 1990s, he was a consistent proponent of assuring American access to space with expendable launch vehicles (ELVs) and eventually building a follow-on system to the Shuttle. In 1980, for example, he led an Air Force Scientific Advisory Board study that, among other recommendations, called for a reversal of the recent policy to rely exclusively on the Shuttle for defense payloads. Also, as president of the American Institute of Aeronautics and Astronautics (AIAA) from 1984-1985, he repeatedly warned of dire consequences if a Shuttle was seriously damaged or lost.

McLucas greatly appreciated the foresight of undersecretary of the Air Force Edward "Pete" Aldridge in resuming procurement of ELVs. After the *Challenger* accident in 1986, he told Aldridge, "Pete, every day I wake up and thank you for not leaving us dependent on the Shuttle." Incidentally, Aldridge revealed to an Air Force space history symposium in 1995 that "the cost of transition from the Space Shuttle back to an ELV capability amounted to about \$16 billion."

Lawrence R. Benson, Albuquerque, New Mexico

[Note: The Aldridge quote is from page 147 of *The U.S. Air Force in Space*, Air Force History and Museums Program.]

"Whose Son is Pictured Above"

In the Fall 2005 issue of *Air Power History* the picture of Lucius Clay is not the right Clay. It is the picture of Army Gen Lucius Clay's son who was an Air Force general. I am sure that you already know this but I had to get my two cents in. Keep up the super work.

Maj. Gen. Clare T. Ireland, Jr. USAF (Ret.)

In the Fall 2005 issue, on page 29, the picture with the caption Lt. Gen. Lucius D.



Clay is not the Gen. Lucius D. Clay mentioned in the text as Commander of the U. S. European Command in 1948. I believe it is a picture of Lucius D. Clay, Junior, taken about twenty years later, who was a USAF general. His father never wore pilot's wings. See *Lucius D. Clay* by Jean Edward Smith, (Henry Holt, 1990), particularly the photo of Clay and his two sons. I have been an enthused reader and collector of *Air Power History* since my friend General Bob Dixon bought me a one year subscription in 1986. Keep up the good work.

Sherman N. Mullin, Retired President, Lockheed Skunk Works.

Editor: The top figure is Gen. Lucius D. Clay, Jr., as pictured in the article as a lieutenant general. Below him is his father, Gen. Lucius D. Clay

Reunions

307th Bomb Wing B-47/KC-97 Association (Lincoln AFB, 1954-1965) will hold its reunion in Charleston, S.C., April 23-27, 2006. Contact:

Jarvis "Flip" Latham
1424 Woodlawn Ave.
Columbia, S.C. 29209-1433
(803) 776-4294
e-mail: k4jhl@earthlink.net

USAF Pilot Training Classes 58C and 58D (all bases) will hold a reunion May 23-26, 2006, at Asheville, N.C. Contact:

Dick Poore
4 Sunset View
Asheville, N.C. 28804
(828)255-8451
e-mail: defossil@aol.com

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“Memphis Belle” Moves to the National Museum of the U.S. Air Force

Dayton, Ohio. The B-17F “Memphis Belle,” the Eighth Air Force’s first heavy bomber to complete twenty-five successful bombing missions over Europe and return to the United States, has been moved to National Museum of the U.S. Air Force at Wright-Patterson Air Force Base in Dayton, Ohio, under the terms of an agreement between the Memphis Belle Memorial Association and the U.S. Air Force.

The “Memphis Belle” was located in the Memphis, Tennessee area since 1946, and was on loan from the Air Force to volunteers until the 1980s, when the Association became its leaseholder. The move to the National Museum will allow the Air Force to share with millions of visitors from around the world the “Memphis Belle’s” story of the perseverance of the United States and her allies in defeating the Axis threat.

The aircraft, a national aviation treasure and widely recognized symbol of American bravery and heroism during World War II, is currently in the Museum’s Restoration hangar in Area B of Wright-Patterson Air Force Base. It is being prepared to undergo several years of restoration work. Once restoration on the aircraft begins, the public will be invited to view it as part of the Museum’s “Behind the Scenes” tours. Museum Director, Maj. Gen. Charles D. Metcalf, USAF (Ret.) promised that the historic plane will receive “a level of care and public visibility befitting

its legacy.” Anyone interested in tracking the restoration’s progress is urged to check the website <http://www.wpaafb.af.mil/museum/>. (Above, from left to right) 88th Air Base Wing Engineering Equipment Operator Chris Moon and National Museum of the U.S. Air Force Restoration Technicians Tim Ward and Greg Hassler unload the fuselage of the B-17F “Memphis Belle” into the Museum’s Restoration Hangar.

(Below) The crew of the B-17 Flying Fortress “Memphis Belle” is shown at an air base in England after completing 25 missions over enemy territory on June 7, 1943. They are,

left to right: Tech. Sgt. Harold P. Loch of Green Bay, Wis., top turret gunner; Staff Sgt. Cecil H. Scott of Altoona, Penn., ball turret gunner; Tech. Sgt. Robert J. Hanson of Walla Walla, Wash., radio operator; Capt. James A. Verinis, New Haven, Conn., co-pilot; Capt. Robert K. Morgan of Ashville, N. C., pilot; Capt. Charles B. Leighton of Lansing, Mich., navigator; Staff Sgt. John P. Quinlan of Yonkers, N. Y., tail gunner; Staff Sgt. Casimer A. Nastal of Detroit, Mich., waist gunner; Capt. Vincent B. Evans of Henderson, Texas, bombardier and Staff Sgt. Clarence E. Wichell of Oak Park, Ill., waist gunner.





The readers of *Air Power History* know their airplanes. Once again, they proved it by identifying last issue's "What Is It?" flying machine. Twenty-one readers sent in postcards. All but one had it right.

Last issue's mystery plane—depicted in a Coast Guard photo provided by Stephen Harding—was the Curtiss SOC-4 Seagull scout observation aircraft, a float-equipped plane capable of being catapulted from battleships and cruisers. Several versions of the SOC were in use when the United States entered World War II, but it was an aging biplane that was obsolete by the standards of the war.

Nevertheless, according to "U. S. Navy Aircraft Since 1911," by Gordon Swanborough and Peter M. Bowers, the SOC was so successful that "it survived until the end of World War II on first-line operations, actually outlasting two [aircraft] produced to replace it."

According to Bowers and Swanborough, the Navy eventually received over 150 Seagulls in various models known as the SOC-1, SOC-2, and SOC-3, as well as 44 SON-1 models assembled by the

Naval Aircraft Factory at Philadelphia, Pa. The Coast Guard operated three SOC-4 models.

The Seagull was powered by a 600-horsepower Pratt & Whitney R-1340 radial engine. The aircraft had a wingspan of 36 feet and a maximum speed of 165 miles per hour.

Retired Navy Capt. Bill Dixon, 84, of Keystone Heights, Fla., flew the SOC aboard the cruiser USS San Francisco (CA 38) during and after the invasion of Saipan in the Mariana islands in June 1944. "We weren't involved in the kind of heroics the fighter pilots were," said Dixon, although the Seagull's job of directing naval gunfire could be risky. On one SOC flight, Dixon carried his ship's gunnery officer—an unusual passenger. "We were involved in shore bombardment supporting the Army and the Marines at Saipan. At one point, we looked down and saw the Japanese overrunning a Marine artillery unit and pushing them toward the sea."

Our "History Mystery" winner is Jim Westwood of Unionville, Va. Thanks to all readers who joined in our "name the plane" exercise.

This Issue's Mystery Plane

Once more, we present the challenge for our ever-astute readers. See if you can identify this month's "mystery" aircraft. The rules, once again:

1. Submit your entry on a postcard. Mail the postcard to Robert F. Dorr, 3411 Valewood Drive, Oakton VA 22124.

2. Beginning this time around, there's a new way to enter. Send an e-mail message with "History Mystery" in the title to robert.f.dorr@cox.net.

3. Correctly name the aircraft shown here. Also include your address and telephone number, including area code. If you have one, please include your e-mail address.

4. A winner will be chosen at random from the postcards with the correct answer. Again, the prize is a gratis copy of "Chopper" a history of helicopter operations written by our technical editor.

This feature needs your help. In that attic or basement, you have a photo of a rare or little-known aircraft. Does anyone have color slides? Send your pictures or slides for possible use as "History Mystery" puzzlers. We'll return them to you.

