

AIR POWER

FALL 2021 - Volume 68, Number 3
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History

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Center: McConnell.
Clockwise from Top
Right: Doolittle and
LeMay, Chapman,
Leavitt, Phillips, James
and Olds, Pitsenbarger.

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The Air Force Historical Foundation is preparing a book featuring **75 Great Airmen** who served between 1947 and today. Look for the book in 2022 to celebrate the Air Force's 75th Anniversary. Send your nominations to 75Great@afhistory.org

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Features

Looking Back from the Age of ISR: U.S. Observation Balloons in WWI <i>Donald M. Bishop & Erik R. Limpaecher</i>	7
Origins of American Close Air Support <i>Wyatt R. Lake</i>	19
The Berlin Airlift: First Test of the U.S. Air Force <i>William P. Head</i>	23
Col. Thomas L. Thurlow and the Development of the A-10 Sextant <i>Thomas Wildenberg</i>	35
Allied Strategic Bombing of the Japanese Occupied Territories in WWII <i>Toh Boon Kwan</i>	41

Book Reviews

<i>The Nuremberg Raid, 30-31 March 1944</i> By Martin Middlebrook	Review by Gary Connor	54
<i>Secret Projects of the Luftwaffe, Volume 1: Jet Fighters 1939-1945</i> By Dan Sharp	Review by Gary Connor	54
<i>British Imperial Air Power: The Royal Air Force & the Defense of Australia & New Zealand Between...</i> By Alex M. Spencer	Review by Gary Connor	55
<i>Countdown 1945: The Extraordinary Story of the Atomic Bomb and the 116 Days that Changed... World</i> By Chris Wallace with Mitch Weiss	Review by John B. Handy	56
<i>RAF Bomber Command at War, 1939-1945</i> By Craig Armstrong	Review by Frank Willingham	56
<i>Under the Southern Cross: The South Pacific Air Campaign Against Rabaul</i> By Thomas McKelvey Cleaver	Review by Frank Willingham	57
<i>Tsar Bomba: Live Testing of Soviet Nuclear Bombs, 1949-1962</i> By Krzysztof Dabrowski	Review by Scott A. Willey	57
<i>B-EB-66 Destroyer Units in Combat</i> By Peter E. Davies	Review by Joseph D. Yount	58
<i>Arado Ar 196 Units In Combat</i> By Peter de Jong	Review by Gary Connor	59
<i>How the RAF & USAAF Beat the Luftwaffe</i> By Ken Delve	Review by Gary Connor	59
<i>Operation Deliberate Force: Air War over Bosnia and Herzegovina, 1992-1995</i> By Bojan Dimitrijevic	Review by Steven D. Ellis	60
<i>The Feiseler Fi 156 Storch: The First STOL Aircraft</i> By Jan Forsgren	Review by Gary Connor	61
<i>Militarizing Outer Space: Astroculture, Dystopia and the Cold War</i> By Alexander C.T. Geppert, Daniel Brandau, et.al., eds.	Review by Rick W. Sturdevant	61
<i>Desert Storm Volume 2: Operation Desert Storm and the Coalition Liberation of Kuwait 1991</i> By E.R. Hooton and Tom Cooper	Review by John Cirafici	62
<i>Air Battles Over Hungary, 1944-1945</i> By Dmitry Khazanov	Review by Gary Connor	62
<i>Eagles Over Darwin: American Airmen Defending Northern Australia in 1942</i> By Tom Lewis	Review by Gary Connor	63
<i>Cold War Berlin: An Island City—Volume 1: The Birth of the Cold War and the Berlin Airlift, 1945-1950</i> By Andrew Long	Review by Steven D. Ellis	64
<i>A-7 Corsair II Units 1975-91</i> By Peter Mersky with Mike Crutch & Tony Holmes	Review by Joseph D. Yount	64
<i>In Good Faith: A History of the Vietnam War, Volume 1: 1945-65 & No Wider War, Volume 2: 1965-75</i> By Sergio Miller	Review by John Cirafici	65
<i>Korean Air War: Sabres, MiGs and Meteors 1950-1953</i> By Michael Napier	Review by Steven D. Ellis	66
<i>75 Years of the Israeli Air Forces: Vol. 1 The First Quarter Century 1948-73 & Vol. 2 The Last... 1973-2023</i> By Bill Norton	Review by Golda Eldridge	66

Departments

President's Message and Award Banquet Details	4
Reference Assistance	67
Upcoming Events	68
History Mystery	70

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Our issue this time seems to be focused on early to mid-Twentieth Century events from World War I to the Cold War.

Our first article is by first-time contributor Donald Bishop, writing with Erik Limpacher. Both of them are at the Krulak Center at Marine Corps University, Quantico, Virginia. Their article is about the use of balloons in various roles in World War I. Very interesting read.

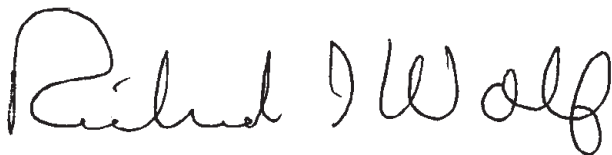
Our second article is an award-winner. Air Force Academy Cadet Wyatt Lake's student paper won the AFHF Award for best historical student paper.. His subject is the development of close air support. The time and place is North Africa, 1942.

Our third article is from award winner and many times contributor, Bill Head, whose subject this time is the Berlin Airlift. His articles are always fun to read.

Our fourth article is from Thomas Wildenberg, who has received many awards over the years and has contributed several times to our pages. His subject this time is celestial navigation, and the development of the tools to simplify it. Don't skip by it, it's chock full of information.

Our final article is from first-time contributor Toh Boon Kwan. His subject is the bombing of Japanes occupied locations likeSingapore and Rangoon during the last two years of World War II. Don't skip over it to get to the reviews of which there are 21 this time..

The President's Message begins on page 4. Don't miss Upcoming Events on page 68, although I fear you must continue to take all dates in that section as still uncertain at this point. If you see something scheduled, be sure to check with the organization sponsoring the event to ensure it will take place. And the closing story is this issue's Mystery. Enjoy!



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From the Chairman

Dear Foundation Members and Friends,

As your new Chairman, I'm extremely pleased to add this introductory note as part of another great issue of *Air Power History*. More than that, I'm pleased to serve as part of the long blue line of Chairmen of the Air Force Historical Foundation.

It's an honor to join you in our goal to ***“Know the Past, Shape the Future.”*** I believe there is much we can do to further that goal together as we reach another turning point in Department of the Air Force history. The end of conventional military operations in Afghanistan marks a transition to a renewed focus on strategic competition with great powers. The creation of the U.S. Space Force offers new opportunities to shape the application of Air and Space power in this competition. Because of your efforts, we have much to offer to the Airmen, Guardians, and their leaders charged with navigating the department through these changes.

I'd like to extend my thanks to Chris Miller for his leadership and service as Chairman and President, and I'd like to welcome Jonna Doolittle Hoppes into her position as President. Jonna and I believe separating the roles of Chairman and President will help us navigate through these changes together by splitting the workload and focusing our attentions on specific areas. We will work closely together, and with the board, to do just that.

Like many membership organizations, it's also time for us to adapt our organization to ensure we remain relevant to new generations of Airmen and Guardians. This includes modifying the way we communicate with these individuals to more accurately relate to their communications preferences and the manner in which they process information.

Next year marks the 75th anniversary of the creation of the U.S Air Force. The Foundation plans to commemorate this anniversary with the release of our upcoming book, *75 Great Airmen*. With the celebration of this monumental milestone and book title, we hope to honor the stories and legacies of these airmen while attracting a new generation of members.

In doing so, we aim to revitalize our brand, expand our social media presence, and increase our overall visibility by utilizing various channels to get the public involved in the nomination process. We hope these efforts will not only provide a qualified list of candidates but also allow various audiences to reflect and celebrate the many “greats” that have had significant impact during their time of service. As we engage in this process, I would like to extend a special thank you to all who have helped us begin this outreach with our booth presence at the Air Force Association's 2021 Air, Space & Cyber Conference in September.

This Fall will also mark our return to a live Awards Banquet in October. I hope you can join us or contribute to the banquet. Our President has developed a plan to expand our part-

nerships with like-minded organizations and the many air museums around the country. We hope to see many of these great museums represented at our banquet.

Finally, thank you for your continued support of the Air Force Historical Foundation. Our survival and relevancy are built on your efforts, and we will continue to rely on your ideas and suggestions as we move forward together.

Respectfully,

James M. "Mike" Holmes,
General, USAF (Ret.)
Chairman

Award Presentation and Annual Awards Banquet

The Foundation will hold its presentation of the Doolittle Award and annual Awards Banquet on Tuesday, October 5, 2021. The Doolittle Award will be presented to the 28th Bomb Wing at the Air Force Memorial, 4:00 PM EDT (free and open to the public), to be followed by the Awards Banquet at Army Navy Country Club.

The evening's festivities will commence with a 5:00 PM social hour; with dinner following.

General John W. "Jay" Raymond of the U.S. Space Force will be honored with the Foundation's Spaatz Award, and Dr. Dan Haulman will receive the Holley Award.

Appropriate attire is service dress for military, and comparable coat and tie for civilian.

We hope you can join us!

Registration for the Banquet is via the following link:
<https://www.afhistory.org/2021-awards-banquet-registration/>

Admittance is by reservation only, and further details can be found at our web site, www.afhistory.org

We can be reached by phone at 301-736-1959

2021 Award Winners

Doolittle Award

28th Bomb Wing
Ellsworth Air Force Base, South Dakota

General Carl A. Spaatz Award

General John W. Raymond, USSF

Major General I. B. Holley Award

Dr. Daniel L. Haulman

Literary Awards for 2021

Best Article Published in Air Power History magazine
Jayson A. Altieri, "Government Girls: Crowd Sourcing Aircraft in WWII"

Best Book Reviewed in Air Power History
Brent D. Ziarnick, 21st Century Power: Strategic Superiority for the Modern Era.

Student Awards

These awards are sponsored by the Air Force Historical Foundation, and are open to cadets in commissioning programs and to officers undergoing professional military education. Award winners are selected by a competitive process within each institution.

Two Air Forces Award (2020) — Group Captain John Alexander, RAF — "The Decision to Reorganise Britain's Air Defence to Counter the V-1 Flying Bomb" - Selection by the Royal Air Force Historical Society

The Air War College Award (2021) — Lt Colonel Jason Monaco, U.S. Army — "Where Art Thou, Pete and Opie? World War II Tactical Airpower Lessons for a New Era"

Air Command and Staff College Award (2021) — Maj Junelene Bungay: "Game-Changing Technology and the Ethics of Strategic Leadership: Examining Technology's Past, Present, and Future Through the Combined Bomber Offensive and Drone Operations"

School of Advanced Air and Space Studies Award (2021) — Major Alex L. Moon, USAF — "Grin 'N Bear It: The Effects of Strategic Decisions on Eighth Air Force Bomber Crews from October 1943 to February 1944"

Air Force Academy Award (2021) — C1C Wyatt Lake: "Origins of American Close Air Support"

General Bryce Poe II Award (AFIT) (2021) — 1Lt Christopher I. Amaddio: "Hazard Mapping for Infrastructure Planning in the Arctic"

Air Force ROTC Award (2021) — 2Lt Tallas Goo, USAF



LOOKING BACK FROM THE AGE OF ISR: U.S. OBSERVATION BALLOONS IN THE FIRST WORLD WAR

Donald M. Bishop & Erik R. Limpaecher

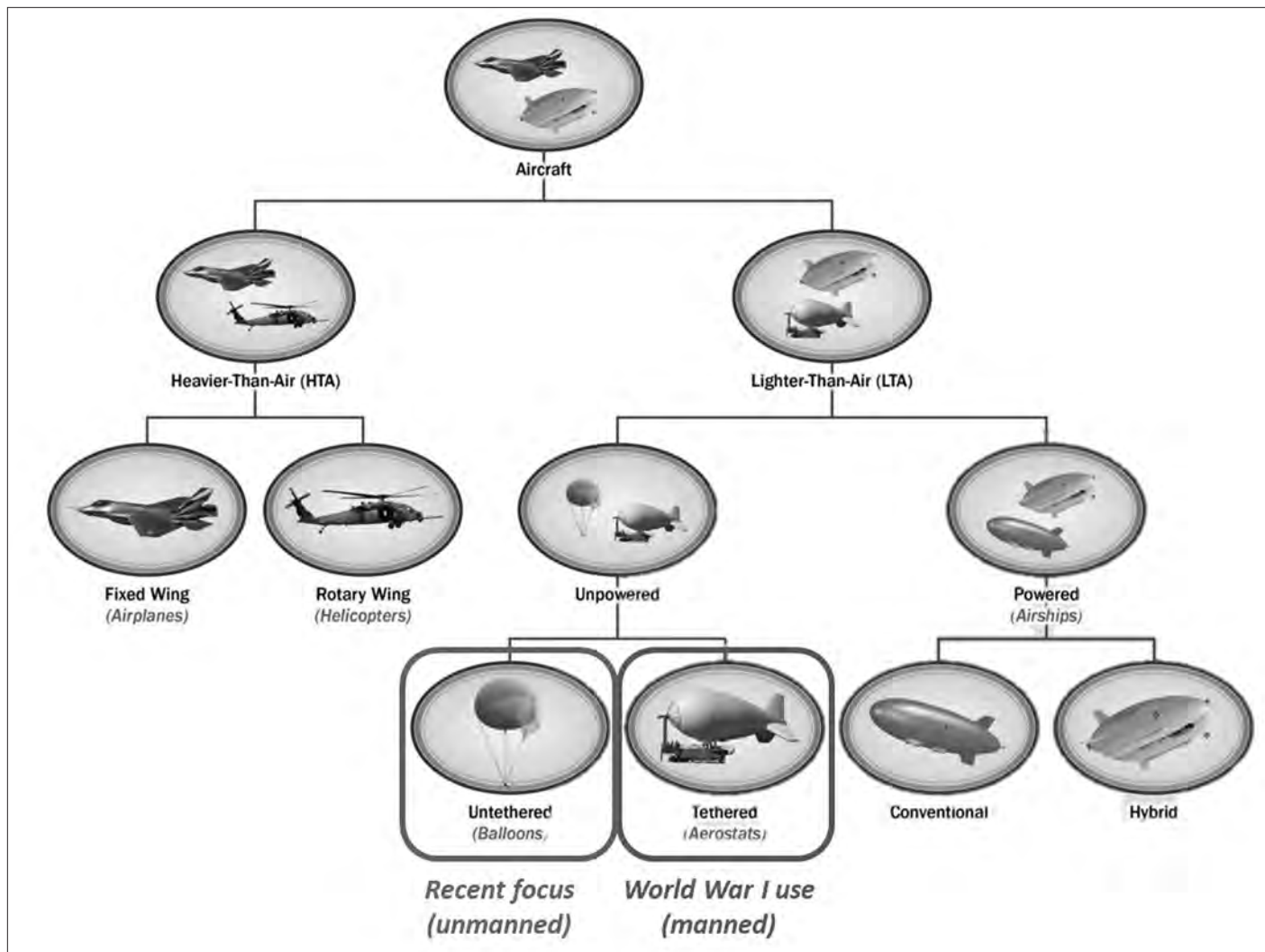
"Operating a Balloon in France: Tenth Balloon Company in Action." (Photo from Camp John Wise Aerostation website.)

Each of the U.S. armed services has programs underway to apply stratospheric balloons to intelligence, surveillance, and reconnaissance (ISR) and communications missions. This is because stratospheric balloons, which operate at 60,000 to 100,000 feet altitude, can provide persistent communications and surveillance coverage over miles of territory. They operate at a fraction of the cost of powered aerial vehicles and can loiter over an area for half a day to multiple days.¹ Several of these programs plan to use hydrogen gas to loft their balloons to the stratosphere.

This renewed interest in the use of hydrogen-filled balloons for high altitude applications opens yet another page in the military use of lighter-than-air aircraft. This history has many fascinating chapters. Among them are the occasional use of balloons, without much effect, on battlefields from the French Revolution to the Crimean War; use of observation balloons by the Union and Confederate armies during the Civil War; balloon reconnaissance in the Spanish-American and Russo-Japanese Wars;² and balloon races. The First World War saw the use of observation balloons at the front, used by all sides; use of other balloons at sea;³ balloon barrages and balloon aprons for point defense of high-value targets against air attack;⁴ and Zeppelins for bombardment. Since the Great War, use of lighter-than-air vehicles included dirigibles and airships; experiments in high-altitude ballooning in the 1930s; both defensive barrage balloons and offensive small balloons carrying incendiaries and anti-power grid cables in the Second World War;⁵ tethered aerostats to help protect forward operating bases and provide aerial views of war-torn cities in Iraq and Afghanistan; and radar aerostats along the southern land and maritime borders of the United States.

Examining the experience of the American Expeditionary Forces in France in 1917 and 1918, most of the Air Service glory went to the aces and the fighter pilots in winged aircraft, but American soldiers and Marines knew that the AEF's balloon companies, equipped with Goodyear R-4 Caquot balloons, were vital on the battlefield. (Because they were tethered, these balloons would now be classed as aerostats, but that name lay in the future.) Indeed, "when the balloon goes up" is still Air Force lingo for "when the fight begins."⁶

Reviewing the use of these hydrogen-filled U.S. observation balloons in combat accords with a key insight of the 2018 National Defense Strategy – "deepening our knowledge of history while embracing new technology and techniques to counter competitors."⁷ It throws in high relief the progress of technology since the Great War ended more than a century ago. And it offers useful perspectives on the use of hydrogen – a flammable gas – in modern lighter-than-air aircraft.



Aircraft taxonomy. The categories of vehicles described in this essay are highlighted. (Chart source is Lighter-Than-Air-Vehicles, Office of the Secretary of Defense, Rapid Reaction Technology Office, 2012.)

Donald M. Bishop is the Donald Bren Chair of Strategic Communications in The Krulak Center at Marine Corps University in Quantico. As an Air Force officer, he served in Vietnam and Korea, and he taught history at the USAF Academy. During his 31-year career in the Foreign Service, the Department of State detailed him to the Pentagon as the Foreign Policy Advisor (POLAD) to the USAF Chief of Staff, General Norton Schwartz. His degrees, both in history, are from Trinity College and Ohio State University.

Erik R. Limpacher is a Non-Resident Fellow of the Krulak Center at Marine Corps University, member of the Defense Science Board task force on Department of Defense (DoD) Dependence on Critical Infrastructure, and leads the Energy Systems Group at MIT Lincoln Laboratory, a DoD Federally Funded Research and Development Center (FFRDC) operated by the Massachusetts Institute of Technology in Lexington, Mass. His team develops advanced expeditionary energy technologies, power systems, and fuels for the DoD.

Observation Balloons in the American Expeditionary Forces

The Balloon Section of the American Expeditionary Forces in France,⁸ part of the Air Service, eventually included 35 balloon companies.⁹ Like artillery, the balloon companies were assigned to support and move with divisions, corps, or armies.¹⁰

The balloon observers – a mix of Air Service, Coast Artillery Corps, or Field Artillery officers¹¹ – ascended above the battlefield to altitudes between 1000 and 4000 feet, communicating via telephone line to the ground. One or two officers took plotting boards, binoculars, and maps of the trench lines with them on each ascension. Dressed in leather and fur, they faced the winds and weather in open wicker baskets. Each wore a harness attached by static line to a silk parachute packed inside a canvas bag tied outside the basket. In case they had to abandon the balloon, all they had to do was jump (no worry about D-rings).

Their most important task was *reglage*, observing the effects of allied artillery fire. If artillery salvos struck to the left or right, or fell long or short of the targets, the observers called in necessary adjustments of fires. They also



Recruiting for the Air Service in the First World War featured both lighter-than-air and fixed wing aircraft.

observed enemy troop movements, and they updated maps of the trenches and defense lines.¹² These lighter-than-air aviators also had a ringside seat as Nieuports and Fokkers duelled short distances away; they reported enemy movements in the air as well as the ground.

According to John Tegler of the Society of World War I Aero Historians, "Sitting aloft in the basket the observer had the whole panorama of his particular section of the front spread before him. His powerful glasses could see accurately everything that transpired in a radius of ten miles or more, depending on weather conditions. He was constantly in touch with his batteries by telephone and could give, via coordinated maps, the exact location of the target and the effect of the bursting shell."¹³

The 170 enlisted men in each Balloon Company had a variety of tasks: balloon and vehicle repair, preparing a camouflaged "balloon bed," inflating the balloon with hydrogen gas, operating the winch mounted on a French Latil truck that spooled the balloon's cable to raise or lower the balloon,¹⁴ operating a chart room and telephone communication center, stringing lines, and "hauling down." Each company had drivers and mechanics, parachute riggers, and cooks.¹⁵ Everyone dug trenches, slept in tents, and en-

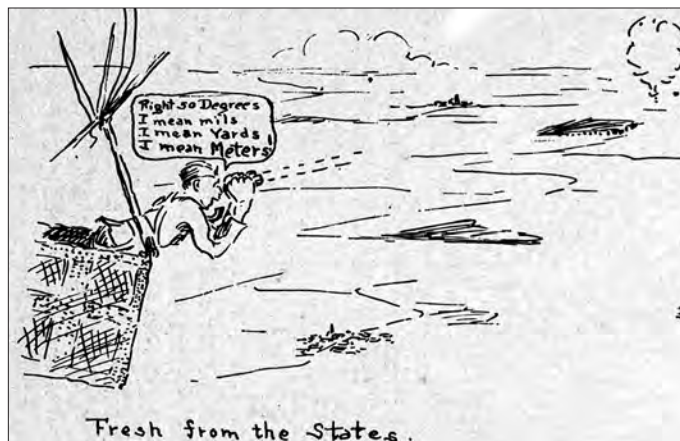


The balloon is up. (*Dust cover illustration from Over There With the Doughboys at St. Mihiel, by George H. Ralphson, [Chicago: M.A. Donohue & Co., 1919].*)

dured the "cooties" (lice). One former balloon company commander also recalled, "That balloon company that selected its best thieves for the ration detail also ate best."¹⁶

When the balloon had to move forward, dozens of soldiers in the company's maneuvering crew moved alongside the balloon with ropes (much like a Macy's parade balloon). Craig S. Herbert, who served in the AEF's Second Balloon Company, recalled moving "through smouldering rubble-strewn villages, over shell-pocked or mined roads, across deeply muddled open fields and barbed-wire to avoid traffic-blocked roads. Maneuvering it around trees, bridges – shinnying up poles to cut overhead wires. Pulling heavily laden 'cast off' trucks, loaded with gas cylinders, by ropes (and incidentally many times pulling mired-in-the-mud artillery guns and limbers that barred their progress)."¹⁷

In 1921, the Air Service provided this summary: "Of the 35 balloon companies then in France, with 446 officers and 6,365 men, there were 23 companies serving with the armies at the front. This balloon personnel had also been



A lighthearted look at observation and *reglage*. (*Source is The Balloon Section of the American Expeditionary Forces, Ovitt and Bowers, eds., 1919.*)



"Getting the basket ready for the observers to make their ascent." Note the parachute container just outside the basket. (Tenth Balloon Company) (Signal Corps photo 111-SC-34348, via Camp John Wise Aerostation website.)

trained in American Expeditionary Forces schools and in every test proved its worth. Our balloons at the front made 1,642 ascensions and were in the air a total of 3,111 hours. They made 316 artillery adjustments, each comprising all the shots fired at one target: they reported 12,018 shell bursts, sighted 11,856 enemy airplanes, reported enemy balloon ascensions 2,649 times, enemy batteries 400 times, enemy traffic and roads and railroads 1,113 times, explosions and destructions 597 times."

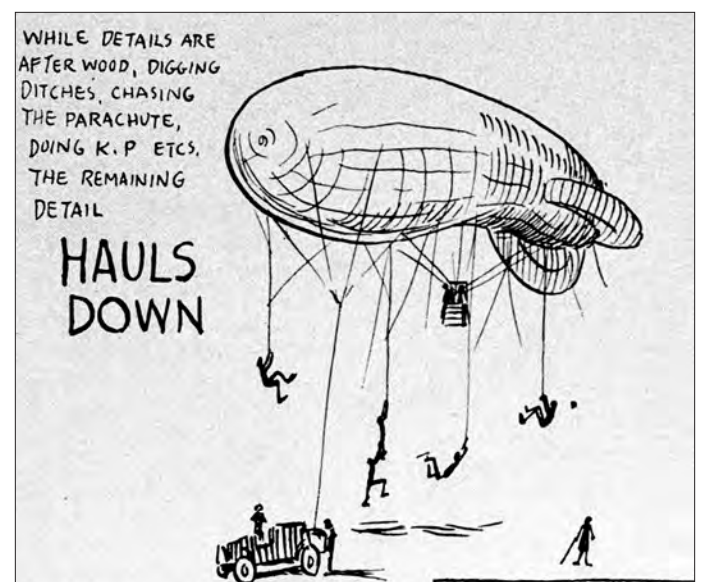
The report added: "Our balloons were attacked by enemy airplanes on 89 occasions; 35 of them were burned during such attacks, 12 others were destroyed by shell fire, and 1 blown over enemy lines. Our observers jumped from the baskets 116 times; in no case did the parachute fail to open properly. One observer lost his life because pieces of the burning balloon fell on his descending parachute."¹⁸

Balloon Corps veteran Craig S. Herbert said the balloons were the "eyes of the Army," and Richard DesChenes credits them as "the forward air controllers of the day." Tegler judged "The balloon became the eye of the artillery and that branch reciprocated with an efficiency beyond anything known before in the history of warfare."¹⁹

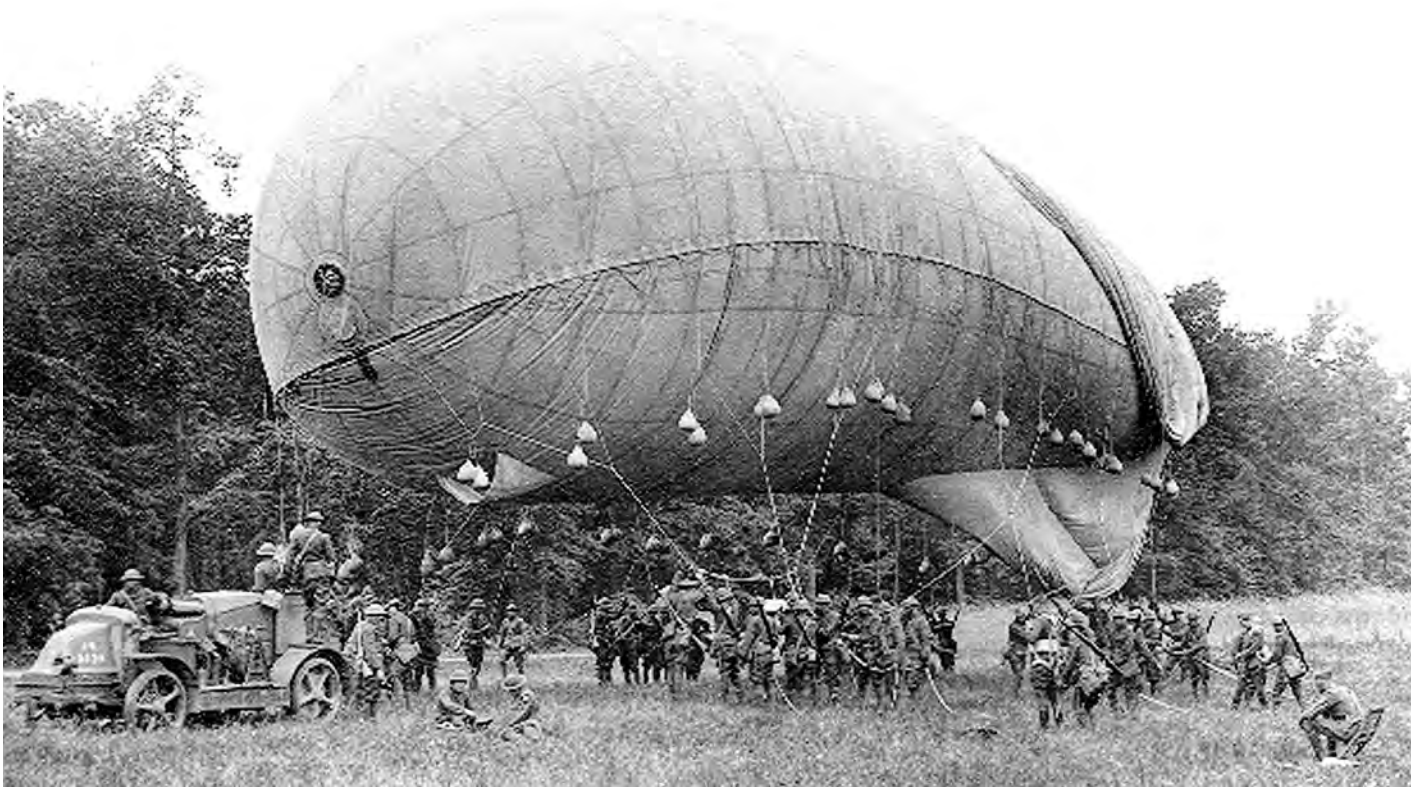
The Goodyear R-4

The French and U.S. armies used the same Type R "Caquot" balloon, named for its designer, French engineer

Captain Albert Caquot.²⁰ The doughboys called them "sausages." Goodyear and other American companies manufactured 642 balloons before the war's end; of these 389 were "floated" (shipped) and 265 "received" in France. Forty-five were provided to the British and French.²¹



Lowering the balloon, as drawn by a puckish doughboy. (Image found in The Balloon Section of the American Expeditionary Forces, Ovitt and Bowers, eds., 1919.)



"Observation balloon about to ascend, 1918." (*World War I Centennial Commission.*)

More than a century after the end of the Great War, only one R-4 – a British barrage balloon manufactured in World War II to the original World War I Caquot design – remains; it is on display at the National Museum of the U.S. Air Force in Dayton (see photo on the next page).²²

A short description was provided by Craig Herbert: "The Caquot contained a partition, known as the diaphragm, which divided the envelope into two cells. The top cell was inflated with hydrogen gas for 'lift', the bottom section filled with air (when in ascension) from a scoop in the nose of the balloon, to provide ballast, preventing the balloon from rolling side wise. At the stern were attached stabilizers and rudder, like the ears and trunk of an elephant. This took the place of the tail-cups. The basket was suspended from the rigging in the center."²³

Measuring 92 feet in length and 32 feet in diameter, the gas capacity of the R-4 was 32,200 cubic feet.²⁴ The net lift of hydrogen is 1.14 kg/m³, which corresponds to 70.9 pounds of lift per 1,000 cubic feet of balloon volume. For a 32,200 cubic foot balloon, that would produce 2,600 pounds of gross lift.²⁵ Much of that lift was counteracted by the weight of the rubberized cotton balloon envelope and lines, the basket, sandbags, one or two men and their gear, the parachutes, and the 5/8-inch steel cable and telephone line that connected the balloon and the ground. (One thousand feet of cable weighs about 660 pounds.)

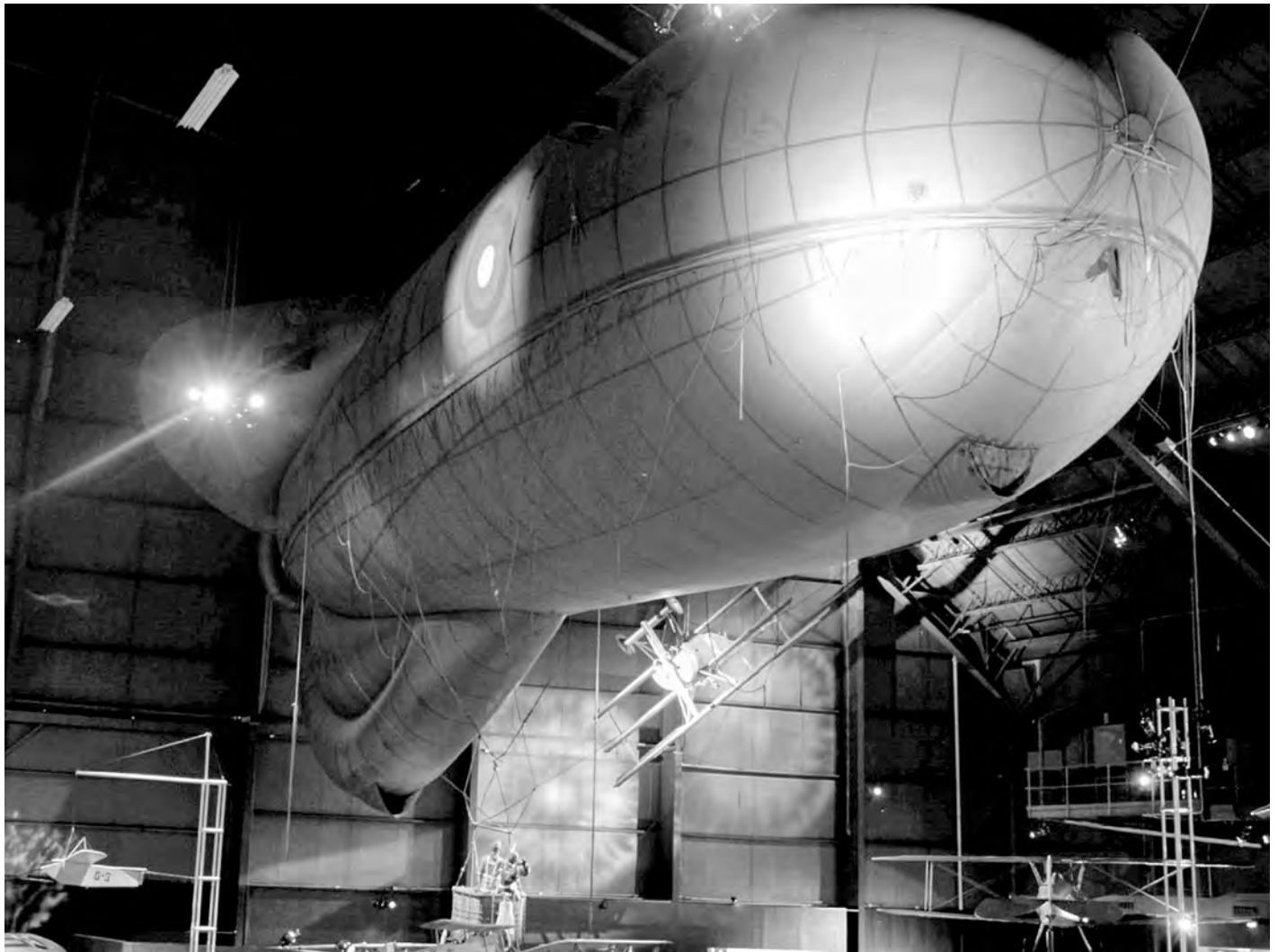
The War Department's 1919 statistical summary, in its section on Balloons, noted "In no field did American manufacturing capacity achieve a greater relative success."²⁶ (This gentle-sounding sentence hints at the many disappointments, even failures, in the manufacture of engines and winged aircraft.²⁷) Producing the large number of ob-

servation balloons in a short time posed many challenges for American manufacturers. Here's just one: cloth for balloons required a very tight weave (140 threads to the inch both ways) and large size (38 to 45 inches wide). Only a few such looms existed in the United States as the nation joined the war in Europe, but by war's end 3,200 such looms were at work, and enough weavers had been trained to operate them.²⁸

Safe Combat Use of Hydrogen

The common method to produce hydrogen at the time was not electrolysis but the capital-intensive "iron contact process," which requires steam, carbon monoxide, and high-temperature iron rods to produce hydrogen.²⁹ As the needs of the allied balloon units exceeded the allies' production capacity, however, the U.S. began to export ferrosilicon to France. When reacted with caustic sodium hydroxide, the ferrosilicon produces hydrogen and benign sodium silicate.³⁰ Seven million cubic feet of compressed hydrogen were purchased from French commercial suppliers, and enough ferrosilicon was shipped to France by war's end to produce 58 million cubic feet of hydrogen.³¹ As part of the war effort, construction of the world's largest hydrogen plant near Paris was due to begin on November 15, 1918.³²

The hydrogen was compressed into cylinders ("tubes"), not then standardized, but usually about four feet in length, filled to 1,800 psi, supplying 370 cubic feet of gas.³³ The United States shipped more than 50,000 cylinders to France.³⁴ It required 160 cylinders of gas to inflate a balloon.³⁵ For "topping up," "the average daily consumption of



Goodyear R-4 Caquot balloon at the National Museum of the United States Air Force. (NMUSAF photo.)

hydrogen for a balloon company in active operations was found to be 2,600 cubic feet.”³⁶

The cylinders filled with hydrogen were first transported from a main depot to railheads near the front. They then moved to balloon company positions by truck; a four-ton truck could carry 40 cylinders. Driving these cargoes on unimproved, muddy roads crowded with other vehicles perhaps containing fuels or explosives, under shell fire or aerial attack, was itself dangerous. Any puncture of a pressurized gas cylinder, if unsecured, could make it a rocket. For the St. Mihiel offensive in mid-September, 1918, 1,500 to 2,000 tubes of hydrogen were stockpiled at Chaudeney, 19 densely trafficked miles from the jumping-off line.³⁷

Despite the hazards inherent in using hydrogen along the front lines, the Air Service balloon companies demonstrated a near-flawless safety record. Two scientists from the Idaho National Laboratory, taking a look back at airships during the First World War, noted that several failures were required in combination to cause a hydrogen accident. “Wartime experiences show that if the hydrogen is kept isolated or confined; that is, unmixed with air, then there is little danger of fire or explosion. The hydrogen must be kept above its upper flammability limit [of 74 percent] for airship usage.... Even energetic scale events (i.e.,

anti-aircraft shells striking or exploding within zeppelins, machine gun bullet impacts, lightning strikes) did not always cause gas fires or explosions. However, allowing the gas to leak out into air and then subsequently providing an ignitor [could result in] hydrogen fires and explosions.”³⁸

These technical realities were borne out by the tactics of enemy pilots. Sending rounds through the balloon envelope did not necessarily down it. Regular bullets would pass through the fabric without more effect than causing some slow leakage. Incendiary bullets might not ignite the gas unless some oxygen had mixed with the hydrogen. The incendiary bullets, moreover, were not “hot” over their full flight; they “had an effective range of 350 yards after which distance the phosphorus was burned out.”³⁹ Major Paul Pleiss, the Balloon Section’s hydrogen expert, wrote “Many instances were on record in which enemy planes did not open fire on the balloon until they were within 50 meters of the balloon.”⁴⁰ To incentivize their pilots to attack the well-protected and largely impervious balloons, Germans credited their pilots with one and a half “kills” for every downed balloon.⁴¹

Inflating a balloon from cylinders required strict safety measures. No smoking was strictly enforced. Soldiers assigned to this duty had to always be aware that the hydro-



"Four soldiers with either the 1st or 2nd Balloon Company posing next to hydrogen gas cylinders with manifold and tube." (Image from *The University of Tulsa, McFarlin Library, Department of Special Collections & University Archives*, image 2001.073.1.016.)

gen not be contaminated with oxygen, and any static electricity could ignite the gas.⁴² At Fort Sill, Oklahoma, on April 2, 1918, static electricity, likely triggered by improper adherence to electrical grounding procedures, ignited a balloon "while the ground crew was still holding onto the guide ropes." Six were killed and 30 more were injured.⁴³ Another accident occurred in Omaha, Nebraska, on May 2, 1918, when the explosion of a balloon killed two and injured 26. The accident was attributed to poor gas quality and a static spark.⁴⁴

Thanks to training and discipline, however, there were no such accidents in France. Three officers and thirteen enlisted soldiers in the Balloon Section gave their lives in France before the armistice, but all the deaths except one came from poison gas, shelling, vehicle accidents, or disease (including the Spanish flu).⁴⁵ As noted, one observer, First Lieutenant Cleo J. Ross of the Eighth Balloon Company, was killed after his balloon was attacked by a Fokker D-7. He safely jumped from the basket, but the burning balloon fabric fell on his descending parachute, and he plummeted to his death, becoming the only balloon pilot to die in battle.⁴⁶ During each of the 5,866 ascensions by Air Service balloon units in France (both at and behind the front) totaling 6,832 hours of flight time, several dozen servicemen worked directly underneath or nearby every hydrogen balloon. To support these manned flights, the balloon men delivered, handled, and dispensed tens of millions of cubic feet of pressurized hydrogen. All things considered, the Air Service companies flying manned balloons filled with hydrogen in combat had an enviable safety record.

During the war, all military balloons were inflated with hydrogen. In 1917 the U.S. Army and Navy agreed that American balloons should rather be inflated with helium. They calculated that if enemy aircraft were unable to flame the American balloons, they could remain aloft longer; a technological advance would enhance military efficiency. Providing helium from the United States was set in motion.⁴⁷

Tegler notes that "until two years before we entered



Inflating the balloon (Tenth Balloon Company). (Signal Corps photo 111-SC-34101.)

the war, the total world production of helium had not been more than 100 cubic feet in all, and the gas cost about \$1,700 per cubic foot." He added that the Army, Navy, and the Bureau of Mines joined hands to adopt a new method of obtaining helium from liquefied gas; production expanded, and the cost fell to ten cents per cubic foot.⁴⁸ The first shipment of 147,000 cubic feet of helium was ready to be transported to France from New Orleans on November 8, 1918, but after the war ended three days later there was no need to ship it.⁴⁹

The U.S. Army continued to use hydrogen in its post-war airships, but after the fiery crash of the semirigid Army Airship *Roma* on February 21, 1922,⁵⁰ piloted and crewed by many veterans of the AEF balloon companies, the Army exclusively relied on helium. By the time the U.S. and British militaries began using smaller, unmanned barrage balloons during the Second World War, they had reverted back to inflating them with hydrogen.⁵¹

Fighters vs. Balloons

Soldiers and Marines on the front knew that "if you could see a German observation balloon, he could see you and accurate artillery fire would soon follow."⁵² The Marines' battle for Belleau Wood in June, 1917, provides just one awful example. "As the fighting increased, German artillery, assisted by spotters in aircraft and balloons, crashed down upon the marines' defensive positions."⁵³ The incoming rounds could be both high explosive and gas.⁵⁴ "What made the German defenses all the more lethal were German observation balloons north of the village of Belleau, from which operators could see all that occurred in the fields. . . . The German spotting balloons . . . were so critical that when Marine Corps General Charles C. Krulak researched the events of Belleau Wood nearly a century later, every oral history he encountered from Marine veterans mentioned the balloons at the battle."⁵⁵

For both sides, then, balloons were high-value targets; downing balloons could leave enemy formations blind.⁵⁶ Eddie Rickenbacker thus noted that on September 26, 1918, the first day of the Meuse-Argonne offensive, "Head-



"Manifold for the hydrogen used to fill the balloons. They always leaked a little." (Photo from Camp John Wise Aerostation website.)

quarters had sent us orders to attack all the enemy observation balloons along that entire front this morning and to continue the attacks until the infantry's operations were completed. Accordingly every fighting squadron had been assigned certain of these balloons for attack and it was our duty to see that they were destroyed. The safety of thousands of our attacking soldiers depended upon our success in eliminating these all-watching eyes of the enemy."⁵⁷

To counter Allied balloons, the German army could shell the balloon company's position and/or direct anti-aircraft fire at the balloon in the air; but only twelve of the AEF balloons were "destroyed by shell fire." That was the lesser threat. Almost triple that number, 35, were burned during 89 air attacks.⁵⁸ Photographs of balloon company personnel on the ground during ascensions give testimony to the reality — all necks are craned to watch for enemy aircraft.

When the balloon was up, six or eight soldiers with binoculars ("lookouts" or "vigies") spread in each direction, climbing trees, watching for German aircraft that might attack the balloon.⁵⁹ If an enemy aircraft approached, the company's French 8mm Hotchkiss 1914 anti-aircraft machine guns went to work. If the aircraft pressed the attack, the observers took to the parachutes so that they could escape death if incendiary bullets ignited the hydrogen.⁶⁰ "From the time the gas leaped into flame until the explosion and fall of the balloon there was an interval of rarely over 15 or 20 seconds," John Tegler reported.⁶¹

Soldiers stood ready with a "spider" of ropes, attached to the cable, to pull the balloon away from observers who jumped — so that if the balloon burned, it would not fall on their parachutes as they descended, as had happened to Lieutenant Ross.⁶²

Fighter pilots knew attacking a balloon was hazardous because the balloons were stoutly defended from the ground. It was a Belgian pilot, Adjutant Willy Coppens, who pioneered the most successful method and became the leading "balloon buster" of the war.⁶³ American ace Eddie Rickenbacker related the elements of Coppens' method —



"Balloon and observers in the air, everyone is looking for enemy planes in the area." (Photo from Camp John Wise Aerostation website.)

include incendiary bullets in the ammunition belts, "make the attack early in the morning or late in the evening, when visibility was poor and the approach of the buzzing motor could not be definitely located," cut the engine, glide silently down to the enemy balloon line for an "attack from a low level," restart the engine, and "zoom up quickly."⁶⁴

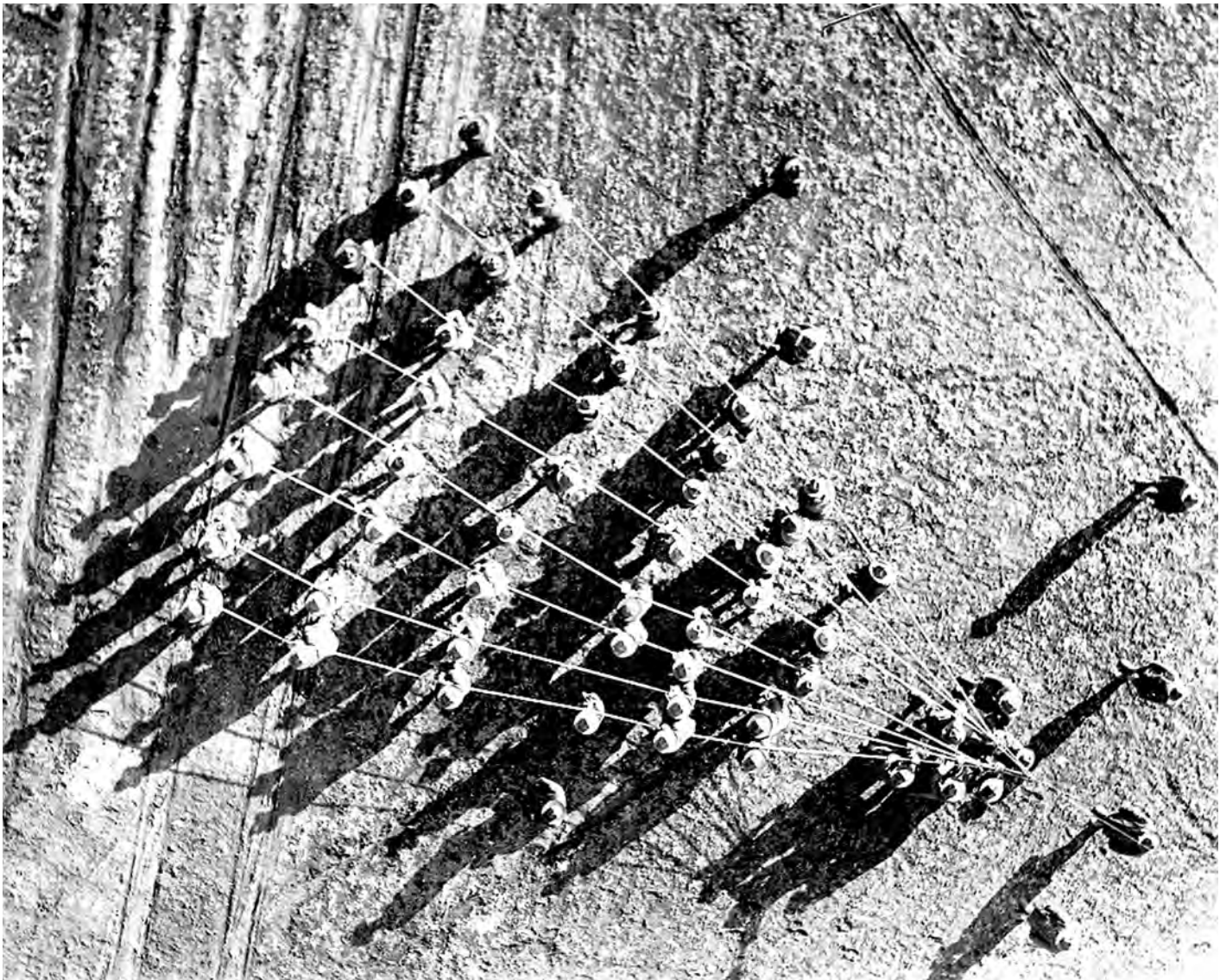
A balloon company's lookouts, the "vigies," played one more role in the aerial combats near the front lines. When the balloon was down, they hung out in the communication center. On one hand, they hoped to avoid KP and other random details, no doubt. In the afternoons, however, the balloon companies might be visited by fighter pilots. To be credited with a "kill," a pilot needed confirmation from someone who witnessed the enemy aircraft go down. The pilots often had been too busy in the air to see what had happened to German aircraft they had fired on. Balloon company observers and the vigies might give testimony.

Then and Now

The same purposes link the observation balloons of the First World War and the new, experimental stratospheric balloons under development. In World War I, the word "observation" embraced a variety of tasks, now more fully explained as "intelligence, surveillance, and reconnaissance" (ISR), and all require communication.

A century ago, observation required human eyes on the target, so balloon observers ascended, endured winds and cold, reconnoitered the battlefield, reported what they saw, and took to the silk when enemy aircraft attacked. While aircrew in winged aircraft could also provide observation and could range beyond the front lines, balloon observers near the trenches had longer loiter times, measured in hours. With advanced technology, the new unmanned stratospheric balloons can loiter for days.

Balloon observers communicated by telephone using gridded maps, and men in the balloon company's communications center passed on information to artillery units and division headquarters over telephone networks they quickly patched together on moving battlefields. Balloon observations were thus communicated to artillery batteries and to division headquarters in near-real time, faster than couriers or pigeons. In contrast, the processing and distribution of aerial photographs taken by aircraft took longer.



"The 'spider' from the basket. (Photo from Camp John Wise Aerostation website.)

Data from new stratospheric balloons can reach operations centers at the speed of light.

In 1918, lifting the necessary weight of men and equipment required a sizeable 32,000 cubic foot hydrogen aerostat. In the twenty-first century, miniaturization packs ISR capabilities into payloads of small weight, so the balloons are as small as 350 cubic feet. The equipment to manufacture hydrogen can fit on a pickup truck, and a balloon can be inflated in tens of minutes.

The World War I balloon men used the materials and textile technologies of a century ago to handle the hydrogen gas that lofted their aircraft. Nevertheless, they logged a near-flawless hydrogen safety record along the front lines, operating manned hydrogen balloons under direct attack from enemy aircraft firing incendiary bullets. Modern unmanned stratospheric balloons can be inflated and launched well away from enemy threat. They use modern anti-static textiles, carbon fiber tanks, sparkless valves, and grounding techniques to effectively eliminate the risk of a hydrogen accident.

The World War I balloons required large amounts of

hydrogen, placing additional demands on battlefield supply and transport. The balloons were easily visible, presenting a large target for enemy fighters. A century later, stratospheric balloons are almost invisible to radar, and they reach altitudes beyond the reach of interceptor aircraft.

Because the balloons of World War I were tethered, moving the balloon, vehicles, and men to new tactical positions, perhaps a few miles away, required considerable effort. These limits on movement worked in France because the front lines, even during successful offensives, moved slowly. No one foresees that wars in the 21st century will be so static. Stratospheric balloons in this century float freely, and they can be moved by adjusting their altitude, for winds move in different directions at different altitudes. GPS and wireless technology link the new stratospheric balloons to the world's mapping, navigation, weather, and communication networks. Everything can be controlled from the ground.

The balloon airmen of the World War I, by contrast, provided what the technology of the time could not: Eyes, minds, physical strength and endurance, and courage. ■



Eyes upward. "Guns mounted on truck, to protect balloon" (Tenth Balloon Company). (Courtesy of Signal Corps photo 111-SC-34097.)

NOTES

1. David Hambling, "The US military is testing stratospheric balloons that ride the wind so they never have to come down," *MIT Technology Review*, Nov. 14, 2018, at <https://www.technologyreview.com/2018/11/14/139092/darpa-is-testing-stratospheric-balloons-that-ride-the-wind-so-they-never-have-to-come-down/>; "High Altitude (HA)," US Army Space and Missile Defense Command, Fact Sheet, at https://www.smdc.army.mil/Portals/38/Documents/Publications/Fact_Sheets/HA.pdf; "Air Force High-Altitude Balloon Program," Kirtland Air Force Base, Fact Sheet, October 2010, at <https://www.kirtland.af.mil/About-Us/Fact-Sheets/Display/Article/825982/air-force-high-altitudeballoon-program/>; M. Harris, "Pentagon testing mass surveillance balloons across the US," *The Guardian*, Aug 2, 2019 at <https://www.theguardian.com/us-news/2019/aug/02/pentagon-balloons-surveillance-midwest>. See also the summary of the High-altitude Attritable Link Offset (HALO) program by Jeff Boleng and Maggie Sizer, "The New Defense Acquisition Workforce Awards – Recognizing the Importance of Software," Defense Acquisition University, Mar. 9, 2020, at <https://www.dau.edu/library/defense-atl/blog/The-New-Defense-Acquisition-Workforce-Awards—Recognizing-the—Importance-of-Software->.
2. This early history is serviceably summarized in Sam Hager Frank, *American Air Service Observation in World War I*, University of Florida Ph.D. Dissertation, 1961, pp. 4-13, 21-23, 69-75, at <https://ufdcimages.uflib.ufl.edu/UF/00/09/79/82/00001/americanairservi00franrich.pdf>. See also John T. Correll, "Balloonists in the Family Tree," *Air Force Magazine*, November 2020, pp. 56-60.
3. A compact discussion of the use of balloons by naval forces during World War I – gunfire adjustment, convoy escort, port defense, antisubmarine – is provided by William G. Dooly, Jr., *Great Weapons of World War I* (New York: Walker and Company, 1969),

pp. 173, 175.

4. Assistant Chief of Air Staff, Intelligence, Historical Division, *Barrage Balloon Development in the United States Army Air Corps 1923 to 1942*, Army Air Forces Historical Studies No. 3, December 1943, pp. 1-3.
5. Raoul Drapeau, "Operation Outward: Britain's World War II offensive balloons," *IEEE Power & Energy Magazine*, October 2011, pp. 94-105, at: <https://site.ieee.org/ny-monitor/files/2011/09/OPERATION-OUTWARD.pdf>; Assistant Chief of Air Staff, *Barrage Balloon Development. FM 4-187, Antiaircraft Artillery Field Manual, Barrage Balloon Service of the Balloon and Balloon Equipment, Low Altitude* (Washington: GPO, 1942).
6. "When the balloon has gone up (origin)" at http://www.grammar-monster.com/sayings_proverbs/balloon_has_gone_up.htm; "The balloon has gone up," The Phrase Finder, Jan. 9, 2002, at https://www.phrases.org.uk/bulletin_board/12/messages/798.html
7. *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, U.S. Department of Defense, 2018, p. 8, at: <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.
8. A fine readable treatment of the Air Service's balloons in World War I is provided by Eileen F. Lebow, *A Grandstand Seat: The American Balloon Service in World War I* (Praeger, 1998). Perhaps the best short treatment was by Craig S. Herbert, "The American Balloon Service in World War I: Gasbags Preferred," *Aerospace Historian*, v. 15, no. 2, Summer 1968, pp. 26, 39-51. In 1921, the Air Service compiled a "Final Report" and a "Tactical History" on its operations in the AEF; both were published by the Albert F. Simpson Historical Research Center and the Office of Air Force History in book form in 1978: *The U.S. Air Service in World War I, vol. 1, The Final Report and A Tactical History*, Mau-

rer Maurer, ed. (Washington: Government Printing Office, 1978), hereafter cited as *USASWWI-I*, at https://media.defense.gov/2010/Oct/13/2001329758/-1/-1/0/us_air_service_ww1-vol1--2.pdf, see esp. pp. 17, 137-142, and 378-386. More details and contemporary texture are found in *The Balloon Section of the American Expeditionary Forces*, S. W. Ovitt and L. G. Bowers, eds. (Tuttle, Morehouse, and Taylor, 1919), hereafter cited as *TBSAEF*. No study of the Balloon Section can now be complete without consulting the detailed and lavishly illustrated Camp John Wise Aerostation website compiled and maintained by Richard Des Chenes at <https://www.john-wise-aerostation.com/>. A famous American journalist, author, and humorist visited a German balloon unit soon after the beginning of the war, before the United States joined the conflict. His book chapter on "Viewing a Battle from a Balloon" is a verbally colorful account; see Irvin S. Cobb, *Paths of Glory: Impressions of War Written At and Near the Front* (New York: George H. Doran Company, 1915), pp. 226-250.

9. The number of companies actually deployed to France was only a fraction of the number requested by General Pershing; see Herbert, pp. 40, 46.

10. The Air Service's Tactical Report commented on the effectiveness of this arrangement; see *USASWWI-I*, p. 387.

11. *USASWWI-I*, pp. 137, 138.

12. The former commander of the Seventh Balloon Company provided a first-hand recollection of observations; see Samuel Taylor Moore, "When Sausages Blazed in the Sky," *Air Force Magazine*, May 1963, p. 85.

13. John H. Tegler, "The Humble Balloon: Brief History – Balloon Service, AEF," *Cross and Cockade Journal*, vol. 6, no. 1, Spring 1965, p. 1.

14. The French winch used with Caquot balloons could attain a haul-down speed of 1400 feet per minute; Stone, p. 9.

15. The Twenty-Sixth Balloon Company wrote out a full description of its manning, by section: balloon winch, 4 soldiers; chart room, 6; gas alarm, 4; lookouts, 8; machine gun, 13; maneuvering group, 27; orderly room, 2; supply room, 2; medical, 3; orderlies, 3; barbers, 2; carpenters, 3; bugler, 1; cobbler, 1; tailor, 1; rations, 8; telephone, 11; transportation, 21; and riggers, 12. See *TBSAEF*, pp. 185-190. More details of "Observation Balloon Operations" are in Richard E. Des Chenes, *The Insignia, Uniforms & Equipment of the U.S. Army Balloon Corps: 1917-1922*, 2d Edition, (Archer, Fla.: Camp John Wise Aerostation, 2013), pp. 79-84. The experience of a soldier in the Twelfth Balloon Company, Austin Walter Johnson, has been recreated by his son in great detail; see Robert Eugene Johnson, *Austin in the Great War: A Nebraska Farm Boy in the 12th Balloon Company* (Palo Alto: WordHawk Publishing, 2018). For one "vigie" in the Tenth Balloon Company, see Ann Carter, "Milton W. Bishop: World War I Barrage [sic] Balloonist Honored," *Avon Park Sun*, Aug. 20, 1980, p. 1C.

16. Moore, "When Sausages Blazed the Sky," p. 88. The extreme difficulty of attacking a balloon was described by Edward V. Rick-enbacker, *Fighting the Flying Circus* (New York: Frederick A. Stokes Company, 1919), pp. 171-175, online at <http://www.wtj.com/archives/rickenbacker/rick18.htm>. "Captain Eddie," America's leading ace, included five German balloons among his 26 aerial victories. For Willy Coppens, see Jon Guttman, "The Greatest Balloon Buster," *Aviation History*, September 2008, pp. 57-58.

17. Herbert, p. 44.

18. *USASWWI-I*, p. 17; Tegler, pp. 1-2.

19. Des Chenes, "Camp Operations," Camp John Wise Aerostation website; Tegler, p. 1.

20. "Caquot Type R Observation Balloon," National Museum of the United States Air Force, Museum Exhibits, Fact Sheet, Aug. 7, 2015, at <https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197400/caquot-type-r-observation-balloon/>. For more detail on Caquot's design, see Patricia Turner Shriver, "The Caquot Flies Again," *Air University Review*, vol. XXI, no. 4, May-June 1980, pp. 48-49, at https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/1980_Vol31_No1-6/1980_Vol31_No4.pdf. A fine plain-language description of the

Caquot's design – with comparisons to the German "drachen" – was provided by Tegler, pp. 2-4. For balloon nomenclature at the time of the First World War, see "Nomenclature for Aeronautics," Report 25, *Fourth Annual Report of the National Advisory Committee for Aeronautics* (Washington: Government Printing Office, 1920), pp. 70-78, at <https://library.si.edu/digital-library/book/annualreportnat4unit>.

21. The American balloon units arriving in France were initially supplied with 20 French Type R balloons. Afterwards all the balloons in American units came from the U.S. For total figures, see *USASWWI-I*, 140, and Leonard P. Ayres, *The War with Germany: A Statistical Summary*, second edition [with data revised to August 1, 1919] (Washington, GPO, 1919), p. 93, at <https://digital.library.unt.edu/ark:/67531/metadc276266/m1/93/>. In addition to Goodyear, balloons were manufactured by Goodrich, Connecticut Aircraft, U.S. Rubber, and Firestone; see Herbert, p. 39.

22. Schriver, pp. 46-54.

23. Herbert, p. 39. During the war, there were occasionally double- or triple-basket configurations, but the AEF balloons all used a single basket.

24. By way of comparison, the volumes of the modern TARS, JLENS, RAID, REAP, PTDS, and MARTS aerostats range from 10,200 to 590,000 cubic feet. See "Tethered Aerostats," 2005, at <http://www.designation-systems.net/dusrm/app4/aerostats.html>.

25. This uses a density of air of 1.23 kg/m³ and density of hydrogen of 0.09 kg/m³. One website explains that "The actual lifting ability of each gas varies with temperature, pressure, and humidity, and to take account of varying atmospheric conditions and gas impurities airship designers often conservatively estimated helium's lift at 60 lbs per 1,000 cubic feet and hydrogen's lift at 68 lbs per 1,000 cubic feet." See "Hydrogen and Helium in Rigid Airship Operations," at <https://www.airships.net/helium-hydrogen-airships/>. Chemistry teacher John Hazen of James Madison High School in Vienna, Virginia, generously explained the ABC's of lift to the author who is a historian.

26. Ayres, p. 93.

27. See, for instance, Christopher Bergs, "The History of the U.S. Air Service in World War I," at <https://www.centenaire.org/en/au-tour-de-la-grande-guerre/aviation/history-us-air-service-world-war-i>. He noted, "while America leapt into the production of several thousands of aircraft, somewhat overzealous estimates fell on inefficient management, resulting in failure. While America was well capable to mass producing vehicles and engines, planes were somewhat of a novelty and production techniques had to be adapted first. In fact, the mass-produced Liberty motor was unsuited to the majority of planes American aviators were eventually equipped with during World War One." More details are provided by the historian of the U.S. Army Aviation and Missile Command; see Russ Rodgers, "WWI industry tried to 'fill the sky with aircraft,'" Oct. 20, 2013, at https://www.theredstone-rocket.com/military_scene/article_7506b6da-416d-11e3-9375-0019bb2963f4.html. "It is little wonder that a year after our entrance naval aircraft production proceeded smoothly while the Army production program was a hopeless muddle, conceded to be a failure." Samuel Taylor Moore, *U.S. Airpower: Story of American Fighting Planes and Missiles from Hydrogen Bags to Hydrogen War-heads* (New York: Greenberg, 1958), p. 54.

28. Tegler, p. 4. The "design and manufacture of a suitable balloon fabric" was "probably the major problem of the balloon program"; Stone, pp. 12.

29. The manual used at the Army balloon schools described the iron contact process; see C.R. Roth, *A Short Course on the Theory and Operation of the Free Balloon*, Second Edition (Akron: The Goodyear Tire and Rubber Company, 1917), pp. 25-26. The Goodyear manual also described the vitriol process, electrolytic method, silicol process, aluminum caustic soda process, hydrolythe, hydrogenate, hydrogen from water gas, Aluminum-potassium cyanide process, acetylene process, iron and water process, silico-actylene process, iron and water process, and decarburization of oils. See also "Hydrogen for Airships," Neville

Shute Norway Foundation, reprint from the Cleveland Industrial Archaeology Society Newsletter No. 82, January 2003, at http://nevilshute.org/Engineering/AMBurgess/amb_hydrogen.php. On cylinders, the article relied on the 1916 version of the Royal Naval Air Service's Hydrogen Manual, and more details of the use of cylinders are in Roth, pp. 34-35.

30. E. R. Weaver, W. M. Berry, and V. L. Bohnson, "The Ferrosilicon Process for the Generation of Hydrogen," Report 40, *Fourth Annual Report of the National Advisory Committee for Aeronautics* (Washington: GPO, 1920), pp. 429-468, at <https://library.si.edu/digital-library/book/annualreportnat4unit>; E. R. Weaver, "The Generation of Hydrogen by the Reaction Between Ferrosilicon and a Solution of Sodium Hydroxide," *The Journal of Industrial and Engineering Chemistry*, vol. 12, no. 3, Mar. 1, 1920, p. 232ff, at <https://pubs.acs.org/doi/abs/10.1021/ie50123a011>; Viktor Hacker, Robert Rankhauser, Gottfried Faleschini, Heidrun Fuchs, Kurt Friedrich, Michael Muhr, and Karl Kordes, "Hydrogen production by steam-iron process," *Journal of Power Sources* 86 (2000), Issues 1-2, pp. 531-535. <https://www.sciencedirect.com/science/article/abs/pii/S0378775399004589>.

31. *USASWWI-I*, p. 142.

32. Paul Pleiss, "Balloon Section Gas," in *TBSAEF*, p. 252. See also *USASWWI-I*, p. 70.

33. "Hydrogen for Airships," op. cit. For interesting details on the manufacture of cylinders to meet the increased demands of the First World War and the associated problems of logistics and transportation, see "Celebrating 100 Years as The Standard for Safety: The Compressed Gas Association, Inc., 1913-2013," slide 16, at <http://www.cganet.com/wp-content/uploads/100thAnniversaryBook.pdf>.

34. *USASWWI-I*, p. 141.

35. "Balloon Operations in the St. Mihiel Advance," *The Weekly Bulletin of Instruction, Army Balloon School, Arcadia, California*, vol. 2, no. 11, Apr. 1, 1919, p. 57.

36. *USASWWI-I*, p. 142.

37. "Balloon Operations in the St. Mihiel Advance," pp. 11, 28, 56-57. During the Meuse-Argonne Offensive, it took the vehicles of the Sixth Balloon Company two days to travel to and from a supply depot located 19 miles away to obtain a new balloon and hydrogen cylinders; *TBSAEF*, p. 90.

38. L. C. Cadwallader and J. S. Herring, "Safety Issues with Hydrogen as a Vehicle Fuel," Idaho National Engineering and Environmental Laboratory, INEEL/EXT-99-00522, September 1999, p. 34, at <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.537.7475&rep=rep1&type=pdf>.

39. *America's Munitions 1917-1918*, Report of Benedict Crowell, Assistant Secretary of War, Director of Munitions (Washington, GPO, 1919), p. 197, at <https://archive.org/details/americasmunition00unit/page/n279/mode/2up>.

40. Pleiss, p. 252.

41. See "Camp Operations" on the Camp John Wise Aerostation website, at <https://www.john-wise-aerostation.com/>.

42. Lebow, p. 20.

43. See "Twenty-sixth Balloon Company," on the Camp John Wise Aerostation website.

44. "History of the Fourteenth Balloon Company," in *TBSAEF*, p. 144.

45. In 1919, the editors of *The Balloon Section of the American Expeditionary Forces* compiled an in memoriam list of 4 officers and 22 enlisted soldiers, but a comparison with the detailed list in Appendix III of Robert Johnson's book shows that five soldiers in balloon units died before leaving the U.S., sixteen lost their lives in France before the Armistice, and twelve more died in France and Germany before returning to the U.S.: *TBSAEF*, p. 247; Johnson, pp. 476-477.

46. Moore, "When Sausages Blazed the Sky," p. 88. "History of the Eighth Balloon Company," in *TBSAEF*, p. 105.

47. For the Navy side of this effort, see *History of the Bureau of Engineering, Navy Department, During the World War* (Washing-

ton: Government Printing Office, 1922), pp. 145-150, at <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/h/history-bureau-engineering-during-wwi.html>.

48. Tegler, pp. 4-5. A recent article cites different figures but likewise testifies to the enormous reduction in cost: "[Clifford W.] Siebel was selling meager quantities of helium for \$2,500 per cubic foot. He quickly calculated that at that rate, the cost of filling a small blimp was more than \$100 million. Ten years later, after the U.S. government established plants at Fort Worth and Amarillo, Texas, the cost had dropped to three cents per cubic foot." See "Discovery of Helium in Natural Gas at the University of Kansas, National Historic Chemical Landmark, Commemorative Booklet," 2000, at <https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/heliumnaturalgas.html>. Seibel was known as "Mr. Helium"; see "Dr. Clifford W. Seibel," at <https://www.findagrave.com/memorial/20054509/clifford-winslow-seibel>. For the whole story of the expansion of helium production during the war, see Clifford W. Seibel, *Helium: Child of the Sun* (Lawrence: The University Press of Kansas, 1968), pp. 1, 23-58.

49. Pleiss, pp. 252-253.

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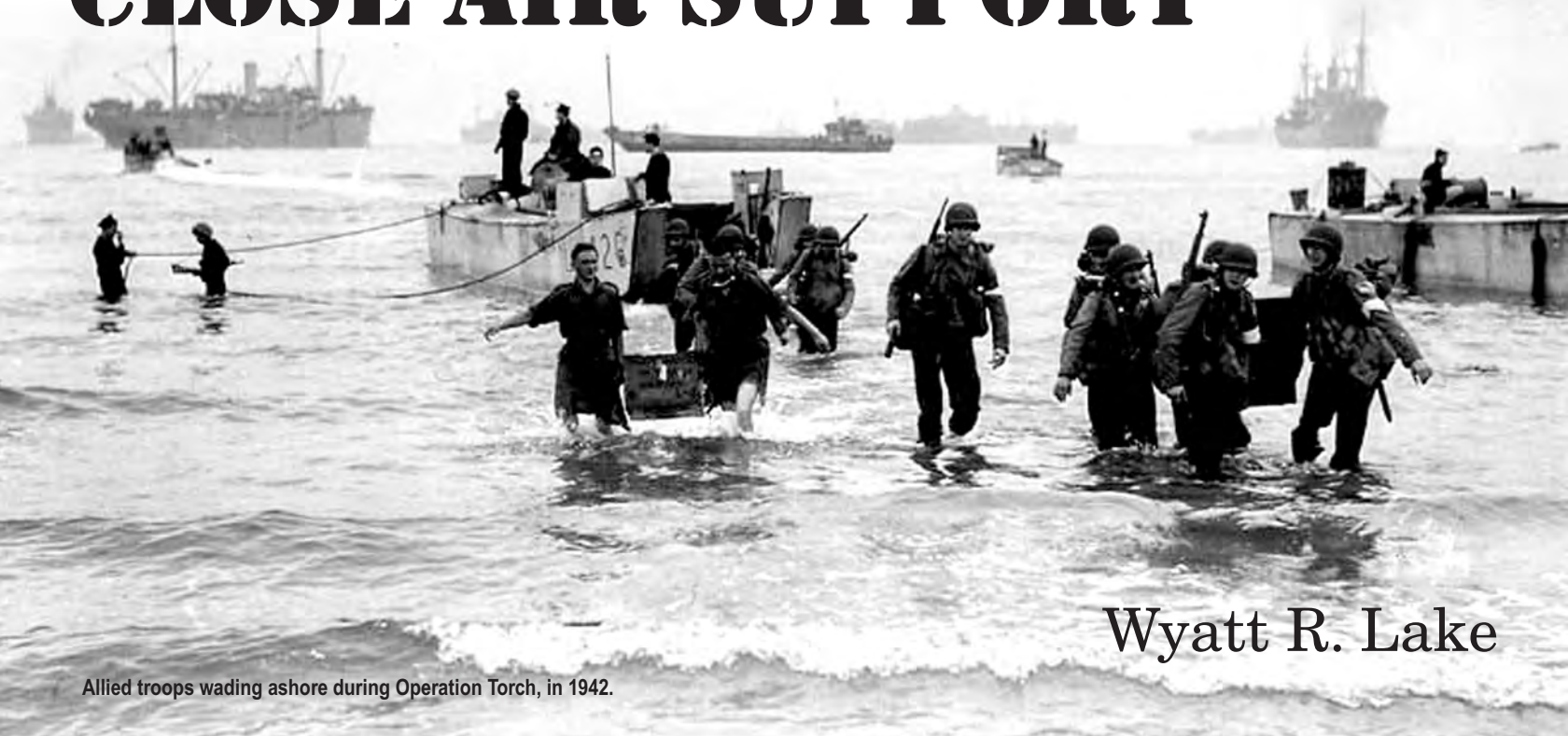
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ORIGINS OF AMERICAN CLOSE AIR SUPPORT



Wyatt R. Lake

Allied troops wading ashore during Operation Torch, in 1942.

It is generally taught that American airpower in World War II was only strategically focused. This belief is mostly true, but it is not the whole truth. Airpower advocates fought for an independent service during the interwar years and World War II, so naturally they had to provide justification. They would prove the need for an independent air force by showing that bombers could win the war. However, not all Army Air Corps/Force members were part of the Bomber Mafia. Important names that advocated for the auxiliary role of airpower were forgotten. Men such as Claire Chennault, Pete Quesada, and Otto P. “Opie” Weyland ensured that even in a bomber-focused air force, airpower would realize its role on the battlefield. Operation Torch soon popped the Bomber Mafia’s bubble when they realized that the Army needed support, but the doctrine was not sufficient. This is where and when American close air support was really born. Operation Torch and the subsequent North African Campaign provided the initial testbed for practicing realistic airpower doctrine, instead of regions like Italy and Northern France where the AAF only perfected the use of CAS.

Prior to the North African campaign, American development of CAS doctrine was lackluster. On April 9, 1942, the Army published the *Army Field Manual 31-35: Aviation in Support of Ground Forces* in order to outline how airpower supported troops on the battlefield.¹ However, due to the Army’s focus to make airpower subordinate rather than how to conduct joint operations and the AAF’s focus to become independent, the concepts presented in the manual are not well defined. For example, “aviation units may be specifically allocated to... subordinate ground units;” however, “support for a subordinate ground unit does not imply subordination of that aviation unit, nor does it remove the combat aviation unit from the control of the air support commander” but, “aviation units may be attached to subordinate ground units.”² The field manual fails to delineate who is exactly in charge of the units. On page six, the manual adds that the ground force commander, the furthest removed from the battlefield, has the ultimate authority. This led to a confusing mess, in which every party involved argued who knows best.

Operation Torch proved how unprepared the USAAF was for support of the Army ground forces. When Torch first began, there was complete decentralization of ground-to-air communication. Both British and American senior Army officers argued for their own personal airpower to provide immediate protection from local problems.³ They called these local groups of airpower, “umbrellas.” Airpower in this form was ineffective because it allowed the *Luftwaffe* to freely attack targets behind Allied lines. General Montgomery commented on the decentralization of airpower command and control in January 1943, where he argued that the “small packets” of airpower each working on their own plan goes directly against airpower’s number one asset, flexibility.⁴ Even more damaging was ordering air support. Requests had to come from the battlefield and make their way up the Army chain of command, and then sent to the “air support party” who advised the



Field Marshal Erwin Rommel, the “Desert Fox.”

ground commander. If the commander approved the request, it went to the “air support officer.” This officer evaluated the request considering seven factors. The air support commander then made the decision. If approved, the support party sent the request down through the chain and to the pilots.⁵ This process took too long to support ground forces in time. Multiple commanders complained about receiving little to no support.⁶

The air arm was unable either to protect Allied ground troops from dive bombing and strafing or to attack enemy ground troops holding up allied advances... The minute those Spitfires went away, the German planes came right out and were on us again. One of our battalions was dive-bombed as many as 22 times in one day.

2d Lt. Wyatt Lake grew up in Lake St. Louis. He graduated from the Air Force Academy with a history degree and is currently awaiting pilot training at Scott AFB, Ill. His paper (this article) won the Foundation's award for Best History Paper for 2021. He wrote on this topic because he believed that the United States gains its military strength through combined arms, and that each branch is equal and has a role to play to ensure victory. His paper was an attempt to explain the development and growth of inter-service cooperation in tactical matters.

The lack of centralized communication with aircraft directly related to the Army's degraded ability to perform its role. However, communication was just one of many problems tactical airpower had during Operation Torch.

Tactical air operations also faltered due to inexperience with airborne operations, poor weather, and misidentification of targets. One of the initial objectives for Operation Torch was to capture the airfields near the landing zones because aircraft had to make a one-way trip to reach North Africa. To solve this issue, C-47s were to drop paratroopers on top of the airfields of Tafaraoui and La Senia the night before Torch began. Instead, all Groups were ordered to go along with the “Peace” plan, which meant that the paratroops would land with the planes because the planes would be “unopposed.” Poor weather scattered a large portion of the force who then landed in Spanish Morocco, French Morocco, and Gibraltar.⁷ The remaining 28 C-47s encountered Vichy French aircraft and dropped their paratroopers who linked up with the invasion force to capture the airfields.⁸ The combination of ignorance towards conducting airborne operations and poor weather caused the force to fail its objectives, but this is not the only time the AAF failed during Torch. November 9, D-Day plus one, two groups of American Spitfires joined to take out French artillery, while the ground forces advanced. The pilots erroneously shot at Allied ground troops who shot down two of the Spitfires in return.⁹ Fratricide would become one of the main issues close air support pilots would have to fix. Tactical airpower during Operation Torch struggled to produce results because the pilots were inexperienced and the doctrine was undeveloped.

The final straw for the ineffectiveness of airpower came during the Battle of Kasserine Pass. Field Marshal Erwin Rommel wanted to stunt the rapid progression the Allies made across North Africa. Rommel managed to push the Allies back over 50 miles. During the attack, ground commanders believed airpower provided almost no support whatsoever. Major General John Lucas reported that he could not find a single case in which troops received close air support.¹⁰ Although this is inaccurate, it still goes to show how little airpower helped. Eventually the AAF took responsibility for “failing to detect the assault and their inability to halt it due to poor weather.”¹¹ The massive failure of the battle resulted in sweeping change. In regards to airpower alone, commands were both replaced and consolidated with Marshal Arthur Tedder in command of the Mediterranean Air Command, General Carl A. Spaatz for Northwest African Air Forces, and Marshal Arthur Coningham for Northwest African Tactical Air Force.¹² Coningham was an important addition because he could translate his success using tactical airpower from the Western Desert Air Force to the units supporting Torch. The RAF and the AAF expected these commanders to clean up the mistakes of Kasserine Pass.

By simply changing the command structure and adding these commanders, tactical airpower became significantly more effective. For example, Coningham directed his efforts towards destroying enemy aircraft for the rest of the campaign. By May, Allied airpower was triple what



General Carl A. Spaatz, then Major General, commanded the Allied Northwest African Air Forces in 1942, later becoming first USAF Chief of Staff.

the Axis possessed, and by mid-April, the “enemy air forces in the central Mediterranean were beaten.”¹³ With air supremacy in the region, Coningham continued to pound the Axis forces with his American and British units. During the final Allied offensive for Tunisia, aircraft flew more than 5,000 sorties. The Germans retreated the majority of their aircraft to Sicily and Italy before the ground offensive even began and left only approximately 100 aircraft to defend.¹⁴ Within days, Allied troops and aircraft pushed the Axis out of Tunisia becoming the first major victory in the European Theater. The Army, in response to the increase effectiveness of airpower, reluctantly conceded that during the last phase of the North African Campaign, Allied aviation attacked enemy troops “with much greater frequency than it had earlier.”¹⁵ The new commanders exhibited a greater ability to support the ground troops with aircraft than ever before.

In tandem with the change of commands, Dwight D. Eisenhower, the Supreme Commander of the Allied Expeditionary Force in North Africa, dumped FM 31-35. This created a vacuum without doctrine for tactical airpower, which he intended to fill. Eisenhower ordered a study to analyze the effectiveness of airpower in North Africa at the beginning of April 1943.¹⁶ Along with the study, the group found under what procedures airpower worked best as well as key control measures. They sent their findings to an air-ground coordination committee in Washington, D.C. On July 21, the committee sent the new doctrine to the Army Chief of Staff, George C. Marshall.¹⁷ The new field manual was FM 100-20, *Command and Employment of Air Power*. The very first sentence demonstrates the importance of the



Air Marshal Arthur Coningham, commanded Northwest African Tactical Air Forces during Operation Torch.

new doctrine. Section 1, Paragraph 1 stated that “LAND POWER AND AIR POWER ARE CO-EQUAL AND INTERDEPENDENT FORCES; NEITHER IS AN AUXILIARY OF THE OTHER.”¹⁸ Historians widely believe that this is the AAF’s declaration of independence from the Army. The statement was controversial within the army, but would prove to be effective nonetheless.

The new field manual defined the priorities of units supporting the battlefield. Field Manual 31-35 stated that the most important target for pilots is the one that poses the greatest threat to the ground troops.¹⁹ This form of target prioritization was too loose and it prevented pilots from providing CAS, which can only happen with air superiority. To fix this, FM 100-20 states that the first priority is gaining air superiority by destroying planes in the air and on the ground. The second priority is interdiction. Aircraft should prevent the movement of troop and supplies into the battle. Finally, pilots can fire upon ground forces to allow the Army to gain objectives.²⁰ Now pilots had a clear set of objectives they could actively pursue to provide support.

The final major changes that FM 100-20 made were the centralization of command and improvement of communication. The manual asserts that to exploit airpower’s flexibility, command and control will be centralized within the Air Force Commander.²¹ By doing so, aircraft can be

massed for decisive strikes against crucial targets. It also adds the distinction that the supreme commander will not attach air units to armies.²² With these changes, all air assets in the region are entrusted to a single person who can effectively deploy aircraft where they are needed rather than flying over unimportant ground units, as allowed by FM 31-35. The manual goes on to add that strike requests will be exchanged through liaison officers “who are well versed in air and ground tactics.”²³ The advent of air liaisons streamlined communication so they could quickly send strike requests to the ultimate authority. The previous doctrine created a complicated process to get requests approved because they had to go through the chain of command as well as the air support party and officer. Now, requests went straight to the liaisons who could discuss assets required and then send it to the Air Force Commander. The changes FM 100-20 made to command and communication drastically reduced the confusion created by FM 31-35.

It turns out that FM 100-20 guided tactical air commanders for the rest of the war. The doctrine initially “became the foundation by which the Allies attempted to successfully plan air-to-ground integration for the next campaigns in Sicily and Italy.”²⁴ Nevertheless, its success in Italy led it to its continued use by the likes of General Otto Weyland. He found that although the Army was reluctant to adopt it, the manual proved sound and most ground units embraced it anyway.²⁵ Weyland’s success and

relationship with General George Patton also encouraged Patton to adopt the manual’s principles. Concepts created by FM 100-20 even went on to influence future Air Force doctrine such as “air mission priorities and centralized air command, even after [FM 100-20] ceased to reflect official doctrine.”²⁶ The sheer importance of the lessons learned from the North African Campaign went on to guide air and ground commanders for the rest of the war as well as future Air Force doctrine.

Due to critical failures during Operation Torch, tactical airpower became an immediate concern for all military leaders. It was clear that appropriate doctrine did not exist because of the Bomber Mafia’s goal to create an independent air force. The Army FM 31-35 attempted to provide a doctrine for the USAAF, but it was too decentralized, unclear, and confusing for tactical airpower to be effective. Instant failures at Kasserine Pass prompted a change of command, which did improve airpower effectiveness on the battlefield; however, it was not enough to solve the issues created by FM 31-35. The study that Eisenhower’s staff conducted, laid out when and where tactical airpower was most effective. This study helped to create FM 100-20, which fixed the majority of the issues with FM 31-35. It was so influential that it saw continued use for the rest of the war and its concepts hold sway in Air Force doctrine today. Operation Torch was the proving ground in which leaders could both create and test tactical airpower doctrine. ■

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The Berlin Airlift: First Test of the U.S. Air Force



William P. Head

President Truman's official aircraft, the "Sacred Cow" on display.

After World War II, airmen worked to create an independent Air Force separate from the Army. In July 1947, President Harry Truman signed a bill on his Douglas VC-54C *Skymaster* presidential aircraft, known as the "Sacred Cow," to do just that, and on September 18, the Air Force opened for business. In less than a year it would face its first big test as an autonomous military branch in circumstances surrounding the Berlin Airlift.¹

The Post-War Events that led to a Separate Air Force and the Berlin Crisis

The rapid demobilization of forces immediately after World War II, although sharply reducing the size of the Army Air Forces, left the core of post-war U.S. airpower untouched. On March 21, 1946, War Department officials created two new commands and modified an existing one. Military leaders re-designated the Continental Air Forces as the Strategic Air Command, and divided the resources of the former organization among the Strategic Air Command and the newly formed Air Defense Command and Tactical Air Command. These three Major Commands and the older Air Transport Command fulfilled the basic strategic, tactical, defense, and airlift roles essential for building the postwar, independent Air Force. On July 26, 1947, when President Truman signed the National Security Act of 1947 into law it established the National Defense Establishment (later the Department of Defense) and a separate Department of the Air Force. This change became official on 18 September when W. Stuart Symington became the first Secretary of the Air Force (SECAF) and on September 26, when General Carl A. "Tooe" Spaatz became the last Chief of Staff of the Army Air Forces (AAF) and first Chief of Staff of the Air Force (CSAF).²

Less than a month later, on October 14, 1947, famed test pilot Chuck Yeager flew the Bell XS-1 faster than the speed of sound, launching the new Air Force into the age of supersonic aircraft. On January 13, 1948, Air Force officials formally discarded the suffixes "Field" and "Army Air Field" in favor of "Air Force Base" or AFB. In a very real sense this was the first major step toward making all installations Air Force facilities. Another major step in forming the modern U.S. Air Force took place on June 1, 1948, African-American service personnel began formal integration into the Air Force. President Truman's desegregation of the military directly impacted not only the makeup of the Air Force, but the personnel which comprised the Air Force and the communities that surrounded their installations.³



General Carl A. "Tooe" Spaatz, first USAF Chief of Staff.

Causes of the Blockade

During the Potsdam Conference, held near Berlin from July 17 to August 2, 1945, the U.S. represented by President Truman, Great Britain represented first by Winston Churchill and later Cement Atlee, and the Soviet Union, led by Joseph Stalin, re-affirmed principles established at the Yalta Conference in early 1945, formally divided Germany and Berlin into three zones of occupation. Britain as-

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Chuck Yeager preparing for his flight that broke the sound barrier.

sumed authority of the northwestern zone, the Americans the southwestern zone, and the USSR the east. As the occupation forces took over control of their zones, no one stopped to consider that Allied leaders had never officially agreed to guarantee rail or road access for the Western powers from their zones to Berlin. At first, the Soviets allowed the U.S. and Britain one road and one rail line to reach the capital city. While the western nations assumed they would later provide more access arteries, such a concession never took place. The Soviets did grant three air corridors from Hamburg, Frankfurt, and Buckeburg to Berlin. In the spring of 1946, the USSR stopped sending food stuffs from their zone to western Berlin. American commander General Lucius D. Clay countered by halting the dispatch of dismantled factories and industries from the west to the Soviet Union.⁴

The tensions in Germany quickly elevated during 1946. Then Soviet Foreign Minister Vyacheslav Molotov declared, "What happens to Berlin, happens to Germany; what happens to Germany, happens to Europe." As the political rivalry progressed toward the Blockade, the occupiers were also faced with rebuilding Germany, particularly Berlin and feeding its population of nearly three million souls. While those in the west labored to care for their zones, the Soviet's oppressive policies during the winter of 1945-1946, left the Germans angry and determined to resist. This was manifest during the local elections of 1946 when those in the eastern zone resolutely voted for anti-communist members of the city government.⁵

Economic and Currency issues

To support the economies of the British and American zones, officials joined them on January 1, 1947 into "Bi-zone". On June 1, 1948, the French zone, created out of the U.S. and British zones in 1947, was added to form "Tri-zone." As early as March 1946, the British created a zonal

advisory board to support German development. The Americans created the Office of Military Government, United States (OMGUS) for essentially the same purpose. All of this and efforts to underwrite the German currency were designed to eventually form a West German government by 1949. The new nation would be known as the German Federal Republic. All of this angered the Soviets who wanted to keep Germany divided for fear they might once again grow powerful and start a third world war. As a result, Russian authorities began to harass western movements wherever possible. They stopped British and American trains to systematically check the identities of passengers. They “buzzed” western aircraft and stopped water traffic often for no apparent reason.⁶

April and a Dress Rehearsal

On March 25, 1948, Soviet officials issued orders to restrict Western military and passenger traffic between “Tri-zone” and Berlin. The restrictions, in fact, began on 1 April. They also upped the ante by announcing that cargo traveling from Berlin by rail had to have permission from the Soviet commander in Berlin before it could depart. Each train or truck was searched first. This process infuriated Gen. Clay who, on April 2, ordered that ground operations be halted and only aircraft transport supplies. Known as the “Little Lift,” the stalemate lasted until April 10, when the Soviets pared back their limitations. Even so, for the next seventy-five days the Russians intermittently stopped ground vehicles. In turn, the U.S. supplied its occupation forces by dispatching twenty flights a day in order to build up an eighteen-day reserve of supplies in case the USSR decided to increase its provocation.⁷

On April 5, the Soviet “buzzing” of Western aircraft had a deadly result when a Russian Yakovlev (Yak)-9 fighter crashed into a British European Airways Vickers Viking 1B airliner near RAF Gatow airfield killing everyone on board both aircraft. This was bad enough but a leaked secret Russian report bragged that, “Our . . . measures have dealt a strong blow to the prestige of the Americans and British in Germany.” They also argued that the U.S. could never afford a sustained resupply airlift of Berlin.⁸

Only four days later, on April 9, the Soviets ordered all U.S. military members operating communications equipment in the Eastern Zone to leave immediately. This precluded the employment of navigation beacons for U.S. and British aircraft flying into Berlin. Finally, on April 20, the Communists demanded that all barges be cleared prior to entering the Eastern Zone. Even as authorities finished sifting through the airline wreckage, British, American, and West German leaders worked out a new more solid German currency. This incensed the Soviets who soon determined to push as hard as possible to force the West out of Berlin.⁹

The Blockade Begins

On June 18, 1948, only a day after the new Deutsche Mark became legal tender, Russian guards stopped civilian

trains all across the Russian Zone as well as truck and car traffic on the autobahn. Nothing moved without Soviet inspections and approval. On June 22, they issued their own new currency telling all the other powers that it would be the only money legal in Berlin. Since much of the West Berlin population’s food and supplies had to be purchased from the eastern sectors, the situation was at a breaking point.¹⁰

With tensions between the former World War II allies growing, on June 24, 1948, Soviet Red Army forces moved to block land and water routes connecting the non-Soviet zones of Germany to the city of Berlin, and halted rail and barge traffic in and out of the capital city. The following day, they interrupted the supply of food to the civilian population in the non-Soviet sectors of Berlin. While they initially allowed vehicles to travel from Berlin to the western zones, this trip was lengthened by nearly fifteen miles due to a phony set of “repairs” being done to a bridge on the regular highway. Eventually, the Soviets shut down this route as well. Equally severe was the cessation of electrical service provided to Berlin from the power plants in the Soviet zone of occupation. As a result, only the air corridors remained open.¹¹

When Allied officials objected to this overt act of aggression, their Soviet counterparts said the Allies had no official occupation rights in the non-Soviet sectors of Berlin. Western leaders responded that the use of the supply routes during the previous three years had given Britain, France and the United States a legal claim to use of the highways, tunnels, railroads, and canals. In fact, as noted, the Western nations had never negotiated or signed any actual agreement that guaranteed land-based access rights. Instead they had relied on post-war Soviet good will. This lack of a real policy now backfired.¹²

With June coming to an end and warm summer days becoming the norm, the situation was not so dire for West Berliners. As of June 25, West Berlin had slightly more than five week’s supply of food, and seven weeks of coal. Of greatest concern was that France, the U.S. and Great Britain were militarily outnumbered due to the post-war reduction of their armies. The United States, shortsightedly relying on its massive nuclear deterrent, had, by February 1948, reduced its troop strength to 552,000. All totaled Allied military forces in the western sectors of Berlin numbered only 8,973 Americans, 7,606 British, and 6,100 French. Soviet forces surrounding Berlin totaled 1.5 million. In reality, the Western armies were a token force designed to keep order and stood no chance against an actual Soviet attack. Nonetheless, General Lucius D. Clay, commander of the U.S. Occupation Zone in Germany, in his June 13, 1948 cable to Washington, D.C., argued vehemently against any pull-back or retreat. He declared, “There is no practicability in maintaining our position in Berlin and it must not be evaluated on that basis. We are convinced that our remaining in Berlin is essential to our prestige in Germany and in Europe. Whether for good or bad, it has become a symbol of the American intent.”¹³

Soviet strongman, Joseph Stalin, and other Russian Communist leaders, reasoned that their country’s rivals

would eventually abandon West Berlin. Stalin was relying on the West's unwillingness to provoke a third major war in thirty years. On the other side, Clay believed the Soviets were bluffing and would not start a conflict for the same reason. Moreover, he assumed Stalin could not afford another war and the blockade was intended to gain economic concessions from the West by exerting political pressure.

As alluded to, while the land routes had never been negotiated, on November 30, 1945, the Soviets and Western Allies had agreed, in writing, to establish three twenty-mile-wide air corridors providing free access to Berlin. In addition, Soviet leaders were hard pressed to claim cargo aircraft were a military threat. In this complex political game the only way to enforce an air blockade and turn back the Western Allies' aircraft would have been to shoot them down. Western leaders soon realized an airlift was the solution to the blockade since such an action would force the Soviet Union to either take military action, thus violating their own agreements in a morally reprehensible manner, or acquiesce.¹⁴

Planning the Airlift

Discussing an airlift was one thing; pulling it off was quite another. First of all, the Western Allies had to develop a feasible plan that could deliver essential supplies fast enough so the West would not have to request Soviet assistance to avert starvation in West Berlin. To this end, Washington directed Gen. Clay to contact Gen. Curtis LeMay the commander of United States Air Forces, Europe (USAFE) to determine if an airlift was even possible. Clay sent a message asking, "Can you haul coal?" Never one to ignore a challenge LeMay, fired back, "We can haul anything." In turn, the Americans consulted with the Royal Air Force (RAF) about a possible joint airlift. It turned out the RAF was already running an airlift in support of British troops in Berlin and General Clay's counterpart, General Sir Brian Robertson, was able to provide some concrete numbers.

During the "Little Lift," executed in early 1948, RAF Air Commodore Reginald Waite had calculated they would need to supply 1,700 calories per person per day. This meant they needed 646 tons of flour and wheat, 125 tons of cereal, 64 tons of fat, 109 tons of meat and fish, 180 tons of dehydrated potatoes, 180 tons of sugar, 11 tons of coffee, 19 tons of powdered milk, 5 tons of whole milk for children, 3 tons of fresh yeast for baking, 144 tons of dehydrated vegetables, 38 tons of salt, and 10 tons of cheese. Altogether, the Western Partners would require 1,534 tons of supplies every day to sustain nearly 3,000,000 people. They needed electrical power and with winter only a few months away, they also needed heating supplied by another 3,475 tons of coal and gasoline.¹⁵

This monumental undertaking would be the first great confrontation of the Cold War and the first big test for the new U.S. Air Force. When Air Force planners began to inventory their resources, they discovered that post-war demobilization left them only two squadrons of C-47 *Skytrain* aircraft (known as *Dakotas* to the British) in Europe. They were capable of carrying 3.5 tons of cargo each;



Allied aircraft unloading supplies at Tempelhof Airport during the Berlin Airlift.

all totaled 300 tons of supplies a day. The RAF proved to be better prepared, since they had already moved some aircraft back into the Germany and they anticipated moving about 400 tons a day. With the daily requirements near 5,000 tons, and without additional aircraft from America, Canada, and Great Britain this initial projection would not be enough. The RAF assured planners they could fly several additional aircraft in from Britain in a single hop. This eventually brought their fleet numbers to 150 *Dakotas* and 40 of their larger *Avro Yorks*, having a 10-ton capacity. With this new fleet the RAF planned to ferry 750 tons a day in the short term. In the longer-term, the U.S. Air Force would have to deploy dozens more, larger, aircraft as soon as possible. The larger aircraft faced the danger of having to land at the tightly packed Berlin airports. The only aircraft suitable proved to be the four-engine C-54 *Skymaster* and its U.S. Navy equivalent, the R5D. The Americans had 565 in service, with 268 in Military Air Transport Service (MATS).¹⁶

Considering Britain's feasibility study, an airlift appeared the best course of action. One remaining concern was the support of the people of Berlin. Clay called in Ernst Reuter, the Mayor-elect of Berlin, accompanied by his aide, Willy Brandt. The general explained, "Look, I am ready to try an airlift. I can't guarantee it will work. I am sure that even at its best, people are going to be cold and people are going to be hungry. And if the people of Berlin won't stand that, it will fail. And I don't want to go into this unless I have your assurance that the people will be heavily in approval." Reuter assured Clay Berliners were prepared to make all the necessary sacrifices and support his actions.¹⁷

Meantime, General Albert Wedemeyer, the U.S. Army Chief of Plans and Operations, was in Europe on an inspection tour when the crisis began. During World War II, from late 1944 until late 1945, he had commanded the U.S. facets of the China-Burma-India (CBI) Theater of operations. Keeping this area supplied by flying over the Himalayas or "Hump" was the largest airlift of the war. His detailed knowledge of this operation from India to China



Unloading supplies in West Berlin.

gave him particular insight into the feasibility of the new undertaking. After studying the plans, the General gave it his wholehearted endorsement.

Canadian, French, British, and American leaders agreed to start a joint operation without delay. The U.S. planners dubbed the venture *Operation Vittles*, while the British & Canadians called their part *Operation Plain fare*. Beginning in September 1948, the Australian contingent designated their part of the airlift *Operation Pelican*.¹⁸

The Berlin Airlift begins

Late in the afternoon on June 24, 1948, with the Soviet blockade underway, Gen. LeMay appointed Brigadier General Joseph Smith, headquarters commandant for USAFE at Camp Lindsey, as the Provisional Task Force Commander of the airlift. Smith had served as LeMay's chief of staff in the XX Air Force when his B-29s assaulted Japan late in World War II. On June 25, 1948, Clay issued the commencement order to launch *Operation Vittles*. Twenty-three hours later, 32 C-47s took off for Berlin carrying 80 tons of cargo, including milk, flour, and medicine. The first British aircraft departed on June 28. Planners expected the airlift to last three weeks.¹⁹

On June 27, Clay cabled Army Undersecretary William Draper recapping the situation:²⁰

I have already arranged for our maximum airlift to start on Monday [June 28]. For a sustained effort, we can use seventy Dakotas [C-47s]. The number which the British can make available is not yet known, although General Robertson is somewhat doubtful of their ability to make this number available. Our two Berlin airports can handle in the neighborhood of fifty additional airplanes per day. These would have to be C-47s, C-54s or planes with similar landing features, as our airports cannot take larger planes. LeMay is urging two C-54 groups. With this airlift, we should be able to bring in 600 or 700 tons a day. While 2,000 tons a day is required in normal foods, 600 tons a day (utilizing dried foods to the maximum extent) will substantially



Loading milk on a West Berlin-bound aircraft.

increase the morale of the German people and will unquestionably seriously disturb the Soviet blockade. To accomplish this, it is urgent that we be given approximately 50 additional transport planes to arrive in Germany at the earliest practicable date, and each day's delay will of course decrease our ability to sustain our position in Berlin. Crews would be needed to permit maximum operation of these planes.

Installations back home rushed to supply their Air Force comrades with whatever they needed. For example, at Robins AFB, in Middle Georgia, workers at the Warner Robins Air Materiel Area (WRAMA) quickly transitioned from their routine maintenance jobs to become important cogs in this vital undertaking. As the airlift commenced between June 25, and June 28, 1948, the WRAMA workforce focused on maintaining parachutes, repairing 50,000 spark plugs per month, and refurbishing propellers for all types of U.S. Air Force cargo/transport aircraft. During the next 15 months of the airlift, the personnel that had labored so successfully on aircraft like C-46s and C-47s in World War II, provided airlifters with the best and most reliable C-47s and C-54s possible. With these tools at their disposal, the crews in Europe ultimately made 277,264 flights and ferried 2,326,204 tons of supplies to West Berlin.²¹

By July 1, the sustainment and deployment system was settling into a routine as C-54s began to arrive in quantity. Rhein-Main Air Base became exclusively a C-54 hub while Wiesbaden retained a mix of C-54s and C-47s. Aircraft flew northeast through the American air corridor



Germans watching supply planes land at Tempelhof Airfield.

into Tempelhof Airdrome, then returned due west flying out through the British air corridor. After reaching the British Zone, they turned south to return to their own bases.

The RAF operated a similar procedure, flying southeast from several airports in the Hamburg area through their second corridor into RAF Gatow in their own sector. They then returned via the center corridor, turning for home or landing at Hanover. Unlike the Americans, the British also ran some round-trips, using their southeast corridor. On July 6, the *Yorks* and *Dakotas* were joined by *Short Sunderland* flying boats. They flew from Finkenwerder on the Elbe near Hamburg to the Havel River next to Gatow. Their corrosion-resistant hulls made them well suited for the job of delivering baking supplies and salt.²²

Managing the Airlift

Accommodating these large number of flights in and out of Berlin required maintenance schedules and fixed cargo loading times. Smith and his staff developed a multifaceted timetable for flights named the “block system.” It was comprised of three eight-hour shifts for the C-54 section followed by a similar C-47 pattern. Aircraft were scheduled to depart every four minutes, with each plane flying 1,000 feet higher than the previous aircraft flight. This pattern began at 5,000 feet and was repeated five times. This system of stacked inbound aircraft was later dubbed “the ladder.”

During the first week of the operation, Allied aircraft ferried an average of only 90 tons a day. During the second week this number reached 1,000 tons. Had this mission been short term, as initially expected, this rate of supply would probably have been sufficient. Soviet state media outlets derided the airlift, calling it “the futile attempt of the Americans to save face and to maintain their untenable position in Berlin.” In fact, while this defiant and heroic operation prompted exciting media reports hailing the work

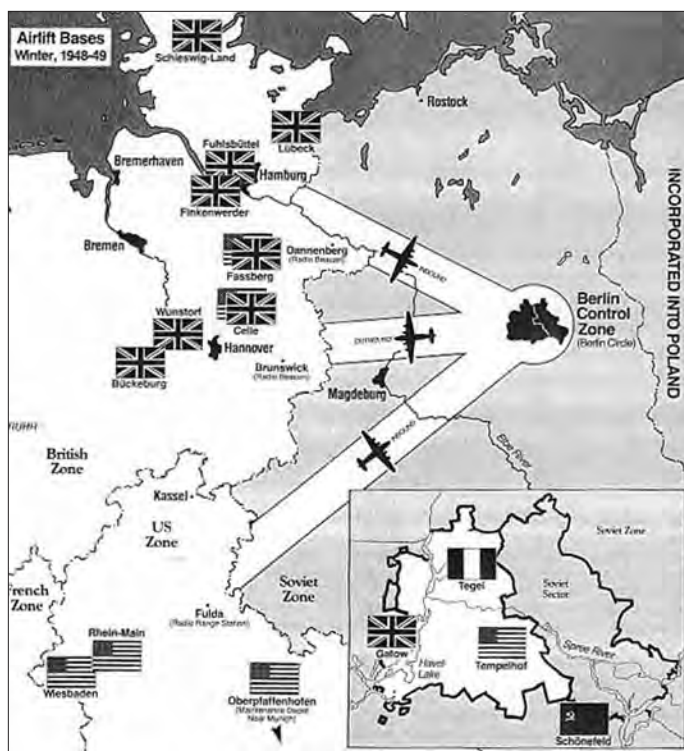
of the crews and the daily increase of tonnage levels, the airlift was not close to its maximum operational capability because USAFE was a tactical organization designed to repel a Soviet invasion, not ferry supplies. The officers and crews involved had a limited amount of airlift expertise. In short, aircraft sustainment was only just adequate, crews were not being used efficiently, transports stood idle too often and too long, necessary record-keeping was haphazard, and most crews were an ad hoc group of “desk personnel.” Indeed, it was hardly “a business-like atmosphere.”²³

Major General William H. Tunner turns the Airlift into a Dynamo

Fortunately, on July 22, 1948, members of the U.S. National Security Council met with Gen. Clay to address these problems, and the attendees agreed they needed to develop a long-term airlift strategy. Wedemeyer recommended the MATS deputy commander for operations, Maj. Gen. William H. “Tonnage” Tunner, formally assume command of the operation. During World War II, Tunner had successfully reorganized cargo/transport deliveries over the “Hump.” At the height of the project, Tunner doubled the tonnage flown into China. When news of this assignment was sent to Washington, Gen. Hoyt S. Vandenberg, Chief of Staff of the Air Force (CSAF) wrote a letter to Wedemeyer approving the appointment.²⁴

Tunner arrived in Weisbaden on July 28, to assume command of the operation, and soon employed his significant experience to adjust and upgrade the entire airlift process. On October 14-15, he completed an arrangement with Gen. LeMay in which he created the *Combined Air Lift Task Force* (CALTF) in order to supervise both the Air Force and RAF ferry campaign headquartered at a central location. As planning for the CALTF transpired, MATS planners deployed eight squadrons of C-54s, which totaled 72 aircraft, to Wiesbaden and Rein Main AB to reinforce the 54 already flying missions. The first arrived on July 30, with the others landing in mid-August. All totaled, two-thirds of all C-54 aircrews were flying missions out of Germany.²⁵

On August 13, only two weeks after his arrival, Tunner, in an effort to boost morale, flew to Berlin to pin a medal on Lt. Paul O. Lykins, the pilot with most airlift flights at the time. In the process he also urged his charges to redouble their efforts. He had anticipated what was about to come. Even before fall set in, cloud cover over Berlin dropped to just above roofs of the surrounding buildings, and heavy rain soon made radar visibility nearly zero. That same afternoon, a C-54 crashed at the end of a runway. Just a few minutes afterward, a second plane landing behind it had its tires explode while trying to avoid it. To make matters worse, yet a third aircraft “ground looped” on the auxiliary runway, closing the entire airport. While no one was killed, Tunner was embarrassed that the control tower at Tempelhof had lost control of the situation while the commander of the airlift was circling overhead, stacked with a dozen other transports. Fortunately, the general acted quickly, radioing all stacked aircraft to im-



Flight patterns used during airlift operations.

mediately return home, miraculously averting any further mishap. In spite of near disasters like the events of what came to be called “Black Friday,” Tunner avoided further problems by vowing to make changes necessary to safeguard against future complications. In his own notes of the affair, he believed this date initiated the future success of the airlift.²⁶

With this goal in mind, Tunner instituted a number of new rules. These guidelines, including instrumental flight rules (IFR), would be in effect at all times, regardless of actual visibility, and each sortie would have only one chance to land in Berlin, returning to its air base if it missed its slot. From the outset, accident rates and delays dropped dramatically. Another change involved unloading. By August, loading personnel realized it took just as long to unload a 3.5-ton C-47 as a 10-ton C-54. One of the reasons for this was the sloping cargo floor of the *taildragger* C-47s, which made truck loading difficult. Possessing tricycle landing gears, the C-54’s cargo deck was level, so a truck could back up to it, facilitating the offloading of cargo. Faced with this reality, Tunner replaced all the C-47s with C-54s and other larger aircraft.

Another procedural change occurred after Gen. Tunner’s first inspection trip to Berlin on July 31. He noticed they were experiencing long delays while the flight crews returned to their aircraft after getting refreshments from the terminal. Tunner ordered them not to leave their aircraft for any reason while in Berlin. Instead, he had jeeps reconfigured into mobile snack bars, distributing refreshments to the crews at their aircraft during unloading. Gail Halvorsen later noted, “He put some beautiful German Frauleins in that snack car. They knew we couldn’t date them, we had no time. So they were very friendly.” Opera-

tions officers handed pilots their clearance slips and pertinent information while they snacked. Unloading begun as soon as engines were shut down on the ramp, reducing turnaround before takeoff back to Rhein-Main or Wiesbaden to thirty minutes.²⁷

To make the most of the limited number of aircraft, Tunner rearranged the altitude “ladder” to three minutes with 500 feet of separation. The entire group was stacked from 4,000 to 6,000 feet. The primary focus became maintenance; particularly adherence to regulations requiring 25-hour, 200-hour, and 1000-hour inspections. The General also reduced block times to six hours to squeeze in another shift, making 1440 hour touchdowns in Berlin a daily goal. In short, Tunner wanted to create a virtual “conveyor belt” which sped up or slowed down as situations dictated. His most important policy was the creation of a single control point at CALTF. Even though it was the least popular rule of engagement, it proved to be the single most effective measure taken. It allowed for highly efficient control over all air movements into and out of Berlin, rather than each air force running their own flights.

One of the more remarkable aspects of the airlift was the role Berliners played. As the ferry process evolved, increasing numbers of Berliners took over the basic manpower roles originally held by GIs. They undertook the lion share of unloading, making airfield repairs at the Berlin airports, and driving the trucks from the airfield to the storage areas. By the end of the Berlin Airlift, almost all this kind of work was performed by Germans, who received additional rations for their labor. As these work crews improved their routine, they were eventually able to unload an entire 10-ton shipment of coal from a C-54 in under ten minutes. Later, crews were increased to 12 individuals and the unloading time dropped to five minutes and 45 seconds.

By the end of August, after only six weeks, the airlift was on course. Daily operations completed more than 1,500 flights a day and delivered more than 4,500 tons of cargo, enough to keep West Berlin supplied. Eventually, the amount of supplies grew to 5,000 tons a day. All of the C-47s had withdrawn by the end of September. Later in 1948, 225 Air Force and Navy C-54s were participating in the Berlin Airlift.²⁸

The Candy Bomber

One of the more unique aspects of Operation *Vittles* stemmed from the actions of Lieutenant (later Colonel) Gail Seymour “Hal” Halvorsen. In the beginning he was simply one of the many Airlift pilots. At one point, he decided to fly in during his off time to make movies of war-torn Berlin with his hand-held camera. During this trip into Tempelhof on July 17, he walked over to a gathering of children standing at the end of the runway to watch the aircraft land and introduced himself. They began questioning him about everything from his aircraft to life as a pilot. He was so taken with their sincere interest that he handed out his last two sticks of Wrigley’s Double Mint Gum, promising to return with more as long they would not fight over the gum. He told them to watch for his plane and he



Gail Halvorsen with his kids.

would drop off more chewing gum when he returned. As the youngsters divided the sticks of gum into small pieces, one child asked him how they would know which plane was his. He replied, "I'll wiggle my wings." The following day, as he made his final approach into Tempelhof, he shook his wings and dropped several packs of chewing gum and chocolate bars attached to handkerchief parachutes to the children waiting below. From then on the number of children grew as he made several more drops.²⁹

Soon letters from grateful Berliners began to pour into U.S. headquarters addressed to "Uncle Wiggly Wings," "The Chocolate Uncle," or "The Chocolate Flier." Initially, Halvorsen's commanding officer had reservations about the gesture and was particularly upset when the story appeared in the various Westerner newspapers. When Tunner became aware, he immediately approved of the deed. Moreover, he gave orders to expand it into Operation *Little Vittles*. Additional pilots participated, and when news reached America, children all over the country sent in their own candy or nickels and dimes to support the program. Hershey's and other candy companies as well as major cloth manufacturers began to send candy and parachutes with their logos prominently displayed. Kids throughout America participated in the campaign to reach across the distances to show their support to their "friends" struggling in Germany.

While actually sending candy was a bit messy, fund raising was very successful leaving everyone feeling they had been part of the larger effort to stand by their counterparts in Berlin. It proved to be publicity that made the Air Force and nation proud. More than 6,000 pounds of candy was dropped to the children of Berlin. The entire campaign could not have been more successful. The children on the ground christened the candy-dropping C-54s "raisin bombers."³⁰

Momentum Shifts toward the Allies

As Operation *Vittles* extended into the fall of 1948,



USAF pilot Gail Halvorsen, pioneered the idea of dropping candy bars and bubble gum with handmade miniature parachutes, known as "Operation Little Vittles".

events increasingly went against the Soviets. As the tempo of the airlift grew, it became apparent that the Western powers might be able to do what most world leaders and experts had believed impossible. They seemed determined to indefinitely supply the city by air alone if necessary. To counter this possibility, starting on August 1, the Soviets officials offered free food to anyone who crossed into East Berlin and registered their ration cards there. This proved to be a total failure as West Berliners almost universally rebuffed Soviet offers of food.

Even as this episode transpired, Soviet and German communists subjected the besieged West Berliners to a sustained campaign of psychological warfare. Communist radio broadcasts, often made over loud speakers, relentlessly proclaimed that all Berlin was legally supposed to come under Soviet authority. They also told the West Berliners that ultimately, the Western Allies had so many problems back home they would abandon the city. They also made it a practice to harass members of the democratically elected city-wide administration, who had to conduct their business in the city hall located in the Soviet sector. In addition, during the early days of the airlift, the Communists also badgered allied aircraft by having Soviet fighters buzz the Allied transports and, at night, shine bright searchlights at them to daze pilots. While USAFE officials reported 733 separate incidents of harassment, none were effective, mostly due to the dogged determination of the crews.³¹

Politics in Berlin

On October 20, 1946, Berliners, with the approval of the World War II allied powers, had drawn up a provisional constitution for all of Berlin. While the Western part of the



The children of Berlin waiting for Gail Halvorsen's candy drop.

city had the majority of representatives, the parliament building was located in the Soviet sector. By the autumn of 1948, members of the non-Communist majority found attending parliamentary assemblies nearly impossible due to Communist harassment. Even when they did make it to the provisional city hall, East Berlin policemen, sworn to protect the parliamentarians, refused to lift a finger when Communist-led crowds repeatedly entered the city hall to interrupt legislative gatherings. Often they physically threatened the non-Communist members. Leaders in Moscow even went so far as to try to seize control of the body on September 6, 1948.

On September 9, in response to this “putsch,” West Berlin Radio station RIAS urged the citizenry to take to the streets to protest Communist bullying. Soon, 500,000 people congregated at the Brandenburg Gate, next to the ruined Reichstag in the British sector. Many West Berlin leaders, in spite of the success of the Airlift, feared the West might abandon them to the Soviets. In an effort to elicit pledges of support from the West, city councilor Ernst Reuter spoke to the crowd and before international media outlets pleading, “You peoples of the world, you people of America, of England, of France, look on this city, and recognize that this city, this people, must not be abandoned — cannot be abandoned!” The inspired crowd pushed towards the eastern sector where several people tore down the Red Flag flying over the Brandenburg Gate. Soviet military police fired into the crowd, killing one demonstrator. The situation may well have turned into a blood bath, had not a British deputy provost intervened and physically pushed the Soviet police back with his swagger stick. News of this confrontation resounded across the world. Its greatest impact was in the U.S., where Americans expressed a strong sense of solidarity with Berliners. By the end of the month, the vast majority of U.S. citizens and leaders made it clear they were resolved not to abandon their “brothers” in Germany.³²

Soon after this clash the majority of Berlin's members of parliament opted to meet at the canteen at the Technical College of Berlin-Charlottenburg in the British sector. The Communist members, who comprised roughly 20 percent

of the parliament, boycotted the meeting. On November 30, 1948, they gathered in East Berlin at the Metropol Theater to declare themselves the legal city government under the leadership of Lord Mayor Friedrich Ebert, Jr. In fact, this action was illegal, and the non-Communist representatives initiated a re-election process on December 5, 1948. The Communists urged Berliners to boycott the election while the non-Communist parties ran for seats, but in the end, 86.3 percent of the western electorate voted. The Social Democratic Party (SPD) won 64.5 percent of the votes or 76 seats. In turn, the Christian Democrats (CDU) garnered 19.4 percent or 26 seats, and the Liberal Democrats received 16.1 percent or 17 seats.

Two days later, the freshly-elected West Berlin city parliament established a new municipal government in West Berlin led by Lord Mayor Ernst Reuter. He had been elected lord mayor in early 1946 but a Soviet veto had prevented him from taking office. By the end of 1948, Berlin hosted two separate city governments. The east parliament, operated under a communist system supervised by house, street, and block wardens. West Berlin's parliament accounted for the de facto political partition of Berlin and replaced the provisional constitution of Berlin with the democratic constitution of Berlin, a document intended for all the city's citizens.³³

The Airlift Expands

New issues confronted the Airlift as 1949 began. At the start of Operation *Vittles*, assessments projected West Berliners would require 4,000 to 5,000 tons supplies a day. However, experts produced this estimation during the summer, anticipating the airlift would last only a few weeks. With the onset of winter, the citizens of Berlin needed a lot more coal to keep warm. Updated forecasts mandated a new daily total of 6,000 tons of supplies for West Berlin, requiring the existing system to dramatically expand to continue the operation.

One rare upside to this situation was the availability of additional aircraft and personnel. In November 1948, the British added their larger Handley Page Hastings to the airlift, and General Tunner had hired numerous ex-Luftwaffe ground crews to remedy the shortage of skilled maintenance workers. Positive developments like these were exceptions, however.

One particularly concerning issue was the lack of runways in Berlin. There were two at Tempelhof and one at Gatow, and neither were designed to support the heavy C-54 loads. To address this problem, hundreds of workers scurried onto the flight lines between landings and spread sand across the pierced steel planking of each runway's Marsden Matting. This solution was only intended as a temporary measure because Allied leaders knew the runways could not endure the winter weather and had anticipated the need for a more permanent fix. In the fall of 1948, construction crews built a 6,000 ft.-long asphalt runway at Tempelhof. While certainly an upgrade, the new flight line required a tight descent directly over Berlin's apartment blocks, testing the skills of even veteran pilots.



C-54s in the snow at Wiesbaden AB during the Berlin Airlift in the winter of 1948-49.

Even so, the runway turned out to be a major upgrade to the airport's facilities. As this new flight line was opened for business, laborers upgraded the old runway from Marsden Matting to asphalt between September and October 1948. During the same timeframe, the British also upgraded the Gatow airport by constructing a new runway of reinforced concrete.

In the meantime, although now involved in the First Indochina War and able to provide only a few old aircraft, the French Air Force consented to build a new and larger airport in their country's sector on the shores of Lake Tegel. French military engineers, managing German construction crews, were able to complete the construction in less than 90 days. Remarkably, thousands of female workers, working day and night, assembled the airport building mostly by hand. To make the runway heavy equipment was required to level the ground, requiring them to repeat techniques used while flying "Over the Hump" in 1944-1945. Workers disassembled the equipment that was too large and heavy and re-assembled them upon arrival, employing five large American C-82 *Packet* transports to fly the machinery into West Berlin. This effort proved once and for all the blockade could not keep anything out of Berlin.³⁴

One potential obstacle for incoming flights approaching the Tegel airfield was a Soviet-controlled radio tower very close to the airfield, which the Soviets had refused to demolish. On November 20, 1948, French General Jean Ganeval decided it had to go, and on December 16, much to the delight of Berliners, French sappers blew it up. When an irate Soviet General Alexej Kotikow phoned to ask how Ganeval could do such a thing, the French commander reportedly replied, "With dynamite, my dear colleague." The airfield later became the Berlin-Tegel Airport.

Another area of improvement was air traffic control. The newly developed Ground Controlled Approach Radar system (GCA) arrived in Europe for use at Tempelhof, and experts installed a second set at Fassberg in the British Zone. With the installation of GCA, aircraft could execute all-weather airlift operations. This expanded capability guaranteed enough supplies could enter Berlin for the city to survive the winter season. Even so, November and December 1948 proved to be the worst months of the opera-

tion. One of the longest-lasting fogs ever recorded covered the entire European continent for weeks. Far too often, aircraft made the entire flight only to be unable to land in Berlin. On November 20, 42 aircraft departed for Berlin, but only one touched down. At one point, the city had only a week's supply of coal left. Then, as if by a miracle, the weather improved so drastically in early 1949 that the airlift delivered more than 171,000 tons of supplies in January, 152,000 tons in February, and 196,223 tons in March.³⁵

As things began to improve, at the end of 1948, President Truman sent Vice President Alben W. Barkley to Berlin to deliver a personnel message which read, "The Berlin Airlift, under the direction of our Air Force is an achievement of historic and far-reaching significance." This heartfelt encouragement as well as improvement in the weather turned everything around.³⁶

Meanwhile back home

In January, the Air Force not only found pride in its efforts in Berlin but also in the formal announcement that airmen would no longer be wearing khaki ("pinks") and brown Army uniforms but blue ones representative of the independent U.S. Air Force. Military airmen quickly ran to any store that might have light sky blue shirts or dark blue pants. Everyone wanted to demonstrate their fervor. However, they were also still deeply committed to Operation *Vittles*. For example, on January 28, the sustainment workforce at WRAMA completed a rush order for the modification of 1,000 fuel pump assemblies for shipment to Germany. In addition, they continued their work on parachutes, propeller assemblies, and especially aircraft spark plugs. As one person put it, "we became the spark plug capital of the Air Force." That April, supported by workers at places like Robins AFB, allied aircraft delivered 12,940 tons of cargo during 1,398 flights to Berlin. It was the largest 24-hour delivery period during the Berlin Airlift. Pilots nicknamed it the "Easter Parade." To honor the efforts of the employees at Robins AFB, on 16 April 1949, several top ranking USAF leaders and members of Congress visited RAFB, including: famed Congressman Carl Vinson, Air Force Secretary W. Stuart Symington, Air Force Chief of Staff Gen. Hoyt S. Vandenberg, and Texas Senator Lyndon B. Johnson.³⁷

Seeing the Airlift to its conclusion

As April 1949 unfolded airlift, operations ran so smoothly the impossible seemed be routine. To break up the monotony, Tunner picked Easter Sunday to eclipse every previous record, including tonnage ferried, aircraft flown, speed of delivery, and cargo delivered. To ensure success, the aircraft shipped only coal, establishing stockpiles of record proportions. Maintenance schedules were altered to maximize the number of aircraft available. From noon on April 15, to noon on April 16, 1949, crews worked around the clock. As previously noted they carried 12,941 tons of coal on 1,383 flights, without a single accident. One unintended, but welcome side effect was that operations in gen-



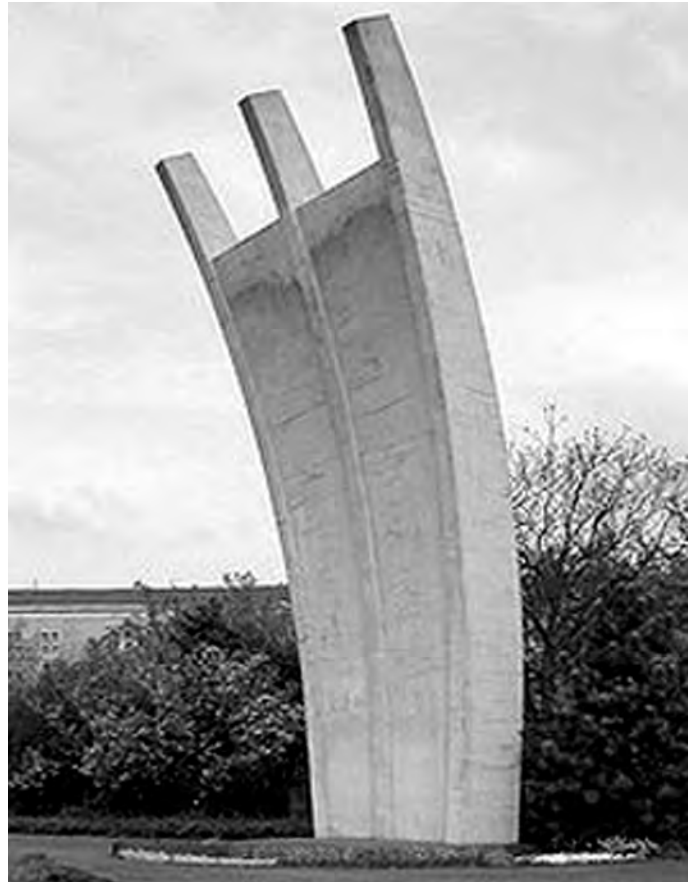
A Propeller Shop in late 1940s. Many were replacements for the Berlin Airlift.

eral expanded daily tonnage from 6,729 tons to 8,893 tons, allowing the Allies to deliver 234,476 tons of supplies in April alone. Indeed, by 21 April 21, the tonnage of supplies flown into the city exceeded the amount previously delivered by rail. The Berlin Airlift had been a total success, one that appeared capable of going on forever.

The “Easter Parade” was the last straw for Soviet leaders. That April, the Russian news agency TASS hinted at a willingness by the Kremlin to lift the blockade. The next day the U.S. State Department announced the “way appears clear” for an end to the blockade. These reduced tensions led to negotiations by the four powers. Soon a settlement was reached, on Western terms, and on May 4, 1949 leaders of the Western allies announced an agreement to end the blockade scheduled for May 12. At one minute after midnight on May 12, 1949, the Berlin blockade ended. Soon, a British convoy departed from West Germany arriving in West Berlin at 0532. Later that day, an enormous crowd celebrated the end of the blockade. General Clay was cheered by the gathering as he prepared to take his leave of Germany. President Truman had announced the General’s retirement on May 3. Back home Clay received a ticker-tape parade in New York City, addressed Congress, and received the Distinguished Service Medal (DSM) from the President.³⁸

A Summation

Even though the blockade had ended, cargo supply flights continued for almost five months to build up supplies to a comfortable surplus. Slowly, but surely, night and weekend flights were curtailed as the surplus reached acceptable levels. By July 24, 1949 three months of supplies had been amassed, ensuring ample time to re-start the air-



Berlin Airlift Monument in Berlin-Tempelhof, with the names of 39 British and 31 U.S. airmen who lost their lives during the operation.

lift if needed. Fifteen months after it began, on September 30, 1949, airlift operations came to a halt. In total the U.S. delivered 1,783,573 tons of cargo and the Royal Air Force 541,937 tons, with a combined total of 2,326,406 tons. Roughly two-thirds of these shipments were comprised of coal.

In addition, the Royal Australian Air Force (RAAF) delivered 7,968 tons of freight and 6,964 passengers during 2,062 sorties. The C-47s and C-54s together flew over 92 million miles. At its high point, the Airlift, saw one plane reach West Berlin every thirty seconds. However, this success came at a high price. The operation cost a total of 101 fatalities, including 40 British and 31 American service personnel.

The majority died in aircraft mishaps. All together 17 American and 8 British aircraft crashed during the operation. The price of the airlift came to approximately \$224 million or the equivalent of \$2.06 billion in the 21st Century.³⁹

In the end, not only had the members of the new U.S. Air Force proved their value as an independent service, but they had helped thwart Soviet expansionism in Europe. The first match of the Cold War had fallen to America, Britain, and France. Soon democracy would become part of the new German Federal Republic (GFR) and the rest of Western Europe. The West had halted the Russians and made it clear they would do whatever was necessary to preserve the hard-won victory of World War II. ■

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Col. Thomas L. Thurlow and the Development of the A-10 Sextant

Thomas Wildenberg

The crowd surrounds Howard Hughes' Lockheed Model 14-N2 Super Electra after its round-the-world flight in 1938.

The A-10 was one of the most commonly used sextants in the Army Air Forces during World War II. Tens of thousands of these compact, easy to use, reliable instruments helped guide American bombers and transports across the Atlantic and Pacific Oceans.

Until the introduction of Loran in 1943, U.S. Army airmen relied on three different techniques (more often than not in some combination) to guide them from place to place: dead reckoning, radio beacons, and celestial navigation. The latter was the only means of accurately providing the navigating data needed for long distance flights over large bodies of water. This required the use of a sextant to take sightings of celestial objects and a series of tables that could be used to convert the sightings data into a line (or lines) of position. Taking celestial readings with a sextant in an aircraft, as Lt. Thomas L. Thurlow noted in an article published in 1935, was “an infinitely more arduous and difficult task than that performed on surface craft.” Thurlow, who authored the first Air Corps text on celestial air navigation a year earlier, was both a pilot and the Air Corps’ leading expert on the celestial navigation.¹

When Thurlow’s article was published, the best device for taking celestial readings in an aircraft was the bubble sextant.* The accuracy of the measurements taken with this device depended on two things: averaging a large number of observations and a pilot who could hold a smooth course. To be of use, these observations had to quickly transformed into lines of position using various tabulated charts that had been specifically designed for this purpose. But, as Thurlow informed the reader, the experienced and the novice often stumbled into simple, exasperating mistakes during the rapid pace that was required to make the large number of calculations required. Errors that became more numerous as fatigue mounted. “It is largely for this reason,” he explained “that such a splendid aid as celestial air navigation is skeptically regarded and is less popular than its worth justly merits.”

Author’s Note: The A-10 and the other “sextants” used by the Air Force were technically “octants.” The former could measure angles up to 120 degrees while the later could only measure angles up to 90 degrees. The sextant, which was introduced in 1757, twenty-seven years after the first octants, enabled more precise observations to be taken in calm seas – a condition that did not occur in an airplane.

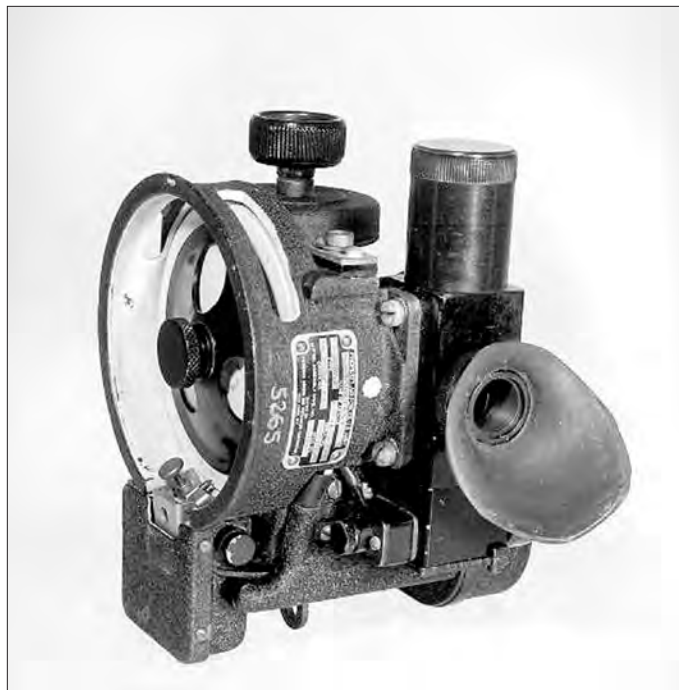
* A bubble sextant provides the aerial navigator with an artificial horizon so that it can be used above the clouds or at night. It contains an air bubble in a liquid-filled chamber that functions like a carpenter’s level, indicating when the sextant is aligned horizontally.



A young Thomas L. Thurlow.

Thomas L. Thurlow was born in Santa Ana, California on May 29, 1905. In 1925, he enrolled at Stanford University. In 1928, Thurlow chose to leave the university before receiving a degree in order to pursue a career in aviation. He may have been enticed by the Air Corps recruiting pamphlet published that year that promised “a fascinating career to the young man of good education, sound health, and keen spirits.” Appointed an Air Corps Flying Cadet, he was sent to the Primary Flying School, at March Field, California, where he attended the eight-month Primary Flying Course. After completing the course on February 27, 1929, Thurlow was sent to the Advanced Flying School at Kelly field Texas for training in Attack Aviation. On Saturday,

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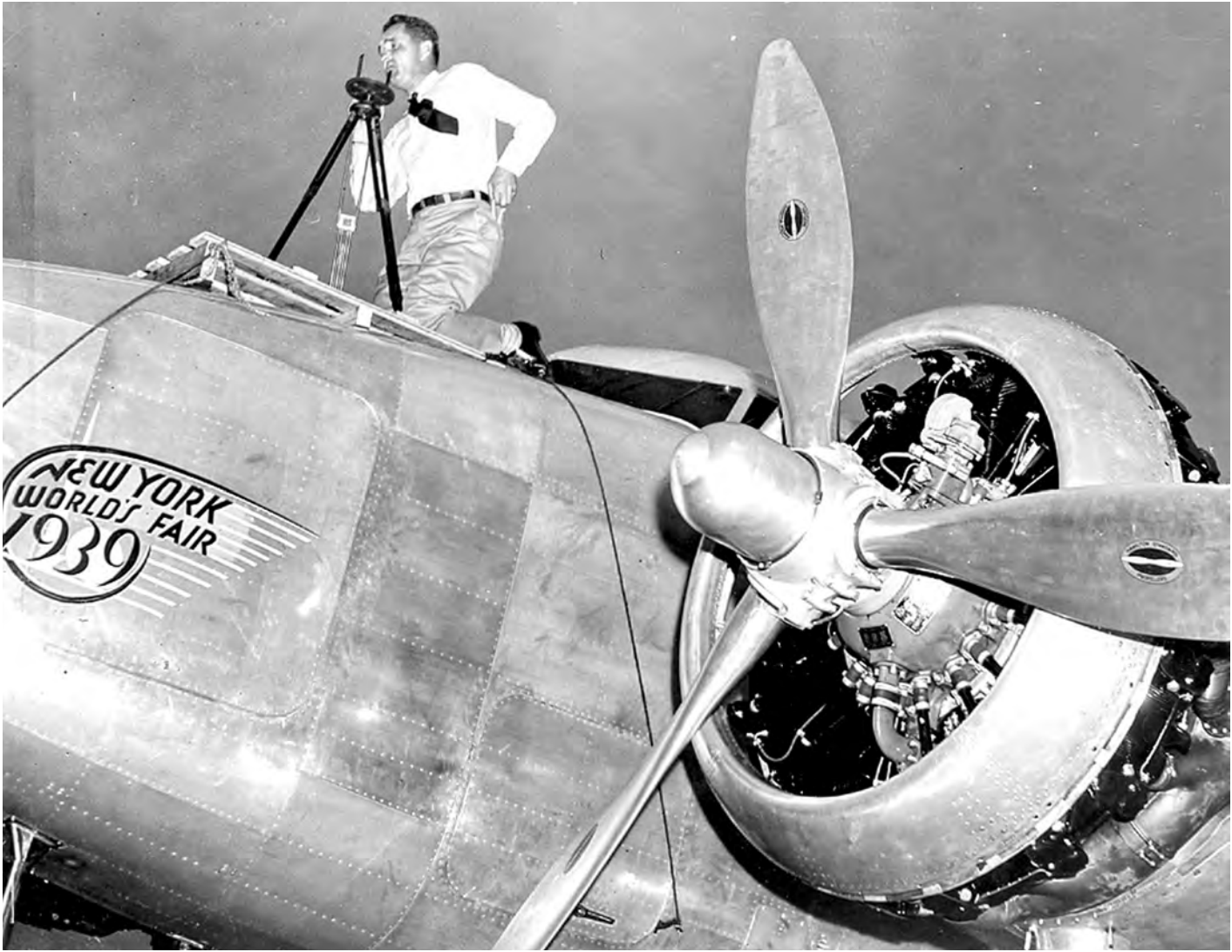


The A-10 sextant.

June 22, 1923, Thurlow was one of 1,010 student pilots who passed in an aerial review at Kelly field before high-ranking Air Corps officers as part of the graduation exercises that took place that day. At the ceremonies later that morning, he was handed a diploma, his commission as second lieutenant in the U.S. Army Air Corps Reserve, and the wings of a rated Airplane Pilot.²

After graduating from the advanced flying course, Thurlow was assigned to active duty with the 90th Attack Squadron at Fort Crockett, Galveston, Texas. He was appointed a second lieutenant in the Air Corps on October 4, 1929, after passing an examination for a commission in the Regular Army. Thurlow remained with the 90th until September 1930, when he was assigned to the Air Corps Technical School, Chanute Field, Rantoul, Illinois, for instruction in airplane maintenance. After completing the course that June, Lieutenant Thurlow was assigned to duty with the 60th Service Squadron as engineering officer.³

Sometime in the latter part of 1933, Thurlow was detailed to Rockwell Field to attend the first class in the newly established school for aerial navigation. All of the students were rated pilots. Each received fifty hours air work as a navigator that included training flights in dead reckoning and celestial navigation over the Pacific. Thurlow graduated on December 15, 1933 and was reassigned as an instructor until the school was discontinued when the Air Corps was directed to carry the air mail beginning in February 1934. At that point he was transferred to the 19th Bombardment Group, relocated to March Field, California, shortly thereafter. His text “Celestial Air Navigation” was issued at that location in March 1934. Although Thurlow was assigned to duty as the supply officer of the 30th bombardment Squadron, it appears likely, based on



This photograph by aviation photographer Rudy Arnold shows the “nose art” of the Lockheed Model 14-N2 Super Electra, “New York World’s Fair 1939.” Lieutenant Thomas Thurlow is “sighting in” the airplane’s navigation instruments prior to the around-the-world flight. (Rudy Arnold Collection, National Air and Space Museum)

his expertise, that he taught the frequently mentioned, but undocumented, advanced training course in navigation conducted within the 19th Bombardment Group. Evidence for this supposition is provided in the foreword of the 1937 text on celestial navigation written by Thurlow stating that it was “patterned after the course in this subject given by the 19th Bombardment Group.”⁴

On July 8, 1936, Thurlow was transferred to the Material Division, Wright Field, Dayton, Ohio. He was assigned to the Instrument and Navigation Laboratory where he conducted experiments in aids to navigation and navigation instruments. In February, 1937, he was given the task of writing a text on celestial navigation for use in the Air Corps, for which he subsequently received a letter of commendation. Thurlow’s transfer and his ensuing work on the *Celestial Air Navigation Text* may have been influenced by Brig. Gen. Frank M. Andrews. Andrews, having taken command of GHQ Air Force established on March 1, 1935, believed in strenuous crew training, including navigation work. Andrews emphasized the importance

of celestial navigation training missions for B-17 crews in a memo to the Adjutant General of the Army written in April 1936. Thurlow’s transfer took place a few months later.⁵

By the mid-1930s, as Deborah Warner explained in her seminal paper on aeronautical sextants in the United States, “aviators were routinely averaging several observations in quick succession.” To simplify this process, Thurlow was one of several individuals that simultaneously began to design aerial sextants with a mechanical average that promised to greatly simplify the air navigator’s job. Thurlow undoubtedly shared his idea with Philip Van Horn Weems, for Weems, one of the world’s leading authorities on navigation, subsequently mentioned it to Carl L. Bausch of the Bausch and Lomb Company in the early months of 1937. Weems deemed it a very important development that would be “the next big advance in celestial navigation.” Thurlow’s design, he said, “saves time, trouble, and possible errors in writing down each of the several observations and then taking the average.”⁶



The crowd surrounds Howard Hughes' Lockheed Super Electra after its flight in 1938.

Weems also mentioned Thurlow's concept to Arthur J. Hughes. Hughes was managing director of Henry Hughes and Sons, one of the leading instrument manufacturers in Great Britain. Hughes immediately put his staff to work on the idea. Philip P. Everitt quickly produced a working model of an averaging sextant and filed patent applications in both Great Britain and the United States titled "Calculating Mechanism for Measuring Instruments." To Thurlow's dismay, the U.S. application was filed on August 2, 1937, one day before Thurlow filed his own application for an "Averaging Device for Observation Instruments" was submitted. After Thurlow's attempt to litigate priority of invention failed, Hughes (feeling that war was on the horizon) agreed to give American manufacturers a free license to instruments made for government use. This opened the door for Fairchild and Bausch and Lomb, both of whom began to produce sextants with the Thurlow averager. The Army also provided funds so that Pioneer could equip their sextant with a Thurlow averager. Thurlow received the first two examples a few hours before he took off as co-navigator on Howard Hughes' recording breaking round-the-world flight.⁷

How and when Howard Hughes first became aware of Thurlow's experience is not known. But shortly after Thurlow reported to Wright Field in July, 1936, Albert Lodwick, Hughes' flight manager, telegraphed Chief of the Material Division Brig. Gen. Augustine W. Robins requesting the services of Thurlow to serve as the navigator on a flight that Hughes planned to make from Shanghai to New York. A month later, on August 10th, Howard Hughes landed his DC-1, dubbed the "flying laboratory" at Wright Field. On board was a five-man team he brought with him to discuss the equipment Hughes wanted to take along for the flight. The next day Hughes met with General Robins to discuss the use of the latest radio and navigation aids being developed by the Air Corps and requested that Thurlow be allowed to join the aircraft's crew. The flight from Shanghai never took place, but two years later Thurlow was given two months leave and allowed to participate in Howard

Hughes' attempt to circumnavigate the globe.⁸

Thurlow, secure in his position as the Material Division's expert on navigation, had nothing to gain from participating in the flight, except for "some rare navigation experience." But the chance to fly as navigator on a potentially record-breaking world flight was a chance of a lifetime for someone who had dreamed of flying the Atlantic since high school. Despite the advice of some who questioned Hughes' abilities, Thurlow decided to "take a crack at the flight," and headed to the Hughes Aircraft hangar at the United Airport in Burbank, California, to help prepare the Lockheed 14 aircraft that Hughes had purchased for the journey. In addition to supervising the installation of the navigator's station and equipment, Thurlow designed and a special periscopic drift meter that was built to his specifications by the Vard Mechanical Laboratory that supplied drafting machines to the aircraft industry in California.⁹

On July 9, 1938, Thurlow flew with Howard Hughes and the rest of his crew that included flight engineer Ed Lund, radio operator Dick Stoddard, and co-navigator Harry Conner, to Floyd Bennett Field on Long Island – the starting point for their round-the-world flight. They spent the rest of the day, most of the night, and the following day preparing the Lockheed 14, christened the "New York World's Fair 1939," for the first leg of their journey. They were not ready to take off for Paris until the early evening. By then, only an hour of day light remained.

Once on board, Thurlow moved the navigation station just aft of the 1200-gallon extra fuel tanks in the mid-section of the cabin. He sat at the navigators table and arranged the instruments and charts that he would use during the first four hours of flight. After a nerve-wracking takeoff, Thurlow set to work checking the accuracy of the compass, which he had arduously aligned during the preparations at Floyd Bennett Field. "As the coast faded away in the darkness and Novia Scotia and Newfoundland slipped to the rear," wrote Thurlow in his private record of the flight, "I paused for a moment to marshal my thoughts . . . Confidence would play an extremely important part of the trip. I had studied astronomy in college, had had more navigation experience than any other person in the Army, had run the Army's Advanced Navigation School during its first few years. If ever I felt confident, it was the moment we passed Newfoundland and headed out over the Atlantic in darkness. I resolved then and there to, above all things, [to] be deliberate, thorough, and cautious in every calculation . . ." At the end of his first 4-hour watch, Thurlow turned the navigating duties over to Harry Conner. For the rest of the flight the two co-navigators would change places every four hours.¹⁰

Twenty-thousand people were on hand to greet the returning airmen when the Lockheed 14 landed back at Floyd Bennett field at 2:30 in the afternoon on July 14, having set a new record for circling the globe. The crowd rushed towards the airplane as soon as Hughes taxied to a stop and shut down the engines. Thurlow was the first member of the crew to deplane. Waiting to greet them was Mayor Fiorello LaGuardia, the president of the World's



The flight crew of Howard Hughes' around-the-world flight, left to right: Edward Lund; Howard Robard Hughes, Jr., wearing a fedora and a white shirt; Grover Whalen, president of the New York World's Fair 1939 Committee, who christened the airplane; Harry P. Connor; Richard R. Stoddart; and 1st Lieutenant Thomas L. Thurlow, U.S. Army Air Corps. (Tamara Thurlow Field via Air & Space Smithsonian.)

Fair, dozens of reporters and hundreds of spectators. With the police half dragging them through the rambunctious throng, Hughes and his four-man crew were taken to a nearby press tent where a brief radio interview was conducted before they were whisked away to Manhattan. The next day Howard Hughes, riding in the lead car, was treated to the traditional hero's welcome of a ticker-tape parade down Broadway viewed by more than a million people. He was accompanied by Thurlow and the rest of the crew who followed in the next car. Behind them, also in an open car were three of the crewmen's wives along with Thurlow's 3-year-old son who was sitting on his mother's lap staring wide-eyed at the throngs of people lining the parade's route. His son, reported the *The New York Times*, "seemed to be having a grand time, for he was not only seeing a parade but riding in one."¹¹

The New York City parade was followed by another in Chicago down La Salle Street where they were again showered with paper. On the 30th, Hughes and his crew arrived in Houston (Hughes' birthplace) to another hero's welcome. "Houstonians lined the downtown streets and the route from the newly-named "Howard Hughes Field" to greet Hughes and his companions. That evening a gala dinner for 700 was hosted by the Houston Chamber of Commerce. Thurlow basked in his new found celebrity status until his leave ran out when he returned to Wright Field on July 13th to resume his duties in charge of navigation instrument.¹²

By the end of the year, Thurlow had begun work on the design of a device that would make it even easier to get good results from the sextant. "I have always regarded the averager a 'stop gap' [measure]," he wrote Weems. "I am now modifying an instrument with a simple attachment

which I have reason to believe will be superior to the averager . . ." The device that Thurlow came up with was a mechanism that determined the median rather than the average of several observations. The idea for this type of device appears to have been inspired by an account of the Favé Lepetit recording sextant manufactured by A. Lepetit of Paris published in the early spring of 1938. Thurlow was not the only one intrigued by such a device as others too were independently working on similar mechanisms. "In February 1939 Weems made some sketches of his ideas for such a device—it would be called a median recorder to differentiate it from the mechanical averager . . ." Weems urged Edwin A. Link (the inventor of the Link Trainer) to incorporate it into a sextant his company had under development. Bausch & Lomb also began working on a median sextant based on Weems design.¹³

In the meantime, the Fairchild Aerial Camera Corporation had begun to develop a new sextant based on a patent filed by Thurlow and Samuel M. Burka on August 3, 1937, for an improved optical system for a bubble sextant. Fairchild was unable to come up with a satisfactory product using this idea however, due to numerous unforeseen technical challenges. Thurlow believed that they had made "a perfectly atrocious mess of the sextant." Fairchild had to start all over again with a design that incorporated Thurlow's median device. He was sufficiently pleased with the new instrument to recommend it to the Army, which designated it the A-10 Sextant.¹⁴

The A-10 was quite easy to use. The navigator pushed a plunger whenever he made a series of sightings in quick succession, which left a series of marks on a white plastic disk recording the data taken during each sighting. When

he was finished taking the shots, he removed the disk and determined the median measurement by eye. Fairchild subsequently received a contract for 8,984 sextants and a number of adjustable bubble-chamber assemblies worth \$2,62,618 in March 1942. Because the Army needed more sextants than Fairchild could produce, additional contracts for A-10s were issued to the Agfa-Ansco Division of the General Aniline & Film Corporation and the Polarizing Instrument Company. In all, close to 30,000 A-10 sextants were produced for the Army Air Forces in World War II.¹⁵

Thurlow spent the rest of his career assigned to the material division where he continued to develop new instruments for navigation attaining the rank of colonel. In April, 1944, he filed his seventh patent for an improved sextant that incorporated a number of features that reduced the errors of due to Coriolis acceleration the provided an "expeditious means for obtaining an accurate reading." He died in a plane crash near Love Field, Texas, on June 19, 1944, while testing a new compass.¹⁶

Thurlow's contributions to the science of navigation have not gone unrecognized. A memorial in the form of the Colonel Thomas L. Thurlow award is given annually to an individual who had made a significant contribution relating to positioning, navigation, and/or timing. The award was founded by Sherman M. Fairchild and is sponsored by The Institute of Navigation.¹⁷ ■

U.S. Patents Issued in Thomas Thurlow's Name

Title	Filing Date
Averaging Device for Observation Instruments	August 1937
Optical System for Sextants	August 1937
Navigation Computer	July 1940
Panoramic Sextant	March 1941
Multiple Bubble Sextant	October 1941
Stabilized Horizon	June 1943
Observation Instrument (sextant)	April 1944

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10. Thurlow, typewritten manuscript, 18-22; "Hughes' Flight Navigations and Navigation Procedure," *Aero Digest*, 4; schematic diagram of internal arrangement of Hughes' plane, *Aero Digest*, 33, No. 2 (August 1938), 46.

11. Field, "About the Author," in Thomas L. Thurlow, *Flying with Howard Hughes*, p. 14; "Hughes Ends World Flight, Setting 3-Day, 19-Hour; 20,000 Cheer Arrival Here," *The New York Times*, July 15, 1938, p. 1; "Hughes Acclaimed Wildly by Crowds; Gets City Honors," *The New York Times*, July 16, 1938, p. 1.

12. "Chicago Hails Hughes," *The New York Times*, July 15, 1938, p. 3; Al Davis, "Hughes' Round-the-World flight Captured Attention of Houston," *The Houston Business Journal*, July 26, 1998, <https://www.bizjournals.com/houston/stories/1998/07/27/editorial4.html>.

13. Thurlow to Weems, December 6, 1938 as quoted by Wright, *Most Probable Position*, p. 151, note 41 page 236; Warner, "Celestial Navigation Aloft," 104; Wright, *Most Probable Position*, pp. 151-52.

14. Warner, "Celestial Navigation Aloft," p. 105.

15. *Ibid*.

16. Thomas L. Thurlow, "Observation Instrument," U.S. Patent No. 2,384,507 filed April 11, 1944; Wright, *Most Probable Position*, p. 153; Field, "About the Author," p. 8.

17. "Colonel Thomas L. Thurlow Award," Institute of Navigation, <https://www.ion.org/awards/thurlow-award.cfm>

"The effects of our Bombing Efforts": Allied Strategic Bombing of the Japanese Occupied Territories During World War II¹



Toh Boon Kwan

The oil tanks at Samboe Island (pictured in 1936) were one of the targets attacked on March 12, 1945. (*Tropenmuseum.nl*.)

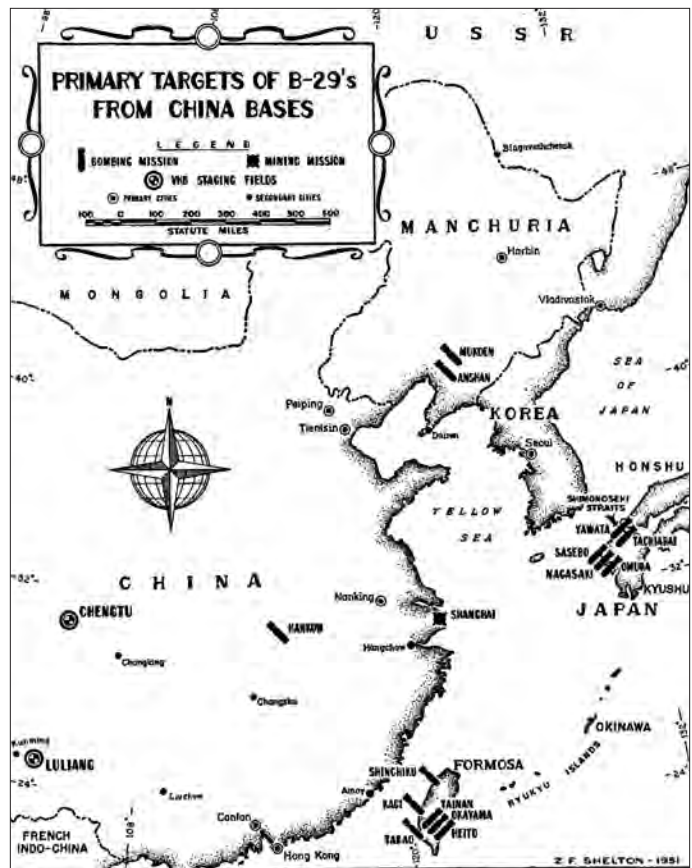
The Allied strategic bombing campaign against Germany and Japan during the Second World War remains a thriving research subject more than seven decades after the end of the Second World War. The subject has a large and extensive bibliography.² In the last two decades, scholars have added another layer of perspective onto this extensive bibliography, namely that of the peoples living under German occupation and suffering from the effects of Allied bombing.³ But the Allied strategic bombing campaign's impact on the peoples in the Japanese occupied territories in the Asia-Pacific region during the Second World War remains a lacuna in the scholarship. Part of the reason may be glimpsed through a comparative analysis of the challenges faced by scholars working on the Muslim world during the Second World War. David Motadel has written that "[t]he history of the 'Muslim world in the Second World War' does not yet form a coherent field of research. Scholars interested in the subject must consult studies on different parts of the Muslim world"⁴ This state of affairs arguably applies to the study of the Allied bombing of the Japanese occupied territories during the Second World War.

The Allied aerial assault on the Japanese occupied territories in the Asia-Pacific involved the United States Army Air Forces (USAAF), the British-led Commonwealth air forces, the Royal Netherlands East Indies Army Air Force (in Dutch, ML-KNIL), and Republican China's air force (ROCAF). Unlike the Combined Bomber Offensive in Europe where the strategic bombing mission was shared equally between the USAAF and the British Royal Air Force (RAF), the overwhelming majority of heavy and very heavy bombers in the Asia-Pacific bombing offensive was controlled by the USAAF. The RAF and Royal Australian Air Force (RAAF) held very modest numbers of heavy bombers (principally the B-24 Liberator) and did not have any very heavy bombers (i.e. the B-29 Superfortress). The scarce numbers of RAF B-24s in Southeast Asia were largely deployed on special duty missions, namely the airborne infiltration of special forces into the Japanese occupied territories and their resupply, and aerial mining of Japanese-held littoral waters. In the last month of the war, with regard to Malaya, special duty operations were prioritized over bombing.⁵ The RAF and RAAF's contribution to strategic bombing, therefore, was marginal relative to the USAAF effort. The Royal Indian Air Force, Royal New Zealand Air Force, ML-KNIL and ROCAF did not have the aircraft and capability to mount a strategic bombing offensive. Thus, the Allied strategic bombing campaign in the Asia-Pacific was largely an American-led effort.

The heterogenous nature of the occupation experience in the newly expanded Japanese empire defy simple generalization of the peoples' response to and perspective of the Allied bombing. The wide spectrum of attitudes and reactions may be illustrated by three survivors of aerial bombing in Singapore during the Second World War. Si-Hoe Sing Sow experienced both Japanese and American aerial bombing during 1941-45 as a child.⁶ When she was interviewed by the local

newspaper in 2017, she shared that she was haunted by her war memories. The longest bombing raid of the Second World War, an American incendiary air raid on Singapore conducted by the XX Bomber Command's B-29s on February 24, 1945, was vividly remembered as a traumatic experience.⁷ The fall of Singapore to the invading Imperial Japanese Army on February 15, 1942 is currently commemorated annually as Total Defense Day. The civil defense air raid warning siren will be tested and sounded to mark this day. But the blaring of the siren brought back bad memories. 'When I hear the siren on Total Defense Day, it brings the fear back. I don't go to war museums or watch war films – it's too much for me'.⁸ For Lee Kip Lee, however, he described in his memoirs the thrill of 'watching and enjoying the spectacle' of B-29s in action overhead on February 24, 1945. He was particularly fascinated by the 'trail of long white vapor' emanating from one of the bombers.⁹ Othman Wok, a future Singaporean politician, was an employee of the port's Water Department and was also doubling up as an Air Raid Precaution Warden when the B-29s struck on February 24. As the incendiaries fell from the sky, Othman jumped into the sea in desperation and hid under the thick concrete wharves together with British prisoners-of-war (POWs) stevedores similarly sheltering from the raid. All of them recited prayers as they waited out the bombing. At the raid's conclusion, Othman summed up his feelings: 'We were a little more cheerful, because finally the Japanese were getting a dose of their own medicine. The British prisoners of war were smiling – they knew the tide had turned'.¹⁰ Si-Hoe, Lee and Othman had experienced the same attack but their impressions of the raid spanned a range of perspectives. Not everyone, everywhere, in all circumstances, regarded being bombed from the air, even from the heaviest bomber aircraft used in the Second World War, as a horrifying tragedy that left them shaken for the rest of their lives, if they survived. What is significant of their personal accounts is their complete lack of integration into chronicles of the air war, which is only beginning to be addressed. The lack of en-

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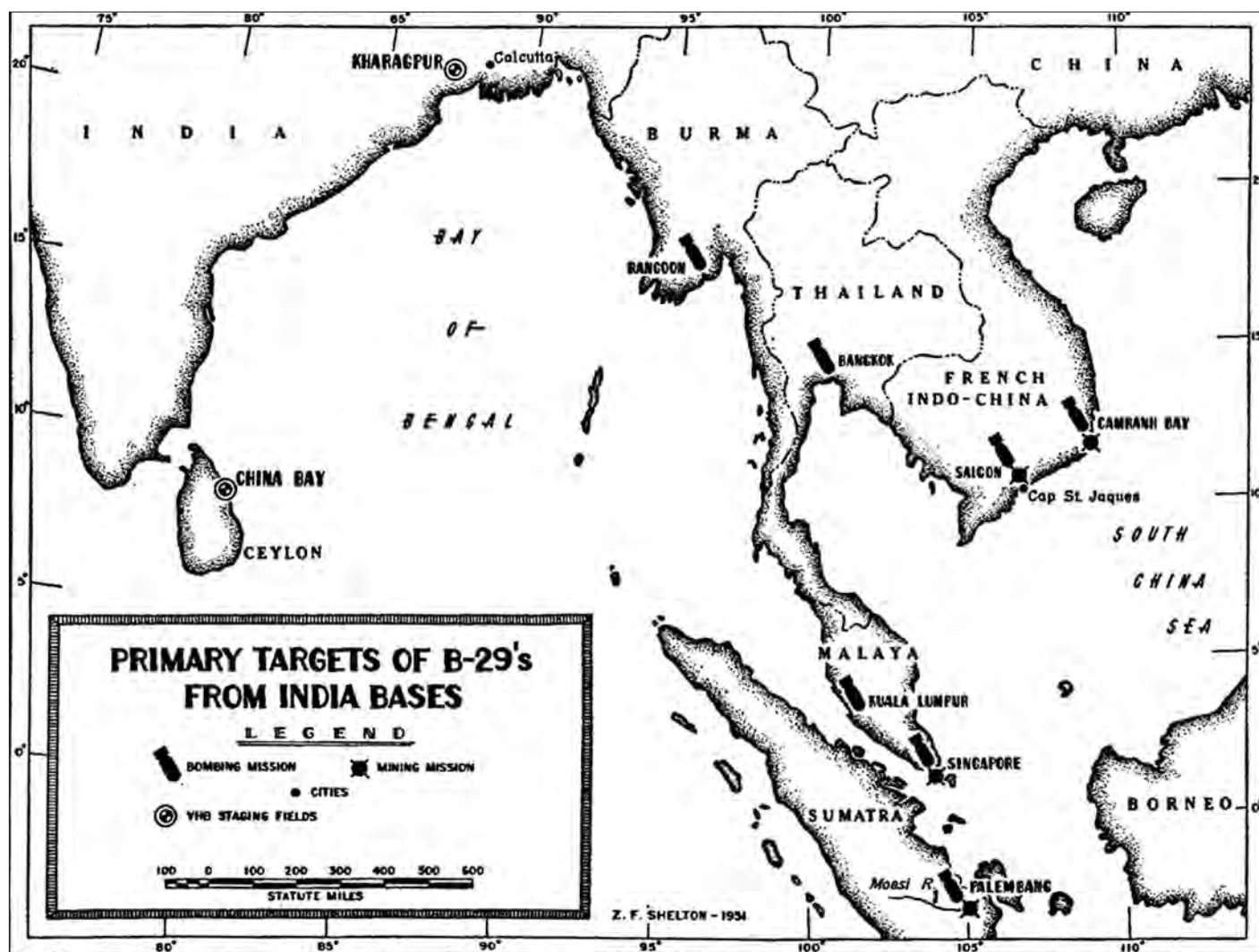
Map of B-29 operations in China. (Map taken from Craven & Cate (1953), *The Army Air Forces in World War II*, vol. 5, p. 134.)

agement between civilian testimonies and the chroniclers of aerial warfare over the Asia-Pacific may be attributed to some of the shortcomings of the official American history of the air war. Jeffrey Barlow had made the following observation:¹¹

The U.S. Army Air Forces's official history, The Army Air Forces in World War II, edited by Craven and Cate, was published in seven volumes from 1948 through 1958. It is, unfortunately, the most dated of the U.S. official histories, both because it was written too soon after the war to benefit from access to a number of important primary sources and because the space limitations imposed on the individual chapters of the volumes required their authors to leave out a great deal of substantive material. Accounts of tactical air (as opposed to strategic bombardment) operations seem to have been especially shortchanged in this series. Accordingly, the history of the Army Air Forces in World War II is a particularly fruitful area for new scholarship.

Finally, American veterans of the air war had also started reflecting 'about the effects of our bombing efforts' in the early 1980s.¹²

At the start of the second decade of the twenty-first century, there remains a dearth of research on the peoples living under Allied bombing of the Japanese occupied territories in the Second World War.¹³ This article, therefore, addresses the current scholarship gap by restoring the agency of these peoples, which is defined as Asian civilians,



Map of B-29 operations in South East Asia. (Map taken from Craven & Cate (1953), *The Army Air Forces in World War II*, vol. 5, p. 153.)

interned non-Asian civilians and POWs living under Allied bombing. Making use of primary sources, such as official records and the oral history interview archives of the Imperial War Museum (IWM), United Kingdom and National Archives of Singapore (NAS), reinforced by diaries, memoirs, newspaper accounts, and relevant secondary source studies, this article considers the memories and perspectives of peoples living in the Japanese occupied territories who experienced Allied bombing attacks during the Second World War. The perspectives of Japanese military personnel will also be included to create a more inclusive historical account, as well as the perspectives of the Allied airmen responsible for flying the combat missions. This article focuses on the XX Bomber Command's strategic bombing campaign conducted by its B-29s against China and Southeast Asia as the nature of the Command's combat equipment enabled it to conduct strategic bombing missions.

Allied Bombing Policy Towards the Japanese Occupied Territories

XX Bomber Command, based in eastern India and operating from forward airfields in unoccupied China, largely

practiced a discriminate bombing campaign over the Japanese occupied territories. Its B-29s targeted military objectives such as 'port facilities at Singapore, railway repair shops and marshalling yards at Kuala Lumpur, Rama VI Bridge Bangkok, Rangoon Dumps, various subsidiary targets, [...] oil installations at Singapore [and] mining of distant ports such as Singapore and Saigon' in Southeast Asia.¹⁴ Important targets in China included the Anshan steel works. Allied bombing policy for XX Bomber Command took into account the potential to cause collateral damage around strategic targets. In February 1945, Saigon's [now Ho Chi Minh City, Vietnam] naval arsenal and dock yard, and port facilities were taken off the target list due to the close proximity of a hospital to the former target, and a POW camp to the latter target.¹⁵ This belated action was taken in response to the February 7, 1945, B-29 mission which had targeted these facilities using radar bombing because of cloud cover over the target. An accidental early bomb release led to bombs falling on residential areas, killing thirty Europeans and around 150 Vietnamese, injuring hundreds but failing to kill a single Japanese.¹⁶ Strategic bombing policy would later evolve to allow attacks on strategic targets located near POW camps. But planners were advised to exercise 'maximum



Air Marshal Sir George Pirie. (© National Portrait Gallery, London)

practicable care' to minimize damage to the POW camps.¹⁷ In his post-war remarks about Allied air attacks on Singapore, Allied Air Commander-in-Chief, South East Asia Air Marshal Sir George Pirie stated 'that, when for military reasons, the city of Singapore had to be subjected to air attack, the Supreme Allied Commander gave specific instructions that the greatest care must be taken to avoid hitting anything but military targets'.¹⁸ In Penang, Malaya, the B-29s targeted military objectives like the harbor.¹⁹ B-29s also bombed military targets like the airfield outside Kuala Lumpur and the city's railroad infrastructure.²⁰ Thus, in Malaya and Singapore, Allied restraint resulted in towns and cities that emerged largely unscathed from the Allied counter-attack in the latter half of the Second World War.²¹

Unlike the Allied air forces, the Japanese military was not as scrupulous in following the rules of war. In Singapore, antiaircraft machine guns were placed on the flat roof of the Telok Ayer Church located in the heart of the city and fired on B-29s attacking military objectives in the city.²² In Penang, following B-29 attacks, Japanese military personnel shifted their offices to residential areas and the local hospital's nurses' quarters.²³ In Shanghai, to prepare for the impending Allied air raids, non-Asian civilian internees were relocated to Japanese military camps in the Yangzipu district while Japanese troops took over the vacated civilian camps.²⁴

The Allied air forces also routinely dropped leaflets over the Japanese occupied territories to warn the local inhabitants of impending air raids and to stay away from Japanese occupied installations. In Singapore, the locals had been forewarned by leaflets dropped prior to the February 24, 1945 air raid. Written in three languages – Jawi, English and Tamil – the leaflets warned: 'Don't co-operate with the Japanese. Stay away from them. Otherwise when we bomb them and you are caught in it, we will not be responsible'.

The Japanese called upon Othman Wok to translate the leaflets: 'They took out their swords and put them in front of me to make sure that I translated the leaflets correctly'.²⁵ Vietnamese language leaflets were dropped to warn the locals to avoid rail lines, bridges, boats and ferries, and refrain from helping the Japanese repair bomb damage. The leaflets warned: 'Our airplanes will come again, and if you are near the target you will probably be killed by association'.²⁶ Leaflets were also dropped over occupied China, for example, at railway hubs to warn railway workers to flee before aerial bombardments commenced.²⁷

The Peoples' Reactions to Allied Bombing

Across China and Southeast Asia, the re-appearance of Allied bombers generally buoyed local morale in the Japanese occupied territories.

The Bombing of Nanjing, Shanghai and Shenyang

When XX Bomber Command's B-29s raided Shanghai, China's most commercially important city, it elicited a range of responses from the city's civilians. During a botched attack against the aircraft factory in the Japanese city of Omura on November 11, 1944, the attacking B-29s were recalled from their mission and ordered to attack other targets in occupied China. Two planes from the 40th Bomb Group, XX Bomber Command bombed the secondary target at Shanghai. The Shanghai central power plant, which had earlier been identified as a possible target, was hit and the city plunged into darkness according to intelligence collected by the communist guerrillas of the New Fourth Army operating behind enemy lines.²⁸ The air strip located outside of the French Concession was also bombed.²⁹ Yan Bin, a clerk in a Shanghai hardware shop witnessed the air raid:³⁰

Around 9 a.m., as I was preparing to do some writing, the air raid alarm suddenly rang out, followed by the drone of aeroplanes and the loud banging of the antiaircraft guns. I put down my pen, walked to my door and peered out. High up in the skies were a formation of two to three aircraft and I could hear the sound of bombs going off. The people had a smile on their fearless faces and this lifted up my spirits. I finally witnessed the prowess of the big B-29 bomber free-wheeling in the skies, dismissing X's planes and antiaircraft guns as child's play. X had boasted of their air defense capability in the press. Based on what I had seen today, it was a laughing stock. Today's air raid ceased around 1 p.m. The raid was unprecedented in its broad coverage and the length of its duration. The people were elated. Although there were civilian casualties, it was even more infuriating that X's antiaircraft shells were deficient and exploded as it plunged earthwards, causing even more casualties, incurring our hatred. I tried writing again after the all clear sounded but I simply could not focus my mind and stopped...

For Yan Bin and his compatriots, seeing B-29s overhead in Shanghai was a big psychological boost and made

a laughing stock of Japanese propaganda. Ronald Charles Blyth was a British civilian internee and a schoolchild during the occupation. He was interned at Yangzipu camp and recalled that there were minimal collateral damage and casualties inflicted on the camp by Allied bombing of the camp's surrounding areas. The bombing raised his spirits as it signaled that the war is nearing its end.³¹

During the same mission, twenty-four B-29s visually bombed the target of last resort, Nanjing. The New Fourth Army gathered intelligence that the railroad ferry on the Yangzi River had capsized with around 3,000 people killed; the dock area was set on fire and cotton stocks awaiting shipment to Japan had been burnt; around 350 Japanese troops were killed when their barracks was bombed; the railroad terminal was heavily damaged and two enemy fighters had been downed.³² In the USAAF official history, the damage to Nanjing 'was noted but none of great military significance'.³³ For B-29 gunners Sergeants Frederick S. Carlton, Watson R. Lankford and Carl B. Reiger, their bomber was brought down over Nanjing that day when their mixed bomb load exploded below their plane. Lankford and Reiger were captured by Chinese puppet troops upon landing and handed over to the Japanese. Carlton also fell into Japanese hands. Another five survivors of the crew led by Major Francis Morgan were fortunate to land among communist guerrillas and safely evacuated back to the United States. The remaining four crew died. It remains disputed what brought the plane down. Major Morgan reported that a flak burst after bombs away brought down the plane. Lankford and Reiger were paraded through the streets of Nanking, with a derogatory placard around their necks, exhibited in a museum for public display and had to give interviews to the Nanjing puppet regime's press. While being paraded, Reiger recalled that 'a Chinese boy ran up and hit me a good blow on the head. The Jap in charge beat the hell out of the boy'. We do not know the motivation for the boy's attack but this contrasted with the good treatment that the communist guerrillas extended to the aircrew under their care. Staff Sergeant Dwight E. Collins, who was part of this fortuitous group of men, would sum up his positive experience thus, 'I've never known a Chinese I didn't like'. Lankford and Reiger eventually ended in a POW camp in Japan where they were liberated. They were lucky not to be executed after their public parade in Nanking, unlike the two captured airmen from Major Joseph Harvey Wilson's crew shot down over Malaya two months later chronicled below.³⁴

XX Bomber Command returned to bomb Omura on December 19, 1944. Thirty-six aircraft took off: Seventeen bombed Omura while thirteen B-29s struck the secondary target, Shanghai. Shanghai's docks, warehouses and shipping were hit.³⁵ Teenager Rena Krasno, born in Shanghai to stateless Russian Jews, was caught in the raid while attending medical school at the Jesuit Université de l'Aurore. As the air raid sirens rang,

[p]landemonium broke out. Students rushed to the windows staring at the sky and cheer-ing each loud boom, while



A Royal Air Force motor transport driver surveys damage caused by Allied bombing at Singapore docks, September 1945.

[their Jesuit lecturer] Père Hernault gazed around with benign bewilderment. He really is a kindly old man. Loud applause clearly indicated the students' hatred for the Japanese Occupation and hope for Allied victory.

The B-29s pierced the sky like silver darts way out of reach of Japanese anti-aircraft fire and fighter planes. [...] Previous air-raids had been depressing but this time, since rumors of Allied victories circulate ceaselessly, we are all optimistic and elated by the presence of U.S. boys somewhere miles above us!

The air raid led to cancellation of the class. As Krasno and a fellow Chinese student, Lee walked towards home through a park, they were caught in the open as Japanese antiaircraft shell bursts rained shrapnel on them. A teenaged Japanese soldier 'started waving and yelling incomprehensible commands' at them, crawled towards them, pushed Krasno to the ground, dragged her to cover and motioned to Lee to follow. As they lay flat on the ground seeking cover, Krasno reflected on this 'spontaneous friendship' of youth from three different backgrounds 'in a moment of danger'. After safely reaching home,³⁶

Papa brought the news that on this same day the Americans bombed the Nanking-Shanghai Railway. A number of passengers were killed, among them three Jews, one of whom was a young man due to be married the following week.

The onset of Allied bombing late in the war also led to conflicting feelings among the peoples living under the Japanese occupation. There was a large community of Jewish refugees who had fled Europe and were stranded in Shanghai during the war's duration. The young Ursula Bacon was one of these refugees and she faithfully recorded Jewish perspectives of American bombing in her memoirs. In her family friend, Paul Levysohn's opinion, 'It's the damndest feeling[...] Here our friends are bombing our enemy to bring about the end of the war, but they could kill us in the process. Life's little tricks!' For Ursula Bacon, 'I didn't know whether to cheer with joy or shake with fright.

So, I did a lot of both'.³⁷ Among the Chinese residents of Shanghai, the advent of American bombing induced panic-stricken fear in some segments of the population while in others, it signaled the imminence of victory and they quietly rejoiced at this thought.³⁸ In Shenyang, northeast China, the initial bombing raid by ninety-one B-29s on December 7, 1944 similarly caused public panic.³⁹ On November 21, 1944, 108 B-29 bombers headed towards Omura. Due to foul weather en route, thirteen bombers diverted to Shanghai and raided the city 'with fair success'.⁴⁰ Yan Bin wrote down his thoughts in his diary.⁴¹

At 7.50 a.m. the air raid sirens wailed. This was followed by the sounds of aeroplanes, bombing, and anti-aircraft fire. The city dwellers hung around in the streets looking on, displaying both caution and joy. Caution because bombs do not discriminate between friend and foe. Joy because the people witnessed the tremendous power of the irresistible B-29 against which the Japanese were helpless. The disparity between Allied and Japanese airpower showed up the latter as a paper tiger... In the afternoon, all the shops were shuttered and the sirens rang out again. Five silver aircraft soared high in the eastern sky, flying nonchalantly as Japanese anti-aircraft shells burst uselessly behind and below the planes. The all clear siren was only sounded around 4 p.m. The air raid had lasted an unprecedented eight hours. All electrical power was cut to the trams, lights and telephones. There were rumors that the power plant was hit and the city was plunged into darkness... Sitting in my room's stuffy darkness under a dim oil lamp, I felt moody. This was the painful darkness before the dawn. Let us grit our teeth and quietly await the forthcoming victory.

The consequences for the city were severe, according to Bernard Wasserstein as 'electricity could be provided only for a few hours in the evening. Much of what remained of Shanghai's industrial production was paralyzed'.⁴² Polish Jewish actress and novelist Shoshana Kahan recorded the day's events in her diary.⁴³

A terrible day and a terrible night. The air raid alarms and bombardments go on the whole night and the whole day. Bombs have fallen on the Japanese area of Yangzipu. Trucks and cars full of wounded people are going by. Hospitals are full with wounded Chinese....

The Bombing of Malaya and Singapore

When B-29 bombers flew over Singapore, Penang, Perak, Kuala Lumpur and Seremban in Malaya in 1944-45, they inspired awe, fascination, fear, quiet jubilation and raised morale.⁴⁴ This section discusses the responses of the rural and urban populations to the appearance of the American bombers.

In the jungles of southern Malaya, British and Commonwealth stay-behind parties, stragglers and special forces infiltrators had taken refuge with the communist guerrillas of the Malayan People's Anti-Japanese Army (MPAJA) since the fall of Malaya and Singapore in Febru-



On February 7, 1945, sixty-four B-29s were dispatched to hit the Rama VI bridge at Bangkok, fifty-eight dropped their bombs and effected the collapse of most of middle span of the bridge (in the third strike at this target) and destroyed the North East approach.

ary 1942. Sergeant John Cross led a British stay-behind party organized by the Inter-Services Liaison Department, the Far Eastern branch of the British Secret Intelligence Service of MI6 and spent the greatest length in-country. Another Anglo-Chinese party was led by Colonel John Davis and Major Richard Broome, members of the clandestine special forces unit, Force 136, the Far Eastern branch of the British special warfare organization, Special Operations Executive. Both Davis and Broome led a mission codenamed 'Gustavus' that successfully infiltrated Malaya by submarine in May 1943. 'Gustavus' was discovered and broken up by *Kempeitai* counter-espionage efforts with tragic consequences in March 1944. The 'Gustavus' survivors lived a fugitive existence with MPAJA guerrillas and lost all contact with their headquarters in India. The first B-29 bombing mission against Singapore on November 5, 1944, therefore, proved to be a fillip to their morale. The sight of B-29s on their homeward bound leg and receipt of an All India Radio broadcast of the successful air raid on Singapore marked their first contact with Allied forces for months. 'Gustavus' only managed to restore communications with headquarters, which had shifted to Ceylon, on February 1, 1945.⁴⁵

The appearance of B-29s overhead on a January 11, 1945 mission against Singapore also buoyed the morale of John Cross' long-suffering party.⁴⁶

[W]e heard the powerful and vibrant noise of an unusually large formation of aircraft flying down from the north. They came into sight high above our clearing, in compact formation, each plane glinting silvery in the sunlight, its wing-spread huge against the blue background. As they roared on towards Singapore we felt certain they must be American B.29s.

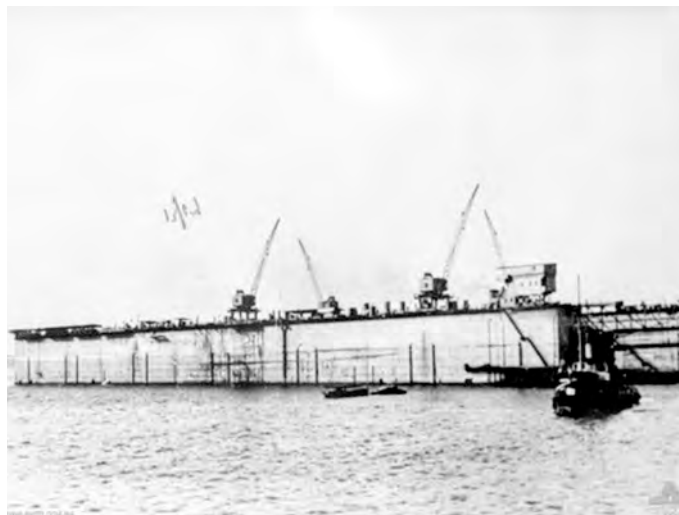
This was at least the second American raid on Singapore, but such was the shut-in nature of our previous camp that we had been denied even this tonic.

Now we determined to get every ounce of excitement out of it. As they passed overhead on their return from Singapore, we switched on our radio. Enemy fighters were after them like horseflies darting on stallions, with, it seemed, as little effect. The B.29s kept steadily on as we watched them, and at the same time we listened-in to the voices of their crews, reporting damage sustained, and warning each other of imminent attacks. The nasal voices were very level, but charged with tension.

Listening in to the American radio chatter and seeing the American bombers overhead, British army straggler, Private E. J. Wright, Norfolk Regiment, was overwhelmed with emotion and hope. Wright was one of two survivors (the other survivor was Private Smith, Loyal Regiment) out of a party of around twenty-five British and Australian soldiers who were living in the jungle in the wake of the Japanese invasion of Malaya. Wright's party eventually met up with John Cross and his men.⁴⁷

On October 5, 1944, 17 covert operatives of Force 136 were successfully infiltrated into southeastern Johore state bordering Singapore. This was the operation codenamed 'Carpenter' led by former Johore planter, Major Paddy Martin. This Anglo-Chinese band formed a new wave of infiltrators to collect intelligence on the Japanese. The 'Carpenter' operation promptly established wireless communications with their base in Ceylon, providing useful intelligence on Japanese naval movements.⁴⁸ Whilst under cover in the Malayan jungle, the Chinese operatives of 'Carpenter' were eager spectators of the dogfights between Japanese fighters and the American bombers as the latter attempted to knock out targets in Singapore. Huang Renda (or Wong Yen Dat)⁴⁹ recalled that he climbed up a tree to get a better view with his binoculars of the aerial battle taking place overhead. When a B-29 was shot down, his guerrilla party rescued a downed American aircrew.⁵⁰

The observers on the ground were not merely passive observers of the Allied warplanes flying overhead. In January 1945, Malaysians helped to rescue two downed B-29 crews who suddenly landed amongst them literally out of the sky. Japanese fighters had shot down both B-29s, one by a ramming attack during the January 11, 1945 raid on the Singapore naval base and commercial port.⁵¹ Local witness Ronendra Karmakar saw a B-29 falling like a burning 'match stick', corroborated by another eyewitness, the young interned Anglican priest John Hayter.⁵² One bomber crashed in Johore state bordering Singapore, and the other bomber came down further north in Negri Sembilan state.⁵³ The trials and tribulations of the two downed bomber crews intersected with the lives of the civilians whom they landed upon suddenly from out of the blue. Major Joseph Harvey Wilson and Sergeant Jerry D. Roberts landed near a village in southern Johore after their bomber was rammed by a Japanese fighter. A Chinese villager Chong Tin Pol watched their parachute descent, met them when they reached the ground and hid the



The British Admiralty No. IX floating dry dock at the Singapore Naval Base, seen here in 1941. A January 11, 1945, raid by American B-29s did little damage, but a following B-29 raid on February 1, 1945, sank the dry dock.

Americans in the jungle. Chong also contacted a dresser P. E. Fernandez to tend to the men's injuries. Together with another two Chinese, Chia Peng Chue and H. S. Ang, the four local men succored the two Americans, hid them from the searching Japanese troops and eventually delivered Wilson and Roberts safely to the communist guerrillas operating in the region, the MPAJA's 4th Regiment. Cross was operating with the MPAJA and later learnt that Wilson was one of five survivors from his plane crash. Wilson and two of his crewmates were rescued by local Chinese. At this juncture, luck and contingency intervened. The party was discovered by the Japanese as they tried to make their way to safety. The injured Wilson escaped unscathed but his two companions were captured, stripped naked and paraded around town in a lorry and publicly beheaded. Wilson was eventually reunited with Roberts, his radio operator, and his co-pilot, Lieutenant Russell Fitzgerald. The three airmen finally joined up with Cross' party and they were all evacuated by the British submarine, HMS Thule on May 31, 1945 and arrived in Fremantle, Australia on June 14, 1945. Wilson had led a charmed existence thus far with some close shaves with death. Bad luck finally caught up with him as his injured leg had to be amputated during his hospitalization.⁵⁴

Major Donald J. Humphrey's B-29 crashed in Negri Sembilan and there were eight survivors. Four of them were rescued by local villagers and spent the rest of the war with the MPAJA, although one airman – Captain Carl A. Hansman – died while living in the jungle just over a month after his rescue. First Lieutenants William F. Duffy and Ernest C. Saltzman, as well as Humphrey lived to return to the United States. Their local rescuers were not as fortunate as these Americans. Fate had two of the airmen fall near P. Sukumaran's garden. Sukumaran successfully got them away to the MPAJA with the aid of a Chinese villager, Hai Hing. But Hai Hing was arrested by the *Kempeitai* a week later and never seen again. Four days thereafter, Japanese troops raided Sukumaran's house, and tortured him for information on the airmen's where-



The house that Mr Si-Hoe built in Silat Road. A young Madam Si-Hoe is looking out from the balcony. (Photo courtesy of Si-Hoe Sing Sow.)

abouts. The *Kempeitai* hung around for twelve days before leaving his house. Dauji bin Sidek and his son were arrested by the Japanese in early February 1945 for aiding the escape of Humphrey's party and their guerrilla companions. Dauji was locked up for two weeks, while his son Ujang endured two months and two weeks of incarceration and regular beatings. The Japanese also burnt down their house as a punitive measure. M. K. S. Panicker s/o Kelu Panicker was arrested in June 1945 for aiding the escape of the American aircrew. He was detained, beaten and later released after he agreed to become an informant. But Panicker took to the jungle instead and waited out the Japanese until their surrender. The other four – First Lieutenant Martin J. Govednik and three gunners – were captured by the Japanese and imprisoned at Outram Prison. Govednik had initially been rescued by Osman bin Hassan, the first villager from Kampong Istana Raja to reach the crash scene. While Osman was trying to contact the MPAJA guerrillas, Govednik was placed with Osman's brother, Ahmad. But Japanese search patrols drove Ahmad and Govednik deeper into the jungle and they lost touch with each other. Govednik subsequently linked up with one of his gunners but both were betrayed to the Japanese by a Malay policeman. Two aircrew were killed in the plane crash while one aircrew died within a day from severe burns suffered escaping the aircraft.⁵⁵

The Eurasian civilians living in Bahau, Malaya were former residents of Singapore. The Japanese cast a suspicious gaze on the Eurasians as they were perceived to be half-blooded Europeans with doubtful loyalties to the new Japanese order. The Eurasians had chosen self-exile to Bahau for the relative freedom it granted from close Japanese scrutiny on Singapore. When B-29s were sighted flying south towards Singapore, the Eurasians were jubilant. As the bombers made the way back to their Indian bases after

dropping their bombs, the sight of Humphrey's bomber going down in flames demoralized the Eurasians.⁵⁶

The appearance of American bombers overhead proved more inspirational for Malayan war heroine, Sybil Kathigasu who was languishing in Batu Gajah gaol in Malaya for aiding the MPAJA. In her jail cell, she heard the deep rumble of aircraft engines.⁵⁷

Gazing eagerly at the corner of sky which was visible through the bars of my cell, I was able to see an unfamiliar streamlined shape sailing majestically, high above the Perak hills. It was not difficult, in spite of the height at which it was flying, to see that it was very much larger than any of the Japanese bombers. It did not need the excited shouts of the other prisoners, and of the warders, to tell me that this was a B29, the herald of our freedom.

Among the civilian internees of Sime Road Internment Camp in Singapore, the November 5, 1944 air raid created 'much excitement' according to British civil servant Frank H. Geake.⁵⁸ Geake had performed military service during the First World War and was an astute analyst of military affairs. Based on the information he had collected on the frequency of air raids, the type of aircraft flying overhead, and the number of aircraft involved in the mission, he was able to predict with reasonable accuracy when the war might end. But the rapid advances in aircraft technology during the war was simply beyond his grasp as the following passage from his diary indicated:⁵⁹

The extreme range for bombers at the beginning of the war was 600 mls. [i.e. miles] and personally I discarded any rumors of bombing supposed to have taken place at more than 600 mls. from any possible base, and, of course, any other 'news' that went with such stories. I had, of course, to bear



Retired teacher Si-Hoe Sing Sow survived World War II and went on to earn a master's degree in chemistry. (Photo courtesy of *The Straits Times*.)

in mind that bombing ranges would very likely be extended as the war progressed. It was extraordinary how people were mesmerized by the term 'flying fortress' for certain American heavy bombers. Many a time when I pointed out about rumors that bombing targets were well outside the range that could be reached, I was told 'Ah, but they might have used Flying Fortresses', as if such machines could perform miracles. In actual fact, I believe their range was slightly less than that of our own heavy bombers.

The B-29 was a game changer in aerial warfare and its abilities perplexed some informed wartime observers who did not have access to the latest military developments.

The 'excitement' of the November 5 air raid proved memorable for the wrong reasons for British merchant seaman and POW Harry Arnold Hesp. He ran afoul of the notorious Japanese camp guard, Kawazue Hatsuchi, nicknamed 'Puss in Boots' by the POWs. Kawazue gained notoriety for sodomizing young POWs and general ill-treatment of the POWs. On that day, Kawazue judged the POW work party he was guarding to be of a low threat, left his rifle and bayonet under Hesp's care and jaunted off to a nearby kampong. While he was away, the air raid sirens blared. Shrapnel started falling from the skies around Hesp as the Japanese anti-aircraft guns opened fire. Hesp took off to a nearby woods with the rifle and bayonet to seek shelter from the air raid. Kawazue saw this, gave a bellow and came over to punch Hesp in the Adam's apple, flooring Hesp for the rest of the day.⁶⁰ Military doctor and POW Thomas Wilson had a contrary experience to Hesp. November 5 was his birthday and the sight of B-29s overhead were a lovely present:

This morning, about 10.30 we heard Ack Ack, followed almost immediately by the siren, & dashing to the door saw four large bombers very high up coming from the west. They were followed by more in threes & fours, & altogether we saw 37, two of which broke off & came directly over us turning south. The first planes we have seen for nearly 3 years!

His joy was further enhanced that afternoon when he received a year old letter from his family bearing birthday greetings. That night, the final instalment of his trilogy of joy took the form of a new pipe gifted by his fellow POW. Wilson ended his diary entry on a high note: 'Altogether my best day for a long time'.⁶¹

The Bombing of Bangkok and Rangoon

Bangkok, Siam (now Thailand) and Rangoon (now Yangon), Burma (now Myanmar) were well within the range of RAF and USAAF light, medium and heavy bombers but the longer legged B-29s were assigned to bomb both cities to blood their crews, hone their skills and simply keep them busy.⁶² The first XX Bomber Command mission was directed at Bangkok on June 5, 1944. Colonel Richard Henry Carmichael led the 462nd Bomb Group on this maiden mission. The B-29 crews were very green as Colonel Carmichael attested in his recollection:⁶³

The way I remember it is that I was scared as hell. What I was scared of was a B-29 running into me because we got down there, and there were planes all over the target. We were in and out. We had no good plan of separation. Everybody was given the same altitude to bomb from. Some people would keep in formation through the clouds. Some of them couldn't. I remember seeing the river in Bangkok, but my attention mostly was looking out to see who we were going to run into. Every time we would come out of a cloud, there would be a B-29 over here and one over there.

Multiple training missions were mounted against Bangkok to prep the B-29 crews.⁶⁴ These training missions were not milk runs by any measure. On December 14, 1944, a mission against the Rama VI bridge in Bangkok led to disaster. Due to heavy cloud cover over the bridge, one formation from the 40th Bomb Group diverted to the secondary target, rail yards in Rangoon. Similar to the calamity that befell Major Francis Morgan's B-29 over Nanjing on November 11, 1944, surviving aircrews were convinced that a collision of bombs below the eleven plane formation had ignited a massive mid-air explosion. Four B-29s were lost and seven damaged. Seventeen aircrew were killed and twenty-nine men became POWs.⁶⁵ But the origins of the mid-air explosion is in dispute if we take into account Japanese perspectives of the incident which were not known to the American aircrews. Rather than the bombs colliding, there's a possibility that a Japanese 8 cm anti-aircraft gun, which the ground eye-witness Sub-Lieutenant Yoshida Hiroshi of the Imperial Japanese Navy heard firing and occurring simultaneously with his sight of a bright flash near the B-29s, had fired its shell into the cluster of falling bombs, igniting the latter. Yoshida had described the B-29s as 'A formation of big, shining, silver wings...' In his opinion, the downing of the B-29s was a 'spectacular show. It was the first time I saw a big bomber crash'.⁶⁶

Rangoon had been heavily bombed by the Japanese and later, the Allied air forces.⁶⁷ As the majority Burman (now Bamar) population, in their quest to break free of



Madam Si-Hoe (third from left) with her siblings and parents, Mr Si-Hoe Tuck and Madam Chung Chuck Soon, in a family photo taken at the roof garden of their Silat Road house after World War II. (Photo courtesy of Si-Hoe Sing Sow.)

British imperialism, had initially sided with the invading Japanese against their British colonial masters before switching sides as the tide of war turned against the Japanese, no love was lost between the British and the Burmans. By war's end, the city had 'been badly knocked about – many gaps amongst the buildings – and many buildings are just shells' according to a newly released British civilian internee transiting through the city.⁶⁸ Another eye-witness, British POW Private Cecil John Samuel Norris was repatriated home via Rangoon at the end of the war. In his diary, he observed that '[t]he water mains and sewers badly damaged and most of the town flooded by the broken mains. It was laughable to see the Burmese washing themselves and clothes in the streets'.⁶⁹

The Unintended Effects of Allied Bombing

Allied bombs did not merely pose a danger to the civilians trying to survive the aerial attacks. Rising prices of commodities and daily necessities were another unintended consequence of Allied bombing raids. Across the Japanese occupied territories in Shanghai and Singapore, prices would rise following each air raid. This phenomenon was due to demand spikes and stockpiling. Rising prices impoverished the civilian population, making life harder for them.⁷⁰

Valuable cultural artefacts were also unintentionally destroyed by Allied bombing. During the March 10, 1945 low level air raid on the Central Railroad Repair Shops in Kuala Lumpur, Malaya mounted by twenty-six B-29s of the 468th Bomb Group, the Federated Malay States Museum located one block away from the Repair Shops received two direct hits. Most of the Museum was destroyed together with 'three-fourths of the exhibits in cases, about

one-fourth of the study specimens; and, possibly, a fourth of the library'. Although no one was killed at the Museum, the Malay clerk cum caretaker, Bachik bin Mohammed Tahir's daughter was killed in a nearby house.⁷¹ An earlier low level attack on the same target on February 19 by 49 B-29s of the 444th and 468th Bomb Groups had damaged sixty-seven per cent of the buildings. Abdul Majid bin Ismail, the son of a machinist with the Central Railway Repair Shops, wrote in his memoirs that the railway quarters that his family lived were badly damaged by the bombing and they 'lost almost all our possessions'.⁷²

Conclusion

Allied bombing, to borrow a phrase from Margherita Zanasi, 'generated a wide spectrum of responses among the inhabitants of the occupied territories'. These varying responses also illustrated 'the complexity of war experiences'.⁷³ This article have shown the morale boosting effects of Allied bombing for one segment of the occupied peoples who were also demoralized by Allied air forces' setbacks, a second segment was fraught with both hope and anxiety, and a third segment was stricken with fear and panic. This wide spectrum of experiences accords with earlier research on local reactions to Allied bombing. The peoples of Singapore largely welcomed American bombing of their island with few dissenting voices. The vast majority of residents in Nijmegen in The Netherlands did not accord blame to the USAAF for bombing their city by mistake in the course of liberating occupied Europe.⁷⁴ The collateral damage caused by American bombing of Amsterdam meant that 'the morale among the people was very bad'.⁷⁵ This poor morale was similar to the bout of demoralization experienced by the Eurasians of Bahau, Malaya mentioned



Mr Othman Wok, a founding father of Singapore and a member of independent Singapore's first Cabinet, who passed away in 2017. (Photo courtesy of *The Straits Times*.)

earlier. Finally, the sullen experiences of French civilians being bombed by Allied planes but with little hatred for the Allied cause was echoed in the Asia-Pacific. This spectrum of experiences and reactions among the occupied peoples of Europe and the Asia-Pacific generally laid in the positive realm, contrasting unsurprisingly with the Japanese negative perception of American bombing of their Home Islands. This divide existed during the Second World War and persists till this day.⁷⁶

This article began with American aircrew veterans, in the last stage of their lives, pondering the effects of their bombing efforts during the Second World War. It is fitting, perhaps, to end this article with the perspective of an Aus-



Baba Lee Kip Lee, who described the fascination of the spectacle of B-29s bombing Singapore, passed away in late 2018. (Photo courtesy of *The Peranakan Association Singapore*.)

trian survivor of wartime Shanghai, currently in her twilight years living in Australia, who shared her perspective of surviving American bombing after reading the author's research.⁷⁷

Yes, it was a bit like this in Shanghai during the last year of the war. We too thought the American planes were just beautiful but listening to bombs fall even though only in the distance was just a wee bit scary. Nor was it a good idea to rush outside to admire them after the first few air raids as one of my Dad's friends got hit by a piece of shrapnel and died. War is no fun. ■

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Book Reviews

The Nuremberg Raid, 30-31 March 1944. By Martin Middlebrook. Barnsley UK: Pen and Sword, (reprint of 1973) 2020. Photographs. Drawings. Maps. Pp. 366. \$29.95 softcover. ISBN: 978-152677490-3

I first read this in the mid-1970s. I read it a second time a decade later while on the faculty of the RAF College Cranwell. Several colleagues suggested it would help me understand why Bomber Command's strategic approach was superior to that of the U.S. Eighth Air Force. Most memorable of both readings was the sense that the book was extremely critical of Air Marshall "Bomber" Harris and Bomber Command's ability to execute his strategy. Middlebrook's story obviously found an audience, because this is its seventh reprint.

At the beginning of World War II, Bomber Command was an ineffective offensive force. In 1941, fewer than 1 in 3 attacking aircraft dropped bombs within eight kilometers of the target. Air Marshall Harris—unapologetically and rabidly anti-German—took over and immediately began to work tirelessly to build Bomber Command into an offensive strike force that would end the war by destroying Germany and as many German people as possible. His strategic approach was euphemistically referred to as "city busting." Later apologists would attempt to defend the strategy by explaining that destruction of urban centers would disrupt war production and impact civilian morale.

"Butcher" Harris made no bones about his objective: "The aim of the Combined Bomber Offensive . . . should be unambiguously stated [as] the destruction of German cities, the killing of German workers, and the disruption of civilized life throughout Germany"

What was the legality of Harris's strategy? The Geneva Conventions establish standards for humanitarian actions during war. They were limited to the treatment of wounded combatants and prisoners of war. It was not until 1949 that, based on actions by recent belligerents, a fourth Convention was modified to include actions "relative to the Protection of Civilian Persons in Time of War." During World War II, there was no statutory prohibition against targeting civilians or urban centers.

By 1943, Harris had rebuilt and expanded Bomber Command into an effective tool for city busting. Raids frequently included over 700 aircraft carrying a variety of explosive and incendiary devices designed to cause urban firestorms. Explosive weapons were frequently equipped with delayed-action fuses to target fire and ambulance services responding to the conflagrations. Conducted at night, these missions made no attempt to identify specific military targets. Such was the nature of the planned raid on Nuremberg on 30/31 March 1943.

German defenders were also improving air and ground radars and air-to-ground communications. These improvements were game changing. The RAF depended on night missions to hide aircraft that flew in bomber streams instead of formations. Once the German interceptors learned

to identify the location of the bomber stream, they could attack the bombers both to and from the target area, inflicting proportionally heavier losses. Flak, searchlight, and precision aiming improved; and paramilitary emergency services were controlled and coordinated to reduce response times.

The Nuremberg raid went horribly wrong. The bombers did not strike the target and suffered exceedingly high losses. Middlebrook does an extraordinary job in telling this story, weaving together factual research as well as first-person narratives.

It would be easy to pivot to an academic discussion comparing Harris's nighttime city busting strategy with the American daylight precision bombing approach. To be honest, toward the end of the war, the USAAF was adopting an area bombing approach like that of the RAF. Numerous biographies written by bomber crews, as well as many personal mission logs, refer to targets as "city centers." Sending 1,000 bombers to target a marshalling yard in the city center made collateral damage and civilian casualties inevitable.

So great was the world's revulsion at the war's impact on civilian non-combatants, that the 1949 Convention was ratified to protect civilian populations. Harris himself was unrepentant. When public disquiet resulted in denial of a campaign star to Bomber Command, he, alone among senior British commanders, declined a peerage. A Bomber Command Memorial opened in 2012 is still the frequent target of vandals.

Middlebrook's book is just as exceptional today as it was when first released. His writing style is smooth and his research and citation impeccable. I unreservedly endorse the book—but not this printing. Its quality is lacking. Cruise the used bookstores for better value.

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



Secret Projects of the Luftwaffe, Volume 1: Jet Fighters 1939-1945. By Dan Sharp. Horncastle UK: Tempest Books, 2020. Photographs. Illustrations. Pp. 336. \$39.99. ISBN: 978-191165808-5

In his seminal 1970 book *Warplanes of the Third Reich*, William Green refers to the myriad late-war German aircraft designs as "freaks of irrationality" and "paper doodles not to be taken seriously." In his *Secret Projects of the Luftwaffe*, Dan Sharp attempts to prove the subject worthy of serious academic discussion. Much of the content is not new; it is a repackaging of material previously published in a series of *Secret Jets* books offered by Morton Publishing between 2015 and 2018.

Sharp brings clarity to the chaotic and Byzantine world of World War II German aircraft design and production. Most armchair aviation historians are aware of the dysfunc-

tion caused by political meddling. That dysfunction is surpassed only by the impact of a lack of strategic vision to focus the work of designers and engineers. Undoubtedly, there was a great deal of “doodling” going on in Germany, in the hopes one of the “doodles” would attract the attention of someone with access to money. Sharp postulates that many German designers and engineers—knowing the war would end in defeat—doodled to audition for post-war positions with Allied aircraft concerns. Operations LUSTY and PAPERCLIP would seem to support this contention. However, there is a substantive difference between doodles and engineering drawings. Sharp fills the pages of this work with numerous technical drawings to demonstrate that the Reich military and political leadership took these design efforts seriously.

Sharp also offers nuggets of knowledge beyond doodles and drawings. The Reich had access to over 60 wind tunnels, in both Germany and occupied countries, many capable of trans- and supersonic experimentation. While many might view German jet and rocket propulsion systems as efficient single entities, Sharp points out that many jet and rocket engines had widely different fuel requirements. This complicated a production and distribution process already under constant stress from allied attacks. He also points out that the physical size of different jet engines meant aircraft were specifically designed for one engine. While the He 280 was, in many ways, superior to the Me 262, it could not accept the larger Jumo 004 engine without substantive redesign. It was cancelled, even though it was further along in development than its competition.

Sharp does offer the occasional head-scratcher. For example, he notes that the Germans should have terminated the Me 262 after prototype testing and diverted its resources to building armadas of the He 162 Volksjäger. This is an aviation application of a critique often directed at the Kriegsmarine, wherein resources directed to constructing the *Bismarck*, *Tirpitz*, and *Graf Zeppelin* should have been used to build hundreds of U-boats instead. In the *Luftwaffe* context, Sharp makes no mention on where he would find the crews, fuel, bases, or infrastructure to support armadas of a single-engine, point-defense interceptors of limited utility.

The book’s glitzy color cover art features Focke-Wulf Triebflügels attacking U.S. Northrop B-35 bombers. The art seems ill suited to a serious treatment of the subject matter. Sharp pulls together a great deal of data to convince readers that, despite all the obstacles they faced, German designers were on the verge of producing the next generation of aviation super weapons. Now if they could have found a way to provide all of the necessary resources, they might have been on to something.

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

British Imperial Air Power: The Royal Air Force and the Defense of Australia and New Zealand Between the World Wars. By Alex M Spencer. West Lafayette, Ind.: Purdue University Press, 2020. Photographs. Bibliography. Notes. Index. Pp. 307. \$39.99 paperback. ISBN: 978-1-55753-940-3

John Boorman’s superb 1988 movie *Hope and Glory* has a scene set in a British classroom. The teacher is a “large red-faced woman” haranguing the nine-year-old students over a hanging map of the world. “Pink... pink... pink... pink... What are the pink bits, Rohan?” “They are ours, Miss,” he responds. “Yes, the British Empire.” This was the time when the sun never set on a British Empire that circled the globe. And during the interwar period, it was an Empire that needed defending against myriad developing foreign and domestic threats. Imperial defense would be provided with a radically shrinking budget and a growing political emphasis on appeasement. Spencer’s *British Imperial Air Power* explains this conundrum in detail as it applied to the relationship between Britain and its Dominions of Australia and New Zealand.

This book has all the hallmarks of an academic treatise repackaged as a commercial publication. Notes and citations are plentiful. Organization is methodical and the text very mechanical; readability suffers. Interestingly, the book buries its lead. Rather than state his thesis up front and then explain and defend it, Spencer takes the longer route of laying out his material and hoping the reader draws the desired conclusion.

The book has a few characters well known to most aviation historians. Most prominent is Marshal of the Royal Air Force Hugh Montague Trenchard, 1st Viscount Trenchard, GCB, OM, GCMG, DSO, better known as the “Father of the Royal Air Force.” Trenchard’s ability to protect the infant RAF during the post-World War I military reorganizations and fiscal drawdowns was perhaps his finest hour. Other characters are a variety of Imperial bureaucrats, some British and others carrying Australian and New Zealander portfolios, each of whom contributed to two decades of paper and empty promises which delayed construction of meaningful defense relationships between critical members of the Empire. Invariably, the delay is attributed to the 1920’s version of the “Peace Dividend.” The dominant bureaucratic sentiment was the Empire would have a ten-year warning of any impending military threat, and ten years would be sufficient time to prepare.

Underlying Spencer’s work is an assumption that airpower is just too expensive when weighed against its capabilities. Even in the 1920’s fiscal setting, that assumption was wrong. When the Empire’s Iraqi member became restive, Trenchard demonstrated that four to six squadrons of RAF aircraft could perform the peacekeeping duties of 27,000 ground troops—all while providing the added benefit of developing military/civilian air routes and infrastructure to strengthen imperial ties. Attempts to develop



similar ties to its Pacific dominions failed, in large part due to the miserly decision making of Dominion bureaucrats.

At the end of the day, Spencer eventually shows that decisions made during the interwar period were made using fiscal criteria to the detriment of all other considerations. He just takes 300 pages to get the job done.

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Countdown 1945: The Extraordinary Story of the Atomic Bomb and the 116 Days That Changed the World. By Chris Wallace with Mitch Weiss. New York: Avid Reader Press, 2020. Photographs. Notes. Bibliography. Index. Pp. 280. \$30.00. ISBN: 978-198214334-3

The 116 days between the death of President Franklin Roosevelt and the August 6, 1945, bombing of Hiroshima featured a dizzying array of interconnected activities moving at a frenzied pace. New President Harry Truman, who had been vice president for only three months before hurriedly being sworn into office, discovered that there was a Manhattan Project. He needed to learn what it really meant and then decide whether and how to use the bombs it promised to produce. Scientists at Los Alamos had to stop refining—and commit to actually producing—two new types of nuclear devices, neither of which had yet been tested. Hostilities ended in Europe, but in the Pacific, the horrific intensity of battle in Okinawa foretold a bloody invasion of the Japanese mainland. The U.S. military was exhaustively planning for that, and thousands of American troops were nervously anticipating it as well. The Potsdam Conference, Truman's first chance to meet and deal with Churchill and Stalin, was rocked by Churchill's election defeat and by the successful atomic test at Trinity, both of which occurred as the conference was underway. And for the "average American," this was a time of great consternation about what was to come next in a war that all wanted to be over.

Television newsman Chris Wallace, inspired during a 2019 meeting at the Capitol held in the very room where Harry Truman received the telephone call that FDR had died, has written a compelling account of that dizzying four-month period. Using short chapters, photos of the players, and a compelling but easy-to-read style, Wallace has woven the stories of many individuals—president to physicist to airman to "calutron girl"—into an overall story that shows how many disparate parts were actually moving together in the push to approve, and then use, the atomic bombs. While nearly fully focused on American political, military, and scientific preparations, Wallace includes the story of a remarkable 10-year-old girl from Hiroshima, so we don't lose sight of what the ultimate impact of those preparations was.

I've read many stories about Hiroshima and Nagasaki,

because I give tours that include *Enola Gay*. No other book weaves as comprehensive a picture as does *Countdown 1945* of how the many parts fit together. Perhaps it's because of the easy-reading quality of the book, but the complexity and interconnectedness of all that was going on really struck me in a way they hadn't before. A new president was trying to establish how he'd govern and deal with world powers during war, while also making a huge decision that would impact us all for generations to come. He got lots of advice on that decision, by the way, but it was his decision to make. And the sheer scope and coordination of the efforts to refine sufficient fissionable material; produce and test "the gadget;" create, equip, train, and deploy the 509th Composite Group; and transport all that was needed to a remote Pacific island made the story all the more absorbing.

Countdown 1945 is well worth reading if one is interested in this short period at the end of World War II. Wallace ends the book nicely, too, wrapping up in his epilogue and postscript what happened next, both to his players and to changing American opinions about the bombings.

Maj Gen John B. Handy, USAF (Ret), NASM Docent



RAF Bomber Command at War, 1939-1945. By Dr. Craig Armstrong. Yorkshire UK: Pen and Sword Aviation, 2021. Notes. Index. Photographs. Pp. 192. \$39.95. ISBN: 978-1-52670-051-3

Armstrong is an experienced historian with a special interest in the history of Northeast England and the Anglo-Scottish borders. His expertise is 19th and 20th century history with a particular focus on social and military history, particularly World War II. He currently splits his time between teaching at Newcastle University and working as a freelance researcher and writer.

In 1939, at the start of the Second World War, Bomber Command faced several critical problems: lack of organizational size to effectively operate as a strategic force; lack of political will to establish sufficiently broad rules of engagement; lack of adequate technology to provide high-performance aircraft with suitable bombload capacity; lack of radio and radar technology to provide accurate navigation and bombing (particularly at night); and the belief that unescorted bombing was practicable.

Armstrong walks through solutions to the above problems as Bomber Command evolved through the seven years of war from 1939 to 1945. Key factors discussed include the rationales for ultimate switch from daylight, unescorted bombing to night bombing and from narrow bombing of industrial and war production targets to area bombing of German and occupied cities and towns. This came with some opposition. However, the appointment of Sir Arthur Harris (a staunch supporter of area bombing as a main way toward the ultimate defeat Germany) to head Bomber Command

provided the leadership required to carry out the job. It is interesting that, as the war progressed, particularly after the invasion of Europe, the return to precision bombing of military targets became again important.

In his introduction, rather than outlining the purpose and scope of what is to follow in subsequent chapters, Armstrong presents a short discussion on the states of preparedness of available bomber aircraft and the RAF Bomber Command in the months leading up to the beginning of the war.

The first chapter, "Feeling the Way," deals with the outbreak of war and realization of the enormous tasks to be faced. In each of the subsequent chapters, Armstrong provides a "Summary of the Year" section which addresses technologies, tactics, policies, and mission successes and failures. This is followed by a section on the evolving "Campaign," which describes various bombing targets and operations, details on personnel involved, and mission outcomes. In fact, Armstrong focuses much of this book on those who participated in the bombing raids and on British public attitudes toward the bombing campaign.

In his conclusion, Armstrong makes no attempt to summarize results of the saga he has presented. Rather, he provides only outcomes of selected personnel events in the post-war period. However, throughout the book he provides a good story of the events facing Bomber Command and its personnel throughout the period. He also provides an overview of technologies and tactics developed by the command along with countering efforts by the enemy. Many vignettes tell of what happened to individuals on various missions. The index itself is comprehensive, which will help the researcher find information on personnel, RAF bases, squadrons, targets and other major wartime events and battles mentioned in the book.

Frank Willingham, National Air and Space Museum docent



Under the Southern Cross: The South Pacific Air Campaign Against Rabaul. By Thomas McKelvey Cleaver. Oxford UK: Osprey Publishing, 2021. Maps. Illustrations. Bibliography. Index. Pp. 352. \$29.99. ISBN: 978-147283822-3

Thomas Cleaver, a U.S. Navy Vietnam veteran, has been a published writer for 40 years. He was a regular contributor to *Flight Journal* magazine and has had a lifelong interest in military history (particularly the Korean War). His most recent works are *The Frozen Chosen* (2016), *Pacific Thunder* (2017), *Tidal Wave* (2018), *Holding the Line* (2019), and *MiG Alley* (2019). This latest work is the product of 25 years of research.

In August of 1942, the U.S. Marines landed on Guadalcanal, Florida, and Tulagi in the Solomon Islands. The primary objective of these assaults was to gain bases from

which to support a campaign to neutralize the major Japanese air and naval base at Rabaul, New Britain. The Solomons Campaign that followed was among the most difficult and bloody in the history of the U.S. Navy. However, it was this campaign, conducted by the Navy using ships that had survived the Japanese attack on Pearl Harbor, other pre-war ships and planes, and the courage of the men behind them, that broke the back of the Imperial Japanese Navy at Rabaul.

This book picks up where Cleaver's 2020 book *I Will Run Wild* (which covered Pearl Harbor to Midway) left off. It reflects both sides' points of view. This saga includes the naval battles of Santa Cruz, Cape Esperance, Tassafaronga, Rennell Island, Savo Island, and the First and Second battles of Guadalcanal. Aircraft carrier, battleship, and destroyer clashes between basically equal forces, along with ground battles on Guadalcanal, Tulagi, Gavutu, and Bougainville are covered. Perhaps of most interest to the aviation enthusiast is Cleaver's coverage of individual air battles. These are basic human-interest stories that describe pilot capabilities, aircraft performance, air-to-air and air-to-ground tactics, maintenance, and innovation. They also demonstrate how the ever-increasing U.S. production of new and improved equipment, coupled with excellent training, slowly ground down the Japanese war machine.

The reader looks into the minds of key U.S. and Japanese leaders (King, Nimitz, Halsey, Yamamoto, Tanaka) as well as individual commanders and pilots. This is supported by the vast amount of information Cleaver gathered from interviews, first-hand accounts, memoirs, logs, websites, and other narratives. He also introduces characters who have been immortalized in TV shows and movies such as *PT-109*, *McHale's Navy*, and *Baa Baa Black Sheep*. The book vividly shows what life was like in primitive jungles and the horror faced by pilots, Marines, soldiers, and sailors in violent land, sea, and air battles, the likes of which will not be seen again.

I like this book! Cleaver's page-turning style and accurate detail guarantee this volume a rightful place on any bookshelf covering evolution of the war in the Pacific. It is an excellent companion to books about this period by other authors such as Hickey, Hornfischer, Morison, Sherrod, and Tillman. It is definitely worth the read!

Frank Willingham, National Air and Space Museum docent



Tsar Bomba: Live Testing of Soviet Nuclear Bombs, 1949-1962. By Krzysztof Dabrowski. Warwick UK: Helion & Co, 2021. Maps. Tables. Diagrams. Illustrations. Photographs. Appendices. Notes. Bibliography. Pp. 56. \$24.95 paperback. ISBN: 978-1-913336-31-8

Helion has scored another winner with *Tsar Bomba*. One of the great features of their books is that the authors are generally from the country or area of the subject and

are familiar with the language and culture. Dabrowski is from Poland and is, therefore, probably at home with the Russian language. His lifelong interest in air warfare during the Cold War, including the aircraft, equipment, and crews involved, is well reflected in this history of early Soviet nuclear activities.

Writing histories of nuclear weapons is not an easy task, as Chuck Hansen (*U.S. Nuclear Weapons*, 1988), John Coster-Mullen (*Atom Bombs*, 2005), and Eric Schlosser (*Command and Control*, 2013) could, undoubtedly, attest. Dabrowski certainly met the challenge despite having to contend with Russian-language sources and Soviet secrecy. What he presents is not the detailed history of Soviet nuclear weapons development that Hansen gave for the US. It is also not a detailed story of the development of aircraft and missiles intended for nuclear delivery. It is, however, a concise, well written history of how the Soviets tested the weapons they developed from shortly after the end of World War II until the 1963 Partial Test Ban Treaty and the advent of ICBMs and SLBMs.

Dabrowski begins with a brief history of the Soviet nuclear weapons program and the test sites used. The USSR exploded its first bomb, RDS-1 (or *Joe-1* in Western parlance), on 29 August 1949 at the Semipalatinsk Nuclear Test Site in the Kazakh SSR. The test and weapon were similar to the 16 July 1945 Trinity test in the New Mexico desert. Soon, better weapons were being developed which, when coupled with the Tupolev Tu-4 *Bull* (the Soviet reverse-engineered B-29) and early jet-powered Soviet bombers, gave the USSR a form of long-range nuclear delivery capability. Much as in the US, Soviet nuclear weapons progressed into fusion weapons along two lines: higher-yield blockbusters for use by strategic bombers, and more-compact, lower-yield weapons for use in tactical operations from fighter bombers. The ultimate expression of the first line was the RDS-202, known in the West as *Tsar Bomba*. On 30 October 1961, a specially modified Tupolev Tu-95 dropped this behemoth over Semipalatinsk. The resulting explosion of some 50-58 megatons was the largest-ever manmade blast. It was a marvelous display of technology in a relatively useless weapon.

The Soviets used both Semipalatinsk and the Novaya Zemlya archipelago for their atomic testing. Unlike U.S. testing, a large number (222) of their tests were airdrops, all being made by a special unit set up for that purpose. The excellent collection of photos, tables, and illustrations greatly add to the story of these tests—the weapons themselves, the delivery aircraft (and air-launched missiles), and the men involved. Dabrowski has done an excellent job of covering one aspect of the twentieth-century nuclear weapons story. The author and publisher both deserve kudos for this book.

Col Scott A. Willey, USAF (Ret), Book Review Editor, and Docent, NASM's Udvar-Hazy Center



B/EB-66 Destroyer Units in Combat. By Peter E. Davies. New York: Osprey Publishing, 2021. 92 Pages. Photographs. ISBN: PB9781472845078

Peter Davies has written over 21 books on combat aircraft in Southeast Asia (SEA). This one focuses on Douglas Aircraft's B-66 series twin-jet bomber. Originally built for the USAF as a Cold War nuclear bomber for European operations, most ended up being modified to serve as electronic warfare (EW) platforms. They filled a significant gap in USAF EW capabilities in both Europe and especially in SEA.

The Tactical Air Command (TAC) needed to replace its World War II-era RB-26C Invaders with an aircraft that could perform the tactical nuclear bombing mission. TAC also wanted to be able to modify it to perform reconnaissance, EW, and weather missions. The Korean War had demonstrated the USAF's deficiency in EW capability. Davies walks the reader through the plane's development and eventual specialization as a badly needed answer to the EW problem.

Derived from the U.S. Navy's A3D Skywarrior (but a completely new aircraft), 294 were built by Douglas in five versions and eight variants. It became one of the USAF's most valuable resources in SEA. While the B-66 had a very short bomber career, the longest lasting variant was the EB-66. The last one was not withdrawn from USAF service until 1975.

From 1965 to 1974, it was the USAF's only platform for jamming and escort duties for strike operations over heavily-defended areas. Over half the book examines the different variants and provides firsthand accounts of the contributions the aircraft and crews made in SEA. The reader's understanding is aided by the excellent collection of period photographs and modern color plates. Many SEA air studies focus on MiG kills or B-52 raids over Hanoi. However, underlying them all was an electronic war between aircrews and Soviet and North Vietnamese radar operators. EB-66s would fly out of airfields in Thailand for missions over North and South Vietnam. Orbiting at the edge of the battlespace or flying with the strike packages, the vulnerable EB-66s identified and jammed enemy radars to protect the attacking forces. Tactical strikes on North Vietnam and Arc Light B-52 raids sometimes occurred only when EB-66 support was available. Without the bravery and skill of EB-66 operators, U.S. losses would undoubtedly have been much higher during the Vietnam War.

Davies explores how the technology and tactics developed by aircrews and planners impacted later EW developments. Their efforts greatly aided development of both the USAF EF-111A Raven (an invaluable asset during Desert Storm in 1991) and the U.S. Navy's EA-6 Prowler, which entered service toward the end of the SEA conflict.

Flying an EB-66 in communist airspace was a sometimes lethal event. Yet these crews flew their aircraft on these vital missions for years. Davies has added greatly to

the information available on this under-covered aircraft and its role in SEA. His prose and style add greatly to the reader's enjoyment of this important topic.

Joseph D. Yount, USAF (Ret) and NASM docent



Arado Ar 196 Units In Combat. By Peter de Jong. New York: Osprey Publishing, 2021. Photographs. Illustrations. Maps. Diagrams. Pp. 96. \$24.00 paperback. ISBN: 978-1-47284497-2

It would be easy to discount Osprey books as formulaic except for the fact that they are so darned good. Their authors and researchers take a niche subject, research the heck out of it, find or create meaningful illustrations to advance the subject, and package it all together in an attractive and complete bundle. The fact that so many publishing houses emulate the Osprey product and process is proof of its success. This book (No. 136 in the combat aircraft series) checks all the boxes. More importantly, it advances floatplane knowledge in a meaningful way.

Floatplanes have been a part of aviation since its earliest days. By the mid-1930s, German floatplanes were highly developed pieces of equipment that were standard aboard Kriegsmarine capital ships. De Jong makes clear that operational limitations, fragility, and logistic shortcomings would always hamper their success. But in telling that story, he includes a myriad arcane tidbits of knowledge. For example, the Kriegsmarine frequently mounted aircraft catapults on the top of main weapon turrets. A great idea at face value. The ship would not have to change course to gain a favorable wind for launch; it could hold course and rotate the turret. Unfortunately, the shock and vibration created when the main guns were fired frequently destroyed any aircraft awaiting launch. Floatplanes of the era are frequently seen with two large floats or one large center and two small outboard floats. The two-float configuration was heavier but more stable. The single centerline float was lighter and created less drag but was much less durable and stable. Durability was a major issue. De Jong offers no statistics, but his anecdotes and service histories indicate many more Ar 196s were lost during attempted landings in rough seas than from any other factor.

The development of the Ar 196 always envisioned the aircraft as a reconnaissance platform. Payload limitations doomed attempts to use it as a search-and-rescue or coastal-patrol platform. It did attain some success in air-to-air combat thanks to a 20mm cannon mounted in its wing. Records substantiate eighteen Ar 196 air to air victories, including Spitfires, Mosquitos, and Short Sunderland "Flying Porcupines." De Jong provides ample citations for all Ar 196 losses and victories.

The description of German-Japanese dialogue on floatplanes is remarkably interesting. Germany traded two

Focke-Achgelis Fa 330A kite gliders for a Nakajima E8N *Dave* floatplane. The Japanese article was repainted in British colors and loaded aboard the German commerce raider *Orion*. Significant numbers of Ar 196s were license-built by Fokker factories in Holland and French factories in Normandy. Virtually all major combatants experimented with float planes. The U.S. put floats on everything from the Wildcat to the Lightning to the Dakota. None achieved the success of Vought's OS2U Kingfisher.

De Jong's book sticks to its contract and does not chase comparisons or technical details. It tells a clear story with an abundance of facts. The book uses high quality paper, so the photographs are crisp and clear. The narrative is a little dry, presenting fact after fact and crash after crash. But the Osprey formula works once again.

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



How the RAF & USAAF Beat the *Luftwaffe*. By Ken Delve. Barnsley UK: Greenhill Books, 2021. Photographs. Tables. Pp. 207. \$34.95 paperback. ISBN: 978-1-7843832-4

My first thought after finishing *How the RAF & USAAF Beat the Luftwaffe* was "What an odd book." The subject has received exhaustive coverage over the last 75 years in every imaginable medium and from every possible angle. Unsurprisingly, Delve's approach is RAF-centric. He makes the case that the RAF "won" by not losing between 1939-43. RAF survival led inevitably to the *Luftwaffe*'s destruction once the Yanks turned up. Delve builds this case without talking about transportation, training, R&D, logistics, production, the Eastern Front, or the Pacific Theater. Lastly, he concludes that destruction of the *Luftwaffe* was as much a result of its own leadership's incompetence as anything the RAF or USAAF did.

The body of the book is divided into segments reflecting select phases of the air war in parts of Europe. A reader should look past the arbitrary data and criteria used and just read the segments as presented. Delve gives great credence to Adolf Galland's 1953 article which presents the *Luftwaffe*'s "How we lost the war" analysis. He also offers citations from a variety of German sources throughout the work. The Galland synopsis is followed by a review of RAF and *Luftwaffe* orders of battle prior to 1939. These segments were filled with anecdotes new to me. Delve says *Luftwaffe* pilots referred to the RAF tactic of attacking bombers in line astern formation as "idiotenreihen" or "idiots in a row." While usually avoiding technical discussions, he explores the cannon-vs.-machine gun controversy in detail.

Many characters mentioned are familiar to the World War II aviation historian (e.g., Mahan, Trenchard, Downing, Leigh-Mallory, et al.), but Beatrice Shilling was a new name who could easily claim a share of the "Most Valuable Con-

tributor to Victory” in the Battle of Britain. Without giving it away, I spent several days researching Miss Shilling and her life and work, and she has laid firm claim to a place in my personal pantheon of heroes. The British gave her more meaningful recognition, awarding her the Order of the British Empire and naming a pub after her. I could not find a British pub named after “Butcher” Harris!

The remainder of the book is divided into specific topics. These are addressed in dissimilar fashions. Sometimes Delve offers a summary to support his title’s premise, but usually not. His habit of picking and choosing what facts he considers worthy substantially weakens his work. He talks about German V-weapons’ lack of effectiveness but chooses not to address how the development of proximity fuses and deployment of the Thames AA belts effectively negated the V1. He offers interesting insight into the poor morale in Bomber Command but presents the night bomber offensive as an aircraft-vs-aircraft confrontation. He then ignores the growth of *Luftwaffe* radar, flak, and communication nodes. When Delve introduces the American arrival into Europe, he restricts his narrative to the Eighth Air Force and its early struggles. He is comfortable talking about the growing size of American air armadas without addressing the role of American industry in building those armadas as well as the unmentioned tactical air forces that paralyzed German transportation and logistics. While discussing German oil and fuel problems, Delve wonders why the Germans did not disperse their refineries the way they did their factories. A pint shared with a petroleum engineer would have answered that question.

The book’s greatest strength is the plethora of facts and anecdotes sprinkled throughout. But Delve’s hyper-selectivity regarding what facts he uses and what facts he ignores is a fatal flaw. I did not find his approach pedantic. I did find it incomplete.

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



Operation Deliberate Force: Air War over Bosnia and Herzegovina, 1992-1995. By Bojan Dimitrijevic. Warwick UK: Helion & Company, 2021. Maps. Tables. Illustrations. Photographs. Notes. Bibliography. Pp. 88 paperback. \$24.95. ISBN: 978-1-91336-30-1

Perhaps the foremost expert on Yugoslav and Serbian military history, Dimitrijevic has published more than 50 books in his homeland and abroad. This is his fifth book in the Helion@war series. In it, he examines the impact of air power on the conflict in the former Yugoslavia after the departure of the various republics from the federation in the early 1990s. Of course, the fighting between the Muslim forces in Bosnia and Herzegovina and those of Serbia and Croatia was the most intense and longest lasting.

Dimitrijevic begins by discussing the Serbian Air Force’s efforts to support ground forces as that nation attempted to prevent Bosnian forces from expanding their control within Bosnia itself. The Serbian Air Force was so effective that its impact prompted an international response to curtail its operations.

In early 1993, U.S. Air Force transports operating under direction of the North Atlantic Treaty Organization (NATO) initiated Operation Provide Promise in which they delivered humanitarian supplies both by air drops to Muslim enclaves and by landings at the Sarajevo airport. This effort continued until August 1994. Meanwhile, Serbian radar sites carefully tracked the transports. They discovered that unidentified C-130s, probably from Saudi Arabia, possibly were delivering military supplies, as well as food and medicine, to the enclaves.

As the war raged, NATO deployed a growing number of attack and air-superiority aircraft to the region. In April 1993, the United Nations Security Council declared that it would enforce a no-fly zone over Bosnia—Operation Deny Flight. But, on February 28, 1994, the Serbian Air Force launched a disastrous attack in which they lost five Soko J-21 Jastrebs to USAF fighters. After that, NATO forces became more involved, targeting Serbian ground forces in retaliation for their shelling of civilian targets. Military flights abated, but the ground war continued.

By late summer 1995, UN and NATO leaders finally decided to unleash air power as a means by which to reach a settlement and end the fighting. Operation Deliberate Force lasted from August 30 to September 13.

Concerned about the effectiveness of anti-radiation missiles, Serbian forces limited the use of their SA-2 *Guideline* surface-to-air missiles. They more frequently used the SA-2 in a surface-to-surface role.

This conflict within the former Yugoslavia was incredibly complex. The introduction of NATO forces added another level of complexity. Dimitrijevic acknowledges that Deliberate Force achieved its goal of ending the fighting. However, he suggests that the USAF failed to learn from this experience, and that would affect its approach in 1999 in Kosovo.

A Serbian perspective of this war balances the more numerous works by native-English writers. While the quantity of information is overwhelming, much of the narrative is tied to land battles. The numerous maps fail to illuminate this aspect and are disappointing. Graphics defining the various forces would have been most helpful. This work is best suited for students of post-Cold War conflicts.

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



The Feiseler Fi 156 Storch: The First STOL Aircraft. By Jan Forsgren. Stroud UK: Fonthill, 2021. Photographs. Notes. Index. Pp. 192. \$35.00 paperback. ISBN: 978-1-78155813-3

Books whose subject matter is a specific aircraft can flow in several quite different directions. Some target the model-building audience and include large numbers of photographs and artwork. Some target the aviation historian and emphasize notable personalities who flew the aircraft or specific events it is associated with (i.e., battles, notable “firsts,” records, etc.). Some try to walk the fine line and appeal to all classes of readers with different degrees of success. Forsgren’s book falls into the last category, but he delivers on all accounts. It contains enough photographs to satisfy image-hungry readers and enough narrative to satisfy historians.

The Fi 156 Storch is perhaps best remembered for two events: Mussolini’s escape from his prison in Campo Sasso and von Greim’s flight into besieged Berlin in the closing days of the war. But the aircraft itself is more memorable for its performance and longevity. Forsgren wisely introduces the reader to the Storch’s designer, Gerhard Feiseler. He parlayed his skill as an acrobatic pilot into ownership of an international aircraft design and production consortium with over 60,000 employees. His company was involved in not only the decidedly low-tech Storch, but also the high-tech Fi 103 (V1) and parts production for the V2 and the Hs 293 anti-shiping glide bomb. His company license-built Bf 109s, including navalized versions for the failed *Graf Zeppelin* aircraft carrier.

Of course, the Storch’s claim to fame was its amazing short takeoff and landing (STOL) capabilities. Carrying a crew of three or a pilot and two stretchers, the Storch could take off in as little as 75 meters and land in as little as 15 meters. Some pilots report using strong winds to hover or even fly backwards. Its light weight and strong landing gear allowed the pilot to arrive at a specific point in a controlled stall. The famed British test pilot “Winkle” Brown recounted an anecdote where he landed the Storch within the confines of a flight deck elevator leaving the deck crew to fold the wings and stow the aircraft below decks without moving it an inch. The Japanese manufacturer Nippon Kokusai Koku Kogyo tweaked the Storch design to develop the Ki 76, an anti-submarine aircraft which operated off a dedicated aircraft carrier.

In the time before rotary wing flight was as widespread as today, many foreign manufacturers attempted to emulate the Storch’s performance by including flaps and slats on simple designs and offering the result to military and civilian markets. At the end of the war, ex-*Luftwaffe* Storch and Storch-clones found their way into the commercial market in large numbers. Several are still flying today. Non-German manufacturers who built the Storch (e.g., Morane-Saulnier, IMAM, and Mraz) attempted to marry the basic design to improved engines and grab a share of

the market. But none of the “look-alikes” ever replaced the original design. Eventually, though, helicopters reduced the fixed wing STOL requirement to a niche market.

Forsgren is a skilled writer. His work is well organized, and his narrative style is smooth. The book is a high-quality product on high-quality paper that shows most images crisply. This book is a great tool for the researcher diving deeper into the Storch.

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



Militarizing Outer Space: Astroculture, Dystopia and the Cold War. By Alexander C. T. Geppert, Daniel Brandau, and Tilmann Siebeneichner, eds. London UK: Palgrave Macmillan, 2021. Photographs. Illustrations. Notes. Bibliography. Index. Pp. xxvii, 443. \$119.99. ISBN: 978-1-349-95850-4

This volume completes a “European Astroculture” trilogy in the Palgrave Studies in the History of Science and Technology series. The first two volumes, *Limiting Outer Space* (2018) and *Imagining Outer Space* (2nd edition, 2018), examined the Post-Apollo period and the cultural history of outer space and extraterrestrial life in the European imagination, respectively, from a refreshing multiplicity of disciplinary perspectives. This third volume “explores the dystopian and destructive dimensions of the Space Age and challenges conventional narratives of a bipolar Cold War rivalry.”

Sandwiched between a lengthy introduction and a short epilogue, the editors have selected and organized trios of chapters under four topical parts. Most of the dozen interior chapters are more refined versions of papers originally presented, in April 2014, at an international symposium on *Embattled Heavens: The Militarization of Space in Science, Fiction, and Politics*. A careful, cover-to-cover study will leave readers nodding affirmatively to Geppert’s contention that beyond mere space culture, “astroculture is the constant oscillation between space-bound imaginaries and spaceflight realities . . . between heavenly utopias and apocalyptic battlefields.”

Knowledgeable readers of *Air Power History* might be drawn especially to Michael Neufeld’s chapter in Part I on “Cold War—But No War—In Space,” followed by Christopher Gainor’s “The Nuclear Roots of the Space Race.” Neufeld concludes, “I cannot help but note the complete disjuncture between space war in astroculture and the actual evolution of military space technology in the Cold War and after.” Gainor emphasizes how repurposed intercontinental ballistic missiles (ICBMs) served as space launch vehicles, and how understanding them as “dual use” devices has resulted in “changing historiographical perceptions.”

In Part IV, these same readers might thumb first to

Paul Ceruzzi's chapter, "Satellite Navigation and the Military-Civilian Dilemma: The Geopolitics of GPS and Its Rivals." Beginning with the so-called "Longitude Problem" and the evolution of position, navigation, and timing systems from the eighteenth century through twentieth, he then "places the evolution of GPS, including its penetration into markets little envisioned by its creators in the context of post-Second World War geopolitics." His placement of GPS receivers within the context of the microelectronics revolution, which enabled what GPS pioneer Bradford Parkinson has dubbed an immeasurably significant "invisible infrastructure," is especially fascinating.

These observations are not meant to berate the other authors. Geppert and Siebeneichner deliver a superb introductory chapter titled "*Spacewar! The Dark Side of Astroculture*." Natalija Majsova, Oliver Dunnett, and Philipp Theisohn examine the militaristic impact of science-fiction cinema and literature on astroculture; while Patrick Kilian explicates the evolution of space medicine and cyborgs; and Anthony Enns explores psychic experimentation and satellite remote sensing history. Chapters by Regina Peldszus and Cathleen Lewis expose the dual-use legacy of mission control centers and space stations, respectively. Finally, Daniel Brandau and Michael Sheehan, in turn, analyze the impact of spaceflight on a divided Germany in the 1950s and on post-World War II West European integration.

While discerning space historians will find relatively few references to new research or previously neglected primary documentation, they will not be disappointed by how the distinguished authors and editors have synthesized previous scholars' work from more than a century past. The book is a sterling addition to any space historian's bookshelf. If the price discourages one from purchasing a copy now, when the publisher released paperback editions of the trilogy's other volumes, the price dropped considerably.

Dr. Rick W. Sturdevant, Deputy Director of History, HQ Space Operations Command, USSF



Desert Storm Volume 2: Operation Desert Storm and the Coalition Liberation of Kuwait 1991. By E.R. Hooton and Tom Cooper. Warwick UK: Helion & Company, 2021. Photographs. Illustrations. Maps. Notes. Pp. 72. \$29.95 paperback. ISBN: 978-1-913336-35-6

Desert Storm stands out as the last conventional military campaign of the twentieth century. It was witness to the large-scale clash of armor and artillery and application of a sophisticated air campaign. Until the Cold War's end just two years prior, a clash of this magnitude was imagined only in an apocalyptic showdown between NATO and the Warsaw Pact on the North German plain. Instead it was waged in a Middle East desert. It was also notable for the comprehensive use of cutting-edge technology that often de-

finied a very different battlefield from the past. Thermal imaging systems, GPS, SATCOM, NVGs, precision munitions, and electro-optics all played an important role in achieving victory. Never before in modern military history had the defending side suffered such incredible losses, while the attacking force lost so very little.

Desert Storm was only an early round of American involvement in unending conflict in the Middle East. Yet, it was an incredibly optimistic first step for the U.S. as the emerging unipolar leader of the post-Cold War era. Consequently, it's difficult to believe that Desert Storm is now over 30 years in the past. Viewed from a different perspective, it was immediately heralded as a validation of a military that had come a long way from its nadir in the aftermath of the Vietnam War. Desert Storm demonstrated the U.S. military's emergence as a formidable force superior to that of any other nation. But how did the campaign actually play out before victory was certain?

This monograph captures an evolving strategy with an uncertain outcome until the overwhelming victory. General Schwarzkopf, the coalition commander, had to bring together, and send into combat, a coalition force drawn from three continents: Egypt, Senegal, Kuwait, France, the UK, Qatar, Saudi Arabia, and other nations that included unlikely allies such as Syria. The coalition leadership, headquartered well to the rear in Riyadh, often misunderstood the reality of the battlefield. Washington's arbitrary selection of a time to declare a ceasefire often conflicted with the fluid situation on the battlefield, causing confusion for front-line commanders in the heat of battle. Confusion existed between Schwarzkopf and his commanders in the field. One senses his frustration in conveying his changing concept of operations to generals who often had a much clearer understanding of the battlefield, the terrain, the obscuring heavy smoke from oil fires, the weather, and the enemy. Some formations were driving hundreds of kilometers across the Iraqi desert with extensive fields of sharp rocks that cut the tires of the critically important resupply trucks. This in contrast to those in the rear who were tested only by downtown traffic in Riyadh.

This short monograph covers a great deal and captures so much of the planning, build-up, politics, and actual liberation of Kuwait. Along the way, limiting factors such as weather, terrain, logistics, and force management surface. Hooton also, in an atypical approach, gives voice to Iraqi generals and their strategic and operational decisions. Despite its brevity, this is a handy reference to and summary of the Desert Storm campaign.

John Cirafici, Milford, Delaware



Air Battles Over Hungary, 1944-45. By Dmitry Khazanov. Warwick UK: Helion, 2021. Photographs. Illustrations. Pp. 150. \$45.00 paperback. ISBN: 978-1-91333620-2

The period covered by this book was one of great turmoil. German partners Italy, Bulgaria, and Romania changed sides to join the Allies, bringing with them oil, agricultural production, manpower, and advance bases. When Hitler learned that Hungary was considering the same path, he moved first by deposing Miklos Horthy and replacing him with an ultra-right-wing leader. He also sent significant air and land resources to stop the Russian advance. However, Axis forces in the theater were still outnumbered 4:1 in aircraft and 15:1 in armor. And most of the Hungarian contribution was in outdated German and Italian castoffs.

Khazanov's story is detailed but told in a very Russian, height of the Cold War style. The Soviet Union carried the bulk of the war-fighting burden in this campaign. To Khazanov, everything Russian was heroic; everything German was incompetent; everything Hungarian was misguided; and Americans were absent except for when they got in the way.

The Soviet campaign consisted of three offensive operations (Debrecen, Budapest, Vienna) and one defensive operation (Balaton region). Dozens of Sturmoviks and Bostons were protected by dozens of fighters, all opposed by a handful of German and Hungarian defenders. Most German missions appear to be ground-attack, not air-defense, sorties. Noted Stuka pilot Rudel was active in this theater in his cannon-equipped Ju 87G-1. Only a quarter of any Stuka unit was equipped with this highly effective model. Khazanov states that most Stuka pilots were young, inexperienced, and ineffective. He takes the same tack with noted *Luftwaffe* aces Barkhorn and Hartmann, giving them their due in a few sentences and then ignoring them as non-factors.

U.S. Fifteenth Air Force contributions receive the same blasé treatment. A 350-plane mission against an aircraft manufacturing facility in Budapest is the only bomber mission cited. Khazanov relies on a quote from Rudel to describe the American contribution: "... (the Soviets) have to thank their Western Allies whose strategic bombers considerably upset the operations of our communications by delivering strikes on cities and railway stations ... There are American fighter-bombers which keep sneaking above the railway lines. We are unable to protect our communications for lack of people and equipment." An unfortunate friendly fire incident where P-38s attacked a Soviet column in Yugoslavia receives much more fulsome treatment.

The book itself is a cumbersome 8" x 12" softcover. The text is rife with words that are not quite right to the English-reading eye. For example, a Soviet aviator describes a dogfight and graphically describes flares (rather than tracers) being shot at him by a German aircraft. The Russian words for flare and tracer are different. For readers not familiar with "Russian English," the book could be an uncomfortable and difficult read.

There are good points, however. The high-quality paper shows the many photographs and color illustrations to good

effect. Many Western readers are probably not familiar with these battles; the book corrects that and shows how Barkhorn, Hartmann and Rudel and many Russian counterparts added to their large victory totals. Seeing the battle through Russian eyes is interesting. However, one simple question stands out: With the overwhelming Soviet numerical superiority and tactical advantage, why did it take seven months to end the campaign? Khazanov does not provide an answer.

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



Eagles Over Darwin: American Airmen Defending Northern Australia in 1942. By Dr Tom Lewis. Kent Town, Australia: Avonmore Books, 2021. Photographs. Illustrations. Pp. 108. \$42.95 paperback. ISBN: 978-0-64866598-4

The defense of Darwin, Australia, took on great significance in the early months of the Second World War in the Pacific. After the fall of the Philippines, Darwin became the core of the wall erected to stop the Japanese advance and prevent the invasion of Australia. *Eagles Over Darwin* explains that the only aviation resources available to counter the aggressors were the Curtiss P-40s of the U.S. 49th Pursuit Group. There were small numbers of Royal Australian AF utility aircraft on scene—mostly converted trainers and transports. But the outdated P-40s flown by novice pilots were the only warbirds standing in the way of experienced Japanese aircrews flying state-of-the-art fighters and bombers.

Lewis provides an engagement-by-engagement description of the 49th's activities from February-September 1942. The story is harrowing, but not for the reasons the reader might expect. During this period, the 49th suffered only four combat casualties despite going against seasoned combat veterans of several land-based bomber units and the 1st Carrier Air Fleet and their A6M Zeroes. Over 30 personnel were lost to accidents in the eight-month period. Lewis attributes many of the accidents to the exuberance of the unseasoned pilots.

There is a lack of substance to the book, but Lewis provides a little by discussing the "reality of air combat" and adding detail to comparisons of the P-40 Warhawk to the A6M *Zeke* and G3M *Betty*. He also goes into detail discussing the combat record of a single American pilot, going to great lengths to impugn his record, reports, and reputation. Lewis explains his assault as preventing the long-deceased pilot from diminishing the honor of the other defenders of Darwin.

The book is a very quick read. The narrative flow is full of facts and citations, but it is dry and lifeless. Lewis is quick to give praise to those he deems as deserving (e.g., USAAF

officers Lt Robert Buell and Maj Paul Wurtsmith), and credits the actions of Darwin's American defenders for forming the close American-Australian relationship. His attack on the single pilot was extremely uncomfortable reading. *Eagles Over Darwin* would be an interesting companion piece to Bob Alford's *Darwin's Air War 1942-1945*. But this book is a comparative lightweight in substance, especially for the price.

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



Cold War Berlin: An Island City—Volume 1: The Birth of the Cold War and the Berlin Airlift, 1945-1950. By Andrew Long. Warwick UK: Helion & Company, 2021. Maps. Tables. Illustrations. Photographs. Notes. Appendices. Bibliography. Notes. Pp. 88. \$24.95 paperback. ISBN: 978-1-914059-03-2

This volume is No. 9 in Helion's Europe at War series and is Long's initial contribution, though as the title suggests at least one more work is in the offing. An enthusiastic researcher of the Cold War, he retired from a career in marketing to focus on writing about military history.

In the first three of four chapters, he discusses the political events that ultimately led to the 1948-49 Soviet blockade of surface transportation between Berlin and the British, American, and eventually French-controlled sectors of Germany. The fourth and longest chapter details the airlift.

While there is nothing much new here, his international perspective balances the accounts typically presented by American authors. One detail most American readers fail to understand is that British aircraft, both military and civilian, carried 23 percent of the airlift's total tonnage. One of the more unique aspects of the British effort was the use of Short Sunderland flying boats until the winter freeze halted operations to Berlin's frozen lakes. American operations and issues do, however, receive appropriate attention.

The airlift provides an excellent example of coalition operations. Over time, the British and Americans worked together to successfully meet an extraordinary challenge and ultimately defeat the Josef Stalin's efforts to pry Berlin from the influence of the Western powers.

This concise work is ideally suited for anyone at all interested in one of the West's earliest Cold War victories. Long has selected a wide array of photos. His maps are sufficiently detailed and are plentiful. Numerous tables convey much information. Modelers will find the color illustrations useful. The absence of an index is all that prevents this from being a complete effort.

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



A-7 Corsair II Units 1975-91. By Peter Mersky with Mike Crutch and Tony Holmes. Oxford UK: Osprey Publishing, 2021. Photographs. Appendices. Pp. 96. \$24.00. ISBN: 978-1-47284063-9

Mersky's book details both the technological developments of the United States Navy's A-7 Corsair II and its world-wide service after the Vietnam War. A-7s were developed during the 1960s to replace the Douglas A-4 Skyhawk in the light-attack role. The Corsair was a decedent of Vought's F-8 Crusader, but its airframe was simpler and cheaper to build, and the aircraft was smaller and subsonic. It joined Navy squadrons in February 1967 and was employed in the Vietnam War.

The A-7's peak service period (within the USN—there was also a USAF version) happened in the mid-1980s. Thirty Navy squadrons, including six Naval Air Reserve units, flew various versions of the A-7. Navy A-7s showed up in practically every post-Vietnam U.S. hotspot from the 1975 Mayaguez incident through Desert Storm in 1991. Readers will learn about the jet's combat experiences during the 1970s (Cambodia), 1980s (Lebanon, Grenada, Libya and Iran), and 1990s (Iraq). Each operation is discussed in detail, and Mersky's expert analysis is supported by numerous first-hand accounts from naval aviators who saw action with the A-7 during these U.S. employments of force. They tell the story of how and what these planes and pilots did. Their comments are both helpful and informative.

Mersky also presents the many improvements made to the A-7 post-Vietnam such as a Forward Looking Infra-Red (FLIR) targeting pod coupled with the AGM-88 High Speed Anti-Radiation Missile (HARM). Other modifications expanded the jet's operational employment envelope and effectiveness. However, by 1991 only two fleet A-7 squadrons remained. Many of the 30 fleet squadrons had been disestablished or had transitioned to the McDonnell-Douglas F/A18 Hornet. However, those two remaining A-7 units (VA-46 and VA-72) played a major role in Operation Desert Storm's campaign to free Kuwait.

Deployed aboard the USS *John F. Kennedy*, the only carrier to operate A-7s during the period, they flew from the Red Sea to targets throughout the area—flying both in the day and night to attack a wide range of defended interdiction targets in Iraq and within "kill boxes" in Kuwait. They delivered a variety of weapons including precision guided munitions, unguided general-purpose bombs, and HARM missiles. Additionally, they were used as tankers for in-flight refueling of other Navy aircraft.

The book contains lots of photographs. These are supplemented with 30 color plates of aircraft markings and configurations. If one is looking for a complete A-7 history that presents all of its technologies and capabilities, this book isn't what you are looking for. However, for those naval-aviation buffs looking for details of the employment

and post-Vietnam successes of LTV's marvelous attack aircraft, this book fills the bill.

Joseph D. Yount, USAF (Ret), and NASM Docent



In Good Faith: A History of the Vietnam War Volume 1: 1945-65 and No Wider War: A History of the Vietnam War Volume 2: 1965-1975. By Sergio Miller. Oxford UK: Osprey, 2020/2021. Illustrations. Maps. Photographs. Glossary. Notes. Bibliography. Index. Pp. 448/528. \$20/\$35. ISBN: 978-1-913118-64-8/978-1-4728-3851 respectively

These books are a useful reference for those removed from the Vietnam War by a half century. *Volume 1* reliably stitches together the war's roots from the French colonial phase, the Second World War, and the shaping events of the Cold War. Vietnam played a minimal role in America's national security concerns before the full blown "American War." Equally important were political developments within Vietnam, independent of external intrigues, and the White House's misleading and contradictory policies. It recapitulates U.S. national security policy from the Roosevelt era onward in an attempt to answer how the U.S. ended up in a conflict that was so costly for all parties involved and damaging in the long term to America's prestige. To answer that, Miller revisits the impacts that the Korean War and the fall of China had on America's post-World War II role as leader of the "Free World" and on U.S. domestic politics.

Somewhat different from more narrowly focused works that exposed the failure of America's leaders during the Vietnam War and their deceitfulness, this volume takes a wide-brush approach to examining primarily the war's political context. All personalities on the path leading eventually to the "American" war in Vietnam appear. Of parallel importance are White House and Pentagon decisions that reveal confused policies and diametrically opposed positions held by senior leadership and principal lieutenants. Seemingly endless "factfinding" trips to Vietnam often provided misleading or politically correct findings. America was complicit in the coup and murder of South Vietnam's president and the downward spiral of the south in the aftermath. Ho Chi Minh allegedly said, "I can't scarcely believe that the Americans would be so stupid."

As one who has been doing scholarship on the war for decades, I was interested in the various positions espoused by high-level U.S. officials. Central to the White House's inexcusably poor decision making were the self-impressed "wise men," advising the president with supposedly well-informed arguments to commit to combat against the Viet Cong/North Vietnamese. In the background were voices unequivocally stating that involvement in the war would be a monumental mistake with grave consequences for both the U.S. and Vietnam.

The book's single most important episode is the 1964

Gulf of Tonkin Incident where an alleged attack on the destroyers *Maddox* and *Turner Joy* (located well off the North Vietnamese coast) occurred. It is important for two reasons: the attack never took place, and it became the basis for Congressional authorization to conduct combat operations against North Vietnam. This is what President Johnson badly needed to commence the Americanization of the Vietnam War.

A reader might conclude that the incredibly wrong-headed arguments leading to catastrophic U.S. involvement (in what was, essentially, a war of choice and not necessity) are so transparently fallacious that no president would ever ignore the war's lessons and repeat such a costly error in judgement. Yet, that is exactly what happened only 35 years later in Iraq by "wise men" who should have known better than advise a president to go to war.

Volume 2 continues with the first U.S. combat units to arrive and engage enemy forces in 1965. With the steady flow of U.S. units came the big lie. Initially, combat troops were sent there to provide base security after a series of successful VC attacks—not to Americanize the war. However, the war quickly changed as hundreds of thousands of American troops aggressively sought out the enemy throughout South Vietnam.

Along with the buildup, there were seemingly endless engagements between American forces and the elusive North Vietnamese Army (NVA). One wonders how either side could ever have hoped to achieve a military victory. On one side, the Americans were trained for a conventional war but were thrust into the frustration of fighting an enemy who melted away into either rugged jungle terrain or the marshes of the Mekong Delta. With helicopter mobility, American generals hoped for surprise and fluidity on the battlefield where, with immense firepower resources, they could annihilate the enemy once he had been fixed in place. On the other side, NVA tenacity, endurance, and commitment to a conflict from which many would not return alive was awesome. The American war depended on "body counts" as a key metric for success; it had little impact on the outcome. The North also used "body counts" but as a political weapon to impact U.S. public opinion and will to continue. The NVA would look for American wounded to execute, thus elevating the numbers reported in the increasingly troubling news sent back home.

General Westmoreland's 1967 speech before a joint session of Congress reflected optimism that the U.S. was on the road to victory. The 1968 Tet Offensive significantly altered that belief. Militarily, Tet was a North Vietnamese and Viet Cong disaster. However, it was a political victory for them because of the news images seen in American homes—images inconsistent with Westmoreland's optimism. The U.S. attempt to win the war militarily ended when President Nixon began "Vietnamization" of the conflict coupled with withdrawal of U.S. forces.

Miller covers the North Vietnamese 1972 Easter Offensive; the convoluted four-year-long peace negotiations; the

Christmas 1972 bombing of Hanoi; and, finally, the face-saving Paris Peace Treaty that allowed the U.S. to extricate itself from a war it should have never entered. His history covers quite a bit of ground yet successfully captures the essence of the “American War” with all its blemishes (e.g., My Lai and a serious Army drug-addiction problem). The closing chapter recounts the sudden collapse of South Vietnamese resistance and the end of a very long war. As predicted, the South Vietnamese people then entered into a very difficult era under the North Vietnamese. Even the Viet Cong did not escape Hanoi’s wrath.

We are now some five decades from that highly destructive war that was damaging in so many ways. It would take years for the U.S. military to recover from discipline, morale, and drug issues. Much of this is barely known or understood by many Americans today. These books provide a handy reference to that war and how America fought it politically and militarily.

John Cirafici, Milford, Delaware



Korean Air War: Sabres, MiGs and Meteors 1950-1953. By Michael Napier. Oxford UK: Osprey, 2021. Photographs. Map. Notes. Appendices. Glossary. Bibliography. Index. Pp. 319. \$40.00 ISBN: 978-1-4729-4444-8.

Napier, a former RAF and British Airways pilot, has written several books on post-World War II aviation and numerous articles for Britain’s leading aviation magazines. Despite the sub-title, he offers a very comprehensive perspective of the air war over Korea as fought by all parties: the Soviet Union, People’s Republic of China, and Democratic People’s Republic of Korea were on one side; and the United Nations (units from the U.S. Air Force and Navy, Royal Air Force, Fleet Air Arm, Royal Australian Air Force, South African Air Force, and Canadian Air Force officers who flew combat missions as exchange pilots) were on the other.

While hostilities between the belligerents began in June 1950 and continued until July 1953, ground combat by the summer of 1951 had become a stalemate reminiscent of World War I. This situation continued almost unabated until the final days, when both sides tried to re-arrange the final lines in their favor.

Prior to the middle of 1951, the conflict ebbed and flowed dramatically from one end of the Korean Peninsula to the other. The book’s organization reflects a chronological approach, with the first five chapters covering the overall situation and the war’s first year. With UN ground forces always outnumbered after China intervened in October 1950, friendly air support prevented a Communist victory.

Of course, the Korean War is best remembered among aviation enthusiasts for the first jet-to-jet combat. Communist aircraft operated from bases in China north of the Yalu

River. These bases were politically off limits, although UN pilots attacked aircraft landing and taking off when possible. The battles over MiG Alley in the northwestern corner of the peninsula, however, are only part of the story.

The most significant contribution UN air power made in eventually securing an armistice was denying the Communist air forces any presence over the front lines. Preventing the regular operation of Communist bases south of the Yalu by regularly bombing them played a key role. Effective close-air-support missions occurred whenever weather permitted, despite significant losses to antiaircraft artillery.

Interdiction of Communist supply lines proved disappointing. Strategic bombing in the first few months destroyed most suitable targets. USAF Boeing B-29 Superfortresses continued to challenge the MiGs near the Yalu throughout the war but were forced to resort to night attacks reminiscent of RAF Bomber Command’s in World War II. Aerial rescue by helicopter or amphibians emerged as standard operations.

This is a lavishly illustrated book. One drawback, however, is the absence of adequate maps, especially when discussing the movement of ground forces up and down the peninsula and the transfer of aerial assets from one base to another. Despite this, I highly recommended it to anyone interested in the Korean air war. It is easily the most comprehensive account I have read. Of course, there are older, more-specialized histories; but, in terms of looking at all aspects, nationalities, and branches, this book is hard to beat.

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



75 Years of the Israeli Air Force: Volume 1 The First Quarter Century, 1948-73 and Volume 2 The Last Half Century, 1973-2023. By Bill Norton. Warwick UK: Helion, 2020/2021. Maps. Tables. Illustrations. Photographs. Notes. Glossary. Bibliography. Pp. 87/85. \$29.95 each. ISBN: 978-1-913336-34-9/978-1-914059-00-1, respectively

These two volumes are more of Helion’s Middle East @ War series. They are large-format, picture-intensive works on air combat, focusing here on the development and employment of the Israeli Air Force (IAF) from its inception in 1948 through the present. They cover combat and air mobility forces with a third volume (not reviewed here) discussing training, combat support, special operations, naval operations, and air defenses. As with all Helion’s offerings in this genre, they are loaded with pictures (almost all photos being reproduced in black and white) and color illustrations of aircraft and unit insignia. An abbreviations and acronyms list is included, which is very helpful given the unfamiliar designations of units and such. There are many useful maps: one of the general Mideast, and numerous others depicting IAF airfields at various times. Interestingly,

in the introduction, Norton solicits feedback on the work and provides his e-mail to encourage readers to reach out.

The book covers the material well, given its limited length. There is a seemingly pro-Israeli bias in spots, but Norton is also not shy about identifying IAF weaknesses and failures. In the end, there doesn't appear to be any effort to glorify or sugar coat the IAF's operations, and Norton shows the warts. The text focuses on organizations and operations with a reasonably robust discussion of aircraft and procurement. This is a challenge for any military force, but more so for smaller nations with more limited funds to purchase outside weapons or limited industrial bases to build their own. Personnel (IAF commanders specifically) are profiled in insets of just a few paragraphs. Given that Israel's strategic situation necessitates maintaining relatively large, capable forces, Norton takes some time to discuss the dichotomy between the requirement for high-end combat aircraft to dominate the battlefield and the need to maintain older types to provide additional combat power. This resulted in the IAF maintaining and modifying many types of aircraft well beyond expected service life. The perennial issue has been where best to spend the money. It is very evident that the IAF's history thru the 1970s was one of making do with what they could get; although, since that time, they have been able to purchase state-of-the-art aircraft, though never in the numbers desired.

The books are generally well done with very few misspellings or grammatical or factual errors. The extensive tables of organization include units, bases, and aircraft assigned, insofar as Norton could determine; the Israelis deliberately don't make all this information publicly available. One of the most useful aspects of these books is the discussion of lessons learned from various conflicts. These are a useful addition to the aviation buff or modeler's book shelf.

Golda Eldridge, Lt Col, USAF (Ret), EdD



PROSPECTIVE REVIEWERS

Anyone who believes he or she is qualified to substantively assess one of the new books listed above is invited to apply for a gratis copy of the book. The prospective reviewer should contact:

Col. Scott A. Willey, USAF (Ret.)

46994 Eaker St

Potomac Falls VA 20165

Tel. (703) 620-4139

e-mail: scottlin.willey@gmail.com

Research Assistance

Request for assistance:

I am trying to find photos of then-Capt. Dale Brannon and then-Capt. John Thompson, when they were respectively CO and XO of the 67th FS on Guadalcanal in 1942, flying the P-39 and P-400 Airacobra. I have plenty of photos of the P-39s and P-400s, and a few of the P-38s but none of these two men. I have been in touch with many of the regular government agencies such as the USAF History Office at Maxwell AFB and the USAF Museum in Dayton, Ohio, and I know Air PowerHistory carried a multi-part article on the squadron a few years ago. Colonel Brannon passed away several years ago, but if there is someone who knows how to contact his surviving family I would greatly appreciate your passing that information on to me. The same for Colonel—maybe BGen--Thompson's survivors.

I usually write about Navy and Marine Corps aviation, but the story of the 67th FS and later the 339th FS with the first P-38s, commanded by then-Major Brannon in theater interests me.

My email is: airwriter@comcast.net

Thanks in advance,
Peter B. Mersky,
Commander, USNR (Ret)

Coming Up



Compiled by
George W. Cully

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

September 9-11, 2021

The **National WWII Museum** will host "Memory Wars: World War II at 75," an international conference to address the shifting landscapes of popular memories of this world-altering conflict. The gathering will be held at the new Higgins Hotel & Conference Center in New Orleans, Louisiana. For more information, see the Museum's website at Home | The National WWII Museum | New Orleans (nationalww2museum.org).

September 9-11, 2021

The **Tailhook Association** will hold its annual symposium at the Nugget Resort in Reno, Nevada. This year's presentation will focus on NAVAIR's role in the Air War over Vietnam. For details, see the Association's website at <http://www.tailhook.net>.

September 17-18, 2021

The **National Museum of the Pacific War** will present its 2021 Symposium at the Museum in Fredericksburg, Texas. This year's theme is "A Catalyst for Change: Diversity in World War II". For information regarding attendance, either in person or on line, see the Museum's website at 2021 Symposium Day 1 | National Museum of the Pacific War (pacificwarmuseum.org).

September 18-21, 2021

The **Air Force Association** will host its annual convention at the Gaylord Convention Center in National Harbor, Maryland. This will be immediately followed by the Association's annual Air, Space & Cyber Conference at the same site. For more details as they become available, see the Association's website at <https://www.afa.org/events>.

October 5-6, 2021

The **Aviation Engine Historical Society** will conduct its annual gathering at the Hilton Doubletree Hotel in Dearborn, Michigan. Expected site visits include the Henry Ford Museum, Greenfield Village, Automotive Hall of Fame and the Yankee Air Museum. For further information as it becomes available, see the Society's website at <http://www.enginehistory.org/>.

October 5-6, 2021

The **Aviation Engine Historical Society** will conduct its annual gathering at the Hilton Doubletree Hotel in Dearborn, Michigan. Expected site visits include the Henry Ford Museum, Greenfield Village, Automotive Hall of Fame and the Yankee Air Museum. For further information as it becomes available, see the Society's website at <http://www.enginehistory.org/>.

October 11-13, 2021

The **Association of the United States Army** will present its Annual Meeting and Exhibition at the Walter E. Washington Convention Center in Washington, D.C. For registration and other details, visit the Association's website at [Home \(ausa.org\)](http://Home (ausa.org)).

October 12-14, 2021

The **American Astronautical Society** will present its annual Wernher von Braun Memorial Symposium in Huntsville, Alabama. For additional details as they become available, see the Society's website at Wernher von Braun Memorial Symposium | American Astronautical Society.

October 12-15, 2021

The **Council on America's Military Past** will hold its annual gathering in Charleston, South Carolina; this meeting will be co-hosted by the Coast Defense Study Group. For further details, see the Council's website at 2021 Conference – CAMP – Council on America's Military Past (campjamp.org).

October 13-17, 2021

The **Oral History Association** will hold its annual meeting in virtual form. See the Association's website at Oral History Association for scheduling information as it becomes available.

October 14-17, 2021

The **Mars Society** will hold its annual convention in virtual format. For registration and other details, see the Society's website at 2021 Mars Society Convention - Dates, Registration & Abstracts - The Mars Society.

October 21-24, 2021

The **Institute for Korean Unification** (IKU), Pusan National University is hosting an international conference on the United Nations and Korean War (1950-1953): Politics, War and Peace. <https://iku.pusan.ac.kr/iku/54496/subview.do>.

October 22-25, 2021

The **Society of Experimental Test Pilots** will hold its 65th Annual Symposium and Banquet at Disney's Grand Californian Hotel and Spa in Anaheim, California. For registration and a schedule of events, see the Society's website at The Society of Experimental Test Pilots (setp.org).

November 18-21, 2021

The **Society for the History of Technology** and the **History of Science Society** will co-host their annual meeting in New Orleans, Louisiana. Check the SHOT website at Annual Meeting – Society for the History of Technology (SHOT) for more details as they become available.

November 30-December 2, 2021

The **Association of Old Crows** will hold its 58th Annual Symposium at the Courtyard by Marriott Washington Downtown/Convention Center in Washington, D.C. For more details, ping a Crow at Annual Symposium - Association of Old Crows.

2022

January 6-9, 2022

The **American Historical Association** will hold its 135th annual meeting in New Orleans, Louisiana. For more details as they become available, see the Association's website at Annual Meeting | AHA (historians.org).

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

George W. Cully
3300 Evergreen Hill
Montgomery, AL 36106
(334) 277-2165
E-mail: warty@knology.net



The Lockheed SR-71 “Blackbird” first flew on December 22, 1964. Called the “Blackbird” partially after the dark color of its fuselage, the SR-71 evaded enemy air defenses by flying both exceptionally high (85,000 feet +) and exceptionally fast (Mach 3+). The SR-71’s unique shape helped hide the airplane from enemy radar. Thus, making it one of the first “stealthy” aircraft. The SR-71 had a crew of two: a pilot and a reconnaissance system operator (RSO). The RSO operated the SR-71’s array of sensors and a camera system. Only thirty-two Blackbirds were built. While twelve aircraft were lost as a result of accidents, no Blackbirds were lost to enemy fire. It’s not because of a lack of trying; over 1,000 air-to-surface missiles were fired at the SR-71s. As part of a budget reduction, the Air Force retired the SR-71 in 1990. Three aircraft were later reactivated beginning in 1995; however, the Air Force’s SR-71s retired for good in 1998. NASA retired its two SR-71s the following year. During its flying career the SR-71 set numerous speed and altitude records, too many to mention here.

To learn more about the SR-71 “Blackbird” explore these articles and videos:

<https://www.beale.af.mil/News/Article-Display/Article/2102872/legendary-sr-71-blackbird/>

<https://www.airmanmagazine.af.mil/Features/Display/Article/2594085/airframe-the-sr-71-blackbird/>

<https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/198054/lockheed-sr-71a/>

<https://www.lockheedmartin.com/en-us/news/features/history/blackbird.html>

https://www.youtube.com/watch?v=QnYhq_OCRpQ

<https://www.youtube.com/watch?v=YqTL-JYzU2E>



This Issue's Quiz:

With the shooting down of Gary Powers' U-2, it became clear to U.S. senior leaders that the U.S. Air Force needed a new reconnaissance airplane capable of penetrating enemy airspace. Kelly Johnson and his team at Lockheed Skunkworks proved up to the task. In complete secrecy they quickly developed a new cutting-edge reconnaissance airplane. It flew for the first time in 1964. The plane they developed flew both very high and very fast. Only a few of these airplanes were built. The airplane was named partially after the color of the fuselage. Can you name the plane?



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