HILLER AVIATION INSTITUTE
AVIATION MUSEUM ▪ EDUCATION & RESEARCH CENTER

BRIEFINGS

JOURNAL OF AIR TRANSPORTATION PROGRESS

QUARTER 3 2000

INSIDE

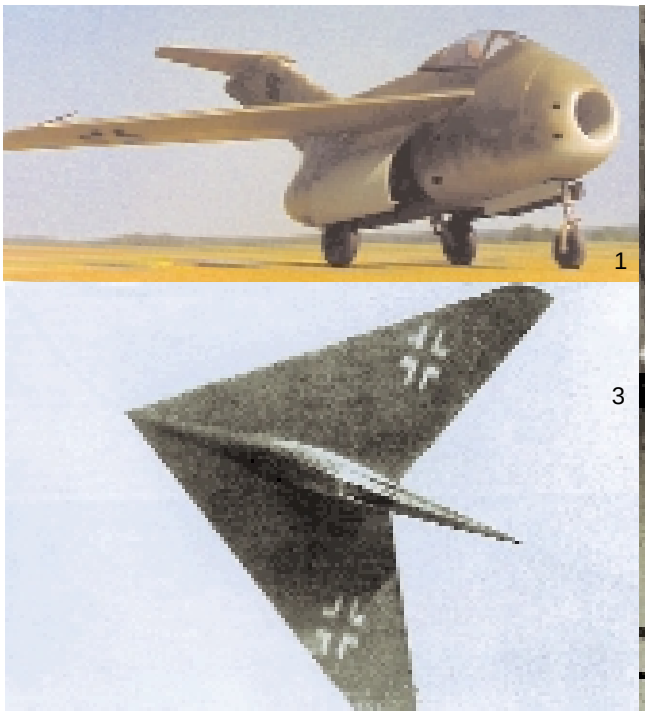
"VERTICAL CHALLENGE DAY" DRAWS 4,000 VISITORS TO EXPERIENCE HELICOPTERS AND MEET THE PIONEERS

"A record-busting event," smiled Admiral William Kozlovsky, Hiller Aviation Institute Executive Director, describing "Vertical Challenge" Day at the museum on August 5th. Some 4,000 visitors turned out to experience helicopters, watching them do surprising stunts, taking rides, enjoying a barbeque, and touring the past and future of aviation in the galleries. Hundreds heard Sergei Sikorsky, son of aviation pioneer Igor Sikorsky, talk of his recollections in flight development. The Flight Shop was crowded too, encircling book signers Sikorsky and fellow pioneer Stanley Hiller. Even the next day was more active than a usual Sunday: The museum had been discovered by thousands more people in the Bay Area.

SPECIAL REPORT

SWEPT-WING TECHNOLOGY COULD HAVE CHANGED THE COURSE OF WORLD WAR II

THE ENTIRE GERMAN AVIATION INDUSTRY WAS RACING TO SUPERSONIC FLIGHT, VIRTUALLY UNCONTESTED BY ALLIED AVIATION ESTABLISHMENTS. ONLY MASSIVE STRIKES BY AMERICAN AND BRITISH PROP-DRIVEN BOMBERS PREVENTED THE COMPLETION AND DEPLOYMENT OF NEW-GENERATION, SWEPT-WING JETS. THEY WOULD HAVE RENDERED THEIR ADVERSARIES OBSOLETE.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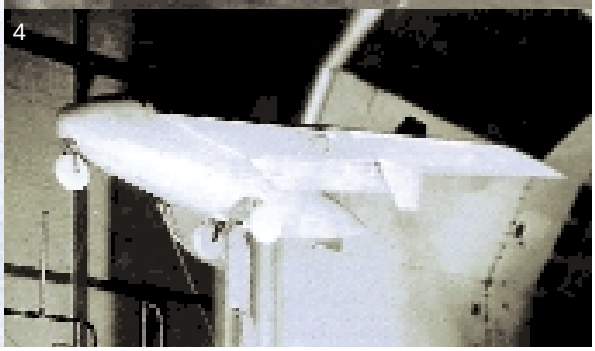
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German mating of turbojets with swept-wing aerodynamics was impressive in the Focke-Wulf Ta 183 V1 "Huckebein" (photo 1), which was scheduled for production in summer 1945.

Arrow-shaped all-wing planes (photos 2 and 3) were far ahead of their time, from the Horten company.

Junkers found its Ju EF 128 (photo 4) promising in supersonic wind tunnel tests.

Some 13 companies were spewing out over 60 configurations with swept wings, pivoting wings, delta wings and even a rotor-to-wing conversion VTOL fighter with tip ramjets. Only a few types saw action, but follow-ons were just months away from deployment when Germany capitulated.

FOREWORD: This account of how the timeline of high-speed flight technology nearly altered world history is told in two parts. In the 1940s, the German aviation establishment was closing in on transonic flight technology. Their only rival was one young American innovator, Robert T. Jones, whose theory on removing supersonic limitations with wing sweep fell on deaf ears in the U.S. "R.T." and the Germans were completely unaware of each other's work. Their countries were locked in war.

The two installments of this saga, here and in the next BRIEFINGS, are based on research by NASA Ames Research Engineer Mark Waters, who knew R.T. Jones before he died last year. With the cooperation of R.T.'s daughter, Harriet Jones, Waters is uncovering new perspectives in the emergence of supersonic flight.

Retired Boeing Vice President George Schairer, who today lives in Bellevue, Washington, was a member of an American team that entered Germany just before the war ended in 1945 to evaluate the progress of Nazi aeronautics. What they found was every bit as shocking as the stories of fantastic planes which had been reported over Belgium and Holland.

Instantly, the controversial swept-wing work of R.T. Jones was exonerated in the world of aviation. His frustration in trying to sell the idea to NACA and U.S. industry was ended.

Boeing, complying with a letter from Schairer written while he was still in Germany, hastened to tunnel-test swept wings replacing the straight wings on its B-47 entry in a bomber competition. It won. In similar quick-step, North American completed its famed F-86 Sabre with the wing sweep of R.T. and his former German adversaries, now known.

And so, on that historic wake-up day in April 1945 at Volkenrode aeronautics center near Braunschweig, leadership in high-speed jet aviation had transferred from vanquished to conqueror, and the gate to supersonic flight had swung open.

PART 1: THE LUFTWAFFE THREAT

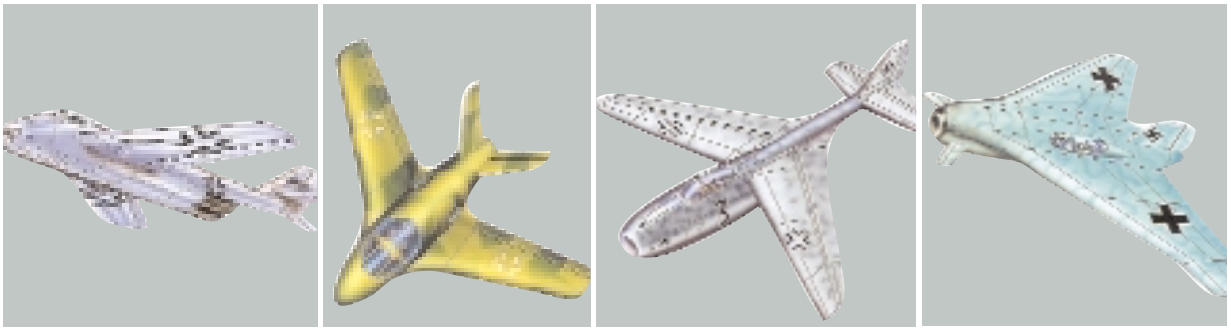
The year was 1944, and the tide of battle in Europe had turned. Acts of daring and sacrifice by allied forces–all-out, often unescorted bombing of German production facilities, the punishing Russian eastern front, and the Normandy invasion–were crippling the Nazi war machine. Normandy's timing, sometimes criticized as too early and costly, appear in retrospect essential, if for no reason other than Germany's development of an aviation technology which could have significantly altered the length and losses of the European struggle.

By mid-year, British and American bombing had nearly deprived Nazis of their oil supply and armament-building capability. The Luftwaffe had lost some 3,500 planes on the ground and in the air, and was fast becoming extinct as a military factor. As 1944 closed, German aviation was suffering for lack of synthetic fuel to fly, and the supply of qualified pilots was diminishing in concert. Many young fliers had barely 100 hours in trainers and none in the aircraft they would ride into battle against an enemy which vastly outnumbered them.

A do-or-die production priority was assigned to a new breed of high-speed, swept-wing jet fighters. It was a hurried tactic, invoking aviation technology to counter the hordes of allied bombers, and to upset the recovery of Britain, which had narrowly survived Germany's own bombers, unmanned pulsejet V-1 "buzzbombs," and the virtually invulnerable rocket-powered V-2s.

A Messerschmitt Me 262 and an Me 163 (foreground) on postwar display in England. The speed of the turbojet Me 262 so exceeded that of allied propeller fighters that the only hope of engaging them was to dive from far above before being detected. Me 262 follow-ons like the Me 163 had increased wing sweep that reduced drag limitations, further boosting the speed advantage.

By October 1944, growing numbers of production Me 262s were airborne, and RAF records showed a sudden five-fold increase in losses of their Mosquito attack bombers.



The unbeatable teaming of wing sweep and improved turbojets brought out the best and worst in German aviation. Designers of too many companies turned out too many configurations, with little coordinative focus. Only a few of hundreds are depicted at left. Meanwhile, Hitler and Goering engaged in a running feud with the aviation industry. It proved to be one of history's classical lessons in the hazards of micro-managing.

At secret Volkenrode and other development centers–many hidden near small villages or ingeniously camouflaged–prized German design teams were making swift progress. Urged on by the Nazi high command, their promising technology began to draw what was left of Germany's production capabilities and materials. Volkenrode's precocious offspring, swept-wing jet airplanes, had the makings of a trump card in the deadly game of conquest.

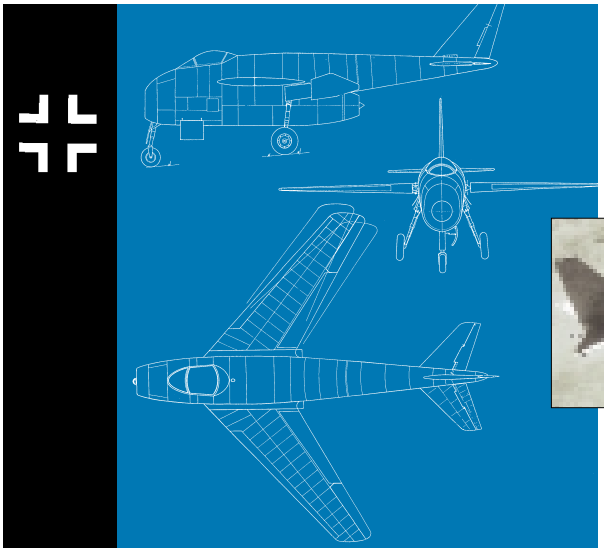
The first product to become a threat to slower, vulnerable allied bombers and fighters was Messerschmitt's Me 262B. Its twin jets and 18.5-degree wing sweep escalated fighter speeds to over 500 mph. But that slight wing sweep in the earlier 1940s was adopted to improve center-of-gravity problems incurred by the plane's two big jet engines. It was not until later in Me 262 follow-on programs, called Project 1101, that wing sweeps of 40 degrees and more were applied specifically to reduce the effects of compressibility at high speeds.

Limited as it was–and doubtless often flown by inadequately trained pilots, the early Me 262's advantages over allied aircraft earned it a feverish production surge late in the war. Some 500 were reaching service by late 1944 and 1,400 were expected soon after.

While hordes of relatively slow, prop-driven allied fighters and bombers were clouding German skies, every German aircraft manufacturer below was focusing on more advanced swept-wing jet fighters to bring the bombers down with raw speed and performance. Focke-Wulf, Henschel, Blohm & Voss, Dornier, Horten and Junkers, as well as Messerschmitt, were fully involved, and all they needed was fuel, more pilots, materials...and a few months more.

Wing sweep to push through sonic barriers appeared early in the mysterious and decidedly unattractive Me 163 "Komet." Designed by famed Alexander Lippisch, who after the war became a factor in American aircraft design, the Me 163 was the first flying hardware to prove Germany's comprehension of high-speed power and aerodynamics, a capability which could have altered World War II.

Although the rocket-powered Me 163 was beset with weaknesses, it flew successfully with no horizontal tail and a wing sweep of 24 degrees, evidence that the Germans



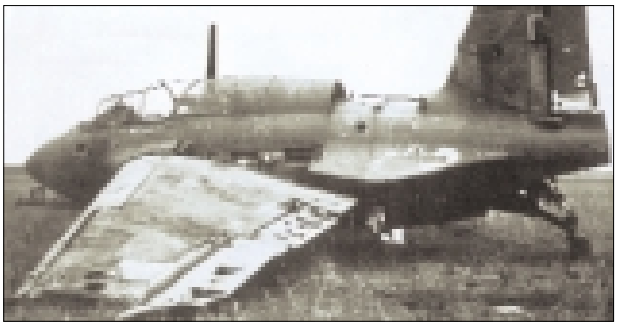
Willie Messerschmitt said his P 1101 project (drawing at right) with pre-set variable wing sweep, would become Germany's ultimate high-speed jet fighter. Undaunted by rejections from the Air Ministry, he nearly finished a test bed before war's end. It was captured in its facility at Oberammergau, and Bell Aircraft's Bob Woods was in a first American contingent to inspect the place. Woods arranged shipment of the P 1101 to the U.S., where it became the basis for Bell's historic X-5 (photo). With help from P 1101 designer Woldemar Voigt, who was pirated from Germany in "Project Paperclip," the X-5 wingsweep became variable during flight.

were mastering the classic compressibility and structural problems of speeds approaching Mach 1.

Reported the Encyclopedia Britannica's 1946 BOOK OF THE YEAR: "Another German unconventional airplane that saw combat was the Me 163. This was an amazing aircraft. It was extremely vulnerable, because of its highly explosive fuels and short range. With proper development, however, it could have also been a serious threat to strategic forces in Europe."

The Japanese version of Germany's rocket-powered Me 163 (right) was a saga of improvisation with little time and poor technical support. A complete Me 163 and detailed plans were enroute from Germany on a U-boat, but it was sunk. Japanese engineers struggled honorably, but their first prototype crashed after the engine cut out, killing the pilot. More help was coming in another U-boat, but it was intercepted by allied ships.

Designed to be even more effective with greater range and endurance than the Me 163 was a sophisticated Project 1101 single-turbojet fighter by Messerschmitt, with a wing sweep which could be preset at 35, 40 or 45 degrees. Authorized by the Reich Air Ministry in December 1944, Willy Messerschmitt jumped the gun and began design in July. The P 1101 maiden flight, scheduled for June 1945, was cancelled forever by the end of European war. Six years later, with America already a year into its next war in Korea, the Bell X-5 jet fighter with variable wing sweep and looking identical to the P 1101, completed its maiden flight. It was obvious that many of the German aerodynamicists and their former enemies were now on the same side and at nearby drawing boards.



Classic system failure

Germany's extraordinary lead in technology appears to have failed through mismanagement by a centrist system. The what-if's of the 1940s are ubiquitous. American and British P-40s, Spitfires, B-17s and many other prop-driven types which turned the tide of battle, would have been no match for Germany's next generation of swept-wing, 600-plus mph jets, if Nazi technology had been given the time and materials to intercept them. In creative technology, German designers were rapidly finding keys to win the war, but the blunders of their Nazi leaders were overtaking them. At the outset, Hitler, Goering and Minister of War Production Albert Speer had grossly underestimated America's capacity for production when its public was aroused. Hitler had evidently believed his own show of Luftwaffe invincibility in the earlier 1940s, and by 1944, the sheer productivity of American and British societies swamped them. In that year alone, the U.S. built nearly 100,000 aircraft; England some 67,000. That Germany turned out 39,807 planes in 1944–and Japan 28,180–while their nations were being bombed into rubble, is remarkable.

Technology to Japan

Even the timing of the atom-bombing of Hiroshima and Nagasaki so evidently close to Japan's capitulation tends to be reinforced by the revelation that Japan was deriving from the Nazis their own version of the Me 163. It would have a specific, vital mission: shoot down the American B-29 bombers devastating Japan's war making capabilities.

Impressed by the speed and climb of the Me 163 Japanese military guests had seen in Germany, Japan negotiated in early 1944 a 20-million-mark contract to build the plane's rocket engine. A complete Me 163B airplane and manufacturing plans were to be delivered to Japan in return for shipments of urgently-needed raw materials to the Reich. The mode of transportation was the only one relatively safe: a German U-boat. The sub never made it, becoming the victim of allied interception before it reached the Pacific. On a second attempt, the Walter rocket engine made it, but the Me 163B was a no-show.

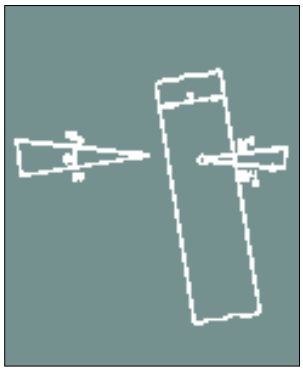
With neither construction plans nor a real plane, following only a manual retrieved from an earlier visit to Germany, Mitsubishi started the "Shusui" (swinging sword) in July 1944, finished a preliminary model in September, and tested it a few weeks later. Prototypes were begun and wooden glider versions of the plane were made for pilot training.

In another display of strange timing, on May 2, 1945–five days before the German surrender–a third sub set out from Norway with complete Me 262 construction plans, this time in the hands of Luftwaffe General Kessler, his staff and sev-

eral Messerschmitt and Japanese engineers, all of whom might conceivably have been saying auf wiedersehen and sayonara to the battlefield. Whatever the goal, it wasn't to happen. Sneaking unescorted through the North Atlantic, they were forced to surface and surrender.

On July 7, 1945–one month before the bombs fell on Hiroshima and Nagasaki., a flawed Shusui was ready for its flight test. After climbing skyward at a 45-degree angle, the rocket engine suddenly cut out, and the swinging sword plunged into the ground. With it went a final, symbolic hope that swept-wings and high speed would be in time to save a war.

It all began in Rome, 1935



Adolf Busemann (left) introduced in 1935 a key to supersonic flight, reasoning that flow over a wing was determined mainly by the component of velocity perpendicular to the leading edge. With wing sweep, that component would decrease (figure). Thus, the free-stream Mach number at which the large rise in drag begins would be higher, meaning that swept-wing planes could fly faster before encountering the drag-divergence phenomenon.

The idea of aircraft speeds approaching and exceeding the speed of sound became a new idea as far back as the 1930s when airplanes were lucky to fly beyond the 200 mph mark. It was Jakob Ackeret, a Swiss aerodynamicist and premier windtunnel designer, whose work resulted in the seminal theories of supersonic flows. He and Hungarian-born Theodore von Karman were in the early 1930s already addressing compressibility and the drag problems which occur when air density increases as the air stream impinges on a solid surface. At low speeds the drag penalties had been negligible; predictability wasn't a major factor. But at higher speeds above Mach .5, the limiting forces became paramount. Ackeret and von Karman studied these characteristics, and their diagnoses led to the beginning of a cure.

It was at the 1935 Volta scientific conference in Rome that Germany's Adolf Busemann delivered a paper on "Aerodynamic Forces at Supersonic Speeds" which introduced for the first time the concept of swept wings as a means to reduce drag at high speeds. The conference, held in an impressive Renaissance building, became a propaganda event staged by Dictator Mussolini, who shocked his captive audience with the scientifically irrelevant news that he had invaded Ethiopia.

The swept-wing solution postulated by Busemann at Volta wasn't lost on German engineers. Following his theory, a concerted effort was begun in Germany to remove the limitations which stood in the path of transonic and supersonic aircraft design. By 1937, a young engineer, Ludwig Bolkow, was verifying Busemann with models and tests. Soon Germany's design teams were at work, now under top security, on a multitude of warplane configurations with varied wing sweeps.

Bizarre and inexplicable in aviation history is the fact that non-German attendees of the Volta conference somehow missed the importance of Busemann's swept-wing conclusions. Were they preoccupied by the political overtones of the conference or by the threatening background rumble of German fascism? Neither von Karman, leading Hungarian-American aero-wizard, nor NACA's Eastman Jacobs, both of whom attended Volta, had an explanation when asked years later. Although von Karman urged the U.S. Army and NACA to develop supersonic facilities as a result of his Volta experience, he offered nothing in wing sweep. In any case, he garnered no government interest in funding supersonic programs, so as World War II approached, the U.S. and its allies spent all their efforts on the mass production of straight-winged, propeller planes. Fortunately, those relatively slow allied bombers and fighters got into the fray soon enough and in such vast numbers that Luftwaffe swept-wing jets were buried in rubble before they had a chance to do the damage of which they were capable. Admirable as Mustangs and Spitfires were, they would have been no match for 540 mph Messerschmitt P 1101 swept-wing jet fighters deployed in force.

Observations: technology and management

Germany's war loss is broadly attributed to aviation mismanagement; Hitler not developing ground-to-air defensive missiles, Hitler not fully utilizing the extraordinary technical advantage presented him by his aviation industry. The Germans had even engaged in nuclear weapons research, terminated by the Reich in June 1942 despite the fact that a nuclear warhead aboard the V-2 would have put devastating logic in the Fuehrer's predilection for offense over defense.

Other observers point to Germany's stricken condition after World War I, probably too cruelly stripped by its conquerors, collapsing into 44 percent unemployment by 1933. Hitler constantly had to choose between investing in the society he was committed to salvage and the expensive technologies his scientists offered to achieve military superiority. Too impressed by his people's recovery under facism, he underestimated the potential of free people when they perceive a threat to their democracy.

That one technology like swept wings, properly managed, could have altered the war's outcome has invited speculation, as analysts seek linkages and lessons for the future. Throughout history, a natural rhythm emerges in scientific discovery. There is danger in failing to pursue ideas whose time have come, failing to guide them to a practical end, failing to share them with the global society. Busemann tried to share his discovery with the world, as did R.T. Jones in America. At first, only the Germans heard the music of "swept wings." Alone in the wrong hands, that one science could have cost the world years of peace and freedom. ■

(Below): R.T. Jones, 1940s; proposed Boeing B-47 gets swept wings after inspection of captured Volkenrode.

NEXT BRIEFINGS
THE UPHILL STRUGGLE:
SWEPT-WING TECHNOLOGY
IN AMERICA

Update: the Educational Alliance

HILLER AVIATION INSTITUTE • MENLO COLLEGE

Following the appointment of Dr. David Nixon as Director of Education at the Hiller Aviation Institute, the alliance with Menlo College has been consolidated through monthly meetings of the joint Operations Committee. With the goal of appealing to a larger group of students, a Bachelor of Science degree in global transportation management is being evaluated. The program would include courses on the history of flight, economic aspects of global transportation, and the environmental impact of new modes of transportation. Another proposed course explores improvements in global transportation through better inter-modal transport, integrating road, rail, air and sea systems.

The effort is based on the premise that to keep pace with a proliferating global economy, a tightly integrated, comprehensive system of global transportation must be developed which addresses congestion, pollution, noise and quality-of-life factors.

Leaders in transportation must come forward with the training and expertise to make such a system work. That's the goal of the Hiller-Menlo educational alliance: produce graduates with exceptional abilities to take advantage of the exciting opportunities in advanced transportation afforded by the global economy.

Results should be seen in the coming academic year as the committee succeeds in generating support.

A "Senior Capstone Management Project" in transportation is being discussed along with a plan whereby students elect global transportation in Individual Directed Research programs. For the wider student body at Menlo College–to stimulate interest in these issues–seminars are being evaluated to be given by experts provided by Hiller Aviation Institute.

December Forum Alert

The final Transportation Forum of 2000 will be a panel discussion about "Technology Development for Noise Alleviation." The speakers will be William Wilshire, Program Manager for noise reduction at NASA Langley Research Center; and Dennis Huff, noise reduction program leader at NASA Glenn Research Center.

Hiller Aviation Institute invites you to a challenging presentation about future aviation

Program 3 in our Transportation Forum series:

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Chief Scientist, NASA Langley Research Center

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Noted author and speaker, holder of five patents and recipient of NASA's Exceptional Scientific Achievement and Leadership medals, Dennis Bushnell is a respected contributor to a broad spectrum of space, aviation, land and sea transportation projects.

Saturday, September 30 at 10:00 a.m.

In the museum's newly sound-equipped Atrium.

Call 650-654-0200 by Sept. 26 to advise if you'll join us. Seating is limited. Free admission to the Forum.

Educators Open House

See first-hand how a tour of the Hiller Aviation Museum can extend your classroom learning for English/Language Arts, History/Social Studies, Math and Science.

• Escorted tours • Discussions with docents • Films • Flight Shop open

Saturday, September 23 from 10:00 a.m. to 5:00 p.m.

For teachers from the North Bay, San Francisco and South Bay

Saturday, October 14 from 10:00 a.m. to 5:00 p.m.

For teachers from the East Bay

Hiller Aviation Institute • 601 Skyway Road, San Carlos, California 94070
Use Holly Street exit from Hwy 101 • Ample free parking available

For further information, please call Marion McDowell at 650-654-0200 ext. 216

Revised Membership Levels and Benefits: Coming January 1, 2001

Memberships are essential to the Hiller Aviation Institute's mission of integrating historical, educational and technological resources to generate career opportunities in aviation and to increase public comprehension of aviation and general transportation issues.

Your participation ensures the continued upgrading of educational exhibits and expansion of programs affording students and the public greater involvement in transportation solutions critical to the nation's economy and quality of life.

To more effectively accomplish these objectives, the institute has studied its membership plan over the first two years of operation. A revision which both simplifies the system and is more practical based on surveys of other institutions will become effective next January 1st. The new plan reduces the number of membership categories from 11 to seven, adjusts dollar values and increases benefits accordingly, as shown in the chart below.

When you become a member, your tax deductible contribution supports:

- Installing new interactive exhibits and maintaining existing ones.
- Conducting education tours and producing study guides for school grades K-12.
- Providing cooperative financial support for the degree program alliance with Menlo College.
- Supporting the educational forum series.
- Sharing in general operating expenses.

We are grateful for your participation in our continuing effort to increase the contribution of aviation to the global society.

–Dr. William B. Roberts, Director of Development

Membership Application

BECOMING A MEMBER OF THE HILLER AVIATION INSTITUTE MEANS YOUR ARE PARTICIPATING IN THE GROWTH OF MUSEUM EXHIBITS AND OF EDUCATION CENTER PROGRAMS.

❑ Sustaining	$50	❑ Patron	$1,000
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Benefits	Founders Circle $10,000	Trustees Circle $5,000	Benefactors $2,500	Patrons $1,000	Directors Circle $250	Supporting $100	Sustaining $50
Membership card for free unlimited admission with the following number of guests	7	7	7	5	5	3	1
Subscription to **Briefings** newsletter	✓	✓	✓	✓	✓	✓	✓
Institute decal	✓	✓	✓	✓	✓	✓	✓
Merchandise discount in Flight Shop	20%	20%	20%	15%	15%	10%	10%
Name plate on Donor Wall plaque					✓	✓	✓
Membership certificate for framing	✓	✓	✓	✓	✓	✓	
Name plaque on Donor Membership Wall	✓	✓	✓	✓			
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BRIEFINGS

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John Straubel
Publisher
Dr. William Roberts

Check our website for future events and membership information: www.hiller.org

Acknowledgements and books available: German aviation and swept-wing history

The material in this special issue's article on German advances in high-speed jet aircraft development before and during World War II draws from a number of excellent books on the subject, some of which are available in the Hiller Museum Flight Shop. The article's primary sources are shown below.

Me 262 Stormbird Rising: By Hugh Morgan. Publisher: Osprey, Reed Consumer Books Ltd., London. Osprey Printing. (Photo, page 3 top: Me 262 and Me 163 restored at RAF base at Cosford in Shropshire. Ian Frimston).

Jet Planes of the Third Reich, the Secret Projects: By Manfred Griehl, Publisher: Monogram Aviation Publications, Sturbridge, Mass. (All photos page 2).

Luftwaffe Secret Projects, Fighters 1939-1945: By Walter Schick and Ingolf Meyer, 1997. Publisher: Midland Publishing Ltd., Leicester, England. (Illustrations, page 3).

Messerschmitt Me 163 "Komet": Text by M. Emmerling; Photos: J. Dressel. Published by Schiffer Publishing, Ltd., West Chester, Penna. (Photo, page 5, Japanese version of Me 163, J8 M1).

Wide-Body - The Triumph of the 747: By Clive Irving; Publisher: William Morrow and Co. Inc., New York, 1993. (Photos on page 5 of R.T. Jones and Boeing B-47 from NASA Archives and Boeing Commercial Airplanes).

The Aerospace Encyclopedia of Air Warfare: Published by Aerospace Publishing Ltd., London. Editors: Chris Bishop and Soph Moeng.

German Aircraft Industry and Production 1933-1945: By Ferenc Vajda and Peter Dancey. Publisher: SAE International, Warrendale, Penna.

Secret Messerschmitt Projects: By Willy Radinger and Walter Schick, Publisher: Schiffer Publishing Ltd., Atglen, Penna. (Plan view, page 5, P 1101)

A History of Aerodynamics: By John D. Anderson, Jr.; Published by Cambridge University Press, Cambridge, England; 1997.

The Me 163B Komet, Development and Operational Experience: By Albert C. Picirillo; Report, 1997 World Aviation Congress; SAE International.

Coming Events

Call 650-654-0200 for details

Saturday, Sept. 2: 10:00 a.m. to 2:00 p.m.

Reno Air Race Day

Inspect close-up those hot "unlimited" racing planes which make Reno's show one of the greatest in the world. Static displays on the Hiller Aviation Museum ramp.

Saturday, Sept. 9: 11:00 a.m.

Pan Am Clipper Day

"Hangar talk" with crew and historians about those fabulous Clippers. Main Gallery at the new China Clipper model built for museum by Ray Atkinson. (Story in BRIEFINGS Q2, 2000).

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