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Testing the First Supersonic Aircraft

Memoirs of NACA Pilot Bob Champine

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For further information about this remarkable man, access Robert Apger Champine on "Google".

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This group portrait displays typical high-speed research aircraft that made headlines at Muroc Flight Center in the 1950s. The Bell X-1A (lower left) had much the same configuration as the earlier X-1. Joining the X-1A were (clockwise); the Douglas D558-I Skystreak; Convair XF92-A, Bell X-5 with variable sweepback wings, Douglas D-558-I Skyrocket; Northrop X-4; and (center) the Douglas X-3.

MACHBUSTER

A Test Pilot Recalls The Early Days of Supersonic Flying,
Where You Either Broke The Sound Barrier or It Broke You!
By W.G. Williams, VAHS

In the mid-1940s a new type of aircraft burned holes in the sky over the western United States. These were research planes, aircraft that were built with government funds for the specific task of learning more and more about high speed aeronautics and about what pilots and designers could expect as airplanes flew faster and faster.

In the past, aviation experiments had been conducted by hardy entrepreneurs who had an idea and then set out to prove the worth of that idea so they could sell it. Rarely was there any government money involved in funding such projects and aircraft used on those missions were normally regular military or civilian types that had been modified for a special purpose.

Even military aircraft were commonly developed as private ventures by manufacturers seeking major production contracts. If the government liked the idea, they bought a lot of them and the company made money; if it didn't, the company lost money and, sometimes, disappeared.

With the quantum leaps in technology that the maelstrom of World War II brought on, it soon became clear that the costs of developing new aircraft were becoming too high to allow private companies to routinely take the gamble. Besides, much was unknown! With aircraft going faster and faster, they were encountering the effects of compressibility. Could this be overcome? How? What about the mysterious "Sound Barrier"? Was it something that could be broken or would planes continue to crash against the barrier, sending their pilots to their deaths?

Melodramatic perhaps, but remember, no one had ever flown faster than sound and lived to tell the tale. What was out there? Whatever it was had just killed Geoffrey DeHavilland, Jr., as he attempted to break the barrier in the new DeHavilland DH-108 Swallow. His death caused the British to completely drop out of the speed race and the questions remained unanswered.

It was these questions and the many others raised by the postwar discovery of the tremendous amount of research that had been underway in Nazi Germany that made the U.S. take action. German scientists had been designing and testing planes without tails and planes with wings that were swept – both forward and backwards – plus planes that used rocket engines for propulsion and planes that had dozens of other strange and possibly wonderful advances. Were the Nazis crazy or might they have been on to something, or lots of somethings?

With those questions in mind, the U.S. government did something very different. It contracted for some airplanes. That in itself was not unusual. The unusual part was that these aircraft had no obvious purpose other than expanding our knowledge of aeronautics. The contracts specifically stated that the planes were not to be considered prototypes for fighters or bombers. Their range was often absurdly short and their carrying capacity was minuscule. Their sole purpose was to explore and document the unknown. Some were designed to just go fast. Some were designed to explore these funny new wings that were bent to the rear. One was designed to test the feasibility of planes without tails, and still another was a direct copy of a German plane that was to make use of wings that could have their sweep angle changed in flight.

Furthermore, the program wasn't just the result of a single good salesman getting a contract for his company. The contracts were spread around. Bell built the X-1, the X-2 and the X-5; Douglas built the X-3 and both phases of the D-558; Northrop built the X-4; and North American eventually developed its fantastic X-15.

As these new research aircraft came out they caught the public's imagination. Airpower had achieved a new importance when the dawn of the nuclear age ended World War II. Now these research programs promised to keep America on the leading edge of technology. Most of the popular magazines of the day devoted both covers and space to the futuristic aircraft and the men who flew them. They made good copy.

The whole concept was exciting. The movies and novels of the day promoted the danger with heroic test pilots going to their death, their planes pummeled by the dreaded sound barrier. *Into The Unknown* was a popular film of the era, and for the next ten years the American public had something new on which to focus its attention, and it was a program that got results.

The Bell X-1 (known at first as the XS-1) proved that the sound barrier could be broken. The Douglas D-558 project was to compare straight wings and swept wings at high speed and, eventually, the Phase II aircraft in the project exceeded Mach 2. The Bell X-2 pushed the speeds even higher; the X-3 explored the use of low aspect ratio wings, inertial coupling, the use of titanium, and led the way to the development of the Lockheed F-104 interceptor; and the X-5 proved the potential of variable geometry wings and led quickly to the short-lived Grumman F10F and later to the F-111, the B-1 and the F-14 Tomcat.

Another unique characteristic of the research aircraft program was that it had a variety of sponsors within the federal government. Although commonly thought of as an Air Force project, the research planes actually had several backers. The X-1 was contracted for jointly by the U.S. Army Air Corps and NACA (the National Advisory

Committee on Aeronautics, the predecessor of today's NASA, the National Aeronautics and Space Administration) and while the first example was being flown by pilots from Bell and the Army, NACA sent the second bird back to the factory for major changes to the cockpit layout.

The Navy also was involved with the research program. It contracted with Douglas to build two types of aircraft that initially were to be identical, except that one would have straight wings while the second would have its wings swept at a 35 degree angle. As in many government contracts, later changes actually made these two aircraft very dissimilar. However, the Navy's program encountered a major problem that kept its aircraft from capturing the public's imagination, unlike the competition from their military brethren, and that was simply their designations. While the Air Corps/Air Force gave their planes the extremely sexy designation of "X-whatever", the Navy's two birds labored under the tongue twisting and distinctly unsexy monikers of "D-558 Phase I" and "D-558 Phase II". The Douglas PR people tried to help by labeling the planes the Skystreak and the Skyrocket, but they never caught the public's attention like the "X" planes.

The first major hurdle for these aircraft was to exceed the speed of sound and return to a safe landing. Air Force Captain Charles E. (Chuck) Yeager was the first to accomplish this feat while flying Bell XS-1 #46-062 on October 14, 1947. At the time, the event was considered to be such a significant accomplishment, that the fact that Mach 1 (the technical term for the speed of sound) had been exceeded was declared "Top Secret" and was not acknowledged until reports were leaked to the press several months later. Since then the story of that first flight has been told repeatedly in articles, books and movies. Now, over forty-three years later, most people uninterested in aviation history have little or no knowledge of early research aircraft other than the X-1 and virtually no name recognition for any of their pilots other than Yeager.

In addition, most of what has been written about these exotic flying machines primarily covers the cold, statistical facts of how often they flew, what speeds were reached on what dates, what types of engine they had, their length and span and other types of technical minutiae. Relatively little has been reported about what it was like to climb into one of these weird birds and try to fly them.

Robert A. Champine, who retired after a long career as the head of the pilot's section of the Research Flight Division at NASA's Langley Flight Test Center, was a young pilot fresh out of the Navy when he was hired by NACA as a pilot to fly P-51s. After a few months at the facility in Virginia, he was given the opportunity to go to Muroc Air Force Base in California to fly the X-1 and the D-558s.

Flight test center at Muroc Dry Lake was hot and, since it was miles from the nearest town, univorm regulations were lax. Here, for example, members of the ground crew gather for a group picture with the second model of the X-1.

Although the Bell X-1 was a small plane, it was stressed to take up to 18Gs because the designers had no idea of what forces would actually be encountered in transonic flight. Since the aircraft sat low on the landing gear, getting in and out presented no problem while the plane was on the ground as shown by Bob Champine, but getting into the craft while it was in the bomb bay of a B-29 in-flight was a bit more difficult....

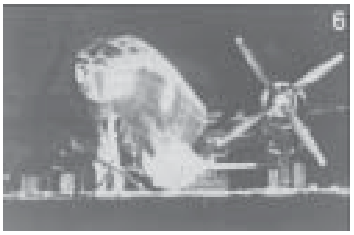
The test pilot fraternity meets to discuss the problems that they encountered flying the new research plane. Here, in front of the X-1 and its mother ship are (left to right) NACA's Bob Champine, USAF Captain Chuck Yeager, and NASA's Herbert H. Hoover (the first civilian to exceed the speed of sound.)

Because the door was placed directly in front of the sharp wing leading edge, exiting in an in-flight emergency would have been impossible. Fortunately, a bail out was never required, but the close confines of cockpit are evident in photo 4.

As one of the handful of pilots who have had experience in flying America's exotic early research aircraft, Bob was recently asked to recall and share some of his experiences and tell what it really was like to be a pilot in the world's fastest planes at the dawn of the jet age.

When Champine got out of the Navy and applied for a flying job at Langley, NACA officials tried to talk him into coming aboard as an engineer or a scientist, since he had a degree in aeronautical engineering from the University of Minnesota. Wanting to fly, he declined, holding out for a pilot's position. In the event that such a slot might not be available, he had covered himself by signing up to attend a VA-sponsored helicopter school at the Sikorsky plant in Connecticut.

Loading the Bell X-1 aboard the B-29 mother ship to be carried aloft required that the research ship be lowered into a pit and the B-29 then rolled over the smaller plane so that it could be hoisted into its bomb bay. Later, a system of hydraulic jacks was used to raise the mother ship.



Since the winds over Muroc Dry Lake picked up early in the day, most flights were made in the early morning requiring the ground crews to work at night. Here the B-29 mother ship, with the Bell X-1 tucked neetly into its bomb bay, is bathed in harsh spotlights as it waits for dawn.

"Melvin N. Gough and Herbert H. Hoover were the pilots' supervisors in those days and I didn't meet the requirements to become a test pilot when I applied at NACA. You had to have 1,000 hours of total flight time and I had 993. I told them that I planned to join the naval reserve as soon as I got out of the regular Navy and I would quickly be able to get those last few hours to comply with the rules. Since Mr. Gough had also been a naval reservist before World War II, I was told, 'Don't worry about it, you're hired'."

Champine went to work for NACA in December 1947. "Langley had over 40 airplanes and I was assigned to flying the P-51s that had wing-flow models and balances attached to their wings. These were miniature models mounted above the thickest part of the wing so that the drag, lid and pitching moment forces on the models could be measured by optical balances. The technicians would install different airfoils, wings with different sweeps and different configurations on these models and we would fly the P-51 up to around 30,000 feet, put them into a 25 or 30 degree dive and go up to the limiting Mach number for the aircraft (about .72 or .73) to generate near supersonic or transonic flow over the wing. This was a way of getting high-speed flow and data from models. In the late 40s, wind tunnels were still not capable of doing this.

"We also had about a dozen P-51s outfitted with different models and different gloves, as they were called, over the wing bay. The pilots would take them up, turn on the instrumentation, dive them, come back and land. After the film from the optical balances had been developed and the engineers had measured the deflections on the film to generate the aerodynamics of the models, we'd do it all again. It was considered dog work and, as the 'new guy', that was my assignment. New people always catch the stuff that nobody else wants to do…but I was tickled pink."

One of the first research aircraft Champine flew was the Bell L-39, one of two built for the Navy. Its wings were swept 35 degrees and its leading edge slats could be bolted on over different span lengths. Champine absorbed a great deal of aeronautical information flying this aircraft which was especially valuable when he flew the Douglas D-558-II that incorporated slats on similar swept wing of 35 degrees, and he recalls that the L-39 flew extremely well.

Since the X-1 program had actually started at the NACA laboratory at Langley, Herbert Hoover, Langley's head pilot, had been the pilot-in-charge. After the Bell pilots flight demonstrated the XS-1, Hoover and Chuck Yeager started to expand the speed envelope to and through the sound barrier. Later, Hoover decided to pass the program on to another pilot and Howard C. Lilly from the NACA facility in Cleveland went out to Muroc. Champine met Lilly at a New Year's Eve party shortly after Bob joined NACA. Only three months later, Lilly was killed in a crash of the D-558-I when the engine failed, severing all of the craft's control cables.

"Mr. Hoover went back to flying the X-1 while still working here at Langley. When he needed to fly the X-1, he would take the C-47 that we had and fly it out to Muroc. The next day, after a rest, he'd get in the X-1 and perform the required flight; the aircraft would then be grounded and he'd come back to Langley until it was made ready for the next flight.

"When Lilly was killed, Hoover made a circuit of the NACA laboratories, looking for a test pilot to take over. When he couldn't get any of the old timers, he got down to the new boys. There was only one other new fighter pilot at Langley besides me, John Harper, and he didn't want the job. Everybody else's experience was in either B-25s, B-29s or PBYs, but all those guys were married and had children.

"There was a lot of spookiness about those research airplanes, one man had already been killed! There was a different way of flying the research craft and they were quite awesome for those days. Nevertheless, when they

finally got around to me, I said, 'Yes!' But, since my experience level was pretty low, I asked to be checked out in the airplanes that we had at Langley to build up my base of experience. Much to my surprise, they agreed.

"In addition to the P-51s, they had P-47s, a P-80, one of the first F8F Bearcats, and the L-39, which was a P-39 that had been modified with swept wings and fixed landing gear. Only the nose gear retracted because the wings were handmade. I was just dying to fly that one.

"There were multi-engined airplanes there, too, that fascinated me. We had two C-47s we used to maintain our IFR proficiency. We also had two B-29s and, although I had trained on patrol boats in the Navy, I was interested in learning to fly a larger four engined land plane. My training for flying the research airplanes out at Edwards involved all these things. In the meantime, Mr. Hoover kept going back out to Edwards in the C-47 and continued flying the X-1."

As Champine prepared to move to Muroc, he spent a lot of time in the sweptwing Bell L-39. Its original program had largely wound down and the airplane had become a hangar queen. Because he was going to check out in it, NACA assigned mechanics to the thing, who brought it back to life.

"It was really a nice airplane. Its wing was swept 35 degrees and it had various configurations of slats that could be added to the leading edge. These slats were just bolted on in different span lengths; they could be put inboard, outboard, or full span; they could be opened or closed. You could learn to fly a lot of different configurations that way and it was a marvelous opportunity to learn to fly sweptwing aircraft.

"It was also a marvelous opportunity to see what happened when you put flow control on a swept-wing; in other words, what happened when you had the slats open vs. having the slats closed. I developed a whole series of flight tests for my own benefit and later this served me very well in flying the D-558-II which had slats on the same 35 degree wing. I enjoyed flying the L-39 a lot: it flew great!

"As a side note, my friends were still in a Navy squadron over at Norfolk; so often, after having arranged for a rendezvous by telephone, I would fly some aircraft over and meet them at a certain place at a certain time. Once I found out that they were practicing carrier landings. Since I didn't have much to do, I joined them in the pattern with this weird swept-wing airplane and shot a few carrier landings. They thought that was really neat and it gave me landing experience which was valuable in my own little training program. But I didn't tell my boss or anybody what I was doing. It's only now, more than 40 years later, that I can tell the story.

"My introduction to swept-wing flight had a few surprises. At very, very high lift, particularly without the slats, or with the slats mounted on the inboard side, the thing would pitch-up terribly. As you increased the angle of attack, you had to keep pushing the control stick further and further forward instead of pulling it back, and this is indicative of very bad stability. That particular plane flew quite well in that it always responded properly to the controls, but at high angles of attack, the neutral trim point of the control stick was always moving forward. Then it was unstable. Outside of that, it was a very nice airplane to fly."

In mid-1948 Bob Champine moved to the California desert test site at Muroc Air Force Base, which later became famous as Edwards Air Force Base. Chuck Yeager had exceeded the speed of sound months earlier and supersonic flight was becoming more of a common thing. Nevertheless, there was a lot to learn and the very first research planes, the X-1 and the D-558-I were still the workhorses. In addition, the site was being used by dozens of company test pilots as they tried to get the bugs worked out of their own firms' aircraft. Sharing the lake bed with the research fleet were such exotic prototypes as the Convair XF-92, the Lockheed XF-90, the Northrop XB-35 and XB-49 flying wings, and the uniquely parasitic McDonald XF-85.

While these military prototypes had two sets of test pilots, the company test pilots and the military test pilots, the research fleet had an added pilot from NACA and that's where Bob came in.

Since there were two X-1s, either could have been first through the sound barrier. Bob recalls that the flight program for NACA's X-1 (S/N 46-063) was several months behind the military because Herb Hoover had some serious objections to the craft's cockpit layout and he told Bell that it was unacceptable. He insisted that it go back to the factory to be modified and that change required about three months. As a result, the military plane had the lead in the race through the barrier.

The military 6062 was never modified and the records show that the military pilot who flew 6062 had lots of difficulties monitoring certain gauges and operating some of the different valves. Champine recalls that 6062 continually had fires and lots of other problems, whereas the cockpit-modified 6063 flew for many years and few of its pilots ever had any trouble. It was a very worthwhile modification even though it did mean that 6063 with Hoobert Hoover aboard did not exceed the speed of sound until several months after Chuck Yeager first did it in 6062.

Once on location, Bob's first opportunity to fly the X-1 came on November 23, 1948, and after a couple of familiarization flights, he pushed the X-1 through the sound barrier for the first time.

"My reaction was that it was a piece of cake. There was no problem; it was very easy to do. I was told that when I got to Mach 1, I should operate the controls through their full deflections. That meant I was to move the controls to full nose up, full nose down, full right roll, full left roll and to kick the rudders just to satisfy myself that the shock waves at Mach 1 left some control but that they were relatively weak at that speed. Since other guys had done it before me, I didn't worry too much and it was pretty much like they said it would be.

"It's true that there was a little tiny bit of buffeting and a little tiny bit of wing dropping, or rocking laterally as I went through the speed of sound, but it was quite controllable. Although at Mach 1 the controls were not very responsive, as soon as you got through Mach 1, good control response returned because then the wing was all in supersonic flow; the shockwave was attached to the leading edge and the controls were in nice flow again; whereas when you were going through the speed of sound, the shock waves danced on the control surfaces and caused the loss of control. Being in a P-51 in a steep dive with the controls shaking would be of far more concern to me than being in the X-1."

Image 1. The Douglas D-558 Skystreak was another of Champines mounts. He remembers it as flying well up until Mach .75, with good, stable handling and climb, but as soon as the shock waves hit above Mach .75, it became difficult to control. Designed by Leo Devlin, it had a flight duration of only 30 minutes on its kerosene type fuel, all of it stored in synthetic rubber-lined wing tanks. On May 3, 1948, test pilot Howard Lilly was killed shortly after takeoff, when the Skystreak's engine compressor disintegrated and one of the turbine blades cut through the plane's control cables.

Images 2 and 3: In the early days of high speed flight, sophisticated pressure and anti-G suits had not yet been developed. As a result, the pilots basically strapped a parachute on over their work clothes, grabbed a helmet, and went flying. In these photos members of the ground crew are helping Bob Champine into the cockpit of the Douglas D-558-I Skystreak for a test flight.

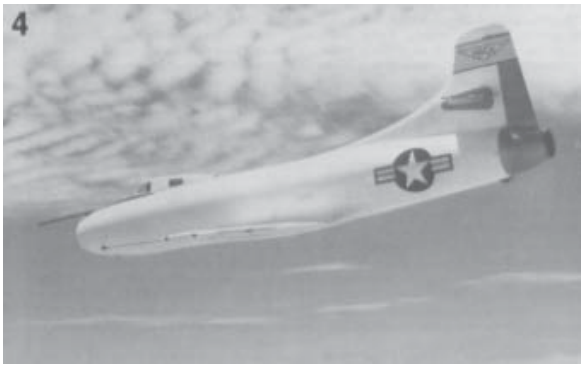


Image 4: The Douglas D-558-I Skystreak was designed to explore the high subsonic flight realms and did so quite economically for several years. Of the three examples built, two are presently on display. Note the family resemblance to the Douglas F3D Skynight and the AD Skyraider. The tail surfaces are almost identical, while cockpit canopy served as a model for that of F-104.

Although the first transonic flight didn't have many surprises, Bob reports that: "The first subsonic flights of the X-1 were just one thrill after another. Just dropping out of the bomb bay was a big thrill the first few times…a tremendous thrill…and it was scary. After you did it three or four times, though, and went back to the office and sat down and thought about it, you realized that it was a really cool way of getting airborne with a heavy and dangerous load of fuel. With an airdrop, you were able to start at around 25,000 feet and you didn't have to go through the takeoff and low-altitude climbout where, if you had a problem, you couldn't do anything about it. But, with an airdrop, if you had a problem after you launched, you could jettison the fuel and glide down to the lake bed. We became very ho-hum about it. It was very routine.

"We did not consider it very dangerous at all. In fact, my salary reflects that. I was out there flying those things on a salary of $2,600 a year and my lifestyle was very austere. I lived in a barracks and it was difficult for me to own an automobile. These barracks were very much like World War II soldiers' quarters; I think that Chuck Yeager may have complained about those living conditions in his book.

"The flights were considered just routine. It was a very ho-hum, eight hours a day kind of operation…for the pilots, anyway. However, you have to realize that in the California desert the wind picks up around noon and so we had to come in early in the morning to do our flying. As a result, the crew preparing the X-1 usually started loading L-O-X (liquid oxygen) and alcohol around midnight. It was a very slow thing because they had to cool down the aircraft like they do on the shuttle today. The loading of the fuels took a long time and the instrumentation guys came in really early to check out all the instrumentation to make sure everything worked and to install fresh batteries and film. Once the fueling started, only essential personnel were allowed next to the airplane, because if the L-O-X and the alcohol got together, there was an immediate explosion. Alcohol spillage of any kind was a dangerous situation.

"Once the aircraft was available for the pilot to go on board, it was very matter of fact, a "Let's go fly today!' kind of operation. After I had been flying out there for about six months, I got a two step raise so I guess I was doing my job. I didn't ask for the raise; I was just delighted to be one of the flyers. I was like a kid with a new toy.

Image 1: The three Bell X-1s were built to explore control forces at Mach 1; the next three second generation Bell research aircraft the X-1A through X-1D, were built to investigate aerodynamic forces beyond Mach 2 and above 90,000 ft. They were larger and technologically improved, with thinner airfoils. It was in the Bell X-1A, on December 12, 1953, that Chuck Yeager experienced his wild ride as depicted in the film The Right Stuff. At Mach 2.4 and an altitude of 70,000 ft, the aircraft suddenly rolled out of control and began tumbling for 36,000 ft. It eventually went into an inverted spin, knocking Yeager into semiconsciousness. Fighting the controls, he managed to pull it out at 30,000 ft. After this, high speed flights were no longer undertaken in the X-1A, although it did reach an altitude of 90,440 ft. in August 1954.

Image 2: Bell X-1D had short career, just one flight. On July 24, 1951, its nose gear failed during landing.

Image 3: Bell X-1E was notable for much shorter, thinner wing than its predecessors. On August 31, 1956, it reached a top speed of 1,480 mph.

"The pilot actually entered the X-1 from the B-29 and we usually did that about 5,000 feet above the ground. That altitude had been chosen because, if you screwed up the works, from there you could get released from the B-29, jettison your fuel and still make a landing.

"Visibility through the canopy was very bad, but it was an increment better than looking over the nose of a P-51 on landing, and it was considered to be acceptable for those days. I thought it was even a little bit better than an F-4U Corsair. When you were at low speeds and high angles of attack coming around for a carrier landing in the Corsairs that I'd been flying, you simply couldn't see over the nose and had to look over the side. The X-1 was flown the same way.

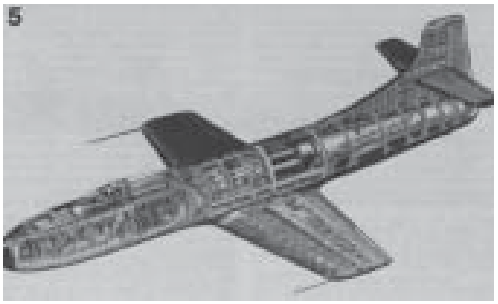
"However, when you were making an approach in the X-1, the dive angle was relatively steep because 220-250 miles per hour was the normal glide speed and the nose was down quite a bit. It had a good glide though. It went a long ways, but when you flared and raised the nose for the actual touchdown, you couldn't see.

"The X-1 was very, very maneuverable. The only place it was deficient was from Mach .95 to 1.01, the transonic range where the controls were not very effective. At high subsonic speeds it was an excellent plane. I can remember Chuck Yeager doing slow rolls in it during his glides.

"When the X-1 was being carried to launch altitude by the B-29, there was always an intercom to communicate to the B-29 crew. When you got into the X-1 and put on your helmet and oxygen mask and got all settled, you would report that you had done so to the aircraft commander in the B-29. The radio communication was a part of the procedures that covered the safety aspects of everything.

"On one memorable flight, we were climbing to launch altitude, around 25,000 feet, and suddenly, I couldn't communicate anymore. I had lost all contact with the bomber. I checked all my connections and they did the same thing at the other end, but we couldn't find the problem.

"Since we were very close to the drop altitude, I took my knee pad card and turned it over and wrote on it: "Secure the drop!" Now, I'd been in the Navy and to a Navy man, to 'secure' meant to stop doing something. I held this up and showed it to the men, forgetting that it was an Air Force crew. The crew chief assumed that 'secure' meant that even though I couldn't talk, I was all set up to drop.



Images 4 and 5: While flying aircraft like the Bell X-1 and the Douglas D-588-I Skystreak, Bob Champine was paid a salary of approximately 50 dollars per week. Built of 75S alloy aluminum, the Skystreak pictured here and in a cutaway was fitted with an air conditioner to cool cockpit temperatures to 100 degrees during high speed runs. The first Skystreak was completed in January, 1947, with the first flight taking place four months later on May 28th.

Image 6: Skystreak as it appeared before installation of V--type windshield, as shown in Photo 4 and drawing No. 5.

"As I sat in the X-1, I could see that the guys were getting ready to drop me. Well, I'm holding this card up and hollering at them and making noises as though I really don't want to go and all of a sudden I heard this little 'pop' as the bomb shackle broke loose and I was flying. Man, I wasn't ready to go anyplace and they're saying, 'So long, Bob! Have a good trip.'

"On that flight, it took some extra time but I did get everything set and I was able to run the rocket engines, do the flight card and make a successful flight out of it without talking to anybody. I still don't know why the radio didn't work.

"Later, as a result of that incident, I insisted that we install wiring for a light system. A red and green light appeared on the flight deck controlled from the cockpit of the X-1. If the aircraft commander had a red light, he needed to check before dropping the plane; if the light was green, he knew the test pilot was ready."

The impression many laymen have of these early research flights is that the pilots just fired the rockets to see how fast they could go as they tried to set new records with each flight. In practice, each flight was fully planned out with a specific speed goal and a preplanned set of experiments to conduct. "At every little speed increment, we had

to operate the controls to measure the rolling velocities, pitching velocities, and yawing angles at each of these Mach numbers."

"Keep in mind that when you ran the engine to maintain fairly high speeds, you didn't have much fuel. With one rocket chamber firing, the fuel usually would run out in ten minutes. If you fired three chambers, you could barely get through Mach 1 and you were out of fuel in about four minutes. With all the chambers firing, the flight was really short. After 13 flights in the X-1, I had only logged 1.2 hours! You had to accelerate, stabilize on your Mach number, do your maneuvers and by then you were out of fuel. You'd have to glide down, land, refuel, come back up again and do the same thing at a slightly higher speed. We made those flights repetitively to measure the flying qualities that could be found at the different Mach numbers."

In addition to flying NACA's X-1, Bob Champine was also responsible for taking up where Howard Lilly left off when his Skystreak crashed. Bob's Skystreak, which has been restored and is on display at the Marine Corps base at Cherry Point, North Carolina, was the last of the three to be built. The Skystreak (covered in the September 1985 issue of Airpower) was a straight-winged, jet powered research craft that was designed to explore high subsonic speeds. Although before Yeager's machbusting flight in the X-1, the Skystreak held the world's speed record, only exceeding Mach 1 on one occasion, when Douglas test pilot, Gene May, got it to Mach 1.01 in a dive on September 29, 1948. Its highest speed in level flight was actually Mach .99 while being flown by NACA's John H. Griffith almost two years later, on June 13, 1950, during its last flight.

Bob remembers the Skystreak as, "a very small plane with a very tight cockpit. It was fun to fly and it flew very well up to about Mach .75. It was easy to become very comfortable on takeoff and climb outs and it had a good rate of climb, around 10,000 feet per minute, which was astronomical in those days, but the high Mach number characteristics were terrible. As soon as it got a shock wave on the wing, it had wing drop, control buffeting and shaking, and a feeling that it just wasn't going to go any faster. You could go into steeper and steeper dives and it just shook harder and harder and became increasingly difficult to control."

"When I landed on one of my earlier flights in the Skystreak, I had trouble seeing through the windshield, it seemed to have streaks on it. Now the windshield of that plane fit very, very tightly against my helmet (the only helmets we had in those days were military hard hats and they were really pretty big) and I realized that the problem was that the paint on the helmet was being rubbed off on the inside of the Plexiglas. To solve the problem, I stripped all the paint off the helmet and glued chamois skin onto it so that it wouldn't scratch the inside of the windshield."

"The Skystreak was a very small airplane that was fitted awfully tight to the pilot to cut down on the drag. In fact, you had to kinda scrunch down and pull your neck in to read the instruments; when you did that, you couldn't see outside and when you saw outside, you couldn't see inside. The smallness of the airplane was very dramatic…very claustrophobic. I was bigger than I should have been to be flying it."

"It had an axial flow jet engine on it with a good thrust-to-weight ratio. Even so, it started out slowly and accelerated slowly. We made all of our takeoffs on the lake bed for safety reasons, since it would allow us to roll as far as we needed. Outside of the fact that it had a small, confined cockpit, the Skystreak really was a neat plane."

"But like all the rest of these planes, it had minimum fuel. In fact, it had tip tanks available and, if we wanted to work at high altitude, we would use those tanks to climb until they were dry, jettison them and then climb some more. We didn't use the tip tanks on most flights, just because they were an extra expense and required extra time to install."

"A typical flight in any of these planes was to explore handling qualities at high speeds through control displacements. We had chains that had one end hooked onto the control stick and the other to the side of the cockpit and we would abruptly displace the control by pulling the stick against the chain. We could adjust the chain for one quarter, one half, three quarters and full deflection. While flying, we'd have to get down in the cockpit and rig up these chains and the deflect the control abruptly against the stop and then hold it until the airplane did its response and then you could bring it back to neutral and disconnect the chain and go to the next point."

"We would fly at certain altitudes and certain speeds in order to plot out the control deflection vs. speed…particularly in the transonic regime. Knowing how quickly the airplane would respond to certain deflections could be equated to flying quality criteria and, as we got toward Mach 1 or transonic speeds, we could see that the aircraft did not respond as well. Wing dropping, as we called it, was caused by a shock wave dancing on the wing or the control surfaces; it would wiggle the controls, making the aircraft begin to rock or oscillate. In spite of trying to correct with the controls, we couldn't keep its wings level."

"That reaction was important to know because it seriously affected the gun-aiming capability of any airplane. Good handling and flying qualities were vital to aircraft design, and learning about these problems was the purpose of these research aircraft."

"To document these responses, we had on-board recording equipment with just a bit of telemetry for the basic things like altitude and speed. The typical pilot's reactions on these kind of maneuvers was limited to saying, 'Well, gee, it really didn't roll very good', or, 'There was a terrible amount of buffeting after I deflected the control', or, 'When I did the pull-up against the chain, there was a pitchup and it was difficult to control.' Those comments from the pilot were always sought after, even if they weren't very scientific."

"The second phase of the Douglas D-558 program was popularly known as the Skyrocket. Originally conceived as a Skystreak with swept wings, the Phase II changed dramatically, until it appeared at its rollout as a needle-nosed crab that looked more futuristic than many of those drawn in comic strips. Like the Phase Is, three Phase II aircraft were built and flown by Douglas, Navy, Marine and NACA test pilots. Originally powered by jet engines and employing a regular takeoff like the Phase I, engineers soon saw that more power would be required."

"Since the NACA Skyrocket, S/N 144 was delivered to us as a brand new airplane that had never been flown, I had the privilege of making the very first flight. It only had a Westinghouse J-34, a puny little engine that didn't have much thrust."

"Gene May, the Douglas pilot, had been flying the earlier example of that airplane and by this time, his had a rocket engine installed in addition to the jet. Each one of its rocket's four chambers put out 2,000 pounds of thrust, whereas on the X-1 each chamber only put out 1,500 pounds.

"I was never allowed to fly that airplane, since its flights were for company development tests and for the Navy. If the Navy wanted specific runs done, they were done in that airplane or the third, which came along later."

"With only that small jet engine in it, 144 was not supersonic. Later, after I left, they installed a rocket, dropped it from a Navy B-29 (PB-1W), and eventually it reached Mach 2. Today 144 is hanging in the National Air and Space Museum in Washington, D.C."

"When I flew the original 144, we had to use two JATO bottles to get it going fast enough to take off. When the flaps and the gear were down, it would not get airborne with just the power from that jet. I would run on the lake for about a mile to get it going as fast as I could and then fire the JATO. With the JATO, I could just get enough speed to take off and retract the landing gear. Getting the gear up would give me enough extra speed to let me retract the flaps, and by then the JATO would run out. I'd dump the JATO bottles at the end of the lake and then it

would finally fly. It was not very enjoyable. (It had been demonstrated on the company airplane that four JATO bottles could be used. Using two was a compromise between what we needed to get us going and the need to keep costs down. If we had used four, it would have cost twice as much for the JATO bottles)."

"Subsonically, it didn't fly too badly…except that in the landing configuration it had a terrible Dutch roll. In fact, on my first approach and landing, I wasn't sure that I was going to make a landing and survive. It would continually roll plus or minus 15 to 20 degrees for a period of about two seconds. Although I was constantly moving the aileron right behind it, I was probably amplifying the problem. I learned that if I punched it a couple of times with the ailerons to stop the roll, it would settle down by itself. When I leveled out in a straight flight and raised the nose for touchdown, then the dampening became pretty positive and it stopped…it was kinda scary for a while. I briefed every guy who flew it after me and said, 'You're not going to crash. You'll control it…in the end…right before landing. But you'll have serious doubts until that point.' We got used to it, but it was never very comfortable.

"There was one other bad thing about that airplane. At high altitudes and at high angles of attack, it had a very violent pitchup. If you pulled up and got it to 4 or 5 Gs, it would suddenly stall in such a manner that the lift distribution on the wing would cause it to pitch-up violently. It would go to extremely high angles of attack, between 45 and 60 degrees, and then it would start to roll violently, so the aircraft became completely and totally out of control – just spinning around in the sky."

"The people who were responsible for these aircraft were scared to death and they criticized me very severely the first time this occurred. They said, 'You never should have let it happen. You're supposed to be a good enough pilot that these things don't happen.' But when they got a look at the instrumentation, everybody was terrified, because all the instruments were going bananas. Other pilots explored that area again and experienced the same problem; the airplane was simply out of control. Once you fell into it, you had no way of controlling it. You just had to ride it out until you eventually were falling nose down in a spin."

"Once you were able to unstall the wing with nose-down elevator, you just used opposite rudder and it would recover in a vertical dive. It was just a matter of sitting there until it stabilized in a spin. You then used spin recovery techniques and it would recover and come out of it. It wasn't all that dangerous except for the fact that the

The much improved, swept wing Douglas D-558-II Skyrocket was originally designed to take off under jet power and then use onboard rockets for high speed runs. When the first planes were delivered, the rockets had not yet been installed and the first test flights were made on jet power alone. Unfortunately, the engine originally installed could not even provide takeoff power and so JATO bottles had to be used. Although capable of using four JATO bottles, in the cash-strapped period following World War II, the NACA crews only made use of two bottles per flight to save money. Champine made the first flight in the Skyrocket, before it was fitted with rocket engine.

pitchup was a brand new problem caused by shock waves on a swept wing. Later airplanes, particularly the F-100, experienced this same problem."

"Now you have to remember that not much was known about shock waves at that time. While scientists in the wind tunnels understood what shock waves were, they didn't know how to handle them. In diving the P-51s with models on the wings, we could look out on the wing and see what was going on. If by chance we were in a certain orientation to the sun, we could actually see the shock wave. The light was dispersed in some manner so a shadow was cast through the shock wave and, as we would maneuver to adjust the dive angle and hold our speed, we could watch the shock wave moving around on the wing. This was a whole new thing and people used to say, 'Aw, you're crazy! You're not sure of what you're seeing.'"

"But we were seeing the real thing! On today's jet airliners, if the sun is oriented just right, a passenger can look out on the wing and see the shock wave. Although the sun has to be just right to cause this shadow, the shock wave is there all the time."

"Research airplanes were great in terms of opening up a lot of new ideas on controllability at transonic speeds and that was the name of the game. When they designed the Century Series fighters, these research planes had given designers a lot of information to go on in terms of controllability, stability, shifts in stability and shifts in tailplane orientation. All the Century Series had movable stabilizers because the research aircraft found that when you move the horizontal stabilizer at high Mach numbers, the controllability was excellent whereas moving the elevator didn't do anything. That led to the development of the all-flying tail surfaces for elevator control."

"A lot of other things were learned, too. Airfoil shapes became thinner and thinner. The two X-1s, 6062 and 6063 had airfoils of different thickness and the drag that was noted on the thicker airfoil made us realize that we needed thinner airfoils in the supersonic regime. Since so much was learned with those first ones, we went on to develop other research airplanes, like the X-3, the X-4, the X-5, and the X-15. The X airplanes did contribute a great deal to improving the knowledge of transonic flight."

"These later aircraft offered dramatic changes in design philosophies. I was on the mock-up boards and participated in making decisions about their design and operating procedures. Although many of these were not good flying airplanes, they resulted in aeronautical knowledge that allowed the industry to build some good airplanes."

"The early research airplanes continued to be flown for quite a long time. Other pilots, like John Griffith, Scott Crossfield, Stan Burchard, and a whole array of others came along after me and flew the same basic airplanes configured a little differently, with thinner wings or more tail surface or something else that was intended to improve the aerodynamics."

Bob Champine was at Muroc less than two years before he requested a transfer back to flying duties at Langley. His reason for the request: boredom!

"I wanted more flights. Flying the research airplanes was a big deal but, when you consider that in over a year I flew only 13 flights in the X-1 and seven or eight flights in the D-558-1 and maybe six or seven flights in the D-558-11, that's not much. Although I was the only NACA pilot at Muroc, they just couldn't turn the flights around any faster with the personnel, equipment, and funding available. Remember, this was just after World War II and the thin allocations from Congress just didn't cover much."

"What I did the whole time I was at Muroc wouldn't even represent one month of flying back at Langley. There we had 25 or 40 active airplanes and a lot of projects to fly. If it had not been for flying the C-47 and the C-45 on our

regular flights to Los Angeles and the flying I did with the naval reserve, I would not have even been able to keep current. I just didn't feel as though I was contributing anything."

After his return to Langley, Bob Champine went from the world's fastest aircraft to the slowest, in that he became a specialist in helicopters and V/STOL aircraft and active in turbulence and vortices studies. He participated in the space program and was the first test pilot to test the Lunar Landing Module that eventually would take Neil Armstrong and Buzz Aldrin to their historic rendezvous. Bob Champine did not actually fly to the moon, but without his expertise and the dangerous flights he and many others made on the threshold of space, there would not have been a moon flight and aviation might still be stalled at the sound barrier, trying to discover a way through it and beyond the stars.

Norm's Note: Bob Champine, my friend and former co-owner of a classic Cessna 190, died on the 100th anniversary of the Wright's first flight, December 17, 2003, in Newport News, Virginia. He will be missed by all, but his legacy endures.

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VAHS Researcher Requests Aid

Life Member Jim Caiella, of Richmond, has been researching for a book he is writing on the history of the Virginia Air National Guard. At this time, the book consists of two parts; the history of the men and women of the Air Guard and the history of its aircraft.

A large portion has been written, but there are significant gaps, primarily in the early years until the acquisition of the unit's F-105s in January 1971. A major goal is documenting each of the aircraft that flew with what is now the 192nd Fighter Wing. To date, he has verified the serial numbers of more than 200 aircraft. Again, there are gaps, especially in the B-26 era and among the ancillary support aircraft. Caiella noted that he had an unverified report of a Constellation in Virginia Air Guard markings. Can anyone provide solid evidence of this?

In support of this research, he has created a web site that, in part, features the VaANG. The main site is : **www.Caiella.org**, but the main page for the Air Guard portions is at: **www.caiella.org/BasePages/Aviation/192FW.html.**

Caiella is interested in talking to anyone and everyone who may have information that would be of interest to readers of such a book. He is also looking for photographs of the aircraft, especially those with little documentation, and from the unit's deployments.

Please contact him either by phone at (804) 741-0656 (home) or e-mail at **caiella@aol.com**.