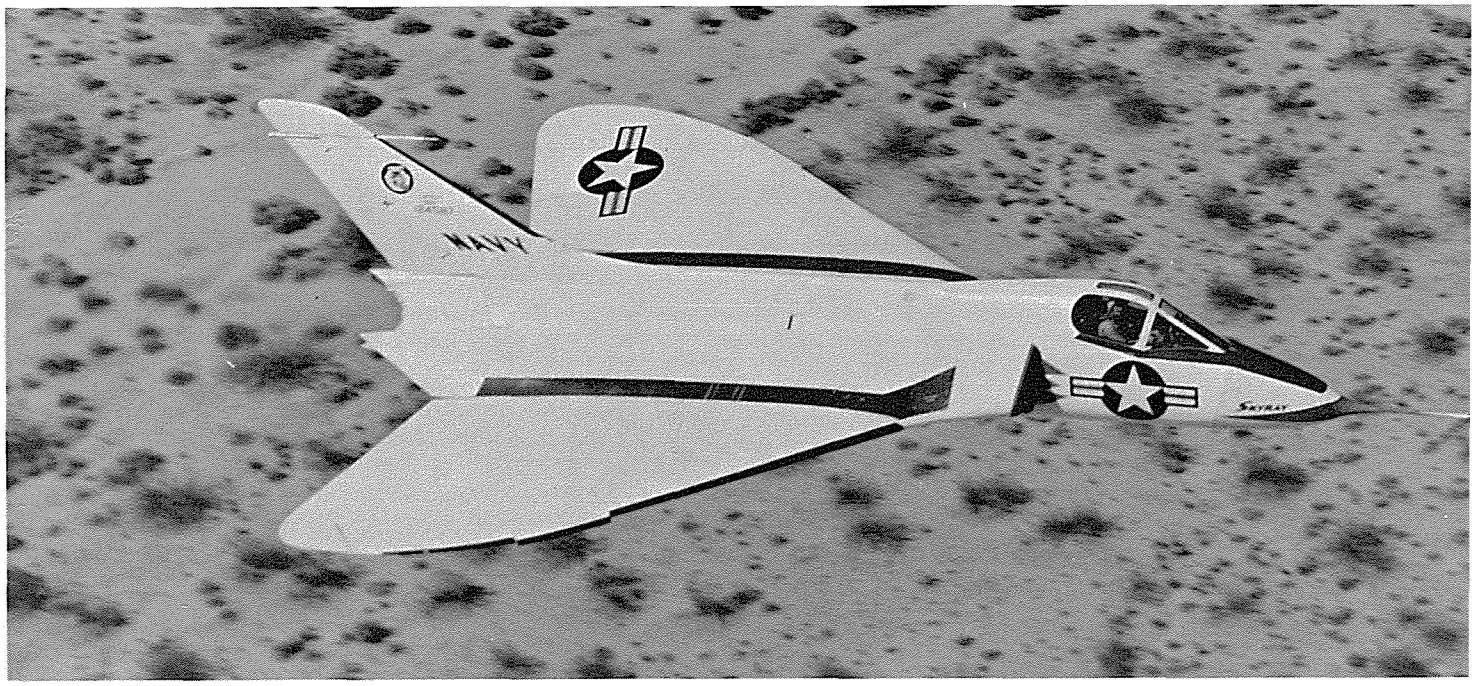


Seven world record flights were made by the Douglas F4D-1 Skyray . . . an airplane that was originally intended to be the Navy's first "flying wing" interceptor.

DOUGLAS F4D-1 SKYRAY RECORD FLIGHTS

By NICHOLAS M. WILLIAMS

INTRODUCTION

With the end of World War II, Navy planners were faced with a serious problem: that of Fleet defense. The tremendous technological advances that had been spurred by the war were beginning to take form in new Russian jet bombers, which clearly made the traditional forms of carrier defense obsolete.

To combat this new threat, the Navy began looking into the possibilities of designing a small, fast-climbing, jet interceptor with good high-altitude performance to destroy any approaching enemy bombers. Rate of climb would be emphasized above all else. The design mission assumed that the carrier's radar had detected an approaching enemy bomber flying at 40,000 feet at 500 knots. The interceptor was required to climb to this altitude in less than five minutes, and maneuver at full afterburner to destroy the bomber in another five minutes. Writers of the day promptly dubbed this "the 10-minute killer mission."[1]

After initial studies had been completed, the Navy picked the El Segundo Division of the Douglas Aircraft Company to design and build the new interceptor. At first glance this choice of manufacturer would seem strange, for the El Segundo Division's fighter experience was limited to the XFD-1 biplane fighter of 1933, the XFT-1 monoplane of a year later, and the rather stodgy F3D-1 Skyknight, then going into production.

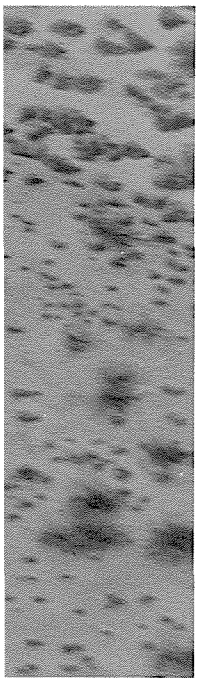
But the El Segundo design team, as would be shown a few years later with their A4D-1 Skyhawk, had a penchant for novel designs. The F4D-1 Skyray resulted. And although it would achieve mixed success in its design mission, the Skyray was to set no fewer than seven world records for both straight and closed courses and time-to-climb. The story of these record-making flights—as well as the planning, preparation, and practice that went into them—is not without disappointment and failure. But although it was to suffer more than its share of problems during a relatively short service life, the Douglas F4D-1 Skyray was well ahead of its peers in design and performance.

DESIGN HISTORY

The story of the Skyray's design goes back to June 17, 1947, when the Navy signed a contract with Douglas El Segundo specifying a design study and engineering data for a delta winged jet interceptor.[2] The Navy's Bureau of Aeronautics, Fighter Branch, was interested in the practical applications of what was then known as the "Lippisch Principle"; the various advantages of the delta wing planform over the more conventional fighter designs of the day.

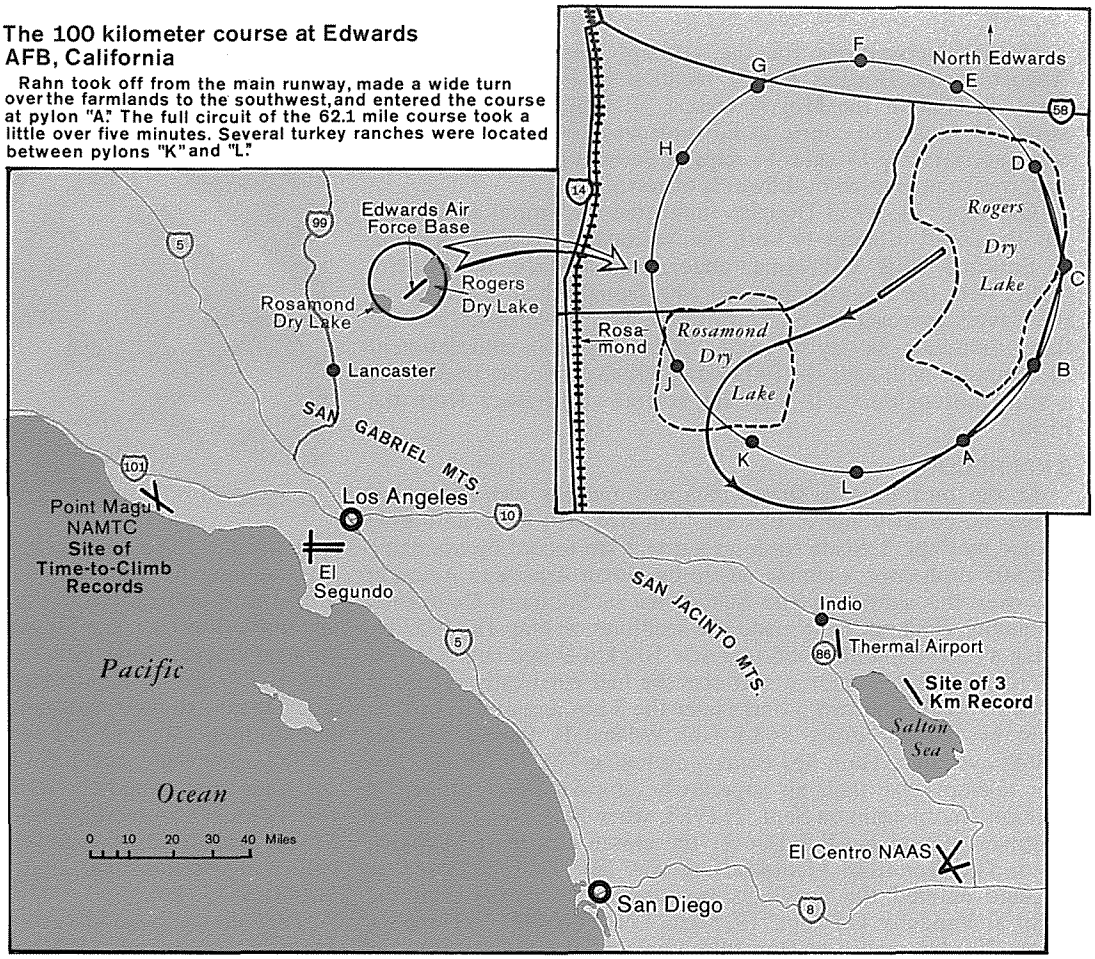
The Navy's interest in low aspect ratio delta wings for a fighter had been stirred by the analysis of German data captured at the end of World War II. The United States had sent a team of technicians to Europe to bring back all possible technology acquired from the various German technical institutions. Gene Root and A.M.O. Smith, aerodynamicists at the El Segundo plant, were part of the Naval Technical Mission in Europe in 1945. Upon discovery of Dr. Alexander Lippisch's work with tailless designs, Root and Smith had a long-standing interest in "flying wings" renewed.[3]

The El Segundo Division of Douglas Aircraft Company had been investigating tailless aircraft since the late 1930's, when Jack Northrop had been with the company. When Northrop left El Segundo in 1936 to form his own company in nearby Hawthorne, Douglas engineers carried on these investigations into high aspect



The 100 kilometer course at Edwards AFB, California

Rahn took off from the main runway, made a wide turn over the farmlands to the southwest, and entered the course at pylon "A." The full circuit of the 62.1 mile course took a little over five minutes. Several turkey ranches were located between pylons "K" and "L."



Map by Peter Mersky.

ratio aircraft. Although these "flying wing" designs had almost no effect on the outcome of the Skyray, Douglas designers were well prepared to recognize the advantages inherent in the "Lippisch Principle," once spurred on by the Navy contract.[4]

In any event, the Douglas design team, headed by Chief Engineer Edward Heinemann, applied the German data to their own studies and began an extensive wind tunnel program. Robert G. Smith made the original layout and arrangement drawings. The initial result was a very low aspect ratio flying wing, with the pilot sitting near the leading edge under a small canopy. However, in order to house all of the components within the wing it was necessary to thicken it to the point where, as speeds approached the "sound barrier," the drag rise was not much different than with a conventional swept wing aircraft.

A series of designs evolved over the next year, as wind tunnel data came in. Step-by-step, the wing was gradually made thinner and a fuselage was projected forward containing the cockpit. An enlarged fillet was placed between the wing and fuselage behind the "aerodynamic shadow" of the intakes to carry the fuel tanks.[5]

In its final form, the Skyray turned out to be quite unique. Although commonly referred to as a "delta," the F4D's rounded wingtips and swept trailing edges made the wing more conventional than seemed apparent. Full span "elevons" served as both elevators and ailerons. Longitudinal trim was accomplished by wedge-shaped pitch trimmers, located inboard of the elevons on the trailing edge of the wing. Due to the high angle of attack upon landing that was inherent with a "delta," a unique four-wheel undercarriage was designed using a small retractable tail wheel to absorb landing shocks.[6] Although having a wingspan of only 33 feet 6 inches, the Skyray's wing area was an amazing 557 square feet, giving it a lower wing loading than other contemporary fighter aircraft. The final F4D planform was selected in 1948 and a contract was awarded for two prototypes, Bu.Nos. 124586 and 124587, to be designated XF4D-1.

Power for the new interceptor was to come from the new high-thrust Westinghouse J40-WE-6, developing 7,000 pounds of thrust, and upon its development, the afterburning version -WE-8, of 11,600 pounds. However, the manufacturer was having serious setbacks in perfecting this engine, and an interim engine, the 5,000-pound thrust Allison J35-A-17, was installed for the maiden flight. On Jan. 23, 1951 Douglas test pilot Larry Payton lifted off the desert floor at Muroc (Edwards AFB) in the first prototype XF4D-1, Bu.No. 124586.[7]

A rather protracted period of flight testing followed over the next two years with the two prototypes at Edwards AFB. This was due to some significant flight problems caused by the advanced nature of the Skyray's design, and by the fact that it was grossly underpowered with the Allison engine. Eventually, both prototypes were re-engined with the J40-WE-6 and the test schedule resumed at a faster pace. The afterburning J40-WE-8 did not become available until mid-1953, but by that time it had already been decided (in March) to switch to the Pratt & Whitney J-57 for the production aircraft.[8]

So, by the summer of 1953, Douglas had its two prototype XF4D-1's busily accumulating flight time. The first, "586," was at Patuxeant River, Maryland, preparing for carrier qualification tests aboard the USS Coral Sea. The second, Bu.No. 124587, was

Bob Rahn, 32-year-old Douglas experimental test pilot in record-breaking XF4D-1 Skyray, Bu.No. 124587. This aircraft only Skyray to have sliding canopy. Douglas Aircraft Co. via Robert O. Rahn

Actual preparations for the attempt were started in mid-August at the Douglas testing facilities at Edwards Air Force Base, located in the Mojave Desert 70 miles north of El Segundo.[11] Since the course at Edwards was Air Force property, it was necessary for Douglas to request permission for its use. This, too, was soon granted by Edwards officials.

On Sept. 14, 1953 Douglas submitted its formal application for the speed attempt to both the National Aeronautic Associa- at Edwards AFB, California, undergoing stability and control flights with the recently installed J40. Douglas had just received the Navy's approval for a change to the J-57 powerplant, and the first production Skyray was still a year away from completion at El Segundo. Although the F4D was gradually showing itself to be a true thoroughbred, it was still several years away from the Fleet.

3 KM RECORD

In the meantime, a flurry of speed records were being set across the country and in Europe.[9] On Nov. 19, 1952, an F-86D piloted by Capt. J. Slade Nash set a new 3 km record by averaging 698.505 mph over a course set up by North American Aviation Co. over the shores of the Salton Sea in Southern California. Jacqueline Cochran next made the headlines on May 18, 1953 by flying a Canadian-built F-86 to a new 100 km closed course speed record of 652.337 mph at a course she had personally set up at Edwards AFB. Just two months later the 3 km record was broken again by the Air Force as Lt. Col. William F. Barnes flew his F-86D over the Salton Sea course, averaging 715.7 mph. To further re-emphasize their air superiority, the Air Force broke the 100 km record again on Sept. 2, 1953, when Brig. Gen. J. Stanley Holtoner piloted his F-86D over the closed course at Vandalia, Ohio. The American record-setting was cut short, however, as England entered the headlines two and a half weeks after the flight at Vandalia. On Sept. 19, Sqdn. Leader Neville F. Duke set a new 100 km record at Dunsfold, England by piloting a Hawker Hunter to a 709 mph average.

Thus, in little less than a year, five new records had been set at the 3 km and 100 km distances alone. As reports of other aircraft and countries' preparations for record attempts became known, the aviation world became charged with the excitement of competition. The stage was set for the Navy and Douglas to step in with the Skyray.

It's uncertain as to how long the Navy or Douglas had been thinking about breaking the world air speed record with the Skyray. Robert B. Smith, a Douglas engineer, had the continuing job of determining what world records any El Segundo-designed aircraft could set. As today, whenever someone wished to try for a speed record and have the results officially recognized, they had to notify the world governing body for all air speed records, the Paris-based Federation Aeronautique Internationale (F.A.I.), pay a sanction fee, and submit the aircraft to an official inspection team to insure that it conformed to the rules that separated the various classes of aircraft. The course also had to be certified as being accurately laid out. In the United States the F.A.I.'s representative, the National Aeronautic Association (N.A.A.), and its officials timed and recorded the speed attempts made in this country. If successful, the speeds or times were forwarded to the F.A.I. for official registration.

In any event, sometime in the late Summer of 1953 Ed Heinemann decided to try for the 3 km record. This relatively short (1.86 mile) straightaway course had long been recognized as the "classic" event by which aircraft were compared. The highest average in four passes was considered the world's "absolute" speed record, as opposed to other records for class of aircraft used or distance around a circular course.

Heinemann wired the Navy's Bureau of Aeronautics for their approval, which was soon granted. The record attempt would be a joint effort of the Navy and Douglas. Cdr. Vic Rowney was assigned as the Navy Project Officer for the attempt.[10]

tion and the F.A.I., requesting that official observers, timers, and their equipment be furnished at the course at Edwards.[12] Shortly after this, however, North American Aviation Co. also submitted an application for the 3 km record try. Upon learning of the Douglas intent, North American officials naturally felt that their new F-100 should have been given the first chance at the record. The Skyray, so their reasoning went, had not been fitted with the afterburning J40, and had yet to exceed 650 mph. The YF-100, on the other hand, had been equipped with the afterburning J-57 for some time, regularly flying in the 750-mph range. However, the National Aeronautic Association insisted that Douglas and the Skyray had the right to make the first attempt by virtue of their earlier application date, and that they could keep this priority until Oct. 15, 1953.

The Skyray's record attempt was to be flown by Lt. Cdr. James B. Verdin, age 35. Verdin had been a Navy combat pilot in World War II and Korea with over 100 missions to his credit before becoming a Navy test pilot. Hollywood could not have come up with a more photogenic choice. Boyishly handsome, Verdin looked the part of a test pilot, and the Navy took full advantage of this in publicity photographs and films of the event.

But the more immediate chore of getting the F4D ready for the speed runs fell to veteran Douglas test pilot Robert O. Rahn, 32. Bob Rahn, born in Harvey, Ill., but raised in Dayton, Ohio, had joined the Douglas Testing Division in 1945 after serving as an Air Force fighter pilot flying Spitfires in North Africa. After 104 missions, Rahn was assigned to Wright Field's Special Weapons Branch. There he flew B-17's, B-24's, and B-25's before being transferred to Fighter Flight Test, where he piloted the long-range P-47N and P-38L. In all, Rahn had over 3,500 hours to his credit in 60 different types of aircraft, including the original developmental stability and control flights with the Skyray. Tall and handsome in his own right, Rahn was to play an invaluable part in the development of many Douglas aircraft.

By mid-September, the afterburning J40-WE-8 was finally installed in the F4D, and the record attempt was scheduled for Saturday, Sept. 26. Rahn made the first unrestricted afterburner flight on Sept. 20. To everyone's surprise, this engine worked flawlessly. After only a few test hops with the afterburning engine, Rahn flew the Skyray through the Edwards 3 km course at low altitude. Bringing the F4D down on the deck at military power, he lined up the aircraft with a long strip of black asphalt that recently had been applied to the desert course to aid visibility. As a further aid, old tires had been piled at either end of the course and ignited, and tall plumes of coal-black smoke rose for hundreds of feet. As he approached the entrance, Rahn fired the afterburner and quickly accelerated to over 700 mph. The desert floor just 100 feet below sped past in a blur as the F4D started buffeting as it approached the speed of sound.

To Rahn at that moment, the experience was terrifying! "I

Lt. Cdr. Jim Verdin in his record-breaking XF4D-1 Skyray. Several weeks after his record flight, Verdin flew first prototype Skyray during carrier qualification trials aboard the Coral Sea. Douglas Aircraft Co. via Lee Saegesser, N.A.S.A.

said to myself, 'What the hell am I doing here?' " An instant later the Skyray suddenly yawed uncontrollably and skidded violently off the course. Rahn quickly cut the afterburner and climbed for altitude, testing the controls for response. After a safe landing had been made the cause of this yaw was soon discovered. The metal shroud covering the Skyray's small tail wheel had peeled back into the airstream during the high speed run.[13]

While Rahn was conducting these preliminary flights over Muroc, the Douglas Flight Test crew were preparing what was hoped an ideal flight plan for the record try. Prior to each flight the aerodynamicists worked out the flight pattern and time, depending upon the current temperature and weather conditions. At the conclusion of each afternoon's practice flights, Douglas technicians often worked until midnight developing motion picture film of the Skyray's instrument readings taken during the runs. These pictures were used in preparing flight plans for the following day's flights.[14]

Over the next couple of days Rahn flew five more high speed flights through the course at Muroc, determining the proper handling technique and the number of seconds of allowable afterburner time. During these speed runs it was necessary to fly the airplane with a fixed longitudinal trim setting. This was due to the rapid acceleration and deceleration of the aircraft with the afterburner on or off. The pilot couldn't take time to worry about trim while flying at these speeds. This resulted in a "tuck under," or nose down trim while flying at maximum speed in afterburner, and a nose up trim condition while using military power in the turns. The odd result was that the pilot had to exert a pull force on the stick while in level flight and a push force during the steeply banked turns.[15]

Handling the airplane in these turnarounds was also tricky. Stringent F.A.I. rules prevented the aircraft from exceeding 500 meters (1,640 feet) in the turns. At the speeds being flown by the F4D, the afterburner had to be cut off the instant it passed out of the course, and the aircraft banked around in a wide, low turn. This rule was originally intended to stop aircraft from diving into the course to gain speed. For the Skyray, however, this maneuver would have been futile. The airplane was flying at its maximum speed near the "sound barrier," and the effects of compressibility quickly brought the Skyray back to the "Vmax" as drag rise took effect. As it was, the 750 mph speed took the F4D-1 many miles beyond the course in a five mile diameter turn!

The number of seconds needed for afterburner operation was a critical aspect to the success of the record try. Every pound of fuel carried by the Skyray was crucial to its speed. If the afterburner were turned on too soon before entering the timed portion of the course, the aircraft would reach its maximum speed before entering and waste fuel. If it were applied too late, the F4D-1 would still be accelerating after it had entered the "traps," and the average speed would be correspondingly lower.

To get as much fuel as possible into the Skyray's tanks, the Douglas crew piped the JP-4 through coils immersed in alcohol packed with dry ice. This reduced the fuel temperature to about 35°F., which also reduced its volume.[16]

During this period in which Bob Rahn was testing the Skyray with its new engine, Cdr. Verdin was assigned an F9F Cougar from NAAS El Centro. He flew this airplane over the course several times to locate and familiarize himself with the various landmarks.

After only one hour and 55 minutes of flight time in the afterburner-equipped Skyray, Rahn turned the airplane over to Cdr. Verdin on Friday, Sept. 25. Up to this date, Rahn's best unofficial speed over the 3 km course was a 737 mph average, bettering Duke's recently set 100 km record by some 18 mph. Unknown to them at the time, however, was the fact that on the same day in 103 degree heat in the Libyan Desert, Britain's Mike Lithgow had officially flown the same speed over a 3 km course. Piloting a production Vickers Supermarine Swift with a cockpit packed with dry ice, Lithgow had broken his countryman's record with a 737.3 mph average.

Back in the Mojave Desert, however, Cdr. Verdin used this Friday to make several high speed familiarization flights in the F4D-1. He felt ready for the attempt Friday afternoon, so the go-ahead was on for the scheduled try the following day.

Unfortunately, a 35 mph wind developed on Saturday, kicking up clouds of sand so thick that the visibility was questionable and the turbulence dangerous. To assess the situation, Verdin and Rahn flew over the course in a company Navion and decided to cancel the flight.

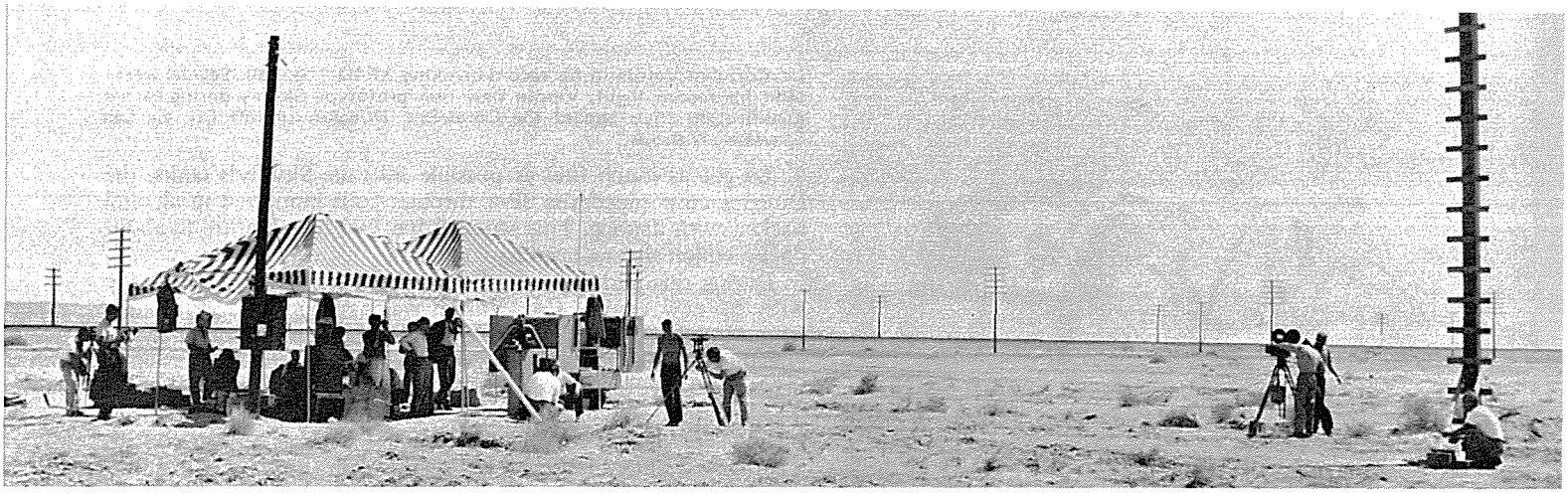
A conference was called that afternoon, and it was decided to take advantage of predicted higher temperatures in the Salton Sea area, some 140 miles south of Edwards. North American Aviation Co. graciously gave Douglas permission to use its privately owned course, along with timing equipment and technicians.

Douglas Testing Division personnel and their tools, along with the National Aeronautic Timers and their equipment, were flown overnight to the El Centro Naval Auxiliary Air Station, 40 miles south of North American's course, and were set up and ready for the runs by noon Sunday. This was no easy feat. In addition to the Douglas mechanics, technicians, engineers, and administrative personnel that had to be moved, there were the N.A.A. officials and timers, and a battery of "impartial observers" that were required to witness the attempt. Stationed at various points along the course, these observers were required to sign notarized statements as to the height of the Skyray during the run. Also helping the Douglas crew with the preparations for the flights were personnel from both the Air Force Flight Test Center at Edwards AFB, and the 6511th Parachute Development Test Group at El Centro.[17]

Verdin, meanwhile, left for El Centro in his F9F, while Rahn had the job of ferrying the F4D to the station. Before landing at El Centro, Rahn flew the Skyray through the course at maximum speed. As the Salton Sea course was actually below sea level, some 2,600 feet lower than the one set up at Edwards, there would be an expected rise in the indicated airspeed of about 25 mph. It would be interesting, he thought, to find out the effects, if any, this would have on the handling of the F4D.

The results were better (or worse) than he had expected. Rahn located the course, and as he was accelerating across the east end of the sea, a pronounced yaw developed at about 5 mph below the maximum speed. While trying to determine what was causing the yaw and whether or not it could be trimmed out, the F4D skidded across the sea to the west side! Although a couple of additional flights were made the next day to try to find out what was causing the problem, it remained a bothersome but acceptable mystery and Verdin decided to take the aircraft as is for the record attempt, now re-scheduled for Monday, Sept. 28.

It was at this time that the Douglas crew learned of Lithgow's attempt at the 3 km record. This was rather disheartening news as



A black and white tent which protected N.A.A. timers and equipment during Verdin's 3 km record attempt. Cameraman at right filming scene for Douglas-produced 16mm documentary, "New Wings for the Navy." Douglas Aircraft Co. via Los Angeles Intl. Airport Public Relations

Rahn's best unofficial run at Edwards was no faster, but it was decided to try again regardless since it was thought the Swift's record was still unofficial.

On Sunday afternoon, Cdr. Verdin made two practice passes over the course, but the F4D developed a fuel gauge malfunction and the Skyray was grounded while repairs were made that night. Monday's attempt was also canceled, however, due to a pitot tube that had to be sent to the El Segundo factory for repairs.

On Tuesday, Verdin managed to complete four officially timed passes, but not without further mishap. Flying the course late that afternoon, when the temperature was below 90 degrees, the first three passes were satisfactory enough: 748.4 and 746.9 mph on the downwind passes and 740.8 mph on the first upwind run. On the final upwind pass, however, Verdin made a sudden climb for altitude near the end of the course as the engine fluctuated due to fuel starvation to the afterburner. "The gauges did a little dance," Verdin later remarked to reporters, "and I thought I'd better head for someplace to land. But it settled down and flew just great." The slow last pass of 734.6 mph brought Verdin's average for the rundown to 742.7 mph. He had needed to make 744.6 mph to beat the British mark by the required 1%. However, as it was still not known that the Swift's record of 737 mph was officially recognized and the speed to beat, there was some agonizing decision-making by Navy and Douglas officials on whether or not to submit the 742 mph run as an official attempt.

There were several factors to be considered. The Navy and Douglas were both eager to submit the record attempt because it would be the first time in Naval air history that a carrier aircraft had held a world speed record. However, several other factors went against a decision to submit the attempt. It was all too apparent that North American was waiting with its F-100, and would probably beat the F4D mark on the first try. The Supermarine Swift was also preparing for another try at the distance, and Hawker was reportedly taking its Hunter down to the Libyan Desert to make another official attempt at the 3 km record. Despite these considerations, the fact that it was known that the Skyray could do better than the 742 mph average was the main reason why it was decided not to submit the speed as an official attempt.

The Americans were not about to give their British competitors any indications of their progress, either. Stated Rahn, "To add to the tension that was already prevalent at this time, trans-Atlantic telephone calls were being placed from London to El Centro and also from Paris, headquarters of the F.A.I., to Thermal, California, where the N.A.A. timers had set up their headquarters. Therefore, we knew that the British were closely following our progress. So, to add to the tension on the other side of the Atlantic, we refrained from giving them information as to what speeds we were obtaining or when we would make an official try." [18]

After the record attempt on Tuesday, Rahn flew the F4D back to El Segundo for minor repairs to the afterburner and to patch some tears in the wing skin and tail cone. The next attempt was rescheduled for Friday, when higher temperatures were predicted for the Salton Sea area. Douglas mechanics took advantage of this delay by completely reworking the aircraft. Every hole in the Skyray was sealed over, the wing slats sealed up, the arresting hook removed, and every protuberance smoothed out or removed. As Bob Rahn observed, "The plane was waxed and really looked like a 'racer'." [19]

Also during this brief intermission, Douglas and Naval personnel from El Centro combined forces to improve the course markings. As the course was laid out over hilly sand dunes and small arroyos draining into the nearby sea, it was impossible to mark it with a strip of asphalt as was done at Muroc. Because of this, Cdr. Verdin had some difficulty determining when to turn the afterburner on and off despite the use of smoke pots.

After discounting several schemes, Douglas, Navy, and National Aeronautic Association officials finally settled on a method that worked quite well. At either end of the course posts were sunk eighty feet apart diagonally to the flight path, and a red nylon material was stretched back and forth between them. Then, with a Navy helicopter and pilot borrowed from El Centro, 5,000 pounds of lime were dropped in a straight line at each end of the course. This helped Verdin eliminate the necessity of making any last-second directional changes. [20]

When rework on the Skyray had been completed at El Segundo, the pressure was on to fly the aircraft back to El Centro as soon as possible for the expected high temperatures on Friday. Again, the weather conspired to delay the record attempt. A thick fog had settled over the Los Angeles Airport, precluding any takeoff by the F4D. It was then a test aircraft in the Douglas Testing Division, and long-established procedure was that no test airplane would be flown in instrument weather. However, the tight schedule of the record attempt enabled Rahn to make his instrument climb through the fog, leaving behind many turned backs at the El Segundo plant. On the cross-country flight to El Centro, Rahn made another maximum run over the Salton Sea course in the cleaned-up Skyray, and the true airspeed he achieved was most encouraging!

In any event, the expected high temperatures on Friday never materialized. Although it reached into the low 90's, it was still too "cool" for an all-out attempt at the record. A temperature of around 98°F would put the speed of sound at approximately 792 mph. The F4D was going to need all the help it could get to set a respectable record, too, for the Douglas crew now learned that the Swift's record was official, and had to be bettered by the required one per cent. This meant that a speed of 745 mph would have to be averaged, and that temperatures around the 100° mark would be vital for a successful flight. The attempt was re-scheduled for the next day, Saturday, October 3rd.

Saturday morning arrived with dismal hopes for a record try. A wind began blowing and meteorological forecasts indicated that the winds would not diminish. Reluctantly, it was decided to cancel the attempt until the following Monday. Everyone had been working seven days a week for the past month, and morale was getting low in the desert heat. As the Douglas personnel were waiting for the company DC-3 to arrive at El Centro, however,

the winds began to slacken, causing a slight but definite increase in the temperature. At the Salton Sea a plot was made of winds and air temperature every half-hour. Not surprisingly, this clearly showed an increase in air temperature with the decrease in wind velocity. Encouraged by this turn of events, Verdin made a test run over the course in his F9F and reported that the turbulence was not excessive. Suddenly, thoughts of a weekend at home were shoved aside as an attempt at the world speed record was on!

While the temperature climbed toward 100 degrees, the F4D was hurriedly prepared for the flight. Rahn spent the last hour with Verdin in "solitary" in an empty room containing a couple of bunks, and sat and talked about things unrelated to flying.

When the temperature peaked at 98.5°F at 3 p.m., Verdin made his way out to the Skyray while Rahn and Douglas Test Pilot Quentin Burden each climbed into one of the red, white, and blue company Navions. The Navions were used to carry an official observer at each end of the course, circling to make sure that Verdin did not exceed 500 meters in the turns. Rahn's Navion also carried a Douglas engineer aboard, who kept track of Verdin's afterburner time during his passes over the course, and made a plot of his remaining fuel.

At El Centro, meanwhile, Verdin was strapping himself into the Skyray, which had been loaded with some 700 gallons of precooled fuel. Several mechanics spent the last moments polishing the Skyray's wings and fuselage to ensure the least air friction possible. Finally, the Skyray, with Verdin riding in the cockpit, was towed quickly to the end of the runway. Two white-overalled mechanics sat at the F4D's wingtips as it made its way past the El Centro flight line.

A portable starter was hooked up to the aircraft once it was stationed on the runway, and as the engine came to life the Douglas and Navy mechanics quickly backed away. Verdin checked the Skyray's instruments for a few moments and then eased the throttle forward. The Skyray slowly gained momentum and, after a long takeoff roll to save valuable fuel, was airborne at 3:22 p.m. Verdin headed north toward the course, and in only a few moments, brought the F4D up to full military power as the smoke from the burning tires came into view. While still several miles from the course entrance, he lit the afterburner and the F4D accelerated to its maximum speed just as he entered the traps.

To observers standing near the course entrance it was an eerie sight. The only sound was the hot desert breeze rustling the sagebrush, and the commotion of various observers as the call came over the radio: "Verdin is airborne!" Moments later the Skyray appeared silently on the horizon; a small white speck against the clear blue desert sky, trailing a faint wisp of smoke behind. The speck quickly grew as it approached at near the speed of sound. Suddenly Verdin and the Skyray had passed and entered the course, accompanied by a deafening roar as the afterburner rumbled and glowed and faded into the distance.

By unofficial watches, Verdin's first pass against the wind was a relatively slow 745 mph. Not fast enough in itself to capture the world record, but the downwind runs would more than make up for this.

As soon as Verdin passed the end of the traps, he cut the afterburner, rolled the Skyray into a steep 70° bank, and made a wide, level 180° turn that took him several miles beyond the course. Each time the F4D shot through the course and started its turnaround, Verdin radioed his remaining fuel to the engineers so that an accurate plot of his fuel situation could be made. There was a real concern that he might not have enough fuel left to make it back to El Centro.

Verdin's next three runs through the course went as smoothly as the first. The Skyray seemed to be performing well, but only the official's photos and measurements would tell if a new speed record had been set.

Exactly 20 minutes and 25 seconds after taking off, Verdin set the Skyray down at El Centro 3,450 pounds lighter, as it had burned approximately 575 gallons of fuel during the brief flight.[21]

After exchanging congratulations, Verdin, Rahn, and some of the Douglas crew flew from El Centro aboard a company DC-3 to the Thermal Airport, 30 miles north of the speed course. Here, National Aeronautic Association officials were beginning the tedious process of developing the films taken of the flight. They had to measure the pictures and compute the Skyray's speed using slide rules, magnifying glasses, and a comptometer. This was done in a dingy back room of the airport office building. As darkness was approaching, a single naked 50-watt bulb burned over a small table where the timers had their equipment spread out. Broken glass lay by the windows and paint was peeling from the walls.

Observing this scene of tired and unkempt men huddled around the now-darkened room, Rahn later observed, "We appeared more like bandits dividing their loot rather than officials from the National Aeronautic Association figuring out a new world speed record."[22]

The computational process took nearly six hours, but the wait was well worth it. The photos showed that the Skyray had indeed broken the record. With passes of 745.075, 761.414, 746.053, and 759.499 miles per hour, Verdin had averaged a remarkable 753.4 mph to give the United States the absolute world speed record over 3 km!

By a curious twist of circumstances, the Skyray's absolute speed record lasted but a month, although its 3 km record remained unbroken for nearly eight years. As expected, within weeks of Verdin's flight, Lt. Col. Frank Everest, Jr., piloted the YF-100 over the same Salton Sea course, breaking the F4D's record. Due to lower temperatures, however, Everest averaged only 757 mph. This was faster than the Skyray, but not by the required one percent. Undaunted, North American officials took advantage of a little-known technicality in the FAI rules.[23] It was discovered that the FAI recognized the absolute speed record as the fastest average over *either* the 3 km or 15 km straight courses. A 15 km course was hurriedly prepared at the Salton Sea and Lt. Col. Everest set a new 15 km record of 755 mph. As this was faster than the Skyray's average it was recognized as a new absolute speed record.[24]

Remarkably, Verdin's 3 km record stood until August 28, 1961, when a Navy McDonnell F4H Phamtom II flew 902.7 mph over a course set up at Holloman AFB, N.M.[25]

100 KM RECORD

After Verdin's successful 3 km flight, everyone connected with the attempt took a much-needed rest over the weekend. The next Monday's activities would be back to business as usual: that of resuming the Skyray's busy flight test schedule at Edwards. Bob Rahn had a better plan in mind, though. As the F4D was in a "racer" configuration, it seemed to Rahn a waste not to try for the 100 km closed course record, too.

That following Monday, Rahn approached Donald Douglas, Jr., with the idea. Douglas saw no objections, and suggested that Rahn look into the possibility of using the 100 km course at Edwards AFB that had recently been set up by Jacqueline Cochran. Rahn flew north to Edwards in a company Navion, obtained the location of the course, and spent most of one morning spotting the pylons from the air.

Located at the north end of the Antelope Valley, the circular 100 km course was made up of 12 tall poles used as pylons. These were set equidistantly around Edwards AFB at 8.3 km intervals (approximately 5.2 miles), for a total distance of 100 km, or 62.1 miles. The east side of the course broadened the eastern end of Rodgers Dry Lake and proceeded north of the highway between the towns of Mojave and Boron, west to the west side of Rosamond Dry Lake, and continued south to the southern edges of both Rosamond and Rodgers Dry Lakes. The whole area was made up of flat, dry lake beds with shallow arroyos draining into them. It was largely unpopulated, except at the southern end of the course where there were a few large turkey and chicken ranches. These ranches, just northeast of the town of Lancaster, caused Rahn a bit of apprehension, but more on this later.

After satisfying himself that the course was indeed usable, Rahn telephoned Ms. Cochran at her ranch in Indio, Calif., to request permission to use it. She was in Japan at the time; however, her husband, Floyd Odlum, told Rahn that the course was available to anyone who wanted to use it.

Once again, Douglas requested permission from the Navy for an attempt on the 100 km record. The Navy was agreeable to the idea if it could be done with a minimum of delay to the testing program with the Skyray.

As this was to be another Navy record attempt it was assumed that a Navy flier would be chosen to pilot the F4D. Much to Rahn's surprise, however, a teletype was received from Bob Canaday, the Douglas-Navy liaison representative in Washington, D.C., stating that BuAer had approved Rahn as pilot. The last line of his message read, "Tell Rahn he owes me a beer." Said Rahn later, "Needless to say, I sent Canaday a case of beer posthaste to show my appreciation for what he and the Naval officers at BuAer had done to obtain the approval for me as pilot."[26] As far as is known, this was to be the first time that a "civilian" was allowed to set a world record in a military airplane.

Another application was submitted to National Aeronautic Association and FAI officials for the record try, now nicknamed "Operation Merry-Go-Round." The official timers and their equipment were once more on their way to Edwards. Whereas this was an attempt on a world class record, rather than the "absolute" one, the NAA/FAI required a sanction fee of only $150 from Douglas. If the attempt was successful, an additional registration fee of $150 was required.[27] Rahn was also told by the officials that he had to buy a "Sporting License" for the flight! "To this day," says Rahn, "I still don't know why I had to buy a Sporting License. I should think that my Commercial Pilot's License would have been sufficient but I have had $3 (the cost of the license) worth of fun just telling the story about it."[28]

During the next week Rahn made many practice runs around the course in an F3D Skyknight, saving valuable engineering flight test time on the Skyray. During these flights, Rahn built up a mental log of landmarks surrounding each pylon as they were very difficult to spot at the high speeds and low altitudes at which the course had to be flown.

At least one account of the record attempt stated that Rahn flew a circular path around the course in a constant 35-degree bank, but this was not so. In order to minimize the distance traveled between pylons, Rahn elected to fly directly from one pylon to the next, rounding each turn in a tight 70-degree bank. After banking around each pylon, Rahn would roll the Skyray back into level flight for the 15 seconds or so it took to reach the next pylon. He would then roll the airplane into another 70-degree bank and change course 30 degrees toward the next pylon, continuing in a counterclockwise direction around the course.

By FAI rules, Rahn was restricted to a maximum altitude of 100 meters. But, as in the 3 km flight, diving into the start of the course would have been futile as the drag rise would have quickly brought the aircraft back to its maximum level speed.

Finally satisfied with his flights in the F3D, Rahn made one final practice flight over the course in the Skyray. During these runs it was necessary for Rahn to secure his lap and shoulder belts as tightly as possible. Moving through the course at over 700 mph, the F4D was constantly shaken by rapid sharp jolts as it passed through the severe desert turbulence. After negotiating only half of the course at high speed, Rahn cut the afterburner and completed the remainder of the flight in military power. This was done because of the turkey ranches at the southern end of the course. It was discovered that the noise of the afterburner and the Skyray's loud shock wave literally scared the fowl to death!

Rahn encountered no major problems on these practice flights, and so it was decided to make an official try for the record on Thursday, Oct. 15. To help him spot the pylons a pile of old tires was stacked near each one and burned so that the dense, black smoke would mark the turns. In addition, two observers were stationed at each pylon; one to make sure that Rahn stayed outside of the pole, the other to flash a small mirror at the approaching plane.

The day of the record attempt turned out to be a relatively cool one, as the temperature slowly peaked at only 76°F. As the many officials, timers, and observers took their stations, the XF4D-1 was loaded with 640 gallons of fuel. Douglas test pilot Bill Davis took off in an F3D and circled the course as a "lamplighter," a signal to the observers at the pylons that the official flight was minutes away, and that the tires should be set afire.

As Davis rounded the course, Rahn sat in the Skyray's cockpit listening on the radio as Davis called out each pylon. When he reached the tenth one, Rahn started the Skyray's engine and was off the ground within a minute and 20 seconds. Rahn quickly brought the F4D to 600 mph using military power, making a wide turn to the southwest of the course. Then, while still several miles away from the first pylon, he lit the afterburner and rapidly jumped to maximum speed just as the first pylon was reached.

Rahn had no difficulty in negotiating the course. The day was beautifully clear and he easily spotted the mirrors, the smoke, and the pylons. Continuing through the course, Rahn's only real concern was in maintaining his speed through each turn. If he slowed too much while pulling the high-G turns, there was a possibility of "backing through" the Mach trim change. Had this happened, it would have caused increased control sensitivity, which would have induced a severe longitudinal control problem by inadvertent overcontrolling. It would have been more of a concern with higher temperatures, but the day was cool and the entire flight was made at speeds above this point.

As it was, the flight was uneventful. Overcoming his first reactions to the situation, Rahn later reflected, "Flying at this speed so close to the ground especially where longitudinal control is at its worst is quite frightening at first, but after two-thirds of the flight was over, I was fairly relaxed and wished that I could get more speed. I actually found myself trying to move my upper torso fore and aft trying to get more speed."[29]

The full circuit of the course took little more than five minutes. As he passed through the traps, Rahn pulled the Skyray up into a vertical climb and did victory rolls up to 10,000 feet before landing.

Upon landing, Rahn was congratulated by the crew and ground observers. They had timed the flight with stop watches, and after some quick calculations had determined that a new closed course speed record had easily been set. The flight had lasted a little over 10 minutes from takeoff to landing, consuming roughly 600 gallons of fuel.

The Douglas team's rejoicing was cut short, however, as the N.A.A. timers reluctantly notified the group that the official timing mechanism had malfunctioned, and that the attempt would not count. However, the flight was repeated the following day, Friday, Oct. 16, with complete success. According to the unofficial observers stopwatches, the second run was only .2 mph slower than the previous day's. The new official record established by Robert Rahn and the Skyray stood at 728.11 mph. This beat the previous record of 709 mph by a substantial margin, and gave the 100 km record back to the United States.

As fate would have it, this record flight would come with an unexpected, but certainly predictable, cost. The Douglas Aircraft Co. soon received a bill for $1,800 . . . for 450 turkeys that had been frightened to death by the Skyray's two full-afterburner circuits of the course![30]

Bob Rahn's 100 km record stood for over five years, but not because of any lack of aircraft capable of besting his speed. Rather, it seems to have been a combination of several factors. There was growing dissatisfaction in the aviation community over the outdated F.A.I. rules that required the courses to be flown at dangerously low altitudes at speeds never imagined decades earlier. Performance-wise, these records had little bearing on a fighter's true capabilities, as the turbojet was never intended to excel at low altitudes. Also, their measurement in ground speed rather than Mach number didn't give a true picture of a modern fighter's performance.

In any event, as far as is known, Rahn's 100 km record was the last one set at low altitude. With sophisticated radar tracking and timing devices, all record attempts could be flown at high altitudes where speed, as well as safety, could be achieved. Rahn's record was eventually broken on Feb. 25, 1959, when Gerald Muselli piloted a Dassault Mirage III to a 1,095 mph average, set at an altitude of 22,970 feet.[31]

WORLD'S ALTITUDE ATTEMPT

Not all of the Skyray's attempts at world records were success-

Robert Rahn streaks past the finish pylon on his second, and official, 100 km flight with average speed of 728 mph. Smoke of burning tires marks pylon A. Douglas Aircraft Co. via Robert O. Rahn

Robert Rahn taxis out to runway, Edwards AFB prior to record flight over 100 km closed course. Note Skyray's nose stripe has been painted over since Verdin's flight two weeks previously. Douglas Aircraft Co. via Robert O. Rahn

ful. In Dec., 1953, the Navy was apparently basking in the spotlight of the F4D's record-breaking flights two months earlier. So much so, in fact, that it was decided to try for the world's heavier-than-air altitude record of 63,668 feet, set the previous May by a British Canberra bomber.[32]

It appears that the Navy wanted to score a publicity coup by making the official announcement of still another Skyray record at the Wright Brothers Memorial Dinner, to be held on Friday, Dec. 18, in Washington, D.C. Cdr. Verdin was assigned to fly the attempt, even though he had never flown the F4D at altitude before. Thusly, a great deal of pressure was placed on the Douglas crew to produce results.

When the trial flights were begun at Edwards AFB by Bob Rahn, however, balky afterburner controls developed on the J40 and continued to cause problems. Fuel starvation and erratic running were to plague the Skyray for some time due to this. Although many high-altitude flights were attempted, Dec. 18 arrived with Rahn still unable to make the Skyray perform at altitude due to the afterburner fuel control problems. After an unsuccessful official altitude attempt on the morning of the 18th, it was decided to make one more small adjustment to the fuel control and have Verdin make a final attempt that afternoon.

It took several hours to locate the official observers in Los Angeles, and it was late in the afternoon before they arrived. Still more time was used for the necessary inspections of the aircraft by the officials. By the time everything was ready for the flight it was 15 minutes before sunset. To make matters worse, the sky had become overcast, a definite hazard to a high-altitude flight.

What happened next is best left for Robert Rahn to tell: "As Jimmy was being strapped in the cockpit, and I was giving him final instructions and advice, I felt that it was foolhardy to make an official attempt at this time and risk losing the aircraft. So I called Al Carder (Manager of Douglas Flight Test at Edwards) up on the ladder and the three of us held a 'secret' conference. We decided just to make a familiarization flight for Verdin. The reason for this secrecy was that considerable effort and time had been expended on the part of the official observers, and we didn't want to cancel without making some attempt. Also, the crew had made an all-out effort in order to prepare the airplane for its second flight this day, and we felt their disappointment would be keen."[33]

Good as their intentions were, this agreement between Rahn, Verdin, and Carder turned out to be unnecessary. Verdin could climb no further than 25,000 feet as the fuel control problems persisted and he was unable to light the afterburner.

UNOFFICIAL TIME-TO-CLIMB RECORD TO 10,000 FEET

As previously mentioned, the key point in the Skyray's design was its climbing ability. This was first officially demonstrated during carrier qualification trials in 1953 aboard the Coral Sea. Then, Cdr. Verdin flew the XF4D-1 to 40,000 feet in under five minutes to meet the Navy's contract requirements.

But although the Skyray was designed to be a fast-climbing interceptor, its ability at this was never really demonstrated until 1955, more than four years after its first flight.

In the early months of 1955 a series of highly publicized, unofficial time-to-climb records was being established by various Navy aircraft. These flights were timed from brake release to 10,000 feet and presumably served to emphasize the Navy's increasing air might. McDonnell's F3H Demon posted the best time at 71 seconds, being set in St. Louis on Feb. 13.[34]

At the time, Douglas was conducting routine stability and control flights with early production models of the F4D-1 at Edwards AFB. Late one Friday afternoon, a week after the Demon flight, Bob Rahn and Al Carder were sitting in Carder's office at Edwards discussing the next day's test schedule when the subject of the various time-to-climb flights came up. Somewhat puzzled, both men wondered what the other companies were trying to prove, since the Skyray, whatever its other failures, could surely take any climbing contest. After some discussion they decided to see what the Skyray could do in the event the next day "just for the hell of it," and without any special preparation to the aircraft they were then using for testing.

At dawn the next morning, Saturday, Feb. 19, Rahn streaked down the runway and pulled the F4D into a near-vertical climb, reaching 10,000 feet in just 56 seconds! Said Rahn later, "I had thought that my Thunderbird, in accelerating up to 60 mph in 10 seconds, was terrific, but acceleration of the Skyray was astounding as 160 mph was acquired in the same 10 seconds. I was so busy during the remaining 46 seconds after takeoff trying to fly a prescribed course on instruments that little reaction was felt on my part until the climb was terminated, and I looked back over my shoulder and saw the runway almost directly underneath 10,000 feet away. The climb performance of the aircraft at 10,000 feet was astounding as the aircraft was in a 70-degree climb and was going at a rate of 28,000 fpm."[35]

TIME-TO-CLIMB RECORDS

Though it was widely publicized, Rahn's flight was unofficial. And though it was obvious in 1955 that the Skyray could have easily broken the existing world time-to-climb records, an official attempt was not made for three more years. Then, in Feb., 1958, Douglas submitted a proposal to the Bureau of Aeronautics, Fighter Branch, requesting that an F4D-1 make an attempt on the four French-held records of 3,000, 6,000, 9,000, and 12,000 meters. These records had been set by Michel Chalard in a Nord 1405 Gerfaut 88 at Istre, France, on Feb. 16, 1957. Douglas engineering data indicated that the Skyray could take the records by a substantial margin. The Douglas engineers also hoped to set an entirely new record of 15,000 meters, nearly 50,000 feet.

Although BuAer had also received a "feeler" from Vought and their F8U-1 Crusader, it was evidently decided that the Skyray stood a better chance to break the French marks, as Douglas received permission to proceed with the attempt.

The Chief of BuAer, Rear Adm. Robert Dixon, authorized funds for the planned record attempt, now dubbed "Operation Intercept."[36] Though Intercept was termed a development project, the only intended development was publicity for the Navy, Douglas, and the Skyray.

Major Edward N. LeFaivre, USMC, 37. Despite reaching altitudes in excess of 50,000 feet, LeFaivre did not wear pressure suit. Douglas Aircraft Co. via Col. E.N. LeFaivre

Major Edward LeFaivre eases F4D-1 down the Point Mugu runway after one of his world record time-to-climb flights.

Adm. Dixon also authorized Maj. Edward N. LeFaivre, 37, to pilot the F4D-1 in the attempts. LeFaivre, the F4D Project Officer at the time, was born and raised in Baltimore, Md. After leaving the Martin Company in 1942, LeFaivre entered Aviation Cadet training and was commissioned a Second Lieutenant, USMC, in 1943. As a night fighter pilot in the Pacific, LeFaivre participated in the Marshall Islands and Okinawan Campaigns. On one sortie he destroyed two enemy aircraft while flying an F6F-5N equipped with an APX-6 radar. In Korea, LeFaivre flew F7F-3N, F4U-5N, and AD-4 aircraft on night interdiction missions, destroying approximately 150 enemy vehicles. Before becoming the F4D Project Officer, LeFaivre had been on exchange duty with the Air Force as an all-weather interceptor pilot with the 354th FIS, based at Oxnard AFB, Calif. LeFaivre was a logical choice for these time-to-climb flights. His skill at flying on instruments would serve him well during these attempts.

The National Aeronautic Association was notified of the record attempt and was requested to furnish verifying officials. As with the Skyray's previous record tries, these officials would certify the times established and, if successful, would forward the results to the F.A.I. in Paris for final certification and recognition.

On Monday, May 12, LeFaivre met with Douglas personnel in Los Angeles to discuss the techniques to be used during the trial flights. A specific program was established during the two-day planning conference. There were many problems in logistics and in plotting the correct flight profile for each altitude attempt. What climb angle would be used? What was the maximum allowable engine temperature? How much "G" force should be applied during rotation? What measuring and recording instruments would be required? These were but a few of the problems to be worked out prior to the record attempts.[37]

The particular aircraft to be used was the sixth production airframe, Bu.No. 130745. "745" was government-owned but on permanent bailment to Douglas because of the continuing need for Douglas to retain a test aircraft, plus the high cost that would be required to rework it to operational configuration. Contrary to publicity releases, "745" was far from being strictly a "standard production model." Various articles had been removed to lighten the aircraft, including the four 20mm cannon, wing and belly stores and pylons, various electronics, and the tail hook and wheel assembly. Special test instrumentation was carried, including a long, tapered pitot tube boom on the nose that projected ahead of the Skyray's shock wave to give more accurate readings.

The funds authorized for the project also included rapid installation of new Wasp-alloy turbine blades in two J-57-P8 engines. These blades allowed higher engine operating temperatures which substantially increased the afterburning thrust of the normal -P8's 14,500 pounds. Only one modified engine was to be used. The other served as a standby in the event the installed engine failed.

As a further aid to the success of the flight, it was decided to conduct the actual record attempts at the Naval Air Missile Test Center, Point Mugu, Calif., 50 miles northwest of Los Angeles. Here, the cold, dense sea air would enable the engine to operate at its maximum efficiency to provide the maximum rate of climb. The prevailing onshore winds would also help reduce the Skyray's takeoff roll.

On Wednesday, May 14, the project team met at Edwards AFB to conduct some practice flights. On the 14th through the 19th, LeFaivre flew nine separate trial flights to test the aircraft's performance with the modified engine and to practice some spin recoveries and the many tasks required during the rapid full instrument climbs.

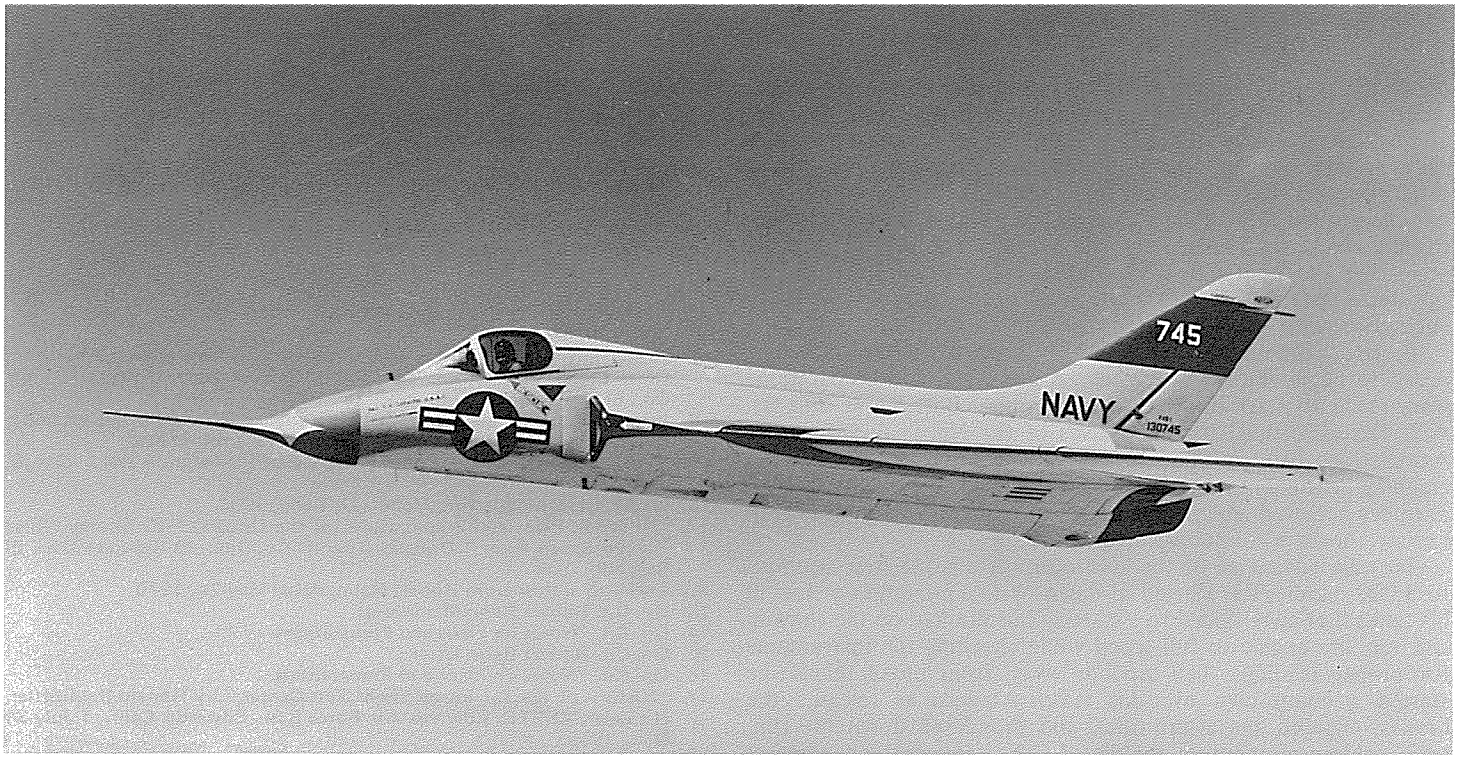
Each separate altitude try required a slightly different flight profile. The technique for the 3,000-meter mark was simple enough: lift off at 150 kts pulling 1.4 G's and zoom to 3,000 meters holding a 70-degree climb attitude. But for each succeeding height the flight profile became more complicated as the Skyray's climbing ability varied with altitude.

The 15,000-meter profile, for example, was especially troublesome. After lifting off at 170 kts, it was necessary to accelerate to about 540 kts up to 10,000 feet. LeFaivre then had to maintain a specified Mach number (about M-.79) in a climb to 40,000 feet. At this altitude the aircraft was zoomed, pulling up at about 1.5 G's until 50,000 feet (a little over 15,000 meters) was reached. What made the flight especially uncomfortable for LeFaivre was the fact that a 10 to 15 degree engine overtemp occurred on each flight above 35,000 feet. Furthermore, at around 43,000 feet the afterburner flamed out, followed shortly by a basic engine flameout at around 46,000 feet. After this happened, LeFaivre held his zoom attitude of 60 degrees until he reached 50,000 feet. At this altitude his airspeed was around 70 kts, and he let the airplane fall forward in a dive to 25,000 feet, where he restarted the engine.[38]

During all of these climbs the Skyray naturally put high load factors on the pilot. But on the 9,000 and 12,000 meter runs LeFaivre was subjected to a constant 2.5 g acceleration during the latter part of the zoom climb. This made it difficult for him to think and observe clearly. As all of these flights were made entirely on instruments, LeFaivre spent much of his time memorizing each individual flight profile.

During these practice flights the combination of desert heat and altitude at Edwards caused the initial thrust and acceleration of the Skyray to suffer somewhat. Because of this the times recorded for the various flights were greater than those needed to break the records, but this caused no real concern to LeFaivre or the Douglas crew.

On Monday, May 19, LeFaivre flew the Skyray to Point Mugu, and preparations were made for the official flights. That afternoon and during the next two days LeFaivre practiced each climb once more, except for the troublesome 15,000 meter climb, which he tried three more times. The effect the denser sea air had

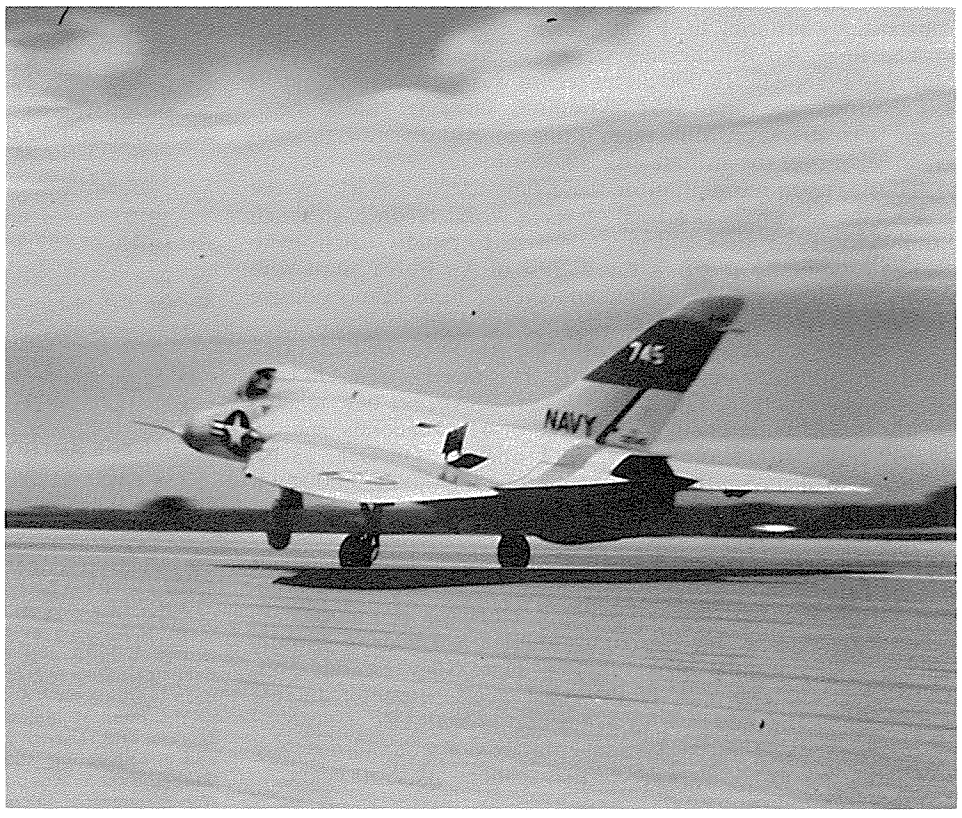


TIME-TO-CLIMB RECORD SUMMARY

Altitude Meters	Altitude Feet	Lift-Off Speed	Acceleration To V_iKts	Acceleration To Alt.	Initial Altitude of Zoom (Ft)	Zoom Load Factor (g's)	Final Speed (V_iKts)	Final Attitude (Degrees)	Expected Times (min:sec)	Actual Times (min:sec)	Nord Gerfaut (2-16-57)
3,000	9,843	150 kts	150	S.L.	S.L.	1.4	215	70°	:42	:44.39	:51.15
6,000	19,685	170 kts	350	S.L.	S.L.	2.0	200	70°	1:03	1:06.13	1:17.05
9,000	29,527	170 kts	540	5000ft	10,000ft	2.5	200	70°	1:25	1:29.81	1:33.75
12,000	39,370	170 kts	540	5000ft	30,000ft	2.5	190	60°	1:49	1:51.23	2:17.7
15,000	49,213	170 kts	540	5000ft	40,000ft	1.4	158	40°	2:29	2:36.05	(none)

Summary of the five time-to-climb record flights flown by Col. Edward N. LeFaivre at Point Mugu NAMTC, Calif., on May 22-23, 1958. Expected times are those projected by Douglas Engineers when the record attempt was first proposed. The 15,000 meter climb was an entirely new record set by the Skyray.

The photos of this page are of the F4D-1 Skyray, Bu.No. 130745 in flight and taxiing. Overall color was standard light gull gray with white under surfaces. The wings, fin and tail cone carried broad red bands, and all landing gear doors and speed brakes were painted with narrow red bands running lengthwise, except for the right main door which was natural metal. A narrow red band was carried behind each side of the cockpit. The radome and pitot tube were painted dark gray with a white design. Douglas Aircraft



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on thrust and acceleration was fantastic, and during the initial practice flights at Point Mugu a major problem developed because of this. Due to the rapid acceleration of the aircraft, the hydraulically actuated landing gear doors would not close! LeFaivre tried three times to start the retraction cycle the instant the aircraft left the ground, but in each case the doors were torn by the onrushing airstream. Fortunately, the problem was solved by simply increasing the hydraulic system operating pressure. This closed the doors several seconds earlier, and no further problems were encountered.[39]

By late Wednesday, May 21, LeFaivre and the project crew felt ready to begin the measured record attempts, and preparations were made to start the following morning. Bert Rhine and Dr. W.S. Dixon, official representatives of the National Aeronautic Association, had jurisdiction over the flights and the special clocking instrumentation. Radar tracking devices would verify the altitudes achieved and the timing clocks would be started as Maj. LeFaivre made a countdown over the radio.

To take advantage of the cold morning air, the first attempt, to 3,000 meters, was started at dawn. With a minimum of fuel in his tanks, LeFaivre taxied to a starting line marked on the runway and ran the engine to full speed while checking the instruments for proper readings. Ten seconds away from brake release he started a countdown over his radio. At zero he released the brakes, engaged the afterburner, and thundered down the runway, gaining momentum rapidly. At the same instant, cameras began recording the flight and the tracking radar was triggered.

As the full afterburning thrust took effect, LeFaivre was subjected to the tremendous acceleration of the lightened Skyray. In only a few seconds the F4D-1 reached 150 kts and LeFaivre pulled the Skyray into a near-vertical climb. The airplane literally stood on a tail of flame as it streaked to 3,000 meters in 44.39 seconds, bettering the French mark by nearly seven seconds!

LeFaivre landed a few minutes later, after having used only 400 pounds of fuel during the brief flight. After congratulations were exchanged, the F4D-1 was fueled again for the 6,000 meter attempt.

The same procedure was used for the remaining flights, with LeFaivre taxiing to the starting line, counting down, and kicking in the afterburner as he released the brakes.

The 6,000 and 9,000 meter time-to-climb records were also broken that day. The Skyray climbed to the first mark in 1:06.13 minutes, and the second was broken in 1:29.81 minutes, both substantially bettering the French times.

The final two altitude tries were saved for the next morning, May 23, 1958. The 12,000 meter record was set by the Skyray as LeFaivre flew the run in 1:51.23 minutes. The final 15,000 meter flight was also successful, establishing an entirely new time-to-climb record for the altitude at 2:36.05 minutes.

Thusly, upon recognition of these time-to-climb marks by the F.A.I., the Skyray held a total of seven world records, although briefly. By 1958, time and progress were to rapidly catch up to the F4D-1, not to mention the disgust of Air Force pilots who naturally felt that all speed records should have been exclusive property of Air Force fighters.

In a little less than seven months the Air Force had captured all of these time-to-climb records with their new F-104A. On Dec. 13 and 15, 1958, Lt. Einar Enevoldson, USAF, set new records for the 3,000 meter climb with a time of 41.85 seconds, and the 15,000 meter event, clocking 2:11.1 minutes. On Dec. 13-14, 1958, Lt. William Smith, USAF, also broke the 6,000, 9,000, and 12,000 meter marks by posting times of 58.41 sec., 1:14 min., and 1:39.9 minutes respectively.[40]

In retrospect, although the F4D-1 was to have a limited service life with Fleet and Marine Corps units, it made a remarkable impact on the fortunes of Naval aviation. Designed as a limited all-weather interceptor, the Skyray also served as a general purpose fighter and a ground strike fighter. One Navy Skyray unit, VF(AW)-3, was even part of the Air Force's perimeter defense system, being the only non-Air Force unit in NORAD.

In all, over two dozen Navy and Marine Corps squadrons were to fly the Skyray during a career that spanned six short years . . . but that's another story.

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