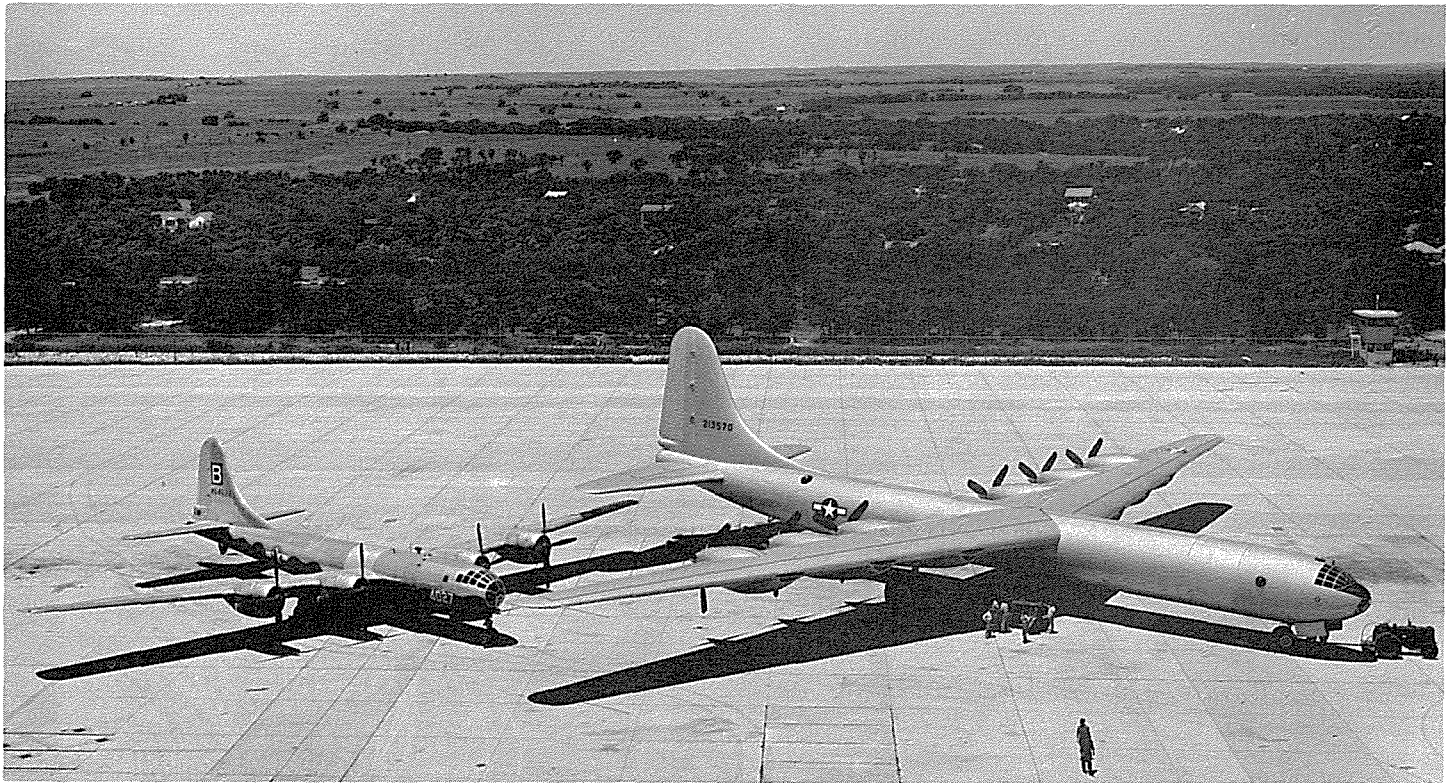




The XB-36, instrumentation not yet installed, and a B-29 brought over from Carswell AAF Base for comparison, June 1946. (Photo - General Dynamics)

DEVELOPMENT OF THE XB-36

PART II By MYERS K. JACOBSEN

The day came nearly 5 years after the original order was placed for the prototype XB-36 to make its first flight. In the warm morning hours of 8 August, 1946, Project Test Pilot Beryl Erickson made two preliminary take-off runs while over 7,000 Convair employees lined the fence along the runway. The entire factory had turned out especially to watch the event. It was going to be another hot Texas summer day with the temperature near 100 degrees. It seemed that everyone realized the importance of this initial flight, the culmination of the most costly project yet made in military aviation.

Inside the XB-36, Erickson perspired from the heat with the rest of the crew but his was different; the strain of responsibility was heavy on him. Along with him was an 8-man crew of all Convair employees. There were G.S. Green, his co-pilot, known as Gus, William P. Easley and James D. McEachern, both flight engineers, and Robert E. Hewes who was flight test engineer. W.H. Vobbe and A.W. Gedeman were both flight test analysts and there were two observers, W.L. Daniel, Jr. and J.M. Hefley. The airplane's gross weight was 200,000 lbs., including 8,000 gallons of fuel and 600 of oil.

Just prior to the takeoff, a B-25 photographic airplane from Wright Field rose to observe and record the historic flight. At 10:10 a.m., the XB-36 slowly and steadily rose from the runway and gained altitude. Among the crowd present, the engineering and management personnel especially felt a sense of relief, now that the XB-36 was airborne at last.

*Part 1 of the "Design Development of the XB-36" was presented in the *JOURNAL*, Winter 1970 (Volume 15, No. 4).

Inside, with much test analysis equipment, the engineers and technicians monitored performance. Erickson leveled off at 3,500 ft. with an airspeed of 140 to 155 mph. In the next half hour, first over the outlying sections of Fort Worth and then briefly over the downtown area, the powerful throb, the distinctive drone of its 6 Wasp Majors caused thousands of citizens to look skyward. It was a sound that would be heard over many distant parts of the globe within a few years. The flight was judged a good one with only a minor wing-flap malfunction; #2 flap would not retract. The XB-36 was in the air 37 minutes. The second flight took place the following week, on August 14. The same crew took off but with Major Stephen P. Dillon, Air Force Flight Acceptance Officer, aboard, and stayed aloft for 2 hours, 43 minutes. The landing gear was retracted for the first time.

As the flight test program continued through the fall of 1946, it was beset with unprecedented difficulties, but these were eventually overcome or minimized by the extensive research program. The XB-36 prototype was, at that era, advancing the "state of the art." Many problems encountered were inherent in the developmental process of any experimental aircraft but Convair's goal, an intercontinental bomber of high altitude, speed, and load capacity, dwarfed all others by its sheer size. It was not surprising, in retrospect, to see problems appear in great magnitude.

Two of the main problems to manifest themselves were lack of proper engine cooling and propeller vibration stress, though both had been extensively investigated in the wind-tunnel test programs. Engine cooling became primarily responsible for the inability of the XB-36 to maintain high-

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altitude operations for extended periods of time above 30,000 ft. A two-speed cooling fan was developed to keep engine temperatures within safe operating limits, along with refinements in carburetion and ignition.

Propeller vibration, which received some negative publicity as a result of some incidents brought into public view, was of great concern. Although the Moffett Field tests had been satisfactorily passed, and had given some indication of the vibration stress to be expected, the pusher configuration and its attendant punishment imposed upon the wing flap structure, powerplants and propellers was greater than anticipated. A series of consecutive flights was addressed to solving this difficulty and the wing flaps, propeller shaft, propeller hub and shank all proved to be under strength.

No aerodynamic means of eliminating the reactions caused by passage of the propeller blade through the wing wake was found. It was overcome by strengthening the affected structures and operating the airplane at certain rpm, speed, and altitude combinations. Under clean-wing conditions, and within a fairly wide speed range, the propeller vibration stress was acceptable, but with flaps down or under high power settings such as experienced in a climb or a field go-a-round, additional stress was created.

On the very first flight, there had been some fabric-rupturing and rib-damage to the flap structure and after the first few flights, all new aluminum-alloy flaps, with metal skin replacing the fabric, were installed. They were six times heavier than the original magnesium-alloy fabric covered design, a considerable weight gain! During one of the early flights, a propeller broke loose, taking a piece of the wing flap with it, and fell 10,000 ft., landing in a farmer's field. An unforeseen fault in design of the shaft was remedied by the simple addition of a curved notch to avoid fatigue and breaking off at that point.

There were numerous failures of the electrical system because of the poor fatigue characteristics of aluminum wiring. In an effort to keep within budgetary weight, the electrical design group tried aluminum conductor instead of the proven but heavier copper. Vibration stress upon the electrical and other supporting systems caused all three engines of one wing to quit on one flight. On another, stress caused the inboard wing flaps to come off. On still another flight, an electrical fire in the bombbay broke out which was not extinguished until after the XB-36 landed. Spark plugs were redesigned to take care of increased wear due to the high lead content of the fuel used.

In the early afternoon of September 30th another incident occurred which brought prominent headlines. While calibrating an airspeed indicator, suspended from the XB-36 by a 75 ft. cable, and attached to a winch in the bombbay, the cable snapped and the 50-lb. instrument fell, smashing through a skylight in a Fort Worth elementary school boy's rest room. Seven children were injured, although none seriously, with mostly cuts and abrasions from the shattered pieces of the indicator and the concrete floor.

Damages to the school and insurance claims for the children were made quickly and with great concern by Convair. A somewhat amusing sidelight was that the instrument, hitting the floor, had gouged a 7-inch hole in the concrete, throwing fragments all over the room. One of these broke the nearby commode, putting it out of commission. It was a rather unsophisticated target for the world's largest and most expensive bomber.

Wind tunnel tests at the NACA Langley Laboratory had predicted poor stalling characteristics for the sweptback wing. Adjustable slots had been incorporated into the design, but during the flight test program, it was proven that the stalling characteristics were satisfactory without

slots. The slots were permanently closed on the XB-36 and eliminated from later models.

Major Dillon was checked out in the XB-36 by Erickson early in the flight test program. Somewhat unsure of the plane's flight control system, Dillon had a little difficulty with his take-off and alternated between a nose-high and a nose-low attitude as he sped down the runway while adjusting the controls. Though making a somewhat awkward take-off, he did make a perfect landing. Erickson kidded him and remarked that he sure did learn to fly the airplane fast.

Major Stephen P. Dillon had returned from North African combat and was assigned briefly to Wright Field to fly B-17's and P-38's for combat-improvement recommendations. Then directed to Wichita, with three other Air Force pilots, he began the development flight testing program for the B-29 airplane. Eddie Allen had been killed a short time before in the crash of the XB-29. This small group worked nearly a year at Boeing Wichita, then moved to the Bell Co. plant at Marietta, Georgia where the other main assembly line of B-29's was. Development flights related to armament and gunnery were controlled from Marietta but performed at Eglin AFB and Boca Raton, Florida. The group also assumed responsibility for initial flight acceptance tests of B-29's coming off the lines at Wichita, Renton, Omaha, and Marietta. Shortly after his assignment to the Fort Worth plant Dillon became the first Air Force pilot to fly the XB-36.

The emergence of the prototype had been accompanied by apprehension and conjecture. Critics had conceded that progress was being made in bigness but what about military effectiveness and necessity? Would the B-36 be a milestone or a millstone? The U.S. position in the world at that time was strong and the Air Force's far-flung airbases appeared well-situated. For the moment, the concept of a bomber of intercontinental capability was not generally popular in some circles.

The 6th test flight was made for the purpose of demonstrating the XB-36 to General Carl A. Spaatz, Commanding General of the Army Air Force, and his party. During a 1 hour, 10 minute exhibition, Beryl Erickson brought the XB-36 over the runway on a very low-level, high-speed pass, a most impressive sight. General Spaatz had been a proponent of the intercontinental bomber and would later play an important part in keeping the B-36 program alive.

Because of the weight being gradually added to strengthen the prototype, the use of a single-speed engine cooling fan, and use of the General Electric BM-2 Turbosupercharger instead of the improved GE BH-2, the highest official altitude the XB-36 obtained was 37,000 feet, reached on 14 August 1947. It's top speed was 346 mph, but cruising speed was 212 mph.

The 16th test flight of the XB-36 was scheduled for Wednesday, 26 March 1947. The scheduled tests were on stress surveys of #4 and #5 propeller hubs at 10,000 feet. But by day's end tests of a much different sort were to take place, unscheduled tests of skill, determination, and courage.

After the usual pre-flight check, pilot Erickson and his copilot of previous flights, "Gus" Green, taxied the XB-36 down to the north end of the runway and requested take-off clearance. Gross weight for this particular flight was 254,000 pounds, including 11,050 gallons of fuel. Aboard were twelve crewmembers, including Curtiss-Wright representatives, Arthur D. Nordhem, and Lewis Clark, and two Air Material Command technicians, MSgt. Dillon W. Mathews and Lt. Wister G. Williams.

At 12:20 p.m. clearance was granted and the XB-36 sped

down the now familiar runway into a 20-mph headwind. Reaching an airspeed of 130 mph they were airborne. Suddenly, and almost immediately after leaving the ground, with the landing gear near its fully retracted position, a violent, sharp-edged jolt shook the airplane. The right-hand main landing gear hydraulic retraction cylinder had burst, causing the side brace strut to break loose from its fitting in the rear wing spar. As Erickson and Green worked to maintain stability, the huge nine-foot diameter wheel swung heavily past its normal "down" position and continued outward, mashing into the lower portion of the adjacent right inboard engine nacelle and crushing fuel, oil and hydraulic lines. An observer scanner in the aft compartment announced over the intercom that heavy smoke and flame were coming from the #4 engine and that there was a failure of the right-hand landing gear. Quickly, Erickson cut the power and ordered the engine feathered. The broken landing gear dangled at an unorthodox angle from the wing.

What was to have been another test flight had now become an emergency situation along with the tremendous responsibility on Erickson for the crew's safety and for the XB-36 prototype, perhaps even the future of the entire B-36 program. Erickson continued his climb upward and leveled off at 10,000 feet. Being informed that only the drag strut had failed, Dillon went aft to inspect the damage, but after realizing it was much more serious, he returned to the cockpit to inform Erickson and Green. Erickson came and viewed the situation for himself while Dillon took the controls. Flight Engineers Jim McEachern and William Easley climbed out over the wheel well and attempted to unfoul some of the damaged hydraulic lines but little could be done to repair the broken landing gear. As Dillon continued holding the XB-36 steady during the gear inspection,

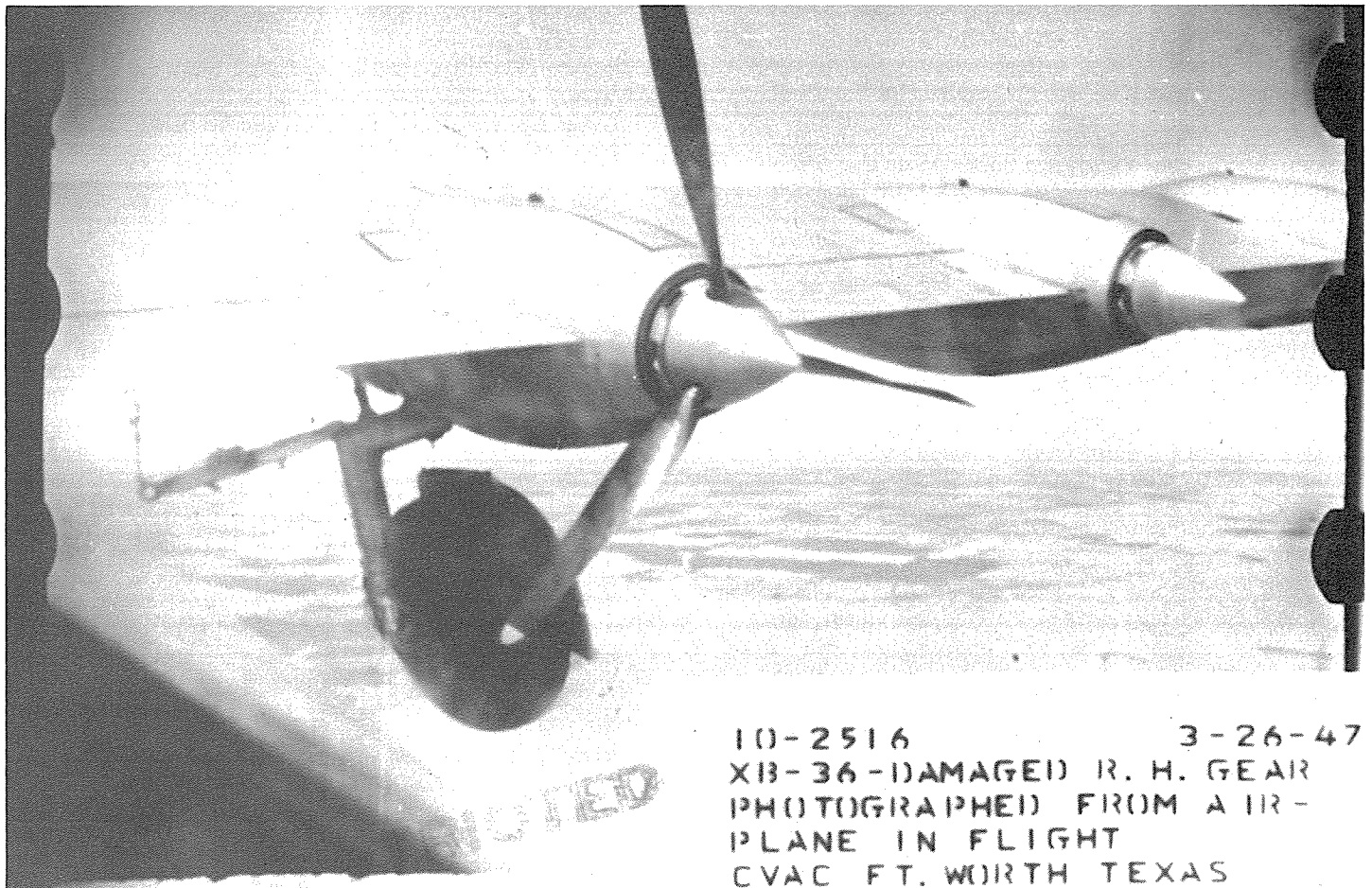
Gus Green, in his slow Texas drawl, radioed the field tower to start setting up preliminary emergency procedures.

Erickson, Green and Dillon conferred and decided to try to bring the crippled airplane in on its broken landing gear, after the crewmembers had parachuted to safety. It would be an extremely dangerous operation, with the possibility of a disastrous explosion and fire if it crashed on landing. The plan was for Dillon to bail out first and set up a 2-way radio contact with Erickson to help him "talk down" the damaged bomber. For three long, apprehensive hours, the XB-36 circled the field while the pilots talked calmly to the tower making arrangements for the crew to jump, and for their own possible rescue in the event there should be a crash landing. A radio-telephone network was set up with two ambulances, the field tower and the Convair plant, ready to spot where the downed men hit the ground. A BT-13 training plane was also to circle the field to assist in spotting the men. At 3:45 p.m. Erickson reported over the radio that the first two men were away at 6,000 feet. Major Dillon jumped first and suffered a sprained ankle on impact.

In spite of his painful ankle injury, Dillon insisted that the ambulance attendants take him back to the airfield so that he could communicate with Erickson and Green as planned. A radio-equipped jeep was not available at the airport so Dillon commandeered a C-47 and positioned it just to the east of the north end of the runway for his important contact with the XB-36. The next 2 hours were sweated out in circling continuously, consuming fuel and lessening the load (all water ballast had been dumped) before attempting the emergency landing. Since there was no provision for fast defueling, the consuming of 7,015 gallons took hours.

The beginning of the "landing gear incident," March 26th, 1947, early afternoon.

(Photo - Convair, San Diego)



10-2516 3-26-47
XB-36-DAMAGED R. H. GEAR
PHOTOGRAPHED FROM AIR-
PLANE IN FLIGHT
CVAC FT. WORTH TEXAS

As the men parachuted, two by two, from the lower right hand aft scanning blister on 6 different passes over the field the pilots would radio the tower, which in turn called the ambulances and Convair safety men, being assisted by Army personnel, so they would be in position to stop the parachutes before they billowed in the gusty winds and dragged the crewmembers to possible serious injury. The stiff wind also caused the men to scatter as they jumped, making it even more difficult to recover them. Nine of the twelve received serious injuries.

Meanwhile, away in New York, the Board of Directors of the Consolidated-Vultee Aircraft Corporation was meeting when word was telephoned to them. The Board and its members clustered around a radio listening to the broadcast account of this dramatic incident unfolding. Convair had a lot at stake and so did the Air Force. If the XB-36 should be destroyed, it could cause a major set-back in the entire B-36 program. Loss of the prototype, then the only B-36 airplane flying, would have brought the flight test program to a halt and added impetus to critics of the B-36 as to its operational serviceability. The program was then being observed closely both by Boeing and Northrop whose B-50 and XB-35, respectively, were becoming fierce competitors for Air Force favor, though each lacked in bomb load capacity and range. Cancellation of the production contract was a possibility and the fledgling Strategic Air Command, barely a year old, might yet be denied its long-range inter-continental bombers.

Could Erickson and Green bring the XB-36 in safely? By late afternoon, radio reports of the incident had brought thousands of people to the area, crowding the highways near the airfield waiting for the outcome. In addition to the

curious civilians and numerous Convair personnel, hundreds of soldiers from Ft. Worth Army Air Field had gathered to witness the XB-36's plight.

By 5:30 the last men bailed out, leaving Erickson and Green alone, who now circled for another seemingly endless 45 minutes, waiting for the winds to die down at sunset and for fire-fighting equipment, ambulances, and the other equipment needed to be in final readiness. It was later described by Erickson as "like waiting for the dentist." Then, at 6:15 p.m., Erickson made his final turn over Lake Worth. The approach was slow, from the north into a 25 mph headwind, and with full flaps. Number 4 engine silent and feathered. The large crowd of spectators watched breathlessly, pressing protesting Army guards forward to obtain a better view of the important moment. Erickson flared out just barely above the ground — the engines fully throttled prior to actual contact.

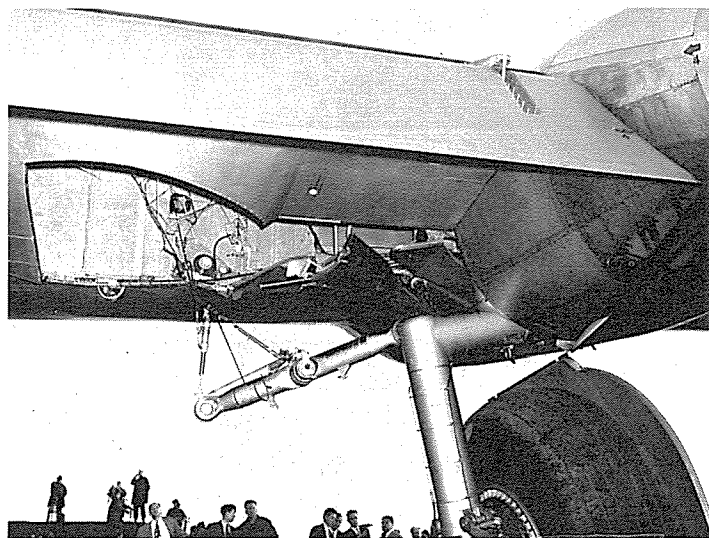
Squarely, and precisely as he could, Erickson put the plane down gently on both wheels. Dillon wheeled in behind in the C-47 him to watch the angle of the landing gear strut. Erickson steered to prevent it's collapsing either inwards or outwards — "bicycling" the airplane down the runway. Immediately after ground contact, the propellers were reversed for braking action. Cheers went up from both the crowd and soldiers across the runway, but the worst was not over.

Erickson carefully steered off the pavement to the left of the runway as Dillon directed. Dillon could hardly keep up with the XB-36's 115 mph landing speed and was racing the C-47 at near takeoff speed. A bad moment came when the XB-36 briefly disappeared in a depression in the runway, where Dillon could not see. He directed Erickson to guide

"A most difficult landing satisfactorily accomplished." Late in the day, 26 March.

(Photo - Convair, San Diego)





Preliminary survey of the damage. In foreground can be recognized Ray Ryan, Experimental Shop Manager, R. C. Sebold, Chief of Engineering, and Henry Growald, Project Engineer, (Photo-Convair)

the plane continuing to the left until it again came in his view. The XB-36 came to a stop with the broken landing gear wedged against the damaged nacelle. It had rolled some 5,500 feet down the 8,200-foot runway. Over the loud-speaker system throughout the Convair plant a simple announcement blared: "The XB-36 has landed safely." Later, to the press, Division Manager Roland G. Mayer, head of the Fort Worth plant, described it as a most difficult landing satisfactorily accomplished. Many individuals paused momentarily for the announcement and then continued to work.

Erickson rolled the XB-36 some 250 feet off the runway before coming to rest. Even though the grassy field was a little damp, the huge airplane sank down only 9 inches into the ground. Having dumped water ballast and all but about 4,000 gallons of fuel, the XB-36 weighed 190,400 pounds. The 4-foot width of the single tires helped substantially to support the plane in the rough ground, a not unpleasant discovery.

Erickson and Green were taken to the plant for debriefing, but no press interviews were granted for the present. As night fell, a security guard was placed around the airplane and Convair personnel began repair preparations. A make shift brace was devised to make the landing gear secure, and at dawn, tractors slowly towed the XB-36 back to the Experimental Building where investigators would determine the reason for the failure of the landing gear.

When the mishap occurred, several small parts of the landing gear assembly had fallen to the ground, including the hydraulic retraction cylinder strut. Later these pieces were recovered for examination. Damage to the engine nacelle was minor. The result of the investigation led to the replacement of the original aluminum-alloy side brace strut boss fitting with one made from steel.

Erickson and Green were back at the hanger early that next morning to watch repair work in progress. Two months later, on 25 May 1947, a special testimonial dinner was given at the Blackstone Hotel, Fort Worth, for the crewmembers of the dramatic 16th test flight. Honoring the crew at the dinner were CVAC President Harry Woodhead, Executive Vice President I.M. Laddon, and Roland G. Mayer. In addition, a statement made by General Spaatz gave his hearty congratulations and noted that the crew's cool resourcefulness and effective action reflected the highest credit to themselves, to CVAC, and to the Air Force.



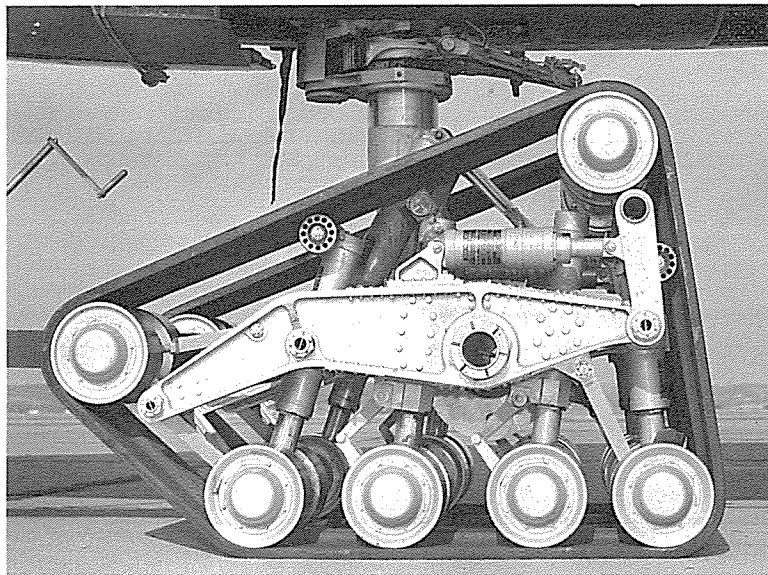
The size of the single-wheel landing gear proved a boon in the emergency landing and taxiing off the runway. Its 110 by 46 inch tire sank only nine inches into the soft earth. (Photo - Convair, S.D.)

The two pilots, Erickson and Green, were duly honored for their role in saving the XB-36 from possible destruction. Major Dillon later received a commendation ribbon from the Secretary of the Air Force "distinguishing himself by meritorious achievement." Erickson received, along with other crewmembers, a fine watch with an outline of the XB-36 on the back of the case. There also was an inscription, the superb landing acknowledged simply by "Well Done."

Crewmembers of the XB-36's 16th test flight.

Injured:	L. Clark — sprained ankle
	Major S.P. Dillon—sprained ankle.
	W.P. Easley—broken ankle.
	M.Hemby—fractured leg.
	R.H. Johnson—broken ankle injuries to back.
	M/S D.W. Mathews—fractured leg.
	J.D. McEachern—back injury
	A.D. Nordhem—sprained ankle.
	Lt. W.G. Williams—fractured leg.
Uninjured:	B.A. Erickson R.E. Hewes
	B.B. Gray W.E. Klegka
	G.S. Green

Track type nose gear for XB-36. (Photo - Convair 10-4577)





At Testimonial Dinner, May 25th. Roland G. Mayer, then Plant Manager (left) in conversation with Major Stephen P. Dillon, USAAF, as CVAC Exec. Vice President I.M. Laddon looks on.



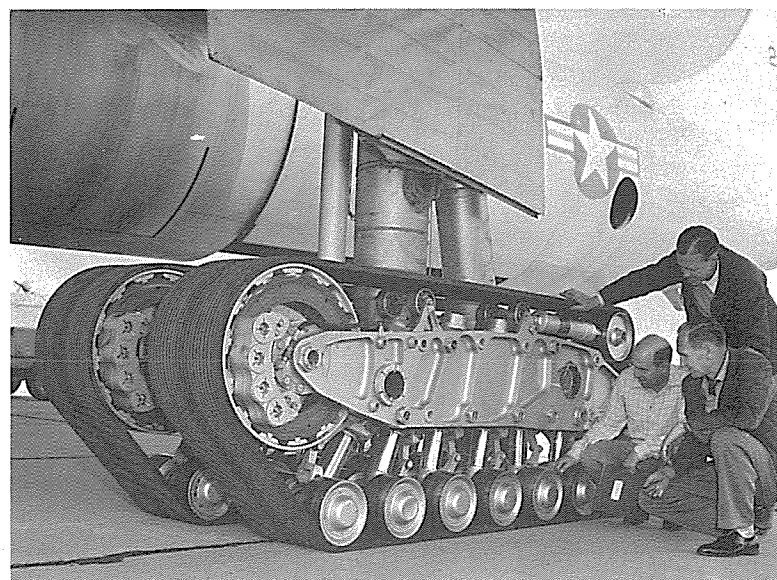
Beryl Erickson, pilot of the XB-36 in its ill-fated 16th test flight, receives commendations and present from CVAC President Harry Woodhead for a job "Well Done." (Photo - Convair, San Diego)

In June, 1948, the XB-36 made its 32nd test flight, this time with a new four-wheel landing gear installed. During 31 previous flights with the single-wheel gear, the airplane had accumulated 89 hours flying time. Other improvements were made to "modernize" the XB-36 in preparation for its anticipated turnover to the Air Force. New 3,500 hp R-4360-41 engines were installed, flight test analysis equipment was removed, the instrument panels were rearranged for more operational serviceability and a portion of the fuselage reskinned because of fatigue and wear. The "buzz" number, BM-570, was painted on the side of the fuselage.

The prototype XB-36 was ferried to AMC, Wright Field on June 19, 1948, accepted by the USAF, and returned to Fort Worth. During much of 1948 and 1949, the XB-36 spent increasingly long periods of idleness in the north yard beside the Experimental Building as the YB-36 and production B-36A's took over the test programs.

In April 1949, one of England's foremost test pilots, Arthur John Pegg, visited Convair/Fort Worth to familiarize himself with the B-36, an airplane similar in size to the Bristol Aeroplane's Company's prototype Brabazon 8-engine commercial airliner then in final construction

Main track type gear installed on XB-36, early 1950. (#10-4574)



phases. Pegg was to take the Brabazon on its maiden flight soon and thought that the B-36 bomber flew beautifully and handled normally in spite of its size. Each airplane had 230-foot wingspan.

Early in 1950 an experimental landing gear was installed, a track-type gear consisting of a series of V-belts around suitable wheels about 16 inches in width of tread. This special gear had been developed by Goodyear Tire and Rubber Company and the Cleveland Pneumatic Tool Company. It applied only 57 pounds per square inch to the runway compared to the 156 per square inch of the four-wheel gear, and could thus permit the use of unimproved runways. It was the first time such a gear had been tried on an aircraft of the weight and size of the XB-36, and the first flight came on 26 March 1950. The apparent effect was rather a rough ride and although the oleo strut took part of the shock, the tire assembly had taken a lot also, and the difference was highly audible. As the airplane gathered speed down the runway, the eerie, screeching sound of the track-gear grew intense until it left the ground. Jim McEachern also described it as "like being on roller skates."

The purpose of the test was only to prove the gear's feasibility on large aircraft. The XB-36 was an available test vehicle of the size required and installation of the track-type gear on the B-36 production airplanes was never intended.

In August 1949, the Air Force Association gave its Annual Airpower Science Award to three Convair men for their roles in the development of the B-36 bomber. The citation was directed to all the men working in many fields that brought the B-36 to a high state of performance by mid-1949. Special recognition was given to R.C. Sebold, Chief Engineer, Robert H. Widmer, Chief Aerodynamicist on the B-36 program, and Ray O. Ryan, who supervised building of the XB-36 and the production models. The award was presented by General Doolittle and the men were congratulated by Secretary of the Air Force Stuart Symington. It was a proud day for Convair. In the same month, unfounded charges against the B-36 would be made leading up to the 1949 Congressional Hearings.

The last Convair Flight of the XB-36 was on 8 August 1950, four years to the day after its maiden flight. It was flown to Wright-Patterson AFB and taken back in charge by USAF. The Air Force later decided it would be too costly to bring the limited-serviceability XB-36 up to production



The XB-36 in mid-1950, being towed out for taxi trials on the new track type landing gear past Carswell AFB in background, showing eleven B-36's on the line. Sliding doors on bomb bay No. 1 are open. These were later changed to snap-open, two-section type in production. (Photo - Convair 10-4581)

B-36 standards with all necessary modifications, and returned the airplane to Fort Worth again in October 1951.

On 30 January 1952 the XB-36 was officially retired. An area was cleared in a field overlooking the north end of the runway for its final resting place. Engines and equipment removed, it fell into a sad state of disrepair as 5 years passed. Then, in May 1957, a last task was assigned to it. The XB-36 was towed over to Carswell AFB to become a "prop" in the base firefighting program. Shortly afterward, the remains of the prototype airplane that became the first true intercontinental bomber type, appropriately named *Peacemaker*, were gradually consumed in flames. Overhead, Beryl Erickson was busy putting General Dynamics' sleek, new supersonic B-58 Hustler through its flight test program.

In the years between the first and the last flights of the

XB-36 there raged a continuing controversy within and outside of the Air Force over the role and the mission of the intercontinental bomber. As it became apparent that the maximum altitude was, by mid-1947 and almost a year of test flying, only around 37,000 feet, the performance charts came under scrutiny by the Air Staff. The newly born U.S. Air Force's highest ranking officers were drawn into the controversy, sometimes taking sides according to their personal experiences or philosophies. Erickson and Dillon flew the XB-36 to an unofficial altitude of over 50,000 feet on one occasion, but due to the inadequate altimeter the log of the airplane could not reflect this.

But even before this, criticism of the XB-36's performance and the B-36 production program was heard from an unexpected source . . . that is another part of the story.

INFORMATION FOR AUTHORS

The preparation of manuscripts for submission to the *JOURNAL* of AAHS is and should be as simple as possible. The major attempt must be in expression of a high standard of accuracy, and the Editorial Staff is ready to and desirous of presenting material in an interesting and attractive manner. The following do's and don'ts are given as a desirable parameter for submission. No payment for articles will be made, and the opinions of authors, while respected as opinions, should adhere to the truth to the maximum extent.

Final drafts of manuscripts should be on standard 8½x11" bond paper, with doublespaced typing throughout. Double spacing shall apply to footnotes and quotations also.

Approximately fifty characters per line should be used in typing the manuscript. This is an aid in estimation of the JOURNAL space required as well as facilitating final typesetting.

Photographs may be of any size, but should be of glossy finish. An optimum size, for two-column width pictures, is 7¼" width, and for single column presentation, is 3¾", since

these sizes can be pasted directly on the camera-ready copy, but in order to do so, the print must be available without restriction, i.e. the normal restriction "do not crop," should not apply.

If photographs must be returned, the author should write his name and address on the reverse side of each photo to be returned. Writing should be done along the border to prevent imprint through the surface of the glossy side.

Captions should be written for each photo giving the minimum amount of information such as date of photo, name of person who took the original, location, names of persons shown, type, number and identification of aircraft shown, negative number or other identification thereof, and points of interest. If the owner of the original negative is unknown then the present source must be given, such as "Courtesy of —", etc. It is intended that photographs should not rely on accompanying text in the article for description; a two to four line caption will enable the photograph to stand on its own better without reference to the text. Thus photo numbers such as "Photo A," or "Photo No. 1," can be eliminated from the final printed article.