History of Aircraft Track Landing Gear

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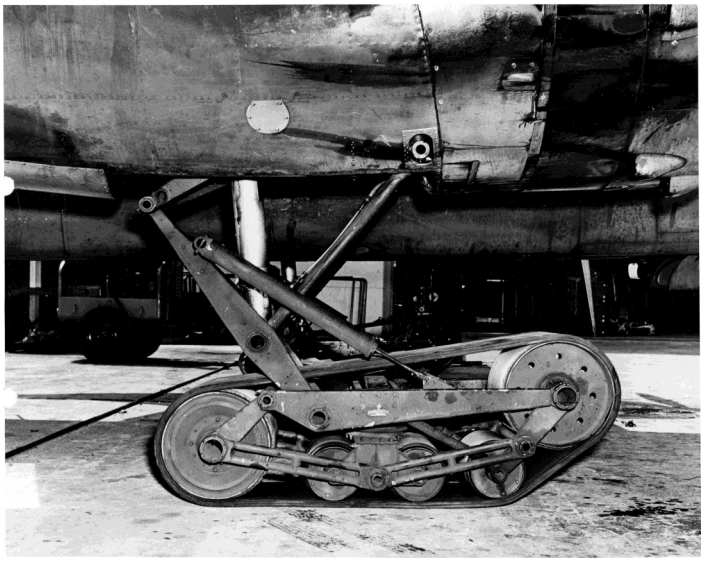
(Extracted from historical study No. 135: Case History of Track Landing Gear)

The design of landing gear is closely related to an aircraft's mission. In the 1940's it was thought that heavy bombardment aircraft, if using conventional systems, would require thick, expensive runways. Track landing gear systems appeared to be a solution to this issue. Substitution of track landing gear for wheel gear would eliminate the need for long, heavily enforced runways and facilitate operations on rough terrain.

In 1944, Military Requirement A-1-1 called for "a new type airplane landing gear effecting maximum practicable weight distribution" suitable for use on pavement and unprepared surfaces. The use of multiple wheel or track gear was suggested. In July 1948, Air Materiel Command advised that the policy for landing gear design should define the surface available for safe aircraft operations.

The idea of applying track landing gear to an aircraft in order to achieve flotation was first presented to the Air Corps by J.W. Christie, inventor of the Christie tank, and representatives of the Dowty Equipment Corporation of Long Island, New York. After being interviewed by General H.H. Arnold in November 1939, Christie was directed to work at Wright Field on drawings for a track landing gear installation on a Douglas A-20. Christie planned to use a belt made by the Goodrich Corporation designed for heavy construction work.



Douglas A-20 with track landing gear.

A contract was issued to Dowty Equipment Corporation in June 1941 for engineering design of the A-20 track gear in the amount of $20,000. The design Dowty proposed to use included an air-inflated belt, two main rollers with brakes, two smaller auxiliary rollers sprung over the part of the belt touching the ground, and a smaller roller or idler mounted under the upper span of the belt to provide constant tension.

By February 1942, the design work with Dowty was completed. A new contract was issued in June to the Goodyear Tire & Rubber Company for design and fabrication of the A-20 track landing gear in the amount of $100,000. Dowty was furnishing the shock absorber, but had subcontracted the experimental and developmental work on the track and mechanism to Firestone. With no design criteria for the A-20 gear, Firestone first designed and built a rubber-belted track gear for a Stearman PT-17 aircraft and later installed the same gear on a Fairchild PT-19 using a different shock absorber. The new track system worked satisfactorily on both.

The A-20 track gear was completed in June 1942 and sent to AMC where it was installed on A-20C No. 41-19158. The gear, which was not retractable, used a conventional nose wheel.

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Testing began in the spring of 1943 and operation was deemed "very satisfactory" under various ground conditions despite the exception of a belt failure during testing. The track gear system weighed nearly twice that of a conventional wheel system and required a take-off distance increase of 15 percent.

In the summer of 1945 the A-20 was being used for taxi testing when it was damaged in an accident. The fuselage was broken and it took nearly a year to acquire a replacement. The test program resumed in February 1946 using A-20H No. 44-466, to determine the structural requirements for track gear. After instrumented tests by Fairchild (the results of which were to be used in the design of C-82 track gear) the plane was returned to Wright Field for tests on hard surfaces including ice and snow. The A-20 test track gear test program was completed in August 1947 and had "proved the flotation principle of track gear entirely sound."

Curtis P-40 with track landing gear.

Concurrent with the testing of track gear on the A-20, Firestone was awarded a $15,900 contract in June 1943 to design and test a track gear system for the Curtiss P-40 fighter aircraft suitable for operations from sandy beaches. The P-40 track system was a dual system (two tracks per side) and was expected to exert only half the ground pressure of conventional gear. The track gear was installed on XP-40 No. 38-10 at Wright Field in September with the use of a conventional tail wheel. Testing began in February 1944 but during taxi testing the system would get packed with snow and ice between the belt and main drums, stretching the belt. In later flights the gear collected sod and mud.

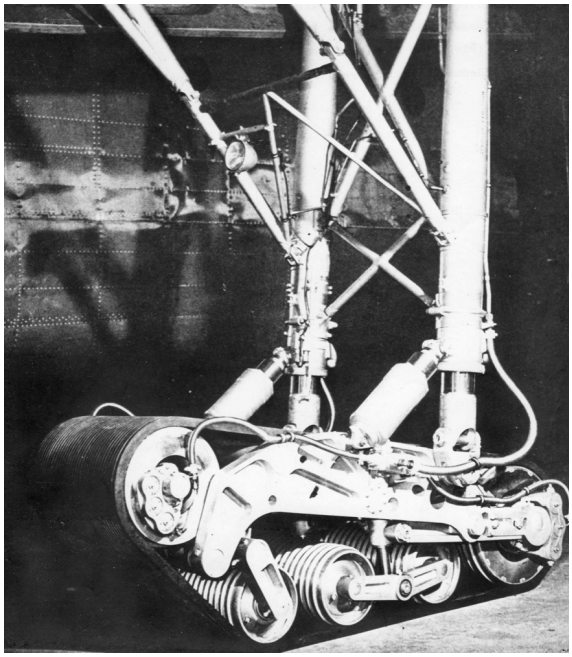
Along with the testing of the track gear system, other P-40 aircraft were being used to test multi-wheel and dual-wheel gear at Wright Field. All of these aircraft were scheduled for further testing by the Proving Ground Command at Eglin Field, but during testing the XP-40 was damaged beyond repair and was placed in storage at the AMC. The testing indicated that the track gear was inefficient for fighter operations due to excessive internal friction on the track, inability of the track to get out of ditches and over obstacles, smallness of the units and the inability of the unit to be sufficiently self-cleaning.

Although the P-40 project failed to produce a gear suitable for fighter operations, much valuable knowledge had been gained. It was concluded (1) that light aircraft required long, narrow tracks, and (2) that future tracks should be designed to conform to the ground pressures prevalent in areas where the particular aircraft was to be operated.

During the fall of 1945, the Fairchild Aircraft Division made a preliminary study incorporating track gear onto heavy cargo aircraft using a C-82 airframe for testing. A contract was approved in November 1946 in the amount of $250,000. The gear consisted of the belt, magnesium bogie, wheels, brakes supporting a shock absorbing structure and retracting mechanism. Fabrication of the main and nose gear assemblies was underway


Fairchild C-82 with track landing gear.

early in 1947. The track gear increased the gross weight of the aircraft by 1,200 pounds. While C-82 no. 44-23014 was being tested at Fairchild, leaking oil springs had to be replaced but Fairchild reported taxi and tow tests were generally successful.



Fairchild C-82 with track landing gear.

Once the functional tests had been completed at Fairchild, the C-82 was returned to Wright-Patterson AFB for operational testing. About this same time, Fairchild was awarded a contract for an additional 23 sets of track gear for the C-82, 18 were scheduled for installation and 5 were for spares. The C-82 gear, unlike the A-20, was completely retractable and steerable. The belt tension of 10,000 pounds was provided by air and oil springs, and "V" grooves helped keep the track on the bogies.

Initial testing indicated that the Goodrich belts for experimental gear testing were too weak. During the summer of 1948 the gear was tested in sand, at this time structural failure occurred in the in the nose gear track and the main gear belt peeled off. Unfortunately, to keep on schedule the production gear could not wait for results of testing.

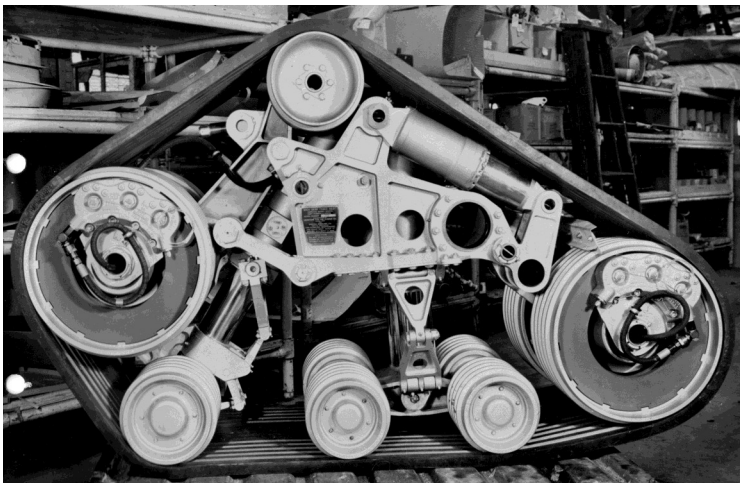
During April 1949, AMC personnel toured various airfields with the track-equipped C-82. The AMC admitted it had been "caught short" in the test phase of the track gear because of the necessity to return the experimental gear to Fairchild while production models were being built, thus delaying test of the experimental set. Also, maintenance of track gear under various ground conditions was a big problem. The track gear worked satisfactorily on sod and on specific types of mud, but it could not operate on sand that did not contain a certain amount of dirt. It was also conceded that ski equipment was better for operations in snow.

Because of belt and other failures in track-equipped aircraft already delivered, it was decided to terminate delivery of seven of the track-equipped C-82's. By the end of April 1949, 10 track-equipped C-82's had been accepted; 8 were behind schedule. Four of the delivered aircraft were to be grounded, 6 were to be stored at Fairchild, and 1 (No. 45-57746) was to be tested further by AMC. Once the tests were concluded, the decision was made not to progress with the track gear system for the C-82. Serial numbers of the C-82's allocated to the production track gear system were 45-57747, 45-57749, and 45-57751 thru 47-57764.

Boeing B-50 with track landing gear.

Boeing Aircraft Company also tested the track gear system. Boeing initially requested to test the track system on a B-29 as a prelude for use on the B-50, but AMC chose to forego the B-29 testing and install the track gear directly to B-50B No. 47-118 in order to accelerate the program. Boeing subcontracted the main gear track and belt to Goodyear and the nose gear and track to Firestone.

Serious problems arose in connection with the B-50 installation. First, Goodyear experienced great difficulty in fabricating a belt that could withstand the high tensile loads, and second, the track gear interfered with the defensive gunnery pattern of the



Boeing B-50 with track landing gear.

aircraft. When the main gear belts were received from Goodyear, they could not be used above 70 miles per hour. The Firestone nose gear belt was also unusable for flight testing.

Taxi tests with the B-50 were performed using a tow truck, since the gear belts were unsatisfactory for flight-testing. When the B-50 made its first flight at Boeing in early 1949, the flight characteristics, including retraction and suspension, were satisfactory. The test program was delayed by maintenance difficulties and bearing failures during the fall and winter and by January 1950 the contract had been completed. No further testing was required on the track-equipped B-50.

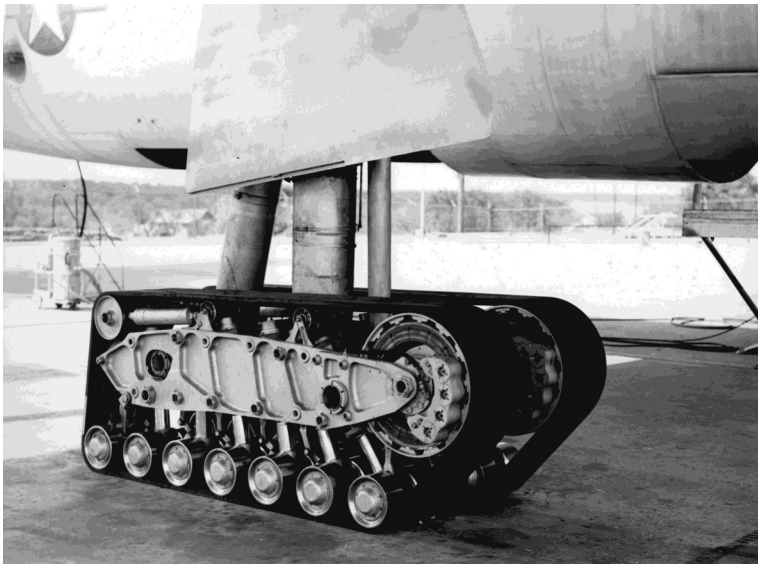
Despite the efforts of the previous flight test programs, the track gear was tested again on the largest aircraft in the Air Force inventory at the time, the Consolidated B-36 Peacemaker. In April 1948, the Consolidated contract was amended to provide for the design, fabrication and installation of the B-36 track gear system. The first XB-36 No. 42-13570 was allocated for the test program. Previously scheduled testing using the XB-36 delayed the track gear program until November 1949. The installation of the track gear was completed in February 1950 and the test program was begun, with the plane under a weight restriction of 250,000 pounds.

The track gear system used two endless belts per side; each belt was 16 inches wide and 275 inches in length. The belts were two inches thick at the center and one inch this at the sides. The thickest portion of the belt wedges into a slot on the bogie which centers each belt. The rubber belts are reinforced with brass-plated steel cables. Although the track gears weighs 5,600 pounds more than conventional gear, it has a maximum average pressure of 57 pounds per square inch as compared with 156 pounds per square inch for quadruple wheel gear tire treads.

With taxi testing completed in early March, the XB-36 was readied for its first flight using the track gear system. The track system used on the XB-36 was the largest system tested on an aircraft. The first and only flight of the track gear occurred on March 26, 1950. The takeoff roll was described as very rough and noisy. The aircraft circled the airfield once and came in for a landing. Parts of the track system left a trail down the runway on rollout. The track system was deemed unfit for such a heavyweight aircraft and the idea was eventually abandoned.

The idea of track landing gear was initially very appealing. Many aircraft proposals were submitted during this time for modification to the track gear system, these included the B-17, CG-4A Glider, C-47, C-119B and C-122. Alaskan Command requested information on C-47 modifications for possible arctic rescue work. Towards the end of the program, the Northrop Corporation submitted a track gear proposal for their RB-49 Flying Wing.

The track gear system was one that held a lot of promise on the drawing board, but through rigorous testing by the Air Materiel Command, it was proven to be impractical for production use.



Consolidated XB-36 with track landing gear.

For further reading, see: Ardath M. Morrow, *Case History of Aircraft Track Landing Gear*, Wright-Patterson AFB: Air Materiel Command History Office, September 1950.

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