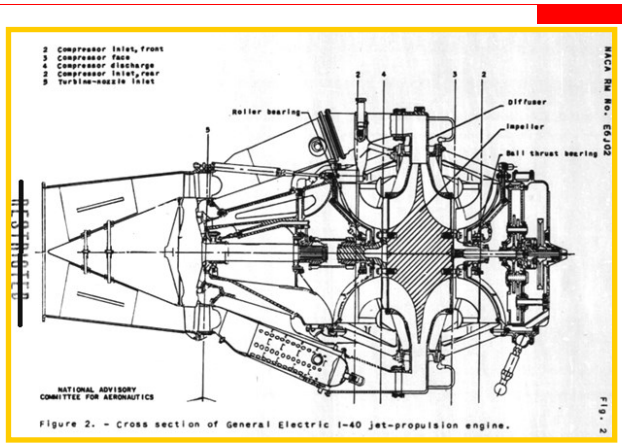
J33/I-40* Turbo Supercharger Jet Engine

By: Jack Waid

Paths to the Present

FLASHBACK

During an early 1941 visit to England, Major General Harold H. Arnold, Acting Deputy Chief of Staff for the Army Air Corps, became interested in the jet propulsion engine under development by the British. At the time, the British were far ahead of the United States. The I-40 engine originated, and was developed by, Air Commodore Frank Whittle of the Royal Air Force and given the name Whittle Engine.



Cross section of General Electric's I-40 jet propulsion engine.

During August 1941, Major D. J. Keirn, Head of the Power Plant Laboratory at Wright Field, OH, visited the Power Jets plant in Lutterworth, England, where construction and testing of the Whittle Engine was taking place, and by October 1941, a Whittle Engine arrived at Wright Field.

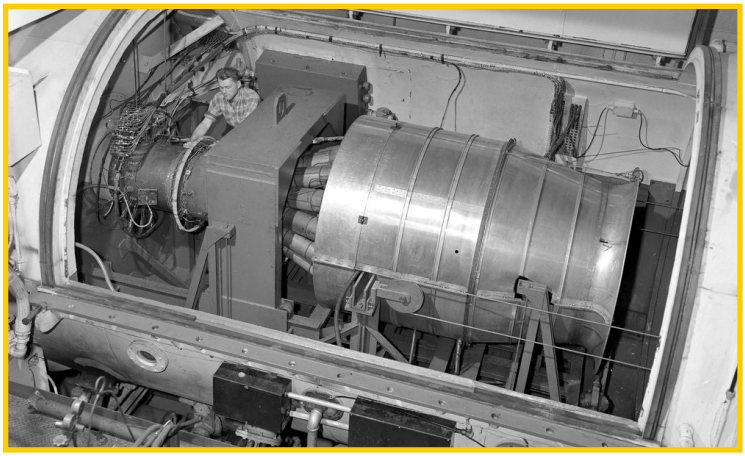
A few months later, a conference was held in General Arnold's office on 4 and 5 December 1941, those in attendance definitively decided to build the Whittle engine in the United States. With this decision came a contract between HQ Army Air Corps and General Electric on 8 December 1941. General Electric agreed to manufacture fifteen Whittle-type engines at a total cost of $730,000; early 1942, this number changed to forty-six.

On 7 October 1942, Colonel B. W. Chidlaw, AC/S(E), Materiel Command, Washington D. C., directed Materiel Center at Wright Field to properly plan and prosecute development of jet propulsion engines and jet-propelled aircraft. Developments in Great Britain and the United States had reached a stage where important tactical possibilities appeared imminent. Subsequently, Materiel Command in Washington D.C. directed Materiel Center at Wright Field to establish an organization to accept responsibility for research and development of jet propulsion engines and aircraft. This organization was set up at Wright Field on 11 December 1942. This small group within the Technical Staff, Power Plant Laboratory, also worked with units in the Aircraft Laboratories of Engineering Division at Wright Field.

A technician uses a micrometer to determine possible distortion of the turbine blades of General Electric's I-40 turbojet engine. The ring of combustor cans, immediately behind the turbine, was Whittle's solution to the combustion problem. *(NACA photo)*

Now a Brigadier General, B. W. Chidlaw, Chief, Materiel Division, Washington D. C., announced on 25 October 1943, a tentative program for development of jet propulsion aircraft based on two types of engines – pure jet and gas turbine. This program was flexible and could be modified when new tactical requirements or engineering changes were developed.

*Manufacturer's designation

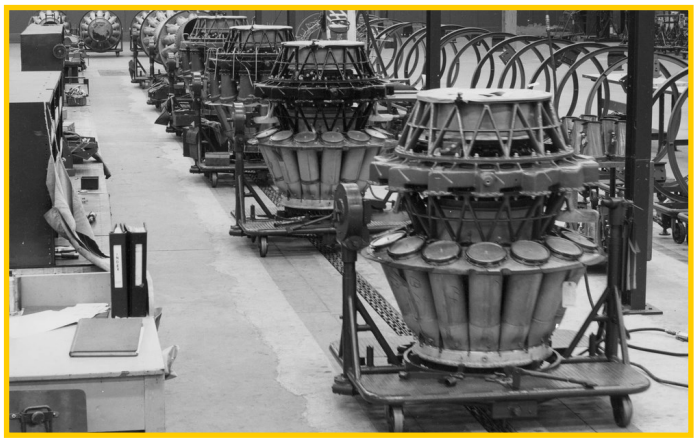


J-33 engine mounted in the altitude tank. (NASA photo)

On 8 January 1944, at Muroc Army Airfield (later Edwards Air Force Base), Lockheed's chief engineering test pilot, Milo Garrett Burcham, took the prototype Model L-140, the Army Air Forces XP-80 (serial number 44-83020) for its maiden flight. This aircraft utilized a General Electric variant of the Whittle Engine. Of note, the Bell XP-59 was the first aircraft to fly with the US version of the Whittle engine, the GE I-A (later known as J31) in Oct 1942. The XP-80 first flew with a Halford H1 engine from a British Vampire after the original engine was damaged by FOD in an engine run. The first GE I-40/J33 flight was in the XP-80A.

Shock waves of a thrust augmentation bleed off J-33 engine. (NASA photo)

As requested by General Arnold during the month of February 1944, Major General O.P. Echols, AC/AS, MM&D in Washington D.C., submitted estimated performance data on the P-59A, XP-80A airplanes and information on the I-40 engine. The first unit of the I-40/J33 underwent static testing on 11 January 1944 at the General Electric Plant. Although preliminary runs were not made at rated speed and thrust, the operation of the engine was considered satisfactory. Five months later, an I-40 engine flew in the XP-80A. Development of the I-40 was first undertaken in June 1943. Development to first run, an amazing 6 months. By 21 August 1944, J33 engines built to the specifications at the time had a probable life of 50 hours before some major part needed repair or replacement.



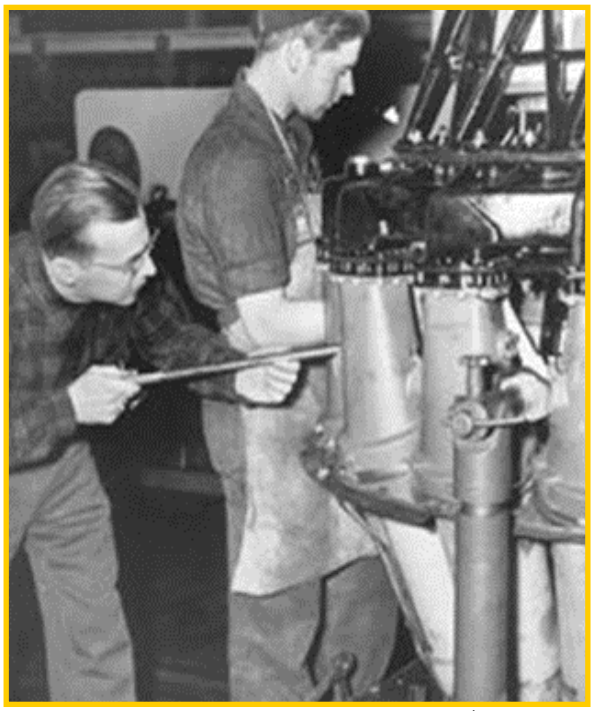
Allison J33 jet engines shown on the Oklahoma City Air Materiel Complex production floor undergoing maintenance, repair and overhaul. (Tinker History office photo)

The Resources Control Section at Wright Field, on 8 April 1944, recommend Allison Division, General Motors Corporation, Indianapolis, Indiana, be licensed to build I-40 engines and that Plant No. 5 at Allison be tooled to produce 1,000 units per months. This requested was made due to General Electric's poor production rates.

From Muroc Army Airfield, Lockheed Aircraft reported prototype XP-80A airplane (utilizing the new I-40 engine) made its initial flight 10 June 1944. Due to difficulty with the flap mechanism, the airplane landed after 35 minutes of flight. The engine functioned satisfactorily and cooled well.

In a memorandum to AAF leaders in Washington on 14 June 1944, Brigadier General O.R. Cook, Chief, Production Division, Materiel Command, stated provisions were made for the installation of I-40 engines in the XP-81 and XP-83 under contract then in effect with General Electric. Additionally, General Motors, Allison Division and General Electric still maintained the production of engines for the XP-80A.

As the war drew to a close, a meeting was held at Wright Field on 30 January 1945, by the Army Air Forces' Air Technical Service Command, Materiel Command, Engineering Division. The meeting was held to discuss the I-40 Engine Operation in Connection with the XP-80A and YP-80A Airplanes. Discussion centered on Lockheed Aircraft Corporation's development problems with the YP-80A, General Electric's I-40-3 operational and maintenance difficulties and a summary from Lockheed about additional flight test experience with General Electric's I-40 engine in the Lockheed XP-80 aircraft.



J33 engine mechanics at Tinker in 1949. (Tinker History Office photo)

After War's end on 18 September 1945, leaders from Wright Field and HQ Army Air Forces, Washington, elected to terminate General Electrics I-40 contract and decided to use Allison Division. Allison Division expressed their willingness to assume complete responsibility for engineering design and further development of the I-40. Also, Allison had a better production record with the I-40 than General Electric. It was believed assigning Allison as the sole manufacturer, "would do a great deal toward insuring continuation of Allison in development and production of both liquid-cooled and gas turbine engines." J33 engines of different variants continued to be used in F-80s during the Korean War and later around the world.

Allison J33 on display in the Modern Flight Gallery at the National Museum of the United States Air Force. (U.S. Air Force photo)

Specifications for the I-40: Type: Turbojet Compressor: Single-stage centrifugal Turbine: Single axial Weight: 1,875 lbs, thrust: 4,600 Max (AAF original request was between 3 to 4,000 lbs of thrust) RPM: 11,750 Max Altitude 47,000 ft. Combustor: 14 interconnected straight-through chambers. Weight, thrust, etc. changed with different variants.

The J33/I-40 was General Electric's first turbojet engine of its own design, its last all-centrifugal-flow engine; as well as the last to be used in US military combat aircraft. The Allison J33 was the first mass-produced jet engine used by the US Military. It powered other first generation jet aircraft including Martin XB-51, Consolidated Vultee XP-81, Lockheed XP-80A F-80A/B/C, RF-80A, QF-80F, XF-14/A, TF-80C, T-33A/B, AT-33A, DT-33A/B/C, RT-33A, QT-33A, WT-33A, T-1A, North American F-86C, Northrop F-89J, and Bell XP-83.

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