Neither Piston Nor Jet

(by Robert G Pelley 2022-07-07)
Bobsganderhistory.com

Gander has long been associated with the piston engine aircraft. With their limited cruising range, they needed to get as close as possible to Europe as they heeded east – and were happy to know that Gander was not far away as they faced the head winds on the way back.

During World War Two, around 10 thousand bombers, military cargos and fighter planes left Gander to support the RAF, RCAF and USAAF in their battle to defeat Germany. After war, great airline companies from Canada, Britain, France, Germany, Israel, Iceland, the US and other countries needed to use Gander in their commercial operations. Their aircraft were generally well-known models: DC-4s, DC-6s, DC-7s, Stratocruisers and Constellations that provided stately service with real cutlery and sometimes lounges and beds.

Some of the later piston-engine models were able to cross the Atlantic without stopping in Gander but by the early 1960, their use was pretty much limited to cargo. They had been replaced by jet aircraft. The early jets were basically DC-8s, 707s and Comets.

But perhaps this usual typology overlooks another type of airplane that was neither piston-engine nor jet engine. In fact, during the period of overlap between the two, another type of engine was being produced – the turboprop.

So what was the difference between the three types of aircraft engines, and especially the piston engine and turboprop, both of which used a propeller and looked much alike.

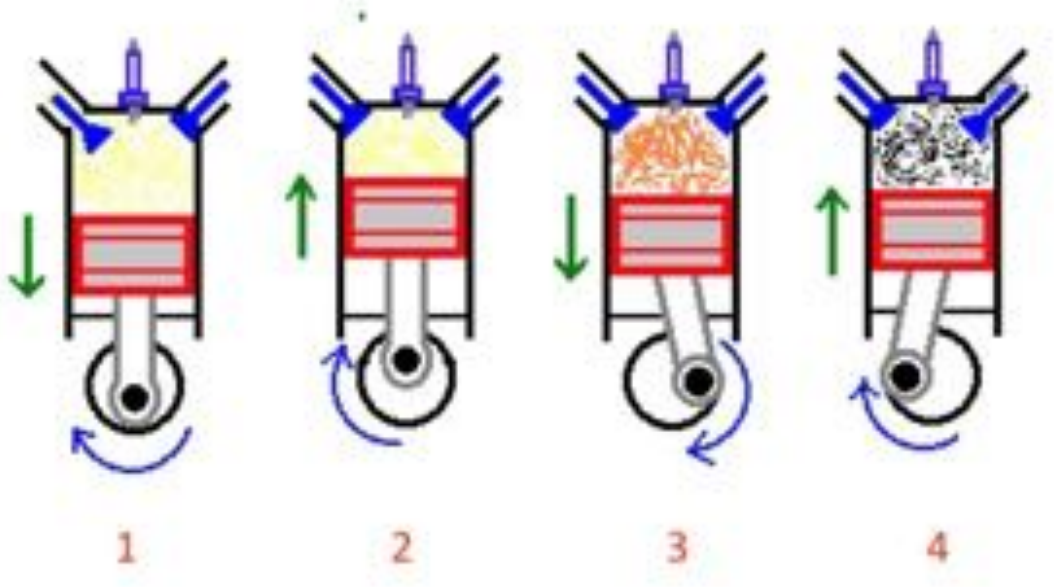
In all cases, these engines work in the same sequence. The difference between them is how they produce the sequence and how the result of their action gets an airplane to move.

The sequence in an engine is:

º intake of air and fuel
º compression of these two intrants
º their combustion
º exhaust

We will call this sequence SSBB, for Suck, Squeeze, Bang and Blow.

The piston engine in a plane is basically the same as that in a car. It is based firstly on pistons that moves up and down. At the bottom they are connected a bit offset, so that they turn a crank shaft, which in turn, through a gearbox, powers the wheels. This can be seen in the following diagram:



! Intake/Suck: a mixture air and gas is sucked into the cylinder (down)
2 Compression/squeeze: the mixture gets squeezed into a smaller area and the temperature goes up

3. Combustion/bang: the piston is driven down by the explosion of the mixture
4. Exhaust/blow: the burnt gas is expelled as the piston moves up, so that this cycle can start again.

In a car, there may be a number of cylinders in a row. Some cars had six to eight cylinders "in line", a single row. This led to the "V" configuration, such as the famous "V-8" engine (two rows of four joined at the crank). Jaguar for example used a V-12 motor in the 1970s-80s.

Piston engines in an airplane can be set up the same way as a car engine, but instead of being used to turn road wheels, they turn a propeller. They can be "in-line" or a "V-configuration". The famous RAF Spitfire fighter, for example, used a V-12 Merlin engine.

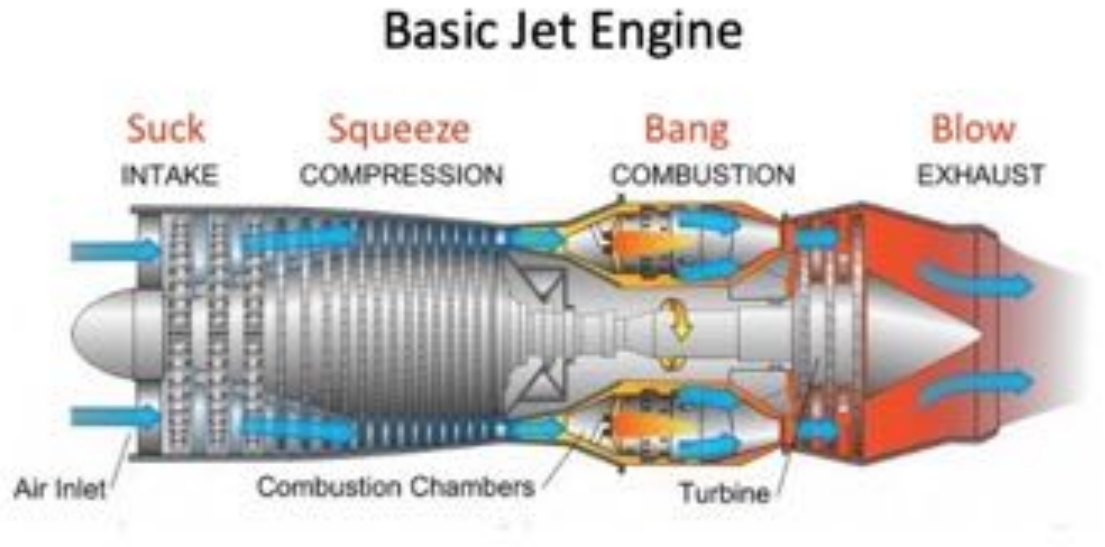
However, during the wartime and post war era, these planes, especially the larger aircraft, used "radial engines". This means that the pistons were organised like flower petals around a central crankshaft.

Like a car, the piston engine in a plane might have turbo-charger or supercharger. This is a basically an “air pump” that forces more air that usual into intake/suck part of the cycle. This used only when extra power is really needed. This, however, does not turn a piston engine into a turboprop.

To understand how a turboprop works, we first have to look a jet engine, which uses the same SSBB sequence as in piston engine.

A bit like a rocket, it is a long tube in which oxygen is mixed with a fuel, so that as it detonates, the exhaust creates thrust or forward movement. This difference between the two is that while the rocket carries oxygen, usually liquid, in an onboard tank, the jet engine sucks it in from the atmosphere as required.

In both cases, the forward displacement of the airplane is based in Isaac Newton’s Third Law of Movement, which states that for every action, there is an equal and opposite reaction. The more the push of the exhaust backward, there is an equal push forward, eventually overcoming the inertia of the plane to get it rolling and eventually airborne.



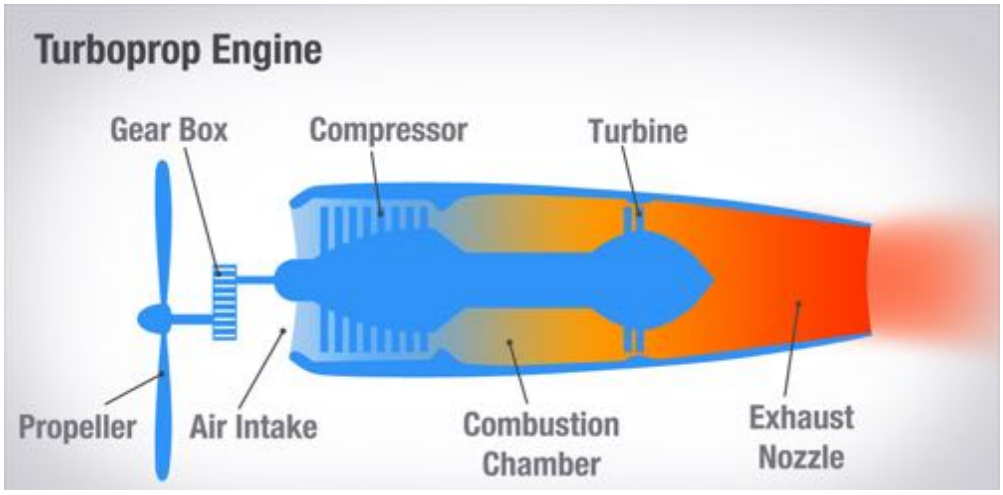
<- Front of plane **Rear of plane ->**

Air is sucked, squeezed and mixed with fuel (kerosene).
It is then detonated and the exhaust pushes the plane forward.

A modern version on the basic jet engine is the “fanjet”. This type of engine, instead of having an exposed propeller in front of the engine to pull it forward, it has a very large fan in the ”intake/suck” section of the engine, hidden within the cowling. This fan aids in forcing the air in, but more importantly, acts itself as a prop, pulling the plane forward as the exhaust does the same.

But this is still not the turboprop.

The turboprop engine combines a jet turbine with an exposed propellor, as in a piston engine. It this case, a central shaft in the jet engine is connected, via gearing system of some sort, to the prop.



The prop is generally offset with respect to the shaft of the jet turbine. The prop is most often seen mounted higher than the motor, though this may not be evident. The configuration as seen on a Dash-8 is quite frequent for commercial aircraft.

In “Old Gander”, the first turboprop that became popular was the Trans Canada Airlines Viscount. As described in Wikipedia, “the **Vickers Viscount** is a British medium-range turboprop airliner first flown in 1948 by Vickers-Armstrong. A design requirement from the Brabazon Committee, it entered service in 1953 and was the first turboprop-powered airliner. The Viscount was well received by the public for its cabin conditions, which included pressurisation, reductions in vibration and noise, and panoramic windows. It became one of the most successful and profitable of the first post-war transport aircraft…”

Again according to Wikipedia, “One reporter, after travelling on an Air France Viscount, wrote in 1953: "Noise level was less than that of piston engines. It was a definite relief to be rid of the rough vibrations... The turboprop is an excellent short-haul airplane and a definite crowd pleaser. The substitution of a lower constant pitch noise and smoothness for the vibration, grunts, and groans of the piston

engine gives the hesitant passenger a feeling of confidence. Viscount cabin windows were huge ellipses, 19 by 26 inches."

The specifications varied with upgrades over the years. A middle-of-series type 810 carried a crew of two pilots, cabin crew and 75 passengers. Cruising speed was 566 km/h, with a range of around 2220 kms. It used a Rolls-Royce Dart engine.

TCA poster 1955

Trans-Canada Air Lines (TCA) was the first airline in North America to use turboprop aircraft. TCA was cautious of the Viscount due to the turboprop engine being a new technology. Praise of the Viscount from pilots and a promise from Vickers to make any design changes desired by TCA persuaded it to procure the Viscoun, instead of the piston-engine Convair CV-240.

On 6 December 1954, the first Viscount was delivered to TCA in a large media event which included an improvised aerial display.

TCA operated the Viscount for two decades until Air Canada (TCA relabelled) ended Viscount services in 1974. it was replaced by the McDonnell Douglas DC-9.

However, that was not the end of turboprops for TCA/Air Canada.

In Britain, in the early 1950s, there was certain discussion between Vickers, who made the Viscount, and British European Airways for a larger turboprop. The requirement was notably a cruise speed of 370 kt, a standard range of 1,000 miles (with 305 miles in reserve fuel), the ability to accommodate up to 100 passengers. Coincidentally, TCA was also looking for another airplane, for its cross-Canada service.

The result was a low-wing airplane, which facilitated refuelling and maintenance, but had the famous “double-bubble” fuselage reminiscent of the old piston engine Stratocruisers. In January 1957, TCA was sufficiently satisfied that it placed an order for 20 model 952, which became known as the Vanguard.

Vanguard in Gander, moving to end for take.off
Hanger 13 in background near cockpit

The Vanguard's larger and heavier fuselage led to the adoption of the newly-developed Rolls-Royce Tyne engine. This powerplant was capable of generating a nominal 4,000 hp, in comparison to the Viscount's Rolls-Royce Dart of about 1,700 hp.

It had a crew of three, could carry 139 passengers and had a cruising speed of 679 km/h with a range of almost 3000 kms.

Another well-known turboprop was the Bristol Britannia, an aircraft built after a British government specification from 1950, with a prototype shown at the Farnborough Air show in 1952. It only went through on occasion through Gander because:

º it was not on a regular schedule
º it, like the jets, had the range to overfly Gander

It was however used at times by the Royal Family on their world tours and went through Gander for refuelling as required. But more important it gave rise to two Canadian variants.

Firstly, the RCAF required a replacement for its C-54GM North Star. in 1954, a licence was issued to Canadair to build a derivative of the Britannia, which became the Canadair CC-106 Yukon/CL44. Canadair built 39 of these Yukon turboprop Rolls-Royce Tyne-powered aircraft, comprising 12 CC-106 Yukon for the RCAF and 27 CL-44D4 passenger/cargo variants for the civil market.

Photo Bombardier

Canada also needed to replace its anti-submarine Lancasters. The contract for the modified Britannia also included provision for a new anti-submarine aircraft fleet, which led to the famous Argus CP-107. Unlike its Britannia forebear, the Argus was a hybrid, using the Britannia wings, tail surfaces and landing gear matched to a "purpose-built", unpressurised fuselage. It substituted North American materials and standard parts for British parts.

RCAF photo

An astute observer might note that that the engines on the Argus seem rather “traditional”. The turboprops were indeed changed from the Bristol Proteus turboprop engines to Wright R-3350 turbo-assisted piston radial engines, which had lower fuel consumption necessary for extended missions at low level.

While all the previous-mentioned airplanes flew through Gander, there were turboprops that were based in Gander, as a more integral part of its economy and history.

Eastern Provincial Airways (EPA) began operating in 1949, with a gamut of aircraft types from the Noorduyn Norseman, well suited to bush operations, to modern 737 passenger jets**.**

In 1960, regular passenger services began to Labrador. Piston engine Curtiss C-46s were leased for the routes, with the first Handley Page Dart Herald twin turboprop aircraft being purchased in 1962. EPA was one of the few operators of the Herald in Canada and the type was never operated by any airline in the U.S.

Dart Heralds on the EPA ramp, hangar 22

In the mid-1960s, EPA returned, so to speak, to its roots when bush and similar operations were its mainstay. One of its workhorses was the famous DHC-2 Beaver, able to get in and out of the roughest of areas. The standard Beaver used a radial engine.

It was replaced however a more modern version, this time using a Pratt and Whitney PT6 turboprop engine. The photos below show the difference.

	
EPA DHC-2 with radial engine	Typical DHC-2T turboprop

EPA also used turboprops to serve the Magdalene Islands, namely Hawker-Siddeley HS 748, a medium-sized turboprop, first designed to replace the piston engine DC-4. It used Rolls-Royce Dart engines and carried up to 58 passengers.

EPA disappeared in 1986 in a merger with Canadian Pacific and its turboprops along with it. However, these planes, along with the others that flew in and out of Gander, from the early Viscounts to late Dash-8s, all made a contribution to that wonderful place called the Crossroads of the World.

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Main References:

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