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# PROPELLER SYNCHRONIZING

multi engine propeller driven aircraft are cursed with an:

- undesirable attribute

Vibration and noise will occur:

- when the engines/ propellers are not perfectly synchronized in term of rpm.

More precisely, passengers and crewmembers are subjected to a:

- thumping beat when the engines are nearly, but not exactly in synchronization

Aside from being an : annoyance

protracted exposure to the vibrating pulses may generate problems with:

- avionics equipment
- engine baffling
- cowlings
- fasteners
- other members of the aircraft

## PROPELLER SYNCHRONIZATION SYSTEMS

When the aircraft is not equipped with synchronization devices:

- the pilot manually synchronizes the propellers
- by carefully positioning the propeller control levers until the pulsating sound is eliminated

## PROPELLER SYNCHRONIZATION

The principle behind synchronizing propellers during cruise flight primarily involves:

- crew and passenger comfort.

the pulsating droning of “out of sync propellers” expose the occupants in the airplane to a :

- fatiguing flight experience.

Airplanes not equipped with synchronization system:

- pilot manually synchronizes the propellers

Aircraft with tachometers that include a synchronizing disk, or synchroscope:

- allow the pilot to precisely synchronize the propellers by observing the reaction of the wheel

If the disk is stationary:

- the propellers are synchronized.

On a twin engine airplane:

- if the wheel rotates in a clockwise direction,
- the right engine is running faster than the left engine
- vice versa if the disk rotates counterclockwise

# PROPELLER SYNCHRONIZATION

To simplify the process of synchronizing engines many multi engine aircraft, both reciprocating and turboprop powerplants, are:

- outfitted with a synchronization system.

## Type I of synchronization system:

When equipped with a Type I system the aircraft will have a

- master engine
- slave engine(s)

Four engine aircraft may include a:

- selector switch to assign which engine is the master
- Meaning: choose one engine of the four engines

This is in the event that :

- one of the master engines fail.
- Meaning: we use this system to change the master engine when it fails

In such cases: when the master fails;

- the crew may select the other master engine and retain the ability to automatically synchronize the propellers

The master engine is the engine that is emulated by the:

- slave engine(s).
- Meaning: the master makes the slave operator like Him

To operate the system, the pilot sets the:

1, master engine for cruise operation

2, brings the other engine(s) to within 100 rpm of the master engine setting

When the synchronizer is activated:

3, the slave engine(s) will be set by the system to provide synchronization

With Type I system The engines will remain in synchronization during the:

- course of the cruise flight
- standard flight maneuvers and turns.

The Type I propeller synchronization system is normally in the Off position during:

- takeoff
- landings
- single engine operations
- slow flight,
- stall practice

The meaning of all of this is that Type I is only used:

- in cruise

Type II of synchronization system:

- do not assign master and slave ranks to the engines

Rather:

- the system will compare the rpms of the engines and raise the speed of the engines running at a lower rpm ( any engine can be the highest )

  meaning : the system chooses a master

- There is a limited range of rpm difference in which the system is able to properly function.

This approach to synchronization is:

- considerably different than the Type I design where the slave engine(s) chases the setting of the master engine

Another difference is that Type II systems may be:

- On during takeoffs and landings

My statement about Type II:

Type II of synchronization system:

- is a automatic synchronization system that chooses a master automatically and the other engines change rpm to follow the master

The difference between the type I and Type II is

- type II is on during takeoff and type I is not
- Type I the pilot chose the master in type II the system chose the master

Regardless of which type of propeller synchronization system is mounted on the aircraft:

- the system will include an rpm sensor for each engine/propeller
- a control box/circuit, and the necessary mechanisms to physically change rpm of the target engine(s)

The controller compares:

- the rpm of the engines and delivers the necessary input(s) to establish and maintain propeller synchronization.

The pilot will normally have to coarsely set the engines to be:

- within approximately 100 rpm of each other before the system will work
- Note: The difference should be 100 rpm if not system wont work

Often, the closer the pilot manually sets the engines to each other:

- the less the system will hunt for the synchronous rpm (the lower the difference the faster the process)

## FADEC SYSTEMS

The FADEC system will provide:

- synchronization and synchrophasing automatically when the engines are operating in a constant speed mode.

The FADEC controllers basically:

- make the necessary adjustments to the engines/fuel controls to save the pilot from this task

# PROPELLER SYNCHROPHASING

Where synchronization contributes much in terms of eliminating the:

- annoying throbbing beat encountered when propellers are not running at the same rpm, having the ability to control the phase relationship between the propeller blades of the engines provides
- an additional means to deal with noise and vibration during flight.

These systems are found on both:

- piston powered aircraft
- turboprops

They are known as:

- propeller synchrophasing systems

propeller synchrophasing systems have:

- the ability to control the phase relationship between the propeller blades of the engines provides
- an additional means to deal with noise and vibration during flight.

The process of synchrophasing may be a two step procedure:
Step 1: First the propellers are synchronized
Step 2: the phase angle of the propellers is altered to provide the least amount of noise and vibration.

On a manual synchrophasing system:

- the pilot will typically rotate a knob until the desired effect is attained.

The basic system uses sensors to:

- determine and monitor the position of a target blade for each propeller blade

Using electronic circuitry:

- the controller determines the relationship of the propeller position between the master engine and slave engine(s).

By activating the system and rotating the control knob:

- the phase angle of the slave engine(s) is altered

Once the pilot attains the smoothest and quietest phase angle:

- the task is complete until the power setting is disturbed

such cases:

- the procedure is repeated to reestablish synchronization and synchrophasing

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# ACTIVE NOISE AND VIBRATION SUPPRESSION SYSTEM

Newer generations of turboprop aircraft:

- may be equipped with an Active Noise and Vibration Suppression system (ANVS) or (NVS).

The performance of the ANVS system normally results in:

- cabin noise levels well below that of conventional turboprop and many jet aircraft.

The system works in a fashion similar to:

- noise cancelling headphones.

The designs of newer turboprop aircraft include features to;

- minimize, to the extent possible, the noise generated by the aircraft without the added comfort of the ANVS system

The Q400 uses the six bladed Dowty propeller. The composite blades are :

- rotated at a lower speed, thereby reducing noise when compared to propellers spinning at higher speeds

As the aircraft achieves propeller synchronization and synchrophasing from the:

- FADEC system,

the ANVS system further supplements :

- the reduction in noise level.

The ANVS system uses a series of:

- microphones affixed to the exterior of the aircraft.;
- They sense the noise applied to the fuselage

An ANVS controller receives the signal from the:

- microphones

After processing the level and frequency of the noise:

- the ANVS controller sends a noise-cancelling signal to a group of transmitters strategically placed around the fuselage.

The resultant action produces a :

- noise-cancelling effect that significantly reduces cabin noise and vibrations.