CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa



# Limited Panel

When any one or more of the basic six flight instruments fails, or is unserviceable, the instrument panel is limited.

Failure of the master instrument, the Attitude Indicator (AI), is the most serious and, therefore, the most commonly simulated. However, failure of the other instruments does occur and it is important to recognise the failure early.

Limited-panel instrument flight at the PPL level requires only the ability to fly straight and level and carry out level Rate One turns onto compass headings (sufficient to reverse course and fly out of cloud). Additional briefings will be required to adequately cover the requirements of limited-panel instrument flight for CPL students.

This exercise simulates the failure of one or more flight instruments, before or after inadvertently entering cloud. In this situation indirect readings of the other flight instruments are used to fill in the gaps as a result of losing the direct information from the failed instruments.

Limited-panel instrument flight still employs the selective radial scan technique, which recognises the changing importance of various instruments with the phase of flight.

## Objectives

To maintain straight and level flight by sole reference to a limited flight instrument panel.

To carry out Rate One level turns onto compass headings.

## Considerations

Various power or information source failures, and their effects on the flight instruments, are discussed, from the least serious to the most serious.

Although the tachometer is not a flight instrument, its possible failure should be briefly discussed. Rpm can be estimated from sound and, since only the gauge is unserviceable, power is still available to be used as required.

### Turn Coordinator (or Turn Indicator)

Turn coordinators are normally electrically driven. If power is not being supplied to the turn coordinator, a warning flag is displayed. Its failure would mean that the rate of turn would have to be estimated using angle of bank (about 15 degrees for Rate One, up to 100 knots). The balance indicator is unaffected.

The turn coordinator is checked for serviceability during taxiing and the electrical system during **SADIE** checks.

### Vertical Speed Indicator and Altimeter

Both VSI and altimeter rely directly on outside air pressure sensed at the static vent. If the static vent becomes blocked, neither the VSI nor the altimeter will indicate correctly.

Failure of the VSI and altimeter would require use of the control instruments (AI and tachometer) to achieve the desired performance. For example, an attitude for 70 knots plus power setting of about 1500 rpm, equals a rate of descent of about 500 feet per minute.

The static vent is inspected for blockages during the preflight inspection.

### Airspeed Indicator

The airspeed indicator's source of power is a combination of the static and pitot system. If the static vent is blocked, airspeed indications will decrease in the climb and increase in the descent. If the pitot system is blocked (most commonly by ice), airspeed indications will decrease in the descent and increase in the climb or, depending on the type of pitot/static system, airspeed indications may simply reduce to zero in level flight.

Failure of the ASI requires use of the control instruments (AI and tachometer) to achieve the desired performance.

The pitot tube is inspected for blockages during the preflight inspection.

### Heading Indicator

Heading indicators are gyro-stabilised and are commonly driven by the engine-driven vacuum pump. If the vacuum pump fails the gyro will gradually run down, losing rigidity, and the DI will become unusable.

Failure of the DI requires direct use of the magnetic compass for heading information.

The DI and vacuum system are checked for serviceability before flight during the taxi and the engine run-up, and in-flight with **SADIE** checks.

Remember that the DI will need to be regularly aligned with the compass, as precession will cause it to indicate the wrong heading.

### Attitude Indicator

The Attitude Indicator is most commonly driven by an engine-driven vacuum pump.

Failure of the AI will require use of the indirect information available from the performance instruments to establish the aeroplane's attitude.

AI serviceability is checked during taxiing and in flight with **SADIE** checks.

## Airmanship

Revise the importance of checking instruments while taxiing and in-flight **SADIE** checks.

## Aeroplane Management

Revise knowledge of the aeroplane's systems in the event of a malfunction.

The turn coordinator and electrical system are protected by circuit breakers (CB). Electrical failure may affect other instruments, for example, fuel gauges.

The static system is commonly backed up by an alternate static source, the location and operation of this should be described.

The pitot head is commonly heated to prevent ice build up.

The serviceability of the vacuum system is confirmed by regular reference to the vacuum gauge.

Using the **SADIE** checks will help to ensure the DI is regularly aligned with the compass.

## Human Factors

Developing a systematic instrument scan to maintain situational awareness is critical.

Because the limitations of the human orientation system are considerable, and instrument failure is rare, **trust the instruments**.

The pilot should not have access to unreliable information that could be used in any way. It is recommended that unreliable information is covered.

# Air Exercise

For this exercise a failure of the vacuum system is simulated – AI and DI unserviceable – and the information available from each instrument to maintain control in each plane is revised.

***Pitch***
Determined from airspeed, altimeter, vertical speed indicator and rpm (noise).

***Bank***
Determined from turn coordinator when balanced (ball), and compass.

***Yaw***
Determined from balance (ball).

The selective radial scan (SRS) technique is described in relation to maintaining straight and level and completing Rate One turns onto compass headings without the master instrument.

For straight and level, the altimeter and turn coordinator are incorporated in the primary scan with VSI and compass included in the secondary scan. Airspeed requires little attention since the Attitude + Power combination will provide the desired performance.

For level Rate One turns onto compass headings, the altimeter and turn coordinator remain in the primary scan, with the importance of the compass gradually increasing as the required roll out heading is approached. Once again, airspeed requires less attention.

# Airborne Sequence

**The Exercise**
Start from straight and level on full panel.

A vacuum failure is simulated and therefore the AI and DI are unserviceable. These instruments are capable of providing unreliable information that could be used, so they are removed from the scan by fitting them with instrument covers.

Straight and level is maintained on limited panel and Rate One turns practised, eventually onto compass headings.

All instrument flight requires considerable concentration, therefore, do not keep the student at the exercise for long periods – little and often is best.