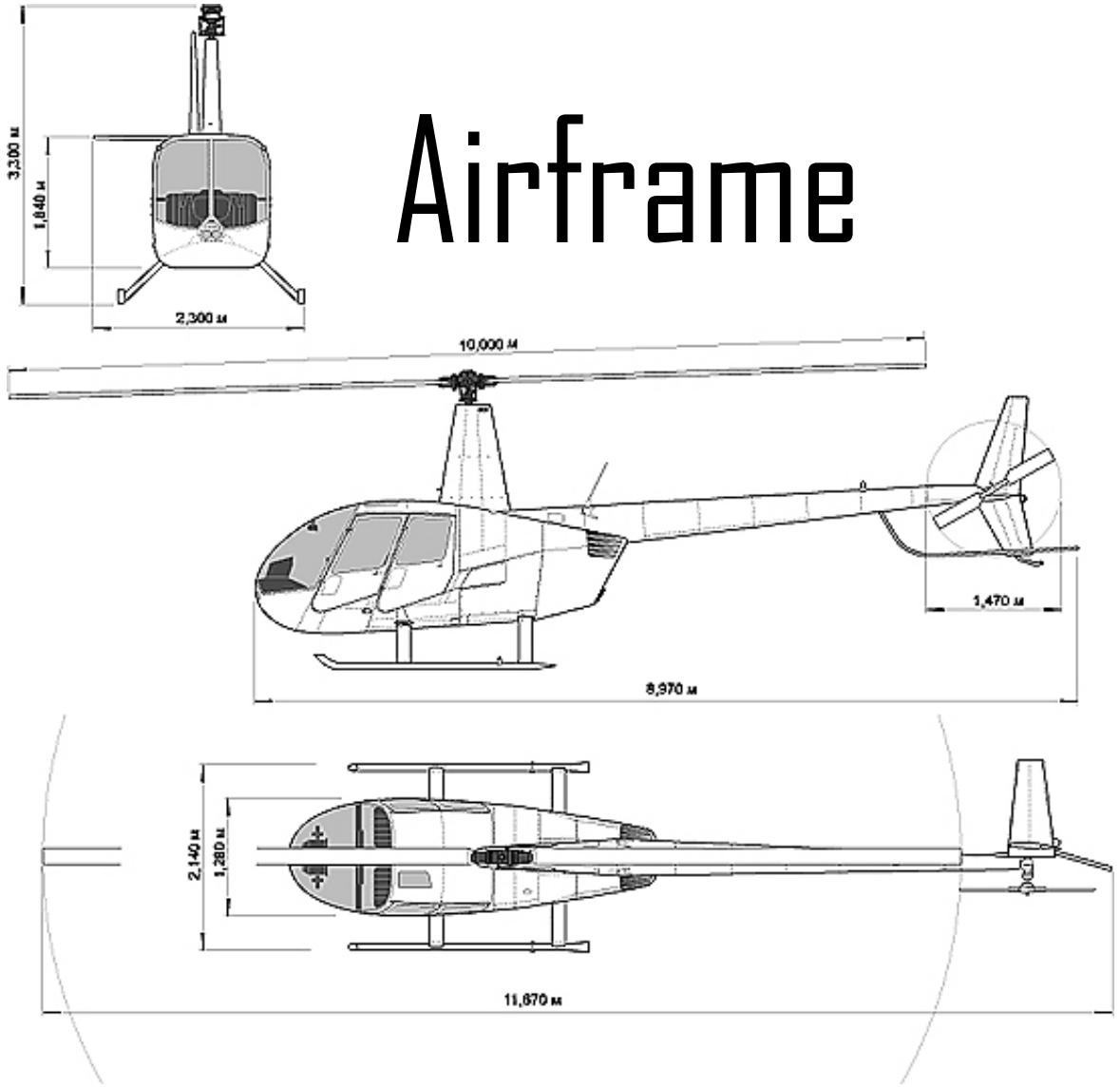
Robinson R44

Systems

YORKSHIRE
HELICOPTERS

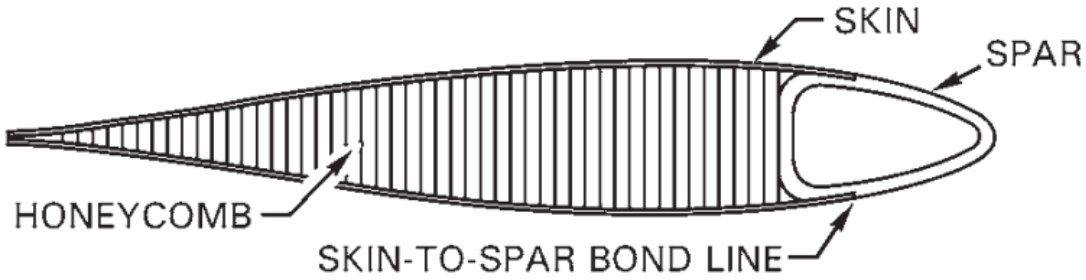
Airframe



The airframe is primarily a metal construction. The primary fuselage is welded steel tubing and riveted aluminium sheet.

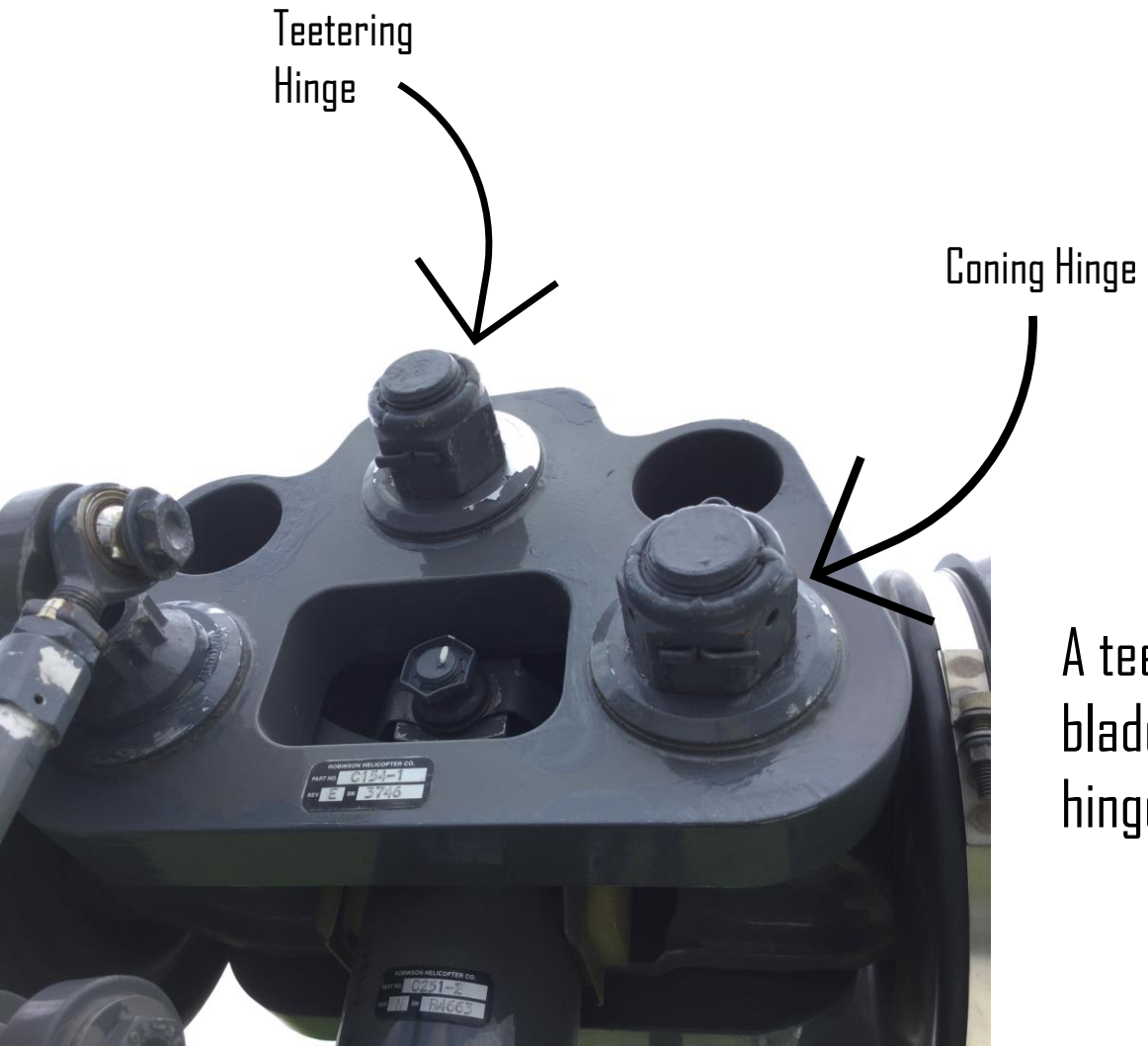
The tailcone is an aluminium semi-monocoque structure where the skin carries most loads.

The original blades were constructed of 2 stainless steel skins with a honeycomb core and an aluminium forged root fitting. In 2010 all blades were manufactured using aluminium instead of stainless steel for better dent protection and corrosion resistance.

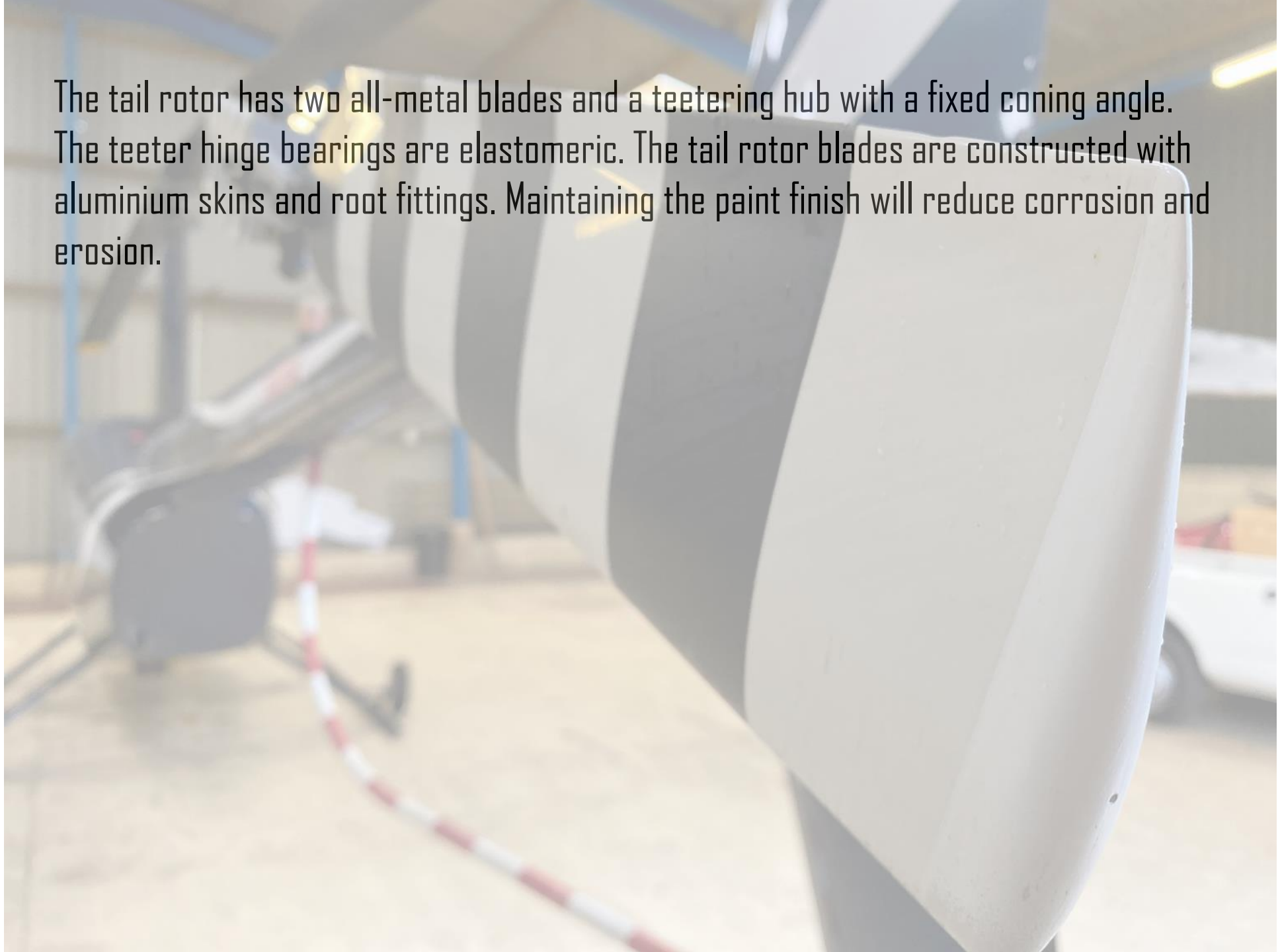


MAIN ROTOR BLADE CONSTRUCTION

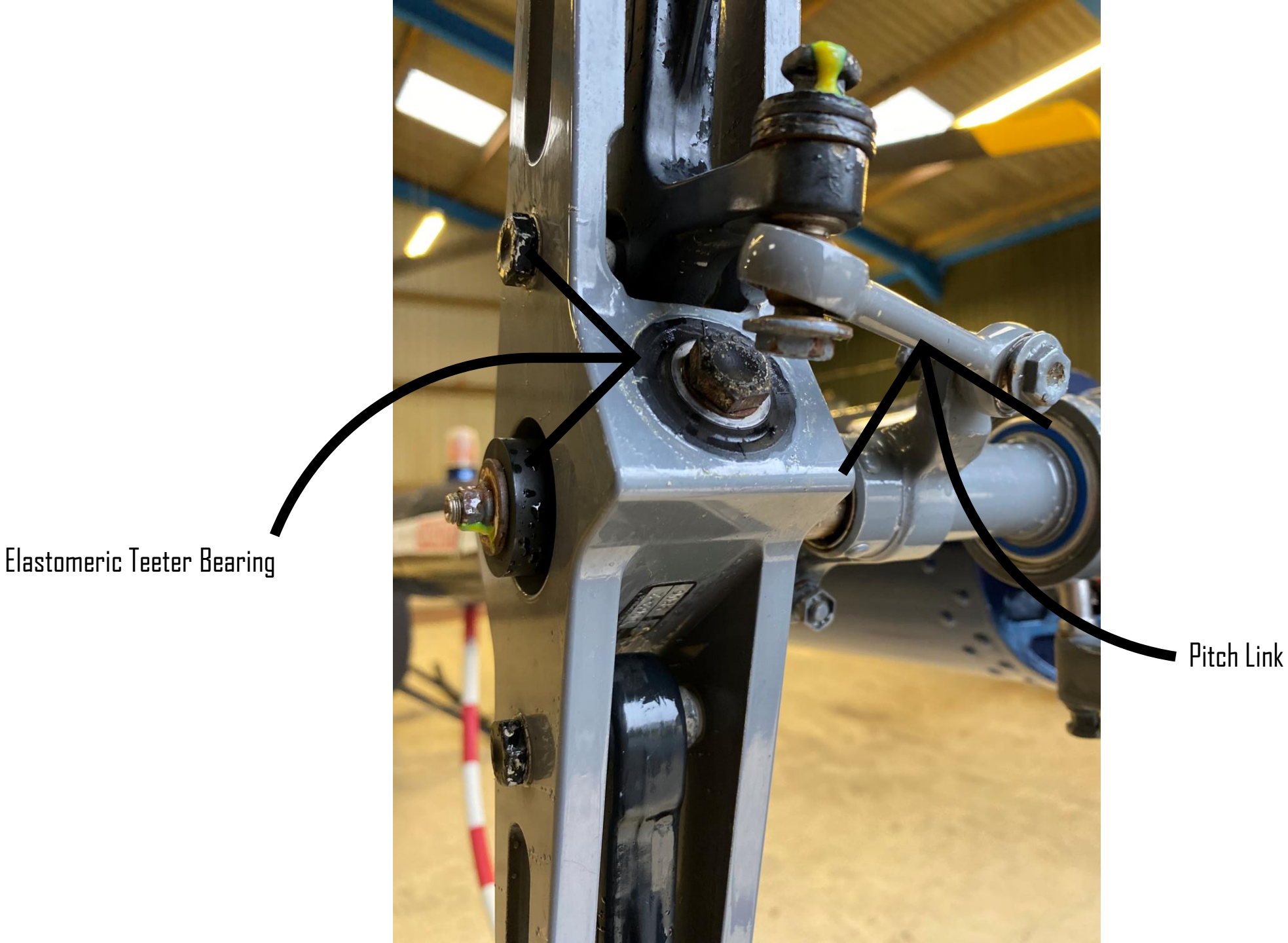
Rotor System



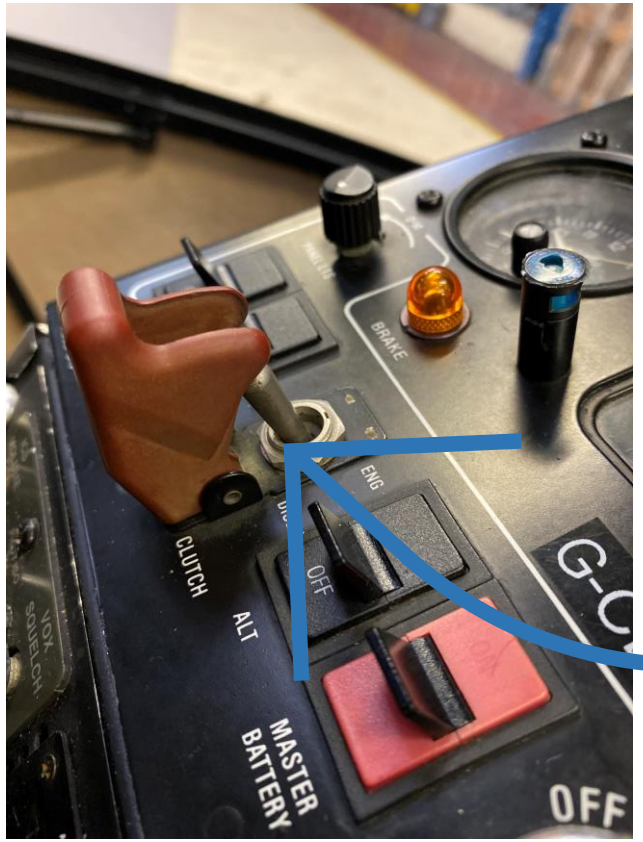
A teetering, semi-rigid, type rotor system is used with 2 aluminium blades . These are mounted to the aluminium-forged hub using coning hinges, while the hub is mounted to the shaft using a teetering hinge.



The tail rotor has two all-metal blades and a teetering hub with a fixed coning angle. The teeter hinge bearings are elastomeric. The tail rotor blades are constructed with aluminium skins and root fittings. Maintaining the paint finish will reduce corrosion and erosion.


Elastomeric Teeter Bearing
Pitch Link

A vee-belt sheave is bolted directly to the engine output shaft. Vee-belts transmit power to the upper sheave which has a freewheel unit contained in its hub.
Power is then transmitted forward to the main rotor and aft to the tail rotor.
Flexible couplings are located at each end of the tail rotor driveshaft and at the main gearbox input.



After the engine has started, when the pilot engages the clutch switch, a clutch actuator is used to raise the upper sheave and tension the vee-belts to allow power transmission.

The actuator senses compressive load (belt tension) and switches off when the vee-belts are properly tensioned.

The clutch actuator switch in the cockpit has a cover to prevent accidental disengagement during flight.

Clutch Switch

Engine

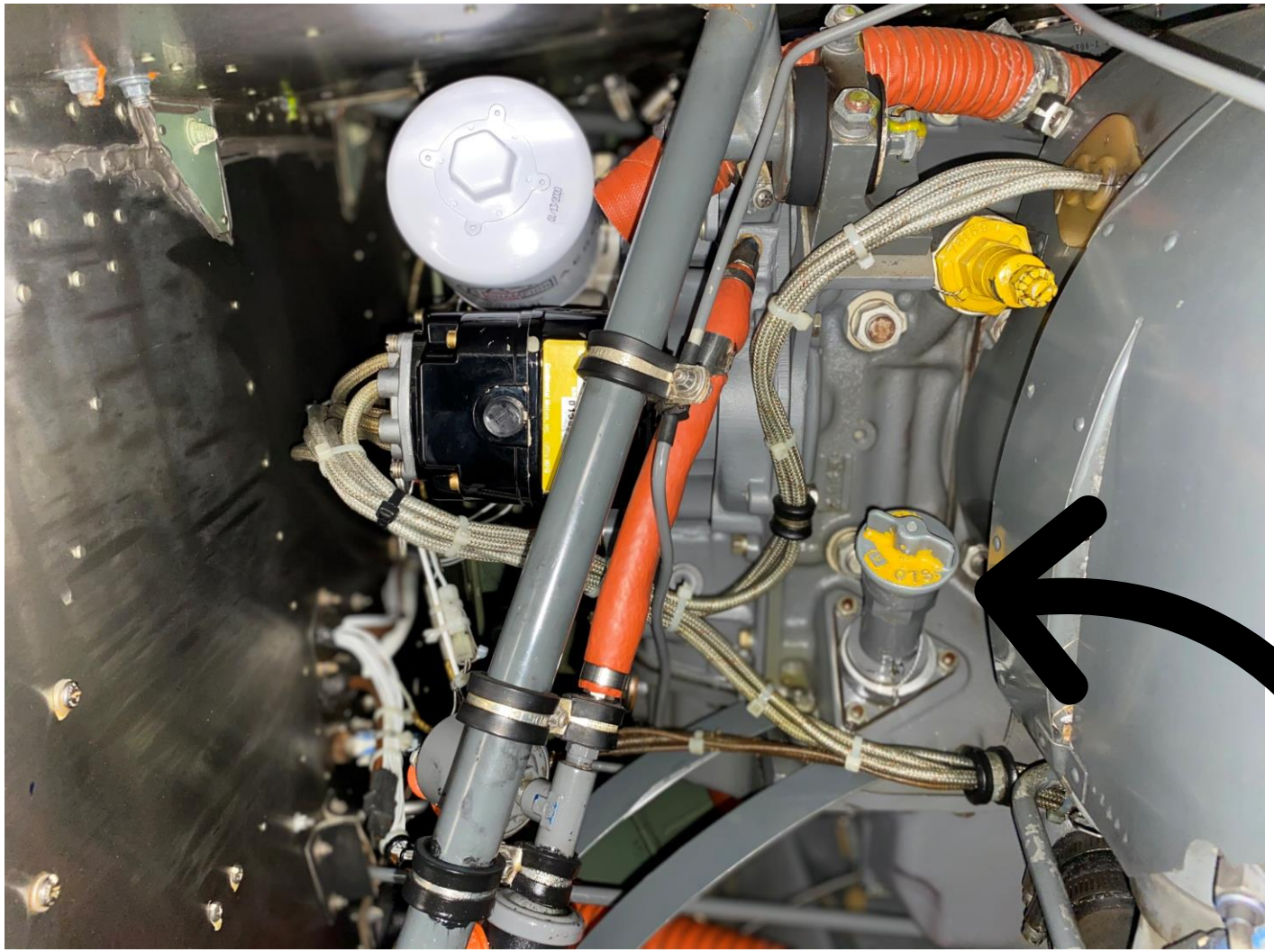
Induction air enters through an opening on the right side of the aircraft.

Raven I

Induction air is mixed with vaporised fuel as it passes through a venturi in the carburetor. The fuel/air mixture is then delivered to the cylinder intake. A sliding valve controlled by a carburetor heat control adjusts the mix of cool and heated air which then flows through a filter and up into the carburetor.

Raven II

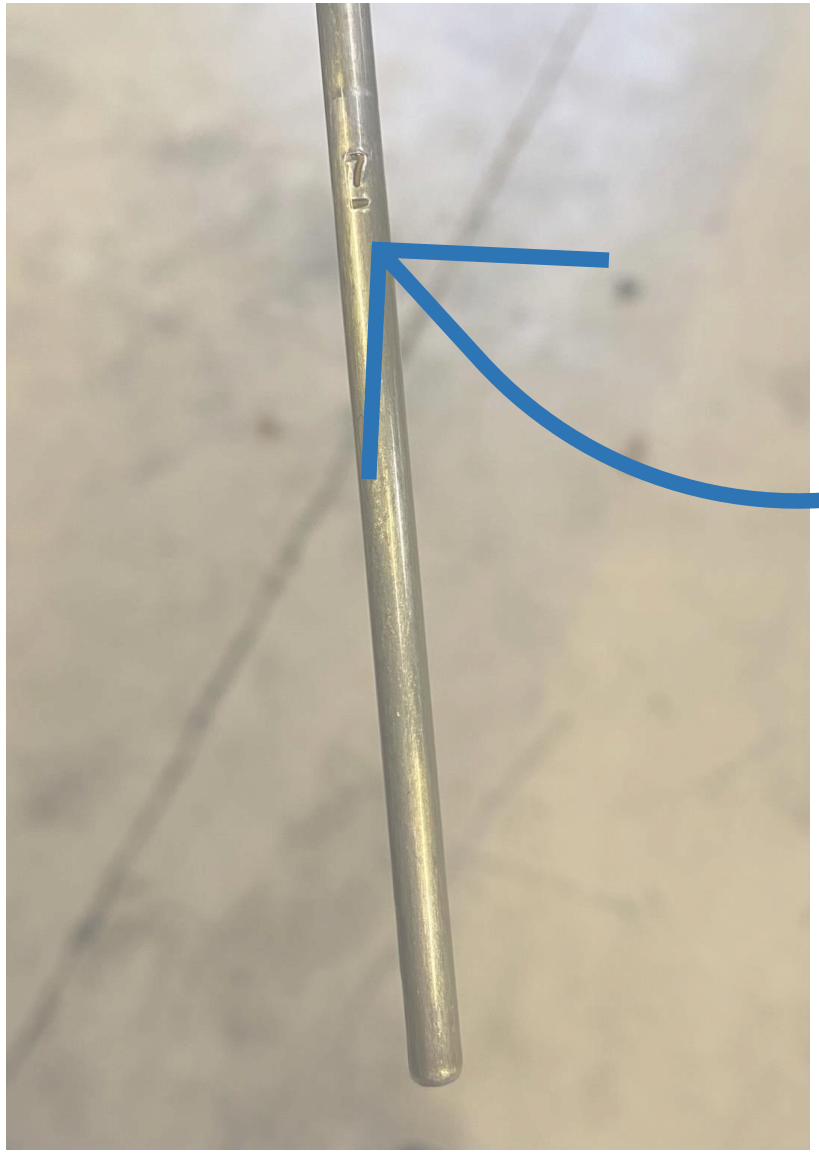
Fuel and air are metered at the fuel control unit but are not mixed. The fuel is injected directly into the intake port of the cylinder where it is mixed with the air just before entering the cylinder.



A view inside the aircraft's left hand side cowling.

The wet sump oil system installed in the R44 models uses an oil pump that draws oil from the oil sump (which is located inside the engine), routes it through a filter screen and, if the oil is hot, through the cooler. From there the oil passes an oil pressure relief valve and is routed into the oil gallery of the crankshaft. The oil flows down into the sump by gravity after it has passed through the engine. The function of the relief valve is to reroute excessive oil directly back to the sump in case of excessive pressure.

Oil filler and dipstick



For pre-flight purposes, the oil level can be checked using a dip-stick, it is scaled in US Quartz. Minimum level for take off is 7 while maximum is 9.

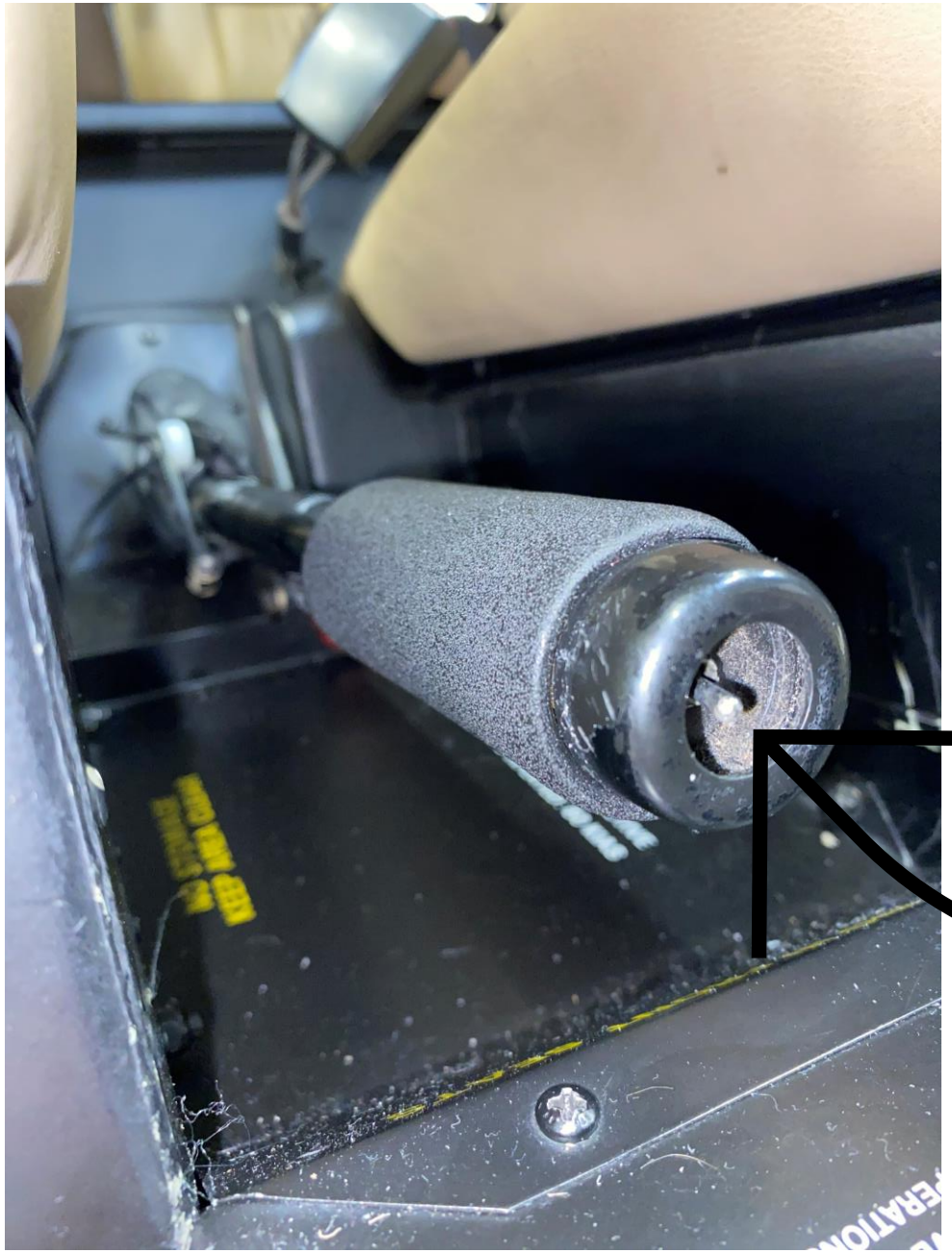
7 US Quartz marker

Throttle & RPM Governor

A twist-grip throttle control is located at the end of each collective. The controls are interconnected and actuate the throttle valve through a mechanical linkage. When collective is raised, the throttle valve opens, and when the collective is lowered the throttle closed. An overtravel spring located in the throttle linkage allows the pilot to roll the throttle off beyond the idle stop prior to a ground contact autorotational landing. This prevents the throttle from opening when the collective is raised.

The governor maintains engine RPM by sensing changes and applying corrective throttle inputs through a friction clutch that can be easily overridden by the pilot. The governor is active only above 80% engine RPM and can be switched on or off using a toggle switch found on the end of the right seat collective.

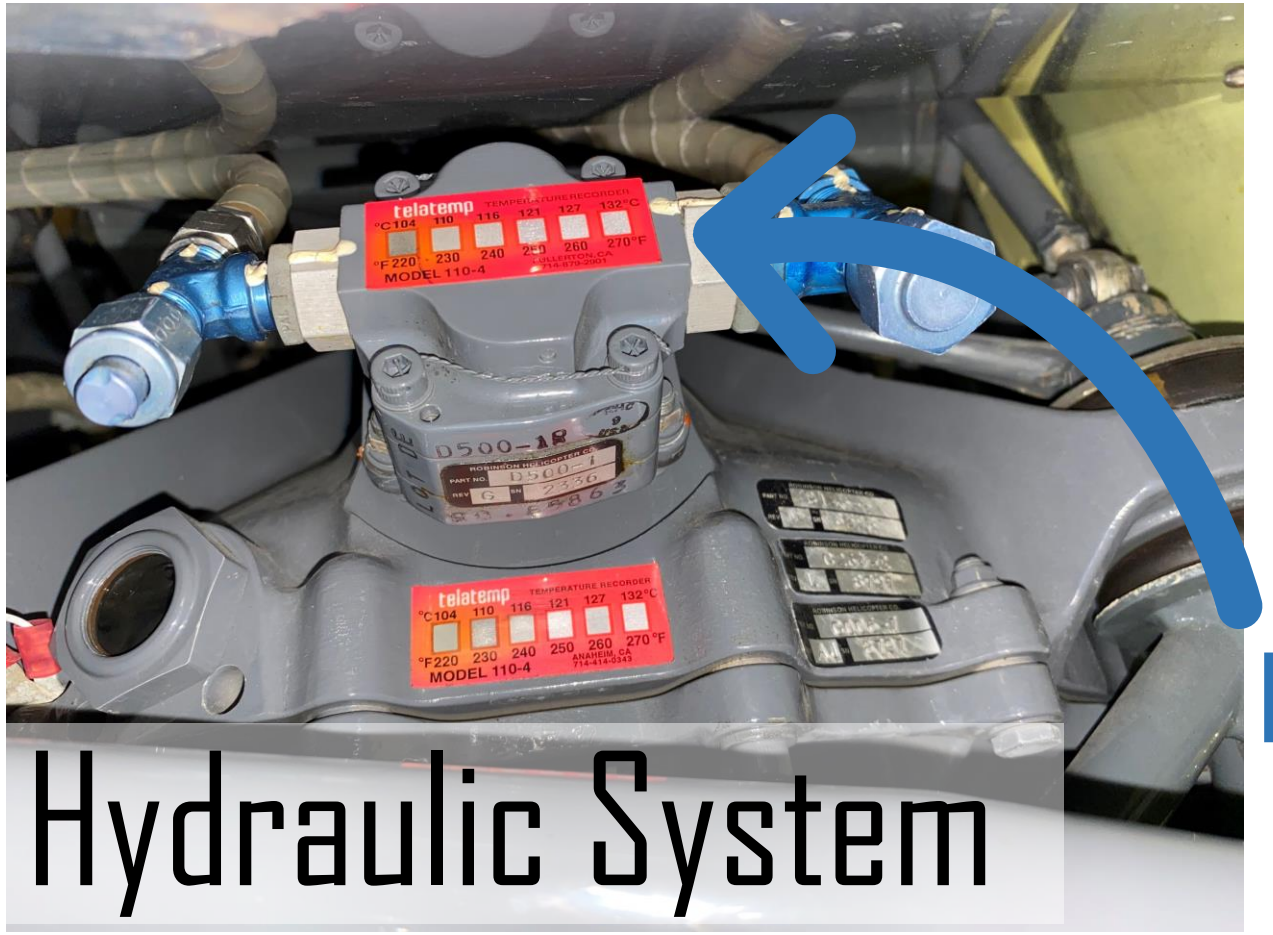
Manual manipulation of the throttle is not usually required except during start-up, shut-down, autorotation practise and emergencies.



The governor is designed to assist in controlling RPM under normal conditions. It may not prevent over-or under-speed conditions generated by aggressive flight manoeuvres.

The governor light will illuminate only if the toggle switch is in the OFF position and does not indicate a malfunction of the system.

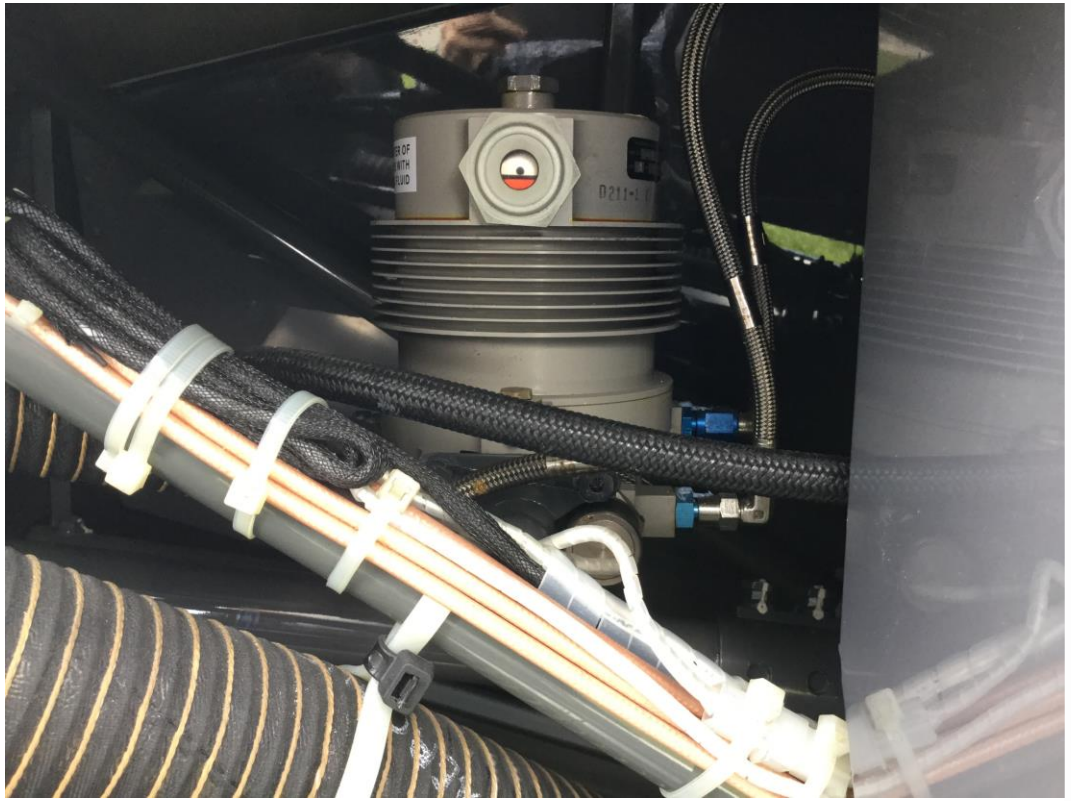
Governor switch on the end of the right pilot collective



Hydraulic System

PUMP

The hydraulic system eliminates feedback forces on the cyclic and collective, it consists of a pump (mounted on and driven by the gearbox in case of engine failure), three servos, a reservoir, and interconnecting lines. Normal pressure is 450 to 500 psi. One servo is connected to each of the three push-pull tubes which support the swash plate.



The reservoir is mounted on the steel tube frame behind the gearbox and includes a filter, pressure relief valve and pilot-controlled pressure shut-off valve. A sight gauge for pre-flight fluid level checks is incorporated in the reservoir.

The fuel system includes main and auxiliary tanks that use flexible bladders in aluminium enclosures in order to reduce the risk of post-crash fires.

The fuel tanks are vented through air vents located inside the mast fairing.

The auxiliary tank is interconnected with the main tank and located somewhat higher so that it will become empty first while some fuel remains in the main tank.

Fuel System

The Raven I fuel system is gravity fed, while the Raven II uses a fuel pump system.

Fuel travels from the gascolator to the electric fuel pump, then to the engine driven pump, then to the fuel control and from there to the flow divider atop the engine via flexible fire-sleeved hoses.

The gascolator fuel filter incorporates a pressure switch, which activates a fuel filter warning light.

The electric fuel pump is a 30gph positive displacement pump and is capable of supplying more fuel than engine demand under all conditions. If the pump pressure falls below 23psi a pressure switch activates the fuel pump warning light.

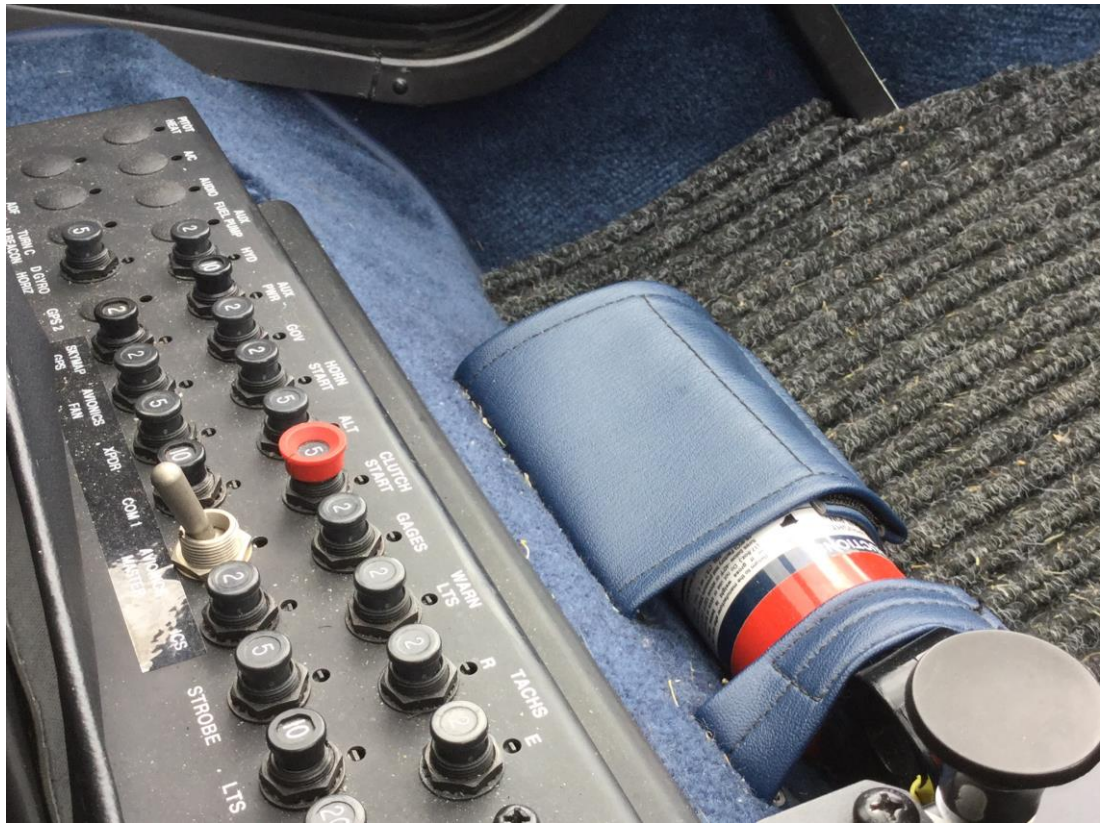
There are drain valves provided for each fuel tank sump, as well as for the gascolator. These should be sampled to check for contamination and to verify the correct grade has been used.

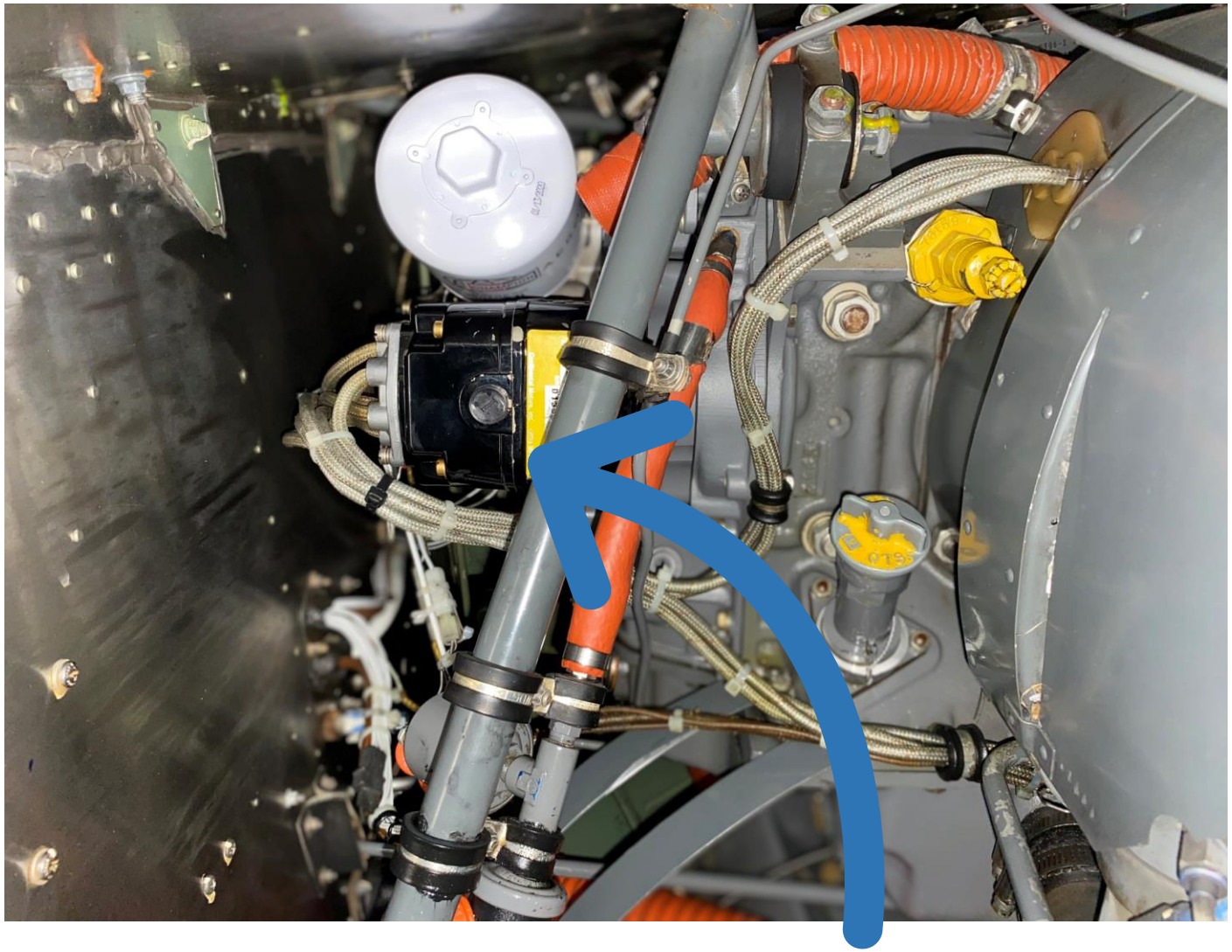
Electrical System

The Raven I uses a 14 volt electrical system including a 14 volt alternator and 12 volt battery while the Raven II uses a 28 volt alternator and 24 volt battery.

In normal operation the engine-driven alternator provides electrical power to the electrical system and charges the battery. The alternator produces alternating current which is then converted to direct current using a rectifier and supplied to the busbar that distributes the current to the electrical components on the aircraft.

Push-to-reset type circuit breakers are located just in front of the front left seat and are marked to indicate their function and amperage. The Master Battery switch on the console controls the battery relay which disconnects the battery from the electrical system.





One of the engine-driven magnetos

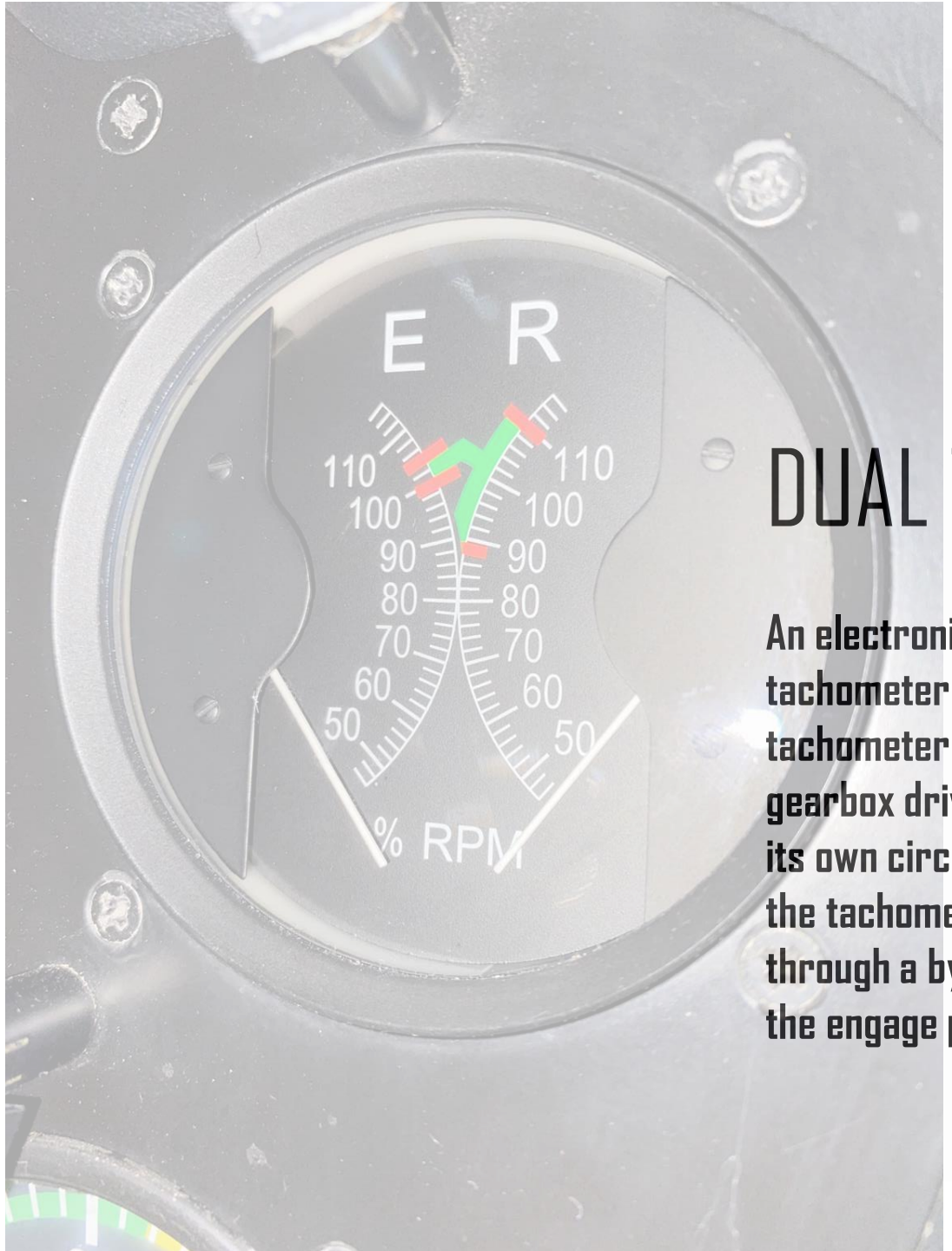
The R44 uses a double ignition system using 2 magnetos. A magneto is a small electrical AC generator driven by the crankshaft, creating a very high voltage that is led to the spark plugs via high-voltage cables.

Using 2 magnetos instead of one increases safety and reliability and also improves combustion. If one magneto fails, the other will continue to operate normally, although a slight decrease in power can be expected. The same is true if one of two spark plugs in a cylinder fails.

The operation of the magnetos is via the ignition switch in the cockpit.

The P lead is the wire connecting the starter switch to your magneto's primary windings, thus P lead. Their primary purpose is to ground the magnetos to avoid accidental starts.

1.Off - Both magneto p-leads are connected to electrical ground. This disables both magnetos, no spark is produced.
2.Right - The left magneto p-lead is grounded, and the right is open. This disables the left magneto and enables the right magneto only.
3.Left - The right magneto p-lead is grounded, and the left is open. This disables the right magneto and enables the left magneto only.
4.Both - This is the normal operating configuration, both p-leads are open, enabling both magnetos.
5.Start - The pinion gear on the starter motor is engaged with the flywheel and the starter motor runs to turn the engine over. In most cases, only the left magneto is active (the right p-lead is grounded) due to timing differences between the magnetos at low RPMs.



DUAL TACHOMETER

An electronic engine and rotor dual tachometer is standard. Engine tachometer signal is provided by magneto breaker points. Rotor tachometer signal is provided by two magnetic senders at the main gearbox drive yoke. Each tachometer is on a separate circuit with its own circuit breaker. With battery and alternator switches off, the tachometers continue to receive power from the battery through a bypass circuit as long as the clutch actuator switch is in the engage position.