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AMROBA Postal Address: **Post Office Box 1011, Hervey Bay, 4655, Queensland**

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How Civil Aviation Standards Improve Safety.

When I started in this industry, safety was not at the level it is today, neither were many standards that now apply to processes, parts, manufacture, especially aircraft oil, grease and fluids now specified by the manufacturer of aircraft and engines.

As these standards have improved over the years, safety has improved, especially in GA.

The FAA has many ACs listing standards. For example:

FAA, AC 20-24 Approval of Propulsion Fuels, Additives, and Lubricating Oils.

This AC provides acceptable methods, but not the only methods, that may be used to approve aircraft, engines, or APUs to operate with specified propulsion fuels and lubricating oils.

***"Note:** FAA Approved product to operate with specified fuels and oils. See references below:*

- *"(2) ASTM International Standard D910, "Standard Specification for Aviation Gasolines."*
- *(3) AC 23.1521-1B, "Type Certification of Automobile Gasoline in Part 23 Airplanes with Reciprocating Engines," dated March 2, 1995.*
- *(6) AC 91-33A, "Use of Alternate Grades of Aviation Gasoline for Grade 80/87, and Use of Automotive Gasoline," dated July 18, 1984.*
- *(11) ASTM International Standard D7547, "Standard Specification for Unleaded Aviation Gasoline."*
  - *The basic difference between Grade 80 aviation gasoline and the two grades of 100 octane fuel is tetraethyl lead (TEL) content. Grade 80 (red) gasoline contains a maximum of 0.5 ml/gal of TEL, whereas Grade 100LL (blue) gasoline may contain up to 2 ml/gal TEL and Grade 100 (green) gasoline up to 4.0 ml/gal TEL. It is this increase in lead content which can produce problems in these older aircraft piston engines.*
- *The FAA does not regulate the distribution systems for either aviation gasoline or automotive gasoline. Nor does it regulate the specifications for either fuel. **It does, however, approve the use of fuel to a given specification in an aircraft engine**."*

When industry manufacturers adopt new oil and grease standards that apply to their products, it is after the new standard has been approved. This has happened in GA aircraft where US automotive fuels have been approved by the FAA under the STC process.US automotive fuel is manufactured to a specified ASTM standard that is not available in every nation.

If Australian automotive fuel does not meet to FAA endorsed ASTM standards, the FAA advisory material provides a pathway to process of certification of the Australian automotive fuel standard and, if it meets the FAA certification process, approve by issue of an ASTC.

FAA AC 1521-1B: Type Certification Automobile Gasoline in Part 23 Airplanes With Reciprocating Engines.

(Gasoline containing more than 11percent by volume of alcohol should be certificated using the guidance in AC 23.1521-2.)

"Acceptable Means of Compliance.

*a. Engine STC. It is mandatory that the engine be approved (by STC or type certificate (TC)) for operation on automobile gasoline before automobile gasoline is eligible for approval in the airplane. (FAA) **AC 20-24B** describes an acceptable method of obtaining approval for the engine to operate on automobile gasoline. Engines that are approved for operation on 80/87 grade aviation fuel, Engines that are approved for operation on 80/87 grade aviation fuel, or normally aspirated engines that have a compression ratio of approximately 7.2:1 or less, may operate satisfactorily on automobile gasoline. Engines having a compression ratio greater than 7.2:1 may experience detonation with associated engine destruction when operating on low-*

octane automobile gasoline. In either case, operation of the engine with any alternate fuel must be shown to meet the minimum design requirements for the engine and be approved. It may be possible for testing of the engine and airplane to be conducted concurrently.

Test methods contained in ASTM D 4814 may be used or alternate test methods may be presented by the applicant to the FAA for acceptance.

(12) Preparation of a Supplemental Airplane Flight Manual(AFM) or AFM Supplement, as applicable, is necessary to specify the airplane's proper operating procedures and limitations. A Supplemental AFM is used with airplanes that were originally certificated:.

This raises one question, do all the fluids, fuels, oils and greases used in aircraft maintenance meet the standards specified by the manufacturer or have an STC or ASTC for use in specified aircraft or engines.

CASA AC 91-25 v1.2 Fuel and oil safety [standards]

Fuels and oils Type, grade and contamination of fuel and oils

"3.1.3. Most aircraft in Australia are certified to only operate on either AVGAS or Jet A1. Certain aircraft are approved to use a substitute fuel. In such cases, the type of fuel acceptable for use will be stated on the aircraft type certificate (TC) or a supplemental type certificate (STC). At all times, relevant persons must adhere to the details of any such approval. An example of such substitutions are recreational aircraft certified to operate on both MOGAS and AVGAS.

3.4 Unleaded (UL) Aviation Gasoline (AVGAS) used in aircraft with spark-ignition engines

3.4.1 The use of any fuel is dependent on that fuel being listed, by specification and grade, for a particular purpose within an approved and recognised data source. For example, even if UL AVGAS is identified as an approved fuel for certain aircraft or engines, if the fuel is not to the specification listed (e.g. ASTM D7547) then it cannot be used.

3.4.2 The use of UL AVGAS in aircraft spark-ignition engines is only acceptable when:

- the fuel is:
  - listed as an approved fuel in the aircraft and/or engine manufacturers approved data or
  - approved by a National Airworthiness Authority of a recognised country, or locally under Part 21 through an avenue such as a STC."

In this situation, are fuels being used compliant with CASA requirement in their AC?

EASA States:

The use of Avgas UL 91, when this fuel grade has been approved for the particular engine types, is possible even if the airframe TCDS specifies a higher minimum number of octane (e.g. Avgas 100LL). In this case, the Avgas UL 91 can be used after implementation of the related Standard Change CS-SC202b, see page 48/49 of CS/STAN

"This Standard Change is suitable for aeroplanes that are approved for operation with Avgas or Mogas in case the installed engine is already approved to use unleaded Avgas UL 91, leaded Avgas 80/87, or Mogas RON 95 (MON 85) in accordance with Standard EN228.

The previously published EASA SIB 2011-01 has been withdrawn after publication of CS-STAN "Standard Changes and Standard Repairs".

***IMPORTANT:** Use of unleaded Avgas UL 91 in engines that have not been approved for the use of these fuels may cause extensive damage or lead to in flight failure, due to the lower Motor Octane Number (MON) of the fuel, compared to Avgas 100LL.*

3. Acceptable methods, techniques, and practices To enable the use of unleaded Avgas UL 91 with this SC, the following conditions are to be met: — the engine installed on the aircraft is approved for use of unleaded Avgas UL 91 and the aircraft is already approved for operation with conventional Avgas (according to ASTM D910, Def Stan 91-90, Mil G-5572, GOST1012-72 or equivalent) or Mogas; or — the engine as well as the aircraft are approved for operation with Avgas Grade 807; or — the engine as well as the aircraft are approved for operation with Mogas RON95 (MON 85) in accordance with standard EN 228; — the installed engine has not been modified and meets the specifications of the original engine Type Certificate; and — placards are installed/amended as needed to allow the use of the approved fuels. Warning 1: Use of unleaded Avgas UL 91 in engines that have not been approved for its use may cause extensive damage to the engine or lead to in-flight failure due to the lower Motor Octane Number (MON) of the fuel, compared to Avgas 100LL. Warning 2: This SC is not intended for approving the use of automotive fuel."

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People and Lack of Approved Standards

This issue concentrates on the people that we depend on to create and maintain this industry.

Without people, growth and upkeep of engineering and continuing airworthiness sector suffers.

Australian civil aviation engineering (airworthiness & continuing airworthiness sectors) has always focused and been dependent on people with many different skills to ensure all levels of the industry function smoothly and safely.

Post WW2 and Korea, the industry had sufficient qualified personnel, mostly ex-services, to enable growth in both operations and engineering.

Predominately, the people from the services were male. Though the civil sector has never been biased against women from becoming pilots or being involved in the design and/or maintenance side of civil aviation, the system has not provided education pathways under-pinning the trades, support skills and supervisory and licencing.

The industry has always known that secondary schooling is where students are mentally focused by the teachers and the education system for their future. The problem in Australia is civil aviation various career paths are not well identified within the tertiary and higher education systems. Where are the Australian Qualification Framework (AQF) qualifications, recognised by aviation employers and licencing authorities for the specific sectors?

Ask secondary schools career advisors whether they advise their students there are careers in civil aviation engineering, design, or maintenance?

- I can tell you; it is near zero.
- Why, because tertiary training does not provide career pathways.

This is known to government who asked AMROBA why a decade ago.

The answer is simple, ever since the airlines and unions negotiated a split in the mechanical pathway into mechanical systems and structures, the education system followed and provided both pathways.

Answer: Amend S98 of the Act to require the regulator to work with Education to provide career pathways. Unless government adds provisions to S98, policy changes won't happen.

The US government continually amend their version of S98, e.g. direction to add mosaic regs.

Their government House & Senate committees are responsible for providing change.

Canadian Maintenance Personnel System

Transport Canada Aviation regulatory responsibility ***to*** *(a) promote aeronautics by such means as the Minister considers appropriate.* We need this added to the Department's responsibility so overseas opportunities become available to our design and maintenance sectors. Once again, without such regulatory direction, it just does not happen.

e.g. Current Canadian requirements enable them to have technical design and maintenance agreements with Europe/US and many others. Industry waits for government to achieve these agreements without amending Sec 98 of the Act to require CASA to obtain such agreements.

Airworthiness Chapter 566 - Aircraft Maintenance Engineer (AME) Licensing and Training - Canadian Aviation Regulations (CARs)

- If only we had continued to harmonise with North America.

This difference has never been recognised by the licencing authority, CASA. CASA only promulgates the knowledge and experience a person needs to gain a licence, not Australian qualifications or training courses meeting ICAO standards like other nations.

This means we are decades behind modern systems like North America, Europe and Asia.

In other mature countries, government educators and aviation regulators work together to provide education career pathways for maintenance and operational personnel.

- Why cannot it be achieved in Australia?
- Why isn't employment based on an education qualification?
- Why are there no defined career pathways defined in the education system?
- Where is CASA's list of VET qualifications needed to hold each of their licences?

The following is only a concept, it needs greater definition to work in this government system.

Career Pathway Basic Concept						
NVET Quals		**Mechanical Pathway**			**Avionics Pathway**	
Based on aviation standards		A/C Transport	A/C Non-Pressurised	Helicopters	Complex plus Type	Basic plus Systems
P 66 M 10	AQF 6 2 Pathways	1. Engineering Manager (Airlines – Large Organisation) 2. Chief Engineer (Aircraft/Component Managers)				
	AQF 5	LAME B1.1	LAME B1.2	LAME B1.3/4	B2	B2 Basic + Systems
P 66 M's As applic.	AQF 4	Trade	Trade	Trade	Trade	Systems
	AQF 3	Specialised	Specialised	Specialised	Specialised	Basic
	AQF 2	Pre-Trade	Pre-Trade	Pre-Trade	Pre-Trade	Pre-Trade

Specialised: Above relates to trade pathways specified by aviation regulatory requirements but there are other maintenance pathways like 'structures', 'welders', 'NDT', 'W&B', component workshop personnel and many others.

- You only need to look over the pond, NZ achieved this many years ago.

In addition, all regulatory systems enable a pathway for experienced trade personnel to obtain a licence. E.g. an allied trade person that has worked on the job for regulatory specified periods.

Why is it only Australia that cannot adopt and implement career pathways like NZ, Canada, Asia, US, Europe, etc.?

It is not an industry fixable issue; it is purely government departments and agencies issue.

Regulator and educators are not providing the civil aviation maintenance, especially in the helicopter, general aviation aeroplanes and avionic (basic plus systems) used in so many non-transport aircraft.

If the training standards are not up to world safety standards, this will impact on safety.

Responsible for Airworthiness

The FAA is compliant with the Convention and its Annexes, so we use it as an example.

The Federal Aviation Administration (FAA)

In the **United States**, the responsibility for **airplane airworthiness** is primarily held by the **Federal Aviation Administration (FAA)**. The FAA's Aircraft Certification Service oversees the design, production, and certification of aircraft, **ensuring they meet safety standards**. Additionally, the **pilot in command** is responsible for determining whether an aircraft is airworthy before flight, and the **owner or operator** must maintain the aircraft in an airworthy condition, including compliance with maintenance and airworthiness directives.

Who Is Responsible for Keeping Aircraft Airworthy

"Federal regulation places primary responsibility for maintaining an aircraft in airworthy condition squarely on the owner or operator, including compliance with all Airworthiness Directives. This is worth emphasizing because many aircraft owners assume their mechanic handles airworthiness. The mechanic performs the work, but the legal obligation belongs to whoever owns or operates the aircraft. If an Airworthiness Directive goes uncompiled with or an inspection lapse, the owner is on the hook.

The pilot in command carries a separate, overlapping duty: before every flight, the PIC must determine whether the aircraft is in a condition for safe flight and must discontinue the flight if unairworthy conditions develop in the air. A renter pilot who accepts an aircraft with a known squawk doesn't get to blame the flight school. Both the owner and the PIC share liability, from different directions.

Required Inspections

Airworthiness doesn't exist on its own. The inspection system exists to catch problems before they become dangerous, and missing a required inspection makes the aircraft unairworthy regardless of its physical condition.

The rest of this article can be read via the link in the heading.

This process is also spelt out in ANRs for GA.

Red Tape Reduction

I have almost completed a change of location to a new address in Hervey Bay and I associated this move with doing a mandatory red tape review and compare it with aviation. From a large premise to a 3-bed apartment means you have no alternative but to reduce your assets and capabilities, not much different when business downsize when industry slows.

I was surprised the number of governments, semi-government and private businesses that provided their services by phone or on-line. Even when you visit an office it is digital.

For instance, Qld Transport uses one form to change car vehicle licence, boat licence, car registration and boat registration address.

But there were some on-line documents that were administrative hard to complete, and these offices, when visited, had the higher number of office workers.

Simple things like our AMROBA trademarks registered address change, was a paperwork exercise, and this is repeated again and again. I always thought the government has all your details, obviously not linked between all departments, at least publicly.

Red tape can be reduced by making industry individuals and organisations responsible for devolved regulatory requirements.

The one thing I am certain, we are no longer the "can-do" country that we were in my working days in aviation. Many front-line personnel were great to deal with, but they admitted they are restricted by their own paperwork. Just like CASA.

To be successful, government need staff with genuine skills to reduce red tape.

Alternatively, remove approvals by making specific individuals/organisations responsible.

1. Positive obligation on regulated actors to report breaches of regulatory requirements.
2. Periodic, risk-based inspections by regulations of regulated actors.
3. Project approval conditions to be made into legal requirements, rather than implemented through Ministerial discretion.

The first change is to impose positive obligations on regulated entities to report breaches of regulatory requirements. This means that when a regulatory requirement is breached, the regulated entity must report it to the regulator. Failure to report such a breach would be met with penalties.

The second component is the use of periodic, risk-based inspections by regulators to monitor the compliance of regulated actors with their underlying regulatory requirements.

Under this approach, regulators would no longer provide approvals to regulated entities prior to a project or activity commencing. Rather, regulators would be responsible for implementing their own compliance and enforcement regime.

This can be achieved by adopting FAR Part 43, applicable clauses of Parts 65 & 91.

We are still waiting.

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