Big Challenges for Little Airliners

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Abstract
This paper looks at several challenges facing the structural safety of little airliners in Australia. They include high usage, inappropriate design standards, inadequate maintenance programs, and dwindling technical support.

It considers some possible solutions, concentrating on better standards for type certificate holders, modifiers, repairers and maintenance programs. Critical to their effectiveness will be a high level of international cooperation.

1. Introduction
Much of rural and regional Australia relies on hard-working little airliners that are decades old. Some have seen nearly half the century of aviation that this conference celebrates. This paper considers some of the challenges of keeping them structurally safe and viable as they continue their vital role into the foreseeable future.

That their airframes have served Australia so well, so far (although there have been times where we have been very, very lucky), is testimony to the diligence of operators, manufacturers and regulators.

However, times are changing. Things we once took for granted are now less certain. Issues are more complex. A more demanding public wants higher safety, but a more competitive industry wants lower costs. These forces have the potential to converge with the greatest impact in the corner of the aviation safety system inhabited by the 'little airliners'.

This paper considers some of the challenges – and some of the solutions.

2. Little Airliners
What are the ‘little airliners’ that are the subject of this paper?

2.1. Little?
Mostly, they are from the United States of America, designed to Civil Air Regulations (CAR) Part 3, the predecessors of the Federal Aviation Regulations (FAR) Part 23. They weigh less than 12,500 pounds (5,700 kilograms) and have nine or fewer passenger seats, two traditional boundaries between ‘small airplanes’ and ‘transport airplanes’.

Some are from England and Europe. These generally met national safety standards similar to FAR 23, which then became the standard for their American type certification.

So, they are not Airbuses or Boeings, or even Beech 1900s or Dash 8s, but aircraft such as these:

Table 1. Little Airliners

<table>
<thead>
<tr>
<th>Type</th>
<th>MTOW (pounds)</th>
<th>Pax</th>
<th>US Cert. Date</th>
<th>US Design Standard</th>
<th>Number in Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aero Commander 500S</td>
<td>6,750</td>
<td>6</td>
<td>1968</td>
<td>CAR 3</td>
<td>40</td>
</tr>
<tr>
<td>Britten-Norman Islander BN-2</td>
<td>6,000</td>
<td>9</td>
<td>1968</td>
<td>FAR 23</td>
<td>34</td>
</tr>
<tr>
<td>Cessna 402C</td>
<td>6,850</td>
<td>9</td>
<td>1978</td>
<td>CAR 3</td>
<td>27</td>
</tr>
<tr>
<td>Cessna 404</td>
<td>8,400</td>
<td>9</td>
<td>1976</td>
<td>FAR 23</td>
<td>29</td>
</tr>
<tr>
<td>Cessna 441</td>
<td>9,850</td>
<td>9</td>
<td>1977</td>
<td>FAR 23</td>
<td>23</td>
</tr>
<tr>
<td>Partenavia P68</td>
<td>4,100</td>
<td>5</td>
<td>1971</td>
<td>FAR 23</td>
<td>45</td>
</tr>
<tr>
<td>Piper PA-31-350</td>
<td>7,000</td>
<td>8</td>
<td>1972</td>
<td>CAR 3</td>
<td>108</td>
</tr>
</tbody>
</table>

¹ Steve Swift is CASA’s Principal Engineer, Airframe Durability. The views in this paper are personal views, and not necessarily CASA’s.
This is what four of them look like:

Figure 1. Aero Commander 500S

Figure 2. Cessna 402C

Figure 3. Piper Chieftain

Figure 4. Britten-Norman Islander

2.2. Airliners?
Those who only travel on the major airlines between the major cities may never have seen or heard of any of the types in Table 1. However, many who live in or visit rural and regional Australia know them and depend on them. Although smaller than the popular image and dictionary definition of an ‘airliner’, they do the same job.² They fly scheduled passenger services with several regional airlines.

They also fly unscheduled passenger services (known as ‘charters’ in Australia) and carry freight.

² Australia’s Macquarie Dictionary (Revised Third Edition) defines an airliner as ‘a large passenger aircraft operated by an airline’. The Australian Concise Oxford Dictionary (Second Edition) similarly includes ‘large’ in its definition. Hence, ‘little airliners’ is the term used throughout this paper. Americans would call them ‘commuters’.

2
3. **Big Challenges**

The little airliners have served Australia well, so far. However, there are some big challenges for the future.

3.1. High Usage

Australia is a big country, similar in size to the continental United States. With similarly long distances, but fewer freeways, air travel is even more important to Australia's economy.

![Figure 5.](image)

Although Australia's area is similar to that of the United States, its population is not. There are only 19 million Australians, but 275 million Americans. Australians are distributed less evenly. Figure 6 shows that 84% of Australians live in only 1% of the continent! The other 16% are scattered widely.

![Figure 6.](image)

The need for rural and regional air services is high, but the traffic volume is low - often too low to support proper transport category aeroplanes. Australia has to rely on some of the small twins that were never designed to be airliners, but are effective in that role.

Australia’s 'little airliners' work hard. Every day, in all weathers, they reliably connect numerous small towns with larger cities, where passengers visit doctors, business contacts, friends or family, or connect with other domestic or international air services. When they are not flying scheduled services, they are available for charter. Some argue that they form the backbone of Australia's rural and regional air services.
Here are some statistics for just one type, the Piper PA-31-350 Chieftain, from a survey that CASA conducted in 2001:

<table>
<thead>
<tr>
<th>Table 2. Piper PA-31-350 Chieftain Survey (2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Hours</td>
</tr>
<tr>
<td>Flights</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
</tbody>
</table>

The above results come from 51 responses from a possible 108. In February 2003, two years later, there were still 108 Chieftains on the Australian register. It looks like they will be around for a while yet. Along with other little airliners, their ages and flying times will continue to increase. Without the solutions discussed later, so will their risk of structural failure.

Some of Australia's little airliners are amongst the oldest in the world, so they could be amongst the first in the world to experience new forms of cracking and corrosion.

It is interesting to compare the age of Australia's little airliners with other public transport vehicles. For example, State laws limit the age of most taxis to a maximum of six years.

3.2. A Clash of Cultures

In civil aviation, there are two safety cultures. There is the airline culture, where fare-paying passengers demand perfect safety. And there is the general aviation culture, where recreational flyers want affordable fun.

Accordingly, in the FAA system, there are two divisions: the Transport Airplane Directorate and the Small Airplane Directorate. It is obvious to even the casual observer that their cultures differ as much as an airline differs from a local flying club. There is nothing wrong with this. The differences are appropriate.

Except for the little airliners, which straddle the two. Since the FAA sorts aircraft types between the two Directorates by size, not service, the little airliners find themselves regulated by the Small Airplane Directorate, not the Transport Airplane Directorate. The author has seen many examples where the former's response to the safety problems of little airliners has been far too relaxed. For example, it tolerated several wing spar failures in Cessna 402s, and more than twenty in Aero Commanders [2], over more than twenty years, before taking action.

Without FAA support, CASA no longer has the resources to bridge the cultural safety gap for the American little airliners operating in Australia.

3.3. Inappropriate Design Standards

The FAA never intended CAR 3 to be a safety standard for airliners – even little airliners. In paragraph 3.20(a), the agency was quite specific that it only intended CAR 3 for non-acrobatic, non-scheduled passenger and non-scheduled cargo operation’. CAR 3 was meant for general aviation.

Later, in FAR 23, the FAA was not so restrictive. Later versions even added a special ‘commuter category’. However, even now, FAR 23 does not require the same level of structural safety required by FAR 25 for full ‘transport category’ airliners. For example, FAR 23 still allows single load paths and the most primitive form of ‘fail-safe’. For decades, FAR 25 has discouraged both. For a fuller description of these issues, see reference [3].

CAR 3 and early FAR 23 (before Amendment 7) did not require a fatigue evaluation (except for pressurized fuselages). This allowed designers to focus, often unconsciously and innocently, on performance at the expense of durability, and manufacturing cost at the expense of inspectability and corrosion resistance. For example, most little airliners have single load paths, so that a single failure can be catastrophic. Some have aluminium alloys 2014-T6 and 7075-T6, stronger and lighter than 2024-T3, but less resistant to cracking and corrosion. Some have no inspection access to critical structural members and joints. Some only came with corrosion proofing as an optional extra, if it was available at all.

This is not a criticism of either the FAA or the aircraft designers. Then, in general aviation, few saw durability as a high priority, either for safety or for sales. Few expected the aircraft to work so hard, for
so long, in a role with such high safety expectations. Nevertheless, the challenge, now, is to equip little airliners with maintenance programs that, arguably, should be even more intensive than those for big airliners - to compensate for their ‘general aviation’ designs being more prone to the effects of age and less forgiving.

3.4. Inadequate Maintenance Programs

A fatigue evaluation\(^3\) not only improves the design, it develops most of the structural maintenance program. Therefore, perversely, if an aircraft type has not had one, not only is its design usually inferior, so, too, is its maintenance program. The inspections are less likely to look in all the right places, in the right ways, at the right times. They are less likely to include areas that are only accessible by major disassembly. They are more likely to try to inspect the uninspectable (more on this later). They are more likely to only cover reported cracks, not predicted cracks.

They are also less likely to control corrosion systematically.

That is why, even if some maintenance programs have, seemingly, worked well for years, we can’t be confident that they will continue to do so as the fleet gets older and develops new problems. It is also why the FAA has publicly described most old maintenance programs as ‘inadequate in scope and content’, and then added that they ‘often do not provide a sound basis for the operator/owner to maintain the airworthiness of the aircraft’. [4]

It is hardly surprising then, that CASA has seen cases involving little airliners where:

- One maintenance program’s inspection of a fuselage bulkhead could not find cracks as long as one metre, because it did not consider inspectability;
- Another maintenance program’s inspection of a wing spar did not prevent several failures, because it did not consider the spar’s uninspectability (caused by its high stress and low fracture toughness); and
- Another maintenance program’s inspection of a wing joint could not prevent failure, because it inspected only one side (visually), even though cracks normally start on the opposite side.

For many years, CASA forced American and other foreign manufacturers to develop life limits or improved inspections as a condition of Australian type certification. However, in 1988, new Civil Aviation Regulations largely removed that power from CASA.

Two clarifications are necessary at this point. The first is that the above criticisms are valid, to varying degrees, for the structural maintenance programs for most little airliners, but not all. One company, Cessna, is voluntarily upgrading the programs for all its little airliners to the latest safety standards. The second is that the inadequacies described here refer only to the effectiveness of the published programs, not to the conscientiousness with which regional airlines implement them.

3.5. Dwindling Technical Support

Our ability to predict fatigue or corrosion, no matter what the safety standard, is still imperfect. It is therefore important that type certificate holders review and amend their maintenance programs to reflect the service experience. This is an important part of ‘Continuing Airworthiness’.

This is another area where the little airliners are less fortunate than their larger brethren. Small aircraft are generally built by small companies, which may be less financially stable than large companies. Most little airliners were designed more than 30 years ago, and went out of production more than 15 years ago. A lot can happen to a small company over those lengths of time.

It would be inappropriate to name names. However, most readers will know of little airliners whose companies are struggling, so that they have to concentrate their limited resources on income-producing new designs at the expense of the continuing airworthiness of the old ones.

The result is often:

- Less safety, if unsafe conditions remain uncorrected; or
- More corrective work for regulators.

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\(^3\) ‘The term is here used in its broadest sense, to mean either the development of life limits (‘safe life’) or inspections (‘damage tolerance’).
The author has seen many instances over the last twenty years where, for one reason or another, type certificate holders have been unwilling or unable to promptly and effectively develop corrective actions for unsafe conditions that have arisen in service. Regrettably, sometimes, the result is preventable, repetitive fatalities.

3.6. States of Design with Different Priorities

The national publicity for the ‘Monarch’ [5], ‘Morris’ [6], ‘Seaview’ [7] and ‘Whyalla’ [8] inquiries shows the extent of public interest in the safety of Australia’s little airliners. It would be most unlikely for the same to happen in the United States.

Perhaps, in the United States, little airliners make up a smaller proportion of the airline fleet. As already mentioned, American airlines generally serve larger cities that support larger aircraft.

Perhaps, in the United States, there is more resistance to regulation, even for safety. Many know of America’s slowness to mandate the wearing of seat belts in cars. Fewer know that the FAA has tried twice to upgrade maintenance standards for little airliners to ICAO standards and international best practice. Both times, the FAA was unsuccessful.

It seems that the United States has its own priorities. Industry lobbying more often holds sway. American type certificate holders are unlikely to develop for Australia’s little airliners what is not required at home. For example, the author wonders whether New Piper will upgrade the maintenance program for the Chieftain.

3.7. Many Modifications

A difficulty with the upgrading of maintenance programs for old aircraft is the number of ‘aftermarket’ modifications that vary stresses and inspectability from the standard aircraft.

A challenge for regulators will be to foster cooperation between manufacturers and modifiers. In Australia, Cessna, who had upgraded the maintenance program for the 402C, met with Hawker Pacific, who had designed a wing reinforcement, to discuss how their products interact. Such unusually good cooperation needs to be repeated for other aircraft types and other modifiers. Maintainers will need supplements to tell them how to vary inspections to suit each modification on their aircraft.

While big airliners also have aftermarket modifications, they do not have as many, like weight increases and winglets, that so fundamentally affect large parts of the maintenance program. Also, companies that design modifications for big airliners are more likely to be big enough to have the necessary skills in ‘damage tolerance’.

There are similar interaction challenges for repairs.

3.8. Industry Competition and Fragmentation

Since competition is the enemy of cooperation, it is not surprising that there is room for improvement in the level of cooperation between Australian commercial operators on structural airworthiness issues. Better cooperation could share burdens for shared problems.

For example, Piper Chieftains are approaching the life limits that Piper developed, and CASA promulgated, many years ago. If New Piper does not upgrade the maintenance program, it could cost the first operator who needs the upgrade a few hundred thousand dollars to get it from another design organization – a high cost for one, but not for many.

For little airliners, one avenue for cooperation might be the Regional Aviation Association of Australia (RAAAA). However, the RAAA’s Technical Working Group would need to take a stronger interest in structural airworthiness issues than it has in the past. (There are already encouraging signs that this will happen.)

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4 ICAO, the International Civil Aviation Organization, describes the essential elements of a ‘Structural Integrity Programme’ in the Continuing Airworthiness Manual, Doc 9642-AN/941.

5 At the time of writing, the Australian Department of Transport and Regional Services was considering a proposal to fund the project for the Piper Chieftain in much the same way as the FAA funded Cessna for the 402 models.
3.9. A Dearth of Affordable Replacements

Low margins mean that many regional airlines lead a hand to mouth existence. Many do not seem to be able to retain enough profit for future capital expenditure. The low Australian dollar has not helped.

From *Flight International*'s November 2002 survey of regional aircraft, regional airlines could consider replacements from the following range of new aircraft under design or in production:

<table>
<thead>
<tr>
<th>Type</th>
<th>Seats</th>
<th>Engines</th>
<th>Pressurized?</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avtekair 9000T</td>
<td>8</td>
<td>2 x turbine</td>
<td>Not stated</td>
<td>Available 2006 at the earliest</td>
</tr>
<tr>
<td>Beech 1900</td>
<td>19</td>
<td>2 x turbine</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Beech 350</td>
<td>15</td>
<td>2 x turbine</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>B-N Islander 2B</td>
<td>10</td>
<td>2 x piston</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>CAG Twin Panda</td>
<td>19</td>
<td>2 x turbine</td>
<td></td>
<td>Westernized Harbin Y-12-IV. Project status uncertain.</td>
</tr>
<tr>
<td>Cessna 208 Caravan</td>
<td>13</td>
<td>1 x turbine</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Explorer 500T</td>
<td>10</td>
<td>1 x turbine</td>
<td>No</td>
<td>Available 2005 at the earliest</td>
</tr>
<tr>
<td>Harbin Y-12-IV</td>
<td>19</td>
<td>2 x turbine</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Ibis Ae-270P</td>
<td>10</td>
<td>1 x turbine</td>
<td>Yes</td>
<td>Available 2004 at the earliest</td>
</tr>
<tr>
<td>Integrity</td>
<td>20</td>
<td>1 x turbine</td>
<td>No</td>
<td>Trislander development. Proposal only.</td>
</tr>
<tr>
<td>LET L-420</td>
<td>19</td>
<td>2 x turbine</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>NAL Saras</td>
<td>14</td>
<td>2 x turbine</td>
<td>Yes</td>
<td>Availability not stated</td>
</tr>
<tr>
<td>Pilatus PC-12</td>
<td>9</td>
<td>1 x turbine</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Reims F406 Caravan II</td>
<td>14</td>
<td>2 x turbine</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Soloy Pathfinder 21</td>
<td>17</td>
<td>2 x turbine</td>
<td>No</td>
<td>2-engined, stretched Cessna 208</td>
</tr>
<tr>
<td>Vulcanair P68 Viator</td>
<td>9</td>
<td>2 x piston</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

All the aircraft in Table 3 cost considerably more than the existing aircraft. For example, a used Cessna 402C costs about A$400,000 [9], whereas even the most basically equipped new Islander costs more than twice that amount [10].

An old Cessna 402C will still do a good job. A new Islander would not be twice as productive. The higher purchase and operating costs of turbine engines and pressurization would reduce affordability even further on many Australian routes. Consider that a new Caravan costs about A$2,400,000 [9] and a PC-12 about A$5,000,000 [11].

Repeating an earlier comment, the old little airliners could be with us for a while yet.

4. ‘Standard’ Solutions

Do the challenges portray a gloomy future? They would, if there were no solutions. Fortunately, there are. The few suggestions that follow involve better standards. There will be others.

4.1. For Type Certificate Holders

Continuing airworthiness is a joint effort between regulators, maintainers and type certificate holders. You often see this relationship illustrated by a ‘three-legged stool’:

Figure 7
The point of the analogy is that continuing airworthiness depends on the strength of all three legs. Yet, in the United States and Australia, only two of the three have to demonstrate their ‘strength’ as a condition of entering and remaining in the aviation safety system.

There are standards for regulators. They are set by ICAO. Two examples are Annex 8, *Airworthiness of Aircraft*, and the *Manual of Procedures of an Airworthiness Organization*. ICAO periodically audits regulators as part of its Safety Oversight Program. It last audited CASA in 1999.

There are standards for maintainers. Two examples are Parts 43 and 145 of the major international codes. Regulators require maintainers to meet these standards – and continue to meet them.

However, in the United States and Australia, there are no competency standards for type certificate holders. FAR 21.13 says that ‘any interested person may apply for a type certificate’ (as does CASR 21.13). Although type certificate holders have responsibilities to report service problems (FAR 21.3) and issue manual amendments (FAR 21.50), the FAA and CASA rarely audit their ability to do so - either before or after the granting of a type certificate.

A promising exception is the FAA’s new Continued Operational Safety Program (COSP), in partnership with Boeing. When the author first learned of this program, in 2001, it was still in its infancy and still confined to the Seattle divisions of Boeing and the FAA. Hopefully, COSP will soon spread to the Small Airplane Directorate and the type certificate holders for the little airliners.

Perhaps, in the past, regulators assumed that the designers, who proved their competence during type certification, would stay with the company and continue to support its products. However, we have since learned that companies can too easily cut such support when times are lean. Or, they sell their type certificates to companies that lack the engineering skills. Or, they just go out of business and the type certificate is ‘orphaned’.

The FAA and CASA could learn from the Europeans. JAR 21.13 is clear that only design organizations can get type certificates. This is very appropriate, because an important part of the continuing airworthiness process involves comparing what happens in service with what the designers predicted. For example, the type certificate holder should check that cracks are occurring *when and where* predicted by the fatigue testing and analysis. If not, they should add to or adjust the inspections in the maintenance program. This is normal and often necessary.

JAR 21.44 is clear about the ongoing ‘responsibilities’ and ‘qualifications’ of type certificate holders. Although the European system is not perfect, regulators have more control if a company has financial troubles that could affect technical support, as happened recently with Britten-Norman and Partenavia.

If regulators were to cancel a type certificate because of holder incompetence, owners could prevent the grounding of their aircraft by banding together to find and fund another design organization. This is just one example of the higher level of cooperation that continuing airworthiness will require, in some cases, in the future.

Two Australian precedents are the Gliding Federation of Australia (GFA) and the Australian Ultralight Federation (AUF). With technical resources funded by members, one of their functions has been to develop corrective actions when type certificate holders are not sufficiently responsive. The GFA and AUF are proof that the concept is practical and affordable. Many of the ‘type clubs’ around the world perform a similar role. All that this paper proposes is an extension of this concept.

4.2. For Modifiers and Repairers
In Australia and the United States, the above is just as true and important for modifiers (including holders of supplemental type certificates) and repairers.

4.3. For Maintenance Programs
For more than twenty years, the design rules have had good standards for structural maintenance programs for new aircraft designs. The challenge is to enforce them retrospectively for old designs - the ones that now need them the most. There are two parts to this. The first is development of the upgraded maintenance program. The second is its implementation.

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The author uses the term ‘standards’ here in the broadest sense, noting that ICAO calls the second document a ‘recommended practice’, not a ‘standard’, because it is advisory, not mandatory.
If an operational rule is broad enough, it can do both. If it unconditionally requires implementation of an upgraded maintenance program, then, if one is not available, operators will have to develop one. Examples are the FAA’s most recent amendments to FARs 121.370a and 135.168 (parts of the Aging Airplane Safety Rule [12]). They require upgrading of maintenance programs to standards such as FAA Advisory Circular (AC) 91-56B, Continuing Structural Integrity Program for Airplanes, or similar.

When type certificate holders upgrade maintenance programs to meet such standards, they often publish the upgrades separately and call them SIDs (Supplemental Inspection Documents). SIDs meet similar safety standards to those of modern aircraft, to ensure similarly systematic and comprehensive control of structural fatigue. For example, Cessna’s SIDs for its old twins meet the same safety standards as the maintenance programs for its new Citation jets.

Simply put, the steps required by the suggested standards require working out:
1. Which parts are critical to safety (sometimes called principal structural elements, or PSEs);
2. Where cracks will start;
3. When cracks will start;
4. The smallest detectable crack (for the inspection method);
5. The longest safe crack (for the required residual strength); and
6. The time to grow from 4 to 5;

Then, scheduling:
7. The first (‘threshold’) inspection earlier than 3; and
8. The repeat inspections at intervals shorter than 6.

All are necessary for a safe structural maintenance program. They are common to other disciplines, such as medicine, and, in hindsight, seem obvious. However, the aeronautical structures community did not begin to widely understand and apply them until the ‘damage tolerance’ design rules clearly articulated them, about twenty years ago.

They will identify uninspectability. That would be the case if the smallest detectable crack were longer than the longest safe crack, such as Cessna’s engineers found when they followed the steps for the 402 wing spar. Or, if the time to grow from one to the other is unpredictable, as is often the case with composites, or impractically short, as is often the case with helicopters. Obviously, uninspectabilities cannot be kept safe by inspections. They are more common in little airliners than many realize. They require replacement or redesign before cracks are likely to develop.

Regrettably, for the little airliners, the FAA’s new rules allow a lesser standard, Advisory Circular 91-60A, The Continued Airworthiness of Older Airplanes. This only explicitly requires the first step (PSE identification), and little else. However, today, it is hard to imagine how companies could develop maintenance programs without the ‘damage tolerance’ steps. Therefore, hopefully, the ‘little airliner’ companies will voluntarily follow them, even if they simplify their analysis by, perhaps:

- Ignoring thresholds and starting all inspections immediately (most aircraft are already quite old);
- Estimating crack growth rates from cracks found in service (instead of by fracture mechanics); or
- Limiting the service lives of parts that are easier and safer to replace than to analyze and inspect (as is sometimes the case for attach fittings, tailplanes and control surfaces).

If an operational rule is narrow, such that it only requires implementation of an upgraded maintenance program, such as a SID, if one is available, then it could create three related problems:

- An inconsistent level of structural safety between aircraft types;
- A maintenance cost advantage for the least safe types; and
- In the longer term, an overall decrease in safety as airlines favor the aircraft types with the least safe, but least costly, maintenance.

Corrosion threatens safety as much as fatigue. It is therefore as important a consideration in the development of a maintenance program. A few years ago, the FAA sponsored a study on Corrosion Prevention and Control Programs (CPCPs) for little airliners, using a Piper Chieftain as an example. This has since led to a Notice of Proposed Rule Making [13]. Given the potential for interaction between corrosion and fatigue, one issue for further discussion might be whether there would be any
safety or scheduling benefits if CPCPs and SIDs were more integrated, instead of being developed and published separately.

4.4. Cooperation

The writing of this paper reinforced the author’s awareness that the future safety of Australia’s little airliners will depend very much on cooperation: between CASA, the regional airlines, the type certificate holders, the designers of modifications and repairs, and the FAA and other regulators.

The author is hopeful. The field of structural airworthiness is another where global cooperation is increasingly available to tackle global problems. Easier and cheaper travel and communication are increasing the informal sharing of problems and exchanging of ideas at the working level.

Some recent examples are the Australian visits (with CASA, regional airlines, modifiers and repairers) by the Cessna engineer who is developing the company’s new SIDs, the FAA engineer who is regulating them, and the CAA (UK Civil Aviation Authority) engineer who has similar responsibilities. More routinely, there is regular communication by email and telephone.

The author is very thankful for such excellent cooperation and looks forward to its continuation. There is still much to do – together – to ensure the continuing airworthiness of the little airliners.

5. Conclusion

The little airliners will be with us for some time yet. Their future structural safety faces several challenges. They are soluble, if we do not ignore them. Part of the solution could be the timely development and implementation of better standards. Success will require a high level of cooperation between all parties, locally and internationally.

6. Acknowledgments

The author would like to thank David Villiers, who conducted and analyzed the Piper Chieftain survey.

7. References


[9] Brisbane Aircraft Sales


