

Metro III

Undercarriage failure

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Investigation Commission (TAIC)

Fairchild SA227-AC Metro III

Undercarriage failure & subsequent wheels-up landing

- **Event description & damage**
- **What went wrong**
- **How**
- **Outcomes and safety actions**
- **Summary**
- **Conclusion**

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Following wheels-up landing



Description

- Aircraft on crew training ex at Gisborne
- Check captain and pilot under command training on board only
- Both pilots experienced
- Aircraft was light
- Wx good, with right x-wind up to 15 kts
- Ex included circuits and landings with simulated OEI

Description (cont)

- Following 2nd circuit a SE go-around from DH
- A/c recircuited with left eng simulated inop
- Normal approach until about 50' agl
- High sink rate and a/c touched down firmly
- A/c landed straight but veered left
- Left u/c seen to collapse aft some 40° past vert
- Left prop strike – unknown by the crew
- Capt ordered a go-around

Description (cont)

- **Controller confirmed left u/c trailing**
- **In up position left u/c protruded some 45°**
- **Crew flew a/c to Hamilton**
- **Good CRM**
- **After fuel burn-off a/c landed wheels selected up**
- **About 1700 m used, more than available at Gisborne**
- **A/c slewed off rwy to right, around right u/c**
- **Crew evacuated safely; no fire occurred**

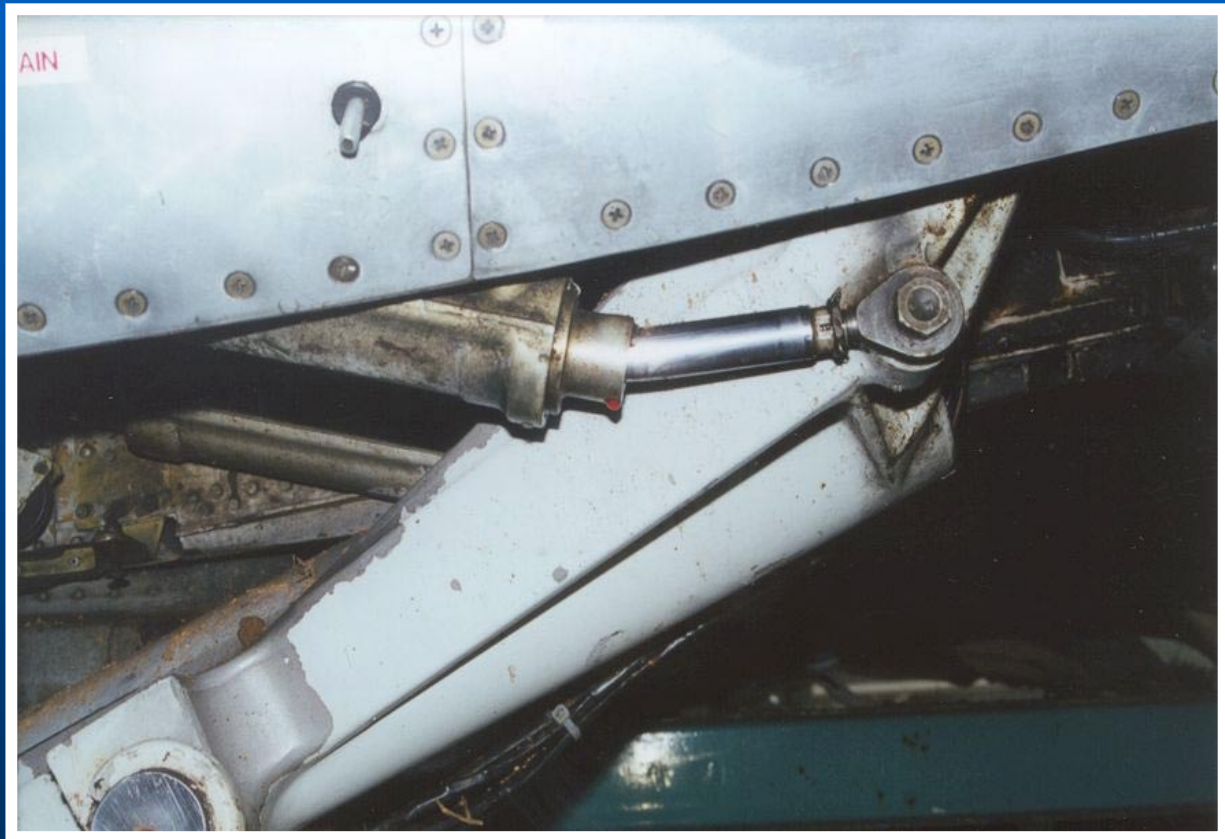
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After wheels-up landing



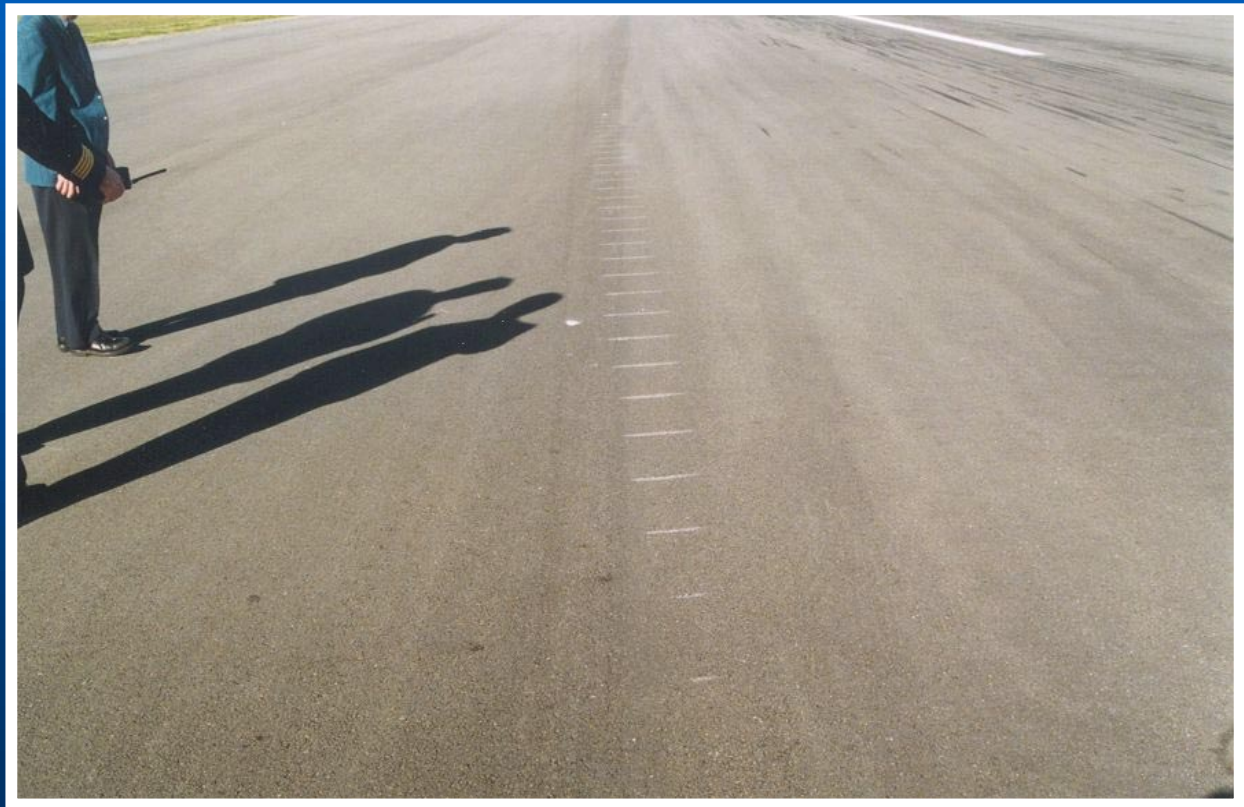
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Bent hyd actuator arm



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Rwy prop strikes



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Some damage



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Some further damage



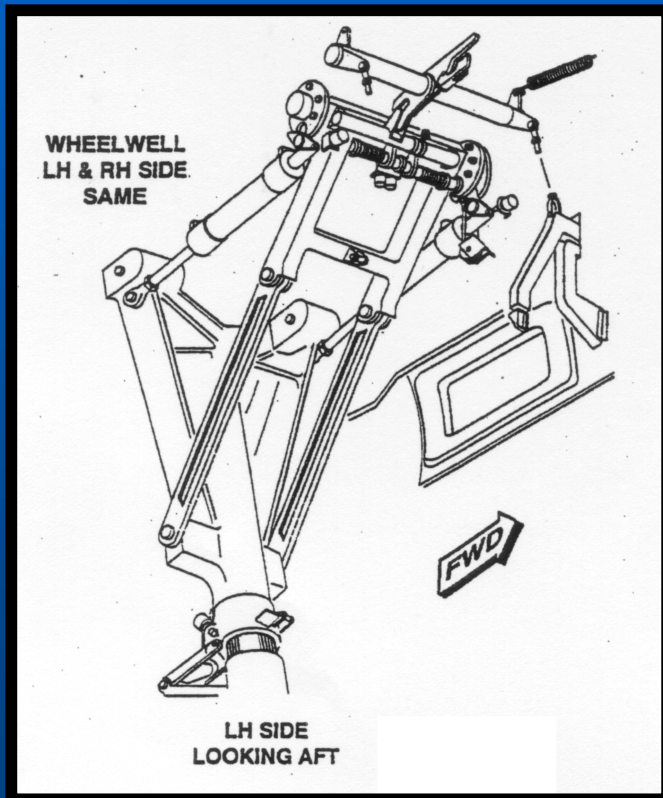
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What went wrong?

- Left u/c outboard drag brace failed near the point where it attached to the u/c leg, through its grease fitting recess
- Load transferred to the inboard drag brace
- Inboard drag brace failed in overload in similar position to outboard drag brace
- Left u/c leg moved aft past its normal vert down & locked position
- Consequently a/c swung left after t/d and prop struck the rwy

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Drag braces





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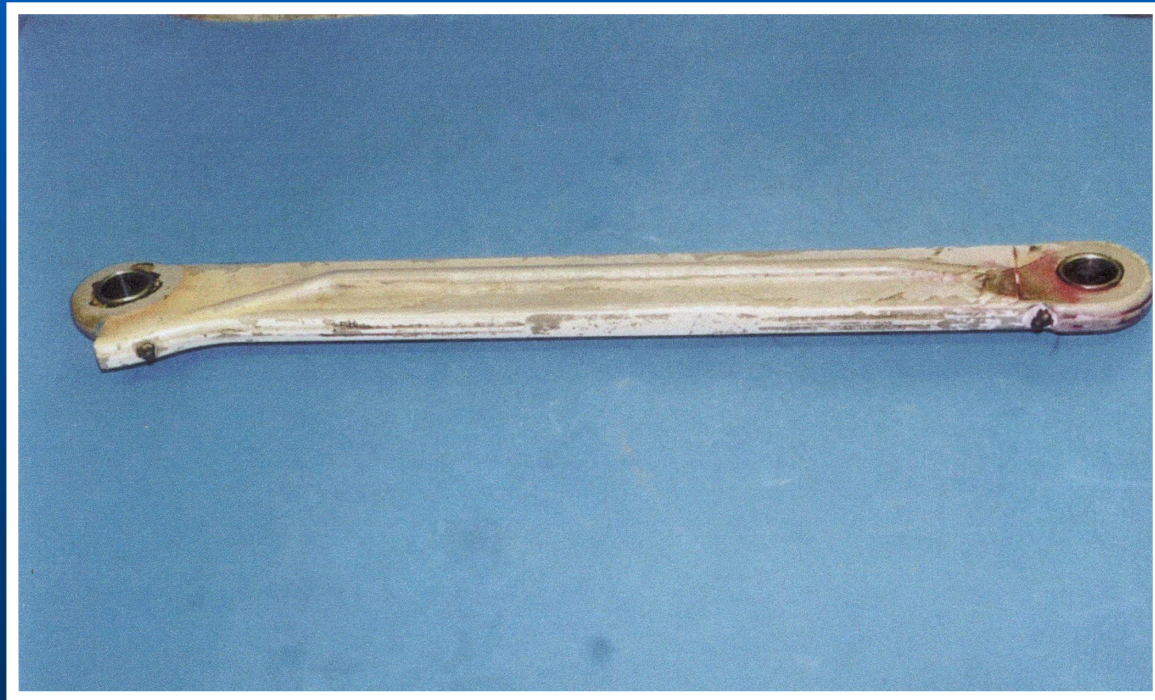
How?

- A fatigue crack had started and propagated in the drag brace's machined grease fitting recess
- Load was transferred to the other drag brace, which failed in overload
- Each landing cycle caused the crack to grow
- Crack was growing rapidly
- Drag braces under tension during Idg & taxiing
- Crack propagating for some 15 000 Idg cycles
- Machined recesses had square edges acting as stress concentrators

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How (cont)?

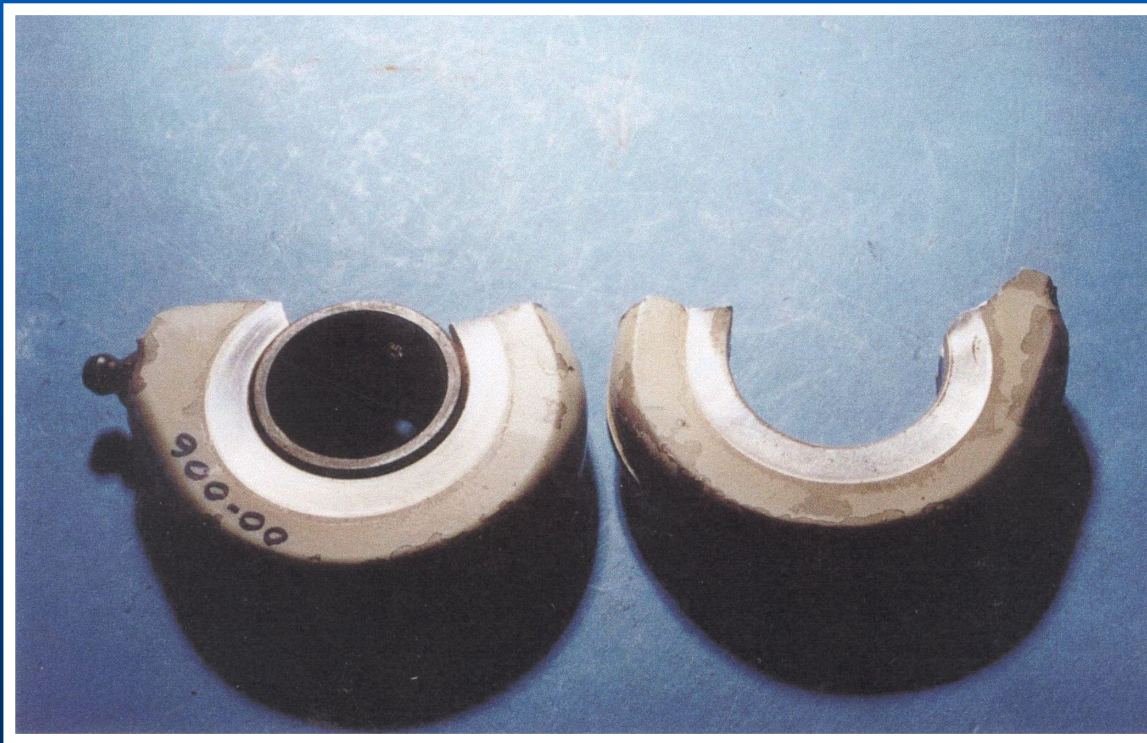
Cracked drag brace from another a/c



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How (cont)?

The 2 failed drag brace end pieces



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How (cont)?

Fatigue crack and overload section



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How (cont)?

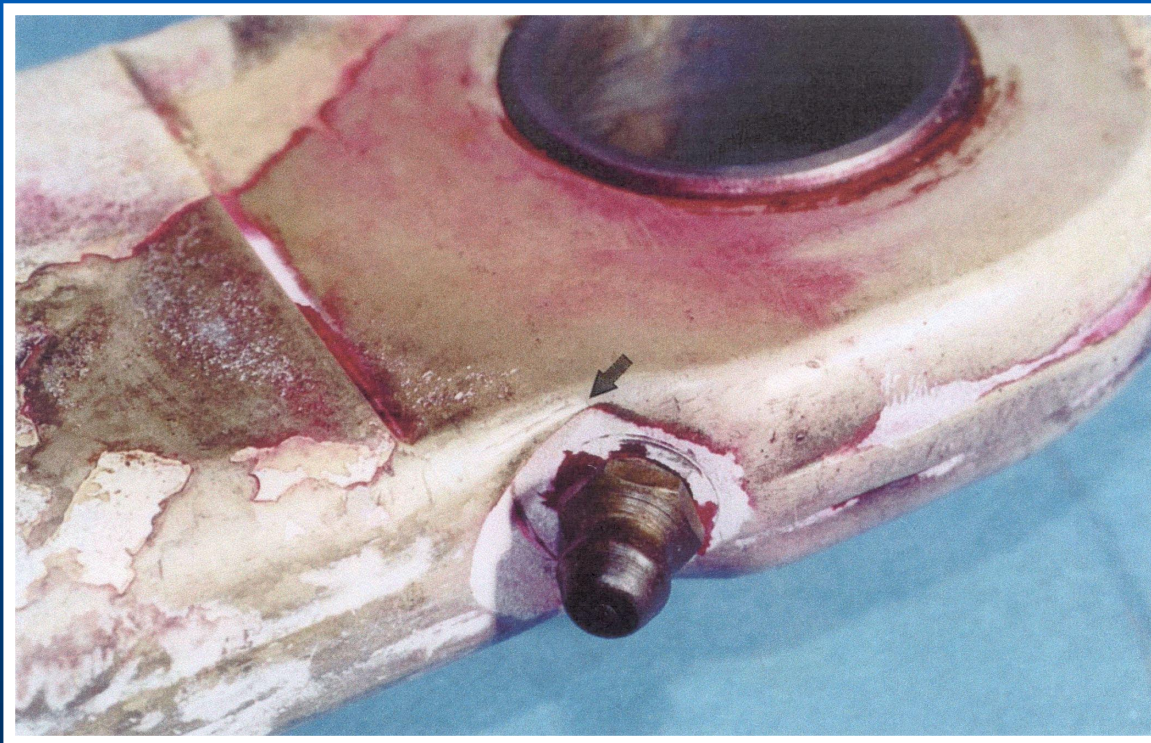
SEM showing fatigue crack & multi origin castellation



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How (cont)?

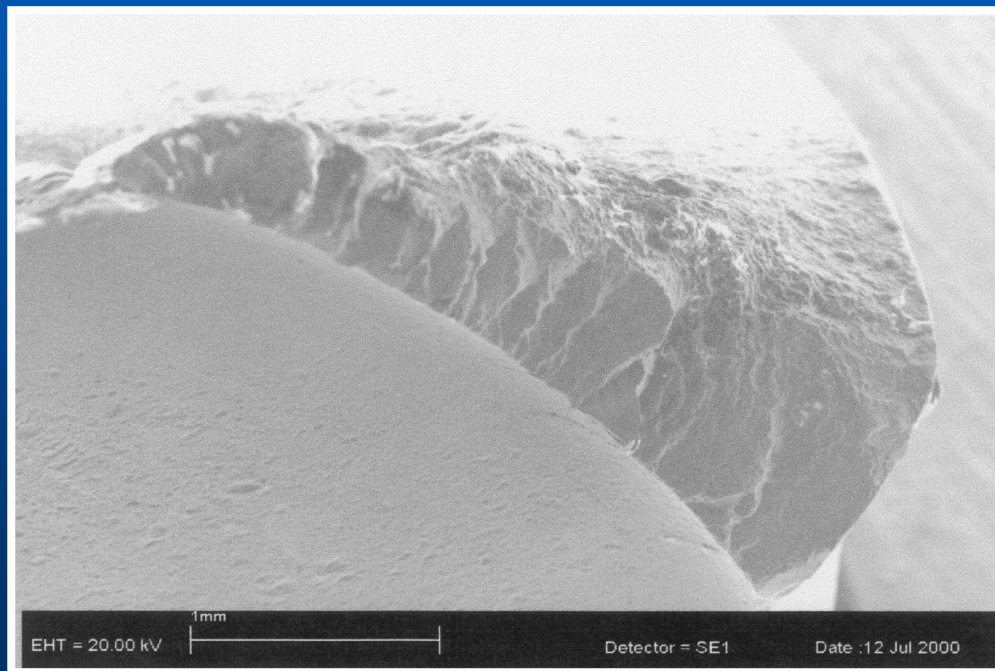
Square machined recess & crack in other a/c brace



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How (cont)?

SEM showing fatigue crack in other a/c drag brace



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How (cont)?

- Drag braces were an on-condition item
- Condition and security checks only required
- A/c engineers performing normal inspections would not detect the cracking
- Dye penetrant crack detection method effective
- No requirement to periodically check the braces specifically for cracks
- Cracks found in the operator's 5 other Metro a/c
- A/c use ranged from some 19 700 hrs; 31 000 ldg cycles – 32 300 hrs; 40 700 ldg cycles

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How (cont)?

- No evidence of corrosion affecting crack start & propagation
- Drag brace material conformed to the manufacturer's specs
- Fatigue cracking resulted and developed from a design and inspection problem

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Outcomes and safety actions

- TAIC advised about the accident
- Operator informed other NZ Metro operators
- Commission advised CAA of the cracking
- CAA officer inspected the braces
- 3 days after the accident the manufacturer's rep arrived in NZ
- Another NZ operator found 2 of its fleet of 6 Metro a/c had similar cracking
- A/c use ranged from some 14 000 hrs; 23 800 ldg cycles – 18 600 hrs; 29 800 ldg cycles

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Outcomes and safety actions (cont)

- Overseas authorities advised of the problem
- No reports of cracking in Metro a/c outside NZ
- The manufacturer issued 2 Service Bulletins and highly recommended compliance
- The NZ CAA issued an AD
- The manufacturer advised it was changing the drag brace material to a tougher material; braces to be machined rather than forged; grease fitting surface to be machined flat or with a smooth radius

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Outcomes and safety actions (cont)

- The US FAA issued an AD
- No safety recommendations were required because of the positive action taken by all parties

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Summary

- Cracking had potential to jeopardize the safety of fare-paying passengers
- Fortunate failure occurred on crew trg exercise
- Directional control could have been lost had crew not carried out an immediate go-around
- Crack developed because of a design & inspection deficiency
- Potentially common to all Metro a/c
- Speedy action taken by all concerned parties to prevent a recurrence was commendable

Metro III Conclusion

To prevent ...
...this!



FOR MORE INFO...

www.taic.org.nz