

SUMMARY OF CRACKED HORN INFORMATION
7-26-2009
HDN

An initial meeting between the International Comanche Society (ICS) and the FAA has been setup, and will occur at the Vintage Aircraft Hanger building conference room at Oshkosh on Wednesday, during the hours of 8:15 and 8:45 am.

ICS Attendees:

**Dave Fitzgerald, 2009 ICS President
Don Nelson, 2009 ICS Treasurer
Lucky Louque, DAR & FAA Mechanic of the Year
Scott Myers, ICS Member and keeper of the survey database**

FAA Attendees:

**Kim Smith, Manager, Small Airplane Directorate
David Showers, Standards Office Manager, Small Airplane Directorate
Marv Nuss, Continued Operational Safety Manager, Small Aircraft Directorate**

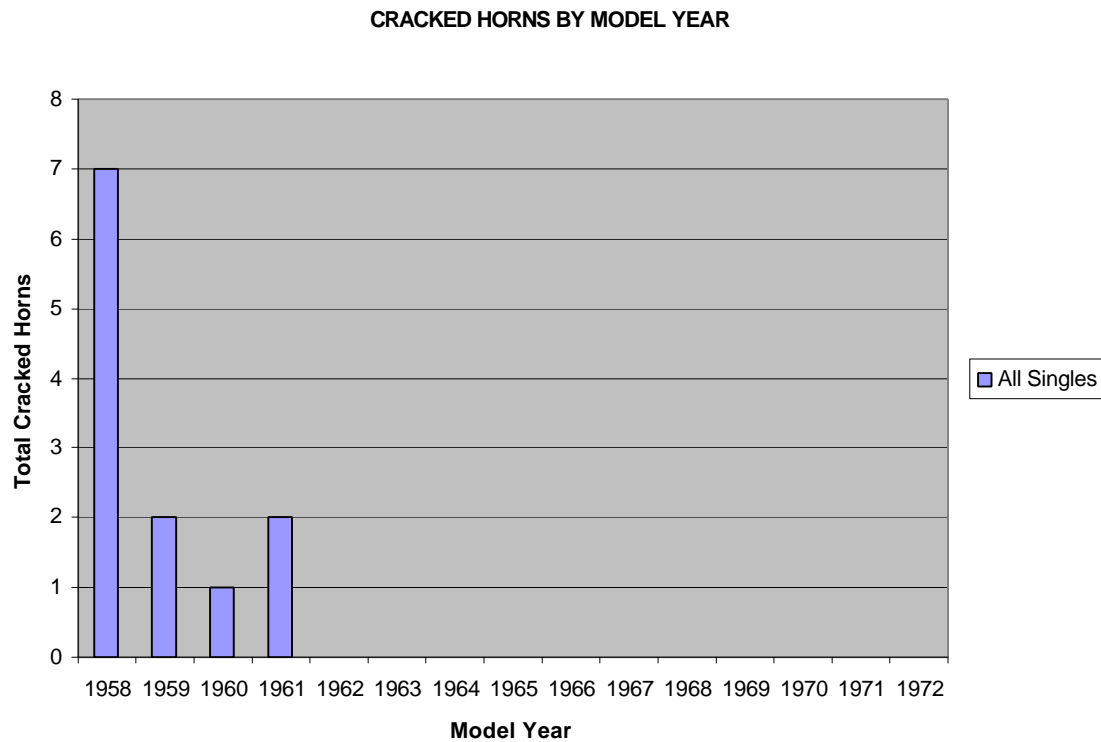
The FAA Administrator has been invited to speak a few words.

Survey Results:

ICS has performed a survey of its membership to determine the extent of horn cracking. The survey was conducted using two Comanche web sites, and direct mailing.

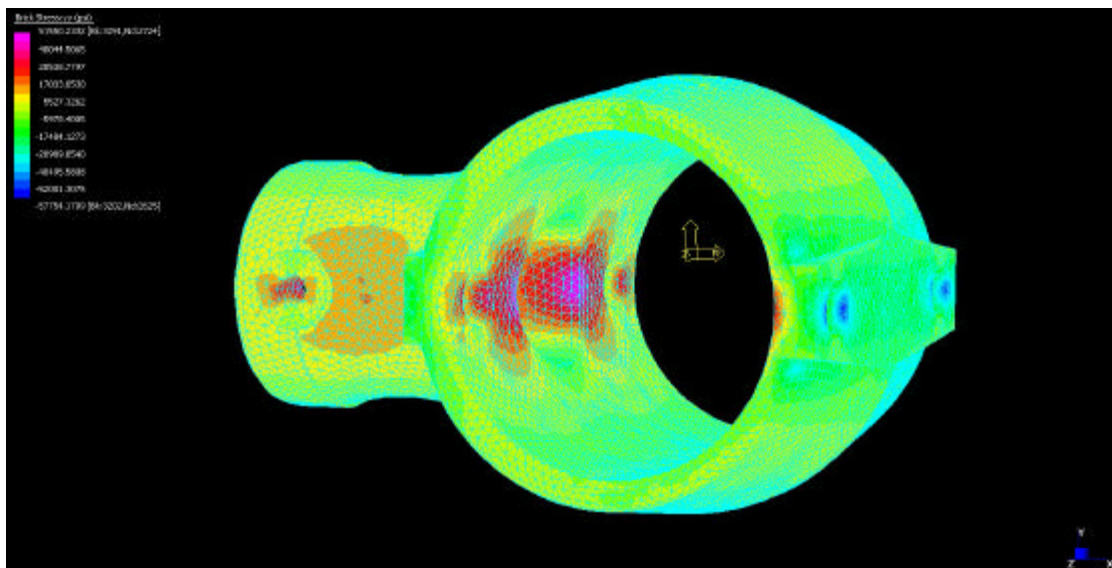
There are 12 reported cracked horns from a survey summary of over 500 responses. The total responses encompass the entire PA24, PA26, and PA30/39 fleet. To date, we have results representing 11% of the directly effected fleet in the FAA Registry. There have been no cracked horn reports from Comanche 400 singles and none for 30/39 Twin Comanche's.

All cracked horns are from the early model singles, produced during 1958 through 1961. ICS believes that Kaiser Aluminum, Erie, PA, produced the known cracked horns. An alternate supplier (date and time uncertain, likely 1962) produced additional horns under the same part number. There are no reports of cracked later model production horns.



Horn Evaluation by Test and Computation

A 3D solid element finite element model clearly shows that installation stresses caused by the interference fit of the counterbalance arm tube is the principal contributor to horn cracking. The force created by bolt torque is the secondary contributor.



Measurements made by ICS member Eric Paul demonstrate that the horn deforms to an oval shape when bolted to the thinner torque tube used by the singles. The thicker torque tubes are used on the 400 Series and all Twins. Per the Service Manual, 5/16 bolts have a torque specification of 100 to 140 inch-pounds.

Torque In-lbs	Deformation Thin Tube	Deformation Thick tube
60	.004	.0014
70	.0042	.0016
90	.0055	.0022
100	.0065	.0027
120	.0085	.0036
140	.010	.004

The oval deformation creates a hoop tension stress state that leads to cracking of the rear, interior surface of the horn. This hoop tension stress is also captured by the FEA results.

Differentiation Between Early Style and Late Style Horns



The early style horn is shown on the left, while the later style horn is shown on the right. The later style horn has a beefier neck section for the counterbalance arm tube. Determination of horn style can be readily accomplished by visual examination and measurement.

Piper SB 1189 and ICS Position

Piper SB 1189 has been written, but not released. ICS believes that this SB is based on a fatigue based vibration coupling between airframe and powerplant, and is not based on solid engineering analysis and data.

All evidence to date suggests that horn cracking is due to Stress Corrosion Cracking caused by as-fabricated installation stress.

If the FAA, in the currently written form, implements SB 1189, this SB to be devastating to the Comanche fleet due to the requirement of unnecessary repetitive inspections causing tight tolerance joints to be damaged.