Totem Pole

- System calibration (Rummel, Forsyth, Goldfine)
- Probe characterization (ISU, Gray, Patton, Broz, EWI)
- Model validation (Knopp, Vukelich, ISU, Gray, Todorov)
- XFN validation (Smith, Hugo, Patton, ISU, Annis)
- Specimen design (Goldfine, Forsyth, Brausch, Annis, Spencer, Moore)
- Cracks versus notches (AMMTIAC, Thompson, Lindgren, Hugo, NRC)
- Number of specimens (Spencer, Annis)
- Noise (Goldfine, Annis, Spencer)
- How do you know you are right??? (Malas, Vukelich, Thompson, Knopp)
- Concurrent programs – data capture (All)
- Others

System Calibration

- AF study by Brausch et al. shows that the variability within ET probes and instrumentation off the shelf within AF depots is negligible
- The AF general NDI instructions, TO -33-2 is being modified to add additional calibration steps to ensure that instrumentation is within the desired capability.
- Master gauging? Has this been addressed?
  - Kevin Smith: did some work including master gauging, found it difficult to set narrow limits on instruments
  - Engine OEMs use master gauging.
- Pros and cons of 3pt cal.:
  - 3pt. Cal not strictly necessary for detection, but is necessary for quantification of size
  - Idea of daily cal. Is to ensure that our combination of instrumentation achieves the ahat vs a that was originally planned

Probe Characterization

- PURPOSE:
  - To ensure that when performing a POD study, we characterize the instrumentation so that the input parameters for a model are known and are correct.
    - Fields not simply amplitudes
  - UT: DONE by ETC already.
  - ET: ongoing efforts at ISU/CNDE.
    - Jeremy Knopp has also done this, and will write up the generic protocol. He will consult with the ISU/CNDE people.
  - Leads to specs for probe requirements.

Model Validation

- 1. How to do validation?
  - Validate within the range of interest vs. experimental data.
  - 1.1 calibrate on reference object, show you get good results on other objects.
    - Extend from some measured results.
  - 1.2 absolute prediction
- 2. Is software (X) validated?

- AF study (Knopp, Aldrin) did some validation of ET model in their recent work.
- Requirements for validation are defined by requirements on POD accuracy?

XFN Validation

- How to validate in absence of POD?

- As we collect more data and experience, may be able to define transfer function generic to a collection of problems.
- Assumptions are made in the process, need to validate we are operating within assumptions, and/or output not sensitive to assumptions.
- Would be nice to predict POD from XFN before knowing the answer, then look at answer from 1823-style experiment.
  - The AANC-presented work at this conference may allow this?
    - Lindgren will follow up on this, consult with FAA whether they are able to fund.

- AUS study on F-18 bulkheads may have enough data. EL/GH to further discuss.

Specimen Design

- Collect the designs (thoughts and lessons learned) used in the works reported herein.
  - AUS, UK, CA, USA

Cracks Versus Notches

- Plans already underway to document.
  - What we know and have evidence for, what we do not know
- Consider how to present this.
  - Session/panel at ASNT Fall? ASIP
- Hosted workshop to further work on cracks vs notches?
- Can use existing C-130 notch specimens at AFRL to predict crack POD.
  - When we get cracked rainbow fitting, then can validate.
  - Also generate cracks in lab in same components.

Number of Specimens

- How to design the specimens to support XFN and FMA.
  - Number, crack sizes, etc.

- At this time, no activity in this area.
- Relation to confidence in transfer function, samples to be used for validation of XFN, FMA.
- How much for a POD study, 1823 style?
  - Existing work by AUS, new 1823 code for confidence bounds.
- Some work done by Meeker in support of the seeded defect engine disk work. Bruce to send paper and dissertation to Pete.

Noise

- Some work is in new 1823 code on characterizing noise distributions.
- Continued effort on this topic is planned.

- Noise distributions from data, effect on false call/decision threshold.

How Do You Know You are Right?

- What is actual engineering requirement for being “right”
  - Still conservative, but how close?
- “gold standard” : MIL-HDBK-1823 study on hardware from in-service aircraft containing cracks that developed in service.
- Strictly speaking, validation of methodology does not require in-service hardware with in-service cracks. BUT there are other reasons to do so.

Concurrent Programs

- AUS (Hugo)
- UK (Smith)
- CA (Butcher)
- NASA (Winfree)
  - Model validation at ISU, Computational Tools
- FAA (Nakagawa)
- AFRL (Lindgren)