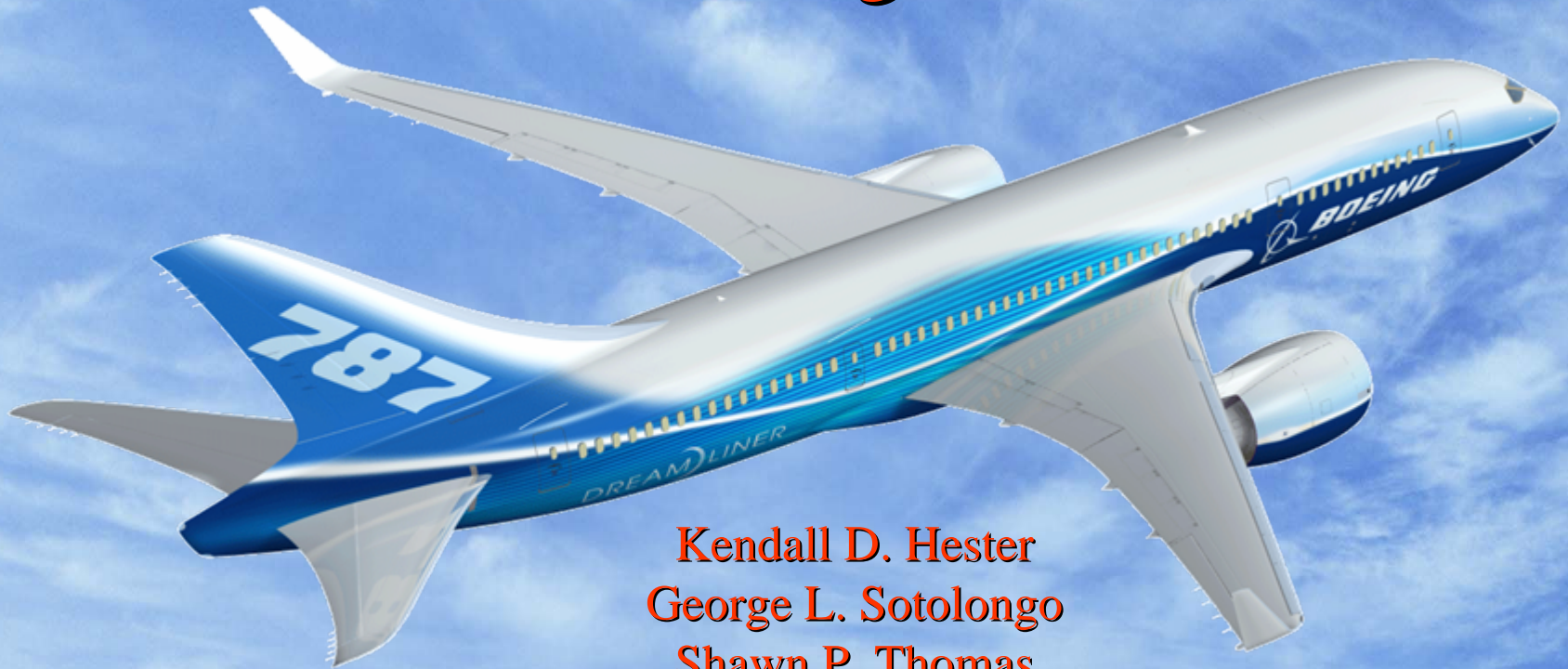




Flammability Certification of Printed Wiring Assemblies



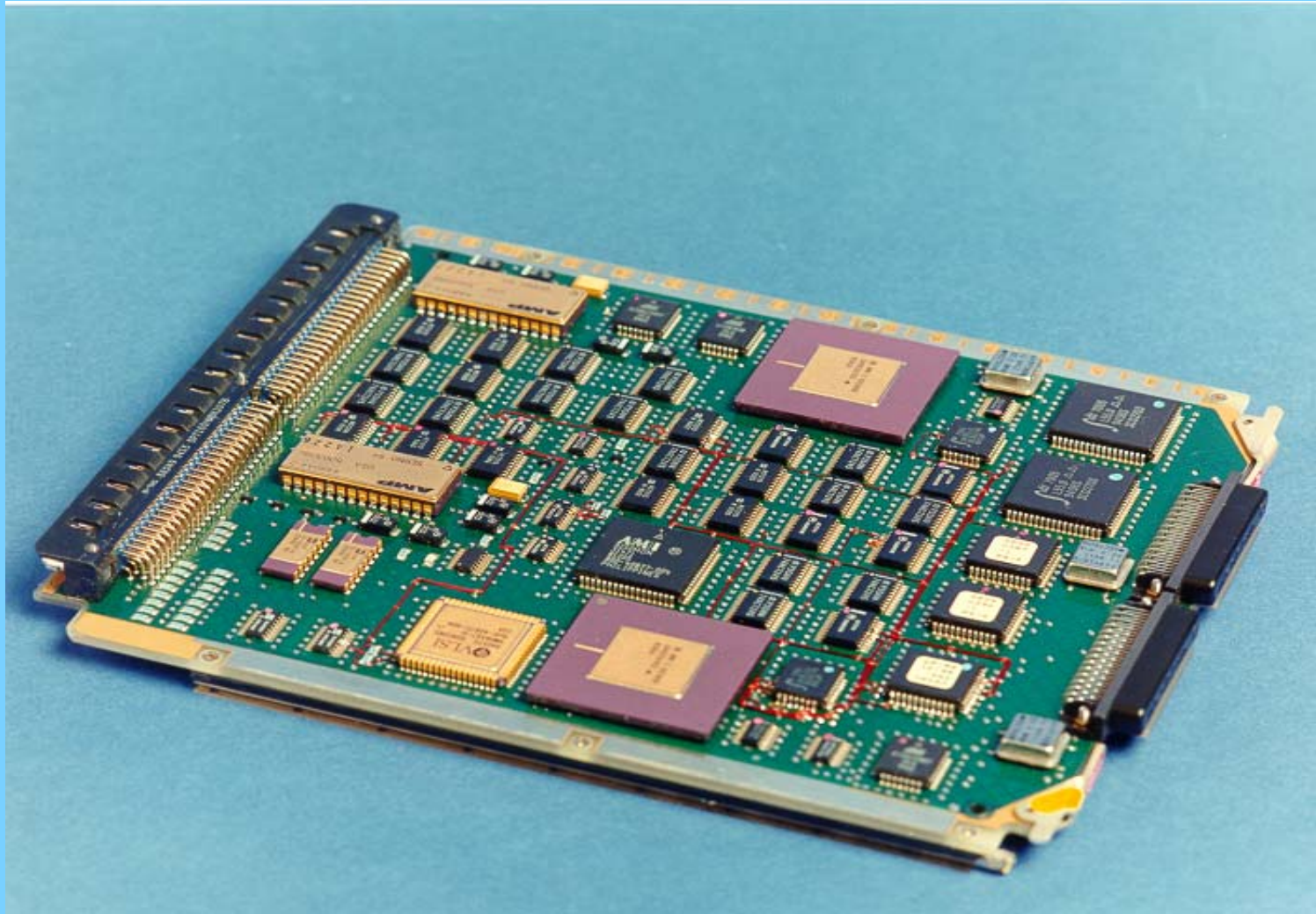
Kendall D. Hester
George L. Sotolongo
Shawn P. Thomas
James M. Peterson
Kenneth C. Young



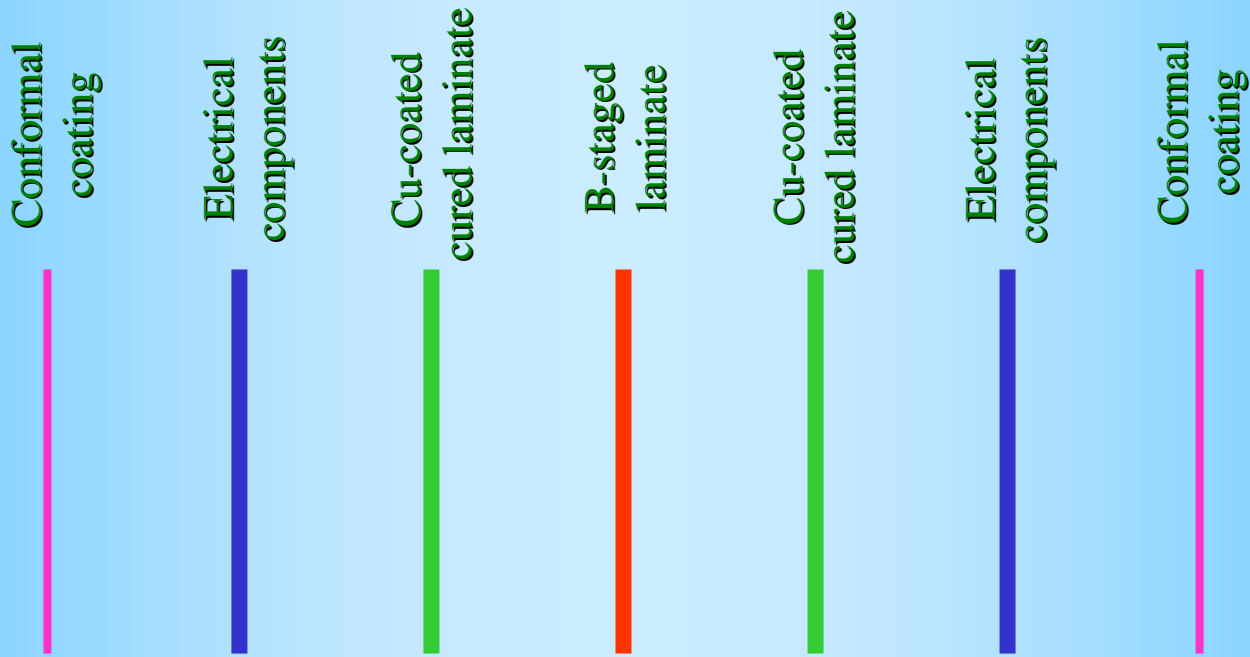
Purpose

- Develop a means of compliance to simplify FAA certification of new design Printed Wiring Assemblies (PWAs) to test data of similar existing PWAs

Typical Printed Wiring Assembly



Printed Wiring Assembly Construction





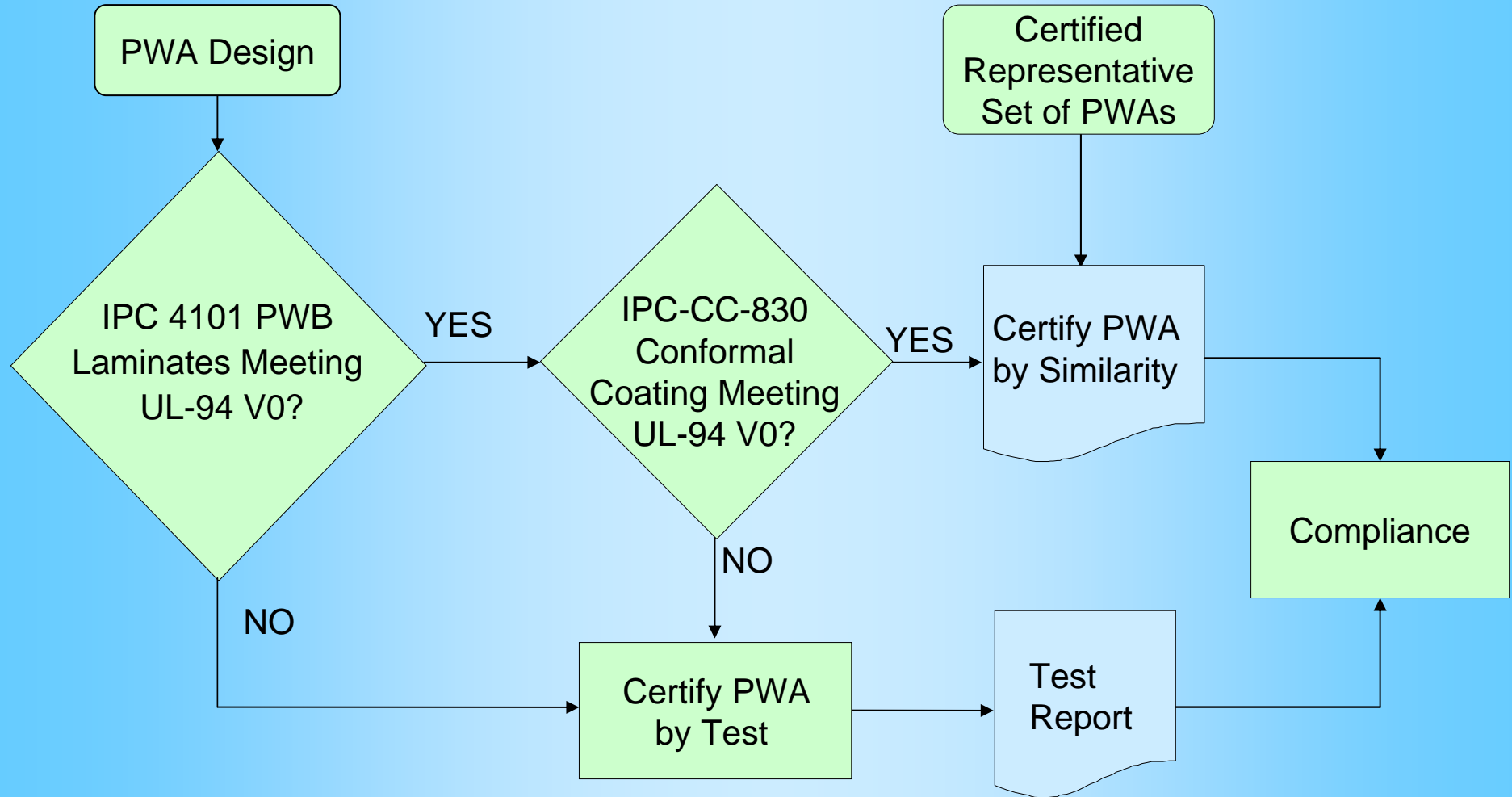
Strategy

- Use standard FAA certification procedures (test plans, conformed test specimens, FAA-witnessed testing) to certify a representative set of PWAs fabricated to industry standard requirements.
- Certify new PWAs made to the same specifications by similarity to the certified representative set.

Strategy (continued)

- Use IPC standards for PWA materials
 - IPC-4101 for PWB laminates
 - IPC-CC-830 for conformal coatings
- Require that all laminates and conformal coatings be manufactured to meet UL-94 V0
- Fabricate representative set of PWAs
- Test set of PWAs to FAR 25.853 requirements
 - 12-sec vertical Bunsen burner
- Certify new PWAs using same IPC-4101 materials by similarity to existing 12-sec vertical data

Certification by Similarity Process Flow

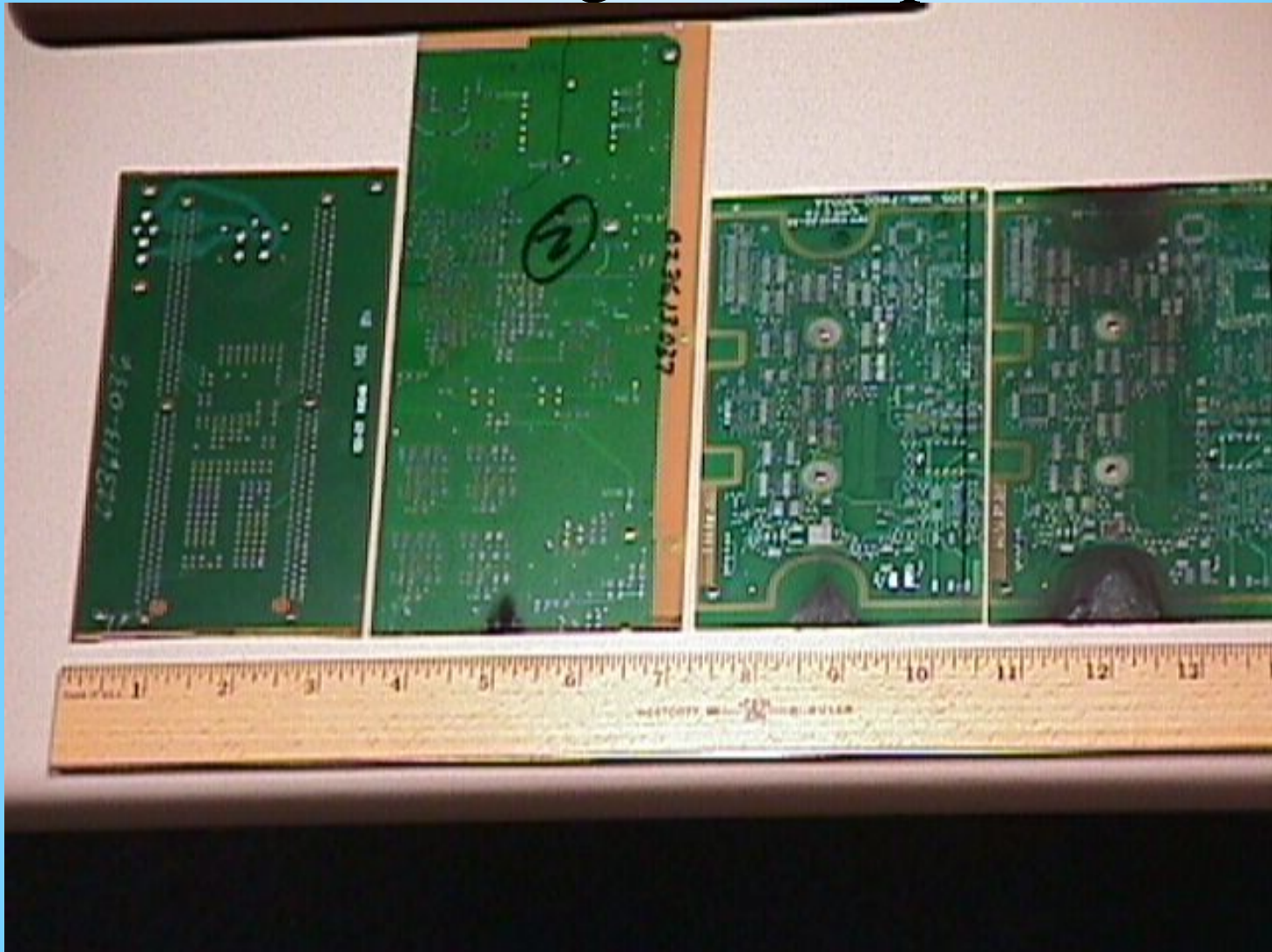




Testing Strategy

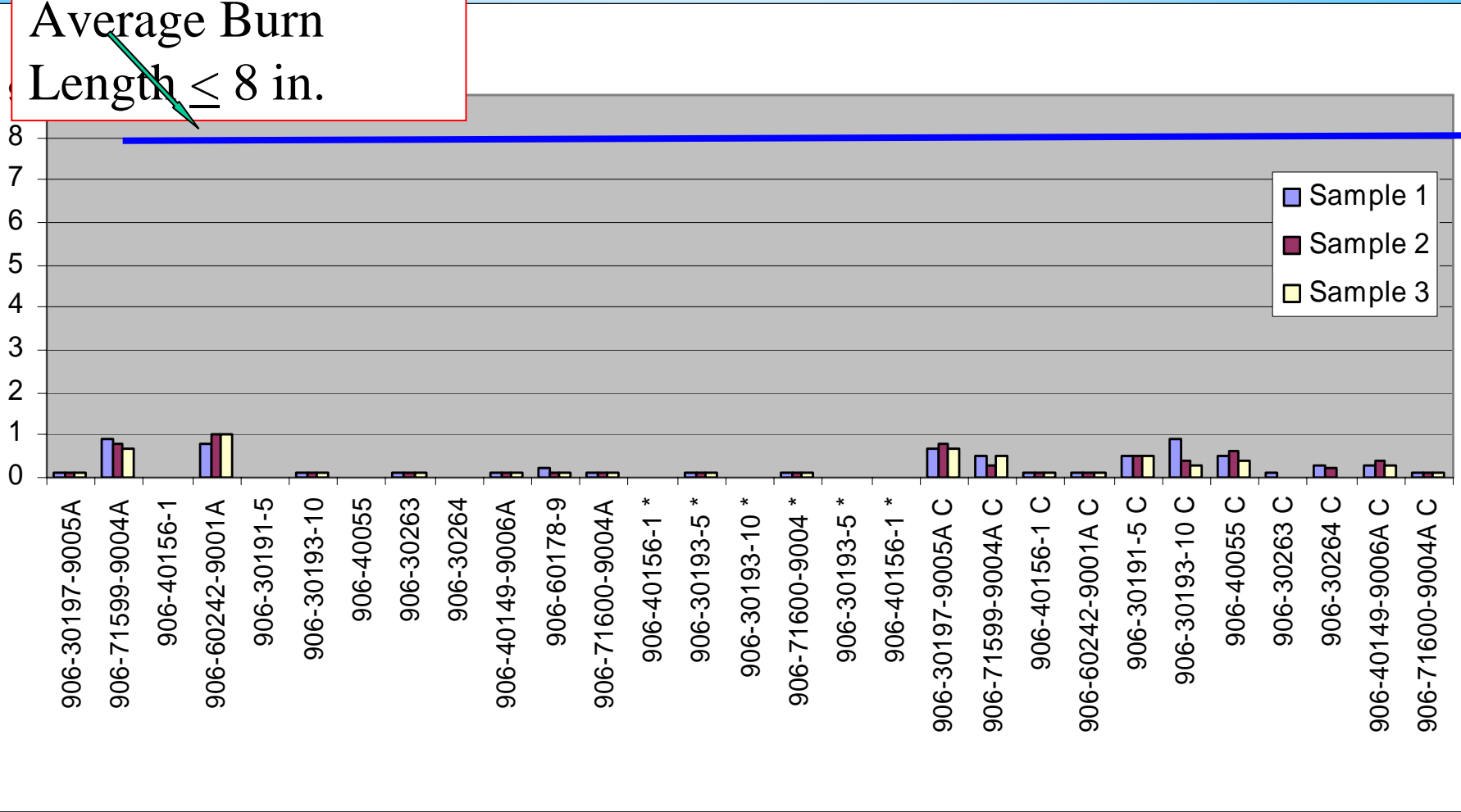
- 82 Production PWAs Tested to FAR25.853
 - PWAs made by 4 different PWA manufacturers
 - Viasystems, Tyco, Holaday Circuits, Cosmotronics
 - PWB components made from IPC 4101 laminates from 4 different laminate manufacturers
 - High temperature, fire retarded epoxy per IPC-4101 /24
 - Nelco, Double Treat, Polyclad, Isola
 - Conformal coatings made from 3 different IPC-CC-830 materials
 - Acrylic, urethane, silicone

Burn Length Examples



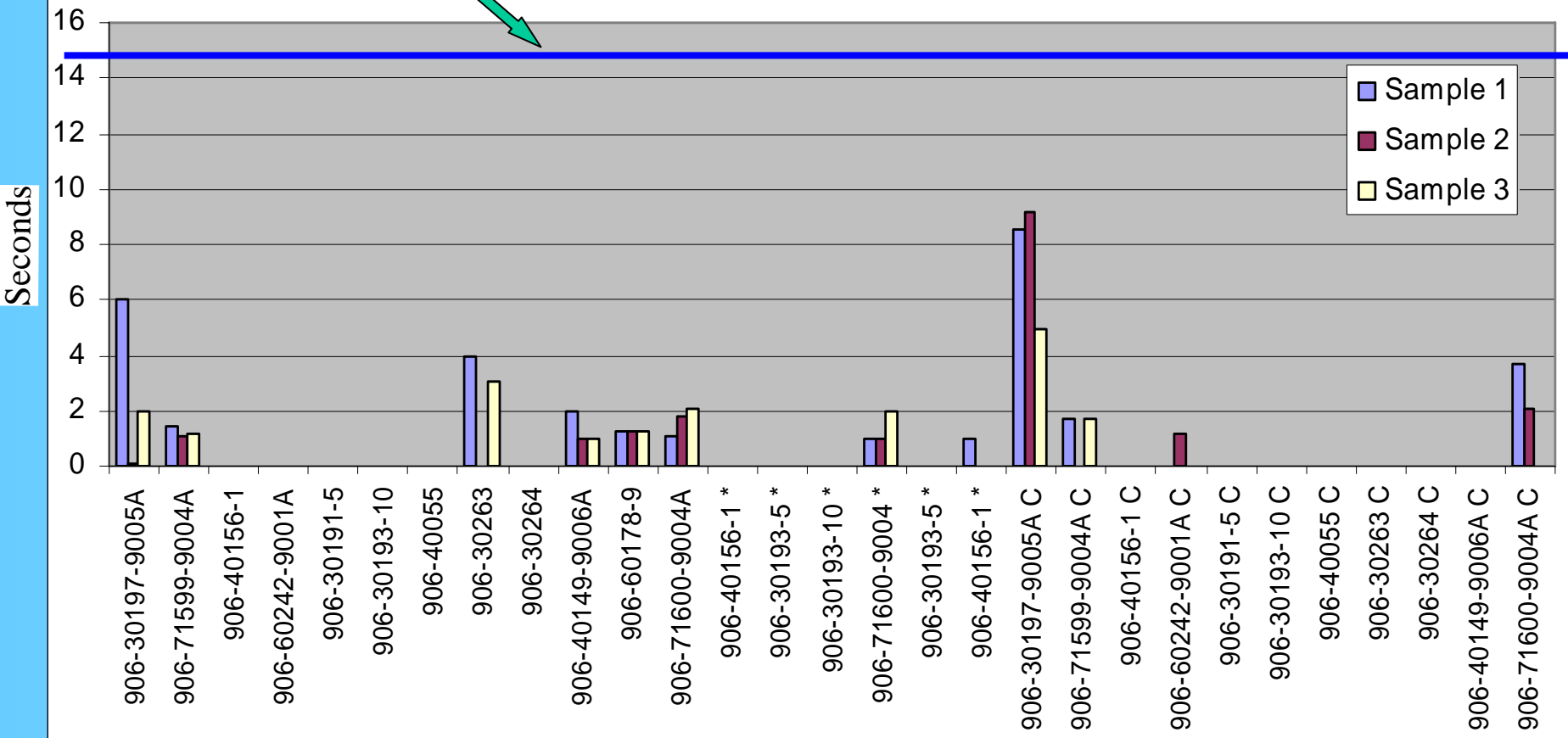
BOEING® Test Results

Max Allowed
Average Burn
Length ≤ 8 in.



BOEING® Test Results

Max Allowed Average
Extinguishing Time ≤ 15 Sec





Conclusions

- Data shows PWA materials are not a significant variable for the /24 specification
 - Thickness, conformal coating, layer count, PWB fabricator (fabrication process), and laminate manufacturer had negligible effect
- FAA 12-sec vertical test data show that PWAs made from IPC-4101 /24 PWB laminates and IPC-CC-830 conformal coatings that meet UL-94 V0 meet FAR 25.853 certification requirements with large margin
- Certification of PWBs by similarity is a valid process