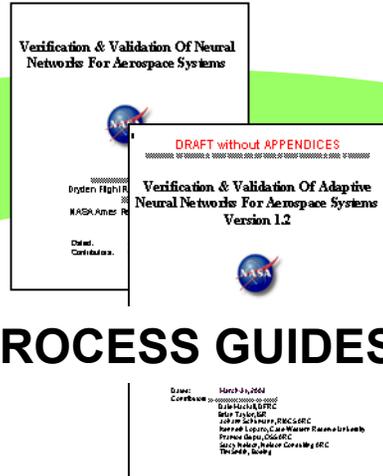


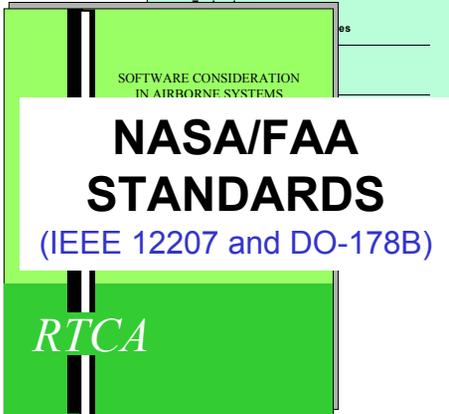
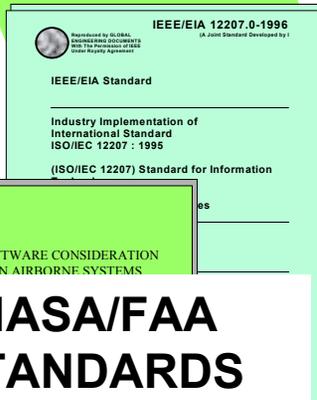
NN Process Guides – Increase Safety & Reduce Costs

GOAL: Determine how to develop neural networks in adaptive Intelligent Flight Control Systems (IFCS) in accordance with NASA and FAA safety/mission-critical certification standards

PROCESS GUIDES

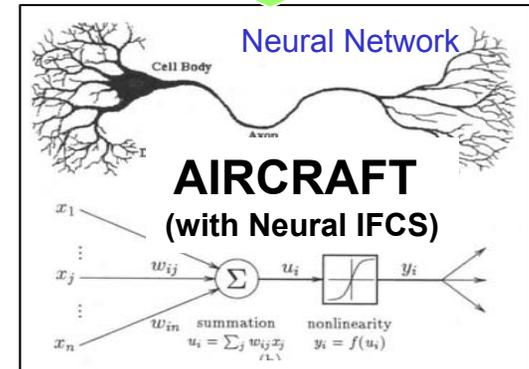


BENEFIT: Provide proven, documented processes and technical methods for building safety-critical, highly advanced flight control systems. Following these guidelines increases safety and reduces cost of future projects with neural networks!



STATUS:
V&V of Neural Networks for Aerospace Systems – finished and used for V&V of F-15 Gen 1 IFCS

• *V&V of Adaptive Neural Networks for Aerospace Systems – 63 page draft*



Explanation of Accomplishment

- **Ames POC:** Stacy Nelson (ASE Group, Nelson Consulting, Code IC, sdnelson@email.arc.nasa.gov or nelsonconsult@aol.com)
- **Background:** The goal of this project is to collaborate with Dryden Flight Research Center (Dale Mackall, V&V Working Group Lead), to document how to develop neural networks in adaptive Intelligent Flight Control Systems (IFCS) in accordance with NASA and FAA safety/mission-critical certification standards. Adaptive IFCS makes it possible for a pilot to land a damaged aircraft that might otherwise crash.

Testing these highly advanced flight control systems is very difficult. To date, processes and methods have been proven and documented for pre-trained neural networks (PTNN). PTNN are software that is trained on the ground and relied upon during flight to provide information about control surfaces. Actual test flights occurred in February and March 2003 revealing that V&V processes and methods documented for PTNN in [V&V of Neural Networks for Aerospace Systems](#) were successful.

Work is underway to document processes and methods for Real-time Adaptive NN (RANN). RANN are trained during flight and provide better adaptive capabilities but are more difficult to verify and validate. While it seems likely that RANN will be approved for mission-critical flight at DFRC, RANN have never been certified by the FAA for safety-critical flight. Contracts are progressing to hire a special team at Boeing to provide expertise about soliciting appropriate FAA certification for RANN so military and commercial aircraft can take advantage of these new improvements.

- **Shown:** How NASA Standards based on IEEE 12207 and FAA Standards based on RTCA DO-178B provided the foundation for documenting processes and methods for V&V of both PTNN and RANN. These standards contain lessons learned from previous projects to streamline development and prevent errors.
- **Accomplishment:** Presented overview of PTNN and RANN guides at Dryden to DFRC management and collaborators from Boeing and ISR during the TQM (technical quarterly meeting) of IFCS 03/05-03/06/2003
- **Future Work:** Complete generic process guide for real-time adaptive neural networks – due 2004