

**Task Title:** Calibration of Optical NDE Based on Neural-Net Inspection of Images

- I. **Objectives:** Develop a calibration procedure for the neural-net inspection of vibration characteristic patterns to identify structural changes or structural damage. Assure that the calibration procedure is consistent with NASA Handbook specifications for vibration testing.
- II. **Center Point of Contact:** Arthur J. Decker  
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- III. **Technical Methodology/Approach:** The neural-net inspection technique that was applied to optical inspection of an ISS cold plate (NASA TM –1999-209388) will be calibrated. That is, the training-set adjustment of sensitivity will be based on force-gauge, accelerometer, displacement, or strain-gage measurements rather than the judgment of the test personnel. The calibration procedure will be made consistent with NASA practices as defined in NASA Handbooks 7004 and 7005, because the neural nets are used to detect small variations in vibration mode shapes in order to flag structural changes or damage. But the methodology developed should be applicable in general to calibration of automated inspections based on pixel data.
- IV. **Customers:** ISS, UEET and Aviation Safety. This work will upgrade an existing electronic-holographic vibration-inspection service that has served diverse NASA and industrial customers.
- V. **Metrics:** The project to calibrate the optical inspection technique will be reviewed frequently with customers and other vibration-test personnel. A suitable test subject will be selected and tested with the new technology. Demonstration inspections will be conducted in Glenn's electronic holography laboratory or in the field. Field inspections will use an existing fiber-optic electronic-holography inspection setup.
- VI. **Products:** The calibration technique will be published together with essential software and documentation tracing it to the NASA Handbooks where relevant. The technique will be included in the existing electronic holography inspection services provided at Glenn.
- VII. **Schedules/Milestones:**
  - Select, acquire, mount and survey (optically) a test structure (2/02).
  - Perform existing neural-net inspection process on test structure (4/02).
  - Identify, acquire and install appropriate gages at critical points on test structure and repeat original inspection process (6/02).
  - Correlate gage readings with the training set composition necessary to flag critical changes (1/03) from images alone.
  - Report calibration procedure (1/03).
  - Test calibration procedure on fiber-optic field setup (6/03).
  - Final Report and Statement of Services Available (9/03).