Defense-Wide
Manufacturing Science & Technology
(DMS&T) Program

Adaptive Machining

PROBLEM / OBJECTIVE

- As complexity of composites increases to enable performance, machining becomes more difficult with common problems including:
  - Bulk Residual Stresses - Resulting from the composite production process causing component to distort as material is removed
  - Thin Walled Parts - Tend to deflect under the clamping forces induced during fixturing for machining and Coordinate Measuring Machine inspection
  - Variability - Increased part-to-part differences vs. metallics
- Machining issues result in longer cycle times, higher costs and scrap rates, problems meeting production rates, large amounts of Work in Process, and too much touch labor
- Current deficiencies are in-process sensing, monitoring and availability of correcting methodologies for errors

APPROACH / BENEFITS

ManTech Response

- Identify, integrate, mature and demonstrate a combination of technologies to ensure the first part, and every part, will meet specifications in a production environment
- Integrate optical non-contact systems in situ to monitor and compensate for in-process errors
- The non-contact sensor-based application will allow changes to be made to machine parameters using selected adaptive control strategy minimizing non-conformances with minimal operator intervention
- Develop an algorithm that can be transitioned to other components easily
- First Transition:
  - Boarded F-35 OMC component:
    - F-35 Auxiliary Inlet Hinge Panel manufactured by Northrop Grumman

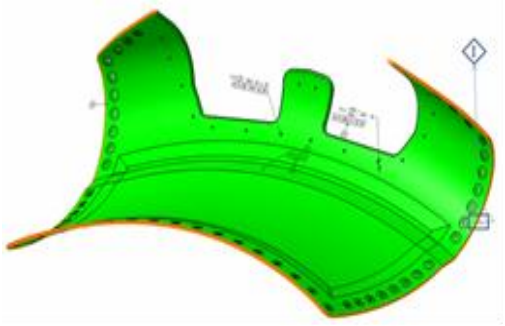
Impact

- Performance baseline & cost metrics have been obtained
  - Potential to reduce rework by 55-85%
  - Reduce cycle time by up to 4 hours per part
  - Conservative cost avoidance of $35M

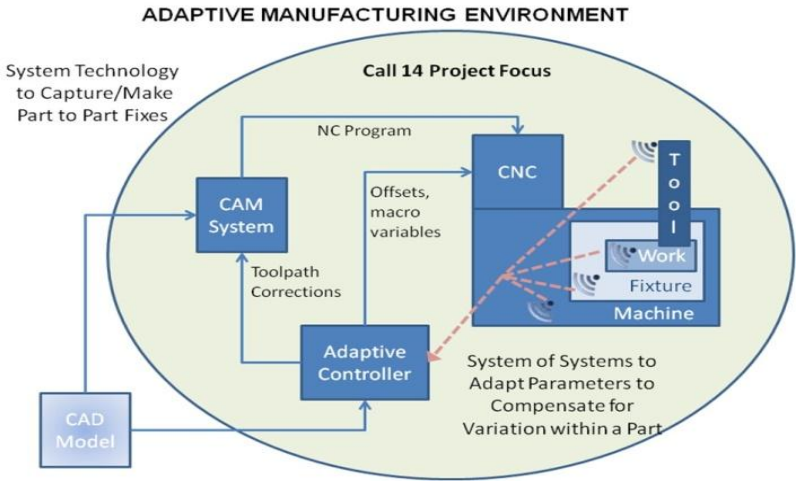
- Provide technology throughout entire industrial base allowing impact to legacy, current and future systems via a Technology Advisory Group

Progress/Recent Accomplishments

- Sensor options evaluated and down selected to the Steinbichler probe integrated laser scanner with tracker & Verisurf software
- Back up sensor also selected for risk mitigation
- Subcontract modified to allow rent free use of JSF tooling
- Demonstration on smaller representative parts scheduled



F-35 Auxiliary Inlet Hinge Panel (NG)



POINT OF CONTACT

Government Point of Contact: Amber Davis, AFRL/RXMS
937-656-4282
amber.davis.3@us.af.mil