

# Technical Challenge Completion Record



Technical Challenge #: **TC-69/TACP01/TTT**

TC Due Date: **05/31/2018**

Completion Date: **05/31/2018**

Technical Challenge: **Turbulence, Transition, and Numerical Method Technologies**

Center / Org: **LaRC/**

Benefit: **Capability will be used to improve designs and reduce design cycle times. Tools will facilitate accelerated introduction of advanced air vehicles and propulsion systems into the airspace system. Research identified technologies that need further development to enable aircraft certification by analysis with the potential of significant reduction in flight testing, resulting in hundreds of million dollars savings in aircraft development programs.**

Tech Challenge Exit Criteria: **Minimum success: Physics-based models and simulation techniques identified that reduce 40% predictive error for 50% of the standard test cases by the due date. Full Success: Physics-based models and simulation techniques identified that reduce 40% predictive error for 100% of the standard test cases by the due date.**

Milestone Exit Criteria Evaluation: **Met** / Not Met (briefly explain in Summary of Completion):

*Technical POC: LaRC/ M. Malik*

Brief Summary of Completion / Accomplishment:

**The close collaboration in the validation experimentation effort was excellent, the complementary research efforts related to fundamental numerical model development, and the activities related to effective HPC utilization on near term architectures that are coming down the pipeline were exactly what NASA should be doing. Even though the TQR panel cannot say that the success criteria were fully met, we do feel that the research funded by TTT/RCA was successful and useful in determining the next suite of CFD validation tests and the problematic flow conditions that continue to be difficult to predict using our current suite of computational tools. Given the TQR Panel's review criteria: 1. The deliverables meet the technical requirements; 2. The appropriate technical approaches were followed in producing the deliverables; and 3. All technical caveats and concerns have been identified and the deliverables: a. Development of more accurate physics-based methods (e.g., higher moment closure); b. Large eddy simulation (LES); c. Advanced numerical methods; d. Transition prediction and modeling; e. Validation experiments; f. Multidisciplinary analysis and design (high fidelity). TQR panel feels that the technical processes were all completed and that the review criteria and all the deliverables were met. Thus, the Milestone TACP-2016-001 has been completed.**

Technical Publication / Conference Paper – References and Supporting records:

1. **M. Malik: 2018 CFD Prediction Error Assessment Workshop. Lockheed-Martin Center for Innovation, Suffolk, VA 23435, Suffolk, VA 23435, USA, March 20, 2018.**
2. **J. Dudek, N. Georgiadis, D. Yoder, and J. DeBonis: RSM, EASM and Modified RANS Results for Propulsion Flows. Lockheed-Martin Center for Innovation, Suffolk, VA 23435, USA, March 20, 2018.**
3. **C. Rumsey: Perspectives on RANS Modeling for Separated Flows (Including Reynolds Stress Modeling). Lockheed-Martin Center for Innovation, Suffolk, VA 23435, USA, March 20, 2018.**

Closure Authority Signature: