Hover Prediction Workshop (HPW) Meeting Minutes

AIAA SciTech Conference 1/9/2018

Attendees

- Nathan Hariharan (Chair, Rotorcraft DG, HPCMP CREATE)
- Jennifer Abras (NAVAIR)
- David O'Brien (US Army AED)
- Jim Baeder (University of Maryland)
- Andy Wissink (Army Aeroflightdynamics Directorate)
- Rohit Jain (Army Aeroflightdynamics Directorate)
- Glen Whitehouse (CDI)
- Todd Quackenbush (CDI)
- Tom Norman (NASA)
- Stephen Wood (JICS)
- Jim Coder (University of Tennessee)
- Quiying Zhao (University of Toledo)
- Chunhua Sheng (University of Toledo)
- Juergen Rouleder (University of Munich)
- Antonio Jimenez-Garcia (Glasgow University)
- Stephen Makinen (?)

Minutes

The meeting began with introductions and an around the room.

- Nathan pointed out Bob Narducci' contributions to the workshop and his inability to attend this year. He then went over a brief history of the workshop which is outlined in his slides.
- The workshop began with the baseline S76 rotor then followed with an analysis of the tip variations. The third year saw a branching out of the focus areas of the attendees, which resulted in more interesting sessions because of the increased variation in the topics. The fourth year introduced the PSP blade.
- There was a summary of the content of the current workshop sessions.
- It was mentioned that the current transition modeling focus area was first brought up by Chunhua.
- It was decided to continue with the current investigations until test data from the NASA/Army HVAB hover tests (PSP with root modifications) is made available. This includes the pre-test investigations and a development of hover prediction best practices.
- The test is scheduled for CY2019, the data will be released in phases after that.
- There was a discussion of how to support any pre-test predictions the participants may pursue. The input data would be needed. This includes blade CAD and facility CAD, but these data will not be available until summer/fall of 2018. Tom mentioned that the blade CAD would be available. He said "maybe" about the facility CAD.

- It was asked what the goal for SciTech 2019 should be. Feedback from the attendees was prompted. It was mentioned that the wake breakdown phenomena was not likely to be solved in the next two years, it is an integrated physics/numerics problem and will be investigated long term.
- It was commented that the integrated rotor performance seems ok even with the wake breakdown, but the integrated results mask the distributed inaccuracies. This is why we should care about the wake breakdown even if the rotor performance is within an acceptable tolerance for applied applications.
- Rohit mentioned that using jut the stand and the rotor should be sufficient based on his pre-test investigations. Some of the areas to look at include freestream, FM, loads, aeroelasticity effects. The elasticity should be looked at as a second iteration. CFD grid studies can be conducted ahead of time there is no need to wait for test data to do this.
- Can an RCAS model be made available? Currently some of the model is accurate, but some of it is estimated and the model has not been validated. Tom mentioned that the manufacturer has to provide the blade properties requested. That will come out, but he is not sure when. Expect a structural model in early 2019.
- Rohit asked how rigid the tunnel blades would be. Tom said realistically it will not be completely rigid. Photogrametry will be used to quantify these effects.
- RCAD model can provide a prescribed deformation for participants that cannot run RCAS or other CSD models. The prescribed deformation from the test will not be available until after the test. Rohit can provide an RCAS model, a Dymore model should also be run for cross-reference similar to the airloads workshop effort.
- Rigid and elastic pre-test predictions should be pursued.
- Nathan mentioned that the goal for next SciTech should be to have the blade geometry for pre-test predictions. It was mentioned that except for the root area the HVAB blade is the same as the PSP blade.
- Facility effects were discussed further. Pre-test facility effects may not be manageable for all participants. Rohit would like to model the side walls to expand on his exiting study.
- Tom wants guidance on conditions to run in the tunnel based on pre-test results. Sensitivity studies will help define the test envelope.
- Andy talked about download and how computations and test do not match. Maybe next phase investigation should use the JVX for download investigations.
- Rohit mentioned that the PSP test has download data.
- Jim Baeder mentioned pursuing the dynamic response measurements based on step changes in collective to obtain a more up to date data set then what is currently available. Tom mentioned that this would involve a high frequency delta change in collective, and some data could be collected, but not everything. Tom said in the end to write up a proposal and send it to him for consideration. The proposal should be specific about what to look for.
- Nathan brought up the need to look at how the wake breaks down in reality. Tom said that shadowgraph information would be available but that this would only show tip vortices not the

braids because of the orientation of the braids. You may be able to quantify wake breakdown based on the appearance of the tip vortices.

- Nathan mentioned that the relative strength of the braids relative to the tip vortices is in question. If the braids have arbitrary direction and are similar in strength can the shadowgraph show them? Tom said that you might see something, but would be hard because of the planar cut of the flow. One of the participants mentioned using PIV to focus on a smaller area to get this data. Tom mentioned the difficulties with PIV data and said that the larger tunnel will increase these difficulties. The PIV should be sufficient to get the core radius, but may not capture the braids.
- Steve M. mentioned being interested in uncertainty quantification. He would like to have data to facilitate uncertainty quantification computations. Tom said that this feeds into the previous sensitivity analysis request.
- Nathan prompted for any final comments.
    - Tom said that for SciTech 2019 there will be no data available for the test. Also for SciTech 2020 there will not be any available data in time for the workshop. SciTech 2021 is the first realistic opportunity to present work based on the test data. Maybe the workshop should be held every other year.
    - Nathan mentioned that this was possible, but there is the risk of losing momentum. There seem to be enough interesting results to hold the workshop every year. The current plan for SciTech 2019 is to look at parametrics.
    - Final comment. Minutes will be sent out. Please provide feedback.