Hover Prediction Workshop (HPW) Virtual Meeting Minutes

Summer Discussion Group Meeting 9/15/2022 3:00-4:00 PM EDT

Attendees

- Nathan Hariharan, HPCMP
- Robert Narducci, Boeing
- Jennifer Abras, HPCMP
- Rohit Jain, Army
- Brian Wake, Lockheed Martin
- Bumseok Lee, UMD
- Marilyn Smith, Georgia Tech
- Jeremy Bain, Joby
- Pieter Buning, NASA
- Tom Norman, NASA
- Forrest Mobley, Boeing
- Matt Hill, Bell
- Peter Lorber, Lockheed Martin
- Jared Carnes, University of Tennesee-Knoxville
- Ted Meadowcroft, Boeing
- BY Min, Sikorsky
- CJ Doolittle, Flexcompute
- Qiuying Zhao, University of Toledo
- Thomas Fitzgibbon, Glasgow University
- Glen Whitehouse, CDI
- Andrew
- Brian Allan, NASA

Minutes

- Nathan opened the meeting, went over typical meeting schedule, asked for updates to e-mails and new participants
- Nathan went over workshop structure and past workshop strategies, highlighted that participant focused paths for contributions are shown to be a metric for success
- 11 papers at SciTech in National Harbor
    - Call for papers, HVAB predictions and full-up rotorcraft predictions
- Introduced speakers, Tom and Bob
- Tom went over HVAB wind tunnel test updates
    - Went over issues to date, but now they are ready to gather data
    - Presented some images of the setup
        - 40 ft off the ground in the facility
        - Pointed out shadowgraph screen on the wall and cameras
    - They are currently working out issues through test runs
    - There is recirculation even though it is a small rotor in a big facility

- Examining how to best deal with variability
  - Showed an example of the shadowgraph data, can extract vortex trajectories from this data
    - Also used real time to look for cross winds and the like
  - Showed a sample scatter plot of CT/sigma vs FM
    - Compared to Rohit's CFD data, compares best to turbulent data
    - Reflective targets on the blade show the flow is turbulent so this makes sense
    - After these targets are removed the curve will change
  - After all this time we are making progress, there is a month or two to go
    - Will take data with standard blades, trip dot blades, and instrumented blades
  - Question (Bob): How was recirculation determined?
    - Look at time record for thrust and torque, can see 10-40 sec periods of unsteady data, presumed to be recirculation
    - We are talking 10-15 lbs out of 1100 lb impact to performance in this case
    - Usually, variability is 10-15 percent for other tests
- Nathan thanked Tom and passed meeting over to Bob
- Bob started the next part of the meeting
  - Workshop is a collaboration of government, industry, and academia to predict hover efficiently
    - Looked at various aspects of the hover problem, good advances
    - In next couple of years advance where we are in terms of single isolated rotor and expand to more realistic calculations
    - Putting together a problem for everyone to work on in the workshop
  - Hover is not driven by external flows, makes it a difficult, but elegant problem
    - Isolated analysis has a place for the fundamentals, but real applications require inclusion of more realistic components, fuselage, ground etc…
  - Went over workshop progress in terms of the grand challenge problem
    - Keep this plan in the forefront
    - After looking over existing workshop conference papers, can see that they are already looking into the items in the grand challenge plan
    - Need to start tackling the other clouds in the plan
  - Blind HVAB calculations
    - Encouraged detailed reporting of the simulations, including distributed data
    - Blind analyses lends credibility to the process, but computations after that are useful as well
  - Introduced the new real world problem
    - We don't have a dataset, so made something up for everyone to work on
      - Can do code-to-code comparisons
      - Even if we had flight test data that would be a challenge in itself
    - New problem is broken into 7 sections, participants can choose which section they want to work on
    - Will focused on the desired results in the discussion to follow
    - First, defined the new real world problem and the common inputs
      - Rotor parameters, HVAB with some fixed parameters
      - Fuselage (ROBINM7) parameters, used with PSP rotor in a publication

- No hub no tail rotor, this is a start
  - Described each of the 7 steps
    - Will take a couple of years to look at
  - Step 1 HOGE compare isolated and installed hover
    - Extract download and thrust recovery
  - Step 2 HIGE at a single collective execute sims as a function of height above the ground
  - Step 3 Groundwash assessment
    - Can compare inviscid and viscous ground planes
  - Step 4 Hover over a hillside
    - Analytical ground contour
  - Step 5 Headwind impact
  - Step 6 Winds from different azimuthal directions
  - Step 7 Decent, most challenging
- Turned meeting back over to Nathan
- Nathan opened the floor to questions, suggestions, etc…
  - Marilyn: we are doing some HVAB work, need to check it is the same as what is described, but did not submit a SciTech abstract, can we present?
    - Nathan: there are multiple avenues to still be able to present at SciTech
  - Thomas F: Will any cross plotting be presented during the workshop?
    - Nathan: we did in the past, we need time to gather data and put something together, so too late to do last minute. Can discuss at DG meeting and consolidate similar results. Note that one-to-one mapping can be misleading, but a comparative paper would be interesting
  - Thomas F: Does the fuselage apply a 3.5 nose up pitch attitude like paper?
    - Bob: yes, it is as reported in the referenced paper and same hub center as well.
  - Thomas F: What blade hinge order should be applied?
    - Bob: there is an order we will publish this in the future
- Nathan, we will take the notes and slides and post to website
  - Thanks to the working group
- Nathan closed the meeting