AHS Technical Meeting on Aeromechanics Design for Transformative Vertical Flight

Transformative Vertical Flight Workshop #5
AHS San Francisco Bay Area Chapter Welcomes You

• 2017-2018 President: Chris Silva
• Technical Activities
  • Monthly Seminars
    • Usually at NASA-ARC, Moffett Field (visitors welcome)
    • Snacks and drinks
    • Looking to get more involvement “outside the Ames fence”
  • Specialists’ meeting on even years
• Social events and charity
  • Wine tasting fundraiser (Cooper-Garrod, Saratoga)
  • Spring social (Moffett Museum)
Downstairs Layout

Holiday Inn Fisherman’s Wharf
Level 1

- Bristol Lounge
- Bristol Buffet
- Bristol Bar & Grill

- Lunch
- Restroom
- Stairs to Mezzanine Level
- Lobby Level 1
- Front Desk
- Gift Shop

Please Note: Not drawn to scale

AHS International
The Vertical Flight Technical Society

UPDATED: 1/10/2018
Layout of the Meeting Rooms

Holiday Inn Fisherman’s Wharf
Level 2

Exit stairs

Emergency Exit

Workshop Room

PACIFIC BALLROOM

TIBURON

SAUSALITO

NAPA

STAIRS TO LOBBY

TELEPHONE

RECEPTION & PRE-FUNCTION

MEZZANINE LEVEL

Lunch Overflow
Afternoon Discussions
Thursday Schedule

1:00-1:15 PM (15 min) **Welcome:** Chris Silva, AHS San Francisco Bay Area Chapter

1:15-1:45 PM (30 min) **eVTOL: Promise & Progress:** Mike Hirschberg, AHS International

1:45-2:15 PM (30 min) **Uber Elevate Common Reference eVTOL:** Mark Moore, Uber Technologies

2:15-2:45 PM (30 min) **Electric & Hybrid-Electric VTOL:** Dr. Brian Yutko, Aurora Flight Sciences

2:45-3:15 PM Networking Break — sponsored by Ricardo

3:15-3:45 (30 min) **Transformative VTOL:** John Piasecki, Piasecki Aircraft

3:45-5:00 PM (75 min) **Transformative Vertical Flight Working Groups/Roadmapping**
  - Roadmapping lead: Mike Dudley, NASA Ames
  - WG1 – Private / Recreational Vehicles: Tony Linn
  - WG2 – Commercial Intra-city: Anubhav Datta, University of Maryland
  - WG3 – Commercial Inter-city: Yolanka Wulff, Ampaire
  - WG4 – Public Services: JD Doo, International Vehicle Research, Inc.

5:00-5:30 PM (30 min) **Four Ways for On-Demand Mobility:** Mathias Thomsen, Airbus Group

5:30-7:00 PM (90 min) **Reception — Sponsored by Uber Technologies**
Friday Schedule - AM

7:45-8:00 AM (15 min) **Overview: NASA Studies on eVTOL:** Chris Silva, NASA Ames

8:00-8:30 AM (30 min) **eVTOL Analysis Tools & Frameworks:** Dr. Rob MacDonald, Uber Technologies

8:30-9:30 AM (60 min) **Panel: Challenges of Urban Air Mobility Airspace** Mod: Dr. Parimal Kopardekar, NASA Ames
   - Dr. Tom Prevot, Uber Technologies
   - Parker Vascik, MIT
   - Uma Subramanian, Voom

9:30-10:00 AM (30 min) **Overview: Urban Air Mobility Skyport, Cabin and User Experience:** John Badalamenti, Uber

10:00-10:30 AM Networking Break — Sponsored by Ricardo

10:30-10:50 AM (20 min) **Discussion: Get Involved and Shape the Future**
   - GoFly Prize Needs Your Help! Gwen Lighter, GoFly Prize
   - Transformative Vertical Flight Needs Your Help! Mike Hirschberg, AHS International

10:50-11:30 AM (40 min) **Overview: Challenges of eVTOL Standards & Certification**
   - Tom Gunnarson, Zee Aero (ASTM)
   - Greg Bowles, GAMA

11:30-12:30 (60 min) **Panel: Challenges of Urban Aviation Ground Infrastructure** Mod: Stan Swaintek, Uber Technologies
   - Paul Stith, Black & Veatch
   - David Sawaya, Pacific Gas & Electric
   - Alan Dowdell, ChargePoint

12:30-1:45 Lunch Break — Sponsored by Bell Helicopter
Friday Schedule - PM

12:30-1:45 Lunch Break — Sponsored by Bell Helicopter

1:45-2:30 PM (45 min) **Panel: The Challenges of Acoustics** Mod: David Josephson, Josephson Engineering
  - Dr. Ken Brentner, Penn State University
  - Dr. Eric Greenwood, NASA Langley

2:30-3:30 PM (60 min) **Panel: Challenges of Hybrid-Electric VTOL Propulsion** Mod: Jason Schug, VP, Ricardo
  - Steve Burns, CEO, Workhorse/SureFly, Inc.
  - Dr. Paul Debitetto, CTO, Top Flight Technologies
  - Reed Danis, Aerospace Engineer, Empirical Systems Aerospace (ESAero)
  - Francesco Giannini, Aurora Flight Sciences

3:30-4:00 PM Networking Break — Sponsored by Ricardo

4:00-4:45 PM (45 min) **Panel: Perspectives on Prospective Markets** Mod: Piyush Bubna, Sr. Consultant, Ricardo
  - Mathias Thomsen, GM UAM, Airbus
  - Dr. Brian German, Associate Professor, Georgia Tech
  - Nikhil Goel, Elevate Product Manager, Uber Technologies
  - Kevin Antcliff, NASA Langley

4:45-5:00 PM (15 min) **Closing Remarks & What's Next** Chris Silva, NASA Ames
Overview:

NASA (RVLT) Studies on eVTOL

Chris Silva

NASA Ames Research Center

Revolutionary Vertical Lift Technology –
Sub-Project Technical Lead: Optimization Process for Conceptual Design
Emerging Aircraft Markets – Integrated Challenges
NASA Aeronautics pivoting to address complex challenges

Integrated Aviation System Challenges

Emerging Market Opportunities

- Electrified Aircraft Propulsion & Integration
  flight-critical, flight-weight power/energy
- Noise
  vehicle & fleet
- Weather/Environment-Tolerant
  vehicle robustness (wind/rain/ice...)
- Assured Autonomous Systems & Human Integration
  autonomous awareness & contingency management
  UAS mission management (one operator/many vehicles)
- Integrated ATM System
  Efficient, high density operations with access to diverse platforms
  in airspace with integrated air/ground/cloud technologies

s/mUAS
Urban Air Mobility
Thin/Short Haul
Large UAS/HALE

www.nasa.gov
NASA Revolutionary Vertical Lift Technology (RVLT) Investment Strategy

FY18+ RVLT technology emphasis

<FY17 RVLT technology emphasis

Technology applicability scales up and down in many areas

- NASA RVLT project technology emphasis will include smaller vertical lift vehicles, particularly emphasizing technology for UAS and UAM
Research Areas for Air Taxi Aircraft Development

**PROPULSION EFFICIENCY**
- high power, light battery
- light, efficient, high speed electric motors
- power electronics and thermal management
- light, efficient diesel engine
- light, efficient small turboshaft engine
- efficient drives

**SAFETY and AIRWORTHINESS**
- FMECA (failure mode, effects, and criticality analysis)
- component reliability
- crashworthiness
- propulsion system failures

**OPERATIONAL EFFECTIVENESS**
- disturbance rejection (control bandwidth, control design)
- all-weather capability
- cost (purchase, maintenance, DOC)

**NOISE AND ANNOYANCE**
- low tip speed
- rotor shape optimization
- aircraft arrangement
- active noise control
- metrics and requirements

**PERFORMANCE**
- aircraft optimization
- rotor shape optimization
- hub and support drag minimization
- airframe drag minimization

**STRUCTURE AND AEROELASTICITY**
- structurally efficient wing and rotor support
- rotor/airframe stability
- crashworthiness
- durability and damage tolerance

**ROTOR-ROTOR INTERACTIONS**
- performance, vibration, handling qualities
- aircraft arrangement
- vibration and load alleviation

**ROTOR-WING INTERACTIONS**
- conversion/transition
- interactional aerodynamics
- flow control

**AIRCRAFT DESIGN**
- weight, vibration, handling qualities
- active control

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