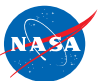


# **FUN3D v13.4 Training**

## **Session 2:**

# **Welcome and Overview**

Eric Nielsen

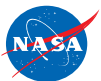


# FUN3D Training Workshop

December 11-12, 2018

Tuesday, December 11

Session 1: Meet and Greet	All	8:00-8:20
Session 2: Welcome and Overview	Eric Nielsen	8:20-8:40
Session 3: Compilation and Installation	Bill Jones	8:40-9:05
Session 4: Gridding and Solution Basics	Eric Nielsen	9:05-9:55
GROUP PHOTO		9:55-10:05
BREAK		10:05-10:20
Session 5: Visualization and Component Performance	Jan-Renee Carlson	10:20-11:00
Session 6: Boundary Conditions	Jan-Renee Carlson	11:00-11:30
LUNCH: Lightning Talks (Reid 3 Auditorium)	Various	11:30-12:45
Session 7: Turbulence Models	Jan-Renee Carlson	12:45-1:15
Session 8: High Speed Perfect Gas Simulations	Mike Park	1:15-1:45
Session 9: High Speed Generic Gas Simulations	Kyle Thompson	1:45-2:15
BREAK		2:15-2:30
Session 10: Geometry Parameterization	Bill Jones	2:30-3:30
Session 11: Design for Steady Flows	Eric Nielsen	3:30-4:30
DINNER: Tucanos Brazilian Grill, 11820 Fountain Way		6:30



# FUN3D Training Workshop

December 11-12, 2018

Wednesday, December 12

Session 12: Mesh Adaptation	Mike Park	8:00-8:30
Session 13: Time-Dependent Simulations	Stephen Wood	8:30-9:00
Session 14: Dynamic Grid Simulations	Kevin Jacobson	9:00-9:30
Session 15: Overset Grid Simulations	Li Wang	9:30-10:00
BREAK		10:00-10:15
Session 16: Aeroelastic Simulations	Kevin Jacobson	10:15-11:15
Session 17: Rotorcraft Simulations	Li Wang	11:15-12:00
LUNCH – ON YOUR OWN		12:00-1:00
Session 18: Design for Unsteady Flows	Eric Nielsen	1:00-1:45
Session 19: Multidisciplinary Design	Li Wang	1:45-2:15
Session 20: Running on GPU Systems	Eric Nielsen	2:15-2:45
Summary of User Feedback/Requests and Open Discussion	All	2:45-3:45



# Administrative Details

- Please do not hesitate to ask questions
  - However, need to stay on schedule
  - Consider saving questions very specific to your use case for the breaks or follow-up
- In-room wireless access:
  - Network: nasaguest (Sign-in page)
- Speakers:
  - Please watch clock and leave time for questions
  - Please repeat questions
- If you signed up for Day 1 lunch, please be sure to turn in your \$10
- If you have not signed up for a breakout meeting and wish to do so, please fill out the online form ASAP – helps us coordinate schedules
- Please submit two online forms by lunchtime on Wednesday
  - **User Feedback/Requests Form**
    - User feedback and requests will be summarized and discussed in the final session on Wednesday
  - **Training Evaluation Form**
    - Very interested in your feedback, good or bad!



# All Material Available Online

- For the v13.4 material presented here:
  - Slides online in PDF format
  - Demo content can be downloaded as a tarball
  - Capture hopefully online soon
- A FUN3D v13.4 manual is available as NASA/TM-2018-220096 on the website
  - Available for download from website
  - Your feedback/suggestions are extremely helpful
- Extensive material from prior training workshops is available on the website
  - Slides in PDF
  - Streaming video
- We hope to eventually add a tutorials document



# The FUN3D Development Team

[fun3d-developers@lists.nasa.gov](mailto:fun3d-developers@lists.nasa.gov)

- Consists of ~10-15 researchers across several branches at Langley
  - Computational AeroSciences Branch
  - Aerothermodynamics Branch
  - Aeroelasticity Branch
- Some people are full-time FUN3D, others part-time
  - Spectrum runs from full-time development to full-time applications
- Also external groups such as Georgia Tech, National Institute of Aerospace (NIA)
- Open to other interested parties joining us
  - Remote, real-time, read/write access to FUN3D repository is available



# The FUN3D Support Team

[fun3d-support@lists.nasa.gov](mailto:fun3d-support@lists.nasa.gov)

***“Who sees my questions to the support alias?”***

- Consists of 14 members of the development team
- All are NASA civil servants
  - Proprietary/sensitive data can be shared/discussed: all are bound by Trade Secrets Act
- Members: Kyle Anderson, Bob Biedron, Jan-Renee Carlson, Cameron Druyor, Kevin Jacobson, Bill Jones, Bil Kleb, Steve Massey, Eric Nielsen, Matt O’Connell, Mike Park, Kyle Thompson, Aaron Walden, Jeff White
- We try to answer all questions; however, please bear in mind code support is not our “day job”
  - Your questions/issues are often mutually beneficial



# The FUN3D User Community

[fun3d-users@lists.nasa.gov](mailto:fun3d-users@lists.nasa.gov)

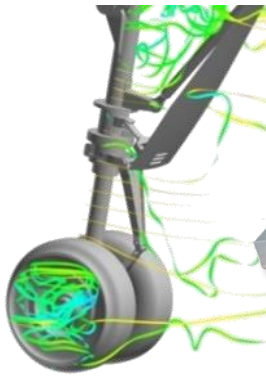
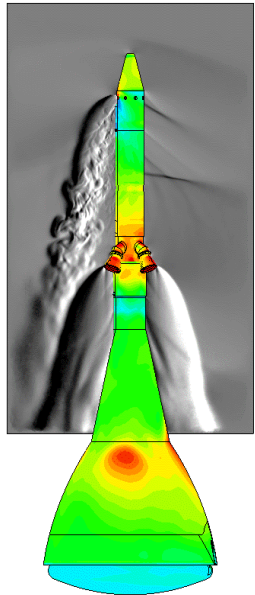
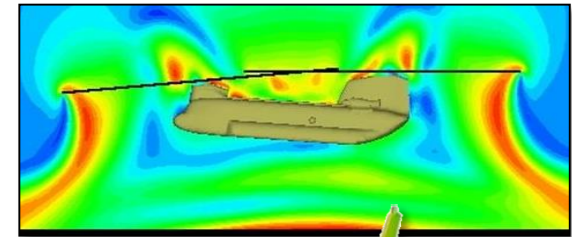
- FUN3D widely used within NASA for projects across the speed range
  - Both engineering and research applications
  - Users routinely running on several thousand cores
- Distributed to hundreds of external organizations across academia, industry, DoD, and OGAs
  - Average about 150 distributions / year
  - Wide range of uses including aerospace, automotive, HPC, etc
  - Wide range of hardware being used
  - From RC enthusiasts on single workstation to groups generating matrices of hundreds of solutions on thousands of HPC nodes



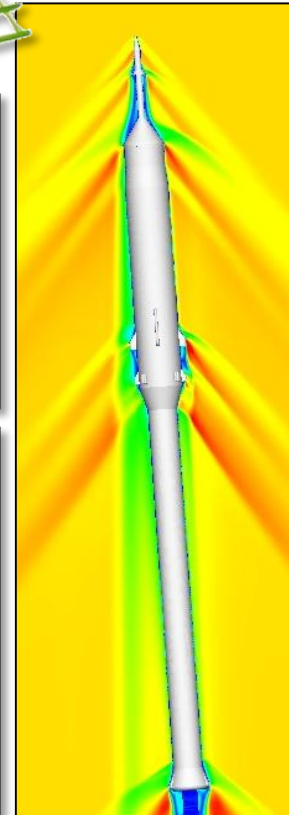
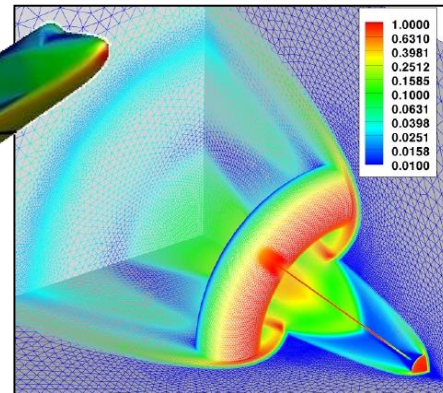
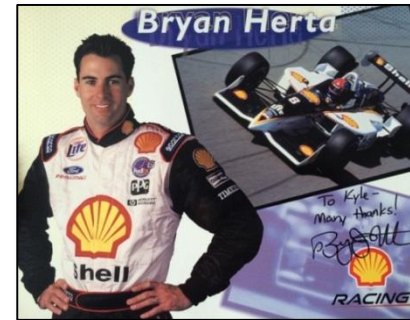
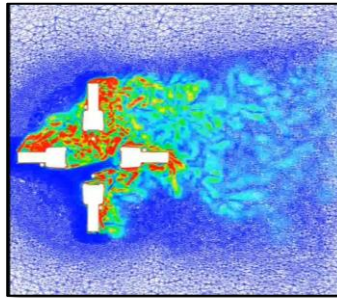


# FUN3D Core Capabilities

- Established as a research code in late 1980s; now supports numerous internal and external efforts across the speed range
- Solves 2D/3D steady and unsteady Euler and RANS equations on node-based mixed element grids for compressible and incompressible flows
- General dynamic mesh capability: any combination of rigid / overset / morphing grids, including 6-DOF effects
- Aeroelastic modeling using mode shapes, full FEM, CC, etc.
- Constrained / multipoint adjoint-based design and mesh adaptation
- HPC/performance optimization paramount; emerging GPU capability
- Distributed development team using modern software practices including 24/7 regression, performance testing



Georgia  
Tech



# Some Final Notes

- The material that will be shown here represents the current recommended best practices for the perfect gas option in FUN3D
  - Simulations with real gas effects are covered Tuesday afternoon in Session 9
- There are always many research and development efforts taking place within the code that are not described here
- If you do not see something, please ask about it

