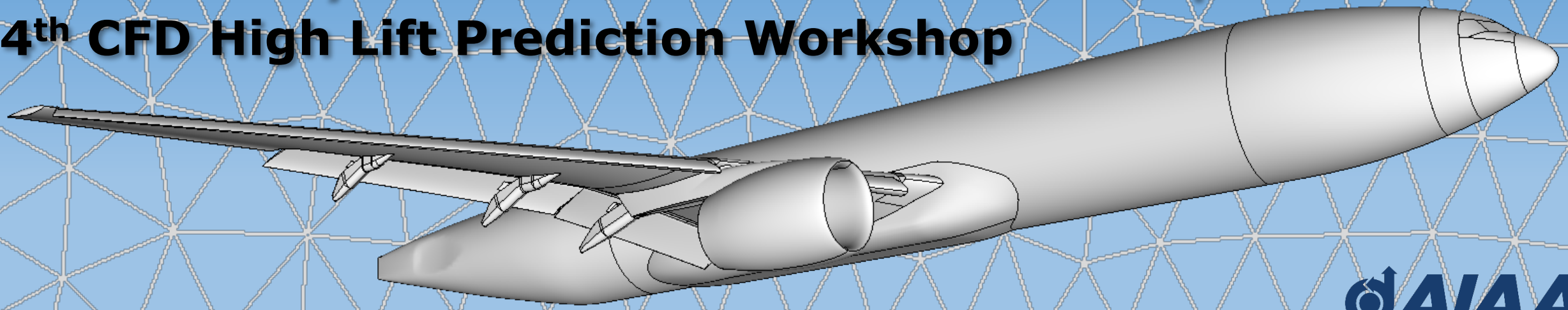
3rd Geometry and Mesh Generation Workshop
4th CFD High Lift Prediction Workshop



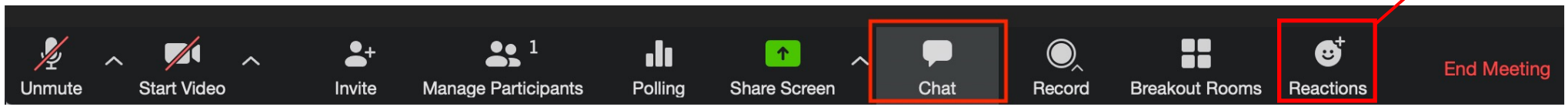
AIAA
SHAPING THE FUTURE OF AEROSPACE

Welcome & Overview

GMGW/HLPW Leadership Team

Event Information

- This is a hybrid workshop.
  - Presentations will be a mixture of in-person and virtual (Zoom).
  - Comments/questions can be via Zoom **Chat** at any time.



  - Use **Raise Hand** feature to ask question, provide feedback.
  - Multiple committee members will facilitate virtual participation on Zoom.
- Recordings – the Zoom will be recorded
  - Presentation talks **WILL** be made available afterwards to registered attendees
  - Discussion sessions will **NOT** be made available afterwards
- In-person Wi-Fi
  - SSID: MarriottBonvoy_conference
  - Password: 22scitech

Workshop Organizing Committees

- The 3rd Geometry and Mesh Generation Workshop (GMGW-3) and the 4th High Lift Prediction Workshop (HLPW-4) committees worked together in a new combined model.

GMGW Committee

- Carolyn Woeber, Cadence Design Systems
- Adam Clark, The Boeing Company
- John Dannenhoffer, Syracuse Univ.
- Mark Gammon, ITI
- Carl Ollivier-Gooch, Univ. of British Columbia
- Bill Jones, NASA Langley Research Center
- James Masters, National Aerospace Solutions
- David McDaniel, DoD HPCMP CREATE
- Todd Michal, The Boeing Company
- Nigel Taylor, MBDA UK Ltd.

HLPW Committee

- The Boeing Company
- Amazon Web Services
- Arnold Engineering Development Complex
- DLR – German Aerospace Center
- Gulfstream Aerospace Corporation
- JAXA – Japan Aerospace Exploration Agency
- MBDA UK Ltd.
- NASA – National Aeronautics and Space Administration
- Cadence Design Systems
- The Spaceship Company
- Textron Aviation
- University of Tennessee, Knoxville
- University of Wyoming

Sponsored by: Meshing, Visualization, and Computational Environments and Applied Aerodynamics Technical Committees

Technology Focus Groups (TFGs)

Technology Focus Groups (TFGs) were created & tasked with trying to answer "Key Questions" of importance to geometry, meshing, and predicting high-lift flows in a collaborative manner.

G: Geometry & Mesh Preparation (GEOM TFG)
Mark Gammon
Adam Clark
John Dannenhoffer
Bill Jones
Doug Lacy
Nigel Taylor

R: Fixed-Grid RANS (RANS TFG)
Jim Coder
Carl Ollivier-Gooch
Yasushi Ito
Misuhiro Murayama
Tony Sclafani
Nigel Taylor

A: Mesh Adaptation for RANS (ADAPT TFG)
Todd Michal
Frederic Alauzet
Dimitri Mavriplis
Mike Park

H: High-Order Discretization (HO TFG)
Steve Karman
Marshall Galbraith
Saikat Dey
Peter Eiseman
Ryan Glasby
Adrien Loseille
Z.J. Wang

L: Hybrid RANS-LES (HRLES TFG)
Neil Ashton
Paul Batten
Andrew Cary
Kevin Holst
Mike Long
Nick Powell
Vangelis Skaperdas
Nigel Taylor

W: Wall-Modeled LES and Lattice-Boltzmann (WMLESLB TFG)
Cetin Kiris
Johan Larsson
Jeff Slotnick
Nigel Taylor

Tremendous initial interest, but also tremendous work (see following slides)

GEOM TFG original members (18)

- **Organizers**
  - CHAIR: **Gammon, Mark** (ITI) PID: G-001
  - **Clark**, Adam (Boeing) PID: G-002
  - **Dannenhoffer**, John (Syracuse University) PID: G-003
  - **Jones**, William (NASA Langley) PID: G-004
  - **Lacy**, Douglas (Boeing) PID: G-005
  - **Taylor**, Nigel (MBDA) PID: G-006

- **Members**
  - **Beall**, Mark (Simmetrix, Inc.) PID: G-007
  - **Bogstad**, Mark (U Wyoming) PID: G-008
  - **Contractor**, Krishna (AneCom) PID: G-009
  - **Crippa**, Simone (Airbus) PID: G-010
  - **Gurram**, Harika (Texas Advanced Computing Center, U of Texas Austin) PID: G-012
  - **Hanke**, Jeremy (Siemens Digital Industries) PID: G-021
  - **Marcon**, Julian (NASA Ames) PID: G-013
  - **Sahai**, Mrigank (Entuple Technologies Pvt. Ltd.) PID: G-015
  - **Skaperdas**, Vangelis (BETA CAE Systems) PID: G-016
  - **Slaughter**, James (Imperial College London) PID: G-017
  - **Sonakar**, Prashant Sureshrao (ESI-OpenCFD Ltd.) PID: G-018
  - **Yasuda**, Hidemasa (Kawasaki Heavy Industries, Ltd.) PID: G-020

GEOM TFG final submissions (4)

- **Hanke**, Jeremy (Siemens Digital Industries) PID: G-021
- **Skaperdas**, Vangelis (BETA CAE Systems) PID: G-016
- **Sonakar**, Prashant Sureshrao (ESI-OpenCFD Ltd.) PID: G-018
- **Yasuda**, Hidemasa (Kawasaki Heavy Industries, Ltd.) PID: G-020

RANS TFG original members (63)

- **Organizers**
  - CHAIR: **Ollivier-Gooch, Carl** (U British Columbia) PID: R-001
  - CHAIR: **Coder, Jim** (U Tennessee, Knoxville) PID: R-002
  - **Ito**, Yasushi (JAXA) PID: R-003
  - **Murayama**, Mitsuhiro (JAXA) PID: R-004
  - **Sclafani**, Tony (Boeing) PID: R-005
  - **Taylor**, Nigel (MBDA) PID: R-006

- **Members**
  - **Abe**, Hiroyuki (JAXA) PID: R-007
  - **Ahmad**, Nashat (NASA LaRC) PID: R-008
  - **Ando**, Yuya (Cradle CFD) PID: R-009
  - **Aubry**, Romain (Naval Research Laboratory) PID: R-010
  - **Balakrishnan**, Narayanarao (Indian Institute of Science) PID: R-011
  - **Becker**, Gilberto (Calidus LLC) PID: R-012
  - **Bercin**, Kutalmis (ESI-OpenCFD Ltd.) PID: R-013
  - **Bogstad**, Mark (U Wyoming) PID: R-014
  - **Bozeman**, Michael (NASA LaRC) PID: R-015
  - **Burns**, Peter (TLG Aerospace) PID: R-016
  - **Chaphalkar**, Aaditya (Vikram Sarabhai Space Centre, ISRO) PID: R-017
  - **Chen**, Jiangtao (CARCD) PID: R-018
  - **Ciloni**, Pedro (Embraer) PID: R-019
  - **Crippa**, Simone (Airbus) PID: R-020
  - **Darbyshire**, Oliver (Zenotech) PID: R-021
  - **DaSilva**, Ricardo (Embraer) PID: R-022
  - **Dehpanah**, Payam (TU Kaiserslautern) PID: R-023
  - **Djeddi**, Reza (University of Tennessee, Knoxville) PID: R-024
  - **Doolittle**, CJ (FlexCompute) PID: R-062
  - **Duensing**, Jared (NASA Ames) PID: R-025
  - **Fitzgibbon**, Thomas (Flexcompute) PID: R-060
  - **Fozan Ur Rab**, Mohammad (NED University of Engineering and Technology) PID: R-026
  - **Gagliardi**, Lucy (ICON Technology and Process Consulting) PID: R-027
  - **Hoarau**, Yannick (Strasbourg University) PID: R-028
  - **Hong**, Junwu (CARDC) PID: R-029
  - **Jensen**, James (NASA Ames) PID: R-030
  - **Kamenetskiy**, Dmitry (Boeing) PID: R-031
  - **Kim**, Chongam (Dept. Aerospace Engineering, Seoul National University) PID: R-032
  - **Langlois**, Marc (Bombardier Aviation) PID: R-033
  - **Laurendeau**, Eric (Polytechnique Montreal) PID: R-034
  - **Le Gouez**, Jean-Marie (ONERA / DAAA / DEFI Chatillon) PID: R-044
  - **Luo**, Andy (TotalSim) PID: R-035
  - **Lynn**, Richard (QinetiQ) PID: R-036
  - **Mahmoudnejad**, Niloufar (Boeing) PID: R-037
  - **Mallol**, Benoit (NUMECA International) PID: R-038
  - **Meganathan**, Abraham (ESI Group) PID: R-039
  - **Moens**, Frederic (ONERA) PID: R-040
  - **Mor-Yossef**, Yair (Israeli CFD Center) PID: R-041
  - **Paloba**, Zaid (MVJ College of Engineering, India) PID: R-042
  - **Peace**, Andy (ARA) PID: R-043
  - **Plante**, Frederic (Polytechnique Montreal) PID: R-034
  - **Rivola**, Vincent (ICON Technology and Process Consulting) PID: R-045
  - **Robles Vega**, Gregorio (ADSCFD) PID: R-046
  - **Sahai**, Mrigank (Entuple Technologies Pvt. Ltd.) PID: R-047
  - **Souza**, Maximiliano (Embraer) PID: R-019
  - **Spalart**, Philippe (Boeing ret) PID: R-049
  - **Subbian**, Gokul (TU Braunschweig) PID: R-050
  - **Talyzin**, Vadim (TsAGI) PID: R-052
  - **Venkatachari**, Balaji (NIA / NASA LaRC) PID: R-053
  - **Wang**, Qiqi (MIT) PID: R-060
  - **Whitbread**, Paul (QinetiQ) PID: R-054
  - **Wick**, Andrew (Helden Aerospace) PID: R-055
  - **Yamamoto**, Kazuomi (JAXA) PID: R-056
  - **Yasuda**, Hidemasa (Kawasaki Heavy Industries, Ltd.) PID: R-057
  - **Yiming**, Du (Israeli CFD Center) PID: R-058
  - **Yu**, Zongfu (Flexcompute) PID: R-060
  - **Zastawny**, Marian (Siemens Digital Industries) PID: R-059

RANS TFG final submissions (18)

- **Murayama**, Mitsuhiro (JAXA), PID: R-004
- **Ahmad**, Nashat (NASA LaRC), PID: R-008
- **Ando**, Yuya (Cradle CFD), PID: R-009
- **Balakrishnan**, Narayanarao (Indian Institute of Science), PID: R-011
- **Bozeman**, Michael (NASA LaRC), PID: R-015
- **Ciloni**, Pedro (Embraer), PID: R-019
- **Darbyshire**, Oliver (Zenotech), PID: R-021
- **Duensing**, Jared (NASA Ames), PID: R-025
- **Hoarau**, Yannick (Strasbourg University), PID: R-028
- **Kim**, Chongam (Seoul National University), PID: R-032
- **Laurendeau**, Eric (Polytechnique Montreal), PID: R-034
- **Mahmoudnejad**, Niloufar (Boeing), PID: R-037
- **Peace**, Andy (ARA), PID: R-043
- **Subbian**, Gokul (TU Braunschweig), PID: R-050
- **Whitbread**, Paul (QinetiQ), PID: R-054
- **Yasuda**, Hidemasa (Kawasaki Heavy Industries, Ltd.), PID: R-057
- **Yu**, Zongfu (Flexcompute), PID: R-060
- **Zastawny**, Marian (Siemens Digital Industries), PID: R-059

ADAPT TFG original members (30)

- **Organizers**
  - CHAIR: **Michal, Todd** (Boeing) PID: A-001
  - **Alauzet**, Frederic (Inria) PID: A-002
  - **Mavriplis**, Dimitri (U Wyoming) PID: A-003
  - **Park**, Mike (NASA LaRC) PID: A-004

- **Members**
  - **Aksenov**, Andrey (TESIS) PID: A-005
  - **Ando**, Yuya (Cradle CFD) PID: A-006
  - **Aubry**, Romain (Naval Research Laboratory) PID: A-007
  - **Balan**, Aravind (NASA Langley Research Center) PID: A-008
  - **Chakravarthy**, Sukumar (Metacomp Technologies) PID: A-009
  - **Chen**, Jiangtao (CARCD) PID: A-010
  - **Clerici**, Francesco (Inria) PID: A-011
  - **Contractor**, Krishna (AneCom) PID: A-012
  - **Galbraith**, Marshall (MIT) PID: A-013
  - **Glasby**, Ryan (U Tennessee / JCIS) PID: A-031
  - **Hong**, Junwu (CARDC) PID: A-014
  - **Housman**, Jeffrey (NASA Ames) PID: A-015
  - **Jansen**, Ken (U Colorado, Boulder) PID: A-016
  - **Jansson**, Johan (KTH / Icarus Digital Math) PID: A-030
  - **Jensen**, James (NASA Ames) PID: A-017
  - **Kowshik**, Suhas (Indian Institute of Science) PID: A-018
  - **Loseille**, Adrien (Inria) PID: A-019
  - **Meganathan**, Abraham (ESI Group) PID: A-020
  - **Mockett**, Charles (Upstream CFD) PID: A-021
  - **Nawani**, Shikshit (College of Engineering Roorkee) PID: A-022
  - **Nelson**, Chris (Siemens Digital Industries) PID: A-023
  - **Reza Ahrabi**, Behzad (Boeing) PID: A-025
  - **Sahin**, Mehmet (Istanbul Technical University) PID: A-026
  - **Serrano**, Leonel ("Lionel") (Boeing) PID: A-027
  - **Shridhar**, Sumukha (RV College of Engineering, Bengaluru) PID: A-028
  - **Sonakar**, Prashant Sureshrao (ESI-OpenCFD Ltd.) PID: A-029

ADAPT TFG final submissions (6)

- **Alauzet**, Frederic (Inria), PID: A-002
- **Park**, Mike (NASA LaRC), PID: A-004
- **Galbraith**, Marshall (MIT), PID: A-013
- **Glasby**, Ryan (U Tennessee / JCIS), PID: A-031
- **Reza Ahrabi**, Behzad (Boeing), PID: A-025
- **Sahin**, Mehmet (Istanbul Technical University), PID: A-026

HO TFG original members (23)

- **Organizers**
  - CHAIR: **Karman, Steve** (Pointwise) PID: H-001
  - CHAIR: **Galbraith, Marshall** (MIT) PID: H-004
  - **Dey**, Saikat (DoD CREATE-FT) PID: H-002
  - **Eiseman**, Peter (GridPro) PID: H-003
  - **Glasby**, Ryan (U Tennessee / JCIS) PID: H-005
  - **Loseille**, Adrien (Inria) PID: H-006
  - **Wang**, Z. J. (U Kansas) PID: H-007
- **Members**
  - **Ahmad**, Nashat (NASA LaRC) PID: H-008
  - **Allan**, Mark (Zenotech) PID: H-009
  - **Chakravarthy**, Sukumar (Metacomp Technologies) PID: H-010
  - **Dehpanah**, Payam (TU Kaiserslautern) PID: H-022
  - **Hirsch**, Charles (NUMECA International) PID: H-011
  - **Imlay**, Scott (Tecplot) PID: H-021
  - **Kamenetskiy**, Dmitry (Boeing) PID: H-023
  - **Le Gouez**, Jean-Marie (ONERA / DAAA / DEFI Chatillon) PID: H-012
  - **Lohry**, Mark (Princeton) PID: H-013
  - **Marcon**, Julian (NASA Ames) PID: H-014
  - **Nguyen**, Ngoc Cuong (MIT) PID: H-015
  - **Peraire**, Jaime (MIT) PID: H-016
  - **Reza Ahrabi**, Behzad (Boeing) PID: H-017
  - **Roca**, Xevi (Barcelona Supercomputing Center) PID: H-018
  - **Ruizgirones**, Eloi (Barcelona Supercomputing Center) PID: H-019
  - **Thiry**, Olivier (NUMECA International) PID: H-020

HO TFG final submissions (4)

- **Galbraith**, Marshall (MIT), PID: H-004
- **Glasby**, Ryan (U Tennessee / JCIS), PID: H-005
- **Le Gouez**, Jean-Marie (ONERA / DAAA / DEFI Chatillon), PID: H-012
- **Lohry**, Mark (Princeton), PID: H-013

HRLES TFG original members (59)

- **Organizers**
  - CHAIR: **Ashton, Neil** (Amazon Web Services) PID: L-001
  - **Batten**, Paul (Metacomp Technologies) PID: L-002
  - **Cary**, Andrew (Boeing) PID: L-003
  - **Holst**, Kevin (DoD CEATE-AV) PID: L-005
  - **Long**, Mike (The Spaceship Company) PID: L-004
  - **Powell**, Nick (Gulfstream Aerospace) PID: L-006
  - **Skaperdas**, Vangelis (BETA-CAE) PID: L-007
  - **Taylor**, Nigel (MBDA) PID: L-008
- **Members**
  - **Abdessemed**, Chawki (Cranfield University) PID: L-009
  - **Ahmad**, Nashat (NASA LaRC) PID: L-057
  - **Anderson**, Kyle (NASA LaRC) PID: L-010
  - **Balakrishnan**, Narayanarao (Indian Institute of Science) PID: L-011
  - **Beall**, Mark (Simmetrix, Inc.) PID: L-012
  - **Bennett**, Shawn (Gulfstream Aerospace) PID: L-013
  - **Bercin**, Kutalmis (ESI-OpenCFD Ltd.) PID: L-014
  - **Bicer**, Baris (Turkish Aerospace) PID: L-015
  - **Browne**, Oliver (NASA Ames) PID: L-016
  - **Chitale**, Kedar (U Colorado) PID: L-017
  - **Contractor**, Krishna (AneCom) PID: L-018
  - **Degrigny**, Johan (CERFACS) PID: L-055
  - **Dehpanah**, Payam (TU Kaiserslautern) PID: L-019
  - **Djeddi**, Reza (University of Tennessee, Knoxville) PID: L-020
  - **Duda**, Ben (Dassault Systemes) PID: L-021
  - **Edge**, Brian (Metacomp Technologies) PID: L-022
  - **Escobar-Gomez**, Jaime Alberto (Universidad San Buenaventura Bogota) PID: L-023
  - **Fitzgibbon**, Thomas (Flexcompute) PID: L-049
  - **Fozan Ur Rab**, Mohammad (NED University of Engineering and Technology) PID: L-024
  - **Gagliardi**, Lucy (ICON Technology and Process Consulting) PID: L-025
  - **Gopalakrishnan**, Pradeep (Dassault Systemes) PID: L-026
  - **Hirsch**, Charles (Numeca International) PID: L-027
  - **Hoarau**, Yannick (Strasbourg University) PID: L-028
  - **Housman**, Jeffrey (NASA Ames) PID: L-029
  - **Imamura**, Taro (U Tokyo) PID: L-030
  - **Jansen**, Ken (U Colorado, Boulder) PID: L-031
  - **Kirby**, Andrew (U Wyoming) PID: L-032
  - **Kiris**, Cetin (NASA Ames) PID: L-033
  - **Laskowski**, Gregory (Dassault Systemes) PID: L-034
  - **Li**, Yanbing (Dassault Systemes) PID: L-035
  - **Lopez**, Omar (Universidad de los Andes) PID: L-036
  - **Luo**, Andy (TotalSim) PID: L-037
  - **Melber-Wilkending**, Stefan (DLR) PID: L-038
  - **Mockett**, Charles (Upstream CFD) PID: L-039
  - **Molina**, Eduardo (Stanford University) PID: L-040
  - **Pleitez**, Caesar (Northrop Grumman) PID: L-056
  - **Probst**, Axel (DLR) PID: L-041
  - **Pylypenko**, Anton (Engys) PID: L-042
  - **Rivola**, Vincent (ICON Technology and Process Consulting) PID: L-043
  - **Shellabarger**, Eli (NASA Langley Research Center) PID: L-044
  - **Spalart**, Philippe (Boeing ret) PID: L-045
  - **Vatsa**, Veer (NASA Langley Research Center) PID: L-046
  - **Viitanen**, Ville (VTT Tech Research Center) PID: L-047
  - **Vos**, Jan (CFS Engineering) PID: L-048
  - **Wang**, Qiqi (MIT) PID: L-049
  - **Wood**, Stephen (NASA LaRC) PID: L-050
  - **Yang**, Hong (Bombardier Aviation) PID: L-051
  - **Yao**, Yufeng (U West of England) PID: L-052
  - **Yasuda**, Hidemasa (Kawasaki Heavy Industries, Ltd.) PID: L-053
  - **Yu**, Zongfu (Flexcompute) PID: L-049
  - **Zastawny**, Marian (Siemens) PID: L-054

HRLES TFG final submissions (6)

- **Ashton**, Neil (Amazon Web Services), PID: L-001
- **Holst**, Kevin (DoD CEATE-AV), PID: L-005
- **Long**, Mike (The Spaceship Company), PID: L-004
- **Browne**, Oliver (NASA Ames), PID: L-016
- **Melber-Wilkending**, Stefan (DLR), PID: L-038
- **Yasuda**, Hidemasa (Kawasaki Heavy Industries, Ltd.), PID: L-053

WMLESLB TFG original members (50)

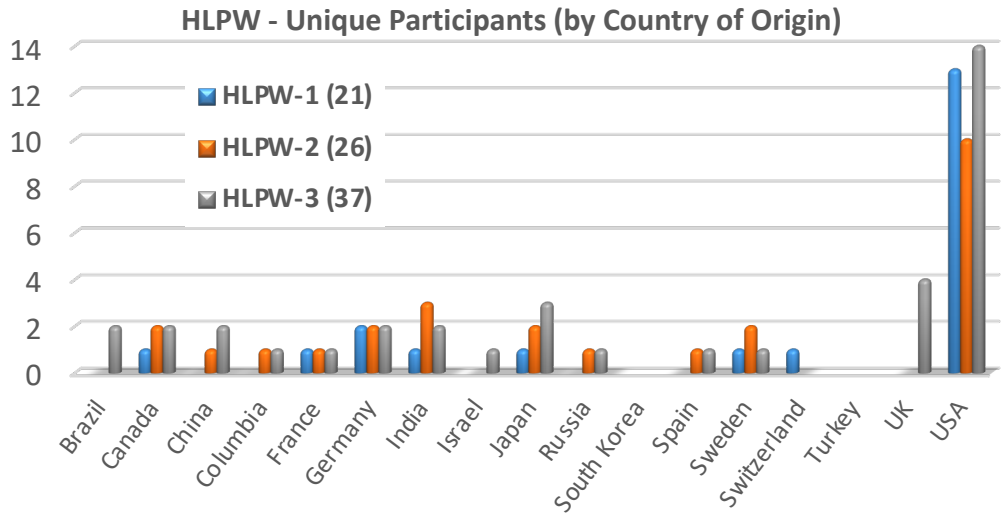
- **Organizers**
  - CHAIR: **Kiris, Cetin** (NASA Ames) PID: W-001
  - **Larsson**, Johan (U Maryland) PID: W-002
  - **Slotnick**, Jeffrey (Boeing) PID: W-003
  - **Taylor**, Nigel (MBDA) PID: W-004

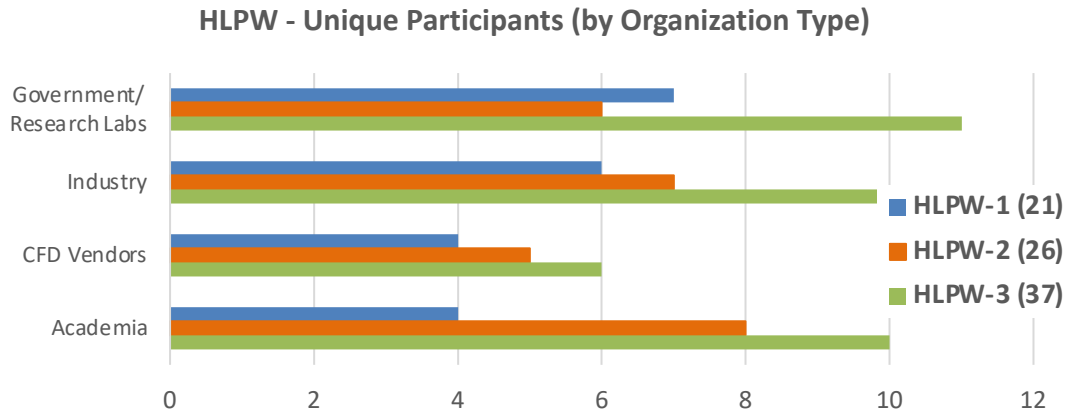
- **Members**
  - **Alonso**, Juan (Stanford) PID: W-005
  - **Amali Uthuman**, Mohamed Yousuf (Boeing) PID: W-006
  - **Anderson**, Kyle (NASA LaRC) PID: W-050
  - **Andersson**, Mans (KTH) PID: W-007
  - **Angelino**, Matteo (U Leicester) PID: W-008
  - **Azevedo**, Joao (Inst de Aeronautica e Espaco) PID: W-009
  - **Balakumar**, Ponnampalam (NASA LaRC) PID: W-051
  - **Batten**, Paul (Metacomp Technologies) PID: W-010
  - **Brionnaud**, Ruddy (Dassault Systemes) PID: W-011
  - **Cary**, Andrew (Boeing) PID: W-031
  - **Chen**, Hudong (Dassault Systemes) PID: W-013
  - **Cheng**, Wan (KAUST) PID: W-014
  - **Cimpoeru**, Andrei (DucaTechs) PID: W-015
  - **Degrigny**, Johan (CERFACS) PID: W-016
  - **Duda**, Ben (Dassault Systemes) PID: W-017
  - **Emory**, Michael (Cascade Technologies, Inc.) PID: W-018
  - **Fernandes**, Luis (NASA Ames) PID: W-019
  - **Ghate**, Aditya (NASA Ames) PID: W-020
  - **Goc**, Konrad (Stanford) PID: W-021
  - **Gomez**, Samuel (Barcelona Supercomputing Center) PID: W-022
  - **Gurram**, Harika (U Texas) PID: W-023
  - **Hayat**, Imran (U Pennsylvania) PID: W-024
  - **Hirsch**, Charles (Numeca International) PID: W-025
  - **Hu**, Xiaohan (U Pennsylvania) PID: W-026
  - **Imamura**, Taro (U Tokyo) PID: W-027
  - **Iyer**, Prahladh (National Institute of Aerospace/NASA Langley) PID: W-028
  - **Jansen**, Ken (U Colorado, Boulder) PID: W-029
  - **Jansson**, Johan (KTH / Icarus Digital Math) PID: W-030
  - **Kambrath**, Prasanth (Boeing) PID: W-031
  - **Kawai**, Soshi (Tohoku University) PID: W-049
  - **Koenig**, Benedikt (Dassault Systemes) PID: W-032
  - **Laskowski**, Gregory (Dassault Systemes) PID: W-033
  - **Lehmkuhl**, Oriol (Barcelona Supercomputing Center) PID: W-034
  - **Lozano-Duran**, Adrian (MIT) PID: W-036
  - **Molina**, Eduardo (Stanford) PID: W-037
  - **Nawani**, Shikshit (College of Engineering Roorkee) PID: W-038
  - **Park**, George (U Pennsylvania) PID: W-039
  - **Pereira**, Godwin (Wipro Limited) PID: W-040
  - **Rapaka**, Narsimha (KAUST) PID: W-041
  - **Samtaney**, Ravi (KAUST) PID: W-042
  - **Sengupta**, Kaustav (Boeing) PID: W-031
  - **Slaughter**, James (Imperial College London) PID: W-044
  - **Thiry**, Olivier (Numeca International) PID: W-045
  - **Vatsa**, Veer (NASA Langley Research Center) PID: W-046
  - **Wang**, Z. J. (U Kansas) PID: W-047
  - **Yao**, Yufeng (U West of England) PID: W-048

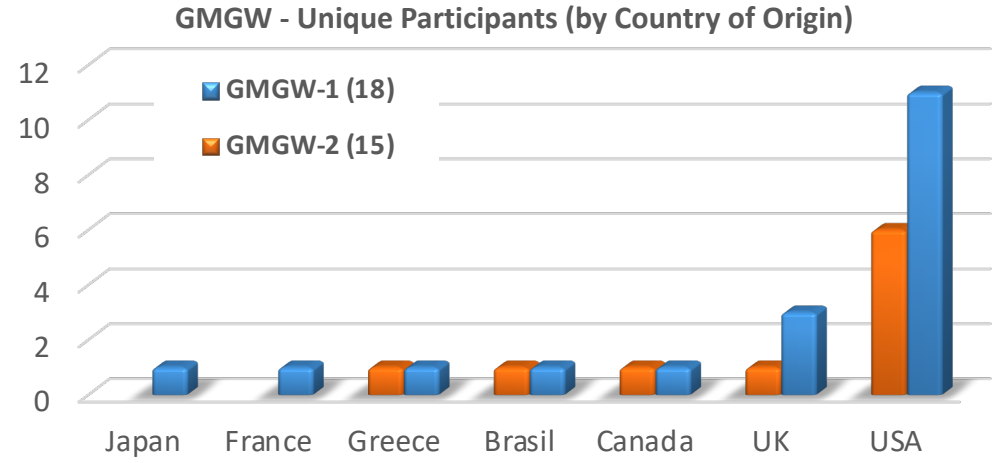
WMLESLB TFG final submissions (9)

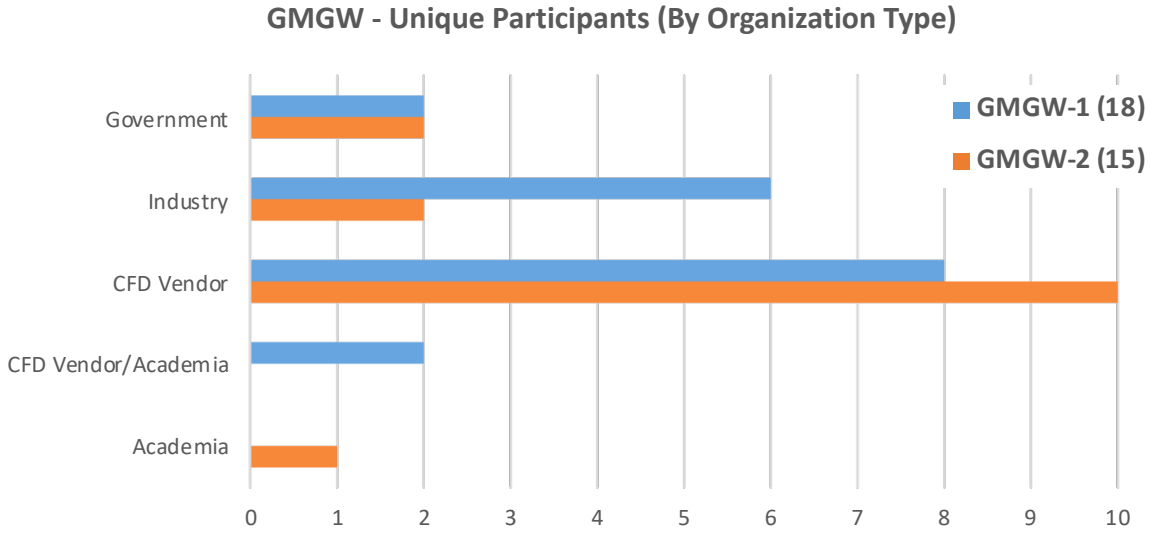
- **Anderson**, Kyle (NASA LaRC), PID: W-050
- **Ghate**, Aditya (NASA Ames), PID: W-020
- **Goc**, Konrad (Stanford), PID: W-021
- **Jansson**, Johan (KTH / Icarus Digital Math), PID: W-030
- **Kambrath**, Prasanth (Boeing), PID: W-031
- **Kawai**, Soshi (Tohoku University), PID: W-049
- **Koenig**, Benedikt (Dassault Systemes), PID: W-032
- **Lehmkuhl**, Oriol (Barcelona Supercomputing Center), PID: W-034
- **Wang**, Z. J. (U Kansas), PID: W-047

Demographics

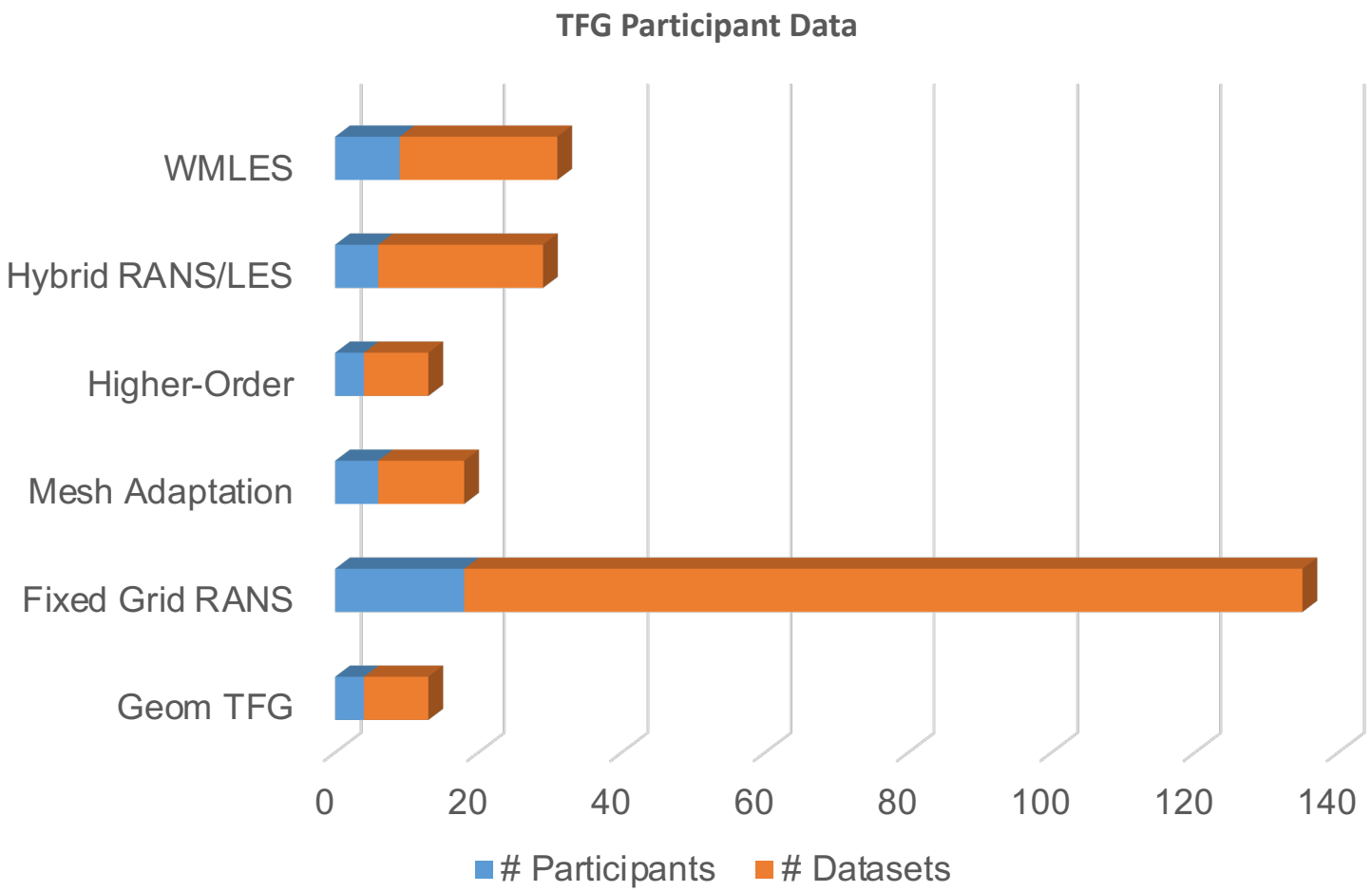








Demographics



	#Participants	# Datasets
Geom TFG	4	9
Fixed Grid RANS	18	117
Mesh Adaptation	6	12
Higher-Order	4	9
Hybrid RANS/LES	6	23
WMLES	9	22
	43	192

GMGW-3/HLPW-4 Participants

Workshop Objectives

- Review and discuss CFD data and comparisons for test cases via TFGs, addressing KQs.
- Summarize findings via workshop-level KQs, and discuss next steps
- Identify post-workshop activities that can enhance findings for Aviation Special Sessions

HLPW-4 Test Cases

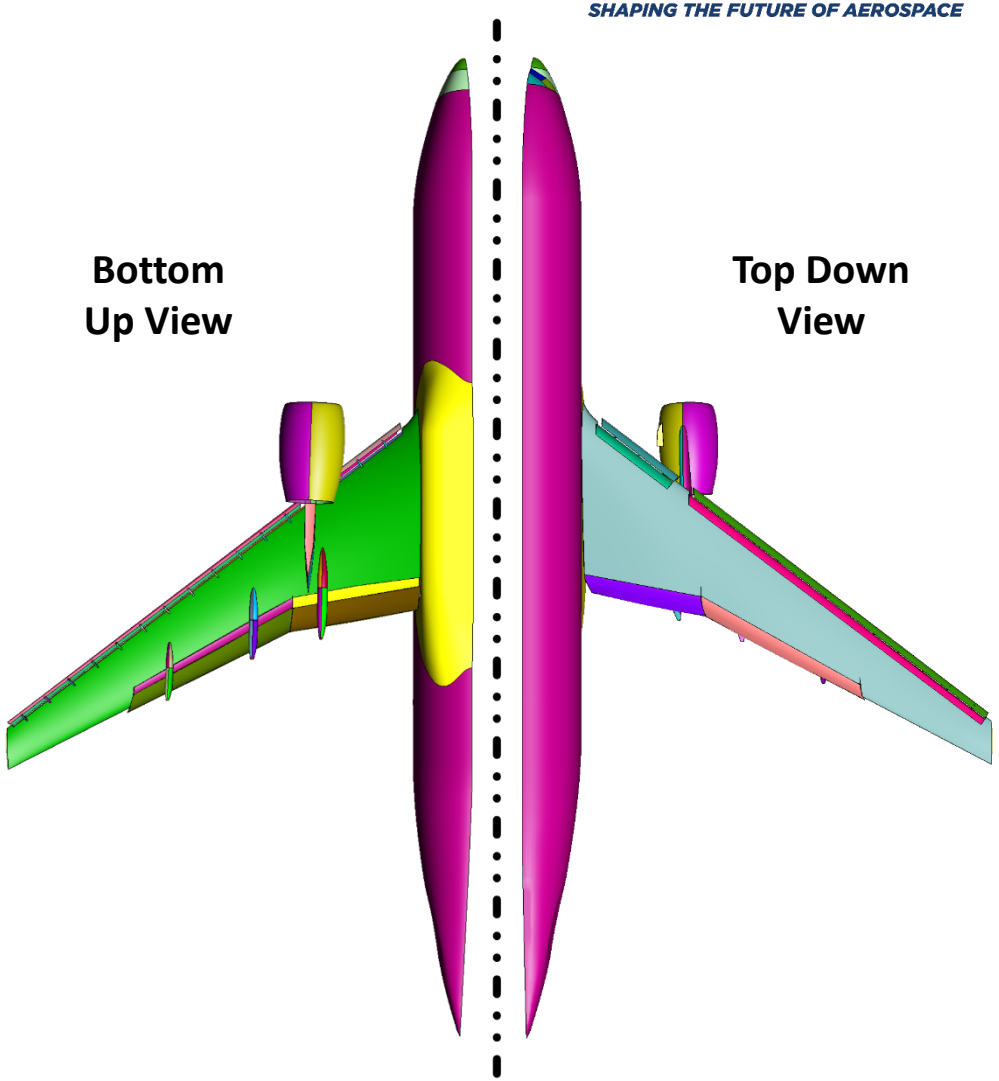
- Case 1 – Flap Deflection Study (AoA=7.05^{o})
  - Nominal flap setting of 40/37 deg. (inboard/outboard) vs. 37/34 and 43/40
  - Case 1a – comparison with wind tunnel data (data from 37/34 and 43/40 have been blind prior to today)
  - Case 1b – grid convergence study for 40/37 deg. at AoA=7.05^{o} in free air
- Case 2 – CL,max Study (full polar)
  - Case 2a – Free air computations with comparisons to corrected data
  - Case 2b – In-tunnel computations with comparison to uncorrected data
- Case 3 – Verification Study
  - 2-D 3-element CRM-HL airfoil section from NASA TMR website: VERIF/2DMEA

Geometry and Mesh Prep TFG Test Cases

- **Challenge A:** Build the complete nominal CRM-HL configuration geometry
- **Challenge B:** Build the CRM-HL flap deflection geometries
- **Challenge C:** Generate best practice surface meshes and identify geometry-related meshing issues
  - Nominal CRM-HL
  - Sonic Boom C608
- **Challenge D:** Incorporate 3D scan data in the generation of a surface mesh suitable for CFD

Geometry

- High Lift Common Research Model (CRM-HL)
- Geometry and Mesh Preparation TFG produced IGES and STEP geometry files for use by workshop participants:
  - CRM-HL
    - Nominal Configuration
      - Inboard/outboard flap angles of 40/37 degrees
    - Off-Nominal Configurations
      - Inboard/outboard flap angles of 37/34 degrees
      - Inboard/outboard flap angles of 43/40 degrees
  - Farfield Definition
  - CRM-HL Boundary-Layer Tripping Information from Qinetiq Test
- Additional geometry files used by TFGs for test cases:
  - 2D CRM-HL and 2D 30P-30N multi-element airfoils
  - Juncture Flow Model
  - Sonic Boom C608



Mesh Generation

- Committee generated and supplied families of all-tet, prism-tet, hex-tet, and structured overset meshes based on workshop RANS meshing guidelines.
  - Guidelines developed collaboratively between the GMGW and HLPW committees.
  - Participants invited to use committee meshes and supply results/feedback on suitability.
  - Participants and TFGs invited to create meshes based on best practices.
  - Information on participants geometry prep and mesh generation gathered in Participant Questionnaires (PQs) and other forms.
- TFGs and Participants generated families and one-off meshes as needed for KQ studies.
  - These “other” meshes uploaded and available on workshop website.
  - Some participant generated meshes may still be outstanding.
- **More than 146 meshes were generated to support workshop efforts.**

Fixed Grid RANS Committee Meshes

ID	Lvl	Type	Cells (M)	Nodes (M)	~Y+	Developer/ Tool	Config
1.1 2.1	A	Tet	71	12	2.25	Cadence/ Pointwise	40°/37° (N)
	B		188	32	1.5		
	C		544	91	1.0		
	D		1200	203	3/4		
1.2 2.2	A	Prism-Tet	29	12	2.25	Cadence/ Pointwise	40°/37° (N)
	B		75	32	1.5		
	C		213	91	1.0		
	D		468	203	3/4		
1.3 2.3	A	Hex-Tet	22	12	2.25	Cadence/ Pointwise	40°/37° (N)
	B		53	32	1.5		
	C		142	91	1.0		
	D		301	203	3/4		
2.1_37/34	D	Tet	1200	200	3/4	Cadence/ Pointwise	37°/34°
2.2_37/34	D	Prism-Tet	463	200	3/4		
2.3_37/34	D	Hex-Tet	298	201	3/4		

ID	Lvl	Type	Cells (M)	Nodes (M)	~Y+	Developer/Tool	Config
2.1_43/40	D	Tet	1200	200	3/4	Cadence/ Pointwise	43°/40°
2.2_43/40	D	Prism-Tet	463	200	3/4		
2.3_43/40	D	Hex-Tet	297	200	3/4		
3 3_37/34 3_43/40	A	Str. Overset		20/35*	2.25	NASA Ames/ Pointwise, Chimera Grid Tools	40°/37° (N) 37°/34° 43°/40°
	B			65/113*	1.5		
	C			232/388*	1.0		
	D			550/953*	3/4		
4	A	Str. Overset		20/35*	1	NASA Ames/ Pointwise, Chimera Grid Tools	40°/37° (N)
5**	A	Hex-Tet	22	12	2.25	Cadence/ Pointwise	40°/37° (N)
	B		53	32	1.5		
	C		143	92	1.0		
	D		310	209	3/4		

* Solution nodes/Total nodes

** Participant-requested modifications to #2 mesh family

Other Meshes

ID	Level	Type	Cells (M)	Nodes (M)	Y+	Developer/Tool	Config
101	C	Hex-Tet	217	172	1	BETA-CAE/ANSA	40°/37° (N)
	C		220	172			37°/34°
	C		218	172			43°/40°
102	C	Hex-Tet	103	68	100	BETA-CAE/ANSA	40°/37° (N)
	C		103	68			37°/34°
	C		102	68			43°/40°
103	A	Hex-Tet	91	68	1	BETA-CAE/ANSA	40°/37° (N)
	B		173	138			
	C		276	218			
	D		389	323			
	E		723	629			
104	A	Hex-Tet	43	30	100	BETA-CAE/ANSA	40°/37° (N)
	B		103	81			
	C		153	110			
	D		238	191			
105T	A	Hex-Tet	100	74	1	BETA-CAE/ANSA	40°/37° (N)
	B		156	121			
	C		278	226			

ID	Level	Type	Cells (M)	Nodes (M)	Y+	Developer/ Tool	Config
106T	C	Hex-Tet	168	125	100	BETA-CAE/ANSA	40°/37° (N)
107*	C	Hex-Tet	311	262	1	BETA-CAE/ANSA	40°/37° (N)
140	C	Body-fitted Cartesian	366	368	1	KHI/Cflow	40°/37° (N)
170	A	Str. Overset	81	83	2.25	CFS Engineering/ ICEM CFD	40°/37° (N)
	B		297	301	1.5		
	C		1068	1078	1.0		
	A	Str. Overset	81	83	2.25		37°/34°
	B		297	301	1.5		
	A	Str. Overset	81	83	2.25		43°/40°
	B		297	301	1.5		
180	D	Hex-Tet		418	100	NASA Langley/ Pointwise	43°/40°
181	C	Prism-Tet		156	100	NASA Langley/ Heldenmesh	43°/40°

* Participant-requested modifications to 103.C
T – Wind Tunnel Modeled

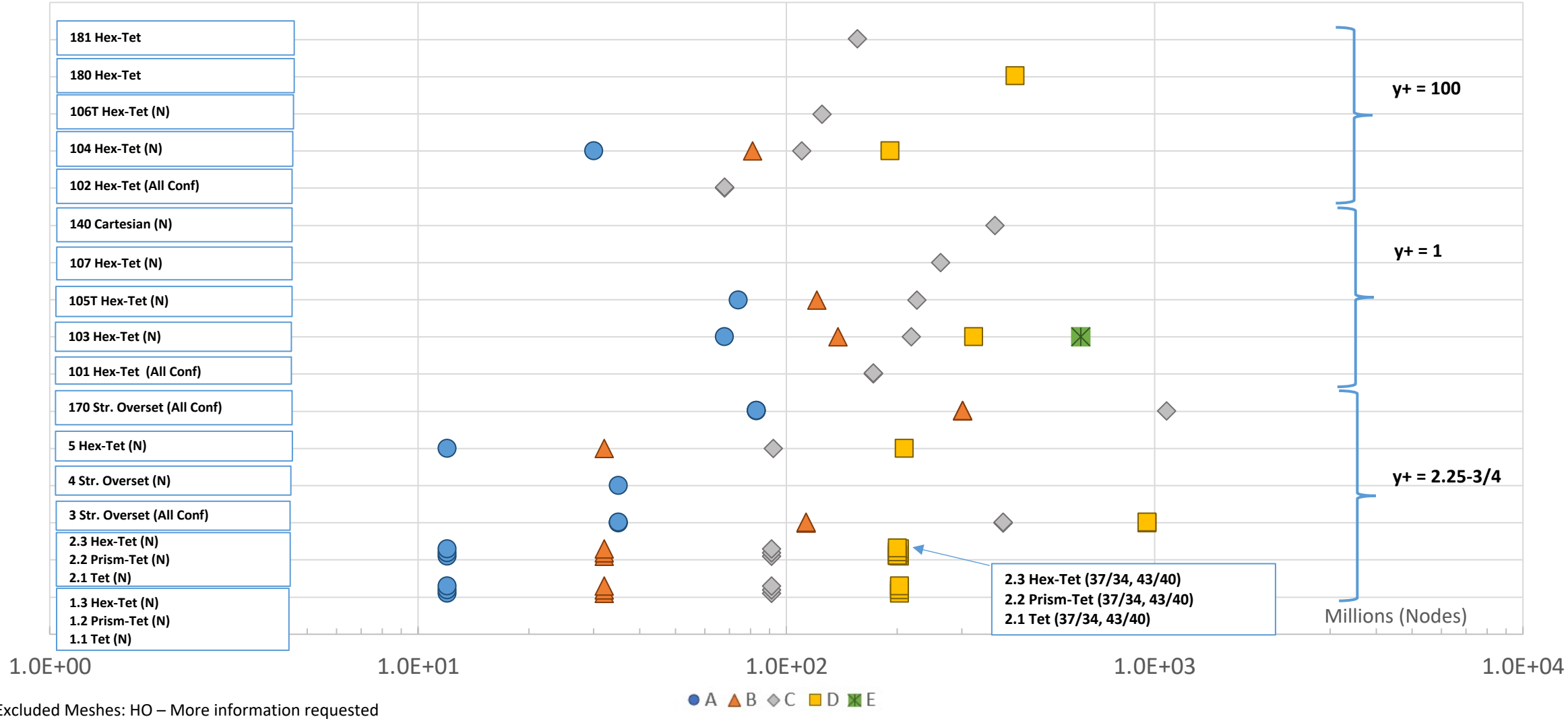
Other Meshes

ID	Level	Type	Cells (M)	Nodes (M)	Y+	Developer/ Tool	Config
131*	Coarse Q1	Tet	5.8	0.98	1.5	Cadence/ Pointwise	40°/37° (N)
	Medium Q1		37.6	6.3	0.75		
	Fine Q1		127.8	21.5	0.5		
	Extra-Fine Q1		276.8	46.4	0.377		
	Coarse Q2	Tet	5.8	7.8	1.5		
	Medium Q2		37.6	50.5	0.75		
	Fine Q2		127.8	171.2	0.5		
	Extra-Fine Q2		276.8	370.3	0.377		
	Coarse Q1	Prism-Tet	2.4	0.98	1.5		
	Medium Q1		14.3	6.3	0.75		
	Fine Q1		47	21.5	0.5		
	Coarse Q2	Prism-Tet	2.4	7.8	1.5		
	Medium Q2		14.3	50.5	0.75		
	Fine Q2		47	171.2	0.5		

*131: Additional WMLES meshes (not shown) generated with y+=100, 200, 800

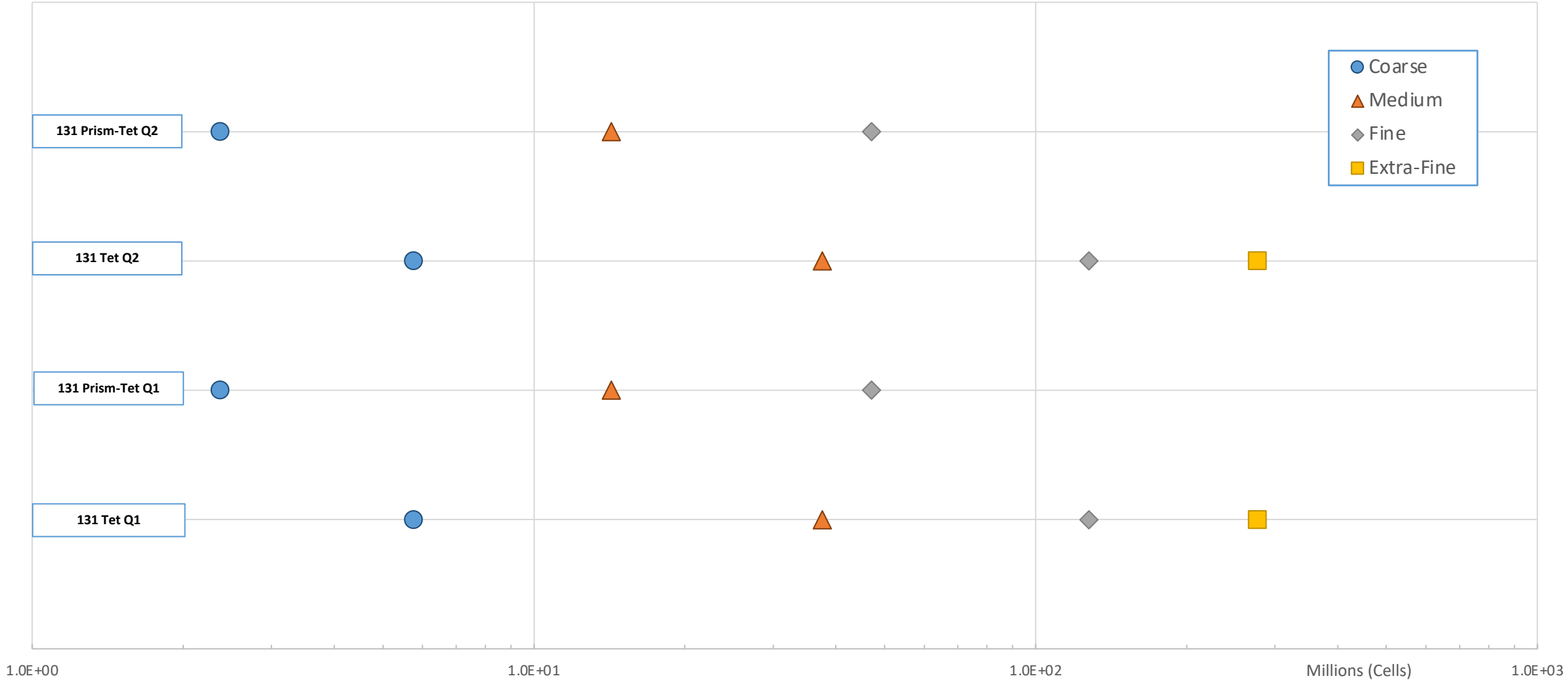
ID	Level	Type	Cells (M)	Node s (M)	Y+	Developer/ Tool	Config
150	Medium Q2	Tet	7.9	10.7	100	Barcelona Supercomputing Center	40°/37° (N)
			6.7	9.2	200		
			4.4	6.1	800		
			2.1	3	Iso		
	Medium Q3		7.9	36	100		
			6.7	30.7	200		
			4.4	20.5	800		
			2.1	9.9	Iso		
160	Coarse Q2	Tet	13.4	18	100	Inria/GAMMA	40°/37° (N)
	Coarse Q2		12.2	16.6	200		
	Coarse Q2		9.9	13.6	800		

Workshop Meshes



Excluded Meshes: HO – More information requested

High Order Mesh Families



Agenda

Friday, January 7th, 2022

6:30 AM	Breakfast
7:00 AM	Registration
7:30 AM	01 Welcome / Overview
8:00 AM	02 TFG Summary - Geometry
8:45 AM	03 TFG Summary - Fixed Grid RANS
9:30 AM	Break
10:00 AM	04 TFG Summary - Mesh Adaptation
10:45 AM	05 TFG Summary - Higher Order
11:30 AM	Boxed Lunch
12:30 PM	06 TFG Summary - Hybrid RANS/LES
1:15 PM	07 TFG Summary - WMLES
2:00 PM	Afternoon Coffee/Cookie Break
2:15 PM	08 Committee Technical Summary
3:15 PM	09 Open Discussion (1)
4:15 PM	Break
4:30 PM	09 Open Discussion (2)
5:30 PM	10 Workshop Review/Feedback
6:00 PM	ADJOURN

Food & beverages will be served outside at breakfast, lunch, and the 2pm break.