



HPC Matters!

How Supercomputing Impacts NASA's Mission

Dr. Piyush Mehrotra

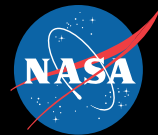
**Chief, NASA Advanced Supercomputing (NAS) Division
NASA Ames Research Center in Silicon Valley**

Sept 11, 2019

Advanced Computing @ NAS



High-End Computing Capability (HECC) Project



NASA's Premier Supercomputer Center

***Charter: to meet the supercomputing needs of all
NASA's Mission Directorates***

Over 600 science & engineering projects with more than 1,600 users

Hosted by the NAS Division at Ames Research Center





Pleiades: 11100+ nodes, 240,000+ cores; Peak performance – 7.25 PF
Top 500 Rank: World #31; US #14

Pilot Project: Modular Facility for Energy Efficient Supercomputing



Electra: 3456 nodes, 124,416 cores; Peak performance – 8.32 PF
Top 500 Rank: World #37; US #15

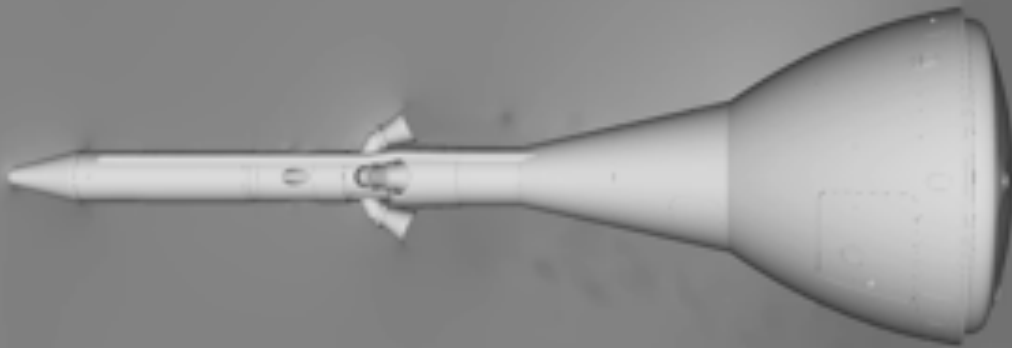
Modular Supercomputing Facility (MSF)



Aitken: 1,150 nodes, 46,080 cores; Peak performance – 3.69 PF
MSF Capacity: >132 PFs using 1.6 million (current technology) cores

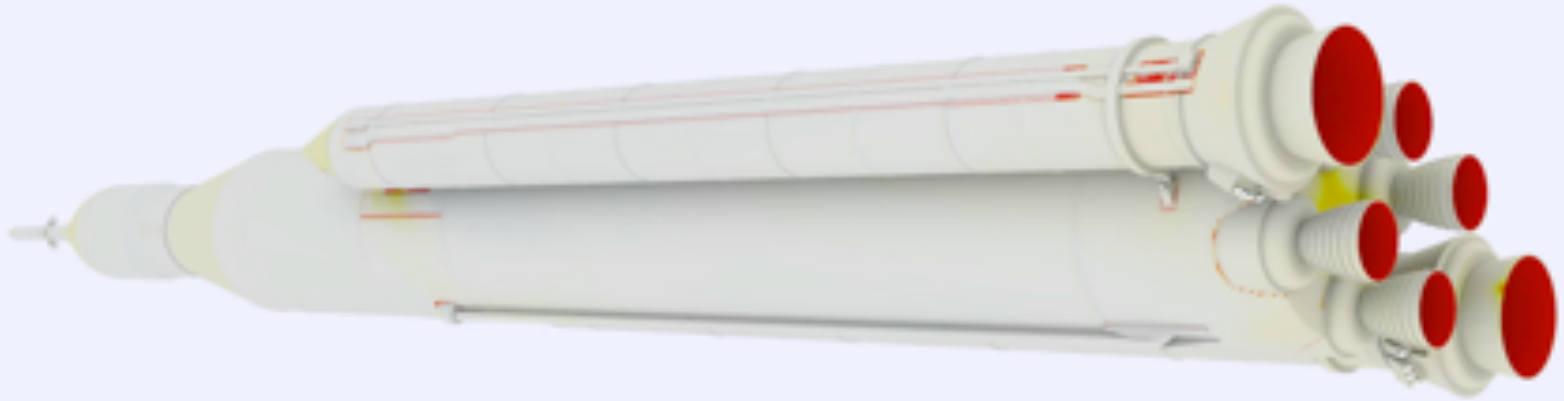
Modeling the Launch Environment



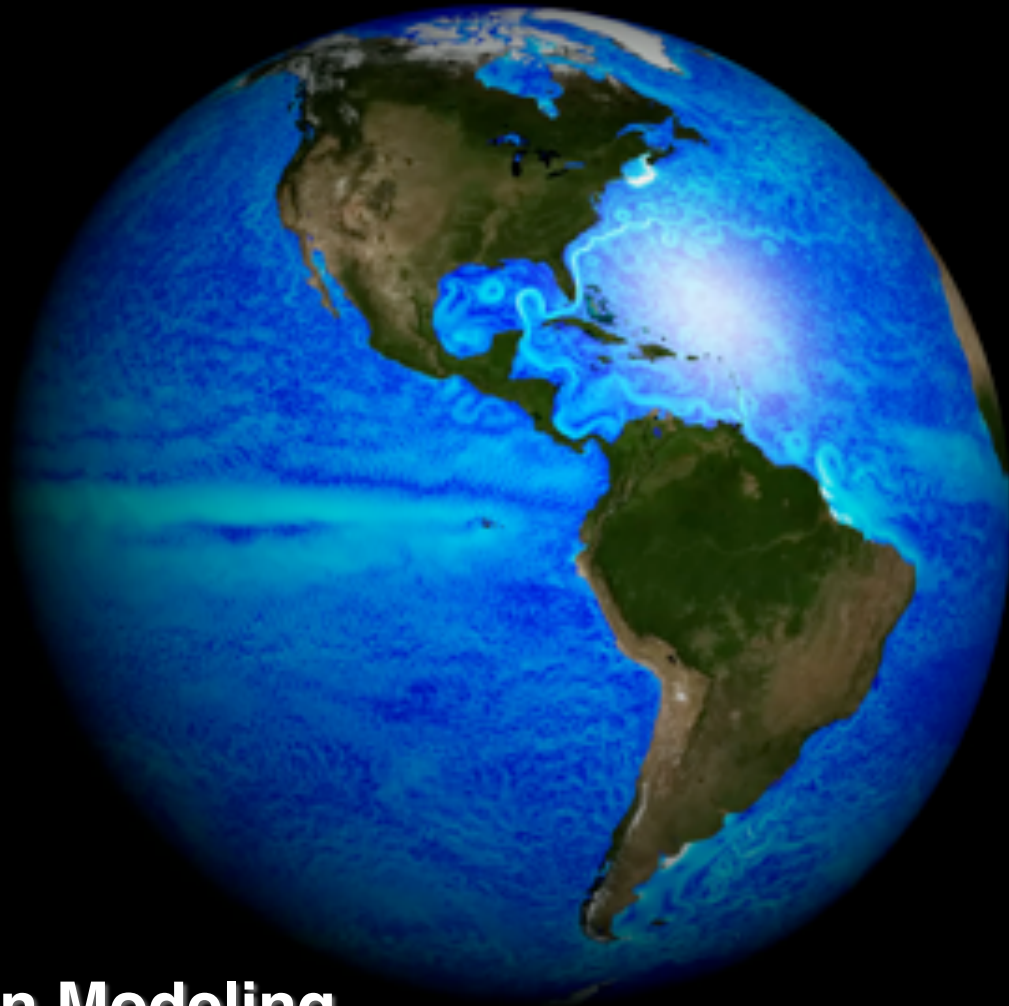


Launch Abort Vehicle Simulation

Space Launch System – Stage Separation



0' 0"



Global Ocean Modeling

Nov 09, 2018 16:07 UTC

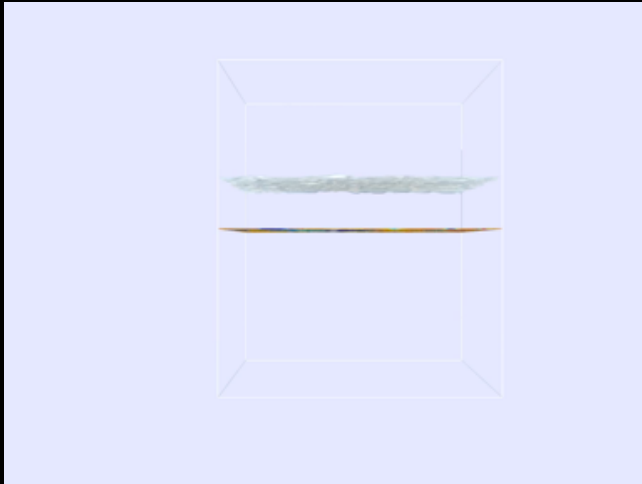


Camp Fire

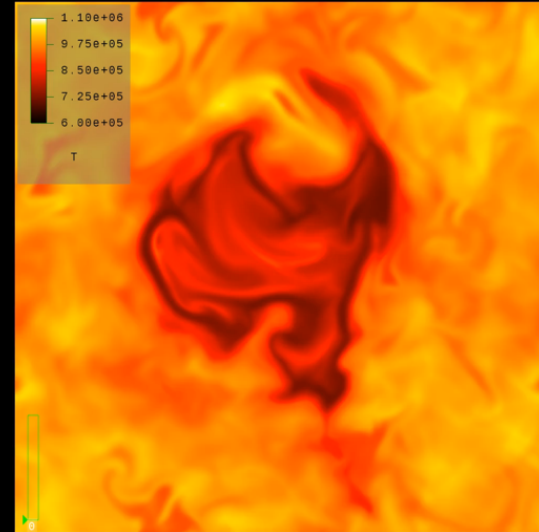
Woolsy Fire

Fire detection from GOES-ABI Satellite Data

Space Weather Forecast



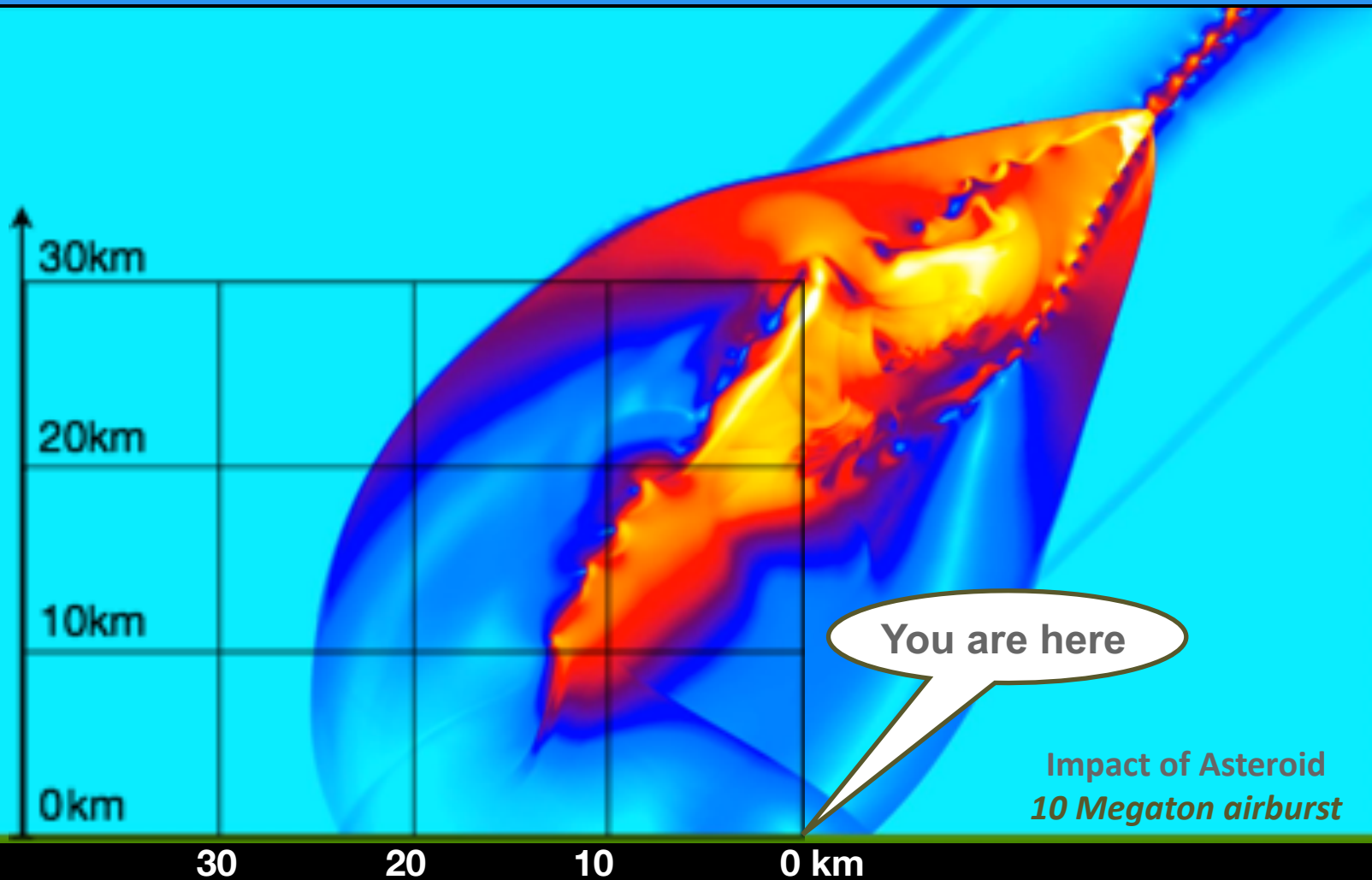
Three-dimensional MHD simulation results reveal spontaneous formation of funnel-magnetized structures in the corona.

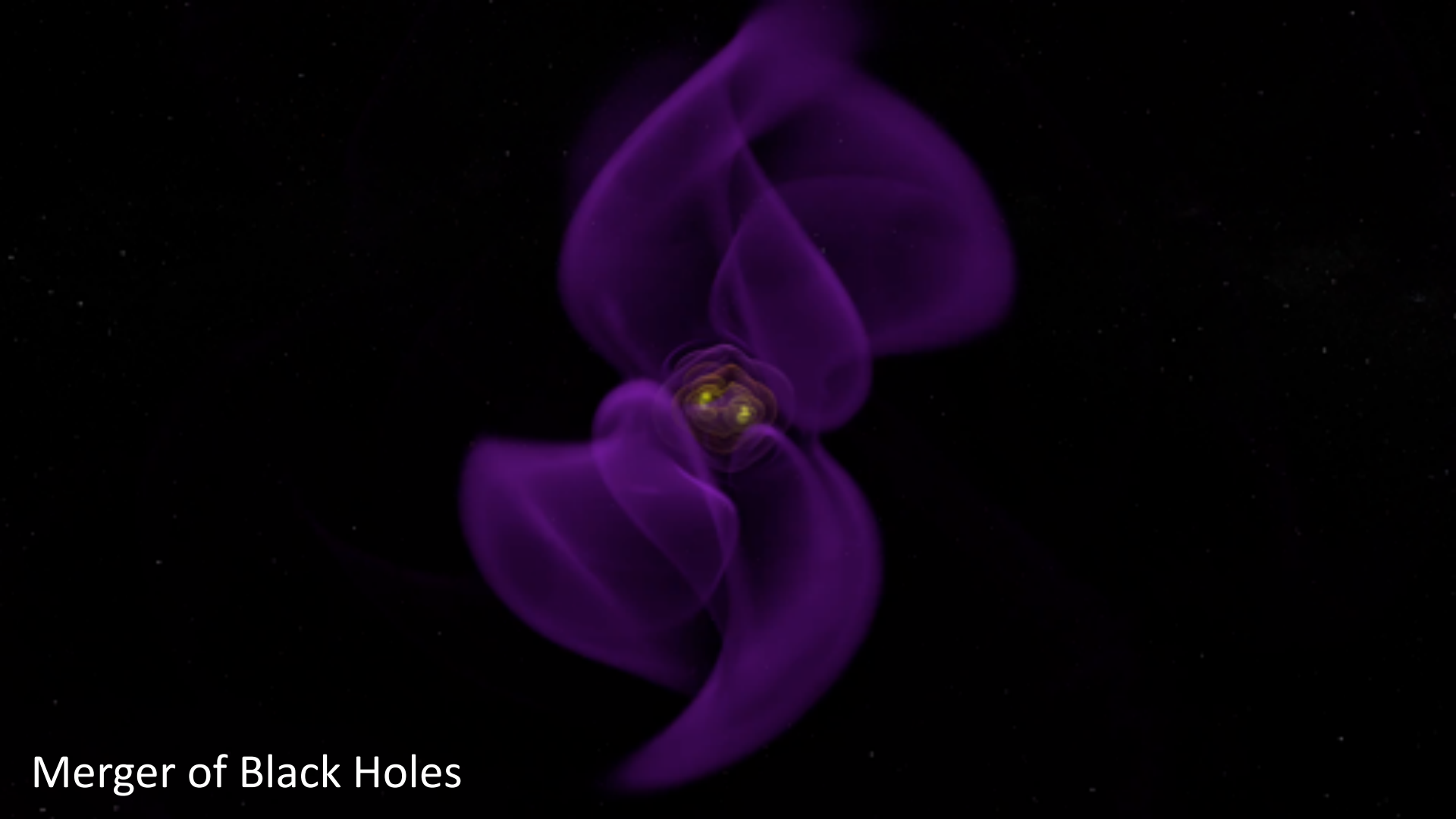


Temperature distribution
10,000 km
above the
solar surface

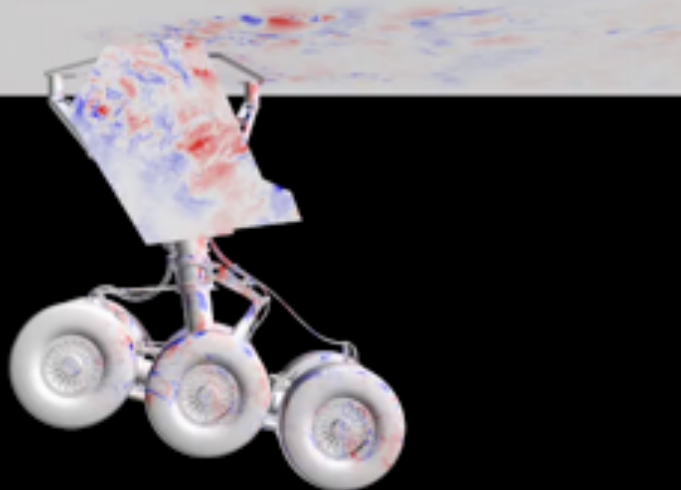


Artist's rendition of a solar flare

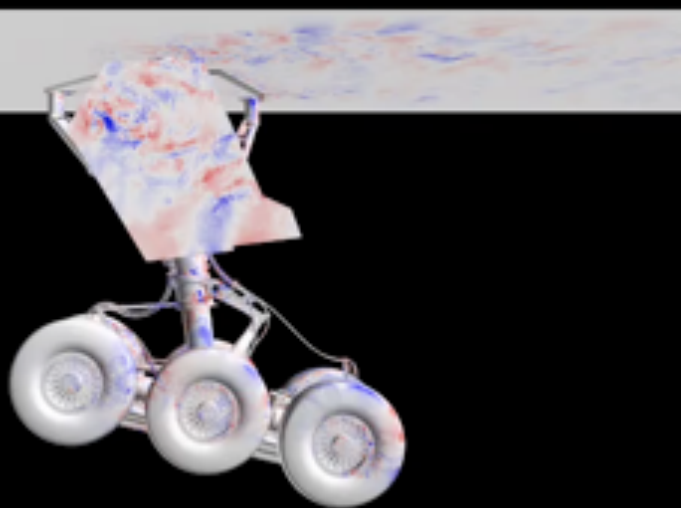




Merger of Black Holes

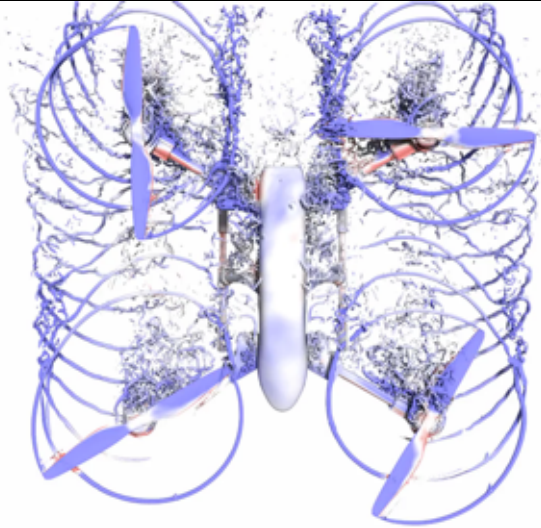


PowerFLOW RunM112_IsolatedM12_13deg: 0



PowerFLOW RunM112_IsolatedM12_toboggan_13deg: 0





Drone Analysis – Original & Improved Configurations

Conclusions



- Today's supercomputers are enabling ever larger simulations – using tens of thousands to hundreds of cores running for days even weeks.
- The increased computing capability has allowed for a dramatic increase in the fidelity of the simulations and the ensuing results
- The enhanced quality and granularity of the data has supported the decision makers, increased our understanding of the Earth system, solar system and the universe while also having a direct impact on our daily lives.

Acknowledgements



- **NAS Division, ARC**
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 - » Visualization Team
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Questions?



piyush.mehrotra@nasa.gov

<http://www.nas.nasa.gov/hecc>