We are a multidisciplinary team of Academic (8) & Research (7) Professors, Doctoral Fellows (1), Research Associates (2), and Graduate (13 PhD, 10 MS) & Undergraduate (10) Students.

We serve government and industry through research and development of advanced computational simulation and design technology to solve real world problems.

We use an application-driven team-oriented approach to basic and applied research on complex and relevant engineering problems.

Our primary customers include DoD, DIA, NASA, NSF, Bell Helicopter, Boeing, Northrop Grumman, and P&W-Rocketdyne with annual funding around $5 M (80% federal, 20% industrial).
• Develop and apply Computational Fluid Dynamics (CFD) technology for simulating the flow of fluid. For example, the air flow around a jet.
• This provides a way to predict performance and improve the design without physical testing.
• CFD has three basic steps.
  ✓ Mesh generation involves representing the vehicle and the space surrounding it by millions of points usually connected by lines and facets.
  ✓ Computational simulation uses a high-performance computer to approximate the mathematical equations that govern the physics of fluid flow.
    … the Navier-Stokes equations have been around since 1845 and remain unsolvable without simplifications.
  ✓ Post-analysis often uses visualization and further computations to extract useful information from the vast amount of data generated.
AFLR Mesh Generation software and technology is currently in use within commercial and research systems throughout automotive, aerospace, and related industries. It is a key enabling technology used throughout The Boeing Company for design and development of commercial (7E7/787) and military aircraft. 787 efficiency improved by 7% over 777 and 20% over 767.
Technology Impact
Engine Manufacturers

- *MSU_Turbo* software (2004 NASA Software of the Year) in use by US jet engine manufacturers as part of NASA Glenn Research Center's Ultra Efficient Engine Technology program.
• $U^2$NCLE CFD and AFLR/SolidMesh Mesh Generation software used to analyze ship rudder manufacturing tolerances at Northrop Grumman Ship Systems.
• $U^2$NCLE & LOCI/Chem CFD and AFLR/SolidMesh Mesh Generation software in use to enhance DIA missile intelligence analysis and to analyze sea-based launch platforms for Northrop Grumman KEI program.
• CFD optimization technology for design and development of Jarvik Heart's new pediatric heart assist pump.
The federal government has invested in CFD technology research for over 30 years primarily to meet the needs of military and space programs. MSU has made significant contributions to this research.

CFD research for military and space has led to significant benefits for aerospace, automotive and other industries that impact our everyday life.

- All modern aircraft (737, MD80, and newer) were designed using CFD to evaluate the aerodynamics. This has significantly improved efficiency, lowered development costs, and improved safety.
- All current automobiles have been designed using CFD for some aspect (underhood cooling, interior HVAC, wind noise, and aerodynamics). This has reduced costs, increased reliability, improved efficiency, and enhanced comfort.
- Industries with lower technology needs are also beginning to benefit. For example, Whirlpool is now using CFD related technology in the design of new appliances (washers, dryers, ovens, refrigerators).
- MSU continues to contribute in all of these areas.