

What is PraVaHa Software?

June 6, 2024 • vajiramandravi.com



About PraVaHa Software:

- **Parallel RANS Solver for Aerospace Vehicle Aero-thermo-dynamic Analysis** (PraVaHa) is a **Computational Fluid Dynamics (CFD) software** developed in **ISRO's Vikram Sarabhai Space Centre (VSSC)**.
- It can **simulate external and internal flows on launch vehicles**, winged and non-winged re-entry vehicles.
- PraVaHa has been **extensively used in the Gaganyaan program for aerodynamic analysis of human-rated launch vehicles**, viz, HLVM3, Crew Escape System (CES), and Crew Module (CM).
- The software is **secure and flexible** enough to **support collaborative development with academic institutions** and government labs.
- **Currently**, the PraVaHa code is operational to **simulate airflow for Perfect Gas and Real Gas conditions**.
- Validations of the code are underway for simulating the effects of chemical reactions that occur during air dissociation upon 'earth re-entry' and 'combustion' as in scramjet vehicles.
- PraVaHa is **expected to replace** most of the **CFD simulations for aero characterisation**, which are currently being **carried out using commercial software**.

- Besides, this software is expected to help academia and other institutions, engaged in the design of missiles, aircraft, and rockets to find solutions to complex aerodynamic problems.

Importance of Computational Fluid Dynamics (CFD):

- **Initial aerodynamic design studies for launch vehicles** demand evaluation of a large number of configurations.
 - **Any aerospace vehicle** moving **through the Earth's atmosphere** during launch or re-entry is **subjected to severe aerodynamic and aerothermal loads** in terms of external pressure and heat flux.
 - **Understanding the airflow** around aircraft, rocket bodies, or CM during earth re-entry is **essential to design the shape, structure, and Thermal Protection System (TPS) required** for these bodies.
 - The **unsteady part of aerodynamics contributes to serious flow issues** around such rocket bodies and creates **significant acoustic noise** during the mission.
 - **CFD** is one such **tool to predict the aerodynamic and aerothermal loads**, which solve numerically the equations of conservation of mass, momentum, and energy along with the equation of state.
-

Q1: What is aerodynamics?

Aerodynamics is the study of forces and the resulting motion of objects through the air. Studying the motion of air around an object allows us to measure the forces of lift, which allows an aircraft to overcome gravity, and drag, which is the resistance an aircraft “feels” as it moves through the air. Everything moving through the air (including airplanes, rockets, and birds) is affected by aerodynamics.

Source: ISRO develops PraVaHa software for aerodynamic design and analysis

Source: <https://vajiramandravi.com/current-affairs/pravaha-software/>

© Vajiram & Ravi. For personal use only.