Research Problems concerning ram accelerators

Selected research topics for the UW setup

Previous publications from the UW setup

1. Low-velocity starting
    a. Study of RAMAC at low projectile entrance velocities (700 - 1000 m/s)
    b. Variables would be the gas mixture and projectile geometry
    c. Experimental and computational study by varying different propellant mixtures and projectile geometry
2. Ventless launch tube operation
    a. Combustion gasses behind the projectile are needed to vented out of the muzzle, this vent gasses are dumped into a tank
    b. This tank acts as a limitation in large scale operations, so a ventless tube operation needs to be developed
3. High velocity operating characteristics
    a. Thermally choked propulsive mode characteristics
    b. Vary the projectile geometry in order to find an optimum shape that would allow it to operate near CJ speed and have minimum mass
    c. A single standard projectile is accelerated through different propellant mixtures to see which one of them provides highest thrust and widest operating range of Mach numbers
4. Superdetonative propulsion mode
    a. Study the effect of projectile material on the thrust and M no. range when operating at speeds greater than CJ speed of gas mixture
    b. Study the dependence of operating M no. range on projectile diameter and propellant heat release
5. High pressure ram accelerator operation
    a. Combustion products being at high pressure resulting into significant real gas effects
6. Performance analysis code incorporating real gas effects
    a. Control volume analysis code for modeling flow conditions inside ramac
    b. Including other equations of state (for real gasses)
7. Performance analysis code incorporating unsteady effects
    a. Making a code accounting for acceleration of gas mass around the projectile
8. Baffled tube ram accelerator
    a. New proposed mode of ramac propulsion with gaseous propellants
9. Numerical scheme for studying hypersonic flows having shock induced combustion and find its usability in air breathing hypersonic vehicles
10. RAMAC uses for direct launch of payloads into earth orbits **UW direct space launch research**

11. Study thrust and M no. range dependence on projectile parameters (shape, material, no. of fins, open-based etc) **UW projectile variation research**
12. Experimental and computational research on baffled tube ramac (BTRA) **BTRA CFD and Exp**
13. Heating and ablation of projectile
14. Using different CFD codes to model the flow inside ramac
15. Study ramac in subdetonative propulsion mode
16. Designing Ramac projectiles by using the scramjet engine technology **Pg 129**
17. Combining ramac with other propulsion systems (rocket) for direct space launch