Reentry Capsule

- Employments of a reentry capsule are considered
  - HAYABUSA, Mars exploration capsule and HTV return vehicle, etc.
- Dynamic wind tunnel test
  - Support interference by moving a mechanical support system

Dynamically unstable from transonic to subsonic speed
Evaluate the dynamic characteristic

Magnetic Suspension and Balance System

- Avoid support interference
- No motion restriction due to a mechanical support
- Suspension and balance system to evaluate aerodynamic forces by measuring coil currents
- Achieve to suspend a model at supersonic speed with a high speed control system (0.1 m - MSBS)

0.1 m - MSBS

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Model Position and Mach Number

- The flow of Mach 0.5 can be created with high-subsonic wind tunnel
- The model displacement can be suppressed within calibration range by reducing total pressure

The capsule model can be suspended!!

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Develop a new position sensor

Dynamic wind tunnel test (reentry capsule)

Optical Position Sensor System

High speed and high accuracy by using 5 CCD line sensor cameras

- Cannot reduce distance between 2 CCD line sensors
- Difficult to measure a low fineness ratio model (capsule model)

Position sensor applicable to a capsule model is required

Objectives

Development of a New Position Sensor

- Count number is proportional to displacement of the model
  (Count number is the boundary value between the model edge and line sensor)

Low fineness ratio model such as a capsule model can be measured

Development of Wind Tunnel Test Technique for a Reentry Capsule Using a MSBS

Minimum Success

- Develop a new position sensor applicable to a capsule model

Full Success

- Suspend a capsule model magnetically in High-subsonic speed

High-Subsonic Wind Tunnel Test

Equation of magnetic force

\[ F_{mag,x} = M_0 h_x l_{drag} \]

\[ F_{load} = M_0 h_x l_{drag} \]

Determine the relation between weight and coil current by using known weight

The capsule model can be suspended magnetically in Mach 0.5 by using MSBS

Drag coefficient will be evaluated by conducting force calibration

Background

Necessary to employ dynamic wind tunnel testing system without the support interference

Support interference by moving a mechanical support system

Dynamic wind tunnel test

Support System

Model