Multiphase Flow in Power and Propulsion Workshop Fluid Stability and Dynamics Workshop

Sponsored by the
Office of Biological and Physical Research,
NASA HQ
Hosted by
NASA Glenn Research Center
15 May 2003

Agenda

7:30-8:00 AM Continental Breakfast
8:00- 10:00 AM Opening Plenary
- 8:00 -8:10 Opening Welcome (Ostrach - NCMR)
- 8:10 - 8:20 Logistics (Kassemi - McQuillen)
- 8:20 - 8:35 Overview Roadmap (Singh)
- 8:35 – 8:55 Nuclear Propulsion - (Johnson - GRC)
- 8:55 - 9:15 Advanced Life Support (Joshi - HQ)
- 9:15 - 9:35 Strategic Research (Chiaramonte - HQ)
- 9:35 - 9:50 ***Overview of Draft Document***
- 9:50 -10:05 Facility Description
- 10:05 – 10:15 Charge to the Panels (McQuillen)

10:15 - 10:45 Break
10:45 – 2:30 Parallel Sessions
- Multiphase Flow Session McCready
- Stability & Dynamics Hochstein &

12:00 - 1:00 Working Lunch

2:30 – 4:00 Plenary Technical Discussion

4:00 – 5:00 Closing Plenary Session - Panel Reports

5:00 Dinner/Adjourn

Glenn Research Center

Two-phase Flow,
Fluid Stability and Dynamics Workshop
Microgravity Science Division
Space Directorate

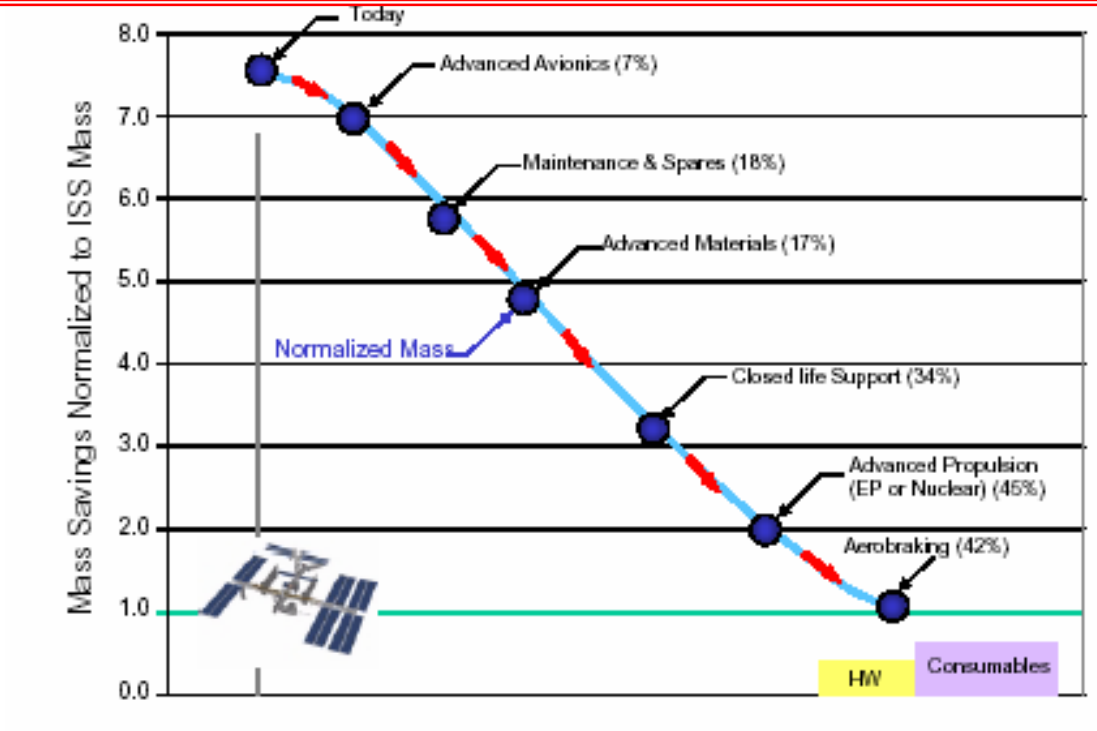
Workshop Purpose

- Short term: Present a research plan and a "roadmap" developed for strategic research for the Office of Biological and Physical Research.
- Long term: Conduct necessary ground-based and space-flight low gravity experiments, complemented by analyses, resulting in a documented framework for parameter prediction of needed by designers.

Various Strategic Planning Exercises

- Research Maximization and Prioritization (ReMAP), August 2002.
- NASA Exploration Team (NExT)
- Led to OBPR's Strategic Research Initiative.

Planned Improvements to Reduce Mass for a Manned Mars Mission



Some Previous Two-phase Flow Workshops & Studies

1986 - Microgravity Fluid Management Symposium
1989 - Workshop on Two-Phase Fluid Behavior in a Space Environment
1990 - The Workshop on the Commercialization of Space Fluid Management
2000 - Microgravity Research in Support of Technologies for the Human Exploration and Development of Space and Planetary Bodies – NRC Report
2000 - Workshop on Research Needs in Space Thermal Systems and Processes for Human Exploration of Space
2000 - Workshop on Research Needs In Fluids Management for the Human Exploration of Space

These Workshops have emphasized the importance of multiphase flow and phase change for NASA's exploration mission.

Goal of these Previous Workshops

- Brainstorm
- Prioritize
- Develop a roadmap

What's Different

- To Brainstorm, our "team"
  - Used previous studies/workshop outputs
  - Received additional input from technology developers
- To Prioritize, our "team" using non-research perspectives
  - Engineer needing to design
  - Operator needing to know how to operate
  - Project/Program Manager deciding whether or not to "buy" technology.
- To Develop roadmap, our "team" considered
  - Two-phase Priorities
  - Available Space Station Resources
  - Available Manifesting Opportunities
  - Schedules for Technology Cutoff Dates

Put on our "engineering" hats

What do they "need" to know

1. Will it Work?
   - Over What Range of Conditions?
   - What are its advantages over other means?
2. How does system respond to transients in setpoints?
   - How do I start it on a reliable basis?
   - How do I safely shut it down so I can restart it later?
   - How does the system respond to changes in operating conditions and set-points.
3. What about system instability?
   - What can cause it?
   - What sequence of events can cause it?
   - How do I identify it?
   - Can the system recover?
   - What is the result of the instability?
   - What sort of damage can result?

Put on our "technology shopper" hat

What do they need to know before they buy into using technology

Be able to test systems in normal gravity and have a high degree of confidence that they will function in a variety of gravity levels with no problems. (The upside down and sideways test)

OR

See an identical system currently performing well for a very similar set of conditions. (Someone else is first)

Prioritization Scheme

Priority Ratings

- **Critical:** enabling technology if not solved, don't or can't go.
- **Severely Limiting:** enabling technology but other systems can be used, but a steep price
- **Enhancements**
  - safety and reliability
  - weight savings
  - cost savings
- **Awareness:** Analysis, modeling, existing resource awareness can overcome difficulties.

Method of Testing

- space-flight experiment (SF)
- ground-based reduced gravity testing (GB)
- normal gravity testing,
- analysis/modeling
- review of existing space-flight / ground-based data for its appropriateness.

Why are we here?

- We have provided you a “strawman” Research Plan and Roadmap
- Review Priorities and Roadmap
- Provide Feedback
  - Does the plan make sense? If not, then let us change it so it does.
  - Will the proposed space-flight experimental facilities adequately address significant questions?
  - What other facilities & tests are needed to address critical and severely-limiting issues?
  - Are there any other elements missing in the plan?