Working Group Session 10A:

Toward a Standard for Goal-Based Operations

Chair: Daniel Dvorak, Jet Propulsion Laboratory, Caltech

Panelists: John Gersh, Applied Physics Lab, JHU

                Mitch Ingham, Jet Propulsion Laboratory, Caltech

                Andrew Rowland, The Aerospace Corporation

                Bonnie Triezenberg, Boeing

What is Goal-Based Operation?

A "goal" is an explicit expression of operator or customer <u>intent</u>

- Specify *what* you want to happen, not *how* to accomplish it
- Express intent in an explicitly verifiable form
- Carry expression of intent into the uplink products
- Allow system to select among alternatives to achieve goals
- Intent includes not only activity objectives but also flight rules and other operational constraints
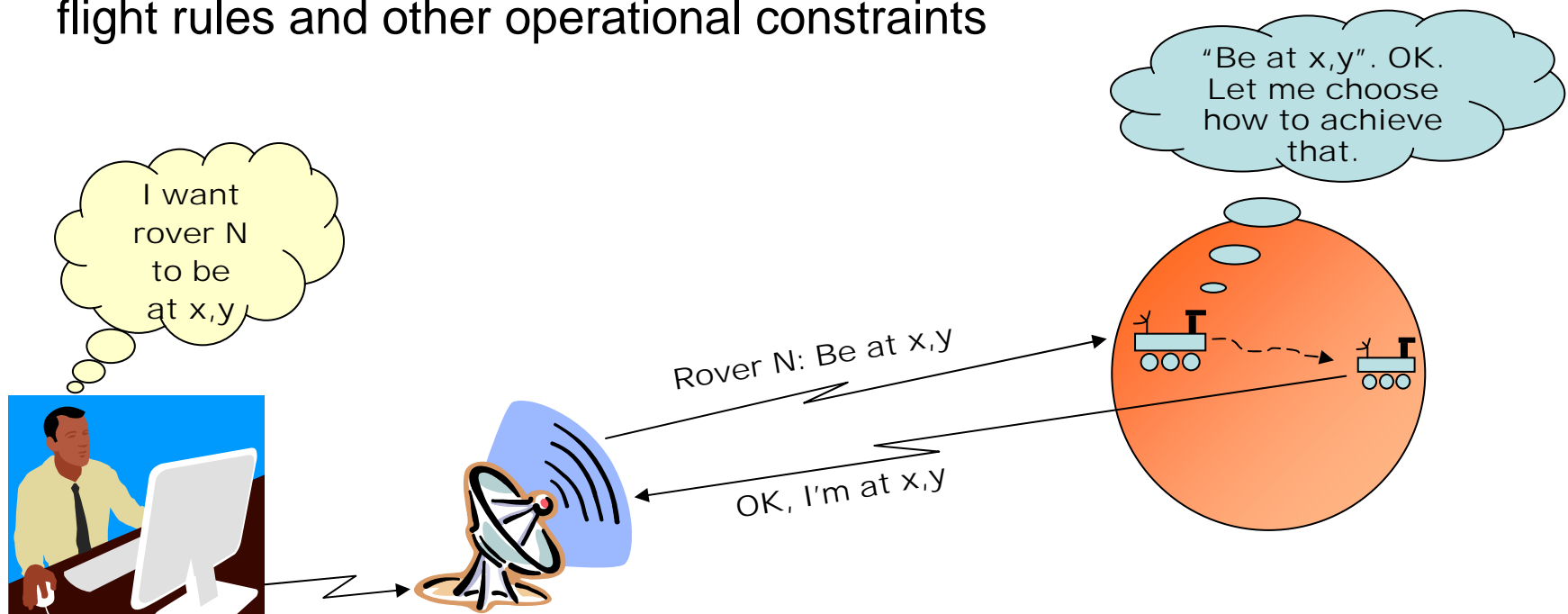
Why Should You Care?

Flexibility, reliability, and robustness

- Systems have a much better chance of …
  - preserving planned functionality, because they know what was *intended* by the original plan
  - responding to opportunities, because they can quickly implement intent *according to local conditions*
- Checking plans becomes more rigorous and complete
- Execution directly monitors results, enabling local fault responses

Operability

- Enables more concurrent, iterative operations planning

Inspectability

- More readable *and* verifiable than sequences, sequence generators, and rule bases

Automation

- Goals are amenable to automated reasoning using domain models
- Easier to encode domain models than rules

Why Do We Need Standards?

Interoperability and reusability

- Goals enable an interoperability standard for control
- Same *high-level* goals can be used by diverse elements of a system
- Hierarchical nature of goals makes them more reusable
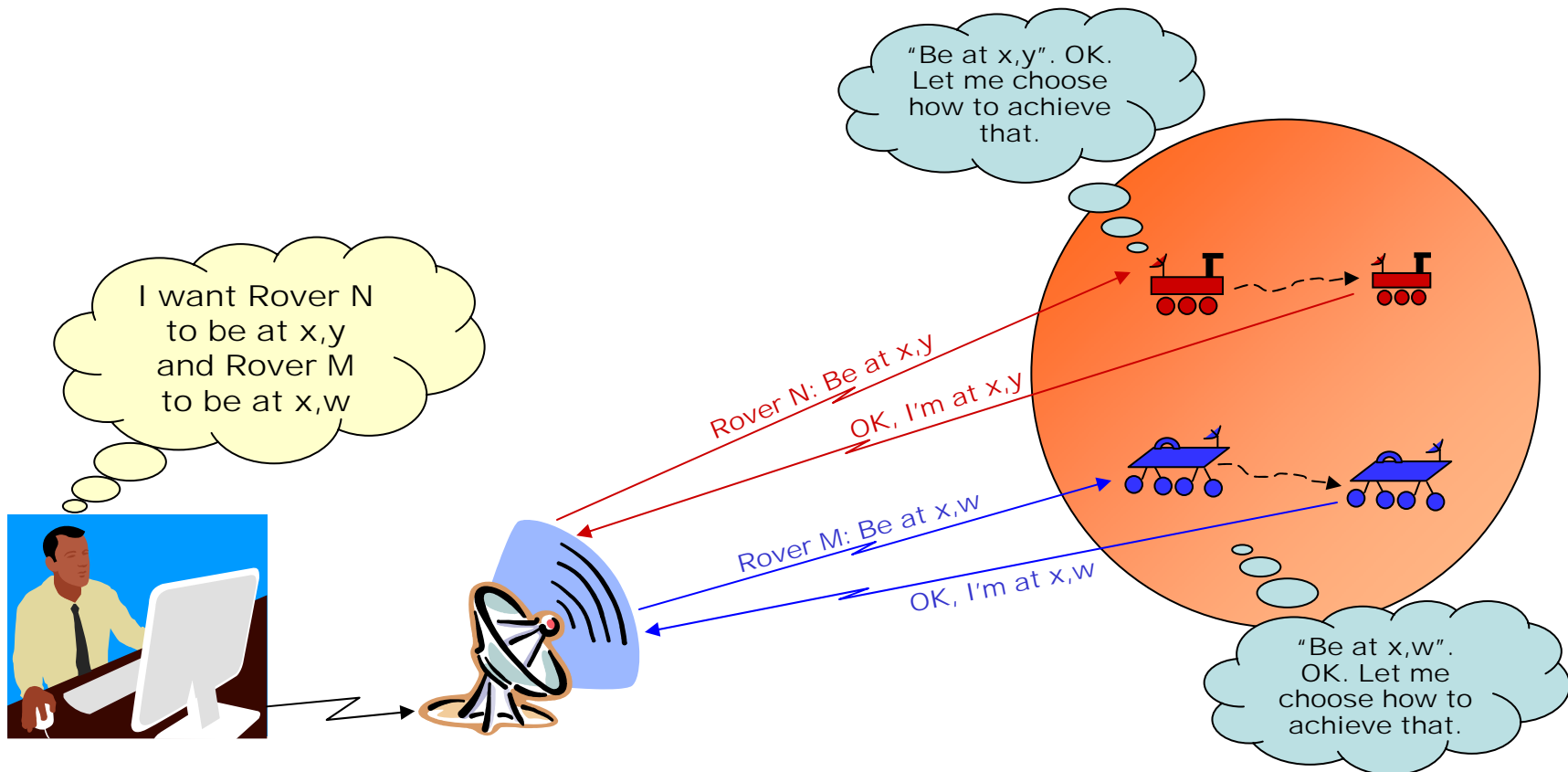
What's the Objective of this Working Group?

Objectives:

- Build a community of interest in goal-based ops
- Raise awareness of motivations and benefits
- Identify issues and set an agenda for a standards effort

Topics of Interest

- Definition of goal-based operation
- Human supervisory dialogue with goal-operated systems
- Visualization of goals and states
- Operations process
- Representation of goals
- Planning and execution
- Verification and validation
- Resource management
- Fault protection
- Barriers to infusion and adoption
- Areas for standards

Agenda

1:00	**Overview of goal-based operations**
1:15	**Panel Discussion + Questions:** *Important issues in goal-based operations*
2:30	**Open Discussion**
3:00	**Break**
3:15	**Quick Summary for new attendees**
3:20	**Panel Discussion + Questions:** *What should be in a standard, and why?*
4:15	**Open Discussion**
4:45	**Next Steps**
5:00	**End**

Panel

Daniel Dvorak (chair)

– Principal Engineer: Planning & Execution Systems
Jet Propulsion Laboratory, California Institute of Technology

John Gersh

– Principal Engineer: Human-Computer Interaction,
System and Information Sciences Group
Applied Physics Laboratory, The Johns Hopkins University

Mitch Ingham

– Senior Engineer: Flight Software Systems Engineering & Architectures
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Andrew Rowland

– Project Engineer, WGS Mission Integration
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– Software Chief Engineer
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