



Agents for Distributed Team Operations

Demonstration

October 2003



Participants

- **Project Coordination**

- NASA/ER2: Jane Malin, Charles Pitman, Lui Wang
- UTMB: Kathy Johnson
- SKT/Metrica: Debra Schreckenghost

- **Technical Staff**

- Lockheed: Pat Oliver
- SKT/Metrica Pete Bonasso, Richard Day, Cheryl Martin, Tod Milam, Arthur Molin
- Titan: Bob Phillips
- Tietronix: Mark Guerra



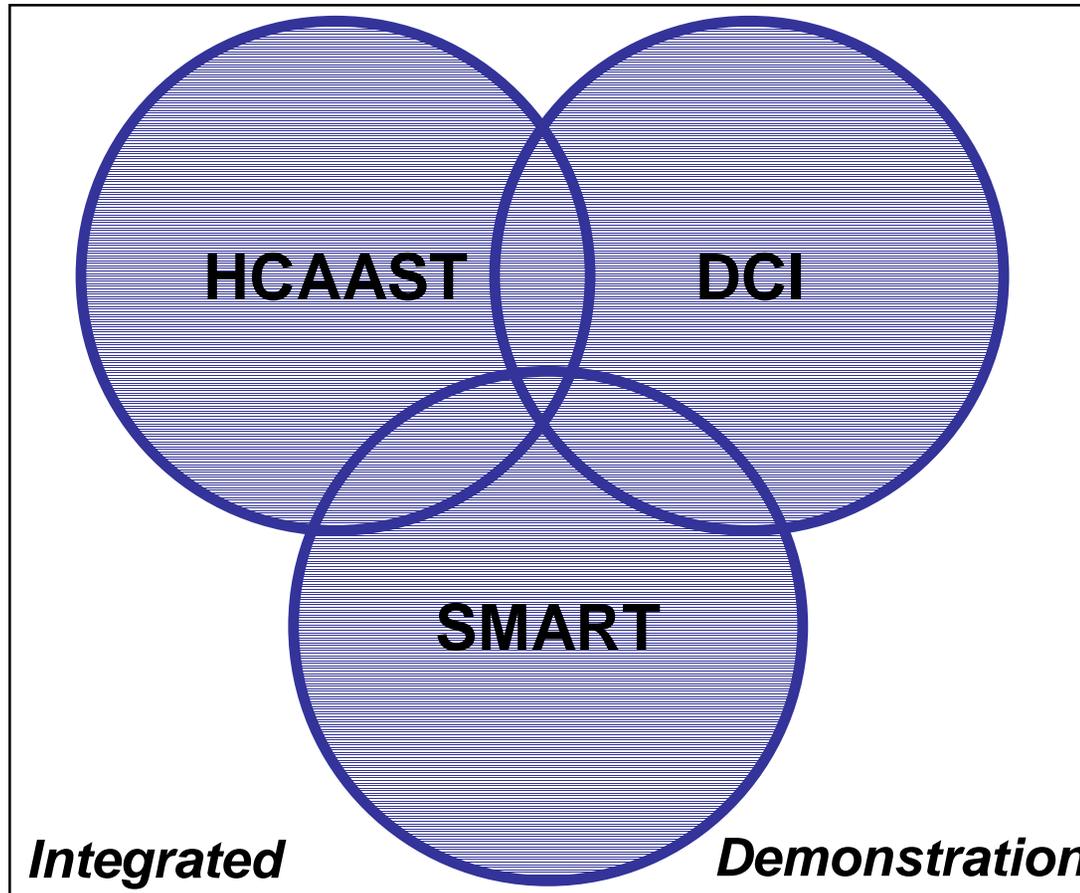
ADTO Demonstrations

- Demonstrations at JSC: Sep 25, Oct 22
 - T.J. Creamer, Bob Dunn, Drew Feuster, Nicolas Patrick
Crew Office
 - Monte Goforth
Chief Engineer, ISS Avionics Software Office
 - Steven Gonzalez
New Technology Development, Mission Operations
 - Susan Torney
ExPOC, Mission Operations Directorate
 - Mike Shafto
IS Program, ARC



Integration of Three JSC Projects

*Human-Centered
Intelligent Systems
For
Mission Operations*



*Distributed Crew Interaction
With Advanced Life Support
Control Systems*

*Human-Centered Intelligent
Flight Surgeon Console*

JSC Automation & Robotics



HCAAST Project

- **Objective:** Assist humans in managing information and communication in support of both nominal and off-nominal operations
- **Approach:** Provide agents working with teamwork tool suite to support distributed teams
 - **Provide *information management agents* for each flight control discipline**
 - HCAAST Information Managements Agents are called Intelligent Briefing and Response Assistant (IBRA) Agents
 - An IBRA agent serves a flight discipline by monitoring for important events and taking actions when these events occur (e.g., log, report)
 - **Develop *web-based support tools* used by both humans & agents**
 - WorkIT: manages action items and documents in a repository, called a workspace, associated with situation
 - Logger: stores notices and events in a database
 - ReportMaker: builds reports based on logged entries
 - **Access *tools and information* using web portal called *Team Workcenter***
- **Principal Investigator:** Jane Malin



SMART Project

- **Objective:** Assist Flight Surgeons in managing information during flight operations
- **Approach:** Develop prototypes and human-centered design methodologies for flight surgeon console
 - **Develop a prototype of next generation human-centered intelligent flight surgeon console**
 - Collaboration with HCAAST project on WorkIT and Logger
 - **Develop a design methodology**
 - *HCDID* – Human Centered Distributed Information Design
Systematic principles, guidelines, and procedures for the design of highly-efficient distributed human-computer systems
- **Principal Investigator:** Jiajie Zhang



DCI Project

- **Objective:** Aid users in working with **Automated Control Agents** and with **Other People** to perform tasks for assigned operational roles
- **Approach:** Provide Distributed Collaboration and Interaction (DCI) Environment to facilitate interaction within human-agent group
 - **Personal *liaison agents* for each human in organization**
 - DCI Liaison Agents are called Attentive Remote Interaction and Execution Liaison (ARIEL) Agents
 - An ARIEL agent serves a single user by providing services to help achieve group goals according to group policies and protocols
 - **Key Features of DCI**
 - Event Notification based on User Role and Location
 - Task Management with Automatic Schedule Updates
 - Group Communication and Awareness, including Location Tracking
 - Situation Summarization
 - Command Authorization for Remote Commanding
- **Principal Investigator:** D. Schreckenghost

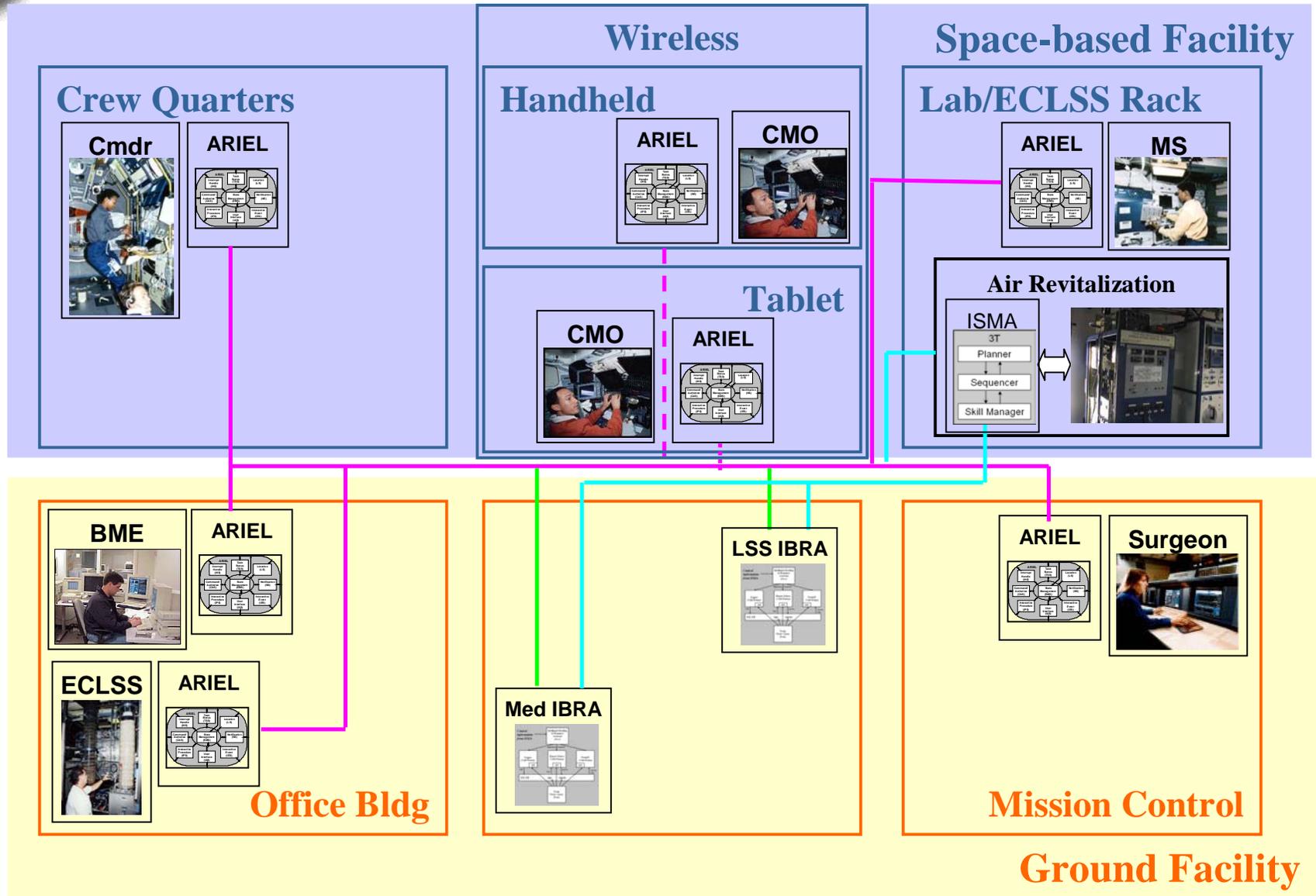


Software Agents from Projects

- **IBRA Agent: Intelligent Briefing and Response Assistant**
 - Information management agent for each flight control discipline
 - IBRA agent monitors for important events and takes actions when these events occur (e.g., log, report)
 - IBRA agent uses web-based tools to create logs, reports, and information repositories (called workspaces)
- **ARIEL Agent: Attentive Remote Interaction and Execution Liaison**
 - Liaison agent for each user; crew and ground agents have different service configurations
 - Crew ARIEL agent
 - Notifies its user of important events based on user role & location
 - Manages its user's schedule
 - Provides group communication and location tracking
- **ISMA Agent: Intelligent System Management Assistant**
 - Automated control agents for each crew life support system (e.g., ARS)
 - ISMA agent reduces operational workload by automating routine reconfiguration and FDIR
 - ISMA in demo is integrated with simulation of air revitalization hardware



Agents for Distributed Team Operations





Human Team in Demo

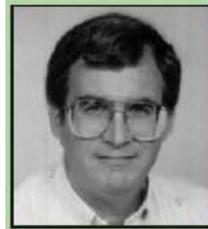
Crew

Crew Med
Officer (CMO)



Tod

Mission
Specialist (MS1)



Pete

Commander



Dave

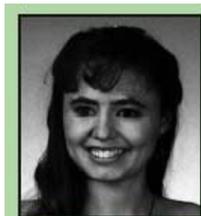
Ground Medical

BioMedical
Engr (BME)



Arthur

Flight
Surgeon



Cheryl

Ground Life Support

ECLSS
Controller



Pat



Demonstration Scenario



Nominal Ops: Crew and ground are aided by their agents in performing routine, periodic checking of life support systems (under autonomous control) and medical equipment

- II. *Anticipated Off-nominal Medical Ops:* Problem of inhalation injury to a crew member, leading to compromised lung function. Agents assist crew and ground coordination to assess and resolve the problem, using established procedures.
- III. *Anticipated Off-nominal Ops:* Problem arises in CO₂ removal system with potential crew impacts and/or degraded performance. Control agent performs routine fault management and support agents help humans in resolving problem.
- IV. *Unanticipated Off-Nominal Ops:* Events II and III interact to create a new problem. Rising CO₂ combined with compromised lung function requires novel problem solving by Flight Surgeon assisted by agents.



Sound Level Monitor Procedure

POWERING UP SLM

LAB1
O5B1

Unstow

1. Unstow:
Acoustic Countermeasures Kit (ACK)
SLM
2. Remove Kapton tape (clear yellow) from the microphone and discard.
3. Make sure the microphone protection grid is screwed on tightly. The microphone grid is the last 5/16" of the microphone.
4. Attach football-shaped windscreen to the microphone end if not already attached.
5. Remove Kapton tape from the power button  and discard.
6. Press .
Wait for load screen to disappear.
7. Press  to check battery level.
8. If the battery level is less than 1 volt above SLM power-off level, change the batteries.
If the battery level is more than 1 volt above SLM power-off level, go to step 9.

Battery
Checkout

Battery
Pantry

- 8.1 Unstow size C batteries (six).
- 8.2 Press .
- 8.3 Press OK.
- 8.4 Press  (twice) to turn SLM off.
- 8.5 Remove battery cover.



Demonstration Scenario

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OPS Concept Demonstrated

- **Supervisory monitoring**
 - Departing from vigilant monitoring by humans requires ability to
 - Focus users attention when something important happens
 - Provide remote access to summaries of events after they occur
 - *Approach: use ARIEL notification to draw users attention to events and notices provided by web-based Team Work Center*
- **Humans and software agents working together**
 - Human-agent teams must reason about the same information
 - *Approach: provide information management tools that can be manipulated by both humans and software agents*
- **Team coordination based on centralized activity management**
 - Ensure duties are accomplished and schedules are revised in face of contingencies, human unavailability, failures, flight rules changes, etc.
 - *Approach: provide centralized planning of user schedules in DCI, activity tracking within ARIEL agent, and procedure support*
- **Team coordination based on awareness of others**
 - Distributing operations requires support for coordinating actions with other team members
 - *Approach: make roles, activities, and location of other team members visible within ARIEL agent*



Requirements: Human Support Agents

