JPL

USER INTERFACE ISSUES IN SUPPORTING HUMAN - COMPUTER INTEGRATED SCHEDULING

Presented to:
Space Network Control Conference on
Resource Allocation Concepts and Approaches

December 12 -13, 1990

Lynne P. Cooper
Eric W. Biefeld

Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA 91109
Mail Stop 301-490

Previously presented at the Fourth Annual Space Operations, Applications, and Research Symposium
Albuquerque, New Mexico June 1990

Operations Mission Planner

SOAR/GESC 1

JPL

OUTLINE

- Introduction
- Background
- Issues
- OMP Interface
- Acknowledgements

Operations Mission Planner

SOAR/GESC 2

JPL

CHARACTERISTICS OF AN OMP SCHEDULE DOMAIN

Resource Allocation Problem

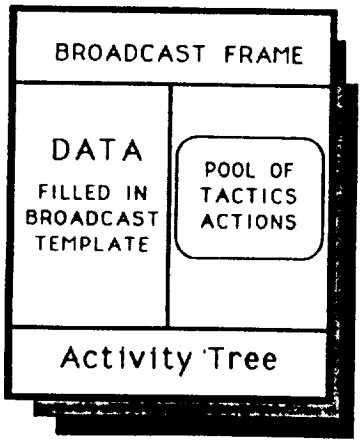
- **Over-Subscribed**
- **Large Numbers of Complex Requests**
- **Changes in Tasking**
- **Changes in Environment**

JPL

WHAT IS A SCHEDULE?

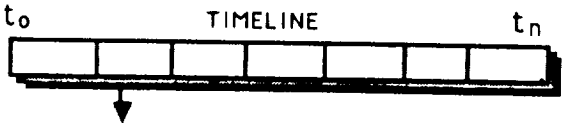
Request

Task
Activity
Set of Steps
Frame



Antenna

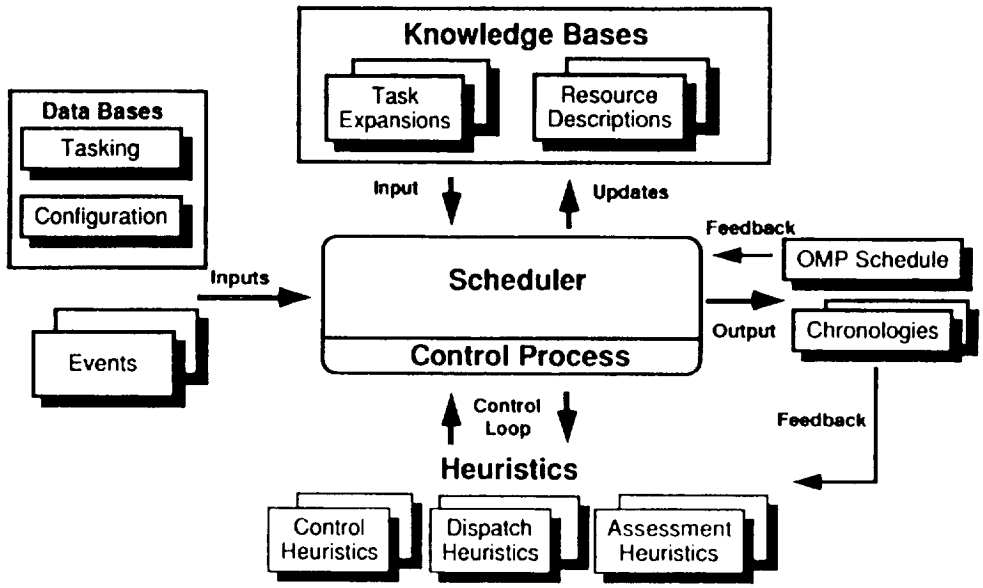
Resource
Timeline
Chronology
Temporal Data Base of Steps, Usage, & Direction



Broadcast 508
Broadcast 632
Direction 53
Chronogram C-12

JPL

OMP ARCHITECTURE



Operations Mission Planner

K-5

SOAR/GESC 5

JPL

Picture of OMP Interface

Operations Mission Planner

K-6

SOAR/GESC 6

JPL

ISSUES

OMP Interface Designed as Developmental Interface for Automated Scheduling System

- Information Underload → Strip Charts
- Information Overload → Histograms, Filtered Gantt
- Modifying Tasks → Edit Window
- Events → Command Window
- Assessment of Schedule → Statistics Display
- Development/Modification of Heuristics → Animated Windows, Chronologies, Parameter Setting

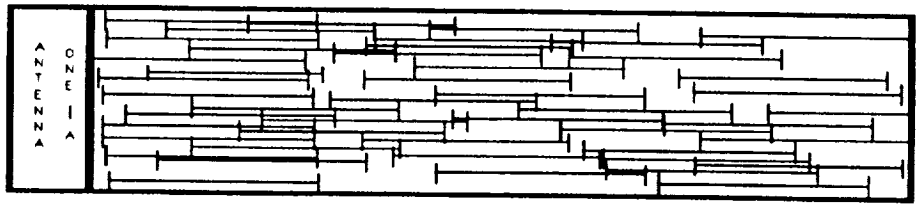
Operations Mission Planner

JPL

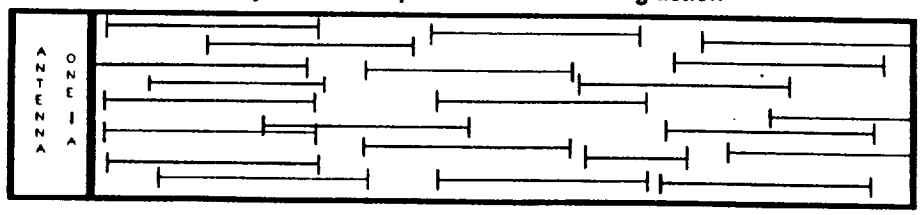
Example: Information Overload

When deleting tasks, show only the lower priority tasks which form the deletion pool

Before Filter: Tasks are indiscernible



After Filter: Show only those tasks pertinent to scheduling action



Operations Mission Planner

JPL

USER INTERFACE DIMENSIONS

Two major considerations in specifying a user interface:

- Functional Distribution
- Type of User

Operations Mission Planner

JPL

Functional Distribution
Example: Operations Mission Planner

Automated Functions	Human Functions
Develop Schedule	ID New Heuristics
Assess Schedule	Direct Manipulation of Schedule
Modify Schedule	Provide Guidance
	"Verify" Schedule
	Monitor Schedule Execution
	ID Problems During Scheduling

Process

Monitor
Create

Operations Mission Planner

JPL

Types of Users

Different Types of Users Require Different Support from the Interface

Human Scheduler

- Adjust Scheduling Process
- Interpret Results of Scheduling Algorithms
- Modify Heuristics
- Perform Statistical Analysis
- Define New Heuristics

Schedule End-User

- Focus Scheduler
- Define Performance Limits
- Request Sequential Activities Lists
- Set Preferences

Both

- Manipulate Tasks
- Manipulate Resources
- Input New Tasking
- Receive Output Schedules

Operations Mission Planner

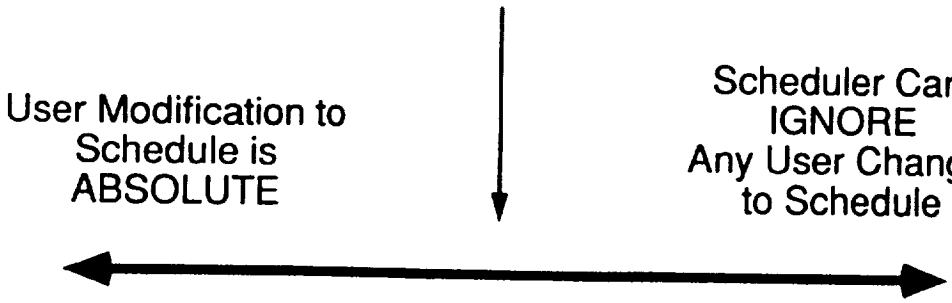
K-11

SOAR/GFSC-11

JPL

INTERPRETING USER INTERACTION

Need to interpret user interaction in the development of a schedule somewhere in the middle of the continuum



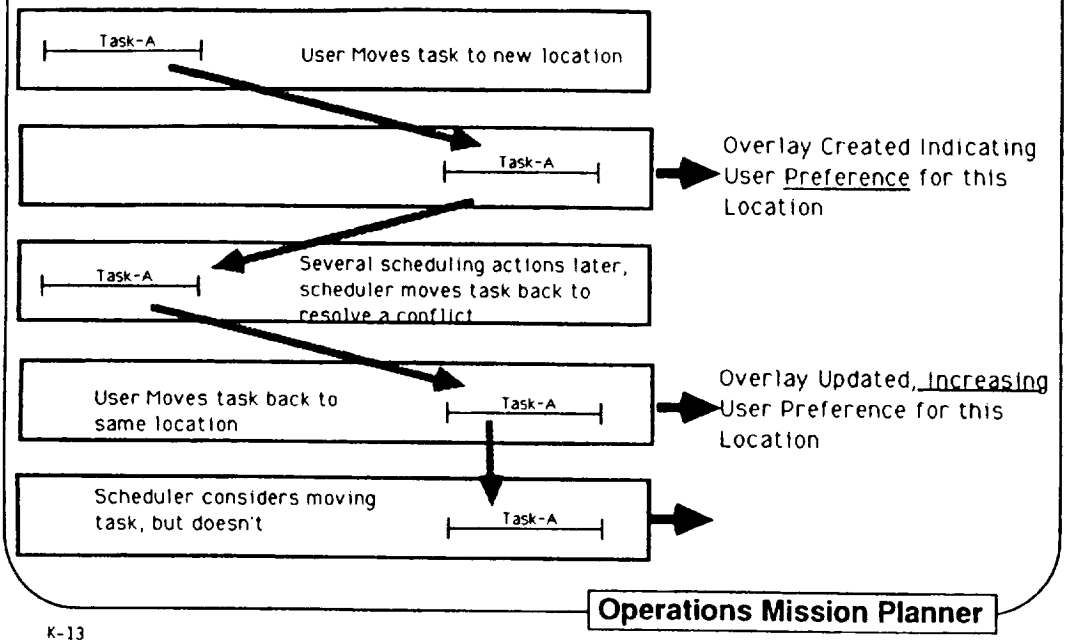
Operations Mission Planner

K-12

SOAR/GFSC-12

JPL

Example: Interpreting User Interaction Using DYNAMIC OVERLAYS



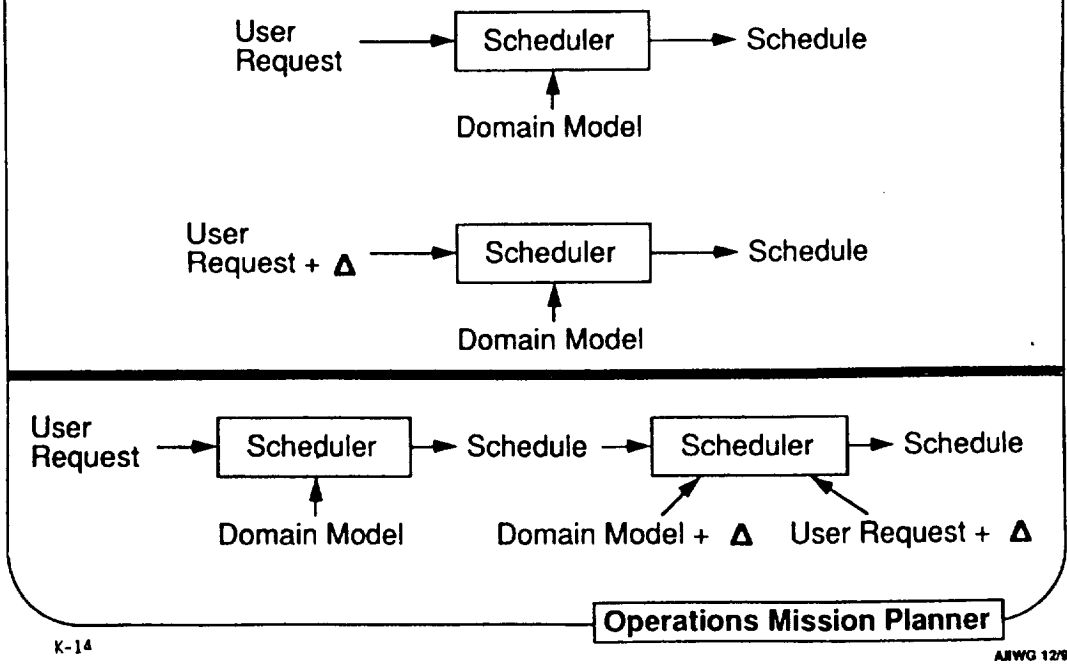
Operations Mission Planner

K-13

SOAR/GFSC-13

JPL

REACTIVE SCHEDULING



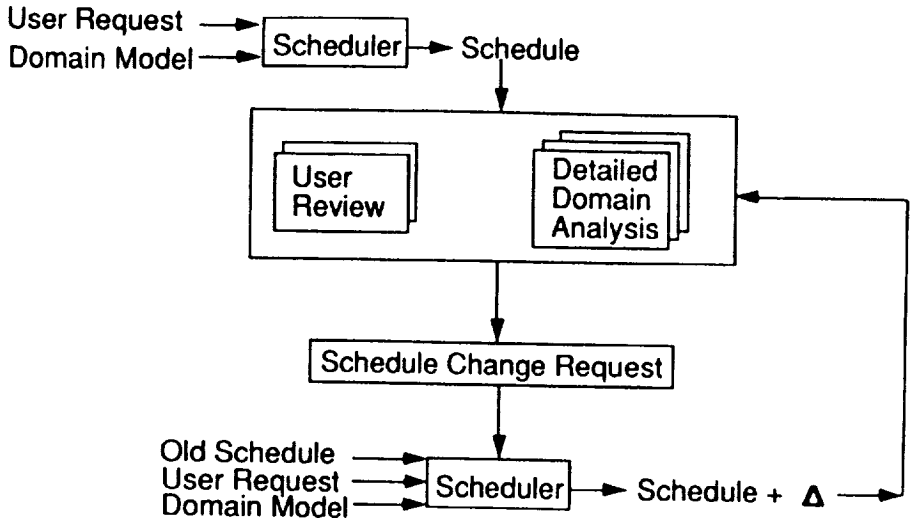
Operations Mission Planner

K-14

AIIWG 12/90-15

JPL

REACTIVE SCHEDULING CONT



Operations Mission Planner

K-15

AIIWG 12/90-18

JPL

TRANSITIONING THE INTERFACE

OMP is in the process of identifying how to transition from an automated/developmental interface to an integrated/operational interface

	Automated	H-C Integrated
Developmental	OMP Provide user insight into what scheduling actions are being performed and why the scheduler is choosing those actions (DEBUGGING)	Develop heuristics which can be interactive with the user. Provide feedback to the user on how his actions are affecting the schedule (INTERACTIVE DEBUGGING)
Operational	Assist an end-user of the SCHEDULE in the process of input/output for the scheduler (BLACK BOX OPERATIONS)	Assist a human scheduler in providing guidance to the scheduler (INTERACTIVE SCHEDULING)

Operations Mission Planner

K-16

SOAR/GFSC-14

JPL

ACKNOWLEDGEMENTS

OMP Research has been sponsored by CIA/ORD, NASA Code R, NASA Code M, and the JPL Flight Projects Support Office

- Technical Lead - Research, Design, & Development
  Eric Biefeld
- Design & Development Support
  Lynne Cooper
- Other Team Members
  David Atkinson, Leonard Charest, Richard Doyle, Loretta Falcone, Jim Firby, Kirk Kandt, Ray Lam, Gaius Martin, Elmain Martinez,Harry Porta