



JPL / UCLA Meeting on Sensor Networks

A decorative graphic element on the left side of the slide, consisting of a diamond shape at the top with a small circle inside, connected by a vertical line to a horizontal line that extends across the slide.

August 12, 2003

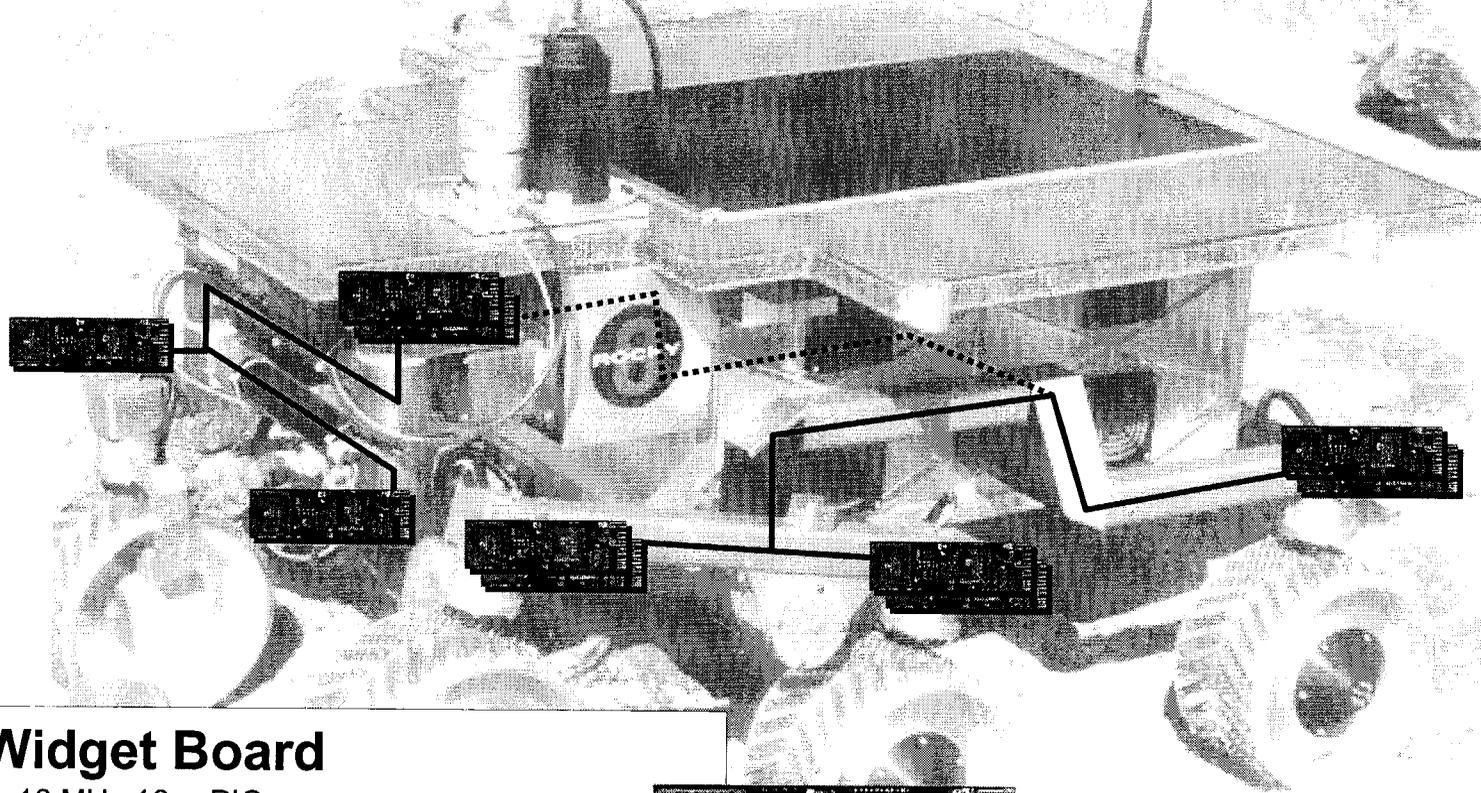


Projects Using Distributed Computing



- Fixed topology - physically connectedness
 - I2C-based control using widget boards (e.g. Rocky 8)
 - Ethernet/FireWire FPGA-based computing and control (e.g. future rovers)
- Changing topology – wireless connectedness (Axel Concept)
 - Mobile units
 - Reconfigurable robots
 - Fault detection and recovery
- CLARAty
 - Reusable robotic software on heterogeneous platforms

Fixed Topology – physical connectedness

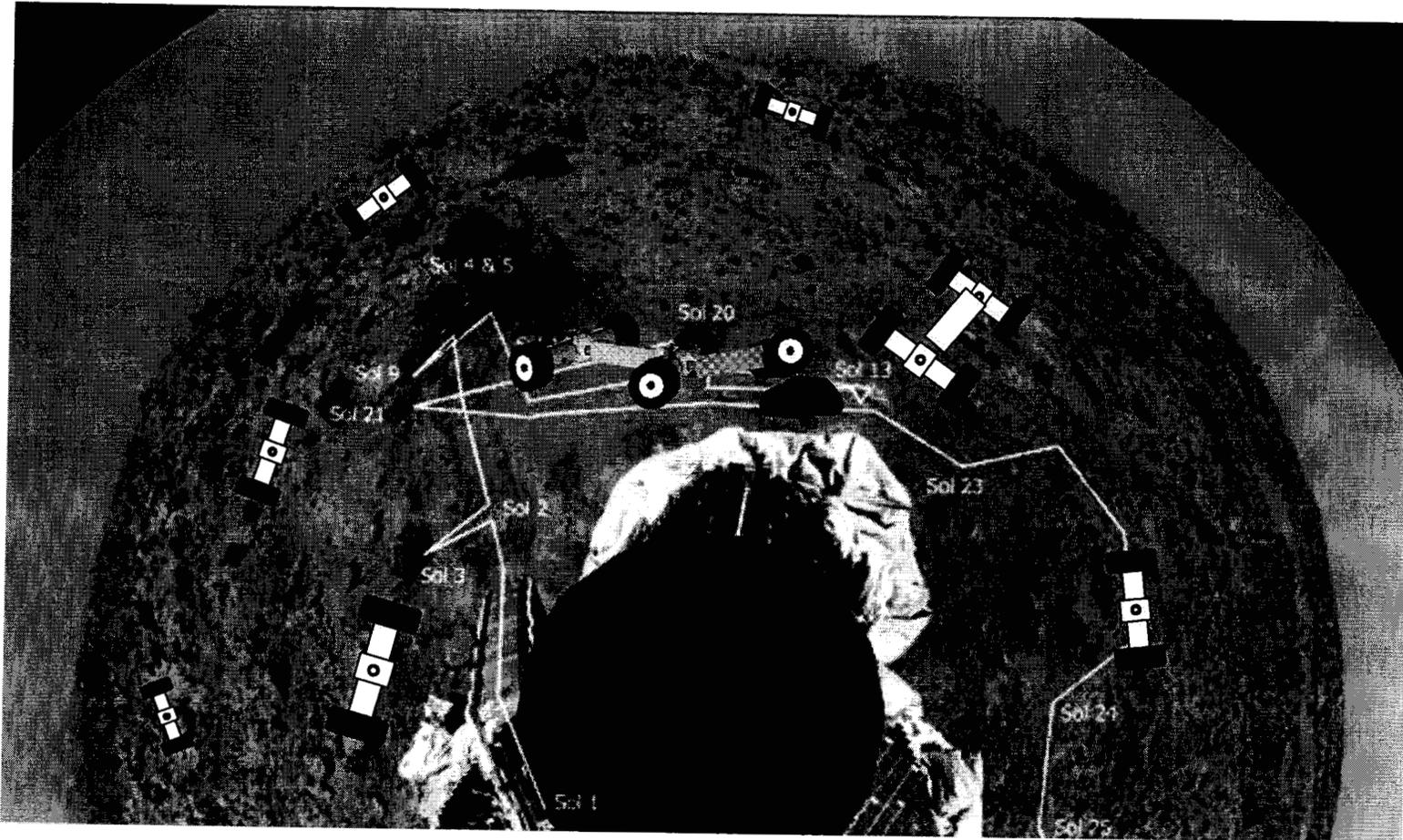


Widget Board

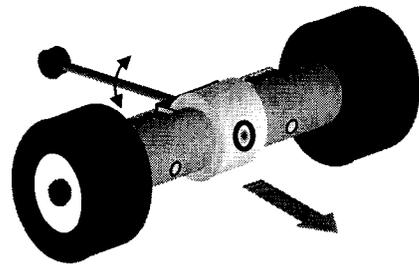
- 16 MHz 16xx PIC processor
- Single-axis motion controller (HCTL 1100)
- On-board analog filter
- 10 digital I/O lines
- 8 (12-bit) single-ended analog-to-digital
- 8 (8-bit) digital-to-analog conversion



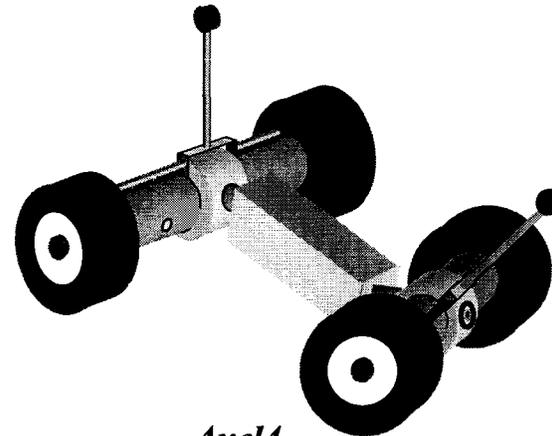
Changing Topology - wireless connectivity



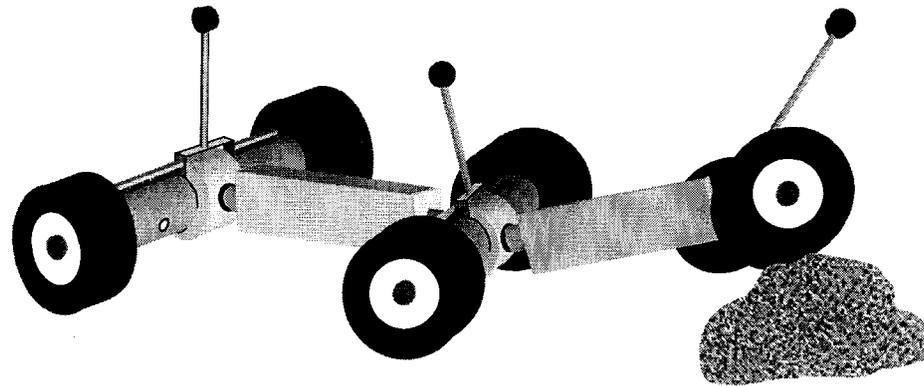
Axel Concept - Wireless Connectivity



Axel2

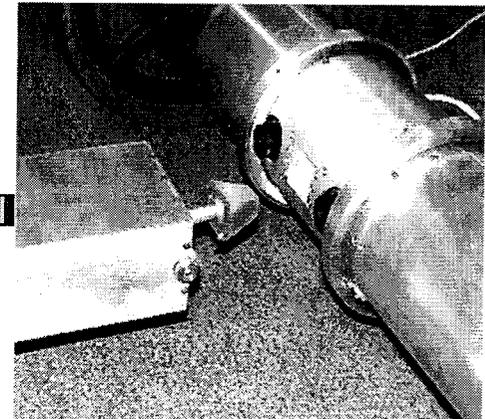
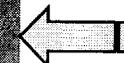
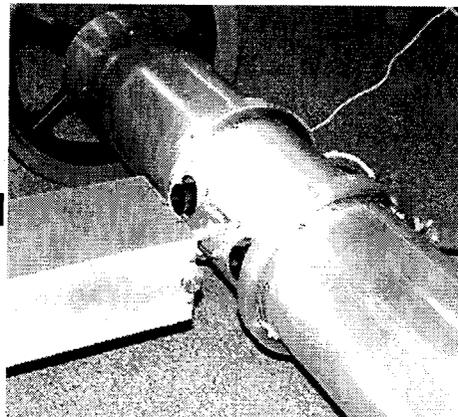
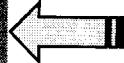
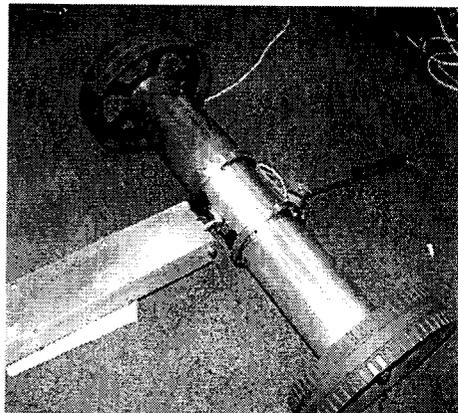
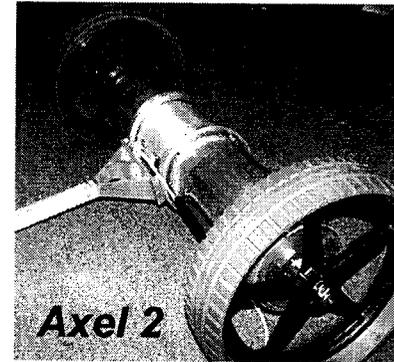
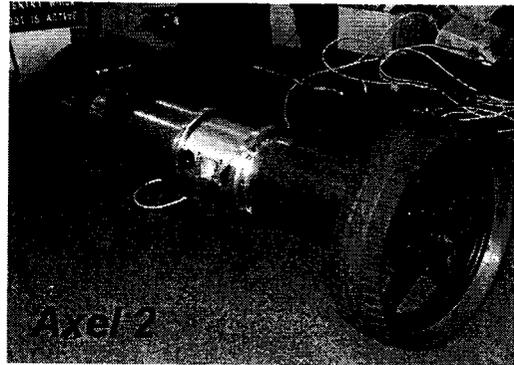
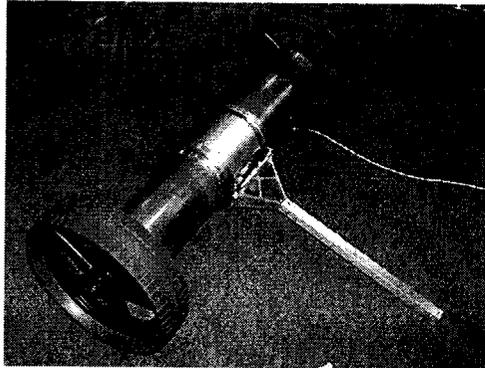


Axel4



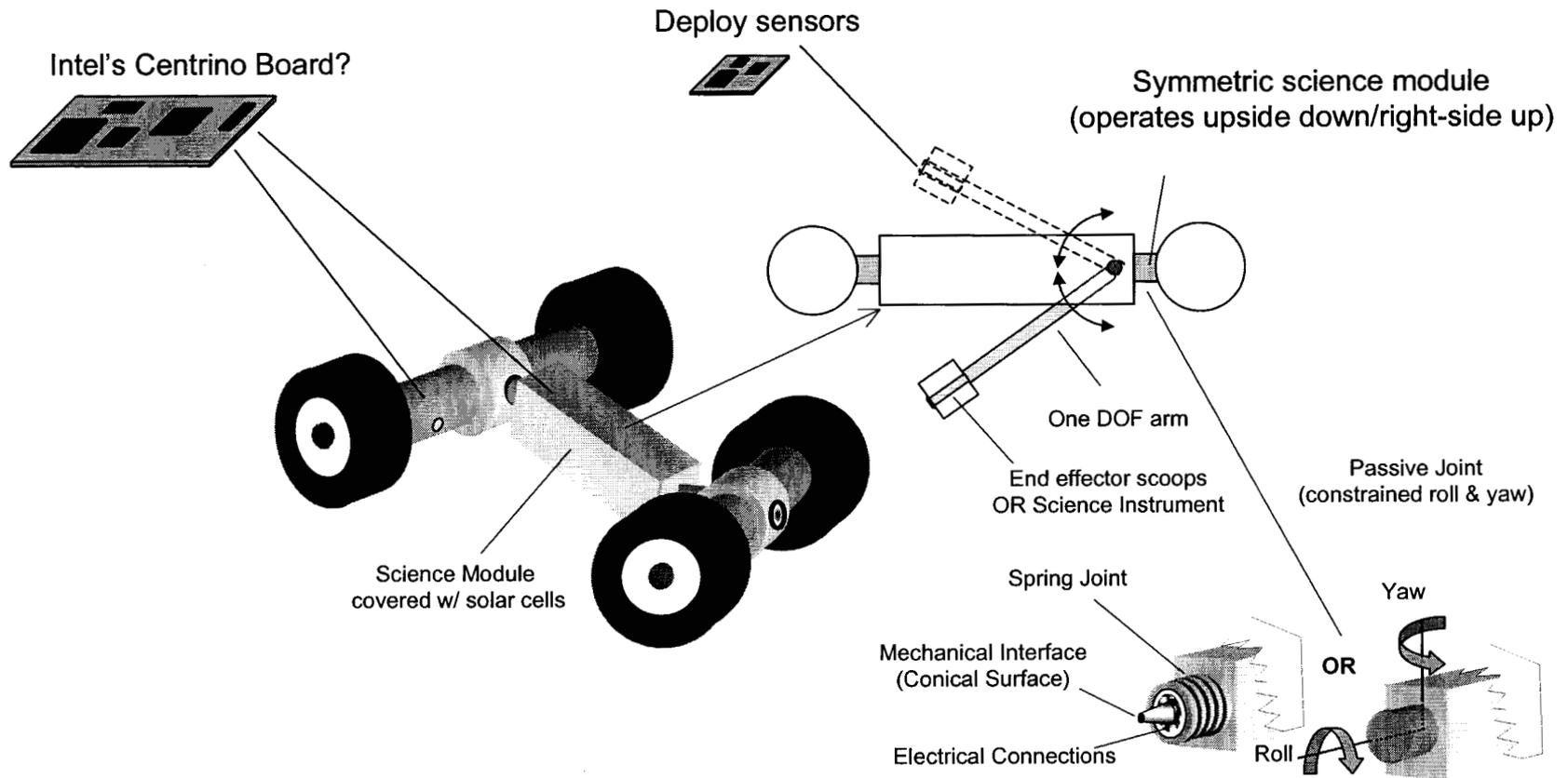
Axel6

Axel Concept - Wireless Connectivity



Docking

Axel Details

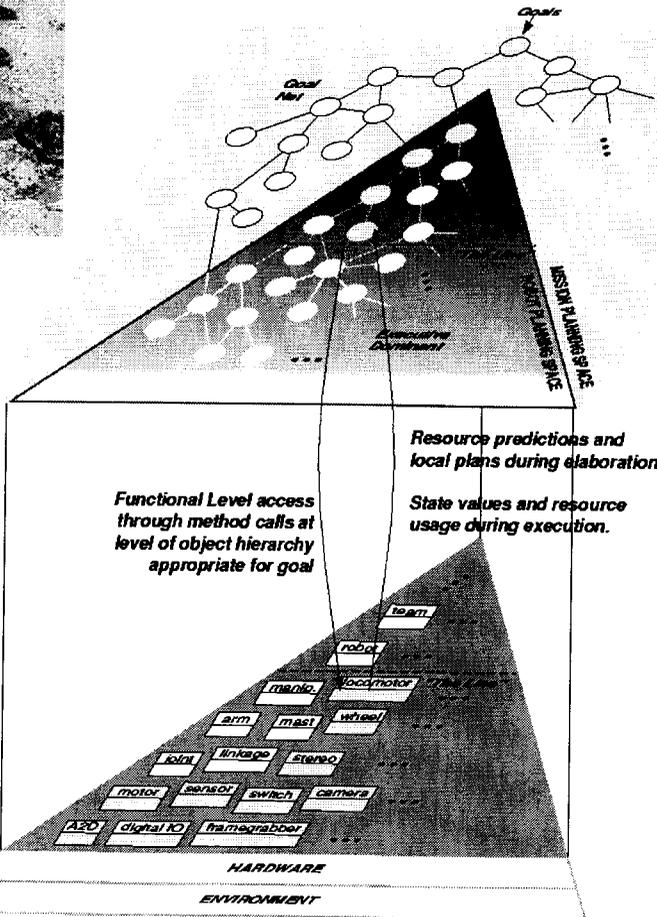
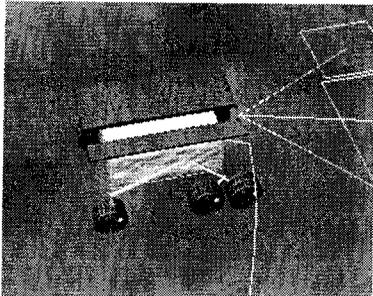
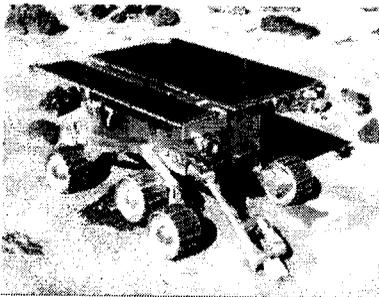
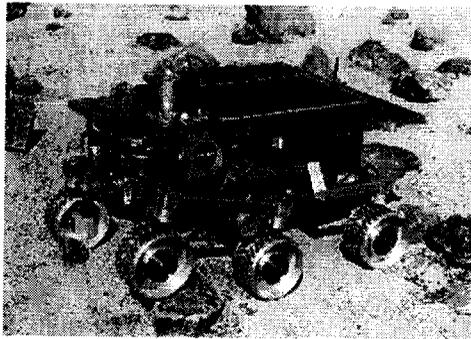




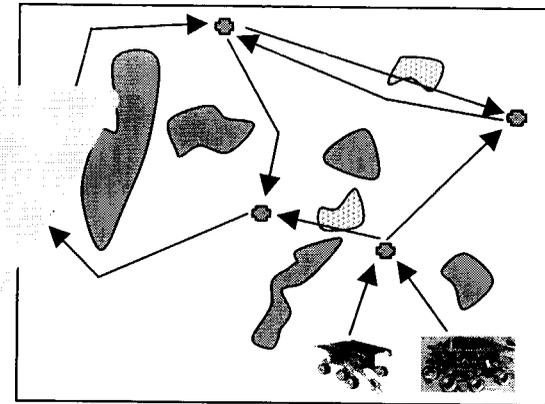
Distributed Robotic Exploration Concept



- Joint proposal on Axel submitted to Mars Exploration Program
 - JPL (organizer and previous lead)
 - University of Minnesota (lead - Prof. Nikos Papanikolopoulos)
 - Intel (Jim Bulter, Myron Hattig)
 - Purdue University (lead – Prof. Ray Cipra)
 - Arkansas Tech University (Prof Murray Clark)
- Proposal includes:
 - Continuation of feasibility studies on Axel concept
 - Development of several prototypes at various universities
 - *Use Intel's Centrino boards*

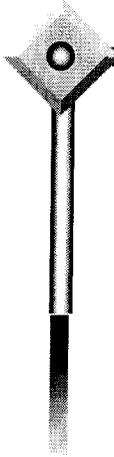


DYNAMIC REPLANNING





Backup Slides





Intel's Initiative



- Intel is leading an open source robotic initiative under the Proactive Computing program focusing on the following areas:
 - Standardization of robotic software - RETF (robotic engineering task force)
 - Distributed sensor networks using mobile robots to support them
 - Development of common computing robotic hardware
 - Low power, small footprint Stayton board – uses 400 MHz XScale processor, flash, and runs Linux
 - Phase 2 – developing next generation Centrino board/processor which adds floating point support



JPL / Intel Interaction



- Several email exchanges and telecon with Intel and JPL:
 - *Center for Integrated Space Microsystems* (L. Alkalai)
 - *Mars Technology Program* office (R. Volpe)
 - CLARAty (JPL's robotic software for research) (I. Nesnas)
- CLARAty task manager attended the second Annual Robotic Workshop at Intel held in Portland Oregon – January 2003
- CLARAty/JPL hosted Intel for ½ a day of discussions with participation of robotic managers to explore future collaborations with the Intel open source initiative
 - Intel and JPL exchanged presentations on current robotic initiatives related to common robotic hardware and software
 - Intel is participating and sponsoring universities in the DARPA Grand Challenge (JPL not participating)
- CLARAty was invited to a special session initially organized by Intel and later by USC on robotic standardizations at the IROS conference.



Possible Areas of Collaboration JPL/Intel



- CLARAty interested in working with Intel and UCLA in defining specifications for standard robotic hardware (flexible, modular, distributed) and software
 - Low power, computational capable and low-cost motion control hardware boards that can be made available to JPL, its university partners, and the extended robotic community
 - Low-power sensor hardware boards with standard hardware/software interfaces.
- CLARAty interested in standardizing and adapting its software architecture to flexible, modular, and distributed robotic hardware components
- CLARAty with additional support can provide the Intel hardware via the CLARAty testbed which will be accessible to a number of developers within its community (JPL, ARC, CMU, and U. Minnesota)