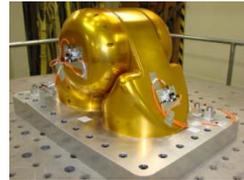


Dexterous Manipulation for In-Space Missions

Dr. Rob Ambrose
NASA JSC March 2010

Robonaut 1 Development History

- **1998**
 - Subsystem Development
 - Testing of hand mechanism
- **1999**
 - Single Arm Integration
 - Testing with teleoperator
- **2000**
 - Dual Arm Integration
 - Testing with dual arm control
- **2001**
 - Waist and Vision Integration
 - Testing under autonomous control
- **2002**
 - R1A Testing of Autonomous Learning
 - R1B Integration
- **2003**
 - R1A Testing Multi Agent EVA Team
 - R1B Segway Integration
- **2004**
 - R1A Autonomous Manipulation
 - R1B 0g Airbearing Development
- **2005**
 - Development of R1C Joints
 - Supervision Across Time Delay
- **2006**
 - Integrate R1B with Centaur Base
 - Thermal, vacuum and vibe testing of R1C



R1A

R1B

R1C

This material has been approved for Public Release and Disbursement

Hubble Aft Shroud Door (4/2004)



This material has been approved for Public Release and Disbursement

Robonaut 2 Development History

- **2007**

- R2 Finger and arm joint concepts
- Prototype series elastic controller



- **2008**

- R2 Single Limb Integration
- R2A Integrated



- **2009**

- R2A completes first assembly task
- R2B Integrated



- **2010**

- February Public Release
- R2A EMI, Power, toxicity testing
- R2B Vibration testing, software safety



R2A

R2B

This material has been approved for Public Release and Disbursement

R2 Public Release February 2010

This material has been approved for Public Release and Disbursement