

Johnson Space Center-Houston, Texas

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| Robonaut<br>RoboSim | INNOVATION - 2004  |              |
|                     | David Christianson | 08 / 20 / 04 |

# ROBONAUT

# ROBOSIM

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**Robonaut:**

a highly dexterous anthropomorphic  
robotic system

**RoboSim:**

a computer simulation of the  
capabilities of Robonaut

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## **Robonaut:** what is it?

A humanoid robot developed by NASA-Johnson Space Center and the Defense Advanced Research Projects Agency (DARPA).

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## **Robonaut: why?**

To develop and demonstrate a robotic system that can function as an EVA astronaut.

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## **Robonaut: capabilities**

In some areas, it has reduced dexterity and performance as compared to a suited astronaut.

In other areas, it is superior to a suited astronaut.

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## Robonauts:

Unit A: fixed base: 43 – Degrees of Freedom (DOF)

Unit B: motion base: 47 - DOF

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## **Robonaut:** physical description

The size of an astronaut in a space suit.

Two five-fingered hands.

Two arms.

One head.

One torso.



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## **Robonaut: hands**

Designed to operate tools used by suited astronauts during EVA.

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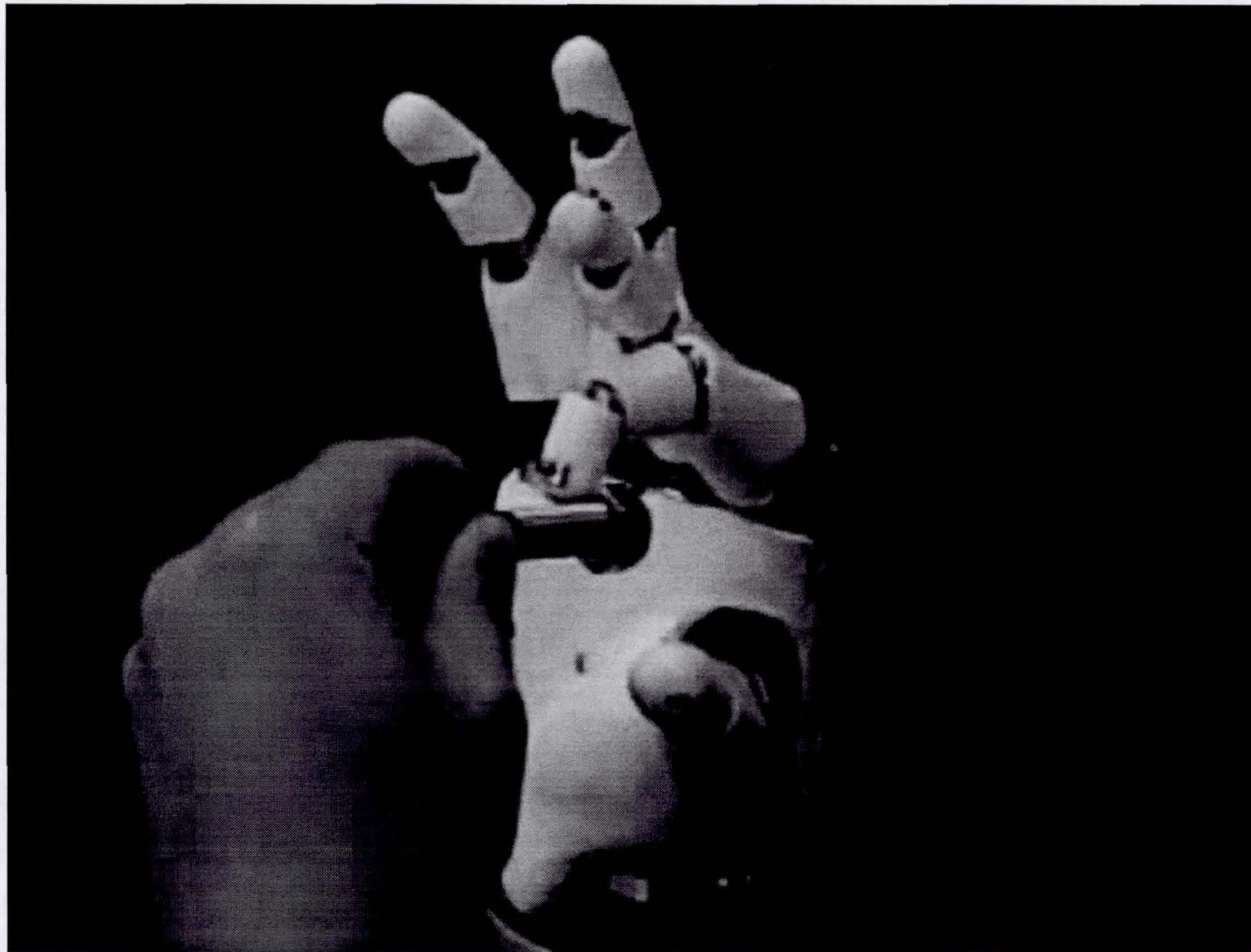
## **Robonaut: hands**

|                         |       |
|-------------------------|-------|
| Wrist:                  | 2-DOF |
| Thumb:                  | 3-DOF |
| First finger (index):   | 3-DOF |
| Second finger (middle): | 3-DOF |
| Third finger (ring):    | 1-DOF |
| Fourth finger (pinkie): | 1-DOF |
| Palm:                   | 1-DOF |

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## **Robonaut: arm**

Designed for

human equivalent strength

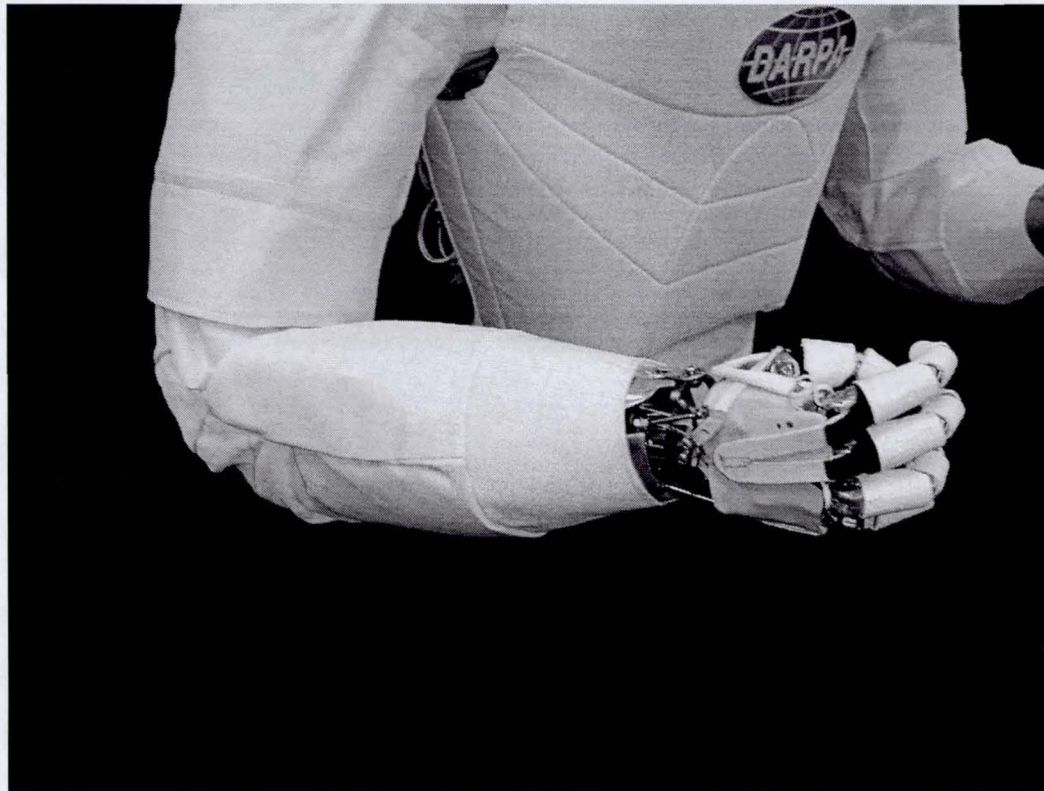
human scale reach

fine motion

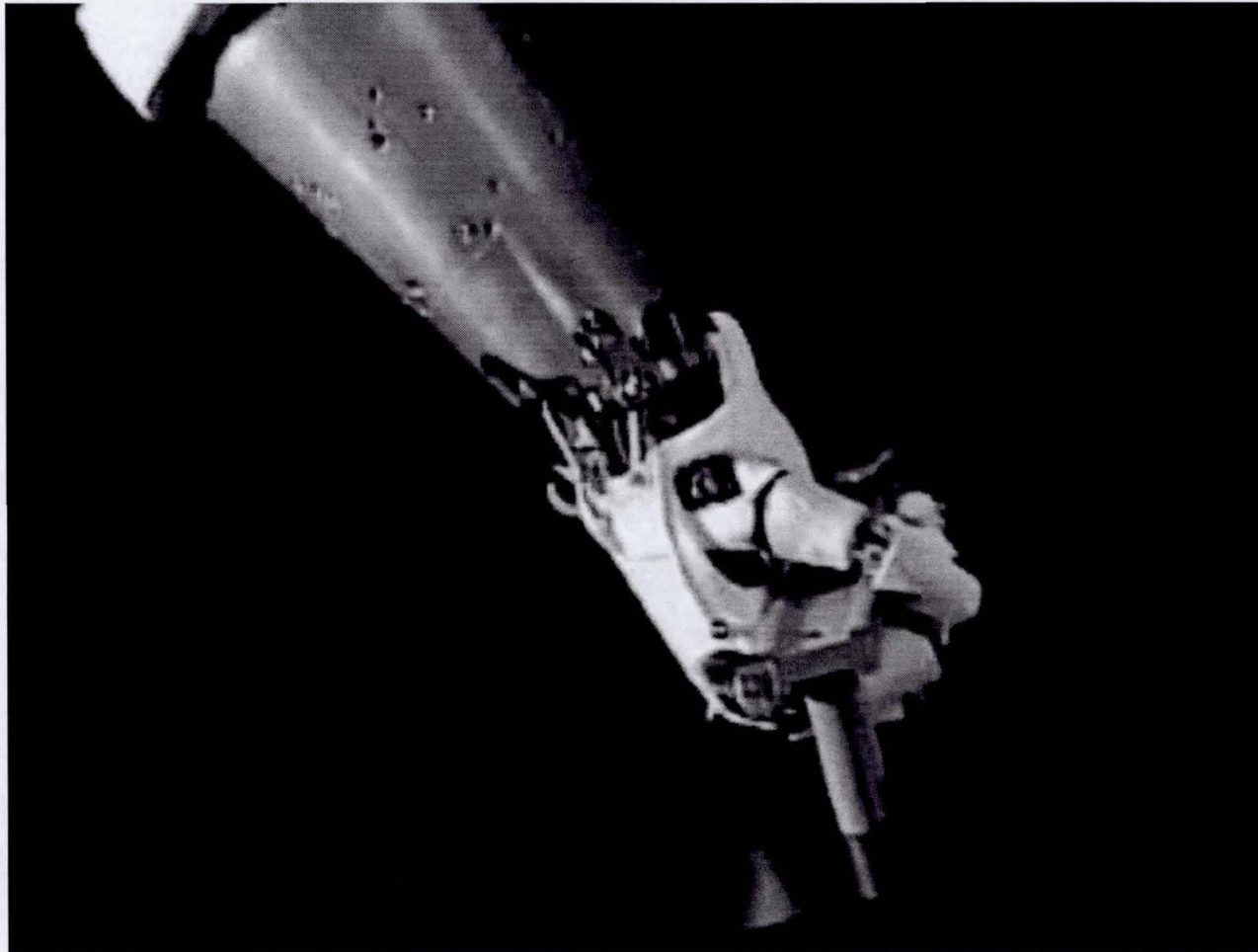
high bandwidth dynamic response

range of motion that exceeds that  
of a human limb

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## **Robonaut: head**

articulated neck

two color cameras deliver stereo vision

interocular distance matches typical human

eye spacing

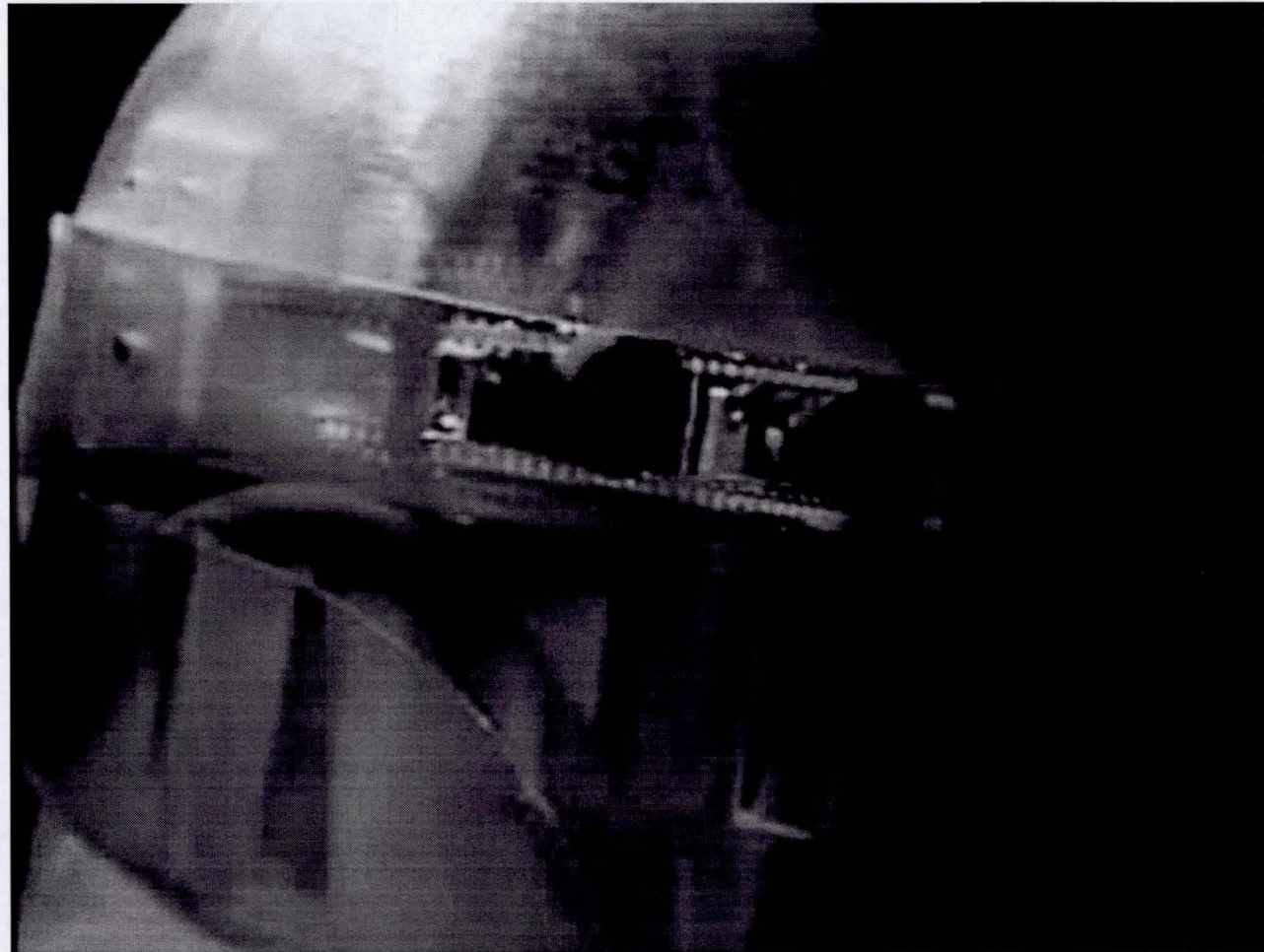
focal distance at arms length



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**Robonaut: control**

most used: telepresence

a human operator controls the action  
of a remotely operated Robonaut

uses:

Helmet Mounted Display

Force and tactile feedback gloves

Position tracking

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**Robonaut:** external interface

through an Application Programmer's  
Interface (API)

every degree of freedom is available to be  
controlled remotely

Robonaut API is compatible with RoboSim,  
allowing development under  
safety of simulation

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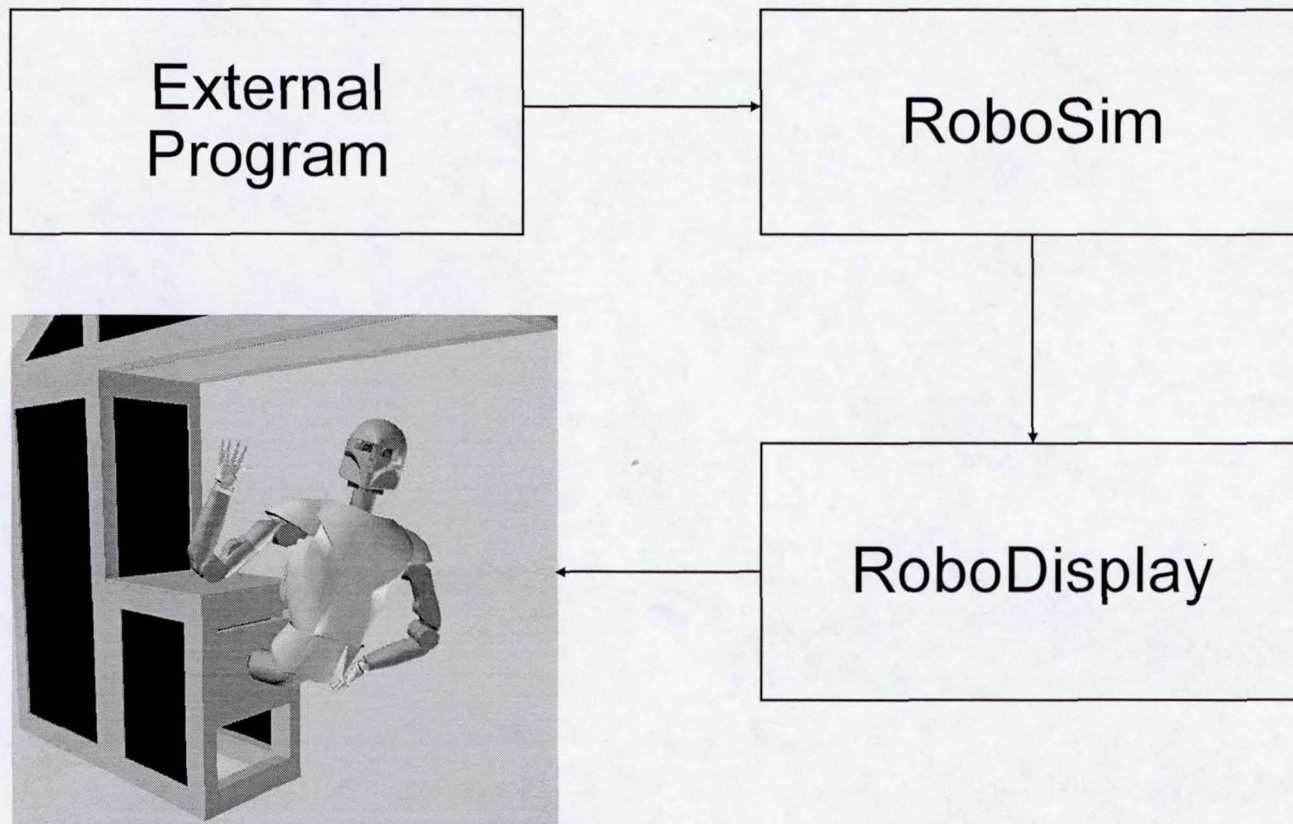
## **RoboSim:** what is it?

Simulation of Robonaut on Windows PC

## **RoboDisplay:** what is it?

Graphics program that depicts the orientation of all the joints of the Robonaut

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## **RoboSim:** why is it?

testing unverified control algorithms on  
robotics hardware is risky

too many users, too little time

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## **RoboSim:** advantages

- test new theories
- test new algorithms
- test new software
- train new personnel



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**RoboSim:**

requires a configuration file

**RoboDisplay:**

requires models and a structure file