

**AN OVERVIEW OF
THE
KENNEDY SPACE CENTER
ROBOTICS PROGRAM**

**SIXTH ANNUAL
SPACE OPERATIONS, APPLICATIONS, AND RESEARCH SYMPOSIUM
AUGUST 6, 1992
L.B. JOHNSON SPACE CENTER**

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KSC is Applications oriented.

ROBOTICS

Primary mission – operational use

**Offer the capability to prove robotics work
on the ground before being used in space.**

KSC ROBOTICS & AUTOMATION PROJECTS

- ✓ **TILE ROBOT (Tessellator)**
- ✓ **HFIR (HEPA Filter Inspection Robot)**
- ✓ **ARID (Automatic Radiator Inspection Project)**

- **SENSOR BASED OBSTACLE AVOIDANCE FOR REDUNDANT MANIPULATORS ("SKIN")**
- **SELF-CONTAINED DEPLOYABLE SERPENTINE TRUSS**
- **KINESTATIC PLATFORM**
- **CG DETERMINATION**

- **PAYLOAD INSPECTION ROBOT STUDY**

TILE ROBOT (Tessellator)

A semi- autonomous robotic system to rewaterproof and inspect thermal protection systems tiles on the underside of the orbiter.

DESIGN FEATURES: 11 degrees of freedom

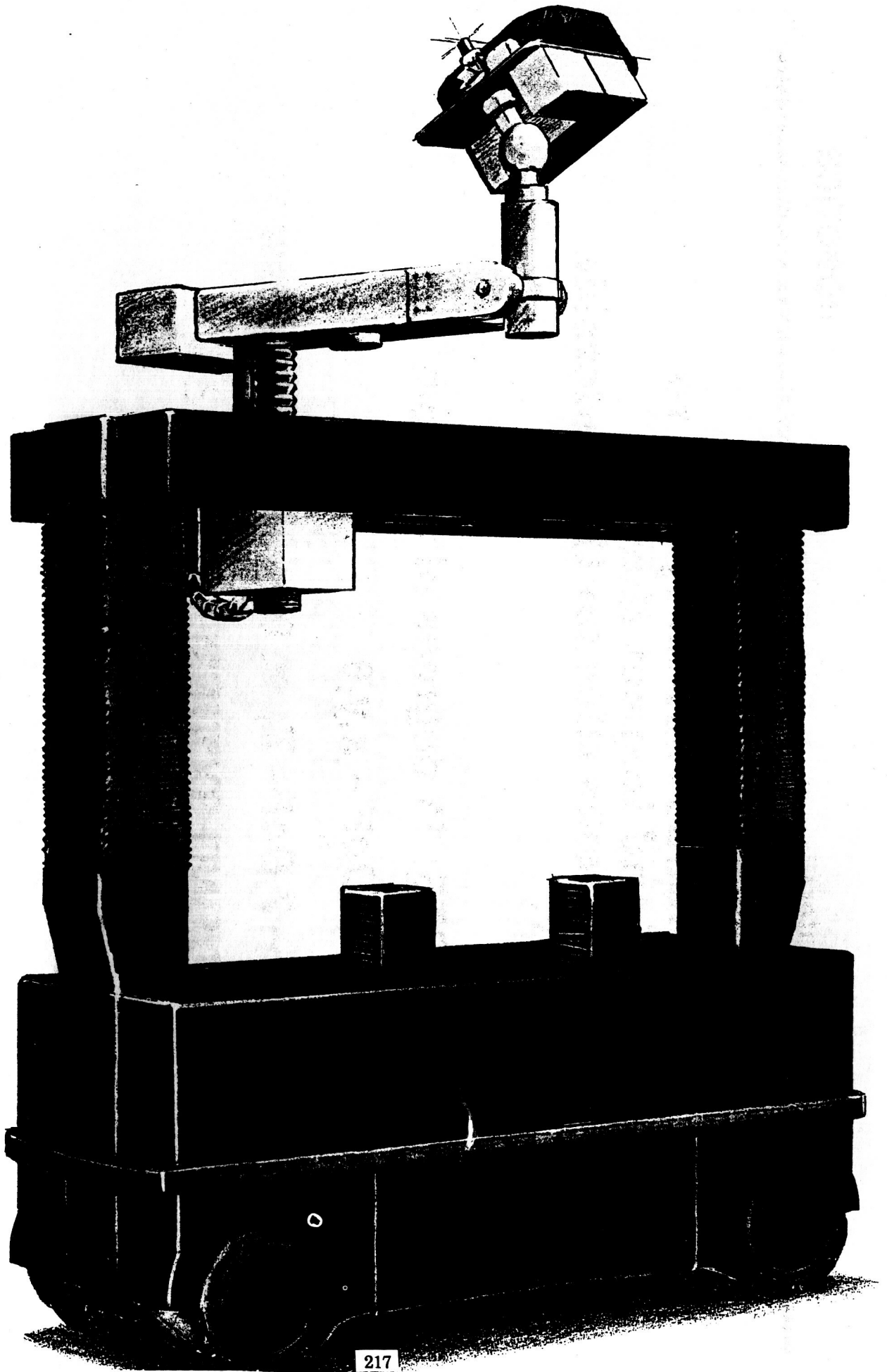
MOBILE BASE - 3 DoF - x, y, θ

MANIPULATOR - 7 DoF - $Z; z, \theta; x;$ pitch, roll, yaw

REWATERPROOFING SYSTEM - 1 DoF - Z

VISION SYSTEM

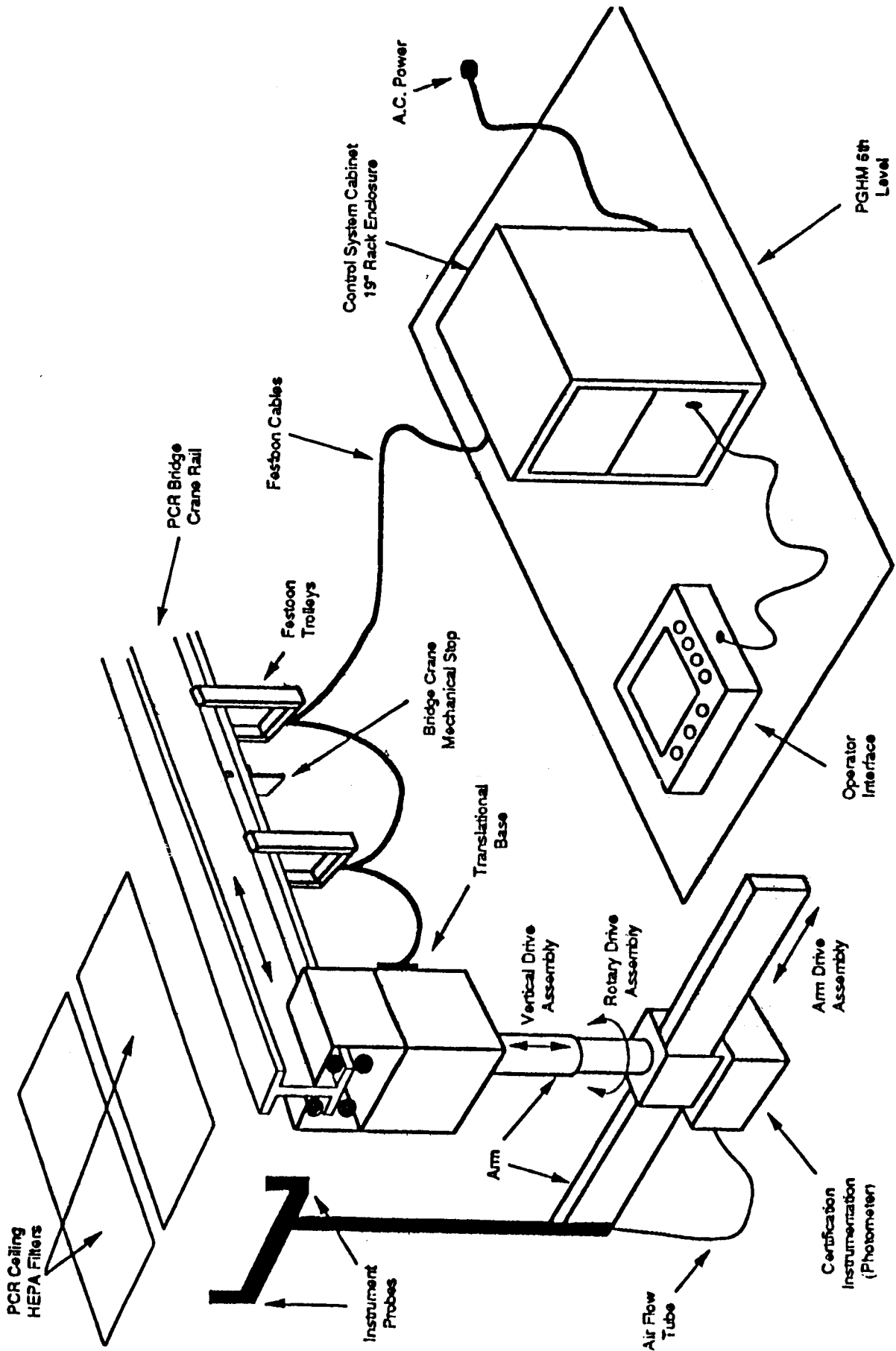
WORKCELL CONTROLLER



**AUTONOMOUS INSPECTION OF HEPA FILTERS
LOCATED AT THE TOP OF THE LC 39 PAYLOAD
CHANGEOUT ROOMS**

DESIGN FEATURES

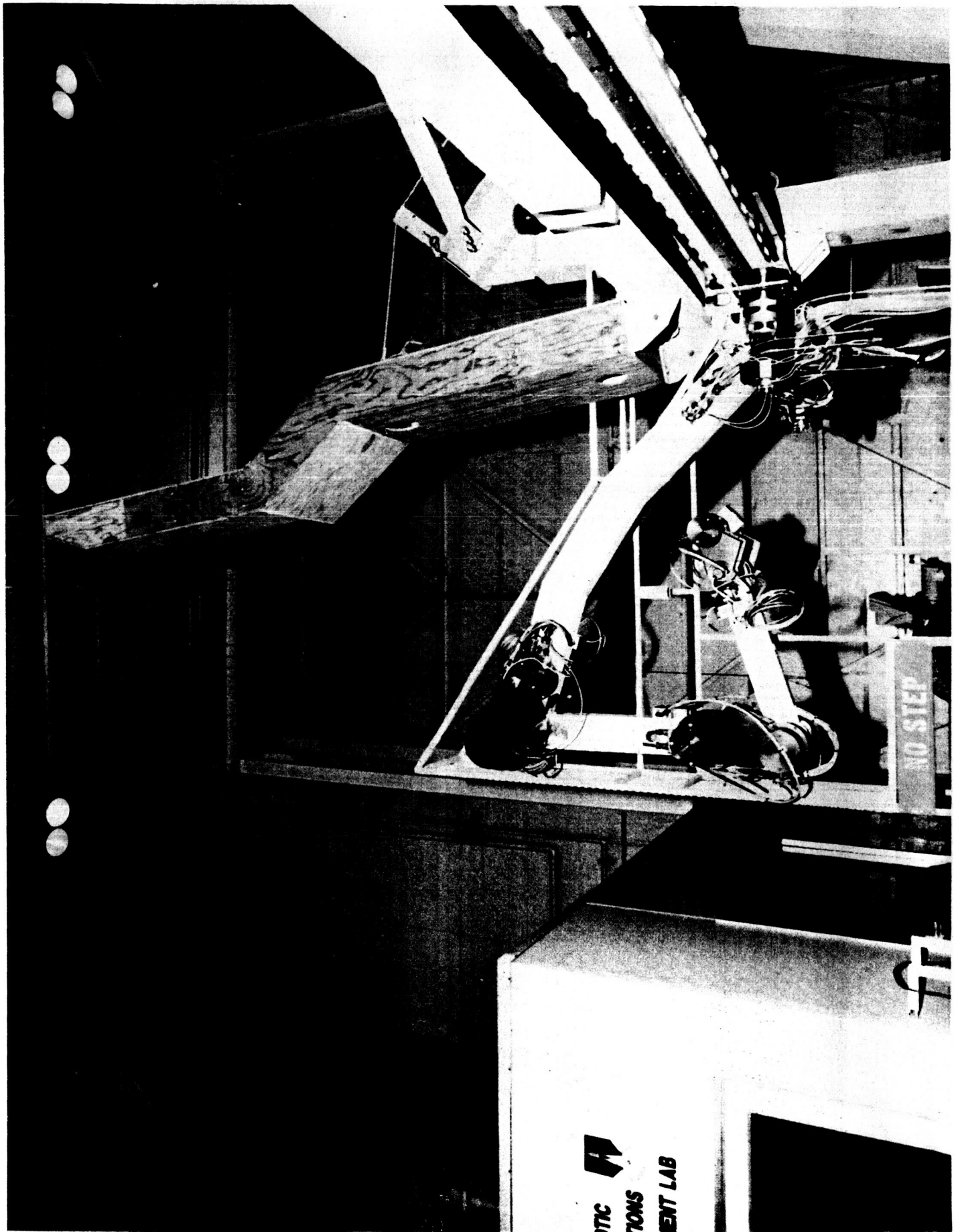
- 4 DEGREES OF FREEDOM – X, Y,Z, θ 3 PRISMATIC, 1 ROT
- USES EXISTING BRIDGE CRANE RAIL
- PORTABLE FOR USE AT PADS A & B
- END EFFECTORS
 - PARTICULATE COUNTER
 - AIR VELOCITY PROBE
 - LASER DISPLACEMENT SENSOR
 - CCD COLOR CAMERA



**AUTONOMOUS INSPECTION OF ORBITER
RADIATORS FOR DAMAGE WHILE IN THE
ORBITER PROCESSING FACILITY**

ARID DESIGN FEATURES

- **RADIATOR DAMAGE DETECTED BY DIGITIZED
IMAGE COMPARISON**
- **FRAME SHIFTING TO ACCOMMODATE ORBITER /
DOOR POSITIONING TOLERANCES**
- **IMAGE SIZE 4" X 4"**
- **INSPECTION TOOL SPEED 2.6 IN / SEC**
- **ESTIMATED INSPECTION TIME 4.5 HOURS**



The KSC Advantage

**KSC OFFERS A LOCATION FOR ROBOTS
TO PERFORM WORK ON GENUINE SPACE HARDWARE.**

WHERE

**ROBOTIC SYSTEMS CAN BE PERFECTED
MISTAKES CAN BE CORRECTED
ROBUSTNESS CAN BE PROVEN**

**ON THE GROUND IN A SAFE, SHIRT SLEEVE
ENVIRONMENT.**