

# 'TECHNOLOGY 2004

## *Paper Abstract*

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**Gov't Agency/Lab The Subject Technology Was Developed By/For:**

NASA/ Jet Propulsion Laboratory  
California Institute of Technology

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**Paper Title:** A Fault-Tolerant Intelligent Robotic Control System

**Category:** Advanced Manufacturing

**Description (use additional sheet if necessary):**

**This research project** involves development of path planning and graphical user interface software at an operator workstation and a manipulator control system (MCS) which translates the commands from the user workstation to control the robot arm. The path planning software developed allows a user to define a path superimposed on a video image of an object. This path is then translated into a set of commands for the robotic arm. The MCS provides rapid error detection and recovery to ensure that control is retained over the arm in the presence of at least one (and in many cases, multiple) hardware or software failure. The workstation provides error detection and recovery for higher level failures with a longer response time. Three major areas of commercial application of the technology are being developed: - **Real time fault tolerance:** The executive layer of the fault-tolerant Manipulator Control System (MCS) being developed is a real time distributed fault tolerant control platform. Our design requirement is to achieve a recovery time of less than 40 milliseconds. This short recovery time opens a new domain of real-time control systems in transportation and avionics as well as robotics. - **Application of robots in safety critical applications:** The physical and logical redundancy used in the fault-tolerant Manipulator Control System will provide an added level of safety within the control system. After being proven in the development and testing process, this will allow a relaxation of some current safety limitations on the use of the robotic arm, (e.g., it may be possible for humans and the robotic arm to work in closer proximity in emergency situations such as fire and rescue). - **Advanced Path planning:** The advanced path planning capability allows an operator to easily define a new path for an object to be traversed for inspection, diagnosis, painting, machining, or other purposes. This capability could be used in a variety of industrial applications, (e.g. complicated clothing patterns could be easily input into a cutting machine in the apparel industry, automated two-dimensional inspection, painting, riveting, and welding operations are made possible in ship building, construction, and aircraft manufacturing).