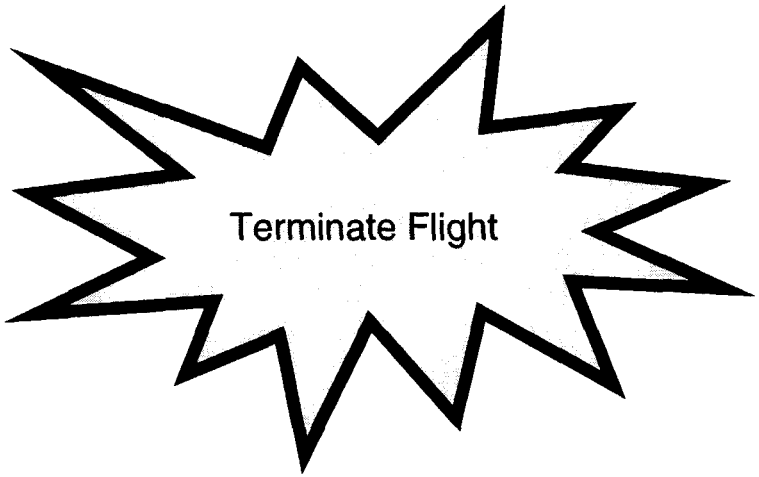

Contingency Software in Autonomous Systems

OSMA Software Assurance Symposium
July 20-July 22, 2004

Robyn Lutz, JPL/Caltech & ISU

Stacy Nelson, Nelson Consulting/QSS

This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, and at NASA Ames Research Center, under a contract with the National Aeronautics and Space Administration. The work was sponsored by the NASA Office of Safety and Mission Assurance under the Software Assurance Research Program led by the NASA Software IV&V Facility. This activity is managed locally at JPL through the Assurance and Technology Program Office

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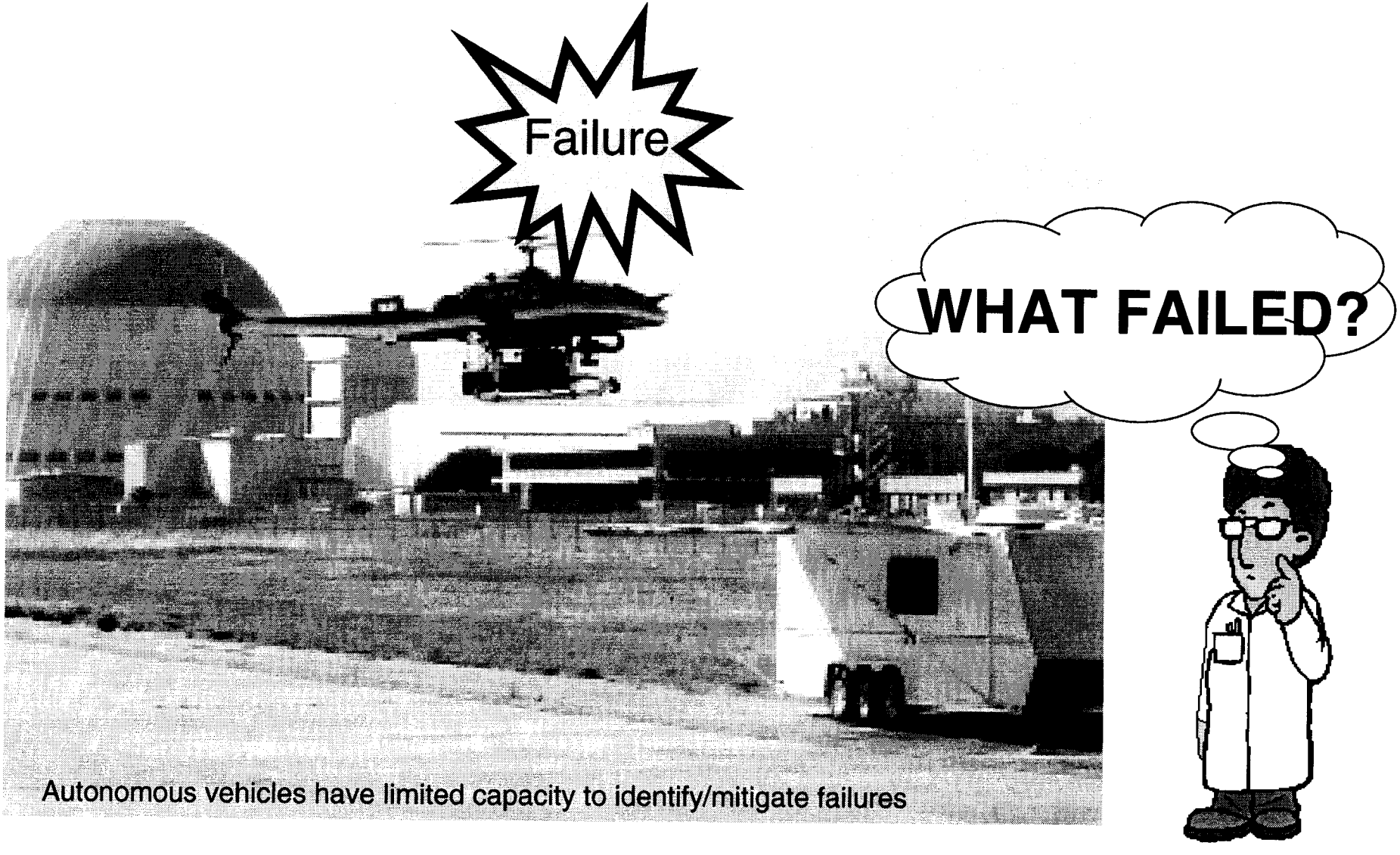
Problem



Autonomous vehicles have limited capacity to identify/mitigate failures

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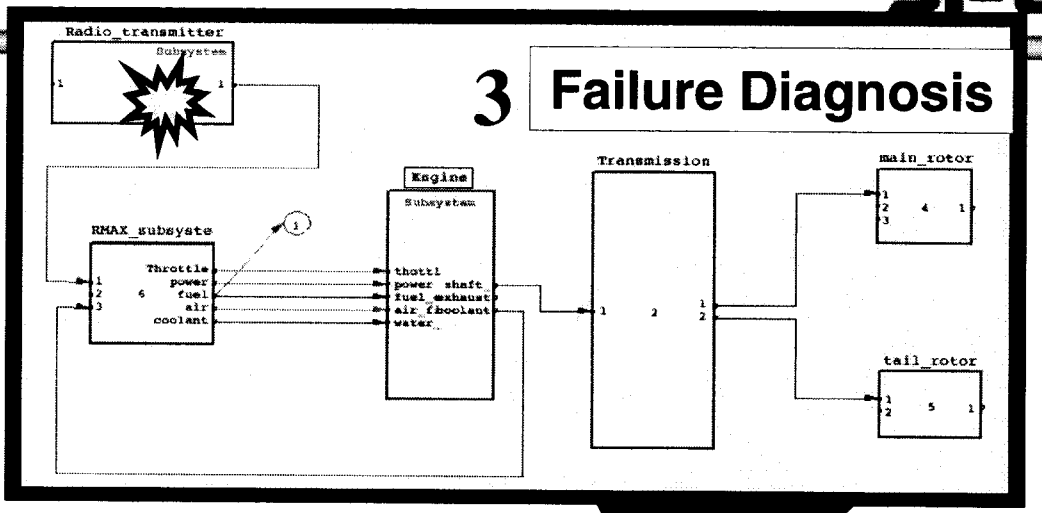
Approach



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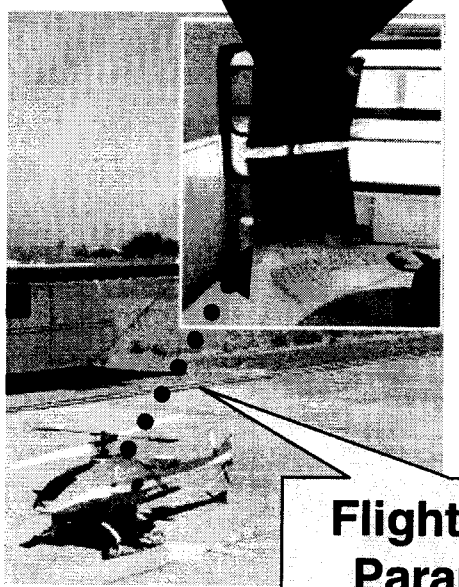
SAFE Vehicle
(Software Adjusts Failed Equipment)



Flight Critical Parameters

- Enhance diagnostic techniques to identify failures
- Provide software contingencies to mitigate failures
- Perform tool-based verification of contingency software and
- Apply results to ARP (and MSL) to pave the way to more resilient, adaptive unmanned systems

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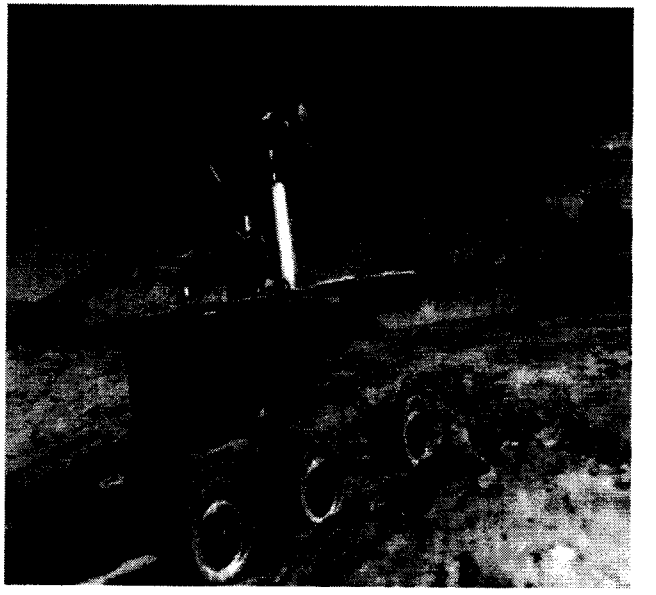
Importance/Benefits

Mitigate failures via software contingencies resulting in safer, more reliable autonomous vehicles in space and in FAA national airspace

Contingency Software in Autonomous Systems

Relevance to NASA



- Adding intelligent diagnostic capabilities by supporting incremental autonomy
- Responding to anomalous situations currently beyond the scope of the nominal fault protection
- Contingency planning using the SAFE (Software Adjusts Failed Equipment) approach

Contingency Software in Autonomous Systems

Accomplishments

✓ Finalized SW contingencies for Communications & Perception with ARP team

✓Delivered report identifying these contingencies (Q3 deliverable)

✓ARP team including us in team meetings and Project Mgr has agreed to try contingencies appearing viable. Considers further investigation & simulation high priority for 4 identified SW Contingencies

✓Participated in DART demo at ARC

Contingency Software in Autonomous Systems

Next Steps

- ***More detailed analysis of SW contingency triggers & required functionality***
- ***Tool-based verification of ARP contingency software***
- ***Begin planning for MSL SW contingencies***
- ***Collaborate with Martin Feather to use the DDP tool to assess risk for SW Contingency plans***