# At a Glance

### What is it?
- The Shipboard Autonomous Firefighting Robot (SAFFiR) is a human-sized autonomous robot capable of finding and suppressing shipboard fires and working seamlessly with human firefighters.

### How does it work?
- Humanoid robot with 24 DOF
- Parallel actuated biped with linear actuators in a bio-inspired geometry
- Capable of omni-directional walking, balancing in sea state conditions and traversing obstacles
- Capable of manipulating fire suppressors (e.g. nozzles)
- Can use existing thermal shielding equipment
- Capable of autonomous navigation of shipboard environment with appropriate sensor suite

### What will it accomplish?
- Fire detection, environmental monitoring and situation awareness capabilities
- Can make use of broad range of fire suppression technologies
- Able to withstand higher heat for longer periods than human firefighters
- Works with human firefighters, responds to gestures and commands

### Point of Contact
Dr. Tom McKenna
tom.mckenna@navy.mil

The objective of the shipboard autonomous firefighting robot (SAFFiR) is to develop human-centric, autonomous systems for fire safety and damage control. This will reduce ship's vulnerability to damage and decrease the recovery time while significantly reducing life cycle costs, size and weight of future damage control systems.

This technology will allow Navy to meet damage recovery mandates and reduce human risks.

The SAFFiR is a key component of a candidate Innovative Naval Prototype program – Damage Control Technologies for the 21st Century (DC-21).

DC-21 would provide shipboard situation awareness and damage control capabilities through the combination of:
- Smart sensors in ship spaces to provide alerts based on detection of gases and incipient fires
- Microflyers to provide rapid response and 3-D mapping of fire and damage
- SAFFiR firefighting robots to aid humans in suppressing fire and provide situation awareness
- Advanced fire suppression technology suitable for robotic deployment
- Advanced human-robot interaction technologies, including gesture and natural language dialog, to enable teaming with human firefighters

### Research Challenges and Opportunities:
- Humanoid locomotive mechanisms with multiple degrees of freedom, achieving dynamic stability in shipboard environment and ability to manipulate tools
- Sensing and navigation of micro-flyers and humanoid in adverse environments with smoke, heat gradients, etc.
- Hardening of robot components for heat resistance
- Higher control level of robot for maneuvering and supervisory control with human firefighters
- Suppression techniques tailored for robotic systems