



Risk Management at NASA and Its Applicability to the Oil & Gas Industry

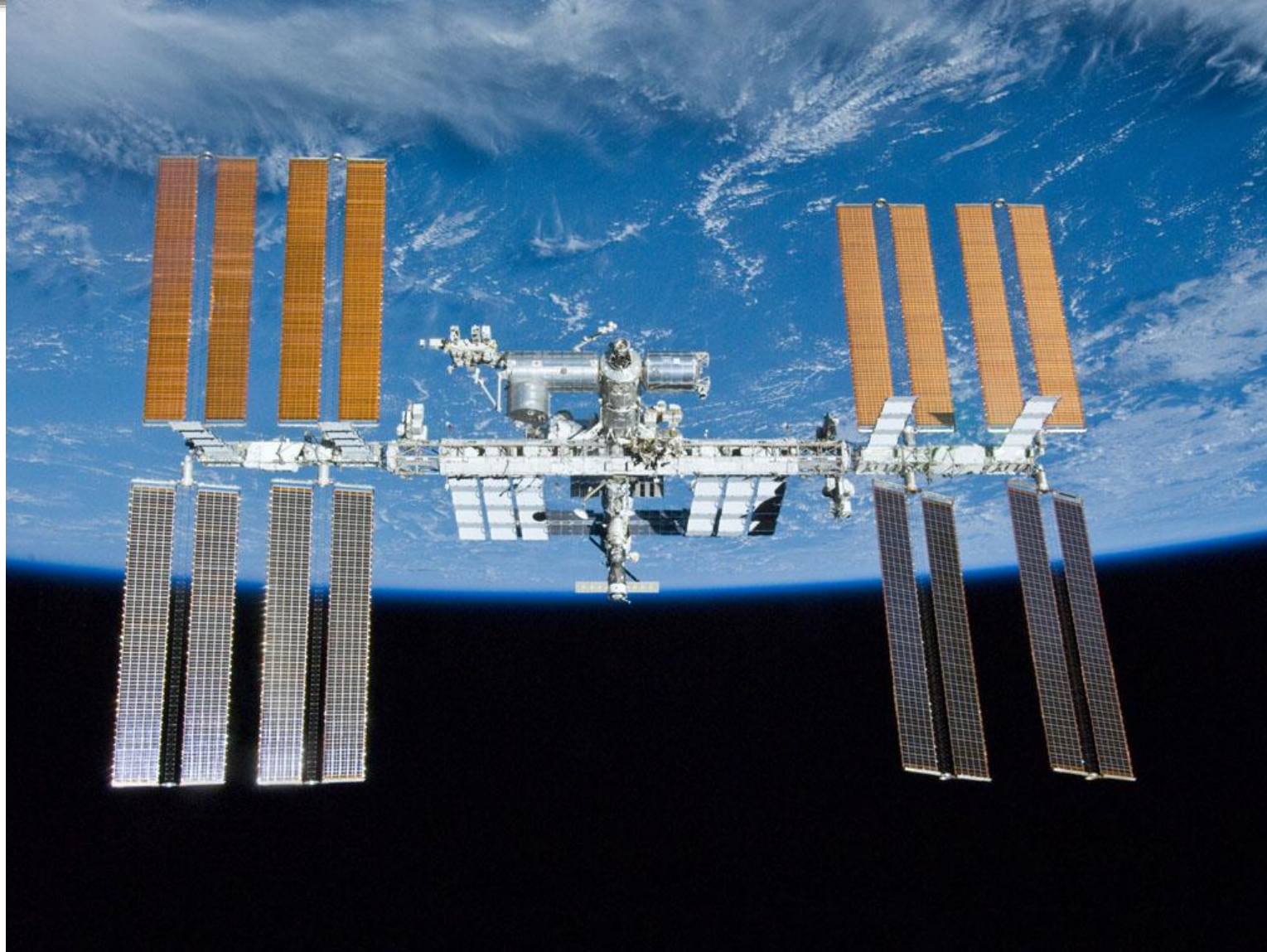
IADC ADVANCED RIG TECHNOLOGY CONFERENCE

September 13, 2016

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International Space Station



International Space Station

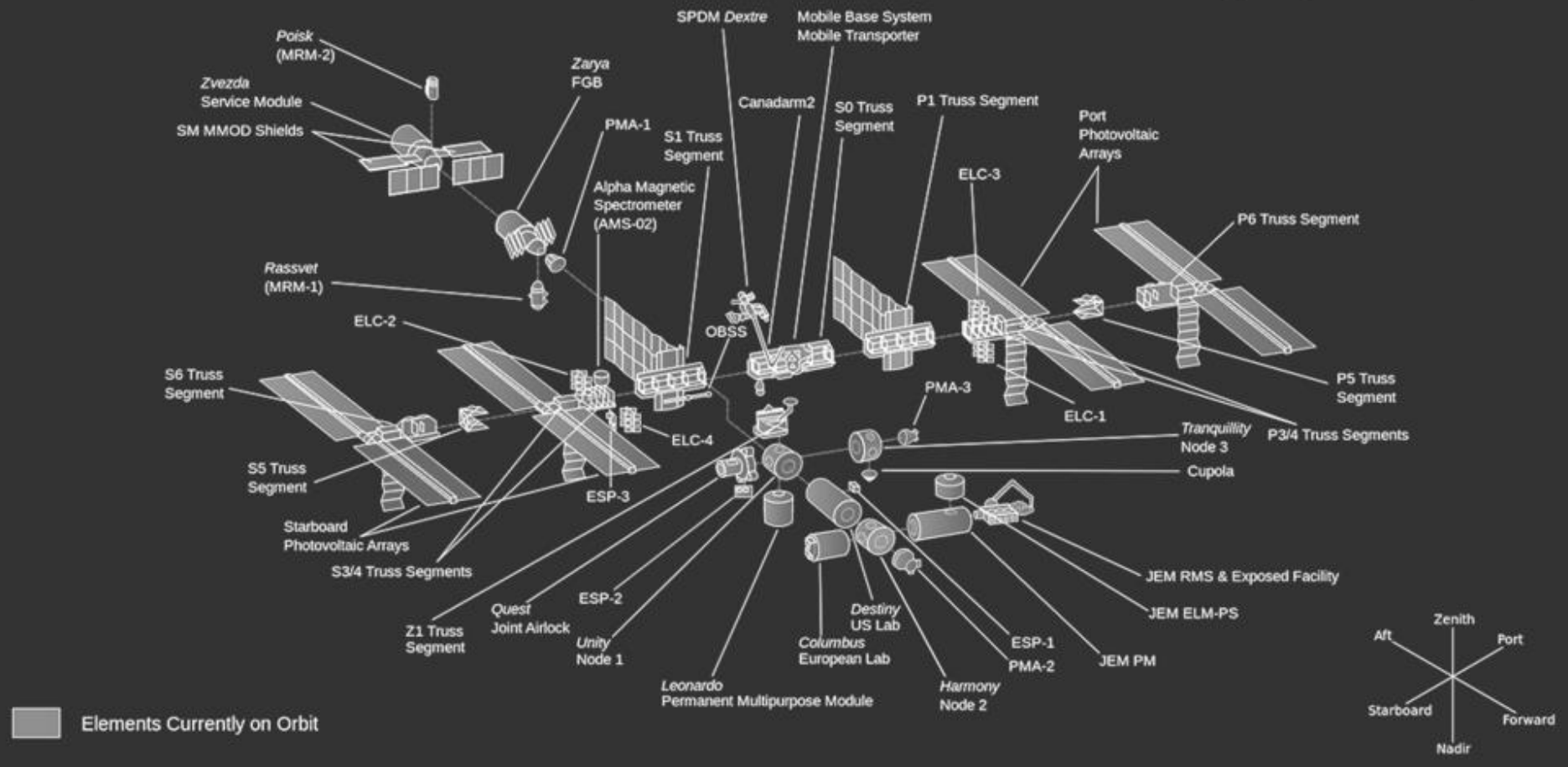


International Space Station

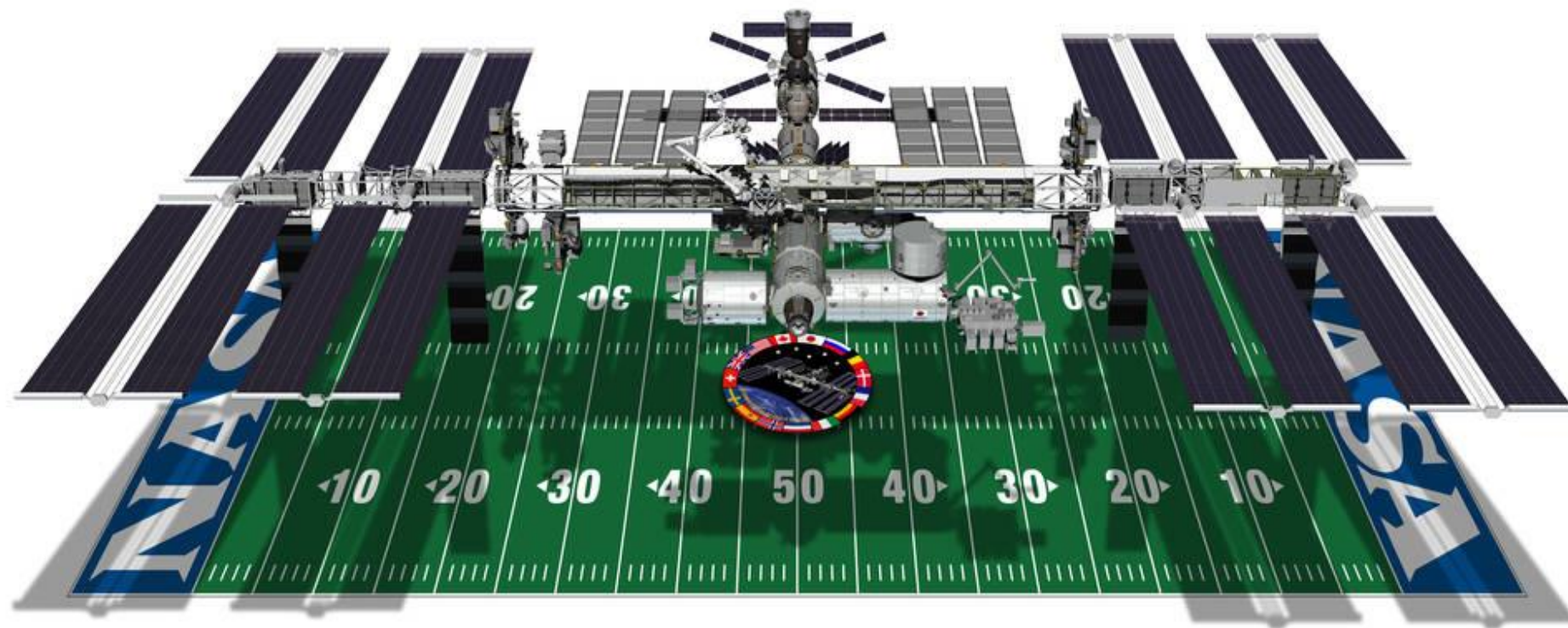


ISS Configuration

As of May 2011 (ULF6 - STS-134)



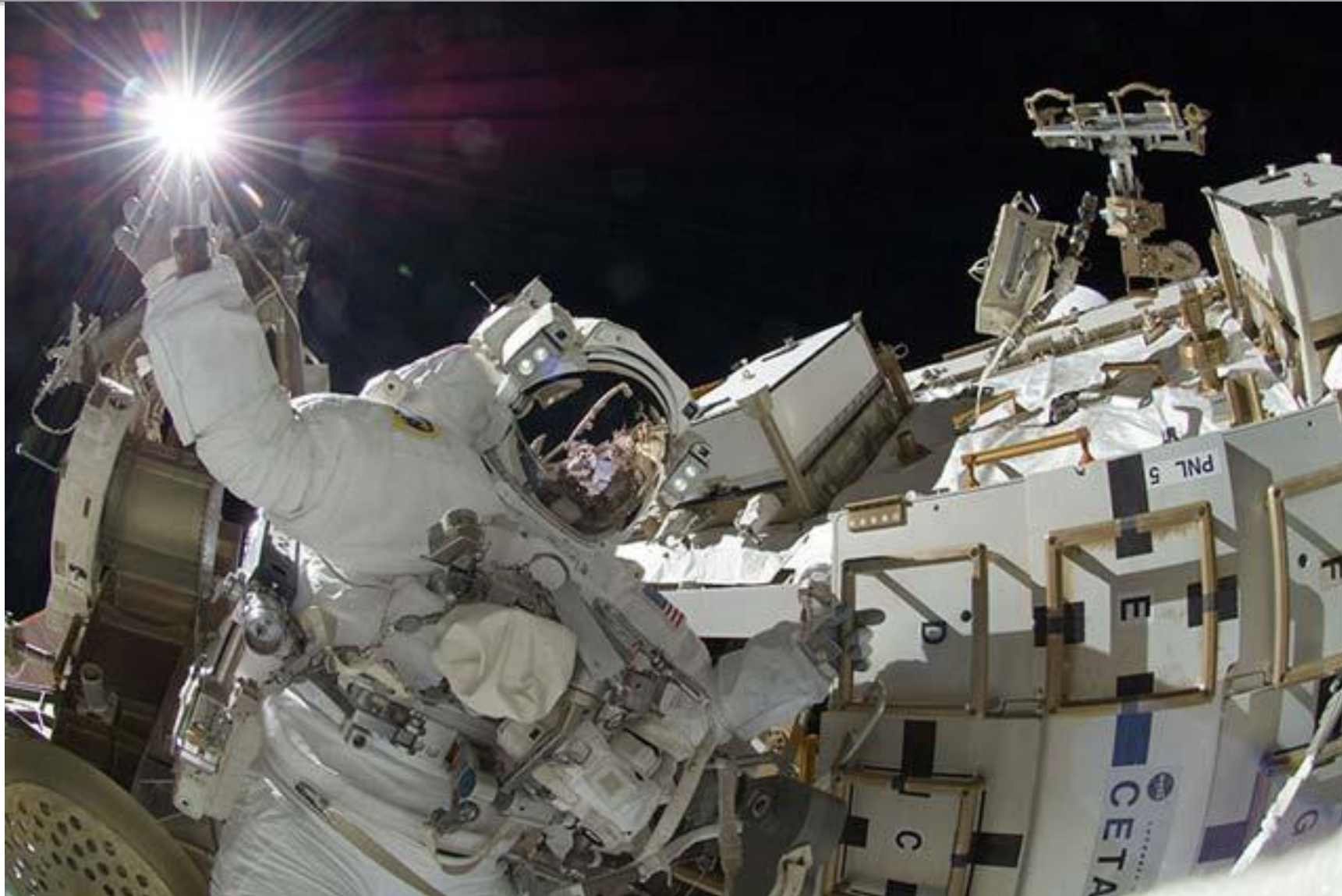
International Space Station



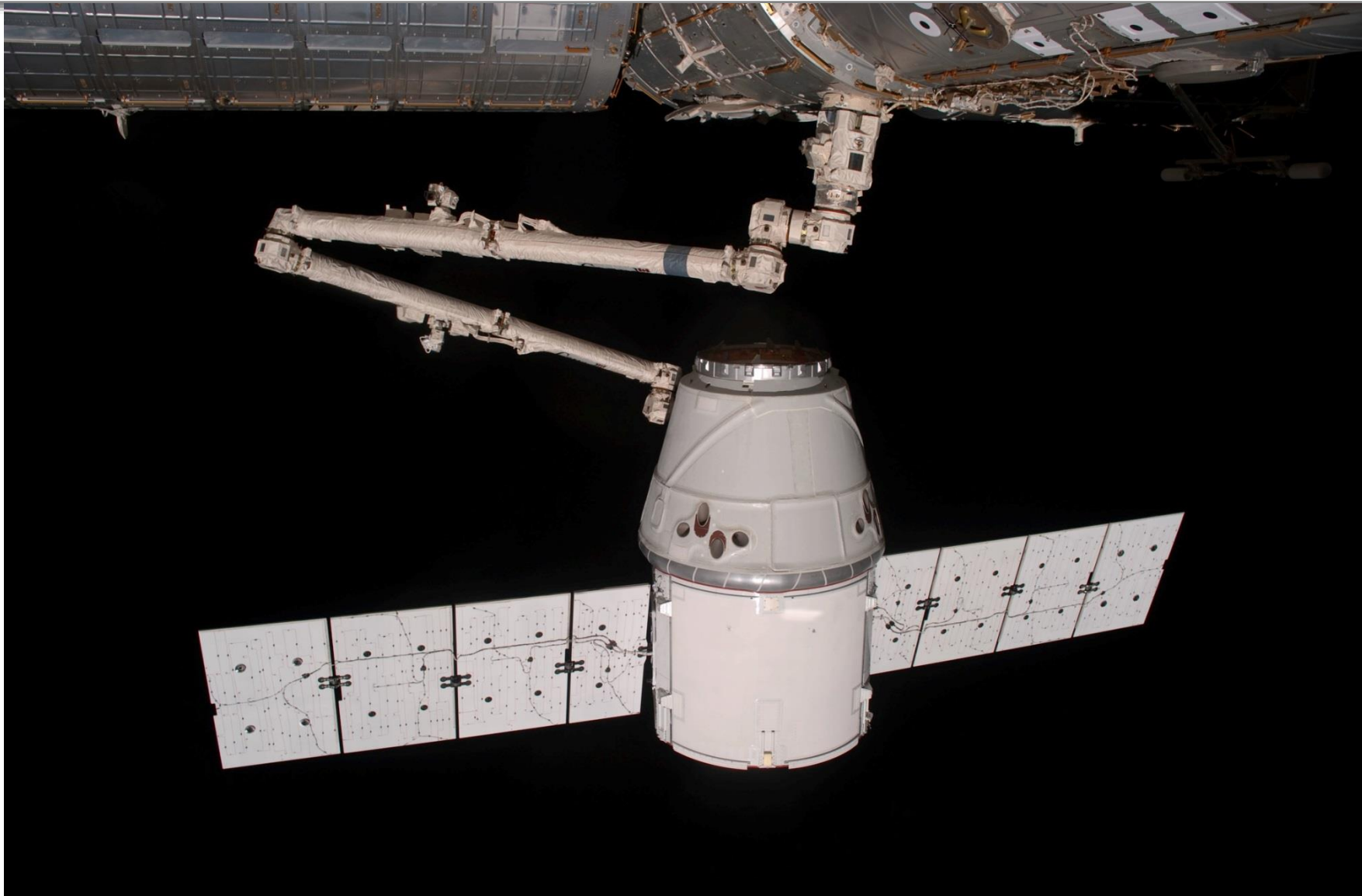
Complex Operations Dependent on Human Involvement



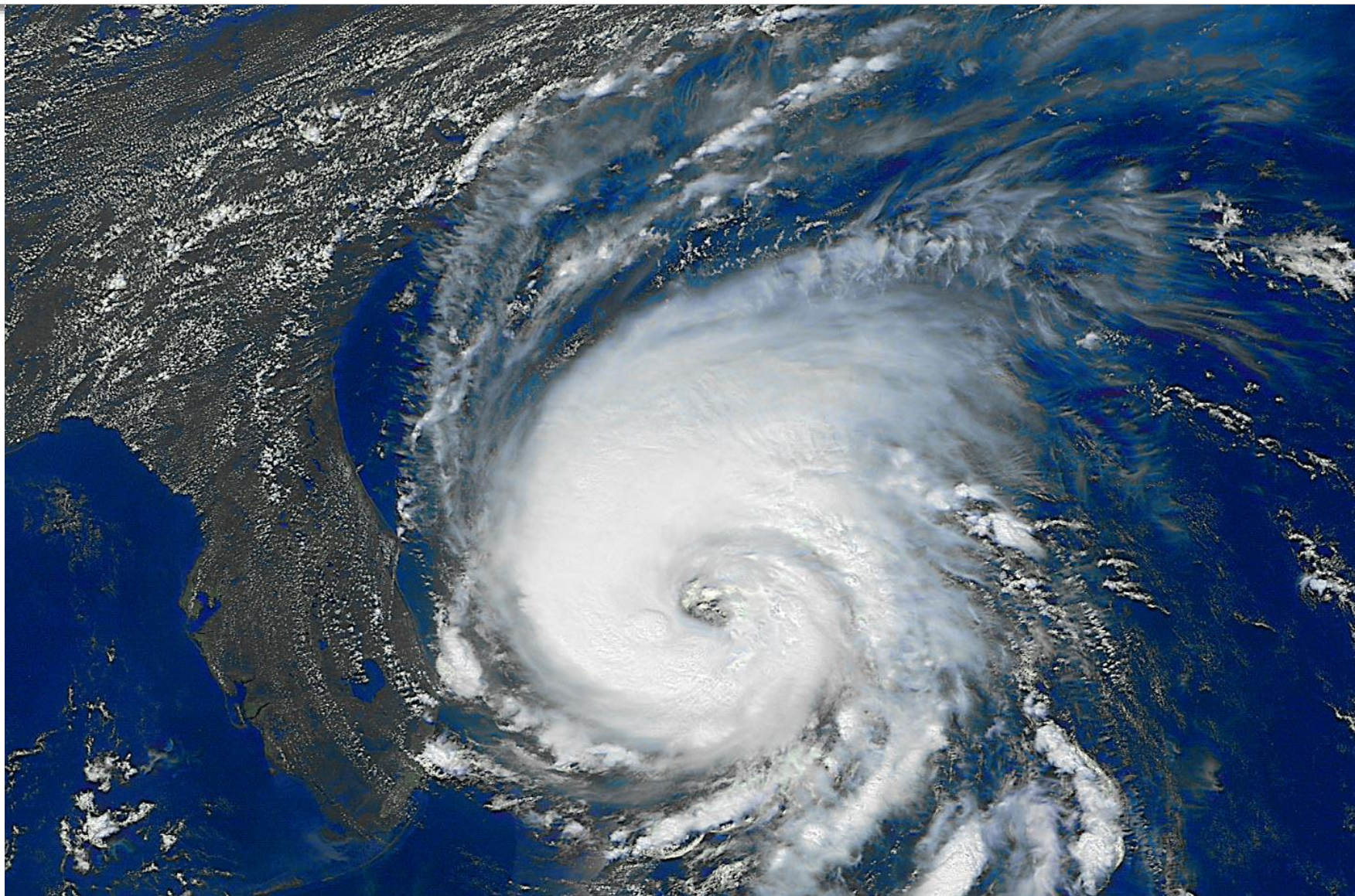
Repair and Maintenance Operations in a Hostile Environment



Ongoing Resupply Operations



Isolated and Not Easily Accessible





PRA's are used to model and quantify ***RARE EVENTS***

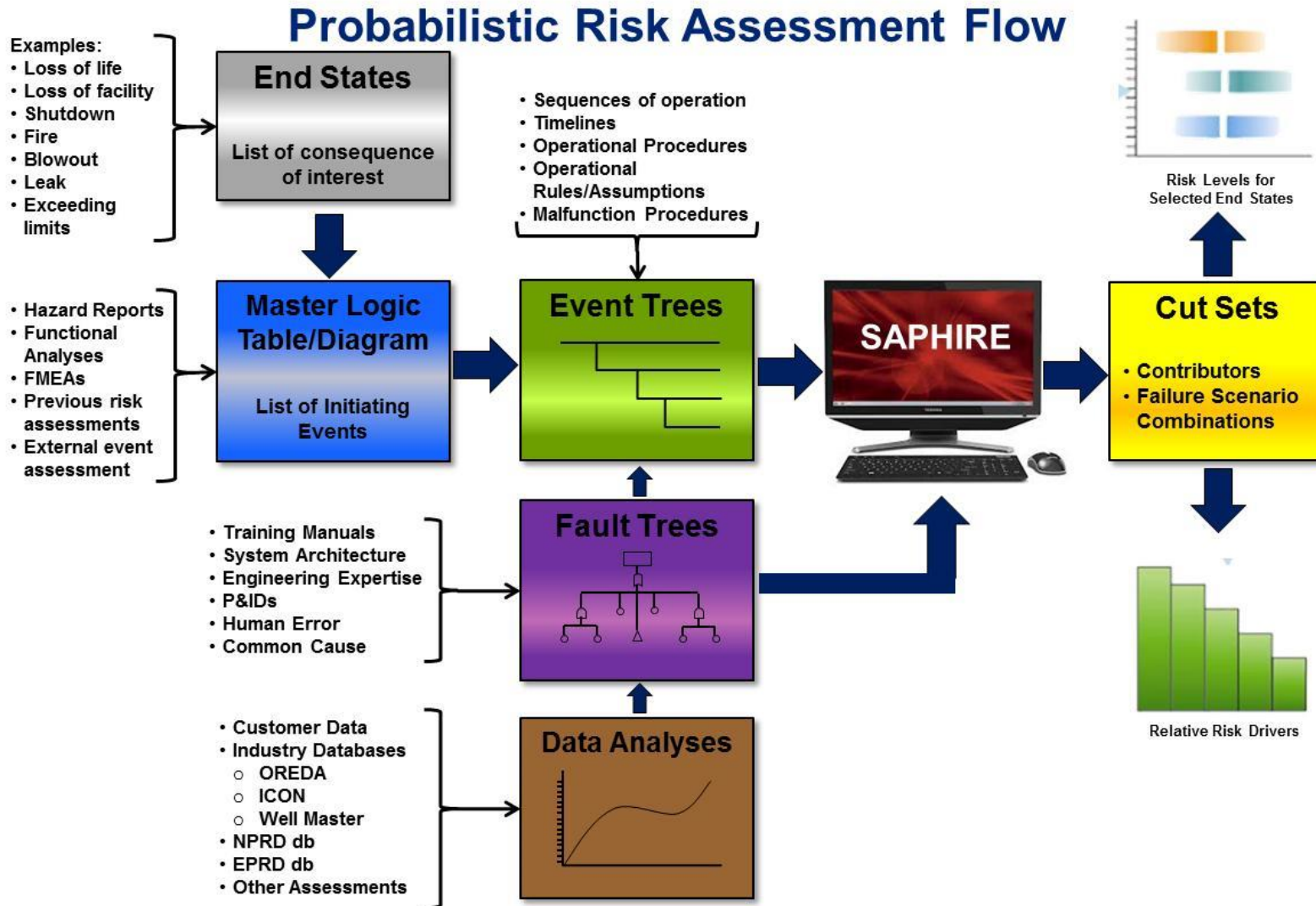
- If we had 100,000 space stations operating for 40 years each with a catastrophic failure of 500 of them, then we could do standard statistics to estimate the probability of catastrophic failure of a space station
- We have only one space station, and it has had minimal experience and no catastrophic failures. Consequently, there will not often be any statistically significant data.



PRA's systematically connect design, logic, operations, human interaction and external influences for all aspects of large complex machines/processes to detect dependencies and effects that the human mind just could not track and grasp on its own.

- » Human Reliability
- » Common Cause

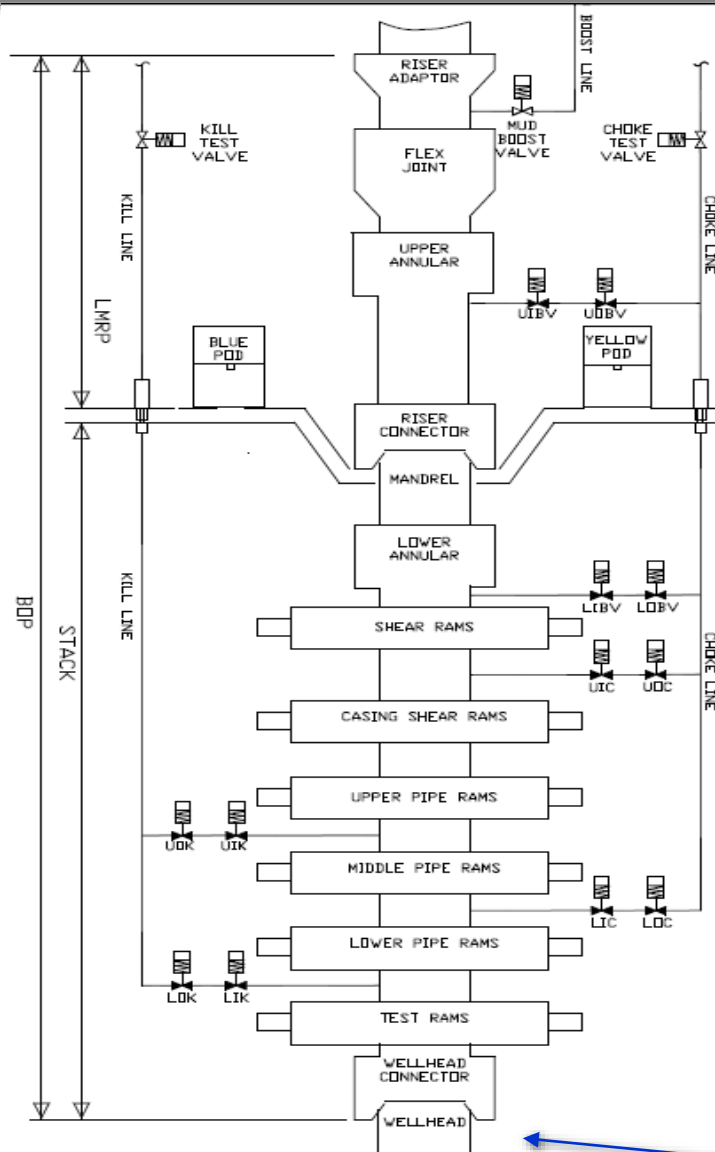
Probabilistic Risk Assessment (PRA)





Generic BOP Modeled

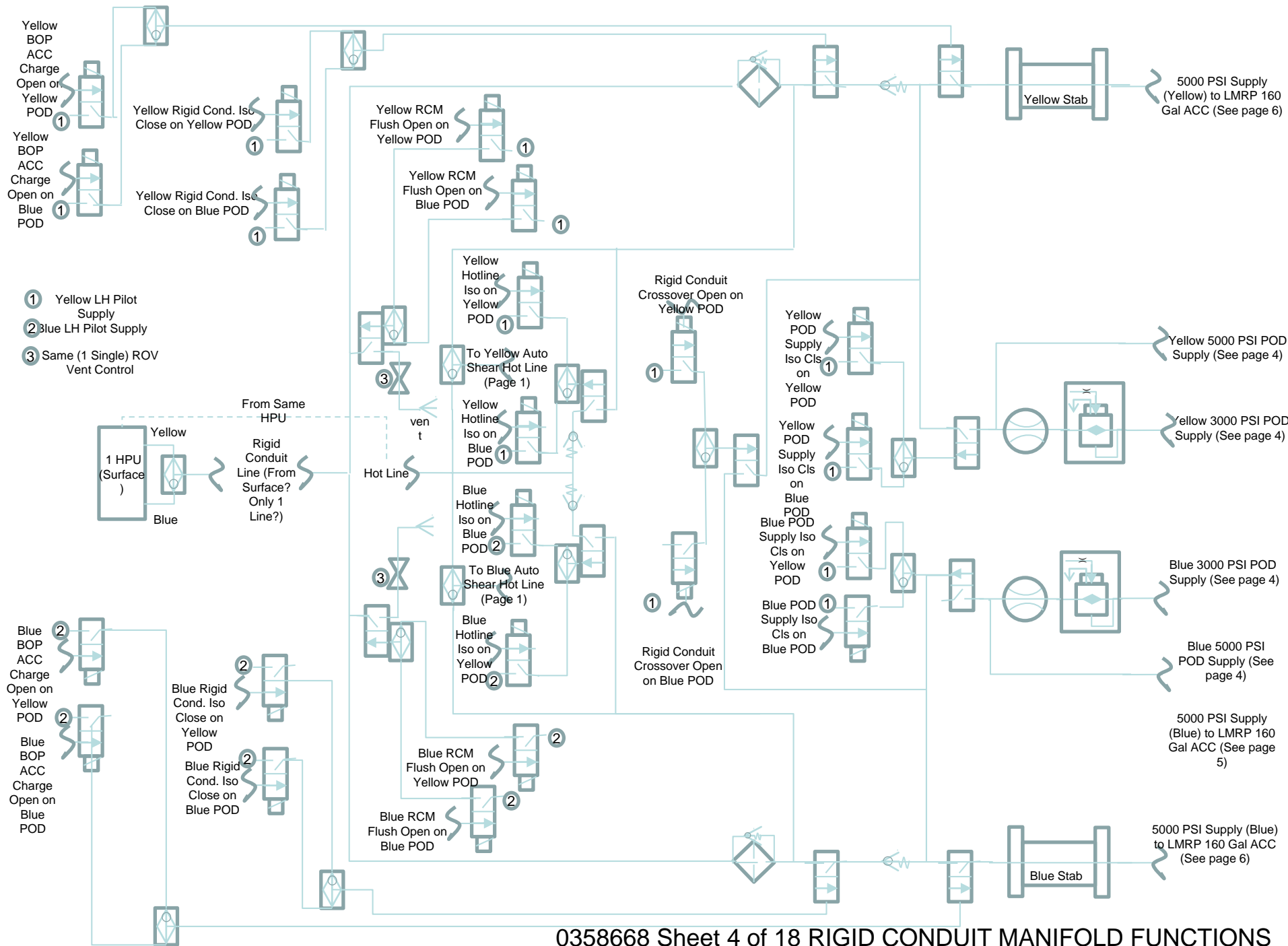
Under a SPACE ACT AGREEMENT between NASA and **Anadarko Petroleum Corporation**, JSC has completed a PRA for a **generic 20,000 psi Blowout Preventer (BOP)**



- Riser Adapter
- Flex Joint
- Upper Annular
- Riser Connector
- Mandrel
- Lower Annular
- Shear Rams
- Casing Shear Rams
- Upper Pipe Rams
- Middle Pipe Rams
- Lower Pipe Rams
- Test Rams
- Wellhead Connector
- Wellhead

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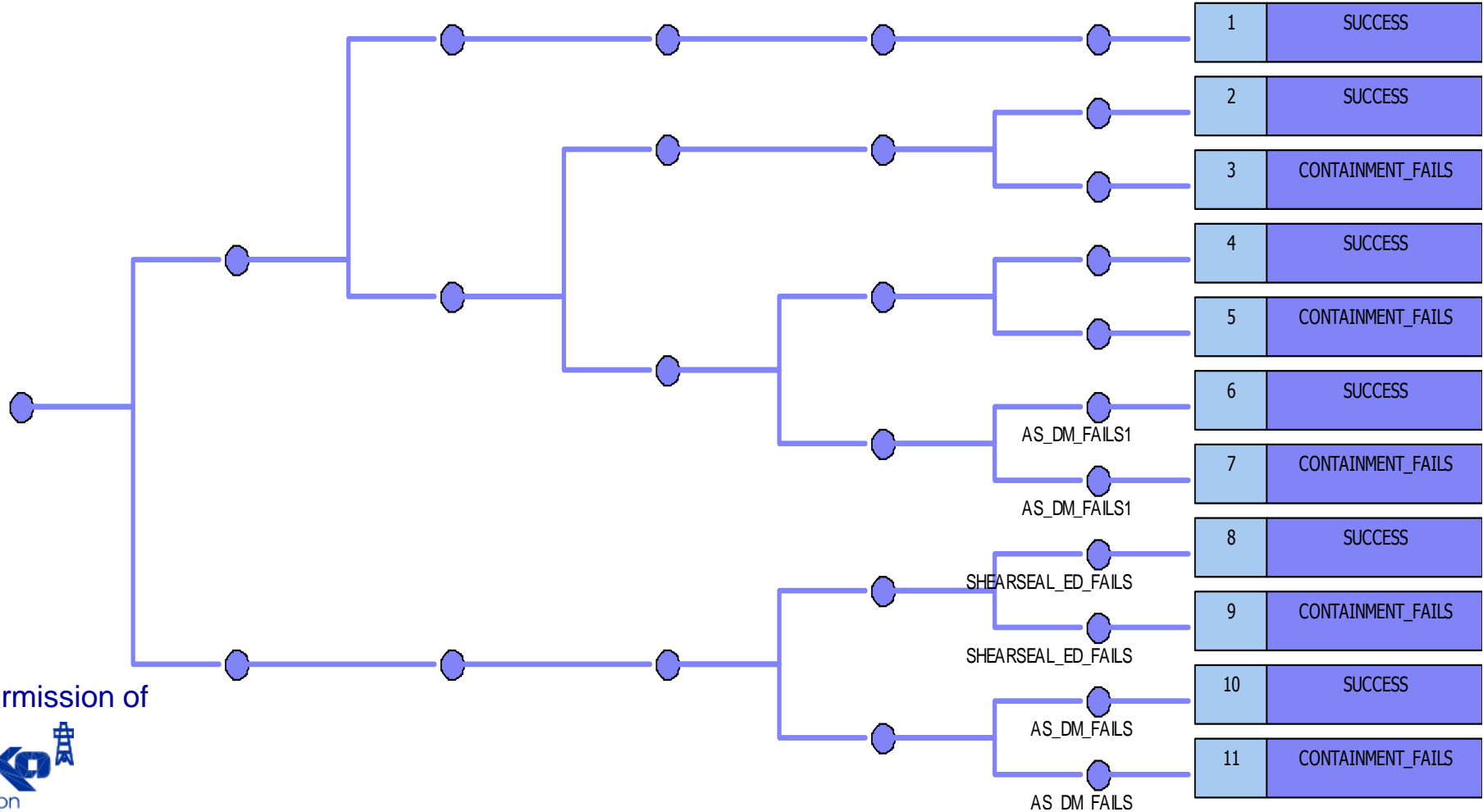




Representative Event Tree

Assumes a disconnect is needed (planned and unplanned)

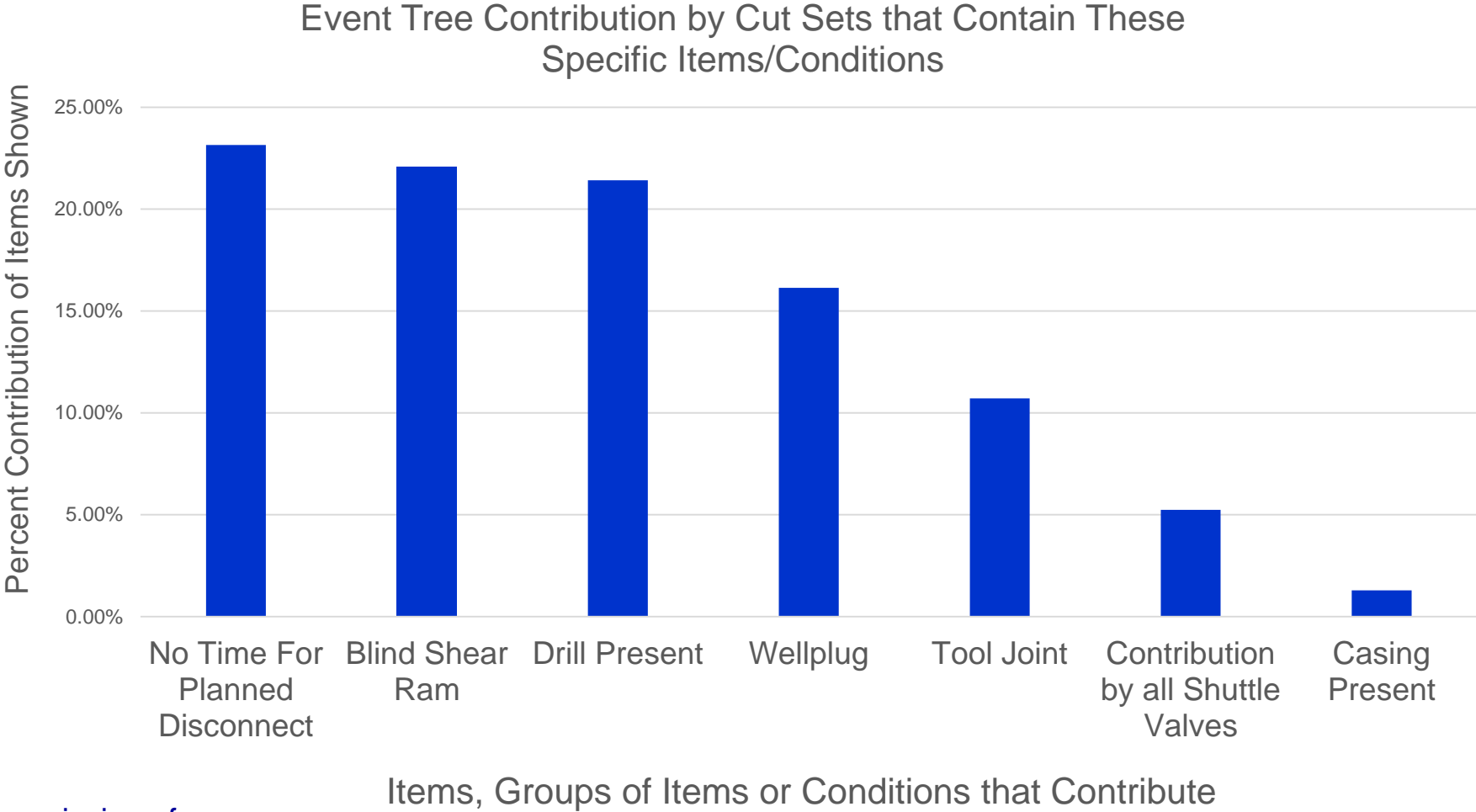
	Not all situations allow enough time for a planned disconnect	If a planned disconnect is possible then a plug is installed and it could fail	Planned disconnect attempted and fails	Emergency disconnect attempt fails	Proper shearing and sealing piping as needed fails to be achieved	#	End State (Phase -)
INIT-EV2	TIME-FOR-PLANNED-DISC	PLUG-FAILS	PLANNED_DISCONNECT_FAILS	EMERGENCY_DISC_FAILS	SHEAR-AND-SEAL_FAILS		



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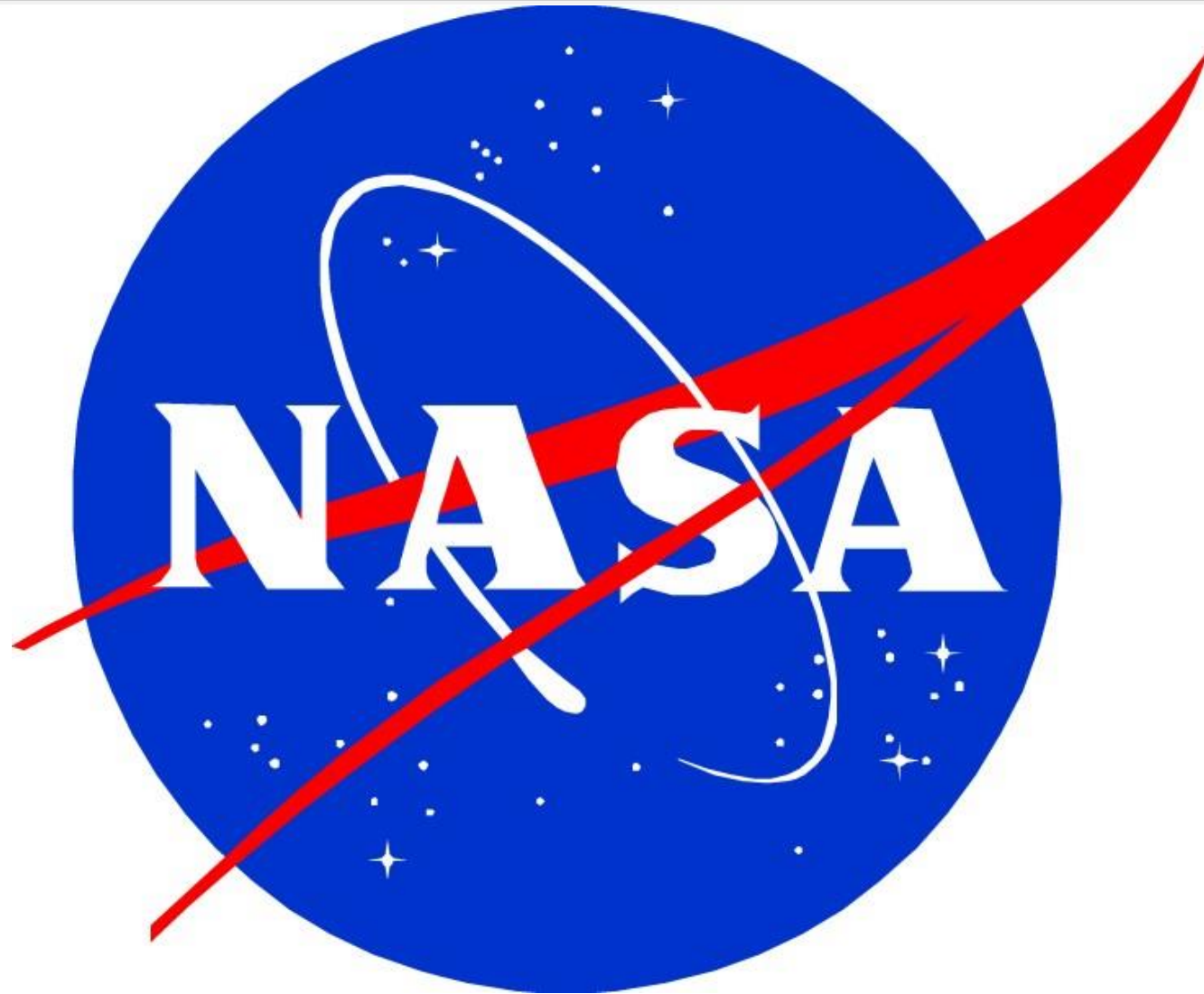


Disconnect Failure: Top Contributors



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Mission Statement: The Bureau of Safety and Environmental Enforcement (BSEE) works to promote safety, protect the environment, and conserve resources offshore through vigorous regulatory oversight and enforcement.

NASA – BSEE Interagency Agreement

The screenshot shows the BSEE website's newsroom page. At the top left is the BSEE logo (Bureau of Safety and Environmental Enforcement) and a navigation bar with links for 'Operating Status', 'Sitemap', 'Contact Us', 'Careers', and a search box. Below the navigation bar is a dark menu with categories: 'About BSEE', 'Newsroom', 'Regulations & Guidance', 'Inspections & Enforcement', 'Exploration & Production', 'Technology & Research', and 'International & Interagency Collaboration'. The main content area is titled 'Home Page > BSEE Newsroom' and features a news article titled 'BSEE, NASA Announce Agreement to Examine Risk Offshore' dated '03/17/2016 WASHINGTON'. The article text states that BSEE and NASA have announced a five-year agreement to share risk management approaches. A quote from BSEE Director Brian Salerno follows. A bulleted list of three primary objectives is provided, with blue arrows pointing from external text on the right to the second and third items. The article concludes with a paragraph about NASA's probabilistic risk assessment technique and a final quote from Jack James at the Johnson Space Center.

BSEE, NASA Announce Agreement to Examine Risk Offshore

03/17/2016
WASHINGTON

The Bureau of Safety and Environmental Enforcement (BSEE) and The National Aeronautics and Space Administration (NASA) have announced a five-year agreement allowing BSEE to capitalize on the best risk management approaches from the aeronautics industry to inform stakeholders and further strengthen worker and environmental safety protections on the Outer Continental Shelf.

"Both BSEE and NASA work in harsh and uncompromising environments, relying on cutting edge technology to go deeper and further than previously thought possible," said BSEE Director Brian Salerno. "This partnership brings together technical experts from BSEE and NASA to focus on the specific risks associated with offshore operations so that we can continue to find ways to improve safety for offshore workers and protect the environment."

Under the agreement, NASA will assist BSEE in achieving three primary objectives:

- further develop BSEE's risk management capability through the use of NASA's probabilistic risk assessment technique;
- evaluate, design, and test technologies and hardware, including emerging technologies and best available and safest technologies; and
- assess failures and near miss occurrences using the resources and expertise of NASA's accredited failure analysis laboratory at the Johnson Space Center in Houston.

Used by NASA, probabilistic risk assessment is a technique to quantitatively model risk. It was used in the modeling of the Space Shuttle Program and is presently being used for the International Space Station and Orion deep space capsule programs.

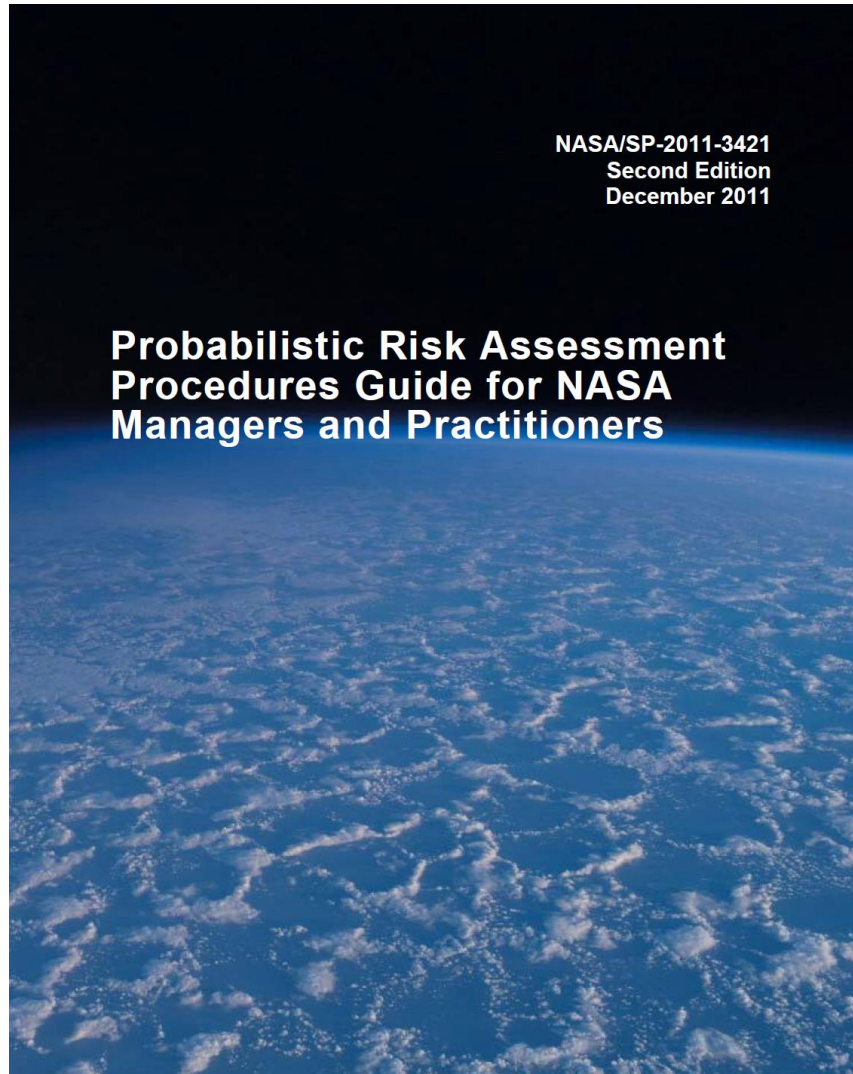
"Whether the task takes one to deep space, or into the deep ocean, the analysis of the environment, training of personnel and risk mitigation factors are similar," said Jack James, technology transfer strategist at the Johnson Space Center. "NASA is pleased to work with BSEE, and we endeavor to learn best practices from each other."

March 17, 2016

5 Year Agreement

NASA's probabilistic risk assessment technique

NASA's accredited failure analysis laboratory at the Johnson Space Center



“Probabilistic Risk Assessment (PRA) is a comprehensive, structured, and logical analysis method aimed at identifying and assessing risks in complex technological systems for the purpose of cost-effectively improving their safety and performance.”

--Introduction; page 1-1



Backup



Space Shuttle **COLUMBIA**
February 3, 2003

PRA's for Human Space Flight
[led by team at JSC]

Space Shuttle

International Space Station

Constellation Program

ExtraVehicular Activity (EVA)

Orion Capsule

Commercial Crew



Space Shuttle Program PRA

SHUTTLE PRA ITERATION 3.2 CONTRIBUTIONS BY ELEMENT OR MAJOR AREA

