NETS 2026

Space Nuclear Applications Panel – Radiation and Shielding

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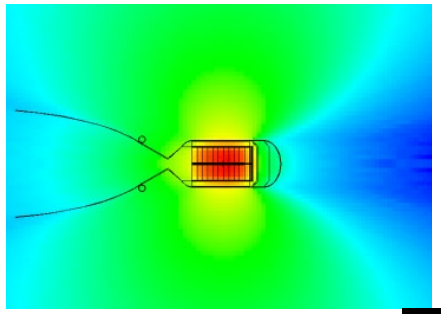
ANS® American Nuclear Society

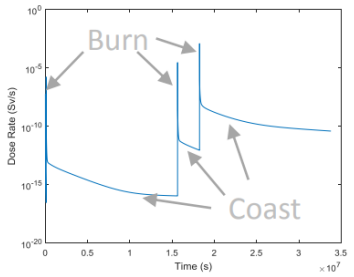
NASA

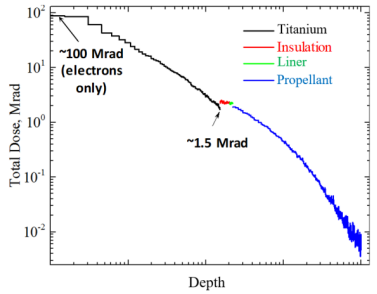
Background/Bio

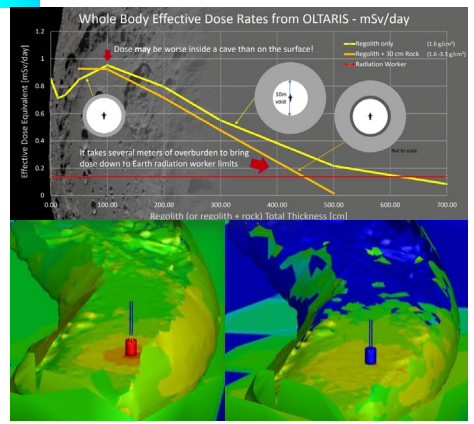
Ph.D. Nuclear Engineering – Oregon State 2017
NASA Since 2013: Intern – Pathways – Civil Service

Radiation models:
-Nuclear Propulsion engines/vehicles
-Space radiation at Earth, Moon, Europa, Planetary-caves

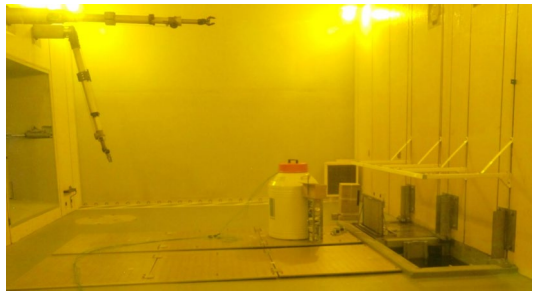




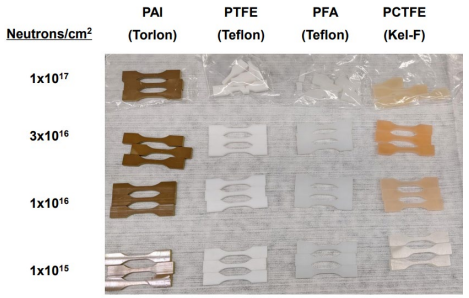




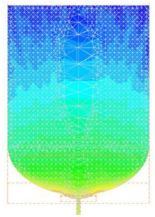
Defining the Environments

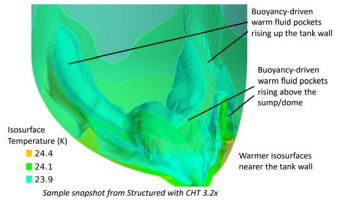


Hardware irradiation & testing:
-Polymeric engine/vehicle mat'l
-Solid rocket motor materials



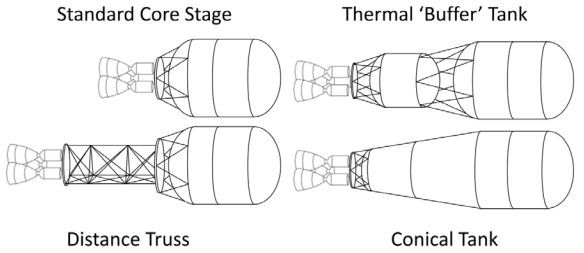
Thermal/Cryo-fluid effects



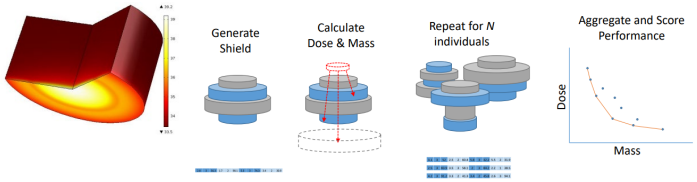


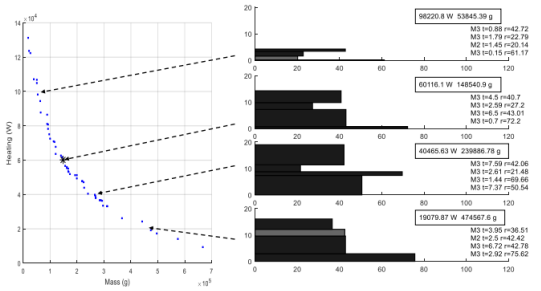
Understanding the Requirements

System Architectures



Shield Design and Optimization

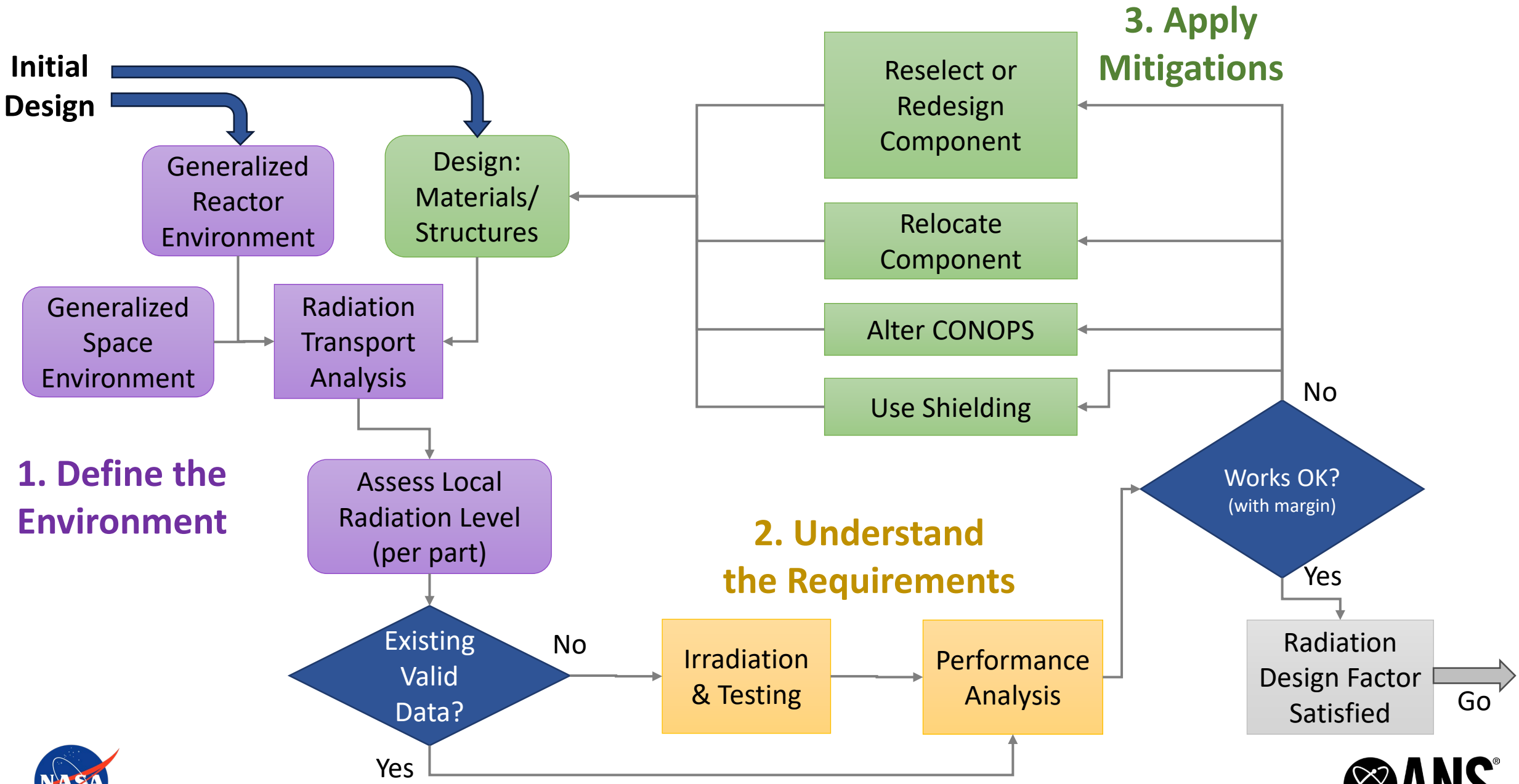




Applying Mitigations

Also… TRIGA Reactor Operator, BS Health Physics, Dosimetry/Detection

Radiation Design Lifecycle



Radiation Design Considerations

1. **Define The Environment**
   -Coarse models OK for early trades, but higher fidelity needed quickly thereafter
   -Don't neglect the 'small' contributions (e.g. scatter) – They are additive

2. **Understand The Requirements**
   -"Rad-hard" can mean many things – Read the fine print
   -Consider the relevant physics and failure modes, not just the number

3. **Apply Mitigations**
   -Shielding is dead-weight – Avoid it, plan for it, and plan for it to grow
   -Think and work at the system level – Radiation doesn't respect 'clean interfaces'
   -Include 'manufacturability' as a factor in the trade-space
   -O.O.M. Issues - 99.99% effective shield turns a flux of 10^{18} into 10^{14} (Still Big!)

DON'T FORGET ABOUT NUCLEAR HEATING