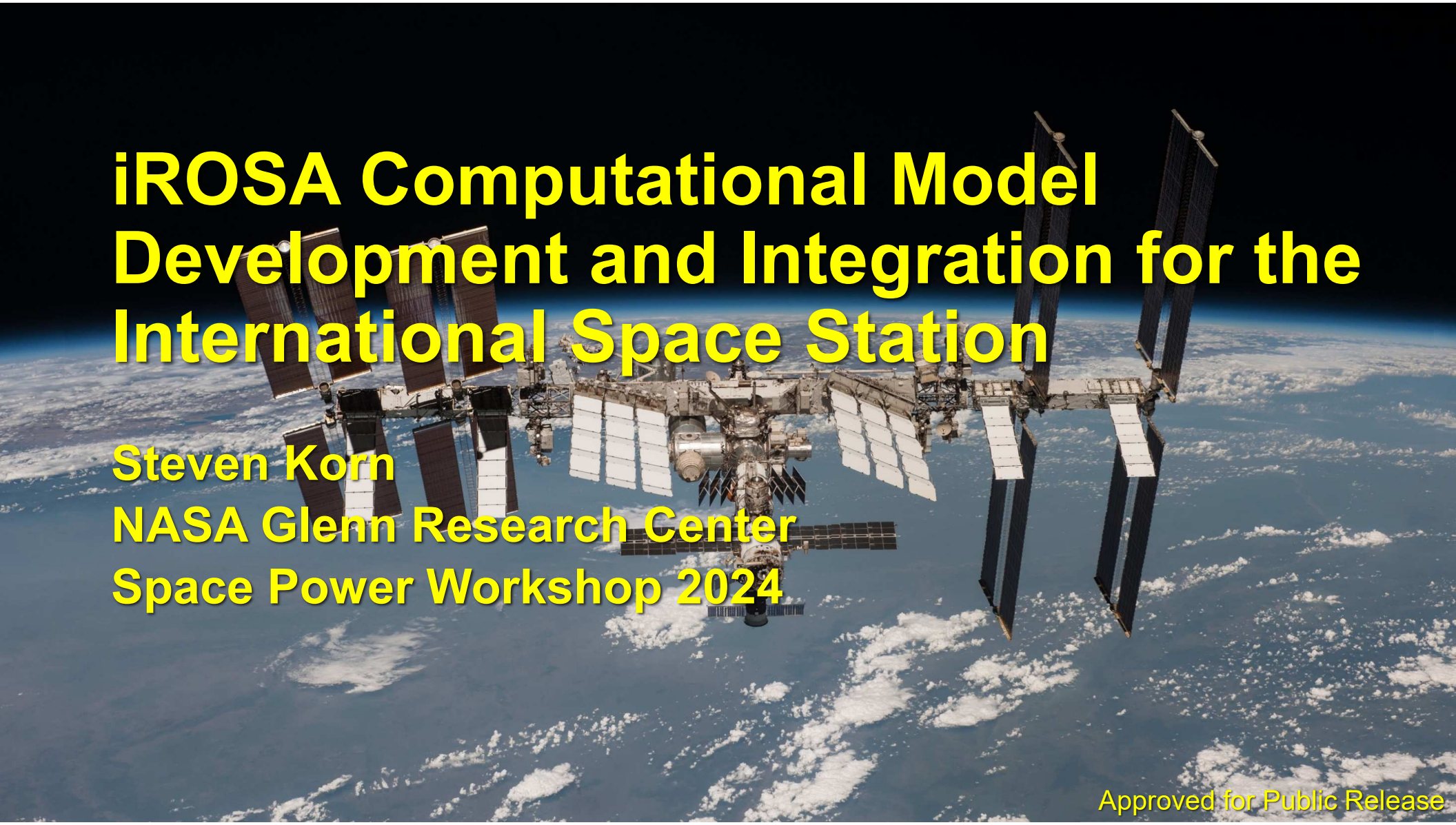
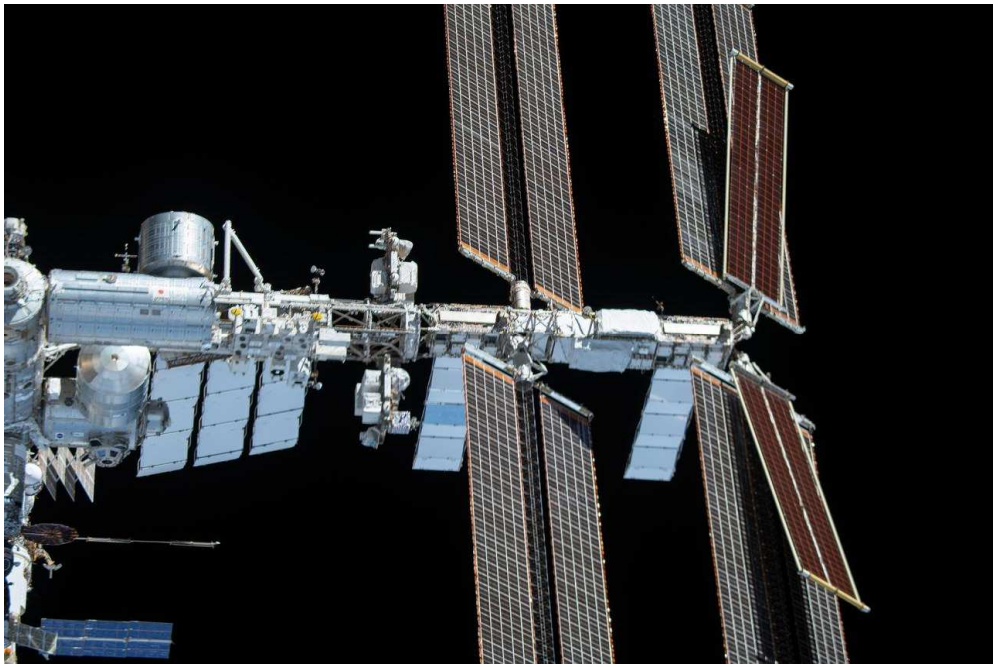


iROSA Computational Model Development and Integration for the International Space Station

Steven Korn
NASA Glenn Research Center
Space Power Workshop 2024

iROSA Installation

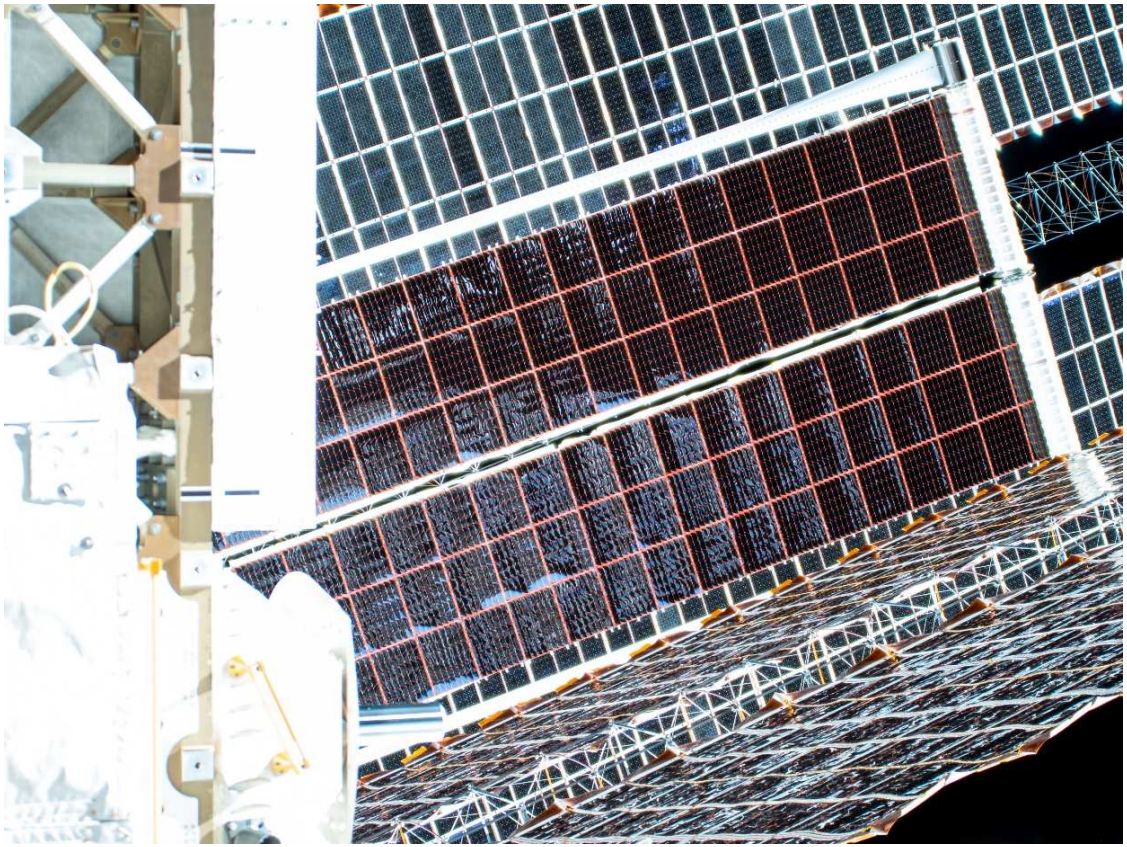


Task for SPACE-ISS Team

- Our team models the EPS of the ISS using SPACE.

- Therefore, we needed to develop and integrate the iROSA into our model.
  - Building up iROSA power calculations
  - Developing new shadowing methodologies
  - Integrating the changes into our model
  - Evaluate the completed model ahead of flight

New Cells and Layout



Different Solar Cell IV Curve

Different Solar Cell Size

Different Degradation Rates

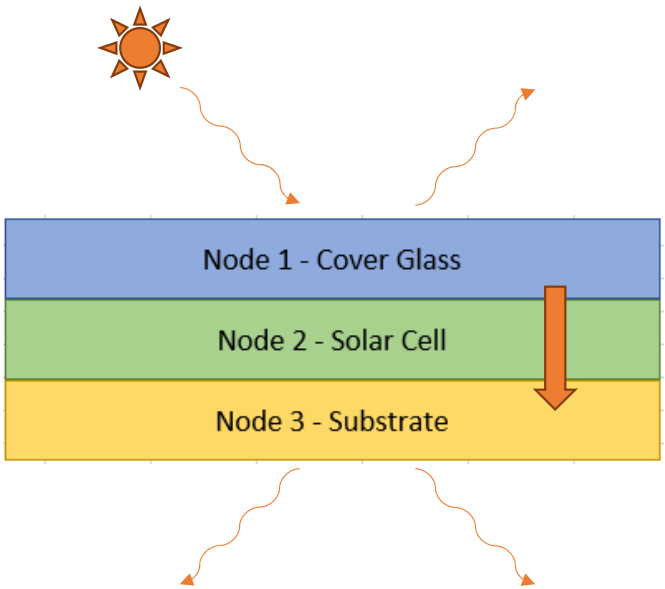
Different Temperature Coefficients

Different Harnessing Resistances

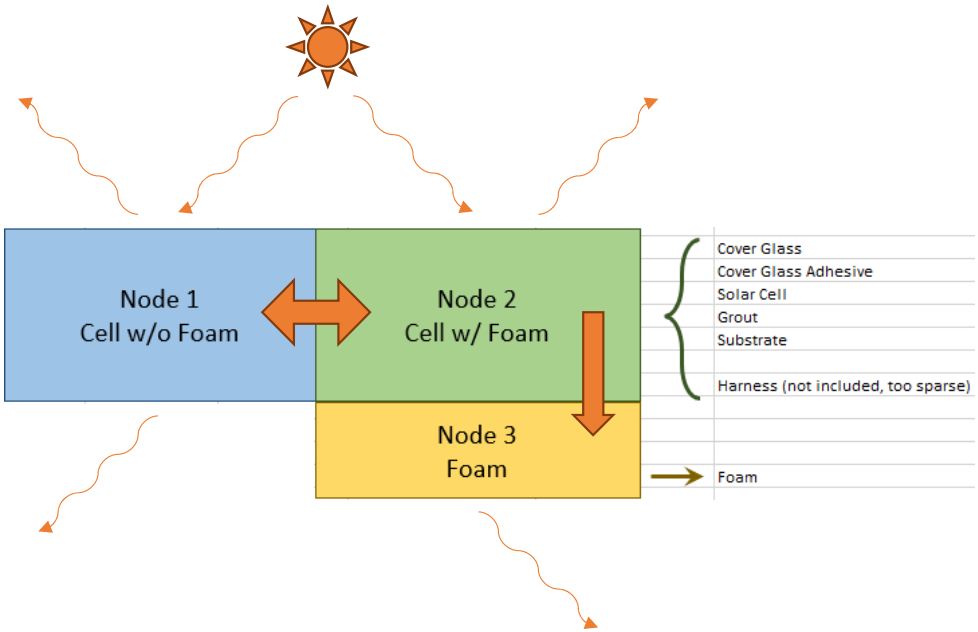
Different Solar Absorptance and Emittance

Different Number of Cells per String

Different Thermal Model



Traditional Node Design

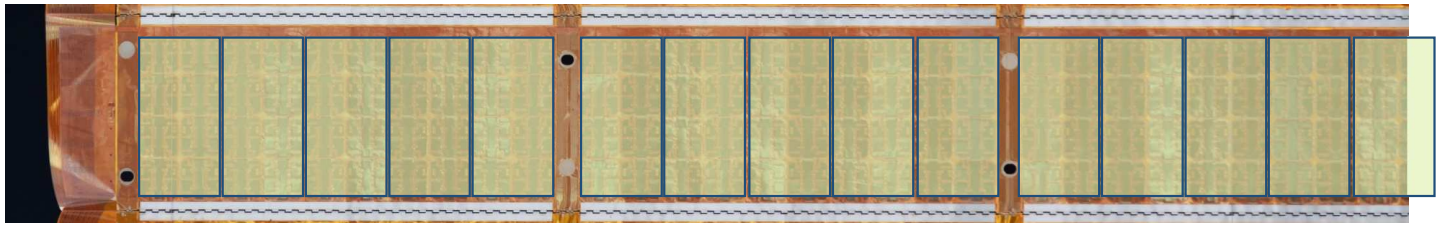


iROSA Node Design

New Shadowing Algorithms

Legacy

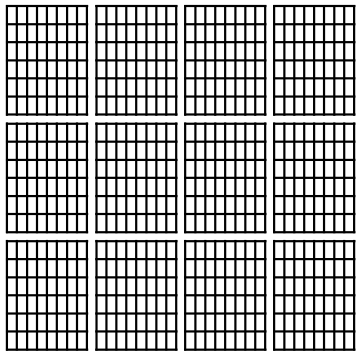
82 panels per blanket



25 bypass diodes along panel

iROSA

18 cells along width



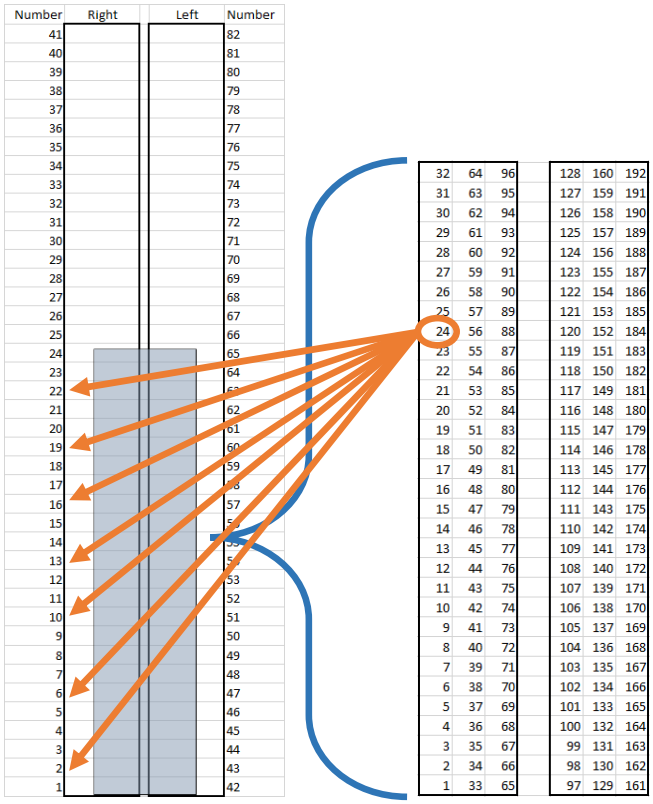
32 panels along blanket

256 cells along length

Legacy Blanket:
25 bypass diodes per panel
82 panels per blanket

iROSA Blanket:
18 x 256 bypass diodes per blanket

String Mapping

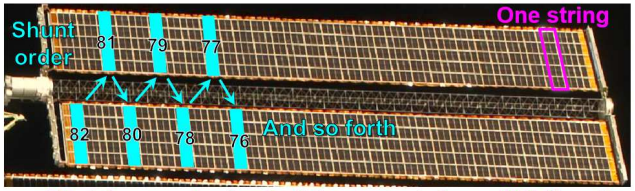


iROSA strings replace Legacy strings nearest the base of the array

Need to map via the shunt order

Background: ISS SAW Operation

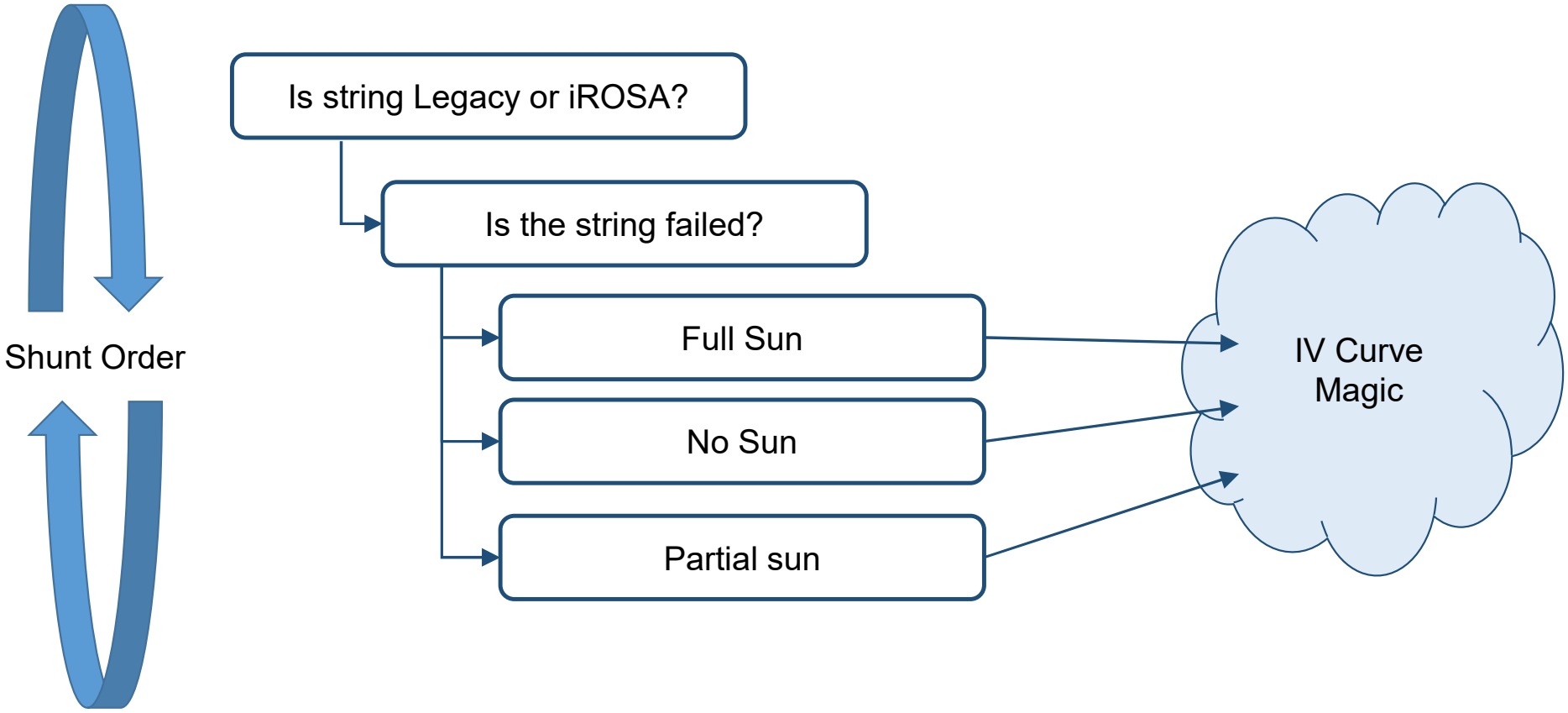
- Each of the power channels on the ISS consists of 82 solar array strings across two blankets to generate electrical power.
- When less power is needed, strings are shunted in a set order.
- A shunted string contributes no electrical power to the EPS and thus heats up due to the solar flux (conservation of energy).



All string numbering in this presentation will follow the shunt order.

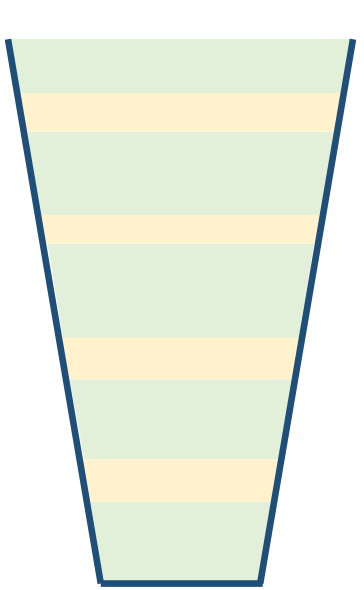
See 2019 SPW presentation

Calculating Power Correctly



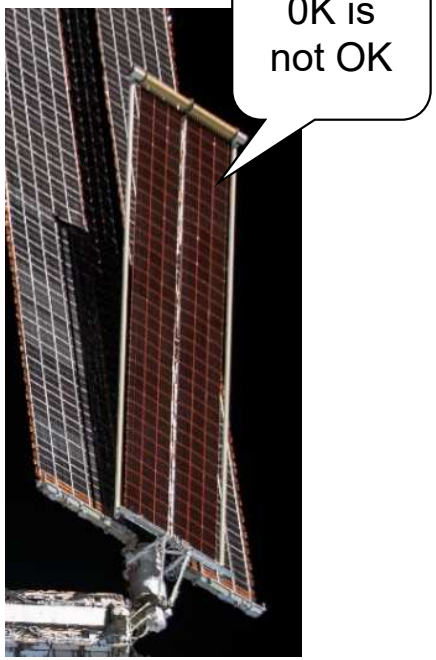
Calculating Power Correctly

iROSA	iROSA
Legacy	Legacy
iROSA	iROSA
Legacy	Legacy
iROSA	iROSA
Legacy	Legacy

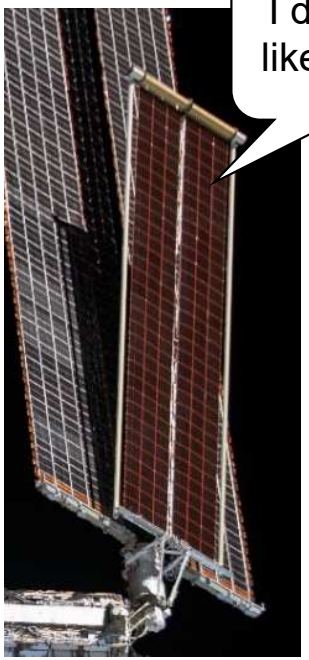


Everything left is shunted

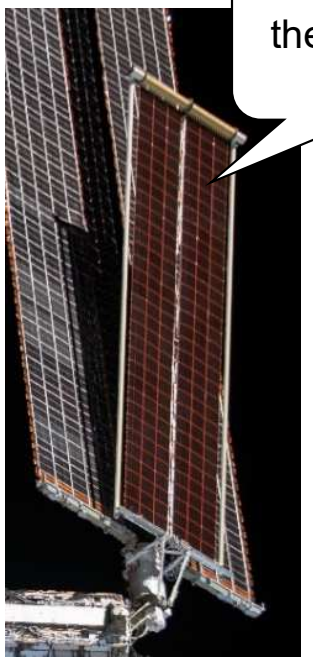
Model Checkout - Fun Bugs



iROSA Temperatures below Absolute Zero



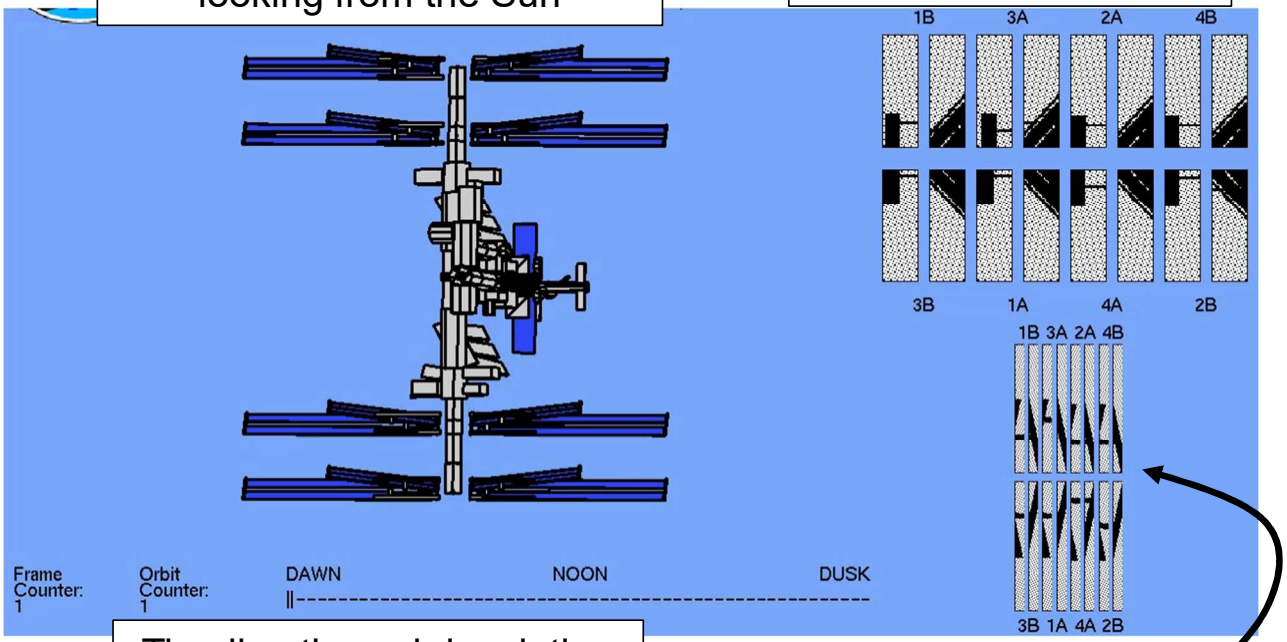
Negative power while in the Sun



Cant in the wrong direction (some of them)

Model Checkout - Most Fun Bug

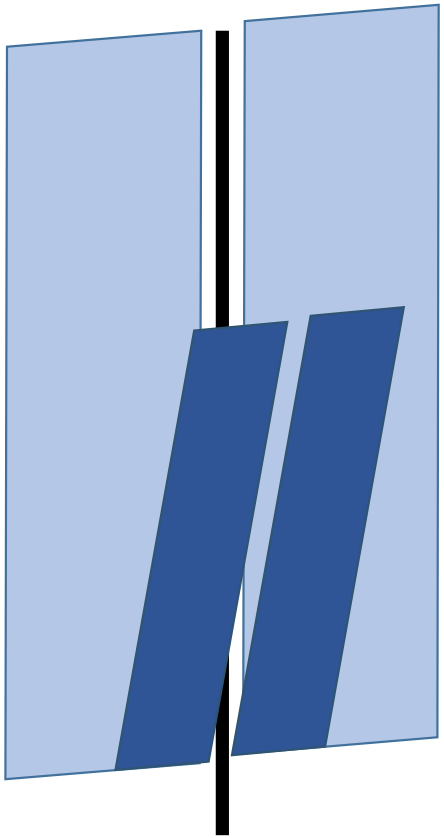
View of ISS as if you were looking from the Sun



Timeline through insolation

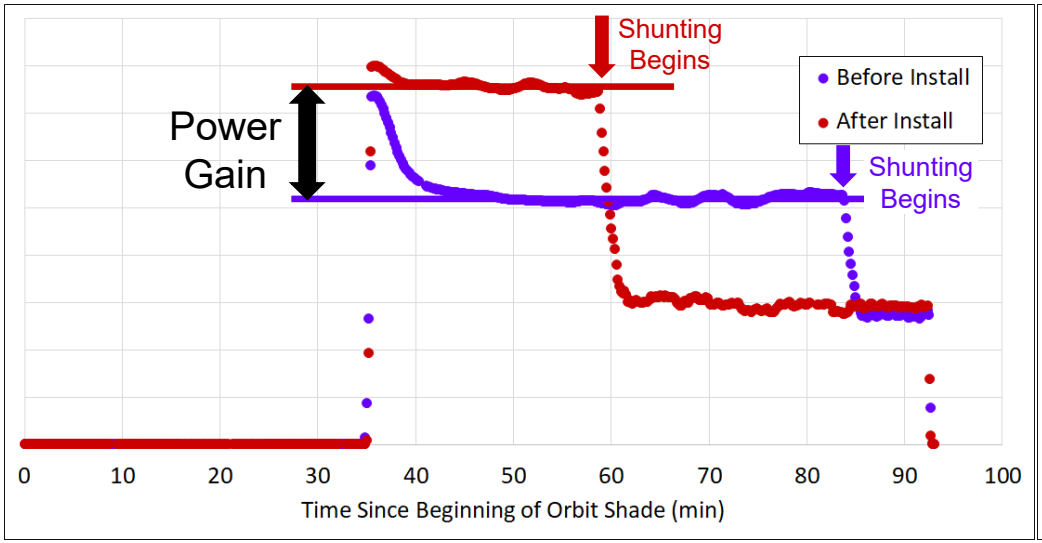
Shadow patterns on Legacy Solar Arrays

iROSA shadow patterns Watch here

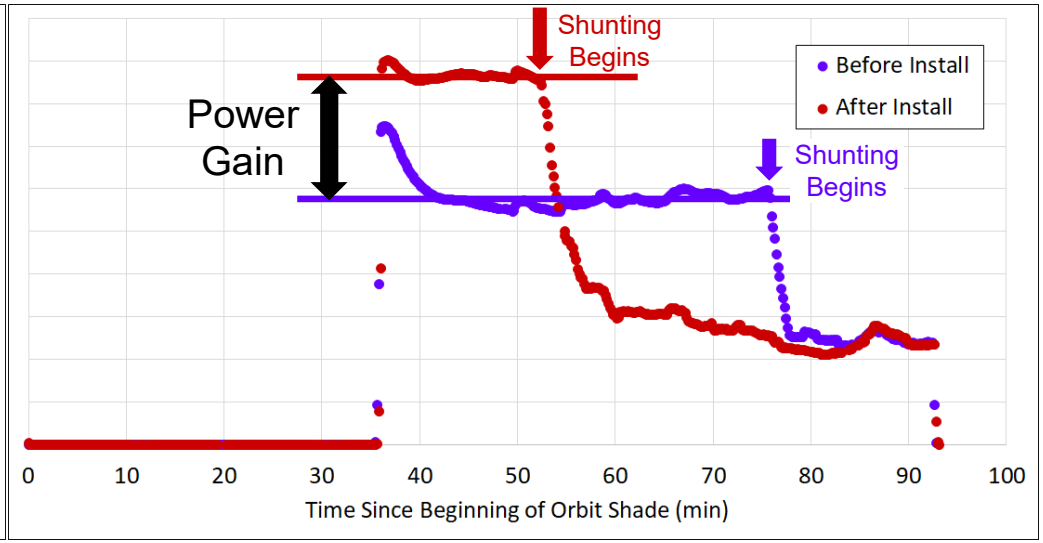


Gains in Power Generation

First iROSA (Jun 2021)



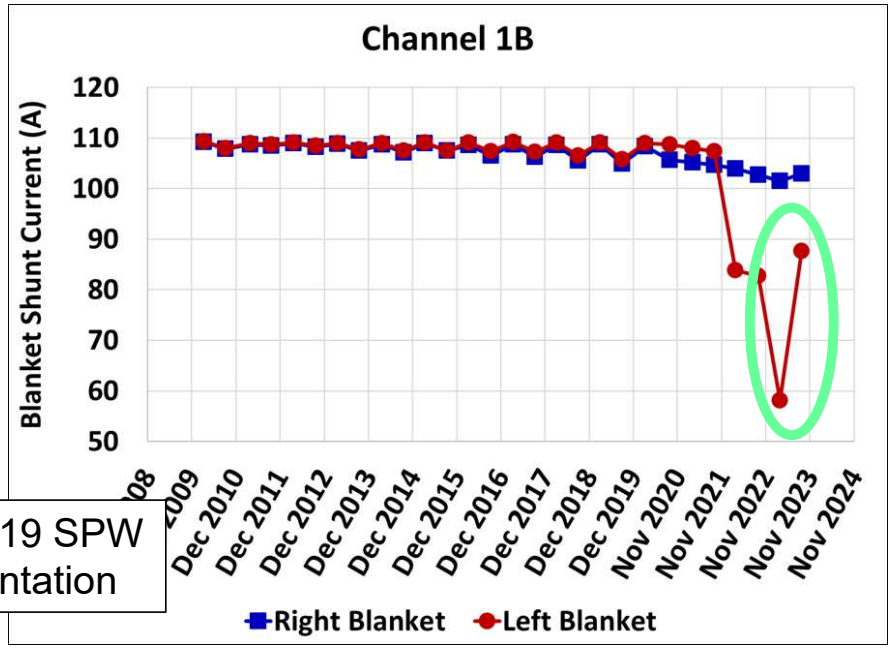
Second iROSA (Jun 2021)



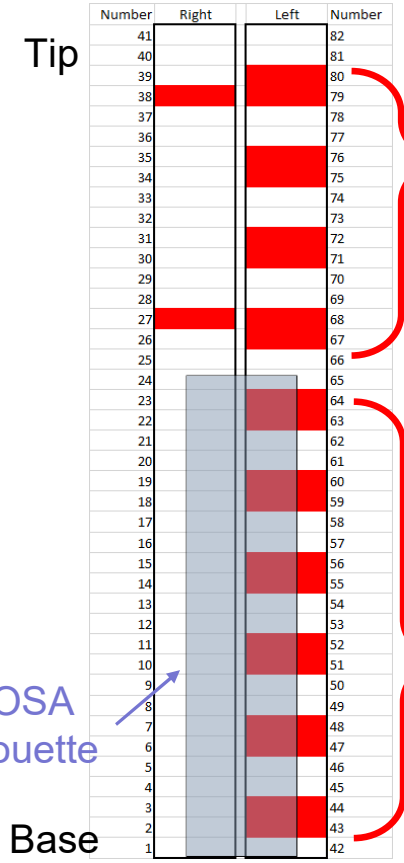
Power Gain from Initial iROSA: *Nominally 5-7 kW* *Best case 7-9 kW*

Restoring Lost Circuitry (kinda)

- **Some of the legacy string failures went away**



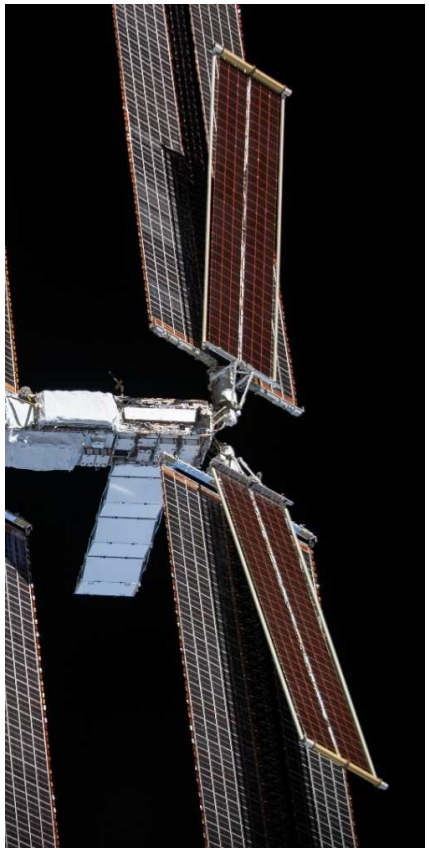
See 2019 SPW presentation



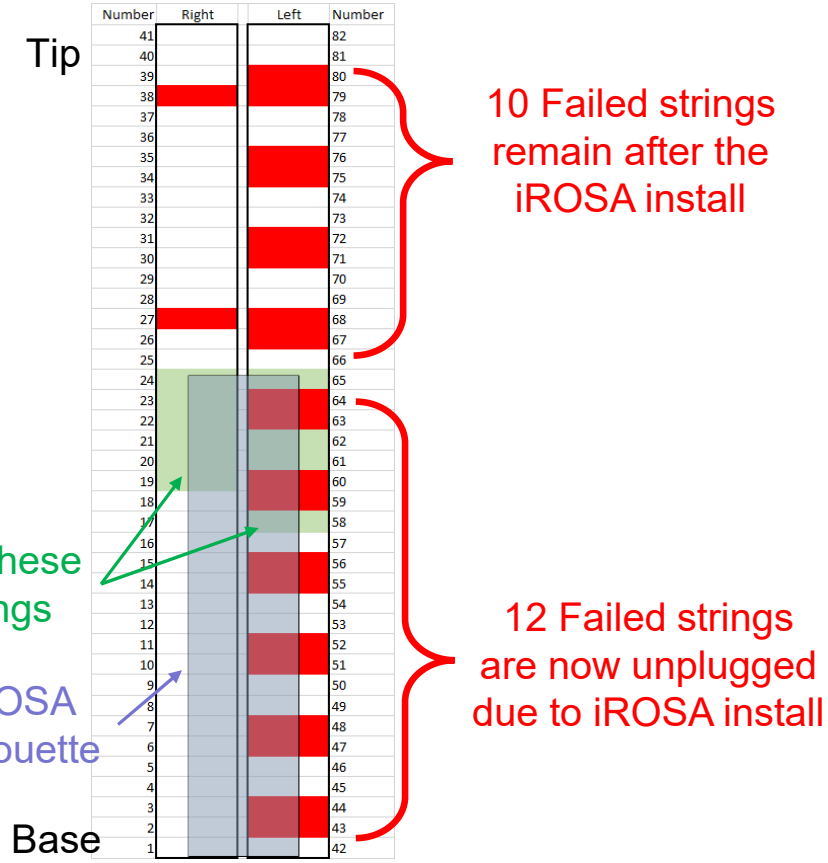
10 Failed strings remain after the iROSA install

12 Failed strings are now unplugged due to iROSA install

Opportunity for Even More Power



- **An off-pointed array lets some light around the side of iROSA onto legacy strings.**
- **Could we unplug the 10 failed strings near the tip and wire in different legacy strings to get some additional power?**
- **Yes. It requires more rewiring on EVA, but could give a bit more power.**



Thank You

- Ann Delleur / NASA GRC
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- Jeff Hojnicki / NASA GRC
- Stuart Wodzro / NASA GRC (former)
- Caroline Austin / NASA GRC (former)
- David Mckissock / NASA GRC (ret.)
- David Hoffman / NASA GRC (ret.)
- Tom Kerslake / NASA GRC (ret.)
- Conference Organizers