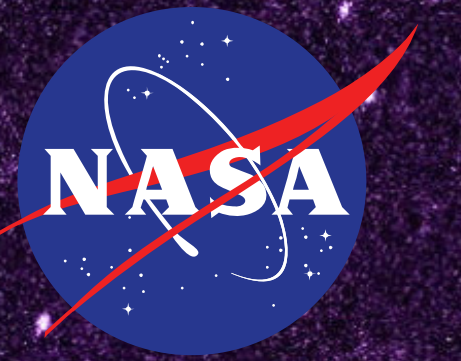
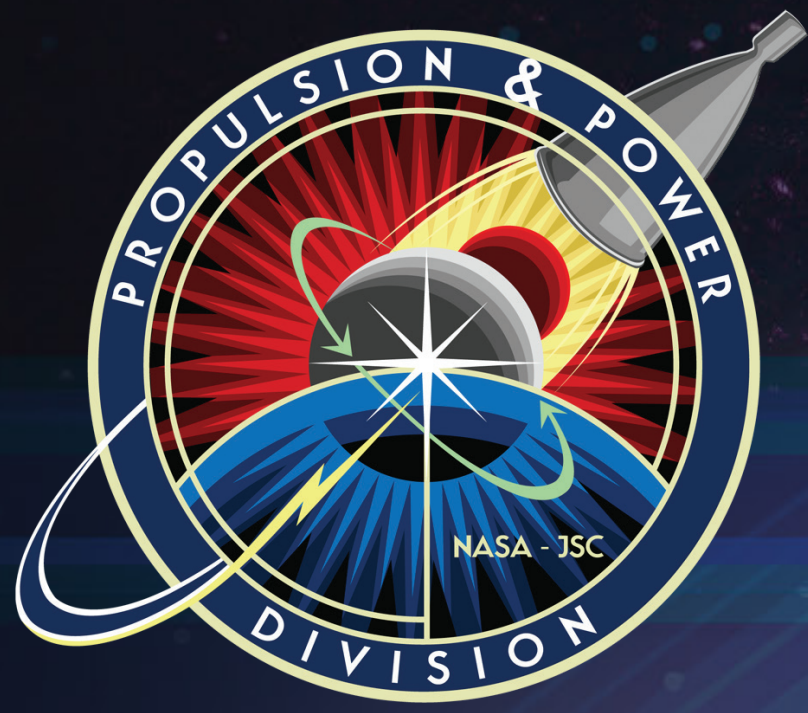




INTERNAL SHORT CIRCUIT DEVICE FOR LITHIUM-ION BATTERIES

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OVERVIEW

Crewed spacecraft battery designs must be resistant to a single cell thermal runaway event.

Validation requires driving single cells in the battery into thermal runaway to represent a catastrophic field failure internal short circuit.

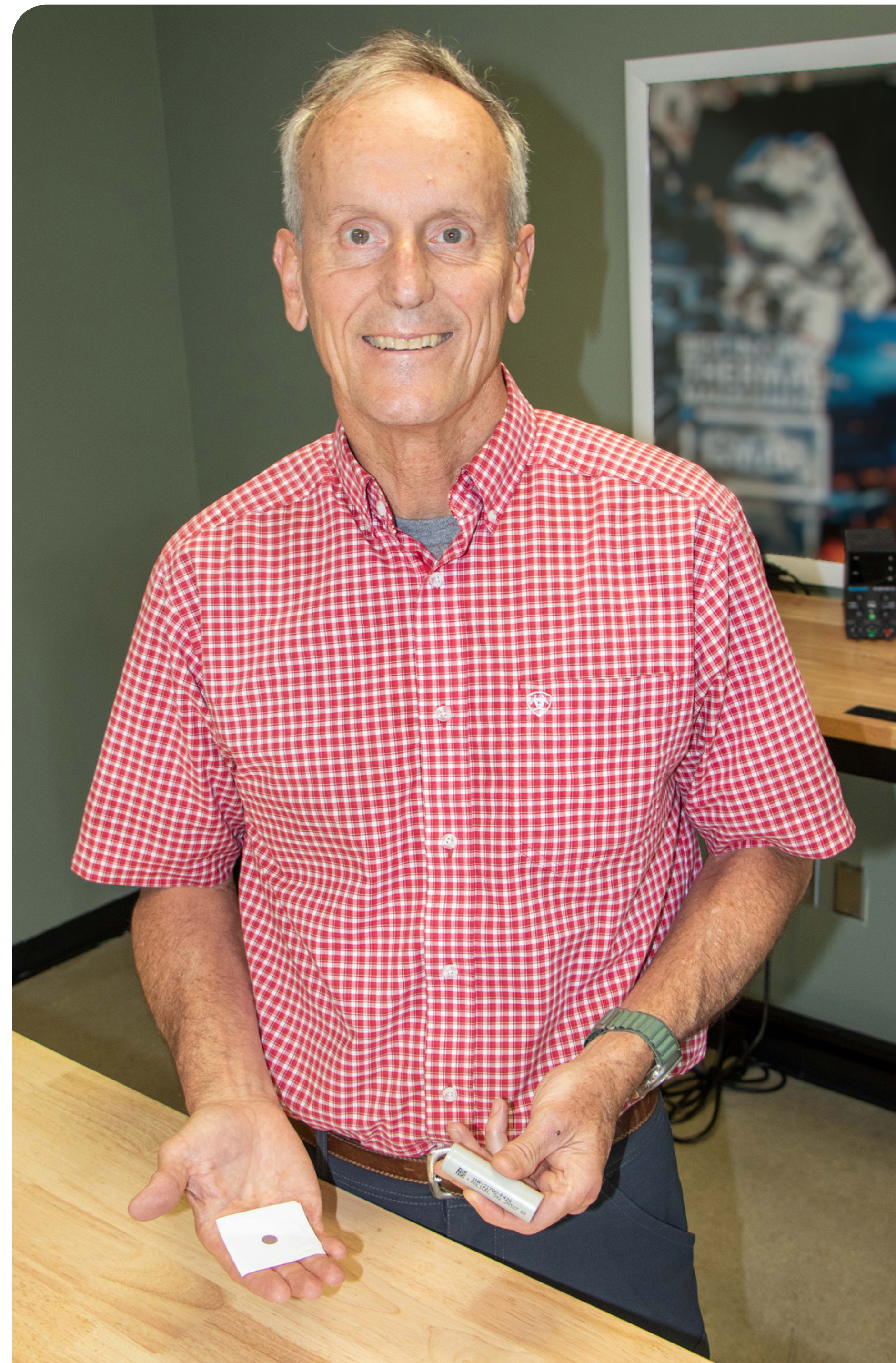
The Internal Short Circuit (ISC) device can trigger a hard internal short circuit inside a lithium-ion cell by heating it above the melting point of the device's wax.

FUNCTION

- ✦ The ISC device consists of one small copper and several aluminum discs, a copper puck, a polymer separator, and a layer of wax as thin as the diameter of a human hair.
- ✦ When the cell is exposed to $> 57^{\circ}\text{C}$ the wax melts and is wicked away by the separator, cathode, and anode. The winding tension in cell jellyroll forces metal components to come into contact and induce an internal short.
- ✦ Device can induce 4 types of internal short circuits:
 - Collector to collector short
 - Active material to active material short
 - Active material to collector shorts (2 types)

The ISC device provides a reliable method to represent the catastrophic thermal runaway response of a li-ion cell to a defect-induced internal short circuit.

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The ISC device has a US patent and earned NASA's 2025 Invention of the Year Award.

