

SPINOFFS

Spinoffs are relatively short learning modules inspired by the LTAs. They can be easily implemented to support student learning in courses ranging from prealgebra through calculus. The Spinoffs typically give students an opportunity to use mathematics in a real world context.

LTA - SPINOFF 17A

The Internal Thermal Control System
in the United States Lab

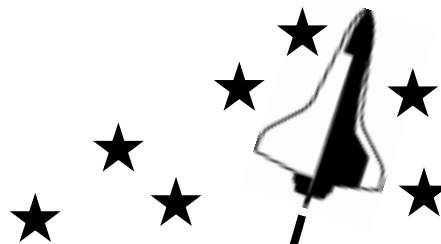
LTA - SPINOFF 17B

Simulations to Test the Electrical Power System

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SPINOFF 17A

The Internal Thermal Control System in the United States Lab

The Internal Thermal Control System (ITCS) is part of the United States lab on the International Space Station. The ITCS consists of two fluid loops, the Low Temperature Loop (LTL) and the Moderate Temperature Loop (MTL). These two systems are essentially heaters that control the temperatures at the places where the different loops cross themselves or each other. The ITCS also contains the “Thermal Safing” system, which is emergency software used to shut down items in the United States lab to reduce the output of heat.

The process of activating the ITCS can be described in the three stages:

Stage 1: Power-Up the Low Temperature Loop (LTL)

- (a) from the laptop on the Space Shuttle Orbiter,
 - (i) apply power to the LTL equipment, AND
 - (ii) apply power to the LTL heaters, OR
- (b) from the computer at JSC,
 - (i) apply power to the LTL equipment, AND
 - (ii) apply power to the LTL heaters, BUT
- (c) the LTL must not be activated by commands from both the laptop on the Shuttle and the computer at NASA’s Johnson Space Center (JSC), Houston, Texas;

AND

Stage 2: Power-Up the Moderate Temperature Loop (MTL)

- (a) from the laptop on the Shuttle Orbiter
 - (i) apply power to the MTL equipment, AND
 - (ii) apply power to the MTL heaters, OR
- (b) from the computer at JSC,
 - (i) apply power to the MTL equipment, AND
 - (ii) apply power to the MTL heaters, BUT
- (c) the MTL must not be activated by commands from both the laptop on the Shuttle and the computer at JSC

AND

Stage 3: Disable the Automatic Thermal Safing System

This is so that the system does not activate while other components of the ITCS are being activated or tested. This system will be reactivated once the rest of the ITCS activation is complete or has been completely tested.

- (a) from the laptop on the Shuttle Orbiter, OR
- (b) from the computer at JSC, BUT
- (c) thermal safing must not be disabled by commands from both the laptop on the Shuttle and the computer at JSC.

EXERCISE

Design a test of the Internal Thermal Control System.