CIS 9000 - Group H

Information Technology Strategy

Baruch College

Jet Propulsion Laboratory

Software Update Process for JPL Ingenuity Helicopter on Mars

Ingentuity uses the Linux operating system and ARM processors

Jet Propulsion Lab Project

Interview Source:

Timothy Canham
JPL Flight Software Engineer

Tim started his career at the Jet Propulsion Lab writing software for the Deep Space Network data processing hardware. His subsequent work was on the Mars Science Lab and the deep space Cassini probe mission to Saturn. Tim then moved on to lead the software team for the groundbreaking Ingenuity Helicopter, the first object in human history to fly on another planet. Currently, he leads the Ingenuity Flight Team as they prepare for additional flights on Mars.

Tim earned a BA in Electrical and Computer Engineering from Clarkson University.

Jet Propulsion Lab Project

Ingenuity Helicopter on Mars

Uses Linux operating system
on a Qualcomm Sanpdragon ARM processor flight board

Also uses a Texas Instruments Automotive Processor

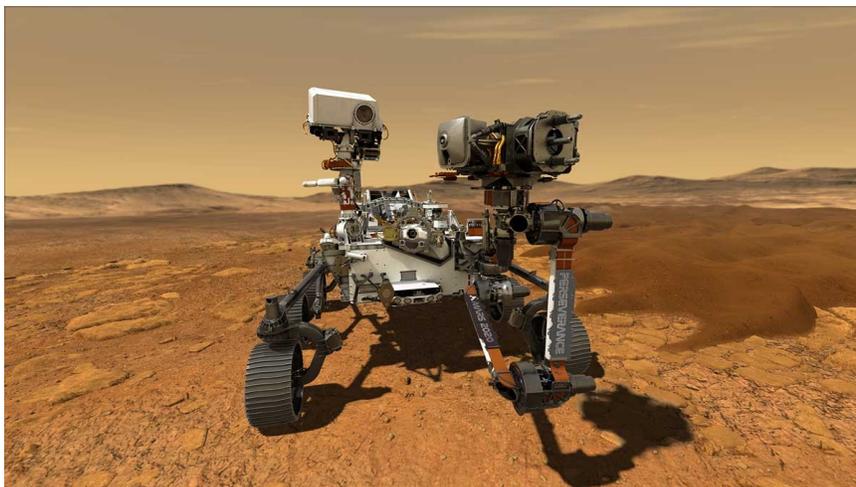The Linux distribution that is being used is Linaro

Specialized for ARM processors
ARM processors are based on the RISC architecture
(Reduced Instruction Set Computer)

Ingenuity also uses a software framework called F-Prime

The Ingenutiy Helicopter was carried to Mars on the
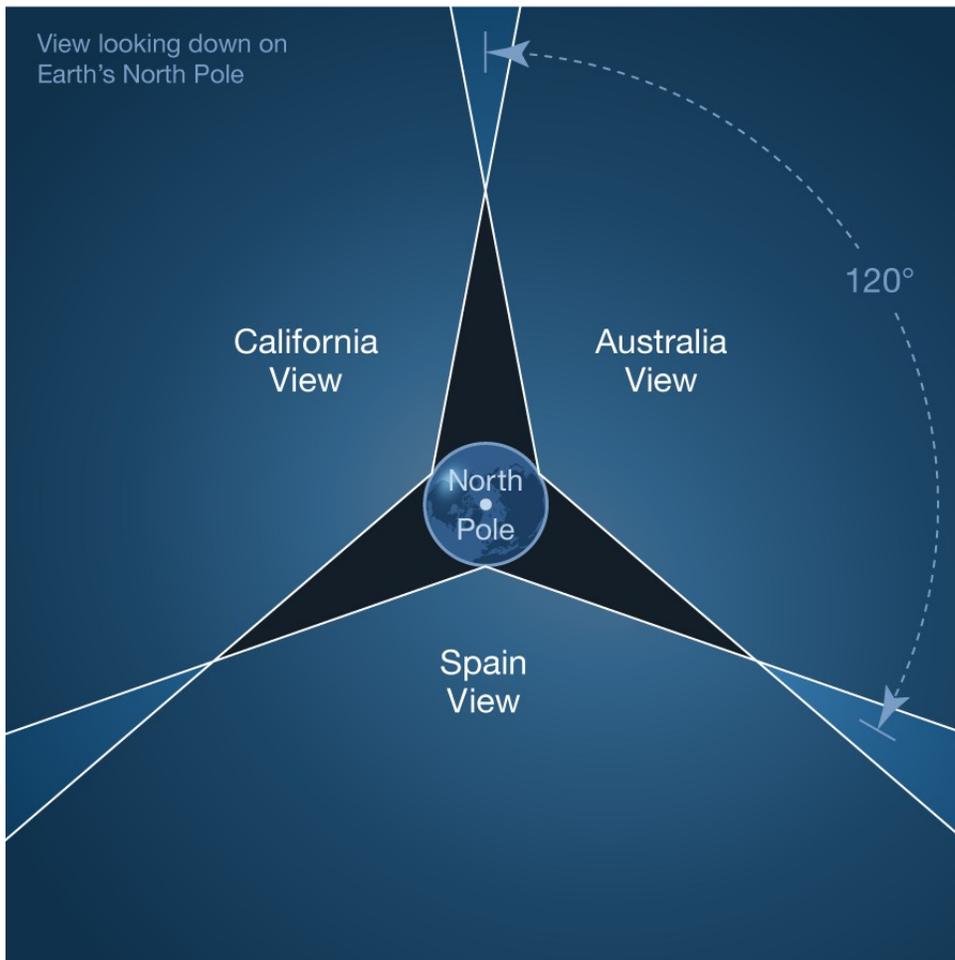Perseverance Rover

The Rover launched from Cape Canaveral on July 30, 2020 and
landed on Mars on Feb 18, 2021 at the Jezero Crater

Upgrades are sent to Mars via the Deep Space Network

Three radio telescope stations make up the Deep Space Network:
California, Spain and Autralia

View looking down on Earth's North Pole

California View

Australia View

120°

North Pole

Spain View

Each station covers 120 degrees of the sky for complete 360 degree coverage

Software Upgrade Process

Software Team Discusses Necessary vs "Nice-To-Have" Updates

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Final List is Reviewed with Perseverance Project Management

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Upgrades are Implemented

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Software Team Schedules Testing Plan

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Quality Assurance Team Reviews Code

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Project Team Reviews Changes and Test Results

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Request is Made of Deep Space Network Operations to Schedule a Time to Transmit to Mars

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Deep Space Network Transmits Upgrade to Mars Orbiter

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Mars Orbiter Sends Upgrade to Perseveance Transfer process takes about 1 week in total

The upgrade can also be sent directly to the Rover