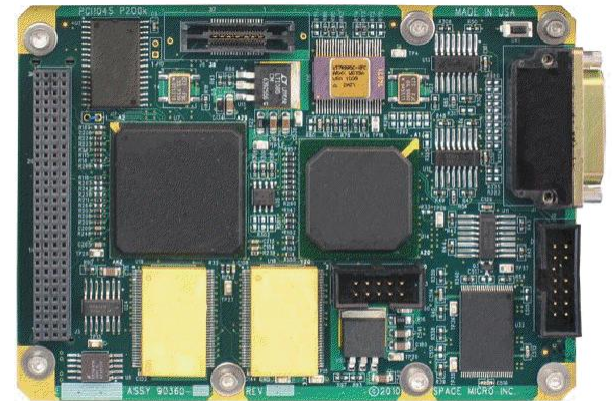# Gumstix in Space

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Terrestrial Computing Power in Space

- Need for space based computer to support computationally demanding tasks such as:
  - Signal processing and analysis
  - Data capture
  - Sensing and detection

- Space qualified computers:
  - 2 or 3 generations behind terrestrial processing technologies
  - Expensive
  - Larger in size, weight and power consumption

Proton 200 – 10cm X 16cm, $120,000

Gumstix – 6cm X 2cm, $100-$200
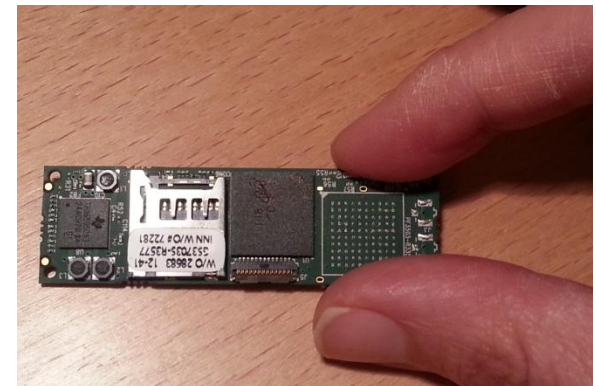
Benefits of Gumstix in Space

DM flight prototype

- Small form factor:
  - Gum stick sized
  - Low power consumption (0.6W)
  - Low weight (4.3g)
- Uses current generation OMAP processors with ARM Cortex-A8 architecture
- Used in mini-super computers, robotics, unmanned air vehicles
- Being studied for use in the Dependable Multiprocessor (DM) by Honeywell.

The Gumstix LEO study is an important step towards their use in a fault tolerant computers.

Space Flight Experiment

- Located on the external
Nanorack of the ISS

- Watchdog protect Gumstix and record events:
  - High current Latch-up and SEFI
  - SEU and SEFI

- Data received via downlink from ISS

| Model	SandSTORM	Earth	Water	Fire
Fight Testing				
CPU (GPP)	Yes	Yes	Yes	Yes
RAM	Yes	Yes	Yes	Yes
NAND Flash	n/a	Yes	Yes	Yes
Ground Testing				
CPU (GPP)	Yes	Yes	Yes	Yes
RAM	Yes	n/a	Yes	Yes
NAND Flash	n/a	Yes	Yes	Yes
GPU	n/a	n/a	Yes	Yes
WIFI	n/a	n/a	n/a	Yes
Bluetooth	n/a	n/a	n/a	Yes
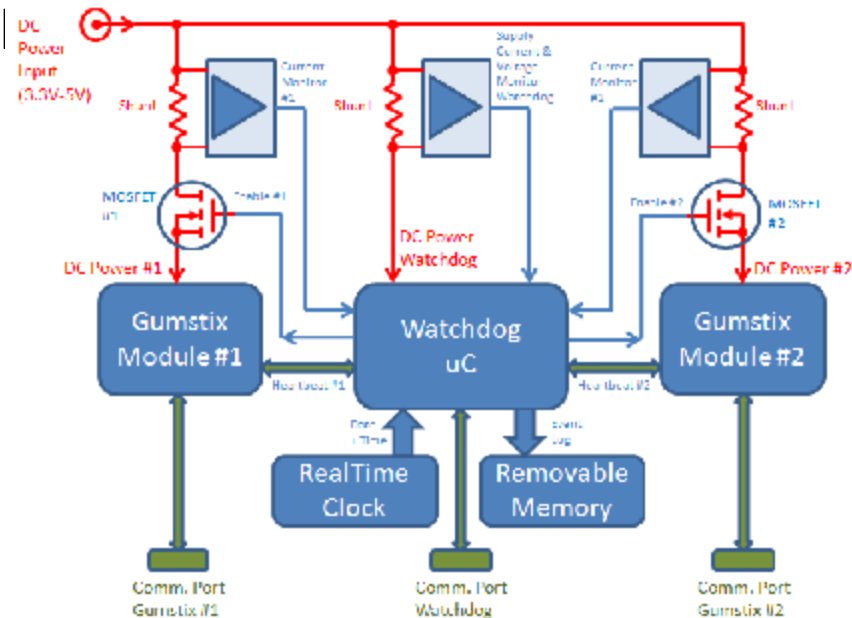
Key Questions :

- How does the LEO space environment affect the Gumstix™ modules?

- What is the net operation time for each Gumstix™ module while in space?

- Is Gumstix™ module performance affected by feature size?
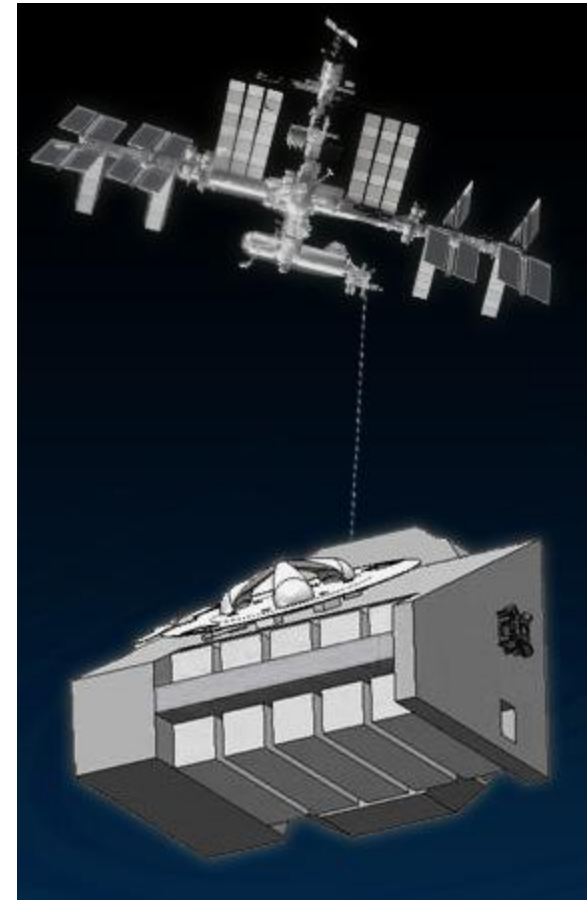
Timeline for Gumstix Space Experiment
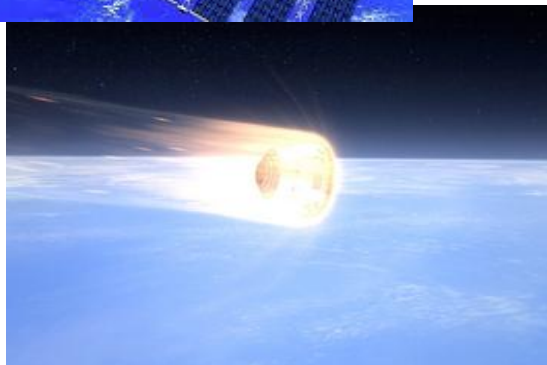
Event	Dates
Program Initiated	4/16/13
Ground Testing at Crocker Nuclear Labs	7/13 to 12/13
Delivery to Nanoracks	1/14
Launched to Space and ISS arrival	6/14
Exposure to LEO	6 month period
Return for Post-flight analysis	Early 2015