



TELEDYNE
MICROELECTRONIC TECHNOLOGIES
Everywhere you look™

Radiation Micro Dosimeter



Teledyne Microelectronics Overview

- Established in 1964
 - Lewisburg, Tennessee
- From prototype to production
 - Enhance design for manufacturability
 - Miniaturize size and reduce weight
 - Improve performance and reliability
 - Comprehensive testing and screening
 - Obsolescence management
- Microelectronics Trusted Source
 - Packaging, Assembly and Test Services
 - DoD Accredited to
 - Mission Assurance Category 1
 - Trusted Category 1A



Teledyne Microelectronic Technologies

- Microelectronic Packaging & Products

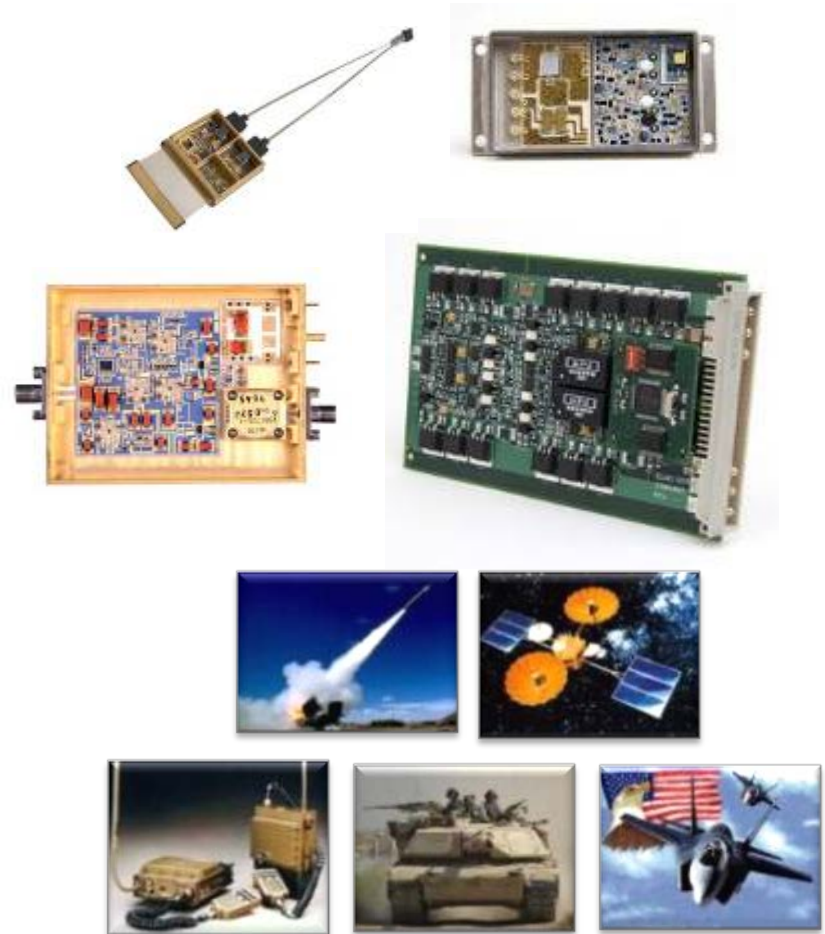
- COTS to Class K
- More than 250,000 single die to multichip packages per year

- Technologies

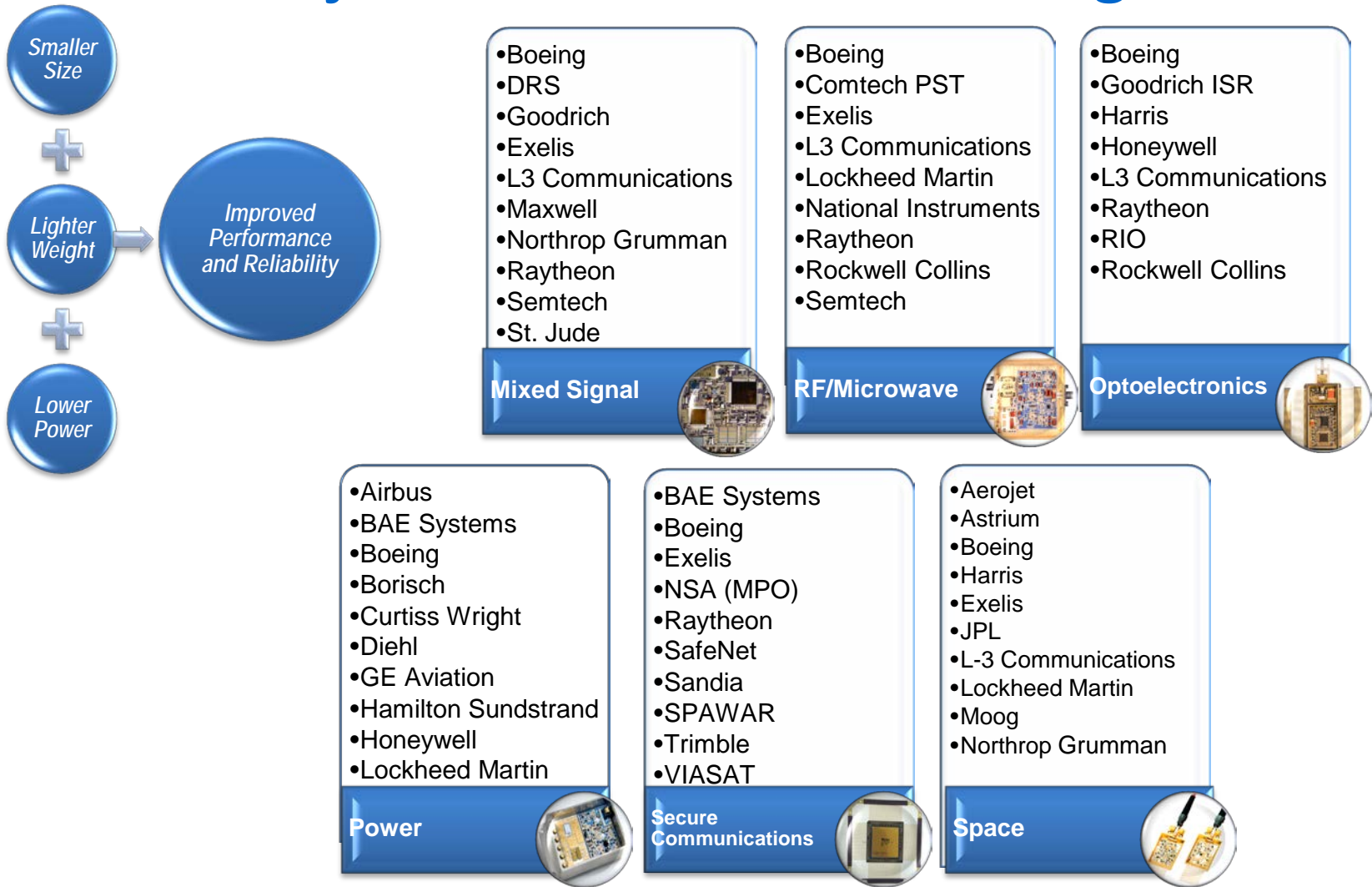
- RF & Microwave
- Optoelectronics
- High Speed Digital and Mixed Signal
- Secure Communications
- Power

- Markets

- Defense (Class H certified)
- Avionics
- Space (Class K certified)
- Secure Communications
- Ruggedized Industrial



Major Customers & Technologies

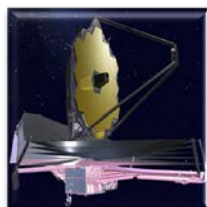


Pioneers in Space



Spacecraft

- ISSI
- Voyager
- Viking
- Mars Observer
- Galileo
- Susei
- Magellan
- Giotto
- MESUR
- Ulysses
- Spacelab
- Sakigake
- Cassini
- Huygens
- Clementine
- GLAST
- Hubble Space Telescope
- James Webb Space Telescope
- Mars Global Surveyor
- Mars Science Lab



Satellite

- Tiros
- DOT
- ANIK
- INTELSAT
- Galaxy
- Palapa
- ERS
- Westar
- Brazilsat
- SBS
- GOES
- DRIRU
- OAO
- Landsat
- Solarmax
- Globalstar
- HS601/701
- Spaceway
- Satcom4000/5000



Launch & Reentry Vehicles

- Titan
- Delta
- IUS
- Centaur
- Atlas
- MK12A
- Space Shuttle
- Scout
- MX
- Minuteman
- Trident
- D5

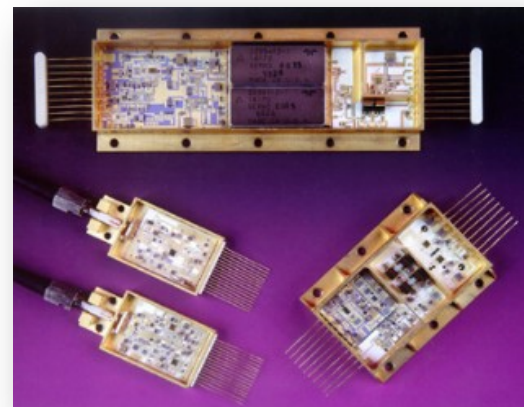


Military Spacecraft

- DSCS
- PMALS
- Milstar
- GPS
- DMS
- PMS
- TDRSS
- PRISM
- Zodiaque
- SDI
- Crosslink
- Classified

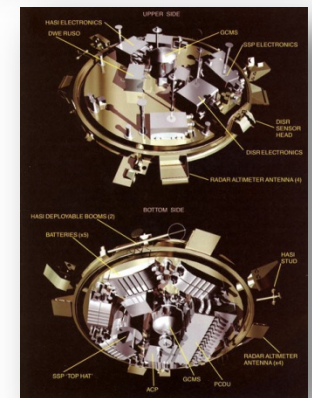
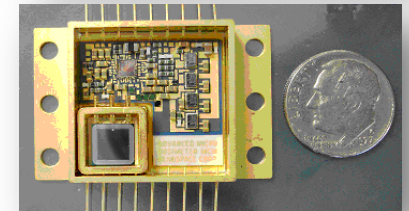
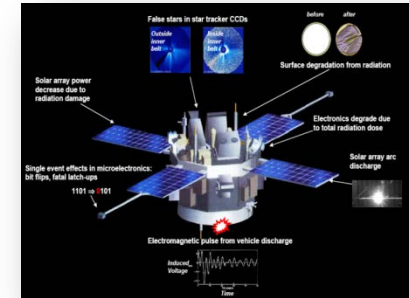
Space Modules to Class K

- Radiation Micro-Dosimeter
- Inertial Navigation
- Power Management and Control
- Stepper Motor Control and Stabilization
- Heater Control
- Imaging, Camera Pointing and Control
- Processor and Memory
- Arcjet Thruster Control
- TWT Control
- NTSC Analog Video Modulator/Demodulator
- FDDI Optical Transmitter/Receiver
- Radar Altimeter
Transmitter/Receiver
Up/Down Converter



Radiation Micro Dosimeter

- Problem: Electronics degrade with accumulation of radiation dose
- Solution: Teledyne's Radiation Micro-dosimeter
- Small enough to
 - place at multiple locations
 - surface and payload
- Real time data
 - alert for hazardous conditions
 - alarm for hostile action
 - anomaly diagnosis
- Accumulated data
 - improve radiation models & electrical designs
 - lead to improvements in spacecraft design
- More accurate modeling, reduces need for costly ray-tracing environmental analysis
- Dose budgets can be developed to establish more accurate estimates of spacecraft life

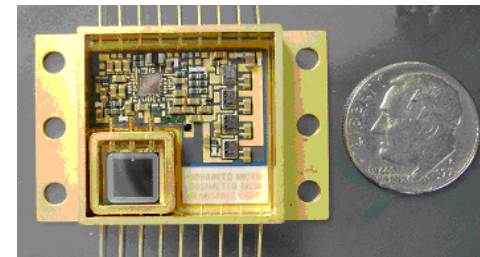


Additional Markets

- **Defense Aircraft, Ships & Vehicles**
 - Provide a radiation monitor to alarm operators of
 - hazardous environmental conditions
 - hostile action
 - Optimize future radiation models & electronic designs
 - Measure radiation during the disarming and storage of nuclear weapons
- **Medical**
 - Monitoring the exposure of personnel and patients to ionizing radiation.

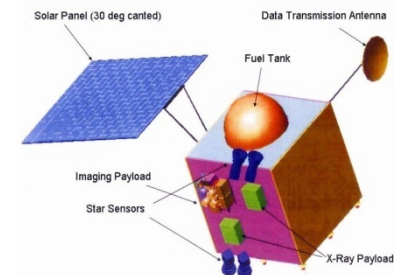
Radiation Micro Dosimeter Features

- Size, Weight, And Performance
 - 1.4" x 1.0" x 0.040"
 - 20 grams
 - 10 mA from 13V to 40V input
 - 14 μ rads to 40Krads
- Small footprint: can be installed next to sensitive components or areas of concern for radiation exposure
- Plug & play: connects to standard spacecraft housekeeping, power and communication busses
- Direct measurement of radiation dose vs alternative indirect measurements
- Integrates signal prior to threshold detection to improve charge collection accuracy
- 3 linear DC and 1 pseudo-log output pins



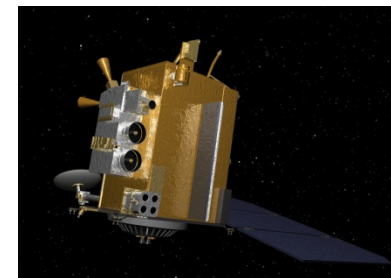
Radiation Micro Dosimeter Missions

- 2008: ISRO Chandrayaan Lunar Orbiter
- 2009: NASA Lunar Reconnaissance Orbiter
- 2009: NASA International Space Station
 - MISSE-7B test bed
- 2009: NRL & Boeing, LEO orbit
- 2010: “Deal” mission: first feedback for improving electron and environmental models.



proton

NASA Radiation Belt Storm Probe (RBSP): inside an instrument called Relativistic Proton Spectrometer.



Sharing Data Information

- The Aerospace Corporation requests that Micro Dosimeter data be shared with them
- The Aerospace Corporation plans to use the data for the purpose of improving space environment models used to predict radiation dose data
- The goal is to process data from the multitude of Micro Dosimeters in orbit
- Aerospace will update their models using this information, and will distribute back to the space community
- Contact information:
 - Sean Reeves, Office of Intellectual Property Mgmt
P.O. Box 92957-M1/300
Los Angeles, CA 90009-2957
310-336-5437, Sean.reeves@aero.org
 - or
 - Dan Mabry, Director Space Instrumentation
M2/269, 310-336-7335, Dan.J.Mabry@aero.org

Frequently Asked Questions

General Performance:

- **Q:** *What kind of radiation does the Dosimeter measure?*
A: Electrons, Protons, Gamma Rays
- **Q:** *How much radiation does it measure?*
A: 14uRads to 40kRads, broadest range in the market
- **Q:** *What is the survivability (max. radiation exposure)?*
A: 40kRads
- **Q:** *Why is the operating temperature only -30 to +40°C?*
A: This is standard range for space level components
- **Q:** *Are evaluation boards available?*
A: They may be available in the future (6 – 8 months)

Frequently Asked Questions

Electrical:

- **Q:** *How much do I have to regulate the power supply?*
A: Unregulated power between 13V and 40V is acceptable
- **Q:** *Do I need current limiting in my circuit?*
A: No current limiting is necessary for power input
- **Q:** *What is the linearity of input vs. output?*
A: +/- 20% is the spec. Average is 2.2%
- **Q:** *What if my voltage regulation exceeds +/-5%?*
A: As long as voltage is within 13V and 40V it is okay
- **Q:** *What is the output voltage 0 to 5V; can it be converted to current?*
A: We do not measure the output impedance

Frequently Asked Questions

Mechanical:

- **Q:** *How do I mount the device?*
A: 6 mounting holes are provided. Mounting/location must ensure the temperature of the device will not exceed specifications
- **Q:** *Is thermal grease required for mounting?*
A: Not required, power dissipation is very low
- **Q:** *Does torque have any affect on the device?*
A: Torque has no effect if within the screw specification
- **Q:** *What affect does vibration and shock have on the device (will it survive Launch and Pyro shock – or separation)?*
A: It will withstand shock & vibration as required in MIL-PRF-38534 Class H or Class K. (Typ. 3000 Gs.)

Frequently Asked Questions

Reliability:

- **Q:** *Does temperature affect accuracy of the device?*
A: The device will meet all performance specifications within the operating range on the datasheet
- **Q:** *Are there any ROHS prohibited materials in the device?*
A: All materials in the device are compliant to MIL-PRF-38534 Class H or Class K. A quotation can be provided if a more extensive analysis is required