Xilinx Solutions for Aerospace & Defense Applications
Issues and Challenges

• A semiconductor supplier must
  – Have leading edge technology and proven experience
  – Provide long-term supply of components
  – Offer military and radiation tolerant temperature graded parts
  – Provide high reliability / high quality parts that will meet strict design requirements
Why Xilinx FPGAs are Ideal for Aerospace/Defense Applications

• Increasing demand for reconfigurability
  – Advanced processing
  – Mission re-use

• Decreasing options for advanced systems/performance
  – Cost
  – Performance
  – Component obsolescence

• Xilinx solutions for high performance & reliability
Xilinx in Space

- Xilinx Flight Heritage
  - MARS2003 Lander (JPL)
    - XQR4062XL: Controlling Pyrotechnics
  - MARS2003 Rover (JPL)
    - XQVR1000: Motor Control
  - GRACE (NASA)
    - XQR4036XL: Sensor
  - FedSat (Univ. Southern Australia)
    - XQR4036XL
  - OPTUS (Raytheon)
    - XQVR300

- ~50 additional programs in various design phases
# Xilinx in Military and Aerospace

## Electronic Warfare, Missile Guidance and Targeting, RADAR and SONAR

<table>
<thead>
<tr>
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## Communications, Signal Processing and Intelligence

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## Aerospace, Avionics and Space

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Mil/Aero Products

• QPro - What is that?
  – QML Products
    • Military "XQ" (N, M, B, Q, SMD)
    • Rad Tolerant “XQR” (N, M, R, V, SMD)

• Why QPro?
  – Extended Temperature Range
  – Ceramic and Plastic Packages
  – QML Qualified Processes
  – SMD Versions Available
  – Product Lifecycle Management
Rad-Tolerant vs Military

- Rad-Tolerant devices = Military Devices +
  - Epitaxial Substrate Wafer (2 microns)
    - Used for latch-up immunity
  - Total Ionizing Dose Assurance (per Method 1019)
    - Each wafer lot sampled and characterized for TID
  - Unique Manufacturing Flows
Manufacturing Flows

• “M” Grade
  – Mil Temp, Ceramic
• “N” Grade
  – Mil Temp, Plastic
• “R” Grade
  – Rad-Tolerant, Mil Temp, Plastic, Similar to Class-V flow
• “V” Grade
  – Rad-Tolerant, Mil Temp, Ceramic, Similar to Class-V flow
• Standard Microcircuit Drawing (SMD)
  – Mil and Rad-Tolerant Devices, DSCC part number
# Manu. Flow Summary

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Supporting the Aerospace and Defense Market
### Targeting Mil/Aero Devices in Xilinx Development SW

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<tr>
<td>-4</td>
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**Speed/Temp Grade**

- Commercial
- Industrial
- Military

- How do I target Mil/Aero devices in Xilinx Development SW?
  - 6.1i has Virtex QPro devices included
  - Otherwise target correct speed grade and pin compatible package
    - E.g. XQ2VR3000CG717 = 2V3000 / -4 / BG728
<table>
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<th>VIRTEX E</th>
<th>VIRTEX II</th>
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<td>SMD &quot;N&quot;</td>
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<td>SMD &quot;Q&quot;</td>
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**Underlined Packages**
Are Plastic and Hermetic footprint compatible

*Non hermetic
## Mil-Aero Virtex Roadmap

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<td>SMD &quot;Q&quot;</td>
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**Underlined Packages**

Are Plastic and Hermetic footprint compatible

*Non hermetic
Rad-Tolerant Devices

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
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<tr>
<td>PQ240</td>
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<tr>
<td>BG352</td>
<td>Yes</td>
<td>BG432</td>
</tr>
<tr>
<td>BG432</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| Ceramic PKG     |            |              |       |        |        |
| M-Grade         | Yes        | Yes          | Yes   | N/A    | Yes    | Yes    |
| V-Grade         | Yes        | Yes          | Yes   | N/A    | Yes    | N/A    |

Underlined Packages
Are Plastic and Hermetic footprint compatible
Rad-Tolerant PROMs

- **XQR18V04**
  - 4Mbit In-System Reprogrammable PROM
  - Latch Up and SEU Immune
  - TID (TBD)
  - Operating Temp Range: -55 to +100degC

- **XQR1701L**
  - One Time Programmable PROM
  - Latch Up and SEU Immune
  - 60KRads

- **XQR17V16**
  - 16Mbit One Time Programmable PROM
  - Latch Up and SEU Immune
  - Rad Specs TBD (Q1’04)
Rad Tolerant Roadmap

System-Level Function Blocks
- DLLs
- High Perf. I/O
- Block RAM

Platform FPGA
- IP Immersion
- 840 Mbps LVDS
- TripleDES
- XCITE
- Multiplier
- DCM

Platform for Programmable Systems
- PowerPC
- RocketIO

RadHard by Design

- 3.3V - 62K gates
  - XQR4000XL
  - 60Krad(Si)

- 2.5V - 1M gates
  - VIRTEX
  - 100Krad(Si)

- 1.5V - 6M gates
  - VIRTEX-II

- 1.5V >8M gates
  - VIRTEX-II PRO

- 3.3V tolerant buffers
- 5V tolerant buffers
Hermetic Packages

**CB228 / Ceramic top-Braized QFP**
Virtex-II Ceramic Packages 
(under development)

• CG717
  – 35 x 35mm body, 1.27mm pitch, cavity-up
  – Footprint compatible with the BG728
  – Developed for the 2V3000
  – Wire Bond, gold
  – Au-Sn lid (hermetically sealed).

• CF1144
  – 35 x 35mm body, 1.00mm pitch
  – Footprint compatible with the FF1152
  – Developed for the 2V6000
  – Flipchip with high lead balls.
Virtex-II Collateral Summary

- **Product Release Collateral**
  - QPro & Rad Hard Data Sheets
  - CG/CF Package Data Sheet and User’s Guide
  - PROM Data Sheet Revisions

- **Product Applications Collateral**
  - Application Note: Configuration & SEU Management “Core”
  - Application Note: Custom TMR circuits for Virtex-II
  - Application Note: TMRTool Flow for EDK (Microblaze)
  - DOC: TMRTool User’s Guide
  - Military and Aerospace Classes in Development
    - Avionics, Aerospace and TMR

- **Software Support & Development**
  - TMRTool: Beta Release Program
  - Scrubgen: Bitstream Support for Virtex-II Scrubbing
Xilinx Mil/Aero Solutions

• QPro Product Line
  – Most comprehensive line of FPGAs rated for military and aerospace applications
    • High-density: up to 6 million gates
    • Voltage range: 1.5V – 5V
    • Plastic and ceramic packages available
    • Military to radiation tolerant grades available
  – Xilinx is committed to this market and provides long term support for all Xilinx FPGAs/CPLDs, including QPro product line

• Resources
  – Dedicated team to support the design needs for aerospace/defense applications
  – Online resources available at www.xilinx.com/esp/aero_defense