# 12th International Workshop on the Application of FPGAs in Nuclear Power Plants

## Trends for FPGA Technology in Safety Critical Applications

Mark Burzynski
Chief Executive Officer

October 14-16, 2019
Budapest, Hungary

Sunport
Connecting Forward

Sunport

# Trends for FPGA Technology in Safety Critical Applications

Where we started in the nuclear industry…

What has been accomplished since then …

What is being accomplished now …

Other trends to watch …

The future for the nuclear sector?

Sunport

## Where we started in the nuclear industry…

- FPGA technology new to the nuclear industry
- Experience with microprocessor technology shaped concerns with FPGA technology
- No specific guidance documents or standards for FPGA technology
- Regulatory bodies had to treat FPGA technology as software


Sunport

# What has been accomplished since then …

- Specific guidance documents and standards for FPGA technology use in the nuclear sector
- Additional standards are in development

Sunport

# What has been accomplished since then …

- Nuclear industry and regulatory bodies have learned how to treat FPGA technology for safety applications
  - FPGA-based systems installed in nuclear plants in many countries
  - FPGA-based I&C platforms now accepted and available for use
  - FPGA technology provides solutions for common cause failure vulnerabilities based on internal diversity features


Sunport

# What is being accomplished now …

- Nuclear industry and regulatory bodies are learning how to treat embedded digital technologies like FPGA in smart devices and how to credit certification of FPGA components, development tools, and products

Sunport

# FPGA-based systems have different vulnerabilities to cyber-attacks than microprocessor-based ones …

- From a high-level perspective, certain limited types of cyber-attacks may be reduced through use of FPGA technology (e.g., corrupting executable code on the platform)
  - may not be true for Class 2 or 3 applications using high-level general-purpose components (e.g., operating systems or third-party software Intellectual Property cores)
- Other forms of cyber-attack (e.g., availability or integrity of system inputs or outputs via digital networks) not affected by technology choice
  - engineering tools and system HMIs can also be corrupted

Sunport

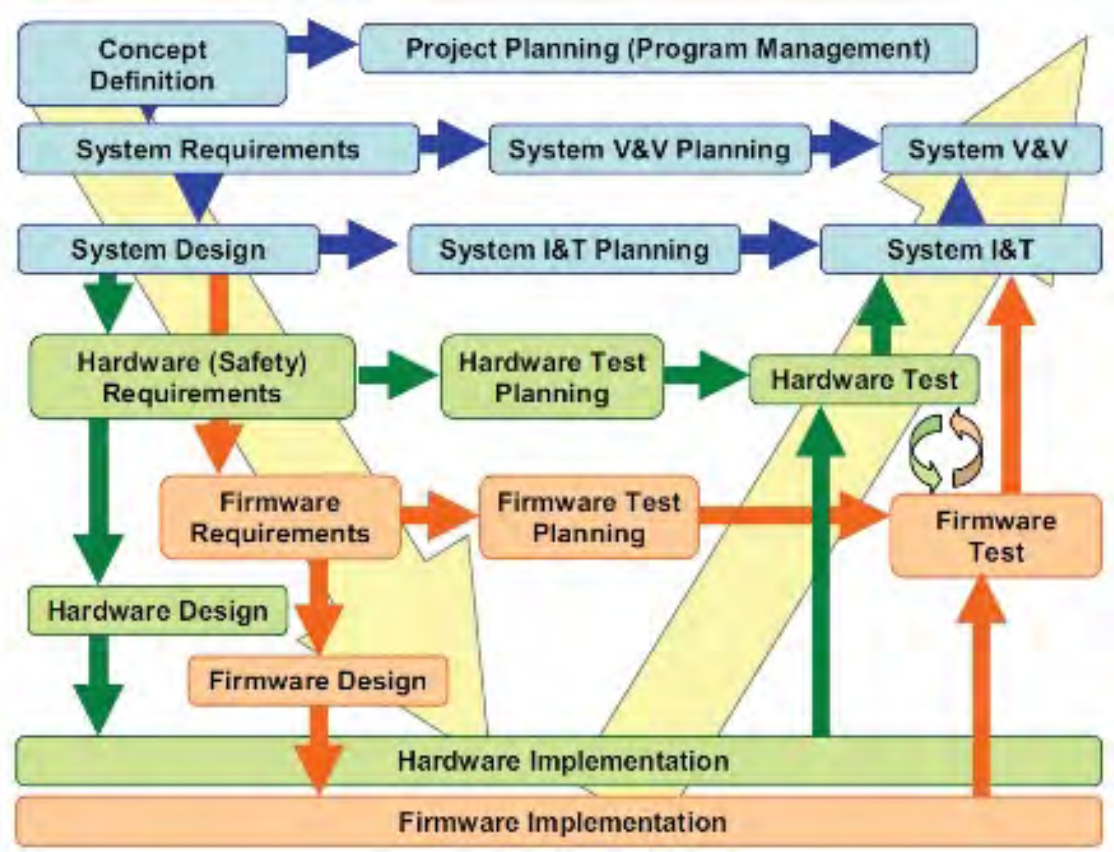
## Other trends to watch …

- Other industry sectors have also developed standards for use of FPGA technology in safety-critical applications
  - Driving market towards certified FPGA components and development tools
  - Driving market towards certified products (e.g., IEC 61508 SIL Certification)

Sunport

# The future for the nuclear sector?

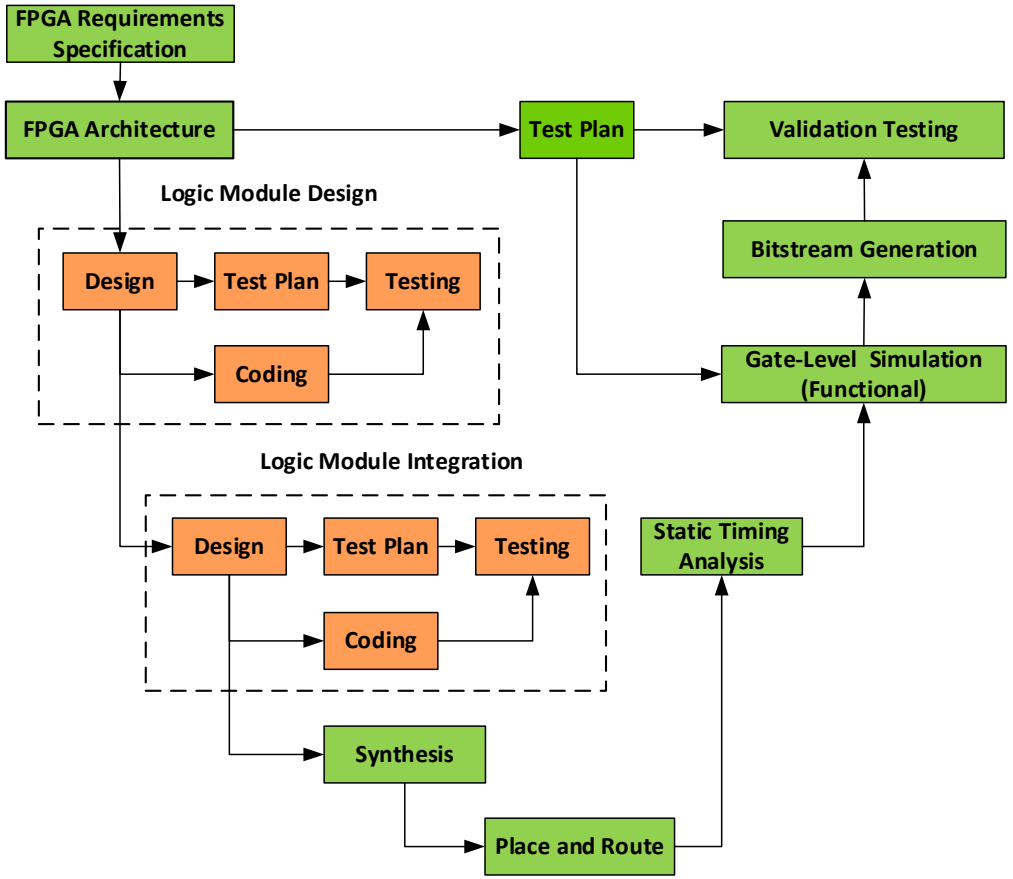
- Accepted standard development processes and tool flows



Sunport

# The future for the nuclear sector?

- Accepted standard development processes and tool flows



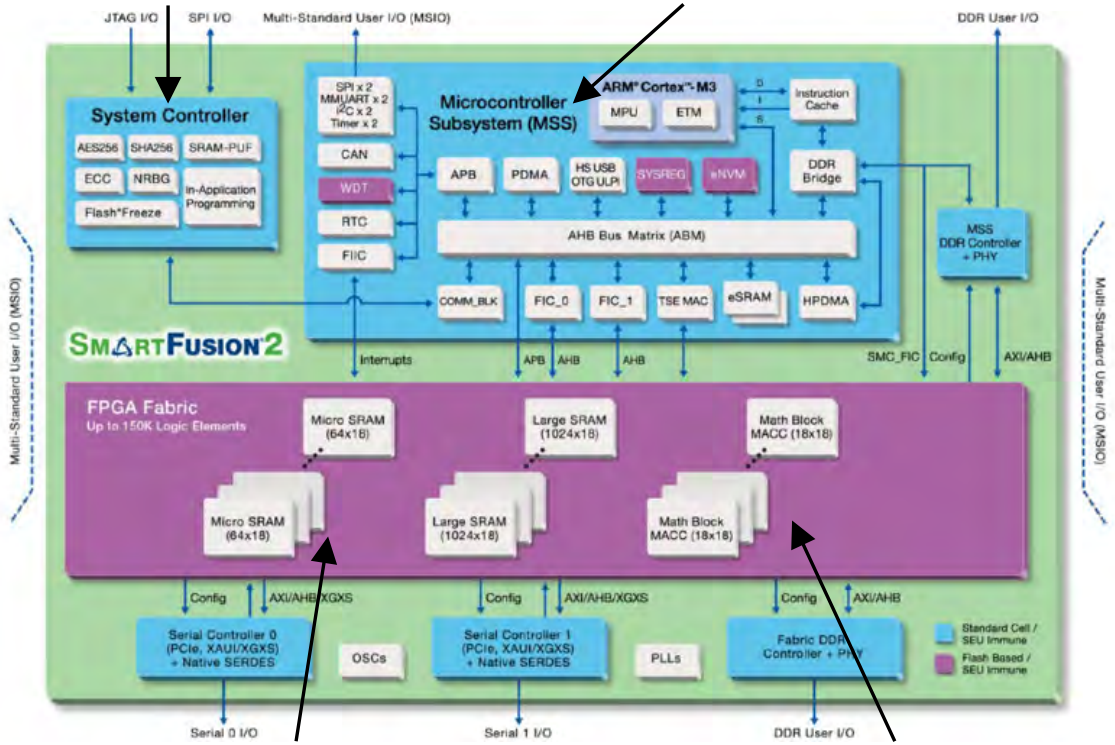
Sunport

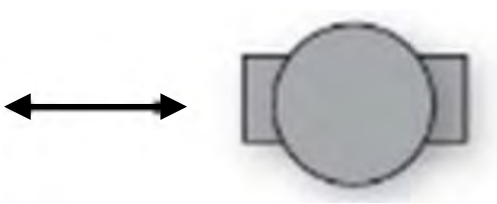
# The future for the nuclear sector?

- Accepted safe integrated solutions for standard industry needs

Security Functions

MCU-Based Motor Controller



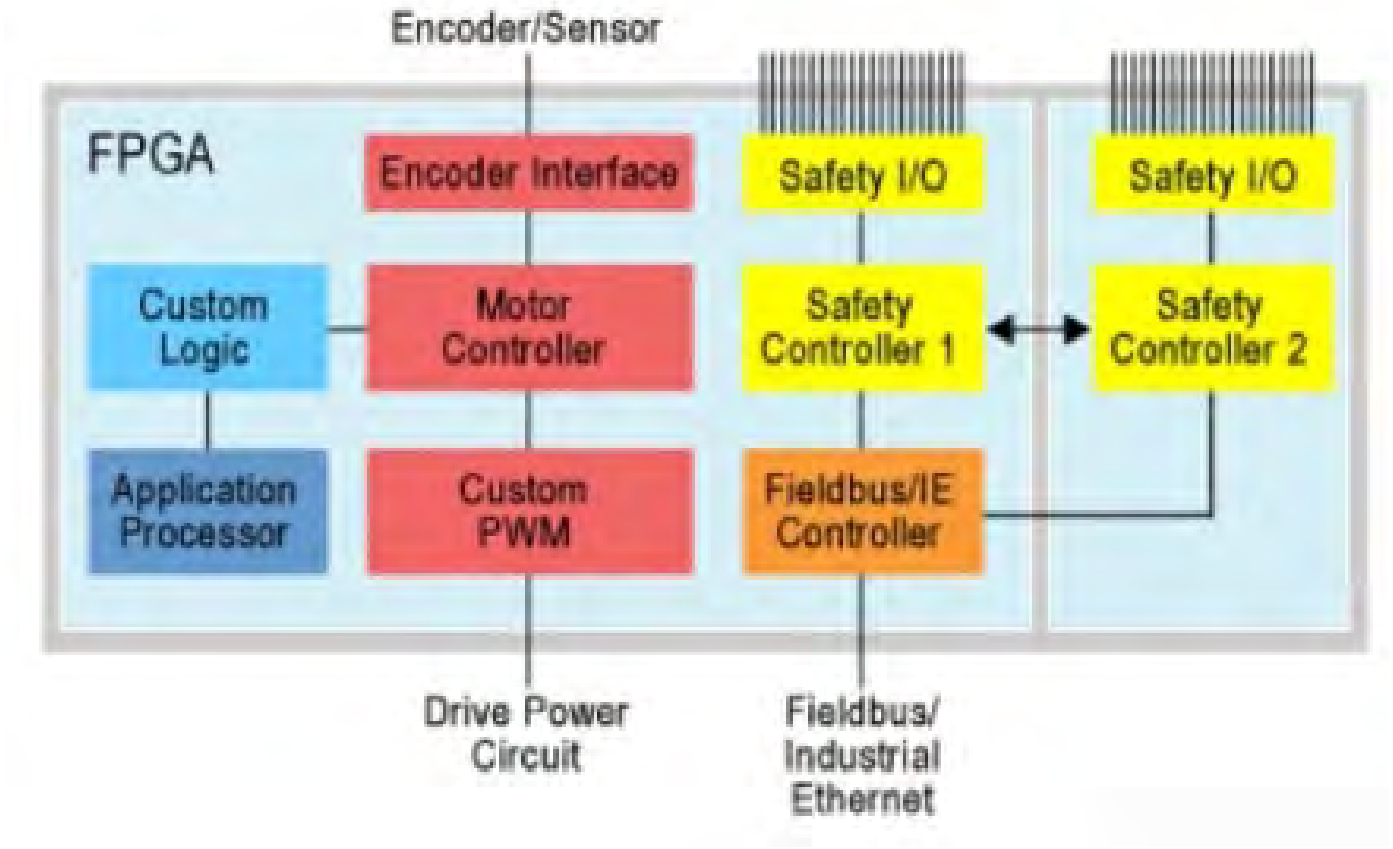
FPGA-Based Motor Controller

FPGA-Based Fail-Safe Circuit

Sunport

# The future for the nuclear sector?

- Accepted safe integrated solutions for standard industry needs



Sunport

# The future for the nuclear sector?

- Realization process improvements through use of certified products

Sunport

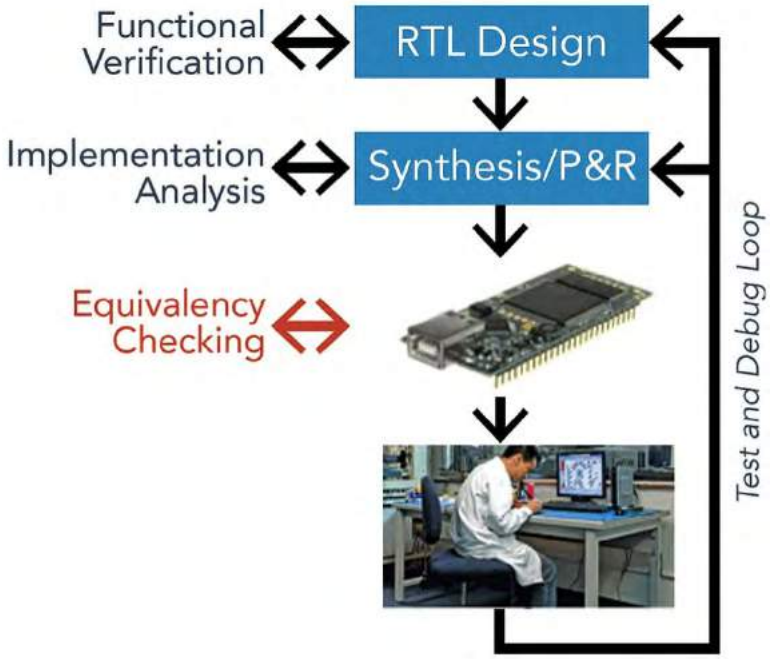
# The future for the nuclear sector?

- Realization process improvements through use of certified products

Sunport

## The future for the nuclear sector?

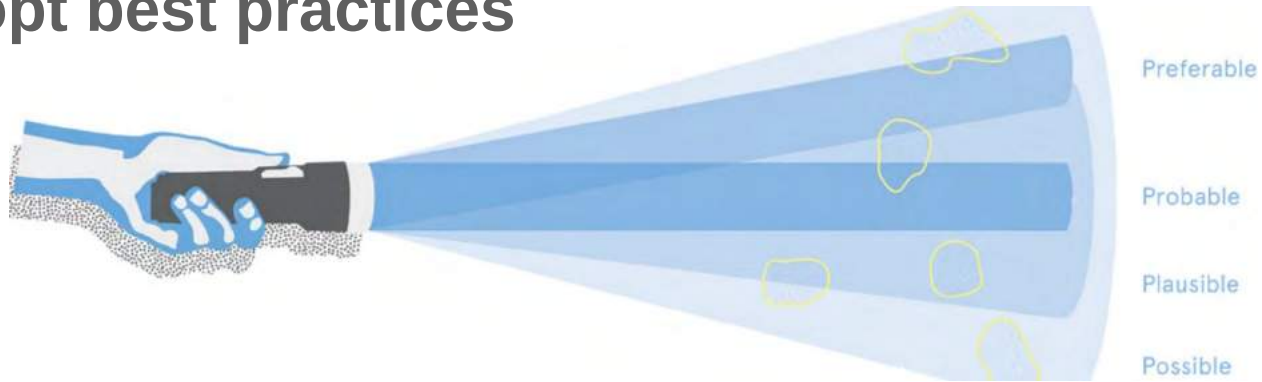
- Continued advancement in design, verification, and validation techniques
  - Code Coverage
  - Functional Coverage
  - Timing Simulation
  - Assertion Based Verification
  - Constrained Random Verificatic
  - Universal Verification Methodol
  - Formal Verification
  - Model Based Design



Sunport

## Our collective challenges …

- Stay abreast of new developments
- Leverage benefits from other industries
- Anticipate advancements in standard products
- Adopt best practices




***Prepare to take advantage of all that is available to improve effectiveness, efficiency, and safety***

Sunport
Connecting Forward

www.sunport.ch

# Thank you

**SunPort SA**

LaCite Business Nucleus Avenue
De l'Universite 24 CH-1005
Lausanne, Switzerland