

# Emerging Technologies for VLSI Application

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MITRE Sponsored Research

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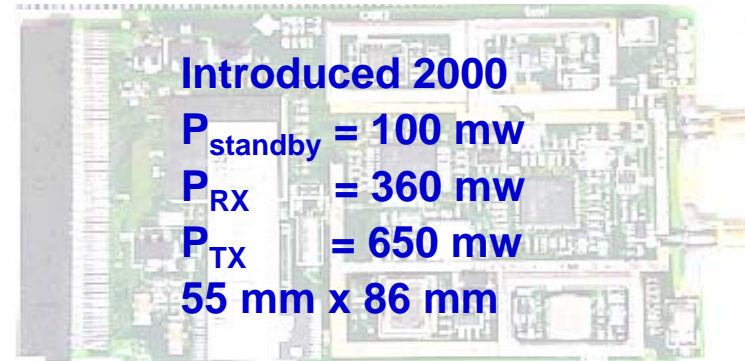
# Problem

- **The warfighter requires small, low-power, and more capable electronic equipment to identify and counteract threats.**
- **The rapid advances in electronics technology support the warfighter's needs but introduce many design challenges.**
- **Addressing these design challenges requires state-of-the-art integrated circuit design flows and techniques to realize practical solutions.**

# Background

- Advances in process technology are driving the convergence of communication, computing, and sensor technologies onto a single silicon substrate.
  - *Systems on a Chip (SoC)*
- The continuation of Moore's Law enables SoC but presents many semiconductor process and design challenges.
  - *Power, signal Integrity, design complexity, etc.*

## Wireless Application (802.11b)



## Introduced 2005

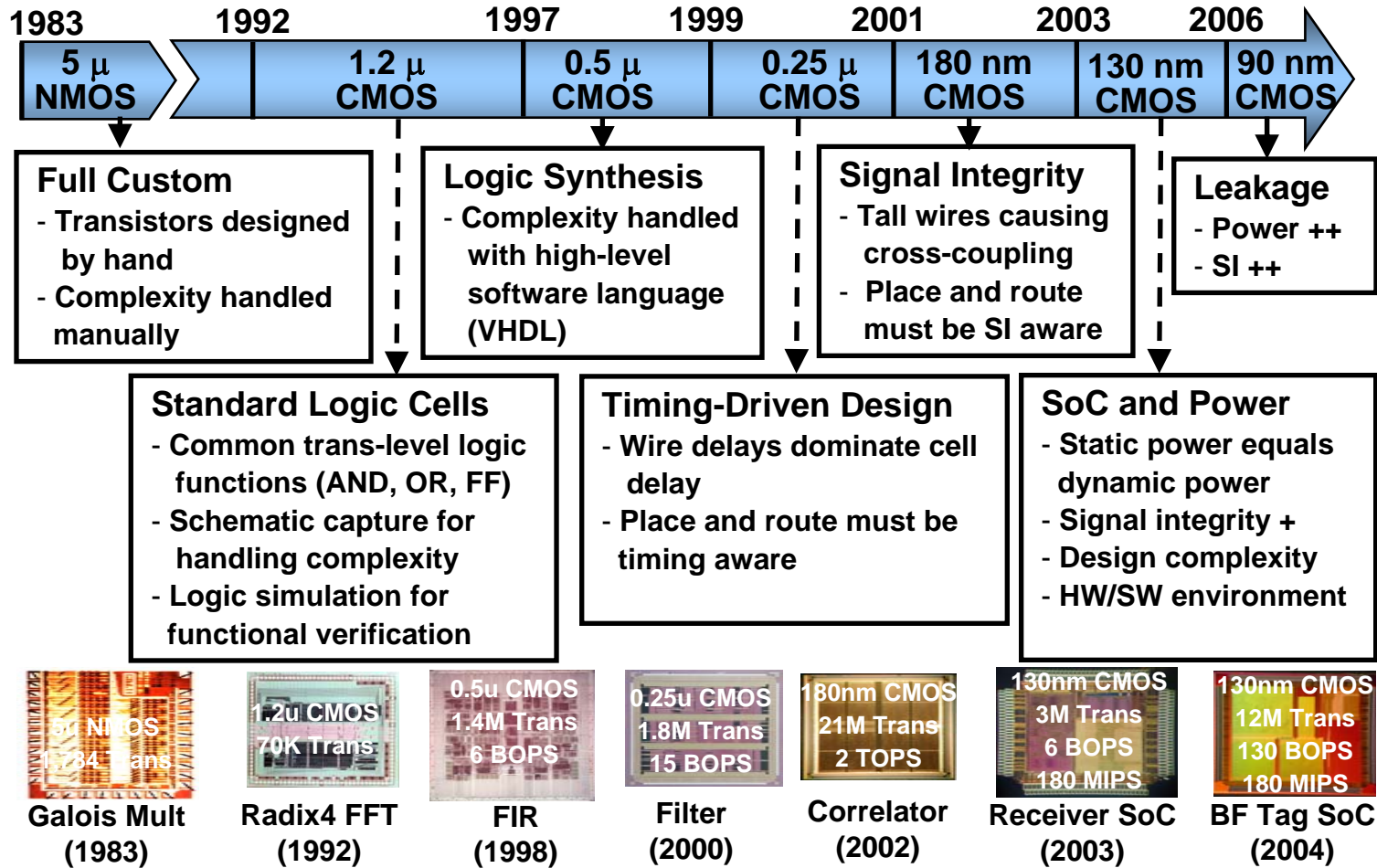
$P_{\text{standby}} = 6 \text{ mW}$   
 $P_{\text{RX}} = 280 \text{ mW}$   
 $P_{\text{TX}} = 450 \text{ mW}$   
14.8 mm x 26.5 mm

***SoC will change the way future military systems are conceptualized and designed. However, the grand challenges introduced by this technology must be solved.***

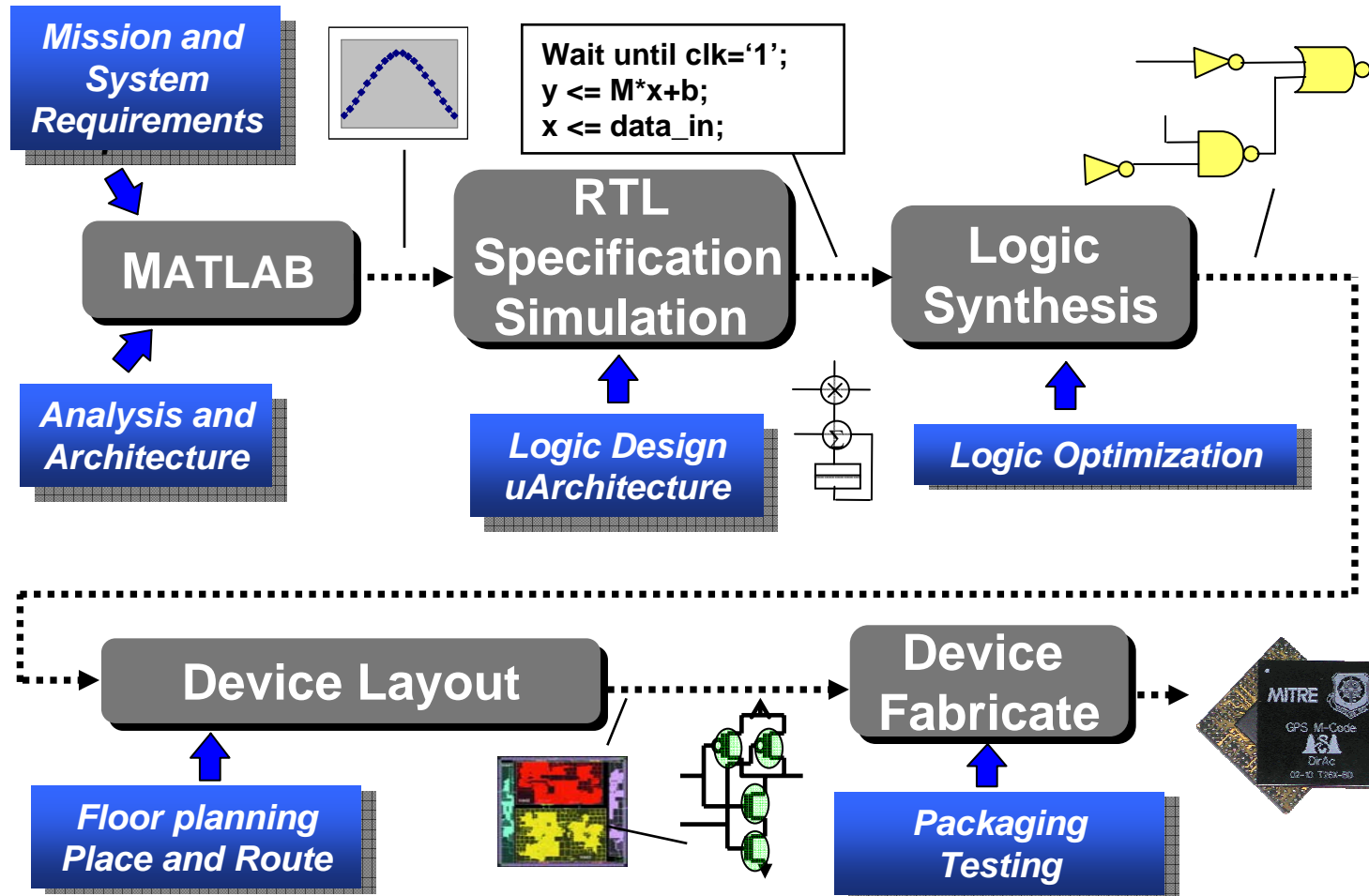
# Activities

- **Develop a SoC design flow and a framework to facilitate design of low-power systems**
  - Analyze and optimize for dynamic and static power dissipation
- **Develop method for analyzing and correcting on-chip signal integrity issues**
- **Improve the efficiency and capacity to develop and verify the functional correctness of SoC devices**
  - Evaluate the efficiency and maturity of *SystemC* and other system-level design specification language alternatives
  - Develop improved verification/simulation techniques for SoC devices using OSI-like layer model
- **Collaboration with industry**
  - Semiconductor Research Corporation (SRC)
  - International Technology Roadmap for Semiconductors

# Highlight



# Demonstration



# Impacts

- This project has enabled MITRE to promote the rapid insertion of state-of-the-art electronics technology into the systems our sponsors require.
- Skills and techniques developed were essential for the successful design and delivery of several recent custom integrated circuit prototypes.
  - M-Code DirAc, M-Code RoC, BFT Tag
- Thorough understanding of semiconductor process and integrated circuit design through real hands-on experience gives MITRE insight and credibility when reviewing sponsor requirements.
  - JTRS and GPS Modernization

# Future Plans

SoC power minimization requires optimization across all system domains

Efficient power conversion  
 Efficient waveforms  
 Efficient RF -> Baseband  
 Power management-aware OS  
 Power-reducing architectures  
 Power-reducing logic optimization  
 Power-reducing transistors  
 etc....

Techniques for reducing size and cost while increasing battery life and performance

