

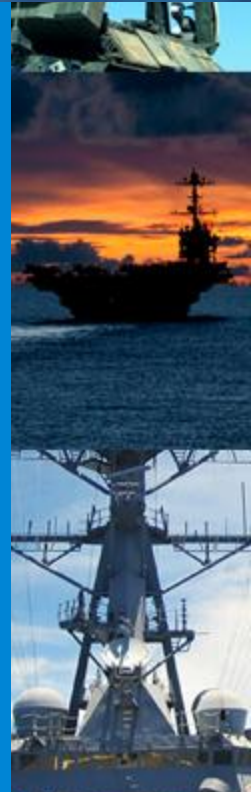


# Winning More Radar Business by being Better, Faster and Cheaper

***Agilent EEsof EDA***

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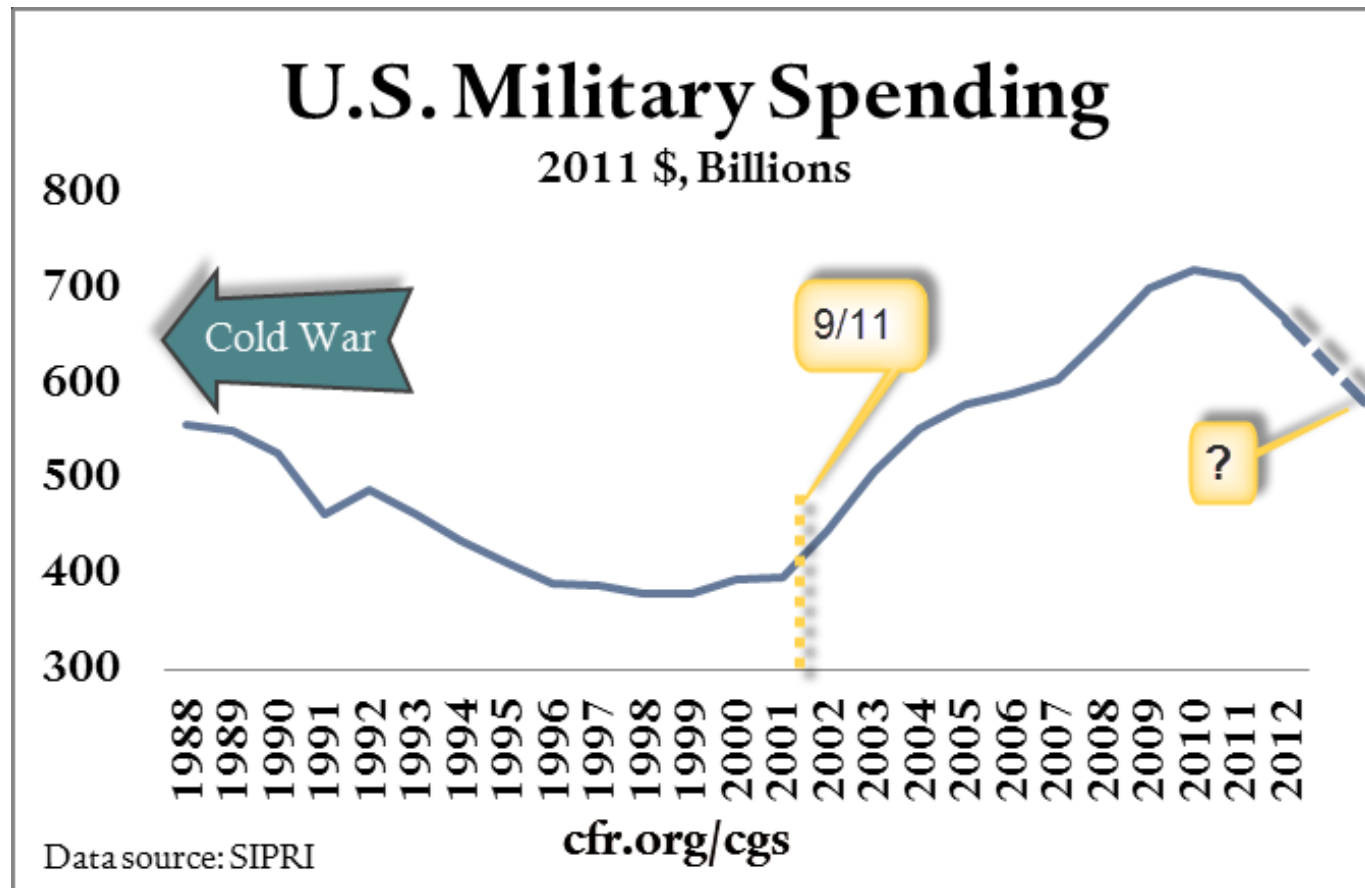


# Agenda

- **Background: Defense spending is decreasing, what can we do?**
- **A Typical Defense Contractor's Research and Development (R&D) Flow**
- **A Comparison of Defense and Commercial R&D Flows**
- **A big defense contractor goes after a potentially lucrative commercial automotive radar contract**
- **An Integrated Design Flow using SystemVue**
- **Summary and Conclusions**



# Defense Spending is Decreasing!



# So What's a DoD Contractor to do?

- Reduce Spending?

- Reduce staff?
- Spin off, Sell off or just close underperforming businesses?
- Seek more foreign business?

- Seek other business opportunities

- Be more aggressive in pursuing new DoD business opportunities
- Utilize the talented engineering staff to seek “outside-the-box” opportunities, especially in the commercial sector

- Fundamentally change how your R&D is done, to become more like a high-tech commercial business instead of a cold-war artifact

*“...Many of the problems facing the (DoD) acquisition system stem from a failure to change a system that was developed in the shadow of the cold war...” Jacques Gansler<sup>1</sup>*



# **Apply Some of their Expertise to Develop Commercial Products**

## **Successfully Transfers from Defense to Commercial Markets**

- **Microwave Ovens (Raytheon/Amana Radarange, 1967)**
- **GPS (“Note: The Infrastructure behind it is still being totally funded by the DoD”)**
- **The Internet (“Sorry, Al Gore!”)**
- **Can you think of others?**

**Why do you think these products were wildly successful but other products, such as the Hummer, were a flop?**

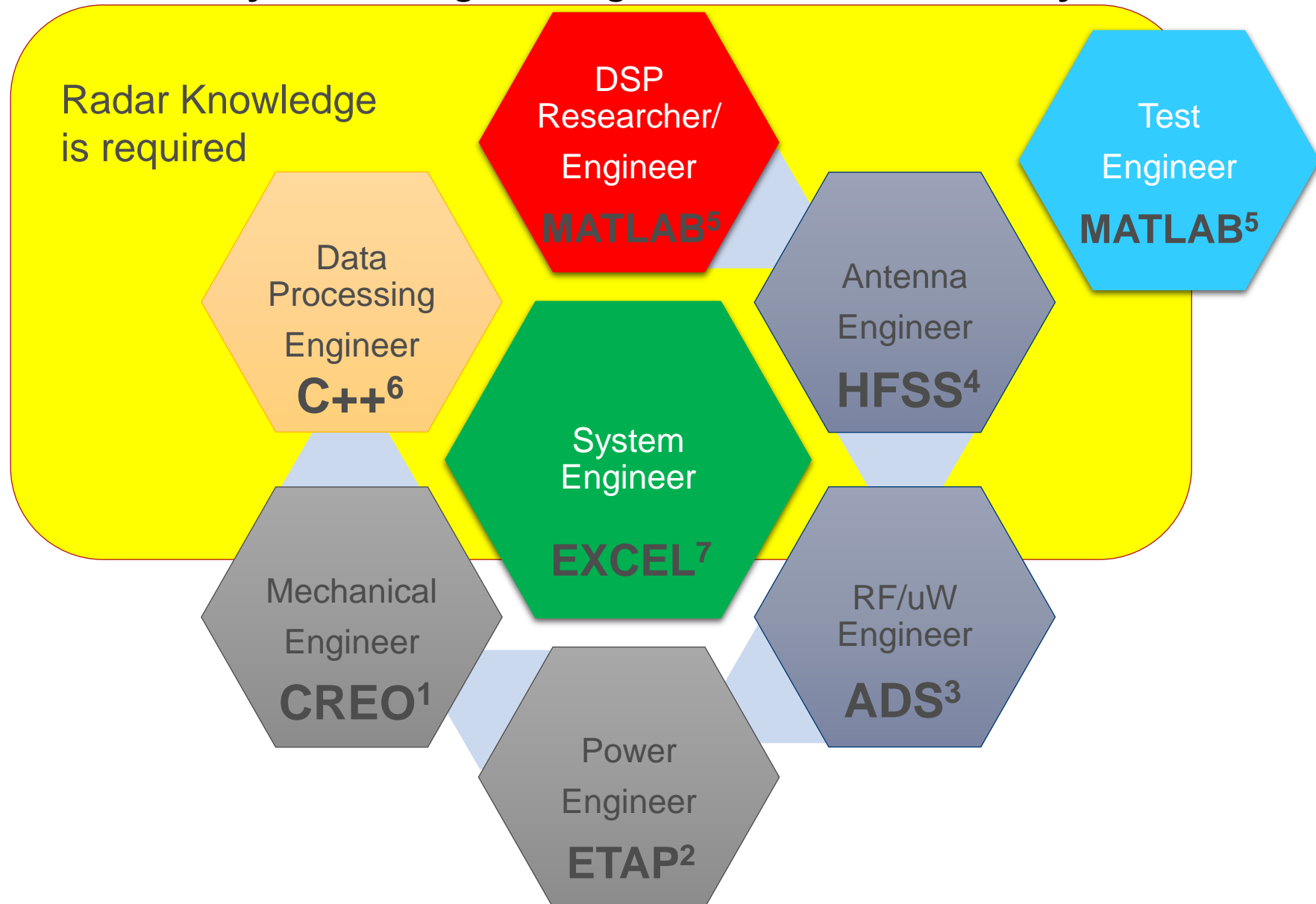


# Differences between Defense Contractors and Commercial Companies

Question	Defense Contractor	Commercial Contractor
Where does funding come from?	From the Government	From Themselves
Types of products to develop?	Military Requirements	Market Forces
How do they get paid for research?	Paid by the Government throughout the R&D process	After delivering a successful product to market
Types of Products	Complex, Stringent Requirements	Simple, Reliable, Moderate Performance
What happens with poor performance or non-delivery?	A Contract Extension is often provided, with extra funding	Hurts their bottom Line and Reputation, Possibly Fatal
What happens with cost overruns?	The Contractor gets Paid for all Expenses. Cost Plus Contracting	Drives up Product Costs, thus Reducing Potential Market Size
What is the Primary Driver for this Business	Build the Finest (Ship, Weapon, Aircraft, Radar) in the world	Increase Market Share and Awareness. Make a Profit
Product Cycle	Years or Decades	Months or Years at most
Technology Sharing	Sharing often Imposed by DoD	Based on Proprietary Advantage
Competition	Few Competitors, Imposed Cord.	Free Market, Price & Quality



# Defense Industry Radar Engineering Roles and their Primary Tools





# Critical System-Level Design Problems

## Disconnected BB/RF Design Flows

- Too many individual tools with little data exchange
- Late integration, difficult troubleshooting and high one-time engineering costs across the product lifecycle

## The Exploding Need for Verification

- With Multi-function Radars, FPGAs and potentially thousands of T/R Modules: There's too much to test!
- No leverage or automation between RF, DSP, and Test groups
- No single view of system requirements, performance, troubleshooting or verification

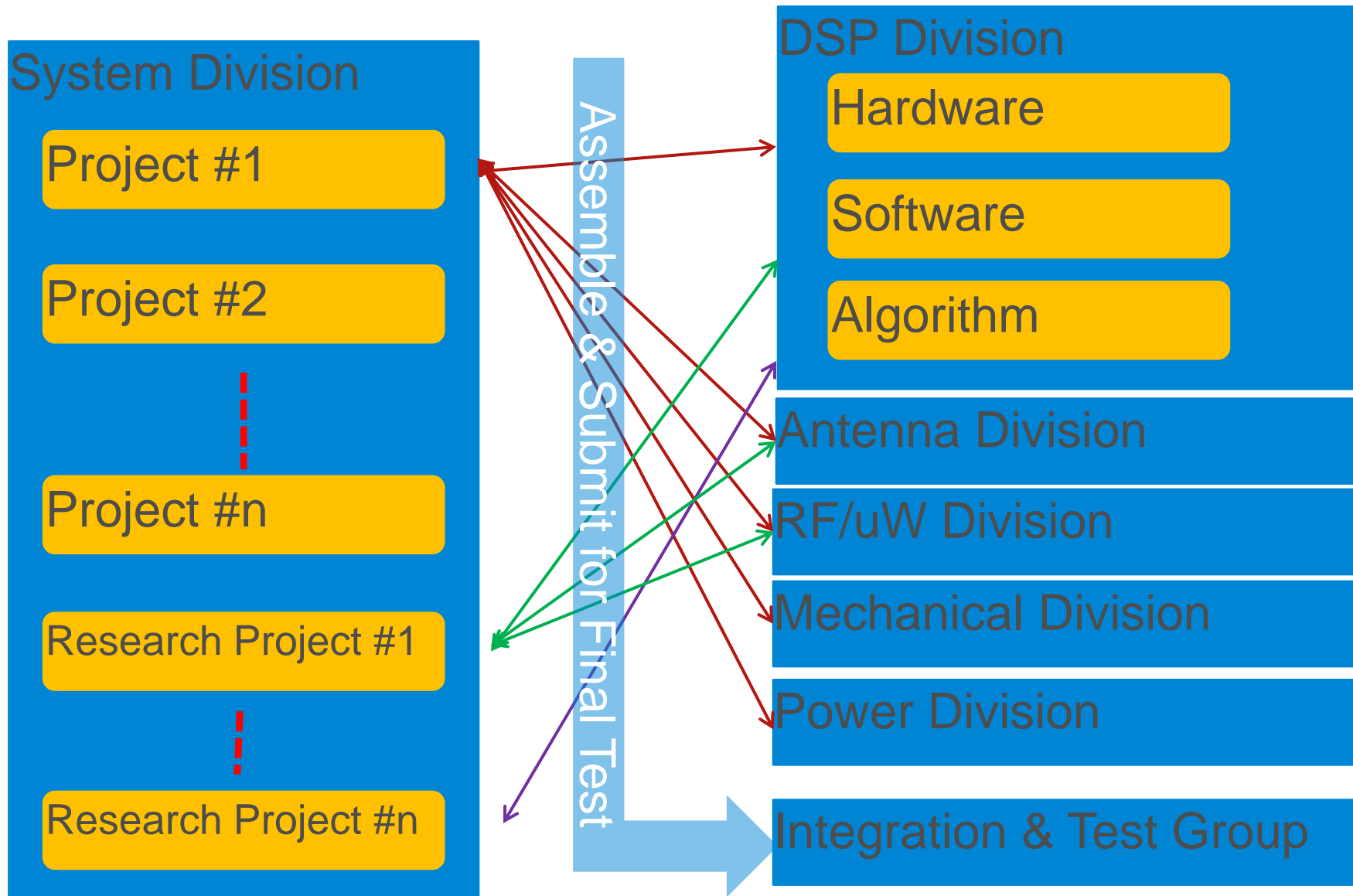
## Inefficient workgroup collaboration

- Poor system-level partitioning and requirements tracking
- No top-down, model-based design flow that spans across RF, FPGA, and T&M domains
- Lack of common interfaces and IP re-use across teams, tools, and product lifecycle





# Today's DoD Contractor R&D Structure



## Scenario – Pursuing a Big Commercial Contract

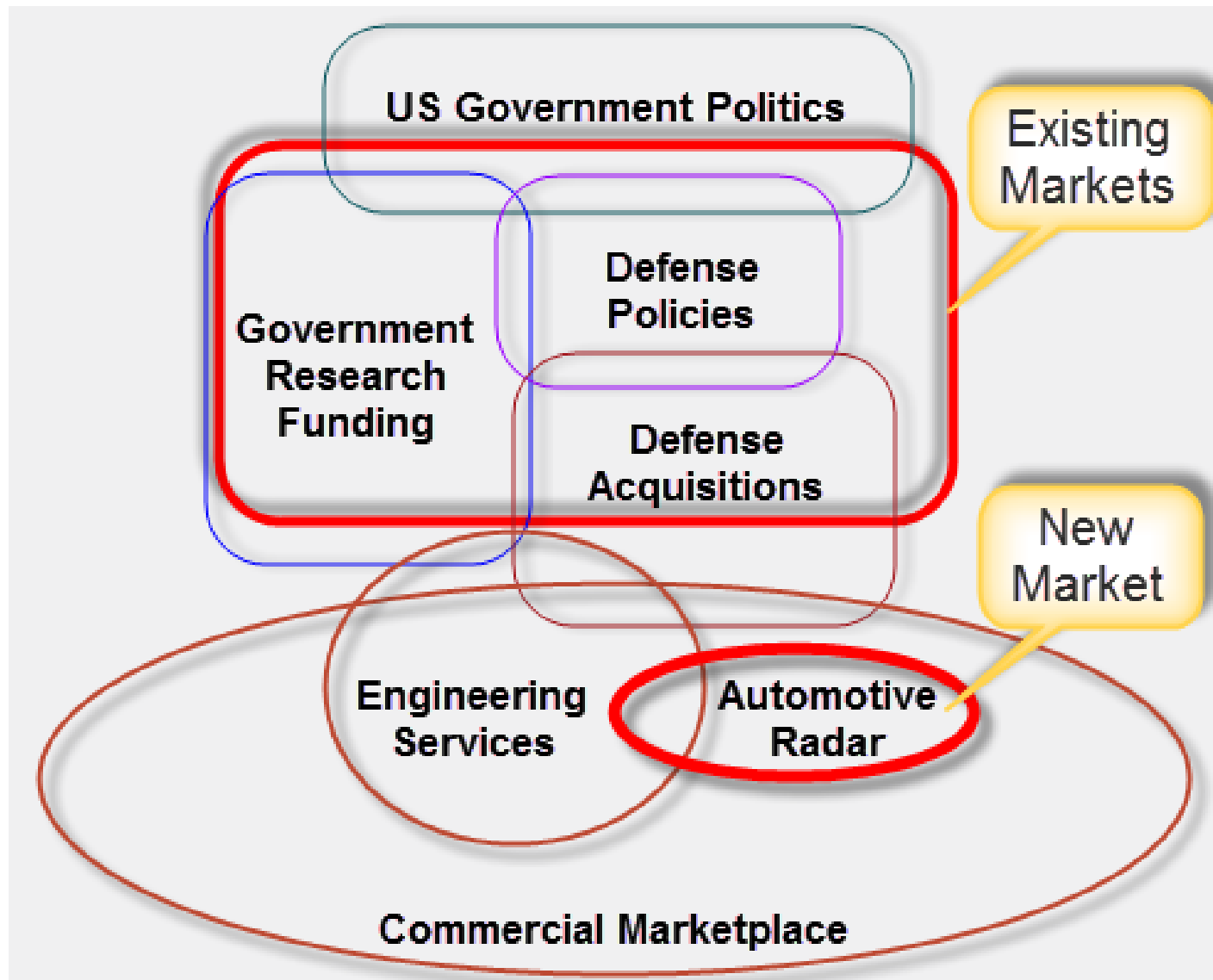
A big DoD radar system producer wants to aggressively go after new business, wherever it might occur. They can see the “writing-on-the-wall” that defense budgets and big programs are being cut. Their sales organization has found out that all of the major automobile manufacturers are looking to implement millimeter wave radar systems for collision avoidance and blind-spot detection for all their vehicles over the next several years. This is ahead of the expected government mandate to have every future automobile and commercial truck built have this capability.

### Questions:

- *What do they have to offer that that other suppliers might not have?*
- *What might the areas of concern be for them?*

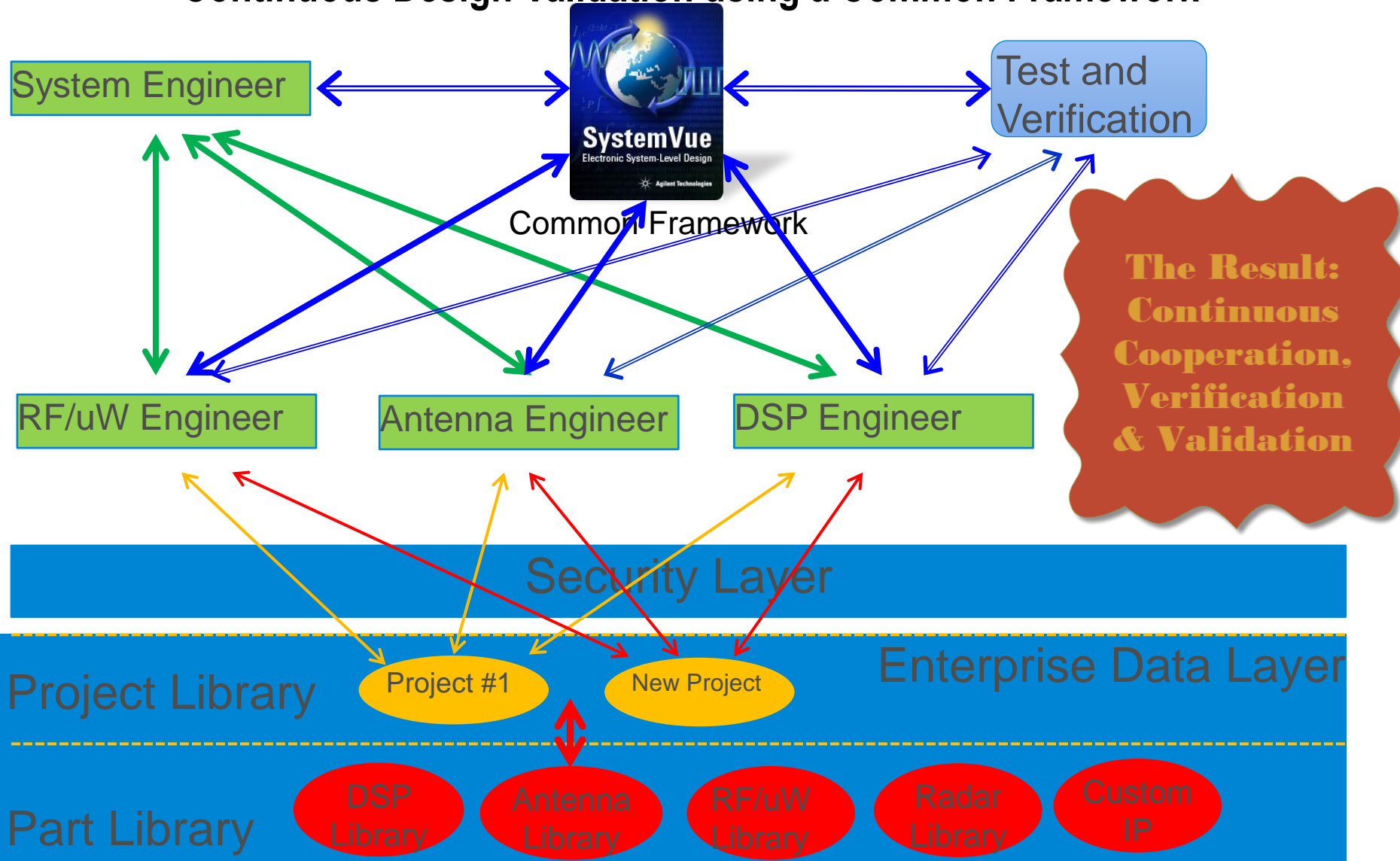


# The Existing Marketplace and the Potential New Commercial Markets



# Advanced Integrated Design and Verification Flow using SystemVue

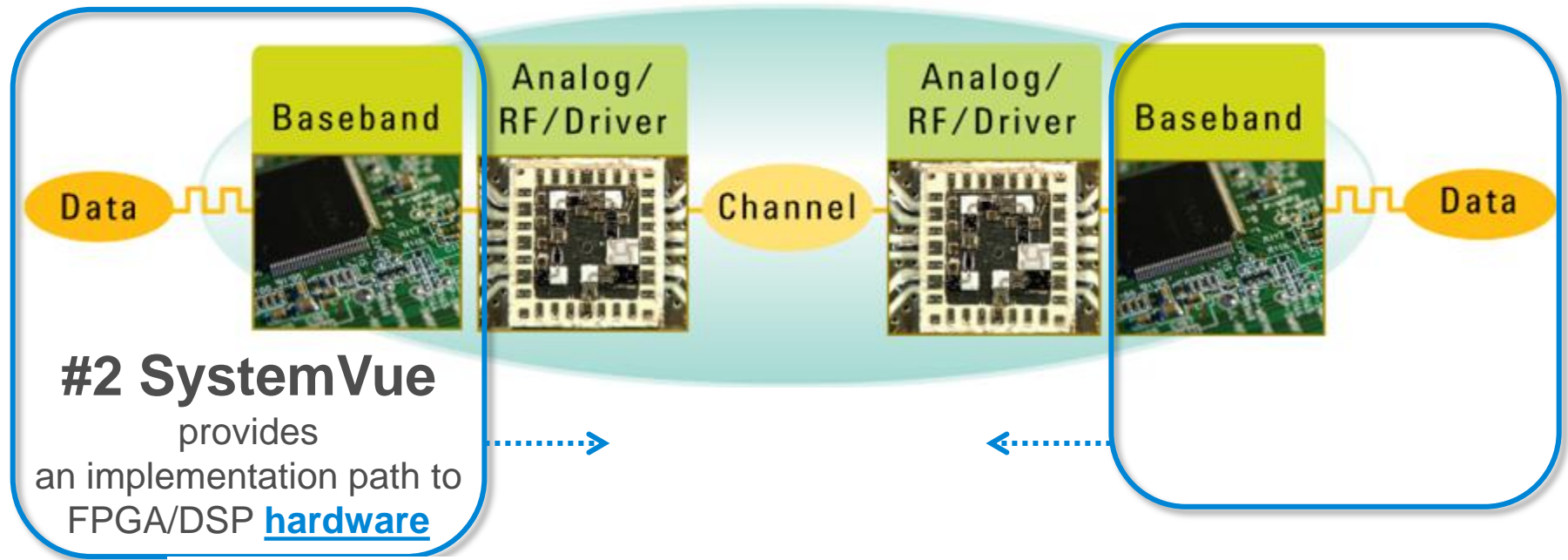
## Continuous Design Validation using a Common Framework



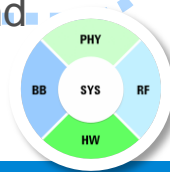
# What is SystemVue?

*System-level design cockpit, focused on Comms & Defense*

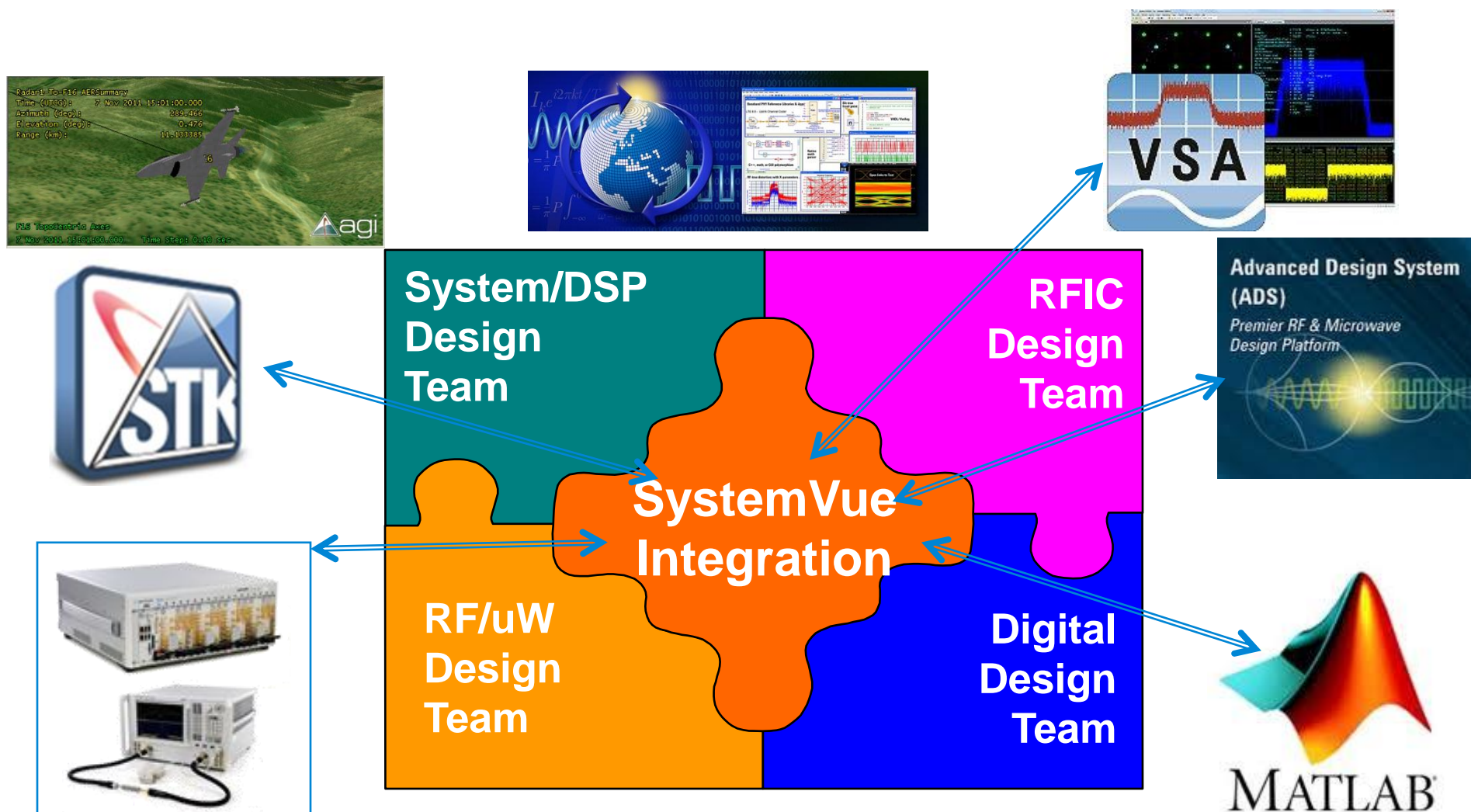
**#1 SystemVue models** Physical Layer (PHY) architectures across multiple Baseband & RF domains, for better system designs



**#3 SystemVue** enables cross-domain verification, connecting Baseband algorithm to RF tools, Standards references, and Test & Measurement.



# Agilent's SystemVue Links to other Programs





# Validate Systems Before, During & After Development

*Transition naturally from Design → Test with a single “cockpit”*



## IP Reference Libraries

4G LTE-Advanced, LTE  
3G HSPA+, WCDMA, EDGE, GSM  
WLAN 802.11ac/n/a/b/g  
WPAN 802.11ad, 802.15.3c  
RADAR Libraries

- ✓ Quickly capture “system level” design concepts
- ✓ Model implementation-level impairments

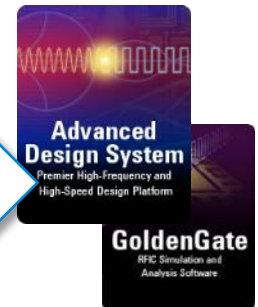
## BB Algorithm Modeling

MATLAB .m  
FixedPoint, HDL/FPGA  
Embedded C++  
Filtering, EQ, Modem



## RF / Analog Channel Modeling

MIMO Channel (OTA)  
Digital Pre-Distortion (DPD)  
RF System Design  
RF EDA platforms



## Test Software

I/O Lib, ComExpert  
89600 VSA  
Signal Studio  
3<sup>rd</sup> Party

## Test Equipment

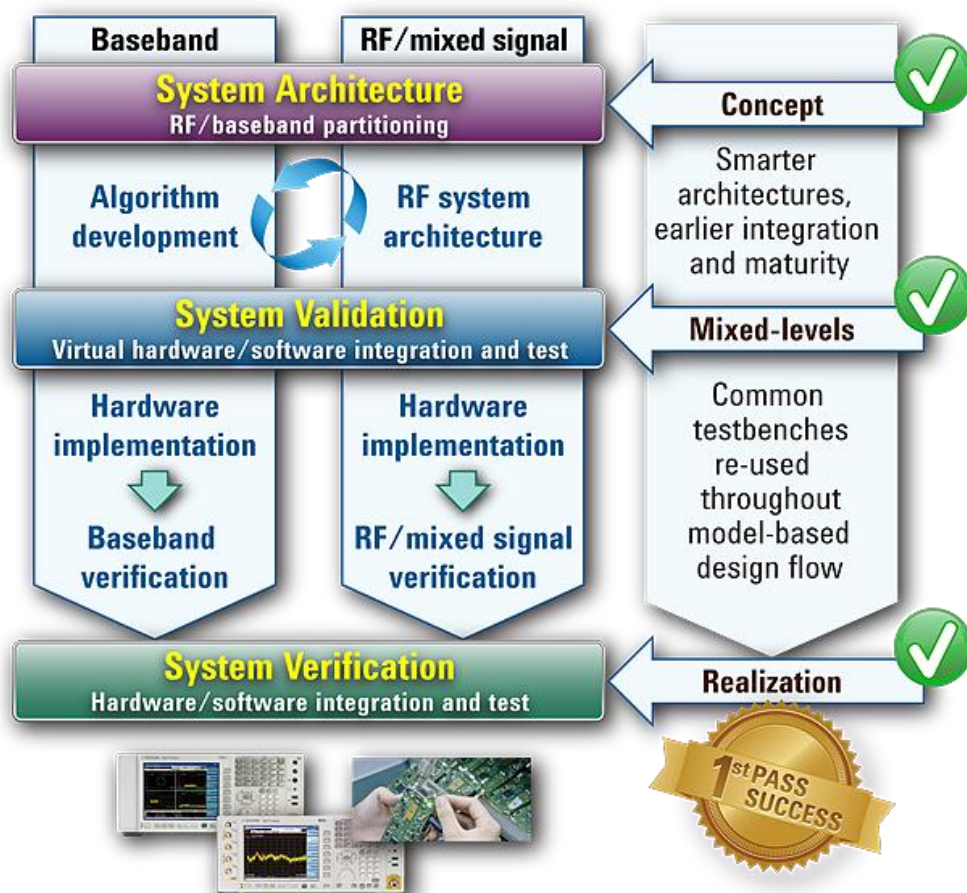
RF Sources & Analyzers  
AWG & Digitizers  
Scopes, Logic, Modular



- ✓ Connect BB, RF, and T&M for rapid validation
- ✓ Rapid prototyping with integrated measurement



# System-level approach: unifies BB/RF design flows



## Design

- ✓ Explore innovative architectures by modeling BB/RF with confidence

## Validate

- ✓ Save design iterations with earlier BB/RF co-verification

## Test

- ✓ Maximize ROI on test assets and design effort



### System Verifiers

- Use “measurement-grade” reference IP, or create custom signals
- Verify system block level interoperability at all levels of H/W abstraction
- IP aggregation, including both BB and RF Systems

# The Bottom Line: In Order to be Successful in Commercial Market:

## A DoD Contractor Might Consider

1. First, consider creating a separate division that isn't burdened by government accounting rules and red tape.
2. Insisting on an Integrated Design Flow.
3. Require simulation results for design reviews
4. Encourage interdepartmental cooperation and coordination.
5. Validating Test Development From the initial behavioral system models throughout the development process
6. Utilize the innovative talent available from the defense organization in combination with engineers who have commercial product development experience.



# References:

1. *Practical Matters for Defense Contractors Converting DoD Technology to Commercial Markets* – Carina Ting, Massachusetts Institute of Technology 2012.
2. Jacques S. Gansler – *Democracy's Arsenal*, MIT Press 2011
3. *Defense Contractors Are Going To Go For The Civilian Market* – Forbes – Loren Thompson – November 8, 2011

