Defense Acquisition in Transition

6TH ANNUAL ACQUISITION RESEARCH SYMPOSIUM

Modeling Open Architecture and Evolutionary Acquisition in ARCI with Applications to RCIP

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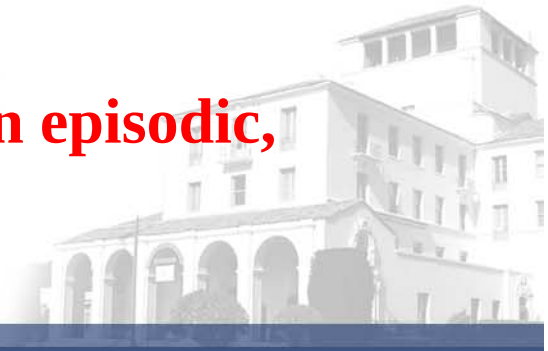
Acquisition Challenges

- **Fast evolution of threats and technologies** – often faster than acquisition programs
- **Need acquisition of systems that are integrated**
  - Across system mission (e.g. ISR, navigation)
  - Across platforms (carriers, destroyers, cruisers, etc.)
  - Across capability improvements (e.g. technology upgrades)
- **Need repeatable capability upgrade process**
- **Rapid Capability Insertion Process** (RCIP)
  - Conceptually designed ,
  - Needs better understanding of drivers of success for implementation

Designing and Managing Fast-Evolving Acquisition

- ***Open Architecture (OA):***
  - Modular design and design disclosure
  - Reusable application software
  - Interoperable joint warfighting applications and secure information exchange
  - Life cycle affordability
  - Encouraging competition and collaboration through development of alternative solutions and sources
- ***Evolutionary Acquisition (EA):***
  - Concurrent development phases
  - Only mature-enough technologies
- **But successful OA/EA programs have been episodic, not standard practice.**



Research Questions

Q1: How have OA and EA been successfully integrated for rapid capability insertion?

Q2: How can successful OA/EA processes and experiences be integrated into RCIP?

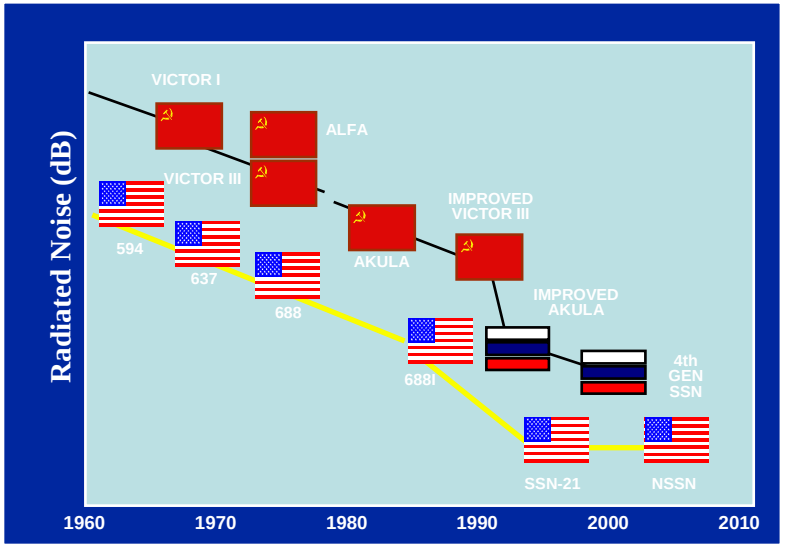
Research Approach

1) Build simulation model of successful rapid capability insertion process (ARCI program)
2) Change simulation model to better reflect RCIP
3) Simulate RCIP under variety of program characteristics and program environment conditions
4) Analyze results to better understand RCIP drivers

The Acoustic Rapid COTS Insertion Program (ARCI) – Background (1of3)

- **Early 1990s:** Real and immediate reduction in submarine sonar advantage

FSU/US Nuclear Stealth

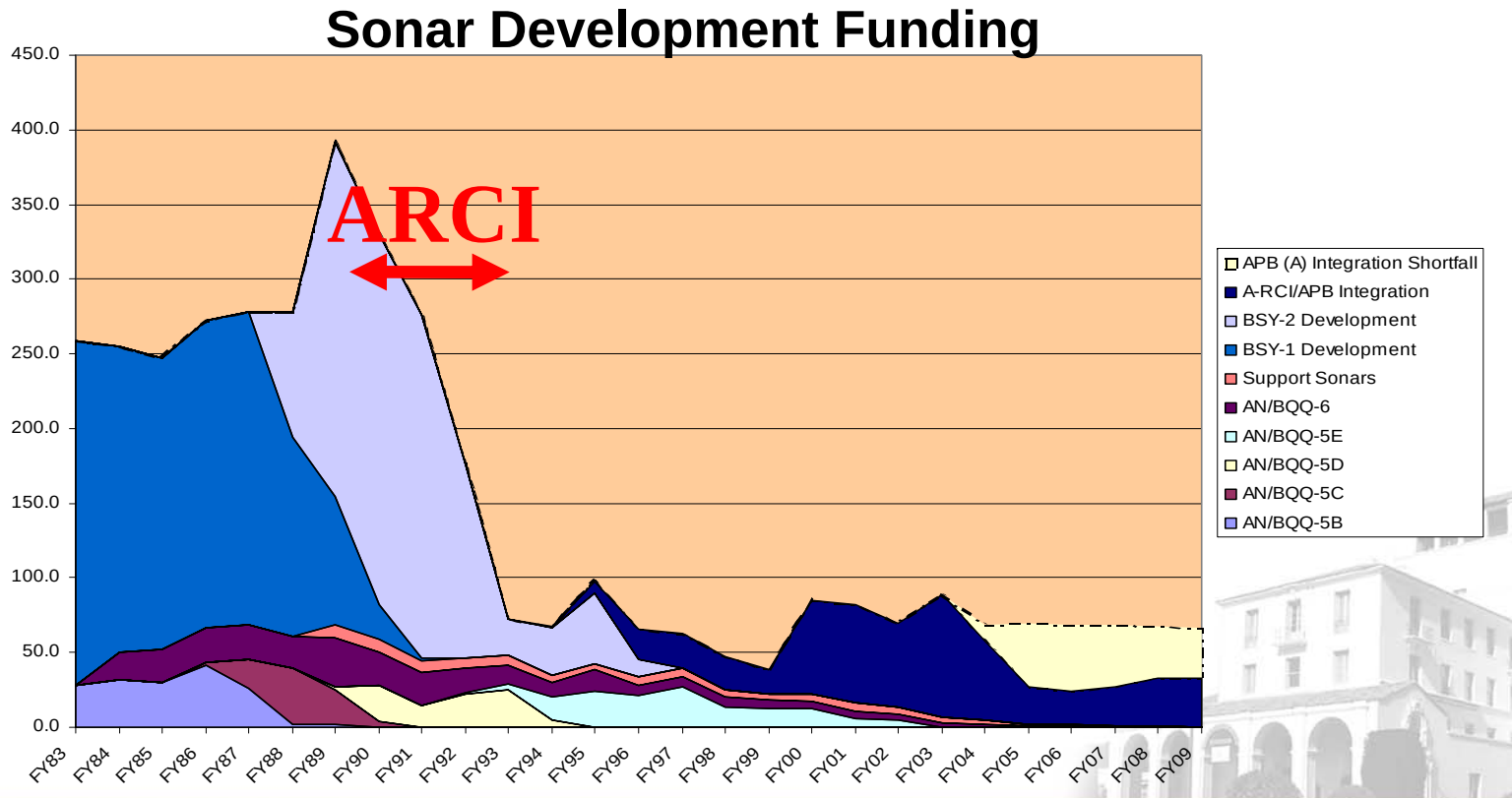


From ARCI – A Historical Perspective, Mr. William Johnson, IWS 7.0
Deputy Major Program Manager
Future Combat Systems Open Architecture

- Critical issue for the operating fleet – ***needed improvement fast!***

ARCI – Background (2of3)

- Sharp reduction in funding – “Build-new" not possible – ***needed improvement cheap!***



ARCI – Background (3of3)

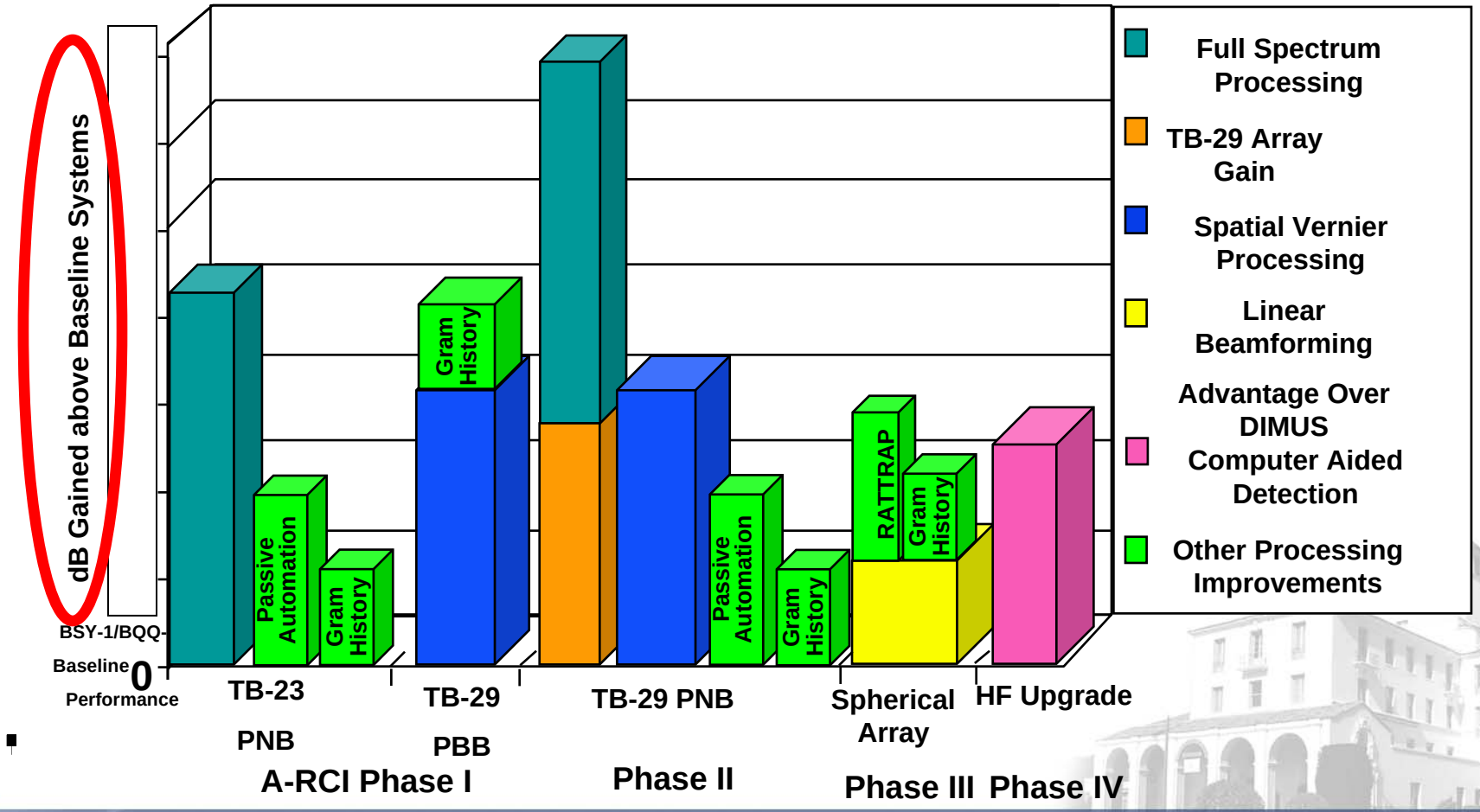
- Legacy processors, software, and work stations were old (circa 1970s) and custom-built – expensive and slow to change – ***needed a different acquisition process!***

ARCI – Program Performance (1of2)

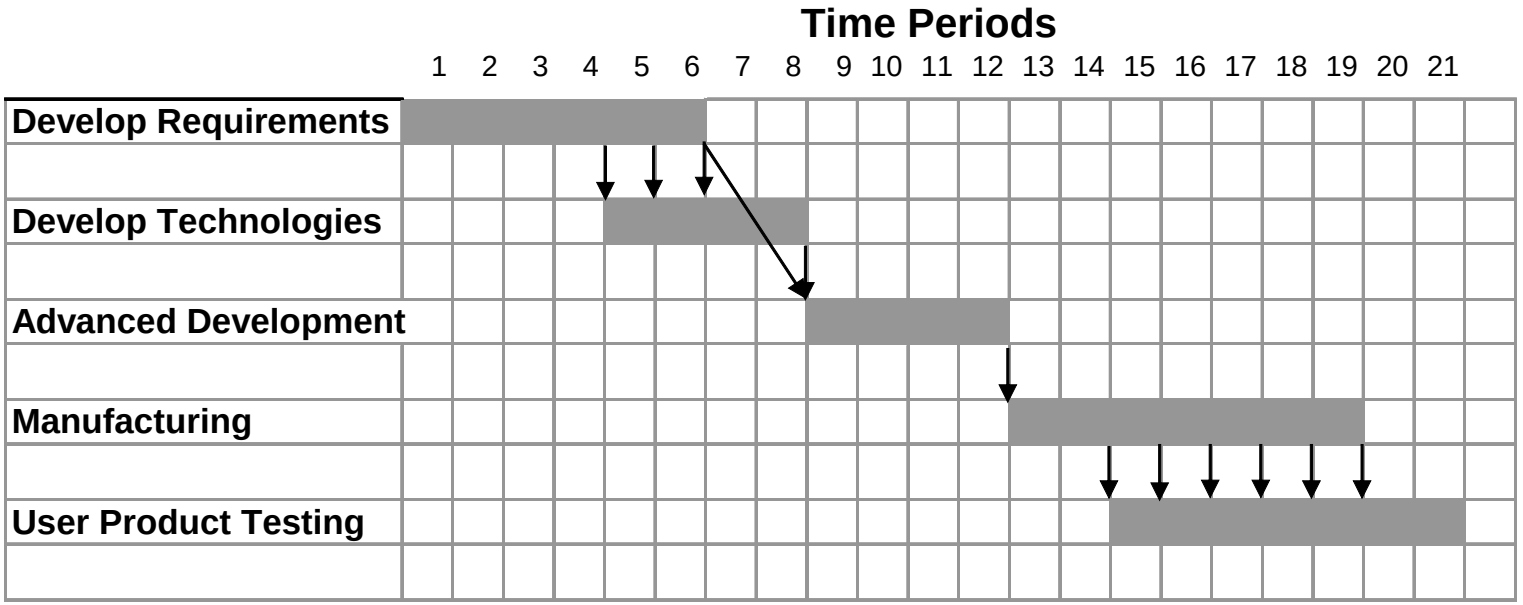
- New upgrades ("builds") every 12 months - ***no schedule slippage***
- ***Cost avoidance > $3 billion***

ARCI – Program Performance (2of2)

- Sonar capability improvement

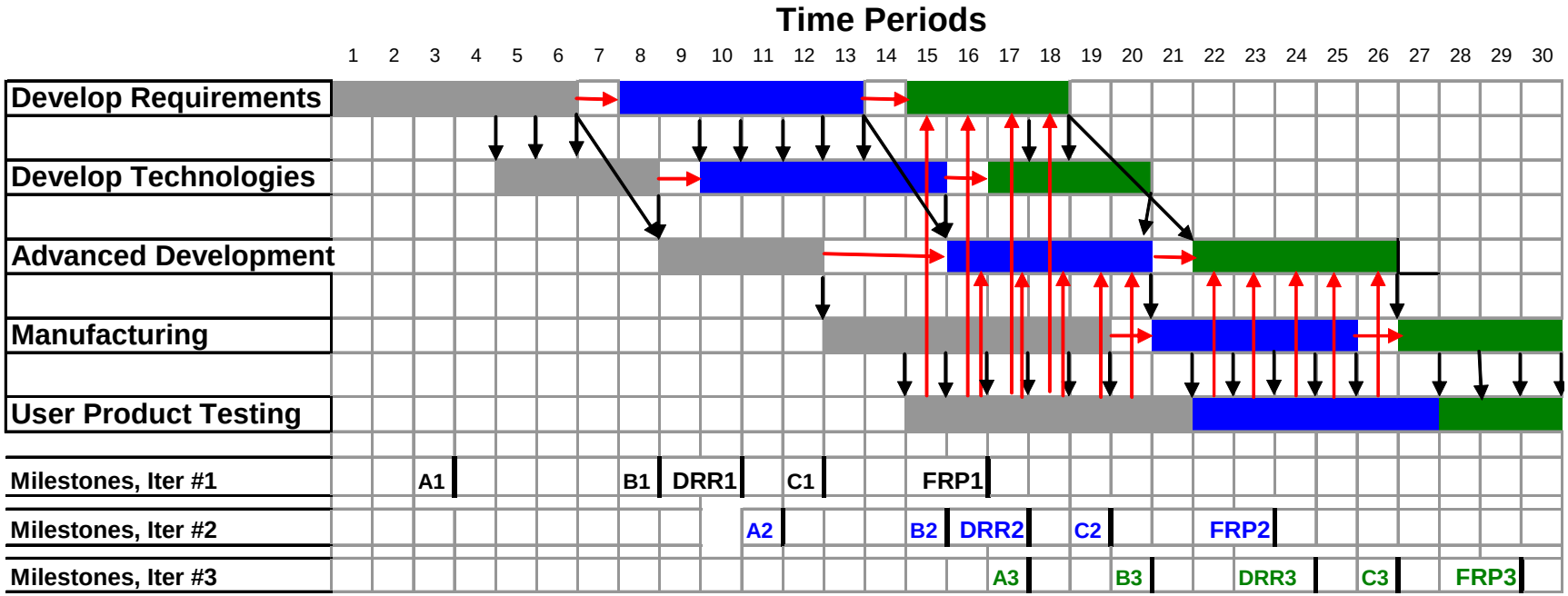


Modeling ARCI:
A Traditional Acquisition Process



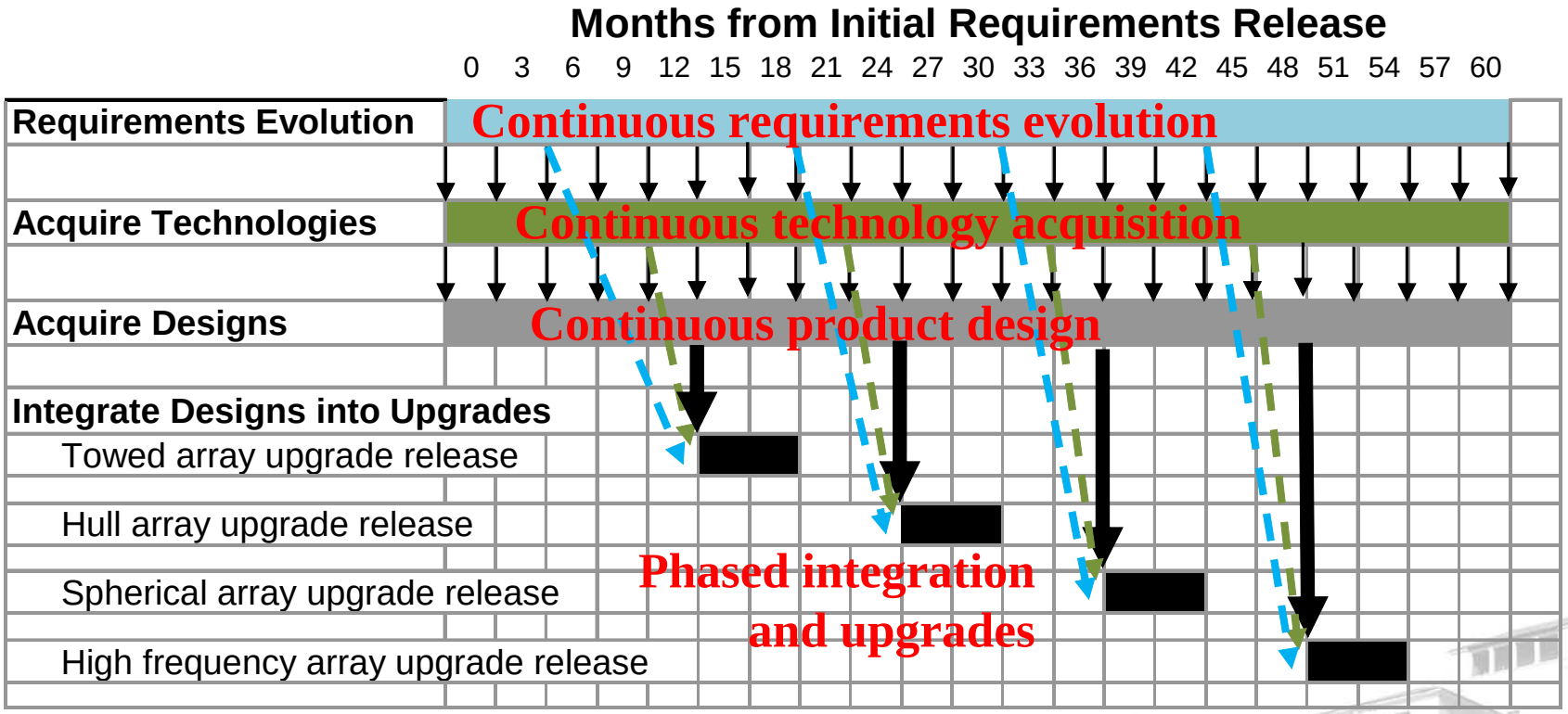
Delays in developing requirements, technologies, or designs often delay deployment.

Modeling ARCI:
An Evolutionary Acquisition Process



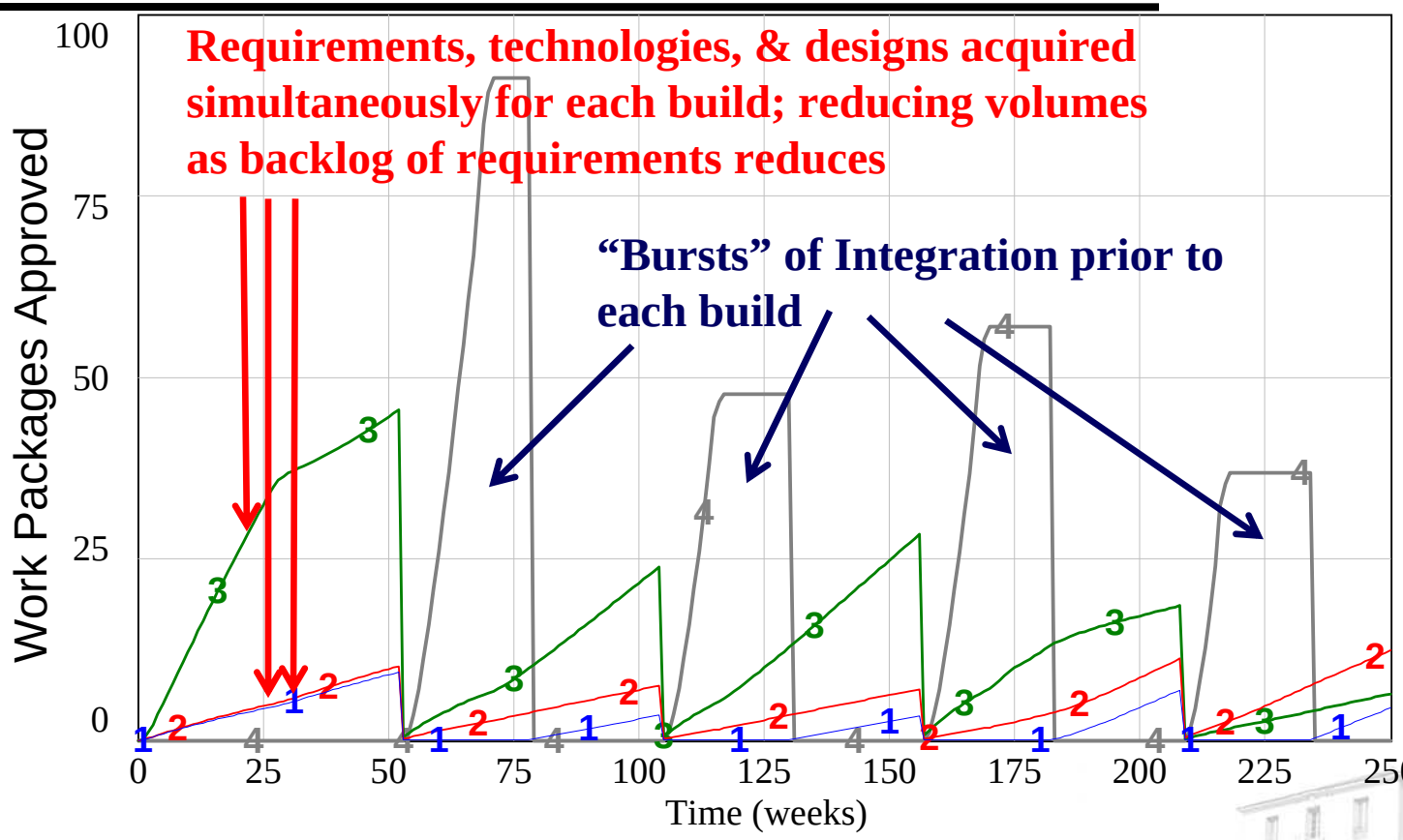
- **Revised EA project model to reflect some important characteristics of Open Architecture (OA):** modularity, standards management, reduced component design, etc.

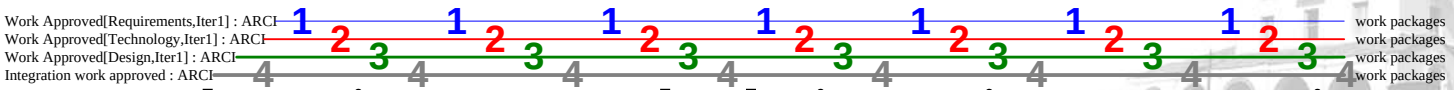
Modeling ARCI:
The ARCI Acquisition Process



- Select mature-only requirements, technologies, and designs at beginning of Integration
- **Delay solutions to next upgrade to not delay build if required**

ARCI –
Simulation Results



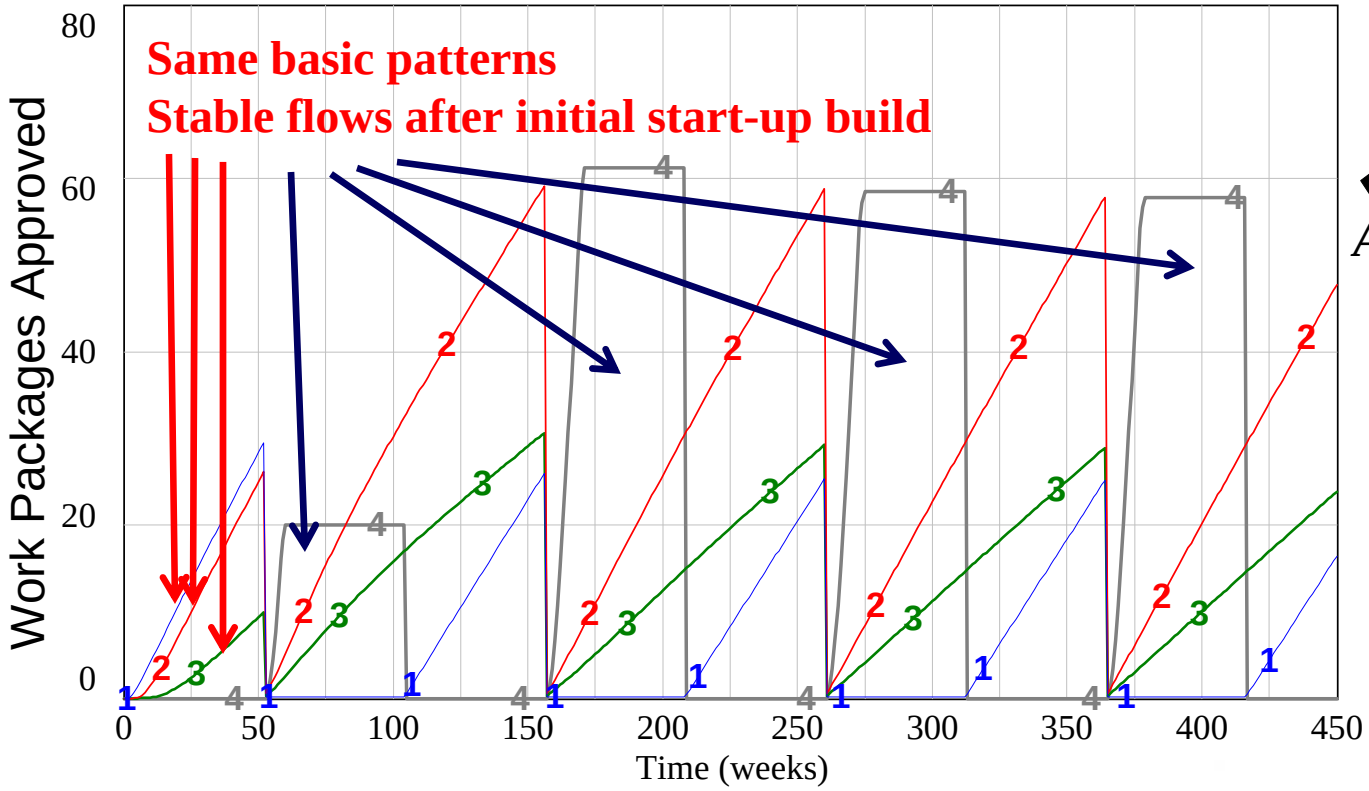


Approved Requirements, Technologies, Design & Integration

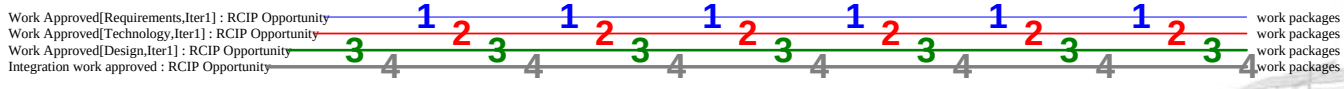
Revising the Model to Reflect the Rapid Capability Insertion Process (RCIP)

- Increase scope to reflect larger programs
- Continuous inflow of new requirements
- No existing inventory of requirements in steady state
- Reduced inventory of off-the-shelf solutions
- Capability upgrades every 2 years (vs. yearly)
- Integration phase duration = 12 months (vs. 6 months)

RCIP –
Opportunities for Improved Performance



← *Steady state*
Avg = 60wp/build



Approved Requirements, Technologies, Design & Integration

ARCI to RCIP –
Implementation Challenges

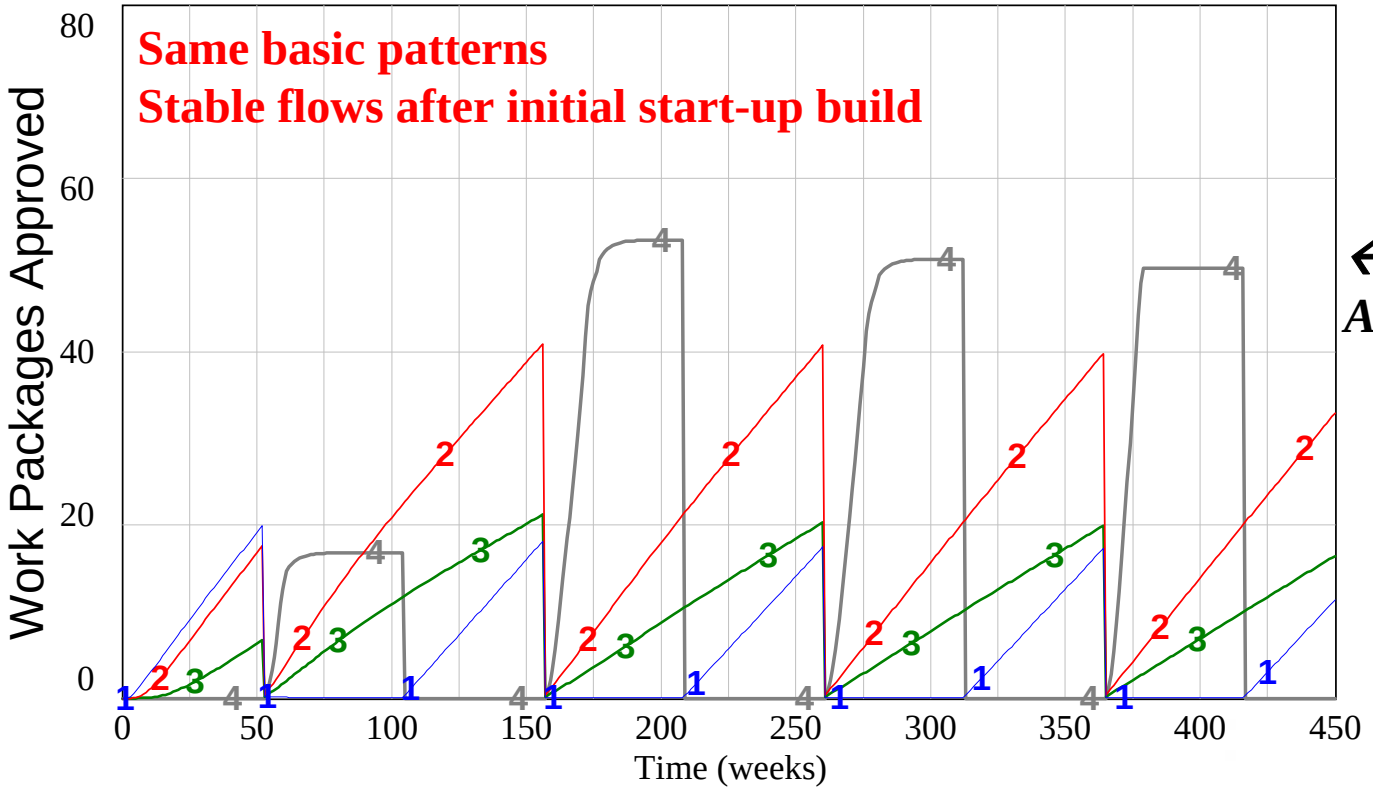
Acquisition Program Feature	Phased Program with OA & EA	ARCI Program	RCIP Programs (vs. ARCI)
Development processes (Requirements, Technologies, Advanced Development)	Repeated separate phases	Primarily continuous processes, ***known requirements***	***Continuous inflow of requirements***
Innovation sources	Primarily through Prime contractor	***Primarily Off-the-shelf solutions***	***Mix of new development & off-the-shelf.***
Product System Modularity	Often integrated across phases & development blocks	***Primarily separate systems*** (towed, hull, spherical, high frequency)	***More systems & system interactions. More inter – system integration required***
Govt./Supplier Relationships	Prime contractor	"Prime" coordinator & multiple solution suppliers	***Larger solution supplier pool***
Primary Locus of Performance Flexibility	Cost, Schedule	Scope	***Scope with possible flexibility in cost***

RCIP Implementation Challenges – Changes to the Simulation Model

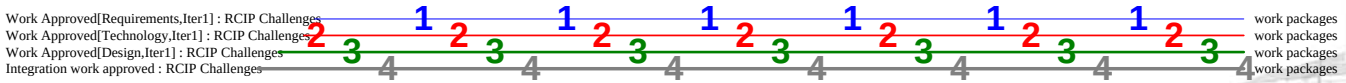
- **Increase scope → more oversight**
  - Reduced productivity on larger scope (reduced 20%)
- **No existing inventory of requirements** (steady state)
- **Reduced inventory of off-the-shelf solutions**
  - Reduce techn. & Adv Dev initially developed (50%)
  - Increased iteration in integration phases (increased 25%)
- **Increased integration required**
  - More integration scope (increased 25%/solution)

RCIP Implementation Challenges

Simulation Model Results

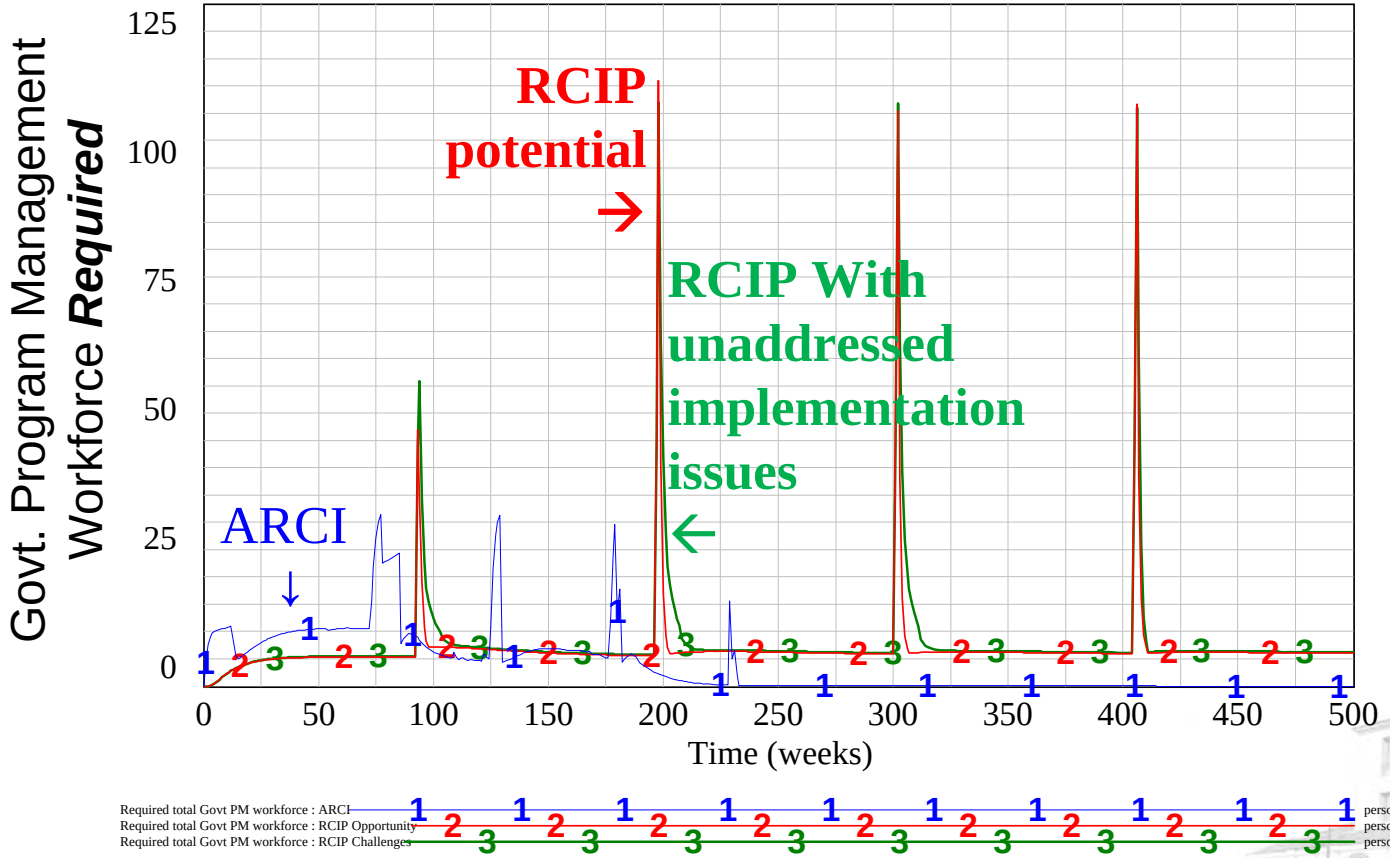


← ***Steady state***
Avg = <u>50wp/build</u>
(16% less)



Approved Requirements, Technologies, Design & Integration

RCIP Implementation Challenges –
The Burnout Challenge



RCIP will require significantly more Government Program Management resources due to "bursts" of integration work.

Implications for Practice

Addressing RCIP Implementation Challenges

Acquisition Feature	ARCI Program	RCIP Programs (vs. ARCI)	RCIP Implementation Risk Management
Development processes	Primarily continuous processes, known requirements	Continuous processes with ***continuous inflow of requirements***	***1) Standardize continuous processes*** ***2) Add rigor for sustainability***
Innovation sources	Primarily Off-the-shelf solutions	***Mix of new development & off-the-shelf.*** More new development	***1)Adapt continuous processes to mix of off-the-shelf/new development solutions*** ***2)Use "only - mature - enough" strategy***
Product System Modularity	Primarily separate systems (towed, hull, spherical, high frequency)	More systems and system interactions. ***More inter – system integration required***	***Operationalize modular configuration management for large scale acquisition with focus on integration***
Government / Supplier Relationships	"Prime" coordinator & multiple solution suppliers	***Larger solution supplier pool***	***Formalize open, transparent, objective, & repetitive competition processes and organizations***
Primary Locus of Performance Flexibility	Scope	Scope with possible flexibility in cost	***Improve user - acquisition coordination to make RCIP responsive to warfighter priorities***

More Implications for Practice

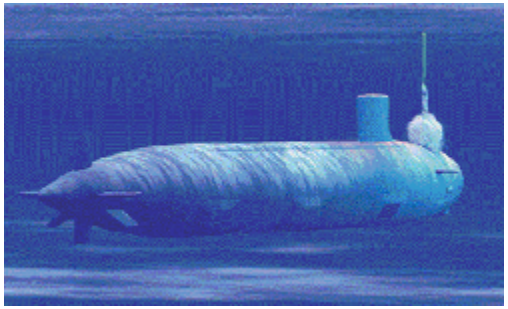
Designing RCIP Implementation

- **Improved integrated organization/process design and description**
  - Frequent solution competitions, closer user-acquisition coordination,
  - As operational as possible
- **New supplier roles**
  - Former "prime" in coordinator-only role, not solution supplier
  - Many and diverse solution suppliers
- **New Government Program Management skills**
  - Dynamic management of requirements selection and solution acquisition (balance flexibility of scope, schedule, cost)
  - Leveraging of existing solutions (e.g. software libraries) (OA)
  - Open competition among many solution suppliers (OA)

Conclusions

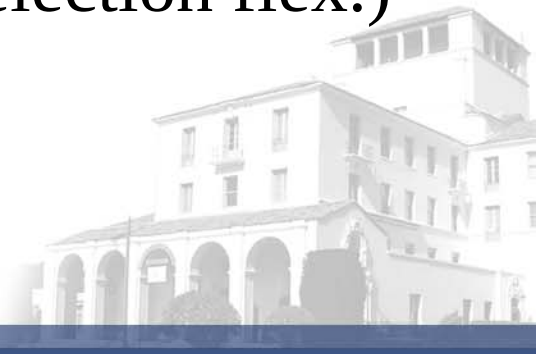
- **ARCI has demonstrated the potential** to radically improve acquisition performance in continuous-upgrade programs
- Implementing ARCI lessons into RCIP for broader use requires the **further development of new acquisition processes, changes in supplier roles, and development of different program management skills**
- Successfully implementing RCIP can **greatly improve acquisition program effectiveness and efficiency** and provide a basis for widespread adoption.

Questions?
Comments?
Discussion?



Analysis of the ARCI Program
Atypical Program Environment

- **Fleet need for fast capability improvement**
  - Extensive and direct involvement by warfighters
  - Strong support by fleet upon demonstration of improvement
- **Very limited funding**
  - Encouraged use of COTS (enormous savings)
- **Many available off-the-shelf technologies & designs**
  - Encouraged use of COTS (provided selection flex.)
- **Era of acquisition reform**
  - Reduced oversight



Analysis of the ARCI Program
Atypical Program Design Features

- **Fixed and frequent capability improvements**
  - Facilitated delaying requirement fulfillment until mature
- **Extensive use of developed technologies & designs**
  - Added capacity &capabilities developed since original development
  - Added flexibility for future upgrades and meeting extra-COTS requirements
  - Many suppliers: ONR, academia, small businesses
- **Extensive replacement of legacy systems with COTS**
  - Inherently modular – accelerated upgrades
- **Continuous warfighter involvement in acquisition**
  - Improved development due to realistic operations input to acquisition
  - Provided typically-unavailable operations data for testing and development
  - Built fleet support through participation

Analysis of the ARCI Program
Atypical Program Management

- **Redesigned supplier relations and processes**
  - Prime contractor in coordinator role only – not supplier
  - Repeated open competitions (& objective solution evaluations)
- **Maturity was the basis for upgrade scope**
  - "Pull" resource allocation based on needs vs. "Push" of requirements
  - Identify and select mature solutions at start of integration
- **Continuous requirements development, technology development, and design**
  - Not tightly linked to program schedule
  - Upgrade content decisions & commitments late vs. early

ARCI's Atypical Objectives –
A Notional Model

- ***When resources constrain progress, what performance dimension is most flexible?***
  Ranking from least flexible to most flexible...
- **Traditional programs:**

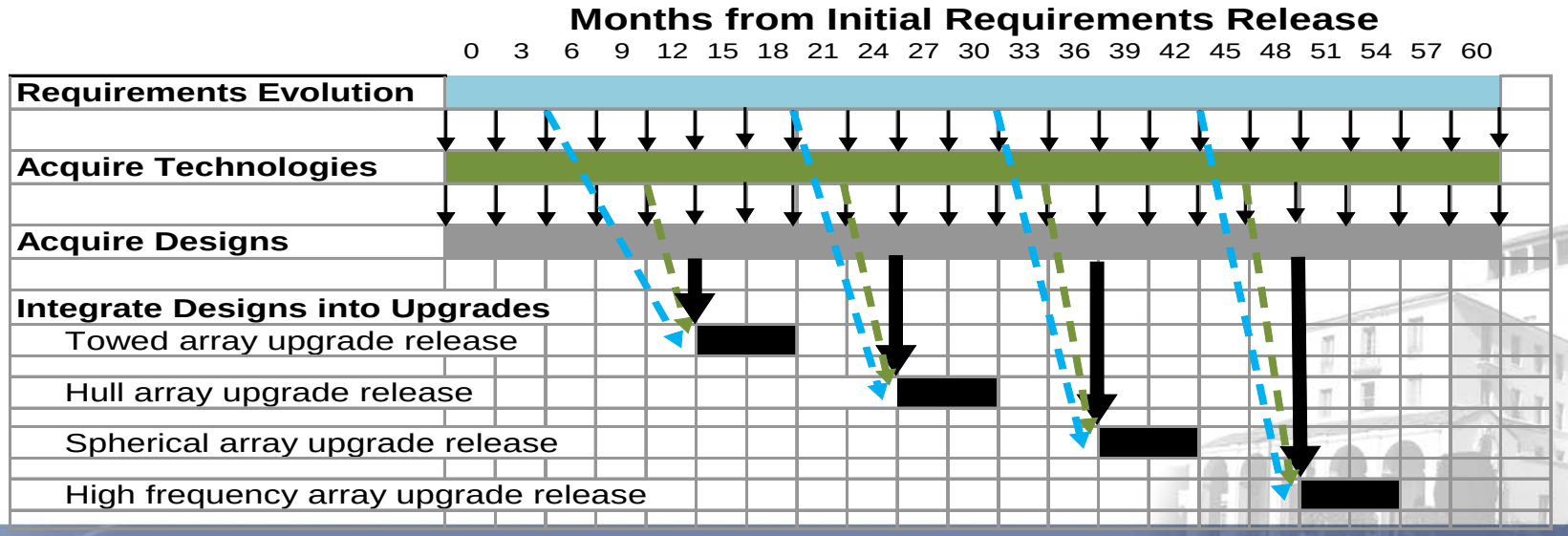
1.% Requirements filled
2.Cost
3.Schedule

- **ARCI:**

1.Schedule (no delaying of builds)
2.Cost
3.% Requirements filled (in this build)

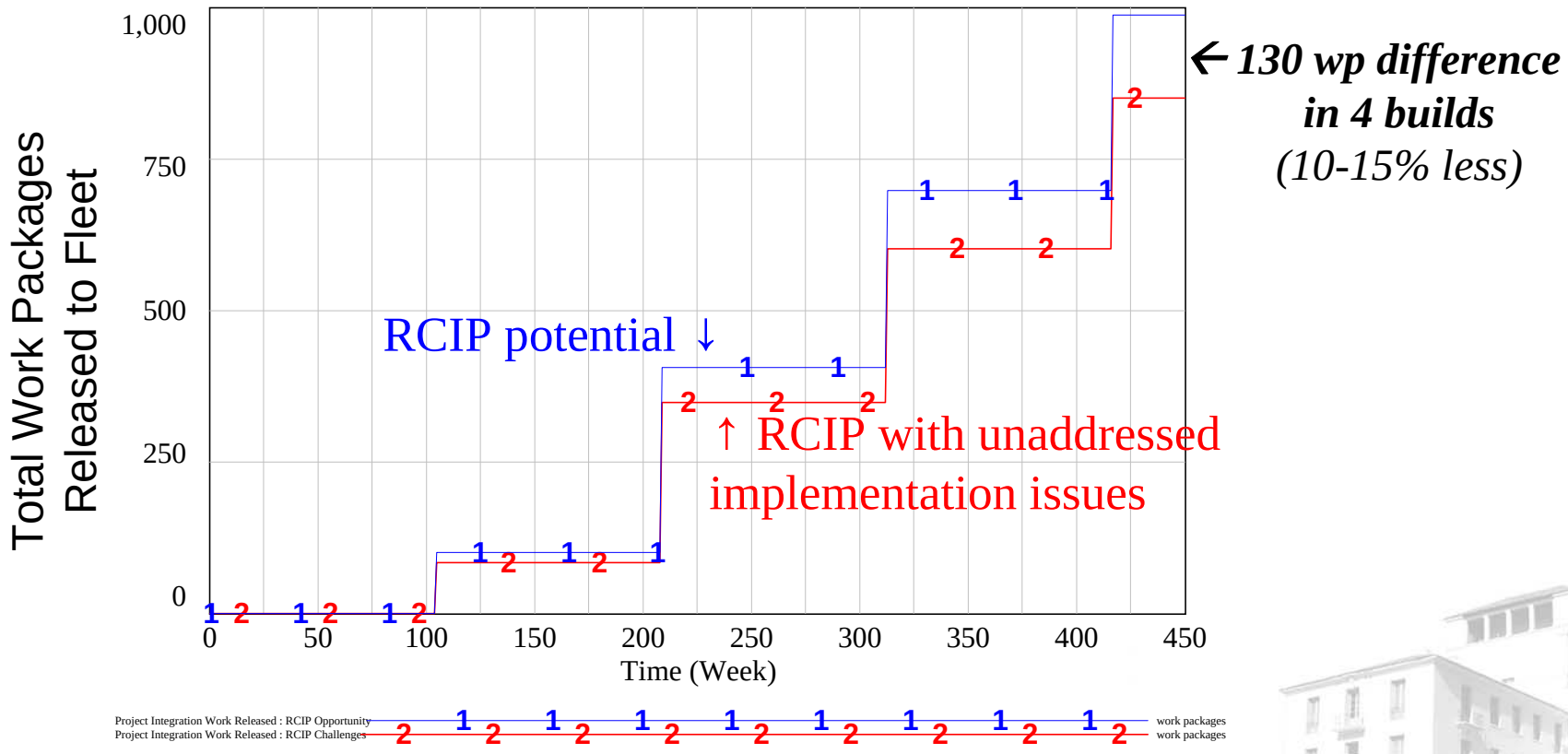
A Simulation Model of ARCI

- **ARCI acquisition process**
- **Six resource types**
  - Technology acquisition, design, integration
  - Program management (govt.) and suppliers



RCIP Implementation Challenges

Implications for Design and Practice



Cumulative RCIP Performance without and with Implementation Issues