Design Agents: A Post-Acquisition Reform Cost-Benefit Analysis

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Design Agents: Overview

- Introduction
- Survey of Literature
- The Phenomenon: Buildup and Demise
- The Programs & the Research Questions
- Quantitative Analysis
- Qualitative Analysis
- Findings
- Recommendations

Design Agents: Introduction

- **By definition, they perform during *early* part of acquisition lifecycle (SD&D). Roles include:**
  - **Requirements Generation**
  - **Technology Development**
  - **Systems Integration**
  - **Other (Source Selection, Supply Chain Management, Testing, Validation)**
- **"Design Agent" sometimes synonymous with "Lead Systems Integrator"**

… all premised on the notion that Industry is more efficient, performing traditionally (but not inherently) Governmental functions

Design Agency & Acquisition Reform: Changing Climate

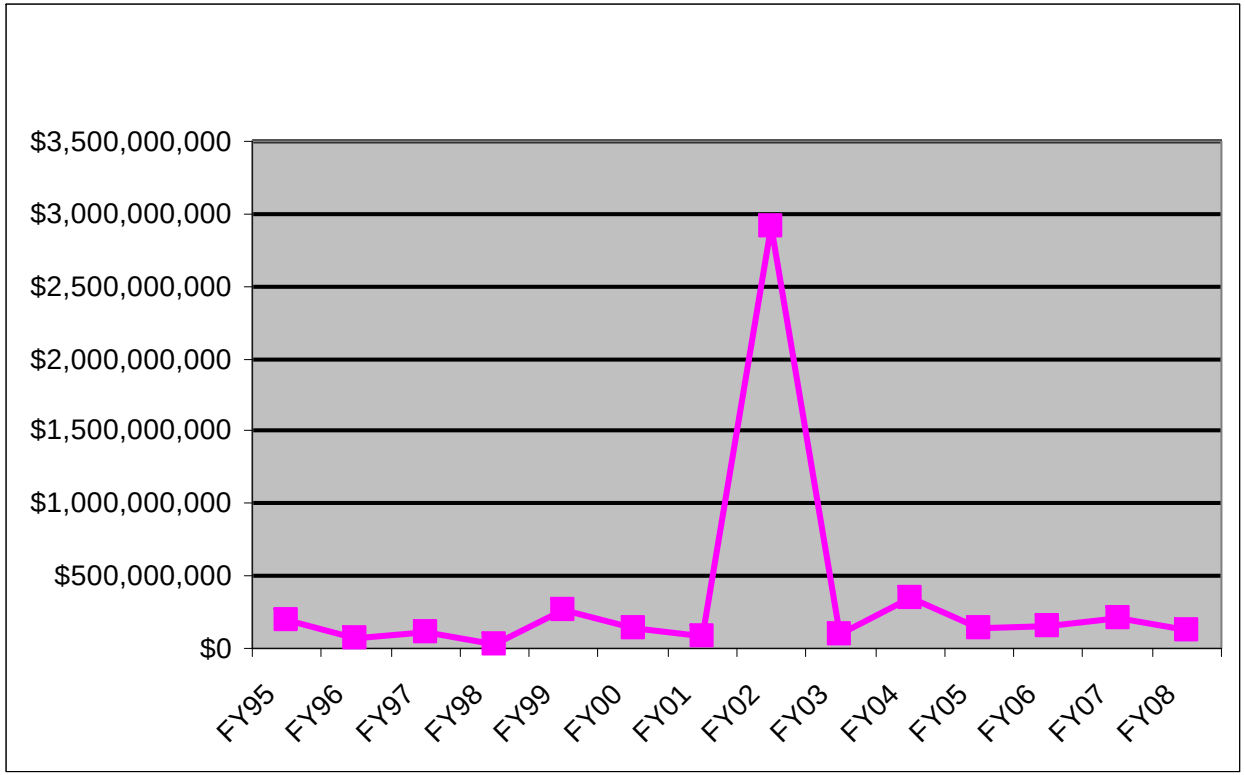
- **Post-Cold War: Dramatic DoD budget cuts**
- **Resource scarcity -> Reforms of 1990s**
- **FARA of 1996 – host of competing values (Efficiency vs. Fairness, Accountability, Transparency)**
- **Ten Years Later: Political / Regulatory Climate Changes**
- **Public-Private Sector Dynamics**

Where are we now? Who's really in charge?

Survey of Literature and Theory

- **No Rigorous Analyses of Design Agency…yet!**
- **Contracting Out Debate (Goodsell, 2007; Globerman & Vining, 1996; Smith & Smyth, 1996; Miles & Snow,1992)**
- **Demanding Customer and the "Hollow Organization" (Crawford & Krahn, 1998; Rickover, 1962)**
- **Lead Systems Integrator (Army's Future Combat System – Flood & Richard, 2005)**
- **Large-Scale Systems Integration (Baron, 2007)**
- **Besal & Whitehead (2001): Contractors in T&E**

Design Agent Contracts: Dollar Value Climaxed in 2002 with DD(X) ~$3B



Source: ***http://www.defenselink.mil/contracts/archive.aspx***

Design Agent Contracts: Prevalence

- **1995-2001**: Dozens of announcements for Design Agent work (Mk41 VLS, AN/SQS-89, PFG-2, Mk15 CIWS, CEC)
- **2002**: Phenomenon climaxed with ~$2.9B Design Agent contract award for DD(X)
- **2003-2008**: Purity of Design Agent work increasingly suspect (DDG-51 class services, etc.)

Design Agent-Led Programs: Mk 41 VLS

Photo: Global Security.org

Lockheed Martin: Design Agent for software, systems engineering and integration of Mk 41 Vertical Launching System.

United Defense Limited Partnership (now BAE Systems): Design Agent for structural and mechanical portions, VLS canisters.

> $91M in contract awards

Design Agent-Led Programs: Trident Missile

Charles Stark Draper Lab

Design Agent for MK-2, MK-3, MK-5, and MK-6 guidance test equipment

>$276M in contract awards (FY95$)

Photo: Massachusetts Institute of Technology

Design Agent-Led Programs: Mk 53 DLS

Photo: U.S. Navy

Sippican (now Lockheed Martin)

Hardware, Software, Systems Engineering & Design Agent services for Mk 53 Decoy Launching System.

>$5M in contract awards (FY01$)

Design Agent-Led Programs: Mk 92 FCS

Lockheed Martin

Design Agent Engineering & Tech Support for Mk 92 Fire Control System.

>$43M in contract awards (FY06$)

Photo: GlobalSecurity.org

Design Agent-Led Programs: CIWS

Photo: Defense Industry Daily

Raytheon

Engineering & Design Agent Services for Mk 15 PHALANX Close-In Weapon System.

> $16M in contract awards (FY99$)

Design Agent-Led Programs: SM-2

Photo: U.S. Navy

Raytheon

Design Agent services and test equipment for Standard Missile 2.

> $65 million in contract awards

Design Agent-Led Programs: CEC

Photo: U.S. Navy

Raytheon

Design Agent to support existing Cooperative Engagement Capability baselines, equipment and computer program installations at Raytheon's engineering labs, land-based test sites, Navy field activities, Fleet assets and other Government assets.

> $200 million in contract awards

Design Agent-Led Programs: Nuclear Subs

Photo: U.S. Navy

Electric Boat (now General Dynamics)

Design Agent services for submarines and shore facilities.

> $800 million in contract awards

Design Agent-Led Programs: DD(X)

Art: DDG1000.com

Ingalls Shipbuilding (now Northrop Grumman)

Agent for the design, build and test of engineering development models for major subsystems and components for the DD(X) class of destroyers. Note: When program transitioned to Detail Design Integration phase, acquisition strategy changed.

> $2.9 Billion in contract awards (FY02$)

Design Agent-Led Programs: Carriers (Ship Alts & Logistics)

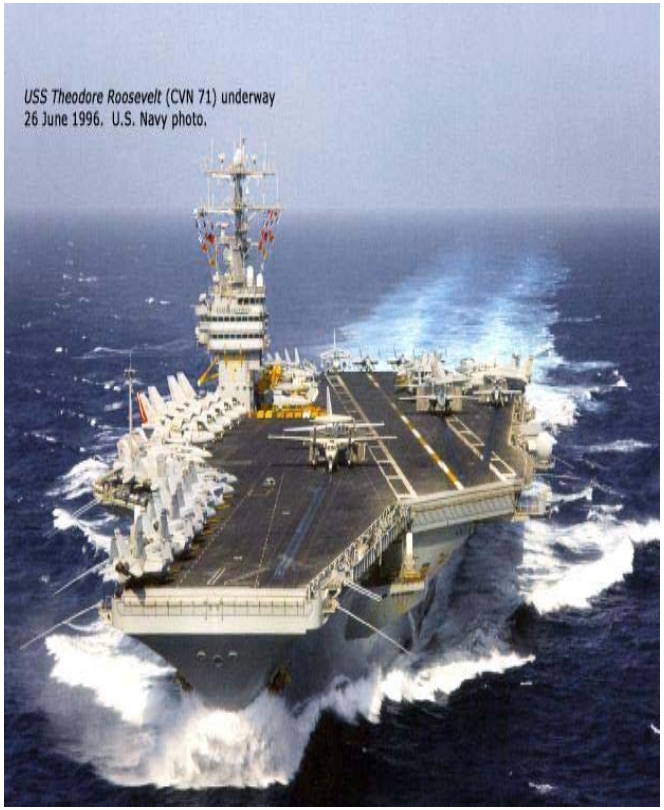


Photo: U.S. Navy

Newport News (now Northrop Grumman)

Design Agent for ship alteration and logistics support packages.

> $20 million in contract awards (FY04$)

Design Agents: Research Questions

- **Has the Design Agent phenomenon driven up acquisition costs for DoD programs?**
  (Quantitative Analysis)

- **Have Design Agent initiatives generally weakened DoD's ability to coordinate and control its major programs?**
  (Qualitative Analysis)

Design Agent vs. Navy-Led: Programs Studied

Cooperative Engagement Capability (Raytheon)

- Hardware and software
- System of sensors

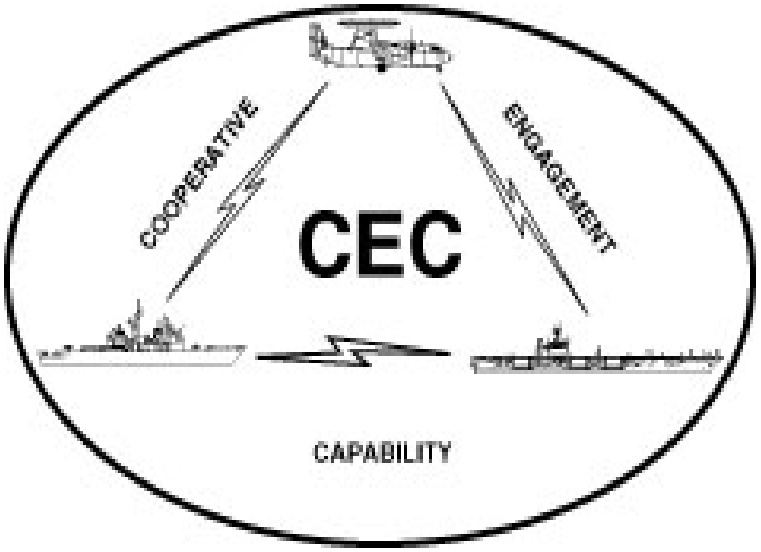
Virginia-Class Submarines (Electric Boat)

- System of systems

Arleigh Burke Destroyers (Navy)

- System of systems

Cooperative Engagement Capability



Recurring SCN estimates range from $6.586M to $11.23M

Raytheon performed Design Agent role; however…

Naval Surface Warfare Center Dahlgren was Software Support Activity and *Systems Engineering/Integration Agent*.

Johns Hopkins University Applied Physics Lab was Technical Direction Agent, *developing specs and prototyping systems*.

Virginia-Class Subs

Recurring SCN estimates of $1.9B (FY05$) were based on two ships per year and joint-production efficiency.

Actual Average Unit Production Cost of ~ $2.3 billion (FY05$) were driven by long production breaks and quantity of one ship per year.

Electric Boat (GD) was Design Agent; Northrop Grumman was alternate shipbuilder.

Arleigh Burke Destroyers (DDG 51)

Photo: U.S. Navy

First Ship was ~ $1.1B (FY85$)

AUPC for Follow Ships ~ $900M (TY$)

Volatility driven by cost-quantity relationships, as well as industrial base concerns and program interdependencies (delay of DD-21; alignment of LPD-17).

Strong Navy leadership steered DDG-51 to long-term success.

Navy was Design Agent; Lockheed Martin was Combat Systems Integrator.

Bath Iron Works & Ingalls: Shipbuilders.

Design Agents: Case Studies

- **Cooperative Engagement Capability:** Ongoing development & improvement (~20 years) overseen by well-balanced team.
- **Virginia Class:** Cost overrun driven by cost-quantity relationship and schedule dynamics.
- **Arleigh Burke Class:** Conscientious balancing of cost-quantity relationship and program interdependencies by Navy leaders.

Design Agents: Findings

- **Cost comparisons of "Design Agent"-led programs to traditional DoD-led programs are difficult, as roles often transcend labels.**

- **Cost comparisons of Military / civilian / contractor personnel are straightforward, but must be understood in (qualitative) context.**

- **Cost-sharing arrangements (Facilities, Software) as well as intra-Government transactions (GFE/GFI) must be clearly understood.**

Design Agents: Findings

- **Delegation of leadership responsibility puts the Navy's technical competence and program-management capacity at risk.**
- **Pressured by profit watchers, industry may sacrifice quality to meet schedule and cost goals.**
- **Poor progress is often discovered too late.**
- **Concentration of industry power**
  - **Stifles innovation / erects firewalls**
  - **Decreases diversity of subcontractors**
  - **Compromises fair business practices**

Best arrangements balance power among FFRDCs, Industry, and Government entities.

Recommendations

"…another order of attenuation is reached when contractors do all the managing related to the mission."

– Goodsell, 2007

- **Boost Government role throughout development**
- **Rebalance risk and rewards for all**
- **Re-invent the Navy's personnel system**
- **Re-ignite competitive zeal**

Concluding Thoughts…

- **Continue to weigh costs and benefits, as market forces influence opportunities for competition, expansion of supplier base, and as regulatory changes create new dynamics.**

- **Stay tuned to political feasibility & public trust issues, as well as evolving norms for business practices in times of war.**

- **The policy cycle never ends!**