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

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

5th Annual Acquisition Research Symposium: Creating Synergy for Informed Change, May 14-15, 2008 in Monterey, CA
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)


- Large-Scale Systems Integration (Baron, 2007)

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

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

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


> $91M in contract awards

Photo: Global Security.org
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

Sippican (now Lockheed Martin)

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

>$5M in contract awards (FY01$)

Photo: U.S. Navy
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

Raytheon

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

> $16M in contract awards (FY99$)

Photo: Defense Industry Daily
Design Agent-Led Programs: SM-2

Raytheon

Design Agent services and test equipment for Standard Missile 2.

> $65 million in contract awards

Photo: U.S. Navy
Design Agent-Led Programs: CEC

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

Photo: U.S. Navy
Design Agent-Led Programs: Nuclear Subs

Electric Boat (now General Dynamics)

Design Agent services for submarines and shore facilities.

> $800 million in contract awards

Photo: U.S. Navy
Design Agent-Led Programs: DD(X)

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.

> $2.9 Billion in contract awards (FY02$)

Art: DDG1000.com
Design Agent-Led Programs: Carriers (Ship Alts & Logistics)

Newport News (now Northrop Grumman)

Design Agent for ship alteration and logistics support packages.

> $20 million in contract awards (FY04$)

Photo: U.S. Navy
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.
Virginio-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)

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.

Photo: U.S. Navy
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!