

Changes in the Navy's Buying Power: Evidence on Basic Questions

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A handwritten signature in black ink, appearing to read "Jino Choi". The signature is fluid and cursive, with the first name "Jino" and last name "Choi" clearly distinguishable.

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Outline



■ Introduction

- TOA trends
- Price trends
- Effects on buying power

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This annotated briefing presents our findings of the study we did for N8B (Assistant Deputy Chief of Naval Operations, Resources, Requirements and Assessments) on the changes in the Navy's buying power. We will start by introducing the questions that we addressed and the summary findings. We will then discuss the Navy's budget and price trends and wrap up with their effects on the buying power.

Questions we seek to address



What have been the trends in Navy budgets and prices?



Why can't the Navy buy as many platforms as it used to?

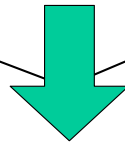
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In this study, we are examining the trends in the Navy's budgets and prices to understand why the Navy cannot buy as many platforms as it used to.

Takeaways

Navy has less to spend on procurement now than before

Navy ships and aircraft cost more now than before



Therefore, the Navy can't buy as many ships and aircraft as it used to—however, the Navy now buys a richer mix of more capable platforms

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We find that the Navy has less to spend on procurement than before and that the Navy's platforms (ships and aircraft) cost more now than before. Although the Navy cannot buy as many platforms as it used to, we recognize that it is now buying a richer mix of more capable platforms (it's akin to consumers buying more Cadillacs and Lexuses than Chevys and Dodges; and today's Cadillac is more sophisticated than it was in the 1970s). Whether the Navy is buying more or fewer capabilities to handle different (more challenging) missions is a separate question that we did not address in depth in this study.

More capable platforms



- Cost more and do more
- Fewer can be bought
- Are fewer needed?
 - Often replacement is one to one
- If fewer are needed, the buying power issue is not as troublesome
 - Research needed on quantifying reduction in number to achieve same effect: e.g., fewer sorties to take out same targets

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One factor creating ever higher procurement prices is increasing platform capability. These platforms cost more and are more capable. Fewer can be bought out of a given budget. Presumably, fewer would be needed to carry out a given mission. Yet often replacement of older platforms is one for one. Research is needed to determine how many are needed, along with issues of changing (growing?) mission and how an increase in capability affects the demand for presence.

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We now begin a more detailed discussion of the trends in the Navy's budget and the prices of the platforms it buys. We start with the budget trend—also known as the total obligation authority (TOA) trend.

Navy has less to spend on procurement now than before

Summary findings

- Navy topline has risen since FY00, but FY06 is still \$1.2B below the 30-year average (FY75-05)
- R&D is at historic high, FY06 is \$6B (or 55%) above the average
- MilPers and O&M taking less than historic average
 - Frees some funds for procurement
 - But didn't come down as much as endstrength and force size

Net effect: Navy has \$4B (or 12%) less to spend on procurement in FY06 than the 30-year average

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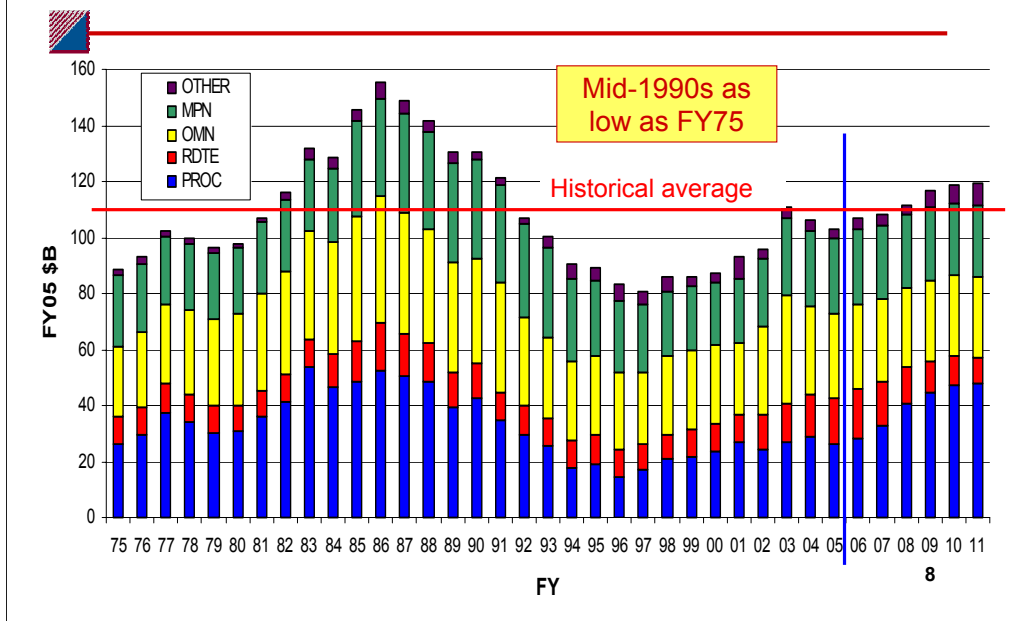
To analyze the current budget, we needed some baseline for comparison. We chose the average of the budget (in constant dollars) from FY75 to FY05. With this as a baseline, it becomes clear that the Navy topline, though it has risen since FY00, is still low by historical standards—about \$1.2 billion below the baseline. Thus, one explanation of why the Navy could be feeling reduced buying power is that the overall budget is not high by historical standards.

Another answer is that R&D is at a historic high (Later, we will discuss why.). For example, FY06 is 55 percent above baseline. When R&D is so high, it uses up funds that could be used for procurement.

MilPers and O&M are below the historical average, freeing some money for procurement. Even more money would be freed for procurement if they had come down as much as endstrength and force size.

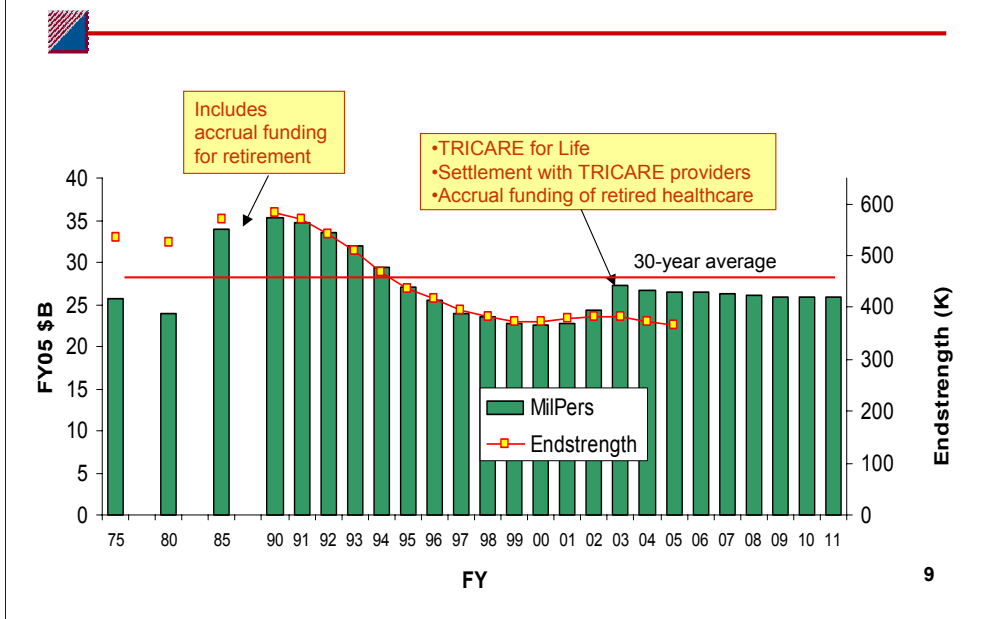
As a consequence of the above, the Navy's funds for procurement are below the baseline.

Navy topline has risen since FY00, but FY06 is still \$1.2B below 30-year average



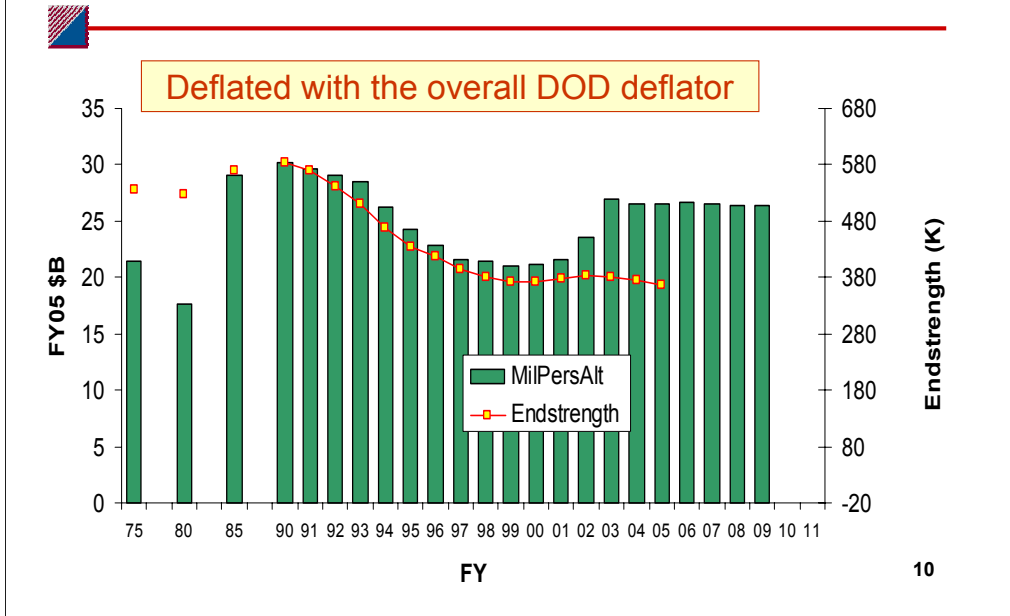
This slide presents the Navy topline from FY75 to FY05 broken down into its major components. We see that even the recent increase in overall budget leaves the Navy below its historical average. The historical average is not reached until FY08 and not exceeded until FY09 and beyond.

After FY00, MilPers rising while endstrength flat



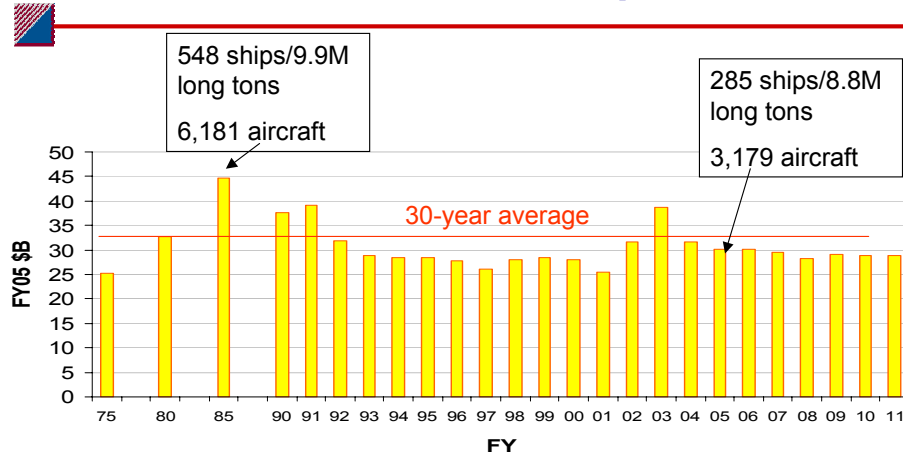
MilPers showed a sudden \$4-billion increase in FY03. Without this increase, attributable to higher benefits and expenses for medical care, there might have been \$4 billion more for procurement in FY05. This extra \$4 billion would have brought procurement in FY05 to near the historical average.

Deflating by alternative deflator, increase in MilPers relative to endstrength starts earlier



One concern with converting budgets into constant year dollars is that the deflators may be defined so as to obscure any growth in costs. Consequently, we used an alternative, and more general, deflator to put MilPers into constant dollars. We used the overall deflator for DOD. This deflated series does not decline as completely with endstrength, suggesting that there was an increase in MilPers even before the increases in FY03 (attributed to medical costs). This earlier increase had been obscured by its deflator.

O&M has not decreased in proportion to decrease in number of ships and aircraft

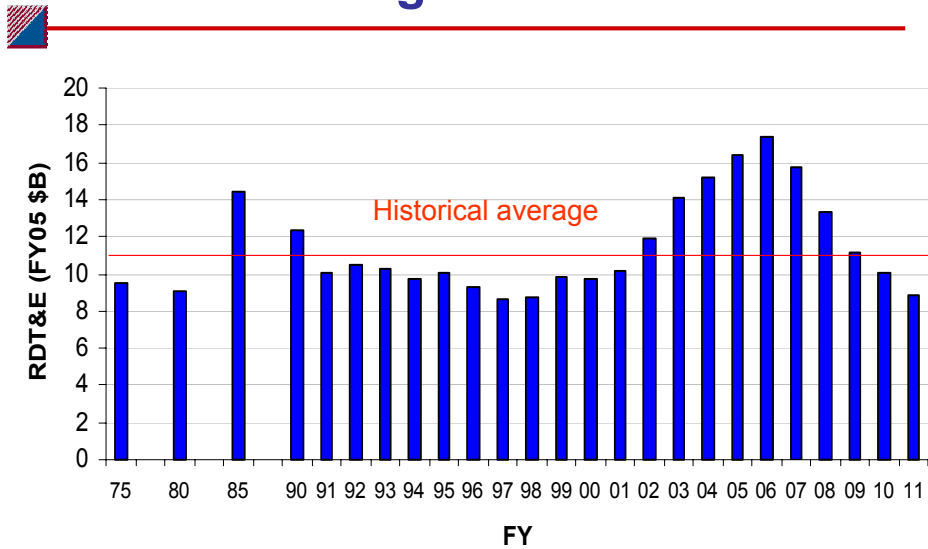


From 1985 to 2005, number of ships, tonnage, and aircraft decreased by 48%, 12% and 49%, respectively; O&M decreased by 32%.

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Ships include “battle force” ships; aircraft includes “inventory”—active and reserve, Navy and Marine Corps. O&M has come down with downsizing after the 1990s but not necessarily in proportion to the number of forces. Part of this might be a change in the composition of forces (e.g., ship tonnage has decreased much less than the number of ships). It might also be an aging of platforms or a difficulty in reducing infrastructure with force levels.

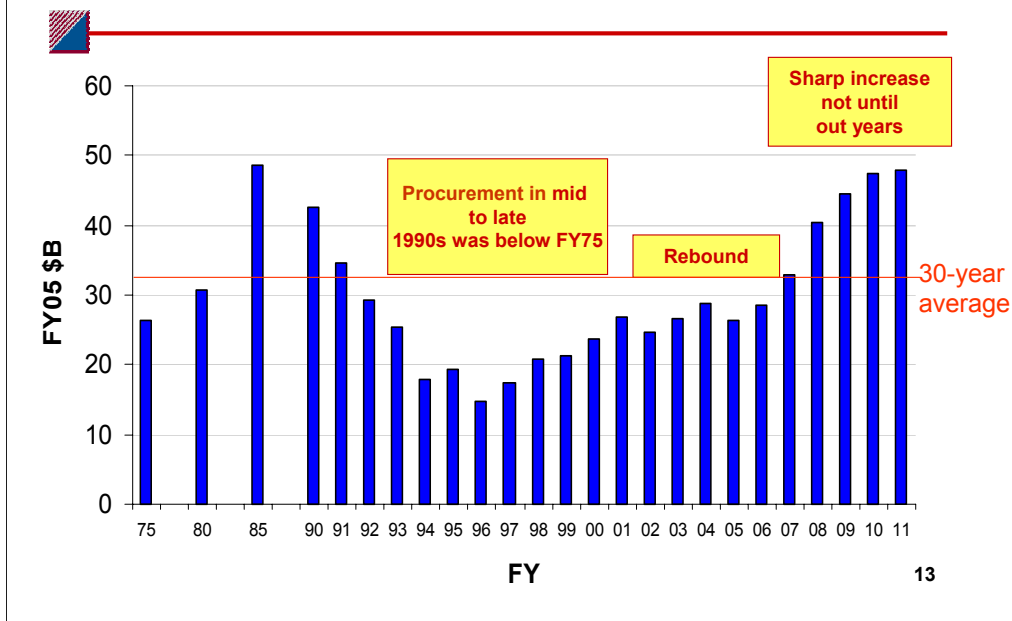
R&D has risen sharply and is now at a historic high



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R&D was not as low relative to the average as was the overall budget in the mid-1990s. And in FY05 and FY06, it is at a historic high. Current budgets plan on R&D declining after FY06. A simple time series model of R&D (shown by the blue line and described in more detail among the backup slides) suggests that imposing this decline may be difficult.

Procurement has risen but remains well below historic average through FY06

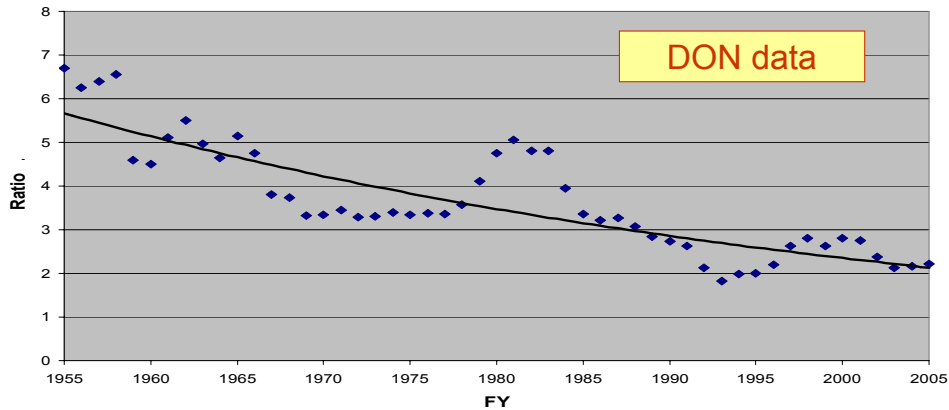


Procurement has risen recently but remains well below the long-term average. The reason is that the recent rebound came from an extremely low base; procurement was very low in the mid-1990s. There is no increase to above the average until the budget years, and it is hard to be sure that this increase will actually take place.

Trend shows R&D supporting less procurement



Long-term trend in ratio of future procurement (average for next 5 years) to current R&D



Navy is spending more in R&D expenditure relative to procurement: \$1 for every \$5 in procurement in the early 1960s, now \$1 for every \$2.2

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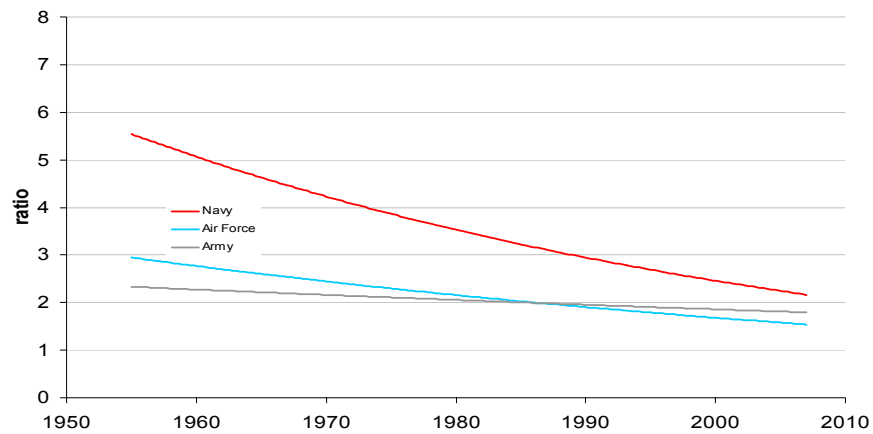
Why is R&D so high in FY05? One reason is that there is a lot of procurement coming in the following years. The other is that there has been a long-term trend in the relation between R&D and procurement, as shown here. The trend means that each dollar of R&D converts into decreasing amounts of procurement and, equivalently, that each unit of future procurement requires more current R&D.

Comparison across departments

Ratio of procurement leading average to RDT&E



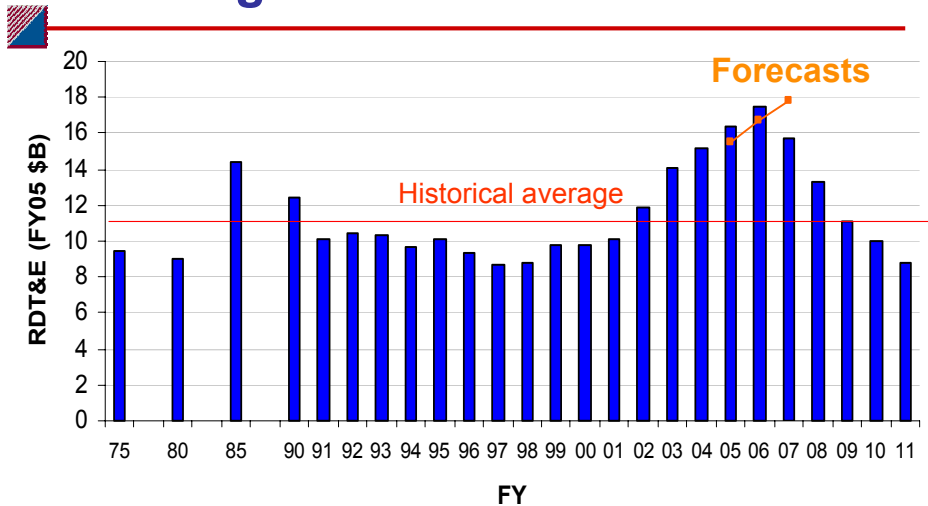
Exponential trends



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The Navy (DON) trends are stronger than those for the Air Force and Army. Right now, we don't know the reasons, but the trend is something DON needs to be aware of for its planning.

Our R&D forecasts suggest that reducing R&D in FY07 will be hard



Navy appears to count on reduction in R&D in out-years to partly pay for procurement

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R&D was not as low relative to the average as was the overall budget in the mid-1990s. And in FY05 and FY06, it is at a historic high. Current budgets plan on R&D declining after FY06. A simple time series model of R&D (shown by the blue line and described in more detail among the backup slides) suggests that imposing this decline may be difficult.

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- Effects on buying power

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Having examined the Navy's budget trends, we now turn our attention to the price trends of the Navy's platforms (ships and aircraft).

Navy ships and aircraft cost more now than before



**Average price of Navy ships and aircraft has risen faster than DOD procurement deflator.
The question is: Why?**

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We first computed average cost of ships and aircraft of a given year (total cost divided by the total number of platforms, regardless of the type or mix of the platforms). Here we illustrate the 5-year moving average of cost of ships and aircraft to illustrate the general trends. As shown, the average price of Navy's ships and aircraft has risen much faster than the general inflation (using the rates from the DOD procurement deflator). The question we ask is: Why?

What are potential causes of price growth?

- Richer mix of platforms
- More capable platforms
- Differential price inflation
- Lower buying quantity
- Possibly, changes in market structure

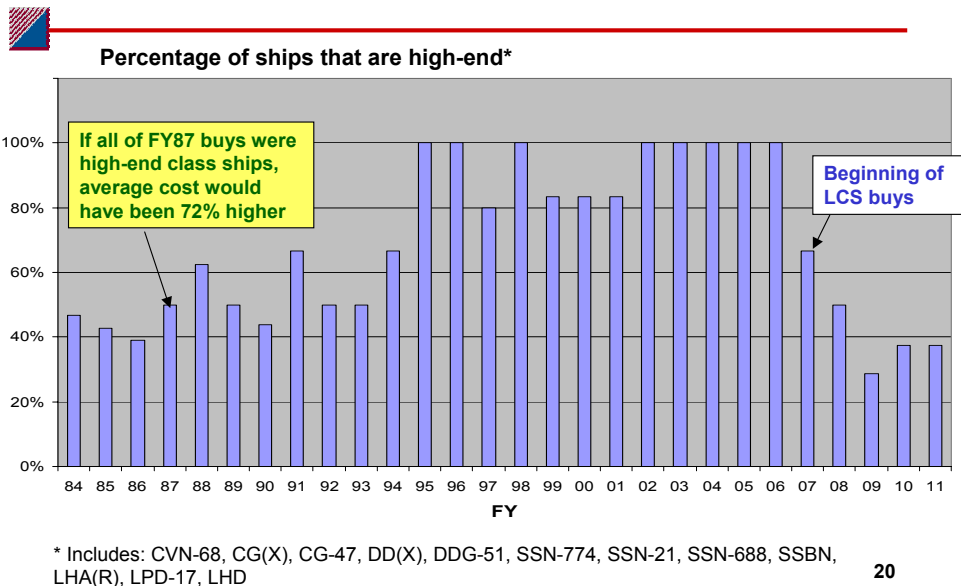
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To answer “why?” from the previous slide, we have developed several plausible causes of price growth:

- The Navy is now buying a richer mix of platforms, leading to higher average cost.
- Individual platforms that the Navy is buying are more capable than their predecessors.
- The inflation experienced by the defense manufacturers may be higher than the general price inflation.
- The Navy is now buying smaller quantities of platforms.
- The defense industry consolidation may have changed the price behaviors of the remaining contractors.

We will discuss each of these in the following slides.

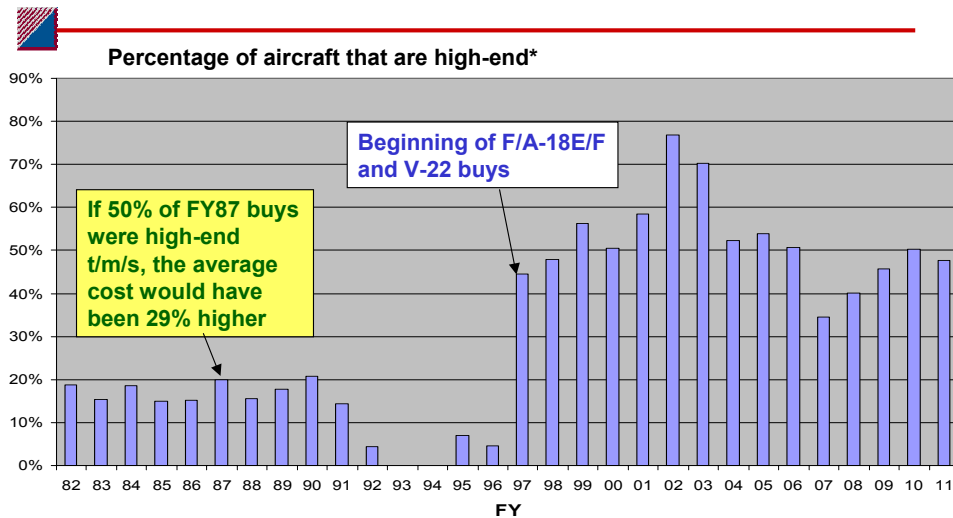
Recent ship purchases are high-end*



This slide illustrates that the Navy is now buying a richer mix of ships than it used to. For example, in 1987, the Navy bought 50 percent “high-end” class of ships (such as carriers, cruisers, destroyers, submarines, and large amphibious ships). The other half consisted of “low-end” class of ships, such as auxiliary ships and mine countermeasure ships. From FY02 to FY06, all of the Navy’s ship buys were of the high-end class; this was one of the major reasons for the high average procurement cost of ships in those years. If all of the Navy’s ship purchases in FY87 were high-end class, the average cost would have been 72 percent higher.¹ The mix shifts in the out-years when the Navy begins to buy littoral combat ships (LCSs).

1. We computed this figure by dividing the average cost of the high-end class of ships purchased in FY87 by the average cost of all ships bought in that year.

Recent aircraft purchases are high-end*



* Includes: V-22, F-14, F/A-18E/F, JSF, EA-6B, EA-18G, E-2C, E-6A, ACS, P-3, MMA, KC-130, C-37, C-40, VXX

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This slide illustrates the richer mix of aircraft that the Navy is now buying. For example, in 1987, the Navy bought only 20 percent high-end type/model/series (t/m/s) of aircraft (such as the V-22s, the high-end fighters, electronic warfare/surveillance aircraft, larger transport aircraft, and the presidential helicopter). The rest of the Navy's aircraft procurement in 1987 was low-end t/m/s aircraft, such as attack aircraft, trainer aircraft, and helicopters. Because of the large increases in the capabilities and the price tag of the F/A-18E/F aircraft, we categorized them as the high-end aircraft and classified the F/A-18C/Ds as the low-end aircraft.

The Navy began buying both the F/A-18E/Fs and the V-22s in 1997, setting a trend for the richer mix. From then on, the Navy high-low mix has been about 50-50. If the Navy aircraft mix in FY1987 had been similar to today's mix (that is, 50 percent high instead of 20 percent), the average cost in that year would have been almost 30 percent higher.²

2. We arrived at this figure by first computing the average cost of high-end t/m/s aircraft and the average cost of low-end t/m/s aircraft in FY87. We then took the average of the two figures (implying the 50-50 mix) and divided it by the average cost of all aircraft purchased in that year.

Navy is buying more capable platforms

- More capable, stealthier, and often bigger

Percentage changes from older to newer platform

	WE or total displacement	% Advanced material	Other technology
F/A-18A-D to E/F	+24%	+74%	++
SSN-688 to SSN-774	+13%	++	++

- Bigger and more capable → more expensive

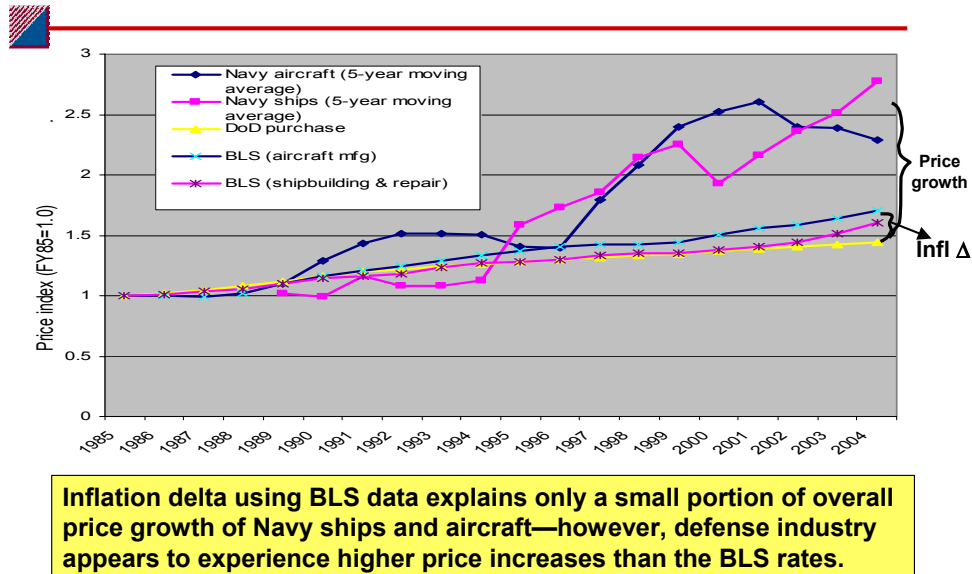
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In addition to the richer mix, the platforms that the Navy is buying are more capable than their predecessors.

For example, the F/A-18E/Fs are 24 percent heavier than the F/A-18A-Ds, allowing them to carry more weapons farther. They utilize more of the advanced materials (such as titanium and composite material) to strengthen the airframe while limiting the weight growth. They also have more sophisticated avionics, and they are more survivable.

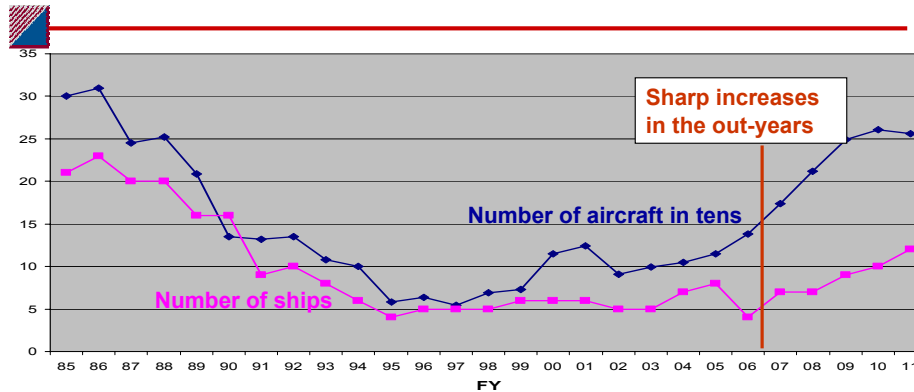
Of course, bigger and more capable platforms are also more expensive.

Shipbuilding and aircraft manufacturing price growth only partially explained by differential inflation



The DOD procurement deflators aim to provide the overall inflation picture for all of DOD's purchases. Different industries, from whom DoD buys things, experience different inflation. The Bureau of Labor Statistics (BLS) provides industry-specific inflation indices. Actual inflation experienced by the aircraft manufacturing and the shipbuilding & repair industries was higher. This graph illustrates the effect of the differential inflation between the BLS industry data and the DOD procurement deflator, which is a relatively small portion of the overall price growth. There are indications, however, that even the BLS rates may not fully capture the inflation in specific defense industries. We will discuss this further in later slides.

Navy is buying fewer platforms: contributes to further increase in unit costs



- Buying fewer units further increases unit price, because:
 - Research spread over fewer units
 - RDT&E appropriation has been increasing over the years
 - Fewer learning benefits
 - Fewer economies of scale

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This slide illustrates that the Navy is buying fewer platforms, which contributes to further increases in unit costs. Buying fewer units increases unit price because:

- Research expenditures are spread over fewer units (recall from the previous slide under TOA trend that the RDT&E appropriation has been increasing over the years).
- Manufacturers gain fewer learning benefits.
- There are fewer economies of scale.

There are sharp increases in the programmed quantities for both the ships and aircraft in the out-years; however, many people question whether that will actually happen. In the past, what was programmed often did not materialize.

Comparing F/A-18A/B/C/D and F/A-18E/F prices*

FY05 \$M**	F/A-18A-D	F/A-18E/F	Delta	Note
Development cost	6098	6338		
Procurement cost	38779	38147		
Total DON quantity	1021	462		FMS of 445 A-Ds
Acquisition unit cost	44.0	96.3	52.3	
R&D spread over fewer units			(7.7)	
Production learning/rate effect			(12.3)	Incl FMS qty effect
Physical capability delta (WE)			(9.1)	WE Δ = 24%
Avionics capability delta			(4.4)	Unit avnx cost Δ
Inflation Δ (2002/1985; BLS>DOD)			(4.2)	Δ is prob. bigger
Other			(14.6)	

* Figures are rough order of magnitude based on recent SAR data; individual effects are oversimplified. Allocation of effects is difficult because they interact with each other.

** Dollars converted to FY05 using the DOD R&D and procurement deflators.

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Here we attempt to explain the difference in prices of the F/A-18E/F and its predecessor series. We realize that this explanation is oversimplified, but our aim is to present a high-level view: the figures are rough-order-of-magnitude (ROM), and we made some artificial allocation of different effects, which interact with each other.

Spreading the R&D expenditures over fewer units (the E/F quantity is less than one-half of the A-D quantity) and fewer learning/production rate effects explain a substantial portion of the overall price difference. In computing the learning/production rate effects, we included the FMS quantities for the A-D programs and the EA-18G quantities along with the E/F quantities. We also accounted for the differences in capability by examining the differences in empty weight (WE) of the aircraft and the unit cost difference in avionics suites (e.g., bigger aircraft can carry more weapons farther, and more sophisticated avionics allow more advanced targeting and greater survivability. We tried to capture the differential inflation by comparing the BLS and the DOD procurement indices at about the midpoints of the A-D and the E/F procurements.

Numerous other effects include other capability differences that we may not have fully captured and differences in support costs and contract strategies (the E/F program uses multiyear procurement (MYP), which, according to the F/A-18 program office, saves about \$2 billion.³ Without MYP, the E/F acquisition unit costs could have been almost \$5 million higher. Some or all of these may help explain the “other” delta. We also suspect that the changes in market structure resulting from the defense industry consolidation may partially explain it. We provide some anecdotal evidences in the following slides.

3. The C/D program was on annual contract.

Two data points on defense industry labor and overhead rates



- Current Forward Pricing Rate Agreement at one of the defense prime contractors

	Engineering1	Engr2	Engr2	Mfg	Support1	Support2
Annual rate	7%	8%	8%	5%	7%	6%
ECI (CBO)	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%

- Grumman's overhead rates in 2004 were 39% higher than what was proposed for LPD-17 in 1996*. Factors contributing to it includes:
 - Smaller base (loss of TAKE ship, cancellation of construction of a commercial ship, and the delay in signing the contract for the next generation destroyer)
 - Rise in medical care costs and the financial market affecting pension fund negatively

* From GAO study, *Improved management practices could help minimize cost growth in Navy shipbuilding program*, Feb 2005

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The annual growth in projected compensation at Boeing outpaces the Congressional Budget Office's (CBO's) projection of wage and salary growth. However, CBO's projections do not include benefits. The last 5 years of Employment Cost Index growth (BLS) range from 3.4 to 4.1 percent per annum, with wages and salaries making up the vast majority of the index.

High labor rates are not a new story for defense contractors. Studies by GAO and RAND show compensation increasing faster than either the CPI or the ECI since the late 1970s through the mid-1990s. For example, pay increases in 1978-83 grew by 75 percent compared with CPI growth of 53 percent and ECI growth of 45 percent.

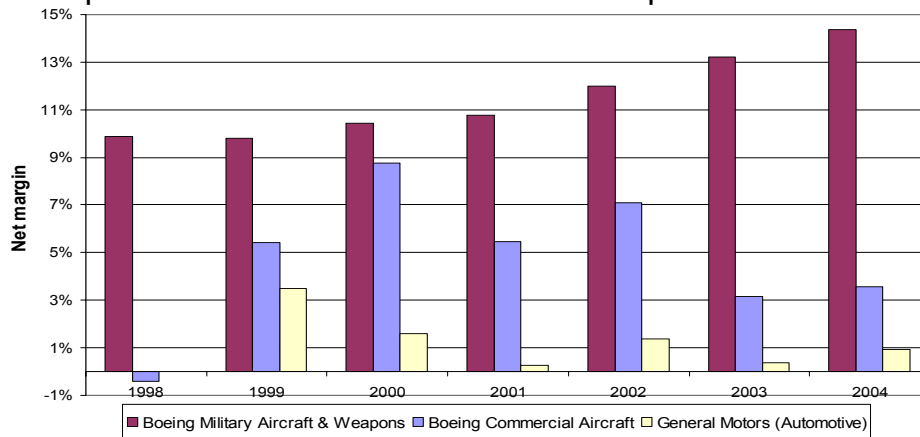
Part of the high wages can be explained by the characteristics of the workforce, which tends to be highly skilled and/or highly educated, translating into a wage premium over other durable goods manufacturing jobs. A RAND study found that in 1983 California aerospace workers enjoyed a 17-percent premium. This premium stood at 20 percent in the early 1990s, despite aerospace and defense industry downsizing. Furthermore, during the downsizing period in California from 1989 to 1994, workers who remained in aerospace experienced real wage growth of 7.3 percent, outpacing nearly all other sectors.

Overhead rates are also increasing at a high rate. A recent GAO study examining cost growth in Navy shipbuilding attributes overhead growth to a smaller base, rising healthcare costs, and financial market conditions affecting pension funding.

Sources: Congressional Budget Office (<http://www.cbo.gov/showdoc.cfm?index=1824&sequence=0>); GAO/NSIAD-85-1, *Compensation by 12 Aerospace Contractors* (Oct 1984); Rand study, *Life After Cutbacks: Tracking California's Aerospace Workers* (1996); GAO study, *Improved Management Practices Could Help Minimize Cost Growth in Navy Shipbuilding Program* (Feb 2005).

Anecdotal insights on defense contractor profitability

Boeing military aircraft division has been more profitable than its commercial counterpart



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From the SEC 10K filings

This chart compares Boeing's Military Aircraft and Missile Systems segment, Boeing's Commercial Airplanes segment, and General Motor's Automotive segment. It is clear that Boeing's military segment is very healthy and is increasing its profitability, while its commercial segment has not performed as well with the margin difference between the two segments growing over time. In comparison with General Motors, the difference is even more striking. GM's net margin is significantly below that of Boeing's military segment.

A similar story emerges when comparing Lockheed Martin's Aeronautics division with Ford's Automotive division. Lockheed's operating margin has outpaced Ford's since 2000, with Ford experiencing negative margins from 2001 to 2004. Furthermore, Lockheed's margin has exceeded 5 percent from 2000 to 2004 and has generally grown over this time period.

The evidence suggests that contractors are very profitable when compared with other large durable goods manufacturers.

Outline



- Introduction
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- Price trends
- ▶ **Effects on buying power**

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Having examined both the TOA and the price trends, we now attempt to quantify their effects on buying power.

Aviation buying power* in FY06 is down 19 percent


- FY06 APN budget (constant dollars) is slightly above (+2%) the 30-year average
- However, average price of aircraft in constant dollars is much higher (+26%) than the 30-year average
- Aviation buying power in FY06 is 81% (102%/126%) of the 30-year average, a loss of 19%

* As measured by the number of aircraft the Navy can buy (does not measure capability).

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The FY06 APN budget, in constant dollars, is slightly above the 30-year average. The average price per aircraft is much higher than the 30-year average. As a result, the buying power of this budget is only 81 percent of the historic average. This means that fewer aircraft can be bought. If capability is substantially higher than the historic average, there may be no loss of overall capability. If the quoted number required has not declined, there will still be a lot of pressure created by the fact that fewer can be bought.

Erosion in Navy's buying power*



	FY05	FY06	FY07
APN budget relative to 30-yr avg	-13%	+2%	+3%
Avg a/c price relative to 30-yr avg	+22%	+26%	0%
Changes in aviation buying power	-29%	-19%	+3%
SCN budget relative to 30-yr avg	-13%	-28%	-3%
Avg ship price relative to 30-yr avg	+24%	+34%	+40%
Changes in ship buying power	-30%	-46%	-31%

Buying power fluctuates widely—largely depends on the mix (therefore average price) of platforms being procured in a given year.

* As measured by the number of ships and aircraft the Navy can buy (does not measure capability).

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This slide shows the calculations for FY05, FY06, and FY07, similar to those in the previous slide. (The numbers in the previous slide are shown in green.)

In general, there has been a substantial loss of buying power relative to the 30-year average. There is, however, a lot of variation from year to year, primarily caused by the mix of high-end and low-end platforms, but also resulting from the learning curve because subsequent buys tend to be lower priced than initial buys.

Summary



- Navy's topline for FY05-FY07 is below 30-year average
- R&D: at a historic high
 - In current year, crowding out procurement spending
 - Trend shows R&D converting to less procurement
 - Decline in R&D after FY07 may be hard
- Procurement: high-end platforms contributing to high cost
 - This problem is partially going away in the out-years
 - Eroded buying power less troublesome if fewer highly capable platforms are needed; needs further examination
 - DoD/Navy appears to pay premium to defense contractors and, perhaps, their workers; merits further examination

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To summarize, the Navy's topline for FY05 through FY07 is below the 30-year average, and the procurement funds are partially crowded out by the historic high level of R&D spending. Prices of the Navy's platforms are higher due to a richer mix of more capable platforms that the Navy is buying now. Combined, they lead to the Navy's inability to buy as many platforms as it used to (or it wants to). However, this erosion in buying power may not be a problem if fewer, but more capable platforms provide as many (or more) capabilities as the larger number of less capable platforms.

There is evidence that DOD/Navy pays premium to defense contractors, in terms of allowing higher wage and overhead rate increases and higher profit margins than the general economy. Our analysis, however, was based on limited anecdotal evidence. Further examination of this issue could be very beneficial.

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