



Data talks... And is Always Relevant

**Major General David J. Eichhorn
Commander, AFOTEC**



**NDIA
13 Mar 2012**



Distribution A: Approved for public release; distribution unlimited.
(Approval given by AFOTEC Public Affairs Office)



Timeless Message



“It is a beautiful and terrible thing, and should therefore be treated with great caution.”

From The Tales of Beedle the Bard by J. K. Rowling





Timeless Message



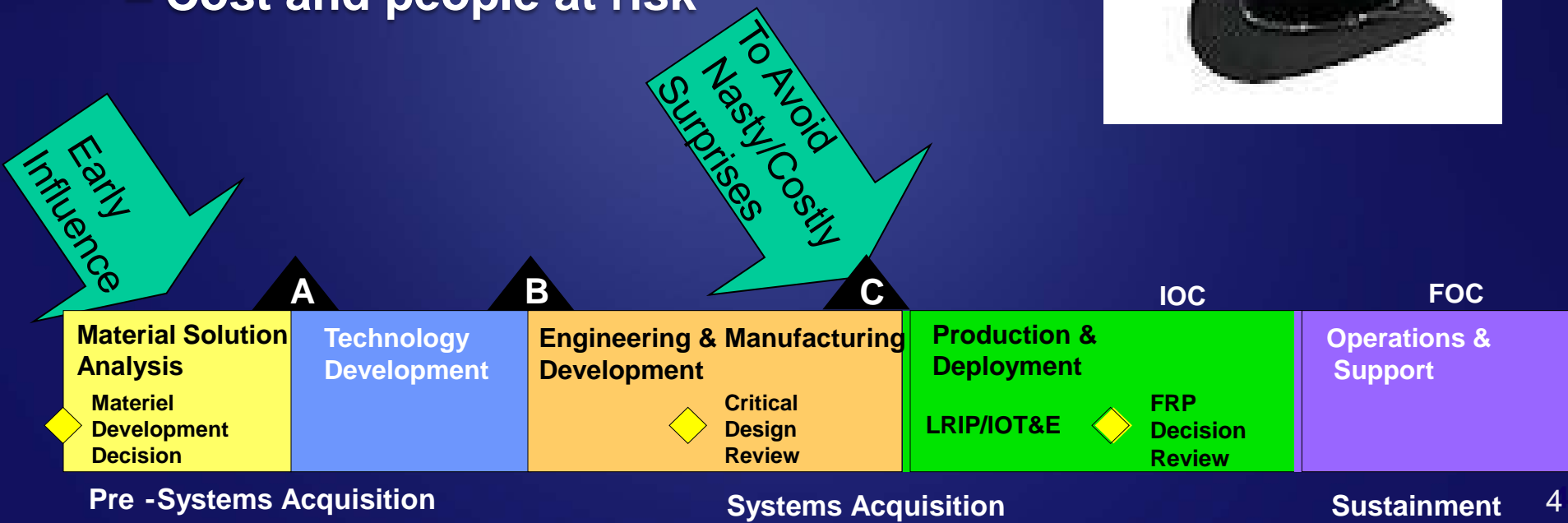
- “With regard to the cost, difficulty, and time required for tests, there is mounting evidence. . .that agencies can no longer afford *not* to **spend the money, take the time, and go to the trouble of performing sufficient tests.** Such an investment may be the only way that total cost can be kept within limits of a system’s operational worth to an agency.”
 - Report of the Commission on Government Procurement, *Acquisition of Major Systems*, December 1972, p. 157



Test Early...Test Often



- **Concurrency is more curse than blessing**
 - Stems from Rosy assumptions to save \$
 - Denial of problems
 - Over reliance on Modeling & Simulation / design tools
- **Risk Management**
 - Software vs hardware
 - Cost and people at risk

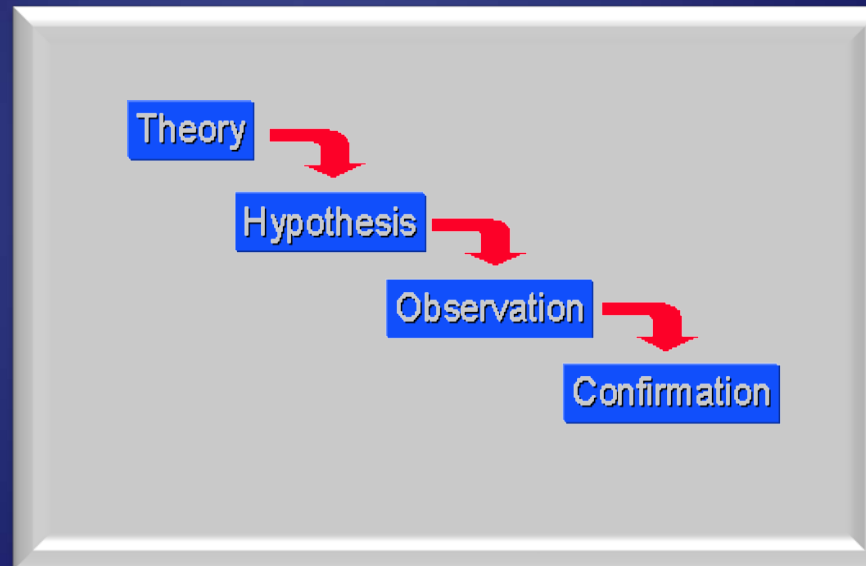




Data Tells a Story



- “OT occurs at the end of the development process, programs typically have fewer degrees of freedom (and resources) left to resolve problems...these test often reveal”
- The obvious conclusion based on deductive reasoning...



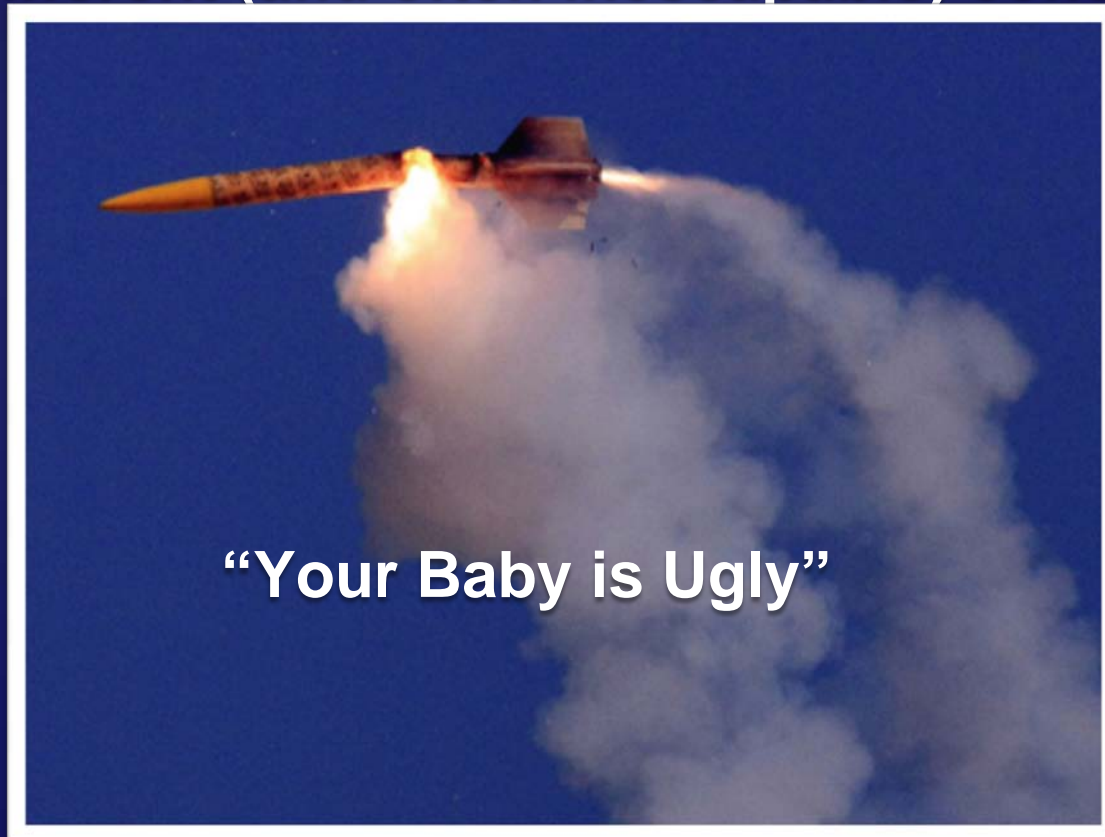
- “The testers are slowing us up and costing this program huge sums of money”



Data Tells a Story



- Test doesn't have the luxury of the 'top down' approach. In test, The data is the data!
- Inductive reasoning based on the test data produces a much different (and often inescapable) conclusion





Transparency--The Primacy of Data



Bloomberg

Our Company | Professional | Anywhere |

HOME QUICK NEWS OPINION MARKETS PERSONAL FINANCE SUSTAINABILITY TV RADIO

Related News: [Economy](#) · [Politics](#) · [Canada](#) · [Italy](#) · [U.S.](#) · [Technology](#) · [Media](#) · [Insurance & Health](#) · [Technology](#)

Angry Birds Boom Spurs U.S. Job Revival

By Rich Miller - Mar 5, 2012 2:35 PM MT

[Twitter](#) [LinkedIn](#) [+](#) COMMENTS QUEUE [Print](#) [Email](#)



Henrik Kettunen/Bloomberg

Angry Birds Rovio Mobile Oy in Espoo, Finland.

A surge in technology-industry hiring is helping to spearhead a [jobs-market revival](#) as demand swells for computer-software applications and data.

Strength in Numbers:

How Does Data-Driven Decisionmaking Affect Firm Performance?

Abstract

We examine whether firms that emphasize decision making based on data and business analytics ("data driven decision making" or DDD) show higher performance. Using detailed survey data on the business practices and information technology investments of 179 large publicly traded firms, we find that firms that adopt DDD have output and productivity that is 5-6% higher than what would be expected given their other investments and information technology usage. Furthermore, the relationship between DDD and performance also appears in other performance measures such as asset utilization, return on equity and market value. Using instrumental variables methods, we find evidence that the effect of DDD on the productivity do not appear to be due to reverse causality. Our results provide some of the first large scale data on the direct connection between data-driven decision making and firm performance.

Keywords: Business Analytics, Decisionmaking, Productivity, Profitability, Market Value

“Using detailed survey data on the business practices and information technology investments of 179 large publicly traded firms, we find that firms that adopt Data Driven Decision making (DDD) have output and productivity that is **5-6% higher** than what would be expected given their other investments and information technology usage.”



5% Doesn't Seem Like That Much



The Tech ONLINE EDITION
Established 1881

HOME NEWS OPINION ARTS SPORTS CAMPUS LIFE PHOTOS BLOGS

Volume 117 >> Issue 11 : Tuesday, March 11, 1997 [PDF of This Issue](#)

Corporation Passes 5% Tuition Increase

Year	Actual Tuition	1989-90 Tuition Adjusted for Inflation
1989	\$14,500	\$14,500
1990	\$16,000	\$15,500
1991	\$17,500	\$16,500
1992	\$19,000	\$17,500
1993	\$20,500	\$18,500
1994	\$22,000	\$19,500
1995	\$23,000	\$20,500
1996	\$23,000	\$21,500
1997	\$23,000	\$22,500

Comparison of MIT Tuition Increases Against Inflation - Source: Bureau of Labor Statistics - Tech Graphic by Saul Blumenthal

This graph plots the rise in tuition between the 1989-90 and 1997-98 academic years against increases solely due to inflation during that time period. The latter plot is the tuition level had all increases in tuition since 1989-90 been a result solely of inflation, as calculated by the Consumer Price Index.

- But over time, its big!



TIME

U.S.



Battleland

Where military intelligence is not a contradiction in terms

U.S. Main | SwampLand | Battleland | The Page | Intelligent Cities | Videos

NATIONAL SECURITY

"Don't Blow Smoke Up My Ass"

By **MARK THOMPSON** | @MarkThompson_DC | February 10, 2011 | +

Like

Tweet 0

Share

Excuse me, but that is the Air Force's top officer scolding the contractors who supply him with weapons. Air Force Chief of Staff Gen. Norton Schwartz didn't mince words Wednesday after giving a speech in Washington, D.C.

When an audience member asked him what contractors could do to help the Pentagon during the coming lean times, Schwartz unloaded:

"Deliver what you promise. Period. Dot. Don't blow smoke up my ass. There is no time for it. There is not money for it. There is no patience for it."

Actions speak louder than words, but those were some that got the contractors' attention.



GEN. NORTY SCHWARTZ

• "The Born

s even you're





Data – Ignore at Your Peril!





Data Tells a Story



- *Meteor Crater
Arizona, USA*
- From the "World's Greatest Wonders" (1930), public domain



Ignorance may be Bliss, but...



- Near Earth Environment 2007-2008
- Objects in red are potential hazards closer than 7M km
- If they hit Earth...it would look like this



A Ride With The Earth

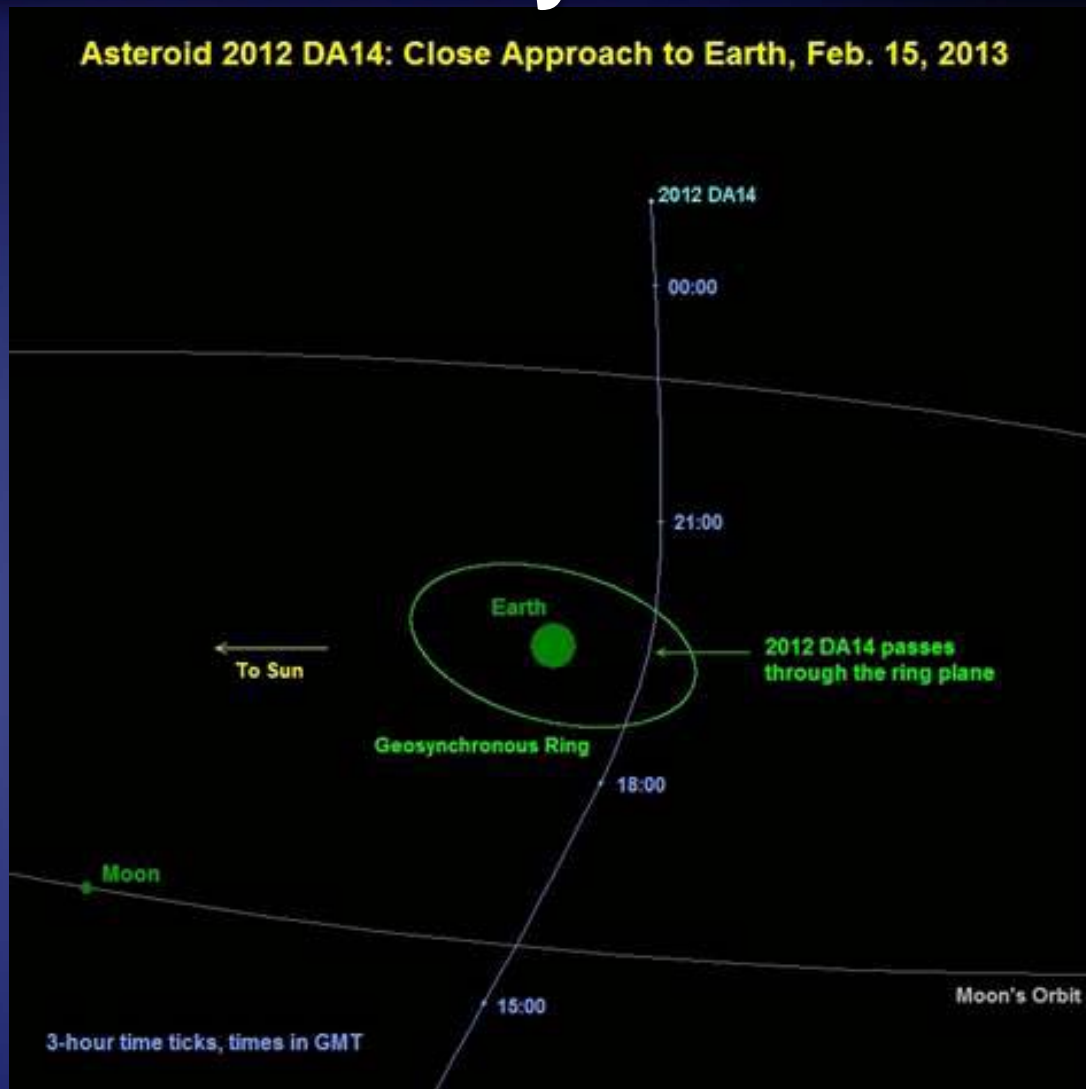
An animation centered on Earth showing the known objects that have approached to within 20 million km between July 2007 and June 2008. See the Animations Page on the MPC website for a description of the symbols used in this animation.



Ignorance may be Bliss, but...wait until next year!



- 150 foot asteroid will give the Earth a 'close shave' on Feb. 15, 2013, coming nearer to our planet than the satellites we've lofted to geostationary orbit
- Huge impacts are a part of our planet's history, after all; one wiped out the dinosaurs 65 million years ago, and it's just a matter of time before another big space rock lines Earth up in its sights, astronomers say!





Discovery & Context



- But...Data must exist in context
 - LAIRCM



- Reported Mission Reliability: 9% primarily due to S/W resets

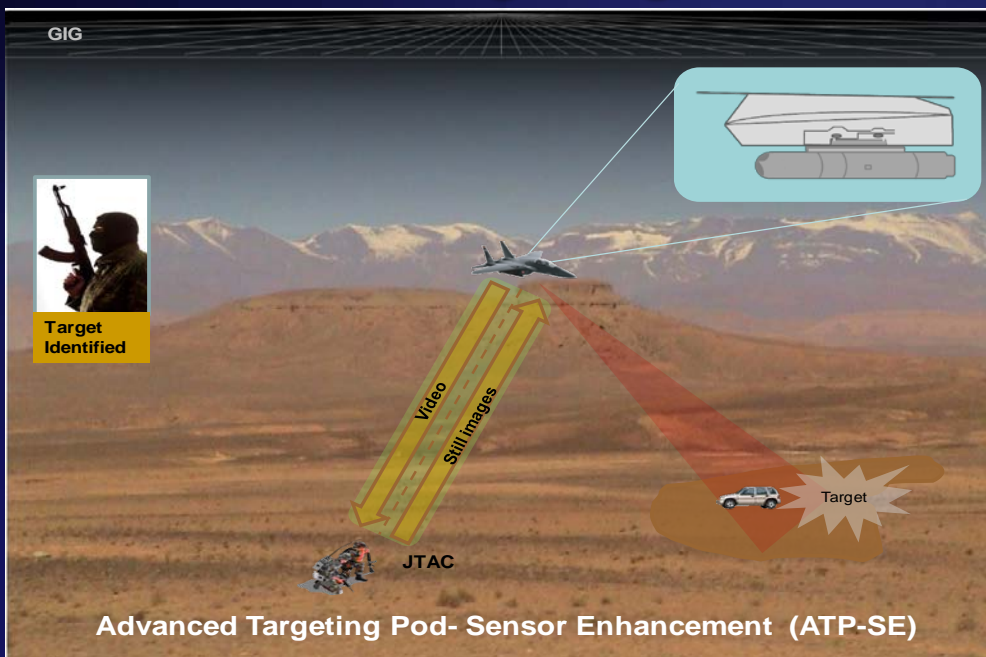
- >90% operational availability – it resets quickly!
- Maybe not so bad after all!



Software in Context



- **Advanced Targeting Pod – Sensor Enhancement (ATP-SE)**



- **LITENING – SE Pod experienced seeming hardware failures**

- FLIR HOT message
- Focus control motor failures





Software in Context



- The LITENING-SE pod was allowed to update the "firmware" on several LRUSs of the pod between the completion of QT&E and the start of QOT&E.
- The firmware fix removed a "FLIR HOT" and would only display the "FLIR HOT" message after the initial cool down.
- The focus control motor for the CCD was out of tune, would go out of limits, and cause a failure. The firmware fix effectively helped control the focus control motor to remain within limits.



Promises or Proof?



- Software drop? Good or bad?



– “Software stability got worse on the last two tapes. High of 12.4 to 5.6 hours currently”





Software & Technology in Context



- At face value, replacing an aging, manned asset seems like a good idea...



- But, what does the data tell us?



Software & Technology It Depends...





Software & Technology in Context

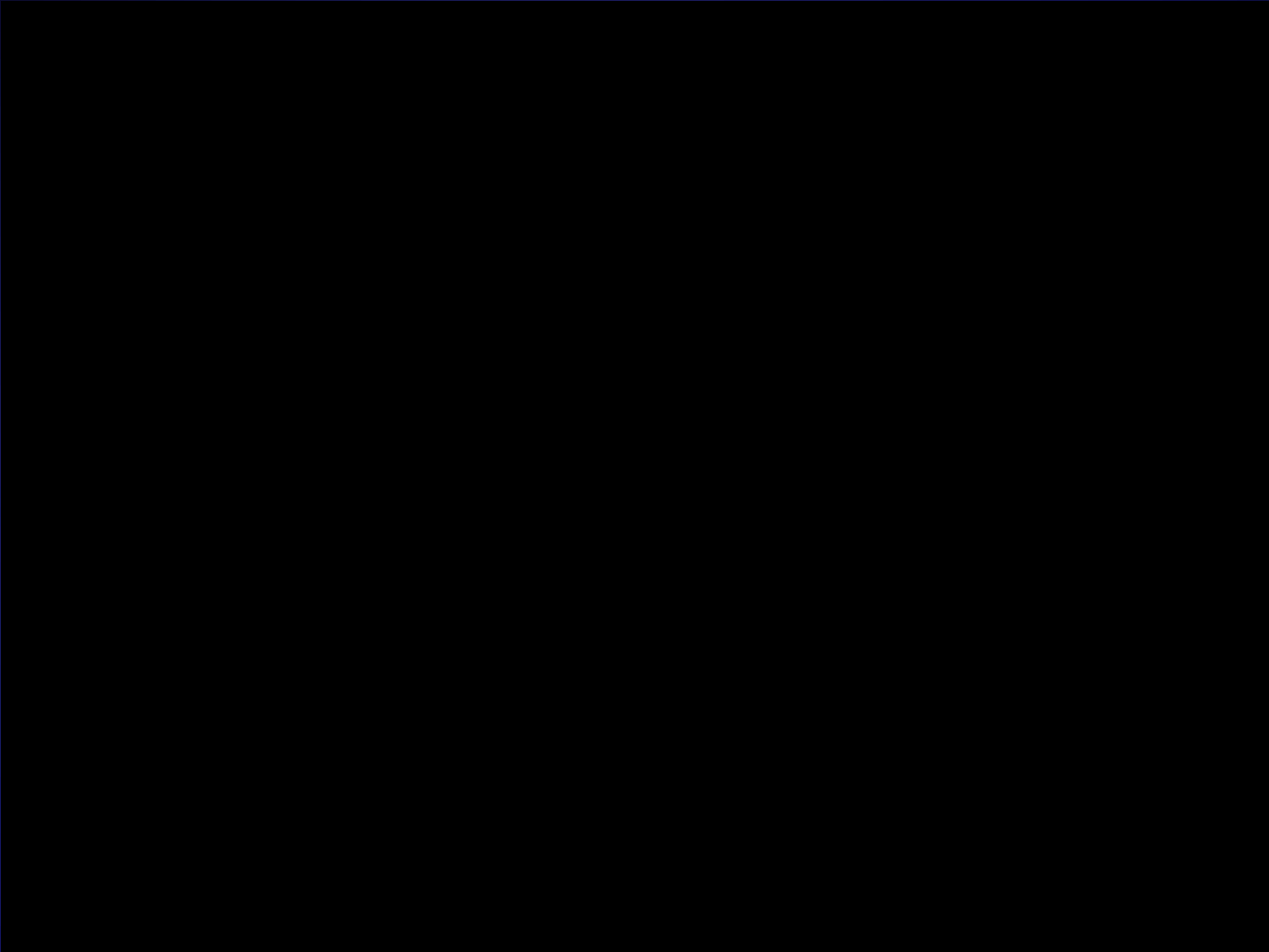


- **Lt. Gen. Larry James, the Air Force's deputy chief of staff and former director of signals intelligence for the National Reconnaissance Office**
 - “Does more altitude buy you survivability, or does persistence provide a radical improvement in the ability to collect intelligence?”
 - “In the last year, the Joint Staff changed the high-altitude requirements for the U-2 and Global Hawk,” James says. “Based on that, the U-2 can meet the requirement for capabilities.
 - The advantage of the U-2 is that it has very good sensor capabilities, among other things...





Software & Technology Cyber Security



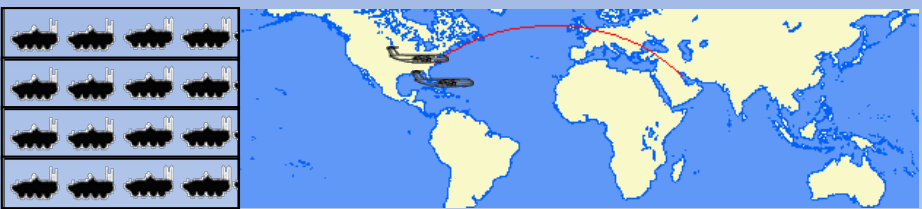


C-5M Usefulness

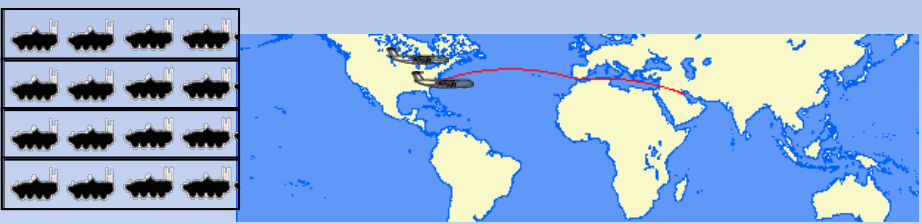


Day 1 Pope AFB En route Kuwait IAP

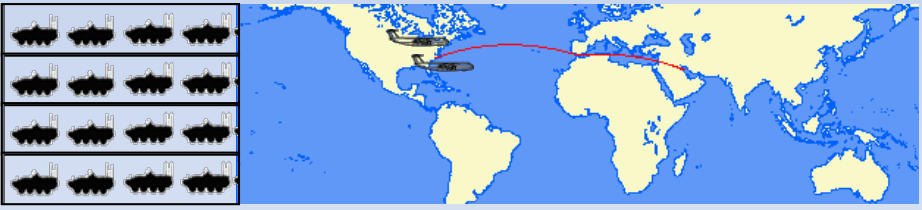
M Direct
 2 LAVs
 39 Tons



M Enroute
 5 LAVs
 97.5 Tons



**Legacy C-5
 Or C-17
 Enroute**
 2 LAVs
 39 Tons





“It was fine...until we got into test.”



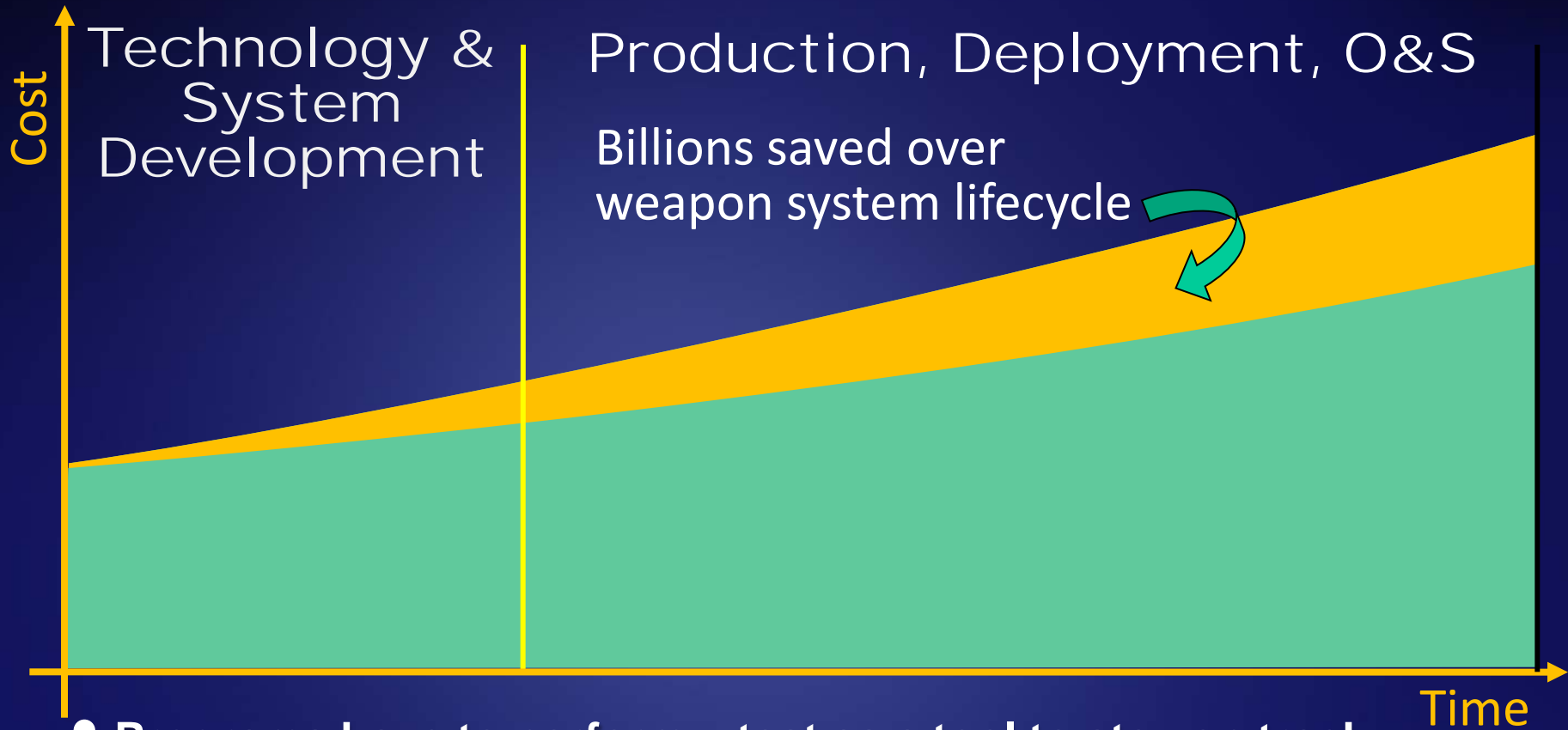
Cost of OT is a relatively small portion (~1%) of the overall program budget, it is a large portion of the budget in the year it occurs. By virtue of being at the end of the development process, testing occurs when the program has few degrees of freedom left to work issues, including a checkbook with little reserve

**Design...Build
...Test...**

**Versus
Buy...Fly...Fix**



Discovery & Context



- Programs have to perform – test as a tool to stay on track
 - Either cost avoidance (prevent the overrun) or pure cost savings



Early Defect Discovery is Key



- Wiedeking's "quality offensive": During Porsche sales crisis, catastrophic failure resulted in the need to understand the cost of defects

- o Defect fixed on the spot cost ~ 1 mark
- o Fixed at end of assembly line ~ 10 marks
- o In vehicle rectification (Final QC) ~ 100 marks
- o At a dealer under warranty ~ 1000 marks



-Business as usual hides system-wide inefficiencies

-Transparency is critical to uncover & resolve problems





Mission, Business, Politics



- Government must integrate
- We need capabilities to execute our mission
- Getting those capabilities to execute our mission is business; industry has to make a profit
- Politics trumps mission and business
 - every dime comes from Congress
- As budgets shrink drastically, we need to shift the paradigm to better “inside the box” thinking

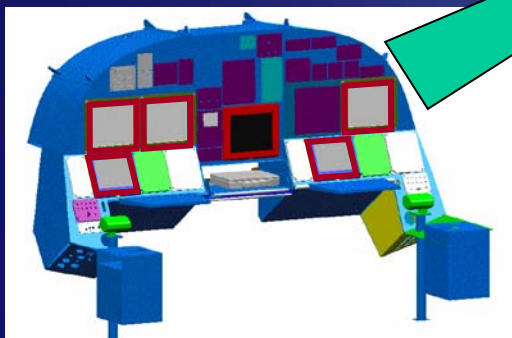
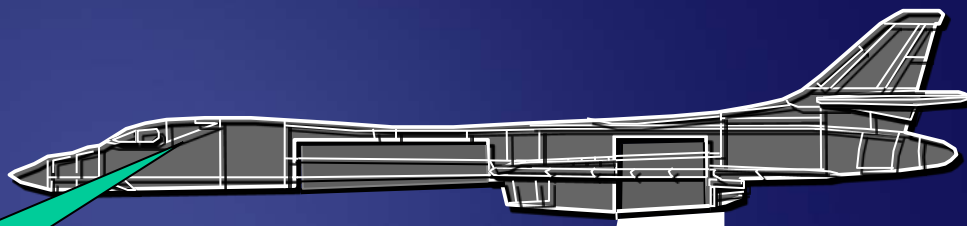




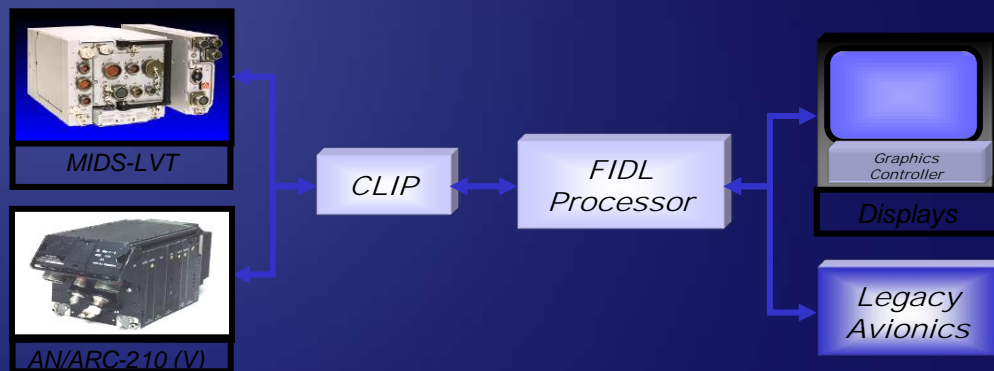
Data Talks Examples



- B-1 FIDL, an example of “rolling the bones”



WSO Station





Data Talks B-1 FIDL



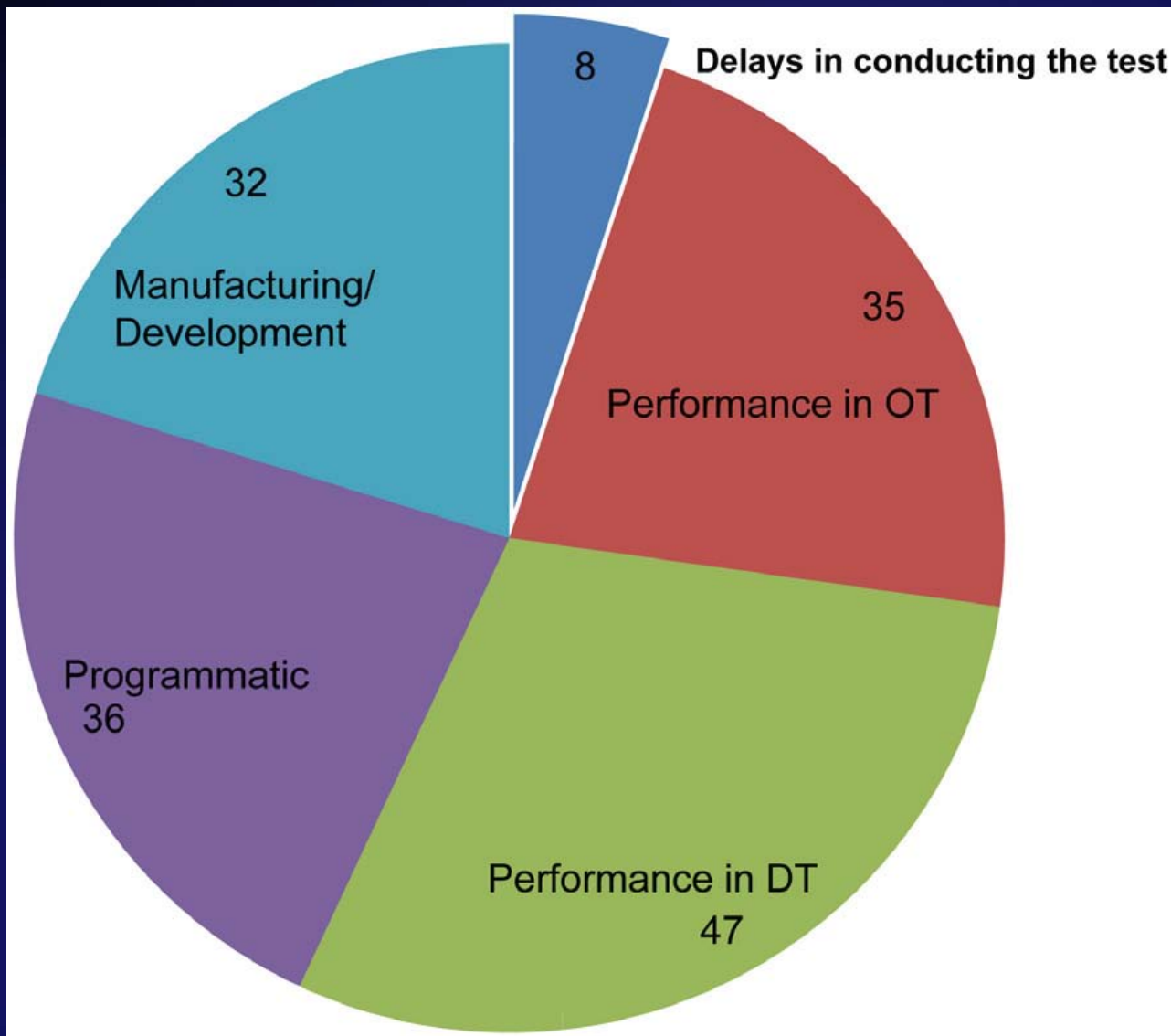
- **B-1 FIDL**
- **DT had insufficient time to complete data analysis for system performance assessment.**
- **DT had incomplete data to characterize FIDL interoperability with defensive system.**
- **software incorrectly updates stationary target coordinates, calling system performance into question with expected low OT ratings**

14 June 2011

FOT&E now planning for Summer '12 and FRP of Jan '13!



Data Talks



- DOT&E study:
- 67 progs. w/ significant delay
- Only 8 were attributed to test delays
- Only 1 program delay was attributed **SOLELY** to test
- The **REAL** problem is in development!



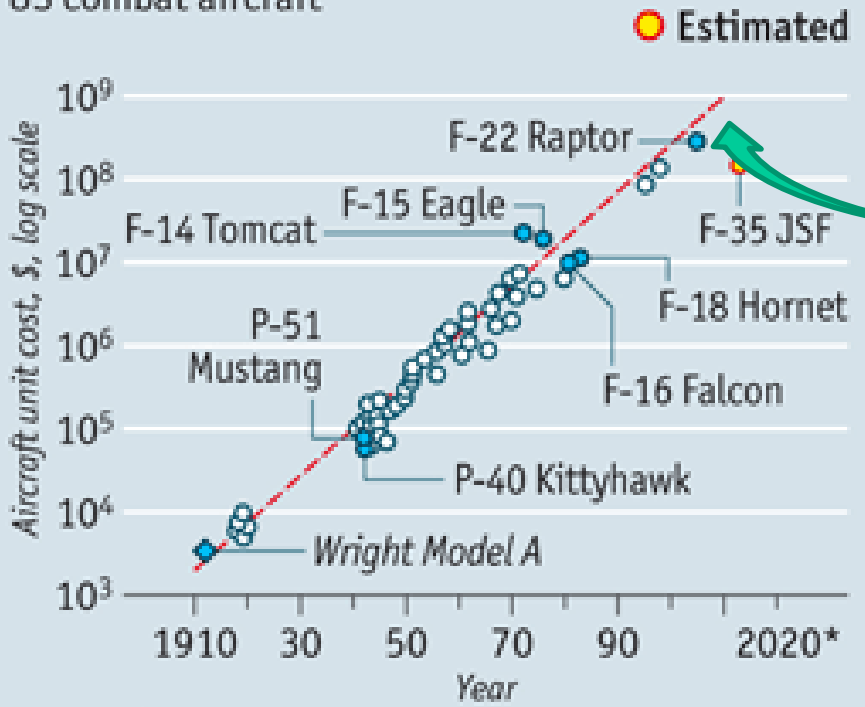
Speaking of the F-35, Was Norm Augustine Correct?



Augustine's, not Moore's law

2

US combat aircraft



Sources: Norman R. Augustine; John D. Christie

*Forecast

But this was an old estimate (circa 2002 at \$66M/copy)...the current?

$$\$382000000000 / 2443 \text{ jets} = \$156\text{M}$$

The strategic challenge the United States now faces is that neither of the viable technological strategies capable of defeating modern counterstealth systems are politically compatible with the absolute commitment that has been made to manufacturing large numbers of F-35 Joint Strike Fighters -- JFQ

“In the year 2054, the entire defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy 3½ days each per week except for leap year, when it will be made available to the Marines for the extra day.”



Summary



- The truth can hurt
- Choices are important
- Development takes time; test is part of development
- Data Driven organizations do better
- Context/weighting of data is critical
- The Truth shall set us free (or save us money)





AFOTEC

AIR FORCE OPERATIONAL TEST AND EVALUATION CENTER

