



AFOTEC

AIR FORCE OPERATIONAL TEST AND EVALUATION CENTER





Budget cuts: Cutting test increases bleeding -- Exponentially!

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



**49th Annual Targets,
UAVs, & Range
Operations Symposium
Fort Walton Beach, FL**

26 October 2011



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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



Adm. Mike Mullen, Chairman of the Joint Chiefs of Staff



"The budget has basically doubled in the last decade. And my own experience here is that in doubling, we've lost our ability to prioritize, to make hard decisions, to do tough analysis, to make trades."

Our culture needs to change back



Healthy Tension



“Testing is the conscience of acquisition”

William Perry

*If two people agree on everything,
then only one of them is doing the thinking.*



Phases of a Program



- 1. Enthusiasm**
- 2. Panic**
- 3. Search for the Guilty**
- 4. Punishment of the Innocent**
- 5. Rewards for Non-Participants**



Best Practice: A More Constructive Test Approach is Key to Better Weapon Systems (GAO Report - July 2000)



- “The [program] also constructed its test plan using optimistic assumptions. For example, program officials assumed that no hardware or software problems would be encountered during ground or taxi tests. They also assumed that one aircraft would be available for flight testing at all times and that all flights would be productive.”
 - Assumed software error rate of 15% despite 100% on B-2 and 60% on C-17

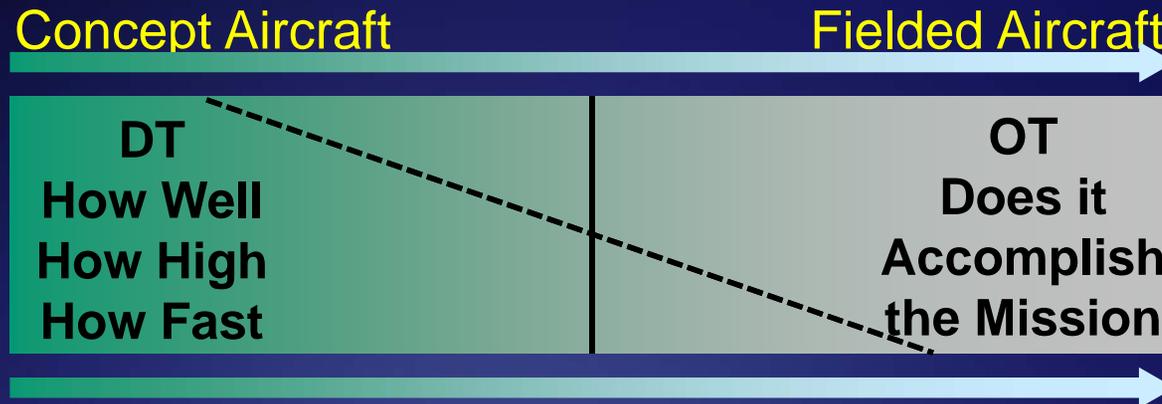
“In addition, planned testing was curtailed to accommodate cost constraints on the overall program.”

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Development and Ops Test

An Opportunity to Save Time & Money



Increasing cost to fix problems

The faded line--less differences today...

- Use of Simulation for Ops Test
- Involvement of contractors in Ops Test
- More systems testing
 - Automatic systems
 - Effects analysis
- Decision systems--requirements matter far more than the operator

Integrated Test, that melds all requirements, will save



Launching a New Program



DILBERT by Scott Adams



Science - Art -
Discipline



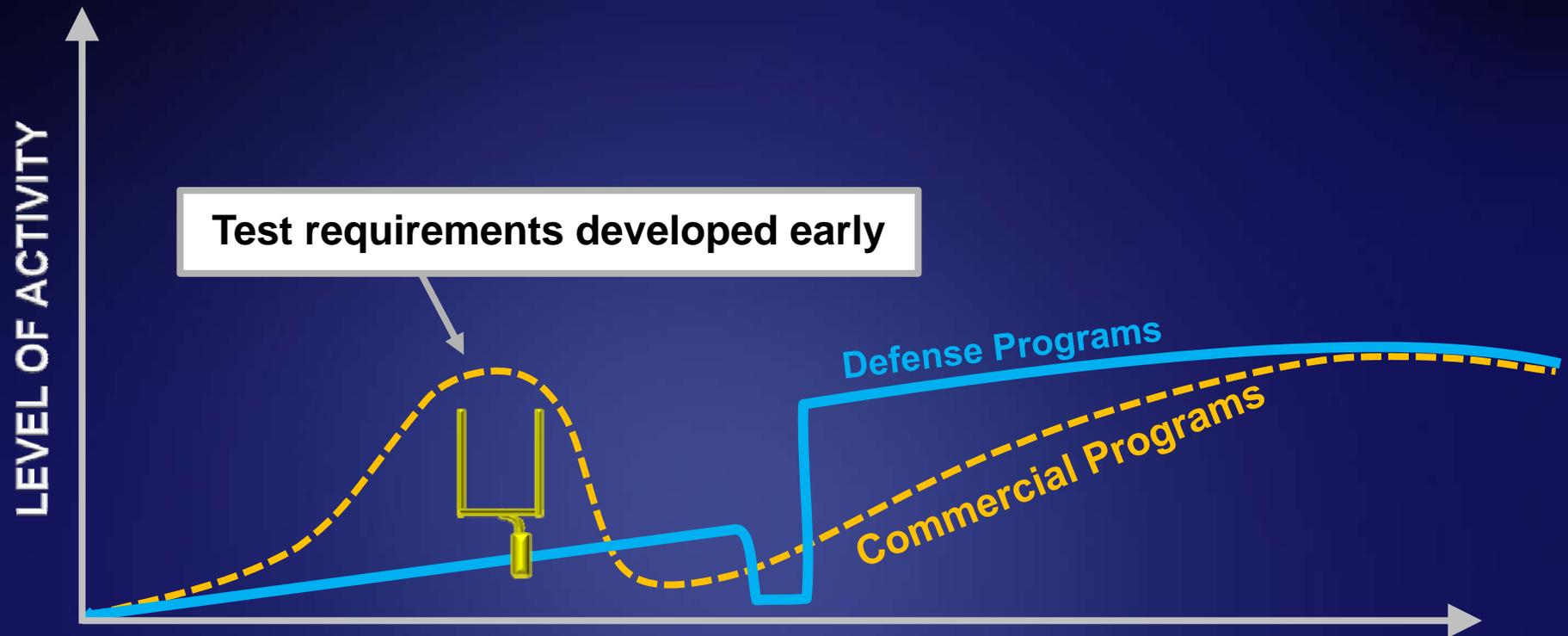
Set Goal Posts Early



- **Contract Specifications**
 - Ensure accountability
 - Encourage true partnering with government as lead
 - Ensures Open Book test



Setting the Right Goals





Early Defect Discovery is Key



- Sooner a problem is discovered, the less it costs to
 - Fix
 - Develop work arounds
 - Cancel program



Speaking Truth to Power



We test to find / solve problems!



Early Program Optimism Is Natural



- Marketing
- “Operationally Acceptable”
- Little bit pregnant
- No deferred requirements
- “Solution Shops”

Realism has to set in...sooner or later

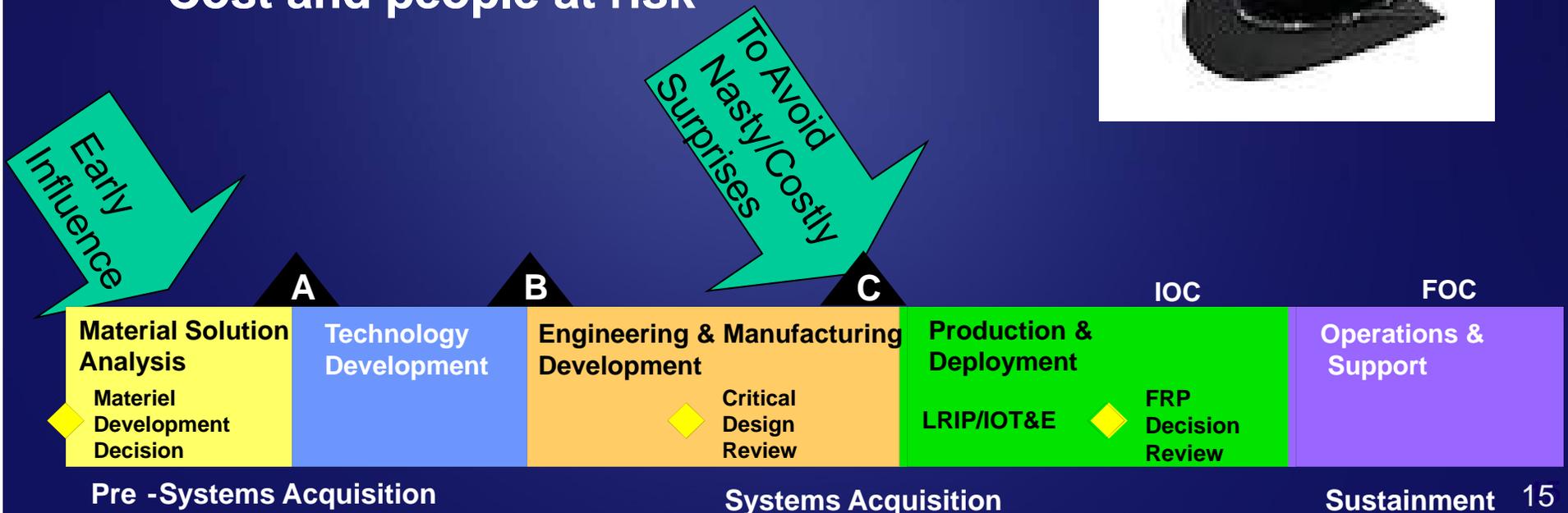
*Schedule behind you is like runway behind you...
Test Early and Often to minimize risk*



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





Test: Your Partner in Successful System Development

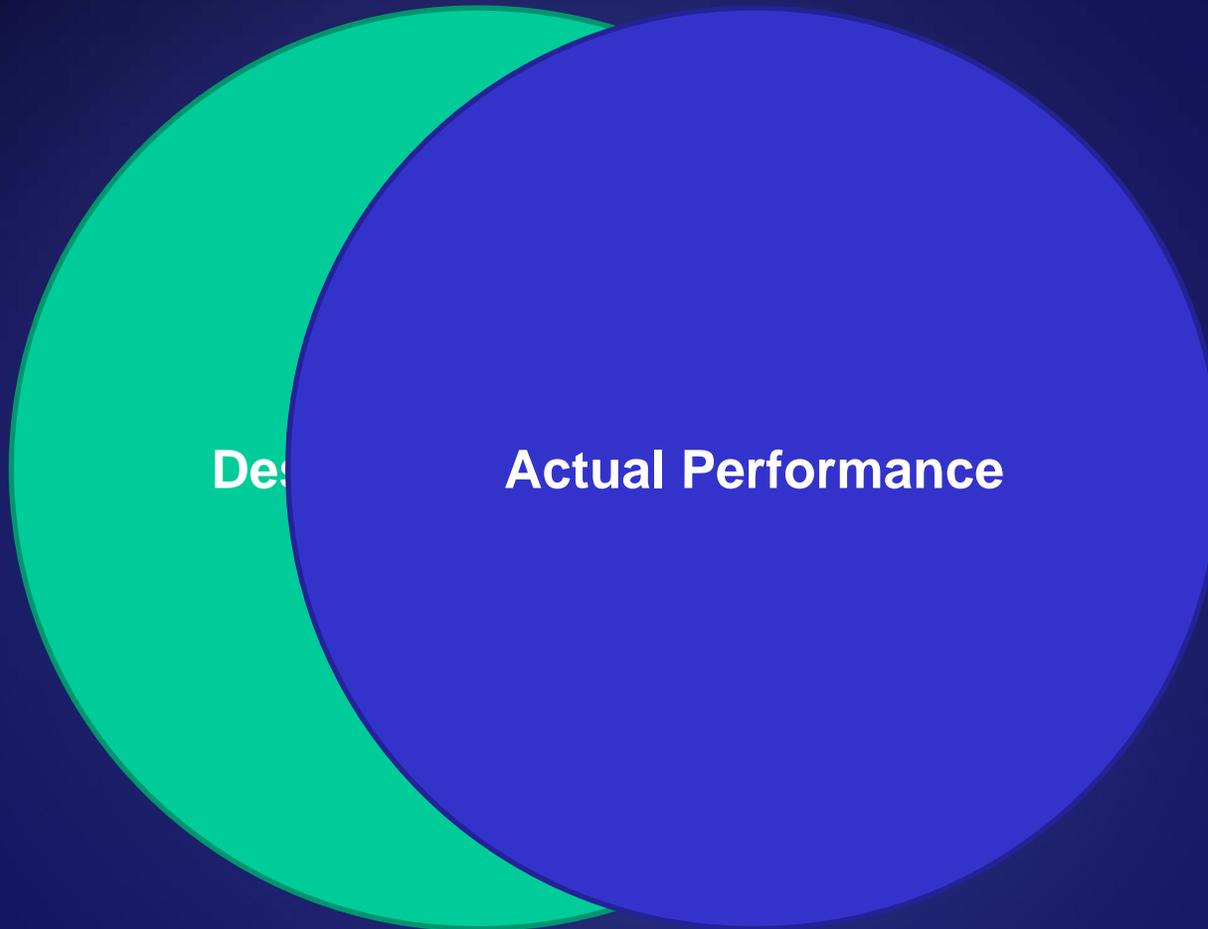


- **Over-reliance on Modeling & Simulation**
 - Garbage in – garbage out
 - Models only as good as known information
 - Circular logic when model is used to design the product and then used to test the product w/o actual test results
 - Won't find problems early – i.e. no big savings
- **Test and evaluation: integral to the development process**
 - Verifies and validates models
 - Measures actual system performance during development
 - Analytic (e.g. 5 test configurations versus 720)
 - Builds a robust, exploitable model





Requirements vs Reality





Test as Part of Development



- The target / weapon combination is dominant
- Weapons / systems have incredible autonomy

- *Test to Integrate*
- *Test to Develop*

Typical Program Cost Pie

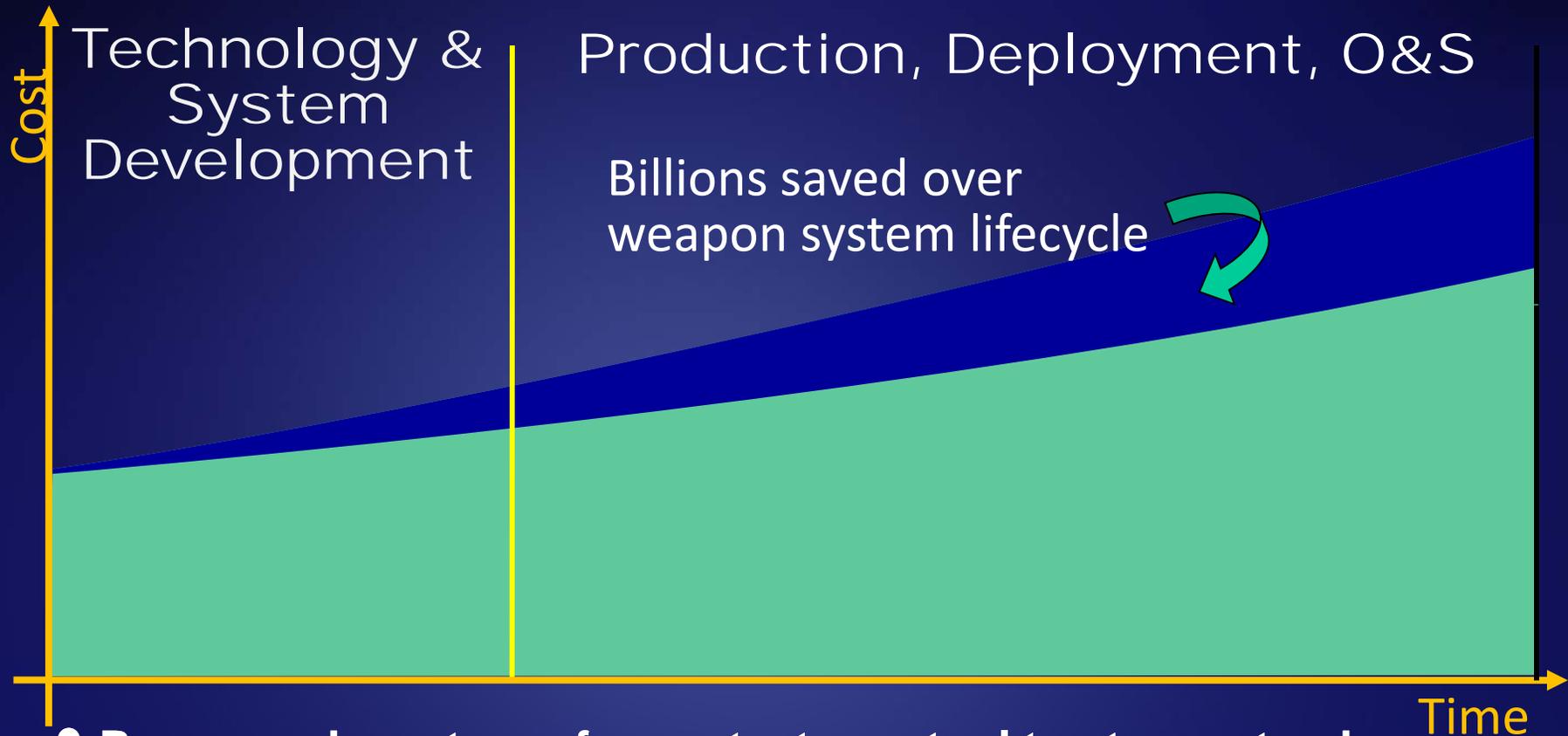


- Development
- Integration
- Test (separate?)
- Other

- Decision Systems/Displays must be deemed user friendly or *hostile* – *Task Friendly Not Just Adequate*
 - *Defined task and Actionable Displays*
 - *“Unique training” closely scrutinized*
- The need for Truth – *Fair and Balanced*
 - *Tedious is tedious while agile is agile (esp. with s/w)*
 - *Easy, precise and timely is the minimum today*

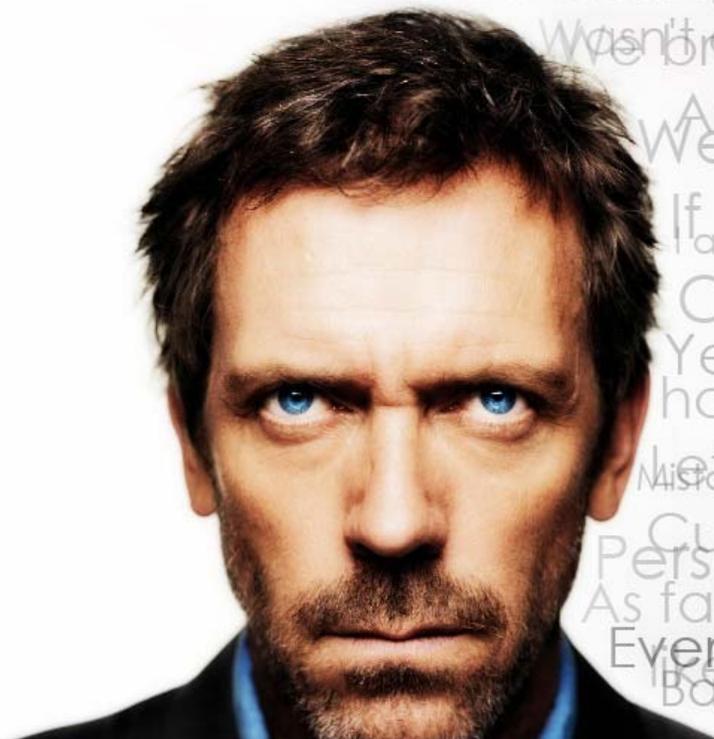


Early Test >>> Later Test Return on Investment



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

Perspective:



Everybody lies.

a doctor who holds your hand while
Unfortunately grant them the greatest re
or one who ignores you while you del
When a baby is born, it's peice of the teediscuss our role
I suppose it would be perfect, I am both amused and annoyed
mp, perfect, pink balloons over a preschooler's forehead
you think I should be less stubborn than yo
Then it's downhill, some hills steeper than others
doctor who ignores you while
Parents get off on their kid's accomplishments
I'm sure he's a good guy. He's probably a great c
They'll annoy you with
Probably a much better guy than I am.
No problem. Have some aspirin from my cin.
And some part of me wants him to die.
Hell, they'll even show you a purple cow
I'm just not sure if it's because I want to be with h
and tell you what a kind of work you want something,
If you talk to God, you're already lying to him.
or if it's because I want her to suffer.
he doesn't smile, he does.
The eyes can mislead,
If God talks to you, you're probably lying to him.
The smile can lie,
but the shoes always tell the truth.
I'll be adding that to my in-dance water supply songs.
Wasn't even so.
He figures out what's going o
And they're all grown up and they've got
Well here's the law in your argument
utterly beautiful
If I enjoy adding life, I don't hate life.
I am a complete str
back pain or you
Come out of your holes, people!
Right, she's stale and stale was con
Yeah. I want to save her. I don't want to
have flesh-eating bacteria, so I'm wrong.
let's cure her with antibiotics and popo-sice
Humiliation comes in all kinds of package:
Mistakes are as serious as the lies. And popo-sice
Cute kids die of the same disease as the other
Perseverance does not lead to anything
As fast as gas, our bodies are used by cavitas
Everybody does stupid things, it for sound byt
Badymo is not a diagnosis, it's a do what's
it shouldn't cost them everything they w



Evils (Costs) of Concurrency (i.e. Rushing It to the Field)



- **64 aircraft built early in the aircraft's production run will require modification to achieve their full flight-hour design lives**
 - **Engineers identified a shortfall with a structural component in their wings**
 - **During recent full-scale durability testing, a crack emerged that was consistent with the analytical predictions**
 - **Must retrofit plans 64 early aircraft**
 - **Durability testing helps identify structural issues early on "to avoid costly sustainment issues later in the life of the aircraft."**





“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 (test)...Build(test)

Versus
Buy...Fly...Fix



Development / Fielding Problems



- Unless your “child” is fully grown, he/she has a lot to learn
- As members of the system acquisition team, problems are expected – nothing is perfect
 - Hardware will fall short
 - Software will glitch

“Why man, I have gotten a lot of results. I know several thousand things that won't work.” Thomas Edison



Testing Concerns



- Independent team assessed concern: testing drives undue requirements, excessive cost and added schedule
 - Examined 40 programs with significant delays
 - 7 experienced some delay (not primary) due to testing
 - 37 programs: problems discovered during test caused much longer program delays than test itself
- DOT&E review of 76 programs
 - cost of OT&E ~1% of total acquisition cost



Result: Testing alone does not cause major program delays or cost increases

j3

Another idea for "37" bullet:

-37 progams: problems discovered during test caused much longer program delays than testing itself

jeffrey.olinger, 6/8/2011



Paradigm: Quickly to the Warfighter!



- Just get it to the user (*sometimes* absolutely necessary)
- Regardless of specification shortfalls – “the contractor did their best”
- The User will determine what system can be used for
 - creating the need for user testers
- Late identification of deficiencies
 - Difficult holding the contractor accountable
- Generates new requirements
 - Fix this and that
- Increases program life cycle cost

“Just because a thing doesn’t do what you expected, it doesn’t mean it’s worthless.” Thomas Edison

But can we afford it?



Hmmmmm



- Program is declared “ready for OT”
 - Contractor test data insufficient to determine spec compliance
 - Developmental testing was incomplete and resource limited
 - Insufficient time to complete data analysis
 - Limited database lowered RM&A prediction confidence
 - Open Cat 1 DRs
- OT performance concludes Not Effective / Not Suitable

Is DoD asking for what it really needs?



Relevancy with Politics

(Fixes Come Late, thus Cost More)



Global Hawk Block 20/30 Initial Operational Test and Evaluation (IOT&E)

- IOT&E Findings are Generating Multiple Program Improvements

- NGC is working with USAF to **proactively address** findings
- ASIP and Reliability & Maintainability key areas of focus...Planning USAF/NGC ASIP Technical Meetings
- Generator solution indicative of positive teamwork

- Improvements Already Evident

- Deployed Block 20/30s are performing quite well ahead of IOC declaration...90% Mission Effectiveness 225 Missions with over 4,300 hours
- Expect DoD Full Rate Production and IOC in Sept 2011

Deficiency	Corrective Action Initiated
Clickbond Nutplates	✓
25 kVA Generator Failures	✓
Kearfott Navigator Issues	✓
Sensor Management Unit (SMU)	✓
Integrated Sensor Processor (ISP)	✓
Common Airborne Modem Assembly	✓
GMS Control Panel (GCP)	✓
Main Landing Gear (MLG) Wheels/brakes/tires	✓
Engine Fuel Nozzles	✓

- These nine deficiencies comprise 81% of all failures during IOT&E
- Several of deficiencies have been completed

Team Proactively Addressing IOT&E Findings with USAF
Results evident in Real World Operations



Objectivity and Accountability



- **Objectivity is #1 goal**
 - **Credibility comes from Objectivity**
 - **Objectivity (generally) comes from Independence**
 - **Developing / fielding capability is the priority**
 - **Technological success is a precursor**
- **Accountability is critical**
 - **Government sets expectations**
 - **Contractor needs clear direction**
 - **Nothing is perfect and what gets fixed versus what gets lived with is a government decision**
- **Resolution is a total team effort**



Best Practice: A More Constructive Test Approach is Key to Better Weapon Systems (GAO Report - July 2000)



- “Commercial firms have found constructive ways of conducting testing and evaluation to help them avoid being surprised by problems late in a product’s development.”
- “However, the pressures of successfully competing for [government] funds to start and sustain a weapon system program create incentives for launching programs that embody more technical unknowns and less knowledge about the performance and production risks they entail...a new program will not be approved unless its costs fall within forecasts of available funds.”

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Best Practice: A More Constructive Test Approach is Key to Better Weapon Systems (GAO Report - July 2000)



- “These Pressures and incentives explain why the behavior of [government] weapon system managers differs from commercial managers. Rewards for discovering and recognizing potential problems early in a DoD program are few. In contrast with leading commercial firms, **not having attained knowledge** – such as on the performance of a key technology – can be perceived as **better** than knowing the problems exist. When valid test results are not available, program sponsors can **assert projected performance.**”

“Accordingly, DoD testers are often **seen as adversaries** to the program.”

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DoD's High Risk Areas

GAO Report, 12 Mar 09



“Ultimately, the process produces more demand for new programs than available resources can support, promoting an unhealthy competition for funds that encourages programs to pursue overly ambitious capabilities, develop unrealistically low cost estimates and optimistic schedules, and suppress bad news.”

Proper DoD leadership to offset this pressure is essential

Testing doesn't cost, it pays!



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



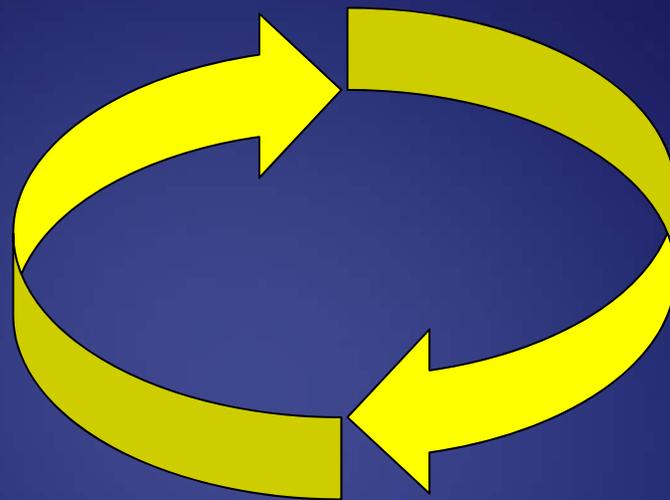


Summary



- The value in test is its potential to reduce bad decisions
- If bad news is avoided – bad decisions will follow
- Relationships are key to savings and success
- Government & Industry both need to insist on clear executable specs/standards
- The government has to lead/direct as the buyer / user
- Need to get Back to Basics
 - Write contracts with enforceable specs (not a bad thing)
 - Stop systems going to the field before they are ready
- Don't marginalize the Acquisition and Test Community
 - Critical role and mission to perform (\$ to be saved)

Testing doesn't cost, it pays!



Testing doesn't cost, it pays!



Punish the Innocent



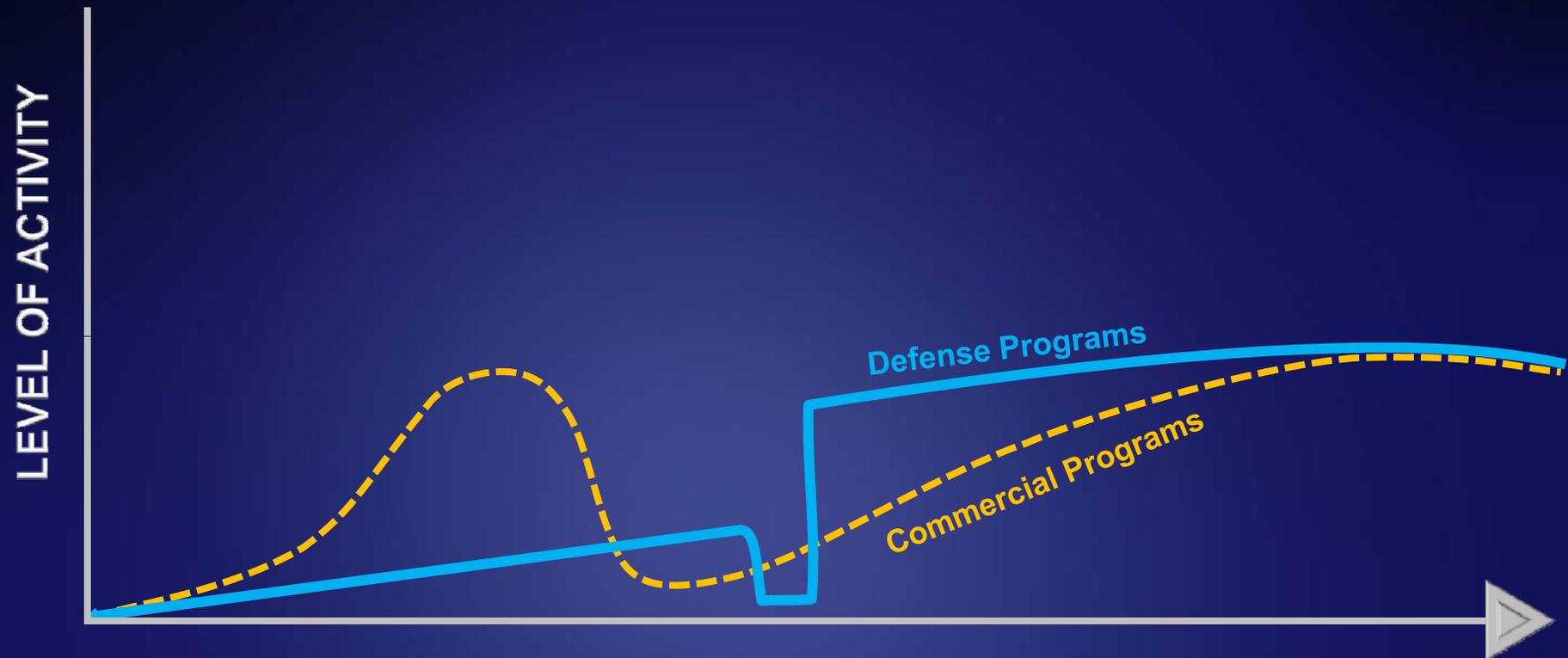
Dilbert



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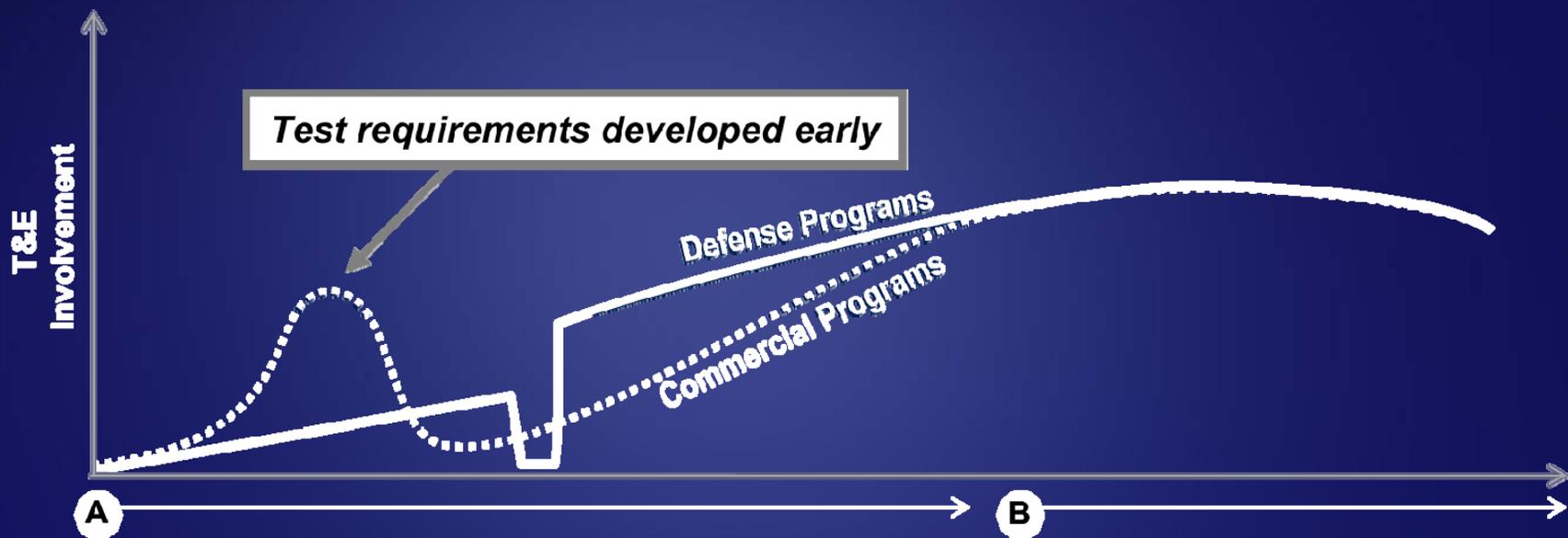


Setting the Right Goals





Test Requirements and Program Lifecycles



Test Requirements development effort and influence varies Between Commercial and Military programs.



Hope versus Reality

Time for Defect Discovery and Solution



- **F-22**
 - 4 year program
 - took ~8 years
- **B-2**
 - 4.5 years, 3,000 hrs, program
 - Took 8 years, 5,000 hrs
- **F-35 (15 a/c, 7 ground test articles)**
 - 7 year, 11,000 hrs, 6,000 flights
 - 22M LOC
 - Schedule to complete development?



Bureaucratic or Effective?



- **Ben Rich, Skunk Works**
- **CIA Agent's View**
- **Contractor versus Government Test**
 - **Interviewing lawyers**
 - **Message management & the B-1B, etc.**
- **2000 GAO View**



JOINT STRIKE FIGHTER

Restructuring Places Program on Firmer Footing, but Progress is Still Lagging Overall



“After more than 9 years in development and 4 in production, the JSF program has not fully demonstrated that the aircraft design is stable, manufacturing processes are mature, and the system is reliable.”

“Engineering drawings are still being released to the manufacturing floor and **design changes** continue at higher rates than desired. More **changes** are expected as testing accelerates.”

GAO March 2011

**Test budgets are puny.
Schedule slips and design changes cost big bucks.**