Einstein's Velvet Gloved FIST: Sneaking Acquisition Agility in Under the Radar

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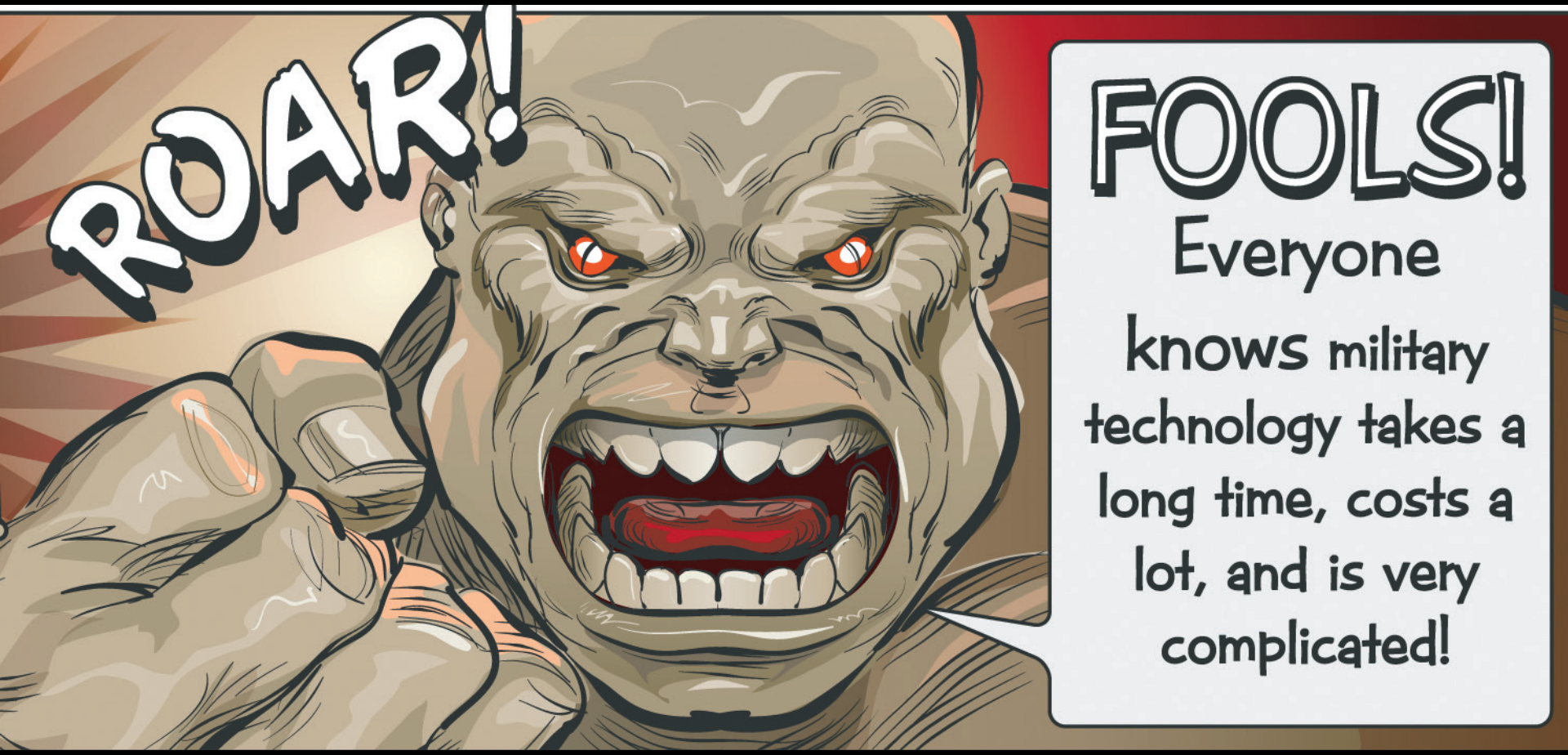
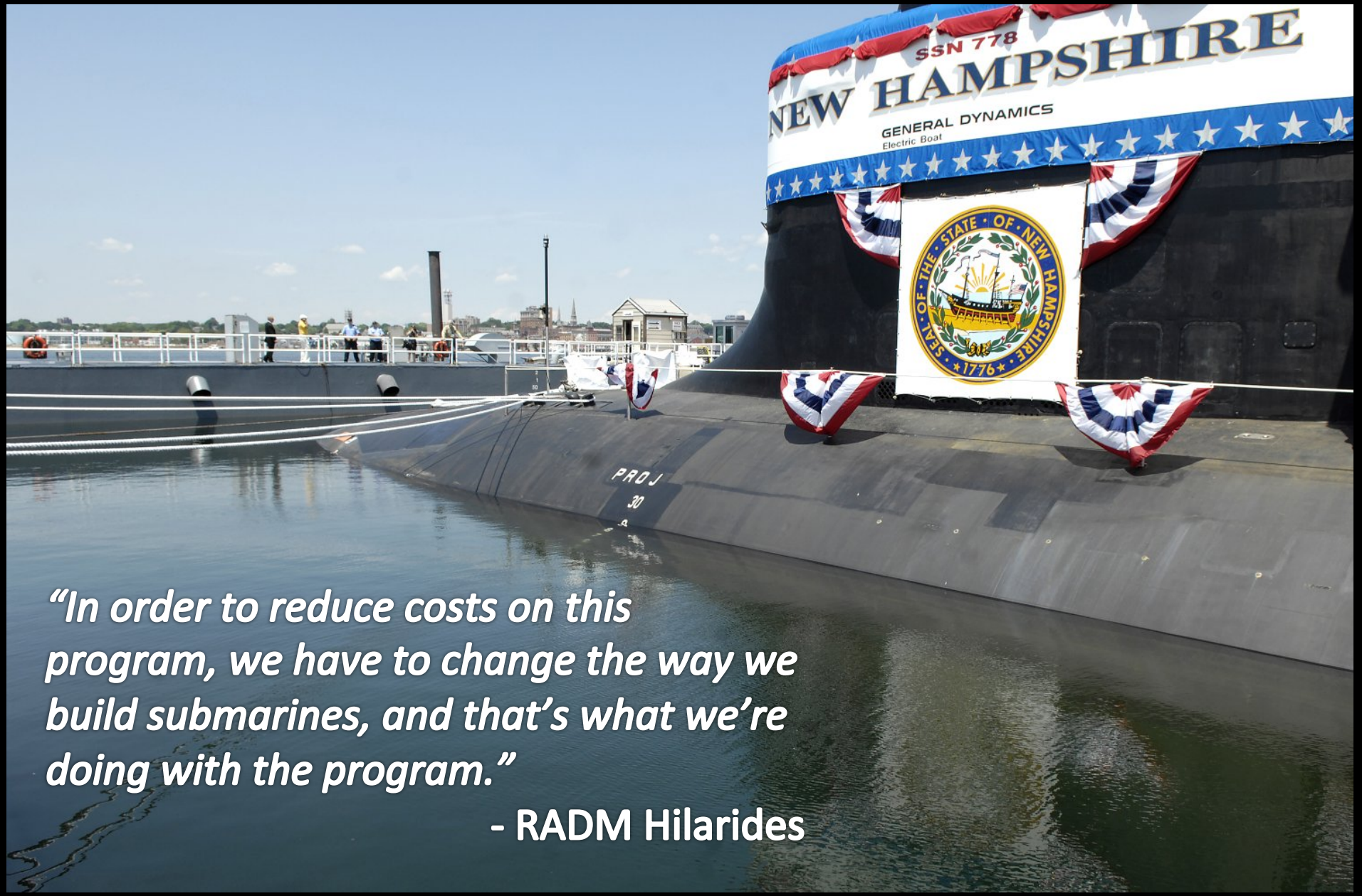
FIST


ROAR!
FOOLS!
Everyone knows military technology takes a long time, costs a lot, and is very complicated!



"In order to reduce costs on this program, we have to change the way we build submarines, and that's what we're doing with the program."

- RADM Hilarides


FIST


Fast

“A hallmark of an executable program with a sound business case is short development cycle times.”

2008 GAO Report

Assessment Of Selected Weapon Programs

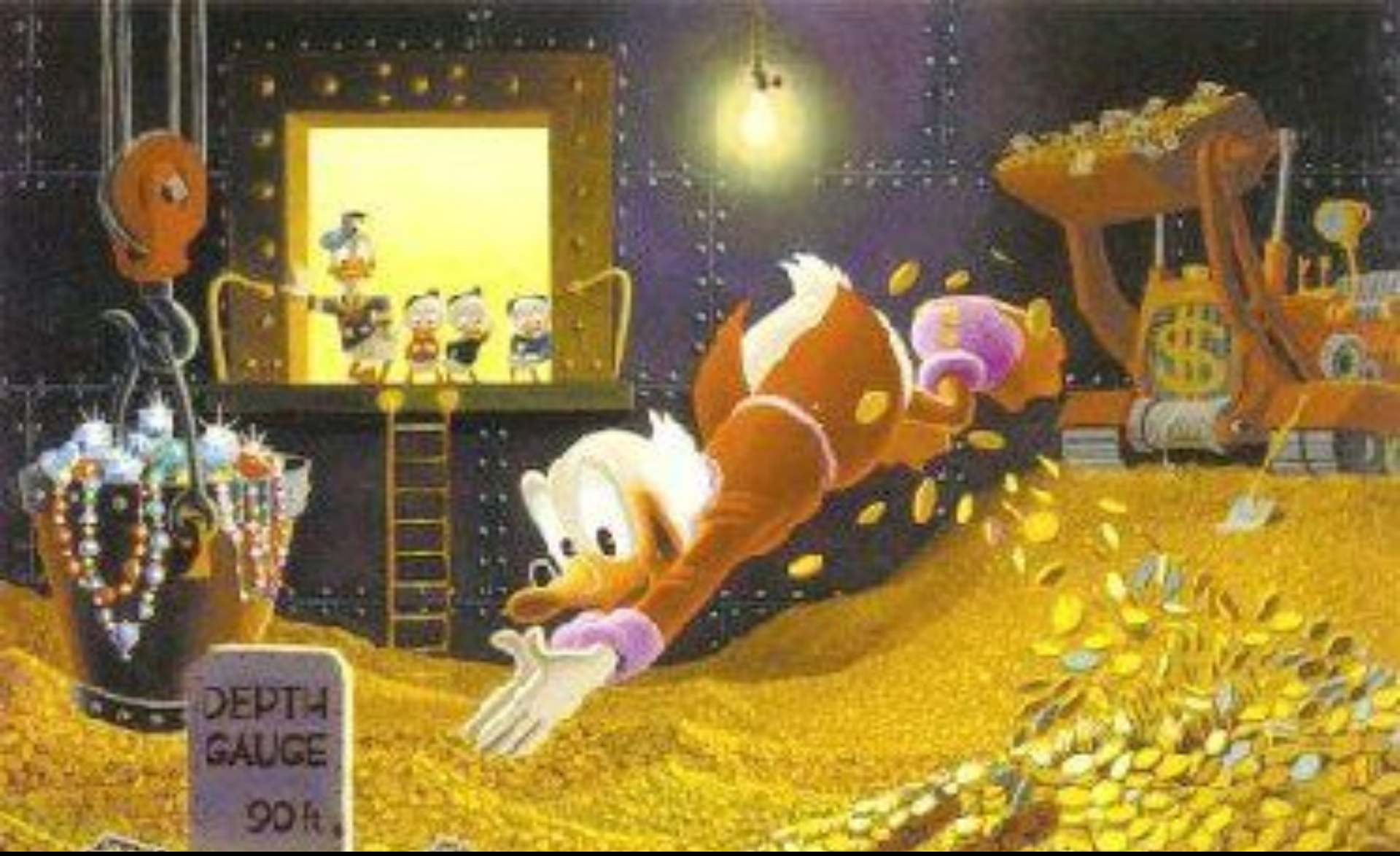
An unreasonably long acquisition cycle… is a *central* problem from which most other acquisition problems stem.

- Packard Commission, 1986

Inexpensive

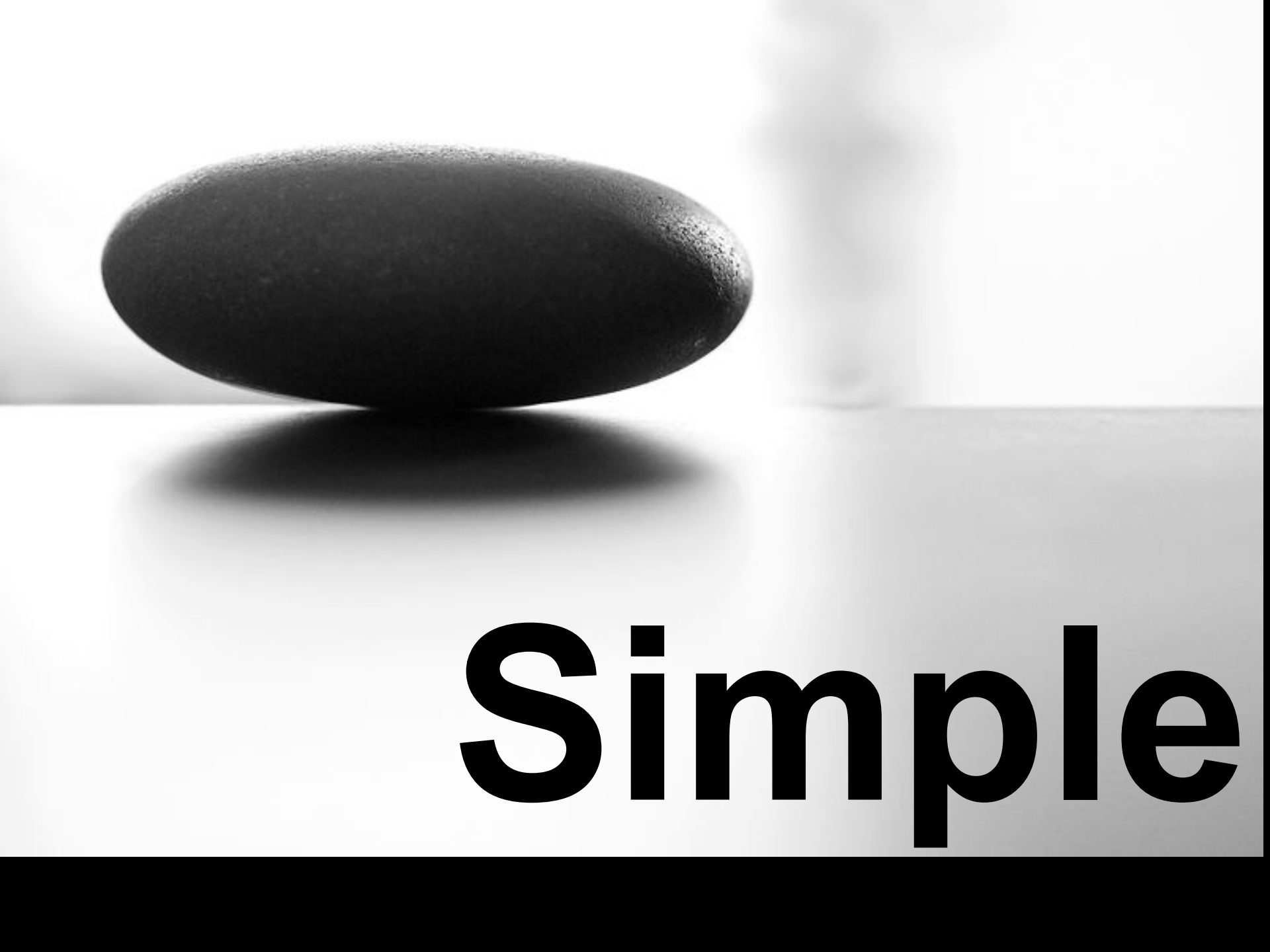
“…the majority of requirements might be satisfied at lower cost…”

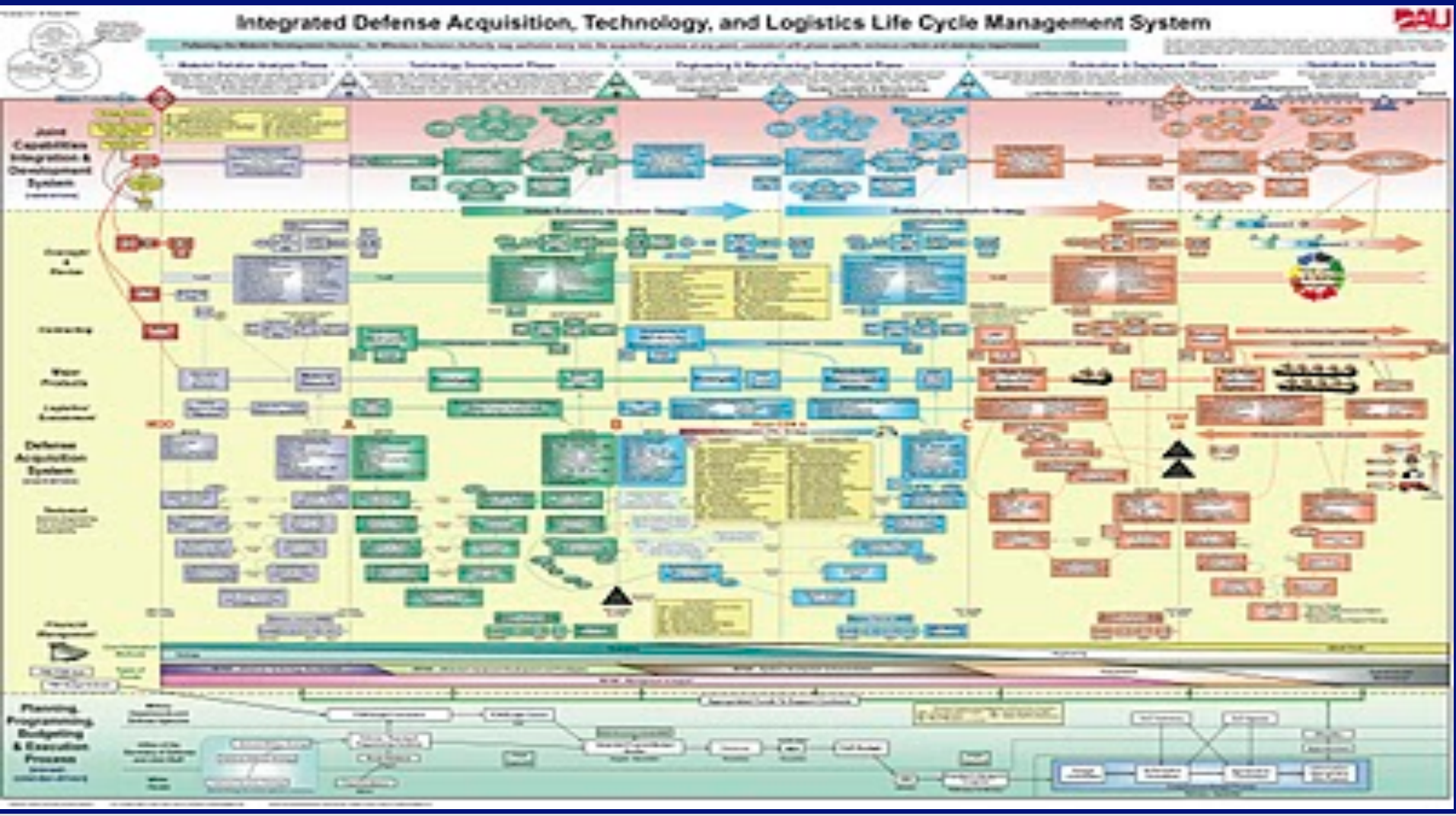
- 2009 USAF Acquisition Improvement Plan



"…the highest funding levels in two decades."

-2008 GAO Report


Simple



“Complex acquisition processes do not promote program success…”

2006 DAPA Report

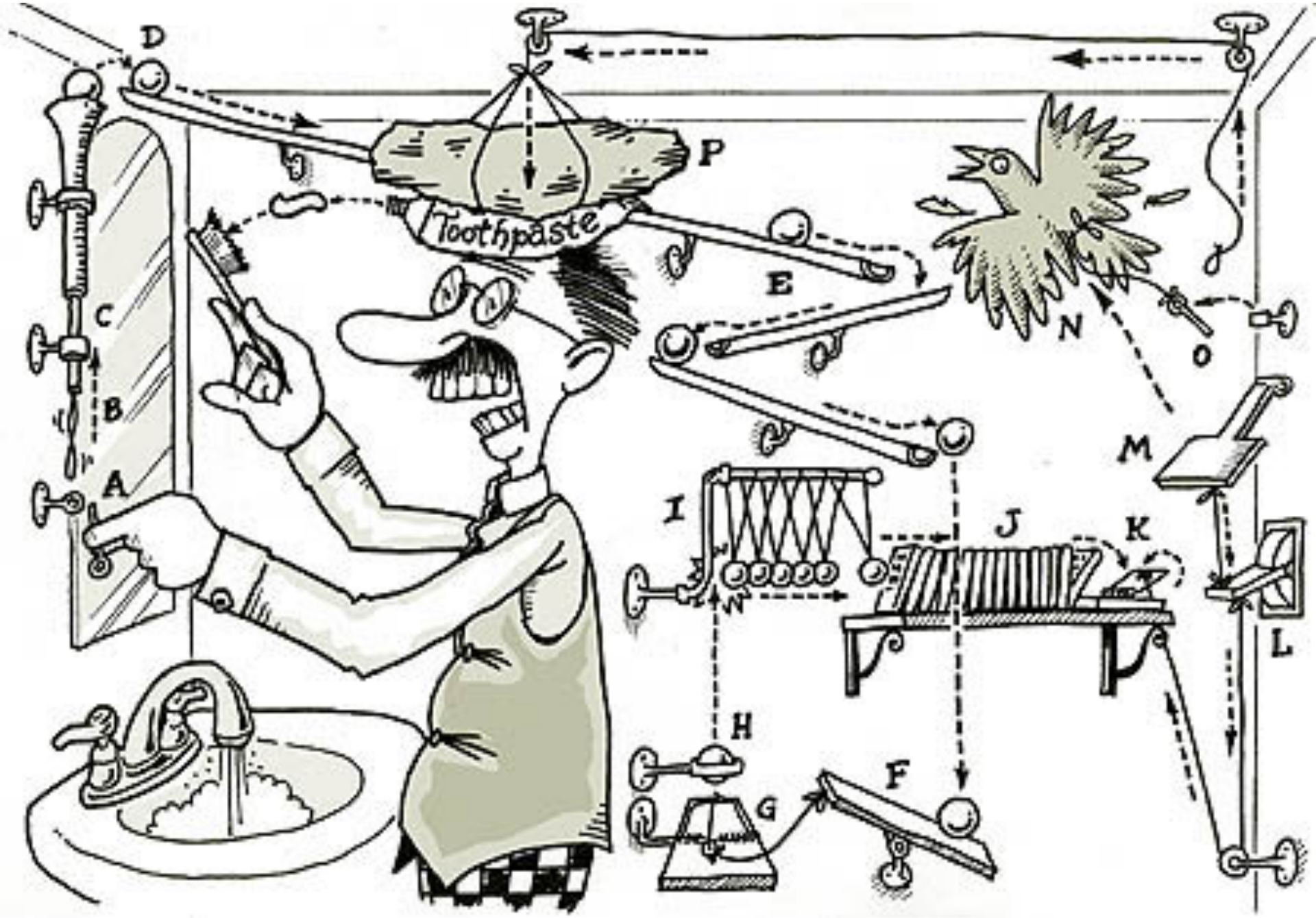
Complexity reduces systems to irrelevance.

- Army's OIF Report

Simplicity scales.

Complexity doesn't.

Metric: How many moving parts?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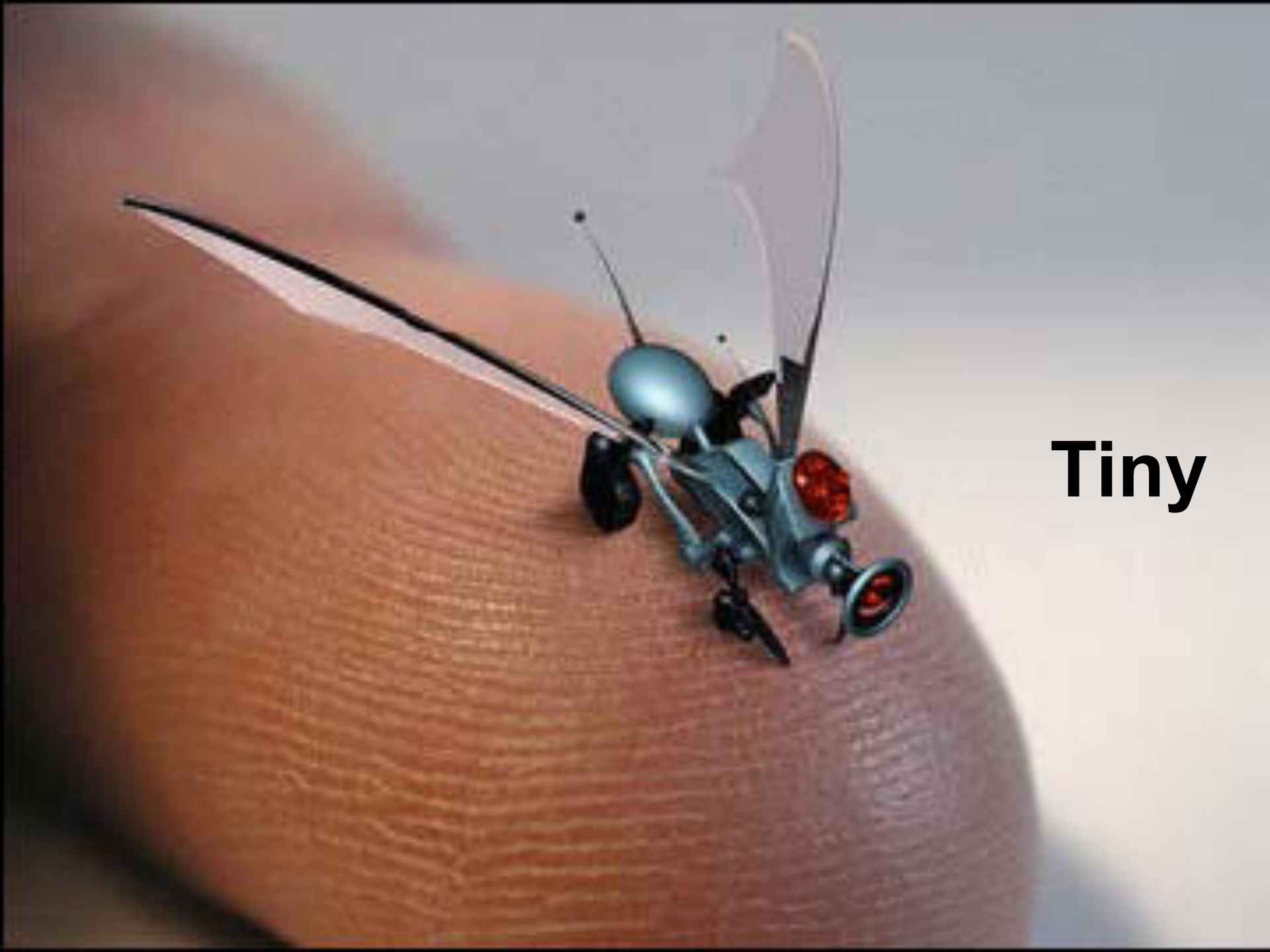

Tiny

Minimize team size,
maximize team talent.


Incentivize and reward underruns

Agile (Scrum, XP, etc)

Lean

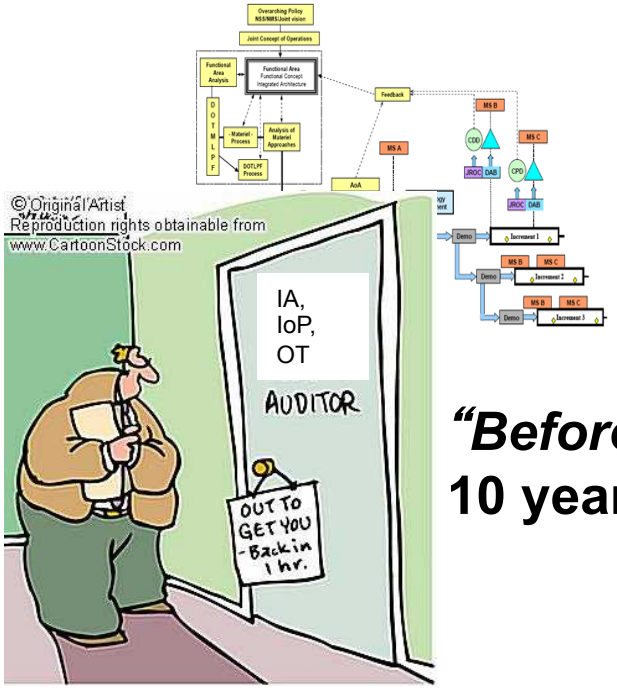
TRIZ

Continuous Process Improvement

Modular Open System Approach

SEI's *Acquisition Archetypes*


MACE



"Before"
10 years

"After"
1 year

Agile, Asymmetric, IT Acquisition A3... Certifying for Success*

*Success always depends on value proposition and business model…

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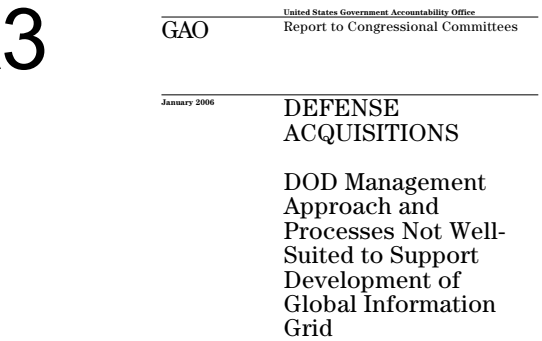
~~e-file~~ Net-ready

Why will we finally succeed at A3 where others have failed?

Defense Science Board (DSB), National Research Council (NRC), and GAO reports* re flawed programs (e.g. GIG, NMCI,FCS, JTRS, etc)

National Defense Authorization Act directives & responses* (e.g. 2010 sect 805, 2011 sect 933) re flawed IT Acquisition process

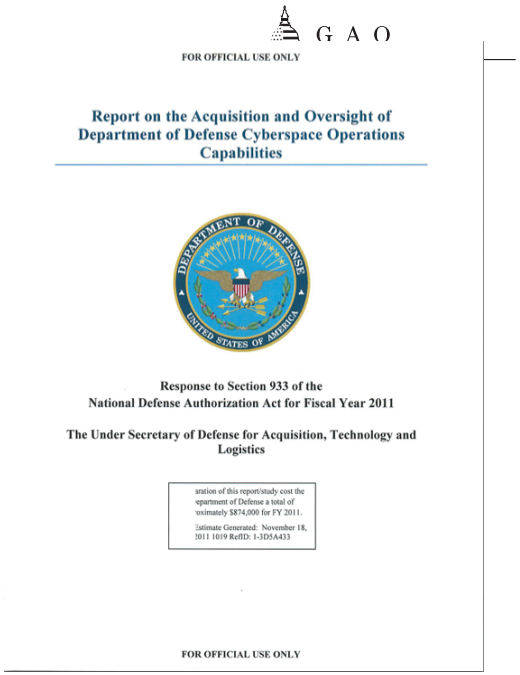


United States Government Accountability Office
GAO
Report to Congressional Committees

January 2006

DEFENSE ACQUISITIONS

DOD Management Approach and Processes Not Well-Suited to Support Development of Global Information Grid



G A O

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Report on the Acquisition and Oversight of Department of Defense Cyberspace Operations Capabilities

Response to Section 933 of the National Defense Authorization Act for Fiscal Year 2011

The Under Secretary of Defense for Acquisition, Technology and Logistics

aration of this report/study cost the epartment of Defense a total of oximately $874,000 for FY 2011.

Estimate Generated: November 18, 1011 1019 RefID: 1-3D5A433

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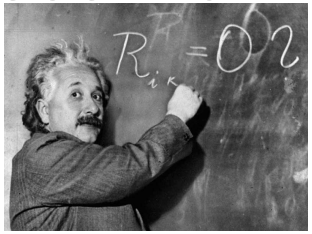
*Netcentric programs are all behind schedule and over budget…IT acquisition process is broken...

We will embrace the truth….

"You can't solve a problem with the same thinking and processes that created it..." Einstein



"You get what you measure…you get what you pay for..." Drucker

Value-based Acquisition Framework (VAF) …or ….

Assured Return on Investment (*RoI*) re *interoperability**, *agility*, Information Assurance (*IA*) and Reliability, Availability and Maintenance (*RAM*) in a large, distributed, software-intensive, *netcentric*, *enterprise*, *cyber*, System of Systems (*SoS*)

**Italics* indicate buzz terms for highly desired, but difficult to define, and/or achieve, attributes

VAF Truth Assertions

To achieve information dominance across cyberspace, a netcentric enterprise must be **agile in both runtime and build-time.**

RoI, i.e. (value-per-capability) X (# of capabilities) ÷ (time discounted in favor of faster delivery) ÷ (cost), depends on incentivizing an ecosystem of stakeholders around a well-understood **value proposition aligned to a carefully designed business model.**

Runtime and build-time **interoperability are necessary to enable agility** across a distributed, information-centric, enterprise.

Agile IA, i.e. the ability to make appropriate need-to-protect vs. need-to-share decisions across enterprise vertical enclaves**, is a necessary condition** for runtime and build-time interoperability.

Interoperability comes at the cost of giving up specialized capability. Universal interoperability is neither possible nor desirable. Therefore, the engineer's job is to build **sufficient interoperability to satisfy specific pragmatic "enterprise" requirements** for information processing.

"Providing value", i.e. demonstrating utility, is an element of interoperability, and as such should be a **testable** aspect of any networked enterprise resource.

Key Performance Parameters (KPP) for Interoperability should tightly couple mission-level Measures-of-Effectiveness (MOE) to system-level Measures of Performance (MOP), to ***assure*** **the existence of customer-defined value delivery chains**.

These MOP, MOE, and resultant **KPPs should serve as the basis of certification, and also the basis for procurement**: i.e. solicitation, source selection, Service Level Agreements (SLA), etc..

A3 ROI Objective: ***Better-***Speed-to-***Better***-Capability

Measurably and testably:

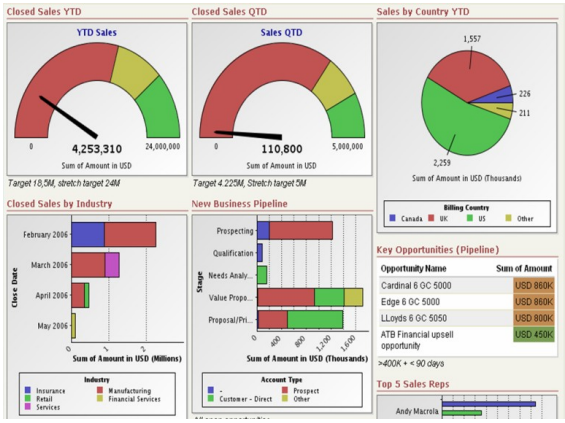
- Improve operational outcomes
- Improve delivered-capability-per-cost-per-time ratio
- Improve predictability of cost and time per delivered capability

Through:

- Rapid, incremental, parallel, D, T&E and C&A
- Reusing components in build-time and run-time
- Creative contracting

Enterprise KPP (E-KPP) = Framework for Measuring, Buying, and Building What Matters

NR-KPP = Objective parameterization of system Information Processing Efficiency (IPE) lead metrics, i.e. Measures of Performance (MOP) tightly coupled to Delivered Information Value (DIV) lag metrics, i.e. Measures of Effectiveness (MOE)



S-KPP = Objective parameterization of IT acquisition efficiency, e.g. re-use vs. re-invention, in context with COTS best practice + FAR facts of life. Equates efficiency of tech refresh to life cycle sustainability.

VAF = Sustainment KPP (S-KPP) + Net-Ready KPP (NR-KPP) = Better speed to better capability = E-KPP!

Solicitation = E-KPP + use case + available $

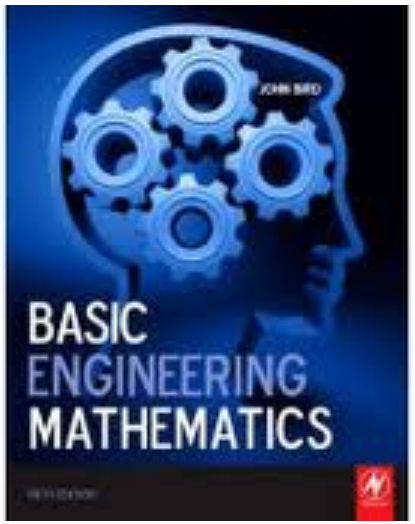
Traditional Systems Engineering 101: Bound the Engineering Trade Space

Sustainability KPP (S-KPP) = A_O

$$A_O = \frac{MTBF}{MTBF + MTTR + MLDT} = \frac{\textbf{\textit{Up Time = Useful Runtime}}}{\textbf{\textit{Total Time}}}$$

If one of my component fails, Ao decreases. How do I get the "9"s I need?

- More spares?
- More redundancy?
- More technicians?
- Better technology?

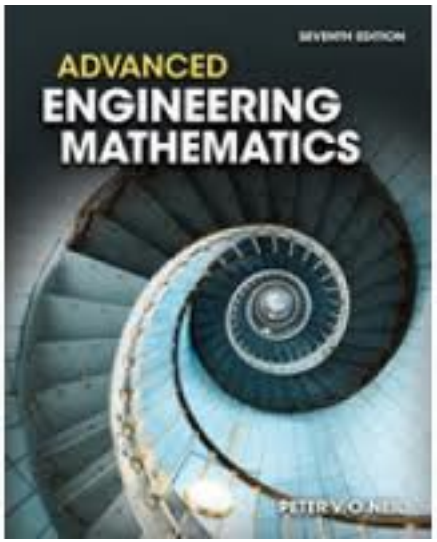


Ao = Operational Availability
MTBF = Mean time between failures
MTTR = Mean time to repair
MLDT = Mean logistics delay time

Software Intensive, Networked, Systems of Systems Engineering 401

$$KPP = A_?$$

$$A_?* = \frac{UsefulTime**}{TotalTime}$$



*$A_?$ = Better Capability Availability

**Time = Run Time, Design Time, Build Time, + Buy Time, ???

Any number of factors beyond my control affect network performance. How do I get the "9"s I need at my node of interest?

- Topology?
- SOA vs. Thick Client?
- C&A, IOP, DT, OT?
- COTS vs. GOTS vs. OSS?
- Build vs. Buy vs. Lease?
- Enterprise vs. Seat License?
- FFP vs. LoE, Long vs. Short Term Contract?

Value-Based S-KPP: a Build-Time Speed-to-Capability *Process* Metric

$$\text{VAF S-KPP} = A_{nr} = \frac{\textbf{\textit{Useful Build-Time}}}{\textbf{\textit{Total Build-Time}}}$$

$$A_{nr} = \frac{(T_D)_{IE}}{(T_D + T_T + T_C)_{CE}}$$

$$T_D = T_I + T_R + T_B + T_O$$

A_{nr} = Net-ready Availability
T_D = Development Time
T_T = Additional Test Time
T_C = Additional Certification Time
$(\ )_{IE}$ = Initial Estimate
$(\ )_{CE}$ = Current Estimate

T_I = Invention Time
T_R = Re-invention Time
T_B = Bundling Time
T_O = Overhead Time

Value-Based NR-KPP: a Runtime System-Level Metric

$$\text{VAF NR-KPP} = A_{iv} \approx \frac{\textit{Useful Info Processing Time}}{\textit{Total Info Processing Time}}$$

Namely,

$$A_{iv} = f(W_P, \text{DIV}, \frac{B_V}{B_T})$$

Information Latency **Mission Outcomes** **Semantic Skill**

A_{iv} = IPE X DIV
where IPE and DIV are positively correlated by definition

IPE = (e.g) W_P X (B_V ÷ B_T)
I.e., as timeliness of critical information delivered increases, and delivery of non-critical information decreases, IPE increases

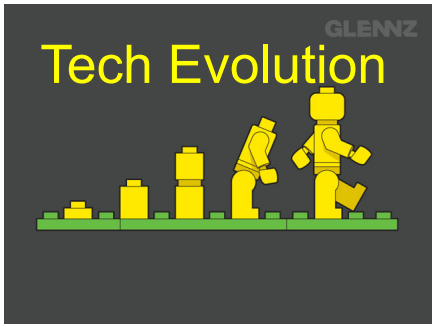
DIV = (e.g.) Pk, P_D, etc.

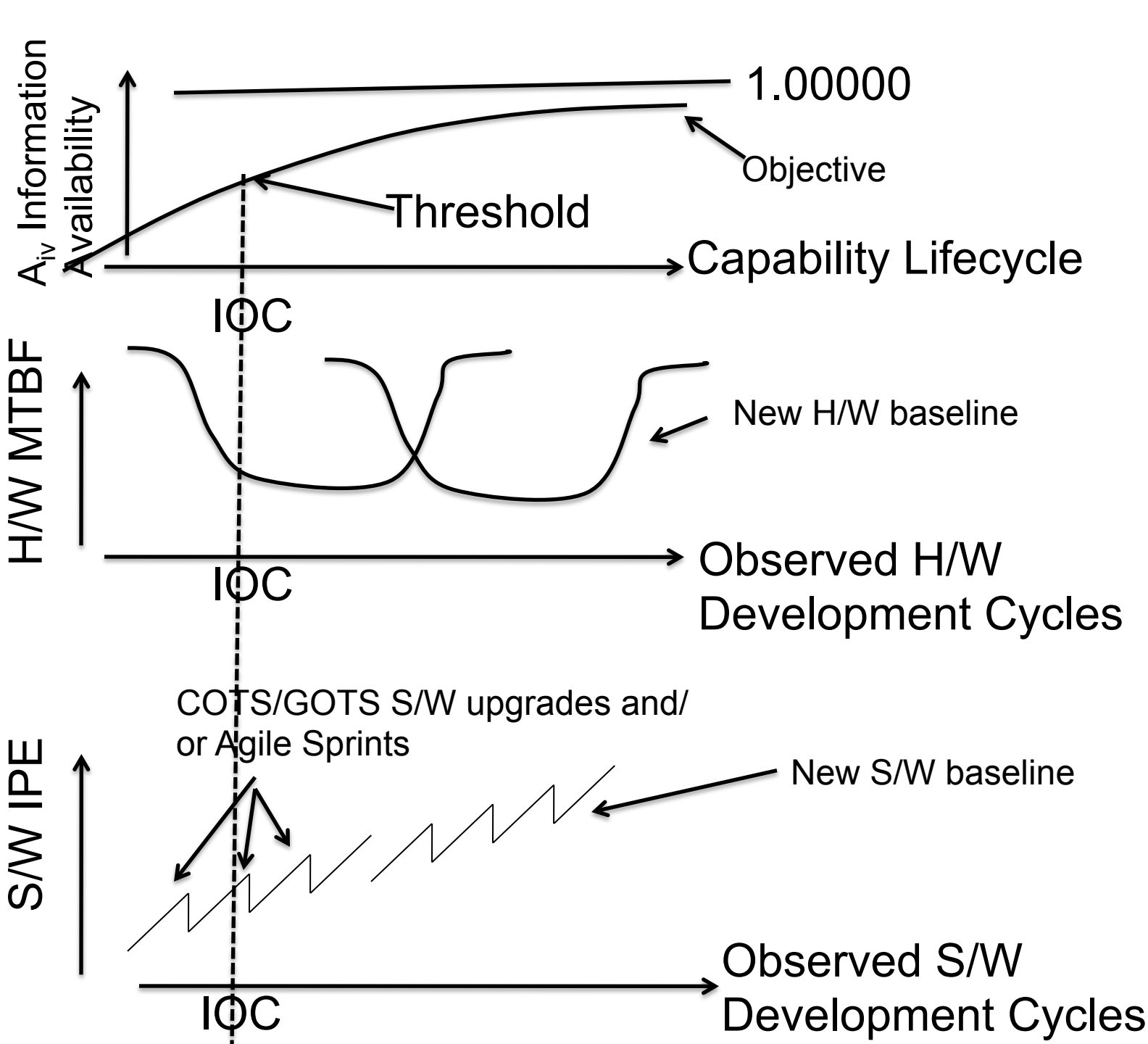
A_{iv} = Information Value Availability
IPE = Information Processing Efficiency
DIV = Delivered Information Value
B_V = Valued Bits Processed
B_T = Total Bits Processed

W_P = Perishability Factor ~ 1/latency, a function of delivery time
Pk = Probability of Kill
P_D = Probability of Detection
"etc" = MOE for mission, safety, logistics, planning, maintenance, etc

VAF Reliability, Availability and Maintenance (RAM)

- Base RAM metrics on VAF S-KPP = A_{nr}
- Use Moore's Law 18 month technology refresh time line as the delivery cycle for transferring increments of functionality.
- Establish E-KPP (i.e. VAF NR-KPP + S-KPP) as the requirement set.
- Set the threshold and objective RAM targets inside the 18 month delivery cycle.
- Adjust RAM targets for each successively delivered COTS s/w bundle to anticipate inevitable reduction in h/w redundancy requirements.




A_{iv} Information Availability
1.00000
Objective
Threshold
Capability Lifecycle
IOC
H/W MTBF
New H/W baseline
IOC
Observed H/W Development Cycles
COTS/GOTS S/W upgrades and/ or Agile Sprints
S/W IPE
New S/W baseline
IOC
Observed S/W Development Cycles

Back Up

A3 Long Poles*

Information Assurance (IA)

- Legacy monolithic IA architecture does not support build-time plug&play acquisition, or runtime "need-to-share"
- Likewise, legacy C&A

Semantic Interoperability (SI)

- Data glut leads to needle-in-a-haystack issue
- Semantic technology state-of-the-art inadequate

Value Proposition and Business Model

- Saying-doing gap between enlightened stated objectives and actual acquisition model

*Must address these issues up front, realistically, and in context with each other ….including policy, technology, and marketing…

A3 Solution = High Assurance Product Line Architecture (HA PLA)

- PLA is industrial best practice for MOSA
  - Well specified “open” architecture supports plug-and-play
  - Specific business model and technology are aligned with interests of ecosystem, e.g. iXXX
- Defense Enterprise must build Agile IA and IoP into its PLA and supporting SDKs
  - GFE IA and IOP components included at the “bottom” of the “stack”
  - Controls inherited at the application level
  - DAA/JITC agree to certify PLA + on-boarding process vice a particular build

VAF: Quantifying & Demonstrating Enterprise RoI

VAF NR-KPP = Testable measure of runtime IoP, i.e. “semantic interoperability”. RoI demonstrated in High Assurance Tactical SOA (HATS) pilot series:

- **20% improvement in probability of detection of High Value Target**
- **100% improvement in detect-to-engage time**

VAF S-KPP =Testable measure of build-time IoP, i.e. “bundle-ability”. S-KPP RoI is equivalent to (e.g.) COTS SOA-based reuse RoI

- SOA re-usable components **cost ~20% more up front** than non-reusable coding
- **Speed-to-capability first article = ~1 year vs. ~ 6 years** for traditional acquisition
- SOA => **2.5 X more re-use** than traditional models.
- Enterprise re-use results in **90% cost reduction** over new development.
  - Sample case = Integrity-as-a-service **30K lines of code @ $5k/line X 1 as a service vs. X many** as a traditional capability.; Re-useable high assurance components **decreases time and cost for C&A**

Value-Based S-KPP Nuance

S-KPP = A_{nr}

$$A_{nr} = \frac{(T_D)_{IE}}{(T_D + T_T + T_C)_{CE}}$$

$T_D = T_I + T_R + T_B + T_O$

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15

Notionally assume the *objective* for a deployment spiral is 18 months. Say *threshold* deployment spiral is 24 months….If Test & Cert time is estimated at 6 months above-and-beyond development, then $(T_T + T_C)_{CE} = 6$; and $(T_D)_{IE} = 18 - 6 = 12$ months. Therefore objective for $A_{nr} = 12/18 = .66$, threshold $A_{nr} = 12/24 = .50$

As $(T_D + T_T + T_C)_{CE}$ slips to the right, A_{nr} decreases (🡻) below objective **:o(**

$$A_{nr} = \frac{(T_D)_{IE}}{(T_D + T_T + T_C)_{CE}}$$

As existing capabilities are wastefully re-invented, T_R increases (🡹) and/or as developers engage in non-value added bureaucratic overhead, T_O 🡹 => $(T_D)_{CE}$ 🡹, and A_{nr} => 0 **:o(**

$$T_D = T_I + T_R + T_B + T_O$$

As T_D stays on schedule, $T_D = (T_D)_{CE}$, and/or as T&C are performed more in parallel with development ($T_T + T_C$ => 0) => A_{nr} => 1.0 **:o)**

As capabilities become more interoperable in build-time, T_B per capability 🡻, and capability per increment of T_D🡹 **:o)**

As Agile is applied to invent gap-filling new plug&play capabilities; T_I per capability 🡻; and capability per T_D🡹 **:o)**

Value-Based NR-KPP Nuance

Assume:

DIV for a notional Defense Enterprise system is Probability of Kill (P_K). In this case, Probability of Detection (P_D) and Detect-to-Engage time (DtE) are components of P_K, i.e. $P_K = f(P_D, DtE)$ such that as P_D↑ and DtE↓, P_K↑.

Say notionally, $P_K = K \times P_D \div DtE$, where K is a known independent function of time.

In this case, IPE is a normalized function of the time it takes to: 1. discover, 2. decide to share, 3. deliver critical classified information.

*A new, virtual, low cost, open standard, high assurance security service + new open standard ISR application + alerting service demonstrates 10X improvement in discover-to-decide-to-share-to-deliver time line, i.e. 10X improvement over initial IPE. Improved IPE demonstrates 2X improvement in DtE and 1.2X improvement in P_D, i.e. 2.4X improvement over initial DIV.

*These notional numbers are consistent with High Assurance Tactical SOA (HATS) pilot series experimental data

Value-Based NR-KPP: a Runtime System-Level Metric

Useful Stuff

$$\text{NR-KPP} = A_{iv} \approx \frac{\textit{Useful Info Processing Time}}{\textit{Total Info Processing Time}}$$

Namely,

$$A_{iv} = f(W_P, DIV, \frac{B_V}{B_T})$$

Information Latency; Mission Outcomes; Semantic Skill

A_{iv} = IPE X DIV
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W_P = Perishability Factor ~ 1/latency, a function of delivery time
Pk = Probability of Kill
P_D = Probability of Detection
"etc" = MOE for mission, safety, logistics, planning, maintenance, etc

$$A_{iv} = \text{IPE X DIV}$$

$$\text{DIV} = P_K = K \times P_D \div DtE$$

$$(IPE)_{CE} = 10(IPE)_{IE}$$
$$(DIV)_{CE} = 2.4K(P_D \div DtE)_{IE}$$

$$(A_{iv})_{CE} = 24(A_{iv})_{IE} = :o)$$

Value-Based Source Selection = Quantified Capability, Per cost, per Agile Delivery Cycle

$(A_{iv})_c$ = Availability of Information Value per developed capability.

Value of Service (VoS) of a system is equal to the sum of the run-time value of each of the composite capabilities

$$VoS_{System} = \sum_{n=1}^{n=k} (A_{iv})_c$$ where c = a particular capability and k = # of capabilities.

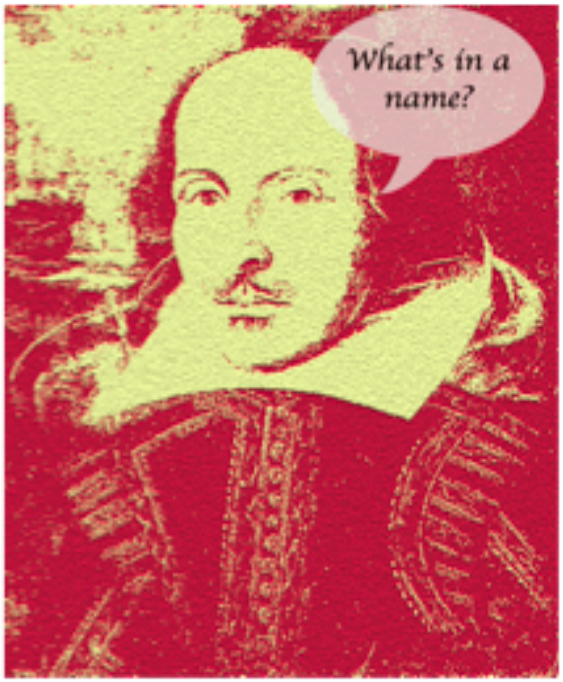
Value-of-Acquisition (VoA) is the total value of the acquisition, i.e. an objective, composite, measure of developed capability, per cost increment, per time increment.

$$VoA_{System} = A_{nr} \sum_{n=1}^{n=k} (A_{iv})_c$$

= (.66 X 24= 15.8) X $(A_{iv})_{IE}$ if we achieve objective in our notionally proposed acquisition. We can easily compare this number to an alternate proposal "apples-to-apples"

VAF Lexicon

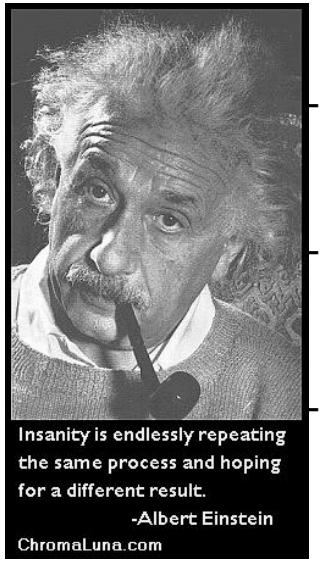
agile = Rapid and adaptive.
Agile = Rapid and adaptive software development via any of a number of disciplined methods.
agile IA = Agile Information Assurance, very rigorously engineered, risk/reward based balance of need-to-protect vs. need-to-share across an enterprise of interest; supports dynamic Risk-adaptive Access Control based on identity, role, and evolving conditions.
agile IoP, build-time = How easily one component "bundles" with others, i.e. off-the-shelf, functionality = build-time interoperability.
agile IoP, runtime : Semantic interoperability across all "verticals" of a networked enterprise assures delivery of valued information to critical nodes in time to enable decisions that measurably improve mission outcomes; arguably equivalent to "smart push".



Cyber = Relating to the virtual, global, electromagnetic communications environment, typically with emphasis on security.
Enterprise = Collective of semi-autonomous "vertical" organization with sufficient common interests to share governance of, and invest in, mutually useful "horizontal" activities and artifacts.
Netcentric = Collaborative, agile, distributed, and effective, especially by leveraging cyber space to achieve information dominance.
OTS = Off-the-Shelf, module is readily available via convenient procurement vehicle, functions properly out of the box (i.e. is interoperable in build-time), and comes with life cycle support.
PLA = Product Line Architecture, industrial best practice for Modular, Open Systems Approach/Architecture (**MOSA**).
A3 = Agile, Asymmetric, Acquisition, a mindset and process that optimizes RoI by recruiting and nurturing expertise, mining success cases, automating and parallelizing processes, and leveraging OTS build-time interoperability to achieve runtime interoperability.
ROI = Return on Investment, value returned per cost; measured as (value-per-capability) X (# of capabilities) ÷ (time discounted in favor of faster delivery) ÷ (cost).
Value = Customer's perception of worth.
VAF = Value-based Acquisition Framework, an enterprise A3 governance model based on commercial and government best practices, and in particular, depends on objectively quantifying "value".

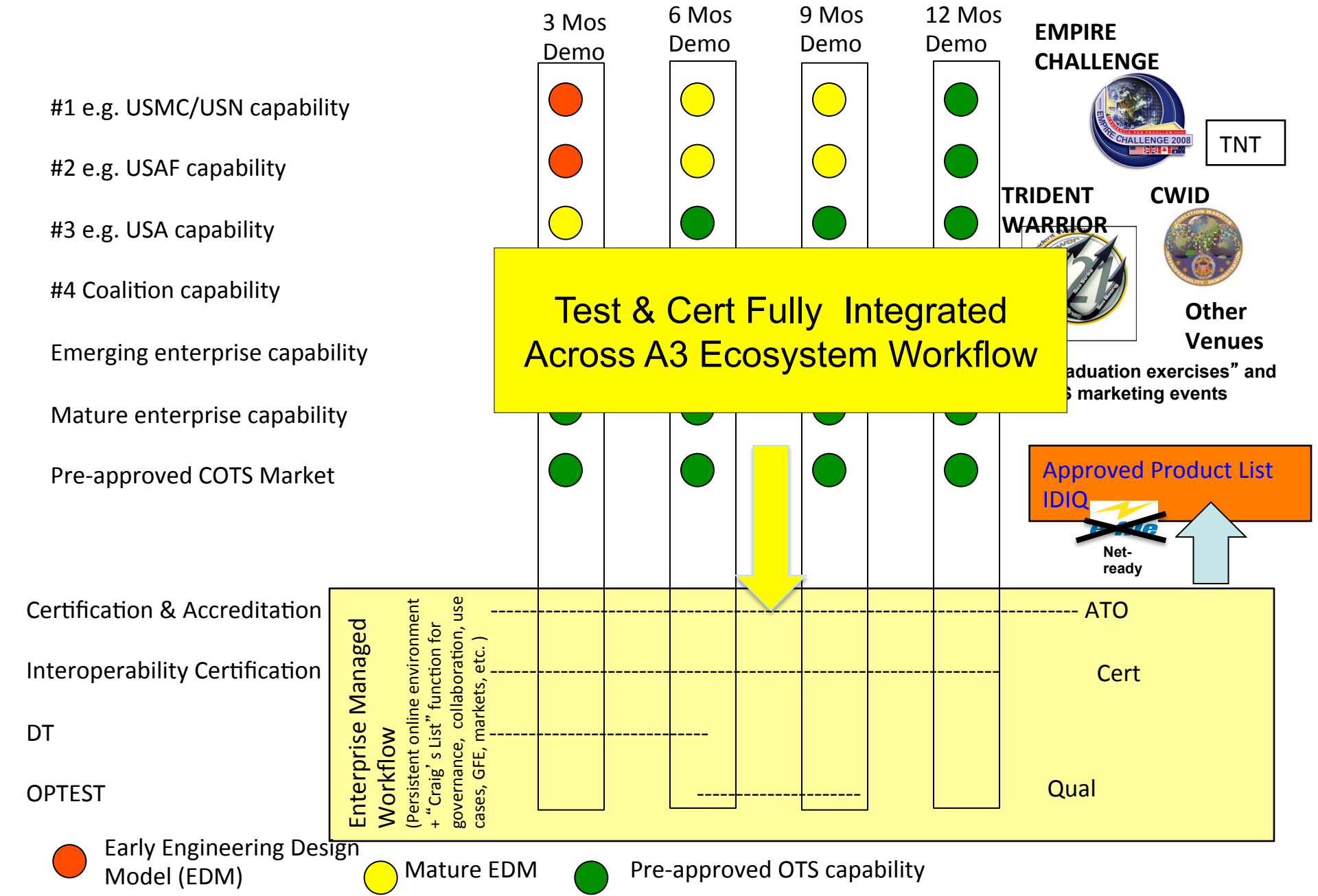
Test & Cert Fully Integrated Across A3 Ecosystem Workflow

- Enterprise-wide test-based development, per Agile best practice
  - Customers in the loop, i.e. “user stories” within Agile Sprints
    - Testers assist operators define objective MOE per specific mission threads
    - Testers tailor MOP per specific system characteristics
- Online, continuous, automated workflow
  - IA, IoP, DT, OT, test and cert in parallel across certification authorities
  - Test & cert in parallel with development across project funding lines
- High Assurance Modular Open Standard Architecture (HA-MOSA)
  - Certify baseline infrastructure with IA & IoP controls embedded
  - Applications inherit controls
  - Certify on-boarding process
- Certification = lucrative logo in COTS marketplace

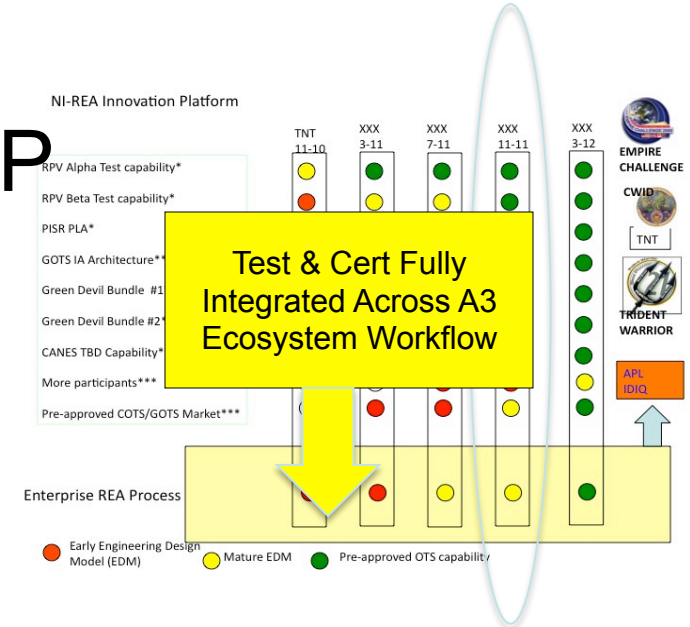


A3 Process

Quarterly, virtual "bundling" events, evaluated by certification authorities against standard use cases. Successful COTS/GOTS bundles earn pre-approved status.



“PlugFest” = Industrial Best Practice to Verify & Validate IoP



PlugFest = orchestrated demonstration of various COTS & GOTS capabilities offered by various providers measured against modeled operational use cases ***in runtime***

PlugFest is consistent with OSD desire for agile IT procurement model

- NR-KPP = “The Plug,” i.e. build-time/runtime Information Interoperability & /IA specs
- Partner with COTS IT industry to iteratively & continuously develop specs based on commercial state-of-the-art

PlugFest ecosystem includes certification authorities, programs, vendors, operators, resource sponsors, S&T sponsors

- PlugFest ecosystem will gradually scale across Defense Enterprise

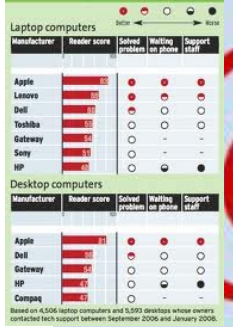
Outcome is approved product list & pre-negotiated contracts

Capability providers bring their offerings to “the lab” and “plug in” to the test harness. Eventually this will be a continuous virtual process.

Successful products earn pre-certified, approved product status.

Ecosystem of government sponsors, certifiers, vendors, government labs and operational customers establish parameters for the PlugFest in the months preceding it.

VAF Business Model



Establish e-Portal for *Consumable-Off-the-Shelf* (COTS) commercial, government, and open source *certified* net-ready components

Apply well-defined VAF metrics and process to define generic and objective "net-ready logo" assessment criteria per enterprise business objectives

Establish persistent, on-line, low barrier to entry, HA-PLA based Development, Test, and Certification environment open to all comers

Use net-ready logo value proposition to create an ecosystem of qualified, motivated, independent government, industry, and academic net-ready providers

- –Require logo as "responsive" to procurements
- –Bake agile evolutionary COTS process into acquisition boilerplate
- –Hardwire cross program collaborative work flow

A3 Governance Model*

- Tier 0 HA PLA infrastructure represents relatively stable, centrally funded, and managed generic “platform”
- Tier 1 services represent program-funded, continuously evolving “brands,” of capabilities that inherit IA & IoP controls from Tier 0
- Tier 2 applications and devices represent open market multi-source, rapidly developing, innovative, plug-and-play interoperable, application-level offerings.

*Per industry best practice, e.g. iPhone, e-Bay developers, Google gadgets, e-File, etc.