Bare Bones SE: Tailoring for Project Success!

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David M. Fadeley, PE, PMP
dbfadeley@verizon.net

Topics

- Tailoring
- Case study #1
- Case study #2
- Bare Bones SE
- Closing thought

An allegorical tale*…

Lesson

Systems engineering is a multi-disciplinary effort that involves both the **technical effort** and technical **project management aspects** of a project…

*Page 2.8 INCOSE SE Handbook v3.1

Tailoring is Crucial

"Not every process will apply universally. Careful selection from the material that follows is recommended. **Reliance on process over progress will not deliver a system…**"

-page 1.3, INCOSE SE handbook, v3.1 (emphasis added)

Tailoring requires Balance between Risk and Process

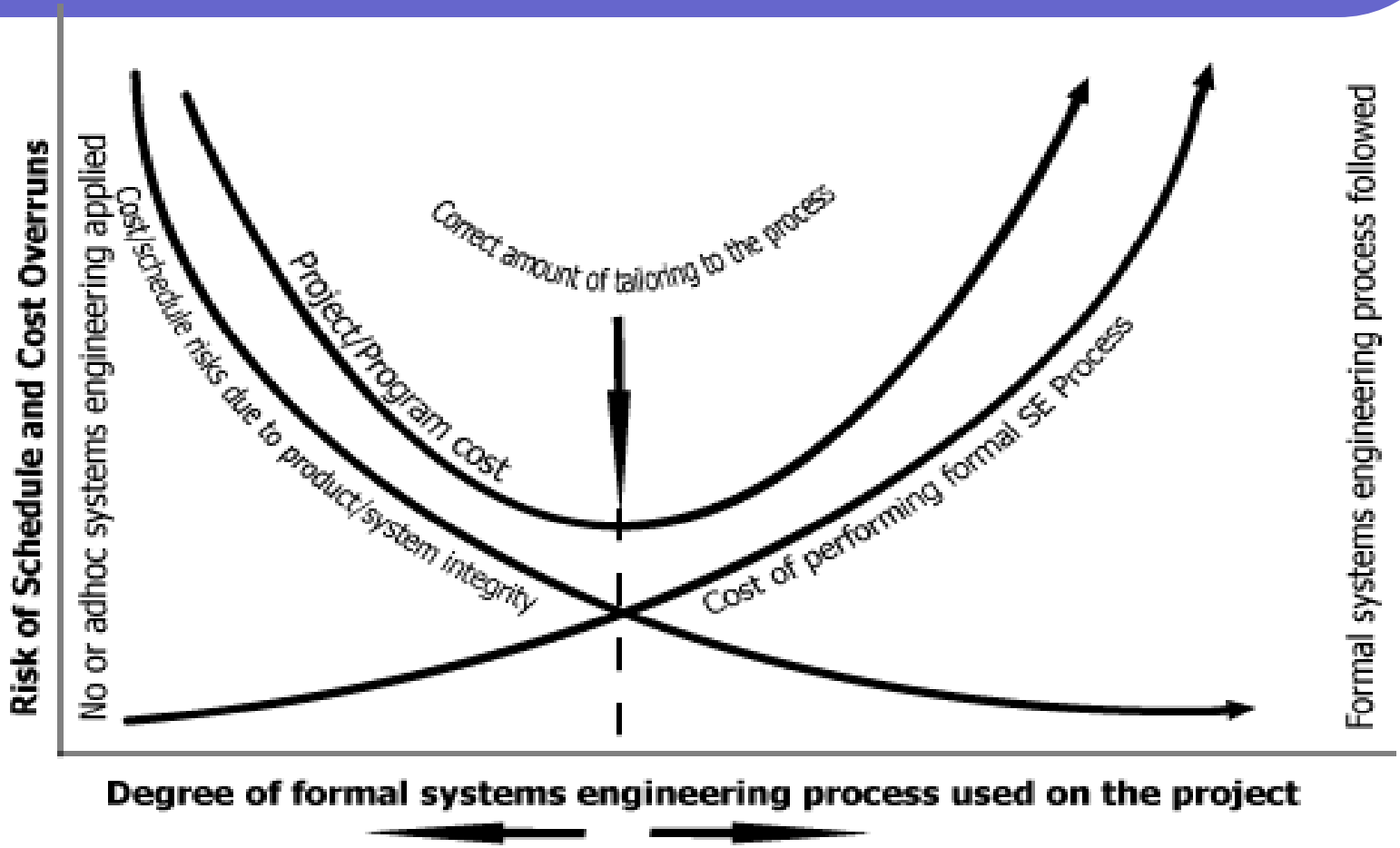


Figure 10-1 From INCOSE SE Handbook, v3.1

Lesson: Schedule runway repairs around landing aircraft

Case Study #1

Project Characteristics

- Federal government agency
  - Projectized organization
  - Govt. manager in another building, 15 minutes away
  - On-site at client
- Core team consisted of 15 contractors from 8 different companies
- Mission Critical **Software Development (C++, Java)** is the product
- Data mining purpose
- 10 month duration

Challenges

- **Requirements** are difficult to verify
  - Incomplete
  - Poorly written
- **Cursory, ad hoc integration** testing by developers
- Software tester finding way **too many "bugs"** and **no pass/fail criteria**
  - Therefore test is characterizing system
  - R&D mentality vs product for use
- **Customer** continually reporting **finding problems** in test
- Overcome these with **no additional people or $**

Solution

- **Wrote Software requirements spec** and put into configuration-controlled
- **Created or significantly improved interface control documents** with external systems
- Wrote **test plan and procedures**
  - Every requirement addressed and verification technique identified (i.e. Inspection, analysis, demonstration, test)
- Tester **emailed test results to team**, what passed and what failed
- Created a **small configuration control board (~4 people)**
  - Reviewed test results
  - Reviewed bugs and prioritized fixes
- Created a **1-2 page feature driven development plan** for management approval, spins every 90 days

Results

- Quality improved significantly(as measured by)
  - Significantly reduced tester discovered bugs
  - Positive management & customer feedback
- Increased confidence in product & team by key stakeholders
- Enabled team to focus on more improvements
  - Significantly increase speed of processing i.e. vision of “clock speed”


Lesson: Don’t attempt to fire a missile until the aircraft is in the air!
Lesson: If, by chance, you see a live missile skidding towards you, move smartly in the other direction.

Case Study #2

Project Overview

- Communications relay
- System consists of hardware, VHDL firmware, embedded Linux OS, software mission apps (C language)
- RF, digital, analog technologies
- Over 10 organizations involved in development & test
- 12 month development
- Enclosed in a rack-mount chassis or smaller depending on operations

Complex and Dependencies!!

Organizational Environment

- Federal government agency
- Local system development organization has all new management, big challenge is delivering mission critical systems
  - New management is home grown (limited experience outside this agency) but wants to do better
  - Mixture of government and contractor personnel (~25 onsite and some offsite)
  - Very little “INCOSE-like SE experience”
  - Many new people (wide range of experience)
- Consensus-building culture
- Matrix organization
- Money controlled by line manager, not the project PMs

Challenge

- Apply system engineering principles, within a system/product development organization not familiar with them, to get quality products delivered on a timely basis that meets customer needs - and is repeatable!
- Why not familiar with SE? Past dominated by quick reaction capability mentality, characterized by
  - Very short deadlines (days to a few months)
  - Driven by 1 or 2 key “requirements”
  - Best effort
  - Incomplete and limited documentation
  - Development by highly technical SMEs (i.e. Heros)
  - Difficult to duplicate project results

Approach

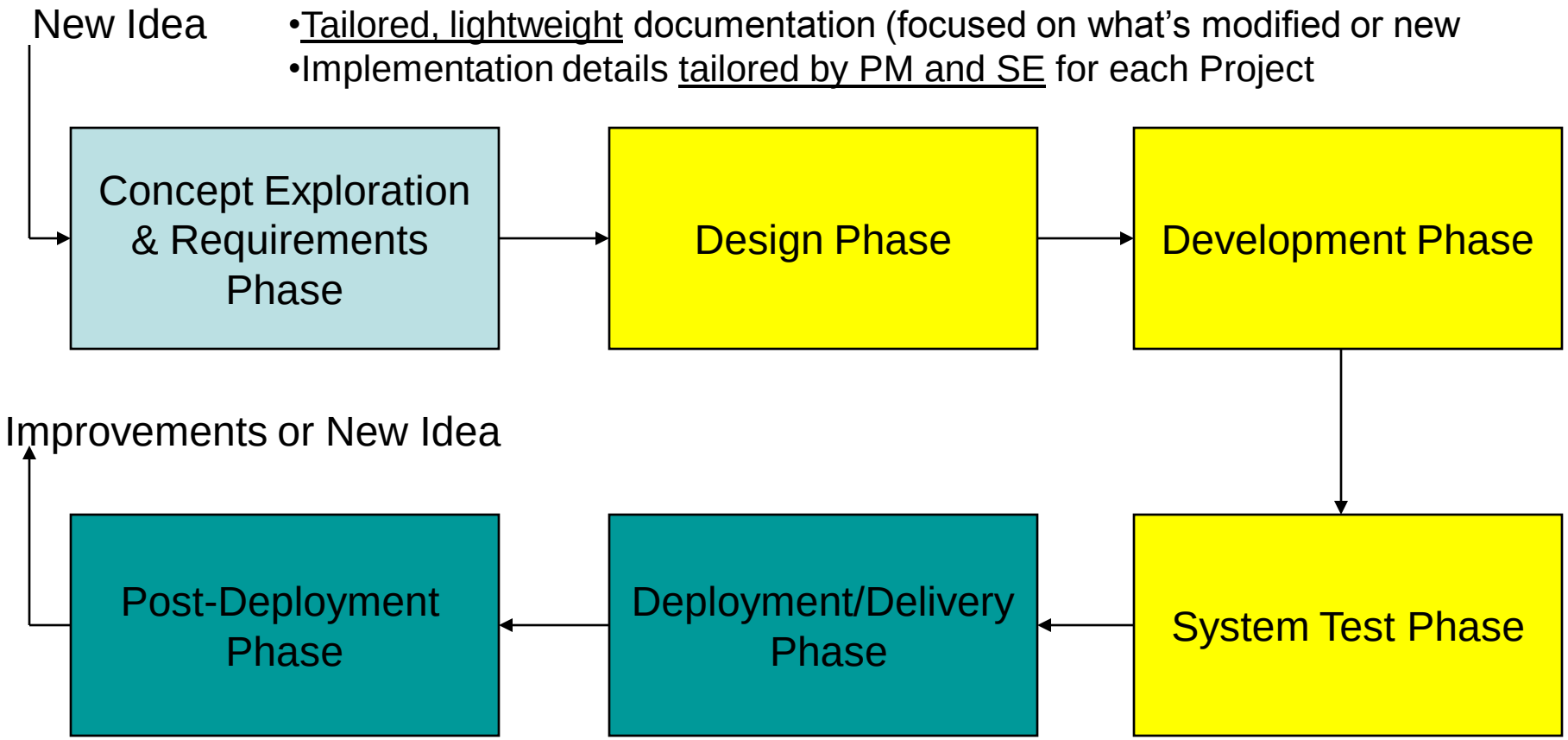
- Developed a lightweight, tailored engineering process framework that focused on essentials
  - Identified key phases and artifacts
  - Inputs, outputs, activities for each phase
  - Exposed to team in a low key way
  - Started using it to minimize additional work on team
  - Milestone management emphasis
  - “How” is decided by each project’s leadership (PM, SE)

Engineering Process Framework

- Block diagram of framework
- 10 milestones
- One page milestone description sheet

Example: Engineering Process Framework

- Distinct, disciplined engineering phases with milestones
- Tailored, lightweight documentation (focused on what's modified or new
- Implementation details tailored by PM and SE for each Project



Problem Definition

Implementation (solution development)

Solution Use

Example
Key Milestones

1. Sr. Leadership Review Board approval (LRB)
2. Systems Requirements Review (SRR)
3. Preliminary Design Review (PDR)
4. Critical Design Review (CDR)
5. Test Readiness Review-I (sys. test in lab environment)
6. Test Readiness Review-II (end to end test in lab)
7. Deployment Readiness Review (DRR)
8. Test Readiness Review for Operational Assessment T&E (operational environment)
9. Operational Readiness Review (ORR)

Example
Test Readiness Review

- What we want to accomplish at the review
  - Ensure system maturity is adequate enough to begin testing
  - Ensure test team is ready to begin testing
- Things to have for the review
  - Successful previous-phase test results
  - List of open discrepancy reports (DRs) and their assessment (if any)
  - Mitigation or workaround plans (as necessary)
  - List of system requirements not yet met (if any)
  - Hardware configuration identified and under configuration control
  - Software/firmware baseline identified and under configuration control
  - Stakehholder-concurred test plan and procedures with RTVM
  - Required test tools available, setup, and validated
  - Test schedules/milestones
  - How test results will be reported-out (e.g. written report, briefing slides, etc)
- To start the next step after the review
  - Approval or conditional approval from person-in-charge

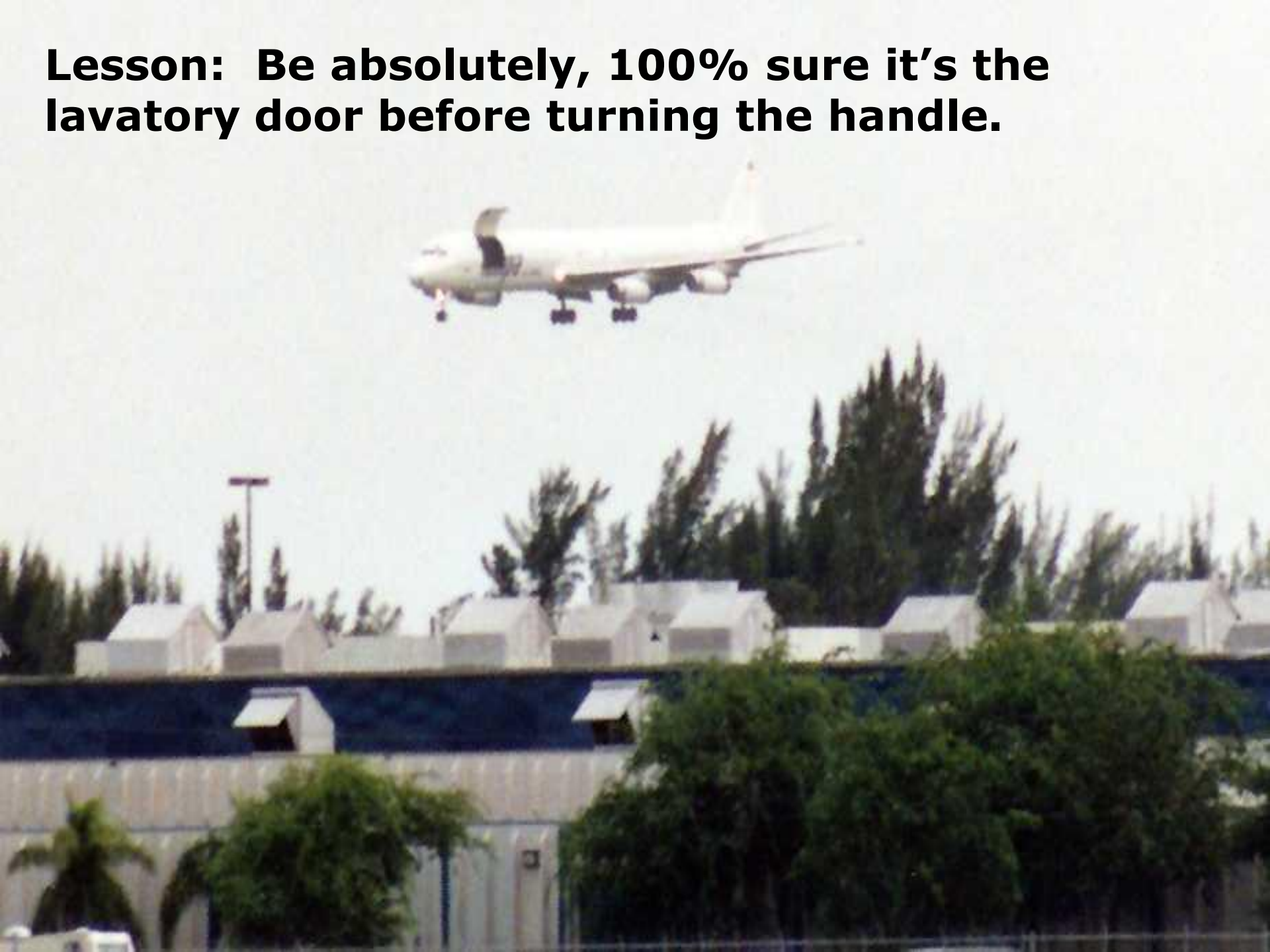
Results

- Product successfully passed system test
- Product delivered for customer test in 2009, more to be ordered in FY10
- Sufficient documentation to do again

Lessons Learned

- R&D attitude had to incorporate product mentality as well (done through key people change)
- Wise managers are crucial enabler
  - Manage by project priorities that change infrequently
  - Keep people on the job to develop expertise and for continuity
  - Govt org for R&D, industry to produce product
- Requirements & testing are still big challenges to some organizations
- Any non-trivial s/w development should consider building in increments per s/w release
- Tailorable SE very dependent on organizational culture
- Continuous, small, planned incremental changes, over long time work best → add up to big change
- Continuous communications
- Lightweight documentation
- Engineering process must allow creativity by project leadership

Lesson: Be absolutely, 100% sure it's the lavatory door before turning the handle.



Bare Bones Systems Engineering

Bare Bones SE for Project Success!
(1 of 4)

- **Bone #1** Identify and define **technical management approach** and **key persons** e.g. PM, SE or technical lead
- **Bone #2** Identify the **operational/user problem** to be solved (ConOps)
- **Bone #3** Identify and define the **deliverables** and **product(s)** (Solution)
- **Bone #4** Identify **key risks** and develop a tailored risk management plan
- **Bone #5** Identify the **development approach** including iterations and increments

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(2 of 4)

- **Bone #6** Identify and define the **engineering phases and process** (including inputs, activities, outputs for each activity/phase) for the organization e.g. 6 phases
  - (Phase 1) PROBLEM DEFINITION: Concept exploration
    - Concept of operations
    - Analysis of feasible solution alternatives, technical approach
    - Key top-level operational and system requirements
  - (Phases 2-4) SOLUTION CREATION
    - (Phase 2) Design
    - (Phase 3) Development (build, code, integrate)
    - (Phase 4) System testing (in lab, and end to end, and in an operational-like environment)
  - (Phase 5) USE SOLUTION: Deployment
  - (Phase 6) IMPROVE SOLUTION OR NEW IDEAS: Post-deployment

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(3 of 4)

- **Bone #7** Identify, define, then execute or oversee the **technical activities** to produce the system/products e.g.
  - Identify and define the **detailed system requirements or properties** (e.g. SRD)
  - Perform **system architecting and design**, as needed
  - Determine **test approach** of the product
  - Identify, define, determine formality and conduct **technical & status reviews**
  - Identify and manage internal and external **interfaces** and interactions
  - Determine **documentation** and formality
  - Identify and define **deployment support** e.g. training

Bare Bones SE for Project Success!
(4 of 4)

- **Bone #8** Determine **post-deployment technical activities** e.g.
  - Identify **lessons learned**
  - Gather **user/customer feedback**
  - Identify **improvements**

Closing Thought

An example of <u>not</u> tailoring properly?☺

Backups

10.2 Tailoring Process

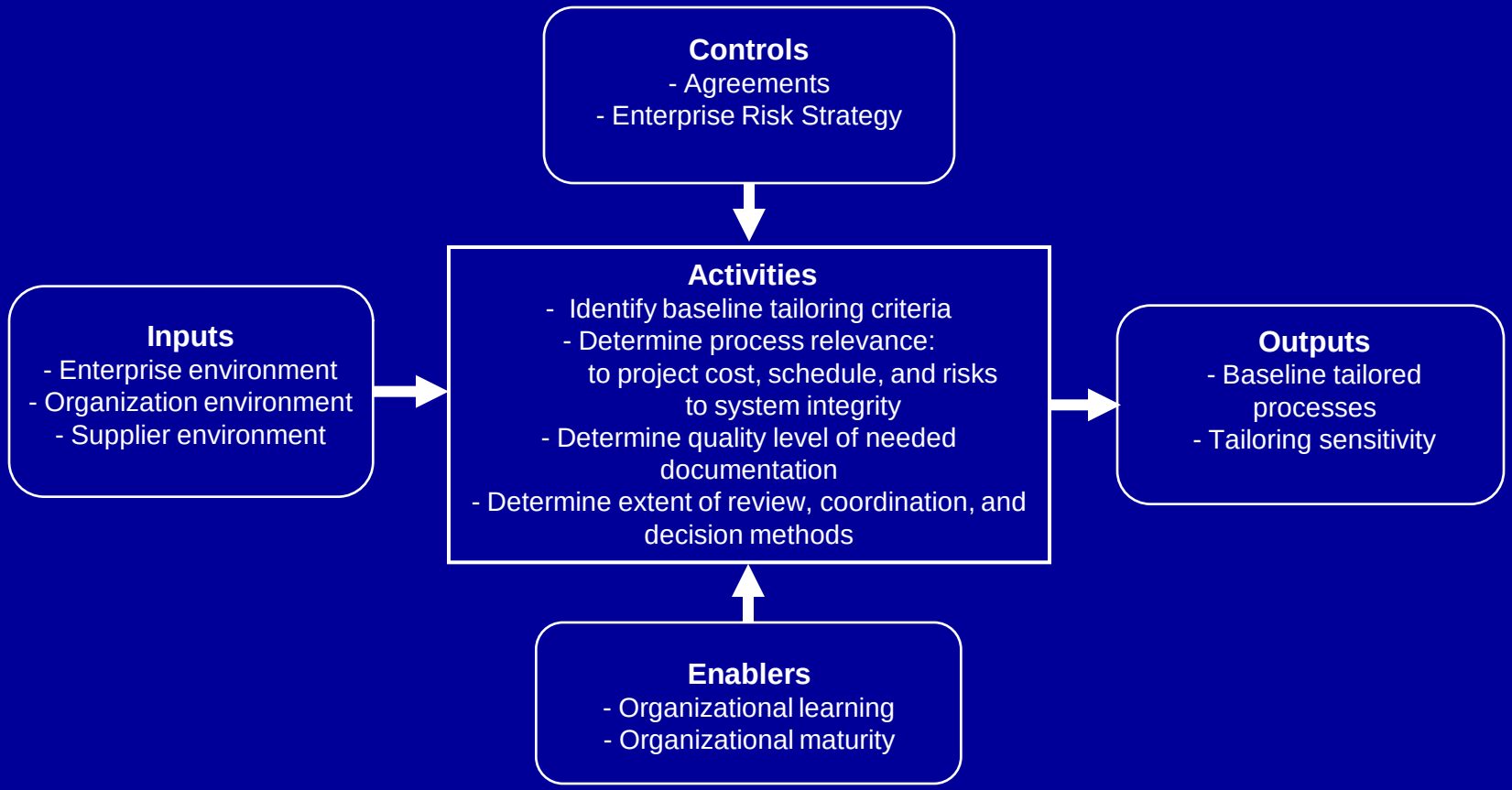
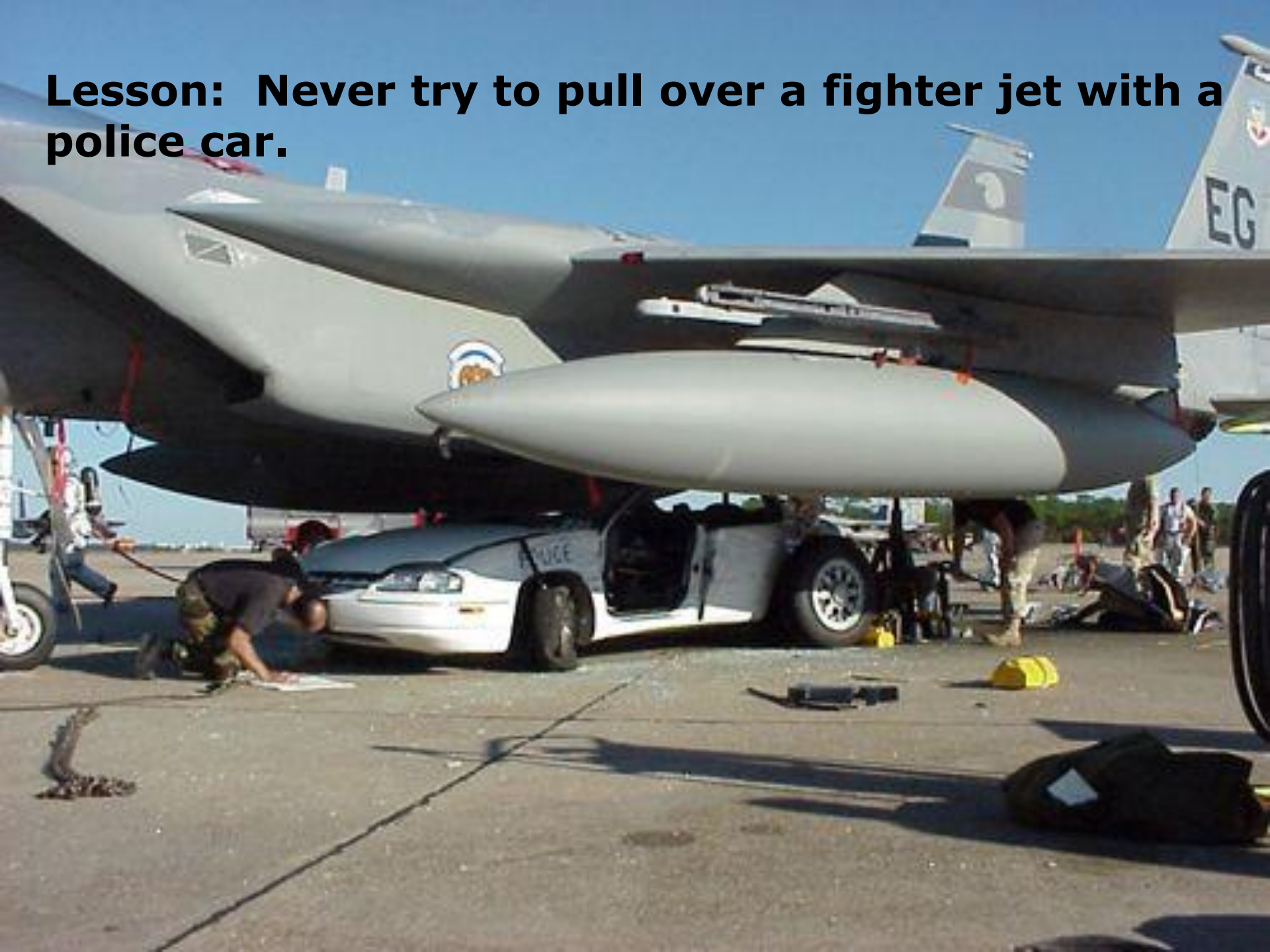


Figure 10-2 Tailoring Process Context Diagram, from INCOSE SE Handbook v3.1


Lesson: Never try to pull over a fighter jet with a police car.

What is SE?
(REF: INCOSE Handbook v3.1, Ch 2)

- Systems engineering is a
  - Discipline
  - Iterative process (both technical and management)
  - Interdisciplinary approach
- Or
- Add SE INCOSE definition pg 1.5

Purpose of SE

(REF: INCOSE Handbook v3.1, Ch 2)

- "Reducing the risk associated with new systems or modifications to complex systems continues to be a primary goal of the systems engineer" para 2.5
- Reduce risk (uncertainty) of having the following occur
  - Cost overruns
  - Schedule delays
  - Not meeting technical objectives
  - Not meeting true customer needs

Example
Project Leadership Focus