

# ***Product Development – Precepts for Success***

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- ❑ There are a number of trends that in and of themselves are having an adverse impact on how we do business and develop products
- ❑ However, changes in the marketplace and in corporate America are indicating the need for adjustments in the “traditional” way of doing business
- ❑ It is not that we should resist these trends, but rather, we need to find a way that minimizes their adverse impact and maximizes the effect they are really trying to accomplish
- ❑ We will take a quick look at these root cause trends, and at some techniques that will help to balance the reality and the objective

## *Trend Directions*

- “Moving Toward” – Evolving trends are causing many to feel that enterprises are overwhelming product development efforts with the implementation of detailed standards, processes, and procedures – with attendant compliance audits
  - As a result, many development teams feel they are spending more time on process development and compliance than on developing new products
  
- “Leaving Behind” – Many elements that worked in the past are now being abandoned
  - How do we retain their value in the new business environment?

## General Trends Occurring Today

- **Moving Toward**
    - Prescription
    - Compliance
    - Security
  
  - **Prescription** - Adherence to prescriptive procedures, focus on just checking off an item on a list, value through the most checkmarks rather than accomplishment of objective
  
  - **Compliance** - Demonstrating compliance and pursuing known approaches to development
  
  - **Security** - Achieving the minimum acceptable level of accomplishment is the expected; achieved compliance is rewarded more than breakthroughs
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- **Leaving Behind**
    - Judgment
    - Challenge
    - Freedom
  
  - **Judgment** - Application of experience and knowledge to the solving of problems, value through determining the most effective solution
  
  - **Challenge** - Demonstrating a willingness to objectively question the “why” and pursuing new avenues of creativity
  
  - **Freedom** - Exploring the unknown and discovering new approaches and solutions; taking considered risks into uncharted territories; finding that breakthrough

## *What Is Influencing These Trends*

- ❑ **Moving Toward**
    - Detailed Standards
    - Process Manuals
    - Capability Assessments
  
  - ❑ **Detailed Standards** - A series of prescriptive task elements that must be performed by the team; specifies detailed activities and expected results
  
  - ❑ **Process Manuals** - Some are so prescriptive that hiring the untrained “off-the-street” might be perceived as an alternative to using skilled engineers
  
  - ❑ **Capability Assessments** - Too focused on assessing the prescribed process elements rather than effectiveness of the product development effort
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- ❑ **Leaving Behind**
    - Framework Standards
    - Knowledge & Experience
    - Progress Assessments
  
  - ❑ **Framework Standards** - A series of pathways that points the team in the proper direction; provides waypoints as the team travels the pathway
  
  - ❑ **Knowledge & Experience** - Application of an engineer’s knowledge and experience as a driver in product development
  
  - ❑ **Progress Assessments** - Evaluating product development against against established product standards - with attendant penalties for negative variance

## ***Enterprises Are Encouraging These Trends***

### ❑ **Moving Toward**

- Artificial Vision Statements
- Process Emphasis
- Transitional Team

❑ **Artificial Vision Statements** - An abbreviated substitute for an enterprise culture

❑ **Process Emphasis** - When used as a substitute for expensive and time-consuming mentoring and training in the creation of a stable and effective team

❑ **Transitional Team** - A team with little or no understanding of the enterprise culture, etc. that performs the assigned effort in accordance with the designated prescriptive rules without loyalty to the enterprise

### ❑ **Leaving Behind**

- Enterprise Culture
- Mentoring & Training
- Experienced Team

❑ **Enterprise Culture** - An environment which defines decision authorities and operational boundaries

❑ **Mentoring & Training** - Building a team that understands the enterprise culture, decision authority, and inherent operational approaches

❑ **Experienced Team** - A team with demonstrated, knowledgeable, experience that can provide a passionate and focused effort as needed

## *Are These Trends Negative?*

- ❑ As implemented - probably!
  
- ❑ But **there are merits** in many aspects of these trends
  
- ❑ We need both progress assessments and capability assessments
  
- ❑ The key is
  - How they are implemented
  - Knowing which elements to select and which to adapt
  - Knowing which elements to apply and when
  - What we can do about how they are applied

## ***Given That Many of These Trends Are Enterprise Driven – What Can a Team Member Do ?***

- ❑ Be aware of the trends – the uninformed can do nothing
  
- ❑ Resist the temptation to over interpret standards
  
- ❑ Discourage generic (“one size fits all”) process applications
  
- ❑ Identify and remove the impediments to getting the job done
  
- ❑ Be proactive

# ***Before Committing to a Project . . . ?***

## *Aspects of a Typical Project – Chances of Success?*

- The Project Manager's main task involves getting this job completed without hurting the status quo; i.e.
  - Monitoring the budget and explaining the variances
  - Determining why schedules were or were not met
  - Attending Executive Committee and Program Review meetings
  - Traveling to the the customer or supplier on project concerns
  - Sequestered to update their resume' if the results of any of the above are adverse
  
- Team members are selected based on availability rather than skills or knowledge (perhaps with the exception of a few key persons)
  
- Planning is skimpy and not correlated with funding
  
- Organizational structure is based on prior networking

## *Aspects of a Successful Project*

- ❑ The Project Manager has a strong vision of the end results, a burning passion for achieving success, and an abiding belief in team responsiveness
  
- ❑ The enterprise's culture is implicitly known by the team
  - Financial focus
  - Operating boundaries
  - Decision Authority and Responsibilities
  - Reward and punishment
  
- ❑ Enterprise culture, processes, and organization are compatible
  
- ❑ Team members share Project Manager's vision and passion
  
- ❑ Planning encompasses a realistic vision of what needs to be achieved and how that vision can be achieved, including assurance that the development triad (technology, cost, and schedule) is balanced and realistically achievable

# *Using Standards*

## ***Some Statistics on Standards***

### **□ Process Standards**

#### **■ EIA/IS - 632**

- ❖ The impact of over 200 requirements (only 4 “shall’s”, but they essentially invoked every statement as a requirement)

#### **■ ANSI/EIA - 632**

- ❖ Only 33 requirements (33 “shall’s”)
- ❖ 42 “Normative” pages, 74 “Informative” pages

#### **■ IEEE Std 1220**

- ❖ Approximately 100 requirements, counting subclauses invoked by higher clauses – with one requirement apparently invoking Clause 6 (30 pages)
- ❖ 63 pages plus 12 informative annex pages

### **□ Capability Assessment Standards**

#### **■ EIA/IS-731 (.1 and .2)**

- ❖ Approximately 270 pages

#### **■ CMMI®**

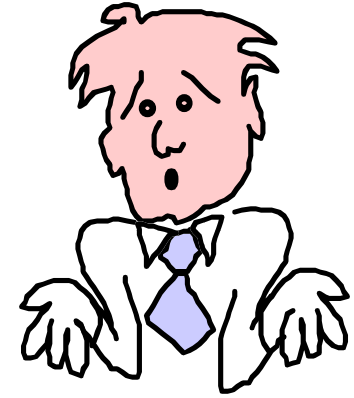
- ❖ Approximately 700 pages for each approach

## Why Process Standards Often Compound the Situation

- Some process standards offer “textbook solutions” that look good on paper, but are too cumbersome to work in practice; i.e., they cite abstract, sequential process elements – with predictable results
- As a result, application often fails to reflect reality – **the way we think and work; i.e.,** developers do not necessarily think in a repeatable, sequential manner
  - Analysis of a problem or a situation usually occurs in a series of starts, jumps, and plateaus –
  - The team examines the collected information at each point for patterns and conflicts until a logical solution is established



## *In That Case, Why Use Process Standards?*



- ❑ *To provide a uniform foundation for teamwork*
  
  
  
  
  
  
  
  
  
  
- ❑ *To provide criteria for assessing performance*

## Select the Appropriate Process Standard Type

- A Framework (Flexible Environment Approach)
  - A series of pathways that points the team in the proper direction; provides waypoints as the team travels the pathway
    - ❖ **Advantage** – Users can (and should) be able to visualize the process as a whole, as well as be able to see and understand how the individual process elements enable achievement of the whole
    - ❖ **Advantage or Disadvantage** – User judgment and experience required to implement
  
- An Instruction Set (Prescriptive Environment Approach)
  - A series of prescriptive task elements that must be performed by the team; specifies detailed activities and expected results
    - ❖ **Disadvantage** – User flexibility and application of judgment is limited
    - ❖ **Concern** – Users have difficulty in visualizing the process as a whole, and often may be unable to identify where they are in the process and why they are at that point

## *And Remember !*

- Effective application of a standard requires the integration of three essential elements –
  - A process which meets the project's needs
  - A bounded infrastructure which supports the project
  - A bounded environment which instills a way of thinking and doing business

## *Using An Analogy To Put Integration of These Concepts In Perspective*

- A process which meets the project's needs
  - A Flight Plan
  
- A bounded infrastructure which supports the project
  - An operational aircraft with specific capabilities
  - Terminal operations with specific capabilities
  
- A bounded environment which instills a way of thinking and doing business
  - A pilot's ability (skills, understanding, responsibility) to operate the assigned aircraft under specified conditions
  - Trained support personnel

***No one would fly unless these three conditions were in place and were integrated – yet we often begin projects without consideration of this critical element for success***

# *Using Processes*

## *Emphasis Is Often on Establishing Rigorous Process*

- Whether
  - A process standard (ANSI/EIA-632, IEEE-Std-1220) is used as a basis for the process, or
  - An assessment standard (EIA/IS-731 or CMMI®) is used to measure process maturity or capability,

the perceived complexity of the standards and the results of using them tend to bury the team in detailed and somewhat academic procedures which constrain the team

- Structured process gets in the way of creative engineering
- Design engineers spend time demonstrating compliance
- Those that are not demonstrating compliance are creating charts for a technical review

## ***But The Needs Of The Project Should Determine The Depth Of Implementation Of a Standard or Process***

- For example –
  - A Technical Plan for a small research project may consist of
    - ❖ A brief listing of the known tasks
    - ❖ The person responsible for each task
    - ❖ The schedule start and completion date for each task
    - ❖ The budget for each task
  
  - A Technical Plan for a major project may consist of
    - ❖ A comprehensive task analysis including required inputs, outputs, responsibilities, traceable to the acquirer/supplier agreement and related technical specification, subordinate tasks with associated comparable information
    - ❖ Detailed schedules with associated dependencies and predictive risk assessments
    - ❖ Description of the methods and tools to be used for each identified task
    - ❖ Required resources and their availability

## *In Planning, Avoid Unnecessary Procedures By Answering Key Questions First and Then Writing the Plan*

- ❑ What is the general problem to be solved?
- ❑ What is the boundary of the general problem to be solved?
- ❑ What are the required inputs and outputs?
- ❑ What are the influencing factors and constraints?
- ❑ What processes and tasks must be accomplished?
- ❑ What resources, methods, and tools are necessary to accomplish the required tasks
- ❑ What is the organizing structure?
- ❑ How will the organization be staffed and managed?
- ❑ When, where, and by whom will tasks and events be completed?
- ❑ What are the risks involved? How will risks be managed?
- ❑ What are the completion criteria for the process tasks?
- ❑ How will project completion be determined?

## *Unless The Customer Requires It, Simplify – For Example*

- Content for the Technical Review as a staged production
  - Hundreds of graphic-based transparencies showing what has been done, who did what, pictures of the product
  - Weeks of preparation
  - The team's presence at the Technical Review for several days
  - Weeks of follow-up
  
- Content for the Preferred Technical Review
  - The driving system technical requirements (from the information database)
  - The working architecture description and logic
  - Preliminary specifications and drawings
  - The key decision makers for both management and the team
  - Less than one day in a small conference room
  - Decision implementation and simple follow-ups

## ***So You Think A Risk Management Plan Is Complex?***

### ***Our Risk Management Plan***

**Our project team will consider the potential impact of our engineering decisions and selections on the total project and ultimate user, and if appropriate, will examine alternate solutions.**

**We will also review the requirements and overall project plan to ensure achievability and to identify areas which may be of concern so they can be reviewed and resolved. In addition, if a team member is concerned about some aspect of the project, especially an inability to meet a specified requirement, they will send the project leader an email stating the concern and why they are concerned about it.**

**Each month, the project leader and key team members will evaluate the concerns identified that month and determine what action, if any must be taken, and what budget will be used. At the same time, if we perceive a concern as a risk item for which testing or other mitigation activity is necessary, we will appoint someone with experience in that area to develop a plan with taskings, milestones, key decision dates, and fallback positions to ensure that this risk doesn't cause project schedule slips or overruns. This constitutes our "Technical Issues & Risk Council".**

**We'll keep a list of all such concerns identified and their actions, status, and closure to use as a checklist. If we cannot resolve these risk items, and potential changes to our project approach are necessary, we will notify the prime partners so an effective alternative (solution) can be devised.**

## *Some Things to Keep in Mind About Processes*

- ❑ Good decisions can be undermined by poor processes
- ❑ Good processes cannot overcome bad decisions
- ❑ Volumes of processes and procedures waste space
- ❑ Process books are no match for embedded culture
- ❑ Impediments created by processes must be identified and eliminated – **in real time!**

# ***Requirements Are Like Food***

***Large Bites Choke***  
***Small Bites Provide Fuel***

## *The Forest, The Trees, and The Leaves*

- A major acquisition in the DoD world may begin with a few hundred or a few thousand requirements
  - The “forest” if the team is lucky, or maybe just a “forest”
  
- As the systems engineering process is applied (requirements validation, mission analysis, alternatives analyses, etc), these few requirements may grow to hundreds of thousands of requirements
  - Trees, trees everywhere (with no sunlight to guide the way)
  
- If referenced and contextual requirements are included, the total requirements count could reach a million or more
  - The leaves are so thick that trees can be identified only by accidentally bumping into a tree trunk – forget about knowing the parent forest
  
- And we wonder why it is difficult to manage requirements!

## *Requirements Management Systems Should Help?*

- Because of underlying database limitations, most Requirements Management Systems (RMS) require the systems engineering team to manage multiple databases
  - Customer requirements
  - System requirements
  - Subsystem requirements
  - Verification requirements

Each with their own set of parameters and rules

- Even if an RMS allows for all requirements in a single database, there may be as many as eighty attributes assigned to each requirement (although the average is probably around twenty or so)
- **Warning** – Consider carefully the structure of an RMS before entering requirements (especially consider how the RMS may be used in the next development phase)

## *So How Should A Team Maintain A System Perspective?*

- Capture the team's imagination with a catch phrase which identifies the driving objective in a simple, focused statement
  - Use the catch phrase as a check on new ideas
  - Post the catch phrase on the walls so it is always visible to the team
  
- Create a brief, top level "System Vision" that enables the team to visualize the system with ease (as well as enabling team members to visualize where they fit in the overall system development)
  - May be a brief written description in non-technical form
  - May be a graphical representation of the system
  - May be a combination of both (preferred)
  - Update as major decisions, new insights, or constraints affect the vision
  - Make sure everyone has a current copy

## As A Minimum, Document Decisions for Primary Systems

<b>System ABC</b>		
<b>Key Product Requirements</b>	<b>Constraints and Other Stakeholder Requirements</b>	<b>Factors Influencing Decision</b>
<ul style="list-style-type: none"> <li>• Requirement 00023 – //</li> <li>• Requirement 00137 – // //</li> <li>• Requirement 01056 – // //</li> <li>• Requirement 00598 – //</li> </ul>	<ul style="list-style-type: none"> <li>• Constraints</li> <li>• Concept of Operations Impact</li> <li>• Other Stakeholder requirements</li> </ul>	<ul style="list-style-type: none"> <li>• Risks</li> <li>• Management input</li> <li>• Affordability</li> <li>• Known customer bias</li> <li>• Lessons learned from prior projects</li> </ul>
<b>Rationale For Decision</b>		<b>Decision Impact</b>
<ul style="list-style-type: none"> <li>• The Decision</li> <li>• How the above information was used to arrive at the decision</li> <li>• (If the above was not used, then the decision is questionable!)</li> </ul>		<ul style="list-style-type: none"> <li>• On other systems (and subsystems)</li> <li>• On the project</li> <li>• On costs, schedule, risk, technology</li> <li>• (This may cause a rethinking of the decision)</li> </ul>

This at least helps ensure visibility at the “tree” level

# *Revisiting the Top-Level Trends*

## Balancing Reality With the Top Level Trends

<ul style="list-style-type: none"> <li>□ Leaving Behind               <ul style="list-style-type: none"> <li>■ Judgment</li> <li>■ Challenge</li> <li>■ Freedom</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>□ Moving Toward               <ul style="list-style-type: none"> <li>■ Prescription</li> <li>■ Compliance</li> <li>■ Security</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>□ Balanced Application               <ul style="list-style-type: none"> <li>■ Top-level processes &amp; guidebooks</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>■ Framework Standards</li> <li>■ Knowledge &amp; Experience</li> <li>■ Progress Assessments</li> </ul>	<ul style="list-style-type: none"> <li>■ Detailed Standards</li> <li>■ Process Manuals</li> <li>■ Capability Assessments</li> </ul>	<ul style="list-style-type: none"> <li>■ Apply care in application &amp; interpretation of standards</li> <li>■ Use assessments to learn of problem areas rather than concentrating on achieving a certain “level”</li> </ul>
<ul style="list-style-type: none"> <li>■ Enterprise Culture</li> <li>■ Mentoring &amp; Training</li> <li>■ Experienced Team</li> </ul>	<ul style="list-style-type: none"> <li>■ Artificial Mission Statements</li> <li>■ Process Emphasis</li> <li>■ Transitional Team</li> </ul>	<ul style="list-style-type: none"> <li>■ Seek personal training</li> <li>■ Seek support from multiple sources in lieu of mentoring</li> <li>■ Develop a personal sense of passion independent of others, yet maintain a team spirit</li> </ul>

## **However –**

- ❑ We tend to be slow in breaking out of the mold
- ❑ It's too easy to follow the norm
- ❑ We tend to continue to do the same thing unless something significant occurs

***But we can do it if we put our mind to it !***

# ***Remember – Focus On The Objective***

***Developing a Product that meets the needs  
and expectations of the stakeholders***