



# **SYSTEMS DEVELOPMENT**

## **BEST PRACTICES NOTEBOOK FOR MANAGERS AND TEAMS**

# PROLOGUE

- By necessity this handout reflects only a general and partial representation of what will be by July 1999 a completed “Systems Development Best (or Good) Practices Notebook For Managers And Teams.”
- The completed Notebook will be the basis for a one to two day educational seminar for managers and program / project teams. The completed copyrighted version will be available on floppy disk and hard copy August 1999.

# PROLOGUE continued

- This handout excludes the Annexes that are part of the complete Notebook ( A. Annotated Bibliography, B. Glossary, C. Computer Aided Tools, and D. Electronic Resources.
- I have attempted to limit the number of pages for reproduction to a reasonable number. Ten condensed examples of best practices are provided in this presentation. In doing so, I am sure the intended message is somewhat “noisy.” The June 1999 version Notebook will be a better product.
- Questions and suggestions are invited--E-MAIL: [jbrill@mbay.net](mailto:jbrill@mbay.net) or FAX: (831) -372-2928 or post : 3125 hacienda Drive, Pebble Beach, CA, 93953.

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# PREFACE

- This notebook was assembled to provide program and functional managers and members of program / project teams a compendium of best practices applicable to systems development.
- The present draft includes 35 best practices of which 2 are classified as “Cardinal Best Practices.”
- Practices are described in non-technical terms.
- They are distilled from many public domain sources and my professional experience.
- The notebook’s contents are intended to be educational in nature--not a “How To” guide or formal training program.
- Enterprises should add to the notebook their own proven best practices and references.
- The focus is on systems engineering implemented within the IPPD (CE/IPD) philosophy.
- This is an on-going work. As of 10/31 98 the Notebook’s page count totals 180 of which 150 pages describe the 35 best practices. The annotated bibliography accounts for 23 of the remaining pages.
- One can question and challenge the use of the adjective “Best”. It may be more accurate to call these practices “Good” ( being desirable or positive in nature) rather than “Best” ( surpassing all others in excellence, achievement, or quality). For example, is there really a “best” systems engineering process ? Thus far in my research, I have identified 15 processes / approaches to accomplishing systems engineering--each is “good”. But selecting the “best” is a unique choice.

# ACKNOWLEDGEMENTS

- Centre National D'Etudes Spatiales.
- ASPEQ.
- INCOSE, IEEE, EIA, & NASA.
- AlliedSignal, Inc.
- Hughes Aircraft Company.
- UTC - Otis



# ACKNOWLEDGEMENTS

- As is so often true and applicable to this work, is that the accomplishments of one individual are stimulated by and partially based on the work of others. In addition to the knowledge gained from the aforementioned companies and professional organizations, I owe much to the many authors of papers, articles, and books on topics that encompass concurrent engineering, systems engineering, and integrated product (and process) development. The complete Notebook includes an annotated bibliography of 20 (or more) references that are cited in one or more of the practices.
- The principal catalyst that launched my research and writing of these practices is a forward thinking senior official of the Centre National D'Etudes (National Center of Space Studies), Paris, France. In July 1997, Mr. Stephane Janichewski suggested to me that it would be of benefit to develop a guide or manual of "best practices" used by the USA and France in their respective space projects. My work on the best practices project was aided by and supported by the work in France of Mr. Jean-Luc Merchadou, Founder and Director of "ASPECQ", a consulting firm in Paris, France.
- Special acknowledgement is due to the contributors to the IEEE Trail-Use Standard 1220-1994 and to Robert Shishko and his associates for producing the NASA Systems Engineering Handbook, 1995.
- I also thank those authors, associations, institutions, and companies in the USA and overseas who have contributed to the advancement of practices for performing systems development "better-cheaper-faster" and to my deeper appreciation and understanding of what it takes to deliver life cycle "stakeholder satisfaction".
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  - B. Glossary
  - C. Electronic Sources
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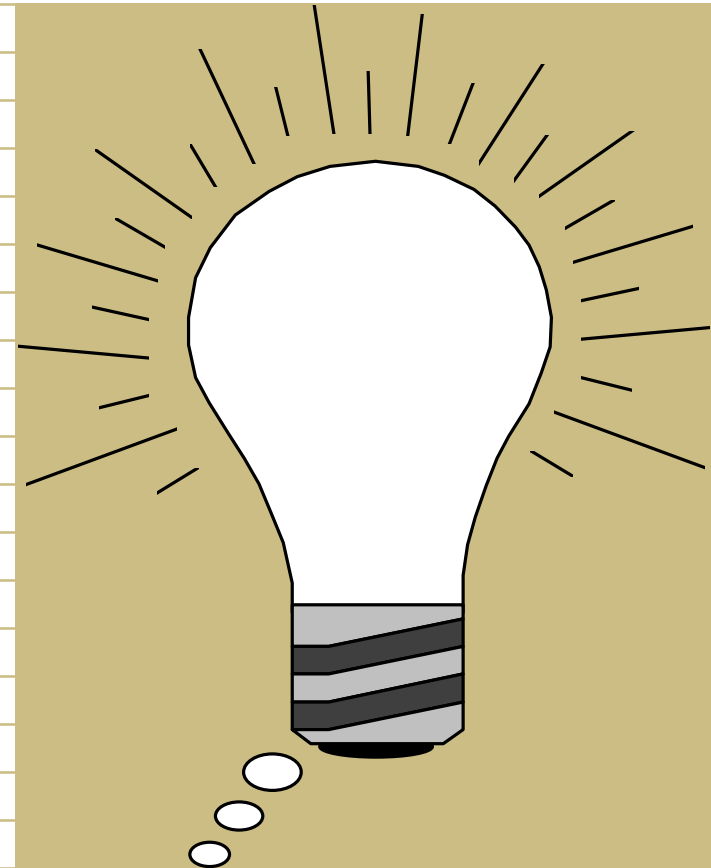
# 1. INTRODUCTION

- WHAT: BEST PRACTICES
- WHY: “FASTER-BETTER-CHEAPER”
- WHEN: SYSTEM LIFE CYCLE
- WHERE: GLOBAL
- WHO: MANAGERS & TEAMS
- HOW: TEAMS-PROCESSES-TOOLS



# BEST PRACTICE CONTENT

- TOPIC OVERVIEW
- NEED
- SOLUTION
- RESULTS
- REFERENCES
- TOOLS
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# GROUPING OF PRACTICES

1. Engineering of Systems
  - 1.1 Methods of Engineering Systems
  - 1.2 Concurrent Engineering
  - 1.3 Engineering Tools
2. Systems Engineering Process
  - 2.1 Requirements Analysis
  - 2.2 Requirements Validation
  - 2.3 Functional Analysis & Allocation
  - 2.4 Functional Validation
  - 2.5 Design
  - 2.6 Physical Verification
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3. Integration of Management
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  - 4.2 Maintainability
  - 4.3 Human Factors
  - 4.4 Security
  - 4.5 Standardization
  - 4.6 Vulnerability-Survivability
  - 4.7 Electro Magnetic Interference
  - 4.8 Technical Performance Measurement
  - 4.9 Producibility
  - 4.10 Design-to-Cost
  - 4.11 Configuration Management
  - 4.12 Integrated Logistics Support
  - 4.13 System Implementation & Support
5. **Other**
  - 5.1 System Cost Effectiveness
  - 5.2 Value Analysis
  - 5.3 Total Quality Management
  - 5.4 Environmental Protection
  - 5.5 Process Reengineering

# CARDINAL BEST PRACTICE #1

- **NEED:** Develop & produce systems that respond to stakeholders' needs.
- **SOLUTION:** Implement & manage a defined systems engineering process within the framework of CE / IPPD & Program Management.
- **RESULTS:** Development time -20% or >; Productivity +40% or >; Cost -30% or >.

# CARDINAL BEST PRACTICE #2

- **NEED:** Increase effectiveness & efficiency of system, design, and specialty engineers.
- **SOLUTION:** Select a computer aided tool set consistent with an integrated & defined CE / IPPD / SE / PM environment.
- **RESULTS:** Improved communications and productivity gains of 25 % or >.



## 2. SYSTEMS ENGINEERING PROCESS

- Requirements Analysis & Validation
- Functional Analysis, Allocation & Validation
- Synthesis
- Physical Verification
- System Analysis
- Control

# SEP Best Practice # 1

- **NEED:** Communicate complete, validated, measurable, and verifiable requirements.
- **SOLUTION:** Utilize a structured process & tool set to analyze & communicate performance, programmatic, and design constraints / requirements.
- **RESULTS:** Mutual agreement among stakeholders on requirements / constraints.

# SEP Best Practice # 2

- **NEED:** Communicate a consistent and complete functional architecture.
- **SOLUTION:** Utilize a structured process and tool set to describe, validate, and communicate what the system must provide / do.
- **RESULTS:** Mutual agreement among stakeholders on the technical “problem”.

# SEP Best Practice # 3

- **NEED:** Create and communicate a physical architecture.
- **SOLUTION:** Utilize a structured process and tool set to analyze and group / partition functions & sub-functions into logical physical elements.
- **RESULTS:** A complete and consistent physical architecture.

# SEP Best Practice # 4

- **NEED:** Confirm & communicate that the physical solution meets stakeholders' needs and expectations.
- **SOLUTION:** Utilize a structured process and tool set to verify completeness, consistency of the physical solution.
- **RESULTS:** Provides a sound basis for detailed design of life cycle products.

# SEP Best Practice # 5

- **NEED:** Objective selection among alternatives.
- **SOLUTION:** Utilize a structured process and tool set to select among alternatives and document rationale for decisions.
- **RESULTS:** Improved decision making, lower risk, & higher success rate.

# SEP Best Practice # 6

- **NEED:** Control resources, activities, and events to a pre-determined plan.
- **SOLUTION:** Establish and maintain a master plan & a shared integrated data base.
- **RESULTS:** Provides a basis for decision making, lessons learned, re-engineering and re-use of products / processes.



# 3. TECHNICAL MANAGEMENT PRACTICES

- Technical Management Plan
- Organization of Integrated Teams
- Risk Management
- Reviews & Audits
- Integrated Test Plan
- Configuration Management

# TM continued

- Data Management
- Technical Performance Management
- Cost Management
- Value Analysis
- System Effectiveness
- Environmental Assessment
- Total Quality Management

# TM Best Practice # 1

- **NEED:** To communicate the technical plan for achieving the program's life cycle technical requirements / constraints.
- **SOLUTION:** Utilize a team approach to prepare and communicate a "living" Technical Management Plan.
- **RESULTS:** Mutual agreement / alignment to technical vision, goals, & objectives.

# 4. ILS BEST PRACTICES

- Reliability
- Maintainability
- Human factors
- Safety

## 4. ILS continued

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- Producibility
- Standardization
- Vulnerability - Survivability
- EMC / EMI
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# IILS Best Practice # 1

- **NEED:** Systems with a high probability of satisfactory operation for a given time period under specified operating conditions.
- **SOLUTION:** Develop, implement, and manage a documented reliability program.
- **RESULTS:** Cost effective systems that will not fail for the required time under the specified conditions.

# CONCLUSIONS

- BEST (GOOD) PRACTICES EXIST.
- ALL NOT CARVED IN STONE.
- NEED TO EDUCATE ALL PLAYERS.
- MUST INTEGRATE PM/ CE/IPPD/ SE.
- SOMETHING TO THINK ABOUT ▪