

***Lockheed Martin Aeronautics Company
Approach to Solving Development
Program Issues***

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- **Industry Trend of Performance on Aircraft Development Programs**
- **What is in the Future**
- **What LM Aero is Doing**
- **Conclusions**

History of Development Performance

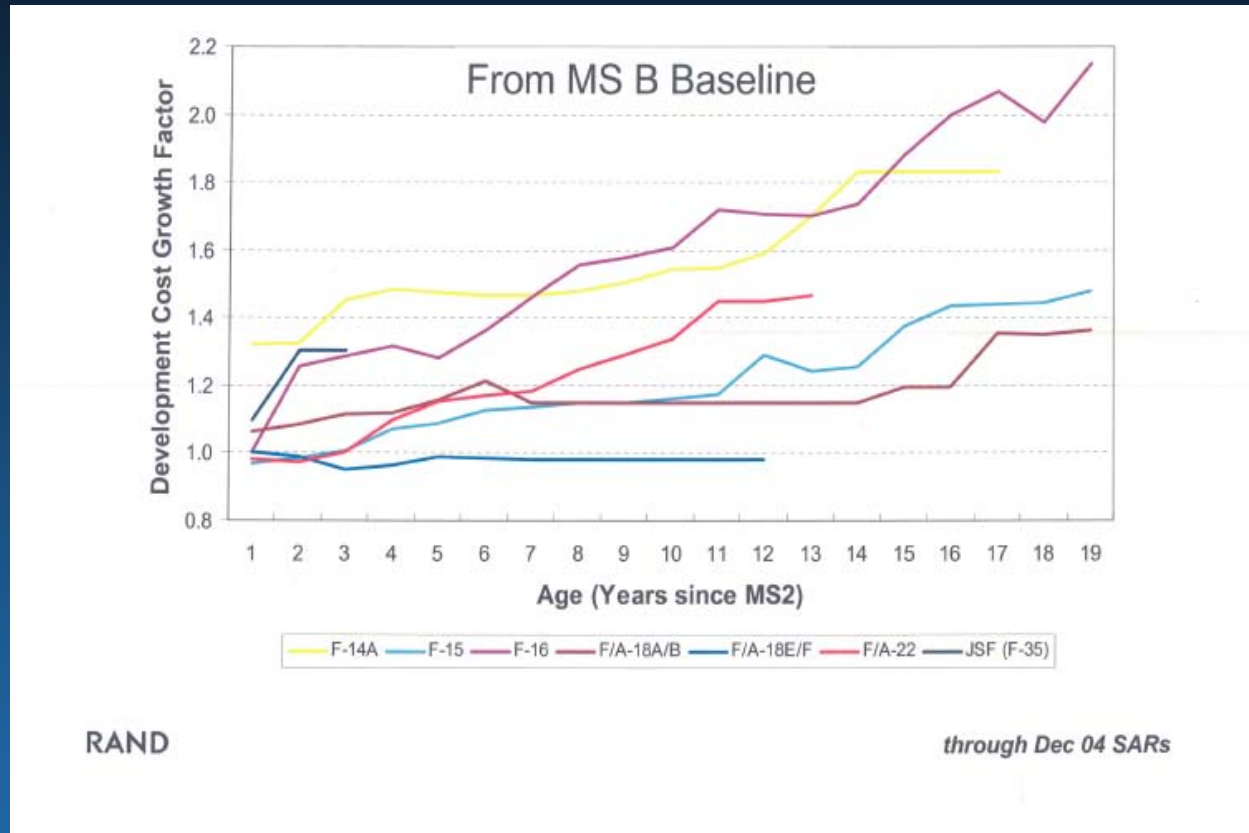


DoD -- "Since 2004, total costs for a common set of 64 major weapon systems under development have grown in real terms by 4.9% per year -- costing \$165 billion (\$BY07) more in 2007 than planned for in 2004"

GAO
2007

AF -- 1.5 development cost growth ratio -- ongoing programs 5 yrs beyond M/S-B -- *No improvement in 3 decades*

RAND 2005

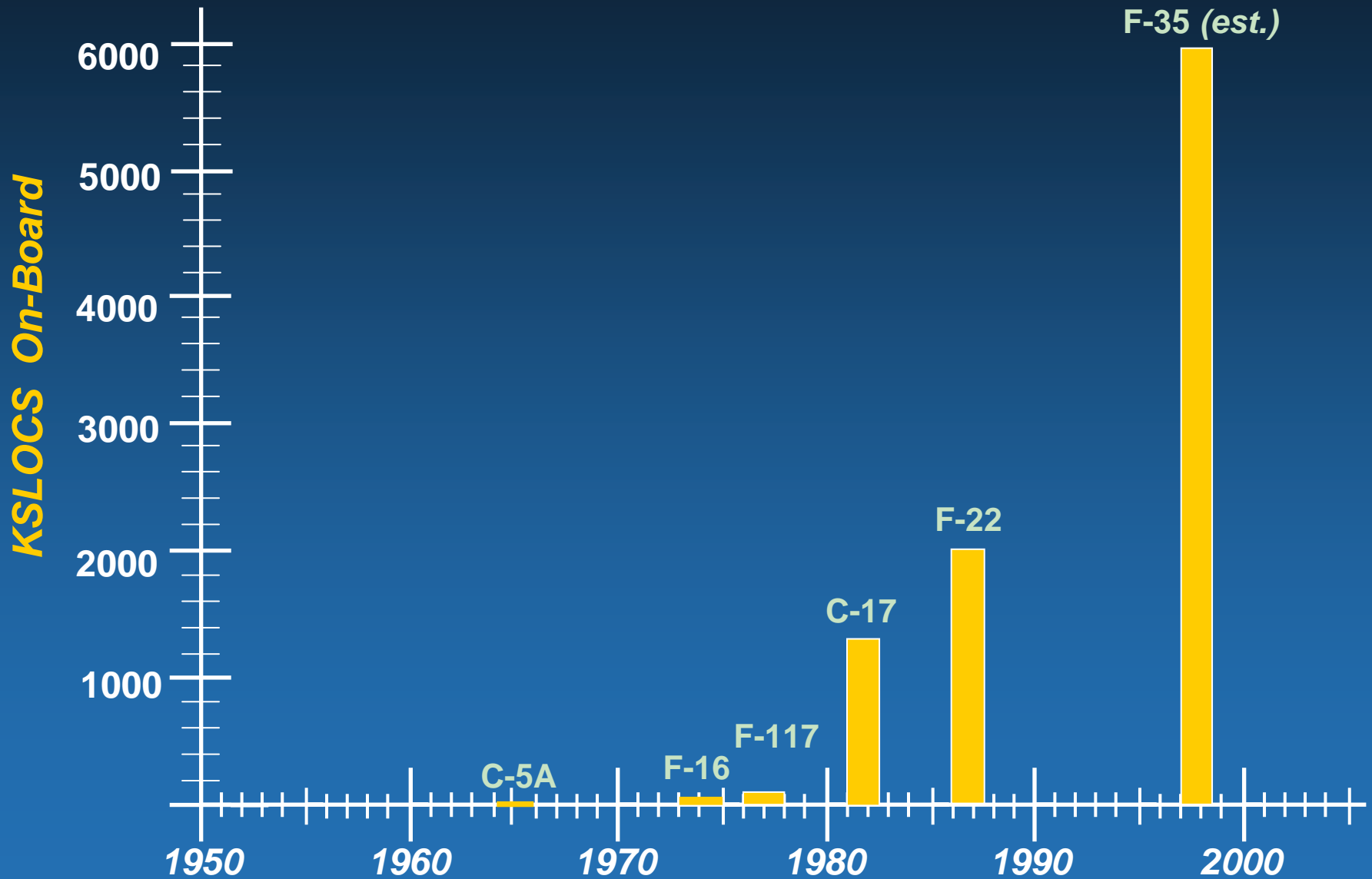


What is in the Future

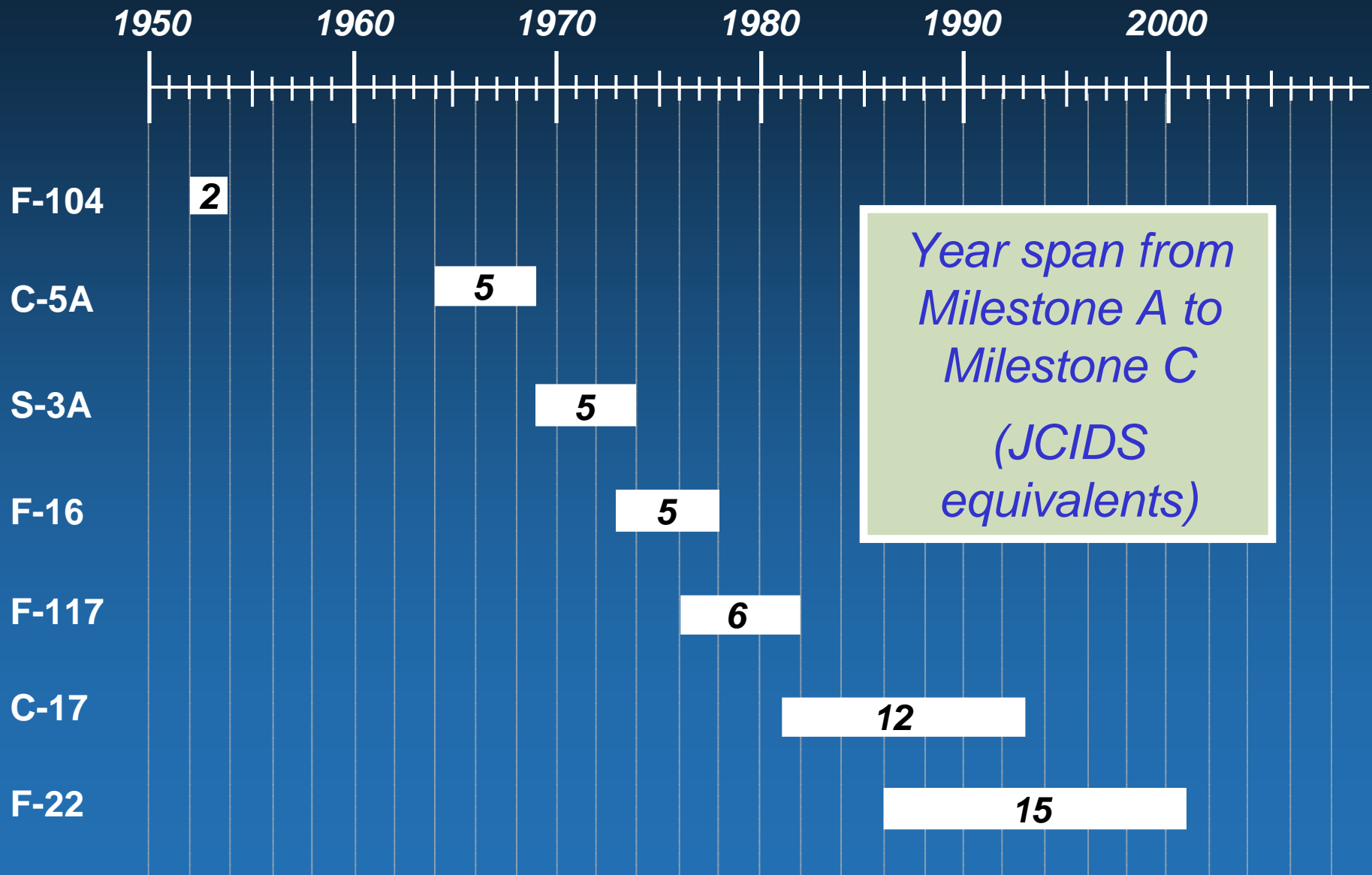


- **New Military Aircraft are Going to be More Complex.**
- **New Aircraft Development Spans are Monotonically Increasing.**
- **Our Future Workforce will be Less Experienced and More Inclined to Change Employers.**

Aircraft Are Becoming More Complex



Length of A/C Development Programs

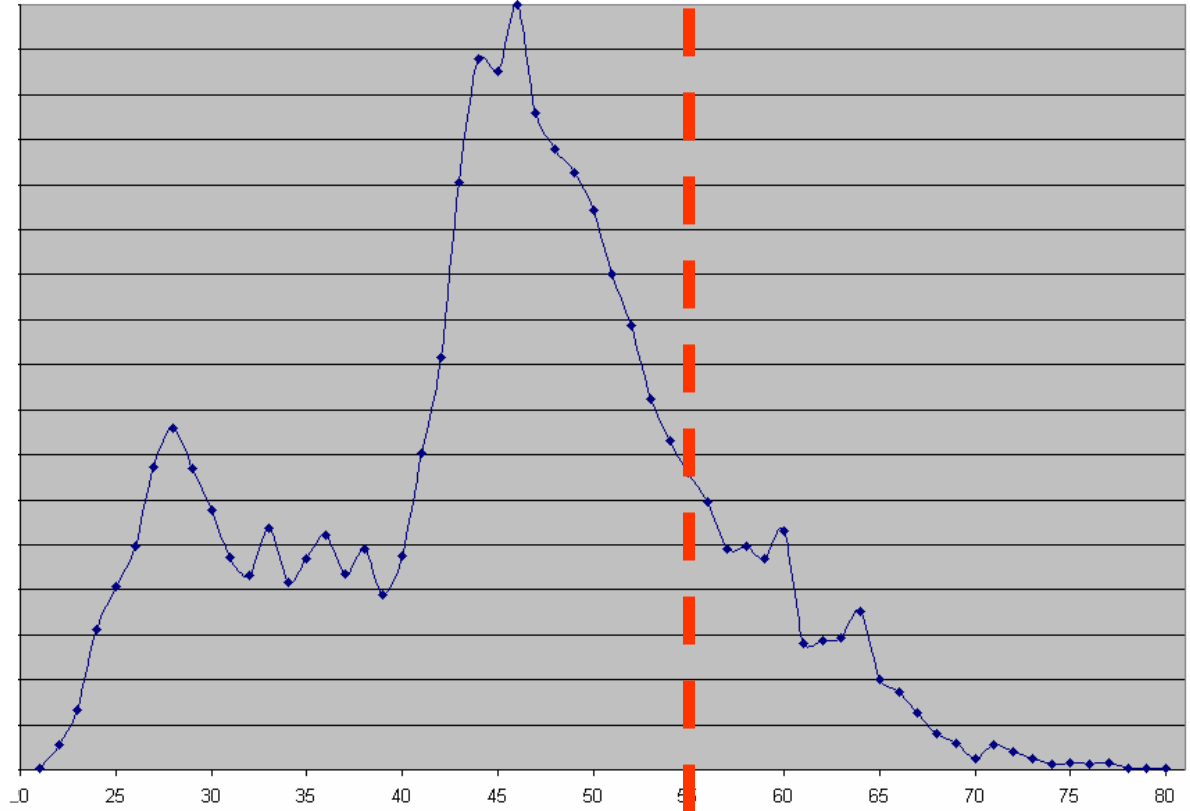


Typical Aerospace Company Age Profile



*Relative
Number of
Employees*

*Median Age: Late
40's*



Age

*Retirement
Eligibility*

**Most Technical Professionals Over
50 have Worked on 3 or More
Aircraft Development Programs**

Root Causes for the Performance



- **Poor Quality Requirements** and Requirements Management Resulting in Designs that do not Fulfill Customer Expectations
 - *Functional Baseline*
 - *Allocated Baseline*
 - *Active Management of Allocations*
- **Poor Technical Planning** Prior to M/S B Resulting in Unrealistic Schedules and Unexecutable Plans
 - *Level of Detail*
 - *Historical Bases for Spans*
 - *Linkage of Higher and Lower Level Planning to Key Integration Events*
 - *Interactively Versus Prescriptively Determined Key Program Event Dates*

Root Causes for the Performance - Continued



- **Limited Experience** of Program Technical Personnel and **Ineffective Command Media**
 - *New Inexperienced IPT Leads are Place in Critical Decision Making Roles without Adequate Help.*
 - *General, High Level Command Media is not Readily Useable by People Working on Development Programs*
- **Inability to Effectively and Objectively Assess Technical Performance**, Quality and Integrity in a Timely Manner
 - *Need for and Type of Corrective Action is Identified Too Late to Avoid Serious Consequences*
 - *Incomplete, Inconsistent and Inappropriate Metrics Incentivize the Wrong Actions*

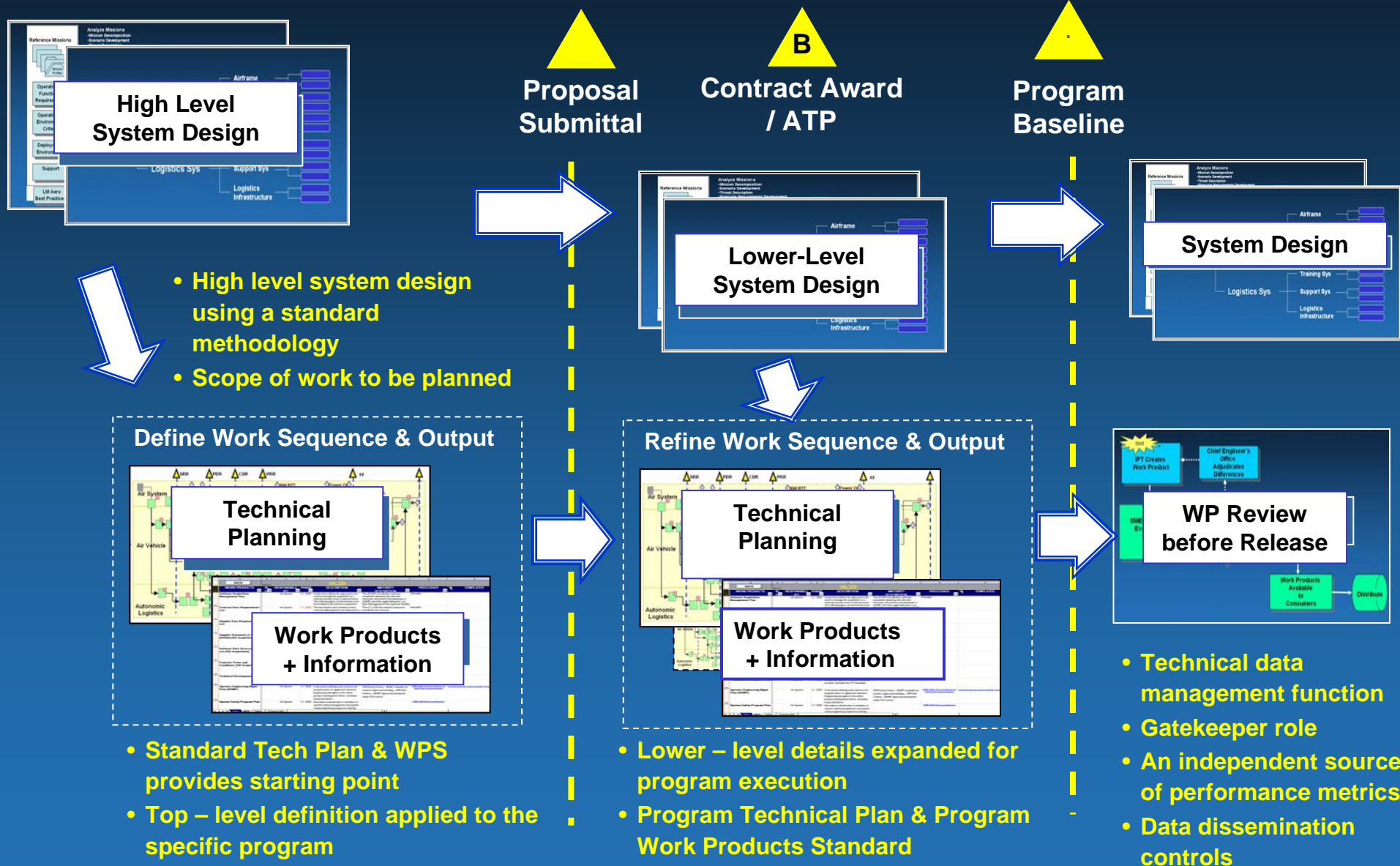
To Say “Poor Systems Engineering” Doesn’t Help

What Lockheed Martin Aeronautics is Doing

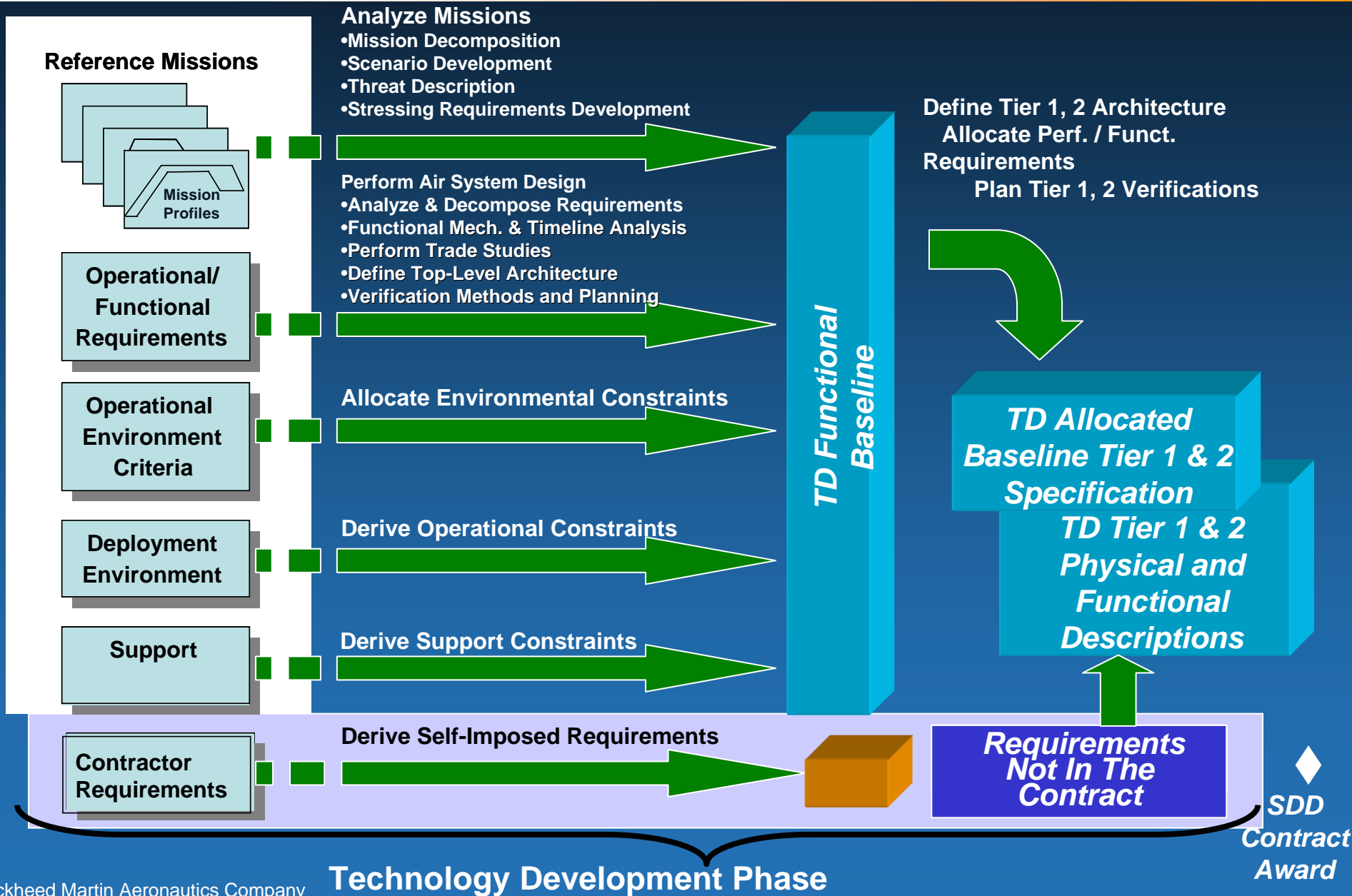


- **Developing a Systematic Method to Define, with the Customer, Functional Baseline Requirements Much Earlier in the Acquisition Lifecycle**
- **Modeling the Aircraft Development Process in Sufficient Detail to Identify the Work Products, the Sequence in which they are Produced and the Work Product Handoffs**
- **Collecting the Best Practice Information for Creating Each Work Product and Making this Information Available to Those People Working on Development Programs.**
- **Instituting a Process to Independently Assess the Adequacy of Each Work Product Before it is Released and Defining Valid Metrics to Assess Real Performance in Every Area of the Program**

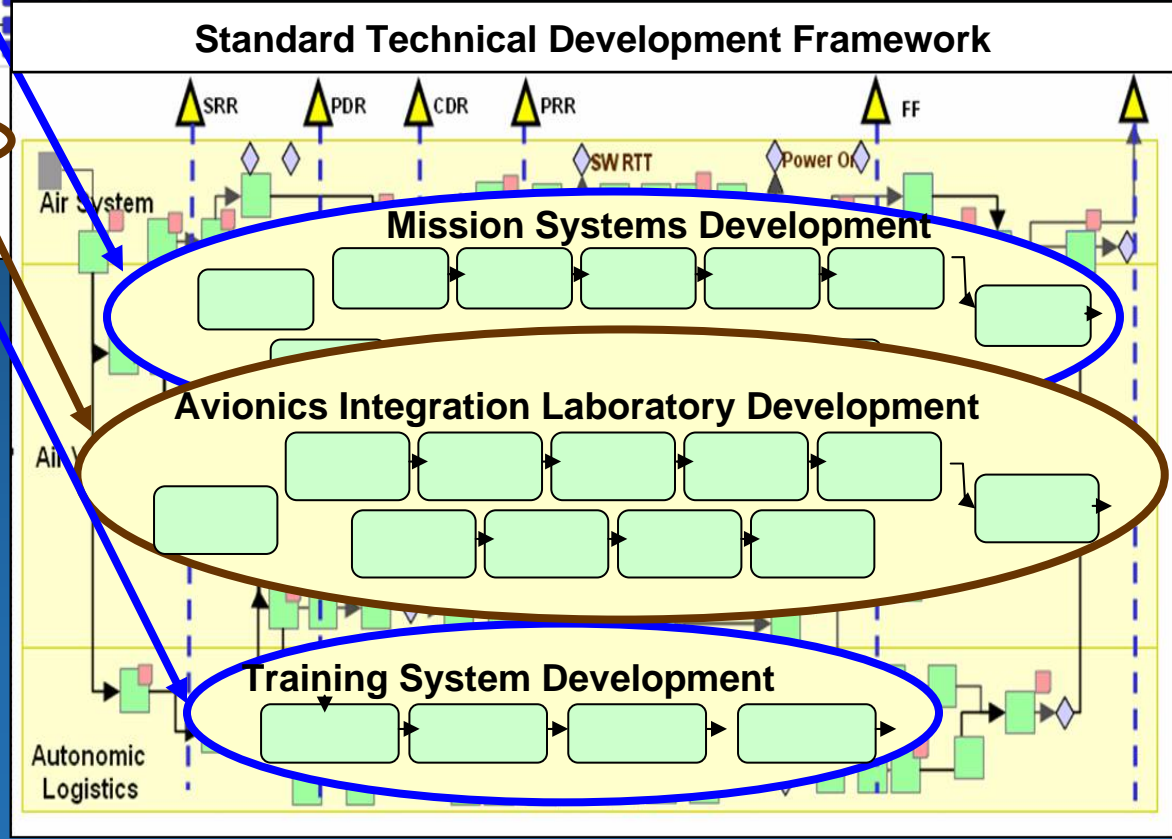
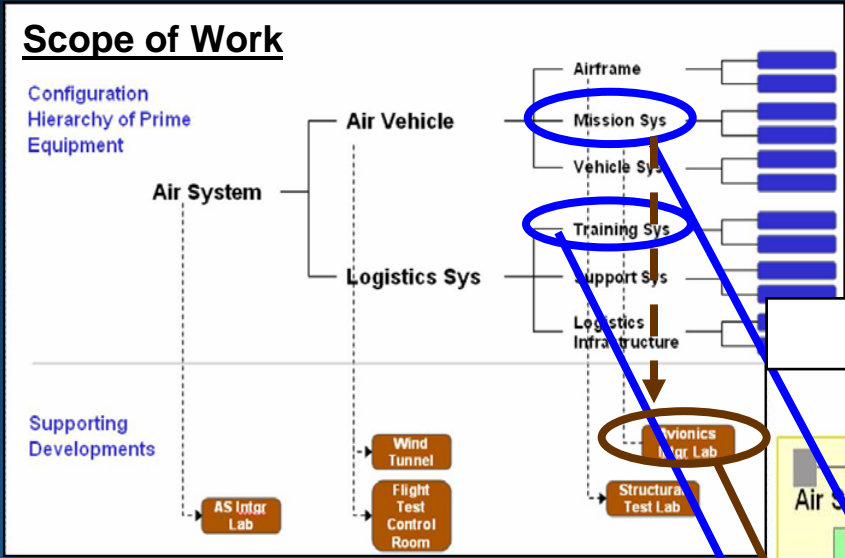
Approach Applies to Pre-contract, Post-award Planning, and Program Execution



Air System Design – Late TD Phase



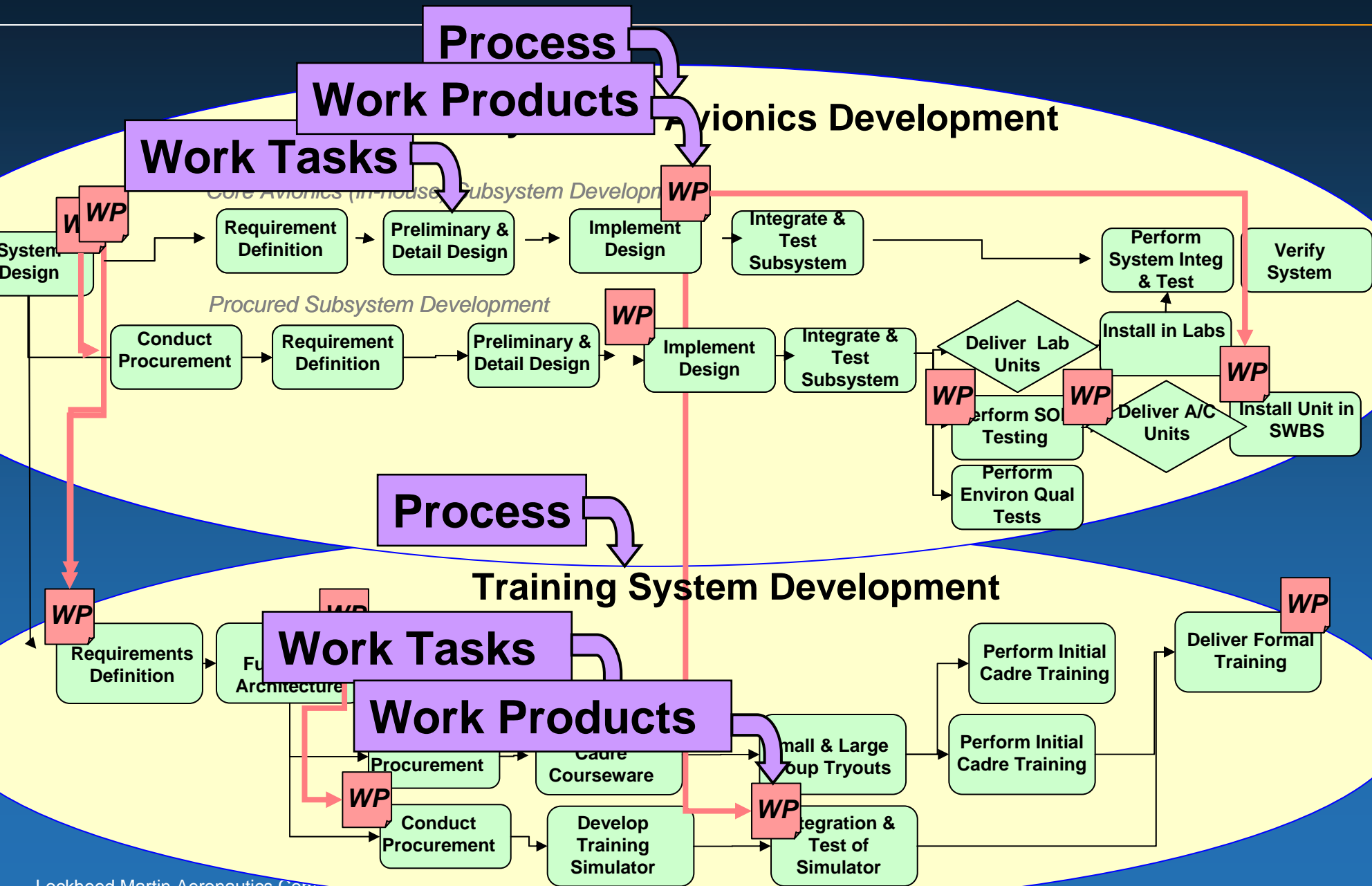
A Functional Execution Model Establishes Effort Scope



Air System Product/Service Tree

Work Flow

Work Flow Captures Tasks, Sequence, and Work Products



Valuable Information to Provide with Every Standard Work Product



Microsoft Excel - WPS Worksheet - (Enable Macros) !!! LMPI !!!.xls [Read-Only] [Shared]

WORK PRODUCTS	RESPONSIBLE IPT	PHASE	DESCRIPTION	MATURITY	PROCESSES
Software Acquisition Management Plan	Air System	3.1 - SDD	The description of the software products contractually required to be provided by a supplier for LM Aero to use for software acquisition use for software.	PM-4001	Notes
Contract Data Requirements List	Air System	3.1 - SDD	The description of the software products contractually required to be provided by a supplier for LM Aero to use for software acquisition use for software.	4001	Notes
Supplier Data Requirements List	Air System	3.1 - SDD	A contractual document with a software supplier that defines the tasks and scope of work, standards and specifications to be invoked, required to be delivered in accordance with the contract.	4001	Notes
Supplier Statement of Work (SSOW) (SW Acquisition)	Air System	3.1 - SDD	A list of supplier documentation produced to accomplish a contractual task as outlined in the Supplier Statement of Work but is not contractually required to be delivered in accordance with the contract.	4001	Notes
Software Data Accession List (SW Acquisition)	Air System	3.1 - SDD	A legal agreement between LM Aero and a supplier setting forth the obligations and responsibilities of each party.	4001	Notes
Contract Terms and Conditions (SW Acquisition)	Air System	3.1 - SDD	Details the way the Technical Plan will be executed. (includes the TP Schedule)	4001	Notes
Technical Development Plan	Air System	3.1 - SDD	A document defining what and how the program plans to apply each Systems Engineering discipline to the entire product development effort. (includes many sub-plans)	4001	Notes
Systems Engineering Mgmt Plan (SEMP)	Air System	3.1 - SDD	Describes in detail tasks & activities of system safety management and system safety engineering required to identify, analyze, and control risks to the system.	4001	Notes
System Safety Program Plan	Air System	3.1 - SDD		4001	Notes

WP Unique Name

Responsible IPT

Phase/Milestone

WP Description

WP Maturity Required

Reference Process (Command Media)

WP Template

Responsible Functional Organization

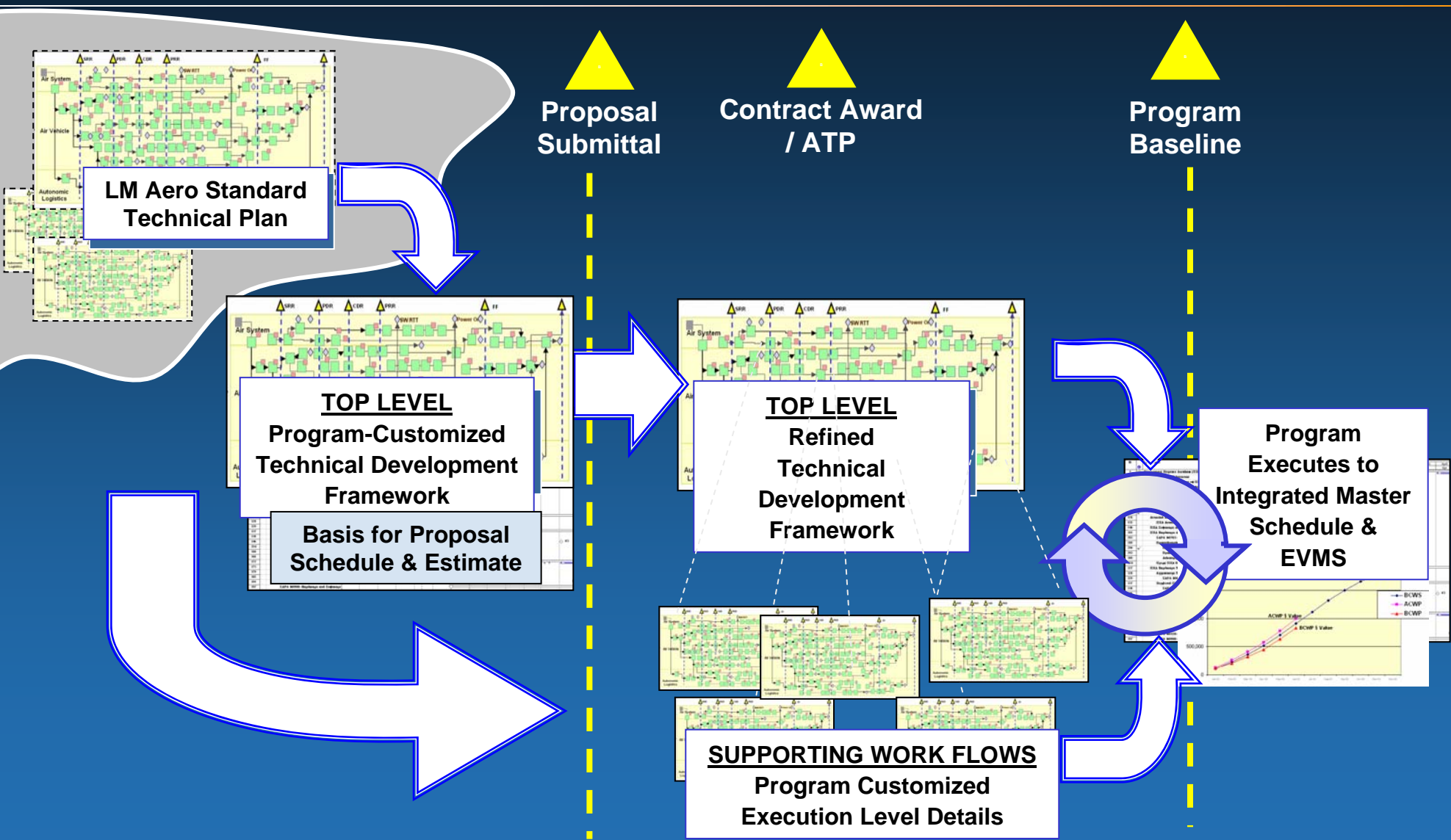
POC

Examples

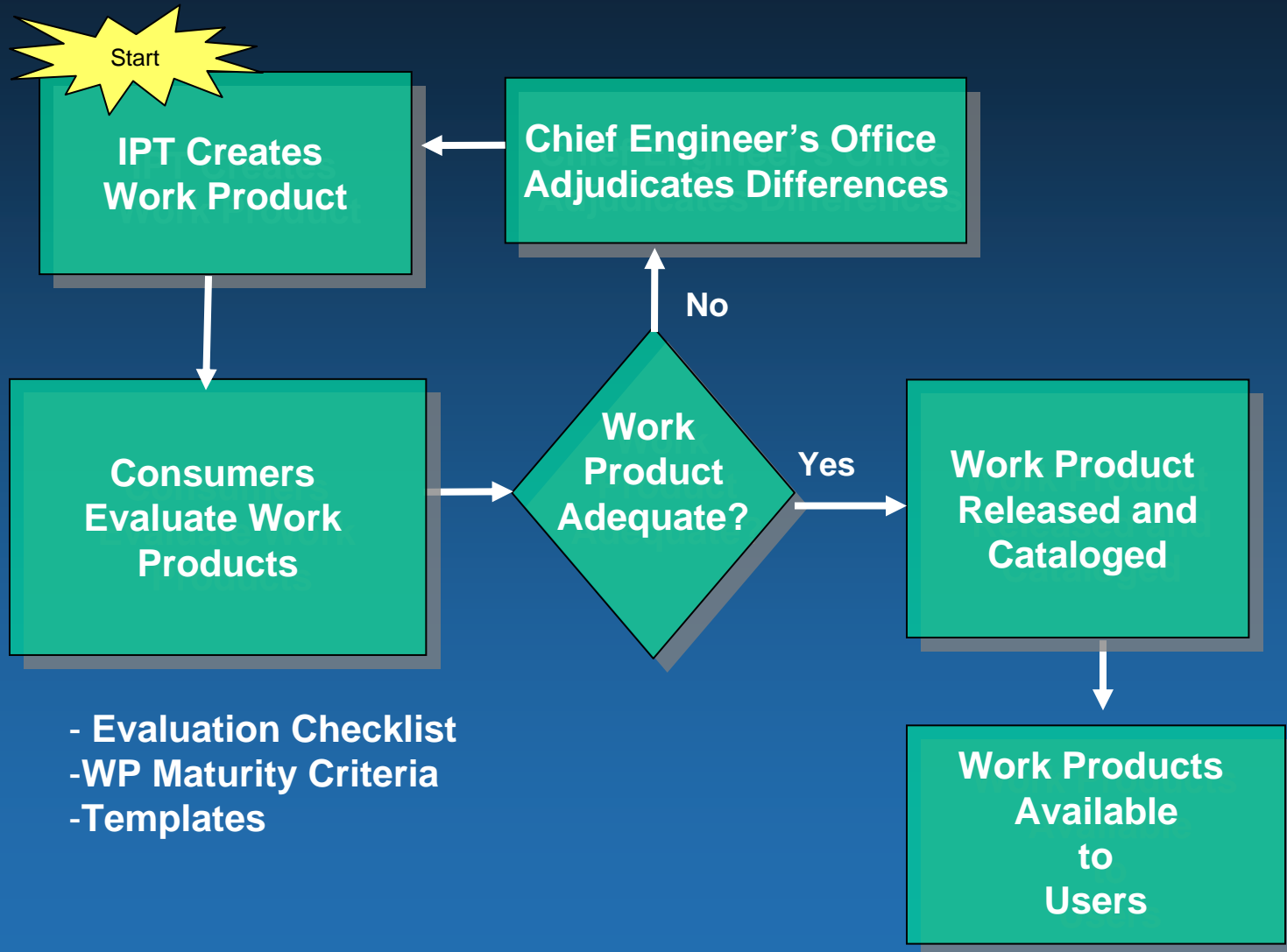
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Standard Plan Provides Sound Basis for Program Starting in Proposal Phase



Technical Integrity in the Release Process



LM Aero Approach to Systemic Development Issues Conclusions



- **In Order to Remedy Many of the Problems with Development Programs, the Necessary Top Level Design and Planning Must be Done Before M/S B.**
- **In Order to Function with Tomorrow's Workforce in Tomorrow's Development Environment, Our Industry Should Take a Lesson from the Commercial World and Make Our Development Business More Turn Key.**
 - ***Standard Planning Templates***
 - ***Standard Processes That Produce Standard Products.***
 - ***Command Media That Define The Best Practice for Generating the Work Product***