

Technology Insertion on Satellite Platforms

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LMU SELP 695
Integrative Project Summary
Spring 2011

Agenda/Outline

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Introduction & Background

- Started my career in aerospace at TRW in 1996 as a harness designer
 - Always interested in system of systems
- Transitioned to a similar role at Hughes Space & Communications in 1998
 - Additional roles include:
 - Telemetry & Command (T&C) System Engineer
 - Mission System Engineer
 - T&C System Engineering Functional Manager
 - Mission Products IPT Lead
- Project idea spawned from frustration related to 2009 IRAD project while a functional manager
 - Subsystem was antiquated
 - Interfaces were not standard
 - Solutions available with no technical development required just interface modification

Problem Summary

- IRAD projects that attempt significant advances are deterred by “gray-beards” that were responsible for the obsolete design
 - Witnessed several IRAD projects get derailed by the fear of change
 - Lack of understanding across the Enterprise of the importance of bus evolution within product lines
 - Very frustrated with approach towards technology insertion and evolution
- There is no clear or consistent commitment to new business capture or technology insertion
- We aggressively recruit the best and brightest only to insist they continue to utilize “heritage” designs

Current Operating Model

New Business Activities

- Last minute requests & decisions

- Proposal team ≠ program team



Development Programs

IRAD Activities

- Indecision
- No consistent interface with new biz activities

Technology Studies

- Completed by technical experts without oversight or interaction with other areas

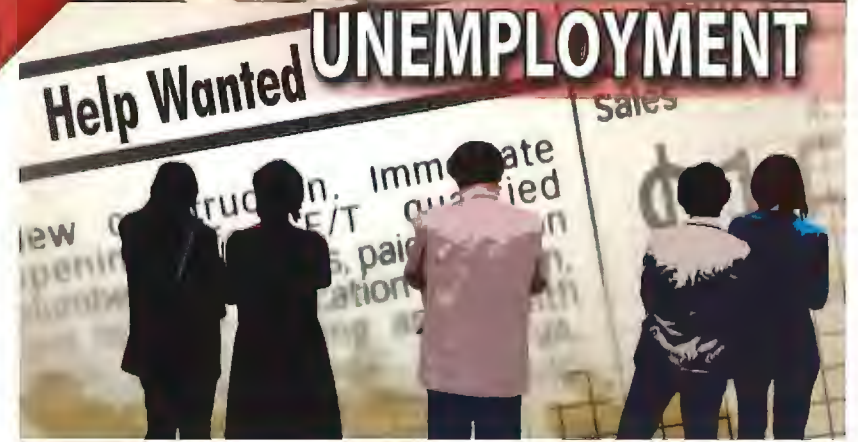
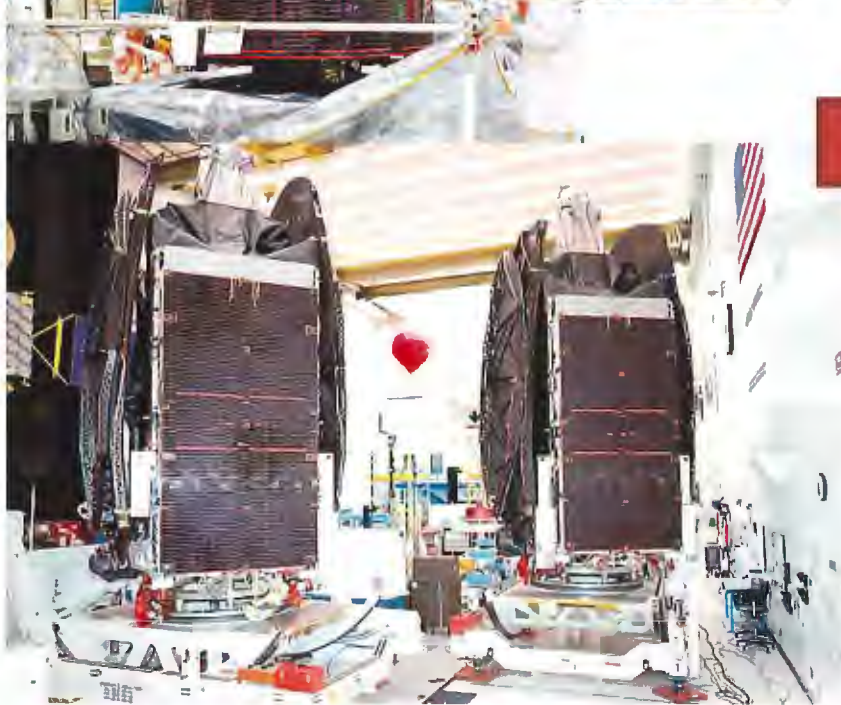
Long-Range Business Plan

- Unclear implementation
- Not distributed

Nothing in place to tie these activities together

Current Operating Model

- Complacent with current design
- Lack of desire/drive to be the industry leader
- Waste time, money and resources convincing customers our antiquated systems are “good enough”
- Technology insertion very payload centric
 - Little or no attention given to bus hardware
- No distinct, high-level organization responsible for new business proposals and technology insertion
- New business activities disjointed from on-going program activities and needs
 - IRAD activities are further disjointed from on-going programs and new business capture activities



Current operating model is not a viable approach for an industry leader or a successful business

Commercial Example

Computers – 60 Years of Constant Evolution



Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

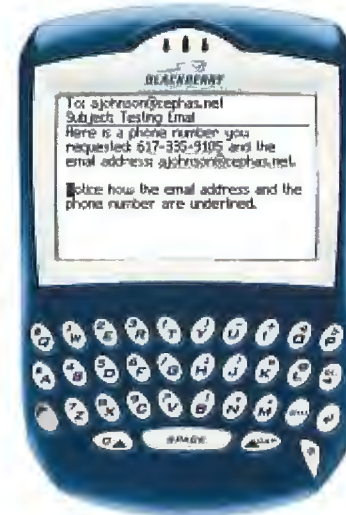


- First Computer
 - 50 tons
 - 25 kW
 - few thousand memory locations
 - hundreds of instructions per second
- Pentium micro processor
 - few grams
 - 25 watts
 - 8 to 32 MB of memory
 - 100 million instructions per second
 - Projected to be obsolete within the decade

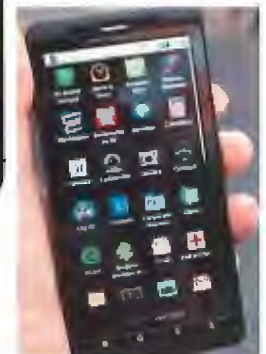
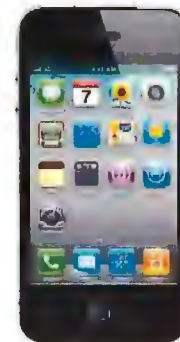


Commercial Example

Cellular Phones



- From mobile to handheld
- From 1983 "brick" to 2011 iPhone4
 - Brick to flip
 - Analog to digital
 - Digital to 3G
 - Data!
 - 3G to 4G
 - What's Next?



Commercial Model

- Constant evolution
- Motivated by the desire/need to be first to market
- Clear and consistent emphasis on designing the next “big” thing
 - Telephones, PDAs, cellular phones
 - Apple iPhone design and OS evolved from early Apple tablet – unclear of its impact to the market
 - Computers, internet access, tablets - iPad
 - Cars – GPS, power steering, airbags
 - Entertainment – HDTV, blue-ray DVD, satellite radio & TV
- Companies that fail to evolve are left behind and either go out of business or lose significant market share
 - Iridium, Zenith, RCA, IBM, Gateway, DHL, Adelphia Cable

Path Forward

- It's time to make significant operational changes
- Apply commercial model for technology evolution
- Create an organization designed to address the need to evolve our technology
 - Embrace industry standards
 - Increase capability
 - Create synergy with all stakeholders
 - Remove the stovepipes!
 - Emphasize areas of market differentiation
 - Utilize the great talent we have to regain our position as the industry leader

Implement the ideas proposed in the "Technology Insertion on Satellite Platforms" project

Project Objective

- Define a system engineering organization that will be responsible for research, development and insertion of next-generation technologies
- Apply relevant commercial business practices to the existing aerospace model
- Define clear roles, responsibilities and accountabilities
 - Create an organization to ensure planned technology achieves the required Technology Readiness Level (TRL) for use
 - Ensure experienced engineers stay in tune with advances within the industry

Project Objective, cont'd

- Define a system architecture and operating model that institutionalizes technology insertion on existing bus architectures
 - Ensure the new approach will continue and significant technology redesign will not be required in the future
- Provide a framework for internal research and development prioritization, risk and financial management & reporting
- Provide the processes and tools required to manage and achieve the technology required for short-term capture and long-range business plans

Key Assumptions

- Company agrees it's time for major change
 - Change must be thorough
 - Implementation must be complete
 - Previous attempts unsuccessful because they did not address the entire problem
 - Newly appointed vice presidents of Technology Development Organization and Business Development Organization have been asked to define organizations to address the problems
- Buy-in from all stakeholders to do what it takes to address the issue:
 - Resources – staff, facilities
 - Funding – capital required for initial set-up and R&D

Key Assumptions, cont'd

- Technology Development Organization (TDO) will not address all problems
 - Concurrent reorganization defines Business Development Organization (BDO)
 - Aligns TDO, BDO and VP of programs
 - Facilitates continuous and effective interaction
 - Emphasizes the importance to and focus of the Enterprise
- TDO will be funded with existing technology development and IRAD dollars
 - ~60 EP organization

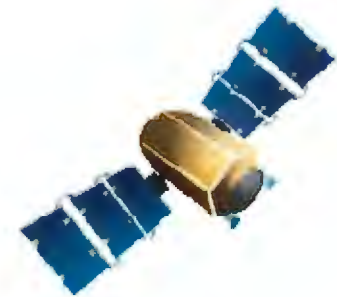
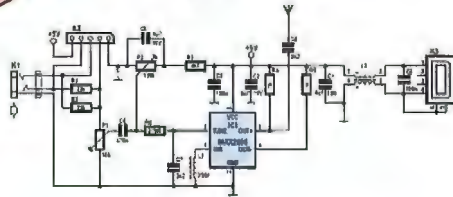
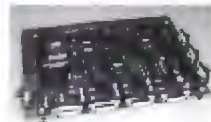
Trade Studies

- Project Objectives resulted in 3 Major Trade Studies
 - How do we address the gap between new business acquisition, technology insertion and program development?
 - Good faith (current model)?
 - Matrix chief engineers from existing programs?
 - Rely on functional areas to bridge the gap?
 - What is the required customer interface? At what level? Frequency?
 - Spend funds to co-locate to maximize interaction?
 - Focus on commercial & government? Just government, cost-plus opportunities?
 - What is the alternative for the commercial fixed-price customer?
 - Return on Investment (ROI) – is it even worth the investment?
 - Technology Assessment – what system/process will be used? How will we decide we are bid ready? Program ready?
 - Develop new strategy?
 - Utilize NASA's TRL?

Technology Development Organization

OV-1 – What & How

IDEA → CONCEPT → ACQUISITION → DEPLOYMENT



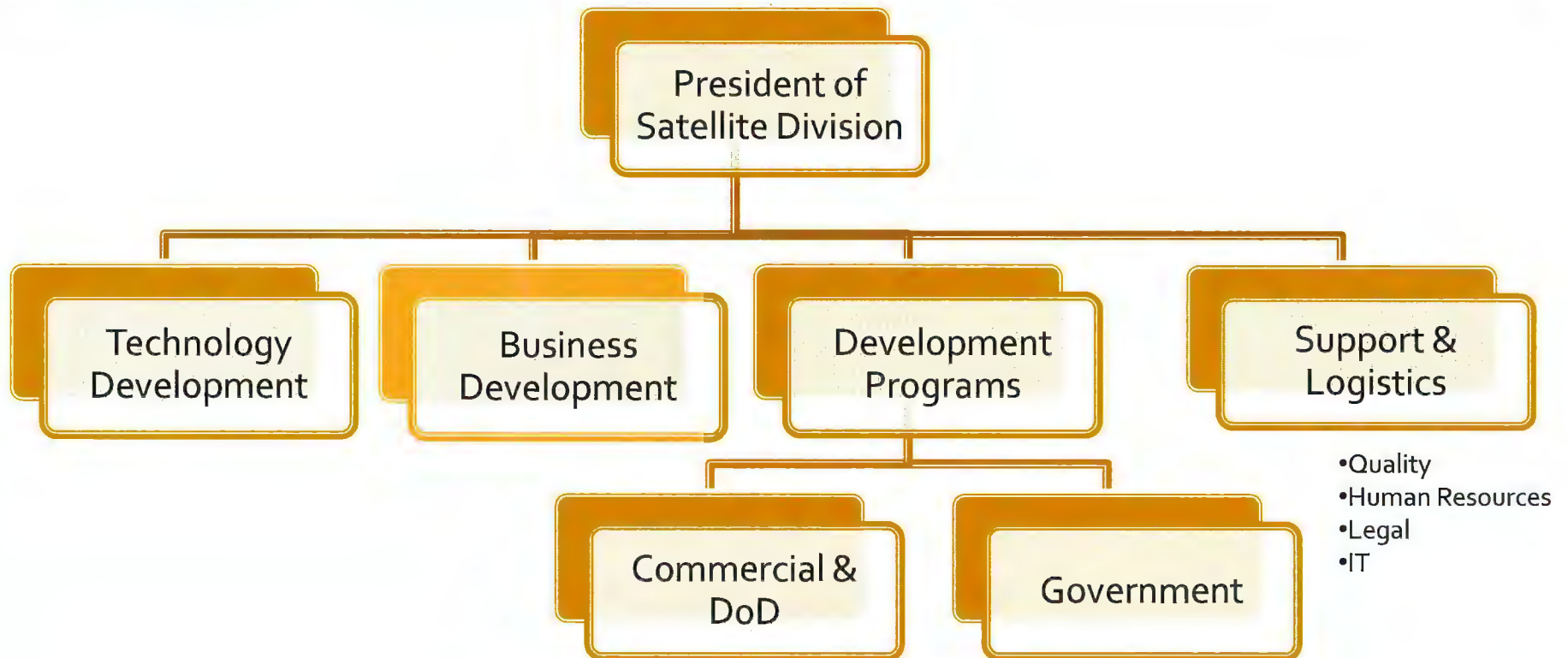
Technology Development Organization

Business Development

Development Programs

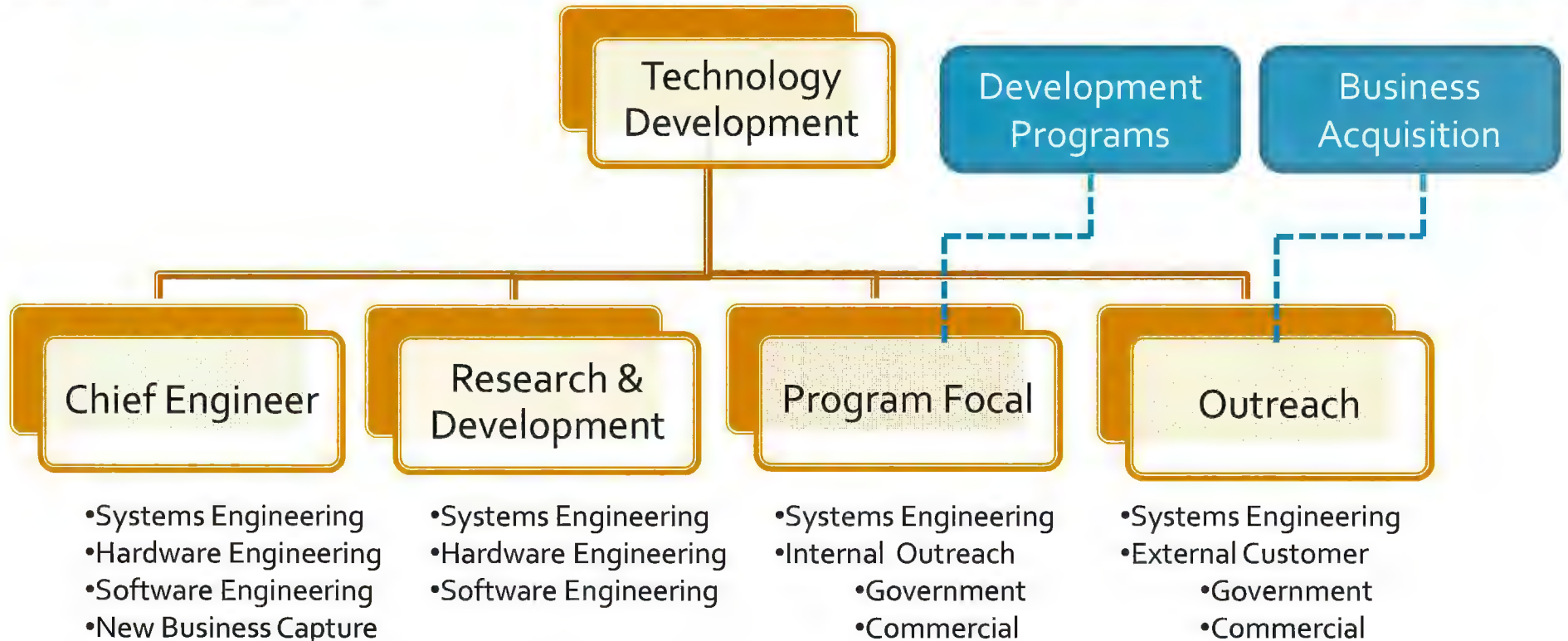
Technology Development Organization

Reporting Structure



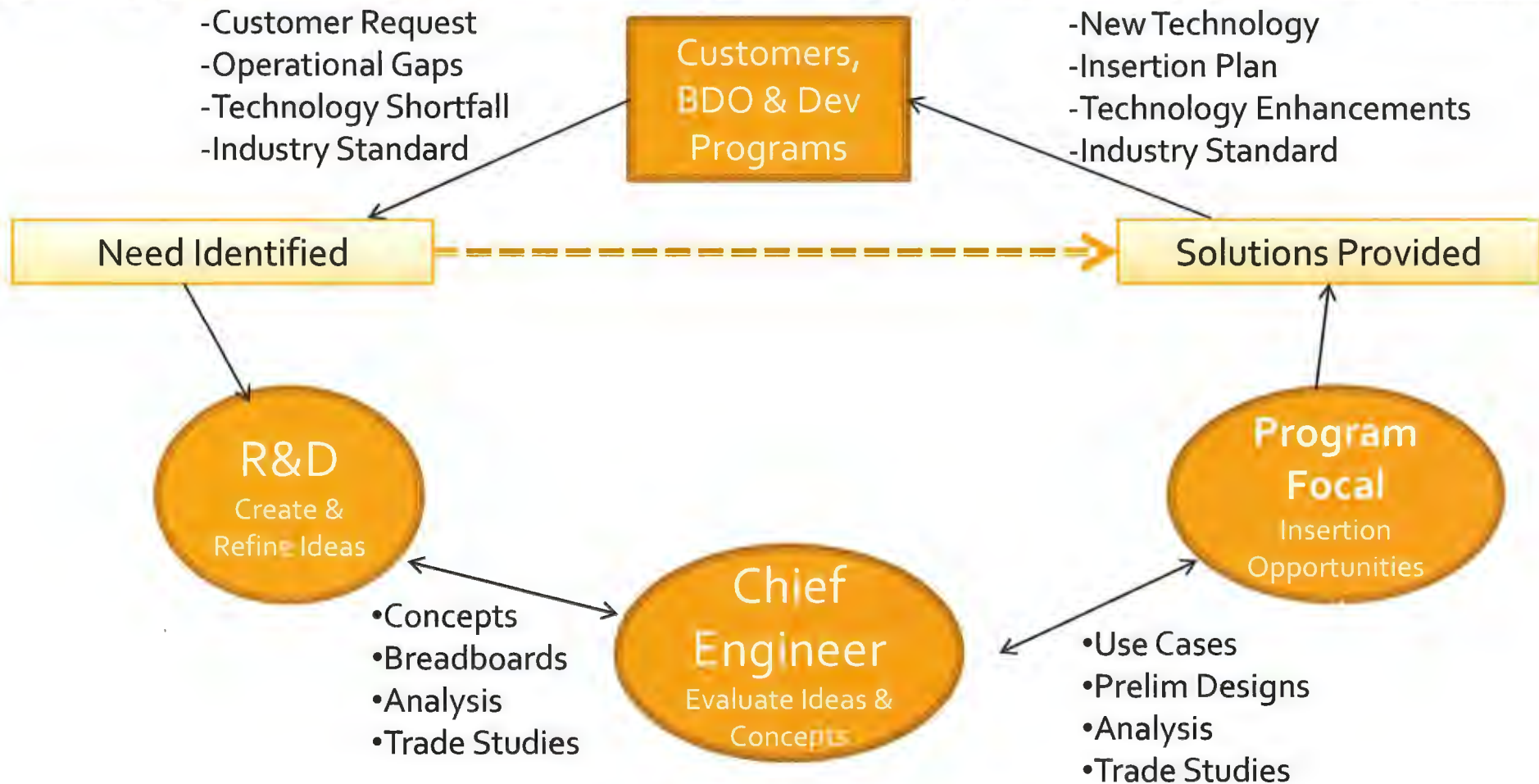
Technology Development Organization

Organizational Chart



Technology Development Organization

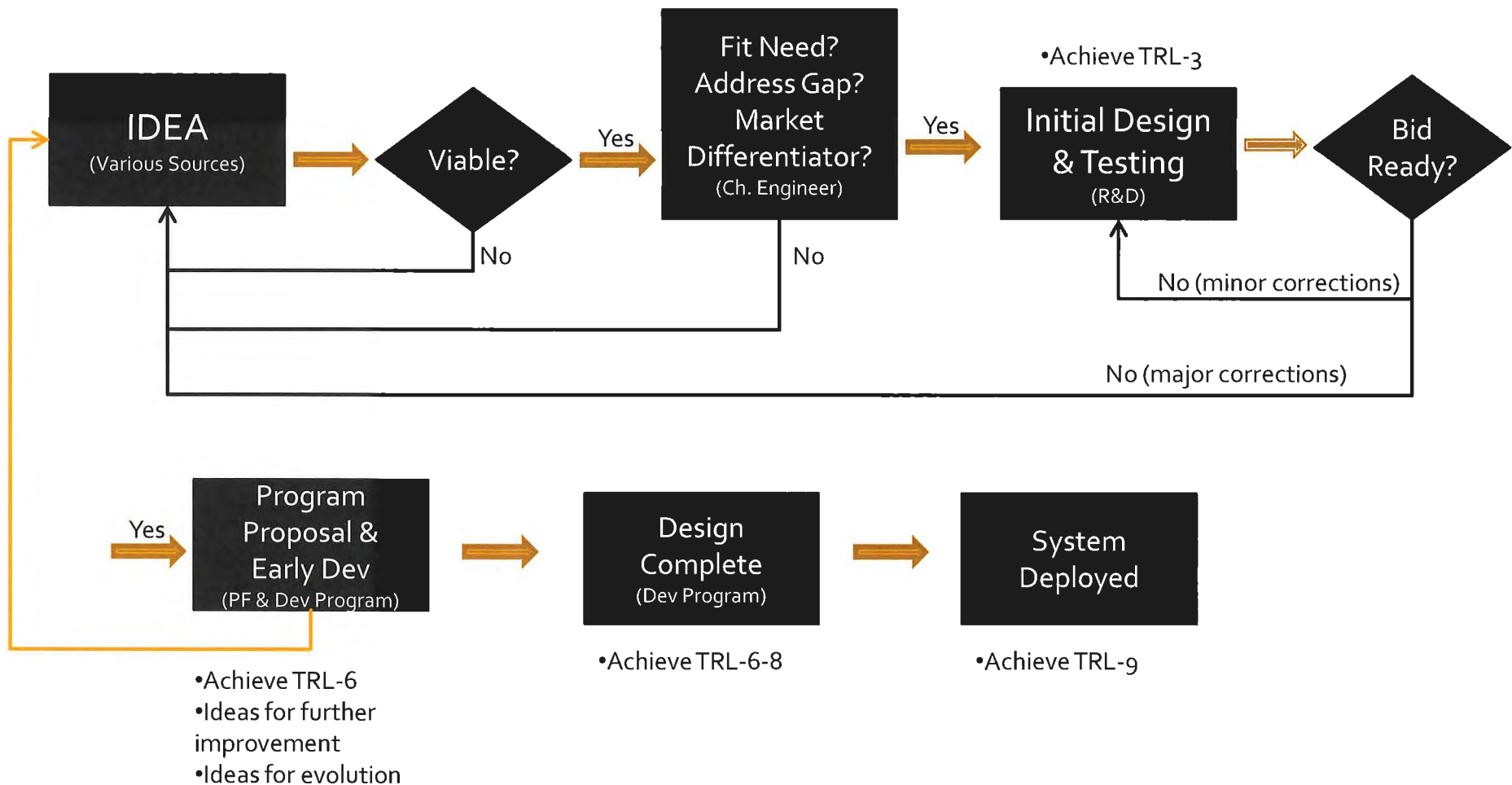
OV-2 – The Interfaces



****Constant Evolution ****

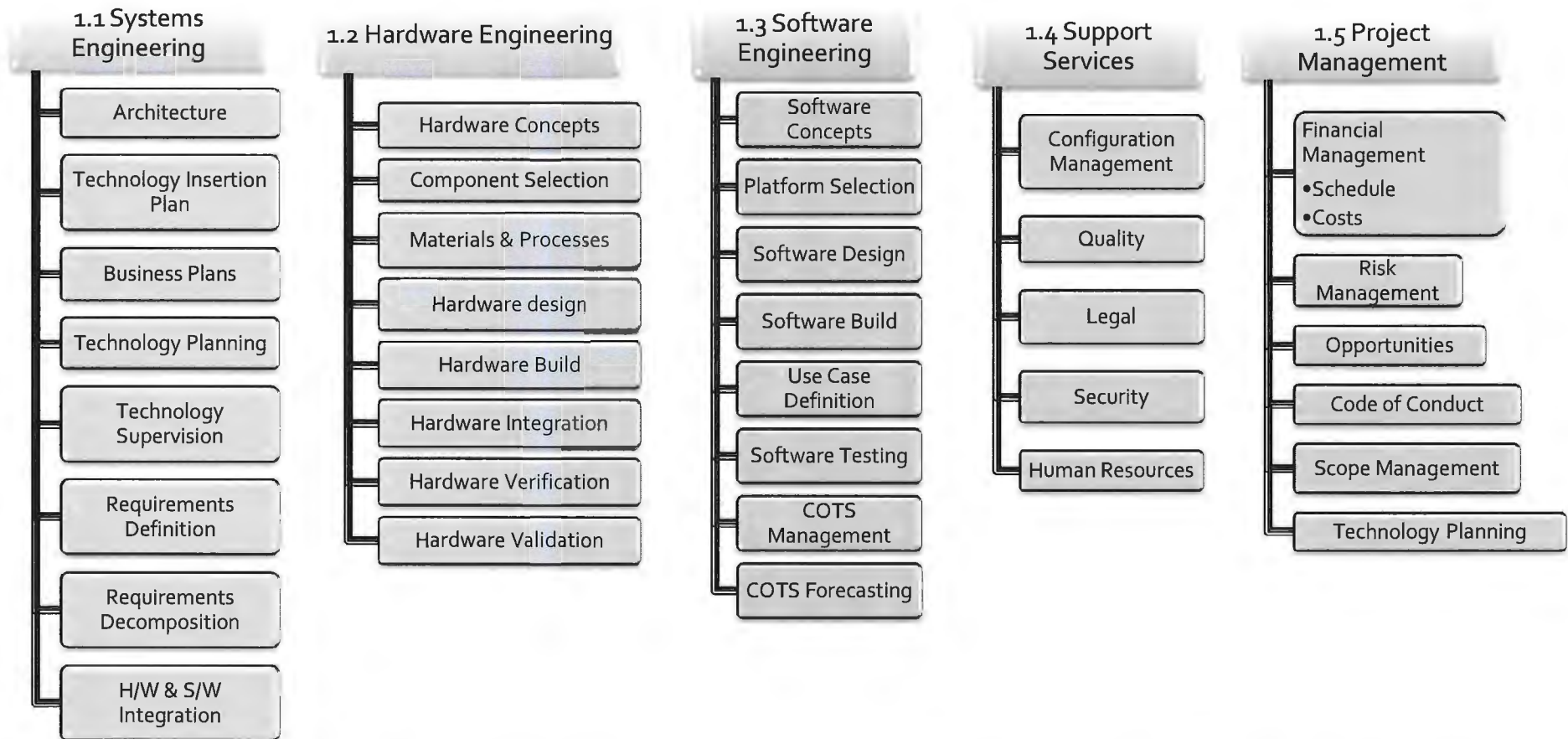
****Synergy Throughout Product Lifecycle****

Technology Insertion Process



Work Breakdown Structure (WBS)

1.0 Technology Development



- Consistent with the Statement of Work (SOW) generated for the Technology Development division

Funding Allocation by WBS

- TDO – 3 EP
 - VP, Office administrator & chief of staff
- System Engineering – 25 EP
 - 20 Full-time & 10-12 Part-time
 - Representatives from structures, mechanisms, power, thermal, propulsion, attitude control, command and data handling, payload, ground software, simulators, spacecraft databases, engineering tools and orbit analysis
- Hardware Engineering – 15 EP
 - Representatives from structures, mechanisms, power, thermal, propulsion, attitude control, command and data handling, payload, ground equipment and simulators
- Software Engineering – 5 EP
 - Software engineers who understand flight software, command & data handling protocols and command and control systems
- Project Management – 3 EP
 - Business operations, scheduler
- Support Services – 5 EP
 - configuration management, quality, human resources, security and legal

Ethical Issues

- Major ethical issues can arise in a technical environment
 - Likelihood increases in research and development environment
- TDO will operate in a method that:
 - Maximizes ecology
 - Quickly and systematically address any conflicts of interest, or the appearance thereof
 - Maintains confidentiality
 - Does not take personal or equipment safety risks
 - Operates with the highest level of integrity
 - Holds everyone accountable for their actions

Code of Conduct

- In addition to the existing Enterprise code of conduct TDO will adhere to the following guidelines:
 - Do what is right
 - Do what is necessary
 - Do what makes sense
 - Keep it Lean and Green
 - Consider your legacy
 - Keep it fresh

Documents & Management Plans

- Documents developed to help manage scope and provide expected results and deliverables include:
 - Statement of Work
 - Code of Conduct
 - Financial Management Plan
 - Near-Term Capture Plan Framework
 - Long-Range Business Plan Framework
 - Systems Engineering Management Plan (SEMP)
 - Systems Engineering Plan (SEP)
 - Technology Management Plan
 - Verification and Validation Plan
 - Risk Management Plan

Risk Management

- Risk managed via the risk board per the *Risk Management Plan*
- Crucial part of technology selection and insertion process
 - Each idea will require a full risk assessment
 - Understanding the risk will help the Chief Engineer and his staff make key choices and technology selections
 - With every change there is always some risk
 - With every interface change there is risk
 - It will be responsibility of every stakeholder to review concepts and assess possible impacts
 - Not all impacts are expected to be negative.....

Opportunity Management

- Opportunity management is just as important as risk management
- Opportunities will be managed per the *Risk Management Plan*
- With every step on the business plan there should be some cost, schedule or other efficiency gained
- Crucial part of technology selection and insertion process
 - Many concepts will be developed to help address an issue or need
 - New technology is smaller, lighter, has increased capability
 - Understanding the expected “gain” will help the Chief Engineer and his staff make key choices and technology selections

Summary

- It is clear something should be done to address the current operational and technical gaps
- The ability to convince customers that the “1985 Camry” is all they need is quickly coming to an end
 - System requires more than just a new paint job
 - Time for a complete overhaul
- Creating the Technology Development Organization will address a key part of the need
 - Will work with BDO and development programs to provide synergy across research and development projects, new business acquisitions and program execution

Why Will This Work?

- The organization forces the desired result
- It aligns all the stakeholders and gets the entire team moving in the same direction
- Minimizes the politics involved in getting new technology used on a platform
 - Buy-in from the concept phase
- Facilitates supporting business acquisition efforts with knowledgeable engineers not crafty marketing agents
 - Not allowed to throw the pitched concept over the fence and move on
- Organization led by a visionary who believes in the company and wants long-term success
 - Wants to see the organization and company reach its full potential