

*Jet Propulsion Laboratory  
Reorganization Design Process*



Case Study

John Blowers

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## *JPL Case Study Elements*

- Evolution Of the Organization
- Current Organization
- The Strategy/Changes Driving The Redesign
- Diagnostic Assessment
- Criteria For Design
- Issues And Design Changes
- Limitations & Constraints
- The Redesign Process – Phases



## *Premise*

JPL is a 72 year old organization that has undergone very little organizational change in the last 40 years. It parallels a lot of small “start up” companies in its evolution and as a small organization grew slowly over time to its present state. It presently operates as a matrix organization with a mix of product and functional or discipline-related elements feeding many projects. The need for some organizational change and possible reorganization has been voiced by senior management. However, senior management does not want wholesale change of the entire organization. The direction is to assess the largest component of the Laboratory, the Engineering and Science Directorate, which consists of approximately 70% of the population of the Laboratory.

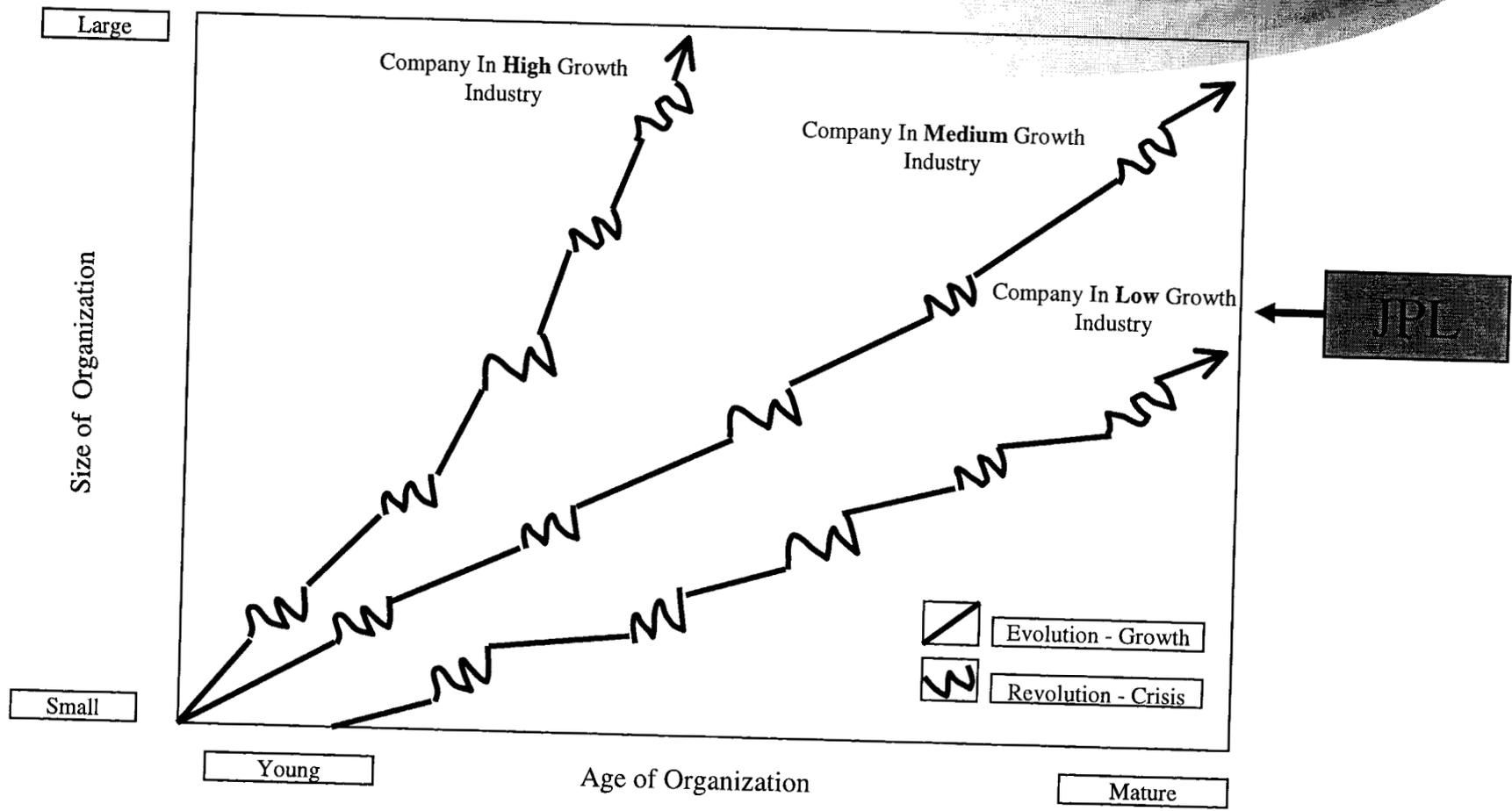


# *Evolution Of The Organization*

- 1930 -California Institute of Technology – JPL Laboratory
- 1936 – Rocket Propulsion – Caltech Lab
- 1940 – US Army Funded Expertise in:
  - Aerodynamics
  - Propellant Chemistry – (rocket fuel)
- 1958 – Transferred to NASA (FFRDC)
  - Building/Flying Spacecraft
  - Guidance & Control/Propulsion
- 1960 – 2003 Robotic Spacecraft



# How Companies Grow

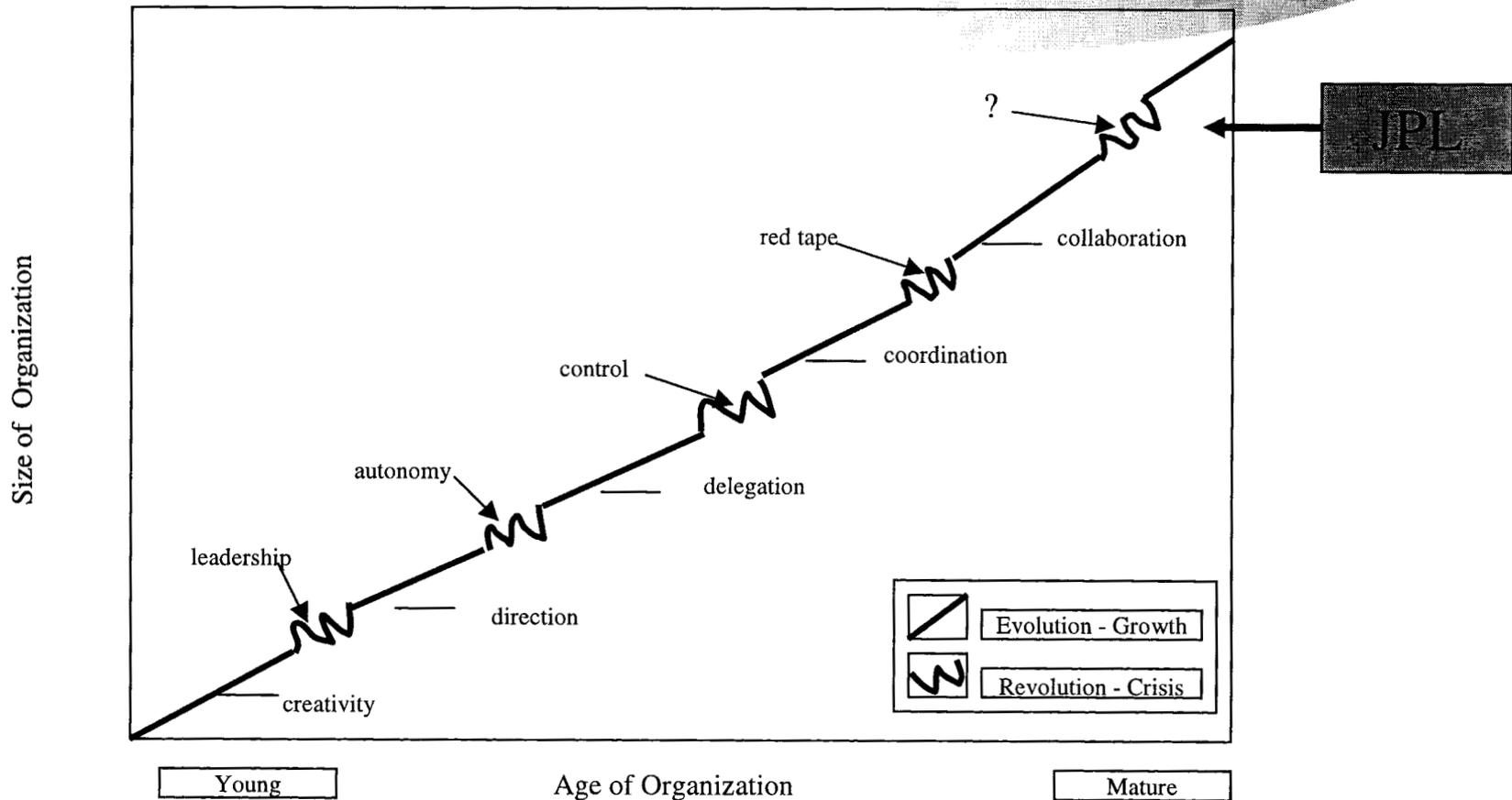


Adapted from Dr. Larry Greiner – Evolution and Revolution – Harvard Business Review June 1998



# The Five Phases Of Growth

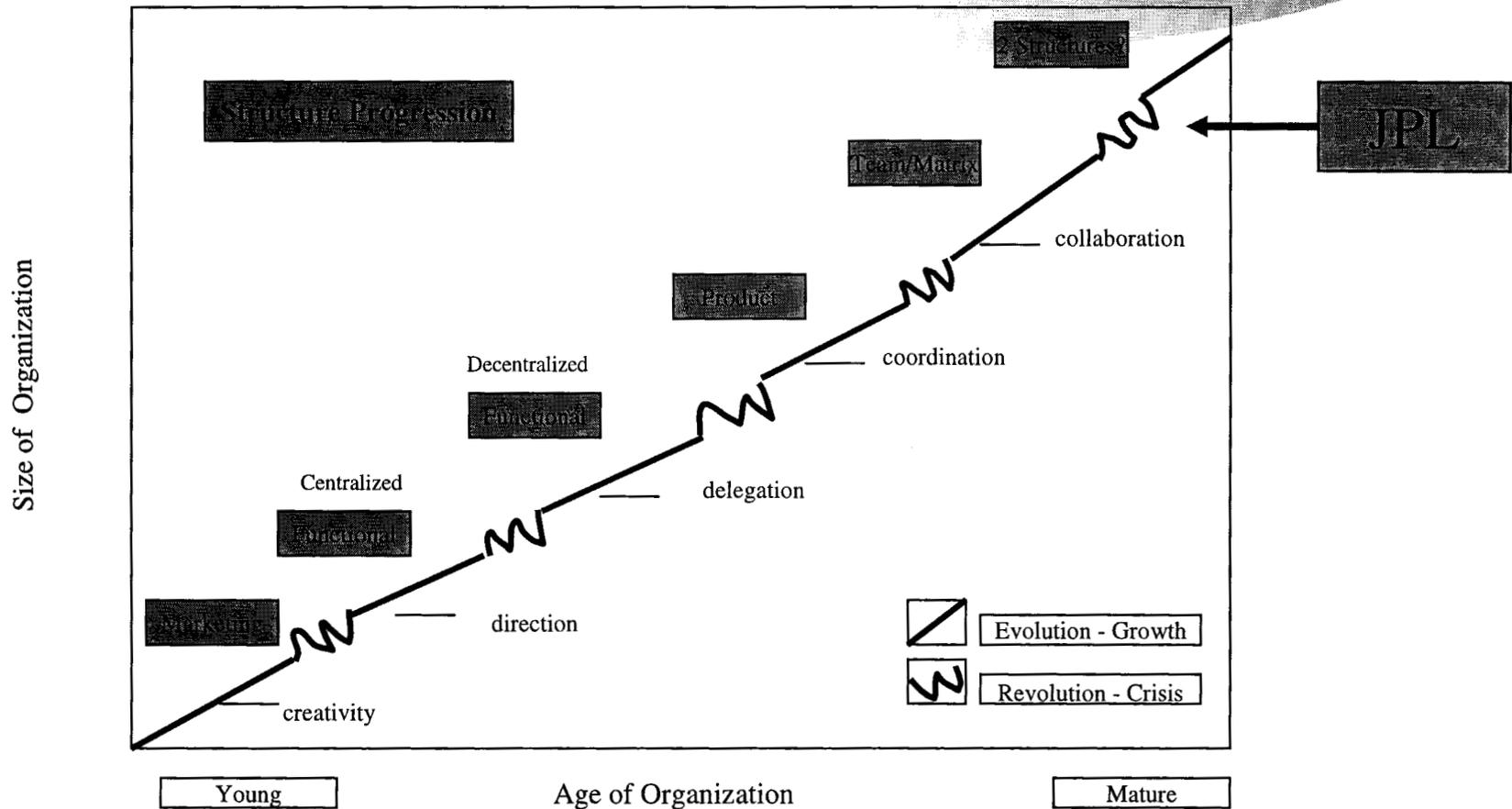
## (How Organizations Grow)



Adapted from Dr. Larry Greiner – Evolution and Revolution – Harvard Business Review June 1998



# The Five Phases Of Growth (How Organizations Structure)



Adapted from Dr. Larry Greiner – Evolution and Revolution – Harvard Business Review June 1998



## *2003 Current Organization*

- JPL is one of 10 NASA Centers
- Federally Funded Research & Development Center
- Managed by Caltech for NASA
- Located on 177 Acres north of Pasadena
- 5,200 employees
- Annual Budget Approx. \$ 1.4 Billion

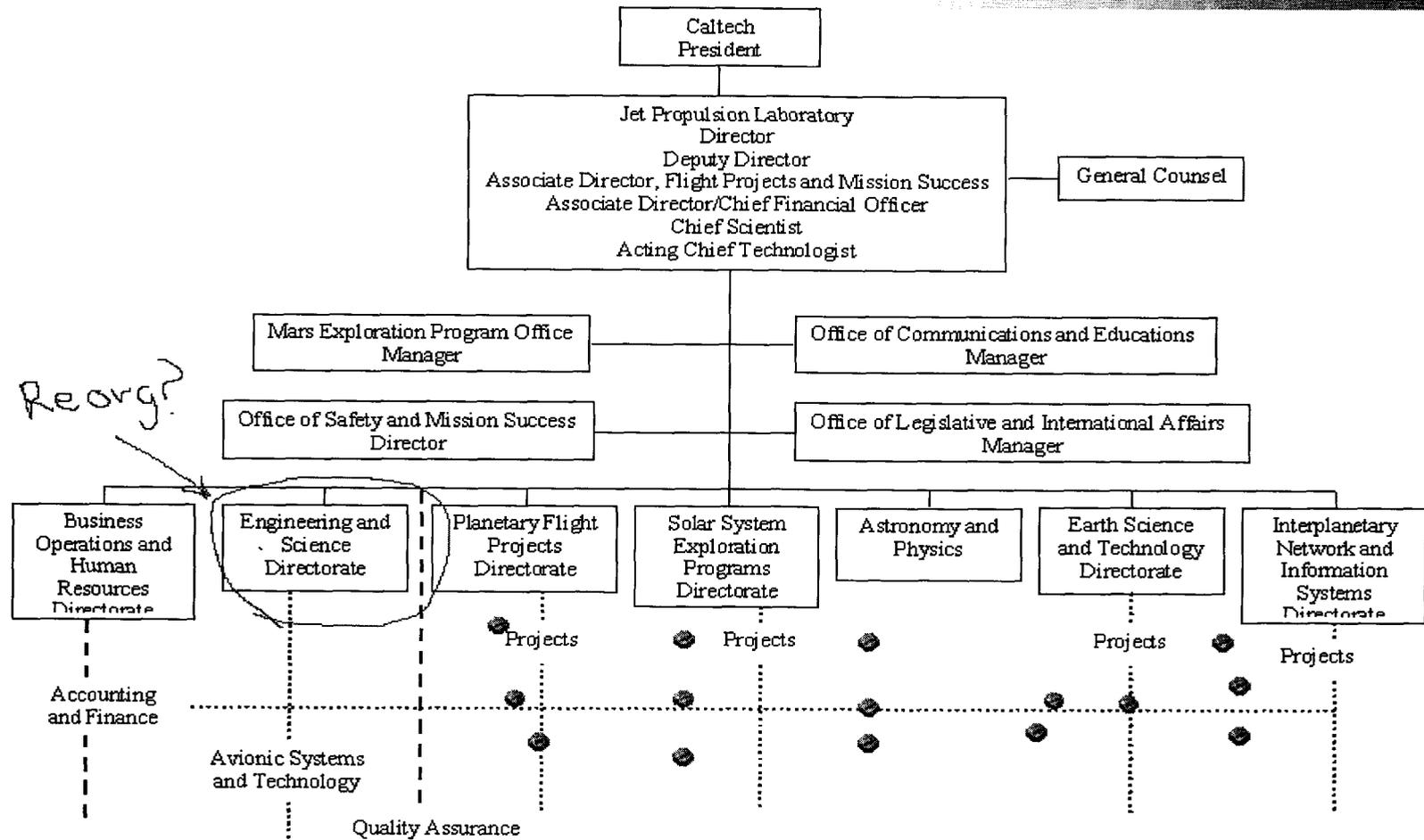


## *Expertise- Competencies*

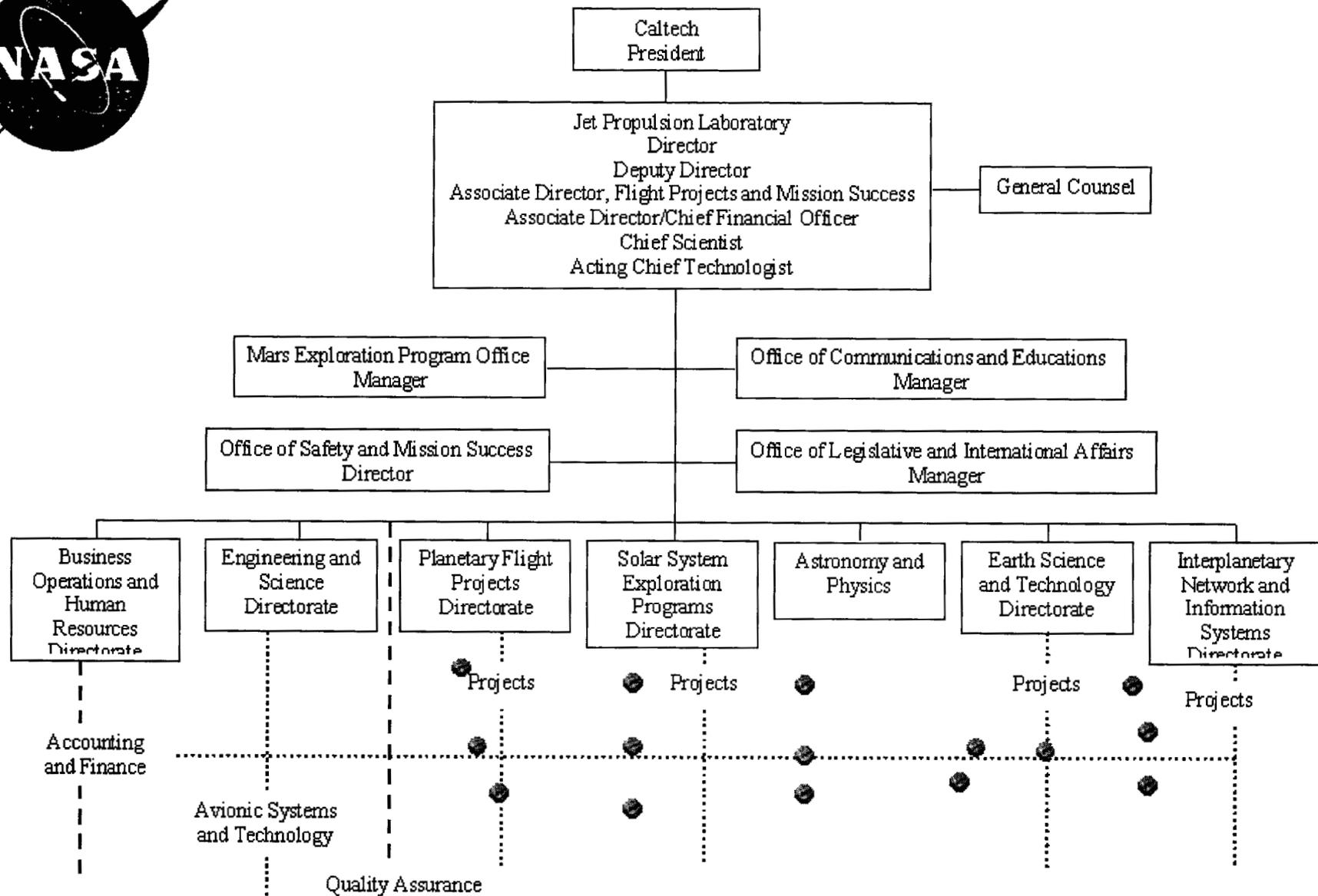
- **Deep Space Planetary Exploration** – Explorer/Voyager/MARS Pathfinder, etc.
- **Earth Science** – Understanding our home planet– SeaWinds, etc.
- **Astrophysics** –formation of galaxies, stars, planets
- **Telecommunications**- Deep Space Network of antenna stations – communication system
- **Technologies** – Deep Space Navigation, Digital Image Processing, Microelectronics, Intelligent Automated Systems and Instrument Technology



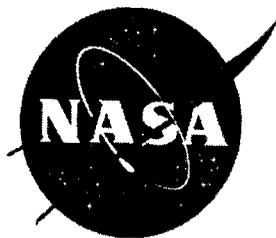
# Current JPL Organizational Structure



JPL Matrix Organization

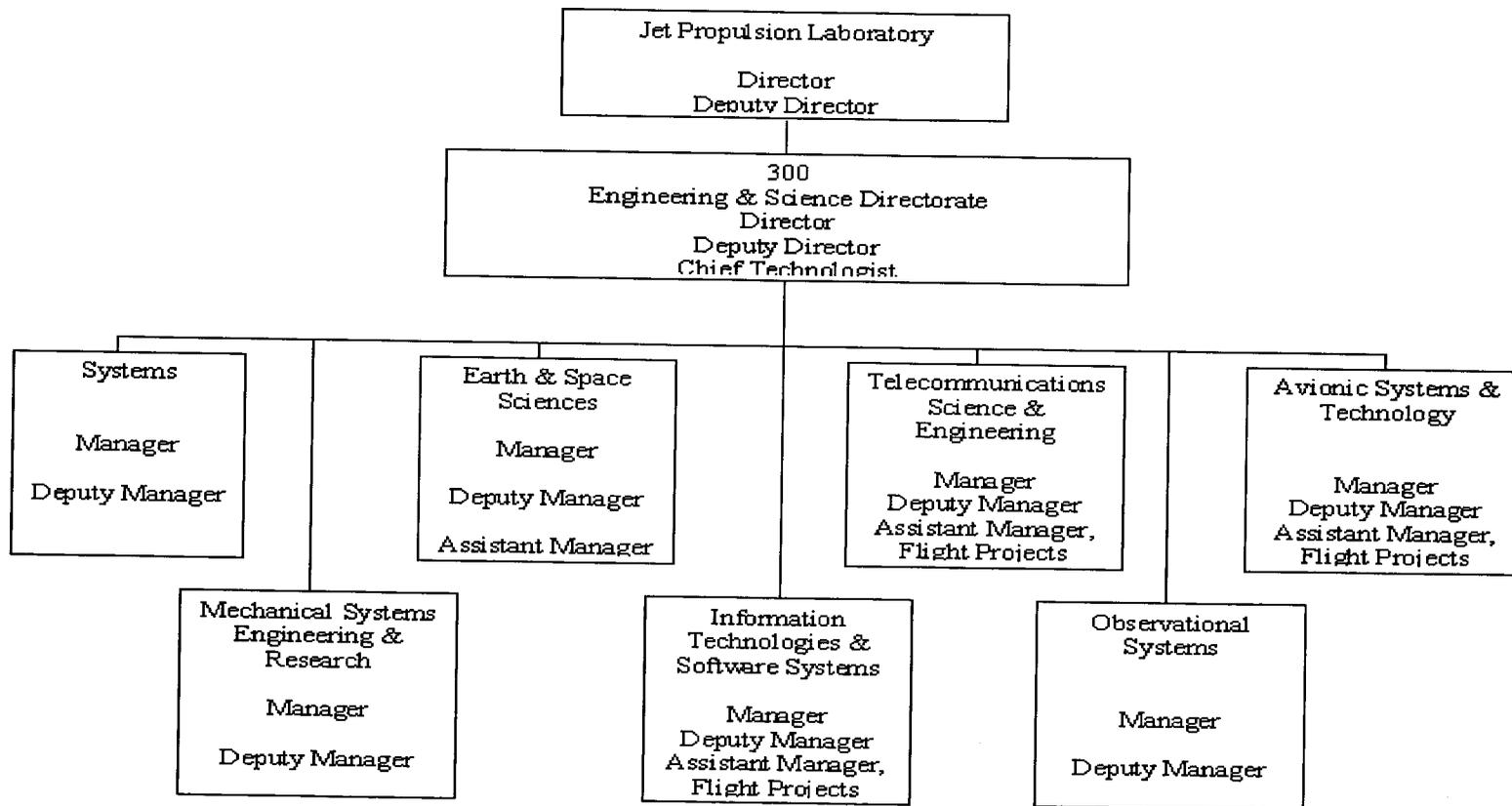


JPL Matrix Organization



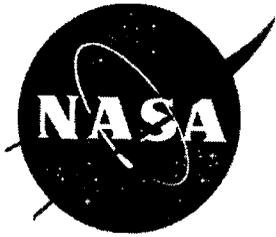
# Current ESD Organizational Structure

Division Level



Engineering & Science Directorate

6 May 2002



# Current ESD (Detail) Org

Section Level

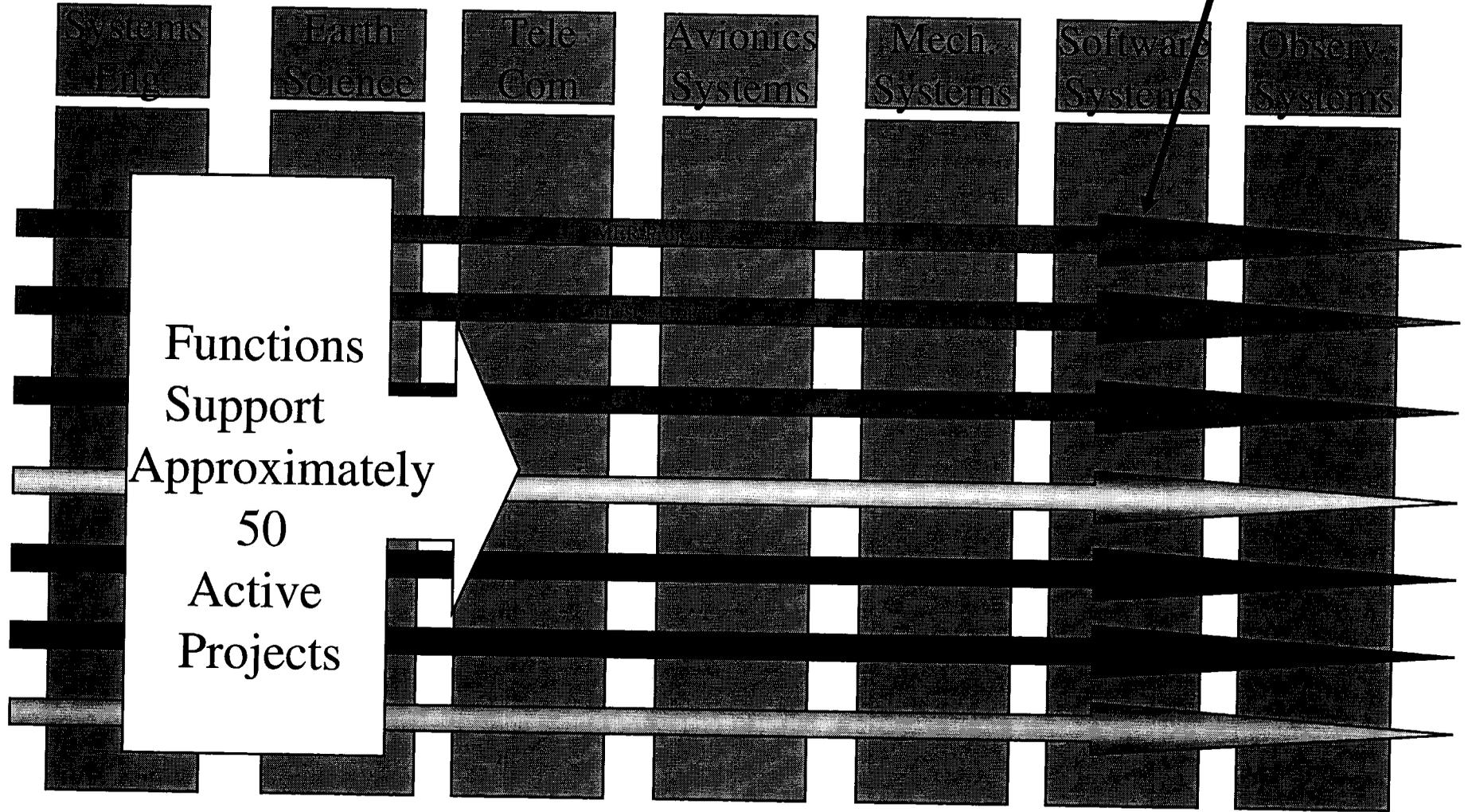
## Structure

Systems	Earth & Space Sciences	Telecom Science & Engineering	Avionics Systems & Technology	Mechanical Systems Engineering & Research	Information Technologies & Software Systems	Observational Systems
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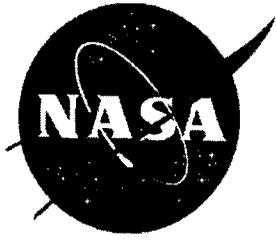
Functions  
Line Org

Projects

# *ESD Organization Matrix View*



Functions  
Support  
Approximately  
50  
Active  
Projects



# *ESD (Line organization) and Project Organization Roles*

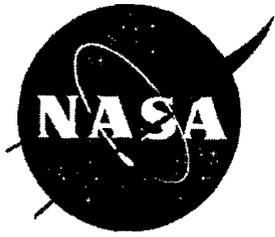
JPL is a matrix organization comprised of both Project and Line organizations both have different roles & responsibilities

## Line Organization Roles: (ESD)

- Provide functional and service resources including people, facilities, material, work processes, technical and business information, produces products and integration of same
- Responsible for quality of personnel and technical work products
- Hiring, Training, mentoring, housing and administrative personnel

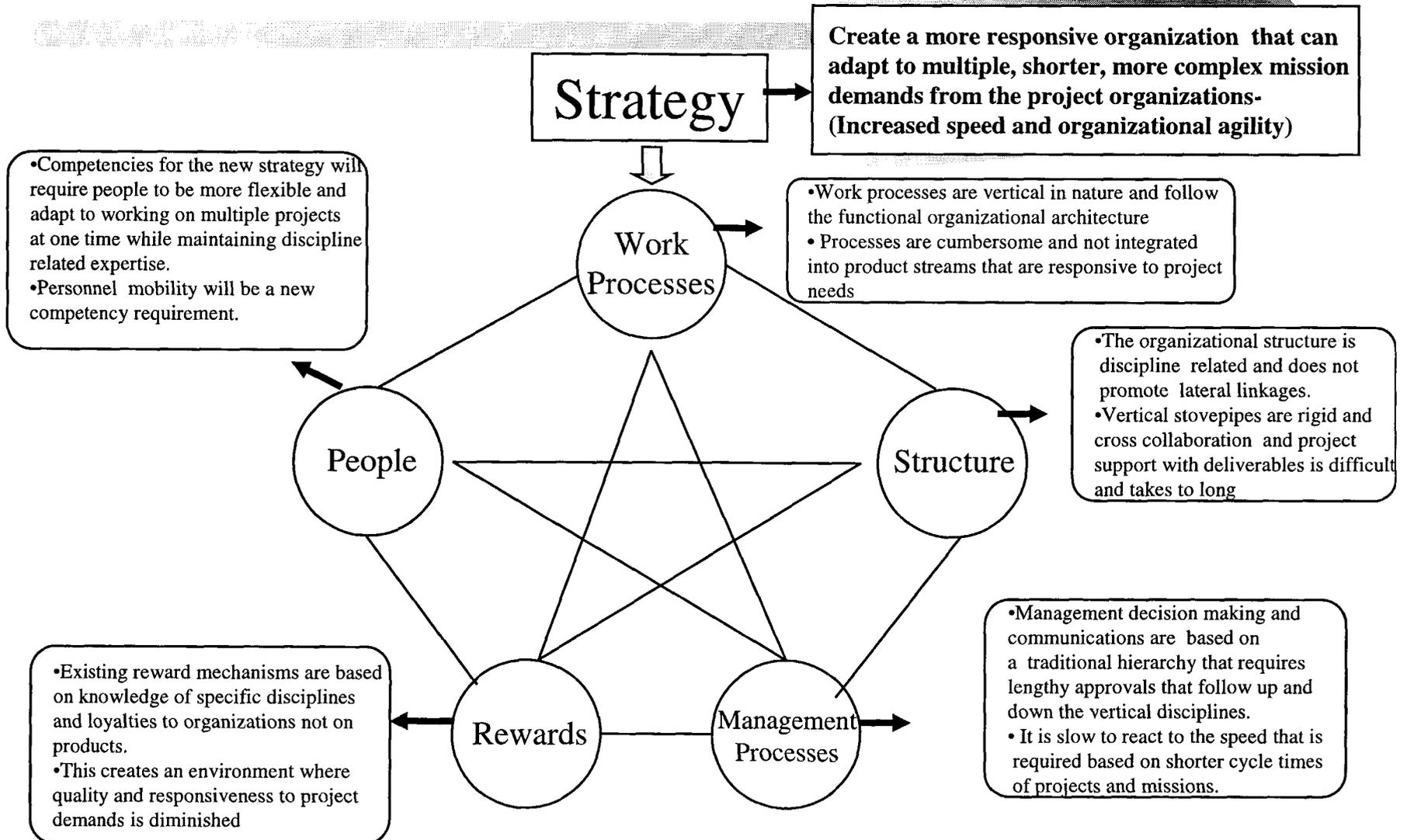
## Project Organization Roles:

- Customer interface
- Flow down of requirements
- Direction of work to be done
- Final word & responsibility for success of project (**Project Manager Rules**)
- Responsible for cost and schedule performance
- Ultimate responsibility for “mission success”



# 5 Star Model – Current State

## Diagnostic





# *Organization Change Drivers*

## Past Business Environment:

- 3 to 4 Large Projects
- Lifecycle 5 – 20 years
- Assigned Work
- No Competition
- Ample Funding
- Rich Talent Pool
- Little Oversight

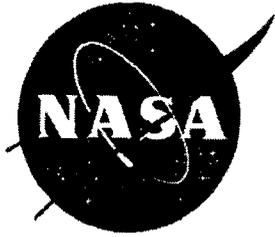
## New Business Environment:

- 50-60 Smaller Projects
- Lifecycle 36 months
- Less Assigned Work
- Industry Competition
- Limited Funding
- Shrinking Talent Pool
- Increased Oversight



# *Design Criteria*

1. Facilitates easy project support. This includes the few in-house projects and many tens of out-of-house projects. This should make it easy for the projects to work with ESD and vice versa
2. Clear roles and charters, with minimum overlaps. One option should include roles built around product lines. Options for roles other than product lines are also encouraged
3. Minimizes/simplifies organizational interfaces in carrying out project work
4. Facilitate a science friendly organization that attracts and nurtures top notch scientific talent
5. Facilitates the creation and development of new, cost competitive mission and instrument concepts required for the many mission and instrument competitions
6. Facilitates the creation and project support for the new class of mobile, in-situ exploration missions



# *Design Criteria*

7. Elevates software excellence in general and in projects, in particular
8. Facilitates technology development and infusion
9. Is cost effective. It is preferable to not increase the number of Divisions or Sections. Decreasing the number of Divisions and Sections is desirable, but not a requirement
10. Facilitates Implementation of JPL Strategic Plan
11. Facilitates the hiring, nurturing and training of employees, and the maintenance of technical and scientific expertise
12. Facilitates the development and maintenance of efficient facilities and technical infrastructure for doing the technical work required for JPL projects



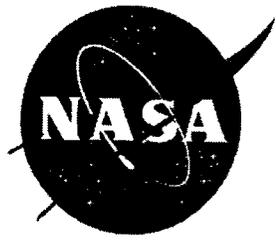
# *Design Changes Required Summary*

- **Issue:** Project support by ESD is cumbersome because of multiple discipline interfaces required.
- **Design Change:** The use of product lines that group related disciplines to products would speed up the response time delivery to projects. (ie. Electromechanical devices require, design, mechanical, electrical and software disciplines be combined.)
- **Issue:** Unclear roles and charters – software is presently organized as a discipline, but is used across several ESD organizations
- **Design Change:** Organize software around product lines, but create a software engineering process group to take advantage of reuse of previous software solutions.



# *Design Changes Required Summary*

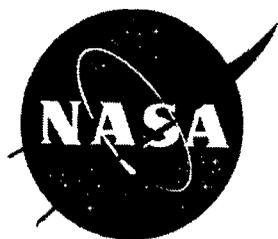
- **Issue:** The present organization does not facilitate a science friendly organization that attracts and nurtures top notch science talent
- **Design Change:** Create a structure to emphasize a science friendly atmosphere including a product line that addresses science and payloads
- **Issue:** The present organization is not designed to address the need for mobile in-situ exploration missions (ie Mars airplanes, Europa Submarines)
- **Design Change:** Create a product line to develop and deliver mobile, in-situ mission capability



# *Design Changes Required*

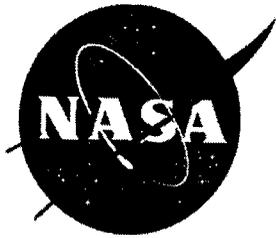
## *Summary*

- **Issue:** The present organization does not facilitate cost competitiveness around mission and instrument concepts required for many mission and instrument competitions:
- **Design Change:** create a mission systems and science payload instrument product line to better apply resources for increased competitiveness
- **Issue:** The present organization does not fully facilitate the hiring, nurturing and training of employees and the maintenance of technical and scientific expertise
- **Design Change:** By creating product lines (teams) personnel will be exposed to more disciplines and a larger breadth of experience. In addition small discipline related organizations can be established to maintain technical/scientific expertise



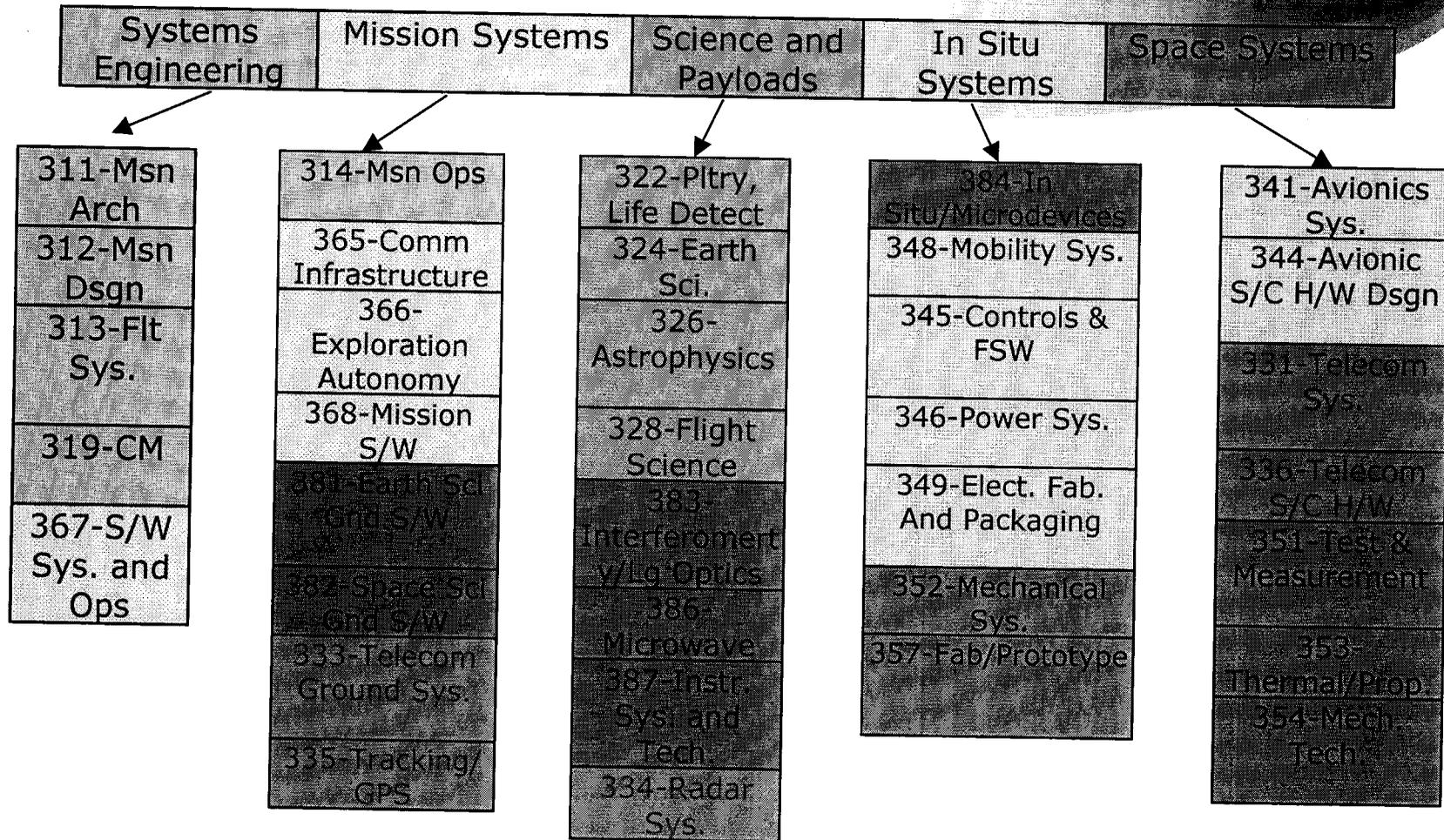
# ESD Current Structure (Before)

Systems	Earth/Space Science	Telecom	Avionics	Mechanical	Software	Observational Systems
31x	32x	33x	34x	35x	36x	38x
311-Msn Arch	322-Pltry, Life Detect	331-Telecom Sys.	341-Avionics Sys.	351-Test & Measurement	365-Comm Infrastructure	381-Earth Sci Gnd S/W
312-Msn Dsgn	324-Earth Sci.	333-Telecom Ground Sys.	344-Avionic S/C H/W Dsgn	352-Mechanical Sys.	366-Exploration Autonomy	382-Space Sci Gnd S/W
313-Flt Sys.	326-Astrophysics	334-Radar Sys.	345-Controls & FSW	353-Thermal/Prop.	367-S/W Sys. and Ops	383-System Interoperability/Equip. Test
314-Msn Ops	328-Flight Science	335-Tracking / GPS	346-Power Sys.	354-Mech. Tech.	368-Mission S/W	384-System Performance/Modeling
319-CM		336-Telecom S/C H/W	348-Mobility Sys.	357-Fab/Prototype		385-System Verification
			349-Packaging & Fab.			387-Operations & Test



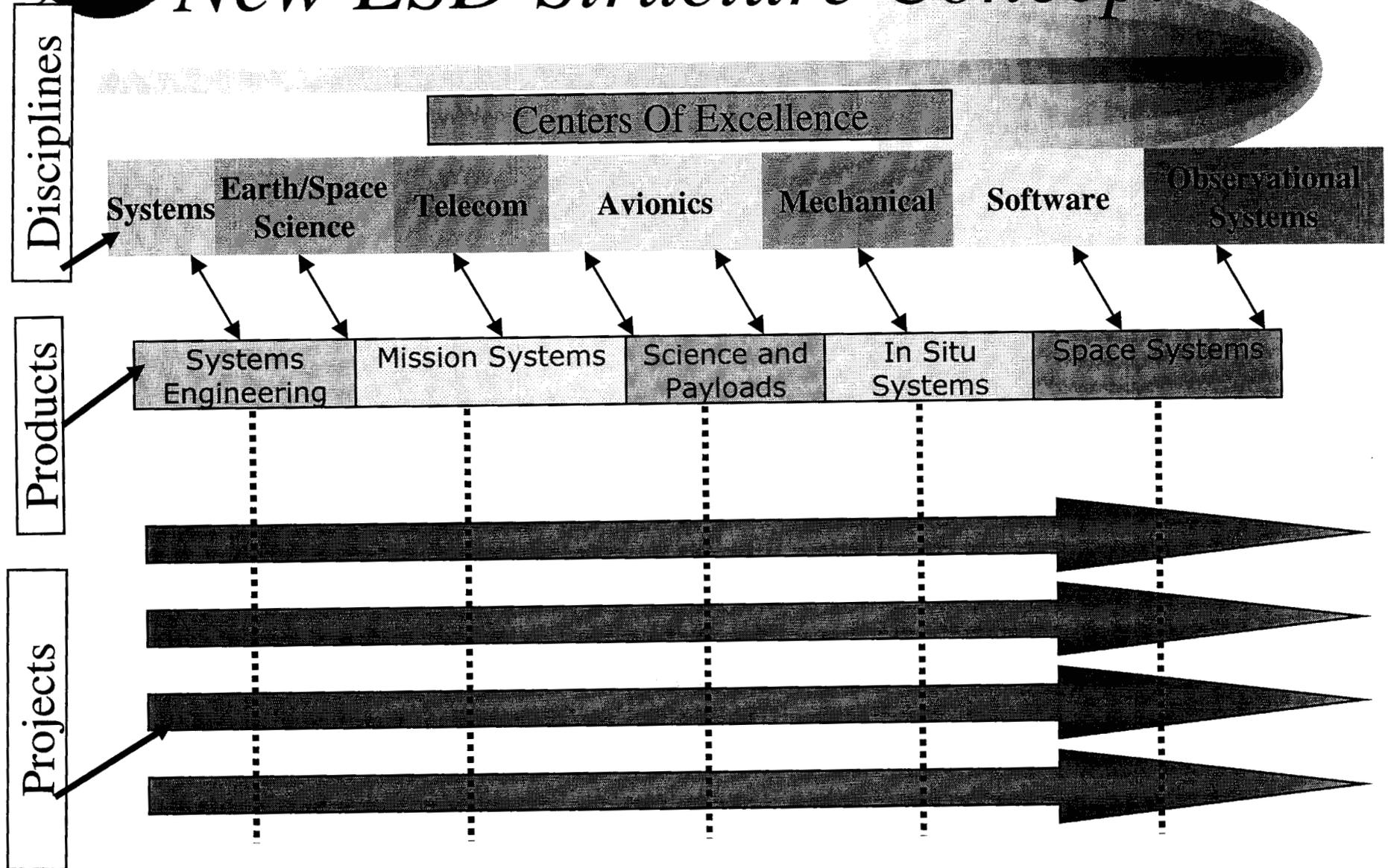
# Alternative Product Structure

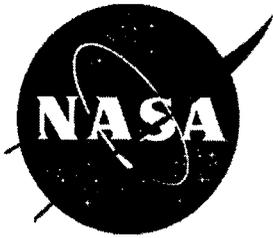
#1





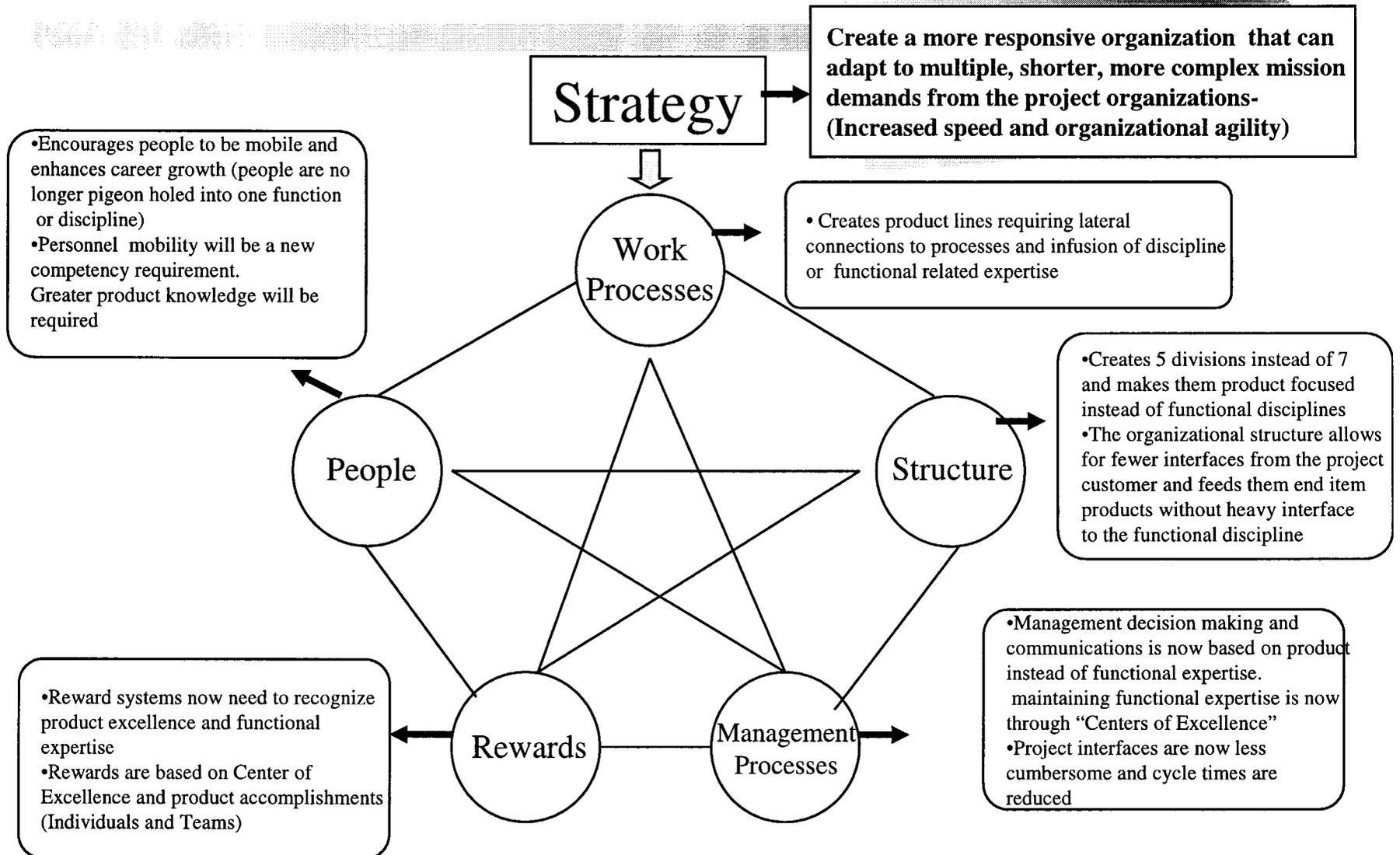
# New ESD Structure Concept #1

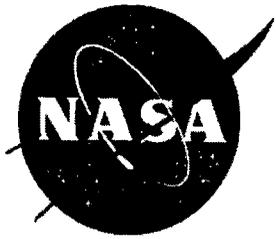




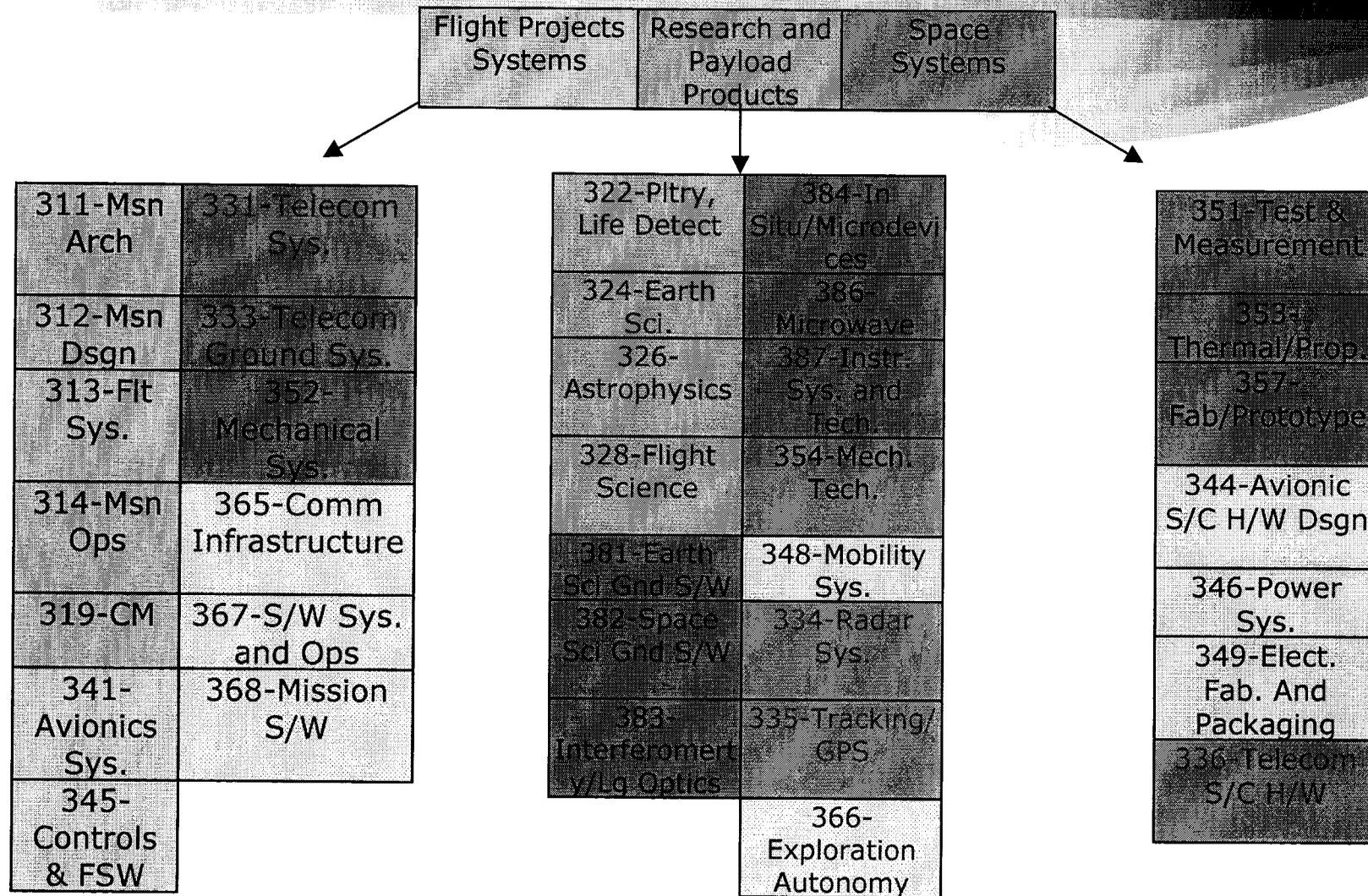
# 5 Star Model – Concept #1

## Diagnostic



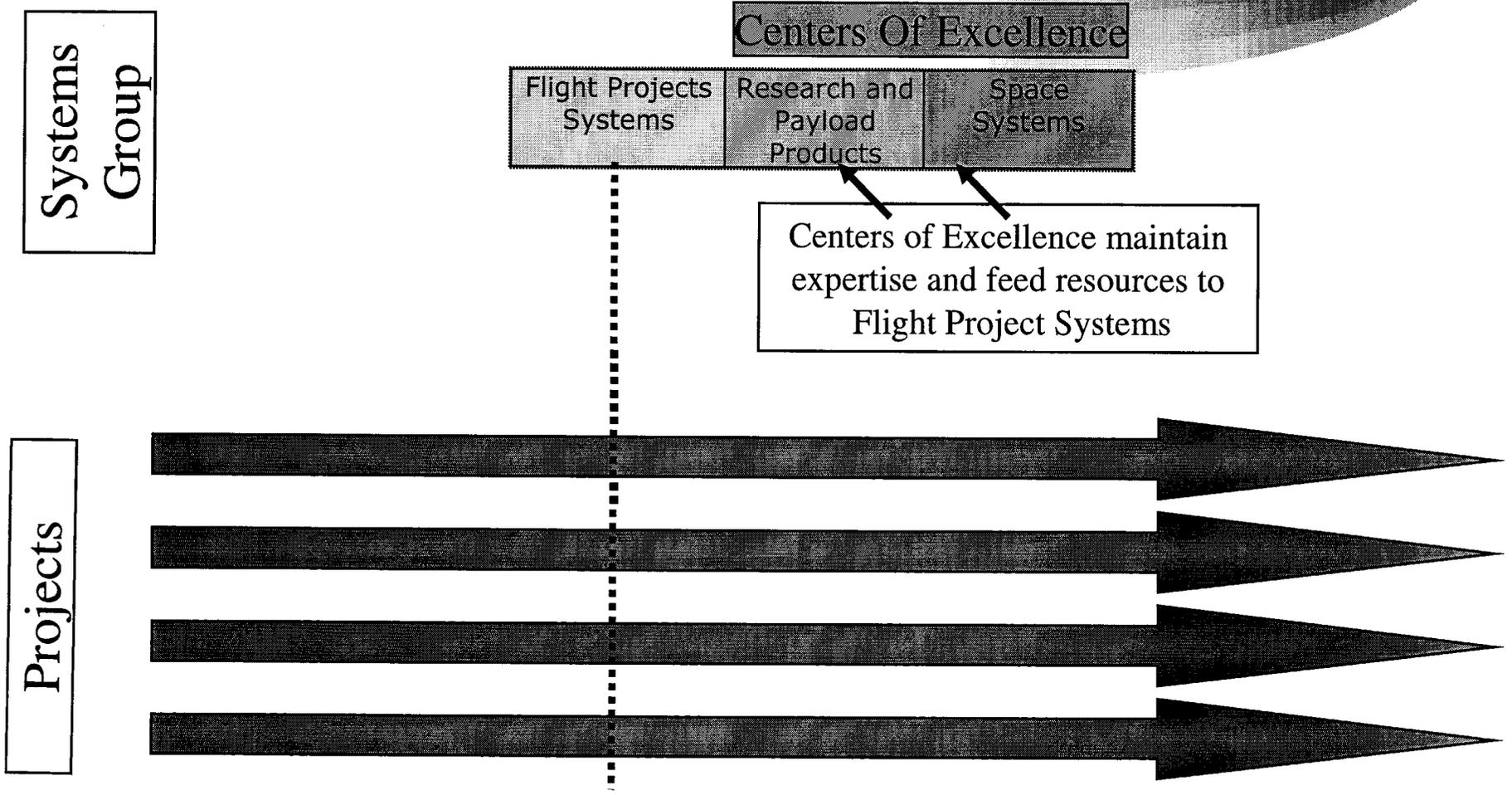


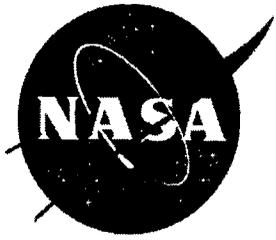
# Alternative Product Structure #2:





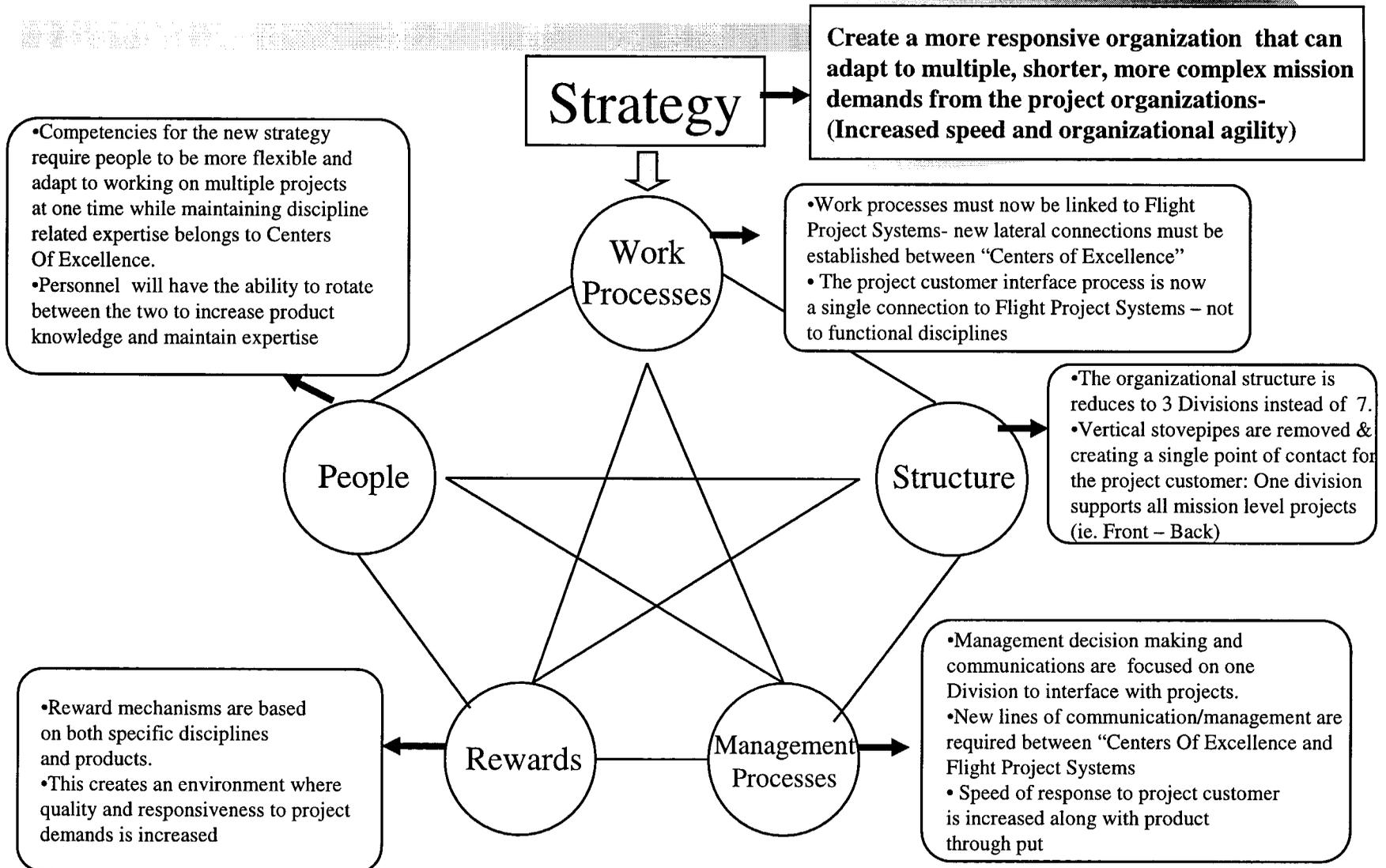
# *New ESD Structure Concept #2*

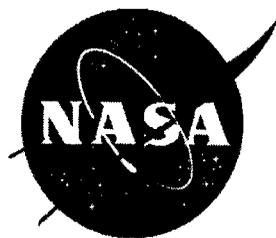




# 5 Star Model – Concept #2

## Diagnostic





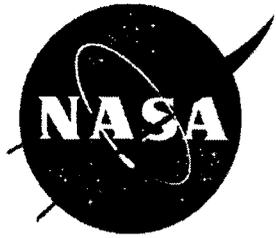
# *Change Management Challenges*

## Challenge:

- Major organization design change has not occurred in 40 years
- Technical expertise has been rewarded over product knowledge
- Resistance to change is very high- present comfort level is high
- Fear that the change will make things worse not better

## Response:

- Have already begun the unfreezing process
- The design team is looking heavily at a product oriented design
- Resistance is being countered with the reality of the change in the business environment
- The design change process includes an in depth look at “unintended consequences”



## *Limitations and Constraints*

- Looking at only the ESD organization for Redesign is a constraint that will probably create problems later on. Any substantial change will affect not only the Project customer, it will also affect linkages with most other parts of the laboratory along with vendors and partners in industry. We will no doubt find that other elements of the organization do not fit or link up with the new ESD organization and most likely will end up redesigning the rest of the organization to a certain extent.

# ESD REORGANIZATION PROCESS

