Teams

Best Practices

- Use an appropriate stage/gate process
- Simultaneous/concurrent engineering
  - Clear tasks
  - Tasks ordered correctly
- Cross functional teams

Concurrent engineering vs. Cross-function engineering

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- Concurrent engineering = design task sequencing
- Cross-functional engineering = who is involved in the design tasks

Cross-functional engineering

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- Shortcomings
  - time intensive
  - meeting intensive
- Benefits
  - reduce rework later
  - improve the quality
  - increase the impact of design for manufacturing
    - earlier in design it is easier to change

Functional groups

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- Systems engineering
  - in charge of ensuring that the system works together
  - interface design and management
- Marketing
  - Define and explore the market
- Supplier liaisons / Materials
  - Work with and negotiate with suppliers
- Research and Technology
  - bring the new technology up to speed
- Quality
  - in charge of testing and validation of the product
- Engineering functions
  - Aircraft: structures, electronics, hydraulics, etc.
  - Automotive: suspension, body, interior, controls
  - Copiers: toner, paper feeds, image processing, etc.
- Manufacturing
  - Tooling designers
  - Assemblers/hourly labor
  - Advanced manufacturing
  - Process designers
- Legal
- Finance

Concurrent and cross-functional categories

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		Concurrent engineering	
		Sequential	**Overlapping**
Cross-functional engineering	**Functionally oriented**	- Traditional hand it over the wall - High risk of expensive late design fixes - Long design cycle	- Hand partial information over the wall - Risk of late design fixes - Risk of design changes affecting downstream tasks - Short design cycle
	Cross-functionally oriented	- Long design cycle - Lower risk of expensive design fixes - Lower risk of design changes impacting downstream tasks	- Short design cycle - Lower risk of expensive design fixes - Higher risk of design changes impacting downstream tasks

Cross-functional product development

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- Making decisions with input from multiple inputs
- Different levels of interactions
  - **Highly coupled** - manufacturing has input during the design process
  - **Coupled** - manufacturing and design evaluate designs together (DFM, FMEA)
  - **De-coupled** - functional teams come in to approve or reject current design

Types of cross-functional work

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- sub-system to sub-system
  - Understanding interfaces between sub-systems and functional systems
- sub-system to process
  - Understanding how the product relates to other non-product disciplines
    - manufacturing
    - marketing
    - delivery

Sub-system to sub-system

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- Cross-stream interaction (vs. upstream/downstream interactions)
- Example: Hardware and electronics communication
- Focus on system integration
- Focus on the interfaces between sub-systems

Work breakdown structure

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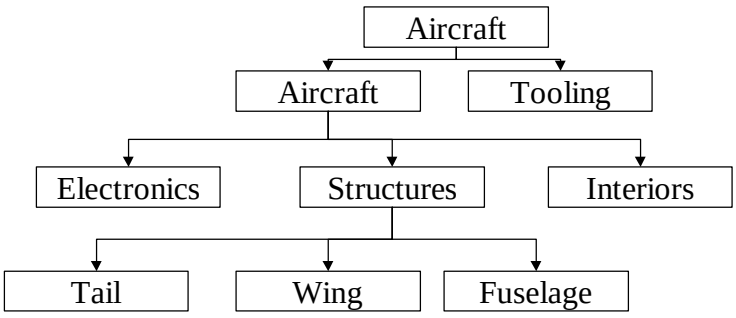

- Product is broken down into sub-systems
- Each sub-system is a “work package” and is assigned to a given group

Sub-system to sub-system

Design the interfaces to

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- Allow for
  - redesign/replacement of functional elements
  - within a set of “rules” that are set by the interfaces between parts
- Enables
  - standard assembly processes
  - rapid redesign and debug

Sub-system to sub-system

Coupled

Uncoupled

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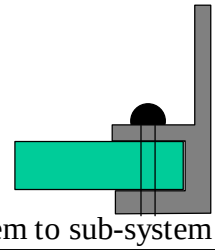
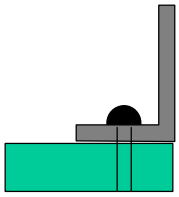
- Chunk A must be adjusted if Chunk B is.
- Requires iteration between sub-assembly groups

- Chunk A and B can be changed independently as long as interfaces are kept the same
- Requires interface standardization agreement between sub-assembly groups





Sub-system to sub-system

Pimmler and Eppinger - Chunk design

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- Sub-systems are highly coupled
  - automotive climate control
- Break the product down into subsystems that reduce the number of cross-chunk interactions

Sub-system to sub-system

Interactions

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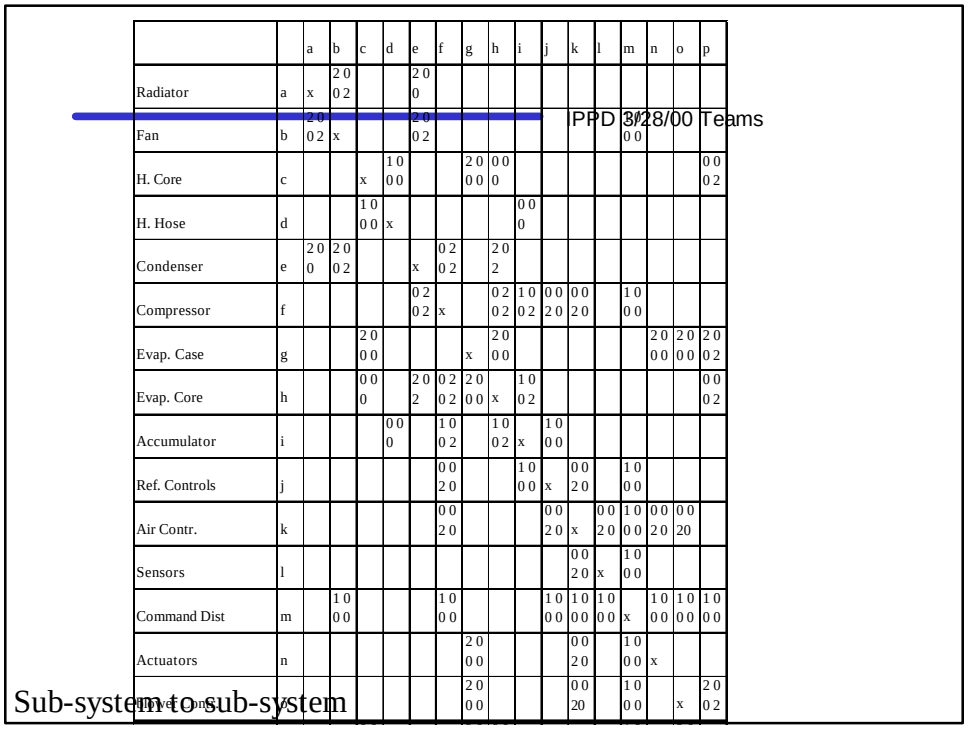
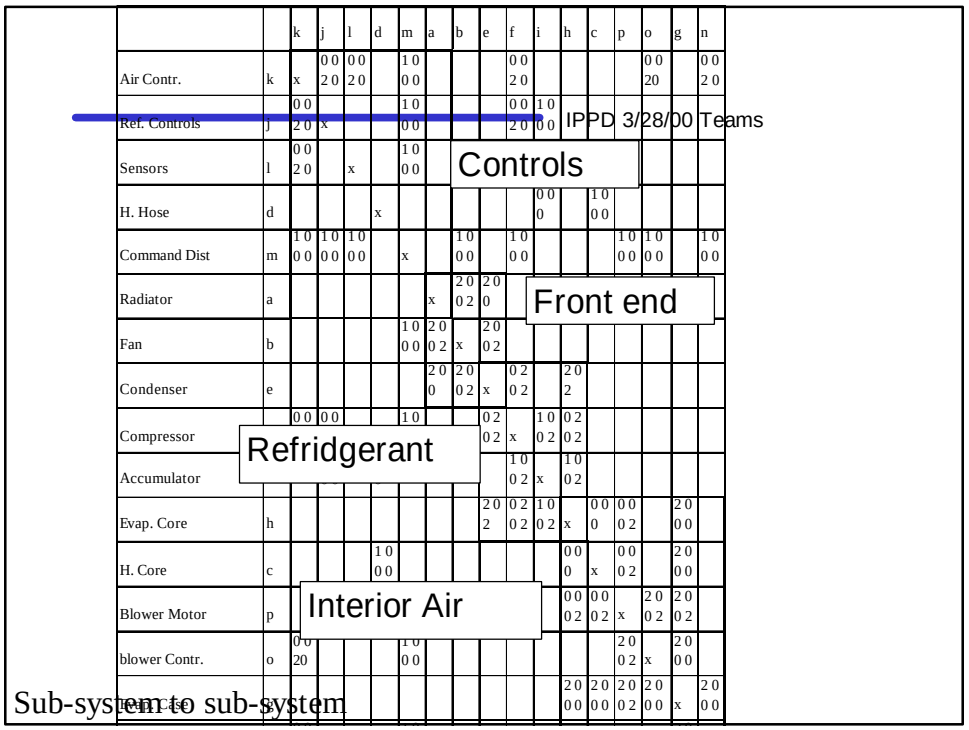
- Spatial - do the parts have geometric interactions
- Energy - do the parts share energy or not want to share energy (i.e., thermal etc)
- Information - signals (i.e., EMF
- Materials - fluid flows etc.

Sub-system to sub-system



		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
Radiator	a	x	202			200											
Fan	b	202	x			202								100			
H. Core	c			x	100			200	000								002
H. Hose	d			100	x					000							
Condenser	e	200	202			x	202		202								
Compressor	f					202	x		202	102	020	020		100			
Evap. Case	g			200				x	200						200	200	202
Evap. Core	h			000		202	202	200	x	102							002
Accumulator	i				000		102		102	x	100						
Ref. Controls	j						002			100	x	020		100			
Air Contr.	k						002				020	x	020	100	002	0020	
Sensors	l											020	x	100			
Command Dist	m		100				100				100	100	100	x	100	100	100
Actuators	n							200				020		100	x		
Blower Motor	p							200				020		100		x	202



		k	j	l	d	m	a	b	e	f	i	h	c	p	o	g	n
Air Contr.	k	x	020	020		100				020					020		020
Ref. Controls	j	020	x			100				020	100						
Sensors	l	020		x		100											
H. Hose	d				x						000		100				
Command Dist	m	1000	1000	1000		x		100		100				1000	1000		1000
Radiator	a						x	202	200								
Fan	b					100	202	x	202								
Condenser	e						200	202	x	202		202					
Compressor		000	000			10			020	x	102	020					
Accumulator										102	x	102					
Evap. Core	h								202	020	102	x	000	002		200	
H. Core	c				100							000	x	002		200	
Blower Motor	p											002	002	x	202	202	
blower Contr.	o	0020				100								2002	x	200	
Evap. Case	g											2000	2000	2002	2000	x	2000

Sub-system to process interactions

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- Upstream/downstream interactions
- I.e., Manufacturing/ DFM analyses
- Ensure that the global optimum is achieved
- Difficult because
  - incentives are different
  - time scales are different
  - language/methods are different
- Subject of DFM lecture later in class

Three types of communication

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- Coordination
  - technical information transfer
  - task coordination
- Knowledge
  - consultation
  - instruction
- Inspiration
  - motivation
  - managerial affirmation

Morelli, et al. “Predicting technical communication in product dev. Organizations”

Team dilemma

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- No clear evidence that cross-functional teams actually improve productivity
  - hard to measure differences
  - no control case
- People know/think it is the “right” thing to do.

Diversity in cross-functional teams

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- Diversity
  - increases internal conflict
  - reduces innovation, performance, etc
  - *but*, increases the teams ability to communicate with the outside world
- Companies need to have diversity in their teams to enable higher quality
- To overcome conflict
  - Training and facilitation
  - Rotation of people through groups
  - Management and evaluation - incentives to perform together
  - Large organizational change

Group vs. Team

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- Group
  - Individual projects with input from other members
  - Incentive structures are external to the group (i.e., functionally oriented)
- Team
  - Team has the deliverables and is responsible for the package
  - Incentive structures are internal to the group

Generalists vs. Integrators

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- Jack of all trades
- Team members have expertise in many areas
- Allows flexibility in team membership
- Dilutes functional strengths
- Specialists with an understanding of how to integrate their areas with others
- Team members are still experts

Matrix organizations

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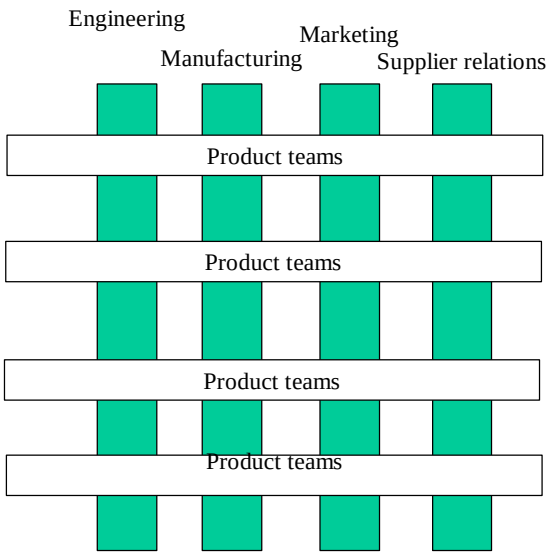
- Each person is a member of a functional and product team
- Functional heads and product heads



Problems with matrix organizations

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- Unclear incentives
  - not sure who your boss is
  - who do you eventually have to satisfy
- Power struggle
  - dual command
- Paralysis of analysis
  - matrix org. ≠ group decision making
  - need a clear leader who makes decisions

Organization types

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- functional teams
- lightweight
- heavyweight
- autonomous

Functional teams

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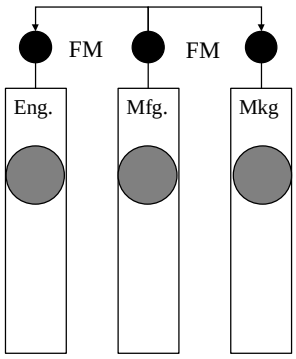
- Process
  - Sequential flow
  - Intermediate meetings to hand off work
- Strengths
  - Strong functional capabilities
  - Clear career path
- Weaknesses
  - System integration is difficult
  - System optimization is difficult



Lightweight teams

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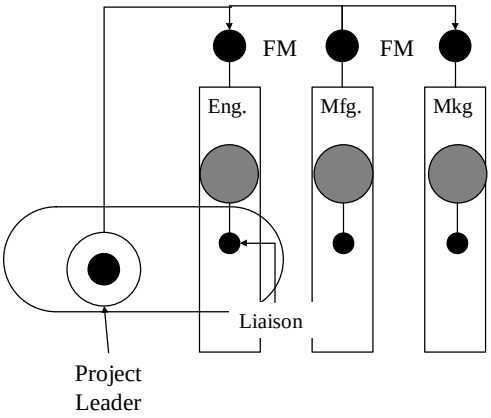
- Process
  - each functional group has a liaison who coordinates the project
  - lead by a lightweight coordinator -- very little status to coordinate
- Strengths
  - same as function plus
  - there is some coordination
- Weaknesses
  - leader has no power



Heavyweight teams

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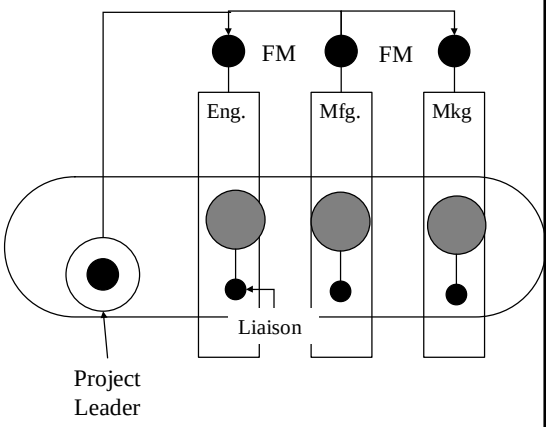
Process
power in project lead

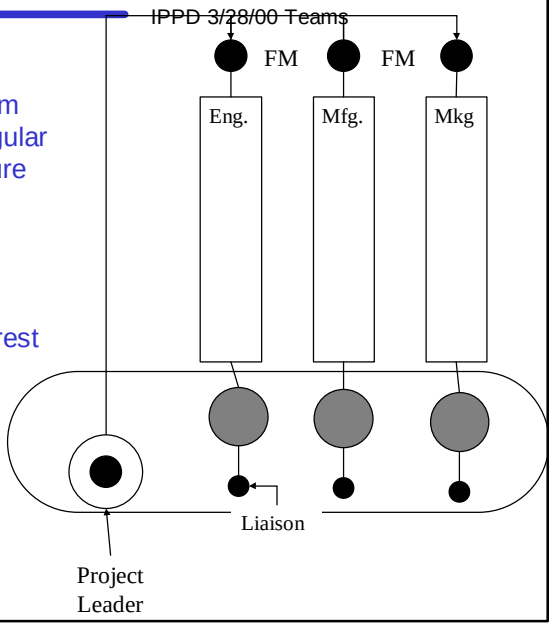
Strengths
cross-coordination

Weaknesses
functional expertise

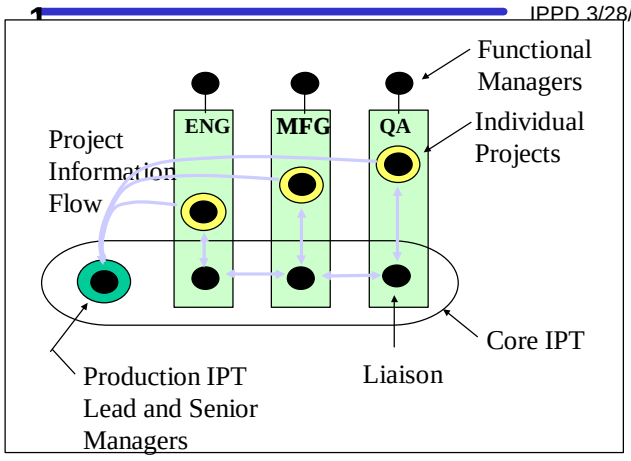


Autonomous teams

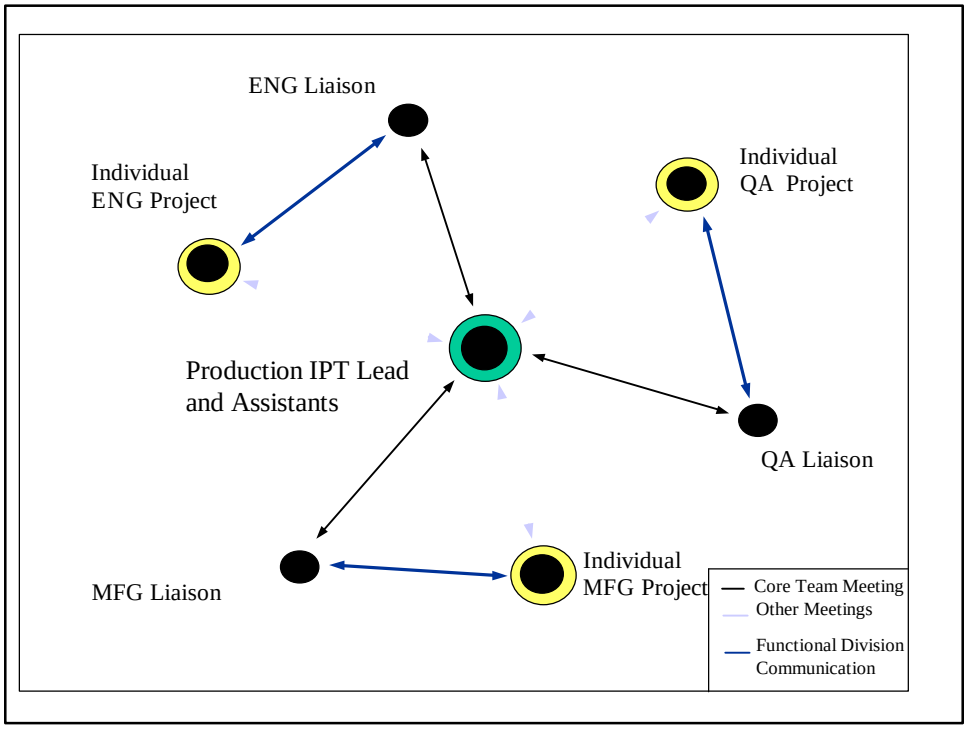
- Process
  - dedicated project team that is outside the regular organizational structure
- Strengths
  - autonomous
- Weaknesses
  - out of touch with the rest of the organization



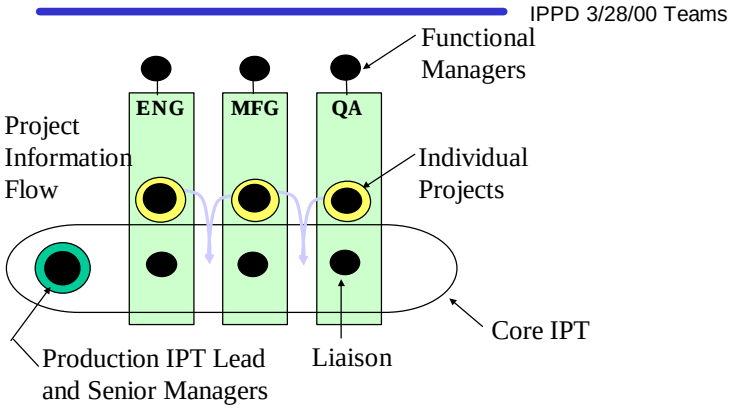
Organizational structures for redesign: Scheme 1



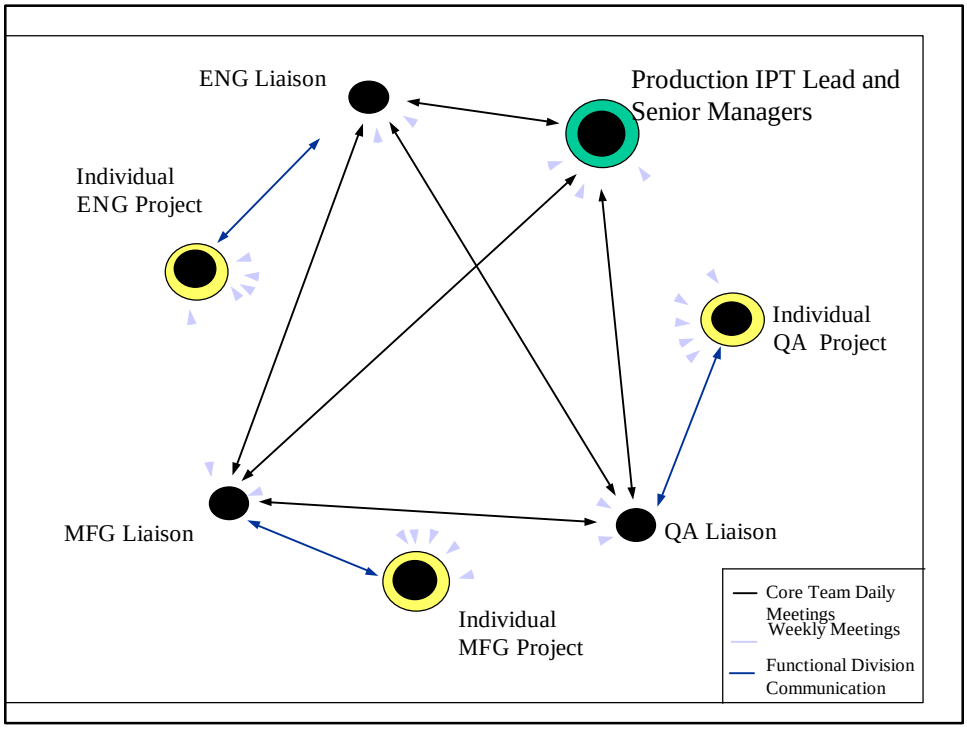
Individual projects developed
Project information given to Lead and assistants

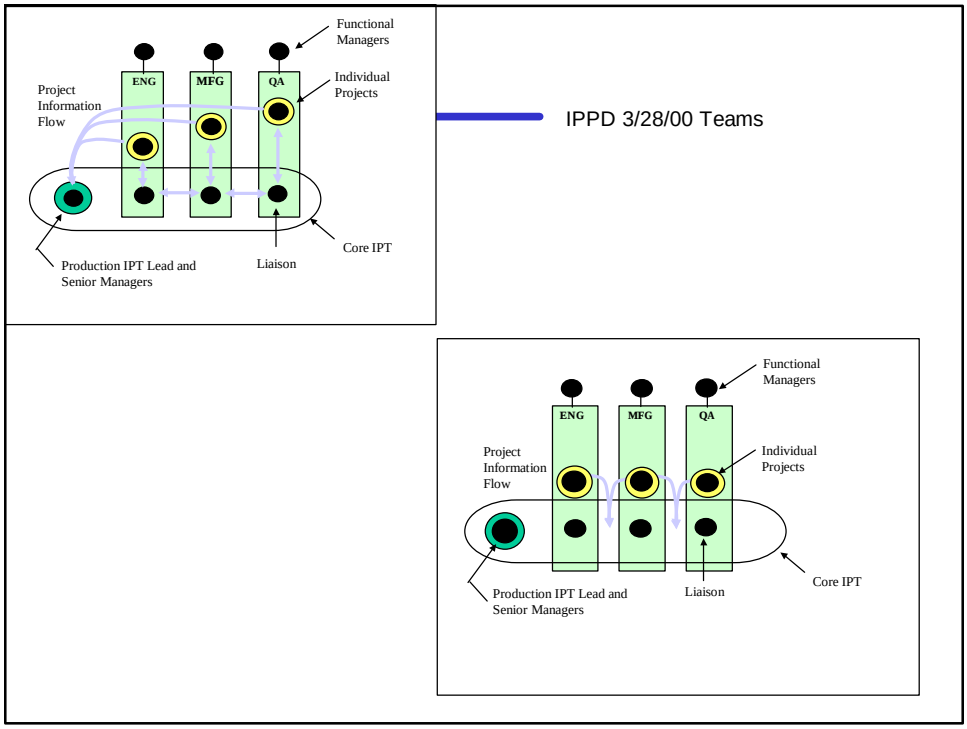


Organizational structures for redesign: Scheme 2



Individual projects in conjunction with production IPT
Project information given to production IPT


ENG Liaison
Production IPT Lead and Senior Managers
Individual ENG Project
Individual QA Project
MFG Liaison
QA Liaison
Individual MFG Project
Core Team Daily Meetings
Weekly Meetings
Functional Division Communication


Functional Managers
ENG
MFG
QA
Individual Projects
Project Information Flow
Core IPT
Production IPT Lead and Senior Managers
Liaison
IPPD 3/28/00 Teams
Functional Managers
ENG
MFG
QA
Individual Projects
Project Information Flow
Core IPT
Production IPT Lead and Senior Managers
Liaison

Japanese vs. US leadership

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- Team leader (shusa) controls all aspects of the car
- has ultimate say
- Team leader is a coordinator who coordinates
- Can be overridden

Leadership responsibilities and characteristics in Japan

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- coordination for many functional areas
- entire life cycle of the product
- concept creation
- specifications, costs, layout and major components
- design
- customer interaction
- negotiate and decide on conflicts
- understand the whole product and process

Thursday

IPPD 3/28/00 Teams

- 1) Present the strategy and plan
- 2) Presentation should focus on the risks and what is your plan to mitigate them
- Tues
  - The Legal Protection of Intellectual Property (HBS #9-898-230)
  - Levin, R., Klevorick, A., Nelson, R., and Winter, S. 1987. "Appropriating the returns from research and development." Brookings Papers on Economic Activity, 3: 783-820.
  - Case: CVD vs. A.S. Markham Corporation (HBS # 9-388-042)