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Customer Success Is Our Mission

Synergy Beyond Expectations – Integrating Engineering Processes

NDIA – CMMI Technology Conference & User Group

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November 17, 2004

Our Organization
Raytheon Fullerton Operations (RFO)

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Network Centric Systems, Fullerton, CA

- Achieved CMMI SW Level 5 in December 2003
  - Achieved SW-CMM Level 5 twice before: 9/2002 and 10/1998
- Achieved CMMI SE Level 3 in December 2003
  - CMMI SE Level 2 in 10/2002

Background – Past Achievements and 2003 Plans

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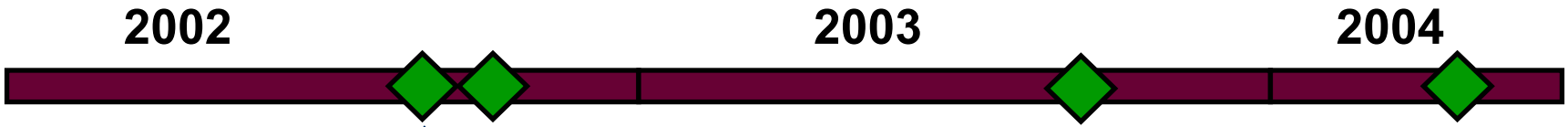

Achievements:

- **SW-CMM Level 5 in September 2002**
- **CMMI SE Level 2 in October 2002**

Planned:

SCAMPI CMMI Class B 3rd Qtr 2003

SCAMPI Class A mid-2004
CMMI SE/SW Level 3

Background – Management Changes to 2003 Plans

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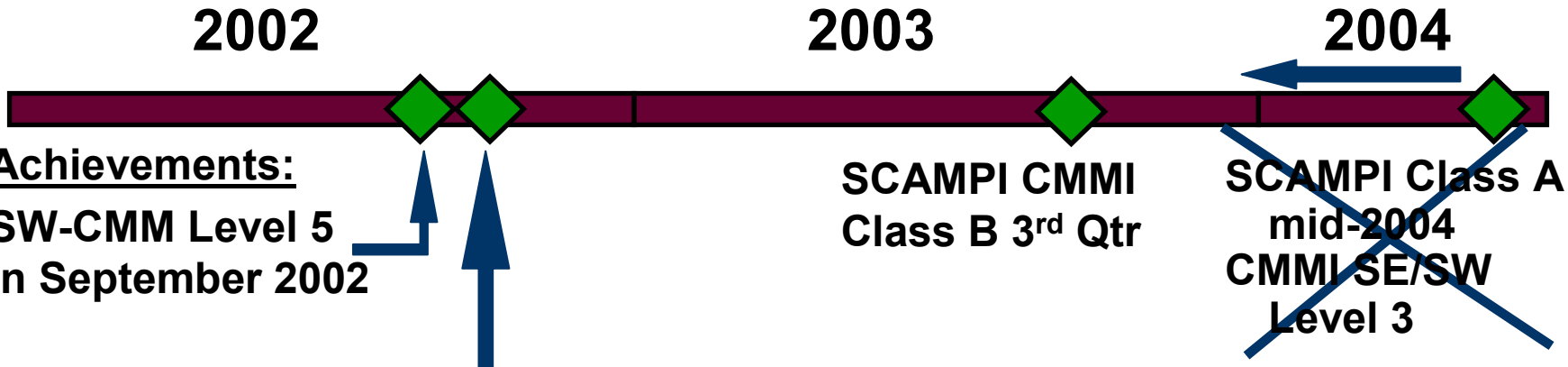

Faster & cheaper!

Management wants SW Level 5 & SE Level 3 in 2003

- Keep up with Competitors
- Budget reduced by 18%
- Higher SW maturity level
- Shorter schedule

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Starting Point => RFO Directives

Section	Functional Area
0	General Management
1	Facilities
2	Law
3	Human Resources
4	Finance
5	**Engineering**
6	**Configuration/Data Management**
7	Reserved
8	**Supply Chain Management**
9	Property
10	Contracts
11	Security
12	Business Development
13	Reserved
14	Reserved
15	Reserved
16	**Program Management**
17	Reserved
18	Information Technology
19	**Quality Assurance**

Initial Approach
Use Existing Directive – Parallel Structures

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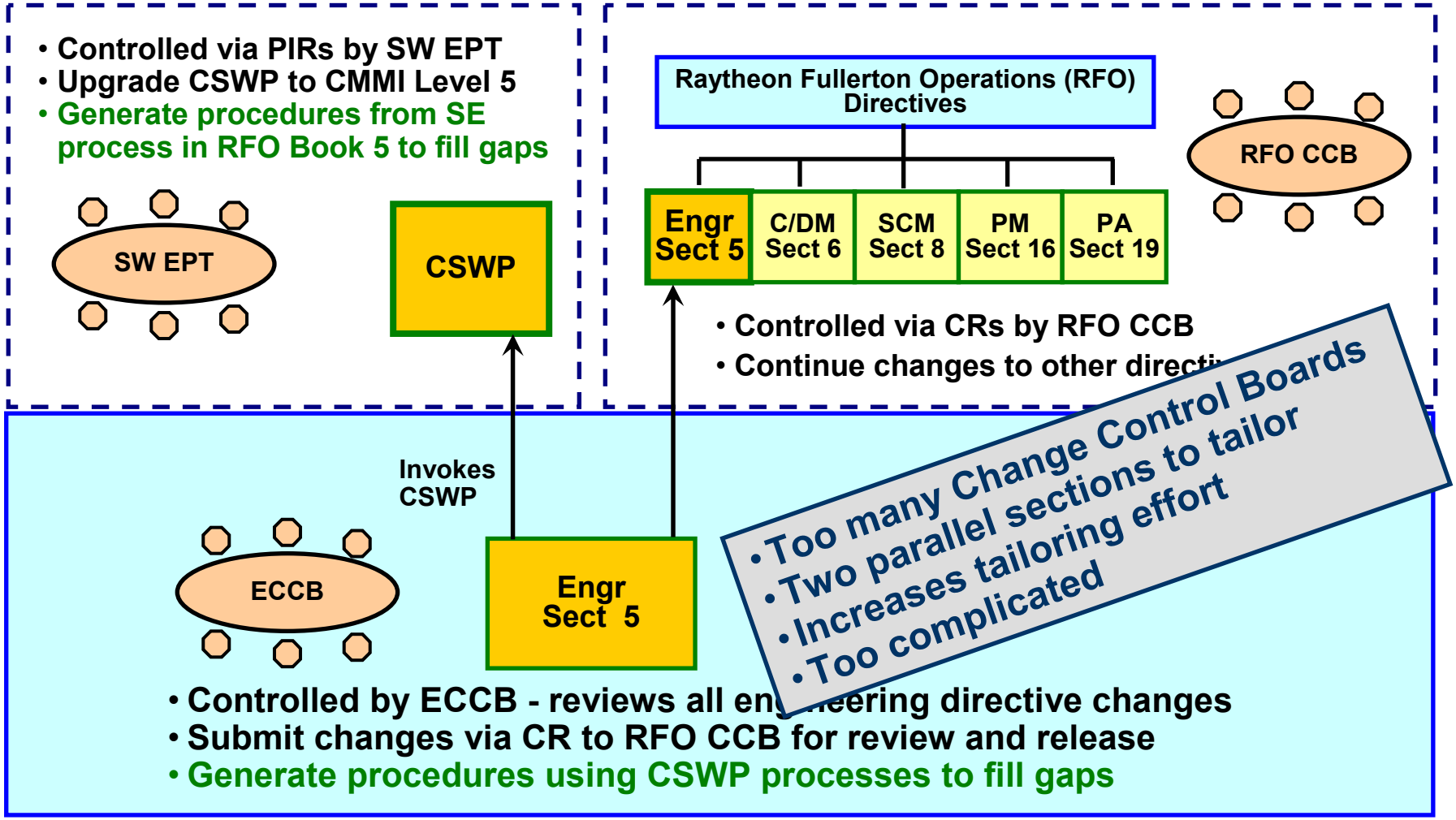

ECCB – Engr Change Control Board
PIR – Process Improvement Request
SW EPT – Software Engr Process Team

Burning Platform - Need to Re-architect Directives

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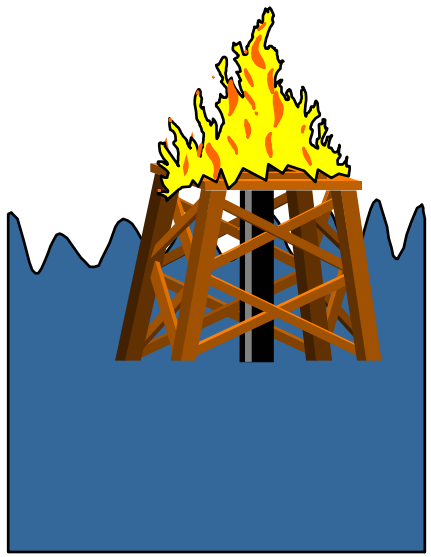
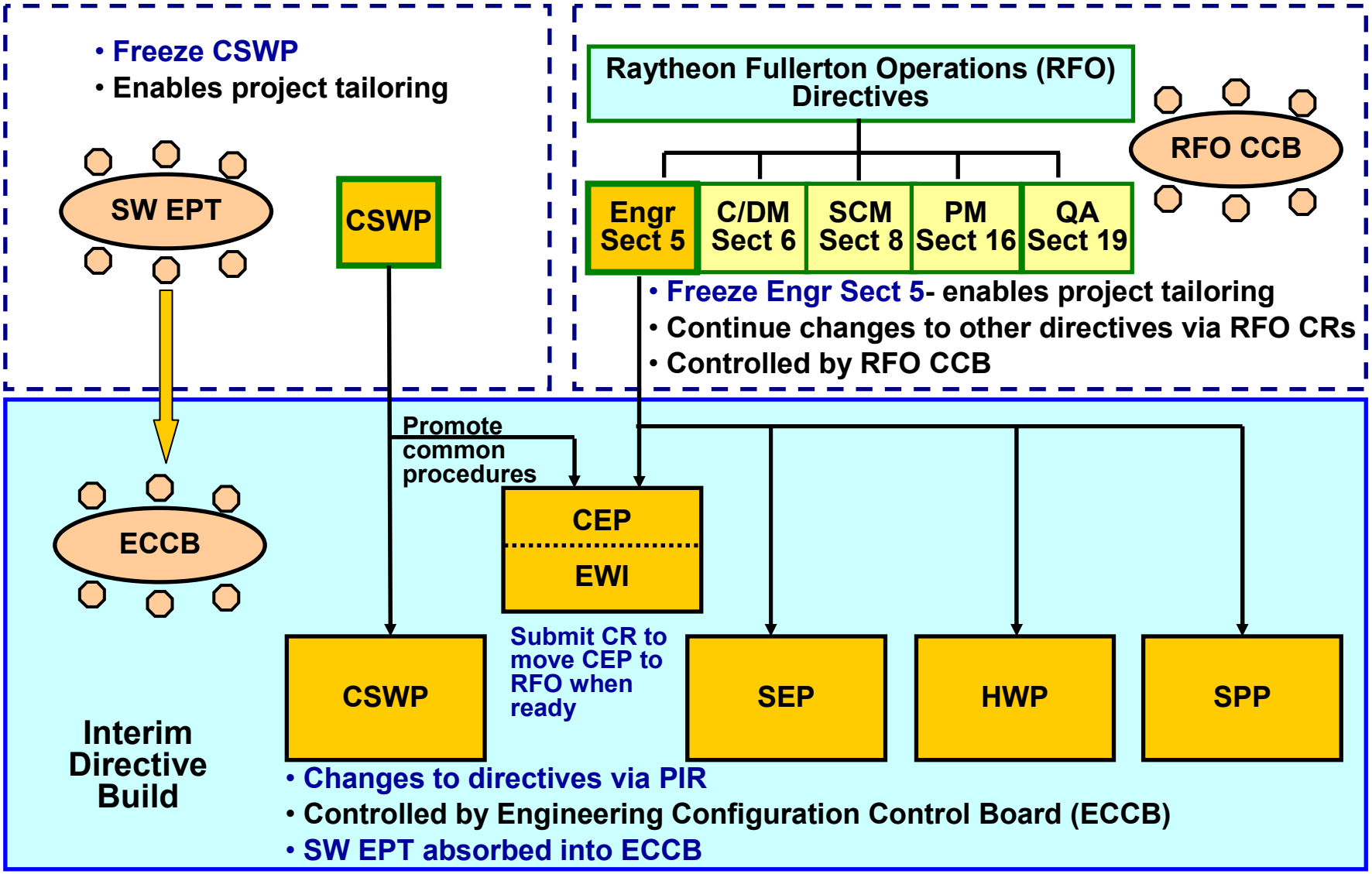
- Cannot add procedures in logical and related groupings - current organization does not support it
- Too many CCBs
  - RFO CCB - RFO Directives
  - ECCB - RFO Engineering Directives
  - SW EPT - CSWPs
- Parallel approach confusing and complicating
  - Common procedures in CSWP, RFO and SE …. confusing
  - Confusing for Process Engineers & Projects
  - If directive structure is confusing, tailoring will be confusing and take extra effort

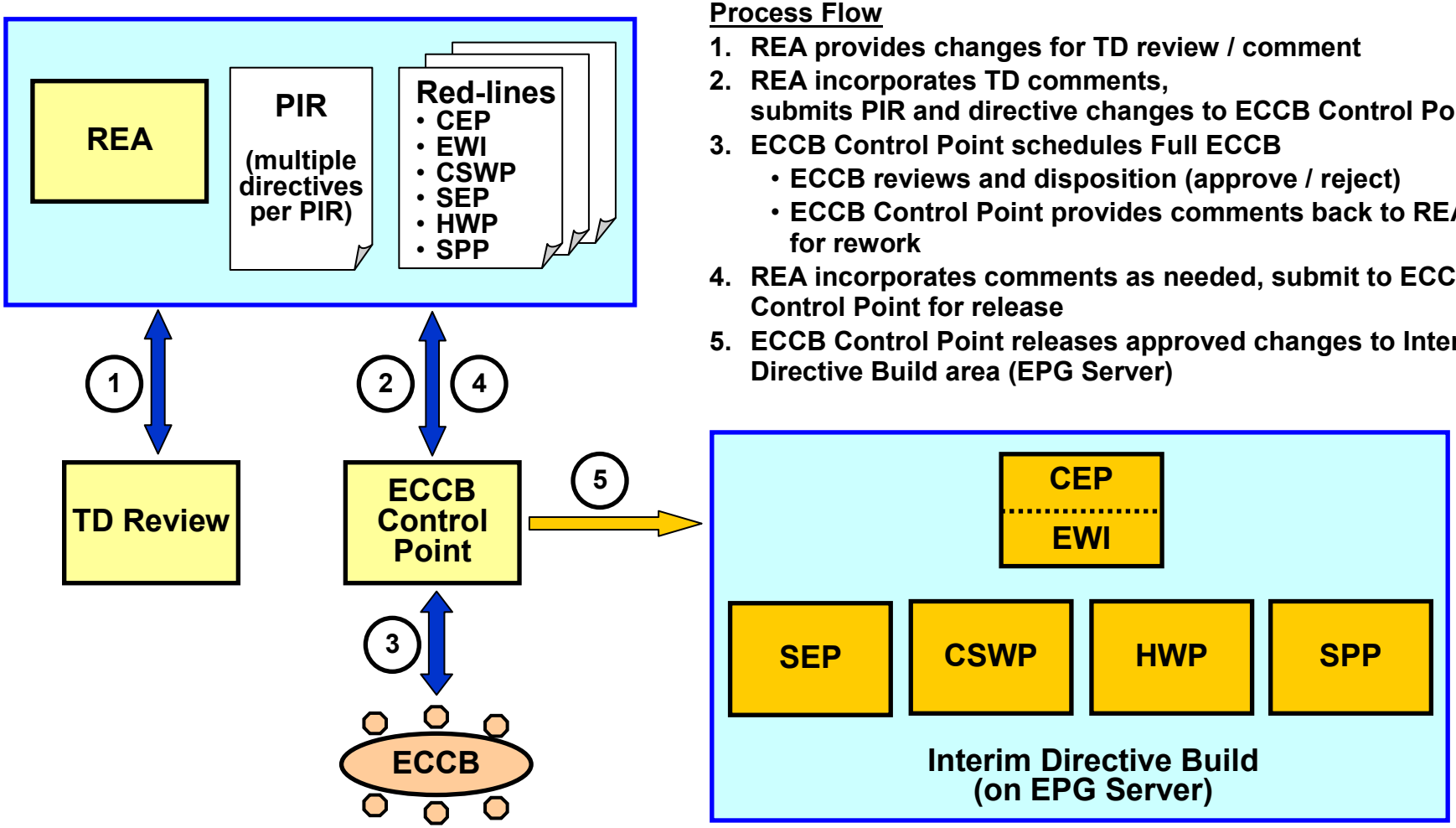


Defined alternate solutions and applied DAR process

Common Engineering Process (CEP) Architecture - Transition State



Engineering Processes
Transition State - Change Flow



Process Flow

1. REA provides changes for TD review / comment
2. REA incorporates TD comments, submits PIR and directive changes to ECCB Control Point
3. ECCB Control Point schedules Full ECCB
   - ECCB reviews and disposition (approve / reject)
   - ECCB Control Point provides comments back to REA for rework
4. REA incorporates comments as needed, submit to ECCB Control Point for release
5. ECCB Control Point releases approved changes to Interim Directive Build area (EPG Server)

Changes to directives via PIR & controlled by ECCB

C/DM, SCM, PM, and PA Processes Transition State - Change Flow (CMMI related changes)

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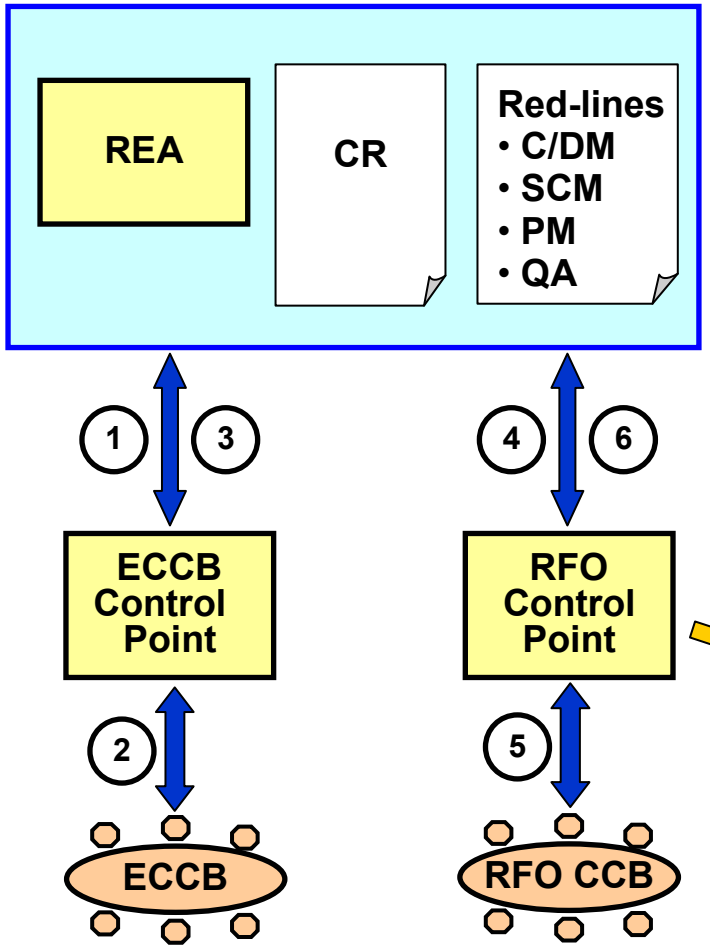
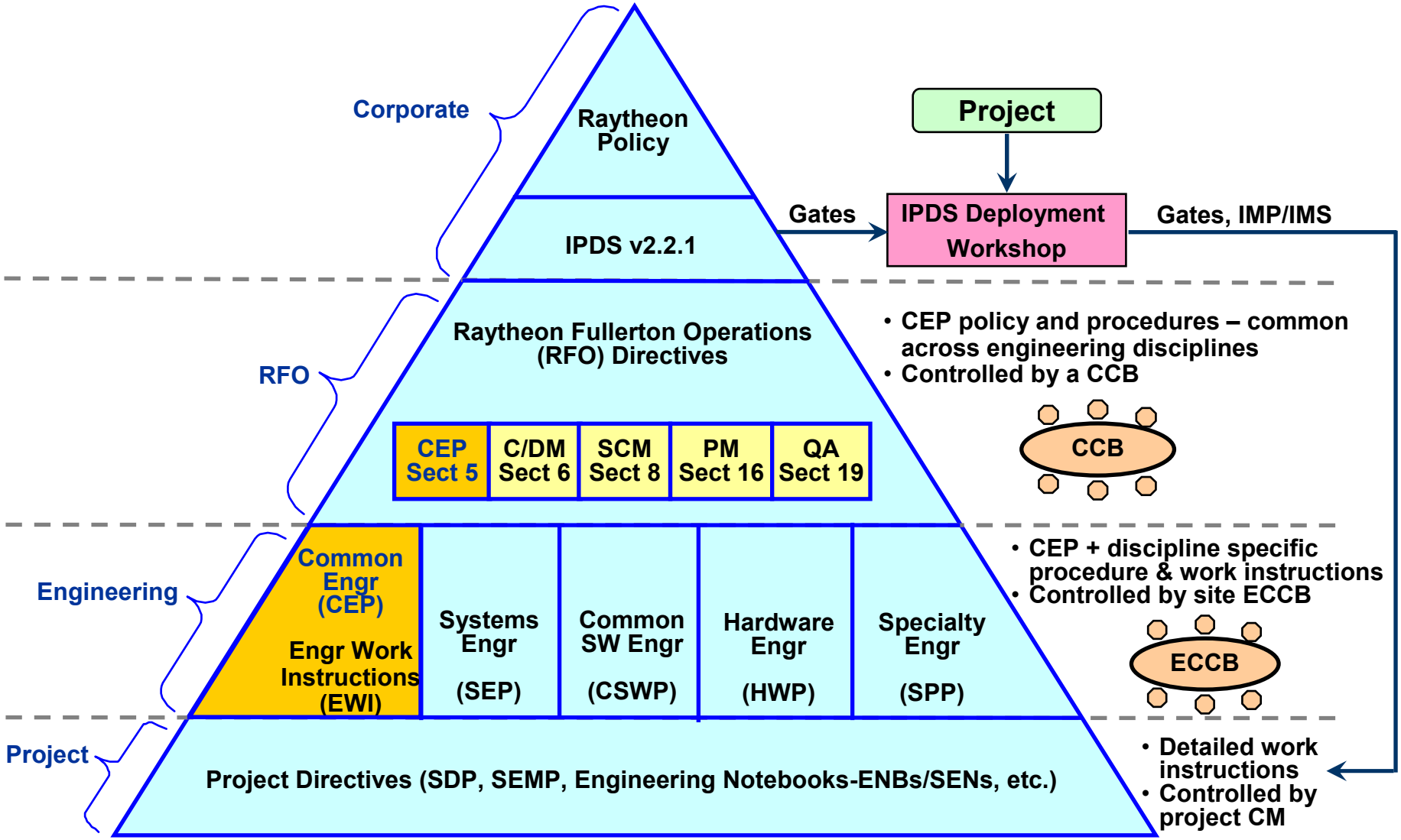


Process Flow

1. REA submits CR & directive changes to ECCB Control Point
2. ECCB Control Point schedules Full ECCB
   - ECCB reviews and disposition (approve / reject)
   - ECCB Control Point provides comments back to REA for rework
3. REA incorporates comments as needed, submit to RFO Control Point
4. RFO Control Point coordinates RFO CCB review
5. RFO CCB reviews, dispositions, and comments
6. REA incorporates comments as needed, submit to RFO Control Point
7. Release approved changes to RFO directive web site

Continue changes to other directives via RFO CRs Controlled by RFO CCB

Common Engineering Process (CEP) Architecture – Final State in 2003



What are the CEP, EWI, SEP, CSWP, SPP and HWP?

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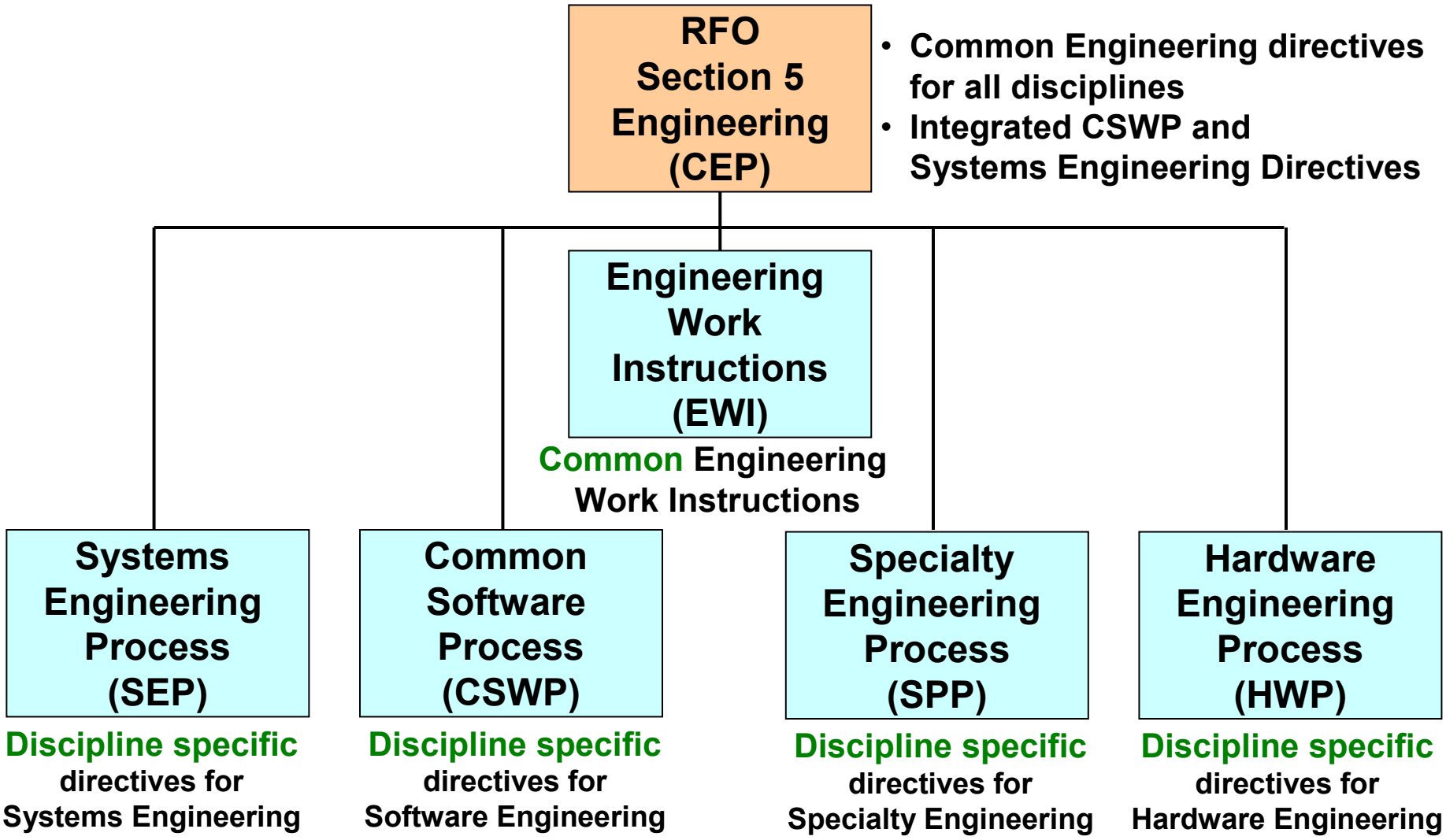

CEP Architecture

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RFO Section 5 (CEP)

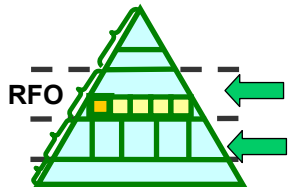
RFO Section 6 – Configuration & Data Mgmt

RFO Section 8 – Supply Chain Management

RFO Section 16 – Program Management

RFO Section 19 – Quality Assurance

Engineering Related Organizational Directives



5-3 Inter-org Coordination

Engineering Bulletins

5-1 Directive Management

5-2 Process & Technology Improvement

5-4 Employee Development

5-5 Project Planning

5-6 Measurement & Project Control

5-7 General Engineering

(CEP) EWI Engr. Work Instructions

Organizational Directives

Project Directives

Applies to Org & Project

SEP Systems Engineering

CSWP Software Engineering

HWP Hardware Engineering

SPP Specialty Engineering

Forms, Templates, Guidelines, Checklists

Discipline Specific Engineering Directives

Benefits of Integrating Engineering Processes (1)

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Engineering Directive Overview

	Total	Mod RFO	Mod CSWP	Mod Other	New	Promote => RFO	No Change
Total CEP Procedures	**48**	38	22	3	14		
Total CEP WI, Prod Stds, Templates, Non-Dir Docs	**47**	7	35	5	13		
Total CSWP Practices and Procedures	**158**		121			63	48
Total SEP procedures and Wis	**7**	4	0	0	3		
Total SPP procedures and WIs	**5**	5	0	0	0		
Total HWP procedures and WIs	**10**	10	0	0	0		
TOTAL	**275**	**64**	**178**	**8**	**30**	**63**	**48**

- **Common engineering processes enabled (42 MMs savings):**
  - Decreased total number of directives from parallel structure
  - More common process than unique
  - Minimized need to create discipline specific procedures for SE and SW
  - Decreased the need to create new procedures
  - Modification of Common SW Processes is higher due to the use of pointers to the new common directives
- **Reuse of SE directives not included in above numbers**

Reduced Cost & Schedule - Met Management Goal

Benefits of Integrating Engineering Processes (2)

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- **Opportunity Realized in 2003 - savings of $259K**

  - Appraisal planning, preparation and conduct efforts have been worked jointly with good synergism
  - Joint SE/SW peer reviews of Gap analysis and joint affinitization of gaps reduced the effort of developing the Gap analysis worksheets
  - SE & SW Synergy resulted in less effort than planned for preparation of training materials due to joint training packages
  - **FUTURE:** Potential additional synergy in remaining training conduct and project plans and procedures updates

- **2004 and beyond**
  - Directive maintenance costs – 1 set of common directive rather than multiple directives for each discipline
  - Training
  - Projects plans and procedures
  - Appraisal costs

SCAMPI Achievements
Rating Profile - Software

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PA	GP 2.1	GP 3.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 3.2	GP 2.9	GP 2.10							SP							
REQM													1.1	1.2	1.3	1.4	1.5									
PP													1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.3
PMC													1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3				
SAM													1.1	1.2	1.3	2.1	2.2	2.3	2.4							
M&A													1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4						
PPQA													1.1	1.2	2.1	2.2										
CM													1.1	1.2	1.3	2.1	2.2	3.1	3.2							
RD													1.1	1.2	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5				
TS													1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2					
PI													1.1	1.2	1.3	2.1	2.2	3.1	3.2	3.3	3.4					
VER													1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2						
VAL													1.1	1.2	1.3	2.1	2.2									
OPF													1.1	1.2	1.3	2.1	2.2	2.3	2.4							
OPD													1.1	1.2	1.3	1.4	1.5									
OT													1.1	1.2	1.3	1.4	2.1	2.2	2.3							
IPM													1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3						
RSKM													1.1	1.2	1.3	2.1	2.2	3.1	3.2							
DAR													1.1	1.2	1.3	1.4	1.5	1.6								
OPP													1.1	1.2	1.3	1.4	1.5									
QPM													1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4						
OID													1.1	1.2	1.3	1.4	2.1	2.2	2.3							
CAR													1.1	1.2	2.1	2.2	2.3									

SE/SW Rating Legend

NAME	COLOR
Fully Implemented	
Largely Implemented	
Partially Implemented	
Not Implemented	

SCAMPI Achievements
Rating Profile - Systems

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PA	GP 2.1	GP 3.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 3.2	GP 2.9	GP 2.10							SP								
REQM													1.1	1.2	1.3	1.4	1.5										
PP													1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.3	
PMC													1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3					
SAM													1.1	1.2	1.3	2.1	2.2	2.3	2.4								
M&A													1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4							
PPQA													1.1	1.2	2.1	2.2											
CM													1.1	1.2	1.3	2.1	2.2	3.1	3.2								
RD													1.1	1.2	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5					
TS													1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2						
PI													1.1	1.2	1.3	2.1	2.2	3.1	3.2	3.3	3.4						
VER													1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2							
VAL													1.1	1.2	1.3	2.1	2.2										
OPF													1.1	1.2	1.3	2.1	2.2	2.3	2.4								
OPD													1.1	1.2	1.3	1.4	1.5										
OT													1.1	1.2	1.3	1.4	2.1	2.2	2.3								
IPM													1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3							
RSKM													1.1	1.2	1.3	2.1	2.2	3.1	3.2								
DAR													1.1	1.2	1.3	1.4	1.5	1.6									
OPP													1.1	1.2	1.3	1.4	1.5										
QPM													1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4							
OID													1.1	1.2	1.3	1.4	2.1	2.2	2.3								
CAR													1.1	1.2	2.1	2.2	2.3										

SE/SW Rating Legend

NAME	COLOR
Fully Implemented	
Largely Implemented	
Partially Implemented	
Not Implemented	

We exceeded our goal of CMMI SE level 3, we were so close to achieving the level 5!

Results of leveraging from engineering disciplines with higher maturity

Enablers to an Integrated Common Engineering Directive System

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- A single EPG to manage Engineering processes
- On projects, engineering leadership headed by a program engineer (PE) responsible for all engineering activities
- All engineering personnel under one Engineering Director at the site vs. separate SE, HW and SW functional organizations
- Strong sponsorship from senior management regarding the “I” in CMMI (not just engineering but enterprise level as well)
- An integrated Quality Assurance organization for all engineering activities
- SE, HW, Specialty and SW use the same process model, CMMI
- Experienced engineering process personnel, with experience on projects at the site
- Utilize EPG liaisons to projects
  - Both SE & SW (HW as required) to provide depth of knowledge and greater level of support
  - Have Team-of-Four meetings to assist process deployment & measures

Lessons Learned

- Process management needs to be normalized across Engineering
- Once started, synergy exceeded expectations, building off each previous one
- Benefit of cross-training Engineering processes
- CMMI training is crucial to success
- CMMI Appraisal experience significantly contributed to the process improvement effort
- R6s baseline was an excellent forum for team building & establishing a practical tactical approach to achieving aggressive strategic objectives