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Life Cycle Considerations of the CMMI Model

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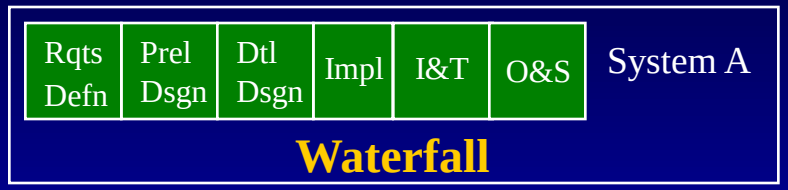
Presentation Purpose - Life Cycle What?

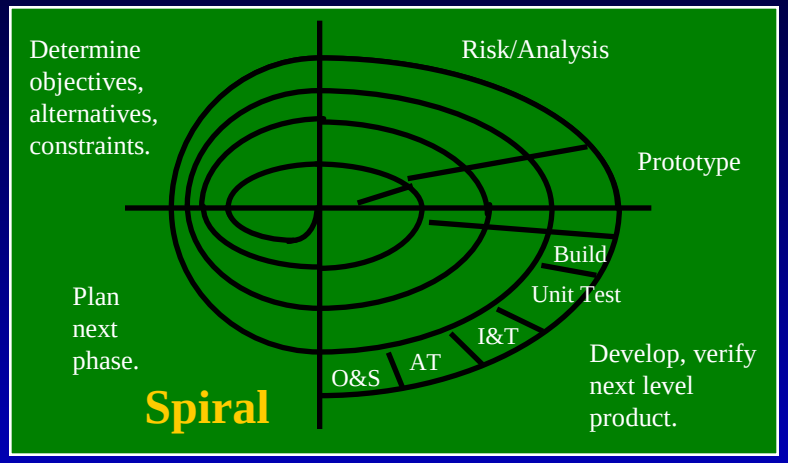
- Life Cycle Models
- Development Life Cycle
- System Life Cycle
- Product Life Cycle
- Program/Project Life Cycle
- Acquisition Life Cycle
- Life Cycle Phases
- Life Cycle Stages
- [Component and Product-related] Life Cycle Processes

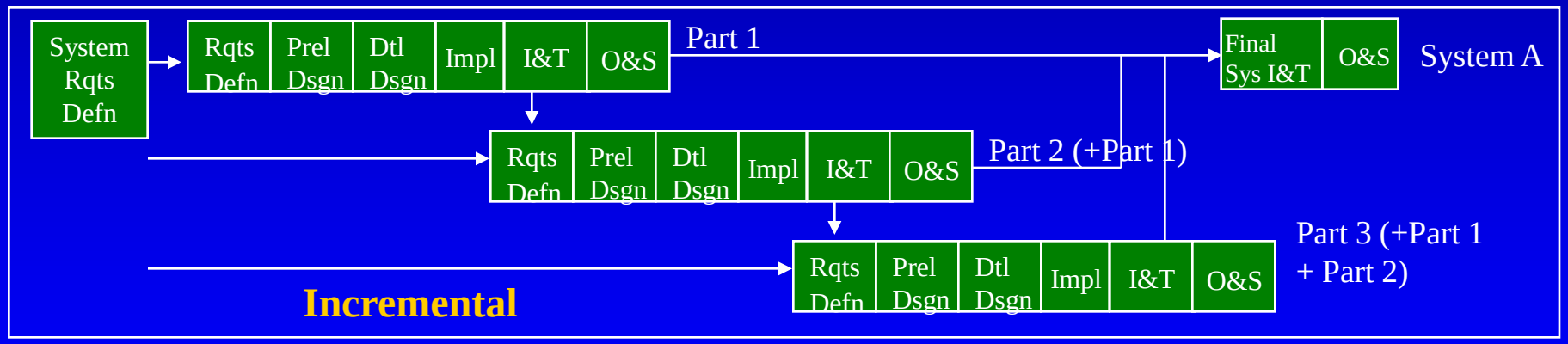
Model Life Cycle Content

- With the move from CMM to CMMI there has been a change in scope in handling life cycle needs
  - SPP-AC-5, A software life cycle with predefined stages of manageable size is identified or defined.
  - OPD-AC-3, Descriptions of software life cycles that are approved for use by the projects are documented and maintained.
  - SQM-AC-1, The project's quantitative quality goals for the software products are defined, monitored, and revised throughout the software life cycle.
- Elaborate on what are the considerations when selecting the project's life cycle model
  - PP SP 1.3, Define the project life-cycle phases upon which to scope the planning effort.
  - RD SP 1.1, Elicit stakeholder needs, expectations, constraints, and interfaces for all phases of the product life cycle.
  - OPD SP 1.2, Establish and maintain descriptions of the life-cycle models approved for use in the organization.
  - IPM SP 1.1, Establish the Project's Defined Process. Subpractice 1, Select a life-cycle model from those available from the organizational process assets.
  - IPM SP 2.1, Identify and document the risks. Subpractice 1, Identify the risks associated with cost, schedule, and performance in all appropriate product life-cycle phases.
  - QPM SP 1.1, Establish and maintain the project's quality and process-performance objectives. Subpractice 5, Derive interim objectives for each life-cycle phase, as appropriate, to monitor progress toward achieving the project's objectives.
  - QPM SP 1.4, Monitor the project to determine whether the project's objectives for quality and process performance will be satisfied, and identify corrective action as appropriate. Subpractice 2, Periodically review the actual results achieved against the established interim objectives for each phase of the project life cycle to appraise progress toward achieving the project's quality and process-performance objectives.

Life Cycle Models







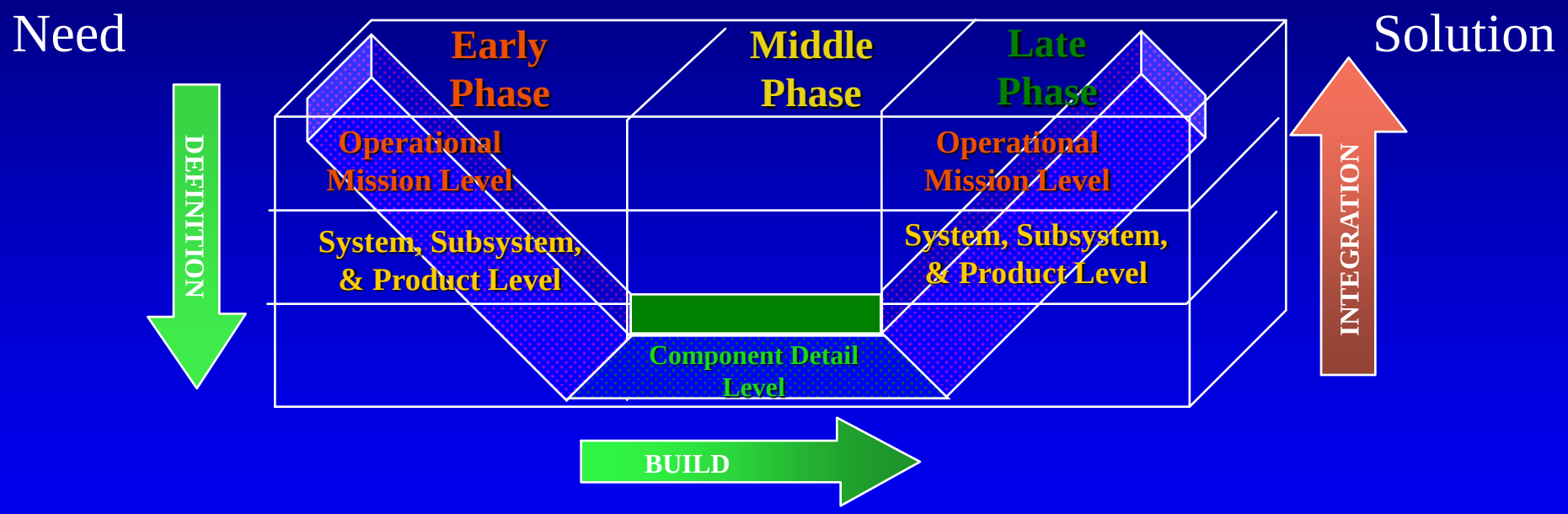
One description of a product life cycle may not be adequate. Therefore, the organization may define a set of approved product life-cycle models.

LCM Selection

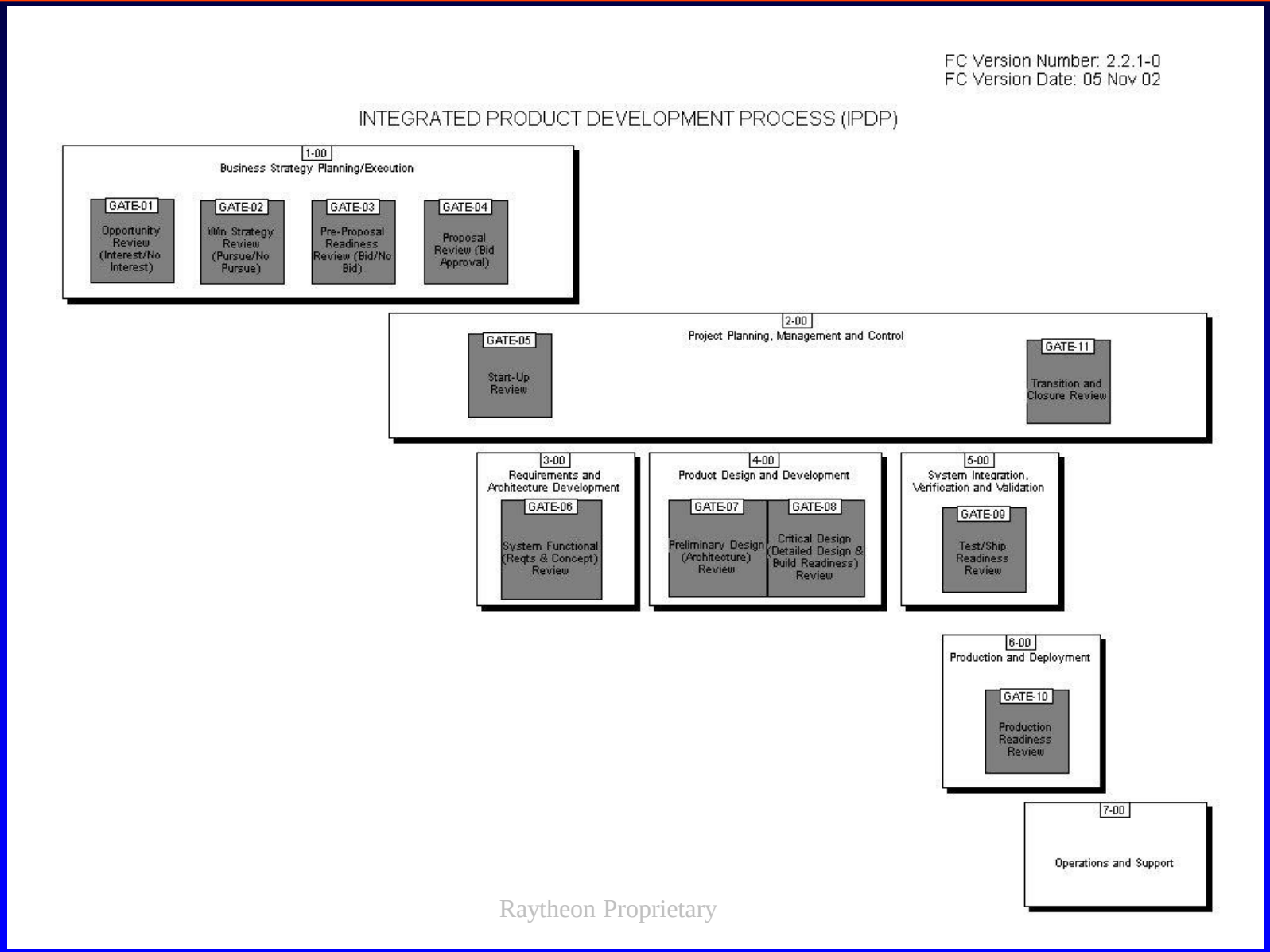
Characteristic	Criteria	W	I	E	S
Changes to a Fielded / Heritage System	Small to moderate changes to heritage system	√			√
	Large changes to heritage system		√	√	
Frequency of Anticipated Changes (Requirement Volatility)	Low	√	√	√	√
	Medium		√	√	√
	High			√	
Anticipated Magnitude of Requirement Changes (Scope/Depth of System)	Low	√	√	√	√
	Medium		√	√	√
	High			√	
Technology Insertion	Existing technology	√	√	√	√
	New technology		√	√	√
	Future technology (within project lifetime)		√	√	
Anticipate Scope of Requirement Change (Breadth)	Small	√	√	√	√
	Medium	√	√	√	√
	Large		√	√	
What is the Ability to Mitigate Risk As a Life-Cycle Model?	Low	√			√
	Moderate	√	√		√
	High		√	√	
Requirements Maturity (#TBDs or #TBRs), 1 - (#TBDs+ TBRs / #TOTAL Reqs)	Mature	√	√	√	√
	Moderately Mature		√	√	√
	Immature		√	√	

Note: Lack of a "√" means that the LCM is not as well-suited; it can still be used, however.

Basic View of the Development Life Cycle



System or Product Life Cycle Process



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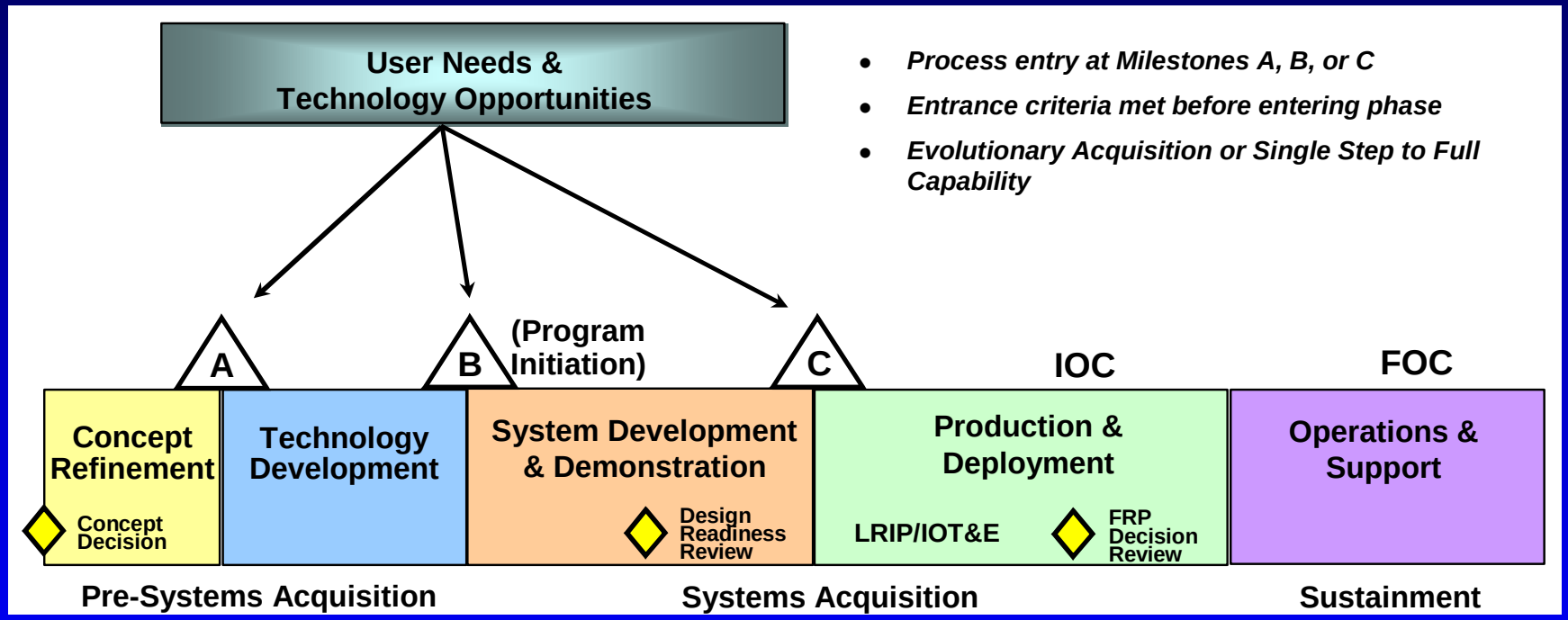
DoD 5000.2 Acquisition Life Cycle



Be careful of the context of the discussion. Program phases and the evolutionary approach (LCM), may be context sensitive.

ISO/IEC 15288 Example of Stages, Their Objectives and Major Decision Gates

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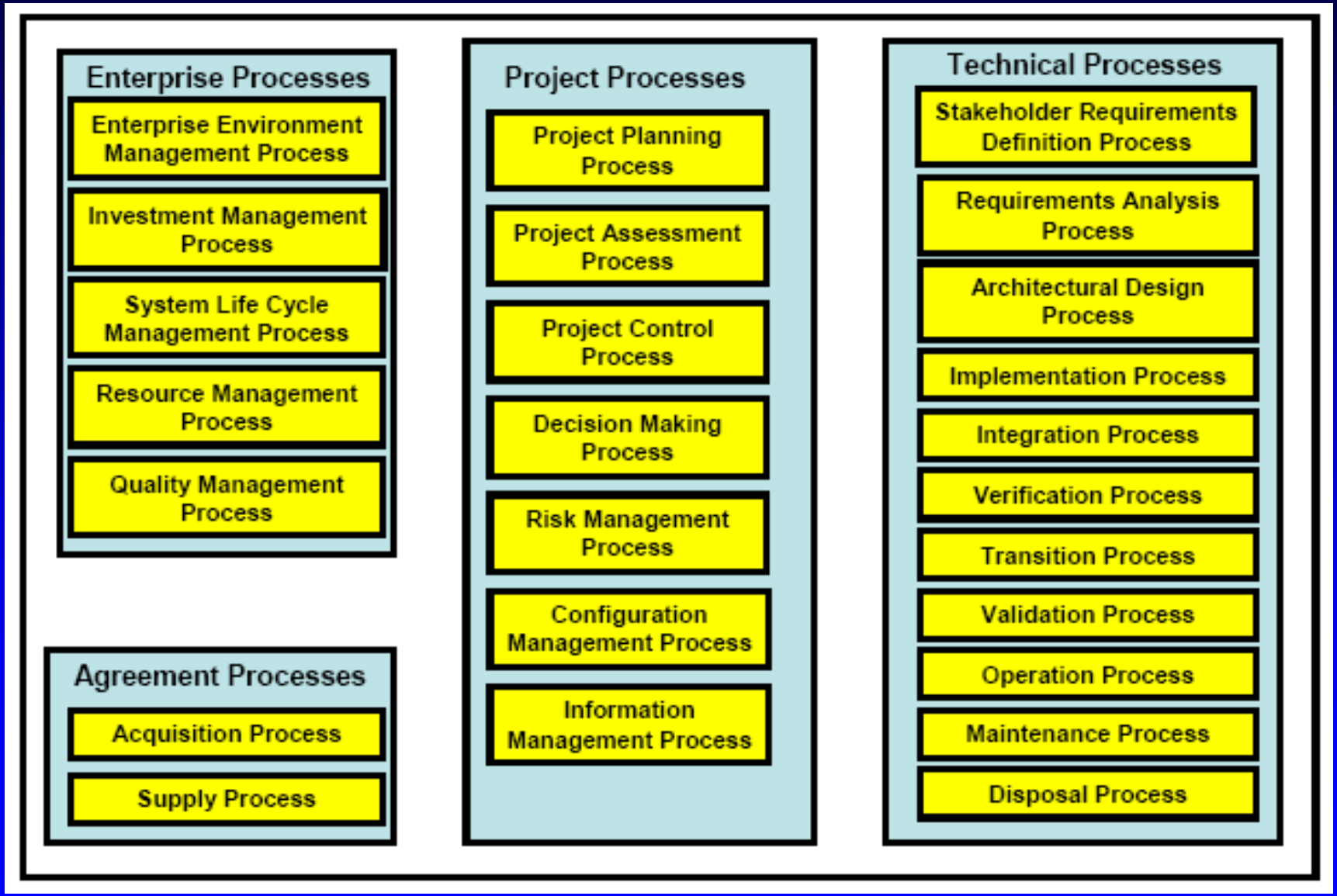
LIFE CYCLE STAGES	PURPOSE	DECISION GATES
CONCEPT	Identify stakeholders' needs Explore concepts Propose feasible solutions	Decision Options: - Execute next stage - Continue this stage - Go to previous stage - Hold project activity - Terminate project
DEVELOPMENT	Refine system requirements Create solution description Build system Verify and validate system	
PRODUCTION	Mass produce system Inspect and test	
UTILIZATION	Operate system to satisfy users' needs	
SUPPORT	Provide sustained system capability	
RETIREMENT	Store, archive or dispose the system	

15288 Life Cycle Processes



Mapping CMMI Processes Over the Product Life Cycle

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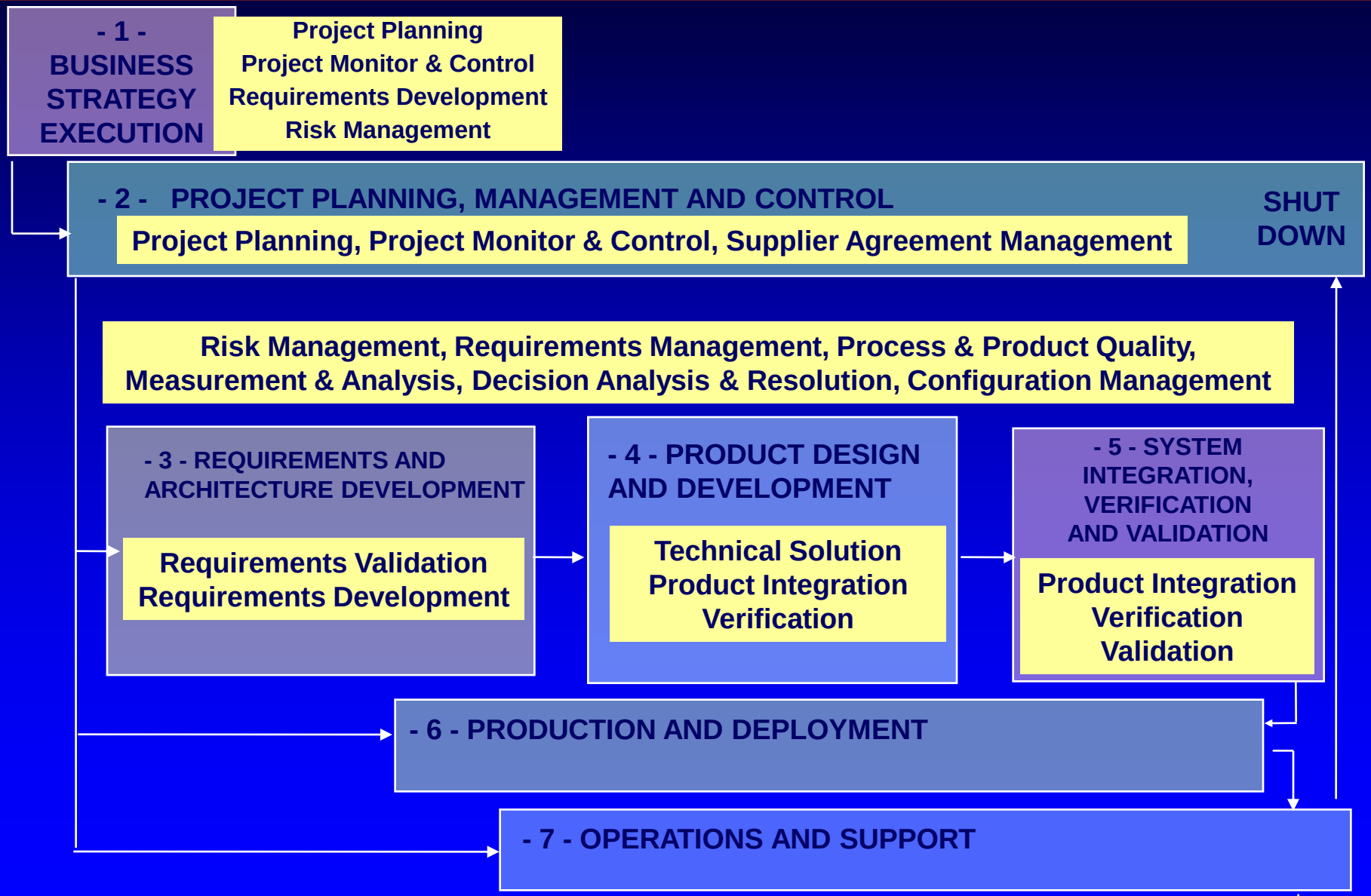

Summary – CMMI Considerations

- CMMI tailoring guidelines cover (1) selecting standard process(es), (2) selecting an approved life-cycle model(s), and (3) tailoring the selected standard process(es) and life-cycle model(s) to fit project needs
- A staged system/product life cycle model, together with a set of organizationally defined development life cycle models, are used to define the overall project's life cycle process and its project plans
- The tailored project/program life cycle process is developed as a part of project planning, whereas the component and product-related life cycle processes are described as developed as work products of the Requirements Development and Technical Solution related program processes

Project Split into Multiple Phases and Spirals

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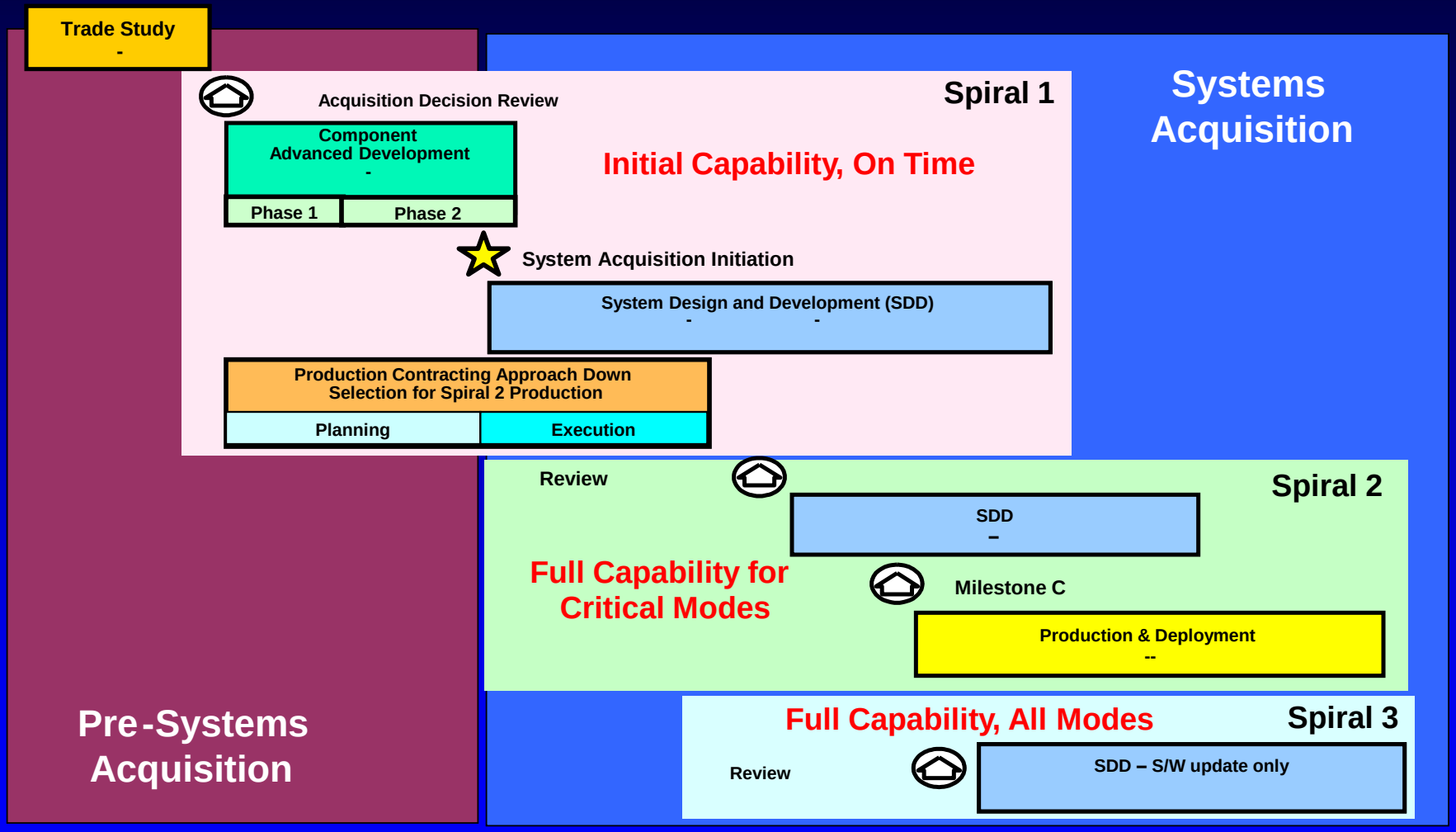

CMMI Model Life Cycle Content Review

- CMMI practices and subpractices directly addressing life cycle considerations
  - PP SP 1.3, Define the project life-cycle phases upon which to scope the planning effort. 2
  - RD SP 1.1, Elicit stakeholder needs, expectations, constraints, and interfaces for all phases of the product life cycle.
  - OPD SP 1.2, Establish and maintain descriptions of the life-cycle models approved for use in the organization. 3
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Summary – Common Shortfalls

- CMMI may not always speak clearly on this subject
- Legacy life cycle models and directives from CMM days may not address all life cycle model and life cycle process needs
- Organizational process descriptions, whether life cycle model based or process focused, DO NOT describe a true life cycle description of system/product phases or processes
- The set of approved life cycle models you have defined may need tailoring and guidance for application to:
  - Overall program tailoring
  - Discipline specific development tailoring
  - Process areas that span the stages of corporate system/product life cycle models

Supplemental Charts

Section Divider

Life Cycle Considerations

- Program acquisition phase and approach, appropriate product life cycle phases, selected processes, and other program considerations must be taken into account
- Tailoring process creates a life cycle model, consisting of stages and processes adapted to satisfy particular circumstances or factors that:
  - Support the standards and models adopted, or required to use
  - Reflects the organizational needs to supply system products

CMMI-SE/SW/IPPD, V1.1, Process Areas

Level	Focus	Process Areas *Including IPPD*
5 Optimizing	*Continuous Process Improvement*	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	*Quantitative Management*	Organizational Process Performance Quantitative Project Management
3 Defined	*Process Standardization*	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management (*2 IPPD Goals)* Risk Management Decision Analysis and Resolution *Organizational Environment for Integration* *Integrated Teams*
2 Managed	*Basic Project Management*	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Initial		