



SCRL-Model for Human Space Flight Operations Enterprise Supply Chain

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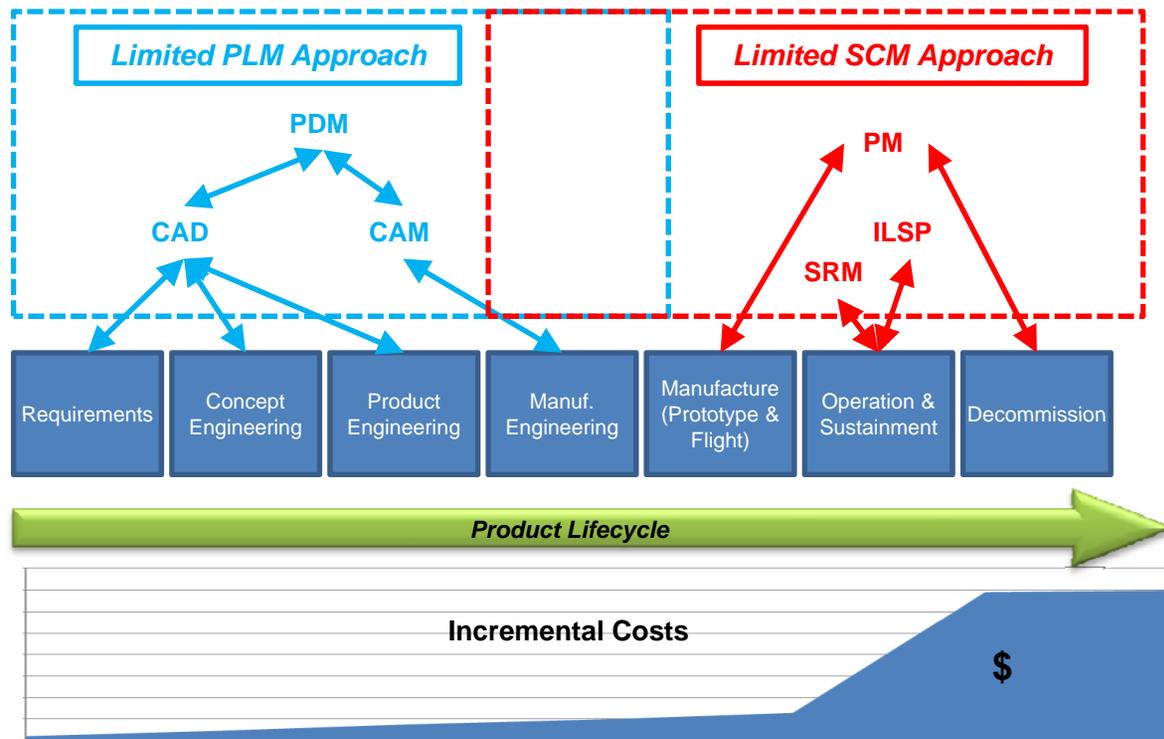


The Need

- **Standard approach to evaluate and configure adaptable and sustainable program and mission supply chains at an enterprise level**
 - End-to-end view
 - Total Lifecycle
- **Evaluate the readiness of the supply chain during the supply chain development phases**



Enterprise Supply Chain Management

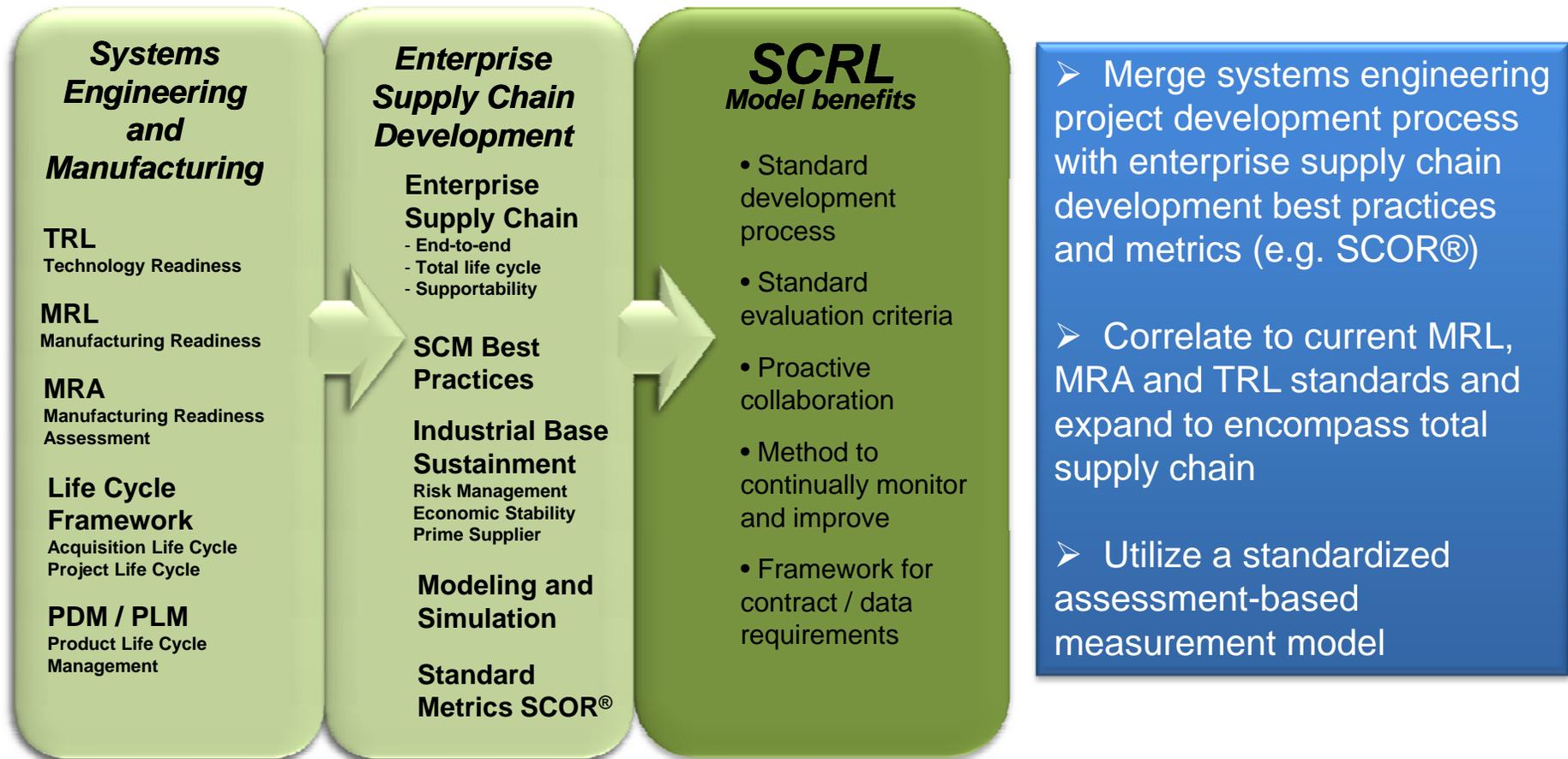


- Total Visibility
- Total Lifecycle
- Meeting Mission Requirements
- On time & at cost
- Sustainable
- Adaptable
- Optimized
- Mitigated Risks
- Continuous Improvement
- Viable Suppliers

*How do we measure SC readiness?
 How do we construct this type of SC?*

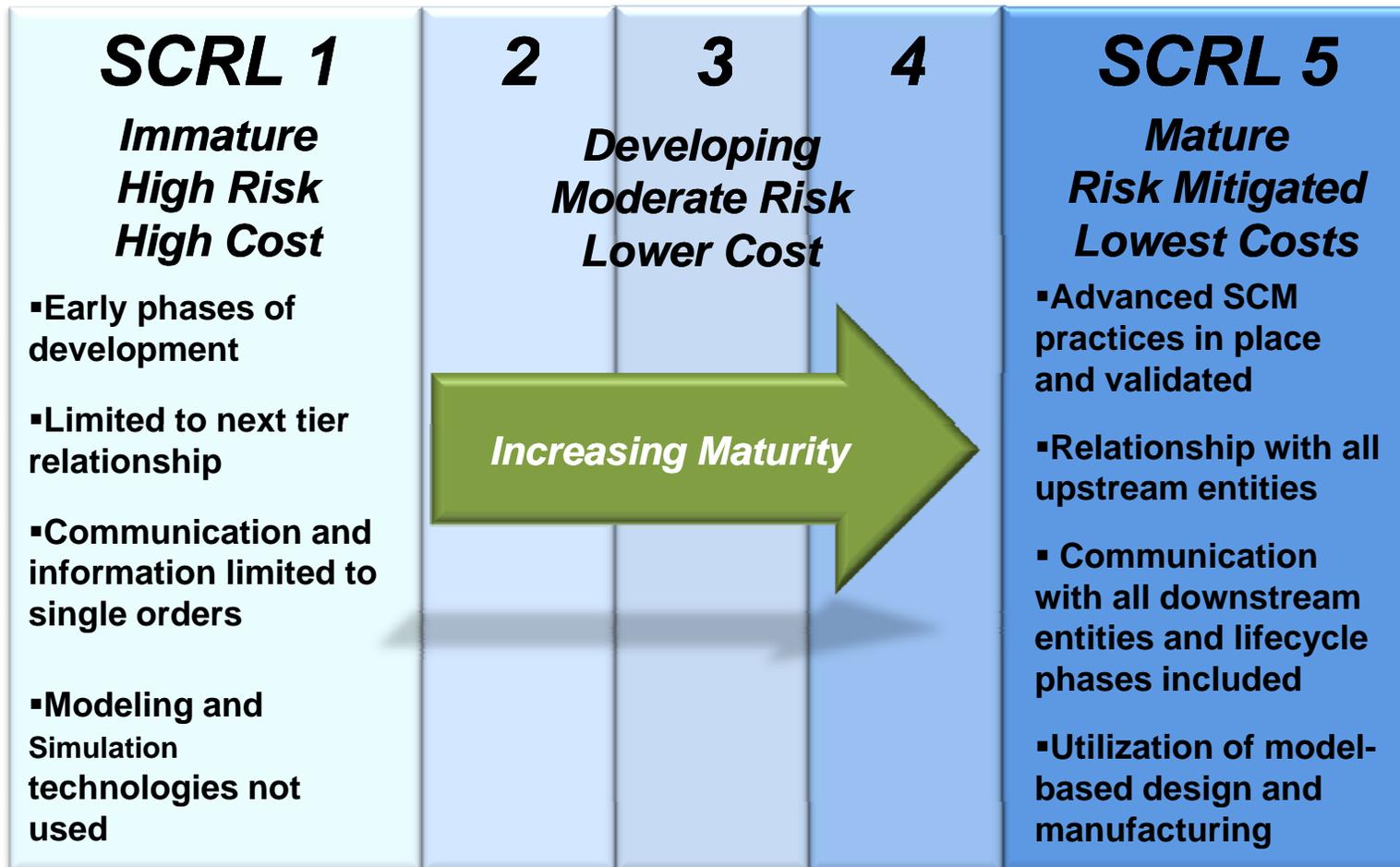


SCRL Model Development





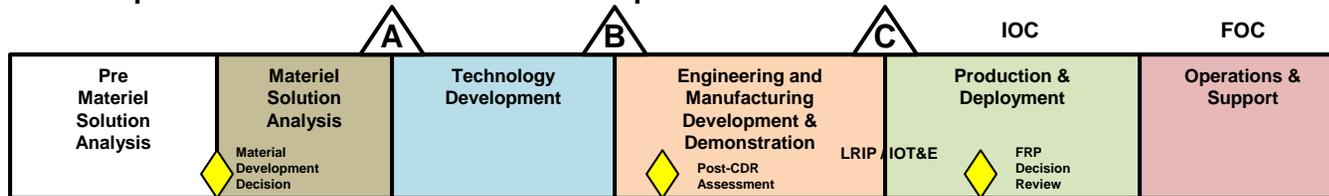
SCRL Model





Utilize SCRL with TRL & MRL

Defense Acquisition Framework and Relationship to TRL and MRL



➤ Supply Chain developed in conjunction with technology and manufacturing

Review and Audits



Technology Readiness Levels



➤ Established reviews and audits trigger evaluation of supply chain

Manufacturing Readiness Levels



Source: Department of Defense, Manufacturing Readiness Assessment (MRA) Deskbook, May, 2009

➤ Levels in technology and manufacturing readiness are considered from a SC perspective



Supply Chain Readiness Levels



SCRL alignment shown is notional.



SCRL: Supply Chain Characteristics

Inventory	Strategic raw material, WIP and FG placement in SC
Strategic Sourcing	Sourcing decisions benefit enterprise, optimum number of SKUs & supp.
Visibility	Ability to see varying levels of the SC
Supplier /Cust Relationships	Working relationships at varying levels of the SC, Improvement focus
Price Adaptability	Impact of variation in the price of commodities
Collaboration	Flow of information up and down the supply chain
Lifecycle Awareness	SC visibility and awareness of the current lifecycle phase
Modeling & Simulation	Apply modeling and simulation to improve SC
Performance Measurement	Metrics used to measure and improve supply chain
Risk Management	Including obsolescence, sole-sourcing, counterfeit parts
Criticality Focus	Focus level on critical parts, path and suppliers
Sustainability	Long term viability of the industrial base
Manufacturing Readiness	Monitoring manufacturing readiness of the SC
Technology Readiness	Monitoring technology readiness of the SC
Sub-Tier Management	All levels of SC adhere to SCRL standards

**Total of 15
Threads**



SCRL: Supply Chain Characteristics

Inventory	SCRL	Requirement
Visibility	SCRL 1	Inventory levels not known throughout the SC. Inventory is not optimized even at the local level.
Supplier /Cust Re	SCRL 2	Inventory levels are being monitored at the local level. Stock-outs and low inventory turns are common.
Price Adaptability	SCRL 3	Inventory levels are defined and managed locally in order to satisfy next-level customer demand. Efforts are being made to identify major stockpiles of inventory throughout the supply chain.
Collaboration	SCRL 4	Inventory is distributed throughout the supply chain with managed buffers at supply chain node interfaces. VMI may be in place at some locations.
Lifecycle Aware	SCRL 5	Inventory is strategically placed throughout the supply chain to minimize total supply chain inventory costs while still satisfying the readiness demands of the system
Modeling & Sim		
Performance Me		
Risk Managemen		
Criticality Focus		
Sustainability		
Manufacturing R		
Technology Rea		
Sub-Tier Manage		



SCRL: Supply Chain Characteristics

Inventory	SCRL	Requirement
Strategic Sourcing		
Visibility	SCRL 1	Supply chain performance is not measured
Supplier /Cust Relationship		
Price Adaptability	SCRL 2	Metrics are used to evaluate and improve supply chain performance at levels 1
Collaboration		
Lifecycle Awareness	SCRL 3	Metrics are used to evaluate and improve supply chain performance at levels 1 & 2
Risk Management		
Criticality Focus	SCRL 4	Metrics are used to evaluate and improve supply chain performance at levels 1 -3
Sustainability		
Manufacturing Readiness		
Technology Readiness	SCRL 5	SCOR metrics and best practices utilized at all levels of the supply chain to provide standard measure of performance and these metrics are routinely used to improve supply chain performance
Sub-Tier Management		

Performance Measurement



SCRL: Level & Assessment

Inventory	<h2>SCRL Assessment</h2> <ul style="list-style-type: none"> <input type="checkbox"/> An Assessment will be used to evaluate the SC readiness <input type="checkbox"/> Assessment questions and performance criteria established for each characteristic to define SCRL <input type="checkbox"/> Overall SCRL for the supply chain being evaluated will be determined by the minimum SCRL. <input type="checkbox"/> The assessment results could then be used to identify the specific supply chain characteristics and practices that should be addressed to increase the SCRL and reduce the risk and cost before moving to the next development phase.
Strategic Sourcing	
Visibility	
Supplier /Cust Relationships	
Price Adaptability	
Collaboration	
Lifecycle Awareness	
Modeling & Simulation	
Performance Measurement	
Risk Management	
Criticality Focus	
Sustainability	
Manufacturing Readiness	
Technology Readiness	
Sub-Tier Management	



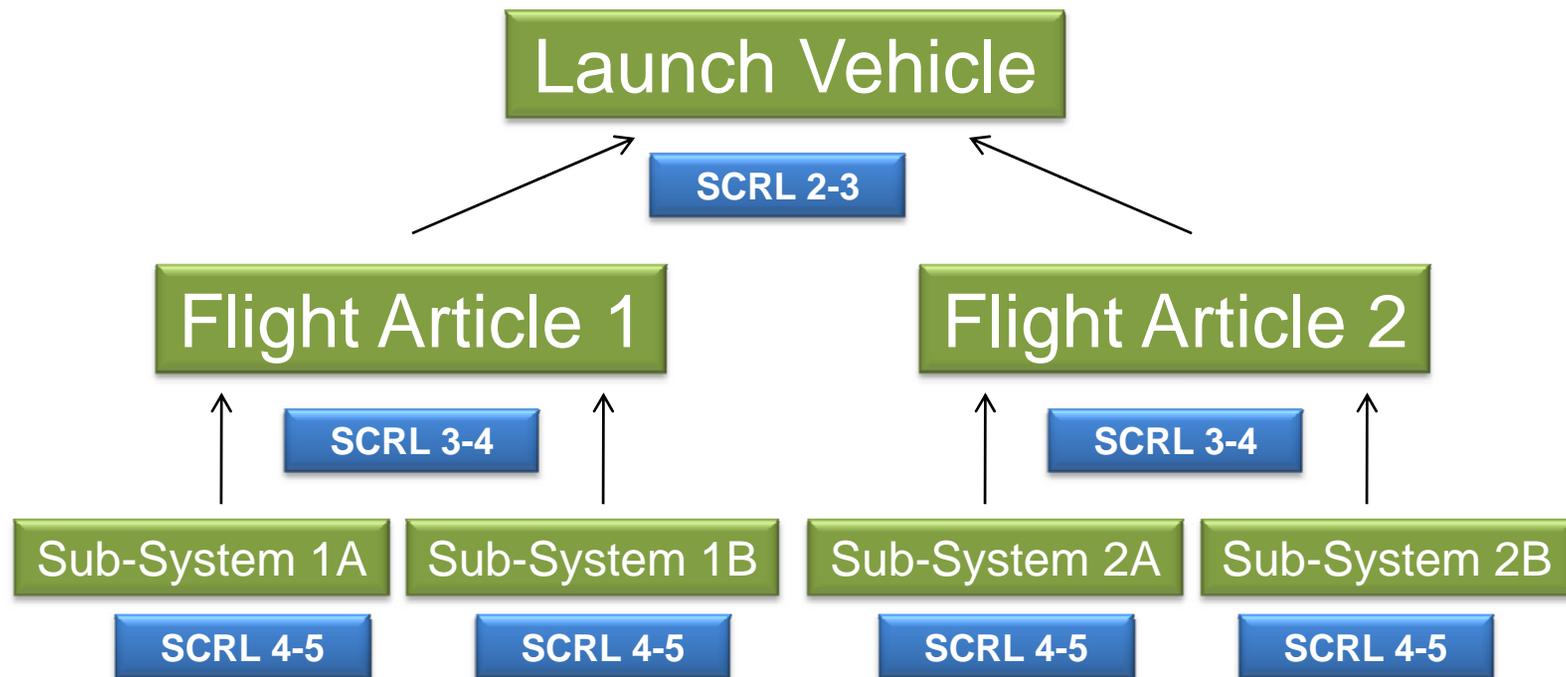
SCRL: Levels by Characteristic

Inventory	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Strategic Sourcing	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Visibility	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Supplier /Cust Relationships	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Price Adaptability	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Collaboration	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Lifecycle Awareness	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Modeling & Simulation	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Performance Measurement	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Risk Management	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Criticality Focus	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Sustainability	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Manufacturing Readiness	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Technology Readiness	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5
Sub-Tier Management	SCRL 1	SCRL 2	SCRL 3	SCRL 4	SCRL 5

Example



SCRL & the Extended Supply Chain



It is anticipated that the Supply Chain Readiness Level required will increase with the depth of the supply chain level assessed.



Benefits of using SCRL

- **Standard Assessment and Construction Model**
 - Concurrently addressing SCM issues in the same manner
 - Risk mitigation can begin in the earliest phases and accurate lifecycle costs can be assessed and controlled.
- **Proactive Collaboration**
 - SC entities develop collaborative structures and relationships
 - Improved visibility throughout SC
- **Continuous Improvement**
 - Identify opportunities for improvement
 - Monitor as SC entities and conditions change
- **Framework for Contracts and Data Requirements**



Path Forward

- **Complete development of matrix**
 - Refine levels and threads
 - SCRLs are in early stage of development
 - Develop body of knowledge/references to support development
- **Peer review of SCRL SC characteristic matrix**
 - Acceptance by government agency
 - Acceptance by industry
- **Develop SCRL Assessment**
- **Perform pilot projects to validate**
 - Good, Bad, OK