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System-of-Systems Measurement

PSM Technical Working Group
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Background

Systems of Systems

- Definition and Description
- State of the practice
- Motivation
- Draft Analytical Framework aka first thoughts on a cost estimation model

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Preface:
Joint Capabilities and SoS

New Joint Capabilities-Based acquisition process identifies "capability needs" from the top-down

Solutions to capability needs will include materiel and non-materiel aspects

Capability solutions will not be "platform centric" but will require the interaction of multiple systems,

…and, by implication, establish the rules by which these interactions are to be governed

These will be "systems of systems"

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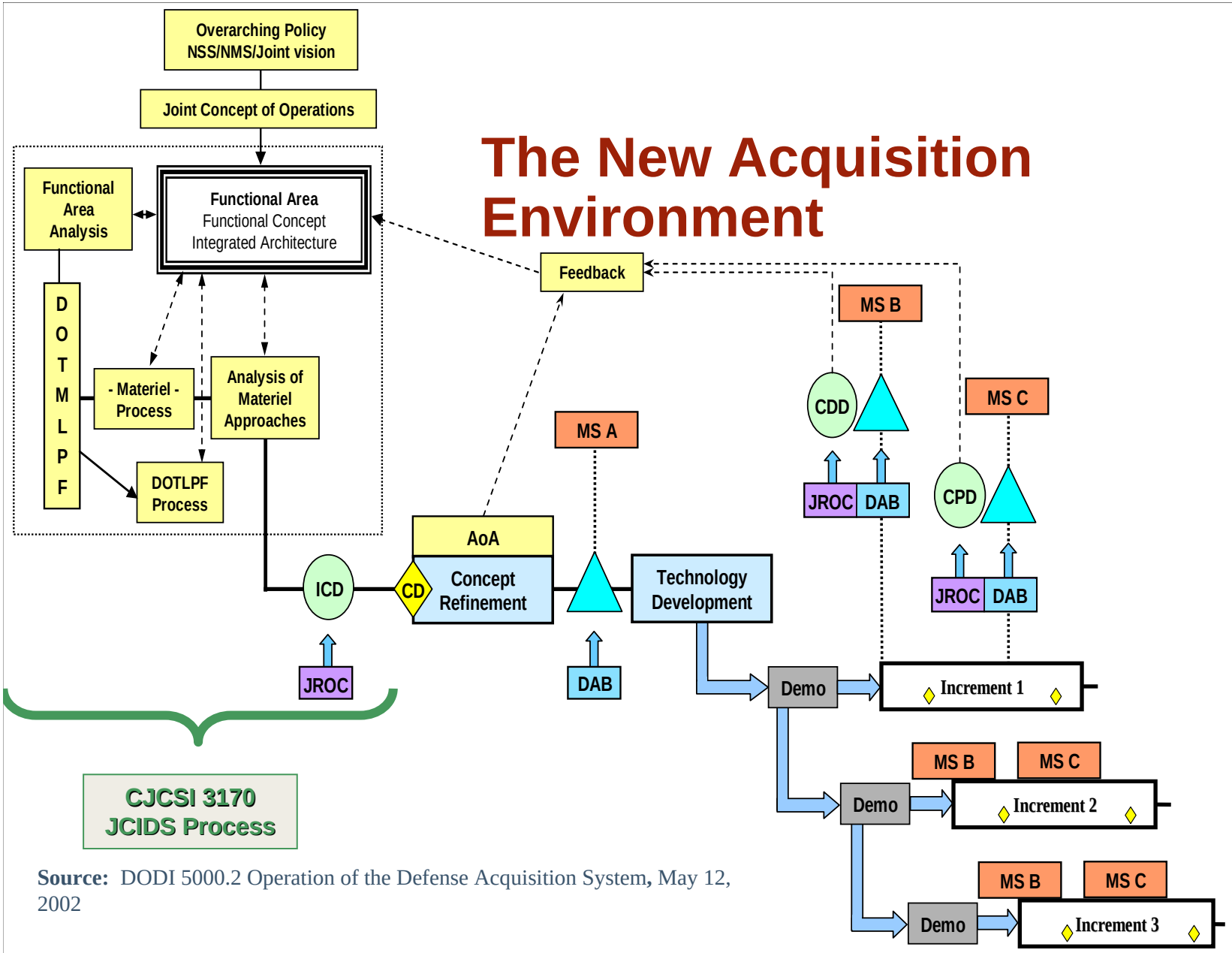
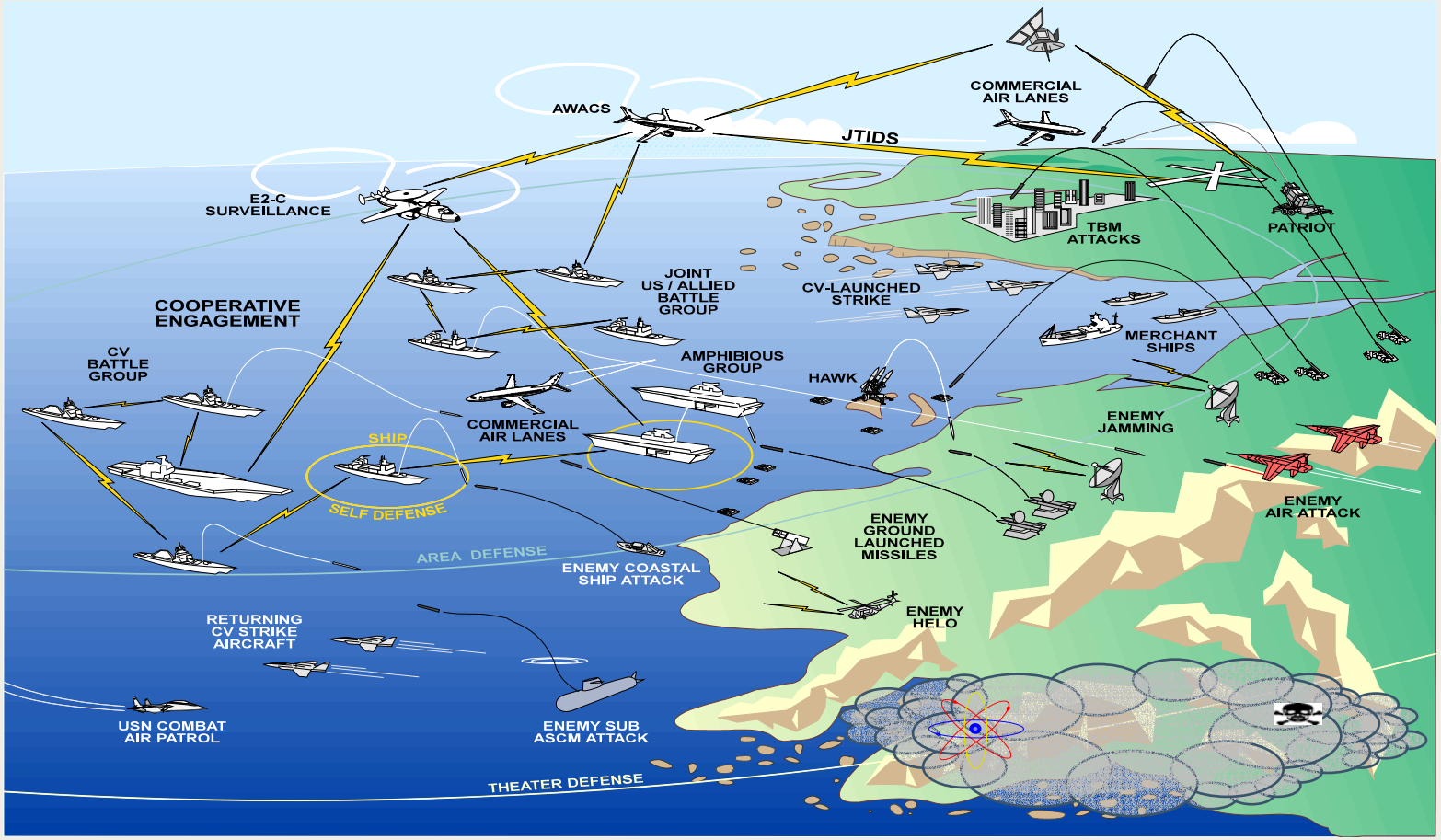
The New Acquisition Environment



Source: DODI 5000.2 Operation of the Defense Acquisition System, May 12, 2002

Motivation for Research: A "Simple" Case



Example: Cooperative Engagement Capability

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Motivation for Research

DoD Requirements, Acquisition, and Programming processes reorienting toward "capabilities-centric" focus (versus platform-, system-, or program-centric)

- DoDI 5000.2 "Operation of the Defense Acquisition System" 5/12/2003
- CJCSI 3170.01C "Joint Capabilities Integration and Development System" 6/24/2003
- Enhanced Planning Process—in development within PA&E

Independent of Policy, DoD is doing more integration and SoS

- Joint warfighter focus, leveraging COTS, NDI
- Forcing legacy, "stovepipe" systems to work together

SoS implementation appears to be problematic

- Emerging pattern of cost overruns, schedule delays, reduced functionality
- Planners typically fail to anticipate SoS development and integration challenges

Difficulties attributed to various factors, including

- Overwhelming complexity
- Lack of analytical tools
- Lack of effective management structures and practices

These issues span the DoD and beyond

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Observations

Difficulties in implementing SoS have arisen from 3 major sources

- Inability to predict the magnitude of the SoS effort
  - Overlook significant drivers of size and complexity
- Lack of tools to translate SoS effort into timely, reliable cost/schedule estimates
- Inability to implement SoS efficiently & effectively
  - Lack effective management structures and practices
  - Institutional barriers to efficient implementation

Issues related to "How much will it cost?", and "How best to do it?"

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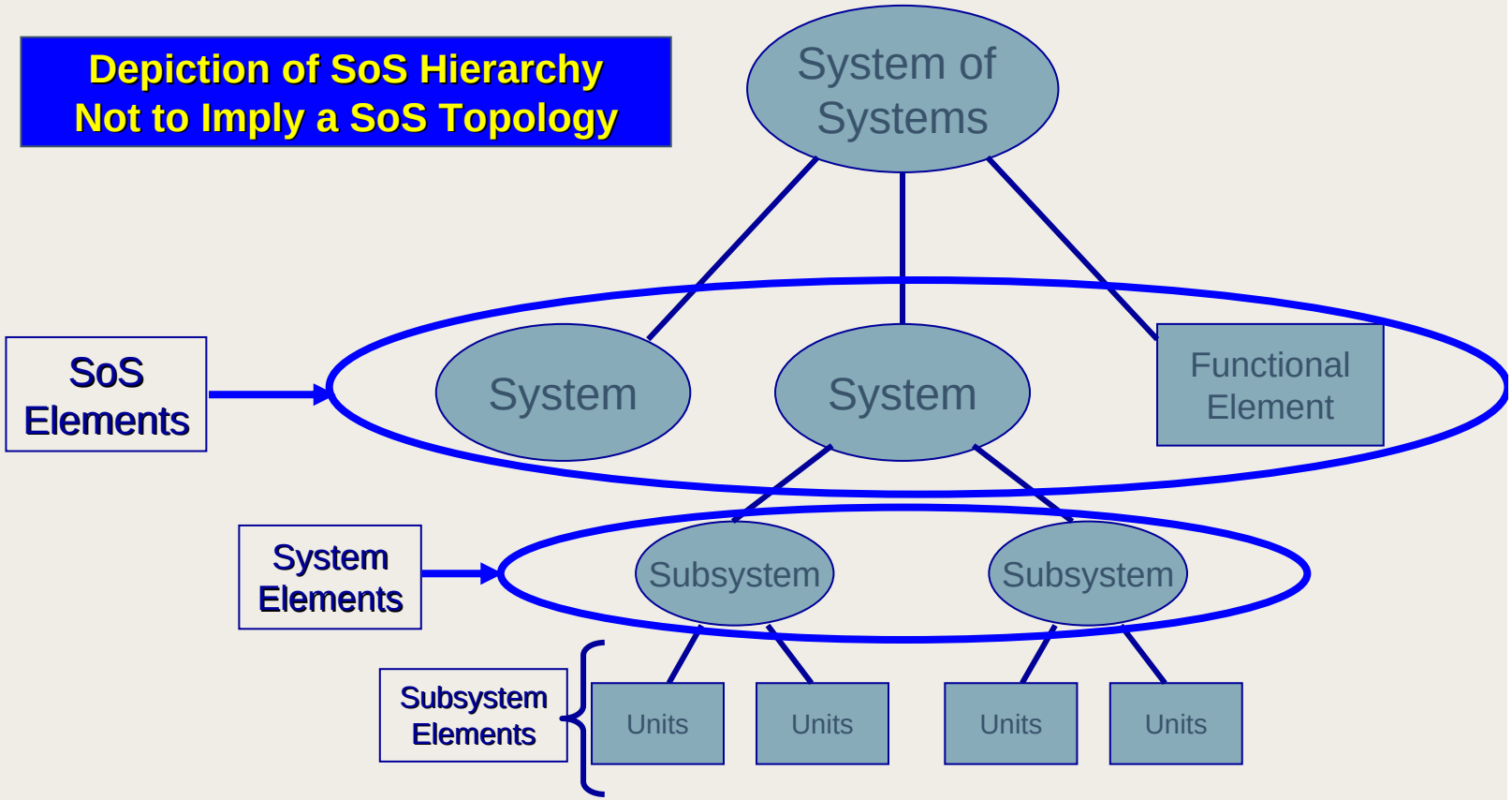
Definitions:System of Systems



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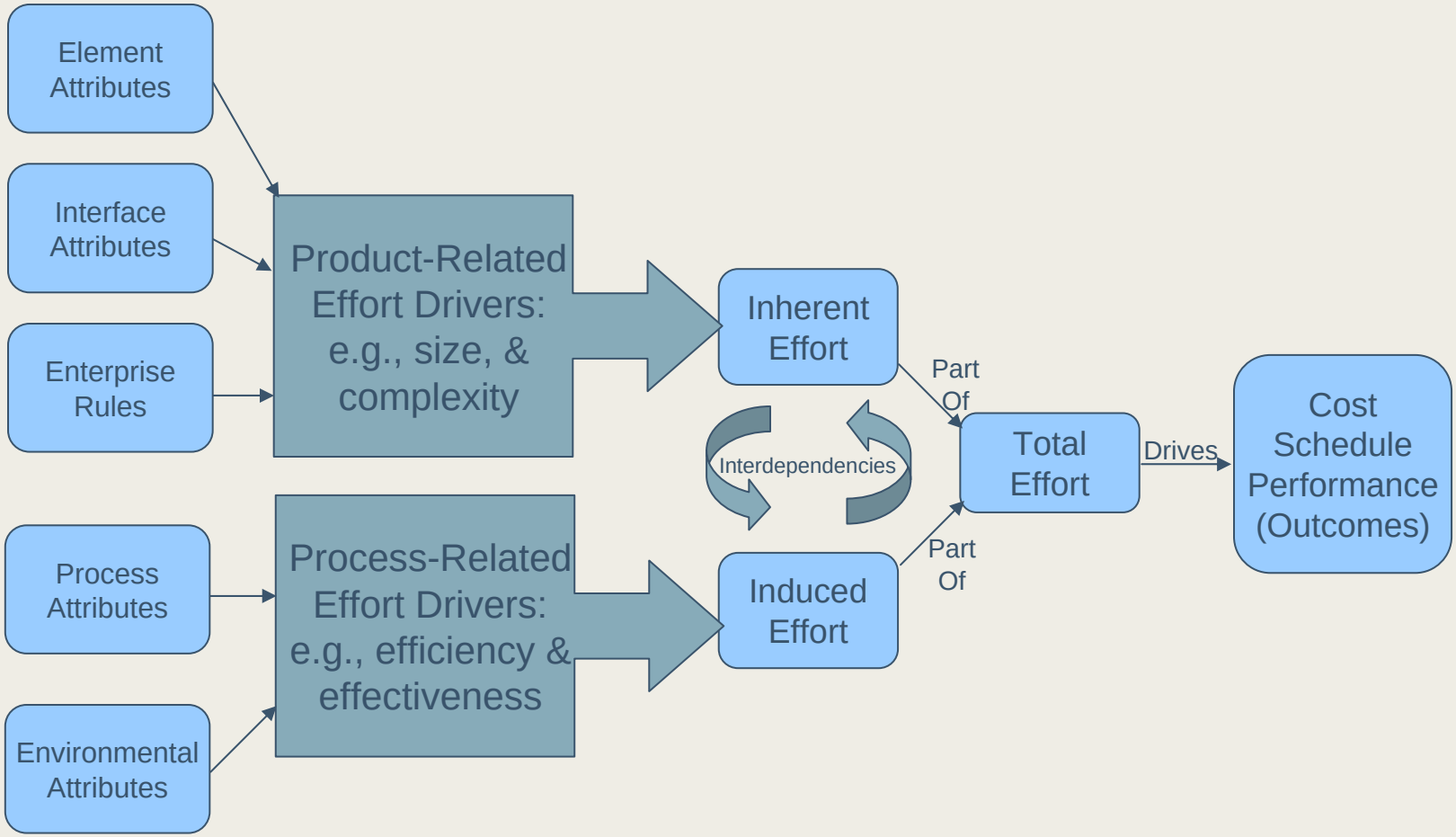
Concept Map of Attributes and Outcomes



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Product-Related Decisions and Attributes

Generally set by operational requirements

Define what the SoS must do

- Capabilities to be provided
- Entities to be incorporated
- Nature of interactions among the elements

Are the output of the JCIDS and AoA processes

Are loosely coupled to implementation and resource considerations

Product-related decisions define magnitude and complexity of the SoS

Have predominant effect on inherent effort

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Process-Related Decisions and Attributes

Process-related attributes are generally set by the acquisition/resource processes

- Process-related attributes define how the SoS is to be implemented
- Process-related decisions impose resource and organizational parameters on SoS implementation

Process-related decisions will affect the efficiency and effectiveness of the SoS implementation

Have predominant effect on induced effort

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Why Distinguish Between Product- and Process-Related Attributes

Different relevant attributes
Different players & decision makers
Different decisions to be made at different times

Both Product and Process Attributes are Significant in SoS cost behavior so BOTH must be captured

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Workshop Goal

Goals:

Identify
- potential size measures
- potential complexity measures
- schedule drivers
- develop/integration process issues

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Agenda

1:00 – 1:30	Introductions and Workshop Overview
1:30 – 2:00	Identification of Size Measures
2:00 – 2:30	Identification of Complexity Measures (technical, operational, programmatic)
2:30 – 2:45	Break
2:45 – 3:30	Schedule drivers
3:30 – 4:00	Other drivers and factors
4:00-4:30	Next Steps, Recommendations and Report Draft

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Participants

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Summary

First we brainstormed a list of questions related to cost factors for system of systems integration.

Second, we worked on measurement specifications for selected questions.

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