The Business Case for MBE

DMC December 2014

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Agenda

- Background
- Individual studies
- High level Business Case
- Q & A

Background

- OSD's Defense-Wide Manufacturing Science and Technology program funded three projects on 3D technical data use in the Model Based Enterprise
  - Project #1
    - TDP requirements for electrical systems
    - Create a standards-based neutral format for tech data exchanges (leverage PLCS to convert to S1000D)
  - Project #2
    - 3D TD exchange among OEM and suppliers
    - Develop a detailed guideline of Model Based Definition (MBD) data transfer between companies with different CAD tools
  - Project #3
    - Develop validation and verification guidelines (new 3D and 2D data upgraded to 3D)
    - Create a standards-based neutral format for tech data exchanges (exchanges between DoD and prime contractors)
    - Includes PLM-to-PLM data exchange

- LMI helped the TDP project teams develop high-level BCAs, and developed a global statement of the Business Case for MBE in DOD

Background: LMI's Task

- Global business case
  - "…on the benefits of the MBE, including costs and benefits associated with system implementation, operation, and maintenance"
- Develop high-level BCAs for individual projects
  - "…working with project teams to establish a framework for identifying and quantifying costs and benefits associated with project recommendations"

Global Business Case

- State of Technical Data in DoD and industry
- TD in the context of the Acquisition Lifecycle
- Lists TDP and MBE initiatives in DOD either completed or underway
- Lays our the challenges DOD faces in integrating 3D models
- Business Case Considerations
- Cost considerations
- Description of Benefits
- Summary
- Recommendations
- Appendices (includes 3 Project Business Cases)

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Business Cases

- Global Business Case
  - Focus on full Acquisition Life Cycle, mostly qualitative
- Project 1 Business Case
  - Focus on delivery of electrical TD to customer via S1000D
- Project 2 Business Case
- Project 3 Business Case

Project Business Case #1

- Focused on Electrical Technical Data
  - Wiring harnesses
  - Output to S1000D V.4, for easier Technical Publications production
- As-Is:
  - Mostly manual processing: extract data from CEEDS, prepare pin map and schematic
- To-Be:
  - Automated extraction of data from CEEDS to PLCS format, and from PLCS to S1000D

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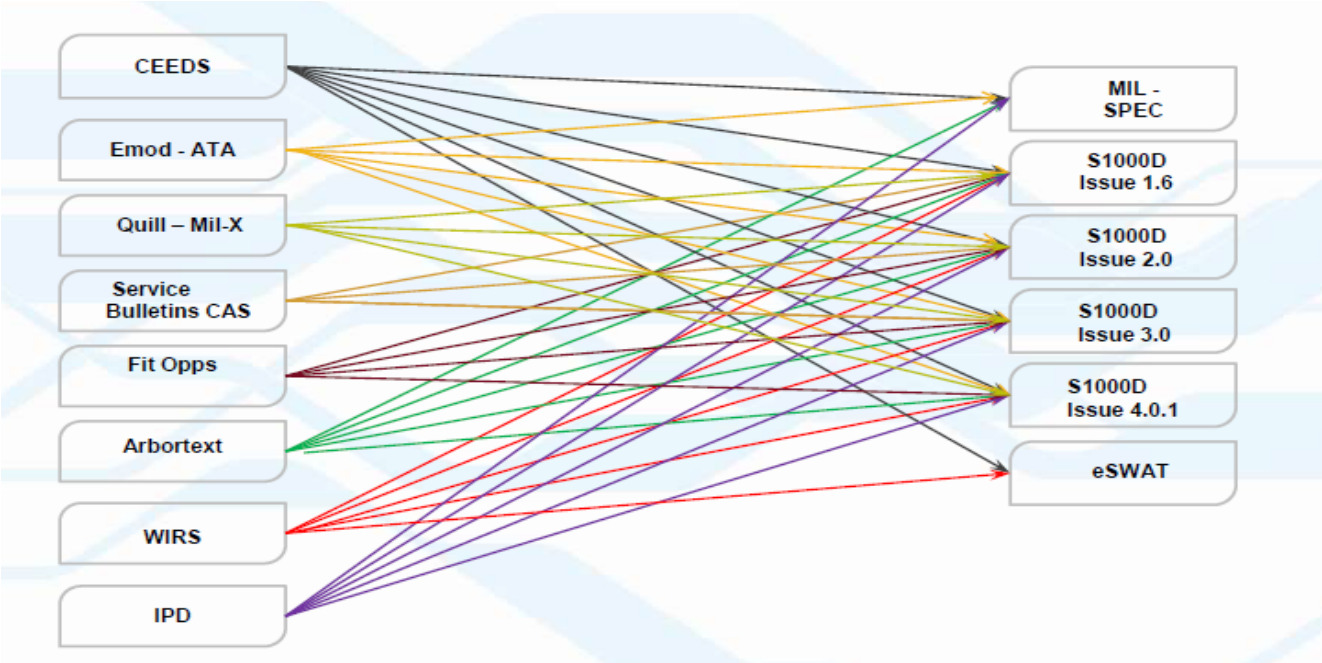
Project Business Case #1 (cont'd)

- Problem statement: There are many software environments in use at the OEM – we can expect that the need to translate to S1000D format will crop up repeatedly.
  - Do we write a translator for each design system in use?



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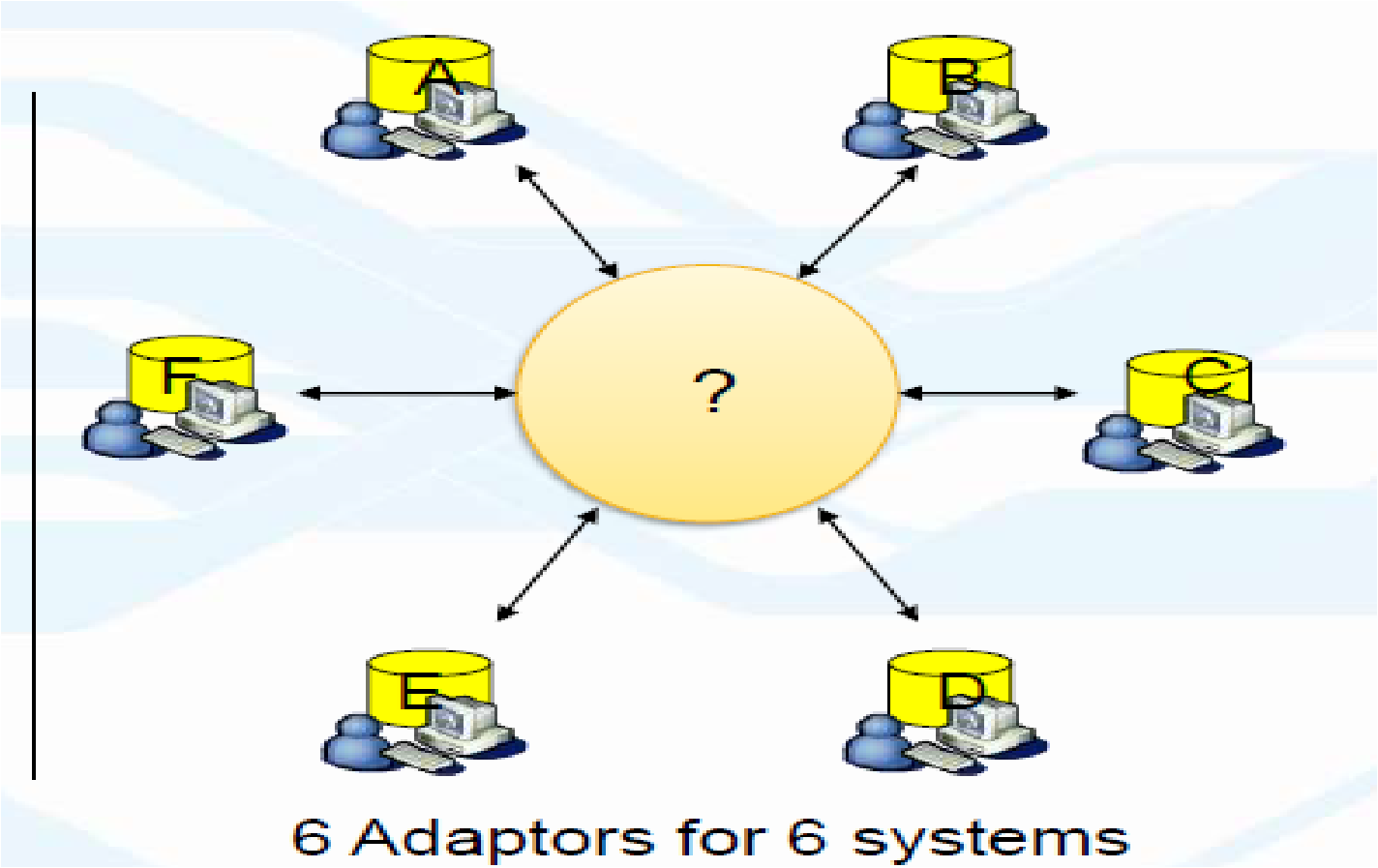
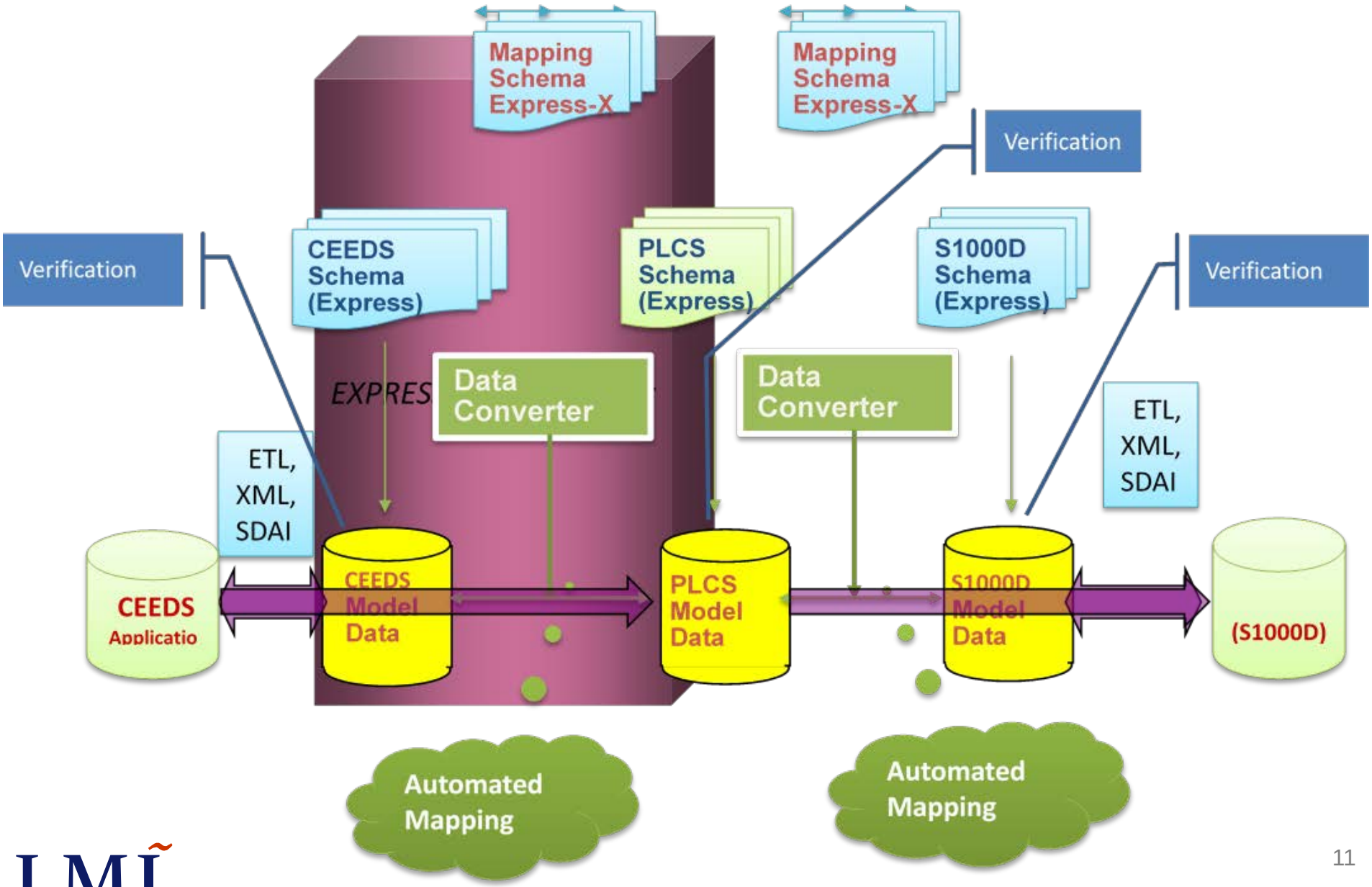
Project Business Case #1 (cont'd)

- Solution: Use a "Rosetta Stone" approach for each design software system in use:



Project Business Case #1 (cont'd)



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Project Business Case #1 Costs and Benefits

- This project captured the labor required to build this translation capability—and the change in labor required, for each subsequent translator built.
  - In 2012, the OEM prototyped this approach on one program
  - In 2013, built this for a different program using CEEDS for design data
  - In 2014, the OEM estimated labor needed for a third program
- This approach, using a standard, vendor-neutral format (STEP AP239/PLCS) as the Rosetta Stone, becomes more efficient with each iteration
  - Knowledge gained of both source and PLCS data formats
  - Data models that can be modified vs. “built from scratch”
  - Better knowledge of the EXPRESS editor and other tools

Project Business Case #1 (cont'd)

- Labor needed using As-Is TD process (mostly manual)
  - 4534 hours in one year, on an 'average' program
- Labor needed to build translator:
  - Prototype: 5340 hours
  - Program with CEEDS: 3980 hours (25% less than Prototype effort)
  - Projection of third platform: 1290 hours (68% less than CEEDS effort)
- The first translator effort may cost more than the As-Is labor, but drops to a positive return on the second and all subsequent translators.

Project Business Case #1 (cont'd)

- Overall savings
  - The positive return on creating this DMS&T-funded project is about 12% (3980 versus 4534 hours) in the first year
  - The OEM's subject matter experts estimate that this savings should increase at about 6 to 8 %annually

Year	As-Is Hours	% Labor Saved	Hours Saved	Labor Rate	Total Savings
1	4534	0%	0	$100	
2	4534	12%	544	$100	$54,400
3	4534	18%	816	$100	$81,600
4	4534	25%	1133	$100	$113,300
5	4534	32%	1450	$100	$145,000
Total	**22,670**	**17%**	**3943**		**$394,300**

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Project Business Case #1 (cont'd)

- Savings for Program 2 with automated TDP capability

Year	As-Is Hours	% Labor Saved	Hours Saved	Labor Rate	Total Savings
1	4534	0.68	-1290	$100	-$129,000.00
2	4534	0.75	3401	$100	$340,050.00
3	4534	0.75	3401	$100	$340,050.00
4	4534	0.75	3401	$100	$340,050.00
5	4534	0.75	3401	$100	$340,050.00
Total					$1,231,200.00

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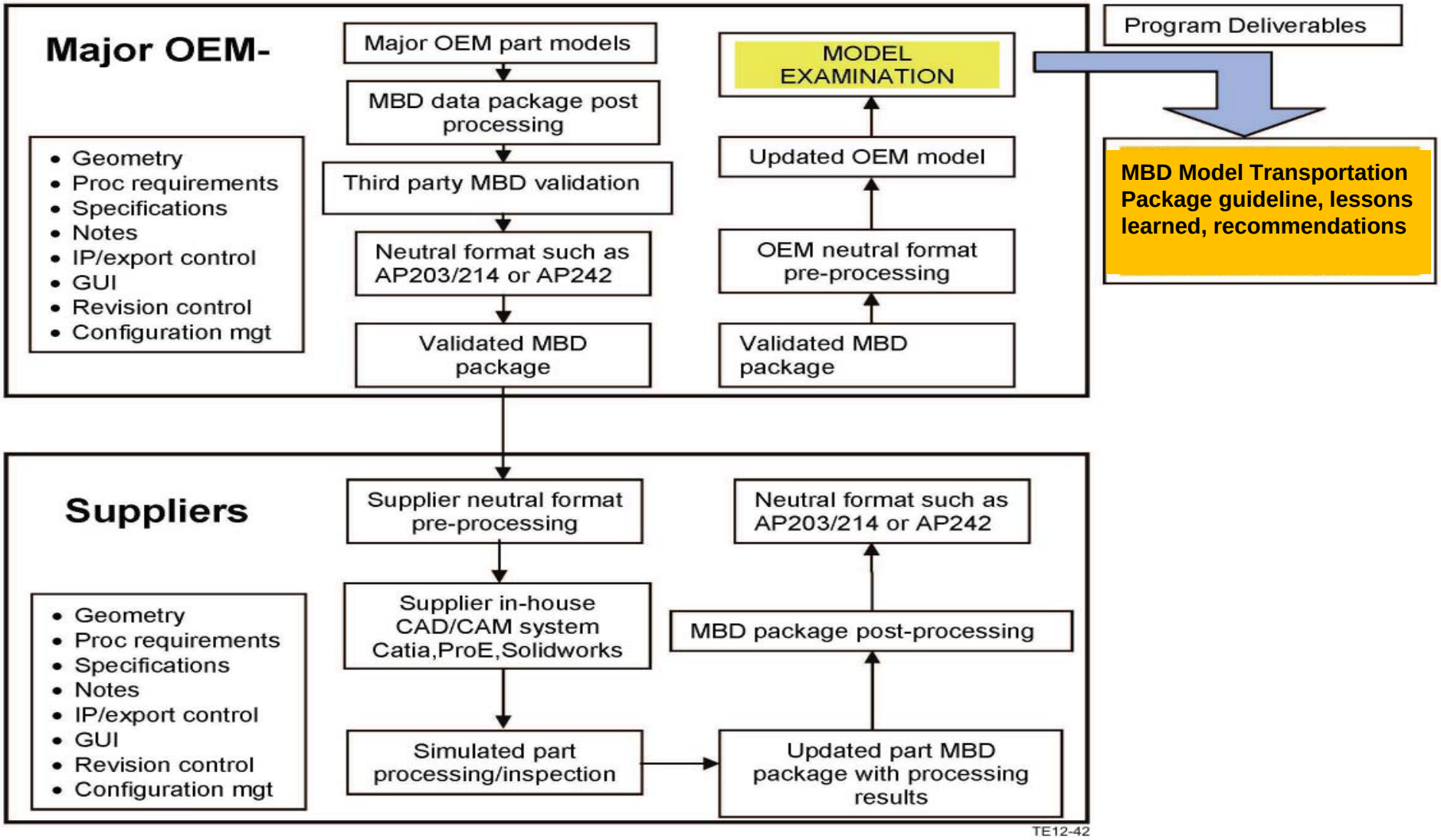
Project Business Case #1 (cont'd)

- Savings continue at about $1.2 M over the first five years
- If we assume that the top 5 OEMs have 20 'average' programs, this savings grows quickly to about $120M over the first five years.

Project Business Case #2



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Project Business Case #2

- This OEM tested the use of 3D models to improve the exchange of technical data to/from suppliers.
- They used 2 simple parts as test data

Process	As Is (2D) Process	To-Be Process
TDP package (JT, PDF, STEP) creation & validation	5.0	10
Data transfer to suppliers	5	4.0
Manufacture of Tooling	40	32
QA of Tooling	5	2.5
Setup of Tooling	5	2
Manufacturing (Forging, Heat treating, machining, etc.)	100	75
Non-Destructive Testing/inspection	50	28
Totals hours	360.0	318.5
Total hours saved		41.50
Percent time saved		11.5%

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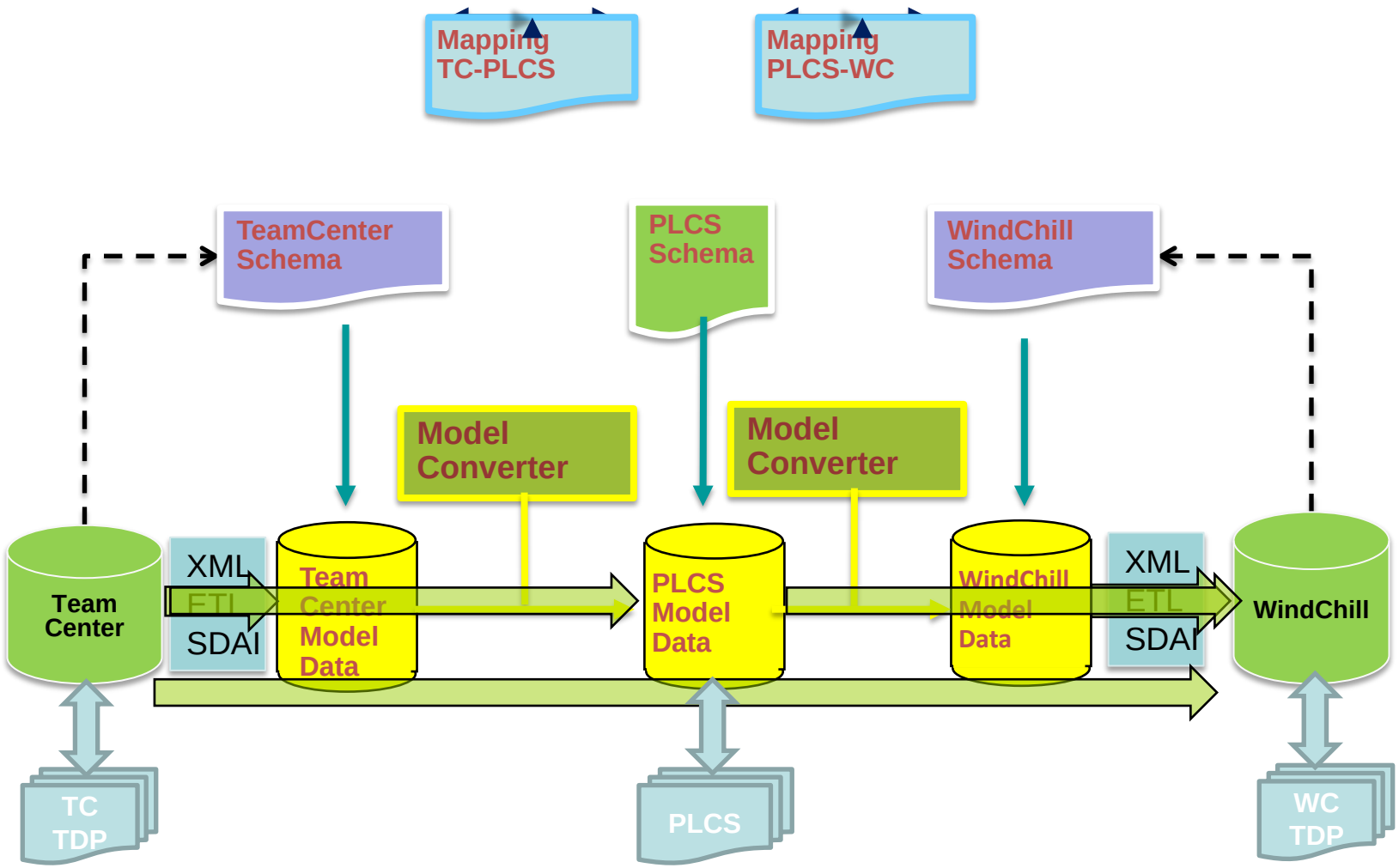
Project Business Case #2

- A savings of 41.5 hours represents a savings of $4150.00 for a single simple part (such as a turbine blade). Considering the number of parts in the DoD supply chain and the money spent on parts, this savings could be considerable.

Project Business Case #3

- This OEM tested the use of standard neutral file formats for PLM-to-PLM delivery of 3D TD.
- The system is a rotorcraft currently in sustainment, with the PMO processing ECOs and other improvements

Project Business Case #3



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Project Business Case #3

	As Is Process		To Be Process		
Tasks in Sustainment Activities	**Labor Cat**	**LoE**	**Labor Cat**	**LoE**	**Savings**
CDRL Delivery/Receipt	CM Team	80 hrs	CM Team	5 min	~3 orders of magnitude
ECP Processing					
TDP gathered	CM Team	160 hrs	CM Team	5 min	~4 orders of magnitude
TDP reviewed --simple complexity	CM Team	160 hrs	CM Team	80 hrs	50%
TDP reviewed --higher complexity	Systems Engineer	320 hrs	Systems Engineer	160 hrs	50%
STDP Generated	Tech Loop	120 hrs	Tech Loop	60 hrs	50%
Field Inquiry Start Point					
Air Worthiness Certification	Can be a review of changes, either from ECP, or from field reports				
SME Evaluation	AMD Engineer	120 hrs	AMD Engineer	60 hrs	50%
Report Generated	Systems Engineer	40 hrs	Systems Engineer	30 hrs	25%

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Project Business Case #3

	As Is Process		To Be Process		
Tasks in Sustainment Activities	**Labor Cat**	**LoE**	**Labor Cat**	**LoE**	**Savings**
Sustainment					
Spares Procurement	Product Manager	5 hrs	Product Manager	1 hr	80%
Tech Pubs	Illustrator	120 hrs	Illustrator	60 hrs	50%
Provisioning	Provisioner	120 hrs	Provisioner	60 hrs	50%
Fielding					
STDP Delivery to warfighter		80% accurate		95% accurate	
Total Hours	**1245**			**512.6**	
Savings -Total hours				**732.4**	**59%**

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Benefits Summary

- Qualitative
  - Faster and more thorough trade-space evaluation
  - Improved cost modeling
  - Early and thorough assessment of producability, maintainability sustainability, and affordability
    - Virtual manufacturing feasibility assessment and process evaluation
  - Suppliers understand design intent more quickly and thoroughly
    - Faster setup of manufacturing processes and less error-prone production
  - Reduction in amount of non-recurring engineering
  - Potential for more competition in bidding

Benefits Summary

- Quantitative
  - For 5 OEMS with 20 programs, $120M over the first five years for TD delivery to customer
  - For primes and parts suppliers (mechanical) -- $4150.00 for a single simple part (such as a turbine blade)
  - For primes and parts suppliers --11.5 % of labor on data exchange and manufacturing processes for both primes and suppliers
  - For PMOs with programs in sustainment with contractor supported logistics: 59% of PMO labor for ECOs and other sustainment processes.