

New Collaborative CAx Tools: Effects on Standardized Work & Phase/Stage-gate Processes

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Problem Statement

As engineering and manufacturing within companies have become less centralized and more global the need for engineering collaboration (EC) and shared global design (SGD) has increased by an order of magnitude!

- ❑ Decentralized companies and their global supply chain suffer from the following Tools, Methods and Processes issues
 1. **Single-user** engineering CAx Tools have not kept pace with the ever increasing demands and needs for EC/SGD.
 2. **Revision'ing and command/control PLM systems** are today's nemesis of instantaneous EC/SGD.
 3. Today's culture of "Engineering Standard Workflows" (ESW) embraces the notion that each discipline be given its **singular siloed ownership moments** during the design process.
 4. Stage-gate process, though not intended to be the "design phased-reviews" process of the 70's and 80's, when mapped on to currently deployed single-user engineering tools, PLM systems and ESW result in frozen data sets, and work stoppage that **extend the development time and cost.**



Engineering Collaboration (EC)

Working together across disciplines to create value while sharing virtual and/or physical space.



Gen 1: Town Hall



Gen 2: WebEx



Gen 3: Presence



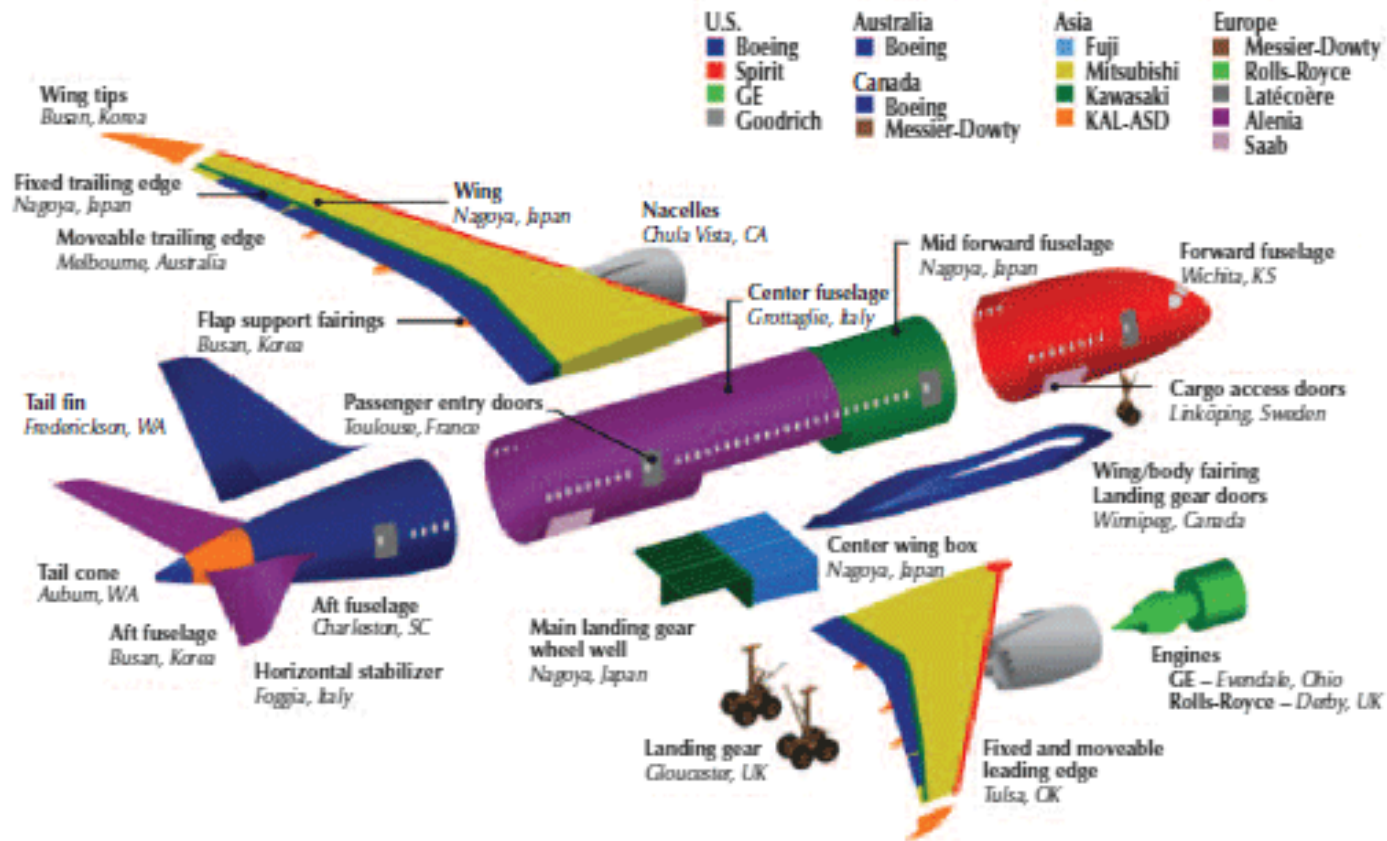
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Shared Global Design (SGD)

Decentralization, Outsourcing, Off-shoring, etc. of Design and Engineering.

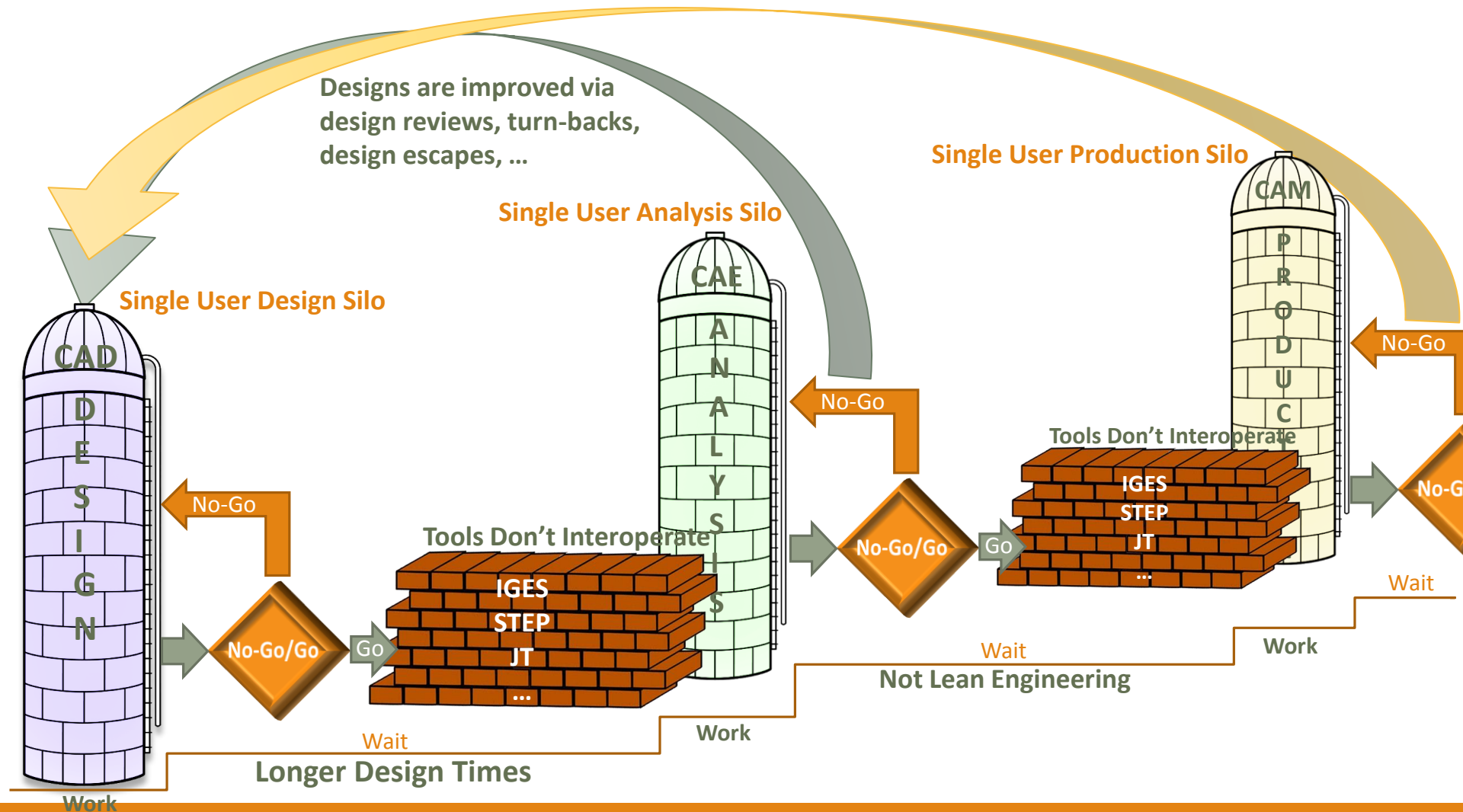


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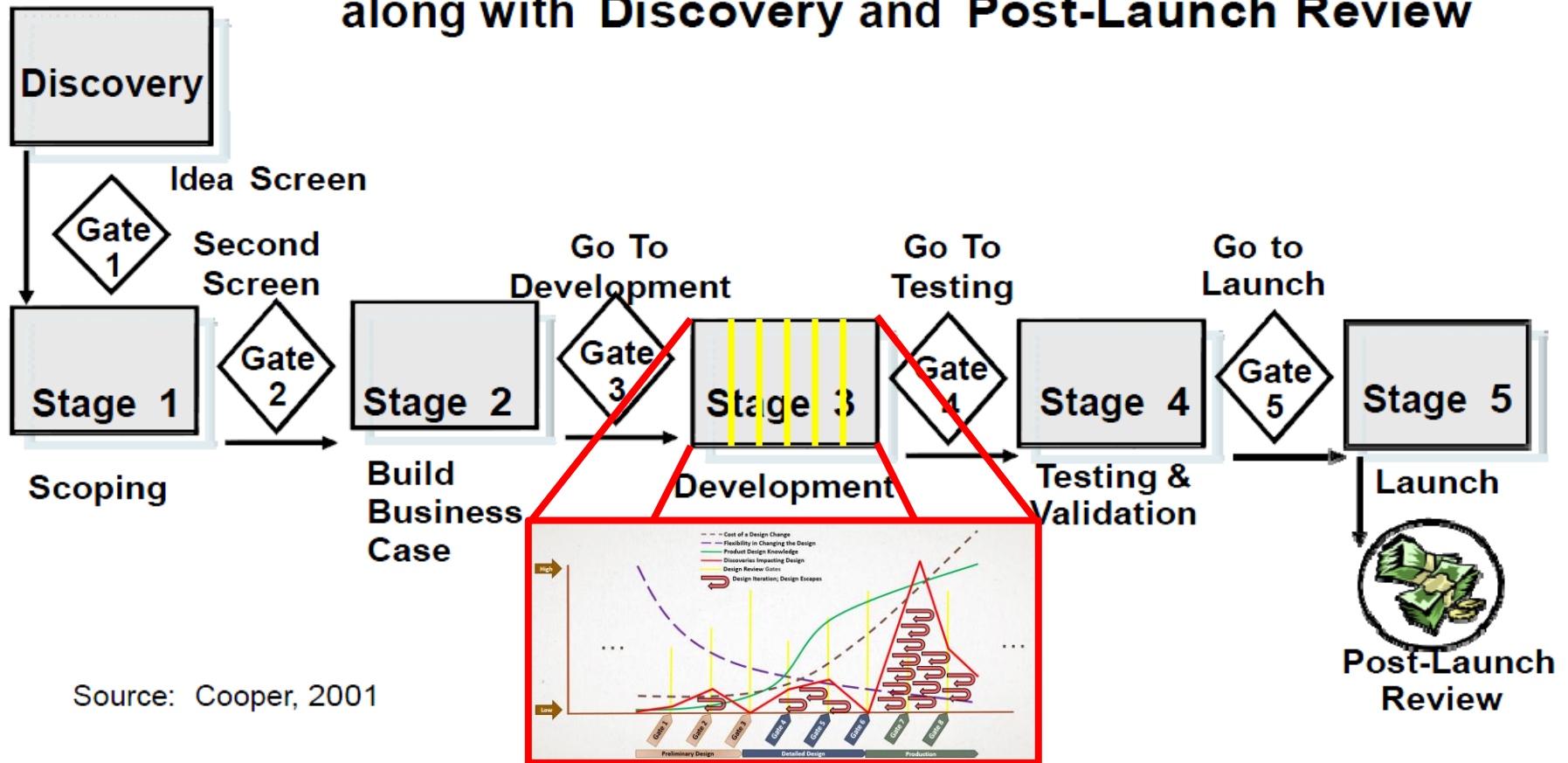
Phased Review Process



General Stage-Gate Process

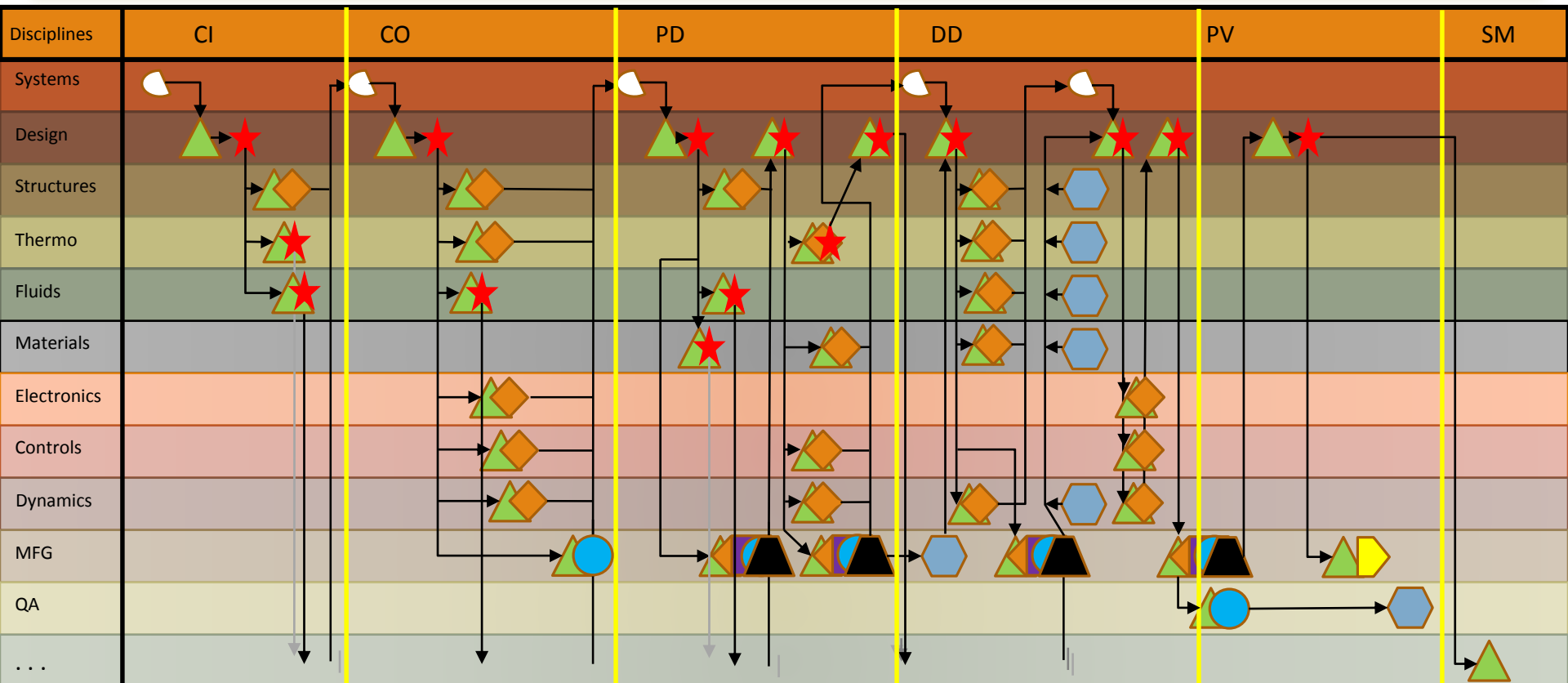
Division of projects into phases/stages, each phase is followed by a go/no-go gate or evaluation.

Stage-Gate®: A five stage, five-gate system along with Discovery and Post-Launch Review



ESW Part Flow Map

Detailed work instructions for the best proven method to produce a product or service, and is the baseline upon which to improve.



 PLM/Modeling
  Analysis
  Validation
  Planning
  Tooling
  Purchasing
  TranslationS
  Parameters
  Production



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Modes of Engineering Work

As the work mode shifts so shifts the modes and frequency of collaboration.

Process — Involving continuity

Think process improvement, improved performance, longer life, ...

Project — Involving start point, check points, end point

Think new Plane, Rocket, UAV, ...

Incident — Involving response to a crises

Think Lithium-ion Battery Problem, Triton Wing Flaw, Rudder PCU malfunction, ...

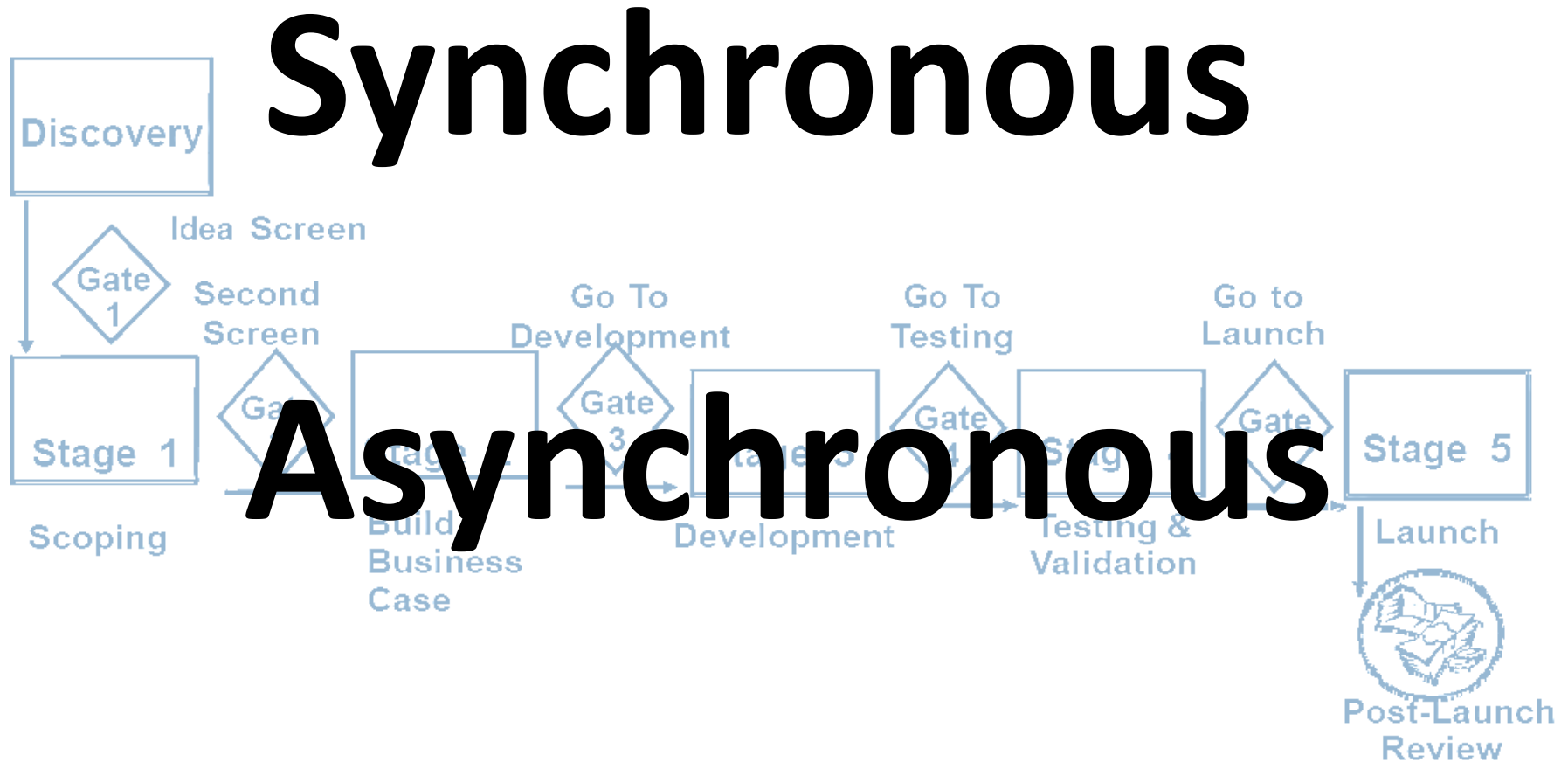


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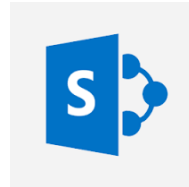
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Tools for EC & SGD



Tools for EC & SGD



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List the Asynchronous Tools used for EC & SGD within your Firm

Rank your list from Most Important (1)
to Least Important (n)



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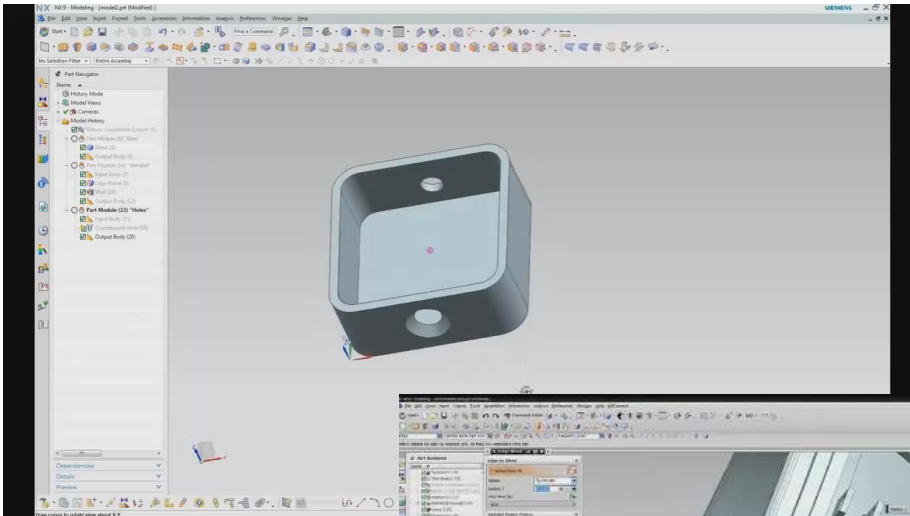


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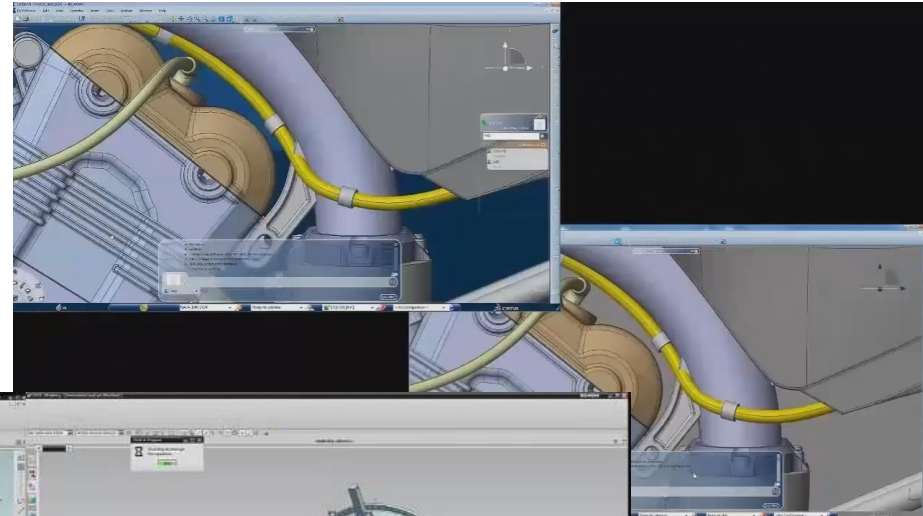
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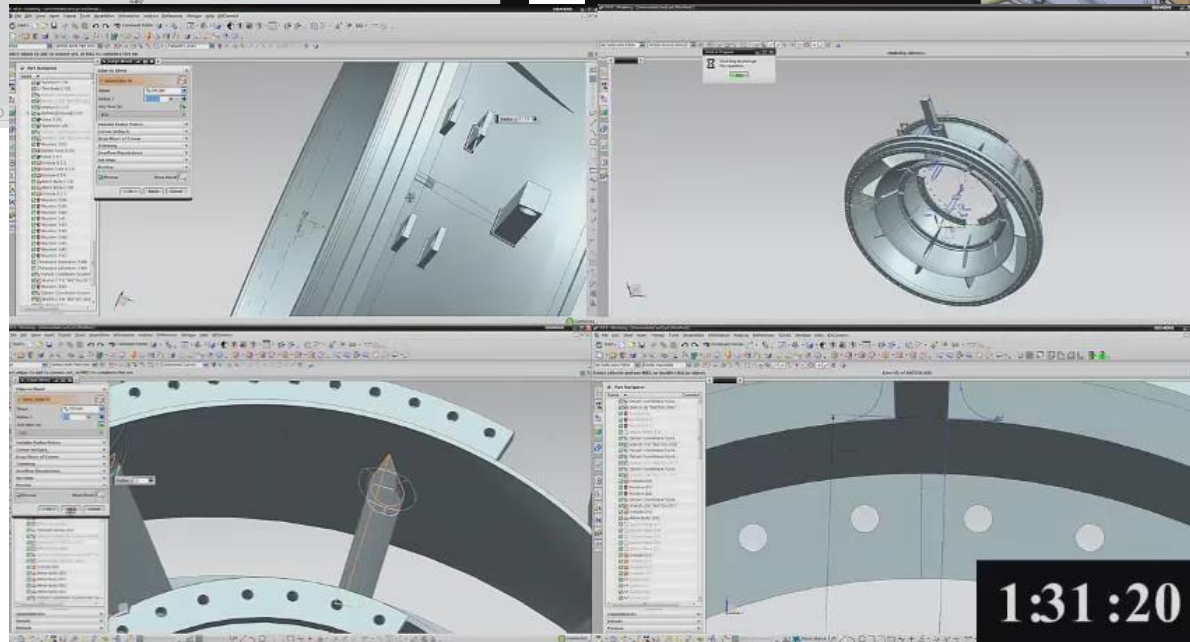
Collaborative CAD Tools for EC & SGD



Part Modules



Collaborate



Connect

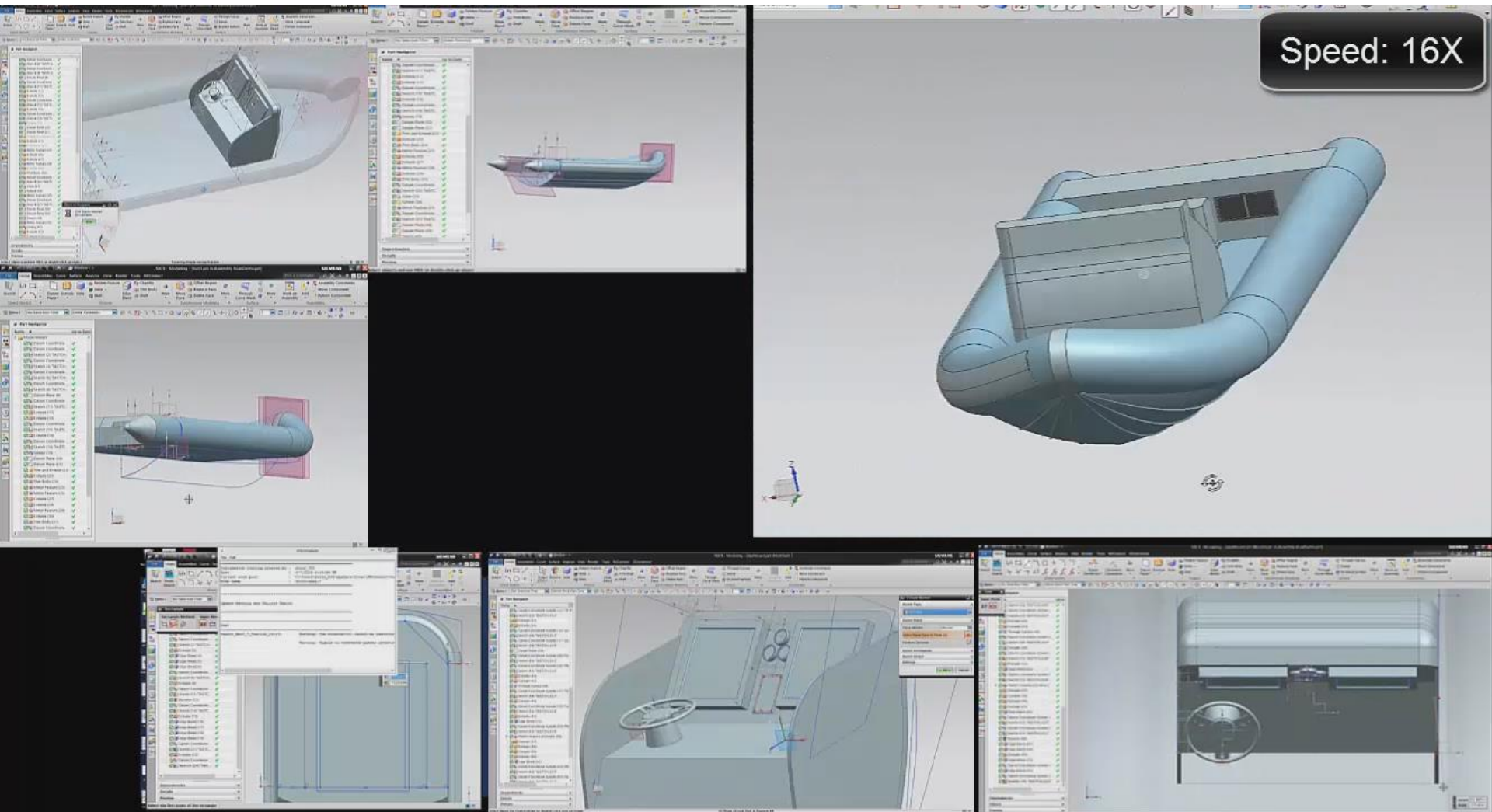


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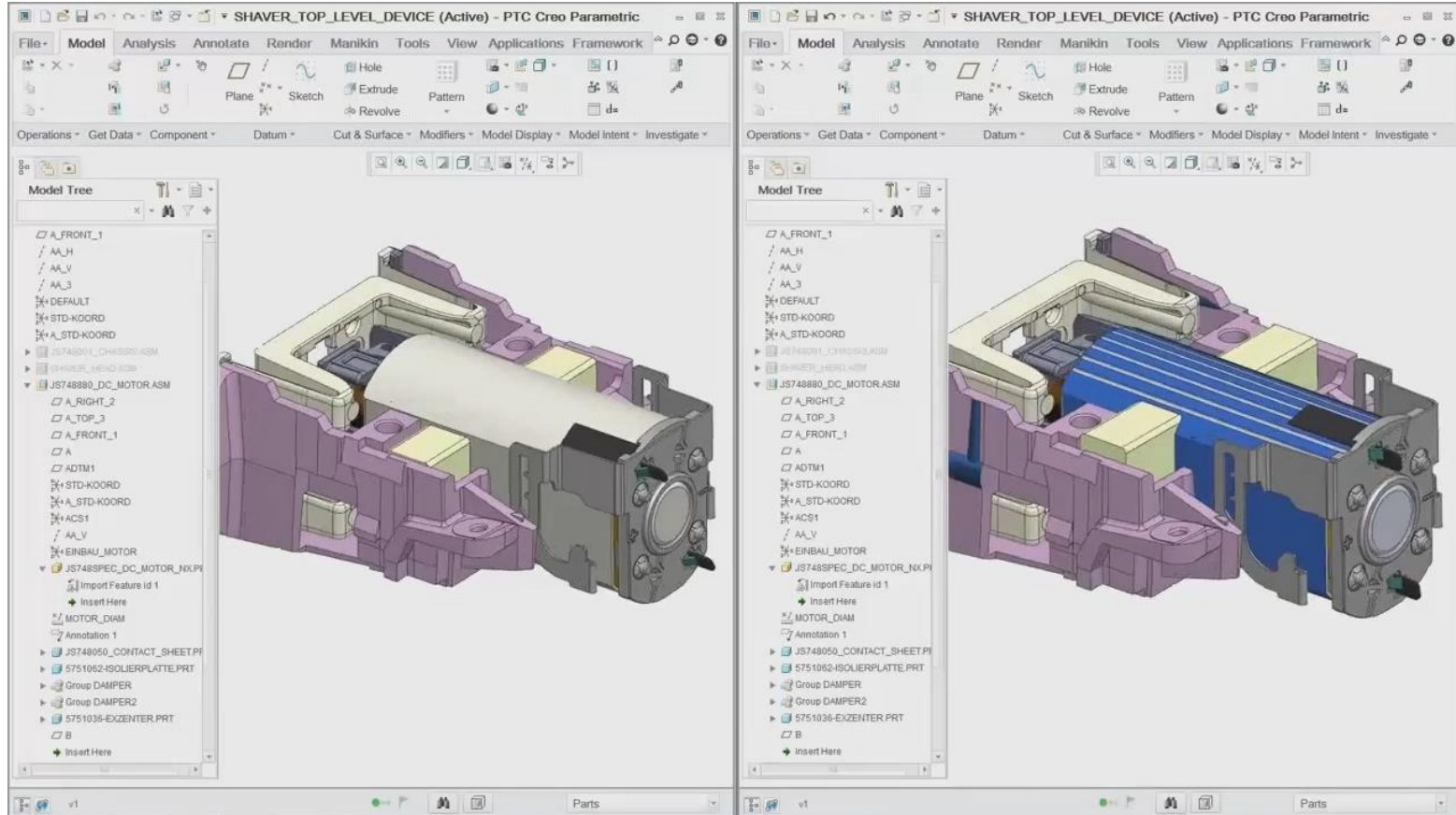


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Multi-CAD Tools for EC & SGD



Unite



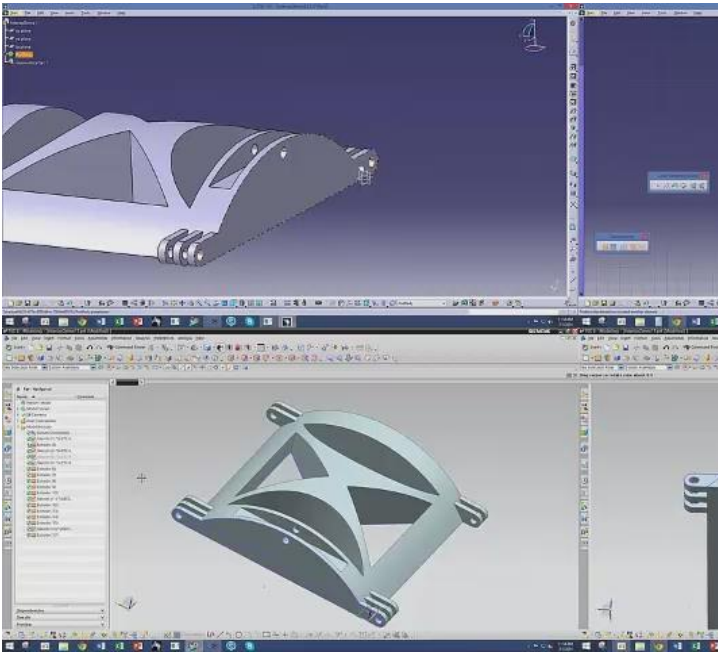
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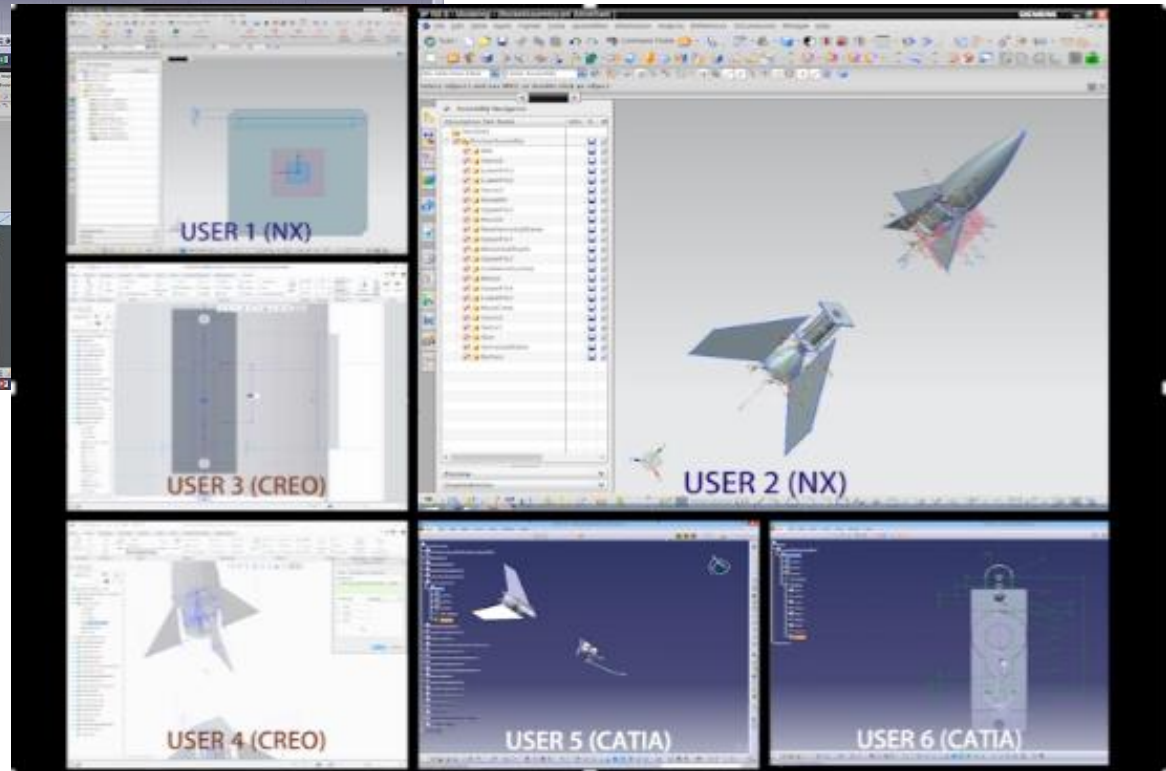
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Multi-CAD Tools for EC & SGD

InterOp



InterOp

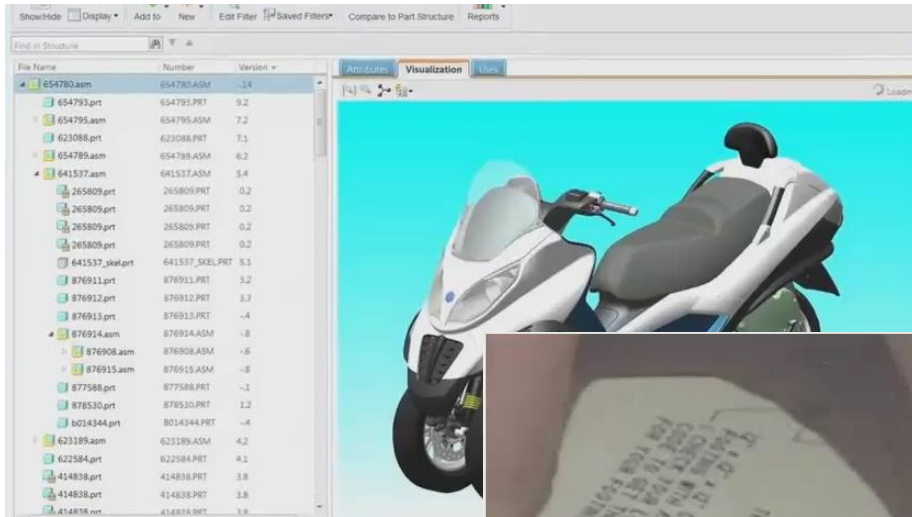


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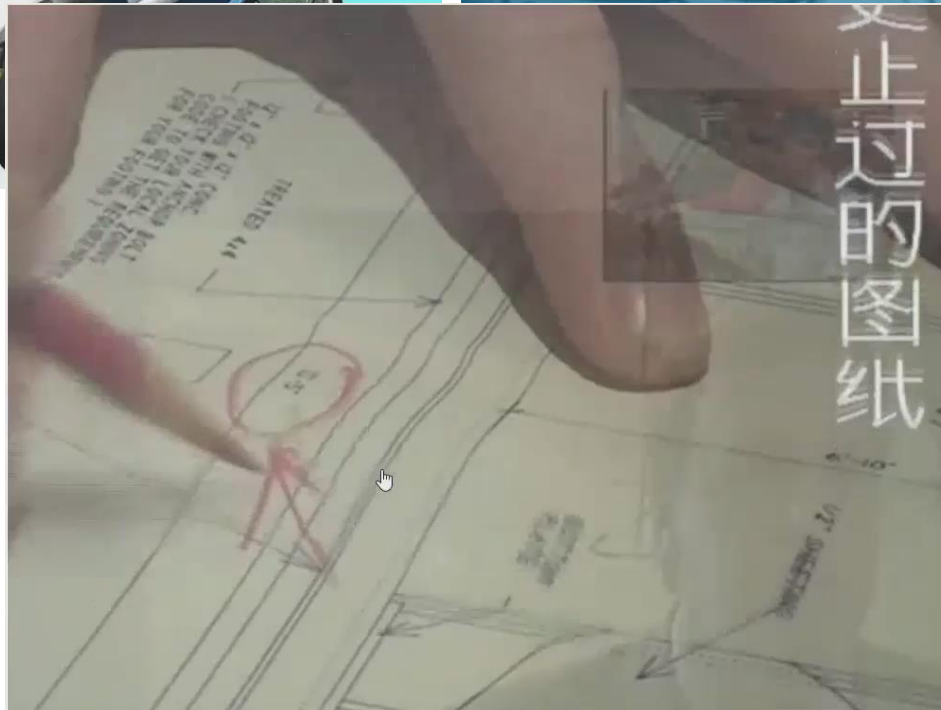
PLM Tools for EC & SGD



PTC



Dassault Systèmes



Siemens

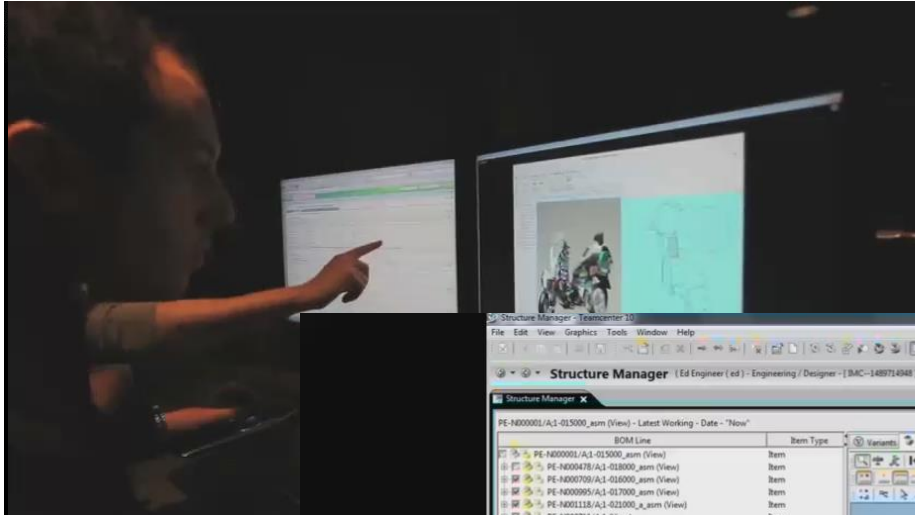


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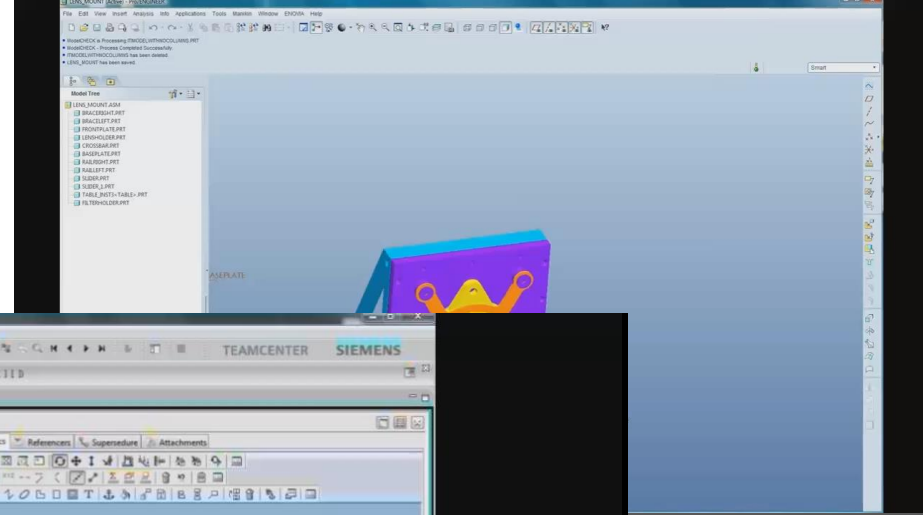
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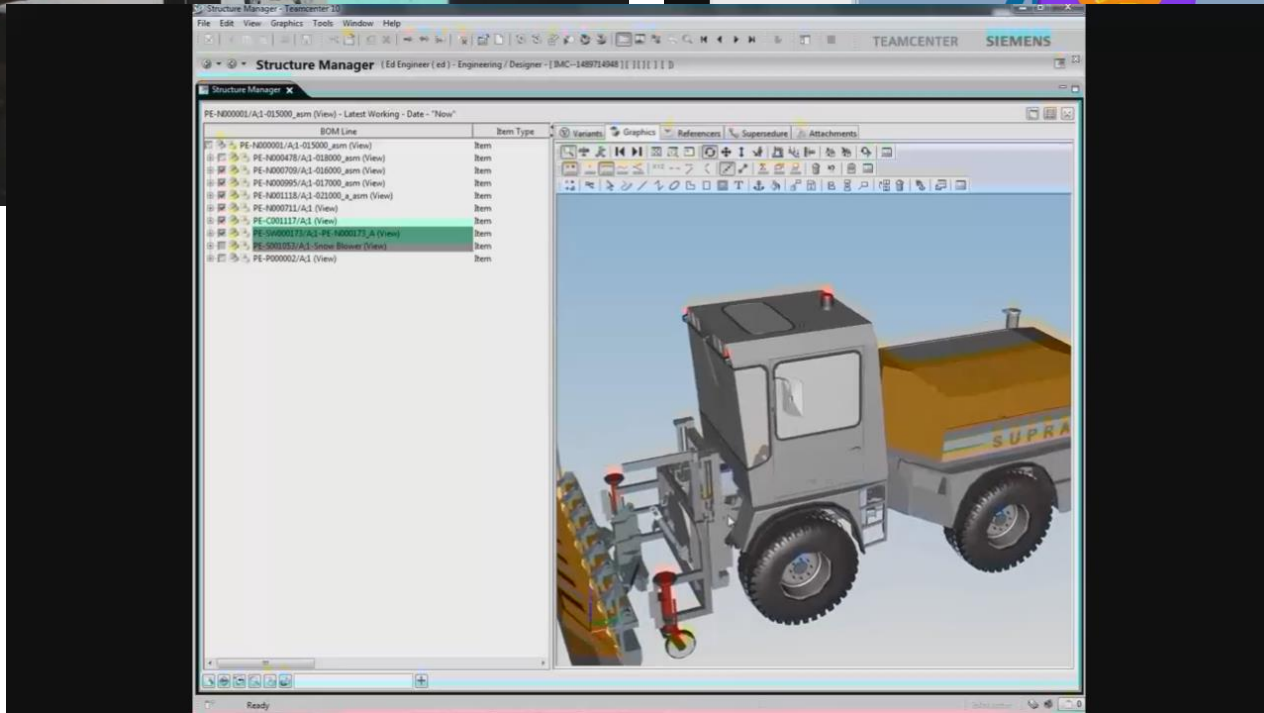
PLM Tools for EC & SGD



Windchill



ENOVIA



Teamcenter



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State of Multi-user & Interop IP

Homogeneous Sync (1/20/2+)

Status	Title	Date
Issued	Collaborative <u>CAx</u> Apparatus & Method	2010
Pending	Multi-user Finite Analysis Systems Apparatus & Method	2012
Pending	Multi-user Decomposition of Design Space Models (US)	2012
Pending	Multi-user Decomposition of Design Space Models (EU)	2012
Pending	Method & Apparatus for Finite analysis Pre-Processing	2012
Pending	Graphical View Selection System, Method & Apparatus	2012
Pending	System, Method & Apparatus for Collaborative <u>CAx</u> Editing	2012
Pending	Parallel Workflow Finite Element Preprocessing Apparatus & System A	2012
Pending	Parallel Workflow Finite Element Preprocessing Apparatus & System B	2012
Pending	System & Methods for Multi-user <u>CAx</u> Editing Conflict Management (US)	2013
Pending	System & Methods for Multi-user <u>CAx</u> Editing Conflict Management (EU)	2013
Pending	System & Methods for Multi-user <u>CAx</u> Editing Data Consistency	2013
Pending	System & Method for Concurrent Multi-user <u>CAx</u> Workflow (US)	2013
Pending	System & Method for Concurrent Multi-user <u>CAx</u> Workflow (EU)	2013
Pending	Method & Apparatus for Concurrent Multi-user Toolpath Creation	2013
Pending	Optimizing Organizations & Management of Teams	2013
Pending	<u>CAx</u> Model Synchronization	2013
Pending	Multi-user <u>CAx</u> Editing of a Model of a Design Object (US)	2014
Pending	Multi-user <u>CAx</u> Editing of a Model of a Design Object (EU)	2014

Status	Title	Date
Provisional	Multi-user PLM	2014
Pending	Collaborative Project Management	2014
Pending	System & Method for Concurrent Multi-user Computer-Aided Manufacturing	2014
Provisional	Permissions & Data Protection in Multi-user CAD	2015

Heterogeneous Sync (0/5/6+)

Status	Title	Date
Pending	System, Method & Apparatus for Collaborative Editing of Common or Related Computer Based Software Output	2013
Provisional	Operation Serialization in a Parallel Workflow Environment	2014
Pending	Collaborative <u>CAx</u> Updates	2014
Pending	Collaborative Product Lifecycle Management	2014
Pending	Interoperable Hierarchical Model for Conducting Multi-user <u>CAx</u> Operations	2014
Pending	Systems & Methods for Providing <u>CAx</u> Data	2014
Provisional	Enforcing Referential Integrity	2015
Provisional	Real-time Acyclic Import Verification	2015
Provisional	Interoperable 2D & 3D Drawing Annotations	2015
Provisional	3D Interoperable & Multi-user Model Based Definitions	2015
Provisional	Two-Dimensional Drawings – Simultaneous Multi-user Interoperability	2015



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Summary and Conclusions

Collaborative PLM and CAx tools dramatically improve EC and SGD and their associated ESWs

- ❑ **The Collaborative Functionality of CAx Tools are Improving,** but not at the pace required for true synchronous EC/SGD.
- ❑ **PLM Systems Successfully Manage Multi-CAD Assemblies,** but lack the instantaneous EC/SGD functionality to dramatically reduce design times, and turnbacks.
- ❑ **ESWs Need Rearchitecting** to take full advantage of the benefits of synchronous multi-disciplinary EC and SGD that use a single source of data.
- ❑ **Stage-gate Processes can become more lean** through the use and adoption of synchronous collaborative PLM and CAx Tools.

