Test Suite for the
CAx Implementor Forum
Round 35J

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1   Introduction

This document describes the suite of test cases to be used for the thirty-fifth round of testing of the CAx Implementor Forum (CAx-IF). The CAx-IF is a joint testing forum, organized and facilitated by PDES, Inc., and the ProSTEP iViP Association. The test rounds of the CAx-IF concentrate primarily on testing the interoperability and compliance of STEP processors based on AP203, AP214, and AP242.

The test rounds in general combine testing of synthetic and production models. Production models will in most cases be provided by the member companies of the organizations PDES, Inc. and ProSTEP iViP Association. When production models are not available from the member companies, "production-like" models will be solicited from the various CAx-IF participants.

This test suite includes synthetic models for testing the following capabilities: Product Manufacturing Information (PMI), both as Graphic Presentation and as Semantic Representation, Geometric Validation Properties, and 3D Tessellated Geometry.

Production models are provided for assemblies and piece parts. The basis for the production test cases is native CAD models. Each test case therefore originates from a single CAD system, and the set of test cases to be pre-processed (converted to STEP files) is unique for each CAD system. After pre-processing, the resulting STEP files are then to be imported/post-processed/read in by the rest of the participants.

1.1   Functionality tested in this round

Functionality tested in this round relates to:

- **Product and Manufacturing Information (PMI)** describes the capability to embed information about dimensions, tolerances and other parameters which are necessary input for the manufacturing and measuring of the part from the 3D model. In Round35J, the focus will be on the two approaches for the transfer of PMI in the 3D model:

    o "Tessellated Presentation" refers to breaking down each annotation into tessellated elements as supported by AP242, and exchanging them as geometry. This preserves the exact shape of the annotation, but is human readable only. The test will include section views as well.

    o "Semantic Representation" refers to the intelligent transfer of PMI data in an associative and re-usable way. This scenario aims towards downstream usage and later modifications of the model. The data is machine-readable, but not necessarily visible in the 3D model. However, the test also includes additional presentation data, which can be linked to the corresponding PMI representation.

- **Geometric Validation Properties** is a mechanism to allow the exchange of geometric properties and their assignment to geometric representations for the purposes of data exchange validation. This includes information about volume, area, centroid, and curves. In Round35J, the focus will be on the additional validation properties for surface data, as well as on the recently agreed optimized implementation structure.

- **Tessellated Geometry** is a simplified representation for the part shape, where the geometry is not given as an exact B-Rep model, but as a collection of simple planar faces (triangles) which can be easily and efficiently created and applied in specific use cases. The scope includes the watertight tessellation format (WTF) and compressed STEP files.

- **Production Models** will be included in this round of testing, in addition to the synthetic models for the above capabilities.


- **AP242 BO Model XML Assembly Structure** is new implementation format introduced with AP242, and the designated process format for many applications in the aerospace and automotive industries. It will be used in combination with a geometry format matching the respective requirement. In the CAx-IF, the geometry files will be in STEP Part 21 format. The XML files will contain the assembly structure and part master information.

1.2 General testing instructions for this round

The general procedures for communication of models and statistics are outlined in a separate document 'General Testing Instructions'. The general instructions can be retrieved from the CAx Implementor Forum web sites. The latest version is v1.11, dated November 15, 2013.

1.3 Testing Schedule

The following schedule has been agreed on for Round 35J:
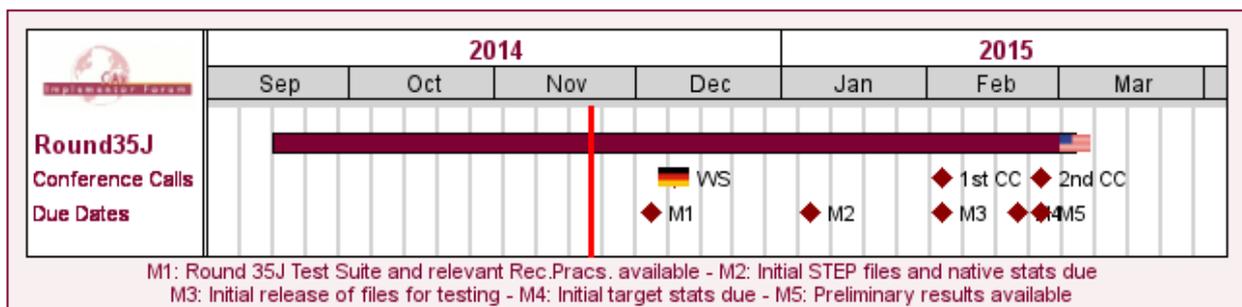
CAx-IF Round35J Schedule

Date	Action
4 Dec 2014 (Thu)	Round 35J Test Suite and relevant Rec.Pracs. available
9 Dec 2014 (Tue)	CAx-IF Technical Workshop in Darmstadt, Germany
7 Jan 2015 (Wed)	Initial STEP files and native stats due
4 Feb 2015 (Wed)	1st CAx-IF Round35J Conference Call / Initial release of files for testing
20 Feb 2015 (Fri)	Initial target stats due
25 Feb 2015 (Wed)	2nd CAx-IF Round35J Conference Call / Preliminary results available
2 Mar 2015 (Mon) - 4 Mar 2015 (Wed)	CAx-IF Round35J Review Meeting in Gaithersburg, MD, USA

Figure 1: CAx-IF Round35J Schedule

The CAx-IF Technical Workshop will be held in conjunction with a LOTAR meeting. Conference calls and web sessions will also be available.

The CAx-IF R35J Review meeting will take place in conjunction with the PDES, Inc. Spring Offsite meeting and a LOTAR workshop. In addition, conference calls and web sessions will be available for those not attending the meeting to dial in.

1.4 Copyrights on Test Cases

1.4.1 CAx-IF

None of the production test cases which were provided by the PDES, Inc. and ProSTEP iViP member companies are released for any purpose. The test cases can be freely distributed among the CAx-IF members, and can be used for any purposes that are related to CAx-IF testing (i.e. testing, documentation of testing efforts), as long as a reference to the originating company is made.

The test cases must not be used for any purposes other than CAx-IF testing or outside of PDES, Inc. and ProSTEP iViP. Test cases provided by the LOTAR project for testing of specific capabilities are applicable to the same restrictions and may not be used outside LOTAR or the CAx-IF.

1.4.2 NIST

The test cases developed at the National Institute of Standards and Technology (NIST) are not subject to copyright protection and are in the public domain. NIST assumes no responsibility for the components of the test system for use by other parties and makes no guarantees, expressed or implied, about their quality, reliability, or any other characteristic. The use of the CAD systems to create the Test Models does not imply a recommendation or endorsement by NIST.

For more details, read the disclaimer at http://go.usa.gov/mGVm

2 Synthetic Test Case Specifications

2.1 Test Case SP4: Semantic PMI Representation

All information about this test case can also be viewed in CAESAR on its Information page.

2.1.1 Motivation

Product and Manufacturing Information (PMI) is required for a number of business use cases in the context of STEP data exchange. Among others, it is a prerequisite for long-term data archiving. In addition, PMI can be used to drive downstream applications such as coordinate measuring and manufacturing.

Semantic PMI Representation relates to the capability to store PMI data in the STEP file in a computer-interpretable way, so that it can be used for model redesign or downstream applications. Though the definition of the data is complete, it is by itself not visible in the 3D model.

Additional presentation capabilities are needed to display the data in a way that it is visible to the user in the 3D model. Addition of presentation is data is optional in the SP3 test case.

2.1.2 Approach

The approach to be used is described in the latest version (at least v4.0, dated October 13, 2014) of the "Recommended Practices for Representation and Presentation of PMI (AP242)", which can be found on the public CAx-IF web sites under "Joint Testing Information".

Within the PMI area, the following functionalities are in scope of Round 35J:

- Semantic PMI Representation

- Graphic PMI Presentation (Polyline or Tessellated)

- Linking of PMI Representation to Presentation

The AP242 schema to be used is the IS version (v1.36), which can be found on the public CAx-IF web sites under "Joint Testing Information".

2.1.3 Testing Instructions

The tests will be performed based on a verified set of test models, each with set of well-defined PMI. These models have been developed in the course of the "MBE PMI Validation and Conformance Testing" project, which has been supported by the CAx-IF in recent test rounds already. The models have recently been improved to address a number of issues found in the initial release from December 2013.

2.1.3.1 Test Model Overview

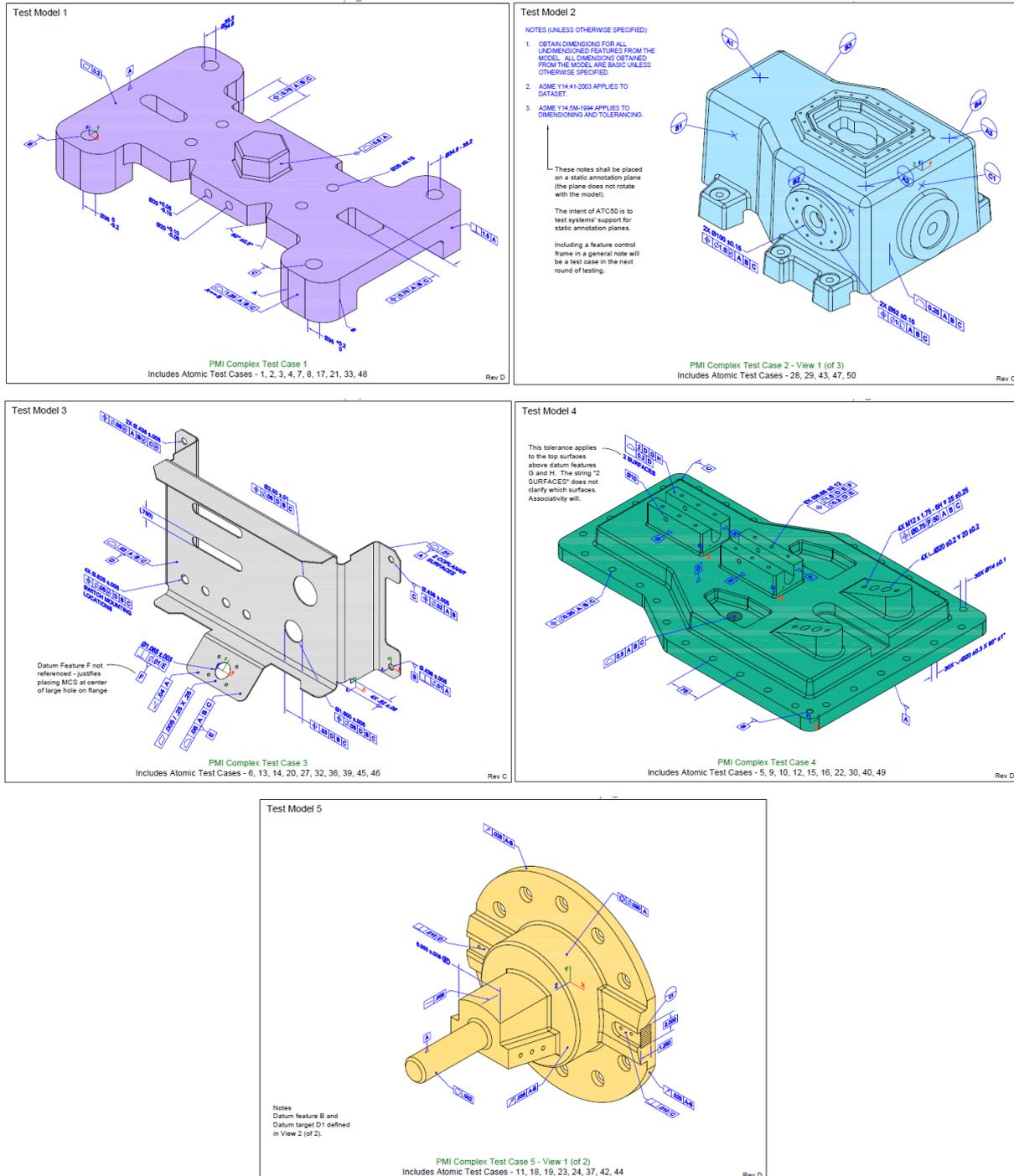The models are designated "CTC" ("Combined Test Cases") and numbered 01 - 05 in reading direction:

Figure 2: Illustrations of the five NIST "CTC" models to be used for SP4

2.1.3.2 Test Model Access

Each of the five test cases has been modeled natively in four different CAD systems:

- Dassault Systèmes CATIA V5 R21

- PTC Creo 2.0

- Siemens NX 8.0

- Dassault Systèmes SolidWorks 2012

The native CAD files, a ZIP file with the test case definitions, and a PDF with release notes for the updated December 2014 versions of the models can be downloaded from this URL:

- http://www.nist.gov/el/msid/infotest/mbe-pmi-validation.cfm

2.1.3.3 Test Model Configuration

The following functionality shall be included in the test files provided for this round of testing, as far as it has been implemented by the CAx-IF participants and is described in the Recommended Practices:

- PMI Representation – the re-usable representation of PMI data should be included in all SP4 models to the extent supported by the native system.

- PMI Graphic Presentation – Many CAD systems require some minimal presentation information to be able to handle the PMI data in a model. There are also use case were both PMI representation and presentation data will be included in the same file. Thus, some form of presentation information shall be included in the SP4 test case as well.

- Linking PMI Representation to Presentation – If a model contains PMI Representation information as well as Presentation data, it is very useful to link the corresponding elements together, so that a Representation element "knows" by which annotation it is being presented in the model. The approach to create this link is described in section 6.3 of the PMI Rec.Pracs. (v4.0).

- Validation Properties – All participants providing STEP files for this test case are encourage to include validation properties as far as supported; in particular for PMI presentation and representation.

2.1.3.4 Statistics

For each STEP file exported or imported for the SP4 test case, vendors must submit the corresponding statistics. To do so, go to the [SP4 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec. Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described below.

Screenshots

If presentation information is contained in the test files, it shall be accompanied by corresponding screenshots. Note that CASEAR allows the addition of multiple screenshots per dataset.

Note that in order to count the GD&T elements for the statistics, per agreement during the R22J Review Meeting, the actual STEP entity types (`datum`, `datum_target`...) shall be considered.

Note that all statistics – native and target – shall be based on the Semantic PMI Representation data only, and not take any presentation into account.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'SP4' followed by the model index; i.e. 'SP4-01' … 'SP4-05'.
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'

scope	A short designation of the scope tested in the model. In the case of SP3, recommended values are:
	   o Representation
	   o Representation + [char.-based / graphic] Presentation
	   o Representation + Linked [… / …] Presentation

dimension	The number of dimensions processed
datums	The number of datums processed
datum_targets	The number of datum targets processed
tolerances	The number of tolerances processed
labels	The number of labels processed
pmi_graphic_pres	all/partial/none – whether the graphic PMI annotations included in the file could be processed correctly
pmi_linked_pres_rep	all/partial/none – whether the Semantic PMI Representation elements and (Graphic) PMI Presentation elements were linked correctly together.
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.2   Model TGP1: 3D Tessellated Geometry with Tessellated PMI Presentation

All information about this test case can also be viewed in CAESAR on its Information page.

2.2.1   Motivation

In addition to use cases that require a fully defined, precise, semantic definition of the part geometry and association PMI as is the focus of the SP4 test case described above, there are also scenarios where the presentation of the data – geometry and annotations – for visual consumption is the primary goal. In such cases, a simplified and optimized version of the model is sufficient.

For this purpose, AP242 introduced a data model for tessellated geometry, which can be used for tessellated part geometry as well as for tessellated PMI presentation. These capabilities have been tested several times in past CAx-IF test rounds, though separately. Round 35J aims at combining what was previously in scope of the "TP3" and "TS1" test cases.

2.2.2   Approach

The approach for 3D Tessellated Geometry is described in the corresponding draft Recommended Practices. The latest working draft (v0.4, dated September 14, 2014) can be found in the member area of the CAx-IF web sites, under "Information on Round 34J of Testing."

The approach for Tessellated PMI Presentation is described in the latest version (at least v4.0, dated October 13, 2014) of the "Recommended Practices for Representation and Presentation of PMI (AP242)", which can be found on the public CAx-IF web sites under "Joint Testing Information".

The AP242 schema to be used is the IS version (v1.36), which can be found on the public CAx-IF web sites under "Joint Testing Information".

2.2.3 Testing Instructions

The tests will be performed based on the same set of NIST CTC models as for the SP4 test case described above.

2.2.3.1 Test Model Overview

- See section 2.1.3.1 above.

2.2.3.2 Test Model Access.

- See section 2.1.3.2 above.

2.2.3.3 Test Model Configuration

The following functionality shall be included in the test file provided for this round of testing, as far as it has been implemented by the CAx-IF participants and is described in the Recommended Practices:

- <u>Tessellated Presentation</u> – include the PMI elements as tessellated annotations. Stroked, outline and filled fonts (and combinations) are allowed, as well as styling of the annotations (colors).

- <u>Definition of "Saved Views"</u> – as far as supported, include the saved views defined in the models, which contain a subset of annotations in the file, and provide a pre-defined position of the model in the design space.

  - o All CTC models contain at least one Saved View. The models CTC-02 and CTC-05 contain several Saved Views. In the test case definitions, each page of the PDF document represents one Saved View.

  - o For each view, a screenshot showing the model layout (displayed elements, orientation, zoom) shall be provided. **Note** that it is possible to attach several screenshots to one set of statistics in CAESAR. The name of the view shall be given as description for the screenshot.

  - o Both "basic" and "advanced" view implementation are allowed

- <u>Cross-highlighting of annotations and annotated shape</u> – if supported, include in the STEP file the information necessary to maintain the association between annotations and the annotated shape elements in a way, that after import, when highlighting an annotation, the shape elements annotated by it are highlighted too, and vice versa.

- <u>PMI Validation Properties for Tessellated Presentation</u> – as far as supported, include the validation properties in the files, and evaluate these after import:

  - o "Number of Segments"
  - o "Tessellated Curve Length"
  - o "Tessellated Curve Centre Point"
  - o "Number of Facets"
  - o "Tessellated Surface Area"
  - o "Tessellated Surface Centre Point"
  - o "Equivalent Unicode String"
  - o "Affected Geometry"

Note that for the creation of the Equivalent Unicode String, the mapping as defined by the "Unicode String Project" report (Revision J) shall be used. This document is available on the public CAx-IF homepages, under "Joint Testing Information".

Note that for the PMI validation properties, the new optimized implementation structure for validation properties can be used. This is currently defined in section 4.10 of the "Recommended Practices for Geometric and Assembly Validation Properties" (Release 4.2, dated October 9, 2014), which can be found on the public CAx-IF homepages under "Joint Testing Information".

2.2.3.4 Statistics

For each STEP file exported or imported for the TGP1 test case, vendors must submit the corresponding statistics to CAESAR. To do so, go to the [TGP1 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

View-related Statistics

Several of the Statistics for this test case are view-related (e.g. number of annotations, positioning/scaling). The statistics cannot evaluate this for all views in the model. Hence, the idea is to select <u>one</u> specific (interesting) view on export and publish its name in the "Saved View" field of the statistics. <u>It is recommended to use the first view (by name, alphabetized) in the model.</u> Then, fill in the other view-related statistics with the values as valid for this particular view. After import, select the view with the name given in the native statistics and again provide the values valid for this view.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec. Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Screenshots

For each Saved View in the model, provide one screenshot, which illustrates the layout (displayed geometry and annotation, model orientation, and zoom factor). Give the name of the view as the description of the screenshot.

Note that in order to count the PMI elements for the statistics, per agreement during the Round 22J Review Meeting, the names of the `tessellated_geometric_set` shall be considered.

See section "Indicating the Presented PMI Type" in the PMI Recommended Practices for details.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'TGP1' followed by the model index; i.e. 'TGP1-01' … 'TGP1-05'.
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
dimension	The number of dimensions processed
datums	The number of datums processed

datum_targets	The number of datum targets processed
tolerances	The number of tolerances processed
labels	The number of labels processed
saved_view	The name of the Saved View which is the basis for the view-related statistics
view_annot	The number of annotations included in the specified saved view.
view_pos	pass/fail, whether the model orientation and zoom factor stored for the Saved View could be restored successfully.
highlight	all/partial/none – whether the cross-highlighting for annotations and annotated shape elements works correctly
tess_pmi_area	all/partial/none – whether the surface area of the Tessellated PMI annotations was validated successfully for all, some or none of the given annotations.
tess_pmi_clength	all/partial/none – whether the total length of segments per Tessellated PMI annotation was validated successfully for all, some or none of the given annotations.
tess_pmi_c	all/partial/none – whether the centroids of the Tessellated PMI annotations were validated successfully for all, some or none of the given annotations.
eq_unicode	all/partial/none - if the encoding of the equivalent Unicode string was correct for all, some or none of the given annotations.
valid_tess_vp	pass/fail, is the instantiation of the validation properties for Tessellated Geometry in the STEP file per the recommended practices?
affected_geo	all/partial/none – whether the affected geometry could be validated correctly for all, some or none of the PMI statements in the model.
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.3 Test Case B4: Geometric Validation Properties

All information about this test case can also be viewed in CAESAR on its Information page.

2.3.1 Motivation

Geometric Validation Properties are one of the most important and successful capabilities of STEP, which distinguishes it from other neutral exchange formats. The properties allow for the validation of the imported data based on key characteristics calculated by the native system and stored in the STEP file, which are then compared against the results computed for the imported model in the target system.

These key values typically are total volume, total surface area and centroid of the model. Based on recent test experiences and refined use cases, it was agreed to separate these values for the different classes of geometry (solids, independent surfaces, and independent curves) that can be found in a model. "Independent" means that these do not take part in the definition of a higher-class topological element, i.e. an independent curve is not an edge of a surface (it may be part of a wireframe model), and an independent surface is not a face of a solid (it may be part of an open or closed shell).

While the Geometric Validation Properties for Independent Curves have been tested several times now, the values for Independent Surfaces are new and hence shall be tested using a suitable hybrid model.

2.3.2 Approach

For the validation properties, the approaches as described in the "Recommended Practices for Geometric and Assembly Validation Properties", version 4.3, dated October 9, 2014, shall be used, in particular:

- GVP for Solid Geometry, section 4.6
- GVP for Surface Geometry, section 4.7 (new)
- GVP for Curve / Wireframe Geometry, section 4.8
- Bounding Box, section 4.9
- Combining Validation Properties for Efficient Implementation, section 4.10

This document is available on the public CAx-IF homepage, under "Joint Testing Information".

2.3.3 Testing Instructions

In Round 35J, the model from Round 34J will be reused. It has been provided by Audi and has been designed for interoperability tests and has been used, among other occasions, in the 2013 JT Application Benchmark facilitated by ProSTEP iViP and VDA.

The model contains:

- The part shape as solid geometry
- The part shape as surface geometry (occupying the same space)
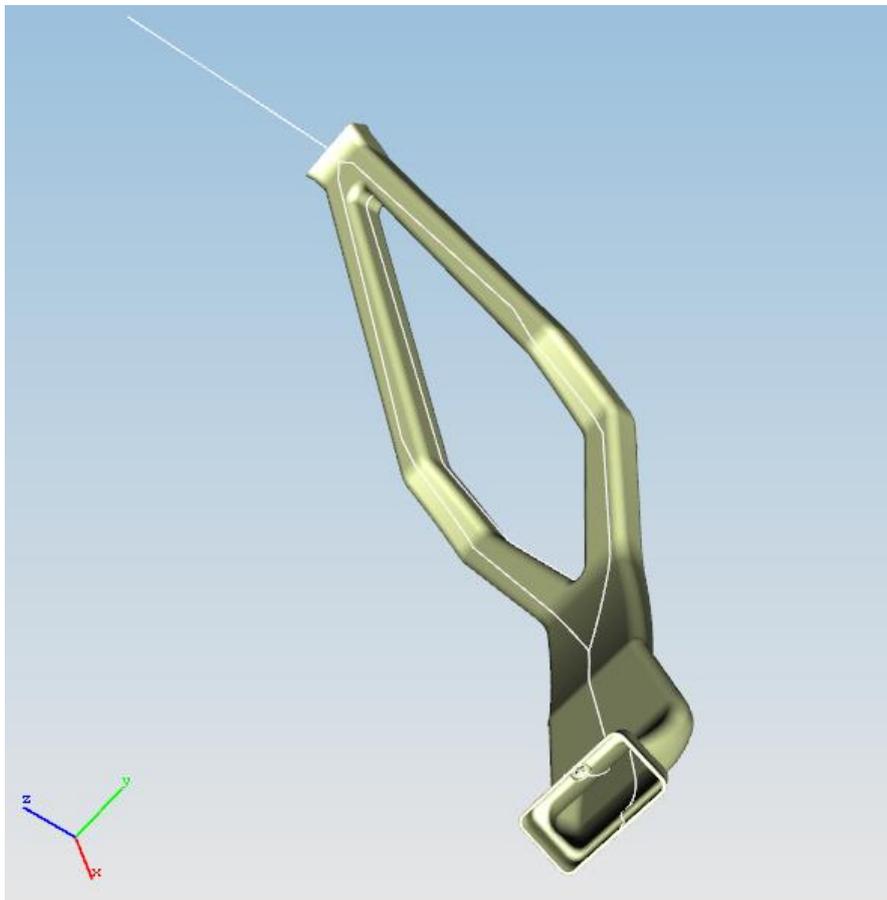- Additional Wireframe geometry

Figure 3: Illustration of the B4 Model

2.3.3.1 Construction of the Model

The model is provided in the following formats:

- CATIA V5 R19 (*.CATPart)

- Creo (*.prt.1)

- NX (*.prt)

- ACIS (*.sat)

The native files are combined into a ZIP archive, which is available from the member area of the CAx-IF homepages, under "Information on Round34J of Testing".

2.3.3.2 Statistics

For each STEP file exported or imported for the B4 test case, vendors must submit the corresponding statistics. To do so, go to the [B4 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'B4'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
unit	The unit the model is designed in
volume	Total volume of all solids
validation_volume	Total volume of all solids as received via the validation property capability
valid_vol	pass/fail, is the instantiation of the validation property 'volume' in the STEP file as per the recommended practices for validation properties?
area	Total surface area of all solids
validation_area	Total surface area of all solids in the model, as received via the validation property capability
valid_area	pass/fail, is the instantiation of the validation property 'area' in the STEP file as per the recommended practices for validation properties?
cx	
cy	Centroid of the model
cz	

validation_cx	Centroid of the model (entire assembly) as received via the validation property capability
validation_cy	
validation_cz	
valid_cent	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
surface_area	Total area of all independent surfaces in the model
validation_sfarea	Total area of all independent surfaces in the model, as received via the validation property capability
valid_surface_a	pass/fail, is the instantiation of the validation property 'independent surface area' in the STEP file as per the recommended practices for validation properties?
surface_centroidx	Combined Centroid of all independent surfaces in the model
surface_centroidy	
surface_centroidz	
validation_sfcentroidx	Combined Centroid of all independent surfaces in the model, as received via the validation property capability
validation_sfcentroidy	
validation_sfcentroidz	
valid_surface_c	pass/fail, is the instantiation of the validation property 'independent surface centroid' in the STEP file as per the recommended practices for validation properties?
curve_length	Total length of all (independent) curves in the model
validation_clength	Total length of all independent curves in the model, as received via the validation property capability
valid_curve_l	pass/fail, is the instantiation of the validation property 'curve length' in the STEP file as per the recommended practices for validation properties?
curve_centroidx	Combined Centroid of all independent curves in the model
curve_centroidy	
curve_centroidz	
validation_ccentroidx	Combined Centroid of all independent curves in the model, as received via the validation property capability
validation_ccentroidy	
validation_ccentroidz	
valid_curve_c	pass/fail, is the instantiation of the validation property 'independent curve centroid' in the STEP file as per the recommended practices for validation properties?
bbox_minx	The (min X, min Y, min Z) corner point of the Bounding Box (per GVP RP v3.3 or later)
bbox_miny	
bbox_minz	
bbox_maxx	The (max X, max Y, max Z) corner point of the Bounding Box (per GVP RP v3.3 or later)
bbox_maxy	
bbox_maxz	
valid_bbox	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.4 Test Case S1: AP242 BO Model XML Assembly with Tessellated Geometry

All information about this test case can also be viewed in CAESAR on its Information page.

2.4.1 Motivation

The exchange of assembly structures with external references to geometry files is a long-used concept in the STEP multiverse, which has proven its value and stability in many business use cases. In the CAx-IF context, so far all files of such a package (structure and geometry) were provided as STEP Part 21 files.

Now AP242 provides a Business Object (BO) Model, which is a comprehensive data model with an XML representation, and was designed with the use case of combined use with other formats in mind. The user community hence requests support of this new format for the established use case of assembly data exchange.

AP242 BO Model XML is the designated standard process format for the automotive and aerospace industries and will be used together with various standardized and proprietary geometry file formats, depending on the actual use case. This also includes tessellated formats. External References and 3D Tessellated Geometry are capabilities that have been tested many times in the CAx-IF already, but always separately. Round 35J aims to combine them into one test case.

2.4.2 Approach

The following schemas and documents shall be used for this test:

- *AP242 IS Business Object Model XML*, dated May 5, 2014 [R34J]

- *AP242 IS Longform Schema (v1.36)*, dated May 22, 2014 [JTI]

- *Draft Recommended Practices for AP242 Business Object Model XML Assembly Structure*, version 0.90, dated November 13, 2014 [R35J]

    o Note that a set of example XML files is available as well, based on AS1 [R35J].

- *Recommended Practices for 3D Tessellated Geometry*, version 0.4, dated September 14, 2014 [R34J]

- *Recommended Practices for STEP File Compression*, version 1.1, dated November 21, 2013 [JTI]

The documents can be found in the following locations, as indicated:

- [JTI] – Public CAx-IF Homepage, "Joint Testing Information"

- [R34J] – CAx-IF Member Area, "Information on Round 34J of Testing"

- [R35J] – CAx-IF Member Area, "Information on Round 35J of Testing"

Each set of files (structure + geometry files) shall be provided as a ZIP package containing:

- For the component part geometry files:

    o A compressed AP242 Part 21 file (*.stpZ) with a tessellated representation of the part geometry

    o Vendors who do not support 3D tessellated geometry in their implementations may provide the part geometry as "classic" STEP B-Rep data (*.stp).

- For the assembly structure:

    o One AP242 BO Model XML file ("all-in-one" approach), or

    o Multiple AP242 BO Model XML files ("nested" approach) – see section 9.2 in the Recommended Practices for AP242 BO Model XML Assembly Structure.

2.4.3 Testing Instructions

The test model that will be used for this test is the well-known "S1" model ("spaceship").

For those vendors who do not have the S1 model at hand, modelling instructions can be found in the Round5J Test Suite document (v2.0), which can be found on the "Joint Testing Information" pages of the CAx-IF web sites, dated October 4th, 2000.
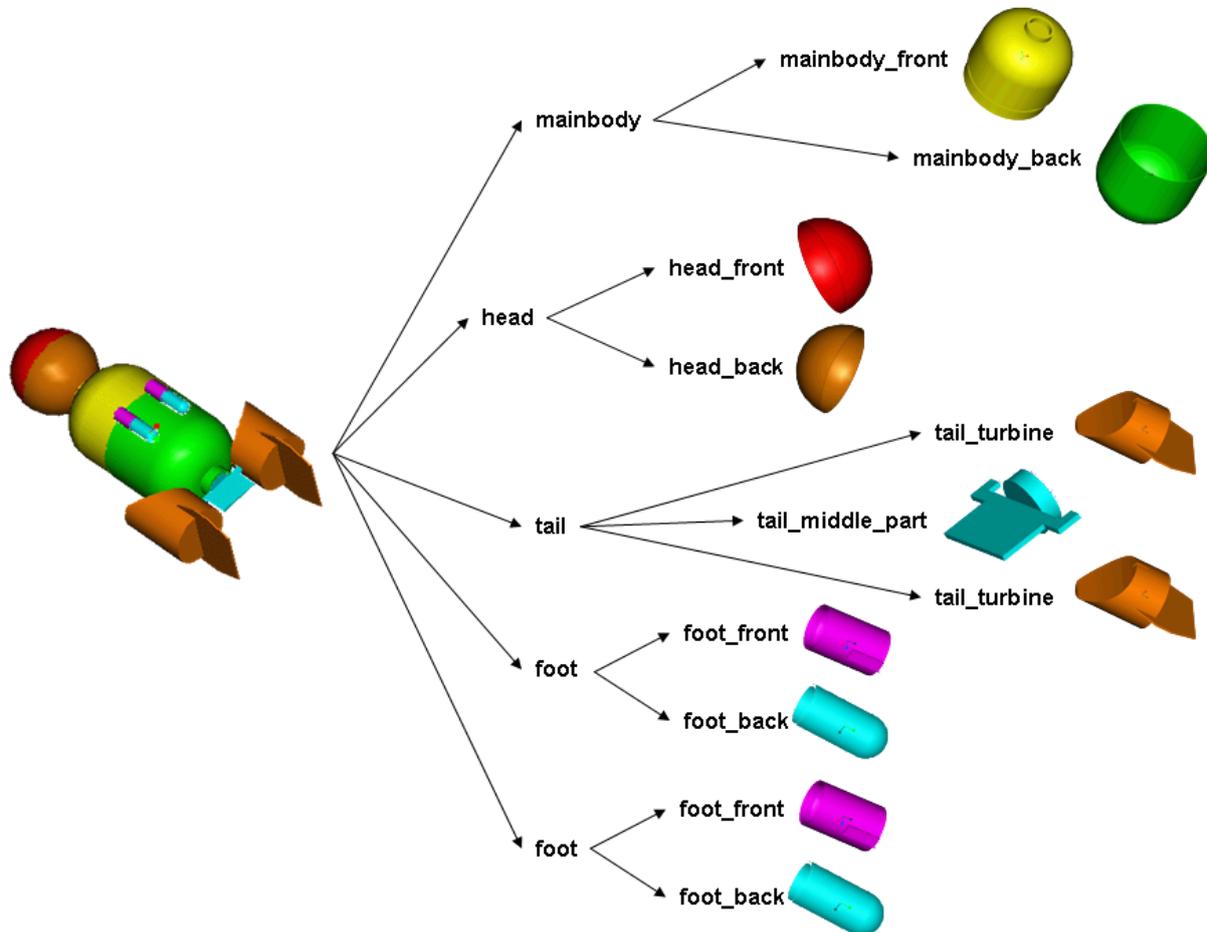

Figure 4: Shape and Structure of the S1 model (spaceship)

The aim of this test is to correctly transfer the assembly structure based on AP242 BO Model XML files, using either the "all-in-one" or the "nested" approach, and referencing tessellated parts.

Since transfer of the S1 geometry itself can safely be considered stable, there will be no geometry-related statistics. The evaluation will focus on completeness and correctness of the assembly structure and the external references.

2.4.4 Statistics

For each STEP file exported or imported for the S1 test case, vendors must submit the corresponding statistics to CAESAR. To do so, go to the [S1 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec. Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'S1'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
fref_found	all/partial/none - indicates if all, some or none of the references to the external files can be found in the assembly structure file(s), and if they are correctly associated with the respective nodes in the assembly structure.
fref_processed	all/partial/none - indicates if all, some or none of the referenced files were be processed correctly to successfully construct the overall model.
assem_struct	pass/fail - if the model structure (assembly tree) was transferred correctly, i.e. no nodes have been added or removed, and all elements are on the correct hierarchical level.
assem_place	all/partial/none - whether the placement of assembly components is correct
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.5 Model CO1: Composite Materials

A test case for composite materials will be added in a later version of this document.

3   Production Models

3.1 PM29

All information about this test case can also be viewed in CAESAR on its Information page.

3.1.1 Motivation

In an attempt to test the STEP processors on real world models, the CAx Implementor Forum will be testing production parts in this round and future rounds of CAx-IF testing. These production models are characteristic for components and assemblies that are encountered in the aerospace and automotive industries. PDES, Inc. and ProSTEP iViP member companies and vendors have supplied these models. As they may contain data about current products of these companies, all native and STEP files related to these models have to be handled confidentially and their use is strictly limited to the CAx-IF activities.

3.1.2 Approach

Testing of Production Models focuses mainly on data quality, not on specific functionalities. Assemblies should therefore be exported as a single STEP file. The file format should be either AP214 (IS or 3rd Ed.), AP203 (2nd Ed.) or AP242 IS (schema version 1.36). In order to support quality validation of the Production Model exchange, all vendors shall include the maximum level of Validation Properties they support, and report them in the statistics. PMI may be included as Polyline Presentation, if defined in the native models.

3.1.3 Testing Instructions

The native models as provided by the user companies should be exported to STEP by all participants who maintain a STEP processor for the respective CAD system. The native models are available on the CAx-IF File Repository in the member area. Once there, browse to the sub-folder "Round 35J > Production Models".

3.1.4 List of available models

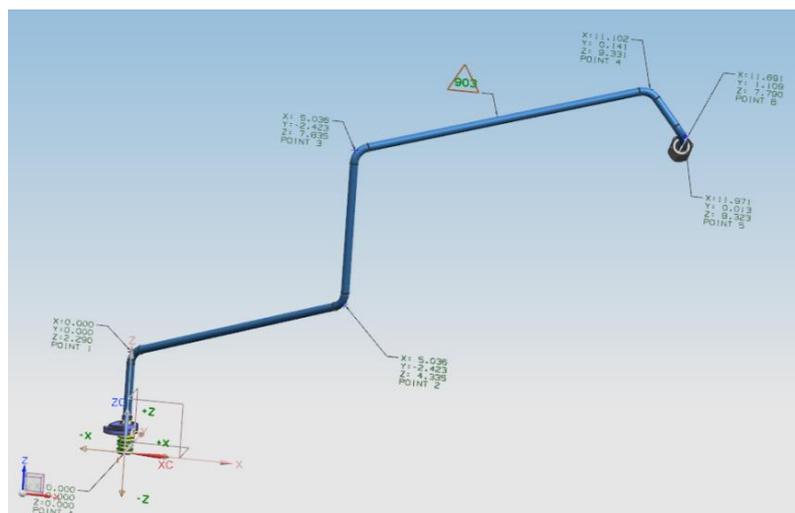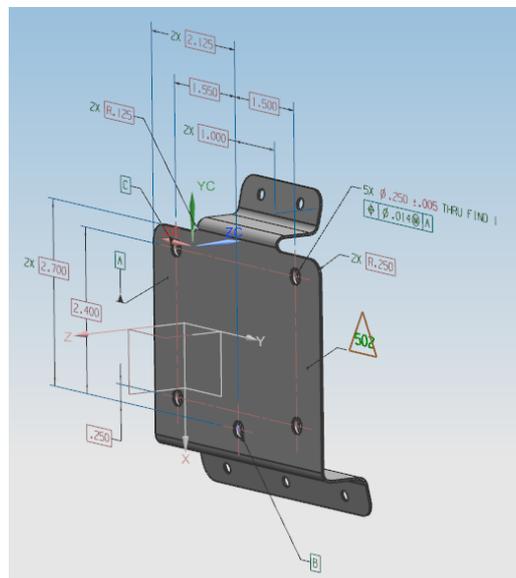| Model name	Stats code	Native System	Remarks
70721769-1_MBE	PM29-1769	NX	Provided by Honeywell Contains PMI
70721872-1_MBE	PM29-1872	NX	Provided by Honeywell Contains PMI

Figure 5: Illustration of PM29-1769 (top) and PM29-1872 (bottom)

3.1.5 Statistics

For each STEP file exported or imported for the PM29 test case, vendors must submit the corresponding statistics. To do so, go to the [PM29 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec. Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a file, report the results found after processing the file as described below:

Data Sheet Columns

column name	description
model	The name of the test model, here: 'PM29'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
unit	The unit the model is designed in
volume	Total volume of all solids
validation_volume	Total volume of all solids as received via the validation property capability
valid_vol	pass/fail, is the instantiation of the validation property 'volume' in the STEP file as per the recommended practices for validation properties?
area	Total surface area of all solids
validation_area	Total surface area of all solids (entire assembly), as received via the validation property capability
valid_area	pass/fail, is the instantiation of the validation property 'area' the STEP file as per the recommended practices for validation properties?
cx	Centroid of all solids
cy	
cz	
validation_cx	Centroid of all solids (entire assembly) as received via the validation property capability
validation_cy	
validation_cz	
valid_cent	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
model_size	model_size is the length of the space diagonal of the 3dimensional bounding box enclosing all entities in the model. The result is the Centroid deviation divided by the model_size
dimension	The number of dimensions processed
datums	The number of datums processed
datum_targets	The number of datum targets processed
tolerances	The number of tolerances processed
labels	The number of labels processed
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file