



**Test Suite for the  
CAX Implementor Forum  
Round 22J**

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## 1.0 Introduction

This document describes the suite of test cases to be used for the twenty-second round of testing of the CAx Implementor Forum (CAx-IF). The CAx-IF is a joint testing forum organized by PDES, Inc. and the ProSTEP iViP Association. The test rounds of the CAx-IF concentrate primarily on testing the interoperability and conformance of STEP processors based on AP 203 and AP 214.

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: Presentation of Geometric & Dimensional Tolerances, both as Polylines and semantically, based on Representation, as well as Assembly Validation Properties.

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.

In addition, this round of testing will serve to collect and verify new files for the CAx-IF STEP file library, which is publicly accessible on the CAx-IF homepages. These files will include Colors, 3D Text, Geometric Validation Properties, and External References.

### 1.1 **Functionality tested in this round**

Functionality tested in this round relates to: Presentation of Geometric & Dimensional Tolerances, and Assembly Validation Properties.

- Geometric & Dimensional Tolerances describes the capability to embed information about tolerances which are necessary input for the manufacturing of the part into the 3D model. Past tests in the CAx-IF were focused on the ‘representation’ approach, i.e. transport the product manufacturing information (PMI) in a re-usable way, without displaying it in the 3D model. In Rounds22J, two different way for ‘presentation’ of PMI in 3D will be tested:
  - “Polyline Presentation” refers to breaking down each annotation into polylines and arcs, and exchanging them as wireframe geometry. This preserves the exact shape of the annotation, but is human readable only.
  - “Minimal Semantic Presentation” relies on the “Representation” capability to render the information contents to be displayed. These are supplemented with basic styling and positioning information, to enable the importing CAD system to re-create the annotation elements using its internal PMI capability.

- Assembly Validation Properties are a new mechanism, which is derived from the “extended” ValProps. It allows for the verification of an assembly without the need to process the referenced geometry, hence focuses on large assemblies exported using the External References mechanism.
- The test cases defined for the public STEP file library cover functionalities that have been well established in past CAx-IF test rounds.
- In addition to synthetic models for the above capabilities, production models are included in this round of testing.

## 1.2 General test 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 CAx Implementor Forum web sites. The latest version is v1.6, dated June 2008.

## 1.3 Preliminary testing schedule

The following schedule has been agreed on for Round22J:

<b>Date</b>	<b>Action</b>
<b>June 4, 2008</b> (Web)	<b>Test Suite available / 1<sup>st</sup> CAx Implementor Forum conference call</b>
<b>ASAP</b>	<b>Production Models (native) released</b>
<b>July 2 (Wed)</b>	<b>Initial STEP files and native stats due</b>
<b>August 6</b> (Wed)	<b>STEP files and native stats frozen / Initial release of files for testing</b>
<b>August 20 (Wed)</b>	<b>Initial Target stats due / 2<sup>nd</sup> conference call</b>
<b>September 30 (Tue)</b>	<b>Target stats frozen / 3<sup>rd</sup> conference call</b>
<b>October 7 (Tue)</b>	<b>Review meeting for test round</b>
<b>October 8 – 9</b> (Wed – Thu)	<b>CAx Implementor Forum meeting, Darmstadt, Germany</b>

The CAx-IF meeting will take place in conjunction with the fall workshop of the “LOTAR” project group for long-term archiving, and the “Infoplatform” workshop, which also includes the User Roundtable.

## 1.4 Copyrights on test cases

Not all of the production test cases which were provided by the PDES, Inc. and ProSTEP iViP member companies are fully released for any purpose. The least common denominator is that the test cases can be freely distributed among the ProSTEP iViP / PDES, Inc. Round Table participants 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 the CAx-IF testing or outside of PDES, Inc. and ProSTEP iViP.

## 2.0 Synthetic test case specifications

### 2.1 Model GD7: GD&T Polyline Presentation

#### 2.1.1 Motivation

Geometric and Dimensional Tolerances are required for a number of business use cases in the context of STEP data exchange. Among others, they are a prerequisite for long-term data archiving. In addition, the GD&T data can be used to drive downstream applications such as coordinate measuring and manufacturing.

For documentation and long-term archiving purposes, the Polyline Presentation approach was suggested and developed by the LOTAR project group. It presents the GD&T information within the 3D model, broken down into lines and arcs, so that it looks exactly as generated by the native system.

#### 2.1.2 Approach

The approach to be used is described in the “Draft Recommended Practices for GD&T Polyline Presentation”, that can be found in the member area of the CAx-IF web sites. Polyline annotations and the definition of saved views (the latter not mandatory) are in scope for this round of testing; the exchange of annotation validation properties is out of scope for this round. This corresponds with what has been tested in the LOTAR pilot.

#### 2.1.3 Testing Instructions

In Round22J, a number of user-provided models containing GD&T information will be provided for testing. They will be made available on the CAx-IF Document Sharing Web Site.

**Note** that **all** CAx-IF participants, even / especially those who have not implemented Polyline Presentation, are asked to import the resulting STEP files. Since the annotations basically are broken down into wireframe geometry (which has been tested in R20J-R21J), the question is to what extent the information can be found by arbitrary CAD systems.

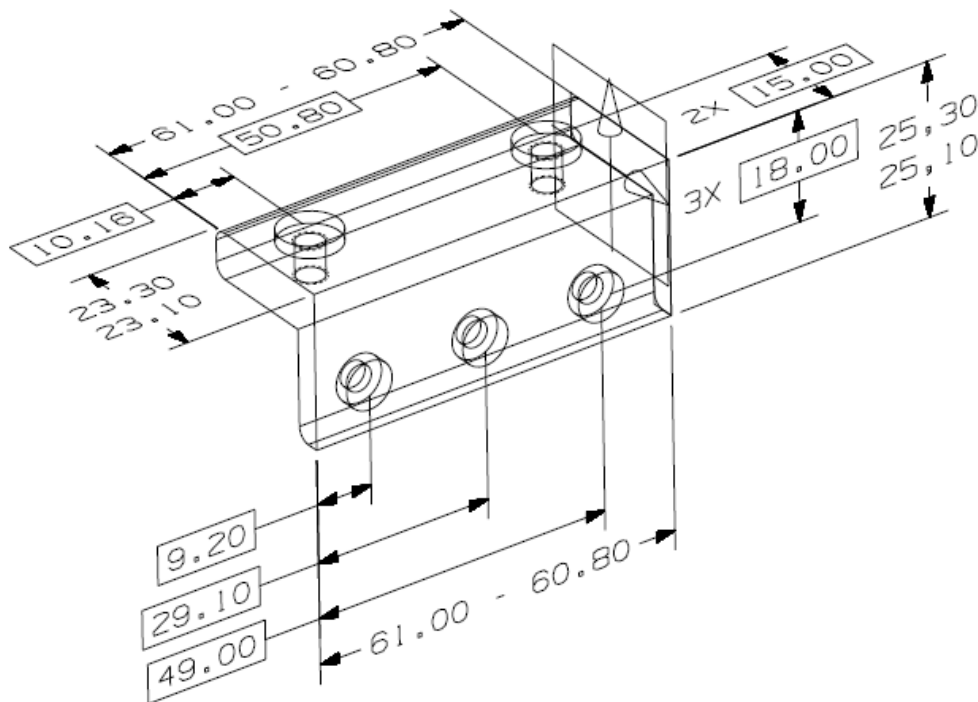


Figure 1: Example for a user-provided part with tolerances.

### 2.1.3.1 Test Models

The following “real-world” GD&T test models are available for Round22J, and can be downloaded from the document sharing web site, under “Round22J > GD&T Test Models”:

Model name	Stats code	Native System	Remarks
P120TEST_PILOT-21.CATPart	gd7_v5a	CATIA V5	Provided by Boeing
P120TEST_PILOT-27.CATPart	gd7_v5b	CATIA V5	Provided by Boeing
P120TEST_PILOT-37.CATPart	gd7_v5c	CATIA V5	Provided by Boeing
Bracket-dim-test.prt	gd7_uga	UG NX	Provided by RC
Bracket-dim-test2.prt	gd7_ugb	UG NX	Provided by RC

### 2.1.3.2 Statistics

For each STEP file submitted for the GD7 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > GD7 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

column name	description
<b>model</b>	The name of the test model, see test models table
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>area</b>	Total surface area of all solids
<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>dim_found</b>	The number of dimensions processed
<b>datum_found</b>	The number of datums processed
<b>tol_processed</b>	The number of tolerances processed
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

## 2.2 Model GD8: GD&T Minimal Semantic Presentation & Representation

### 2.2.1 Motivation

Geometric and Dimensional Tolerances are required for a number of business use cases in the context of STEP data exchange. Among others, they are a prerequisite for long-term data archiving. In addition, the GD&T data can be used to drive downstream applications such as coordinate measuring and manufacturing.

In contrast to the Polyline approach, Semantic Presentation relies on the GD&T Representation capability to define the contents to be displayed, and supplements these with positioning and styling information to create the appropriate notes in 3D space. (Associative) 3D Annotations including Unicode characters have been tested in previous rounds in preparation for this test case.

### 2.2.2 Approach

Recommended Practices for the implementation of GD&T Representation, and initial guidelines for GD&T (semantic) Presentation, can be found on the WikiSTEP page, see <http://wikistep.org/>. In addition, a draft Usage Guide outlining the interdependencies between the GD&T elements is available in the CAx-IF member area under “Information on Round22J of Testing.” The actual approach and scope of the GD8 test case is that of the NIST pilot.



### 2.2.3 Testing Instructions

In Round22J, a number of user-provided models containing GD&T information will be provided for testing. They will be made available on the CAX-IF Document Sharing Web Site.

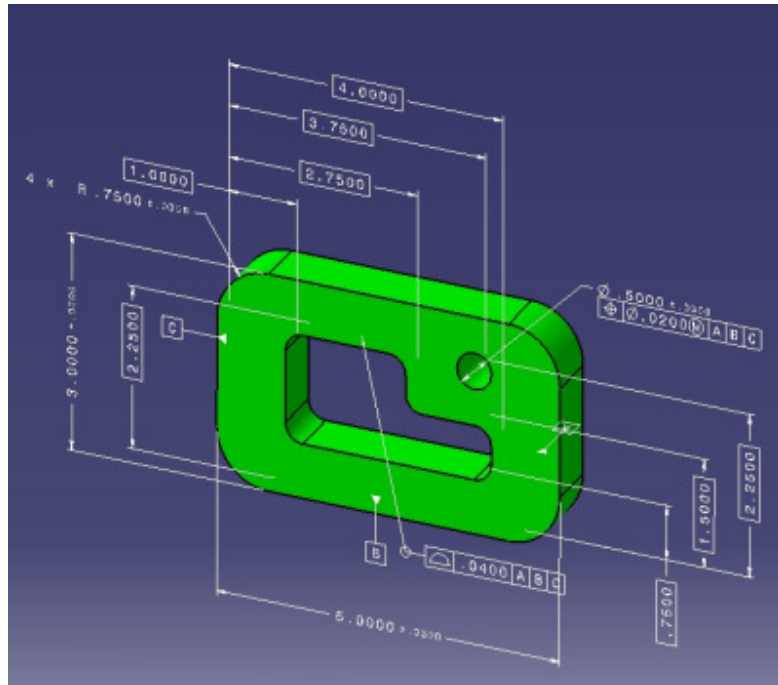


Figure 2: Example for a user-provided part with tolerances.

#### 2.2.3.1 Test Models

The following “real-world” GD&T test models are available for Round22J, and can be downloaded from the document sharing web site, under “Round22J > GD& Test Models”:

Model name	Stats code	Native System	Remarks
P120TEST_PILOT-21.CATPart	gd8_v5a	CATIA V5	Provided by Boeing
P120TEST_PILOT-27.CATPart	gd8_v5b	CATIA V5	Provided by Boeing
P120TEST_PILOT-37.CATPart	gd8_v5c	CATIA V5	Provided by Boeing
	gd8_pea	Pro/Engineer	
	gd8_peb	Pro/Engineer	
	gd8_pec	Pro/Engineer	

#### 2.2.3.2 Statistics

For each STEP file submitted for the GD8 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > GD8 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

<b>column name</b>	<b>description</b>
<b>model</b>	The name of the test model, see test models table
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>area</b>	Total surface area of all solids
<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>dim_found</b>	The number of dimensions processed
<b>datum_found</b>	The number of datums processed
<b>tol_processed</b>	The number of tolerances processed
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

## 2.3 Model AV2: Assembly Validation Properties

### 2.3.1 Motivation

The existing Validation Properties for assembly data, known as “ValProps II” or “Extended ValProps”, provides a suitable mechanism where geometrical data is provided along with the product structure. However, for the incremental exchange of STEP files, where the product structure might be included but the geometry of the component parts may be omitted, this approach is not applicable. Similarly, if the product structure is broken down into smaller sub-assemblies, the component data is not available in the sub-assembly files and so it is again not applicable.

The additional “Assembly Validation Properties” will provide a verification capability where geometry is not present. It will make it possible for the exchange of assembly data to be verified in two ways. The first will ensure that the number of instances found at each node is correct, while the second will ensure that the position and orientation information for each instance is correct.

### 2.3.2 Approach

The approach used was first tested in Round21J, and is described in the “Recommended Practices for Assembly Validation Properties”, available under “Joint Testing Information” on the CAx-IF homepages.

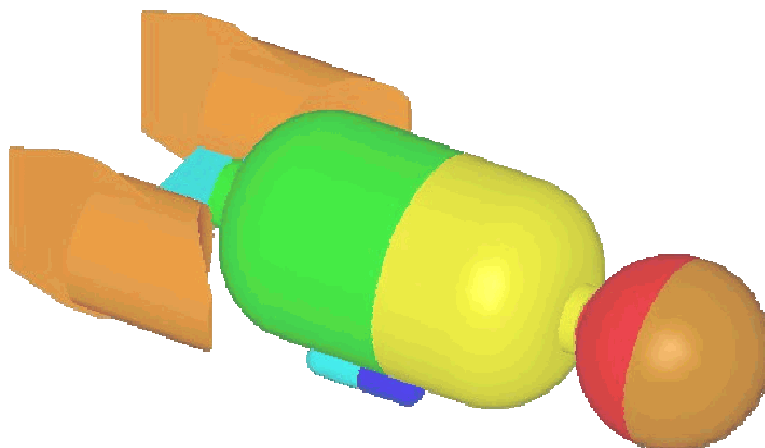
### 2.3.3 Testing Instructions

The Assembly Validation Properties shall be tested using the model known as S1 or “spaceship”, adding the number of children and notional solids of dimension 10x10x10 at each node. This model is also used in the STEP file example given in the draft Recommended Practices.

In order to distinguish this test case from the spaceship for the STEP file library, the designation for Assembly ValProps testing will be “AV2”.

#### 2.3.3.1 Construction of the S1 model

This test case has been used in a number of previous CAx-IF test rounds, therefore the modeling instructions are not repeated here. If a vendor would like to participate in this test case and does not yet have the model, the construction information can be found e.g. in the Test Suite for Round5J, available in the “Joint Testing Information” area of the CAx-IF web site.



*Figure 3: Shape of the AV2 model (spaceship)*

#### 2.3.3.2 Statistics

For each STEP file submitted for the AV2 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > AV2 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

<b>column name</b>	<b>description</b>
<b>model</b>	The name of the test model, here: AV2
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>area</b>	Total surface area of all solids
<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>children</b>	pass/fail, indicates whether the number of children for each node in the assembly tree matches the AVP value given in the STEP file
<b>valid_child</b>	pass/fail, is the instantiation of the validation property 'number of children' in the STEP file as per the recommended practices for validation properties?
<b>notional_solids</b>	all/partial/none, whether the position of all, some or none of the assembly components in the model could be validated through the 'notional solids' AVP.
<b>valid_notion</b>	pass/fail, is the instantiation of the validation property 'notional solids' in the STEP file as per the recommended practices for validation properties?
<b>fudged_node</b>	The name or id of the node in the assembly tree for which an error is returned by the Assembly Validation Properties
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

## 3.0 STEP File Library Models

### 3.1 Model IO1: Colors & 3D Text

#### 3.1.1 Motivation

The transfer of Solid Color and Overriding Face Color is one of the oldest functionalities tested in the CAx-IF. It has been tested since Round1J, and thus should be provided in the public STEP file library by a number of STEP processors.

The model is a non-assembled single solid model having a color assigned to the solid, for the inner face of the hollow shaft an overriding face color is specified and the edges limiting the drilled holes have another color assigned.

#### 3.1.2 Approach

##### 3.1.2.1 Presentation Colors

Solid colors and overriding face colors shall be included by every system exporting this model for the STEP file library. The approach to be used is described in the “Recommended Practices for Colors & Layers”, dated 11-08-2001, available on the “Joint Testing Information” section of the CAx-IF homepages.

##### 3.1.2.2 3D Annotation

3D text has also been tested since the early days of the CAx-IF, although it is supported by only a limited number of STEP processors. Nevertheless, all vendors supporting this capability should include 3D annotations with the IO1 mode. The approach to be used is described in the “Recommended Practices for 3D Associative Text”, dated 01-13-2000, available on the “Joint Testing Information” section of the CAx-IF homepages.

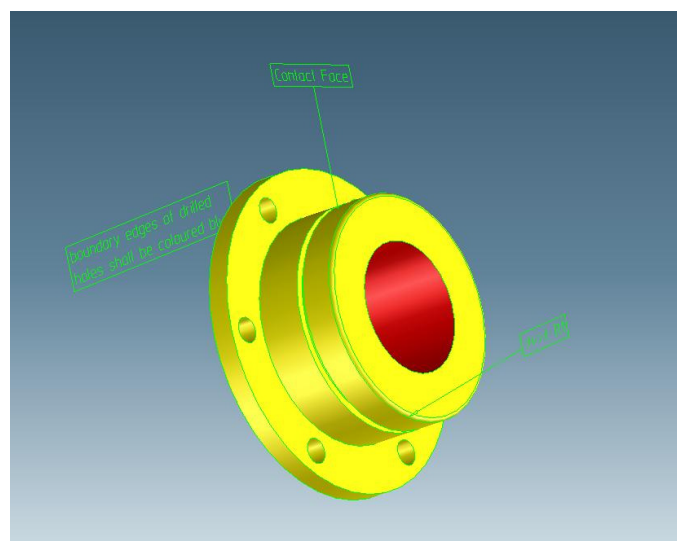


Figure 4: Annotated shape of the IO1 test case

### 3.1.3 Testing Instructions

#### 3.1.3.1 Construction of io1

##### **Shape**

For those vendors who do not have the IO1 model, modelling instructions can be found in the Round2J Test Suite document, which can be found on the “Joint Testing Information” pages of the CAx-IF web sites, dated 09-01-1999.

##### **Presentation**

The following colours should be chosen:

- solid colour: yellow
- overriding colour for contact face: red
- overriding colour for profile boundaries: blue

##### **Annotation**

Due to the variation in annotation related capability of the systems, only basic regulations are defined:

- style the texts with an arbitrary colour
- associate the text "contact face" to the inner face of the shaft
- associate the text "boundary edges of drilled holes are coloured blue" to the edge of any/ the drilled hole profile
- define the text "boundary edges of drilled holes are coloured blue " as a multi-line text
- select an arbitrary placement of the text
- optionally, add a third annotation containing special characters encoded in Unicode (see R20J and R21J Test Suite documents for details):
  - German umlauts or French accents, using the \S-encoding
  - Asian characters, using the \X2-encoding

Systems not allowing one or the other of the above should try to find the closest work-around (e.g. associate to geometry instead of topology, omit associativity, etc.)

#### 3.1.3.2 Statistics

For each STEP file submitted for the IO1 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > IO1 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

<b>column name</b>	<b>description</b>
<b>model</b>	The name of the test model, here: 'IO1'
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>area</b>	Total surface area of all solids
<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>color_t1</b>	Text color used for the single-line text.
<b>color_t2</b>	Text color used for the multi-line text.
<b>color_sd</b>	all/partial/none – if the color of the solid in the model is totally correct, partially correct, or lost completely.
<b>color_f</b>	all/partial/none - if overriding face color in the model is totally correct, partially correct, or lost completely
<b>color_e</b>	all/partial/none - if overriding edge color in the model is totally correct, partially correct, or lost completely
<b>valid_txt</b>	all/partial/none - whether the specified texts appear in the model
<b>valid_txt_assoc</b>	all/partial/none - whether the association of the text to the elements for the geometric model as described above is correct
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

## 3.2 Model AS1 : Geometric Validation Properties

### 3.2.1 Motivation

The Geometric Validation Properties were the first capability to enable verification of the data exchange in the STEP file, by adding information about the model to the model itself. The key parameters for solid models are total volume, total surface area and the centroid.

The first extension to these validation properties was the functionality to verify the placement of components in an assembly, often referred to as “Extended Validation Properties”, or “Val-Props II”.

Both levels of validation are well-established and supported by a wide range of STEP processors, and hence shall be included in the public STEP file library.

### 3.2.2 Approach

Geometric and Extended Validation Properties (ValProps I & II) shall be included by every system exporting this model for the STEP file library. The approach to be used is described in the “Recommended Practices for Geometric Validation Properties – 2<sup>nd</sup> Extension”, dated 07-25-2007, available on the “Joint Testing Information” section of the CAx-IF homepages.

### 3.2.3 Testing Instructions

Please note that system vendors that do not support the extended validation properties capability may also submit test files for this model. They are required to enter 'na' as the value for all ValProps II-related stats.

#### 3.2.3.1 Model construction

##### *Shape*

For those vendors who do not have the AS1 model at hand, modelling instructions can be found in the Round8J Test Suite document, which can be found on the “Joint Testing Information” pages of the CAx-IF web sites, dated 09-05-2001.

##### *Geometric & Extended Validation Properties*

The values for the overall volume of the assembly, its total surface and its centroid shall be computed and transferred via the STEP file.

In addition to this, the centroid data and Shove-IT information for the subassemblies and parts shall be transferred for ValProps II.

#### 3.2.3.2 Statistics

For each STEP file submitted for the AS1 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > AS1 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

column name	description
<b>model</b>	The name of the test model, here: 'AS1'
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'



<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>validation_volume</b>	Total volume of all solids as received via the validation property capability
<b>valid_vol</b>	pass/fail, is the instantiation of the validation property 'volume' in the STEP file as per the recommended practices for validation properties?
<b>area</b>	Total surface area of all solids
<b>validation_area</b>	Total surface area of all solids (entire assembly), as received via the validation property capability
<b>valid_area</b>	pass/fail, is the instantiation of the validation property 'area' the STEP file as per the recommended practices for valprops?
<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>validation_cx</b>	Centroid of all solids (entire assembly) as received via the validation property capability
<b>validation_cy</b>	
<b>validation_cz</b>	
<b>valid_cent</b>	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
<b>model_size</b>	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
<b>shoveit_ok</b>	pass/fail, indicates whether the model passed comparison of the Extended GVP (i.e. no parts/subassemblies misplaced), or failed.
<b>valid_shoveit</b>	pass/fail, indicates whether the target system considers the implementation of the instance information valid as per the recommended practices
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

## **3.3 Model S1: External References**

### **3.3.1 Motivation**

### **3.3.2 Approach**

(Nested) External References shall be included by every system exporting this model for the STEP file library. The approach to be used is described in the “Recommended Practices for (Nested) External References”, dated 01-19-2005, available on the “Joint Testing Information” section of the CAx-IF homepages.

### **3.3.3 Testing Instructions**

The External References shall be tested using the S1 model. This model will be split up into a set of STEP files:

- One structure STEP file containing only the complete assembly structure for basic external references, or
- One structure STEP file per level of the assembly structure, i.e. each containing one node of the assembly tree and its immediate children, for nested external references, plus
- One geometry STEP file for each component part used in the S1 model.

#### **3.3.3.1 Construction of the S1 model**

This test case has been used in a number of previous CAx-IF test rounds, therefore the modeling instructions are not repeated here. If a vendor would like to participate in this test case and does not yet have the model, the construction information can be found e.g. in the Test Suite for Round5J, available in the “Joint Testing Information” area of the CAx-IF web site.

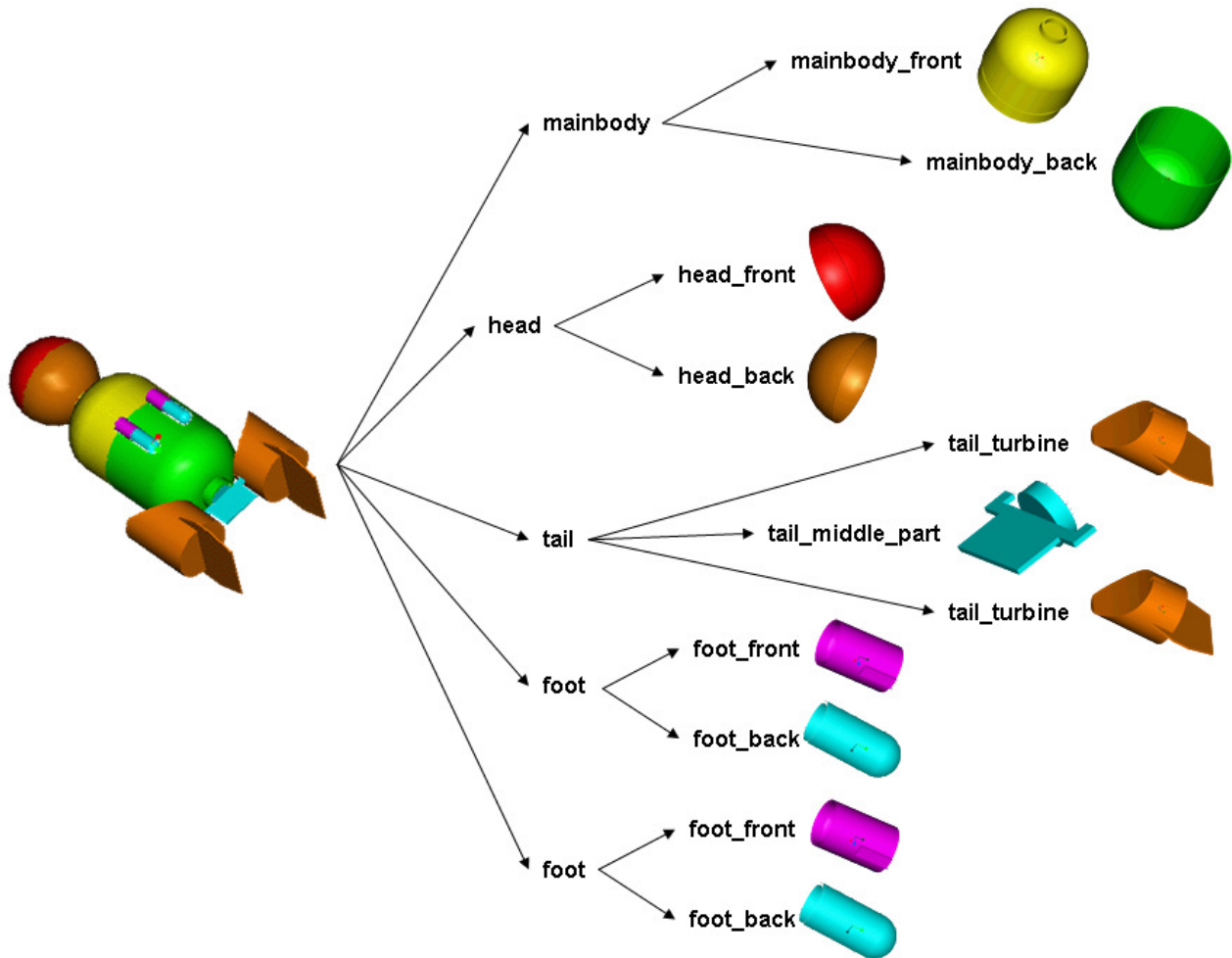


Figure 5: Shape and Structure of the S1 model (spaceship)

### 3.3.3.2 Statistics

For each STEP file submitted for the S1 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > S1 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

column name	description
<b>model</b>	The name of the test model, here: 'S1'
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>area</b>	Total surface area of all solids

<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>fref_found</b>	all/partial/none - indicates if all, some or none of the file references for the external geometry can be found the file node associations to the external geometry can be established
<b>fref_processed</b>	all/partial/none - indicates if all, some or none of the referenced files can be processed to construct the overall model
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

### 3.4 Model DM1: Density and Material name

#### 3.4.1 Motivation

Usually, transfer of different materials is not included in geometry exchange via STEP. On export, a consistent density for all parts is assumed.

This capability provides an approach to transfer density values (as real values) and material names (as strings). Using the density information, the center of geometry of a model can be distinguished from the center of gravity. The material name can be used to receive further information about that material, e.g. from a database.

Though supported by only a limited number of STEP processors, it was agreed to add this test case to the STEP file library, since it provides capabilities of interest for interoperability testing with PDM and CAE processors.

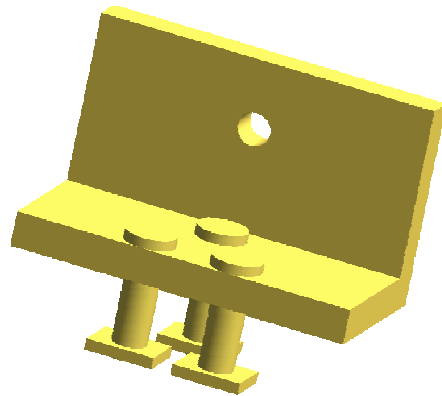
#### 3.4.2 Approach

Material Identification shall be included by every system exporting this model for the STEP file library. The “Material as Product” approach to be used is described in section 5.1 of the “Recommended Practices for Material Identification and Density”, dated 07-12-2005, available on the “Joint Testing Information” section of the CAx-IF homepages. Density information may be included as either a general property of the material (section 5.2) or as a material property (section 5.2).

#### 3.4.3 Testing Instructions

##### **Shape**

The test model is based on a sub-assembly of the well-known AS1 model, i.e. one of the “L-bracket assemblies”. Modeling instructions for the AS1 model and its subassemblies can be found in the Round8J Test Suite document, which can be found on the “Joint Testing Information” pages of the CAx-IF web sites, dated 09-05-2001.



*Figure 6: Shape of the DM1 model*

This sub-assembly is composed of three individual parts, each of which should be assigned a different density and material name. Suggested values are:

Part	Density	Material name
L-bracket	.160 lb/cu in	AMS 4928; Titanium 6-4
Bolt	.285 lb/cu in	AMS 5613; Greek Ascoloy
Nut	.297 lb/cu in	AMS 5662; Inconel 718

Due to the different densities, the center of gravity will differ from the center of geometry. These coordinates, besides the transferred values for density and material, will be the focus of this test.

### 3.4.3.1 Statistics

For each STEP file submitted for the DM1 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > DM1 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

column name	description
<b>model</b>	The name of the test model, e.g. 'AS1'
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>area</b>	Total surface area of all solids

<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>gravx</b>	Center of gravity for all solids
<b>gravy</b>	
<b>gravz</b>	
<b>density</b>	Density value for the L-Bracket part
<b>material</b>	Material name for the L-Bracket part
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file

## 4.0 Production models: PM20

### 4.1 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.

### 4.2 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 AP203e2. In order to support quality validation of the Production Model exchange, all vendors shall include the maximum level of Validation Properties they support. In addition, since Round18J, the native and target statistics will include ValProps.

All source system native models and STEP files may be analyzed for data quality by the "CADIQ" developers. STEP syntax and structure will be checked by the CAx-IF facilitators. In order to enable an end-to-end analysis of the data exchange, all vendors importing Production Model STEP files are asked to submit the resulting target model from their system along with or instead of the target statistics.

### 4.3 Testing Instructions

The native models as provides 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 will be made available on the CAx-IF Document Sharing Web Site under "Round 22J > Production Models".

### 4.3.1 List of available models

Model name	Stats code	Native System	Remarks
Motion Stage	pm20_pe	Pro/Engineer	Provided by Raytheon

### 4.3.2 Results

For each STEP file submitted for the PM20 model, vendors must submit the corresponding native statistics to the online statistics and results database, CAESAR. To do so, log in to CAESAR, go to “Test Rounds > R22J Test Cases > PM20 Data Sheet”, and either fill in the web form, or upload a comma-delimited file (.csv) with the following data:

column name	description
<b>model</b>	The name of the test model, e.g. 'AS1'
<b>system_n</b>	The system code of the CAD system creating the STEP file
<b>system_t</b>	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
<b>unit</b>	The unit the model is designed in
<b>volume</b>	Total volume of all solids
<b>validation_volume</b>	Total volume of all solids as received via the validation property capability
<b>valid_vol</b>	pass/fail, is the instantiation of the validation property 'volume' in the STEP file as per the recommended practices for validation properties?
<b>area</b>	Total surface area of all solids
<b>validation_area</b>	Total surface area of all solids (entire assembly), as received via the validation property capability
<b>valid_area</b>	pass/fail, is the instantiation of the validation property 'area' the STEP file as per the recommended practices for validation properties?
<b>cx</b>	Centroid of all solids
<b>cy</b>	
<b>cz</b>	
<b>validation_cx</b>	Centroid of all solids (entire assembly) as received via the validation property capability
<b>validation_cy</b>	
<b>validation_cz</b>	
<b>valid_cent</b>	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?

<b>model_size</b>	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
<b>shoveit_ok</b>	pass/fail, indicates whether the model passed comparison of the Extended GVP (i.e. no parts/subassemblies misplaced), or failed.
<b>valid_shoveit</b>	pass/fail, indicates whether the target system considers the implementation of the instance information valid as per the recommended practices
<b>date</b>	The date when the statistics were last updated (will be filled in automatically)
<b>issues</b>	A short statement on issues with the file