METHODOLOGY

of CATIA Implementation in ATLAS Technical co-ordination Project

Fully Compliant to Policy of CAEC (Computer Aided Engineering Committee)
of CATIA Implementation at CERN

CERN 2004

Purpose

Development of CATIA 3D model Life Cycle for ATLAS Technical co-ordination project

Aims

Separation stages, with

- identification of amount of input/output documents and methods of creation and representation for each stage;
- distribution of tasks and responsibilities of team members

CATIA team

Virtual heterogeneous team will be join engineers from different departments, institutions and countries.

Team will be responsible for development and implementation of CATIA models for ATLAS Technical co-ordination project

Team members to be:

1) Euclid engineers – ATLAS Technical co-ordination team (CERN)
2) CATIA Engineers – ATLAS Technical co-ordination team (CERN)
3) CAD Engineers – CAD Technical support team (CERN)
4) CATIA Engineers – CATIA Engineering center (Georgia)

Description

CATIA model development/Implementation Life Cycle foresees 5 main stages called by POINTs.

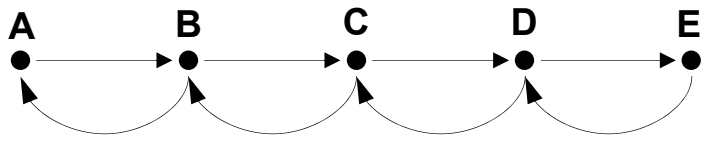
Point A: Splitting

Point B: Transferring

Point C: Checking/Manual Building

Point D: Creation of Product DMU model

Point E: DMU Analysis of interferences



Life Cycle Tree

Each Point encapsulates methods of data progression, associative documents and methods and tools of its representation.

In addition Life Cycle tree represents distribution of responsibilities according to concept – "children's are responsible for their parents". So, down stream Point engineer will be responsible for up stream Point (only 1 level) engineer activity and will approve his/her results with associative documents. Approving has to be done after, when engineer successfully created the model of current Point.

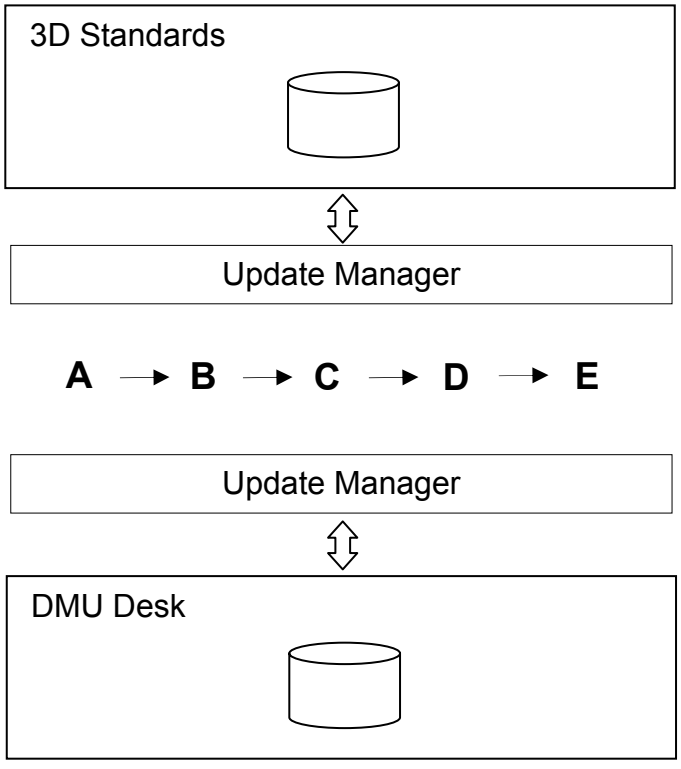
Before approving engineer of up stream Point (only 1 level) participate in model development on current Point (feedbacks on the tree). It means that output documents of up stream Point can be changed according to requirements of current point development.

Information Structure

Split models will be stored in 3D standards Database, while translated models, DMU models and results of interference analysis will be stored in DMU Desk Database.

Both Databases will be accessible through the Web-based applications.

Update manager will manage and update documents in both databases and will be responsible for Database representation.



Distribution of Tasks

Tasks and responsibilities in CATIA team will be distributed as it is shown below:

Point A: - Euclid engineer, ATLAS Technical co-ordination team (CERN)

Point B: - CAD engineer, CAD Support team (CERN)

Point C: - CATIA engineer, CATIA Engineering center (Georgia)

Point D: - CATIA engineer, ATLAS Technical co-ordination team(CERN)

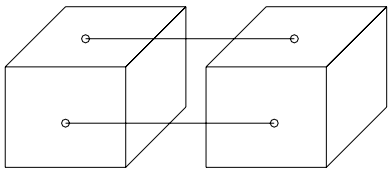
Point E: - CATIA engineer, ATLAS Technical co-ordination team CERN)

Point A: Splitting

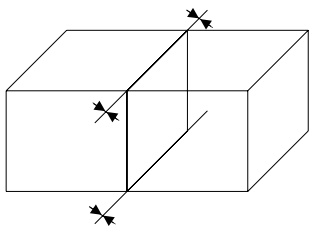
The purpose of Point is to split initial Euclid model in number of separate parts according to limitations of Euclid software – model have to contain less then 32.000 points. Euclid engineer have to divide initial model on sub-models, create structure of split model, identify principle geometrical constraints which are characteraized position of model, prepare detailed specification of each sub-model and all related documents, submit all documents in 3D standard and DMU Desk Databases.

Geometrical constraints to be identified as optional:

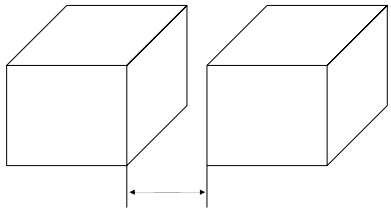
1. Coincidence elements (surface, edge, axis, etc)



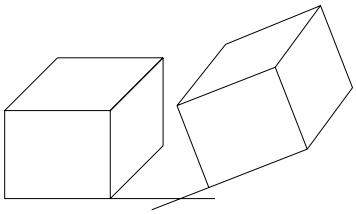
2. Contact elements (surface, edge)



3. Offset elements (surface, edge)



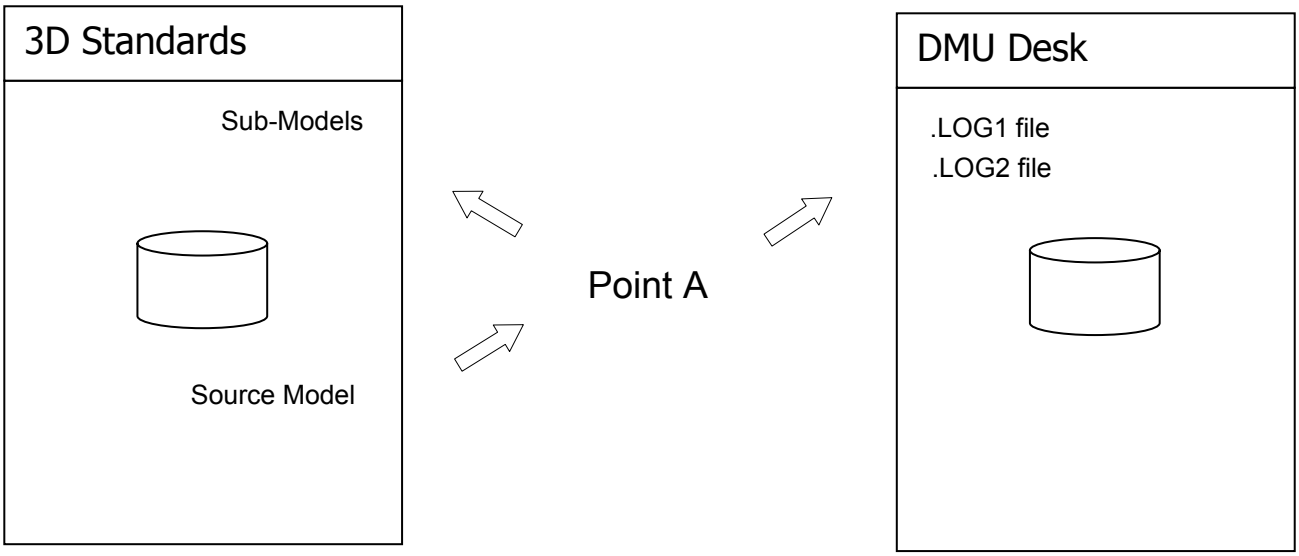
4. Angled elements (surface, edge, axis)



5. Verticality to Beam, Horizontality to ground, etc

Output Documents

1) Part model in CDD
2) .LOG1 file, with identification of associated to each sub-model names, number of points, envelope dimensions, general geometry (volume, square, etc).
3) .LOG2 file, with identification of split model tree and structural constraints
4) Print copy drawings



Documents distribution in Databases

Point B: Transferring

The purpose of Point is to convert Euclid models from 3D Standard Database into CATIA V5 native models.

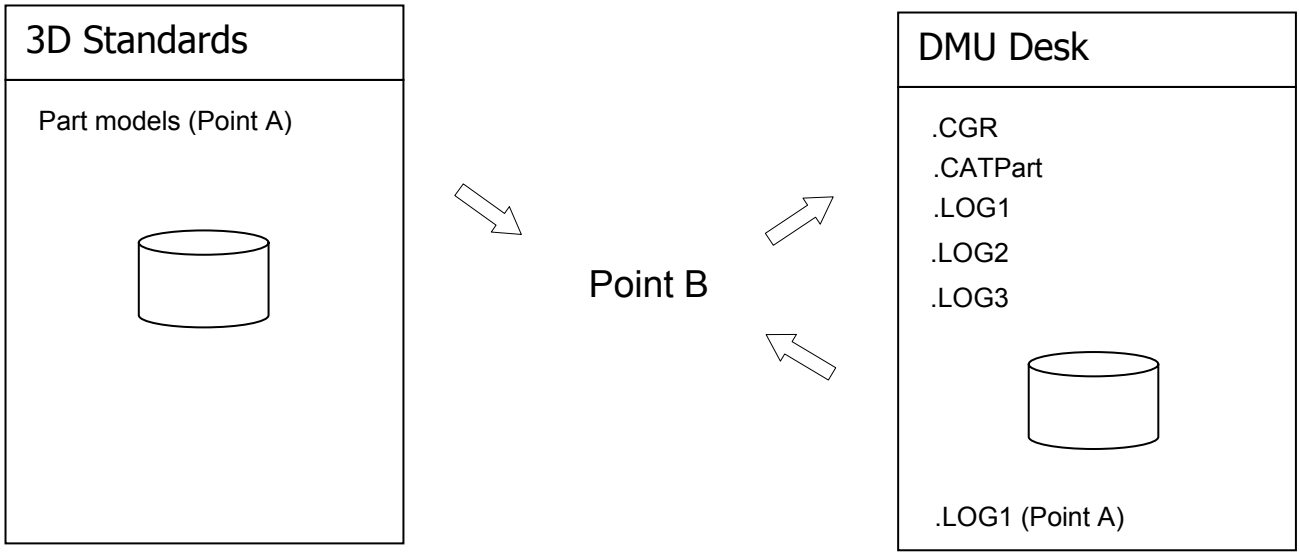
Transformation has to be done into *two* CATIA V5 native standards:

.CGR – CATIA graphical representation standard, which is facet-based geometrical representation of model

.CATPart – CATIA native standard without history, which contains geometrical representation of model in terms of solids and surfaces. This representation enables to build the structural constraints and will be implemented during creation of product DMU models. However, detailed geometry in term of sketches are disabled which restricts any possibilities to edit model in CATIA*.[1]

Output Documents

1) .CGR files
2) .CATPart / .CATProduct files
3) .LOG1 – summary information about creation of neutral file .E3I
4) .LOG2 – summary information about creation of CATIA native .CATPart files
5) .LOG3 – detailed description of faults



Documents distribution in Databases

*1 Compliant to policy CAEC (Computer Aided Engineering Committee) of CATIA Implementation at CERN

In case of errors during transformation, transfer engineer have to contact with Euclid engineer and make cooperative steps as follows:

1) Make several time re-transformation of existing models
2) Assist in checking and editing of models in Euclid
3) Assist in re-splitting of model in Euclid and carry out re-transformation.

In case if error remains after execution of above mentioned steps, request on manual re-building of model in CATIA have to be signed, with creation of corresponding .LOG document.

Point C: Checking

The purpose of Point is to check correctness of transformation of CATIA models from EUCLID and manual creation CATIA models in those cases when transformation is impossible, due to restrictions of software application of transformation.

Models checking have to be done in directions as follow:

1) Checking completeness – have to be done to ensure that all components are presented in CATIA model.

   .CGR and .CATPart files have to be compared in this case. While .CGR is facet-based model, no geometrical recognitions are doing during transformation. Therefore .CGR will contain full number of elements.

2) Checking geometry – have to be done to ensure that dimensional values are correct and CATIA model has right position in space.

   Control points, which can be characterized above mentioned checking parameters have to be identified on model.

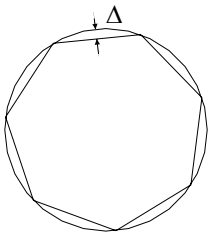
   Coordinates of control points in both, CATIA and EUCLID models have to be measured and compared.

   Additional geometrical parameters (volume, square, etc.) have to be measured in CATIA models and compared with EUCLID model values.

3) Checking approximation – have to be done to ensure that approximation in .CGR models are less then allowable variation.

   Converted .CGR model is hard copy of .VRML model which is created according to visual representation of model in EUCLID. However, this representation contains approximation of splines. Thus, some

dimensions on model will be less or more than the origin. For instance, approximation of boundary cylindrical surface will receive fewer dimensions as origin, while approximation of holes, more.

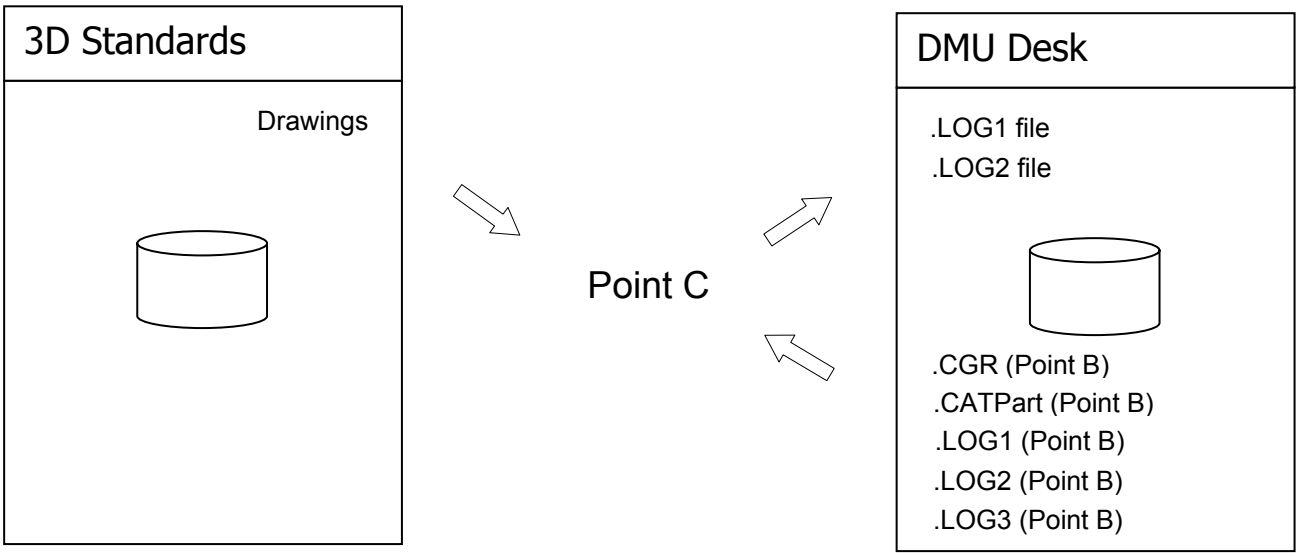


Therefore. Especially for relatively big dimensions, value of inaccurateness (Δ) has to be measured to ensure that approximation is less than predicted value.

In case of receiving request on manual re-build of CATIA model, on the base of EUCLID model drawings .CATPart CATIA native model with history have to be created.

Output Documents

1) .LOG1 file, with results of checking completeness and approximation
2) .LOG2 file, with results of geometrical measurements of control points and differences.



Documents distribution in Databases

In case of not allowable variation of inaccurateness between transferred and initial Euclid models, cooperative steps with transfer engineer have to be done. If problem will not be solve, request on manual re-creation of CATIA model have to be signed.

Point D: Creation of Product DMU

The purpose of Point is development of Product DMU and updating of ATLAS DMU.

Splitted Euclid model will be re-built in CATIA on the base of .CATPart sub-models already checked in Point C. They will be inserted into product structure tree and main constraints, identified on Point B, will be added. Then final checking of full product has to be done through the measurement of control points.

Three different levels of .CGR models are considered in this case:

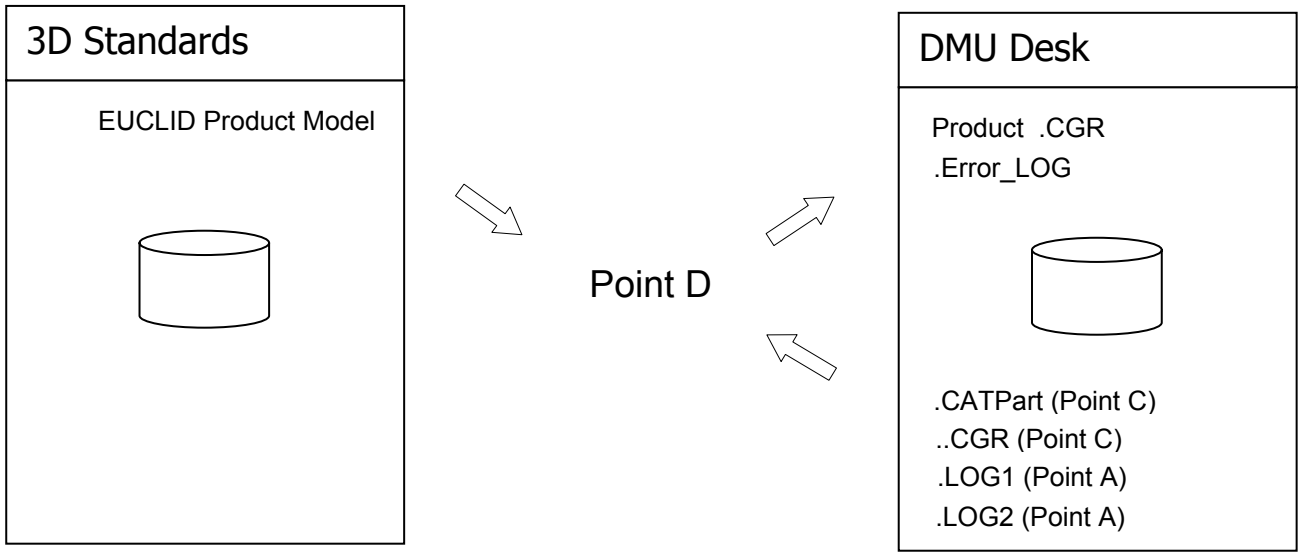
Sub-model .CGR – using for re-building of Product in CATIA. Will be accessible to CATIA engineer from ATLAS Technical co-ordination team.

Product .CGR – built on the base of sub-model .CGR and using for updating of ATLAS structure and for future interference analysis. Will be available to CATIA engineer from ATLAS Technical co-ordination team.

ATLAS .CGR – built on the base of Product .CGR and using for 3D representation and navigation of ATLAS for different purposes. Will be available to everyone.

Output Documents

1) Product .CGR file
2) Error_LOG file



Documents distribution in Databases

In case of not a›roduct model and EUCLID initial product model, request for re-splitting (Point A) of model have to be signed and corresponding Error_LOG file have to be prepared.

Point E: Interference Analysis

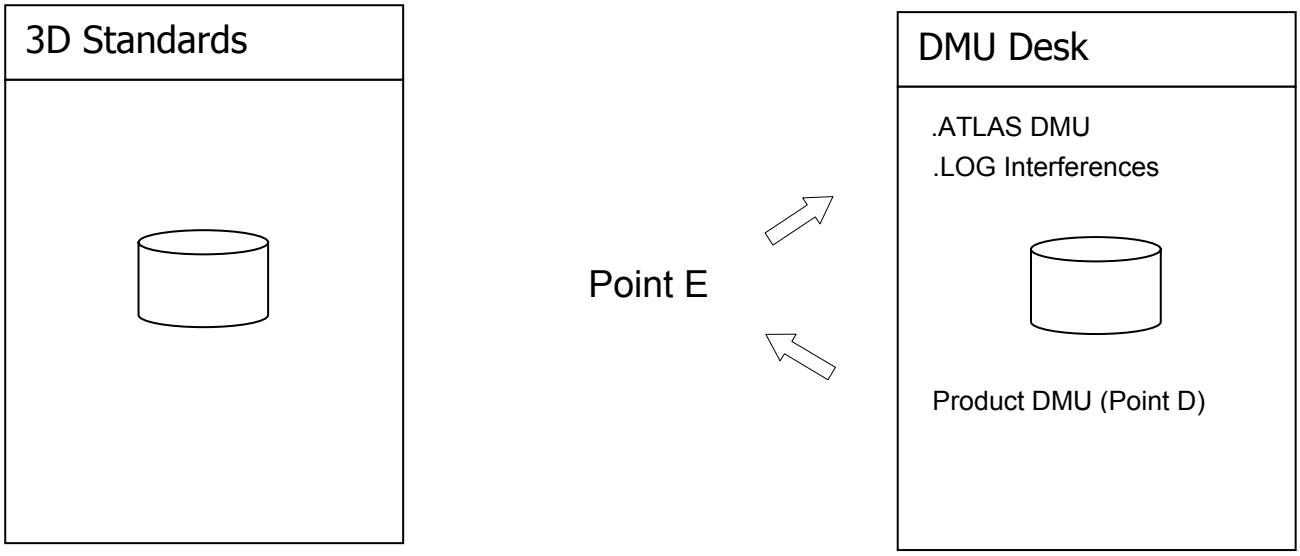
The purpose of Point is to create ATLAS DMU representation from Product DMU models and checking interferences as follow:

1) Clashes
2) Contacts
3) Critical Distances

Several updated ATLAS DMU models will be generated with different structures, sections, etc.

Output Documents

1) ATLAS DMU model
2) LOG with results of interference analysis



Documents distribution in Databases