Parallel Geometry Validation

Cristina Martínez
Gulfstream Aerospace
Corporate Product Lifecycle Management

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Agenda

Gulfstream Product Line

Project Schedule

3D Model Based Type Design (MBTD)

Laws of Data Consistency

Geometry Validation Process

Next Steps

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Education

Universidad Autónoma de Baja California, Mexicali, MX

- BS, Mechanical Engineering, Thermal & Fluids
- MBA, Human Resources & Finance
- PhD candidate, Engineering Management

Industry

Automotive & Aerospace

- Mechanical Design Engineer
- Data Exchange Engineer
- MBE Tools & Process Development
- Geometry Validation Analyst

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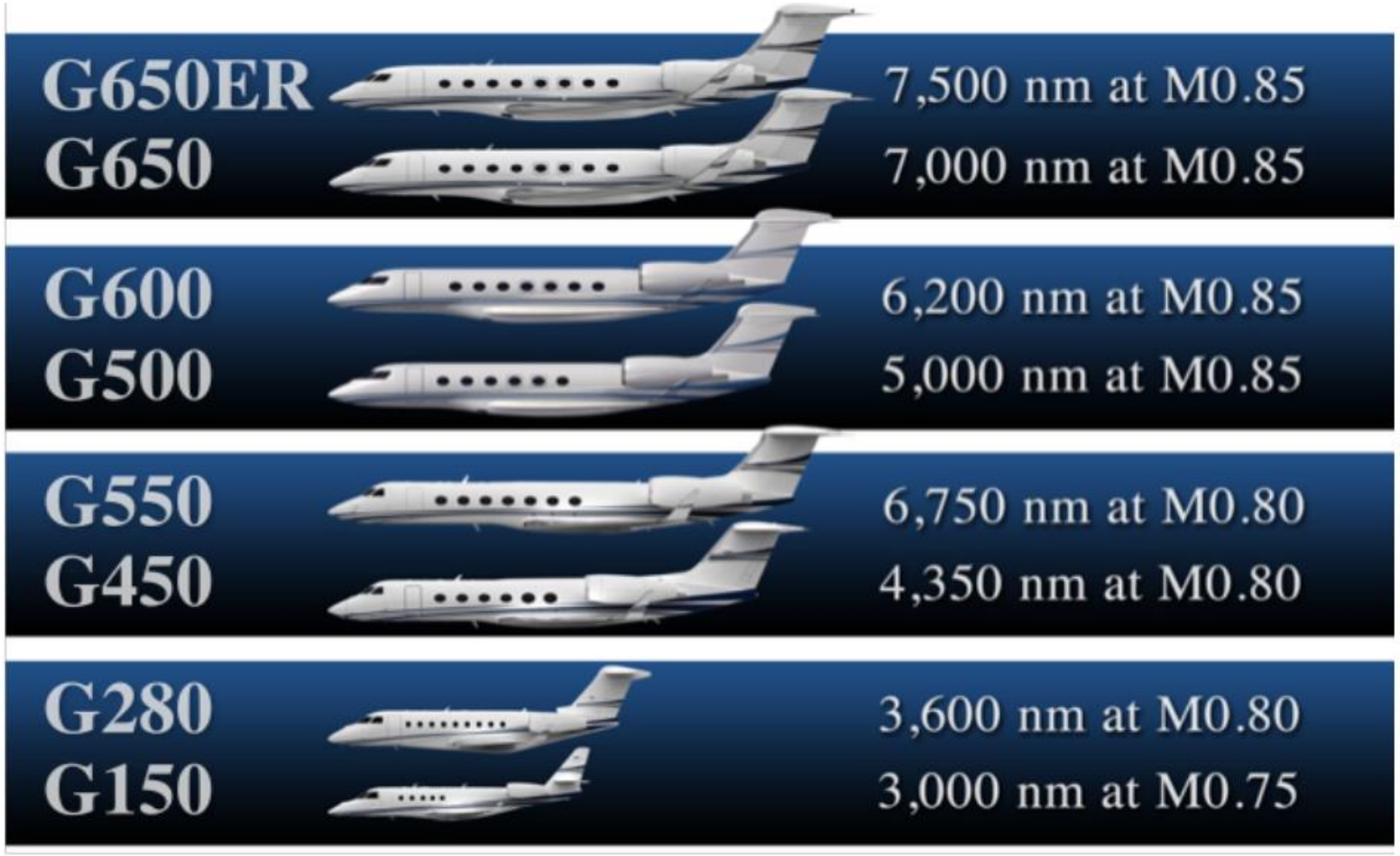
Gulfstream Aerospace Corp (GAC) Product Line



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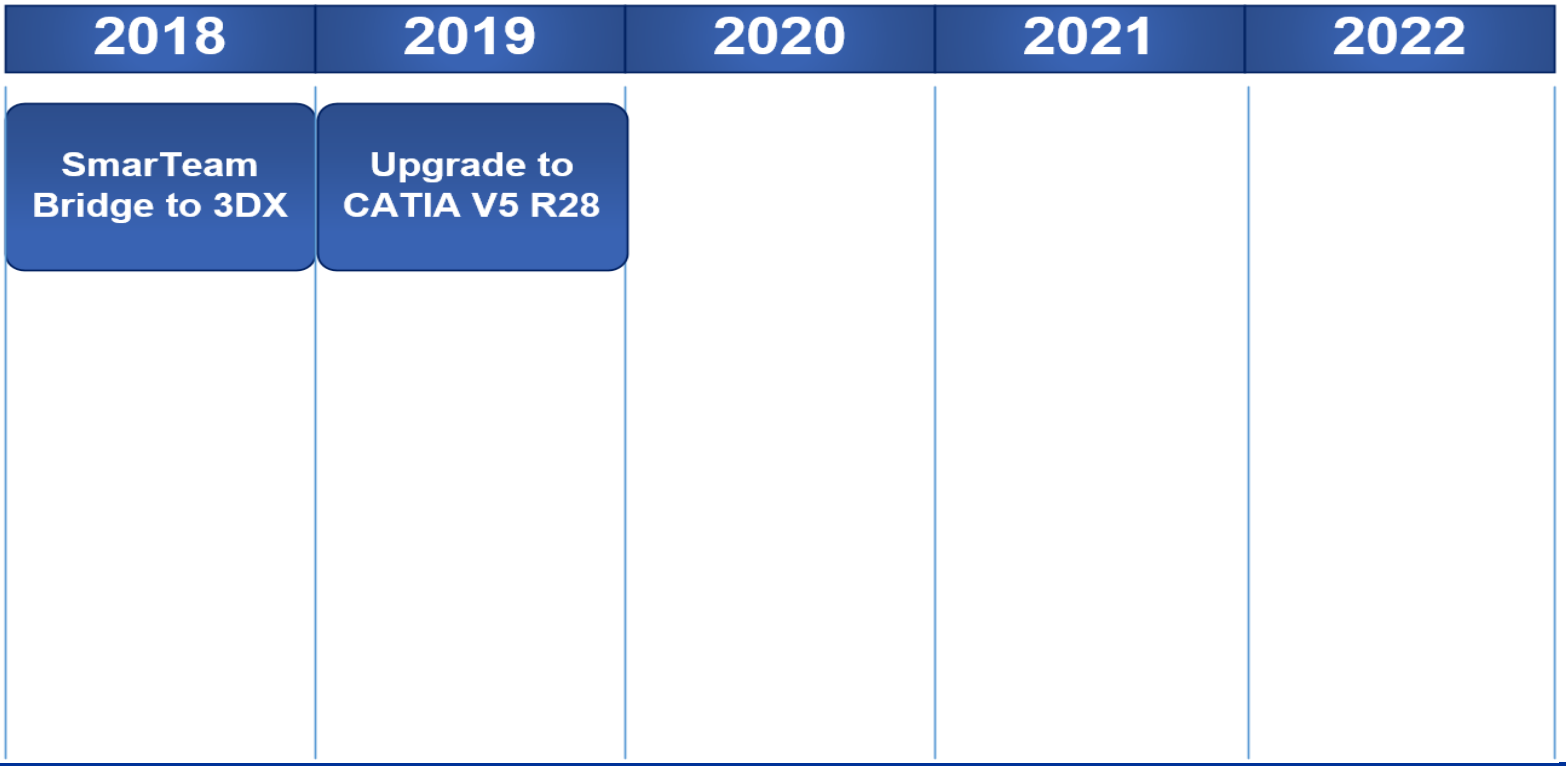
Project Journey



Rigorous process will verify model data (topology & metadata) prior to upgrades.

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3D Model Based Type Design (MBTD)

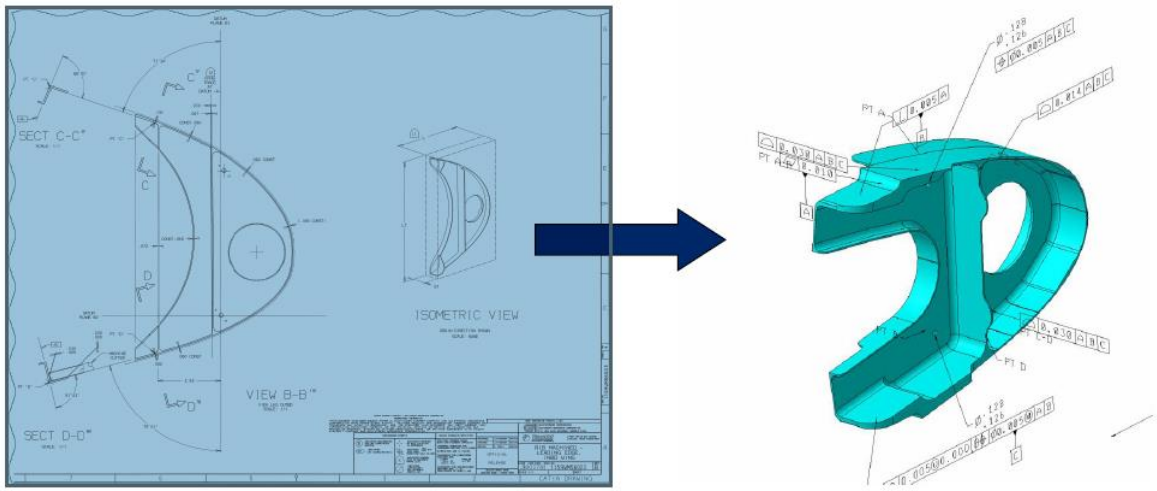
True 3D electronic representation of aircraft

Includes fasteners, shims, hardware, hoses, etc.

Relies on geometry versus text

No dimensions on models

Users interrogate models for relevant dimensional information



Eliminates paper, design ambiguity. Saves time & money. Raises quality.

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3D MBTD Considerations

Life of product = life of data

Aircraft have 50–75 year life cycle.
Data must “live” for a very long time.

Ensure data integrity

Focus GAC tools, processes, & procedures to protect data.
Check released data at bit / byte level every 24 hours.
Released parts are never upgraded to a newer CATIA edition.
(example: CATIA V5 R25 → CATIA V5 R28)

Validate data at every environment change

Validation processes use same hardware & software configuration as for model design & release.
Tolerance level = 0.001mm = 3.94×10^{-5}in

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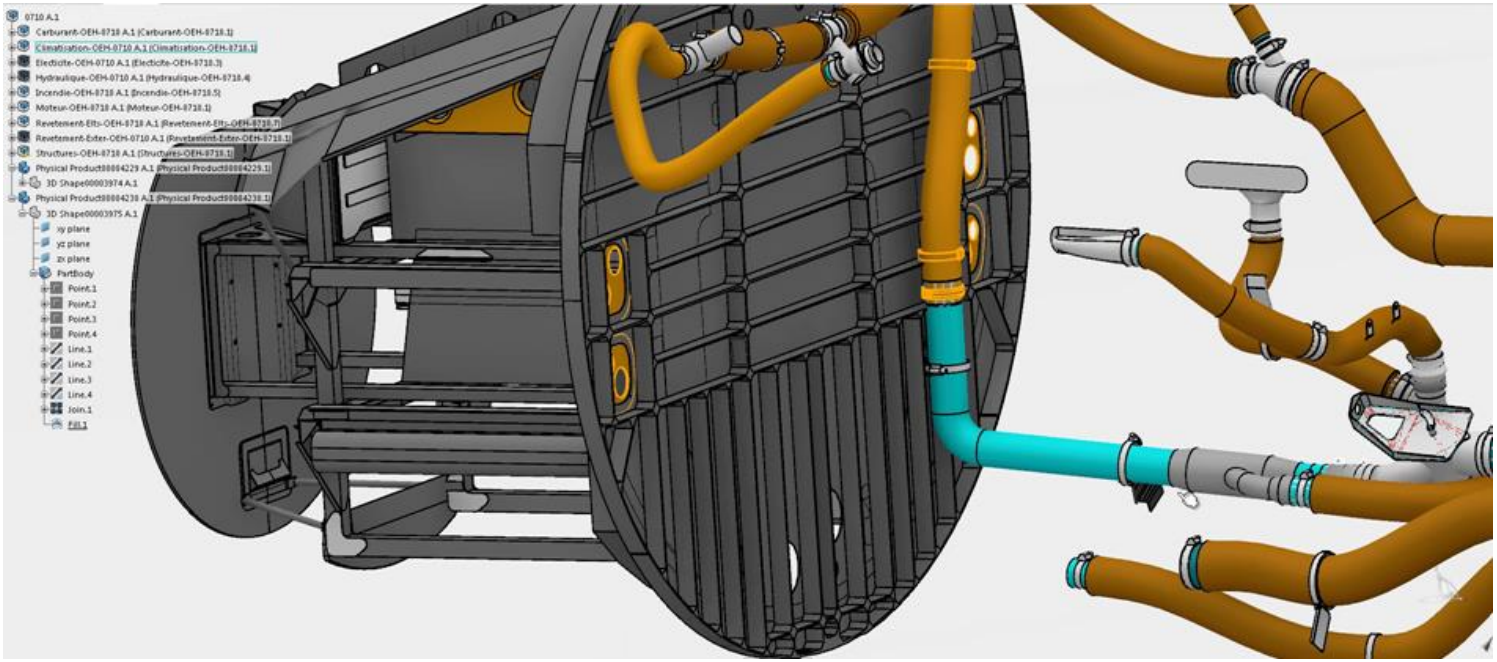
Data Portability



Designs use only entities supported by STEP

- All visible geometry
- Some hidden geometry (composite part plies)
- Annotations
- Specification tree

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Business Requirements for Validation

FAA type-design certification = GAC 3D MBTD

Certification content = STEP features

∴ **Scope of validation = STEP exportable geometry + PMI**

Persist presentation view of certification content

Available for life of aircraft (**>** 50 years)
Validate at every environment change

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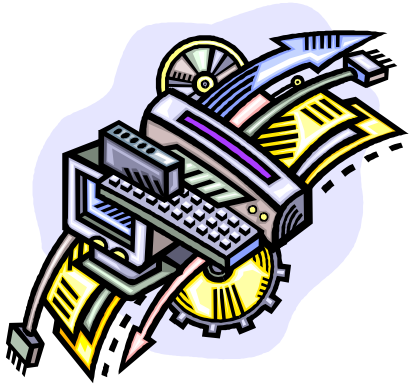
Model Data Presentation & Interpretation

Stored

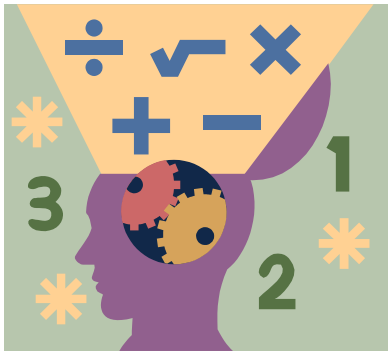
Presented

Interpreted

DATA



Environment Processing



Interpretation

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Ganser's Law of Consistency #1

The same data processed by the same environment is *presented* the same.

Always.

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Ganser's Law of Consistency #1

Data processed by an environment into a *presentable* form once will *always* be *presented* the same in that environment.

∴ *Consistently* stored data presents *consistently* within a *consistent* environment.

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Ganser's Law of Consistency #2

GIVEN:

Environments that produce the same *interpretation* are considered *equivalent environments*.

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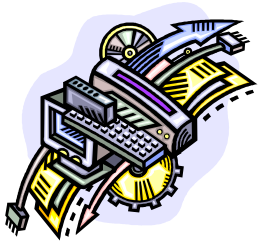
Ganser's Law of Consistency #2

IF

THEN



When all *data* is validated,
then the *environments*
can be considered equivalent.

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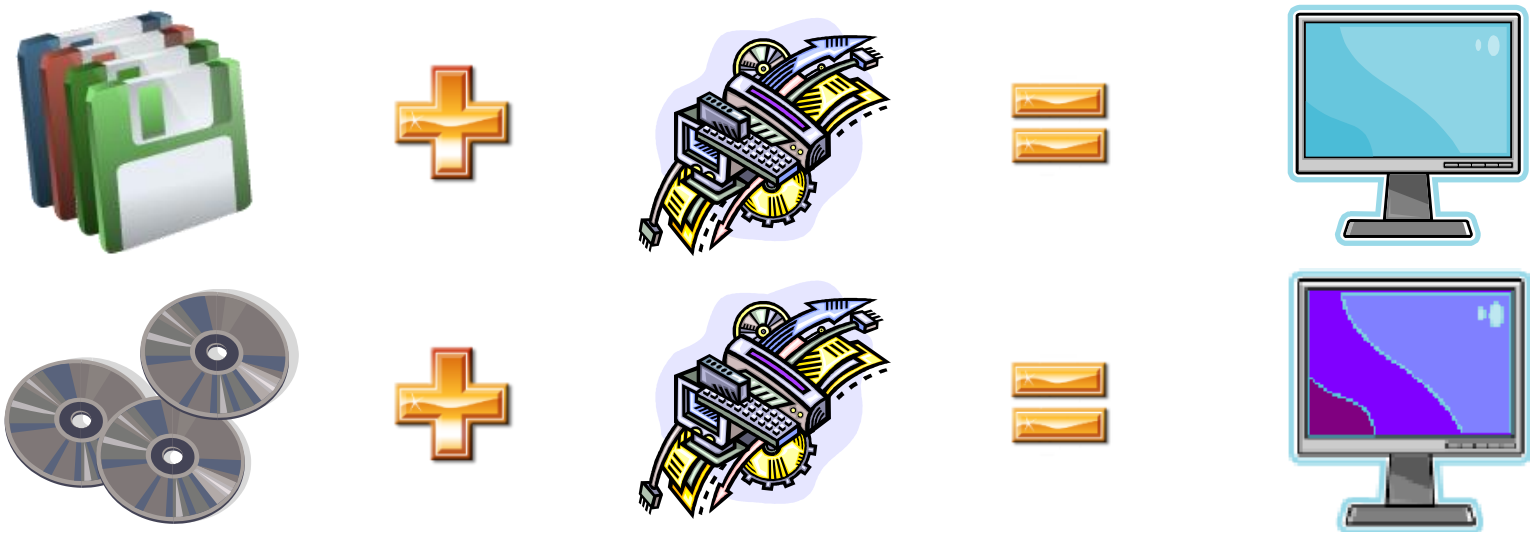
Ganser's Law of Consistency #3

GIVEN:



Stored data **that produce the same interpretation are considered equivalent** ***stored data (files)*****.**

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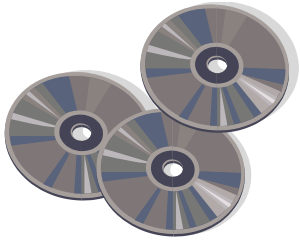
Ganser's Law of Consistency #3

IF

THEN



When all *data* is validated,
then the *stored data*
is considered equivalent.

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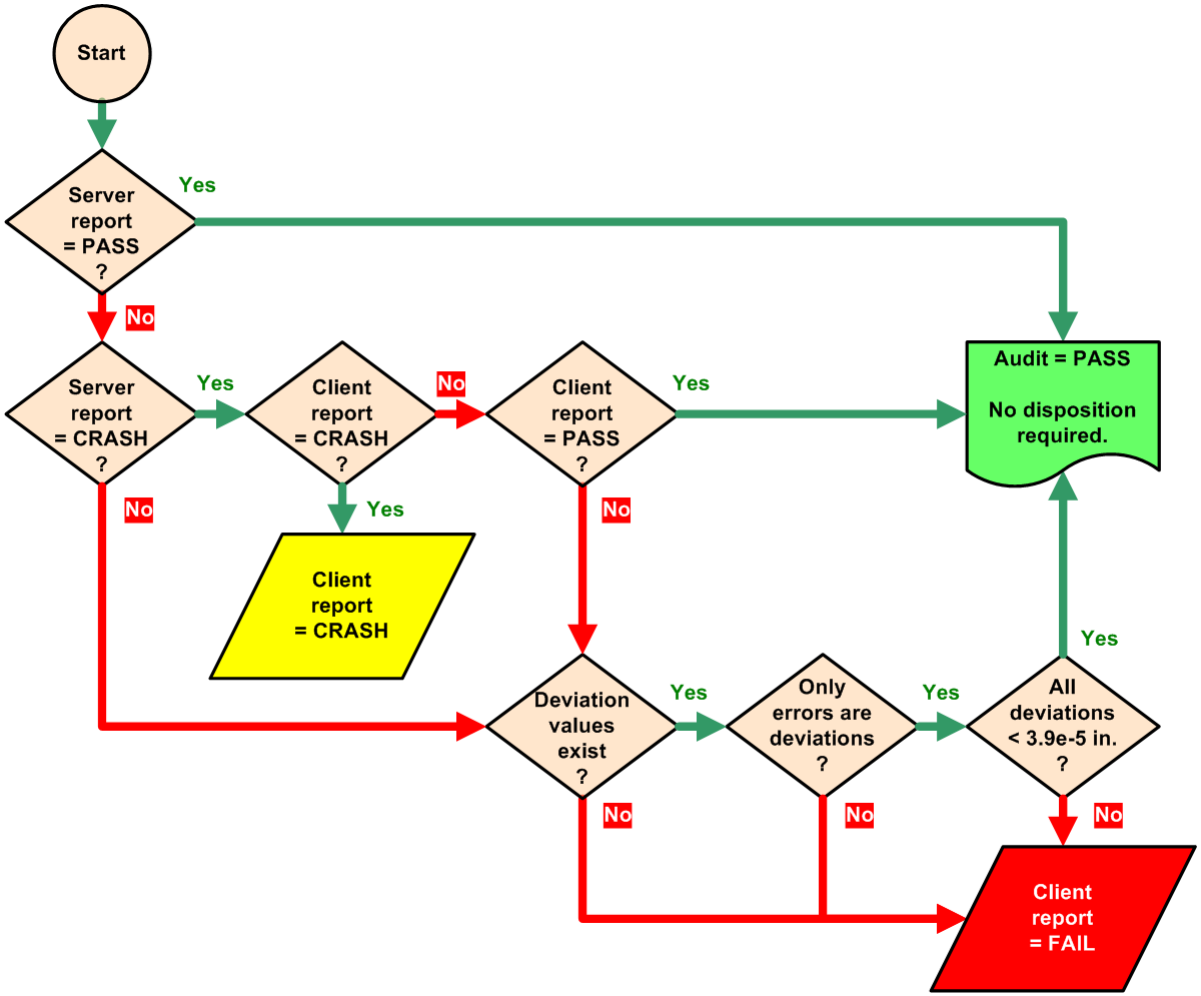
Geometry Validation Process

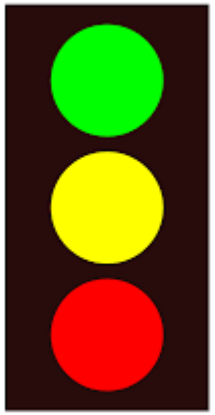


Outputs

Pass

Crash

Fail



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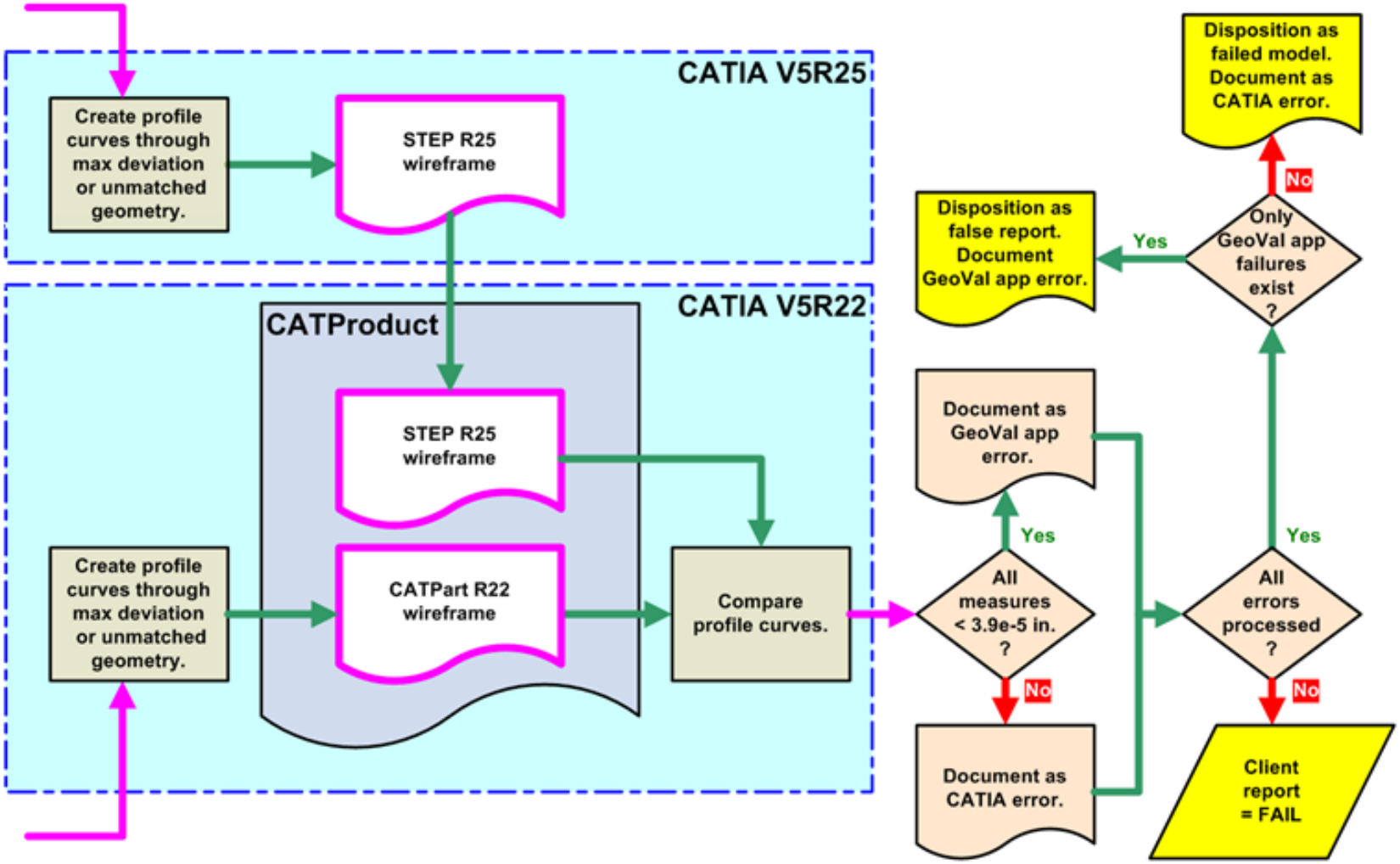
Disposition Process for Crashes and Failures



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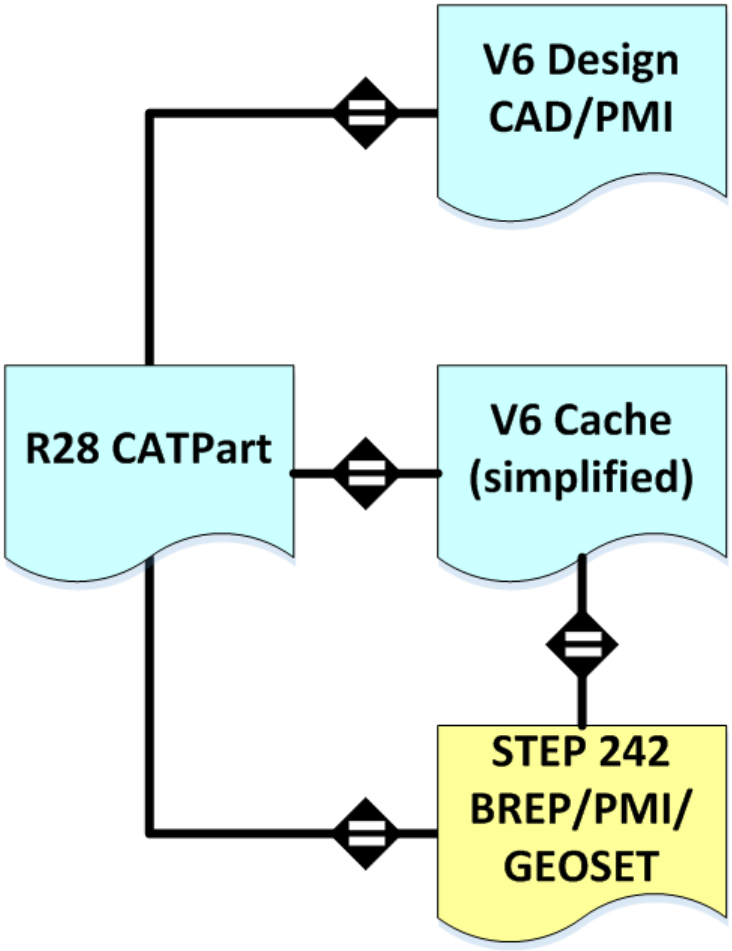
Next Project: 3Dx Validation Scenarios



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Strategy for Next Project

Develop a CAD classification model

Interrogate geometrical/ technological features to determine type:

- Mechanical
- Sheet Metal
- Composite
- Wire Harness
- Tubing

Identify complexity levels for released parts

Create configuration files to process each type.

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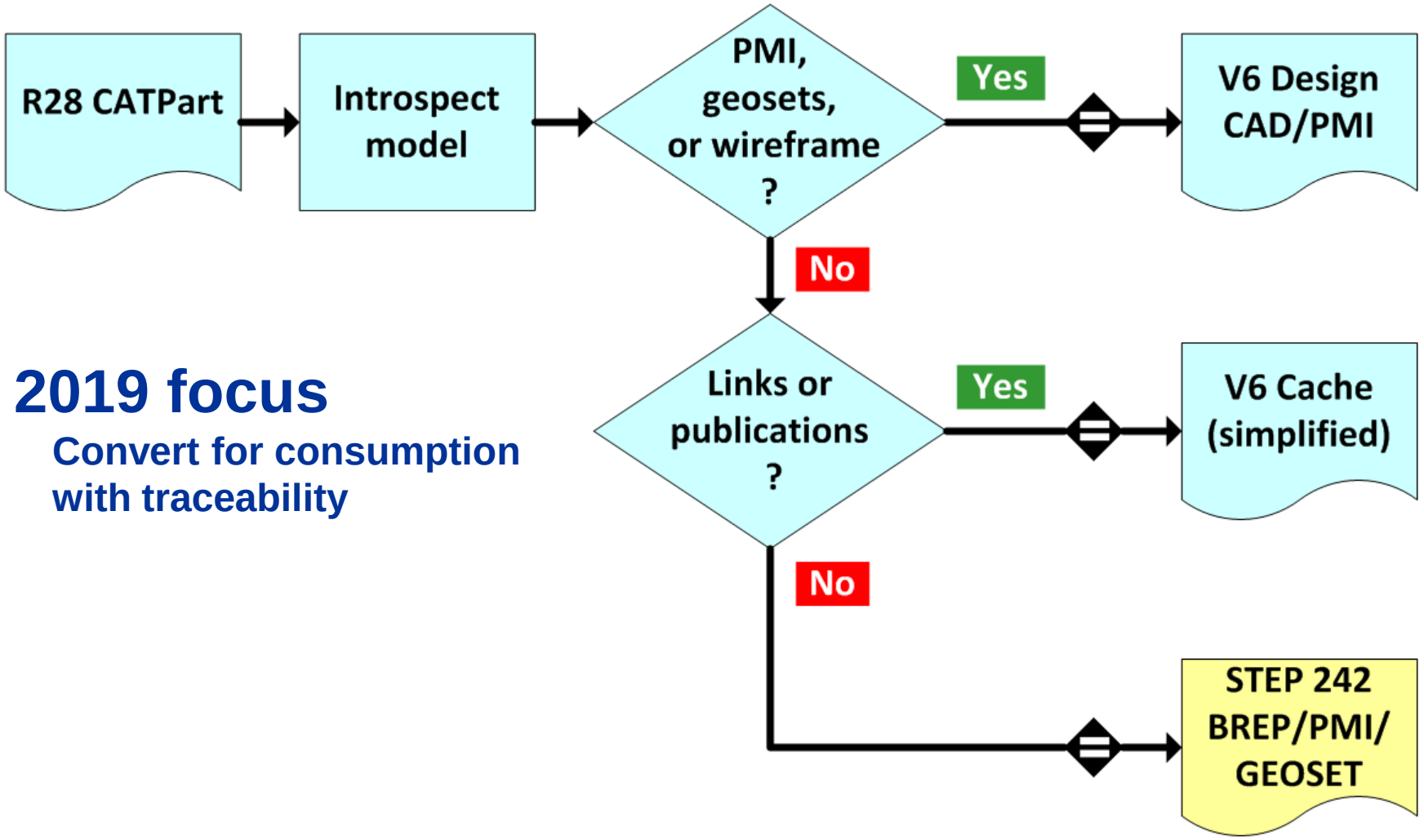
CAD Classification Model



2019 focus

Convert for consumption with traceability

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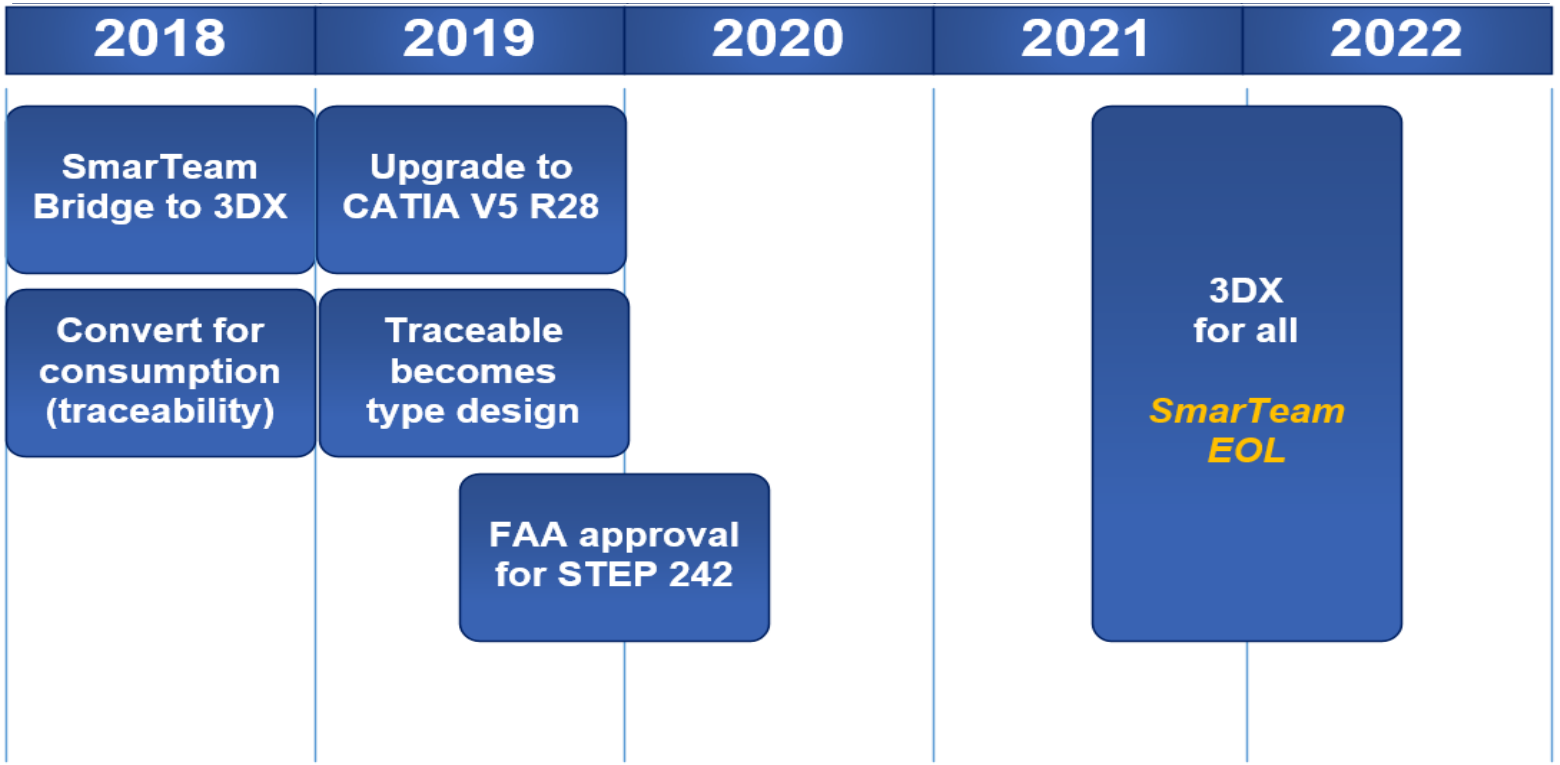
Next Steps



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