Standards for Digital Manufacturing

AP238 Edition 2

STEP Tools, Inc.
http://www.steptools.com

Dr. Martin Hardwick
hardwick@steptools.com
RPI & STEP Tools Inc.
14 First Street Troy NY

Edition 1 testing

Smart Data

**Simulation**

Process

Digital Manufacturing
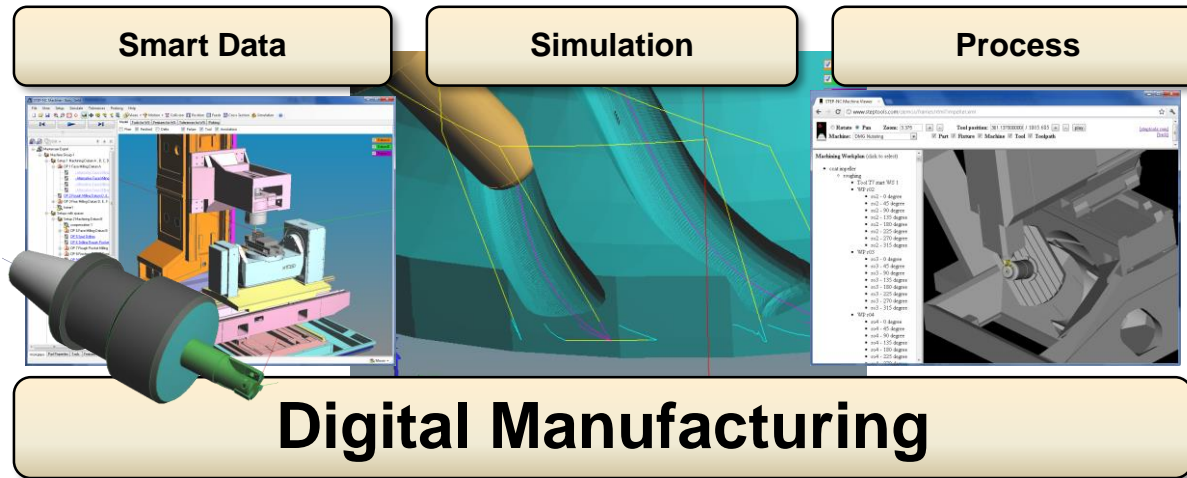
Assembling STEP-NC Process from Catia, Mastercam, NX

WebGL 3D Viewing of CAD and CNC

Intelligent machining using PMI

CAM Exchange tests with Boeing, Scania, Sandvik, and ISCAR – enabling market for better machining solutions

Working with Okuma, Makino, MTConnect to put live simulation on the CNC

© Copyright 2014 — STEP Tools, Inc.
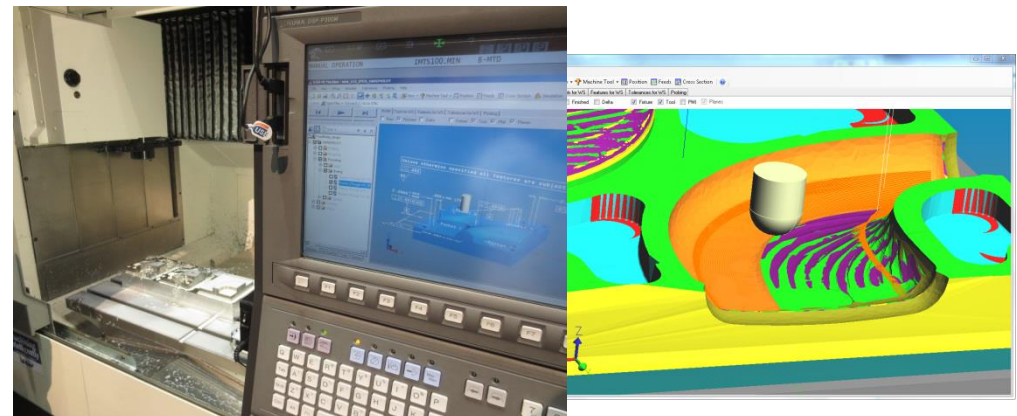
Machining models enable Savings

- **We asked Sandvik and ISCAR to optimize a Boeing machining program**

- **We sent them machining models for selected operations**

- **They read the models, selected better tooling**

- **Returned optimized process to Boeing**

- **Machining Tests at Boeing and KTH (Sweden) confirmed simulator estimates**
  - **Profiling time 2,680 sec reduced to 859 sec**
  - **Pocketing time 1,104 sec reduced to 726 sec**

Edition 2 opportunities

Test cases

Engine Mount Bracket

NIST ATP

Development of Edition 1 1999 to 2007

DARPA SBIR

Testing by STEP-Manufacturing TC 184/Sc4 Wg3 T24 2006 to 2016
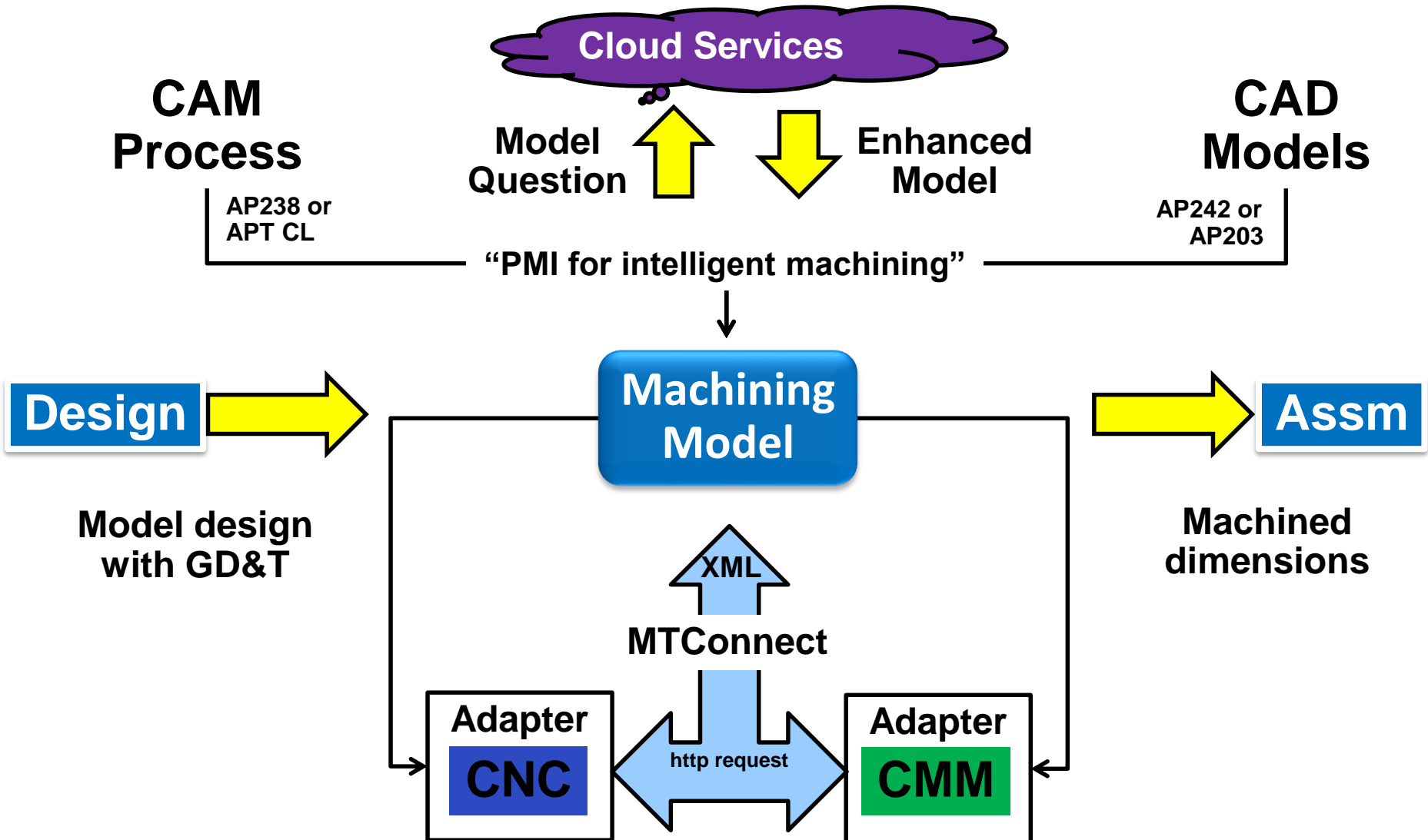
New opportunities

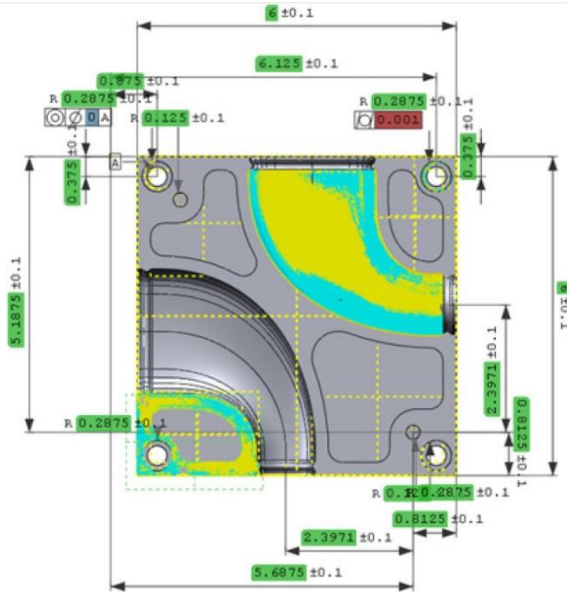**Cloud services**

GD&T validation
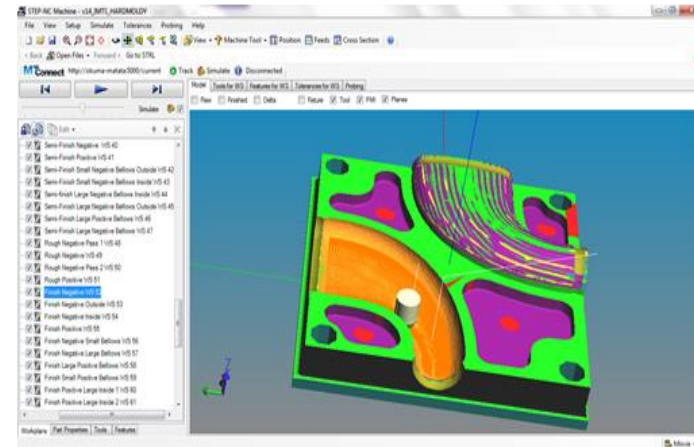
Robot machining

Additive processes

Configuration management

Cloud services

STEP*NC*

NC Generation, Tooling Optimization, Process Monitoring

Cloud Services

CAM Process

AP238 or
APT CL

Model Question

Enhanced Model

CAD Models

AP242 or
AP203

"PMI for intelligent machining"

Design

Model design
with GD&T

Machining Model

Assm

Machined
dimensions

XML

MTConnect

Adapter
CNC

http request

Adapter
CMM

Virtual CMM

Part with GD&T

Mesh generation
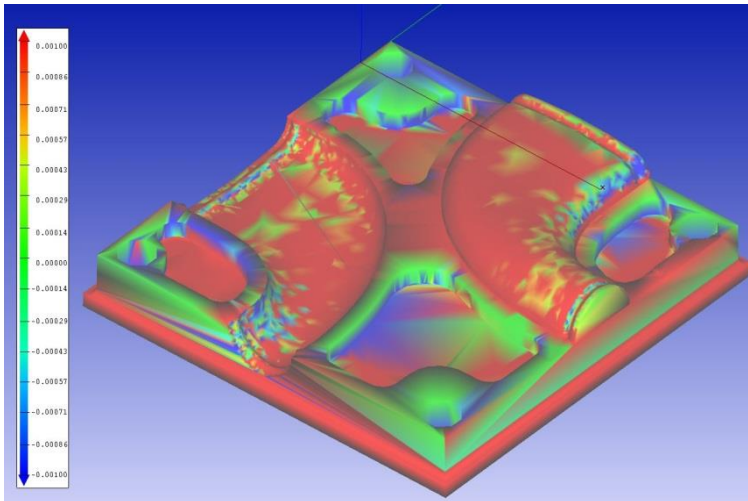
Virtual Metrology

Real Metrology

Robot machining

Wing assembly

Stress free

Stressful

STEP
Model

**Machining
Model**

XML

MTConnect

MTConnect
Stream

Adapter
Robot

http request

Adapter
Tracker

Additive processes
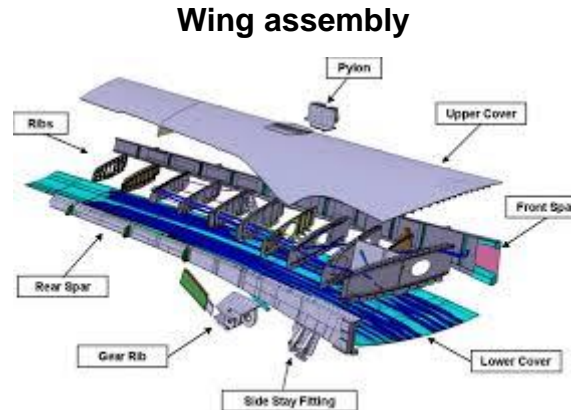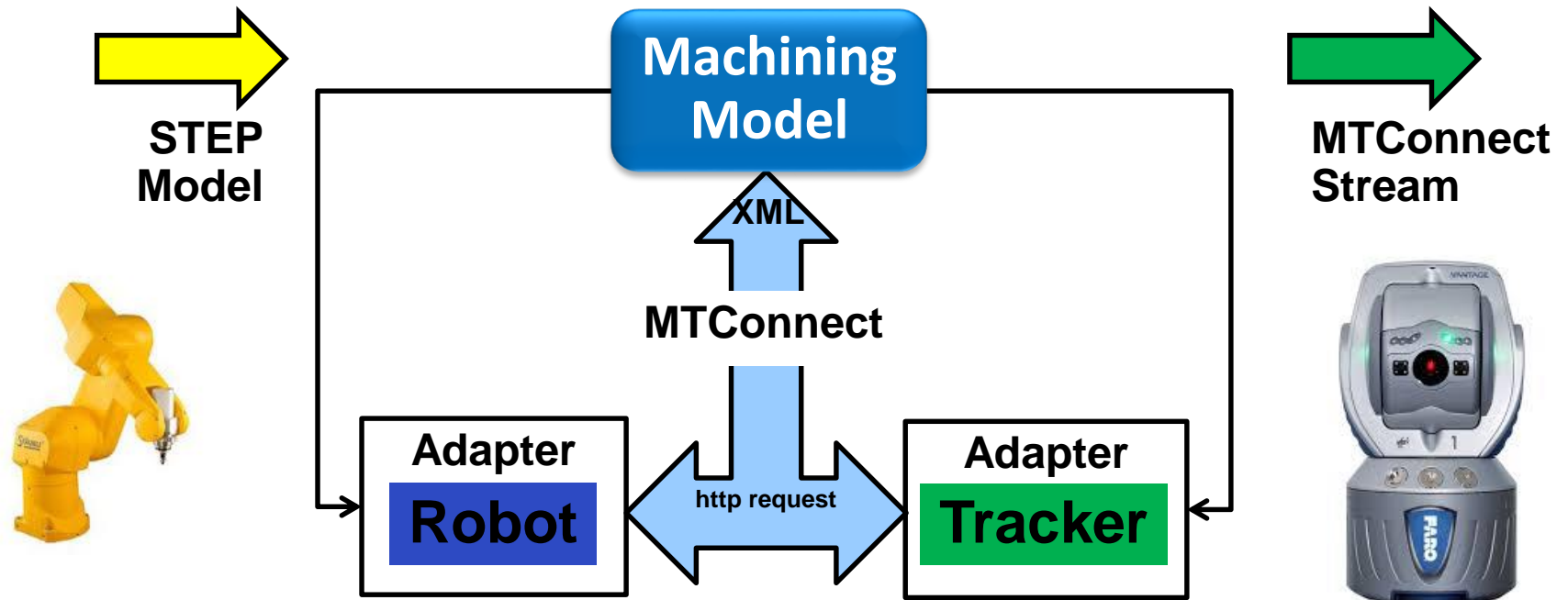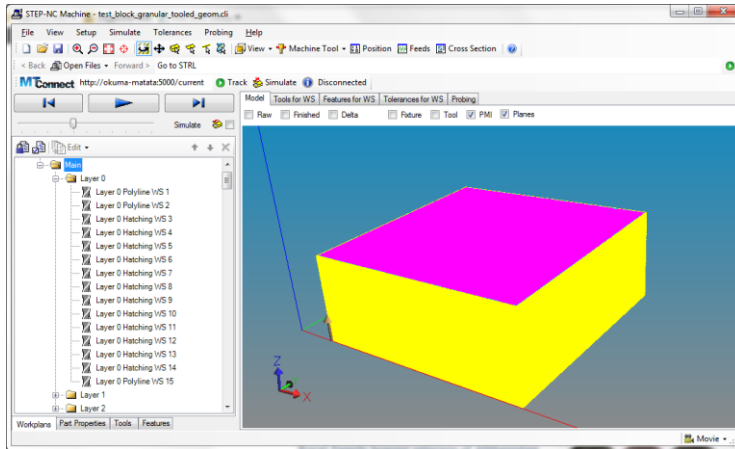
All layers

One layer

One hatch

Process data for hatch

Summary of STEP-NC opportunities

- **<u>Model based machining is 15% more efficient</u>**

Going Forward
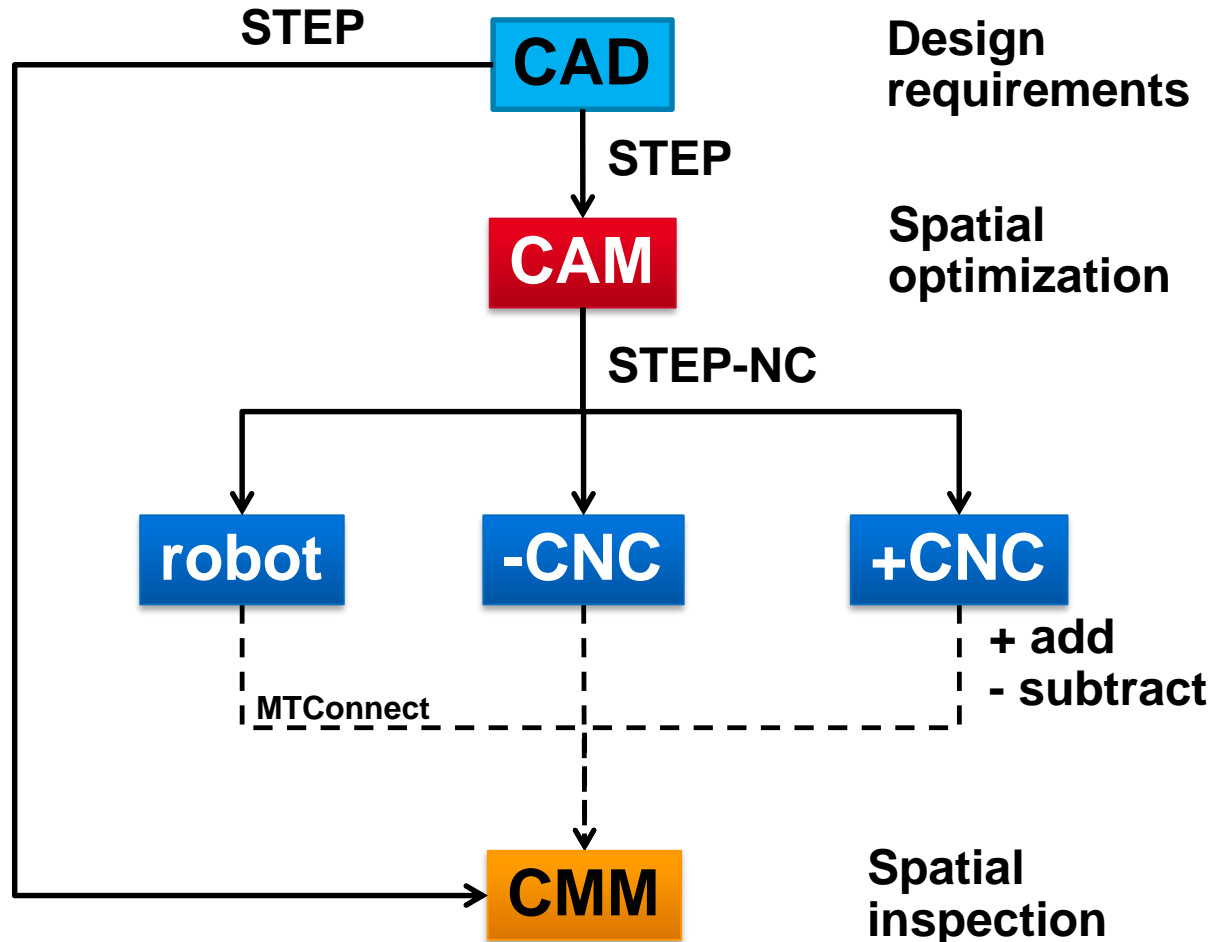
AP238 Edition 2:

- **Formalize changes determined during 10 years of testing**

- **Switch to AP242 GD&T from AP224 GD&T**

- **Integrate ISO 13399 to enable visual representation of key parameters on tool model**

- **Integrate ISO 14649 to enable visual representation of key parameters on process model**

- **Support extremely large data models for additive manufacturing**

- **Kinematics for robots and high accuracy machine tool modeling**