

STEP-NC Pilot Demonstration
OMAC STEP-NC Working Group Meeting
3 February 2005
Orlando, Florida USA

2nd November 2004



Demonstration Description

The purpose of the scenario is to demonstrate the use of STEP AP 238 (“STEP-NC”) in practice during the upcoming OMAC STEP-NC Working Group meeting, 3 February 2005 in Orlando Florida USA. The demonstration will show each of four CAM or CAD/CAM systems generating STEP AP 238 NC process plans for test part milling, and each of three CNCs simulating the milling. All $4 \times 3 = 12$ combinations will be tested. Changes to the design will be suggested by the audience, and a selected CAD/CAM-CNC combination will show the resulting data flow and machining live.

For the demonstration, the October 29 2004 version of AP 238 will be used, the version completed for the October balloting deadline. Demonstration will be limited to Conformance Class 1 (CC1). STEP data exchange will be through Part 21 physical files.

Test parts will be 3-axis and 5-axis versions of the NAS 979 circle-diamond-square part with a conical pocket. Corresponding AP 203 Edition 1 geometry .stp files will be imported into the CAD/CAM systems.

The participants include the following:

- Chen-Han Lee from UGS Corp.;
- John Callen from Gibbs;
- Ming Liu and Waris Jaffrey from The Boeing Company/Wichita;
- David Odendahl from Boeing/Tulsa;
- Sid Venkatesh, King Yee and Mauro Costas from Boeing/Seattle;
- Carol Tierney and John Witco of General Dynamics Land Systems;

- Martin Hardwick from STEP Tools Inc.; and
- Fred Proctor from NIST.

Participants from Dassault Systemes, CNC Software Inc., Parametric Technologies Inc., Siemens AG and GE Fanuc may also be included. The target CAM or CAD/CAM systems include the following:

- UGS's NX;
- Dassault's Catia V5;
- Gibbs' GibbsCAM;
- CNC Software's Mastercam;

The target CNC systems include the following:

- Siemens' 840D;
- GE Fanuc's 18i; and
- GE Fanuc's 30i.

Test Parts

Two test parts have been selected: the National Aerospace Standard (NAS) 979 "circle diamond square" part with a conical central pocket suitable for testing 5-axis machining (CDS-5), and a 3-axis version without the conical central pocket (CDS-3), both scaled down by half from the original NAS specification. The parts are shown in Figure 1. Reference AP 203 .stp files for these two parts are available at <http://www.isd.mel.nist.gov/projects/stepnc>, in the "Data Repository" section.

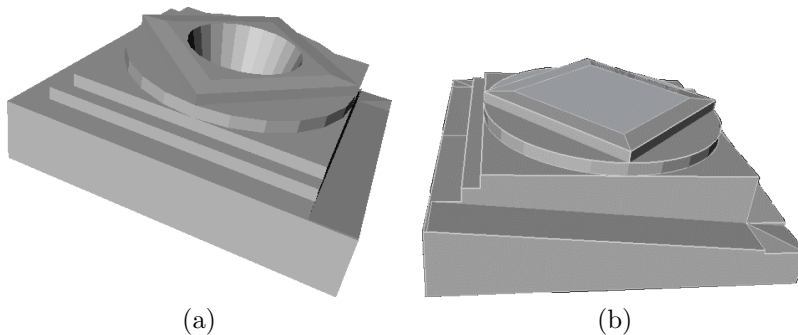


Figure 1: Test parts: a 5-axis circle-diamond-square part with a conical central pocket (a), and its 3-axis counterpart without the conical feature (b).

Scenario

The demonstration is split into two parts, a “canned” demo and a “live” demo. The canned demonstration will exercise STEP-NC for each of the 12 combinations of CAD/CAM-CNC systems possible, as depicted in Figure 2, or some representative subset of combinations if time is limited. For the live demonstration, an audience member will select one combination, and make a design change to a test part. The full process planning-machining sequence will be demonstrated for the selected combination. Machining will be simulated using actual CNCs and either software simulation or motor test stands. Actual machined parts from prior full tests will be shown.

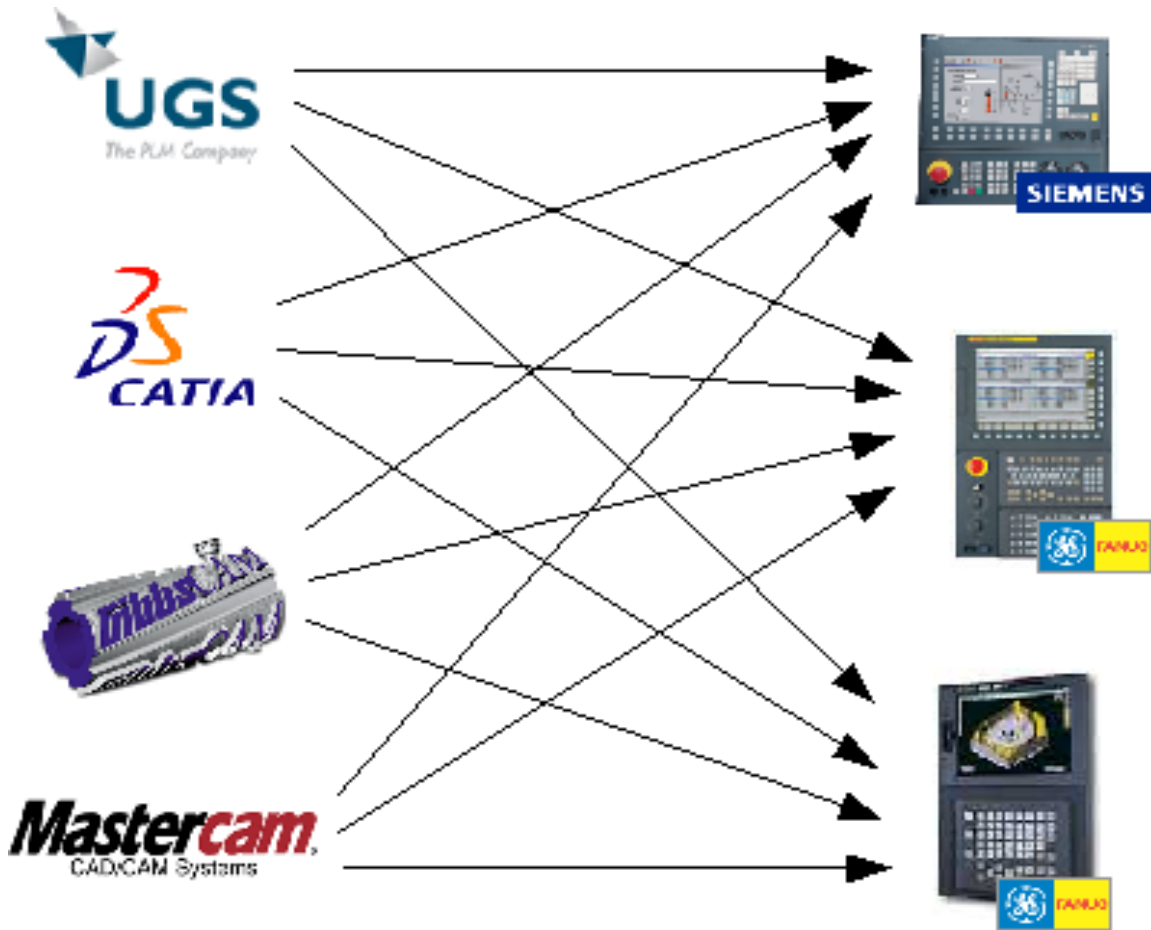


Figure 2: *Combinatorial testing of CAD/CAM and CNC.*

1. One of the 12 CAD/CAM-CNC combinations possible is selected. Depending upon the CNC selected, either the 3-axis or 5-axis part will be demonstrated.
2. The AP 203 geometry for the test part is imported into the CAM or CAD/CAM system. The process planner works to recognize features, assign tools and pro-

cess parameters for each feature, saves the project and exports an AP 238 process plan.

3. `apconform` is run to check that the exported data conforms to STEP AP 238 CC1. Presumably it does. If not, the CAD/CAM vendor should fix the problem and repeat (2) until it passes.
4. The exported AP 238 process plan is imported into the CNC, and milling is run in simulation. The resulting “part” is visually verified against the design.
5. The preceding steps are repeated for each of the remaining combinations.

For the live demonstration, the audience is asked for a design change and CAD/CAM-CNC combination of interest. The previously saved project file is loaded into the CAD/CAM system, rather than the original AP 203, sparing the audience from repeated viewings of the full CAM phase. The suggested change is made, and the sequence follows the canned demonstration.