Annex - Purpose and justification of NWIP

1. The specific aims and reason for the standardization activity

This NWP is related with ISO 14649: a data model for the CAD-CAM-CNC chain, which is expected to encompass the whole scope of e-manufacturing. The new data model formalized as ISO 14649 is under development by ISO TC184/SC1/WG7 for the replacement of the old standard so-called G & M codes, formalized as ISO 6983 which has been used since the 1950s. There are several parts in ISO 14649 for specifying various purposes. The current status of ISO 14649 is summarized as follows.

Table 1. Current Status of ISO 14649 Documents.

Part No.	Title	Publication
1	Overview and Fundamental Principles	IS
10	General Process Data	IS
11	Process Data for Milling	IS
12	Process Data for Turning	IS
110	***Machine Tools for General Processes***	***NWIP***
111	Cutting Tools for Milling	FDIS
121	Cutting Tools for Turning	IS

As shown in the Figure 1, the information contents of ISO 14649 are composed of; 1) task description, 2) technology description, 3) tool description, and 4) geometry description. The task description describes the logical sequence of executable tasks and data types. Details of each *workingstep* are covered in the technology description in reference with the tool description and the geometry description. The current model of ISO 14649, however, does not cover specification of machine tools to be used for executing the workingsteps. Thus, it is necessary to develop a new data model for specifying the machine tools via this NWIP. Upon completion, this data model will be formalized as Part 110 of ISO 14649.

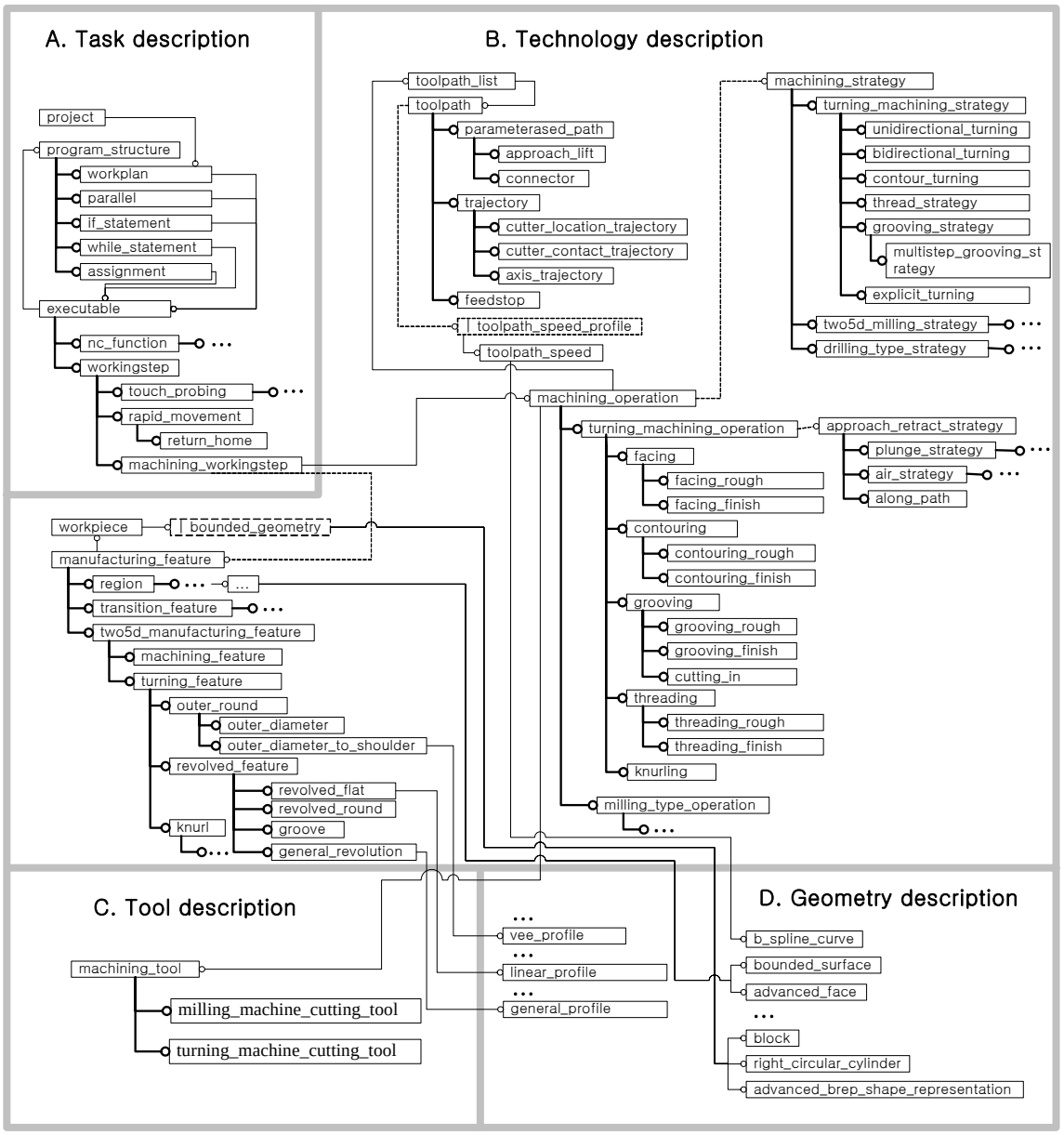

Figure 1. EXPRESS-G representation of overall schema of turning STEP-NC data model.

2. The main interests that might benefit from or be affected

- Developer side: CAD/CAM Vendors, Machine Tool Builders, CNC vendors,
- End user side: CAD/CAM system end users, Machine tool end users, CNC users
- System Integration: SI Software developers

The detailed descriptions are given below:

The impacts of the new interface scheme are most felt in the CAD-CAM-CNC chain. In the sense that

STEP-NC data model is an extended product data model including process plan information, it can be used as an information highway encompassing CAD, CAPP, CAM, and down to CNC, thereby enabling the what-so-called 'art-to-part' dream to come true. That is the 3D model (of part DB) can turn into a physical part by CNC like producing a hard copy from a printer. Specifically, at the CAD-to-CAM level between design and manufacturing, the NC extension parallels STEP's overall ability to seamlessly facilitate data flow in B2B situations. Those savings derived from it have a synergy effect, complementary each other. Since the 3D model can be sent directly to manufacturing, time saving of 75% (according to an analysis [Hardwick, M, 2001, "Justifying the STEP-NC savings," Proc. of 4th MDICM IRB Meeting, June 2001 (available from http://www.steptools.com). Note that 'STEP-NC (ISO 14649)' in Fig. 2 is represented as AP238 in the above Reference, which is AIM version of ISO14649.) can be easily achieved over the current process, where conversion into a drawing should take place before it is sent to manufacturing.

Further, since the new data model defines all the information for process planning, the process planning step can be greatly simplified, paring 35% - 60% over the normally required for the step. By implementing feature recognition capability in CAM system based on STEP-NC data model, the process planning task can become a 'push-button' task for producing 'universal' part programs nullifying any postprocessing for CNC to be used for machining. In the near future, the new interface scheme will be used as a means for implementing Internet's B2B activities, E-design, and E- manufacturing.

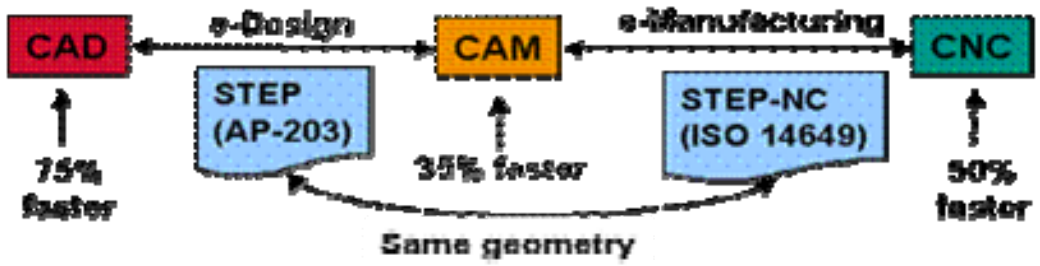

Figure 2. Benefits of STEP-NC interface scheme in CAD-CAM-CNC chain

From the perspective of CNC, the new data model is very significant providing CNC with all the information about 'what-to-make' and 'how-to-make' with its machine tools. In other words, depending on how the new data model is implemented, CNC would be able to incorporate various intelligent functions, which is not feasible in the conventional control based on ISO 6983. According to a survey of STEP Tools US, time saving of 50% is reported. This is a rough estimate mainly considering the

machining time with adaptive control based on STEP-NC model. Besides the time saving, there can be many other tangible benefits which cannot be measured by time, such as machining accuracy, quality improvement, automatic part set up, on-machine inspection, automatic collision avoidance among others.

3. Feasibility of activity

There are no factors that could hinder the successful establishment or global application of the standard.

4. Timeless of the standard to be produced

STEP-NC is not a new technology, and being stabilized by looking at the following aspects. The research developments identified previously have been contributed by a number of major academic and industrial establishments. The following are representative example of interoperable manufacturing research in alphabetical order: Aachen University (German), Airbus (France), University of Auckland (New Zealand), University of Bath (UK), CADCAMation (Switzerland), EPFL (Switzerland), NIST (USA), POSTECH (South Korea), University of Santa Catarina (Brazil), University of Stuttgart (Germany)

5. Urgency of the activity

As shown in Table 1, all the essential elements have been developed and used for implementation excepy for machine tool data models proposed in this NWIP. Considering this, the NWIP is very urgent for the complete exploitation of the STEP-NC technology.

6. The benefits to be gained by implementation of the proposed standard

The benefits from this NWIP is the same as given in Section 2. This is because the NWIP is for filling up the part not covered in the current ISO 14649.

7. Harmonization of the NWIP

- ISO TC184/SC4/WG3/T24
- ISO TC39/SC2