NX Machining Summary

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May 8, 2006
NX Machining Goals & Strategy

NX Machining goal
- Expand our leadership position

NX Machining product strategy
- Continue to invest in the major industry segments
- Expand the User base by entering into the Mid-Market
  - Machinery
    - Multi-functions machines
    - High production machining
  - Die/Mold (automotive & high tech)
    - Plastic injection mold tooling
    - Automotive die tooling
    - Progressive die tooling
  - Aerospace & Defense
    - Airframe manufacture
    - Turbo machinery
### NX Machining Roadmap

#### NX4/CAM
- **Q4/2005**
  - **Usability**
    - Support for Wizard Builder
    - Dialog Enhancements
  - **Feature Base Milling**
    - Feature Enhancements
    - Solid Edge Feature
  - **3x Milling**
    - Plunge Milling
    - Form Tools
    - Trochoidal Milling
  - **Turning**
    - Solid Silhouette
  - **5x Milling**
    - VAP –No Floor
    - Tool Axis Optimized
  - **ISV**
    - Mill/Turn IPW
  - **Multi-Function Machines**
    - Mori NT 2000

#### NX5/CAM
- **Q1/2007**
  - **Usability**
    - Integration with SE
    - Design of User Interface
    - Noncutting Moves
    - Post Processors Library
  - **3x Milling**
    - Simple Milling
    - Contact Contour
    - Interpolath ToolPath
    - Z-level Enhancements
    - GM Enhancement
  - **5x Milling**
    - Interpolated Tool Path
    - Z-level 5 axis
    - VAP Ph 2
  - **Feature Based Machining**
    - Feature Teacher
    - Process Teacher
    - eM Machining Shared Components
    - On Machine Probing
    - Machine Kits

#### NX6/CAM
- **Q1/2008**
  - **Usability**
    - Noncutting Moves Engine
  - **Velocity**
    - Design of UI for VAX
    - Post Processors Library Cont’d
  - **FBM**
    - Contour Feature Support
  - **Milling**
    - Simple Milling
    - Variable Axis Cavity Milling
    - Variable Axis Surface Contouring
  - **Probing**
    - Closed Loop Machining
    - Adaptive Machining
    - CMM Support
  - **Application Integration**
  - **Machine Kits**
  - **Additional Multi-function machines**

#### Legend
- Project completed or delivered
- Project under development
- Proposed project

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NX 4 Topics

- Usability
- Milling
- Turning
- Multi-Axis Milling
- Integrated Visualization & Simulation
Directions

- Efficient and consistent user interface and interaction (measured by user work-flows)
- Discoverable -- easy to learn

NX 4 Projects

- Journaling
- Dialogs Enhancements
- Machining Wizard
NX4 Milling

Directions

- Provide efficient tool paths for Fixed Axis Milling
- Continuous Improvement in High Speed Milling

NX 4 Projects

- User Defined Tool
- Plunge Milling
- T-Cutting
- Face Milling
- Cavity Milling Analytic Tool Paths
- Trochoidal Cutting
**NX4 Turning**

**Directions**
- Improve usability
  - Support complex cross-sections
- Support the functions of Mill/Turns and 4-Axis Lathes

**NX 4 Projects**
- Solid selection
- Sync-Manager Enhancements for multiple spindles
- Multiple Work Plane for multiple turrets
- Multiple Cut Regions in one operation
- Controller Drill Cycles

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**Directions**
- Provide Highly Automated Processors
- Reduce User interaction

**NX 4 Projects**
- Contour Profiling
- Cutter Positioning
- Multiple Passes
- No Floor Machining
- Contour Profiling
- Curvature Matching
Directions
- Provide a virtual machining environment
  - Material Removal
  - Machine Tool Simulation
- Cutter path Verification

NX 4 Projects
- Integrated IPW for Mill/Turns
- Gouge Checking Consolidation
- ISV Enhancements
NX5 Topics

- Usability
  - Feature Based Machining
  - Complex Machining
  - Integrated Machine Validation
  - Quality
  - Machine Kits
NX 5 Usability Objectives

- Simplify learning
- Ease of use
- Improve discoverability for new users
- Increase consistency
- Make it easier to use for all users
Ease of learning & use – Dialog consistency

Capabilities
- Dialog presentation and interaction consistency
- Improved dialog display and interaction
- Edit dialogs are equivalent to creation

Why is it important to you?
- Makes NX consistent and predictable through use of standard “blocks”
- Learning task is much reduced for all users
- Amplifies the return from advanced NX capabilities and productivity tools

This is a very large project
NX5 Velocity Projects

- Role Based Environment
- Updated UI Dialogs
  - Streamlined
  - Consistent
- Operation Navigator (ONT)
- Easy to load posts/libraries
- Teamcenter Express Integration
- Misc. Projects
 NX 5 Topics

- Usability
- **Feature Based Machining**
- Complex Machining
- Integrated Machine Validation
- Quality
- Machine Kits
Feature Based Machining Projects

Feature Recognition
- Extends recognition to broken hole, interrupted holes, new features.

Feature Manager Enhancements
- Extends recognition to broken hole, interrupted holes, new features.

Manual Hole Making
- Simplified holemaking for Velocity

Why is this important to you?
- This expands the sets of features available to be processed
- It should expand usage by 25%
- Could allow complete automation of prismatic parts giving 10x productivity
- Heidelberg, W&H, EMF, eM Machining

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Feature Recognizer Enhancements

- Implement Feature Recognition components from eM-Machining
  - Open and interrupted holes
  - Blend support
  - Language enhancements (Cone/In, Cone/Out, etc.)

Why is this important to you?

- This expands the sets of features available to be processed
- Could allow complete automation of prismatic parts giving 10x productivity
Feature Manager Plans

- Navigator Implementation
- Other FBM Enhancements
  - Feature Update Report
  - Multiple Setup Support
  - Compound Feature Support
Manual Hole Making

- Geometry selection similar to Point-to-Point
- More user control over point order and geometry selection
  - Faces, Edges, Arcs and Points
  - All Holes on Face / Solid
  - By Vector
  - By Min Max Diameter/Depth
  - By Blind / Through
- Recognizer powered hole detection
### Feature-Based Projects

**New Mold/Progressive Die Wizard Support**
- FBM Process and data per Excel
- Generic Template
- Can also be used for non MW/PDW

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NX 5 Topics

- Usability
- Feature Based Machining
- Complex Machining
- Integrated Machine Validation
- Quality
- Machine Kits
Fixed Axis Milling

Directions

- Extending Mold & Die to Variable Axis
- Enhancements in HSM
- New Milling Pattern

NX Projects

- Interpolated Tool Path
- 3+2 machining in Z-Level
- Expanded On-part
- Library Enhancements for User defined tools and tracing points
- Increased support for contact contour
Interpolated Tool Path

- New Method of Selecting Geometry
- Cut Pattern will follow selected curves
- Tool paths will be morphed
- New cut patterns depending on curves that are selected
- Available to multiple processors
Z-level Cut Levels

Capability in NX 5

- Control Z-level cut levels by specifying a maximum cusp height

Why is this important to you?

- Z-level finishing is an important technique for HSM
- Cusp control is essential to good semi-finishing and finishing
Interpolated Path
- Initial start of a new and improved Variable Axis Surface Contouring modules

Enhancement for Multi-Axis
- Source Contouring will be enhanced to support tilting of the tool
- Enhance Z-Level Profiling

Quality Enhancements
- Analytic Tool Path Ph 2
Capability in NX 5

- New Method of Selecting Geometry
- Cut Pattern will follow selected curves
- Tool paths will be morphed
- New cut patterns depending on curves that are selected
- Available to multiple processors

Why is this important to you?

- It allows the user to define a variety of cut patterns for higher productivity and improved quality
Enhance our 5-Axis Capabilities

Capability in NX 5
- Provide 5-axis capabilities in volume roughing operation, Z-Level and eventually Cavity Milling.
- 5-axis moves appear only when needed

Why is this important to you?
- Better roughing leads to faster cycle times on the machine
- 5-axis roughing is growing industry item
- Product differentiator
**Variable Axis Contour**

**Capability in NX 5**
- Initial start of a new and improve Variable Axis Surface Contouring modules
- Allows for improved user control over tool axis

**Why is this important to you?**
- This project will incorporate some of the new feature implemented in VAP for higher quality machining finishes.
Topics

- Usability
- Feature Based Machining
- Complex Machining
- Integrated Machine Validation
- Quality
- Machine Kits
Why is this important to you?

Probing techniques and closed loop machining are very important to maintain consistent quality during production, especially with castings and forgings of variable size/volume.
Topics

- Usability
- Feature Based Machining
- Complex Machining
- Integrated Machine Validation
- Quality
- Machine Kits
Multi-Function Machine Kits

Capability in NX 5

- Kit will contain
  - Kinematics Model
  - Software Controller
  - Post processor
  - Templates

Why is this important to you?

- This will allow high productivity out of the box. Users can program complex machine tools and take advantage of new machine features with investment in machine models and posts.