

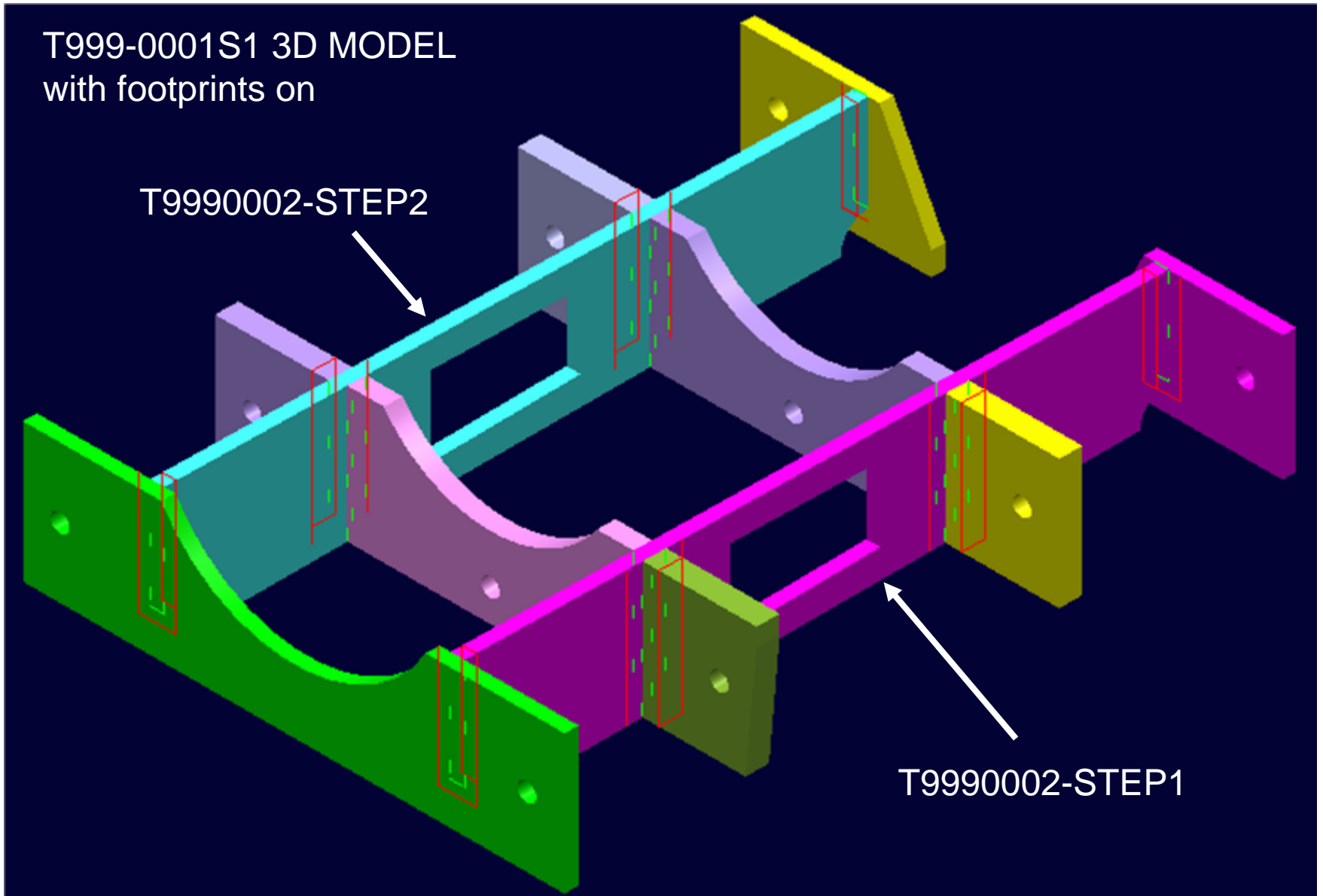
# AP-238 Plate Cutting and Marking

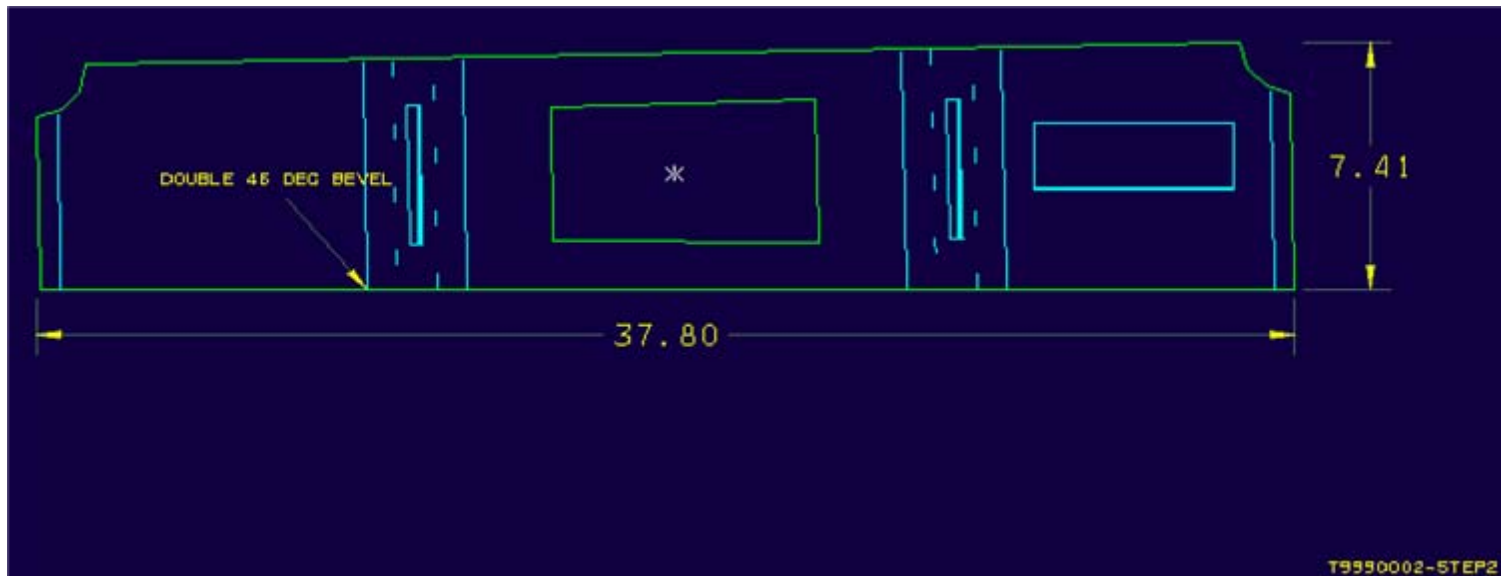
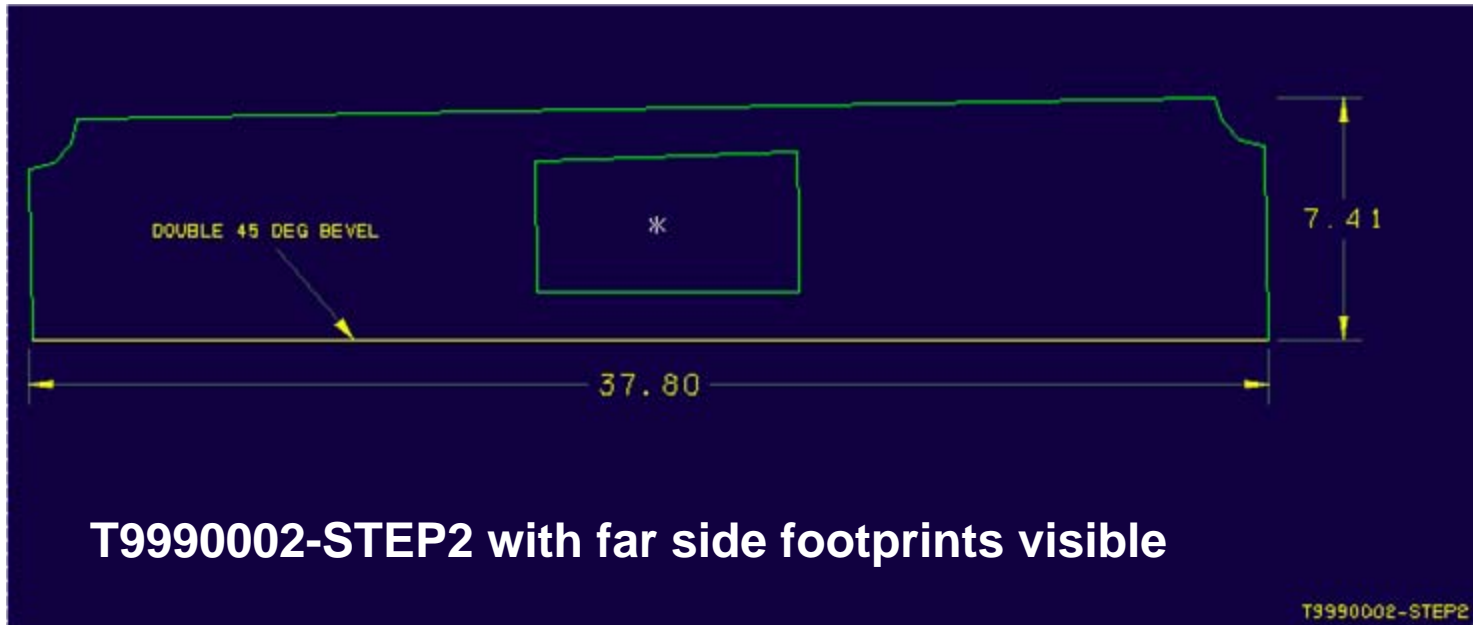
*NSRP Panel Project*



**STEP Tools, Inc.**  
14 First Street, Troy, NY 12180  
(518) 687-2848 / (518) 687-4420 fax  
<http://www.steptools.com>

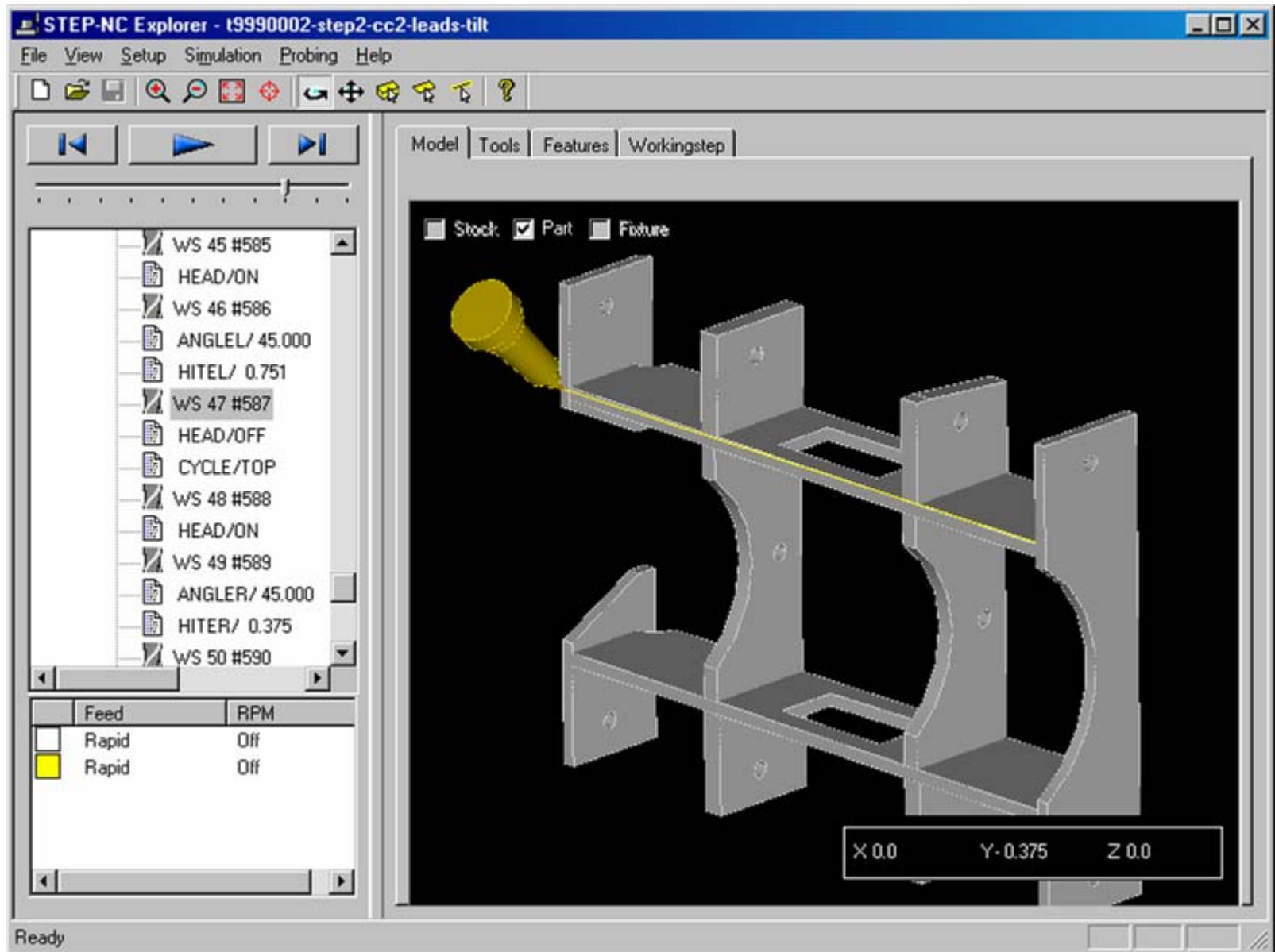
- **Demonstrate STEP-NC for cutting and marking from actual shipbuilding data sources**
  - AP203 geometry for plate shape
  - CATIA APT to describe the marking and cutting process
  - Include straight and bevel cuts, line and text marking
- **Construct AP238 CC2 data to describe plate and process**
- **Prototype tools to drive ESAB plasma cutter and laser marking machines from AP238 data**
- **Cut actual plate at EB Quonset Point facility**



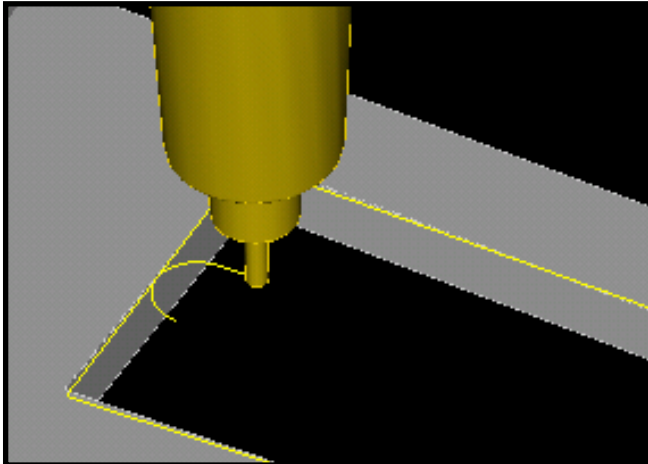
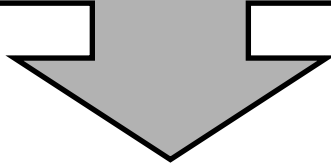
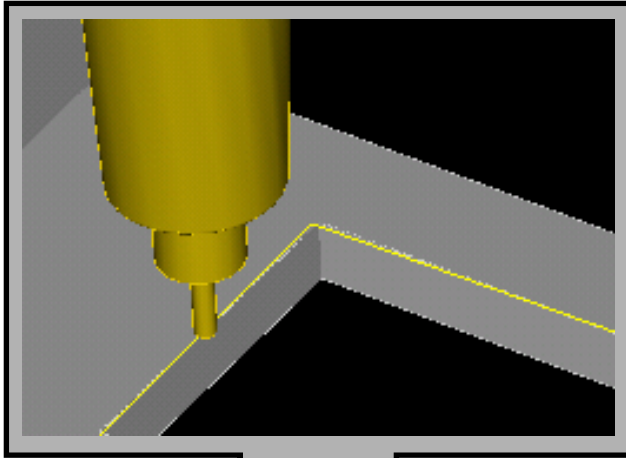


- **Process APT data to produce AP238 process**
  - Used tools already developed for milling and turning information
  - Created AP238 “extended nc function” instances for extra plate cutting APT data like head on/off, bevel angle, marking line width
  - Eventually extend AP238 to hold these in the operation technology descriptions
  
- **Add STEP geometry to the process to see in context of workpiece**
  - Matching location required moving geometry 100 yards!

# AP238 Data for Plate Cutting and Beveling **STEP** Tools, Inc.

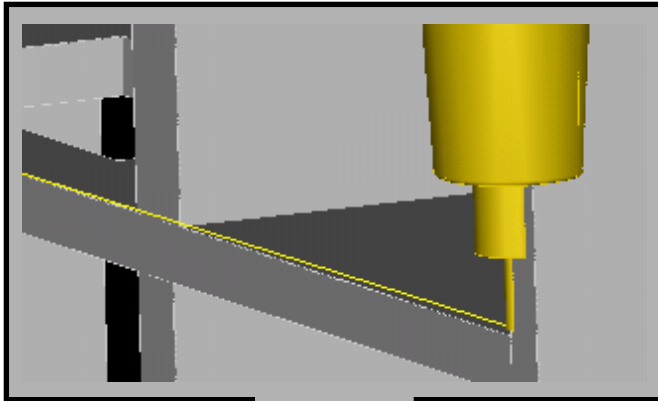


- **As designed, cuts start right on edges**
  - For plasma cutting, lead ins and lead outs are required to avoid gouging the part
  - Also important for bevels to give cutting head time to traverse into position after piercing
  
- **Created utilities to add lead ins and lead outs to the STEP-NC data**
  - Today, these are added by nesting systems like Optimization, Majestic, Sigmanest, etc.
  - These systems could read and write STEP-NC in the future.

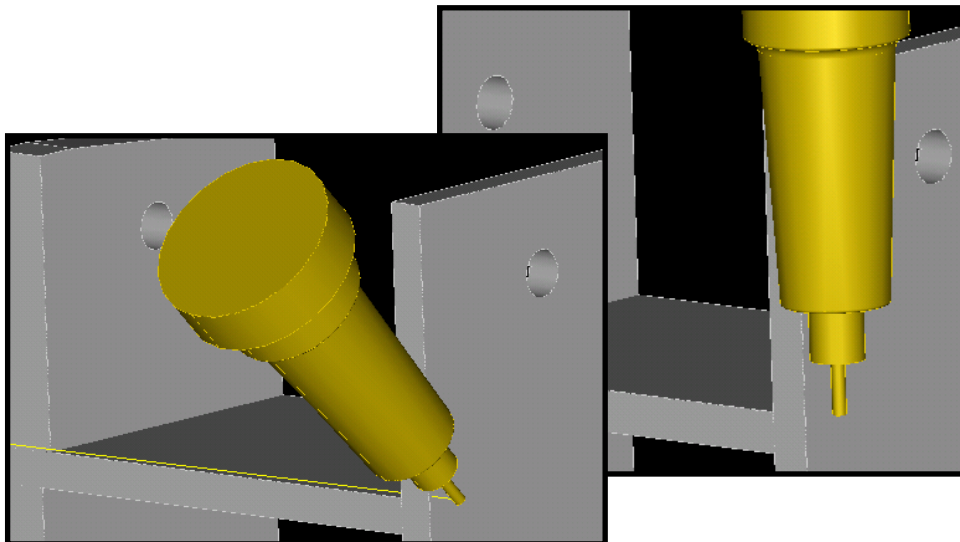


## Tangential Entry/Exit

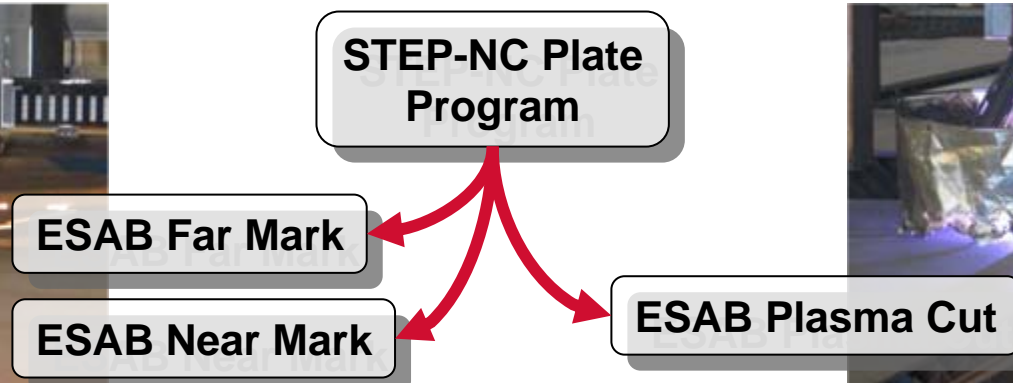




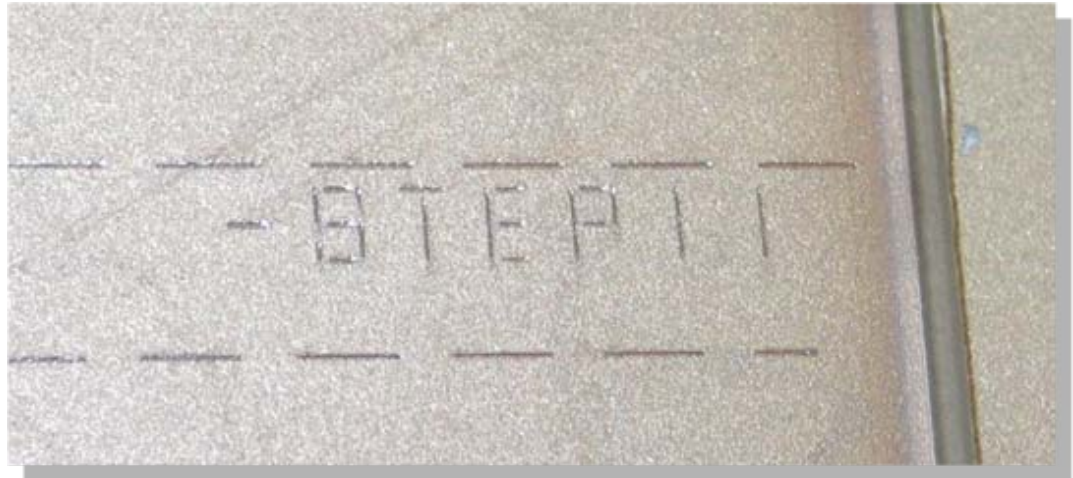
## Bevel Entry



- **Extend existing AP238 CNC interface to export codes for ESAB controls**
  - Many unique codes, machine peculiarities, close contact with EB personnel required to understand them
  - Local conventions for setup and registration of the plate, coordinate system transformations for near/far, etc.
- **Single STEP-NC program for entire plate**
  - Need to split into separate programs to cover near-side marking, far-side marking and cutting



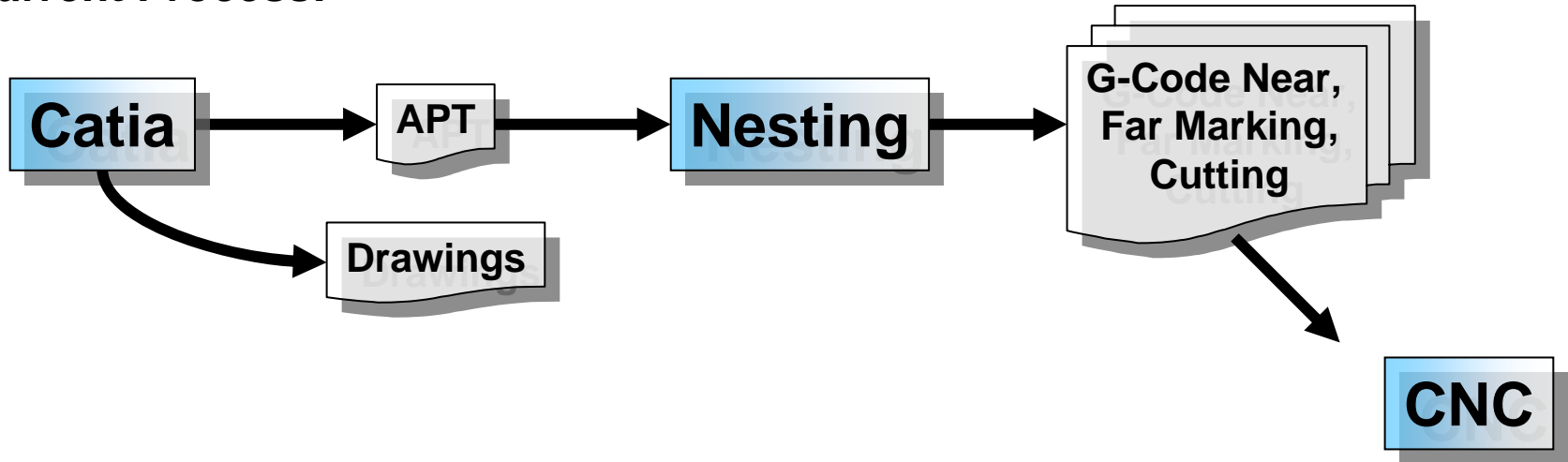
- **Some APT and ESAB codes are rather obscure**
- **Example, marking the text “-STEP11”**
  - In APT: MARK/ 45, 83, 84, 69, 80, 49, 49, 0, 0
    - » Represented as numbers corresponding to ASCII
  - In ESAB Codes:
    - » F100.0
    - » G89D003
    - » G81D0.375
    - » G82D271.1
    - » G80
    - » (-STEP11)
    - » D004
    - » M75
- **In addition, there are machine peculiarities like ordering of codes, decimal points, etc.**



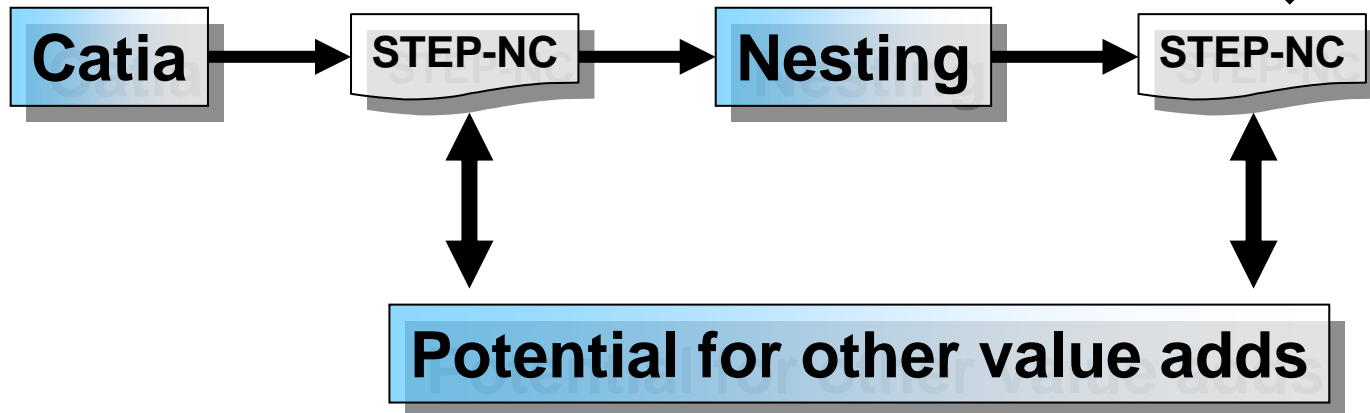
- **May 9, 2007, Marked and cut the test part at EB Quonset Point facility**
  - **Marking and cutting successful. Minor issue discovered with ordering of an ESAB marking code, corrected on site.**
  - **Simulator no substitute for the real thing!**



## Current Process:



## STEP-NC Process:



- **Integrate Cutting and Marking Parameters into a draft ARM**
  - Extend technology descriptions for cutting and marking parameters
  - Use results of Northrop Grumman study
- **Test process improvement opportunities**
  - Beveling for small and/or detailed edges
  - Edge quality control (e.g bounce prevention)
- **Demonstrate at second site**
  - Validate ARM
  - Ensure portability