

## **DNC / CRONOS Deployment 703040**

Federal Manufacturing & Technologies

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**An Agile Machining and Inspection Subproject**

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## **Abstract**

*KCP tested a classified DNC / CRONOS as a pilot project in FY06 in the Reservoir Machining area. The pilot proved as a successful way to distribute classified NC Programs to machines that run both classified and unclassified programs securely. This also allows for elimination of CREM for machines which had to swap out classified and unclassified hard drives previously. This project's purpose is to rollout this technology to the remaining machining areas, predominately Department B, Department C and Department A. Associated with this activity is the modification of business practices in the Tool Room / Model Shop areas and to address licensing issues for MASTERCAM to incorporate DNC CRONOS.*

## **Summary**

This project provides the capability to download CNC part programs from a CRONOS-based distribution system directly to the required machine tools in Departments B and C. It also provides for CRONOS-based distribution of part programs in the Model Shop Department A, where those programs are produced by the model-makers using MasterCam software

The project completed hook up of all 7 existing machines in Department B with one new client PC for stand alone programming and administration; 19 of 22 existing machines in Department C adding one new client PC; and 23 of 55 existing machines plus 19 new client PCs in Department A. This entailed the design and installation of fiber network, interface equipment within the machine tool control cabinet and connection to the new CRONOS network. Machines not hooked up were mainly those located in unclassified working areas that housed un-cleared workers. For those instances, materials and equipment was procured and is now ready for installation in the new facility.

Tool and Model makers in Department A use Mastercam and CRONOS differently than the other machining departments. Model markers make their own programs in Mastercam while production departments use NC Programs generated by the NC Programmers in Unigraphics. Business practices and networking / software issues had to change in a method that did not substantially change Cyber security rules. The decision was made to transfer all the Mastercam licenses to a network server. The sharing of licenses has decreased programming time on the CRONOS network in comparison to classified stand-alone computers.

The team also had to determine any changes necessary to the NC interface and to Matrix to manage Department A part programs. Upgrades to existing access controls employed in the NC Interface were made to support the security requirements placed on limited access program. Stand alone controlling equipment was replaced by networked diskless workstations. Administrative issues were worked through to allow networked

workstations to operate unattended (overnight). Additionally, the altered NC interface allows development programs to be transmitted without the use of Matrix interface. The altered NC interface significantly improves the response time of the Toolmakers.

The project takes the Special Application Machining areas into a CRONOS environment that will be used in the new building, allowing for machining program transfer in a classified environment without the need for producing CREM. The DNC CRONOS deployment is primarily responsible for eliminating CREM in Departments A, B, and C and also greatly reducing hand transfers of classified part programs. This will eliminate the risk of mishandling classified data and greatly speed up the loading of machine programs for development and production parts.

## **Discussion**

### **Scope and Purpose**

NNSA charged FM&T with the elimination of as much CREM as possible. This project was initiated in response to this directive. Classified NC programs were brought to the floor using CREM. Transferring these classified NC programs along the classified network was our way of meeting this challenge.

This project provides the capability to download CNC part programs from a CRONOS-based distribution system directly to the required machine tools in Departments B and C. It also provides for CRONOS-based distribution of part programs in the Model Shop Department A, where those programs are produced by the model-makers using MasterCam software.

Tool and Model makers in Department A often produce their own programs at the machine and they need to use Mastercam and CRONOS in different ways than the other machining departments. This project investigates and establishes new business practices for using CRONOS in Department A. This project also requires testing of MasterCam in the CRONOS environment and making modifications to Matrix and the DNC interface in order to support new roles for the Department A Model Makers. Purchasing new licenses or transferring licenses from SATURN license server, and installing a license server on CRONOS is a part of this new capability. Training of personnel for Matrix and NC Interface enhancements has also been provided.

The project is taking the Special Application Machining areas into a CRONOS environment that will be used in the new building, allowing for machining program transfer in a classified environment without the need for producing CREM. The DNC CRONOS deployment is primarily responsible for eliminating CREM in Departments A, B, and C and also greatly reducing hand transfers of classified part programs. This will eliminate the risk of mishandling classified data.

For those few instances where machines cannot be hooked up to a classified network at their existing locations, but will be on CRONOS in the future new building, materials and equipment is procured and ready for installation in the new facility.

## **Prior Work**

There was a project in FY05 to come up with a new DNC system. At that time, the KCP laid out two systems: One on SATURN for unclassified DNC, and one on CRONOS for classified DNC. Security was always a little uncomfortable with the two distribution systems and dual use on a single machine. Since that time, the background processes for moving unclassified data from SATURN to CRONOS have been put into place. This had a lot to do with setting up MATRIX on CRONOS since it didn't exist there before. Several of the machines around, largely in Department C, were put onto the unclassified DNC on SATURN. Classifications were maintained by swapping hard-drives. For example, if an unclassified job was required, an unclassified hard-drive was inserted and the machine was connected to the network for DNC. If a classified job was required, the machine was disconnected from the network, the unclassified hard-drive was removed, and the part-program was hand-carried to the machine, typically with the hand-held DECITEK box. This satisfied security requirements as closely as possible. However, it also created CREM for those classified hard-drives.

The DNC CRONOS Project began in FY06 by using Department D Reservoirs as a testing ground for installation and use of the classified DNC CRONOS network. Department D was finished out in FY06 and the effort in FY07 and FY08 is to roll out the DNC to the rest of the plant's machining areas (Department B, Department C and Department A).

The project began with two systems in Department C; this is a leftover from the dual system described above. Most of the machines in Department C and Department B have the unclassified DNC available. So the scope includes running the CRONOS DNC where needed, using the criteria that if a machine ever runs classified jobs, it gets connected to the classified DNC on CRONOS and the hard-drive (if it has one) gets permanently mounted in the machine. This eliminates the CREM involved, and any unclassified jobs can get distributed via CRONOS by the background processes.

The Model Shop / Tool Room areas (Department A) had no connections at the onset of this project. There was too much classified use in there for SATURN to have been connected earlier. The need was to determine what is to be connected in those areas; how those connections are used, and what other CRONOS workstations are required. Support for MASTERCAM license server may also be required.

## **Activity**

The DNC CRONOS deployment is primarily responsible for eliminating CREM in Department A, Department B and Department C in the past couple of years. It is also estimated that SAM will avoid hand transfer of 50 to 60 classified part programs per year now that CRONOS is easily accessible. These hand transfers required carrying floppy disks to machines with classified programs that then had to be destroyed in Technical Security.

The project completed hook up of all 7 machines in Department B with one new client PC; 19 of 22 machines in Department C with one new client PC; and in Department A, 23 of 55 machines plus 19 client PCs. Machines not hooked up were mainly those located in unclassified working areas that housed unclassified workers. For those few instances where machines will be on CRONOS in the future new building, materials and equipment was procured and is now ready for installation in the new facility. Others not hooked up are those that will not be moved to the new facility and are not needed for substantial classified work between now and then. This was determined from consultation with departmental supervision and engineering.

To complete this project the fiber network was designed and installed in the Model Shop and Tool Room (Department A), Reservoirs (Department D), Rubber & Plastics (Department B) and General Machining (Department C). Interface equipment was installed within the machine tool control cabinet and connected to the new CRONOS network.

Interface equipment was commissioned in one of three forms. If the machine control was Open Architecture (Windows-based operating system), then it was connected directly to the Ethernet port. If the machine control was proprietary, then it was connected via a Decitek Box. Those with Heidenhain Controls were connected via a mini PC installed inside their control cabinet.

## OPEN ARCH (OA) Software and Setup Procedure

This section identifies the software loaded on Open Architecture machine controls to process DNC file transfers.

The software loaded on the OA controls is a combination of VB programs called OpenArch\_Serialio.exe and SetComm\_Port.exe. The Install\_OpenArch\_Serialio.exe program loads the F-Secure server software which acts as a service and creates a DNC User account needed for verification for incoming part programs to the device. It also runs SetComm\_Port.exe to determine which serial port will be used to load part programs through the serial port in case the network file transfer process is not working. The use of the handheld DNC file transfer box is through the serial port and is our backup system if needed. All of these pieces are bundled up in an install called Install\_OpenArch\_Serialio.exe program. The OA machine will contain a directory called c:\program files\OpenArch\_Serialio which contains the software used for loading part programs by the DNC handheld device through the serial port. In the Start menu, an entry under Programs will be created called OpenArch\_Serialio. This software is used to run the DNC serial interface software when used in conjunction with the DNC portable handheld BTR device. It basically sucks the information out of the Decitek handheld device and places it in what ever directory the user specifies. After the install is run and all the proper information has been added to the Matrix database the OA control is ready to do downloads and file transfers. The OA install software is located on a CD-ROM in the pocket of the DNC Windows documentation.

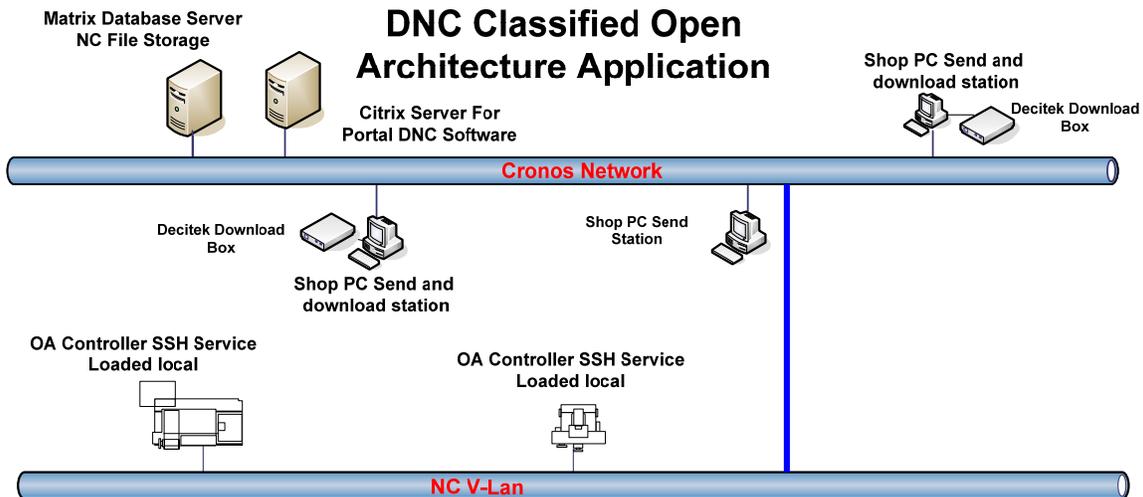
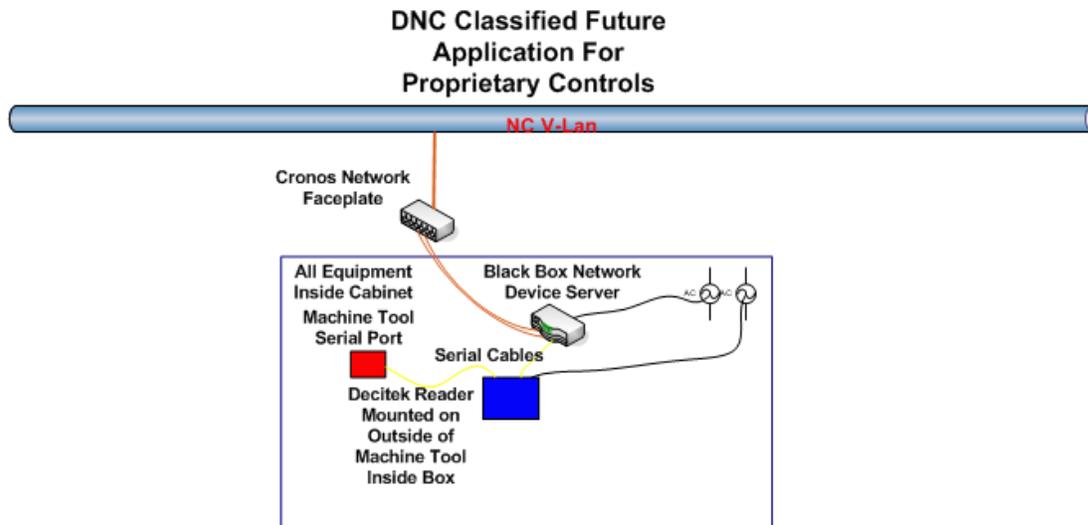


Figure 1: Open Architecture Applications

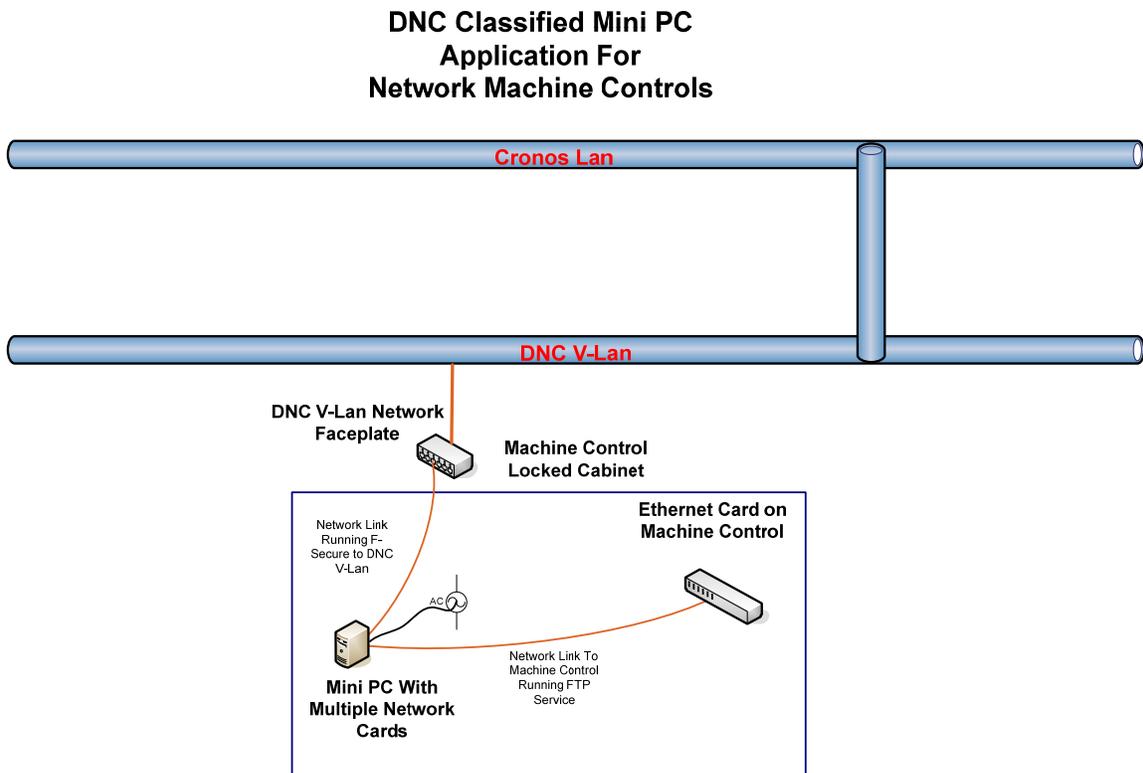
## Proprietary Definition

Proprietary NC machine controls are basically the older and sometimes newer machine controls that do not use a Windows-based operating system to conduct NC part program loading. These controls use serial and parallel port data transfers to enter information into the control. In these cases we can use a serial or parallel device to send data to the machine control. For all practical purposes we use a device called a BTR or behind the tape reader. Decitek makes such a device that emulates the old mylar tape reader used for loading programs. What is done for these machine tools is a Decitek tape reader is installed in the cabinet of these machines and files are transferred to this device via a Lan network serial device (Terminal Server). From the Decitek reader emulator (BTR) the part programs are sent and loaded to the machine control. Sometimes portable handheld Decitek BTRs are used to connect to either a serial or parallel port for file transfers. This is our backup system in case the Network or database is down.



## Heidenhain Definition

The mini PC requires that an additional piece of software be added to its system in order to communicate between the machine controller and the PC itself. This software is Windows FTP Server. It is a configurable FTP service. Since the mini PC is on the Cronos DNC V-Lan, nothing else on this LAN will be able to see, connect, or transfer files between the mini PC and other machines on the LAN except the machine control connected to this mini PC. One directory, the C:\DNC directory, will be locked down for the machine controller to see. Files transferred from the Cronos DNC system are stored into this directory.



**Figure 3: Mini PC Application**

The CRONOS and SATURN DNC machine tools will be moved to the new facility, used for dual build capability while moving in the present facility, or distinguished to meet the NNSA goal of removing CREM from the current facility. Some of the machine tools are currently installed in red badge areas. In this case they were fitted for the interface in the control cabinets but the equipment was not left in the machine tool nor were the machines hooked up to the CRONOS network.

Under the KCRIMS plan the equipment from Department A, Department E (unclassified machinist training area), and Department C (both the classified and unclassified room) will be combined into one Special Application Machining (SAM) department. Department D and portions of Department F (Welding) and Department G will be combined as the Gas Transfer Systems (GTS) department. Both GTS & SAM will be within the secure portion of the new facility where all the machine tools will be capable of running classified product and where the CRONOS network will be available. Therefore there will not be a need for CREM to transfer classified programs from the servers to the machine tool controllers.

### **MasterCam and CRONOS in Department A**

The Model Shop / Tool Room areas, commonly known as Department A, had a few more challenges to migrate standalone classified Mastercam software to networked diskless CRONOS workstations. Tool and Model makers in Department A often produce their own programs at the machine, and they need to use Mastercam and CRONOS differently than the other machining departments. Business practices and networking / software issues had to change in a method that did not substantially change Cyber security rules.

The project proceeded by investigating whether to purchase new Mastercam licenses or transfer licenses from individual Dongles on classified standalone computers to a network server. The decision was made to transfer all the Dongle licenses to a network server. The network server allows Toolmakers to share licenses. Before, if a classified stand-alone computer did not have a type of license available, the toolmaker went without. The sharing of licenses has decreased programming time on the CRONOS network in comparison to classified standalone computers.

The team also had to determine any changes necessary to the NC interface to Matrix (or similar) functionality for use in managing Department A part programs. Specific workstation hardware requirements to run Mastercam in a diskless environment were determined and worked out for Department A. Upgrades to existing access controls employed in the NC Interface were made to support the security requirements placed on limited access programs supported by Department A. This enabled standalone controlling equipment to be replaced by networked diskless workstations. Administrative issues were worked through to allow networked workstations to operate unattended (overnight). Reviews were performed by an IT review board to ensure these changes were made in a timely manner that supported the project schedule.

NC Interface changes included setting up program numbers to support Department A machines. Department A staff user accounts were set with appropriate permissions for the Process Engineering and Numerical Programmer roles.

Additionally, the altered NC interface allows development programs to be transmitted without the use of Matrix interface. Toolmakers can send programs that need no structure for archiving and no backup. These programs are easily reproduced. The altered NC interface significantly improves the response time of the Toolmakers. A Toolmaker will typically program a small feature or group of similar features. Using the altered NC interface, the toolmaker can send a small piece of the CNC program to the machine. As each piece is sent to the machine, the Toolmaker can run the program on the machine and correct, if necessary. Finally all the small pieces can be gathered into a master program. This master program can be documented through the original NC interface and allows Matrix to retain control of version and history. Furthermore, using the altered NC interface allows unclassified programs to reach the machine in a timely manner. Before, migrating unclassified programs would take up to one hour. Using the altered NC interface allows development unclassified programs to be used immediately.

Training of skilled trade support for Matrix and NC Interface enhancements was performed by NC Analysts. Then a pilot program/evaluation with the Tool Room and Model Shop areas was executed using the altered NC Interface and altered Department A practices.

## **Accomplishments**

The project completed hook up of all 7 existing machines in Department B with one new client PC for stand alone programming and administration; 19 of 22 existing machines in Department C adding one new client PC; and 23 of 55 existing machines plus 19 new client PCs in Department A. Client PCs are more prevalent in the Department A area to support the numerous Tool and Model Makers on the floor programming duties. This entailed the design and installation of fiber network, interface equipment within the machine tool control cabinet and connection to the new CRONOS network. The CRONOS and SATURN DNC machine tools will be moved to the new facility, used for dual build capability while moving in the present facility, or distinguished to meet the NNSA goal of removing CREM from the current facility.

DNC CRONOS Deployment is primarily responsible for eliminating CREM in Department A, Department B and Department C. It is also estimated that the new SAM area will avoid hand transfer of 50 to 60 classified part programs per year now that CRONOS is easily accessible.