

Implementation of a Barcode Interface to an Existing SAS® Database Using SAS/AF® and SAS/FSP® Software, and SAS Screen Control Language

Lee Maddy, Niagara Mohawk Power Corporation

Abstract

The Investment Recovery Facility of Niagara Mohawk Power Corporation is both a depository for items that have completed their useful life cycle at the company, and a processing facility that produces high quality paper and metal raw materials to be sold for further production. In an effort to improve the efficiency and accuracy of the operation's inventory, the combination of SAS Software and Norand UHF radio-frequency technology was chosen to implement the IRDBMS® (Investment Recovery Database Barcode Management System). The system provides a solution for automating the management of data for a paper and metals processing/recycling facility.

This paper focuses on the incorporation of SAS Version 6.08 operating in the MVS environment, radio frequency, and barcode technology in order to maintain and deliver on-line real-time inventory information for a recycling facility.

Introduction

Niagara Mohawk is an electric and gas utility headquartered in Syracuse, N.Y. It provides electricity to more than 1.5 million customers across 24,000 square miles of Upstate New York, and natural gas to about 512,000 customers in Eastern, Central and Northern New York state. It is Niagara Mohawk's corporate vision to become the most responsive and efficient energy services company in the northeast and energy supplier of choice in today's increasingly competitive utility environment. To help achieve this vision in an most environmentally conscience manner, the Investment Recovery facility was established in 1984 to recycle assets no longer needed for company operations. In 1987 the company started recycling office paper, and in 1991 and 1994 the facility was expanded in order to increase its ability to recycle. The facility has recycled over 2.5 million pounds of paper in 1995. It also processed scrap aluminum and copper wire into more than 6 million pounds of nuggets of pure metal using a wire granulator machine. The facility also recycles used laser printer cartridges, and sells computers, furniture, office equipment, streetlight lenses, ferrous products (made of, or derived from iron), and materials such as used light bulbs and gas meters. This effort is part of Niagara Mohawk's commitment to remove these items from the waste stream to ensure we live in a cleaner and heathier environment.

After collecting data manually for several years, and

keypunching it into a database, it was decided that by automating data collection, efficiency could increase and costs could be reduced. Due to the trend toward deregulation and competition within the utility industry, it became important for utilities to run their operations more efficiently, at a lower cost, and with less resources. Investment Recovery personnel turned to the Systems Group of the Materials Control department of Niagara Mohawk to incorporate their knowledge of warehouse management and radio frequency technology and to improve methods of collecting data within their paper and metal processing efforts.

The IRDBMS® was created by using a combination of SAS/AF®, SAS/FSP®, SAS® Screen Control Language, Norand® Radio frequency terminals, PSC® barcode scanners, Weigh-tronix® weight scales, Monarch® thermal transfer barcode printers and Printronix® line printers. The system was implemented in two phases: •Phase one, the startup phase, consisted of the installation of all hardware. It involved the initial barcoded prelabeling of existing paper and metals inventory, which was required before phase two could begin. Completion of phase one served as an audit of existing inventory, promoted feedback from users, and facilitated implementation of phase two. •Phase two consisted of using weight scales to produce bar code tracking labels, in conjunction with data entry and barcode scanners, for on-line, real-time adding and picking of warehouse material inventory, and report generation via IRDBMS®.

The system is composed of several hardware and software components. Each fork lift is equipped with several pieces of equipment: Norand RT5920 radio-frequency truck terminal with laser scanning gun; an integrated fork lift scale with Weigh-tronix scale indicator; and Monarch Renegade barcode printer (see fig. 1).

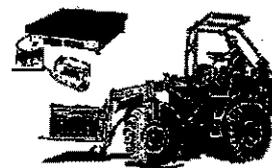


Figure 1- Fork lift

The RT5920 is a DC-powered RF mainframe communications terminal mounted to the frame of the fork lift. It communicates via RF waves to the corporate IBM 3090 computer through the RS-232 port on a Norand RC2250 controller, connected to a Norand RB3001 base radio station transmitter (see fig. 2). Using the weight scale

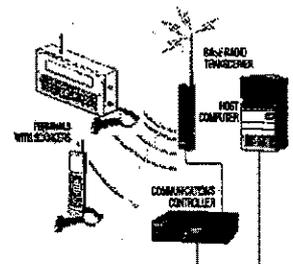


Figure 2 - RF Communication

indicator and fork lift scale, an operator weighs (finding the net, tare and gross weight) paper and metal product to print a bar coded tracking label with the Monarch printer. The operator applies the barcode label to the product container and then proceeds to sign into the system through the RF fork lift terminal, which updates the inventory datasets. The IRDBMS® is written using SAS/AF®, SAS/FSP.® and SAS® Screen Control Language. Menus direct users and manage the process of data collection. The system utilizes FSEDIT, and FSVIEW screens for data capture, validation, error checking, browsing, and editing.

Data Accessed

The system reads and writes to several datasets:

- The INVENT dataset stores the weight, type classification and processing information for the inventory of all paper and metals prepared through the sorting or granulating process.
- The HISTORY dataset is the archival version of the INVENT dataset. During the process of picking inventory - at the point of time when material is physically removed from inventory, and loaded on trucks - records are moved from the INVENT to HISTORY dataset.
- The FMDS dataset maintains the format for updates of codes and description pertaining to the paper and metals inventory.
- The COMITMCD dataset is a lookup table that validates and translates barcoded commodity item code types into their corresponding equivalents.
- The NXTRECD dataset contains transaction weights. As warehouse personnel load paper bales onto trucks, the individual weight of each bale loaded is decremented from a maximum truck load of 40,000 lbs. and reported as remaining weight to be loaded.
- The YN dataset is a lookup table that verifies that a screen choice of "Y"es or "N"o are the only legitimate values.

Recycling Process Overview

Each day, waste paper is collected from locations throughout the company and dumped into a conveyor. It is sorted by Monarch Industries employees (the vocational division of the Onondaga Association for Retarded Citizens) into various grades to be resold. After sorting, each grade of paper is compacted into a bale. Warehouse personnel then weigh the bale using the fork lift scale, produce a barcode tracking label and sign into the system via the RF terminal to update the inventory.

Tubs of waste scrap metals (such as old wire and pole line hardware) are also received daily. Monarch Industries employees remove miscellaneous "bugs" (pole line hardware and connectors, etc.) and sort the wire into similar types. After the bugs are removed, the scrap wire is dumped into the granulating machine, which cuts the wire into small nuggets and separates it into its component parts, leaving pure aluminum, copper, steel and insulation. Once gaylords of these products are filled, they also are weighed, a barcode tracking label is produced, and the system is updated via the RF terminal.

Screens and Keys

In order to make the system as user-friendly as possible and not rely on typing commands, it directs the user to perform particular tasks through the use of screens and function keys designed to perform an action (such as add, search, repeat find, etc.).

Warehouse personnel use a barcode template to aid in the login process (see fig. 3), and their Norand RT5920 fork lift RF terminal, to access the main menu of the system.

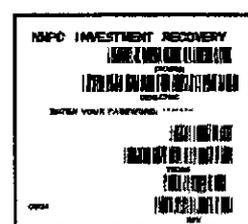


Figure 3- Template

From the main menu (see fig. 4), the user will choose either the paper or metal applications.

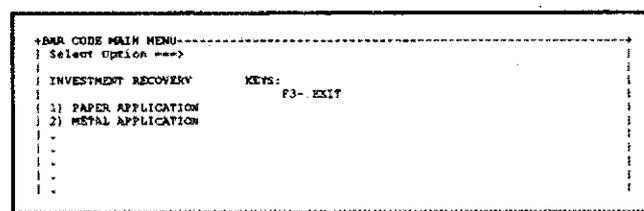


Figure 4 - Main Menu

Paper Applications Menu: (see fig.5)

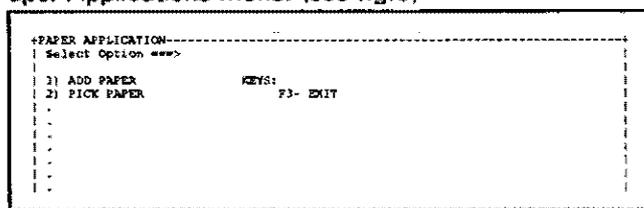


Figure 5 - Paper Applications Menu

1) Add Paper: If paper is to be added to inventory, (see fig. 6) [PF7] is pressed to add a new observation. The

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bale number, commodity item code, and net weight are scanned into a screen in the database. Observations are automatically saved by pressing enter, upon exit, or

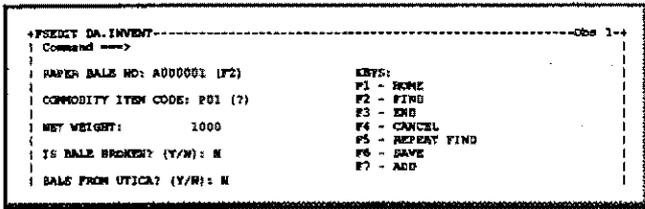


Figure 6 - Add Paper

after pressing [PF6].

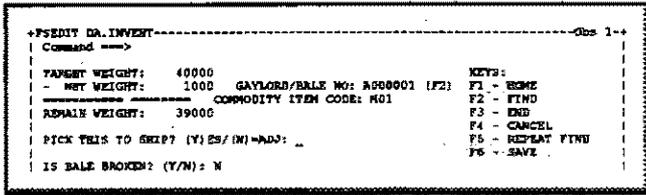


Figure 7 - Pick Paper

2) Pick Paper: If paper is to be picked from inventory, the picking screen (see fig. 7) starts with a target weight of 40,000 lbs., the equivalent of one truckload. As observations are flagged as picked ("Y" in the pick this to ship?" field), the net weight of each observation is subtracted from the target weight to equal the remaining weight. This weight is the available amount of weight that can still be loaded on the truck. Adjustments can be made by placing a "N" in the field. Once all observations are flagged to be picked for shipping, and the user presses [PF3] to end, the flagged observations roll from available inventory to the history inventory file.

Metals Applications Menu: (see fig. 8)

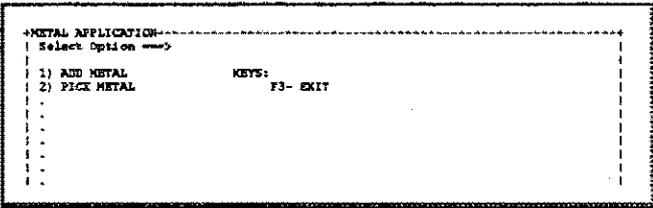


Figure 8 - Metals Applications Menu

1) Add Metals: If metal is to be added to inventory, [PF7] is pressed to add a new observation, the gaylord number, commodity item code, and net weight are scanned into the system. (See Fig. 9) This works the same as the paper application.

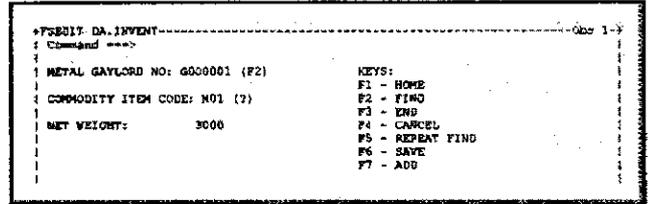


Figure 9 - Add Metals

2) Pick Metals: Before metal is to be picked - through the use of a inventory report, and an FSVIEW screen - the marketing/sales manager selects gaylords that have

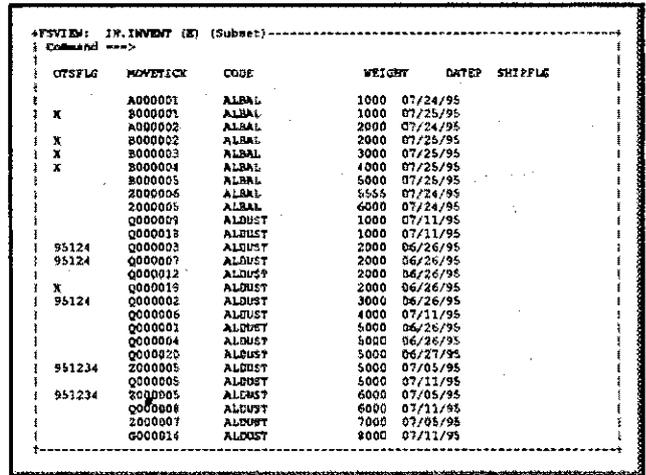


Figure 10 - Marketing Selection Screen

been sold and are ready to be picked by warehouse personnel.(see fig. 10) They flag them on a FSVIEW screen with an Order to Sell (OTS Invoice) number. Warehouse personnel then access the Pick Metals

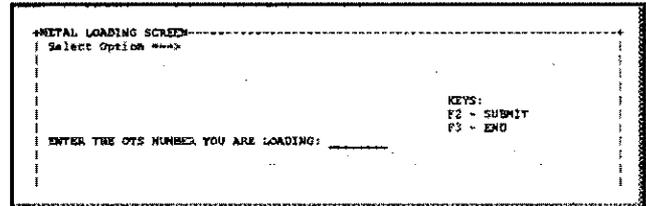


Figure 11 - Metal Loading (screen.1)

screen (see fig.11), enter OTS number of the material to be loaded, press [PF2] Submit, and the Metals picking screen appears (see fig.12), with the dataset

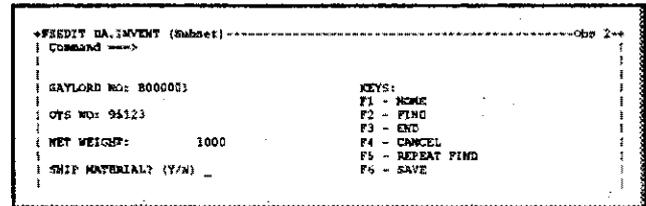


Figure 12 - Metal Loading (screen 2)

subsetting by the OTS number. Once all observations are flagged to be shipped, and the user presses [PF3] to end, the flagged observations roll from available inventory to the history inventory file.

Code Examples

Example 1: Using WHERE and FETCH for validation

```

/* test comitmc to code and typefat */
comdata=open('in.comitmc','i');
call set(comdata);
rowwhere(comdata,"comitmc="||comitmc||"");
rowfetch(comdata);
if rc ne 0 then do;
  errorn comitmc; cursor comitmc;
  msg_"Commodity Item Code '||comitmc||' is not on lookup table";
end;
comdata=close(comdata);

```

Note: When the dataset COMITMCD is being opened, the screen value of the field named "comitmc" is compared with the valid values of "comitmc" in the COMITMCD data set. An error message is displayed in the screen if the value is invalid.

Example 2: Selection list using datalistc

```

call wregion (1,35,25,45);
if (modified(comitmc)) and comitmc="" then do;
  codeid=open('in.comitmc','i');
  if index(comitmc,"?") then do;
    comitmc=datalistc(codeid,'comitmc code codefat typefat');
    codeid=close(codeid);
    goto main;
  end;
  codeid=close(codeid);
end;
else if (modified(movetick)) and comitmc="" then do;
  errorn comitmc; cursor comitmc;
  msg_"Commodity Item Code is required.";
end;

```

Note: On the add paper, or add metals screens if a "?" is placed in the commodity item code field, a window is displayed containing the valid values. The user selects a value from the list and that information is brought into the observation.

Example 3: Using a temporary file for computations

```

/* adds wt back in if shipflg **/
if (modified(shipflg)) and shipflg='N' and holder=0 then do;
  trgtwt=trgtwt+sgt;
  romupdate(temp);
  shipflg="";
  holder=1;
  dates=.;
  msg_"WGT ADJUSTED - VIEW TARGET WGT";
  tempwt=trgtwt+sgt;
end;

/* won't let shipflg be adjusted twice in a row */
if (modified(shipflg)) and shipflg='N' and holder=1 and dates=., then do;
  msg_"TARGET WGT HAS ALREADY BEEN ADJUSTED";
  shipflg="";
end;

if (modified(shipflg)) and shipflg='N' and holder=1 and dates=., then do;
  trgtwt=trgtwt+sgt;
  romupdate(temp);
  shipflg="";
  holder=1;
  dates=.;
  msg_"WGT ADJUSTED - VIEW TARGET WGT 2";
  tempwt=trgtwt+sgt;
end;

```

Note: On the pick paper screen, if an observation is

picked to ship "Y", then the net weight is deducted from the target weight in order to find the remaining weight. If the user changes his/her mind, the code in example 3 is used to add the net weight back into the temporary dataset. The holder keeps the user from being able to add the net weight back twice in succession.

Example 4: Using PUT statements to embed barked printer language

```

submit continue;
data in.invent; set in.invent;
run; filename printer sysout=destcomwz515; run;
proc sort data=in.invent(wheret=otsfig="otsnumb") out=invent;
  by movetick;
run; options page=1 ps=50 ls=132; run;
data invent; set invent end=eof; by movetick;
today=date();
time=time();
file printer header= notice linesleft=11;
put /@26 movetick $8, ;
if eof then put
  //@16 'Total number of items to be picked:' @53 _n;
return;
h:
pg=1;
put @47 'NIAGARA MOHAWK POWER CORPORATION'
  @91 time time5. @98 today weekdate25. @127 pg 5.
  /@50 'INVESTMENT RECOVERY SBOUP'
  /@44 'ITEMS TO BE PICKED FOR STAGING REPORT'
  //@40 'OTS NUMBER:'

  put @2 '-CREATE: STANDWRE:792';
  put @2 'SCALE: DOT';
  put @2 'BARCODE';
  put @2 'C3/9/X1/R6:DRAK:4:150';
  line1 = "||| |"||left(otsfig)||"||";
  put @2 line1;
  put @2 'PDF';
  put @2 'STOP';
  put @2 '-EXECUTE: STANDWRE';
  put @2 ' ';
  put @2 '-NORMAL';
  put @2 '-DELETE FORM: STANDWRE';

  put /@26 'GAYLORD'
  /@26 'NUMBER'
  /@26 '*****';
run; filename printer; run;
endsubmit;

```

Note: Each barcode printer manufacturer has its own unique, proprietary language. By formatting your output using Put statements, the barcode printer commands can be embedded into reports or labels.

Summary

The combination of SAS software, radio frequency, and barcode technology has allowed the Investment Recovery Facility at Niagara Mohawk Power Corporation to manage its processing/recycling efforts in an on-line, real-time environment. It assures an accurate inventory for marketing purposes, while supplying a user-friendly interface for warehouse personnel.

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For More Information

Lee Maddy
Niagara Mohawk Power Corporation
300 Erie Boulevard West, MIMS B-1
Syracuse, NY 13202
(315) 428-6838
MaddyI@NIMO.COM

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