NOAA TECHNICAL MEMORANDUM NWS CR-70

# AUTOMATIC DISTRIBUTION OF AFOS PRODUCTS CREATED AT THE NOAA CENTRAL COMPUTER FACILITY VIA HAMLET (RJE) PUNCH STREAM

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page 1; last sentence of Abstract should end with "are also discussed"
page 2, line 46; "fron" should be "from"
page 13, line 42; "addotional" should be "additional"

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## ABSTRACT

This paper presents a summary of pertinent information concerning an efficient, totally automatic method for distribution of Automation of Field Operations and Services (AFOS) products created at the NOAA Central Computer Facility (NCCF) using a HAMLET (RJE) punch stream. This method directs NCCF data products to AFOS without halting RJE and does not require processing of RDOS files or any other manual intervention. It uses standard AFOS and HAMLET features. With the use of this method, NCCF data may now receive automatic distribution to such systems as AFOS, local site data bases and the weather wires via an RJE punch stream. This information was gained by the Missouri Basin River Forecast Center (MBRFC) through experience over a two and one-half year period beginning in June 1981. An overall strategy of operation is provided, as well as more specific details and references. It is hoped that this paper will help offices avoid the many pitfalls involved in the development of a similar procedure and provide the basis for the standardization of this process, especially in the National Weather Service (NWS) Hydrology Program. Important concepts concerning closely related topics such as practicalities of Computer Language Store (CLS) memory use, binary data on punch stream and Asymmetric Multiprocessing System (ASP) and Operating System (OS) Job Control Language (JCL).

## 1. INTRODUCTION

The Missouri Basin River Forecast Center (MBRFC) has been automatically transmitting model generated hydrologic guidance products to National Weather Service (NWS) communications systems for over seven years. Initially in this period, guidance products such as spring snowmelt outlooks and headwater/flash flood guidance were composed at the NOAA Central Computer Facility using files and hydrologic models resident on the IBM 360/195. These products were then automatically transmitted via the IBM 360/40 communications computer at the NCCF to the Internal Radar Report And Warning Coordination System (RAWARC) teletype circuits. After the recent commissioning of the Automation of Field Operations and Services (AFOS) communications system by NWS, NWS offices could utilize both

text and graphic products. Some guidance producing offices made the decision to create these products on the AFOS hardware, namely the Data General mini-computers. This is perfectly valid if the data and guidance producing models reside on these computers. This procedure has been well documented by Western Region(1).

However, the majority of operational data and most guidance producing models that MBRFC uses reside at the NCCF. Therefore, MBRFC chose to develop a procedure which composes AFOS hydrologic guidance products at the NCCF and transmits these products to AFOS via HAMLET (RJE) in the local Data General S/230, without any manual interventions. This procedure works similarly with RJE running in the Data General S/140.

Many offices are now independently starting to develop procedures to accomplish the transmission of AFOS products created at the NCCF using the RJE punch stream. This paper describes the general strategy of the procedure used by MBRFC and more specific details and subtleties involved in each of the development decisions. This is done in order to help other offices avoid problems during development and operation. It also attempts to point out the necessity for standardized software and procedures to accomplish the task.

## 2. GENERAL STRATEGY FOR PRODUCT CREATION AND DISTRIBUTION

The problem of automating the composition and dissemination of NCCF model generated AFOS products using RJE involves balancing the use of available computer resources versus the convenience of a "hands off" process for creating products which will use the communications capabilities and display flexibility of AFOS. The rapid communications capabilities should be utilized, but only with a mindful eye toward the impact upon the current saturated network.

The process must also utilize standard hardware and operating software, thereby avoiding additional procurements. It must allow for both text and graphic products. It must be totally automated, efficient and not require manual interventions. It must not adversely affect available hardware resources or negatively impact other systems' functions. Finally, it must allow for sufficient controls so as to prevent negative impacts upon the AFOS system during development and implementation. The procedure developed by MBRFC satisfies all of these requirements.

Three critical items must be implemented for optimum use of computer resources and for truly automated AFOS text and graphic product transmission from the NCCF via RJE. These three basic items follow.

1. Composition of the complete AFOS product at the NCCF.

2. Transmission of all products to remote site via one RJE punch stream.

3. Automatic transfer of the product fron RJE to AFOS.

The most basic critical item of the MBRFC procedure involves the decision to compose the complete product, ready for AFOS transmission, entirely at the NCCF. This allows for complete

automation of the process and does not require storing of the punch stream as an RDOS file at the local site or any other manual interventions, such as PMOD program processing on the S/230 or a save, process and retransmit technique.

Composing the final product at the NCCF is the only way in which graphics or text products can be transmitted to AFOS automatically using the RJE punch stream. For graphics, this is required because graphic products contain a mix of character and binary data. HAMLET software cannot translate this mix of data properly. Due to the way AFOS software counts lines for pagination, text products must also be composed at the NCCF in a format ready for transmission. Therefore in both cases, for automatic transmission of AFOS products from the NCCF via RJE, the final composition (i.e., translation, protocol, etc.) must take place at the NCCF. This composition of the final product at the NCCF involves the use of NCCF data files, hydrologic model software and AFOS product composition software. The AFOS product composition software at the NCCF directs the completed AFOS product to the RJE punch stream.

A second critical item of the MBRFC procedure is the allowance for transmission of both text and graphic products on the same RJE punch stream. This conserves NCCF punch stream allocations as well as the limited number of S/230 asynchronous ports available.

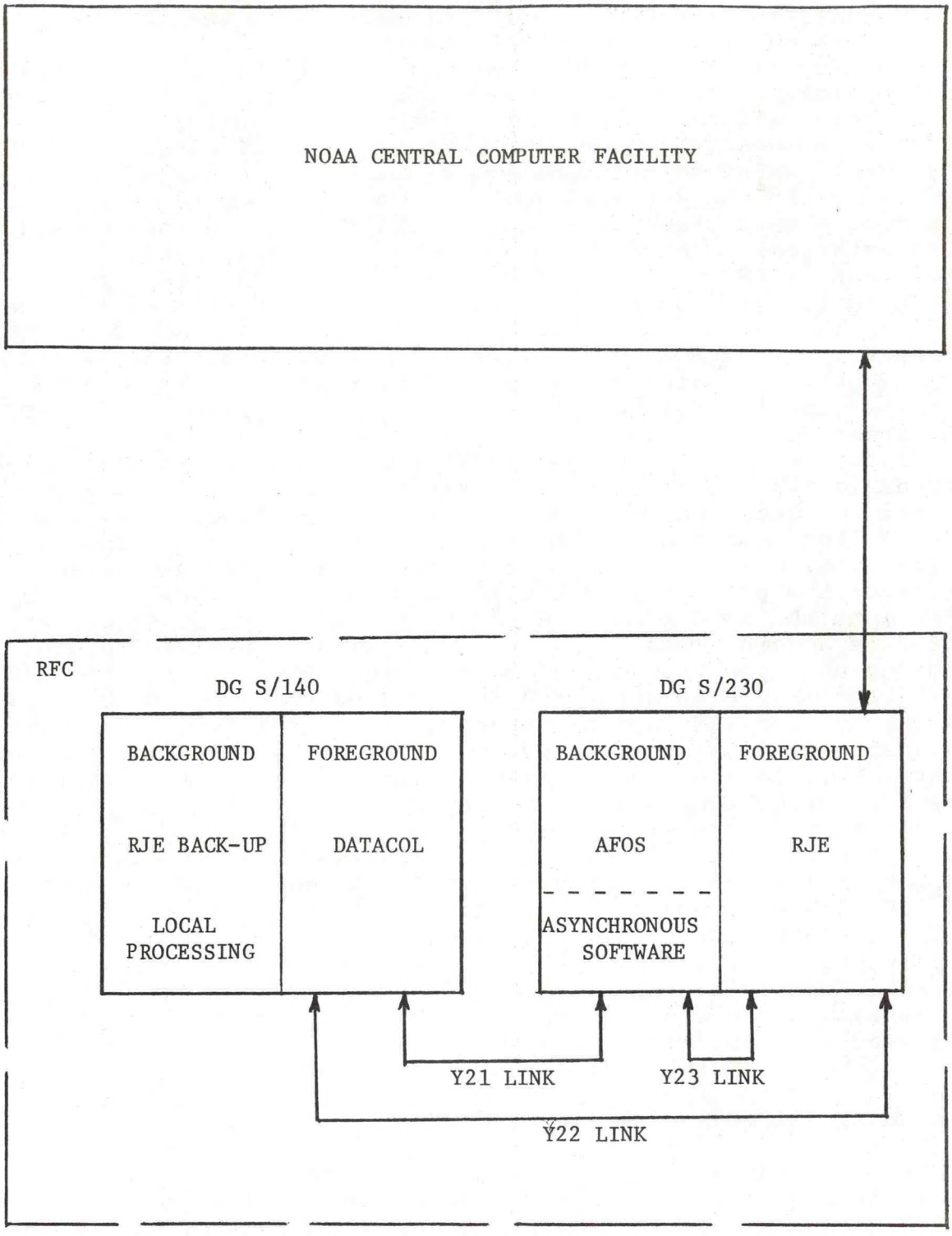
The final critical item of the procedure is the automatic transfer of the product from the RJE ground (S/230 foreground for the RFCs) to the AFOS ground (S/230 background for the RFCs). This transfer is accomplished by RJE automatically sending the punch stream out an asynchronous line multiplexer (ALM) port on the S/230, which in turn has been connected to a second ALM port on the S/230. Since this second ALM port has been initialized in the asynchronous line directory, it is constantly monitored by the AFOS asynchronous software. Because the punch stream product is in the form expected by the AFOS asynchronous software, it will be transmitted on the AFOS network or stored locally, depending on the product addressing. Also, if the product is included in the asynchronous product scheduler, it can be asynchronously transmitted to devices such as the S/140, weather wire or other peripherals.

If the three items summarized above are not implemented, serious problems will result during the development of a total text and graphic product transfer method from the NCCF using the RJE punch stream. All necessary procedures and some of the problems encountered with deviation from the MBRFC procedure are discussed in detail in the remaining sections of this report.

## 3. HARDWARE CONFIGURATION

The required basic hardware for an RFC configuration is depicted in Figure 1. Cable link Y23 on the S/230 is required for AFOS/RJE communications and allows for automatic entry of AFOS products from the NCCF via the RJE punch stream. For further versatility, cable links Y21 and Y22 provide for communications between the S/140 and AFOS and between the S/140 and the NCCF via RJE.

Appendix A provides more detailed information concerning the Y21, Y22 and Y23 cable links. An additional reference for these




BASIC HARDWARE CONFIGURATION

FIGURE 1

connections is the RFC Functional Cabling Diagram" #ISL/AFOS-0206, Rev. D, dated September 18, 1981.(2)

## 4. HAMLET (RJE) CONFIGURATION

Several important parameters and concepts concerning RJE punch stream file or device assignment must be considered for proper transmission of AFOS products. Communications parameters and device or file assignments can be made either statically or dynamically. Static assignment allows permanent setting of punch stream parameters and device or file assignment. In this mode, manual operator intervention is not required for the NCCF to send the punch stream to the local site. Dynamic assignment requires a manual operator intervention each time a punch stream is opened. This is because no permanent file name or device has been assigned to the given output stream. Therefore, for totally automatic product transmission, static assignment must be used.

To succesfully receive AFOS graphic products created on the NCCF, the HAMLET (RJE) software features concerning the output stream assignment must be considered even more closely. HAMLET has the capability to convert expanded binary coded decimal interchange code (EBCDIC) characters created at the NCCF to American Standard Code for Information Interchange (ASCII) characters for use on the Data General S/230. AFOS graphic products contain a mix of binary and character data. HAMLET cannot convert the EBCDIC character data in the punch stream without destroying the integrity of the binary data. Therefore, the conversion must be done at the NCCF before transfer back to the local RJE site and the local HAMLET software must be set so translation does not take place.

HAMLET also has the facility to pad all punch stream records to 80 columns by inserting blanks at the end of smaller records. This is fine when punch card output is desired. However, this feature should not be used for graphic products because AFOS would interpret these blanks as binary data, thus creating "bad" graphic products. Additionally, it is highly desirable that the punch stream be statically assigned to the proper ALM port to make the transfer of products automatic. To do this, HAMLET must be initialized to allow appending to disk files. The punch stream translation, padding and appending parameters have been set at HAMLET communications generation time (HCGEN) during total generation of the current RJE load. Therefore, in order for HAMLET to do all of the things previously mentioned above (i.e., to statically assign punch stream N1 to QTY:nn with no padding, no EBCDIC to ASCII translation and with appending to disk files), the command line in the HAMLET STARTUP.CM file (which is controlled at the local site) should read:

```
A N1 QTY:nn /A/P/T
```

Refer to the Data General HASP II Workstation Emulator (HAMLET) Users Manual 093.000116-01 for further description and clarification.(3) See section 6A, Asynchronous Software, and Section 6B, Operating System, in this technical memorandum for discussion of QTY:nn.

At first glance, it appears that by making automatic creation of AFOS graphic products possible we have made creation of text

products on the same line more difficult. Not only is no translation occurring, carriage returns are not being added at the end of each punch stream record as normally occurs concurrent with translation. Both of these tasks must now be accomplished by AFOS product composition software provided by the user at the NCCF.

It turns out that due to a quirk in AFOS and the way HAMLET and the NCCF communicate, the command line in STARTUP.CM would have to be the same as shown for graphics in order to also succesfully transfer text products. The quirk in AFOS is that it relies on line feeds to achieve pagination. AFOS expects a carriage return and a line feed at the end of each line of text. Order is important. A line feed followed by a carriage return will not work. With this in mind, there is no way to take advantage of the HAMLET EBCDIC to ASCII translation capability and end up with a proper AFOS message automatically transmitted from the NCCF via RJE punch stream.

To automatically transfer an AFOS text product, the HAMLET punch stream must be initialized as recommended for graphic products. Translation must occur at the NCCF. An ASCII carriage return and line feed must be added for each line of text before the punch stream is returned to the local RJE site.

## 5. IBM 360/195 CONSIDERATIONS

### A. AFOS PRODUCT COMPOSITION SOFTWARE

As mentioned previously, the AFOS product composition software at the NCCF is very basic to the success of the overall transmission strategy. This is because the punch stream data created by this software must be in a form which can be automatically interpreted by AFOS software and then transmitted to the AFOS network or stored locally. This means that the NCCF AFOS product composition software must be highly reliable, thoroughly tested and must strictly adhere to AFOS protocol. This software must also be capable of providing reasonable controls on the AFOS products created, such as by limiting the size, compacting the product format, eliminating unnecessary blank characters and detecting and substituting for embedded ETX and DLE.

Since this topic is so important, the remainder of Section 5 will discuss critical NCCF considerations in detail. Section 6 includes detailed discussion of AFOS protocol. Sections 8, 9 and 10 will provide further requirements for AFOS text and graphic product composition at the NCCF.

### B. BINARY DATA ON PUNCH STREAM

The current system configuration at the NCCF does not provide for support of binary data on the punch streams when transmitted from the NCCF to the local site via RJE. However, tests at MBRFC indicate that the only punch stream data being modified on output from the NCCF, are the 100 octal bytes (equivalent to EBCDIC space or ASCII @ characters). With one exception, the modification (which occurs on the NCCF side) is that trailing 100 octal bytes (spaces) in a punch record are truncated. The exception occurs when a single 100 octal byte is the only data in the punch record and it is left justified (i.e., the first and only data in the punch record). This

happens when the NCCF computer thinks it is sending a blank card. In this only exception, the data are transmitted as is and not modified.

The truncation problem can of course create serious problems. Trailing 100 octal bytes can be perfectly valid data for AFOS text and graphic products. When this problem is not resolved in the NCCF AFOS product composition software, "bad" products are created, seemingly at random. What actually happens is that, say for a graphic product, whenever a 100 octal byte happens to fall at the end of a binary punch stream record, it is truncated by the NCCF. This destroys the integrity of the transmission format for the graphic and a "bad" product results. This product could display garbage on the Graphics Display Module (GDM) or it could cause the system to crash when displayed.

The only way binary data can be output to the punch stream is in an xxA1 format, where xx ranges from one to 80. MBRFC has identified five options which will maintain the integrity of the binary data, but only two are of practical interest. The first method uses a 1A1 punch record format. This method preserves trailing 100 octal bytes simply by writing each byte as a seperate record with no padding, no translation and with appending to disk files at the local RJE receiving location. The NCCF will properly send one 100 octal byte in a 1A1 format as previously mentioned.

The major objection to this method is the increased processing time required at the local RJE receiving site. A recent test at MBRFC indicates that approximately 4000 characters in a punch stream are transferred in 4 seconds using 80A1 format versus 32 seconds using 1A1 format. There was no other RJE traffic at the time. When both print streams and the card reader stream were active as well as the punch stream, the time was increased to 1 minute and 17 seconds to transfer the 4000 characters using 1A1 format. A minor additional point is that the EXCPs on the IBM 360/195 were increased from 300 to 4300 when going from 80A1 to 1A1 format and CPU time from 0.74 seconds to 1.64 seconds.

The method recommended and implemented by MBRFC to overcome the lack of support of binary data on the punch stream is to make a "fix" in the NCCF AFOS product composition software. This software "fix" detects and substitutes for trailing 100 octal bytes in the 80A1 format punch record. The software simply scans the output array, detects trailing 100 octal bytes and on output, writes one 100 octal byte 1A1 punch record for each trailing 100 octal byte in the original 80A1 record.

The detection and substitution method is recommended for the following reasons.

1. RJE transfer of 80A1 records is much more efficient than using 1A1 records. Actual wall clock time, S/230 and IBM 360/195 CPU time and IBM 360/195 EXCPs are all much less with the 80A1 transfer.

2. Detection and substitution for 100 octal bytes due to NCCF software considerations is logically equivalent to the necessary detection and substitution for 203 octal bytes and 20 octal bytes. These two substitutions are dicussed in Section 6E and are dictated by AFOS software and Data General hardware requirements.

3. Should the NCCF fully support binary punch stream data in the future, no changes will be required to the AFOS product composition software. The few lines of code in the detection and

substitution "fix" would just be superfluous protection.

Detailed examples of communications between the NCCF and RJE at MBRFC are given in APPENDIX B.

C. PUNCH STREAM HEADERS AND TRAILERS

The NCCF adds identification header and trailer records to the punch stream. When actual cards are being punched, these headers and trailers are simply thrown away by the person operating the punch device. However, when the punch stream is stored as an RDOS file, the headers and trailers become a part of the file. Therefore, the data cannot be displayed by an AFOS "DSP" command unless an applications program has been run on the file and the header and trailer stripped.

With the totally automated MBRFC method of transfer, one does not have to be concerned with this manual effort. This is because AFOS asynchronous software will effectively strip off the NCCF header and trailer punch stream identifier records and they will not be stored with the product in the AFOS data base. Thus the products can be immediately displayed, just as any normal AFOS product, without manual intervention or processing.

D. EBCDIC/ASCII TRANSLATION

As previously mentioned, EBCDIC to ASCII translation must occur at the NCCF for an automated transmission procedure. This is true for graphic products because the integrity of the mixed binary and character data is lost in any translation process which acts on the entire product or punch stream output without properly discerning what portions should and should not be translated. The character data must be translated from EBCDIC to ASCII, but the binary data must remain unchanged.

Translation of text products from EBCDIC to ASCII must occur in the NCCF AFOS product composition software because of the way AFOS software controls pagination of text products. If translation occurs at the local RJE site, a carriage return is added at the end of each line of text. This is fine until the product length exceeds a page. After this happens, all remaining text in the product will be compacted into the last character slot of the first page because AFOS software is counting line feeds (which is not in the data stream) for pagination. If a line feed is added in the NCCF AFOS product composition software, a carriage return would still be added upon translation at the local RJE site. Since this would put the line feed/carriage return in the wrong order, proper pagination would still not be accomplished.

If a carriage return followed by a line feed are added in the NCCF AFOS product composition software, with translation occurring at the local RJE site, an extra blank line would be inserted between all lines of text. Therefore, translation from EBCDIC to ASCII must occur entirely in the NCCF AFOS product composition software with no translation at the local RJE site.

A note of caution is given to those who use the various EBCDIC/ASCII translation routines available at the NCCF. The full range of 256 characters should be tested and verified against a

standard table (such as the IBM Reference Summary(4)) since some of the translation routines may be very specialized in nature and possibly not compatible with AFOS.

E. JOB CONTROL LANGUAGE

In general terms, two types of control cards may be utilized for RJE batch job submission to the NCCF. These types are the standard OS Job Control Language (JCL) used to direct the execution of the programs and describe I/O devices and the Asymmetric Multiprocessing System (ASP) control cards. OS JCL is the minimum control required for job execution. However, ASP control cards provide for more flexible use of the system as a whole. They provide for tailoring operations to an individual remote location's specific configuration. Examples of the use of ASP control cards are to change job priority, direct output stream destination and change default output stream volume limits.

The punch stream "FORMAT" ASP control card is of greatest concern in the transmission of AFOS products. It can provide for the following four functions if the punch stream has been statically assigned at the local RJE site (see Section 4 for discussion).

1. If the local site's AFOS system is down, the appropriate ASP control card can direct the AFOS product output to another RJE site. Of course the other site, probably an RFC, must have that product in its data base.

2. The appropriate ASP control card can cause a waiting period between opening of a series of punch stream outputs. This is necessary for multiple product output due to AFOS data handling limitations for data from asynchronous lines.

3. During procedure development, it is sometimes necessary to take down the AFOS communications line temporarily while opening an experimental product on the punch stream. ASP control cards can allow for a waiting period before the punch stream opens, so that local site AFOS communications may be brought down.

4. During unstable AFOS operating periods, it is sometimes desirable to make the transmission of AFOS products from the NCCF have a manual intervention step at the local RJE site in order to assure that AFOS is functioning properly (comms and acomms lines up) during the transmission. ASP control cards can allow for this.

The following two examples show the use of ASP control cards for properly controlling the punch stream when it has been statically assigned at the local RJE site.

```
//*FORMAT PU,DDNAME=,DEST=MKCFCPU2,FORMS=STANDARD
//*FORMAT PU,DDNAME=,DEST=MKCFCPU2,FORMS=TO-AFOS
```

The first example will cause automatic opening of the punch stream at the local RJE site. No manual intervention is necessary to open the punch stream. As previously mentioned in Section 4, no automatic transmission can occur if the punch stream is dynamically assigned at the local RJE site. The second example will cause a request-to-send message to appear on the local RJE site console when the job has completed at the NCCF and the punch stream is ready for transmission. The punch stream will not open until the operator at the local RJE site has granted permission-to-send by typing ".START

PU2" on the RJE console. The "TO-AFOS" field is simply a comment which will appear on the console, whereas "STANDARD" is an actual parameter which provides for automatic sending of the punch stream.

Three "words" of caution are in order. The "FORMS" "pause" control is a toggle type setting from job to job. Therefore, it is recommended that for complete control, the above two example types be used and not a default available through the omission of the "FORMS" parameter. Secondly, as previously mentioned in Section 4, no automatic transmission can occur if the punch stream is dynamically assigned at the local RJE site. There must be static punch stream assignment. Finally, ASP control cards or OS JCL cannot be used for translation for reasons previously discussed in Section 5D.

Refer to the ASP programmer's manual for further ASP control card discussion.(5)

## 6. AFOS CONSIDERATIONS

### A. ASYNCHRONOUS SOFTWARE

RJE automatically sends the punch stream containing AFOS products to an ALM port which is assigned by the procedure detailed in Section 4. This port is connected to a second ALM port which must be set up for proper handling by the AFOS asynchronous software. These port assignments should conform to the standards as outlined in the W/OH2 memo dated 18 February 1983 (APPENDIX C). The line characteristics must be set properly. For the first port described above (QTY:15), the line characteristics are set using the procedure detailed in Section 6B. For the second port (QTY:14), the line characteristics and initialization are handled by entering the proper AFOS asynchronous directory dialogue. See Figure 2 for an example.

The asynchronous software searches the punch stream data for a product which must begin with "ZCZC CCCNNNXXX" and end with "NNNN". If it cannot identify the product, an "A." RDOS file is created. For development purposes, this "A." file can be displayed on AFOS using the "DSP" command or an FPRINT made using RDOS. Refer to RDOS handbook for FPRINT details.(6)

When scheduled and addressed properly, an AFOS product can be routed to local peripheral devices, the AFOS network or other offices' peripheral devices. Later portions of this report will describe AFOS product protocol in more detail. Further information on asynchronous communications can be obtained in AFOS Handbook 5.(7)

### B. OPERATING SYSTEM

The operating system (RDOS) of the RJE host computer must be modified so that the punch stream will be transferred properly by RJE to the AFOS asynchronous software. This is done by octal editing the operating system to select the desired line characteristics of the ALM port. The options for these characteristics are depicted in Figure 3.

The ALM line characteristics for the 16 ports at MBRFC are located in ZSYSRFC2.SV file starting at word $24046_8$. The line

```
  LINE NUMBER:      0       LINE NAME  [IBM360 195]  ALM PORT NUMBER (0-31)    [14]
STATE WEATHER WIRE  (Y-N)  [N]          LINE UP WHEN AFOS INITIALIZES  (Y-N)  [Y]
MESSAGE LOG REQUIRED  (Y-N)  [N]              IMPLEMENT BREAK RESTART  (Y-N)  [N]
RECEIVE ONLY LINE  (Y-N)   [N]                TRANSMIT ONLY LINE  (Y-N)       [N]
IF TRANSMIT ONLY, ALLOW RECEIVE TO DETERMINE BUSY  (Y-N)                      [ ]
CURRENT LOOP CIRCUIT (Y-N)  [N]      CONTROL INPUT HIGH IN BREAK STATE (Y-N)  [N]
NEED CONTROL OUTPUT (CO) HIGH  (Y-N)    [N]    ASCII OR BAUDOT   (A OR B)    [A]
IF ASCII, 7 OR 8 BIT (7-8)   [8]          ENTER PARITY (1=ODD,2=EVEN,3=NONE)  [3]
CIRCUIT BAUD RATE (ENTER A-N)  [M]           NUMBER OF STOP BITS (1 OR 2)     [1]
A.   50   E. 134.5   I.  600   M. 4800
B. 56.9   F.   150   J. 1200   N. 9600       IF 8-BIT ASCII, IS THERE
C.   75   G.   200   K. 1800                 BINARY DATA ON CIRCUIT-  (Y-N)   [Y]
D.  110   H.   300   L. 2400
```

EXAMPLE ASYNCHRONOUS DIRECTORY DIALOGUE

FIGURE 2

ALM PORT CONTROL PARAMETERS FORMAT

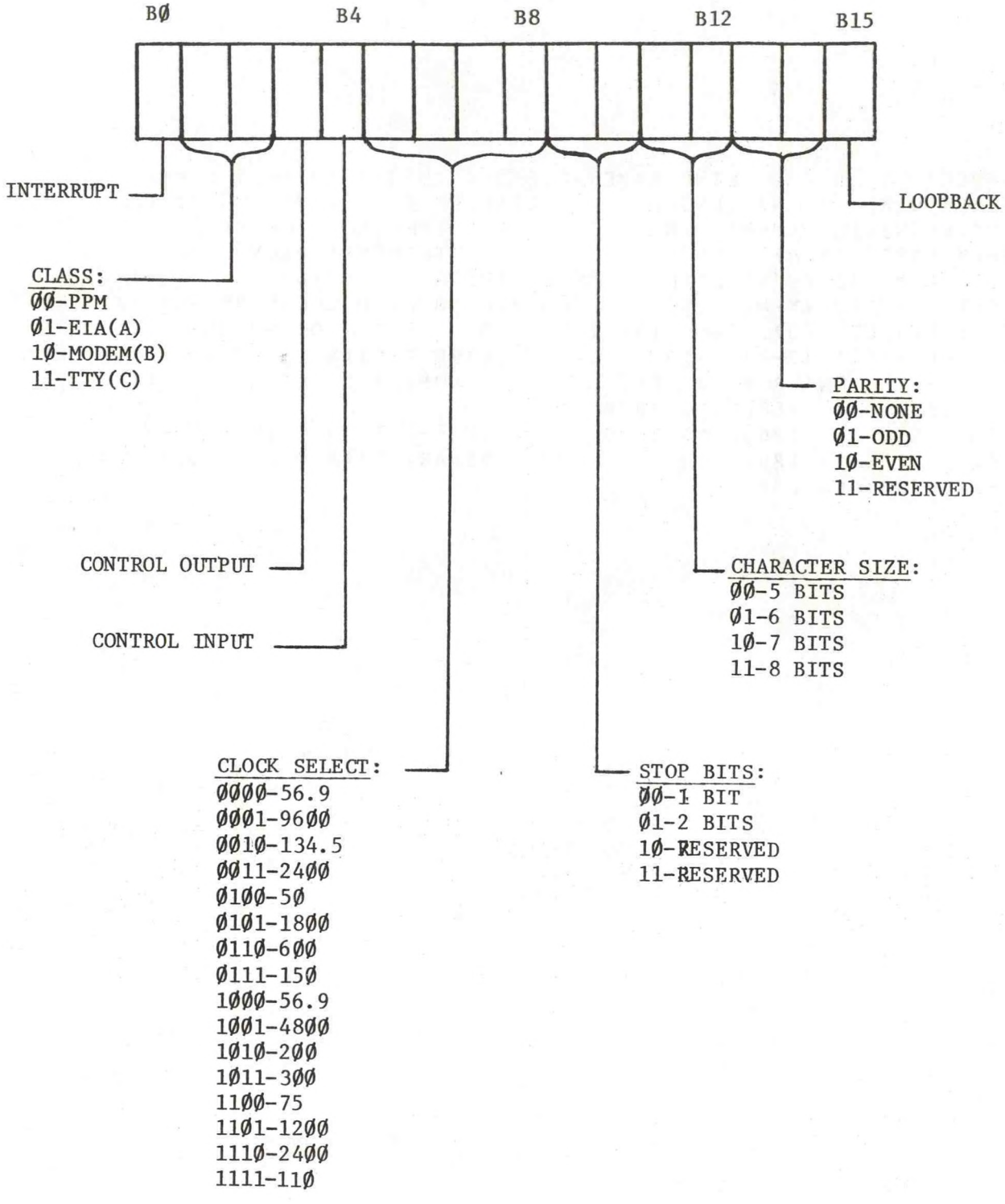



FIGURE 3

characteristics for QTY:15 (RJE to AFOS) are at word $24065_8$. This location must be edited to contain the value $062230_8$ for the following line characteristics.

| | | |
|---|---|---|
| Interrupt | = | No |
| Class | = | TTY |
| Control Out | = | No |
| Control In | = | No |
| Clock Select | = | 4800 Baud |
| Stop Bits | = | 1 |
| Character Size | = | 8 Bits |
| Parity | = | None |
| Loop Back | = | No |

Note that $062230_8$ = 0 110 010 010 011 000$_2$, which sets the ALM port parameters depicted in Figure 3.

C. UNIVERSAL TRANSMISSION FORMAT (UTF)

All AFOS products are composed of an identification header, a set of Universal Transmission Format (UTF) data and an ending trailer. The specific header and trailer for products entered from an asynchronous line are detailed in Section 6D.

The set of UTF data, which makes up the majority of the product, contains the product type identifier coded subset and the body of the product itself. The product type identifier coded subset can be one of various available subsets. The product type identifier coded subsets begin with a byte which is called a mode or command byte. This mode byte specifically identifies the type of AFOS product contained in the remainder of the UTF as either a graphic or an alpha-numeric product.

All graphic products begin with a graphic product definition subset. The graphic product definition subset must begin with a $301_8$ mode byte to identify the product as a graphic. All normal text products must begin with a $305_8$ mode byte followed by a $200_8$ byte. The $305_8$ byte identifies the data as alpha-numeric characters and the additional $200_8$ byte is used to specify that the alpha-numeric characters are not associated with a graphic product. The additional $305_8$ and $200_8$ bytes are the only UTF coded subset needed to identify a product as a normal text product. However, with graphic products, several more identifier bytes are needed. These additional identifier bytes define items such as zoom factors, zoom thresholds, I & J screen coordinates, number of words in the subset, etc.

For a text product, the body of the UTF data set simply consists of the desired lines of text. For graphic products, the body of the UTF data set consists of addotional coded subsets which contain display data. Some of the possible types of subsets for graphics are relative vectors, absolute vectors, alpha-numeric characters and offset alpha-numeric characters.

It should be noted that a $203_8$ byte (ETX) concludes the display of all AFOS products and follows the UTF data set. It is highly recommended that the UTF product type identifier coded subset and the $203_8$ byte always be supplied by the NCCF AFOS product composition software. In some cases, such as for text products, the $305_8$ and $200_8$ bytes and the $203_8$ byte will be added by the AFOS

asynchronous software. However, the results are not always consistent. Therefore, it is best to satisfy AFOS protocol in the NCCF product composition software. More details on UTF are provided in the UTF manual(8) and in a Western Region technical memorandum on graphics created on Data General hardware.(1)

As an additional note of interest, AFOS software automatically supplies the $305_8$ and $200_8$ bytes and the $203_8$ byte for text products created with normal AFOS message composition at an ADM. This can be checked by doing an FPRINT on an RDOS file version of a standard AFOS product created through AFOS message composition.

D. HEADERS AND TRAILERS

The AFOS asynchronous software expects to receive text and graphic products in a certain format. The software will search for a "ZCZC CCCNNNXXX" to discern a valid AFOS product. As previously mentioned, the NCCF punch stream identifier record will be effectively stripped off. The software also expects the AFOS product itself to end with a $203_8$ byte followed by an "NNNN". The "NNNN" is also stripped off, whereas the $203_8$ byte is stored with the product in order to indicate the end of display pointer for that product.

AFOS addressing for products which have been entered to the network from asynchronous lines which have been specified as containing binary data (see directory dialogue example, Figure 3) is handled differently for text than for graphics. Text product addressing is located in the body of the message, whereas graphic product addressing immediately follows the product identifier "CCCNNNXXX". The valid header and trailer (including addressing) for text products entered fron an asynchronous line follows.

```
ZCZC CCCNNNXXX(CR)(LF)
(305₈)(200₈)WOUSOO DDHHMM??AAA(CR)(LF)
    -----      text      -----
    -----      data      -----
(203₈)NNNN
```

The DDHHMM is the date-time group and the AAA is the valid AFOS addressee. The parenthesis are used to denote a single byte value.

The valid header and trailer for graphic products entered from an asynchronous line follows.

```
ZCZC CCCNNNXXX*AAA(CR)(LF)
(301₈)   -----   graphic   -----
         -----     data    -----
(203₈)NNNN
```

Once again, the AAA is the valid AFOS addressee and the parenthesis contain one byte value. The *AAA may be omitted for graphics. If it is omitted, routing will default to ALL. The *AAA may also be expanded to provide for further asynchronous routing. A very useful feature of addressing is the *000, which provides for local storage only. See Section 7 of this report and AFOS Handbook 5 (7) for further detailed discussion.

E. EMBEDDED ETX AND DLE

The NCCF AFOS product composition software must protect against two restricted bytes when creating AFOS products. The first restricted byte is the $203_8$ (ETX). This is interpreted by AFOS software as a pointer for the end of display of a product. If this ETX byte appears in the body of a product, it will cause termination of display at that point. For graphics, this effectively truncates the remaining portion of the product. The NCCF AFOS product composition software overcomes this problem by detecting $203_8$ bytes (since could be perfectly valid binary data for a graphic) and substituting a $020_8$ byte and a $014_8$ byte (must be in that order) in place of it.

The second restricted byte is the $020_8$ (DLE). This is a data link escape command which will cause an interruption in the data format mode. The NCCF AFOS product composition software overcomes the $020_8$ byte (since could be perfectly valid binary data for a graphic) by substituting a $020_8$ byte and a $020_8$ byte in place of it.

F. PAGINATION

AFOS acheives pagination for text products by counting line feeds. The only way to accomplish proper pagination and control of line spacing in text products created at the NCCF and automatically transmitted to AFOS via RJE is to insert a carriage return followed by a line feed at the end of each line of text (see section 5D for further discussion). Also, the local RJE site must be set up so no translation of the punch stream takes place. There is no deviation from this for automated transfer.

G. COMPUTER LANGUAGE STORE (CLS) MEMORY

The Interactive Display Generator DGS-800 graphics display module (GDM) has been designed in such a way that the host computer is not required to control the performance of operator desired manipulations (zoom, overlay, etc.) of displayed graphic products. After product display, these manipulations are accomplished without accessing the host computer CPU. This is done through the use of a Computer Language Store (CLS) memory and other hardware and firmware located primarily in the display generator card file of the GDM. In the current configuration, the CLS memory capacity consists of 32 K 16-bit words for a total of 65,536 bytes. As an option, another CLS memory board can be added to double this capacity.

Several items need to be considered in order to allow for proper use of the CLS memory. The 32 K 16-bit word capacity is divided into four individual storage areas of 8 K 16-bit words each. These 8 K 16-bit word boundaries are absolute and violation of the boundaries will result in GDM errors or product truncation errors. The first 8 K 16-bit word area is set aside exclusively for background data and is designated channel 00. Channel 00 stores the background display data for all of the three possible crt monitors driven by one display generator. The other three 8 K 16-bit word areas are set aside as foreground data storage areas for channels 1, 2 and 3. Each of these three channels are associated exclusively with one graphic crt monitor. For example, channels 1, 2 and 3

storage areas might be wired to drive crt monitors 1, 2 and 3, respectively. Background data for all crt monitors would be supplied from the channel ØØ storage area. Background data storage area is further divided into smaller sections as discussed later.

Five additional more specific points must be understood for efficient CLS memory use.

1. The CLS data format is not the same as UTF. CLS format is a compacted version of UTF. CLS format compacts the necessary information supplied from the first two bytes of each UTF coded subset. Also, CLS format does not use the graphic product definition UTF coded subset, the header product identification information or the trailer information. Therefore when calculating the CLS memory used by a product, do not include the product identification information, the first two bytes of each UTF coded subset or the entire graphic product definition UTF coded subset.

2. "Built-in" CLS record pointer overhead is insignificant compared to the 8 K 16-bit word channel capacities. See appropriate references for additional information.(9,1Ø,11)

3. Background data storage area (channel ØØ) is managed differently than foreground data storage area (channels 1, 2 and 3) in CLS memory. A strict 8 K 16-bit word limit exists on foreground data displayed on any one CRT. Background data storage limits depend on which channel the data are assigned. Background data for channel 1 has an 8 K 16-bit word limit. Background data for channel 2 has a 5.3 K 16-bit word limit. Background data for channel 3 has a 2.7 K 16-bit word limit.

4. Background data storage limit of 2.7 K 16-bit words exists if one wants to avoid any possibility of interference among all background data which may possibly be displayed on the three crt monitors driven by one display generator. Background data storage is occupied by the last data read into the 2.7 K storage area of each channel. For example, if channel 1 associated background data of 8 K 16-bit words is read into channel ØØ storage (this is automatically done when calling up an AFOS graphic product), followed by a 4 K 16-bit word channel 2 associated background in channel ØØ and a 2 K 16-bit word channel 3 associated background into channel ØØ, interference will occur among displayed backgrounds. After data display analysis procedures (zoom, overlay, translate, etc.) are made at the control panels, the resulting background displayed on channel 1 will have 2.7 K words blanked out and overwritten by channel 2 background data and 2 K blanked out and overwritten by channel 3 background data. The resulting background displayed on channel 2 will have 1.3 K blanked out and overwritten by channel 3 background data. Channel 3 background data display will not be affected in this case.

5. Through the use of the "DSP" command, more than three products can be displayed on one crt monitor. The actual effective limit to the data displayed using the "DSP" command is not based on number of products, but rather on the cumulative total data size of the products displayed. This cumulative total cannot exceed 8 K 16-bit words for the foreground data. The "DSP" command always loads a particular foreground channel. Background data can be overlayed on the same crt monitor by calling up the desired AFOS background by the specific AFOS background product identifier. This loads the data into the seperate 8 K 16-bit word background channel

ØØ. Using the "DSP" command to display an RDOS file version of a background would cause an error if the total length of the display data in foreground and the RDOS file background was greater than 8 K 16-bit words. This is because a "DSP" command always loads a foreground channel, whereas calling up an AFOS graphic in the normal manner always loads the associated background into channel ØØ and the foreground data in a particular foreground storage area. Another, more practical limit to the number of products overlayed using the "DSP" command is that only three channels can be specifically controlled by the crt monitor panel. In some instances though, this restriction would be tolerable.

Further more detailed CLS memory test results are available from MBRFC.

### H. NATIONAL PLAN FOR AFOS HYDROLOGIC GRAPHIC PRODUCTS

Some progress is being made toward the use of graphic products created by offices other than NMC. NWS Office of Hydrology is nearing completion of a national plan for AFOS hydrologic graphic product implementation. However, problems other than obtaining product identifiers alone must be solved. These other problems deal with priorities, product inventory lists, AFOS software handling of associated map backgrounds, nationally supported software and others. This project requires input and cooperation from both the field and headquarters for successful implementation.

### I. COORDINATION

Coordination must be made with the appropriate Regional AFOS System Manager to obtain required approvals before attempting any of the procedures described in this document.

## 7. TRANSMISSION OF NCCF PRODUCTS TO DATACOL

When properly coded, AFOS messages created at the NCCF may be automatically directed and posted to the DATACOL data base. Cable link Y21, Y22 and Y23, which allows for AFOS products to be directed from the NCCF to the S/14Ø via the S/23Ø, were described in Section 3. The standard RFC AFOS ALM-16 port assignments are shown in Appendix C. Specific instructions for the set-up for this transfer to DATACOL are given in the DATACOL configuration guide.(12) Information on message coding and actual posting to the DATACOL Gateway data base is given in various NWS Central Region technical memorandums.(13,14)

It should be noted that for automatic product transfer to DATACOL when only local AFOS storage is desired, NCCF AFOS product composition software should use the proper addressee. The specific local site addressee, ØØØ and LOC are not treated the same for asynchronous routing to DATACOL. For graphic product addressing on lines designated as 8-bit with binary data, ØØØ and LOC addressees will not route asynchronously to the S/14Ø. The specific local addressee, such as KRF, must be used. For text product addressing for 7-bit lines, LOC will not route asynchronously to the S/14Ø. The specific local addressee and ØØØ will successfully route

asynchronously to the S/140.

## 8. STANDARD GRAPHICS SOFTWARE

Currently there is nationally supported software at the NCCF which will create and transfer graphic products to AFOS via a RJE punch stream. The user must supply the main program which will access appropriate data files and transfer these data in the proper manner to the existing graphics software. This nationally supported software is documented in a soon to be published technical note.(15)

MBRFC and other offices have demonstrated the value and utility of automatically generating AFOS graphic products for items such as flash flood guidance, observed precipitation, contoured precipitation estimates from observed precipitation, water supply data, hydrographs, etc. With the local addressing capabilities for graphics, development in this area can progress with negligible impact on the AFOS network or the local site's operation in general.

## 9. STANDARD TEXT SOFTWARE

There is currently no nationally supported software at the NCCF that will transfer text products to AFOS via a punch stream. The Office of Hydrology plans to support this software in the future. In the meantime, the MBRFC has NCCF software that has been running operationally at MBRFC and NCRFC since July 1981. The FORTRAN source code is located in catalogued partioned data set NWS.MKC.PROD.SOURCE, member name MKC2AFOS. Anyone planning to create text products on the NCCF is urged to examine this software.

Program MKC2AFOS reads disk text files, translates EBCDIC to ASCII and inserts an ASCII carriage return and a line feed at the end of each line. Additionally, MKC2AFOS provides the header and trailer information required by AFOS, as well as routing codes. Proper AFOS identifiers and routing information for each permissible product are stored on a seperate file which is easily updated by executing commands in MKC2AFOS. The identifier of the file to be sent is compared to those in the approved identifier file. The file is not sent to AFOS if an exact match is not found.

Program MKC2AFOS translates EBCDIC to ASCII code by calling an assembly language subroutine MKCTRANSL. In an ideal world there would be one nationally supported subroutine at the NCCF to translate EBCDIC to AFOS compatible ASCII. Unfortunately there is none. Currently, many translation routines exist at the NCCF. All that were examined translated at least one EBCDIC character to a non-standard ASCII character for a variety of reasons. We have gone to considerable effort to make MKCTRANSL completly compatible with the ASCII code expected by AFOS. This translation subroutine is available in catalogued data set NWS.MKC.PROD.SOURCE, member name MKCTRANSL. The executable module is located in catalogued data set NWS.MKC.PROD.LOAD, member name EBTOAS. You are invited to use this executable subroutine or to make copies of the source code should any modifications to the translation table be necessary. We ask that you advise us of any problems encountered with the MBRFC translation routine so that we can make the appropriate changes to our copy.

Listed below are some additional capabilities of MKC2AFOS. These features were added due to the operational considerations or

to accomodate AFOS limitations.

1. MKC2AFOS will not allow products to exceed the current AFOS limit of 5 pages of text.

2. If multiple AFOS products are generated by one job, MKC2AFOS will create a seperate punch stream for each product. This allows the forecaster to force the NCCF computer to pause before sending each AFOS product until a command is entered at the RJE console (see Section 5E). This feature was provided due to the lack of handshaking on the AFOS asynchronous lines. AFOS will lose data if about 5 products and/or 120 lines of text are entered asynchronously without a pause. The threshold of possible lost data varies with AFOS traffic.

3. Trailing blanks on each line of text are deleted before the products are sent to the punch stream. This software is redundant as long as the NCCF computer deletes trailing blanks (see Section 5B).

4. MKC2AFOS provides hardcopy of AFOS products on the line printer. If the forced pause described in item 2 above has been utilized, products can be verified before being sent to AFOS. If need be, an individual product can be cancelled before it is transmitted on the punch stream with the following command to the NCCF computer.

```
.C PU2
```

All punch stream output for one job can be cancelled with the following command.

```
.C PU2,J
```

## 10. SUMMARY

This paper has presented an efficient, automated method for transmission of AFOS products created at the NCCF using a RJE punch stream. It also discusses the many related items which must be provided for in the NCCF AFOS product composition software, along with items concerning the effective use of AFOS itself.

The introduction of coded messages containing hydro-meteorological data which are both man and machine readable (SHEF) has been an important NWS automation milestone. Now, through the use of methods described in this paper, both text and graphic guidance and raw data products can be automatically distributed among the NCCF, the RJE display devices, the AFOS communications system, the local site's data base (DATACOL), and other peripheral equipment by users with access to the NCCF.

## REFERENCES


1. "AFOS Graphics Creation From Fortran",NOAA Western Region Computer Programs and Problems, NWS WRCP-No. 18, Salt Lake City, Utah, March 1981.

2. "RFC Functional Cabling Diagram", Drawing No.ISL/AFOS-0206 REV/D, September 18, 1981.

3. "HASP II Workstation Emulator(HAMLET) User's Manual (RDOS)",093-000116 -01, Data General Corp.

4. "System/370 Reference Summary",IBM,GX20-1850-1, 9/72.

5. "IBM System/360 and System/370 ASP Version 3 Asymmetric Multiprocessing System Applications Programmers Manual",IBM,GH20-1291-1,1973.

6. "RDOS/DOS User's Handbook",Data General Corp.,093-000105-03,May 1978.

7. "AFOS Handbook 5 Reference Handbook, Volume 3, Station Operations, Chapter 4, Asynchronous Communications",NWS OTS/AOD, Aug. 1983, DRAFT.

8. "Universal Transmission Format Version 2.0",NWS SDO, Oct. 1977.

9. "Interactive Display Generator DGS-800, Maintenance and Operation Manual",Ford Aerospace And Communications Corp.,WDL Division, Sep. 1979.

10. "Instruction Manual and Directives for AFOS, Volume 3, WSFO Theory of Operation",NOAA NWS Engr. Division.

11. "Programmer's Reference Guide, GDM and ADM",Ford Aerospace and Communications Corp., WDL-TR7676A.

12. "Program Configuration Guide for DATACOL, Rev. 7.20",David C. Leader, NWS-CNRFC,1/10/82.

13. "An Explanation of Standard Hydrologic Exchange Format and Its Implementation in the Central Region", Bonnin and Cox, NOAA-NWS Technical Memo NWS CR-67,April 1983.

14. "The Posting of Standard Hydrologic Exchange Format Data to the RFC Gateway Database", Bonnin, NOAA-NWS Tech Memo NWS CR-68, April 1983.

15. "Creation of AFOS Graphics Using the IBM 360/195", Van Blargan and Olsen, NOAA NWS Tech Note, to be published.

Y21, Y22 and Y23 CABLE LINKS

# A P P E N D I X  A

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

April 26, 1983

W/OTS141 - RFM

TO: All NWS Regional Headquarters, Area Electronics Supervisors, and Electronics Technicians (EHB-13 Distribution)

FROM: W/OTS1 - J. Michael St. Clair

SUBJECT: Transmittal Memorandum for Engineering Handbook No. 13, Issuance 83-6

1. Material Transmitted:

Engineering Handbook No. 13, AFOS, Volume 1, Section 3.0, Modification Note No. 33: Asynchronous Interface, RFC AFOS to RFC Gateway.

2. Summary:

On the completion of this modification:

a. The Y22 cable links the S-230 to the S-140 allowing transmission of RFC products from the NOAA Central Computer Facility via the AFOS System to the RFC Gateway.

b. The Y21 cable links the S-230 to the S-140 allowing transfer of AFOS Hydrologic Products to the RFC Gateway System for storage.

3. The Y23 cable links S-230 background (RJE) to foreground (AFOS) allowing 360/195 AFOS products received via RJE to be disseminated on state and regional distribution without manual reentry.

3. Effects on Other Instructions:

None.

4. Certification Statement:

This modification has been tested and implemented by the AFOS experimental facility.

5. Reporting Modification to WSH Engineering Division:

Target date for completion of this modification is May 27, 1983.

After the Senior Electronics Technician has made this modification, he should fill out Form H-28 and send it to W/OTS11, Engineering Division, 8060 13th Street, Silver Spring, Maryland 20910.
(See attached H28).

Please note that the equipment code is CCM for both WSFO's and WSO's.

AFOS MODIFICATION NOTE NO. 33
(For Electronics Technicians)

SUBJECT : Asynchronous Interface RFC AFOS to RFC Gateway

PURPOSE : Three async connections will be added to the RFC S230 and S140 computers in order to increase system efficiency and utility.

EQUIPMENT AFFECTED : AFOS, CCM, RFC Gateway Computer System

PARTS AND DRAWINGS REQUIRED :
1. RFC Functional Cabling Diagram #ISL/AFOS-0206, Rev. D
2. Y21 Cable
3. Y22 Cable
4. Y23 Cable
5. Wire Assembly Diagram

PROCUREMENT : Diagrams and cables will be supplied by Engineering Division, W/OTS141.

SPECIAL TOOLS REQUIRED : None.

TEST EQUIPMENT REQUIRED : None.

TIME REQUIRED : 3 hours.

GENERAL:

The three connections made are:

A. AFOS/S230 async port to Gateway/S140 async port (Y21).
B. Another AFOS to Gateway port to port as above (Y22).
C. Two AFOS/S230 async ports connected to each other (Y23).

PROCEDURE:

Power off the AFOS/S230 communication multiplexer. Power off the RFC Gateway/S140 expansion communication multiplexer.

NOTE: Check with the Hydrologist-in-Charge or the RFC S/140 System Manager in order to identify the appropriate ALM board and port assignment to be used for Y21 and Y22 connection in the RFC Gateway computer system.

Install cables as directed:

1. Install (Y21 cable) from A05-J5 S/230 comms mux to A22 port x S/140 comms expan mux per diagram ISL/AFOS-0206, Rev. D. EHB-13 WSO, Volume 4, Figure 5-113 shows communications connector and pin locations. The A05-J5 S/230 6-pin connector is installed on odd numbered pins 43 through 53.

NOTE: A. The 6 pin connector could be installed backwards (observe that pin 1 is the leftmost pin when connection is made to the backplane pins).

B. The backplane of J5 will have one pin open on both sides of the J5 connector when installed correctly, provided J3 and J7 are in use. A22-port x S/140 comms mux expansion chassis 25-pin female connector connects to the male connector of port x.

2. Install (Y22 cable) from A05-J7 S/230 comms mux to A22-port x S/140 comms mux expan chassis per diagram ISL/AFOS-0206, REV. D. The A05-J7 S/230 6-pin connector is installed on odd numbered pins 57 through 67.

NOTE: A. The 6-pin connector could be installed backwards (observe that pin 1 is the leftmost pin when connection is made to the backplane pins).

B. The backplane of J7 will have one pin open on both sides of the J7 connector when installed correctly provided J5 and J9 are in use. A22-port x S/140 comms mux expan chassis 25-pin female connector connects to the male connector of port x.

3. Install (Y23 6 in. cable) from A05-J15 S/230 comms mux to A05-J16 S/230 comms mux per diagram ISL/AFOS-0206, Rev. D. The A05-J15 S/230 6-pin connector is installed on odd numbered pins 17 through 27. The A05-J16 S/230 6-pin connector is installed on even numbered pins 18 through 28.

NOTE: A. The 6-pin connectors could be installed backwards (observe that pin 1 is the leftmost pin when connection is made to the backplane pins.

B. The backplane of J15 and J16 will have one pin open on both sides of each connector.

This concludes modification note 33. Refer to the test procedure for testing and evaluation of this modification.

Test Procedures: The following steps are to be followed in the demonstration of the RFC Connections.

1. Bring up a current AFOS-RFC software AWSO load. Utilize AFOS Message Composition to create a miscellaneous product. The header line of the product created must have the following information: ZCZC CCCNNNXXX

   The trailer line of the product must have the following information: NNNN

   Between the header and trailer lines the miscellaneous product will be created.

2. Display this product on the AFOS ADM.

3. Send this product to the AFOS PPM and save the copy and annotate appropriately.

4. Utilize the ASYNCH scheduler to send this product to the RFC Gateway System via Y21 cable, per drawing ISL/AFOS-0206, Rev. D.

5. Verify that the product sent from step 4 has been received by the RFC Gateway System and stored on disk.

6. Display (from disk) a copy of the product sent from step 4 on the RFC Gateway System D-200 console.

7. Switch the RFC high speed line printer from AFOS to the RFC Gateway System and send the product from disk to the high speed line printer. Save this copy and annotate it appropriately.

8. Send the product (received from step 4) to AFOS-RDOS from the RFC Gateway System via Y22 cable, per diagram ISL/AFOS-0206, Rev D.

9. Verify that the product sent from step 8 has been stored on AFOS DP1 disk.

10. Display the product sent from step 8 on the RFC AFOS system KCRT.

11. Switch the RFC high speed line printer back to AFOS from the RFC Gateway System and send the product from DP1 to the high speed line printer. Save the copy and annotate it appropriately.

12. Utilize the XFER CLI command in the free ground of AFOS to send the product (received from step 8) to AFOS. Remote job entry to AFOS via Y23 Cable, per drawing ISL/AFOS-0206, Rev D.

13. Verify that the product sent from step 12 has been stored in the AFOS data base (DPO).

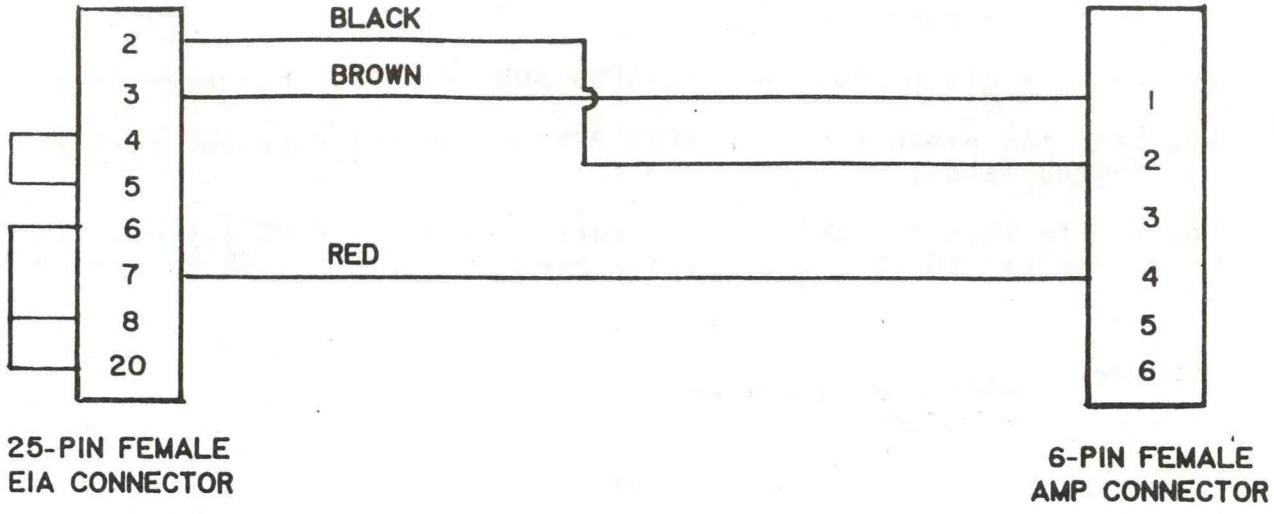
14. Display the product on the AFOS ADM from the AFOS data base.

15. Send the product to the AFOS PPM. Save the copy and annotate it appropriately.

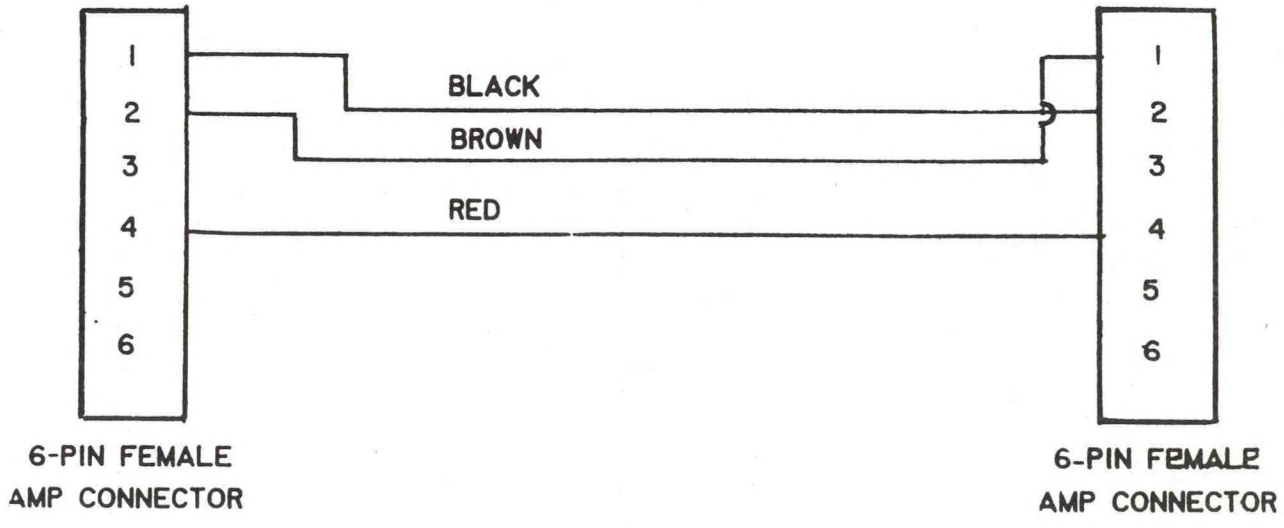
16. Verify that the original product created on AFOS (step 1) is identical to the product displayed on the AFOS ADM in step D2.

Attachments: Wire Assembly Diagram
H-28 Form

## CABLES Y21, Y22




## CABLE Y23 (6 INCH)




## WIRE ASSEMBLY DIAGRAM

| 1. ORG | 2. PAY PERIOD (Last day) YEAR MONTH DAY | 3. STATION REG. | 4. AREA SECTOR | 5. INITIALS | 6. HOURLY SALARY | 7. REPORTED BY: | 8. GENERAL PURPOSE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

WS FORM H-28 (7-77) U. S. DEPARTMENT OF COMMERCE NOAA NATIONAL WEATHER SERVICE

## ENGINEERING PROGRESS REPORT

| SEQ | 9. STATION | REG. | 10. AREA SECT | 11. CATEGORY PROGRAM | 12. WORK TYPE | 13. TOTAL – TIME (Hours) RT | NT | PT | MT | ST | 14. TRAVEL MILES | 15. PER DIEM (Travel w.h.s) | 16. COST CODE | 17. COST (Dollars) | 18. ORDER NUMBER | 19. NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | | | | C C M | M O D | | | | | | | | | | | MOD # 33<br>CCM Serial # |
| 1B | | | | | | | | | | | | | | | | Date Modification completed |
| 1C | | | | | | | | | | | | | | | | |
| 1D | | | | | | | | | | | | | | | | |
| 1E | | | | | | | | | | | | | | | | |
| 1F | | | | | | | | | | | | | | | | |
| 1G | | | | | | | | | | | | | | | | |
| 1H | | | | | | | | | | | | | | | | |
| 1I | | | | | | | | | | | | | | | | |
| 1J | | | | | | | | | | | | | | | | |
| 1K | | | | | | | | | | | | | | | | |
| 1L | | | | | | | | | | | | | | | | |
| 1M | | | | | | | | | | | | | | | | |
| N | | | | ADMIN. | | | | | | | | | | | | FOR LEAVE ENTER WORK TYPE:<br>LVA = Annual Leave<br>LVC = Compensatory Leave<br>LVH = Holiday<br>LVS = Sick<br>LVM = Military or Other |
| O | | | | LEAVE | | | | | | | | | | | | |

20. REMARKS

Blocks 1 through 10 must also be filled out.

Enter time required to complete Mod in Col. 13d (MT).

This Mod must be reported into the EMRS System before June 27, 1983

COST CODES:
C = CONTRACTS
T = TRANSPORTATION OF THINGS
P = PURCHASED LOCALLY
G = GOVERNMENT FURNISHED
N = NONCAPITALIZED PROPERTY
M = CAPITALIZED PROPERTY

SUPERSEDES WS FORMS H-13 AND H-18 WHICH ARE OBSOLETE AND EXISTING STOCKS SHOULD BE DESTROYED.

# BINARY DATA ON PUNCH STREAM - TEST RESULTS

## A P P E N D I X  B

# BINARY DATA ON PUNCH STREAM - TEST RESULTS

## INTRODUCTION

The next two pages are the test notes for the examination of NOAA Central Computer Facility (NCCF) punch stream data at the local RJE site. A Spectron Datascope (D-502) was connected to the local site modem (Bell data set 2096-A-L1) in such a way as to display on the scope outgoing data (to the NCCF) just before it went into the modem and incoming data (from the NCCF) when just exiting the modem.

The last page of this appendix gives a brief analysis of the meaning of the test as it relates to truncation of trailing 100 octal bytes (EBCDIC space and ASCII @).

Spectron Data scope out 502

10 Aug 83

9600 b/s

Framing pattern $32_{16}$ $32_{16}$

Idle line = $FF_{16}$

FF FF FF AF 92 32 32 32 32 32 32 10 70 FF

~~Data scope Output for:~~

20 cards, 4, 5 card groups, written in 80A1

no padding, no translation, ~~no~~ w/ appending

| Card # | Contents |
|---|---|
| 1-5 | $100_8$ |
| 6-10 | $100_8$ $100_8$ |
| 11-15 | $100_8$ $100_8$ $100_8$ |
| 16-20 | $80 \times 100_8$ |

Data scope output for above:

Stored as Betty DP1

interpreted for hexadecimal

FFFFFFFFFFFF55323232323232100284 8FCF958FB4FFA3F0C1
F1AAFFC8E6C8D2E2E3C1C7F4AAFFC8C6E3F0F7C6F0F0F1B4FF
00958FC1400095 8FC1400095 8FC1400095 8FC1400095 8FC140
00958FC140 0095 8FC140 0095 8FC140 0095 8FC140 0095 8FC140 Same
00958FC140 0095 8FC140 0095 8FC140 0095 8FC140 0095 8FC140 Same
00958FC140 0095 8FC140 0095 8FC140 0095 8FC140 0095 8FC140 Same
00958EB4FFA3F0C1F1AAFFC8E6C8D2E2E3C1C7F4AAFFC8C6E3
F0F7C6F0F0F1B4FF0095800000 1032 1032 1026 6777 FFFFFFFF

Next output is for 2 cards, 80A1 N pad, N trans, w/ append

Card 1

Card 2

Data scope output

Couldn't capture this 2 card output

1st card of pgm A — stored as BG0

Card# Set following ASCII to punch stream in 80A1

① W@WW@@WWW@@@WWWW@@@@WWWWW@@@@@WWWWWW @@@@@@@WWWWWWWWW@@@@@@@@WWWWWWWWW@ @@@@@@@ WWWW@@@@

② END^TEST@ ——> 72 times

③ (FF)# ——> 56 times, ABABABABABABABABABABABABABAB

④ AB ——>

⑤-17 AB ——>

FFFFFFFFFFFFFFFFFFFFFFFFFFFFAF92323232323232100 2
858FCF958FB4FFCAF1F1F0F1AAFFC8E6C8D2E2E3C1C7F4AAFF
C8C6E3F0F7C6F0F0F1B4FF00958FCA57405757582A35783A457
84A557855A65786A757587A857588A457 00 958FC8 454E4420 5445
5354 0095 8F BF FFB9 FFD8 41424142414241424142414241424142 41
424142414241424142 00 958FFF41424142414241424142414241424142
41424142414241424142414241424142414241424142414241424142
41D1424142414241424142414241424142 40 42 00 95 8F FF 4042
40424142414241424142414241424142414241424142414241424142
41424142414241424142414241424142414241424142414241424142
41424142414241424142414241424142 D1 42 41 42 41 42 41 42 41 42 4142
4142414200958FFF4142414241 42 41 42 41 42 41 42 41 42 41 4241 4241
42414241424142414241424142414241424142 4142414241424142414241
4142414241424142414241424142414241424142 D1 42 41 42
4142414241424142414241424142 00 00 80 00 00 10 32 10 32 10 26
201A FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

## BINARY DATA ON PUNCH STREAM - TEST RESULTS

### BRIEF ANALYSIS

The procedure used to examine punch stream data from the NCCF was to wire the Datascope as previously mentioned, execute a batch program on the IBM 360/195 and then capture the punch output in the Datascope buffer as it came out of the local modem (i.e., before acted upon by any S/230 software). The IBM 360/195 program simply directed a series of ASCII card images to a punch stream which was dynamically assigned at the local site. This assignment was made in order to control the exact time the punch stream would be sent. The punch stream had no padding, no translation and did have appending to disk file at the local site.

The notes show the ASCII card images sent to the punch stream by the IBM 360/195 test program and also the Datascope output. The Datascope output is in two-place hexadecimal (i.e., each line represents 25 characters).

The first test shown in the notes sent 20 ASCII card images on the punch stream. The first group of 5 card images contained one leading 100 octal byte on each card image. The second group contained two leading 100 octal bytes on each card image and the third group contained three leading 100 octal bytes. The fourth group of 5 card images contained eighty 100 octal bytes on each of the five card images. The results of the first test show that all card images were sent exactly the same. The NCCF truncated all trailing 100 octal bytes. The computer thought it was sending 20 blank cards. Therefore, the NCCF does not support binary data on the punch stream.

The second test contained only two card images and the punch output was so short that it could not be captured with the quick eye-hand coordination of the investigator.

The third test is somewhat more complicated and shows not only the trailing 100 octal byte truncation but also the repetition code for punch stream data transmission. The five card images sent to the punch stream contained the ASCII characters as shown in the notes. The first card image (begins on line three, just after 00958FC4) shows that a W, an @ and then two W's were sent. Then comes a duplication code for two @'s, namely, an 82 hexadecimal. The duplication code for W appears to be Ax followed by the W, where x is the numerical duplication factor. Note that the last characters of the first card image are the four W's. The four trailing 100 octal bytes (ASCII @ and EBCDIC space) were truncated.

STANDARD RFC AFOS ALM-16 PORT ASSIGNMENTS

# A P P E N D I X  C

Standard RFC AFOS ALM-16 Port Assignments

| Port # | J # | Physical device | Baud rate # |
|---|---|---|---|
| 0 | 1 | Asynch Modem | (300) |
| 1 | 2 | Asynch Modem | (300) |
| 2 | 3 | DTCA - Dialer | |
| 3 | 4 | (not specified) | |
| 4 | 5 | AFOS to DATACOL | 1200 |
| 5 | 6 | (not specified) | |
| 6 | 7 | RJE (RDOS) to DATACOL | 1200 |
| 7 | 8 | (not specified) | |
| 8 | 9 | Card Punch | |
| 9 | 10 | Master ADM | |
| 10 | 11 | Printer Plotter (PPM) | |
| 11 | 12 | ADM2 | |
| 12 | 13 | ADM3 | |
| 13 | 14 | ADM4 | |
| 14 | 15 | AFOS to RJE (RDOS) | 4800 |
| 15 | 16 | RJE (RDOS) to AFOS | 4800 |

(continued from front inside cover)

NWS CR 48 Manual of Great Lakes Ice Forecasting. C. Robert Snider December 1971 (COM-72-10143)

NWS CR 49 A Preliminary Transport Wind and Mixing Height Climatology, St. Louis, Missouri. Donald E. Wuerch, Albert J. Courtois, Carl Ewald, Gary Ernst. June 1972 (COM-72-10859)

NWS CR 50 An Objective Forecast Technique for Colorado Downslope Winds Wayne E. Sangster. December 1972 (COM-73-10280)

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NWS CR 55 Detecting and Predicting Severe Thunderstorms Using Radar and Sferics. John V. Graff and Duane C. O'Malley. June 1974 (COM-74-11335)

NWS CR 56 The Prediction of Daily Drying Rates. Jerry D. Hill. Nov. 1974. (COM-74-11806)

NWS CR 57 Summer Radar Echo Distribution Around Limon, Colorado. Thomas D. Karr and Ronald L. Wooten. Nov. 1974. (COM-75-10076)

NWS CR 58 Guidelines for Flash Flood and Small Tributary Flood Prediction. Lawrence A. Hughes and Lawrence L. Longsdorf. October 1975
NWS CR 58rev (PR247569/AS) NWS CR 58(revised) March 1978 (PB281461/AS)

NWS CR 59 Hourly Cumulative Totals of Rainfall - Black Hills Flash Flood June 9-10, 1972. Don K. Halligan and Lawrence L. Longsdorf (PB256087)

NWS CR 60 Meteorological Effects on the Drift of Chemical Sprays. J. D. Hill. July 1976. (PB259593)

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NWS CR 63 A Program of Chart Analysis (with some diagnostic and forecast implications). Lawrence A. Hughes. March 1978 (PB279866)

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NWS CR 67 An Explanation of the Standard Hydrologic Exchange Format (SHEF) and its Implementation in the Central Region. G. Bonnin and R. Cox. April 1983 (PB83193623)

NWS CR 68 The Posting of SHEF Data to the RFC Gateway Database. G. Bonnin. April 1983 (PB83 222554)

NWS CR 69 Some Basic Elements of Thunderstorm Forecasting. May 1983. Richard P. McNulty (PB83 222604)

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