IMAGE DISPLAY AND MANIPULATION SYSTEM

(IDAMS)

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USER'S GUIDE

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IMAGE DISPLAY AND MANIPULATION SYSTEM

(IDAMS)

USER'S GUIDE

Prepared by

COMPUTER SCIENCES CORPORATION

For

GODDARD SPACE FLIGHT CENTER

Under

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ABSTRACT

This document is intended as a combination operator's guide and user's handbook for the Image Display and Manipulation System (IDAMS). Information is presented to define how to operate the computer equipment, how to structure a run deck, and how to select parameters necessary for executing a sequence of IDAMS task routines. If more detailed information is needed on any IDAMS program, see the IDAMS Program Documentation.

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SECTION 1 - INTRODUCTION

1.1 SUMMARY

The Image Display and Manipulation System (IDAMS) User's Guide provides concise instructions for the operation of the IDAMS system. Section 2 briefly discusses the CDC Real-Time Scope operating system, the overlay structure, IDAMS core requirements, and the IDAMS hardware configuration. Section 3 describes procedures for operation of the system and contains illustrations of typical run decks for the user's reference. Section 4 briefly describes the function of each task program and defines the special parameters required for that routine. Section 5 contains a list of messages that may be encountered in the operation of the system.

1.2 CAPABILITIES

IDAMS consists of a modular package of task routines which perform a wide range of image processing operations. These tasks can be combined in any way the user desires, as long as he provides for required inputs and outputs. A short functional description of each task is given below:

1. BATCH - IDAMS task entry module. This is an executive control program and is not callable as a task.
2. TESTGN - Special purpose test pattern generator.
3. LIST - Program to list an IDAMS tape on the line printer in integer format.
4. CONTRAST - Position-independent radiometric correction routine.
5. CONVOLVE - Two-dimensional image convolution program.

6. EXPAND - Program to enlarge an image using a set of weights to specify an arbitrary interpolation scheme.

7. SHADE - Position dependent radiometric correction routine.

8. FFT - One- or two-dimensional Fast Fourier transformation routine.

9. FPCON - General purpose conversion routine for transferring and/or converting floating-point data between tape and disk.

10. SMOOTH - Task routine for performing a convolution on a floating-point array on disk using a symmetric weight matrix.

11. CXPACK - Program used for converting between a symmetric half-array representation of Fourier components of a real array and packed representation, both on disk.

12. ERROR - Executive message generator which is not callable as a task.

13. REDUCE - Program to reduce image size by straight averaging.

14. HISTO - Histogram and image statistics generator.

15. CHAROUT - Program to print a graphic version of a tape image on the line printer.

16. TEXTGN - Text generator to add alphanumeric annotation to the picture.

17.	NEIGHBOR	- Program to print from an IDAMS tape, a neighborhood of pixels about a specified point.
18.	DISPLAY	- IDAMS interactive display program package, used for working with the color and B/W monitors.
19.	MODIFY	- Tape image editor, used to make corrections to individual pixels or lines of an image.
20.	INSERT	- Window insertion and mosaicking routine.
21.	GRID	- Grid overlay generating program.
22.	GEOMTRAN	- Generalized geometric transformation and image rotation program.
23.	CHIPGN	- Reference chip generation and update routine.
24.	RZOMAP	- Reseau detector for Return Beam Vidicon (RBV) imagery.
25.	CORREL	- Image correlation routine.
26.	RESECT	- Spatial resection program.
27.	UTMGEO	- UTM to Lat/Long, Lat/Long to UTM conversion routine.
28.	FPMULT	- Floating point array multiplication routine.
29.	FPSUM	- Floating point array addition or differencing routine.
30.	FILTGN	- Filter generation program.
31.	RANDGRAY	- Random gray level generator.
32.	IMERGE	- ERTS bulk image to IDAMS tape reformatting routine.

33.	PMERGE	- ERTS precision image to IDAMS tape reformatting routine.
34.	PPUPDATE	- Disk editing and update program for files used in precision processing.
35.	VPICIN	- VICAR (JPL image processing system) to IDAMS tape reformatting routine.
36.	INCREASE	- Program to increase the size of an image without interpolation.
37.	COLOR	- False color encoding routine.
38.	FPLIST	- Floating point listing utility program.
39.	DMDOUT	- IDAMS to Digital Muirhead Display tape conversion program.
40.	ADDPIX	- Picture addition program.
41.	FORMAT	- IDAMS to rectangle image format and vice versa.
42.	HISTCONT	- Histogram-contract correction program for 6-scan line problem.
43.	JOYSTICK	- Interactive display program with joystick capabilities.
44.	MSSCON	- Special-purpose convolution program for 6-scan line problem.

SECTION 2 - SYSTEM REQUIREMENTS

2.1 OPERATING SYSTEM

The IDAMS system has been designed to operate under the CDC Real-Time Scope 1.2 Operating System. RTS 1.2 was chosen to minimize operating system core requirements.

2.2 CORE REQUIREMENTS

A minimum of 16K words of core is required to execute an IDAMS task. However, additional core could be easily utilized to greatly enhance overall system efficiency.

2.3 HARDWARE CONFIGURATION

The present version of the IDAMS system has been designed to operate on the CDC 3200 using the RTS 1.2 Operating System. The hardware available for the IDAMS System is listed in Table 2-1 below, and the interrelationship of the equipment is shown schematically in Figure 2-1:

Table 2-1. IDAMS Hardware

CDC 3200 Central Processing Unit	5 Magnetic Tape Units
3200 Console	CDC 212 Display Equipment, Model 3291-A
Console Typewriter	Color CRT
Reader	Black and White CRT
Printer	IDAMS System Panel
Card Punch	Display Disk Drives
Disk Drive	

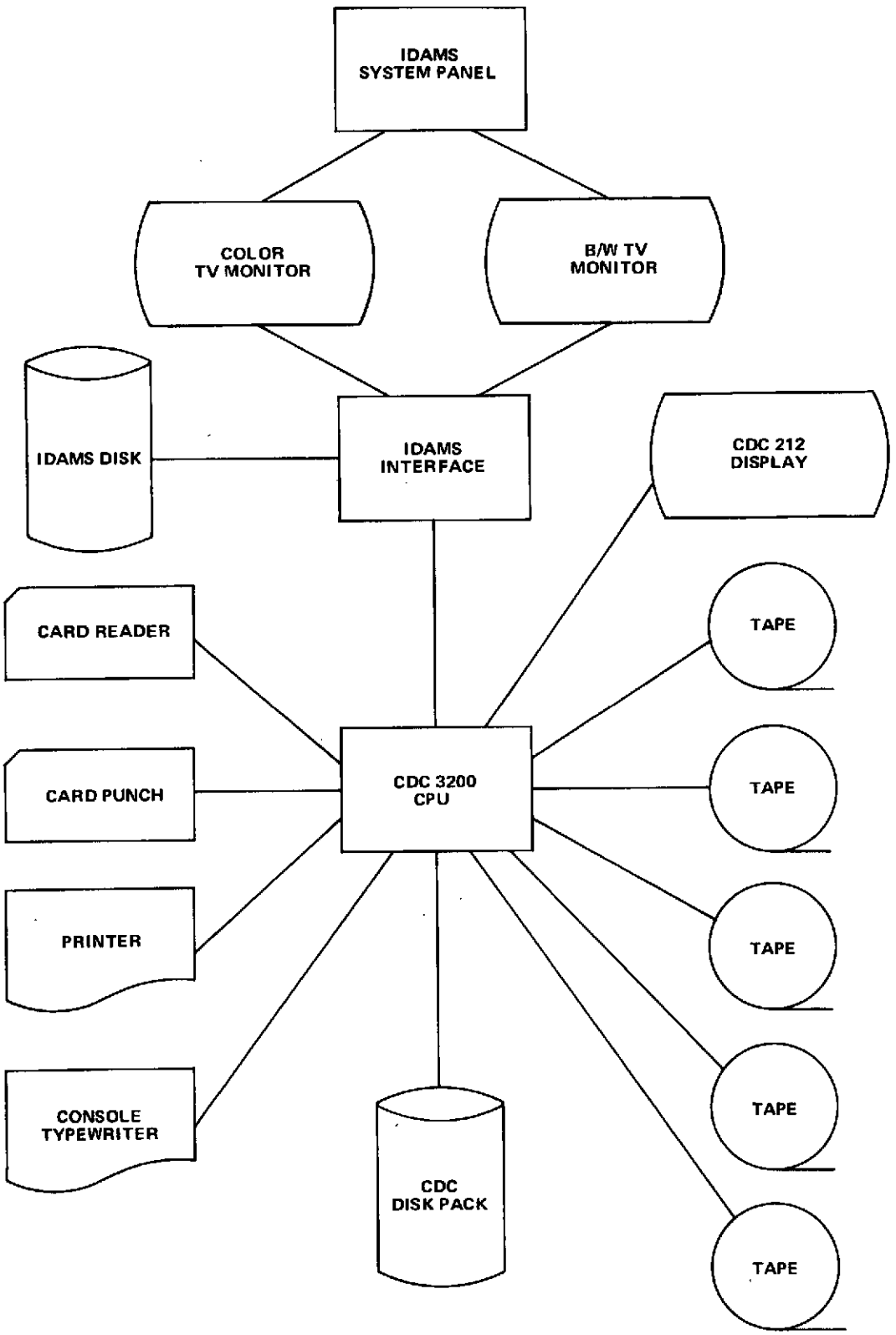


Figure 2-1. IDAMS Hardware Configuration

SECTION 3 - RUN PROCEDURES

3.1 INTRODUCTION

Normal operation of the IDAMS System will require very little operator intervention. Most of the effort will be in mounting and demounting image tapes between the various processing steps. The task cards that make up the input data deck maintain overall control of an IDAMS run. The processor brings each task to be executed into core from an overlay tape, which is separate from any data tapes being used.

3.2 GENERAL INSTRUCTIONS

The RTS Operating System will reside on the magnetic tape assigned to Channel 1, Unit 0. IDAMS programs will be stored on an overlay tape to be mounted on LUN (logical unit) 54, arbitrarily assigned to Channel 5, Unit 3. Remaining tape drives may be used for input and/or output image tapes. In addition, a scratch pack must be mounted on the disk drive.

3.3 INITIATING AN IDAMS RUN

It is the responsibility of the user to supply a correct IDAMS run deck and overlay tape. The operator should perform the following steps:

STEP 1 — Place the IDAMS run deck into the card reader and press AUTO.

STEP 2 — Check the system tape mounted on Channel 1, Unit 0 to be sure it is marked RTS 1.2.

STEP 3 — Make sure the disk drive is in READY status.

STEP 4 — If necessary, load the system into core by performing the following steps:

a. Press STOP, MC, AUTOLOAD on the 3200 Console

b. Wait for DATE to be typed.

Press FINISH on the Console Typewriter keyboard.

The JOB, SEQUENCE, and EQUIP control cards will now be read, typed on the console typewriter, and listed on the printer.

STEP 5 Following the typewriter message, READY?, load the designated overlay tape on Channel 5, Unit 3 and any data tapes which may be provided on the indicated tape units.

STEP 6 Press FINISH on the Console Typewriter.

STEP 7 The operating system will now build an overlay tape from input binary decks, if necessary, then pass control to the IDAMS executive after typing "RUN,n" on the console typewriter. The first IDAMS message

IDAMS PROCESSOR - CARD MODE

will now be typed. If the first data card contains a task name, the next message will be

THIS IS taskname

If a switch is to be made to interactive mode, the following lines will be typed

NOW SWITCHING TO INTERACTIVE MODE
IDAMS PROCESSOR - INTERACTIVE MODE

STEP 8 As execution of each task begins, the message

THIS IS taskname

will be typed until the job ends either normally or abnormally, at which time one of two messages

will be typed. For normal terminations the message is

NORMAL END OF JOB

For abnormal terminations the message will be of the following form

FATAL ERROR IN taskname
ERROR CODE AND MEANING FOLLOW
IEROR = nnnnn
(One line description of error, see Section 5)

3.4 SPECIAL INSTRUCTIONS FOR THE 212 USER AND THE DISPLAY USER

3.4.1 Instructions for the 212 User

The IDAMS package has been written to normally execute in a batch mode. In order to enter task and parameter data through the 212 Display Station, a special task card with the word SWITCH must be inserted into the data card deck at the appropriate point to switch the input medium from the card reader to the 212 display station. The 212 should be powered on and ready before any attempt to switch to it is made. The messages

SWITCH
NOW SWITCHING MODES
IDAMS PROCESSOR - INTERACTIVE MODE
READY FOR INPUT

will now be presented on the 212, after which task and parameter card data may be entered in the same format as card input as long as each line is restricted to 50 characters or less.

3.4.2 Instructions for the DISPLAY User

In order to operate the DISPLAY task, certain components of the DISPLAY hardware must be powered on and properly connected to the CDC 3200. The following checks should be made by the user prior to referencing DISPLAY.

1. The user must verify that the proper patch panel has been inserted into the IDAMS Terminal Rack (the equipment box to the left of the IDAMS Control Panel). The patch panel is located in the bottom left corner of the left side of the terminal rack. There are two patches that fit into this panel. In order to operate DISPLAY, the multicolored patch panel which is marked DISPLAY, must be connected to the terminal rack. The user must switch the patch panels if the wrong patch panel is connected. (Note: When an attempt is made to operate DISPLAY with the wrong patch panel connected, the IDAMS function code table never appears on the 212. The job must be reloaded if the patch panel is switched after referencing the DISPLAY task).

2. The TV connect switch must be switched "on." This switch is located in the upper left corner of the IDAMS Control Panel, the equipment located to the left of the TV's. If this switch is in the disconnect position, images cannot be dropped onto the TV.

3. The two TV sets should be powered on. The color TV control is in the bottom left corner of the TV. It must be turned to the channel marked "B." The black and white TV has an on/off control on the right side of the TV control panel.

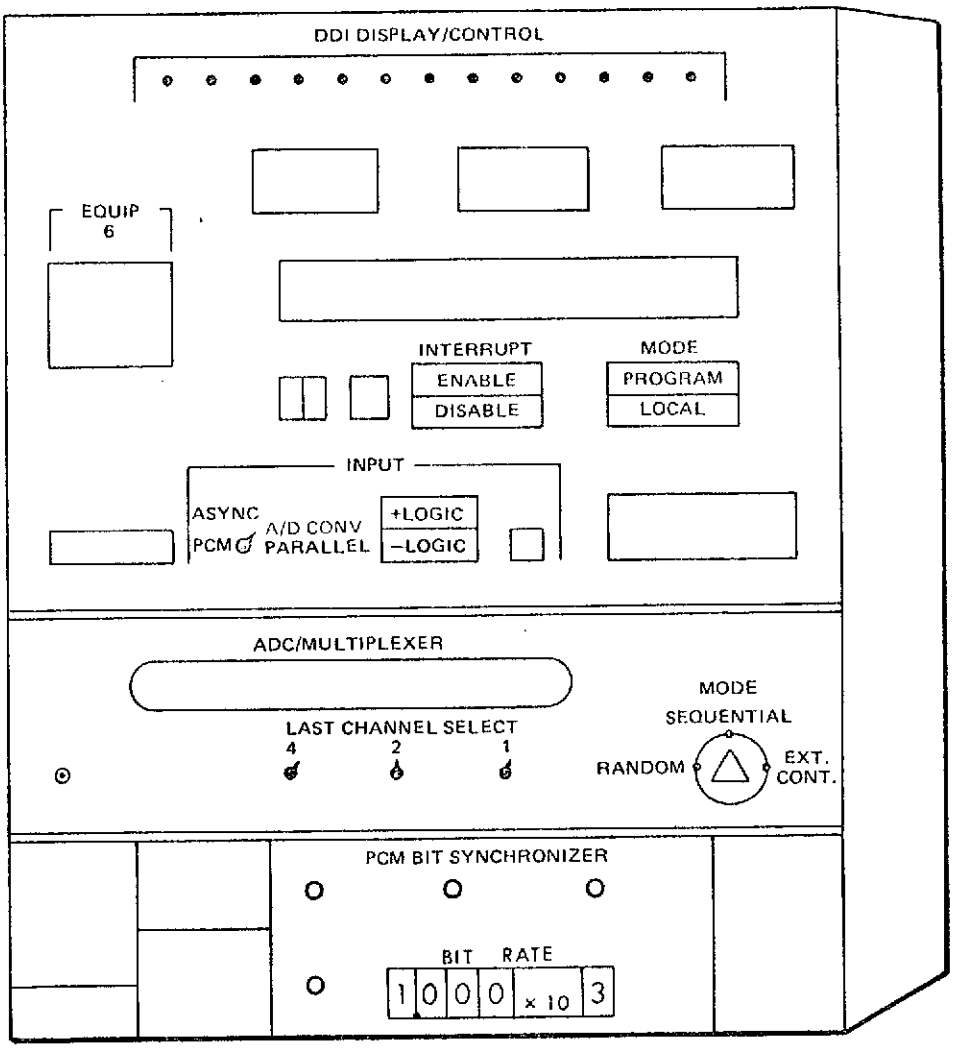
3.4.3 Instructions for the JOYSTICK User

If the user is referencing task JOYSTICK, then the Digital Data Interpreter (DDI) must be checked to assure that the relevant switches are correctly set. The DDI, which is situated along the north side of the computer room,consists

of three units: the DDI Display/Control, the ADC/Multiplexer and the PCM Bit Synchronizer. A diagram of the three units with the switches which must be properly set is given in Figure 3-1.1, along with a table indicating the proper switch setting. All other switch settings are inconsequential.

3.5 CDC JOB CONTROL CARDS

A standard set of CDC control cards is used to execute the various tasks in the IDAMS Processor. Data cards control entirely the selection of a particular sequence of tasks for execution from the available programs on the overlay tape (the cards are described in Section 4). Figure 3-1 shows a typical deck structure as it would look for a run utilizing an existing overlay tape.



SWITCH SETTINGS

DDI UNIT	SWITCH NAME	SETTING
DDI DISPLAY/CONTROL	INTERRUPT	DISABLE
DDI DISPLAY/CONTROL	MODE	PROGRAM
DDI DISPLAY/CONTROL	INPUT	A/D CONV
DDI DISPLAY/CONTROL	LOGIC	+ LOGIC
DDI DISPLAY/CONTROL	EQUIP	6
ADC/MULTIPLEXER	LAST CHANNEL SELECT	ALL TOGGLE SWITCHES UP
ADC/MULTIPLEXER	MODE	SEQUENTIAL
PCM BIT SYNCHRONIZER	BIT RATE	1.000×10^3

Figure 3-1.1. Digital Data Interpreter

```
77
88          (End of file card)

(Data cards, see Figure 3-3)

7
9 RUN,15

(Overlay cards and decks, if needed.  See Figure 3-2)

(Core resident programs)

0
7           (Main Overlay Card)    Note: 0/7 = 12-0-7-9 Punch

7
9 EQUIP,54=MTC5E0U03,45=63

7
9 EQUIP,47=MTC5E0U02,48=MTC1E0U01,49=MTC1E0U02

7
9 JOB,IDAMS,,,NP,ND

7
9 SEQUENCE,001
```

Figure 3-1. IDAMS Processor Deck Structure

3.5.1 Sequence Card

The first card in any job must be the SEQUENCE card. Its format is:

```
7
9 SEQUENCE,j
```

where j is any 1-to-3 digit sequence number.

3.5.2 Job Card

The second card must always be a JOB card. The format is:

```
7
9 JOB,IDAMS,,,NP,ND
```

The name IDAMS is an arbitrary job name. NP and ND are special parameters used to free additional core and are required.

3.5.3 Equip Card

The EQUIP cards shown next in Figure 3-1 are used to assign physical units to logical units. (All EQUIP specifications may be combined on a single card if so desired.) The general format is:

```
7
9 EQUIP,Lun=MTCcE0Uuu
```

where,

Lun	=	LOGICAL UNIT NUMBER 1-56
c	=	CHANNEL NUMBER 0-7
uu	=	UNIT (DEVICE) NUMBER 00-77

Channel and unit assignments are arbitrary, but within the IDAMS Processor these conventions have been adopted:

1. a. Overlay tape - LUN 54, Channel 5, Unit 03
   b. Special input tape - LUN 54, Channel 5, Unit 03

2. Standard input tape - LUN 49, Channel 1, Unit 02

3. Standard output tape - LUN 47, Channel 5, Unit 02

4. Scratch or intermediate tape - LUN 48, Channel 1, Unit 01

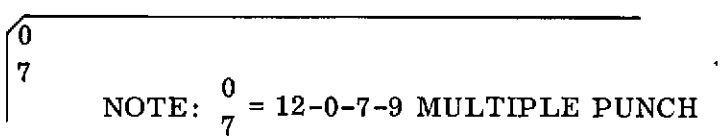
5. a. RTS System tape - LUN 63, Channel 1, Unit 00

   b. Special input tape - LUN 45, Channel 1, Unit 00

This configuration permits execution of COMPASS and FORTRAN jobs between IDAMS Processor runs with a minimum of tape handling. Except for the system and overlay tapes, selection of logical unit numbers is at the discretion of the user.

3.5.4 Main Overlay Card and Deck

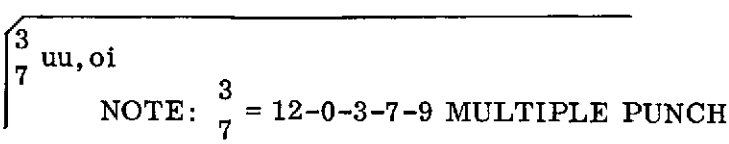
The MAIN overlay card appears next in the card sequence and is required for every run. Its format is as follows:



This card defines the core resident portion of the IDAMS Processor. The binary decks for DRIVER and the general purpose subroutines must follow immediately.

3.5.5 Overlay Card

Every task within the IDAMS Processor is in a separate overlay. Each overlay is headed by an overlay control card formatted as follows:



where

uu = Logical unit used to store the overlay (=54)

oi = Overlay identification (01-99)

Currently, these overlay assignments have been made as follows in Table 3-1.

Table 3-1. Overlay Assignments

Overlay ID	Task Name	Overlay ID	Task Name	Overlay ID	Task Name
01	BATCH	21	GRID	41	FORMAT
02	TESTGN	22	GEOMTRAN	42	HISTCONT
03	LIST	23	CHIPGN	43	JOYSTICK
04	CONTRAST	24	RZOMAP	44	MSSCON
05	CONVOLVE	25	CORREL	45	TEST45
06	EXPAND	26	RESECT	46	TEST46
07	SHADE	27	UTMGEO	47	TEST47
08	FFT	28	FPMULT	48	TEST48
09	FPCON	29	FPSUM	49	TEST49
10	SMOOTH	30	FILTGN	50	TEST50
11	CXPACK	31	RANDGRAY	51	TEST51
12	ERROR	32	IMERGE	52	TEST52
13	REDUCE	33	PMERGE	53	TEST53
14	HISTO	34	PPUPDATE	54	TEST54
15	CHAROUT	35	VPICIN	55	TEST55
16	TEXTGN	36	INCREASE	56	TEST56
17	NEIGHBOR	37	COLOR	57	TEST57
18	DISPLAY	38	FPLIST	58	TEST58
19	MODIFY	39	DMDOUT	59	TEST59
20	INSERT	40	ADDPIX	60	TEST60
				61	TEST61
				62	TEST62
				63	TEST63
				64	TEST64

The individual overlays need only be run as part of the job when the overlay tape is not usable (e.g., out of date) in its current form. Numerical order of overlays is not required; instead the overlay tape should be built with most frequently used programs placed first for maximum efficiency. BATCH and ERROR should always be 1-2 in the deck structure.

3.5.6 Segment Card

Very large overlays require the use of one or more segments in order to fit within core. When segmentation is necessary, the binary decks for each subsection of the task program must be preceded by a segment card with the following format:

$$\begin{cases} {}^{2}_{7}\ \text{uu, oi} \\ \end{cases} \qquad \text{NOTE: } {}^{2}_{7} = \text{12-0-2-7-9 MULTIPLE PUNCH}$$

where

uu = Logical unit used to store the overlay (=54)

oi = Overlay identification

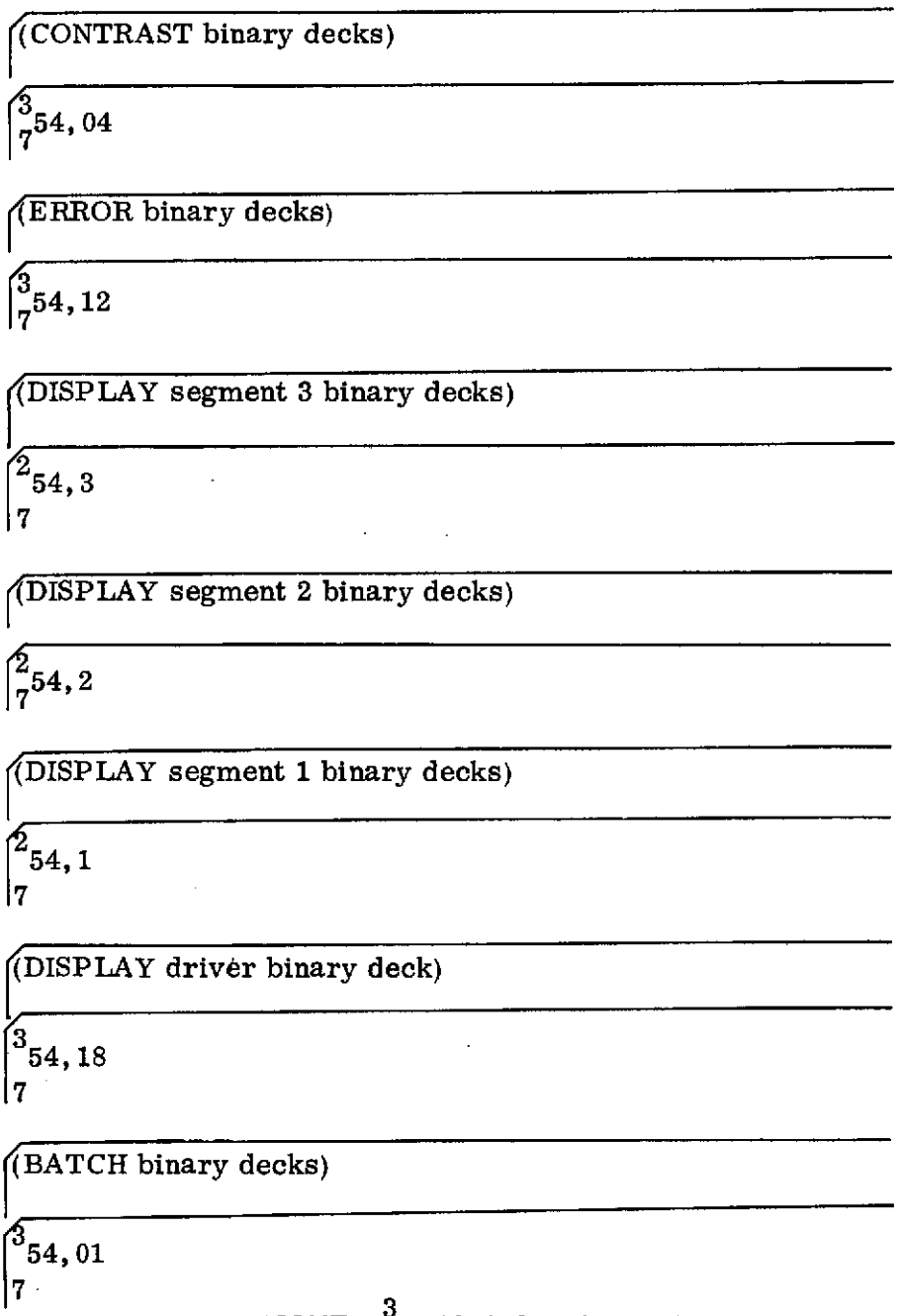
The first card in any overlay deck must be an overlay control card followed by at least one binary program deck which then may be followed by 1-99 segment cards and their associated binary decks.

An example of overlay and segment cards to build an overlay tape containing a subset of the IDAMS system is shown in Figure 3-2.

3.5.7 Run Card

The next card in the sequence is the run card, which causes program execution to begin. It has the following format:

$$\begin{cases} {}^{7}_{9}\ \text{RUN, mm} \end{cases}$$



NOTE: $\begin{smallmatrix}3\\7\end{smallmatrix}$ = 12-0-3-7-9 Punch

$\begin{smallmatrix}2\\7\end{smallmatrix}$ = 12-0-2-7-9 Punch

Figure 3-2. Representative IDAMS Overlay Deck, Including Segments

where

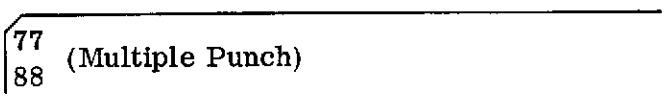
mm = run time limit in minutes

3.5.8 Data Cards

To perform any sort of image manipulation using the IDAMS Processor, the user must supply a series of data cards to specify which tasks are to be executed and to provide data parameters for the use of each task being called, as shown in Figure 3-3. These cards are fully described in Section 4.

3.5.9 EOF Card

The CDC operating system requires that the last card in any job deck be an EOF card. It has the following format:



```
77
88          (EOF card)
END
2
LIST, (EXPAN1,49,1), (1,1,100,100),,1
3,3,1,1,2,2,4
EXPAND, (CONV1,47,1), (1,1,100,100), (EXPAN1,49,1),1
LIST, (CONV1,47,1), (1,1,100,100)
2,3,3,0,1,1,2,2,4
CONVOLVE, (TEST1,49,1),(1,1,100,100),(CONV1,47,1),1
7
9RUN,10
```

Figure 3-3. Typical IDAMS Data Card Deck

SECTION 4 - IDAMS DATA DECK PREPARATION

4.1 INTRODUCTION

To perform any sort of image manipulation using the IDAMS Processor, the user must supply a series of data cards to specify which tasks are to be executed and to provide data parameters for the use of each task being called. A typical card deck was shown in Figure 3-3. If the 212 Display Station is to be used for input, card images up to 50 characters long may be supplied in place of data cards.

Two general formats are used for all tasks, the task card format and parameter card format. These formats are discussed in Sections 4.2 and 4.3. In addition to parameter data, other types of task-dependent input may be needed. Input and output tapes in IDAMS format are commonly used. IDAMS format is described in Section 4.4. Certain routines handle tapes in specialized format but unless specifically stated otherwise, all tapes should be assumed to be in IDAMS format.

A few task routines, such as FPCON, which convert data from one representation to another, FFT, CXPACK, SMOOTH, and RESECT, expect input from disk. Normally, prior execution of one of the IDAMS Processor tasks, either in the current job or an earlier one, creates the disk input. There is no need to specify disk input or output explicitly as parameter information to any task.

4.2 TASK CARD

The task card is used to define which task program is to be executed and to provide information for tape I/O, when required.

This card follows a free format. Fields and subfields are expected in a specific order, outlined below, but exact column alignment is not necessary. Only the task name is mandatory in all cases.

Field	1. TASKNAME	2. INPUT
	NAME,	(TAPEIN, LUNIN, FILEIN, TAPIN2, LUNIN2, FILIN2), *

Field	3. SIZE	4. OUTPUT	5. CARDS
	(SP, SL, NP, NL),	(TAPOUT, LUNOUT, FILOUT),	COUNT

where,

Field

1. TASKNAME is one of the predefined IDAMS task names (1-8 A/N).

2. INPUT defines the input files to be used, if any. This field consists of either three or six subfields enclosed in parentheses and separated by commas, as follows:

   Subfield

   1. TAPEIN - Primary input tape name (1-8 A/N, first letter alphabetic)
   2. LUNIN - Primary input tape logical unit number (1-55)
   3. FILEIN - Primary input tape file number (1-999)
   4. TAPIN2 - Secondary input tape name (1-8 A/N, first letter alphabetic)
   5. LUNIN2 - Secondary input tape logical unit number (1-55)
   6. FILIN2 - Secondary input tape file number (1-999)

   Subfields 4-6 may be omitted if no secondary input tape is needed and Subfields 1-6 may be omitted if no primary input tape is needed.

3. SIZE defines a subset of the primary input to be used for processing. This field has the following subfields enclosed in parentheses:

   Subfield

   1. SP - Starting pixel relative to beginning of input tape records (default = 1)
   2. SL - Starting line relative to beginning of input tape file (default = 1)
   3. NP - Number of pixels to process, beginning at pixel SP
      This subfield will default to NPI, the total number of pixels per line of the primary input image.
   4. NL - Number of lines to process, beginning at line SL
      This subfield will default to NLI, the total number of lines in the primary input image.

   Any subfield may be defaulted as long as missing subfields are set off by commas. If all subfields are defaulted, replace the entire field with one comma.

4. OUTPUT defines the output file to be used if any. This field consists of three subfields as follows:

   Subfield

   1. TAPOUT - Output tape name (1-8 A/N, first letter alphabetic)
   2. LUNOUT - Output tape logical unit number (1-55)
   3. FILOUT - Output tape file number (1-999)

   If no output tape is needed, omit the entire OUTPUT field, but set it off with a comma.

5. CARDS is a one word integer field which gives the number of following parameter cards required by the current task.

NOTE: Since only the task name field is required, the simplest possible task card would be one with only the task name punched into it (defaulted fields at the end of a task card may be omitted entirely).

In addition to the normal use of task cards to select a particular applications program for execution, three special uses are currently defined. These are NOTE, WAIT, and END.

The NOTE card is used for adding comments to the stream of source language data. The task name field must contain the word NOTE, but any valid text information may be entered next. Continuation lines are permitted. When this card image is read or input through the 212 display, its contents are output to the 212 and the line printer.

The WAIT card permits the system to automatically execute a PAUSE and wait for operator intervention at the console typewriter. This ability is handy if tape mounts and demounts are necessary between processing steps. The task name field must contain the word WAIT, but variable text information (possibly operator instructions) may be included in the remainder of the card image. Input data is output to the console typewriter, 212 display, and the line printer.

The END card is used to signal the end of task and parameter data. END is used in place of the task name. There are no other fields.

4.3 PARAMETER CARDS

Parameters are supplied in the order required by individual tasks in free format. Unused parameter fields must be set off by commas except that trailing parameters which are not used may be omitted. If no special parameters are required for the task to be executed, the entire card may be left out. There may be up to 50 parameter cards for one task.

A description of the specific parameters required by the various tasks in the IDAMS Processor are described in the following paragraphs.

4.3.1 BATCH Parameters

Execution of this task is automatic. Therefore, no task card and no parameters are necessary.

4.3.2 TESTGN Parameters

This is a special purpose task to generate a 340 pixel by 270 line test pattern of horizontal, vertical, and diagonal bars and a series of 20 by 20 gray blocks ranging from 0 to 63 on an IDAMS output tape. There are no parameters although an output tape must be defined on the task card.

4.3.3 LIST Parameters

This program will print all or part of an input tape on the line printer in integer format. Two optional parameters may be supplied in addition to defining a primary input tape. These are:

1. ISKIP = interval between lines of input to be printed (1 or 0 implies all lines are to be printed).
2. IBLOCK = block list option. If = 1, data is packed without horizontal and vertical spacing. If zero or blank, normal spacing is used.

4.3.4 CONTRAST Parameters

This program will alter gray level values of a picture using either a standard internal table, a user-supplied table, or a table generated from a piecewise linear graph specified by pairs of old and new values. An input and output tape must be defined on the task card. CONTRAST can also be used to truncate 1 to 5 of the least significant bits in each pixel. If the internal conversion table is to be used, no special parameters are necessary. Otherwise, they should be included as shown on the following page.

1. N = 0, if standard (internal) table of new values is to be used.

   N = 1, if a user-supplied (external) table of values is to be used.

   $2 \leq N \leq 11$, if paired coordinate points of old and new values are to be used.

   $-5 \leq N \leq -1$, if +N low order bits are to be truncated from each pixel.

2.,... Not used if $N \leq 0$. When N = 1, a table of 64 new values must be supplied.

   When $N \geq 2$, N pairs of old, new points are expected.

4.3.5 CONVOLVE Parameters

This task routine will convolve an image with a set of weights. The convolution program requires that an input and output tape, six special parameters, and a table of weights be defined. In addition, full use of the CDC disk pack is required as a scratch area. The special parameters and weight table are provided on the parameter card in the following order:

1. NX = X-dimension of weight array
2. NY = Y-dimension of weight array
3. INCRX = spacing between output pixels
4. INCRY = spacing between output lines
5. IDIV = quantity by which input integer weights are to be divided to generate normalized fractional weights. If = 0, divide by sum of weights.
6. ISYM = 0, if full weight table supplied
   = 1, if only upper left quadrant supplied
7.,... IWGHTS = NX*NY or ((NX+1)/2)* ((NY+1)/2) weight values for ISYM = 0 or 1, respectively.

4.3.6 EXPAND Parameters

EXPAND is a task routine for generating an expanded image using a given set of weights. The program requires an input and output tape, six single parameters and a table of weights. The special parameters and weight table are supplied in the following manner:

1. NX = X-dimension of weight table
2. NY = Y-dimension of weight table
3. MX = magnification desired along X axis
4. MY = magnification desired along Y axis
5. IDIV = value by which each integer weight is to be divided for normalization
6. ISYM = 0, if full weight table supplied
   = 1, if only upper left quadrant supplied
7.,... TABLE = NX*NY or ((NX+1)/2)* ((NY+1)/2) weight values for ISYM = 0 or 1, respectively.

4.3.7 SHADE Parameters

SHADE, a position-dependent radiometric correction program, requires an input and output tape, eight special parameters, and a table of calibration values. The special parameters and calibration table are specified as follows:

1. INITX = X-coordinate of upper left calibration point
2. INITY = Y-coordinate of upper left calibration point
3. INCRX = spacing between sample points in calibration grid
4. INCRY = spacing between sample lines in calibration grid
5. NX = number of columns in grid
6. NY = number of rows in grid

7. LEVEL1 = lower true gray level used for calibration

8. LEVEL2 = upper true gray level used for calibration

9.,... LMEAS = 2*NX*NY measured gray-level values (integer format with two implied decimal places); value corresponding to level 1 comes first in each pair

4.3.8 FFT Parameters

FFT will perform a one- or two-dimensional Fast Fourier transform on a complex array, maximum size 1024. This routine requires full use of the CDC disk pack for temporary storage and as an input/output area. These special parameters are needed:

1. MX = $\log_2$NX, where NX is the number of columns in the array on disk

2. MY = $\log_2$NY, where NY is the number of rows in the array on disk

3. IDIM = dimension of FFT required
   1 = one-dimensional, FFT performed along rows only
   2 = two-dimensional, FFT performed along rows and columns

4. ISIGN = sign of exponential function
   -1 = use negative sign, normally used for direct transform
   +1 = use positive sign, normally used for inverse transform

4.3.9 FPCON Parameters

FPCON is a general purpose conversion routine for transferring floating-point data between tape and disk, and carrying out the required conversions. The need for defining input and/or output tapes on the task card is dependent on which

conversion codes are selected. The two following special parameters and a list of 1-5 transfer/conversion codes are necessary for execution:

1. NX = number of complex values per line of packed array on disk. NX is one-half the number of pixels per line of a real image, scaled (six-bit) array, and power-spectrum or autocorrelation array. NX must be a power of 2; $2^2 \leq NX \leq 2^9$

2. NY = number of lines in array. NY must be a power of 2; $2^0 \leq NY \leq 2^9$

3-7. ICODE = one to five codes each specifying a transfer/conversion step. ICODE values have the following meanings:

ICODE	Meaning
0	Terminate conversion/transmission
1	Six-bit image data to floating point on disk (implicit packing into complex)
2	Six-bit linear scaled data to first half-word of complex on disk
3	Six-bit linear scaled data to second half-word of complex on disk
4	Six-bit log scaled data to first half-word
5	Six-bit log scaled data to second half-word of complex on disk
6	Floating-point tape to disk (implicit packing into complex)
7	Complex modulus-plus-phase to complex real-plus-imaginary
8	Modulus to modulus squared

ICODE	Meaning
9	Shift full real array with center origin into same with origin at corner
10	Modulus-plus-phase to full real array of modulus
11-19	Inverse of 1-9, respectively
20	Complex modulus-plus-phase to full real array of modulus squared
21	Disk to printer floating point listing
22	Tape to printer floating point listing

4.3.10 SMOOTH Parameters

SMOOTH is a task routine for performing a convolution on a floating point array on disk using a symmetric 3 x 3 or 5 x 5 weight matrix. No tapes are used. The special parameters are:

1. NX = number of real values per line of data on disk
2. NY = number of lines of data on disk
3. IDIM = dimension of weight matrix (3 or 5)
4. IDIV = divisor of weights
5.,... IWGHTS = four (IDIM = 3) or nine (IDIM = 5) integers representing weights in the upper left quadrant of the weight table; these values will be converted to floating point by IDIV to form normalized weights.

4.3.11 CXPACK Parameters

This is a task program for converting between a symmetric half-array representation of Fourier components of a real array and packed representation.

Disk is used for input and output; no tapes are involved. Three parameters are needed:

1. MX = $\log_2$ of the number of complex words per line of packed array
2. MY = $\log_2$ of number of lines in array
3. IUNPCK = conversion code
   0 = pack
   1 = unpack

4.3.12 ERROR Parameters

The message processing program is executed automatically and requires no task card and no parameters.

4.3.13 REDUCE Parameters

This program reduces the size of a specified area of an IDAMS input tape image by the smallest integer factor which will just permit it to fit within a specified output area. The reduction is achieved by a straight averaging of input pixels. Edge fill is used if necessary to extend the output image to the specified size. Input and output are IDAMS format tapes. The parameters are:

1. NPO = Number of pixels per output line
2. NLO = Number of lines of output
3. IFILL = Gray level to use for edge fill, default = 0

4.3.14 HISTO Parameters

This task routine reads an IDAMS format tape and produces a printed listing of both a numeric table of intensity frequencies and a histogram of those frequencies. The mean, median, and standard deviation are also provided. There are no special parameters.

4.3.15 CHAROUT Parameters

CHAROUT will convert a selected portion of an IDAMS input tape image to alphanumeric format. The results are listed on the line printer and, optionally, also output to tape. A 64-position conversion table is stored internally or, alternatively, input as parameters.

1-64. Optional 64-position conversion table of alphanumeric characters to be printed. Default is an internal table. Character string, if supplied, must be input consecutively with no intervening blanks.

4.3.16 TEXTGN Parameters

This routine is used to generate one or more lines of text data of varying sizes for output to a blank tape or to combine with an input image tape. The input tape is optional although an output IDAMS format tape will always be created. The parameters are:

1. SPO = Starting pixel for left edge of text line(s)
2. SLO = Starting line for top edge of first line of text
3. ISIZE = Size of output characters. If ISIZE = 0, 1 or blank, each generated character will occupy an area of 8 pixels and 11 lines, including surrounding spacing. For ISIZE > 1, multiply the basic size by ISIZE.

4.,... Variable number of text lines, each on a separate data card. The first line is expected on the second parameter card.

4.3.17 NEIGHBOR Parameters

This task routine will read an IDAMS format tape and produce a printer listing of a neighborhood of pixels around a specified point. The parameters are:

1. IPIXL = Central pixel about which the neighborhood of points is to be listed

2. LINE = Central line about which points are to be listed

3. ISIZE = Size of array to be printed. ISIZE must be no longer than 40.

4.3.18 DISPLAY Parameters

DISPLAY calls the IDAMS display package whose parameters are provided interactively through the 212 Display Station. By specifying the name DISPLAY on the task card, the following function code table is displayed on the 212 screen.

IDAMS
FUNCTION CODES

BOXGEN	01	ENLARGE	04	LEFT	06
RESEAU	02	SHRINK	05	RIGHT	07
ERASE	03			UP	08
LOCATE	10			DOWN	09
DATA	11	ZOOM	17		
DATA1	12	EXIT	18	REWIND	13
SELECT	16			FORWARD	14
				REVERSE	15

In order to execute any one of the functions, the user must type in the corresponding numeric code and depress the SEND key. A description of each function is given below.

Code	Function	Description
01	BOXGEN	Generates a box, which, if no reseau mark is presently displayed on the TV, is centered on the TV screen and has the following (pixel, line) coordinates: upper left corner (283,206), upper right corner (421,206), lower left corner (283,306), and lower right corner (421,306). If

Code	Function	Description
01 (Cont'd)		a reseau mark is already displayed on the TV, a box (138 pixels by 100 lines) which will be located around the reseau coordinates, will replace the reseau mark. To alter the location and size of the box, refer to the functions LEFT, RIGHT, UP, DOWN, SHRINK, and ENLARGE.
02	RESEAU	Places a reseau mark on the TV screen which, if a box is not presently displayed on the TV, has the following (pixel, line) coordinates as its center: (357,256). If a box is already displayed on the TV, a reseau mark which is located at that the data contains 32 gray level values and, box. To manipulate the reseau's location, refer to the functions LEFT, RIGHT, UP, and DOWN.
03	ERASE	Removes a box or reseau mark from the TV.
04	ENLARGE	Increases the size of the box which is displayed on the TV. To stop the enlarging action, the user must depress the SEND key.
05	SHRINK	Reduces the size of the box which is displayed on the TV. To halt the shrinking action, the user must depress the SEND key.
06	LEFT	Moves the box or reseau mark to the left. The left action is halted by depressing the SEND key.
07	RIGHT	Moves the box or reseau mark to the right. The right action is halted by depressing the SEND key.

Code	Function	Description
08	UP	Moves the box or reseau mark upward. The upward action is halted by depressing the SEND key.
09	DOWN	Moves the box or reseau mark downward. The downward action is halted by depressing the SEND key.
10	LOCATE	Returns the coordinates of the box or reseau which is presently displayed on the TV screen. When the user wants to clear the coordinates from the 212 and have the function code table reappear, the SEND key must be depressed.
11	DATA	Drops an image tape file which contains 64 gray level data onto the TV. The program requests two input parameters. The tape unit on which the image tape is mounted must be keyed in after the request appears on the 212. After the SEND key is depressed, a request for the color gun number will appear. The TV has three TV refresher disk files available for image data storage and each disk can be assigned to one of the three available color guns (red, green, or blue). The color gun parameter is a value which determines which disk file(s) the user wants to use for storing an image. The parameter is an octal representation of a three-digit binary number, in which each digit corresponds to one of the disk files

Code	Function	Description
11 (Cont'd)		and the "on-off" conditions are represented by ones and zeros, respectively. The following table shows the correspondence between the color gun number, the disk assignments, and the binary number from which the parameter value was derived.

Color Gun Number	Disk File(s)	Binary Representation Disk 3	Disk 2	Disk 1
1	1	0	0	1
2	2	0	1	0
3	1 and 2	0	1	1
4	3	1	0	0
5	1 and 3	1	0	1
6	2 and 3	1	1	0
7	1, 2, and 3	1	1	1

Once the user has specified the disk file(s) into which the image data are to be stored and the SEND key has been depressed, the image will be dropped to the disk and displayed on the TV. The user can define which color is to be associated with each disk by manually setting the three color wheels switches on the IDAMS Control Panel. The three wheels, from left to right, represent the color guns of red, green, and blue, respectively. By setting the wheels to the appropriate disk number, the user has complete control over the color assignment of any image stored in the TV disk files.

Code	Function	Description
12	DATA1	Drops an image tape file onto the TV. The required parameters are described above under function code 11. DATA1 differs from DATA in that the data contains 32 gray level values and, therefore, the data words do not have the least significant bit shifted off. However, the most significant bit will be truncated since only five bits of data can be displayed at one time.
13	REWIND	Rewinds a requested tape. The program requests the logical unit number on which the required tape is mounted. After keying in the tape unit number and depressing the SEND key, the tape is rewound to loadpoint.
14	FORWARD	Forward spaces a tape a specified number of files. The program requests the logical unit number on which the required tape is mounted. After keying in the tape unit number, the program requests the number of files over which the tape is to space forward. Once the SEND key is depressed, the tape is forward spaced the specified number of files.
15	REVERSE	Backspaces a tape a specified number of files. The program requests the logical unit number on which the required tape is mounted. After keying in the tape unit number, the program requests the number of files over which the tape is to be backspaced. Once the SEND key is

Code	Function	Description
15 (Cont'd)		depressed, the tape is backspaced the specified number of files.
16	SELECT	Enables the user to select the coordinates of a box which is to be displayed on the TV. The program requests that the coordinates be input in the following order - leftmost pixel, rightmost pixel, top line, lower line. The line numbers should be paired even, or odd, but not mixed. This is a display hardware requirement. The parameters must be separated by commas and the final parameter must be followed by a blank. Any blanks placed between parameters are ignored.
17	ZOOM	Takes the area bound within a box on the TV image and increases or reduces it into a TV size image. The program requests the name of the image which is presently displayed on the TV. After entering in the name and depressing the SEND key, the TV image's tape unit is requested, and is followed by a request for the file number (be sure to specify the file number with two digits). A message reminding the user that the master tape must be mounted is displayed on the 212, and is followed by a request for the master tape's unit number and file number. Before the program begins the ZOOM procedure, information about the new output tape is requested. The user is asked to supply the output tape name, the

Code	Function	Description
17 (Cont'd)		unit number and the file number. The program requests that the user specify if the input parameters are believed to be correct. If a "Y" is returned, the program continues with the ZOOM process. However, if an "N" has been returned, the program begins the input parameter requests again. This gives the user, who is aware of an input parameter error, another chance to supply the correct input. (Note: After keying in the proper response to all requests, remember to press the SEND key.) The program will display on the TV whether an increase or reduction of the master image was necessary and the multiplication factor involved. The "ZOOMED" image will reside on the output tape when the program is completed, and the user must reference DATA when he wishes to drop the image onto the TV screen.
18	EXIT	Returns control to the IDAMS main driver program.

For special instructions pertaining to the operational procedures involved when using DISPLAY and the TV, refer to Section 3.4 (Special Instructions for the DISPLAY User).

4.3.19 MODIFY Parameters

MODIFY is a task routine which permits the user to edit individual lines and/or pixels in an IDAMS data tape. The supported functions are specified by keywords, followed by one or more edit parameters. These sets (S) must be supplied as follows:

1. S_1 = Function code--ADD, DEL, MODL, or MODP

   ADD - insert one or more new lines starting at a specified line number

   DEL - delete one or more lines, starting at a specified line number

   MODL - modify all or part of a line by averaging between the preceding and following lines

   MODP - replace one or more pixels in a line with an arbitrary input value

2. S_2 = Starting line number--This indicates the first line to be added, deleted, or modified

3. S_3 = Number of lines or value--For ADD and DEL, this field indicates the number of lines affected (default = 1)

For MODL, this field is always set to 1.

For MODP, this field contains an input value for the pixels being replaced (default = 0).

4. S_4 = Starting pixel--for MODL and MODP only, this field may be used to specify a starting pixel other than the beginning of the input line (default = SP from the task card). Not used for ADD and DEL.

5. S_5 = Number of pixels--for MODP and MODL, this field is used to specify a number of pixels no greater than the number in the input line (MODP default = 1, MODL default = NP from the task card). Not used for ADD and DEL.

NOTE: Modify has the following restrictions:

1. DEL used on the same line as MODL or MODP will abort the run.
2. MODL and MODP will edit only one line at a time.

4.3.20 INSERT Parameters

INSERT provides a capability for superimposing a portion of one image upon another. Two IDAMS image tapes are accepted as input with the primary input tape considered to be the base and the secondary input tape the window. A single composite IDAMS image is output. The SIZE field on the task card defines the portion of the input image to be processed. In addition, INSERT requires the following special parameters:

1. INSPW = Starting pixel of window in secondary input (default = 1)

2. INSLW = Starting line of window in secondary input (default = 1)

3. NPWNDW = Number of pixels of window in secondary input (default = total number of pixels from secondary input label)

4. NLWNDW = Number of lines of window in secondary input (default = total number of lines from secondary input label)

5. IOTSPW = Pixel position in output of upper left corner of window (default = 1)

6. IOTSLW = Line position in output of upper left corner of window (default = 1)

7. IFILL = Fill character to use if needed (default = 0)

4.3.21 GRID Parameters

This task routine superimposes a reference grid on an IDAMS image tape or creates an output grid only if no input is specified. The following special parameters are required in addition to defining input and output tapes on the task card:

1. JUNCP = Pixel number of first grid junction, default = (NPGRID + 1)/2

2. JUNCL = Line number of first grid junction, default = (NLGRID + 1)/2

3. NPGRID = Grid block width in pixels

4. NLGRID = Grid block length in pixels

5. LINSIZ = Grid line size, default = 1

6. LINLVL = Grid line gray level, default = 0 except when IFILL = 0, default = 63

7. IFILL = Fill character to use if no input data, default = 0

4.3.22 GEOMTRAN Parameters

GEOMTRAN is a generalized geometric transformation program used to approximate a wide range of non-linear transformations with piecewise linear transformations. This routine requires the use of five tape drives and the entire disk pack for auxiliary storage. Input and output tapes must be defined on the task card, together with the following special parameters:

1. SPO = Starting pixel for window in output
2. SLO = Starting line for window in output
3. NPO = Number of pixels for window in output
4. NLO = Number of lines for window in output
5. NOSEG = Number of line segments in mapping grid
6. NOPOT = Number of points in mapping grid
7. ICODE = 0, if parameters are to be input from cards
   1, if parameters are to be read from disk
8. SEG = Starting and ending points for each of the NOSEG line segments
9. XO, YO = Input pixel and line number for each of NOPOT grid points

(8+NOSEG*2). XP, YP = Output pixel and line number of each of NOPOT grid points

4.3.23 CHIPGN Parameters

CHIPGN is a task program which extracts one or more reference chips from an image and writes them onto a new reference tape or adds them to an existing reference tape. CHIPGN can also print out the directory of an existing reference chip tape. If a reference tape is being created, the user must specify

the source image as the primary input and the reference chip tape as the output. If a reference chip tape is being updated, the user must specify the source image as the primary input and the reference chip tape as the secondary input. No output tape is required. If the reference chip tape is to be listed only, the user must define it as the primary input with no other tape references. Parameters are supplied as keywords, followed by values to be given that keyword. All keywords and values are assembled into a parameter set associated with one chip until a keyword is found which logically belongs in a different set. Up to 99 chips may be added to a chip tape. The following necessary parameters can be input in any order:

1. CPP = nnnn--Pixel location on input image chip center

2. CPL = nnnn--Line location of chip center

3. LAT = dd,mm,ss.s$^{N}_{S}$--Geographic latitude in degrees, minutes, and seconds North or South. If the N/S designator is omitted, north latitude (+) is assumed unless the value is preceded by a minus sign. Degrees and decimal fraction is also acceptable.

4. LONG = ddd,mm,ss.s$^{E}_{W}$--Geographic longitude in degrees, minutes, and seconds East or West. If the E/W designator is omitted, east longitude is assumed unless the value is preceded by a minus sign.

5. ZONE = nn$^{N}_{S}$--UTM zone number. If the N/S designator is omitted, north is assumed unless the number is preceded by a minus sign.

6. UTME = nnnnnn--UTM Easting in meters. Zone central meridian = 500,000 meters.

7. UTMN = nnnnnnn--UTM Northing in meters, equals meters from Equator in northern hemisphere. In southern hemisphere, a false Northing of 10**7 meters is added so that grid distance from Equator equals UTMN - 10**7 meters.

8. ELEV = nnnnn--Elevation above sea level in meters.

9. MEMO = cc...cc--Up to 24 alphanumeric characters of identifying memorandum enclosed in quotes (optional field).

NOTE: If LAT and LONG are input, UTME, UTMN and ZONE must be omitted, and vice versa.

4.3.24 RZOMAP Parameters

This is a task routine used for locating reseaus on Return Beam Vidicon (RBV) imagery using a digital filter which is highly selective for vertical and horizontal bars. One IDAMS format input image, representing RBV sensor output, is required. The special parameters are:

1. IDEGR = 3 or 5, desired degree of polynomial fit used for interpolation, default = 3

2. MP = Estimated pixel location of midpoint of upper left reseau

3. ML = Estimated line location of midpoint of upper left reseau

4. IP = Estimated spacing between reseaus along lines (pixel increment)

5. IL = Estimated spacing between reseaus perpendicular to scan lines (line increment)

6. NCOL = Number of columns of reseaus, default = 9, maximum = 9

7. NROW = Number of rows of reseaus, default = 9, maximum = 9

8. ICODE = Nominal reseau table indicator. Format is n + 10*m where m is the spectral band number (1, 2, or 3) and n = 0 if using stored table, n = 1 if table is to be computed, n = 2 if user is supplying table.

9. LP(i), LL(i) = Pixel and line coordinates of nominal reseau locations, beginning with i = 1 for upper left, and proceeding from left to right along a row and then to successively lower rows. Default: use stored table.

NOTE: A zero for any of the first eight parameters or for LP(1) is interpreted as a defaulted value. For MP, ML, IP, and IL default values are obtained from the upper left corner of the table of nominal values.

4.3.25 CORREL Parameters

CORREL determines the relative positioning of a reference chip and an image segment for which the normalized variance between gray-level values is a minimum. The image segment is assumed to be the primary input tape and the reference chip the secondary input. The parameters are:

1. MCP = Central pixel location in reference (mask) image

2. MCL = Central line in mask

3. NPM = Number of pixels in mask, preferably odd

4. NLM = Number of lines in mask, preferably odd

5. ISAVE = If zero, correlation results are not saved on disk. Otherwise, results are saved in record ISAVE of the control point file on disk.

NOTE: The search area (variance matrix) size is defined by:

NCOL = NP - NPM + 1
NROW = NL - NLM + 1

4.3.26 RESECT Parameters

This routine uses an iterative differential correction procedure to obtain corrections to the nominal spacecraft attitude and altitude which minimize the variance between the observed image locations of selected control points and the locations computed using the corrected attitude and altitude parameters and the known geographic coordinates of the control points. The corrected parameters are then used to compute a grid of displacement values by means of which GEOMTRAN can transform the image to a UTM projection.

RESECT requires six parameters, followed by data tables if required. The parameters are:

1. ISENSOR = RBV, MSS, or other allowed sensor type of up to four characters, the first being alphabetic

2. ISCALE = Number of meters per resolution element (pixel and line separation) in output grid, integer format

3. IALIGN = Alignment of output grid
   0 or default--along spacecraft track
   1--along north-south axis

4. IEPHEM = Source of ephemeris data
   0 or default--table on disk
   1--table input after parameters

5. NCPOINT = Number of control points for which data are input as parameters
   0 or default--use table on disk
   2 or greater--specified number of sets input as parameters

6. NRESEAU = Number of sets of reseau locations input as parameters
   0 or default--use table on disk
   3 or greater--specified number of sets input as parameters

NOTE: Refer to the program description for RESECT in the Program Documentation if further information is needed.

4.3.27 UTMGEO Parameters

This program provides a capability for transforming UTM grid coordinates into geographic latitude and longitude, and vice versa. The two types of conversions may be intermixed between parameter sets during a single execution of the program. Parameters are supplied as keywords, followed by values to be given that keyword. When a set is complete (LAT, LONG) or (UTME, UTMN, ZONE), the values are converted to the other coordinate system. Parameters can be input in any order as long as one set is complete before a member of the next set is encountered. The parameters are:

1. LAT = dd, mm, ss.s$^{N}_{S}$--Geographic latitude in degrees, minutes, and seconds NORTH or SOUTH. If the N/S designator is omitted, north latitude (+) is assumed unless the value is preceded by a minus sign. Degrees and decimal fraction is also an acceptable form.

2. LONG = ddd, mm, ss.s$^{E}_{W}$--Geographic longitude in degrees, minutes, and seconds East or West. If the E/W designator is omitted, east longitude is assumed unless the value is preceded by a minus sign.

3. ZONE = nn$^{N}_{S}$--UTM zone number. If the N/S designator is omitted, north is assumed unless the number is preceded by a minus sign.

4. UTME = nnnnnn--UTM Easting in meters. Zone central meridian = 500,000 meters.

5. UTMN = nnnnnnn--UTM Northing in meters, equals meters from Equator in northern hemisphere. In southern hemisphere, a false northing of 10**7 meters is added so that grid distance from Equator equals UTMN - 10**7 meters.

4.3.28 FPMULT Parameters

Task program which forms the products of corresponding elements of two floating point (real, complex, or mixed) arrays, one of them stored on tape and one on disk. FPMULT requires the following parameters:

1. NX = Number of complex values or one-half number of real values per line of both input arrays

2. NY = Number of lines in both input arrays

3. ITYP = Type of arrays being multiplied
   1 = Both real, both corner origin, or both center origin
   2 = Both complex, real-plus-imaginary format
   3 = Both complex, modulus-plus-phase format
   4 = One real array, corner origin and one complex, real-plus-imaginary format
   5 = One real array, corner origin and one complex, modulus-plus-phase format

4.3.29 FPSUM Parameters

This task routine computes the sum or difference of two floating-point (real or complex-plus-imaginary) arrays, one on tape and one on disk. The parameters are

1. NX = Number of complex words per line or one-half number of real words per line

2. NY = Number of lines of data

3. X1 = Floating-point multiplier for all elements of primary input array (from tape)

4. X2 = Floating-point multiplier for secondary input (from disk)

4.3.30 FILTGN Parameters

FILTGN generates filters corresponding to a two-dimensional modulation transfer function (MTF) in the form of a product of a radially symmetric MTF and a one-dimensional MTF oriented along either the X-axis or the Y-axis. The parameters are:

1. ITYPE = Type of filter to be generated
   1--Frequency domain (MTF)
   2--Image domain (convolution weights)

2. NCOL = Number of columns in filter.
   For frequency domain, must be power of 2:$2^1 \leq$ NCOL $\leq 2^9$
   For image domain, must be odd and ≤ 33

3. NROW = Number of rows in filter. Same restrictions as for NCOL.

4. MAXGAIN = Maximum gain in final MTF, as integer multiple of zero-frequency gain; this permits avoiding over-enhancement of high-frequency noise when filter is product of two high-emphasis filters.
   Default on 0: No tests are made

5. AXIS1 = X or Y (single letter) - axis along which first MTF component is aligned.

6. ISYM1 = Symmetry of first MTF component:

1--Linear. MTF value depends only on coordinate along AXIS1, and is constant in direction perpendicular to it.

2--1000 - Elliptical (1000 = circular) with major axis along AXIS1 and minor axis = (ISYM1/1000) times major axis for each elliptical contour.

7. INPUT1 = Mode of input for first set of MTF values

1--Full table of MTF values

2--Piecewise - linear representation by coordinate pairs

3--High/Low emphasis filter

8. (Data) = Specification of MTF values along AXIS1. Format depends on mode of input, as follows:

INPUT = 1

N--Number of values in table

$K_1, K_2, \ldots, K_n$ - MTF values time 1000 (i.e., 333 represents .333) beginning with zero frequency

INPUT = 2

N--Number of pairs of coordinates

$M_1, K_1, M_2, K_2, \ldots, M_N, K_N$ - pairs of values, with M_i = integer frequency value followed by K_i = 1000 times MTF value. Values of M_i must be strictly increasing.

INPUT1 = 3

IHF--Ratio of high-frequency MTF to low frequency (D.C.) - MTF, times 1000 (i.e., IHF = 200 means high frequency, MTF is .200 times D.C. MTF).

I3DB--Frequency at which frequency - dependent part of filter is 50% of maximum (3d.b. point).

9. AXIS2 = X or Y--Alignment axis for second input MTF. If default or zero, only one MTF supplied

10. ISYM2 = Symmetry for second MTF, if any. Same codes as for ISYM1.

11. INPUT2 = Mode of input for second MTF, if any. Same codes as for INPUT2.

12. (Data) = Specifications of MTF values along AXIS2, if any. Same formats as for first MTF.

4.3.31 RANDGRAY Parameters

The random gray level generator routine enables the user to either generate an image of random gray valued pixels with a given mean value and standard deviation, or to add random gray values with a mean of zero and a given standard deviation to each of the pixels of an input tape image. The parameters are:

1. The standard deviation of the random numbers to be generated
2. The "seed" of the generator
3. The mean value of the random numbers if no input image is given

4.3.32 IMERGE Parameters

This task routine unpacks the data from four 7-track ERTS computer compatible tapes (CCT's) representing the four strips of one spectral band of an RBV or

MSS bulk image and builds a single output image tape in standard IDAMS format. The parameters are:

1. ITYPE = Image Type: 1 = RBV, 2 = MSS
2. NBAND = Integer number of spectral bands to be processed
3. IBAND1 = Integer band number for first spectral band to be processed
4. OUTNAME2 = 5 to 8 alphanumeric characters specifying the name to be given to the second output tape (if any)
5. IBAND2 = Integer band number for second band (if any)

NOTE: The name specified on the task card for the output tape is applied only to the first spectral band requested. Additional spectral bands are named in the parameters. The input size field on the task card is ignored; the output image always represents the entire input image.

4.3.33 PMERGE Parameters

This task routine unpacks data from precision 7-track ERTS computer compatible tapes (CCT's) and builds a single output image tape in standard IDAMS format. The parameters are:

1. ITYPE = Input type: 1 = full frame tapes
   2 = 1/16th frame tapes
   3 = 1/4 frame tapes
2. NBAND = Integer number of spectral bands to be processed
3. IBAND1 = Integer band number for first spectral band
4. OUTNAME2 = 5 to 8 alphameric characters specifying name to be given to second output tape (if any)
5. IBAND2 = Integer band number for second band (if any)
6. = Name and band numbers for additional bands, if requested

NOTE: The name specified for the output tape on the task card is applied only to the first spectral band requested. Additional spectral bands are named in the parameters. The input size field is ignored; the output image always represents the entire input image.

4.3.34 PPUPDATE Parameters

PPUPDATE is a task routine which provides a capability for adding, deleting, changing, or listing records in the data files on disk containing ephemeris, reseau location, control point location, and geometric transformation information for use by the precision processing programs. Parameters are supplied in sets (S) where the first and second parameter in each set is a keyword defining the file and operation. The remaining parameters in each set are to be input in the same order and format as specified in the PPUPDATE program writeup in the IDAMS Program Documentation. The parameters are:

1. S_1 = File ID, keyword with the following meanings:

   EPHM - Ephemeris and annotation file
   RZO - Reseau location file
   CP - Control point location file
   GRID - Grid point location file
   LINK - Linkage file for grid points
   ALL - All files
   DONE - End of input delimiter

2. S_2 = Mode, keyword with the following meanings:

   INIT - Initialize the designated file

   LIST - List designated file, including header record (except for LINK, whose header is printed with GRID)

   ADD - Add a data record, and update record count in header

DEL - Delete a data record, close up gap, and update count in header

CHNG - Change a record

3. S_3 = For DEL and CHNG, record number

   0 - change header record (CHNG only)

   >0 - change or delete specified data record

   For ADD, all parameters necessary for a new record start in this field

4. S_4 = For CHNG only, a new data record starts in this field

4.3.35 VPICIN Parameters

This task routine converts an image which has been generated in standard VICAR (JPL Image Processing System) format on a 7-track tape using the IBM 360 tape conversion mode into an image in standard IDAMS format. Only one special parameter is required:

1. LUNV = Logical unit number of the tape drive on which the VICAR tape is mounted. The input tape field on the task card must be defaulted, although the output tape is to be defined in the standard way.

4.3.36 INCREASE Parameters

This task routine, the inverse of REDUCE, increases the size of a specified segment of an input image by the largest integer factor which will just permit it to fit within a specified output image. Edge fill is used if necessary to center the image in the output area. The parameters are

1. NPO = Number of pixels per output line
2. NLO = Number of lines of output
3. IFILL = Gray level for edge fill, default = 0

4.3.37 COLOR Parameters

This is a task routine for altering gray-level values of a picture using three translation tables (for red, green, and blue) which can be defined as standard internal tables, user-supplied external tables, or as tables generated from a piecewise linear graph specified by pairs of old, new parameter values. The parameters, one set (S) per band, are supplied as follows:

1. S_1 = Keyword defining color band; RED, BLUE, or GREEN
2. S_2 = Option code
   - 1 = use standard, internal table
   - 2 = user supplied table
   - 3 = pairs of coordinate points follow
3. S_3 = Table number if $S_2 = 1$
   - Not used if $S_2 = 2$
   - Number of pairs if $S_2 = 3$
4. S_4 = Not used if $S_2 = 1$
   - Table of 64 values if $S_2 = 2$
   - Pairs of coordinate points if $S_2 = 3$

4.3.38 FPLIST Parameters

The task program FPLIST provides a floating-point formatted printer listing of a user-supplied area on disk or tape. The parameters are

1. NX = Number of pixel values to be printed. NX must be a power of 2, $2^2 \leq NX \leq 2^9$.
2. NY = Number of lines to be printed. NY must be a power of 2, $2^0 \leq NY \leq 2^9$.

4.3.39 DMDOUT Parameters

The IDAMS to Digital Muirhead Display tape conversion program requires that only an input and output tape be defined, no special parameters are necessary.

4.3.40 ADDPIX Parameters

The routine which adds two images together has the following special parameters.

1. ISSP = Secondary input tape starting pixel
2. ISSL = Secondary input tape starting line

4.3.41 FORMAT Parameters

The routine to convert a base image to IDAMS format requires one special parameter as follows:

LUN = Logical unit number for tape containing the unformatted image.

4.3.42 HISTCONT Parameters

This program produces six histograms in which each graph represents the intensity frequencies of a unique set of ERTS/MSS scan lines. The program also produces a cumulative histogram and table using one of the scan line sets as the base detector line. A look-up table for each set of scan lines is generated such that when a contrast conversion is applied to the scan lines, the output values will yield histograms that closely match that of the base detector histogram. The program will also generate new histograms for the five altered scan line sets. The user can execute only the histogram phase, or only the contrast phase, or both phases by specifying the following parameters.

1. IBASE - the base selector line number (1 through 6)
2. ITAB - (a) if not specified, implies the histogram and contrast phases are to be executed

   (b) a table of 320 values (5 sets of 64 new values to be used in the contrast phase). When these values are present, only the contrast portion of the program is executed.

4.3.43 JOYSTICK Parameters

JOYSTICK calls the IDAMS joystick package whose parameters are provided interactively through the 212 Display Station or through the joystick control box. By specifying the name JOYSTICK on the task card, the following functions code table is displayed on the 212 screen:

IDAMS

FUNCTION CODES

(CODES 01 - 09 ARE FUNCTIONAL IN TASK DISPLAY)

LOCATE	10				
DATA	11	ZOOM	17	REWIND	13
DATA1	12	EXIT	18	FORWARD	14
SELECT	16			REVERSE	15

In order to execute any one of the functions, the user must type in the corresponding numeric code and depress the SEND key. A description of each function is given below:

Code	Function	Description
10	LOCATE	Returns the coordinates of the box or reseau which is presently displayed on TV screen. When the user wants to clear the coordinates from the 212 and have the function code table reappear, the SEND key must be depressed.
11	DATA	Drops an image tape file which contains 64 gray level data onto the TV. The program requests two input parameters. The tape unit on which the image tape is mounted must be keyed in after

Code	Function	Description
11 (Cont'd)		the request appears on the 212. After the SEND key is depressed, a request for the color gun number will appear.

The TV has three TV refresher disk files available for image data storage and each disk can be assigned to one of the three available color guns (red, green, or blue). The color gun parameter is a value which determines which disk file(s) the user wants to use for storing an image. The parameter is an octal representation of a three-digit binary number, in which each digit corresponds to one of the disk files and the "on-off" conditions are represented by ones and zeros, respectively. The following table shows the correspondence between the color gun number, the disk assignments and the binary number from which the parameter value was derived.

Color Gun Number	Disk File(s)	Binary Representation Disk 3	Disk 2	Disk 1
1	1	0	0	1
2	2	0	1	0
3	1 and 2	0	1	1
4	3	1	0	0
5	1 and 3	1	0	1
6	2 and 3	1	1	0
7	1, 2, and 3	1	1	1

Code	Function	Description
11 (Cont'd)		Once the user has specified the disk file(s) into which the image data are to be stored and the SEND key has been depressed, the image will be dropped to the disk, and displayed on the TV. The user can define which color is to be associated with each disk by manually setting the three color wheels switches on the IDAMS Control Panel. The three wheels, from left to right, represent the color guns of red, green, blue, respectively. By setting the wheels to the appropriate disk number, the user has complete control over the color assignment of any image stored in the TV disk files. Once the color gun number has been entered and the SEND key depressed, the image will be dropped on the TV.
12	DATA1	Drops an image tape file onto the TV. The required parameters are described above under function code 11. DATA1 differs from DATA in that the data contains 32 gray level values and, therefore, does not have the least significant bit shifted off. However, the most significant bit will be truncated since only five bits of data can be displayed at one time.
13	REWIND	Rewinds a requested tape. The program requests on which tape unit the required tape is mounted. After keying in the tape unit number and depressing the SEND key, the tape is rewound to loadpoint.

Code	Function	Description
14	FORWARD	Forward spaces a tape a specified number of files. The program requests the logical unit number on which the required tape is mounted. After keying in the tape unit number, the program requests the number of files over which the tape is to be spaced forward. Once the SEND key is depressed, the tape is forward spaced the specified number of files.
15	REVERSE	Backspaces a tape a specified number of files. The program requests the logical unit number on which the required tape is mounted. After keying in the tape unit number, the program requests the number of files over which the tape is to be backspaced. Once the SEND key is depressed, the tape is backspaced the specified number of files.
16	SELECT	Enables the user to select the coordinates of a box which is to be displayed on the TV. The program requests that the coordinates be input in the following order - leftmost pixel, rightmost pixel, top line, lower line. The line numbers should be paired even, or odd, but not mixed. This is a display hardware requirement. The parameters must be separated by commas and the final parameter must be followed by a blank. Any blanks placed between parameters are ignored.

Code	Function	Description
17	ZOOM	Takes the area bounded within a box on the TV image and increases or reduces it into a TV size image. The program requests the name of the image which is presently displayed on the TV. After entering in the name and depressing the SEND key, the TV image's tape unit is requested, followed by a request for the file number (be sure to specify the file number with two digits). A message reminding the user that the master tape must be mounted is displayed on the 212, and is followed by a request for the master tape's unit number and file number. Before the program begins the ZOOM procedure, information about the new output tape is requested. The user is asked to supply the output tape name, the unit number, and the file number. The program requests that the user specify if the input parameters are believed to be correct. If a "Y" is returned, the program continues with the ZOOM process. However, if an "N" has been returned, the program begins the input parameter requests again. This gives the user, who is aware of an input parameter error, another chance to supply the correct input. (Note: After keying in the proper response to all requests, remember to press the SEND key.) The program will display on the TV whether an increase or reduction of the master image was necessary and the multiplication factor involved. The "ZOOMED" image

Code	Function	Description
17 (Cont'd)		will reside on the output tape when the program is completed, and the user must reference DATA when he wishes to drop the image onto the TV screen.
18	EXIT	Returns control to the IDAMS main driver program.

For special instructions pertaining to the operational procedures involved when using JOYSTICK and the TV, refer to Section 3.4 (Special Instructions for the DISPLAY User).

The other means of supplying parameters is by activating one of the six buttons on the joystick control box. The buttons and stick have been assigned the following functions:

Button	Function
1	Generates a box on the TV; if a box is already displayed on the TV, by activating button 1 the box is erased.
2	Generates a reseau on the TV; if a reseau is already displayed on the TV, by activating button 2 the reseau is erased.
3	Returns the coordinates of the box or reseau which is presently displayed on the TV screen.
4	Enables the user to move the box or reseau left, right, up, or down by moving the joystick left, right, up, or down.

Button	Function
5	Enables the user to enlarge and shrink the box by moving the joystick up and down, respectively.
6	Enables the user to vertically enlarge and shrink a box by moving the joystick up and down; enables the user to horizontally enlarge and shrink a box by moving the joystick right and left.

4.3.44 MSSCON Parameters

This task routine convolves an image with a cyclical set of weights. The weight table is defined by its first six rows, which are convolved with the input data sequentially by line. After the first six lines are exhausted, further convolution of the data is done with weights from the first row, with succeeding convolutions being made with successive rows. This special-purpose convolution program requires that an input and output tape, six special parameters, and a table of weights be defined. The special parameters and weight table are provided on the parameter card in the following order:

1. NX = X-dimension of weight array
2. NY = Y-dimension of weight array
3. INCRX = Spacing between output pixels
4. INCRY = Spacing between output lines
5. IDIV = Quantity by which input integer weights are to be divided to generate normalized fractional weights; if = 0, divide by the sum of weights
6. ISYM = 0, if full weight table supplied
   = 1, if only upper left quadrant supplied
7. IWGHTS = Set of six row matrices defining the weight table

4.4 IDAMS TAPE FORMAT

Most tasks within the IDAMS Processor use an input image tape in standard format as the starting point for further processing. The format used for all standard tapes (input and output) is a label in record one, followed by 1-5000 data records. Each label is 25 words long and each data record occupies up to 1251 words (line number in word 1, followed by 1-5000 data characters packed four to a word). All records are written and read in binary mode. Formats for label and data records are shown as follows.

Record	Word	Definition
1(LABEL)	1, 2	Tape File Name
	3	Number of pixels per record of image data
	4	Number of lines of data, excluding the label
	5	Tape logical unit number
	6	Tape file number
	7-14	Floating point data or master image parameters (see note)
	15-25	Unused
2-N (DATA)	1	Line number (value is one less than actual record number)
	2-M	Up to 1250 words of image data, packed four pixels to a word

NOTE:

1. If floating-point data is copied from disk to tape using FPCON code 16, words 7-14 contain four floating-point values representing maximum and minimum values of the array: These are described in paragraph 4.9.1 of the program documentation. For character arrays created by scaling floating-point data using FPCON codes 11 through 15, words 7-10 contain the floating-point value for character value 0 and the increment between successive values.

2. When an image is expanded or shrunk by using the 212 display package (DISPLAY) as a task routine, certain history information which follows is saved in the new label.

Word	Definition
7-8	Master image name
9	Starting pixel of master
10	Starting line of master
11	Multiplication/Reduction Factor
12	File number of master
13	Number of pixels of master used
14	Number of lines of master used

SECTION 5 - MESSAGES

5.1 INTRODUCTION

There are four classes of messages which may be generated by an IDAMS run; CDC 3200 RTS operating system messages, IDAMS executive messages, IDAMS general purpose subroutine messages, and IDAMS application program messages. General purpose subroutine and application program messages may be either fatal or non-fatal.

Fatal messages are generated when a non-recoverable error condition is detected. Such a condition will cause the run to abort unless sense switch 4 on the CDC console is set on to provide automatic error recovery. IDAMS fatal error codes are produced in addition to the error message and consist of a five-digit integer packed as follows:

tt/s/ee

where tt is a task identifier, s is a subroutine code, and ee is the specific error. Fatal tape I/O errors have been standardized in the following manner:

Code	Message	Explanation
tts03	LUN nn--END OF FILE	An end-of-file condition was detected while reading from the given logical unit, fatal error.
tts04	LUN nn--TOO MANY PARITY ERRORS	More than an arbitrary number of tape parity errors has been sensed on logical unit nn, fatal error.
tts05	LUN nn--EQUIPMENT ERROR	The indicated tape hardware has failed, fatal error. A customer engineer should be called.
tts06	LUN nn--END OF DEVICE	An end-of-tape mark has been sensed, fatal error.

Non-fatal messages are informative only and cause no interruption of program execution.

5.2 CDC 3200 RTS OPERATING SYSTEM MESSAGES

CDC system messages are described in the CDC 3200 document "Computer Systems, SCOPE/Disk SCOPE, Reference Manual", Pub. No. 60171200 in Appendix E, "System Messages and Diagnostics."

5.3 IDAMS EXECUTIVE MESSAGES

The following messages are written on the console, printer, and 212 display (if active) by the IDAMS executive. At the beginning of each execution run

IDAMS PROCESSOR - CARD MODE

THIS IS taskname (console only), or variable task and parameter data (printer and 212 display only)

When a SWITCH task card is encountered, these additional messages will be written

NOW SWITCHING MODES
IDAMS PROCESSOR--INTERACTIVE MODE
READY FOR INPUT (printer and 212 display only)

At the end of a job, one of two termination messages will be output. For normal terminations the message is

NORMAL END OF JOB

For abnormal conditions, the following message is written

FATAL ERROR IN taskname
subroutine name WAS IN EXECUTION (optional line)
ERROR CODE AND MEANING FOLLOW IEROR = ttsee
(one line descriptive error message)

5.4 IDAMS GENERAL PURPOSE SUBROUTINE MESSAGES

The messages described below may be generated by one of the general purpose subroutines when called from a task routine. If the message is indicative of a fatal error condition, the error code will be given along with the message explanation. It should be noted that although a subroutine may generate a fatal error code, task routines have the ability to ignore these errors if circumstances permit.

5.4.1 LBLRD Messages

The tape input label processing subroutine may generate the following non-fatal messages:

Message	Explanation
INPUT LABEL DATA--NAME=aaaaaaaa, nnnn PIXELS, nnnn LINES, LUN nnn, FILE	Standard tape input label information
LBLRD--WARNING, NO MATCH ON LUN nn, LUN CHANGED TO nn	The logical unit number found in the tape label did not match the one supplied. The one supplied is being used.

LBLRD may also generate one of the following fatal error messages:

Code	Message	Explanation
tt107	BAD FILE NO nnn	The given file number could not be located on the input tape, fatal error
tt108	aaaaaaaa ON LUN nn NE aaaaaaaa	The tape file name passed to LBLRD did not match the one found in the label record; fatal error.

5.4.2 LBLWRT Messages

The tape output label processing subroutine may generate the following messages:

Code	Message	Explanation
--	OUTPUT LABEL DATA-- NAME=aaaaaaaa nnnn PIXELS, nnnn LINES, LUN nn, FILE nn	Standard tape output label information
tt207	BAD FILE NO nnn	The file number passed to LBLWRT did not correspond to data found on tape; fatal error.

5.4.3 IDAMSDSK Messages

The disk input/output subroutine may generate the following non-fatal messages:

Message	Explanation
DISK NOT READY--WHEN READY, PRESS FINISH	Disk power not turned on, not up to speed or control A on front panel of the Control Data Peripheral Controller not set to position 2.
DISK CHECKWORD ERROR CYL nnnn TRK nnnn	During disk read a checkword error was encountered; processing will continue using the doubtful data unless cancelled by operator.

The following fatal error messages may also be generated:

Code	Message	Explanation
tt307	SEL, OUTW, OR INPW INSTR. REJECTED	After accepting CON instruction, disk failed to accept subsequent instructions.
tt308	DISK OVERFLOW	The number of calls specified by DPPUT or DPFETCH would have required reading or writing beyond cell 32319.
tt309	DISK ADDRESS ERROR	Disk cell location specified by DPSEEK was not between 0 to 32319 (program error) or was refused by Disk Controller (hardware error).

Code	Message	Explanation
tt310	LOST DATA	Channel transferred data faster than disk read or write rate (hardware error).
tt311	WRITE LOCKOUT	Unable to write on disk.
tt312	BAD DISK TRACK NO nn ON CYLINDER nnn	Specified track has been tagged as bad using Disk Controller switches.
tt313	RESERVED TRACK NO nn ON CYLINDER nnn	Specified track has been reserved using Disk Controller switches.
tt314	TOO MANY CHECKWORD ERRORS	Repeated checkword errors have occurred causing execution to terminate.
tt315	UNKNOWN DISK ERROR, STATUS CODE = nnnn	The specified status code does not indicate any of the errors above.

5.4.4 READRITE Messages

The tape input/output subroutine may generate the following non-fatal error messages:

Message	Explanation
PAR ERR, LINE nnnn LUN nn	A parity error has been detected on the indicated tape unit or on disk, execution continues.
nn PARITY ERRORS ON LUN nn RUN WILL ABORT AT nn	More than some arbitrary number of tape parity errors has been detected, execution will terminate if a threshold number is exceeded.

5.4.5 UTMCON Messages

The UTM/LAT-LONG conversions subroutine may generate the following fatal error messages:

Code	Message	Explanation
tt507	LONG/CENTRAL MERIDIAN DIFF GT 4.5 DG	The longitude given is more than 4.5 degrees away from the specified central meridian, the program exits abnormally.

Code	Message	Explanation
tt508	LATITUDE GT 90 DEG OR LT--90 DEG	An input latitude value is illegal, UTMCON exits without further processing.
tt509	NO CONVERGENCE FOR LATITUDE	The iterative formula used for computing latitude did not converge to within ± 1 degree in five iterations, abnormal exit.

5.4.6 TWOFIT Messages

The two-dimensional least-squares fit subroutine may generate the following fatal error messages:

Code	Message	Explanation
tt607	POLYNOMIAL DEGREE LT 1 OR GT 5	The requested polynomial degree was not between 1 and 5, abnormal return.
tt608	TOO FEW KNOWN POINTS	The number of points with known values is less than (IDEG + 1) * (IDEG + 2)/2 where IDEG is the degree of the desired polynomial, abnormal return.
tt609	MATINV GAVE SINGULAR SOLUTION	The maxtrix inversion subroutine gave a singular solution; known points did not occupy at least (IDEG + 1) different X positions and IDEG + 1 different Y positions where IDEG is the degree of the polynomial abnormal return.

5.4.7 TTWLVE Messages

The 212 display station I/O handler may generate the following messages:

Message	Explanation
212 CONNECT FAILURE, NOW LOOPING UNTIL READY	Attempts to connect the 212 have failed for 1 second, the system will loop until ready. The 212 equipment should be checked to ensure that it is operable.

Message	Explanation
CHANNEL 4 BUSY OVER 3 SECONDS	The I/O channel connecting the 212 to the CPU has rejected the SELECT command for three seconds.

5.5 IDAMS APPLICATION PROGRAM MESSAGES

The message described below may be generated by one of the IDAMS applications programs (task routines). Fatal errors are signified by the presence of an error code.

5.5.1 BATCH Messages

Although BATCH, the IDAMS task entry module, is part of the IDAMS system software, error codes it may generate follow the format for task routines and are included here for ease of reference.

BATCH produces the following non-fatal messages:

Message	Explanation
(Free format task card information) (Free format parameters)	Each user-supplied set of task and parameter information is written to the printer and 212 display.
(IDAMS executive messages)	See Section 5.3

BATCH can generate the following fatal messages:

Code	Message	Explanation
1007	ILLEGAL CARD TYPE	The task name read did not match any name kept in an internal table.
1008	MISSING DELIMITER ON TASK CARD	Parenthesis, commas, or fields were incorrect on the task card.
1009	2NDARY INPUT LUN LT 1 OR GT 55	The secondary input tape logical unit number specified was outside the limits defined for programmer units.
1010	2NDARY INPUT FILE NO LT 1 OR GT 999	The secondary input file number did not fit within the arbitrary limits of 1 to 999.

Code	Message	Explanation
1011	OUTPUT LUN LT 1 OR GT 55	The output logical unit number specified was outside the system limits defined for programmer units.
1012	OUTPUT FILE NO LT 1 OR GT 999	The output tape file number did not fit within the arbitrary limits of 1 to 999.
1013	NO PARAMETER CARDS SPECIFIED	The parameter card-count field was not greater than zero for a task program requiring at least one parameter card.
1014	STARTING PIXEL LT 1 OR GT 5000	The starting pixel specified was outside the design limits of 1 to 5000.
1015	STARTING LINE LT 1 OR GT 5000	The starting line field was outside the design limits of 1 to 5000.
1016	INPUT LUN LT 1 OR GT 55	The primary input logical unit number was outside the limits defined for programmer units.
1017	INPUT FILE NO LT 1 OR GT 999	The primary input file number did not fit within the arbitrary limits of 1 to 999.
1018	STARTING PIXEL TOO LARGE	The starting pixel number was greater that the length of the input image lines.
1019	STARTING LINE TOO LARGE	The starting line number was greater than the number of input image lines.

5.5.2 TESTGN Messages

There are no messages produced by the test pattern generator.

5.5.3 LIST Messages

LIST will print out the contents of an image file but generates no unique messages.

5.5.4 CONTRAST Messages

The following fatal error messages may be produced by the contrast modification routine:

Code	Message	Explanation
4007	N NOT LE 11 AND GE -5	The first special parameter contained a value out of range.
4008	COORDINATE VALUE GT 63 OR LT 0	An old or new gray level value was beyond the range 0-63.
4009	OLD COORD NOT STRICTLY INCREASING	A specified value of the old intensity was less than or equal to the preceding value.

5.5.5 CONVOLVE Messages

The convolution filtering program may produce one of the following fatal error messages:

Code	Message	Explanation
5007	SUM OF WEIGHTS = 0	User has specified weight normalization by dividing by sum of weights (IDIV parameter = 0) and this sum = 0.
5008	NY TOO LARGE FOR AVAILABLE CORE	Insufficient core to hold both weight table and NY data segments of minimum possible length.
5009	WEIGHT VALUES TOO LARGE	Sum of either positive or negative weights, after normalization, exceeded 32.5, making possible uncorrectable overflow.

5.5.6 EXPAND Messages

The weighted image expansion routine may generate the following fatal error messages:

Code	Message	Explanation
6007	WEIGHTS DIVISOR IDIV EQUALS ZERO	Weight divisor parameter of zero cannot be processed.

Code	Message	Explanation
6008	WGHT SUBSET NORMALIZED SUM TOO BIG	An uncorrectable overflow (output value more than 32.5 times input value) could occur with weights normalized as specified by the weight divisor parameter.
6009	NY AND NP ARE TOO LARGE FOR CORE	Insufficient core available to hold enough input lines for the size of weight table defined.

5.5.7 SHADE Messages

The position--dependent gray level correction program may generate the following fatal error messages:

Code	Message	Explanation
7007	NX EXCEEDS 21	More than 21 columns of calibration points were specified.
7008	NX * NY EXCEEDS 441	More than 441 calibration points were specified.
7009	SOME DATA LIES OUTSIDE CALIB GRID	Specified region of input image was not entirely enclosed by calibration grid.
7010	INVALID CALIBRATION DATA	Spacing between columns or rows of calibration grid not positive, second gray level value specified was not greater than the first gray level, or second number of a pair of measured values was not greater than the first number.
7011	SCOPE/INTERCEPT OVFL INPT VALUE nnnn	Value of slope or intercept computed from pair nnnn of calibration data was outside the range -127 to +127.
7012	COEFF OVFL, CAL GRID ROW mmmm COL nnnn	An interpolation coefficient associated with row mmmm and column nnnn of the calibration rectangles was less than -127 or greater than +127.

5.5.8 FFT Messages

The Fast Fourier transformation routine may generate the following fatal error message:

Code	Message	Explanation
8007	ARRAY SIZE TOO LARGE	The program limits the size of the complex data array to no more than 512 * 512.

5.5.9 FPCON Messages

The floating point conversion routine may generate the following fatal messages:

Code	Message	Explanation
9007	TRANSFER/CONVERSION CODE LT 1 OR GT 22	An invalid conversion option was specified on input.
9008	NL OR NP NOT AVAIL-ABLE ON INPUT	The number of lines or number of pixels to be processed is not available on the input tape.

5.5.10 SMOOTH Messages

The floating-point data smoothing routine may generate the following fatal error messages:

Code	Message	Explanation
10007	TABLE DIMENSION NOT 3 OR 5	The parameter defining the dimension of the matrix used in the smoothing process must be either 3 or 5.
10008	NX OR NY ZERO OR NEGATIVE	The parameter NX or NY, defining the number of points per line or number of lines, was input as zero or a negative value.
10009	WEIGHT TABLE DIVISOR LE ZERO	The parameter IDIV by which the weight matrix will be divided must be a positive value.

5.5.11 CXPACK Messages

The complex packing and unpacking routine generates no special messages.

5.5.12 ERROR Messages

The error processing task routine is part of the IDAMS executive but is included here for reference. When a fatal error is detected in one of the task routines, ERROR will produce the following message block on the printer, typewriter, and 212 display:

FATAL ERROR IN taskname

subroutine WAS IN EXECUTION (optional line)

ERROR CODE AND MEANING FOLLOW

IEROR = nnnn
(Variable error message description)

For jobs that end normally, the following message is output:

NORMAL END OF JOB

5.5.13 REDUCE Messages

The image reduction program generates no special messages.

5.5.14 HISTO Messages

The histogram and statistics routine prints out a graphic histogram, a frequency table, and statistical parameters for an image. No special messages are generated.

5.5.15 CHAROUT Messages

The character format image tape-to-printer program prints an image in character form but generates no special messages.

5.5.16 TEXTGN Messages

The text generator program produces no special error messages.

5.5.17 NEIGHBOR Messages

The program which produces a printer listing of a neighborhood of pixels about a specified point may generate the following warning message:

Message	Explanation
ARRAY SIZE REDUCED TO 40*40	Maximum array size for neighborhood of points to be printed is 40*40, processing continues with reduced output.

5.5.18 DISPLAY Messages

The 212 display station interactive program package generates a number of non-fatal messages which are defined in the program documentation. There are no special error messages.

5.5.19 MODIFY Messages

The image editing routine will scan the input parameters and print out any data found to be out of range. In addition, the following fatal error messages may be produced:

Code	Message	Explanation
19007	BAD LINE NUMBER	A conflicting or illegal line number has been defined as an input parameter.
19008	BAD FUNCTION CODE	An illegal function code was defined on input.

5.5.20 INSERT Messages

The window insertion and mosaicking routine may generate the following non-fatal messages:

Message	Explanation
ONLY nnnn WINDOW INPUT PIXELS AVAILABLE	The line length defined for the secondary input exceeded the available length.

Message	Explanation
ONLY nnnn WINDOW INPUT LINES AVAILABLE	The number of lines defined for the secondary input exceeded the available line count.

In addition, one of the following fatal error messages may be produced:

Code	Message	Explanation
20007	2NDARY INPUT STARTING PIXEL TOO BIG	The starting pixel value specified was greater than the highest pixel number in the image.
20008	2NDARY INPUT STARTING LINE TOO BIG	The starting line number specified was greater than the last line in the image.

5.5.21 GRID Messages

The grid overlay routine may produce the following fatal error message:

Code	Message	Explanation
21007	BAD GRID SIZE PARAMETER	The number of pixels or lines defined on input for grid block size was 0 or negative.

5.5.22 GEOMTRAN Messages

The geometric transformation program produces no error messages.

5.5.23 CHIPGN Messages

The reference chip generation routine will, if requested by input parameters, print the contents of the chip tape directory on the printer. As new chips are added, the input values, new directory entry, and converted results are also listed. In addition, the following warning messages may be printed:

Message	Explanation
aaaa IS NOT A KEYWORD	An illegal keyword was detected, execution continues.

Message	Explanation
CHIP AT CPP = nnnn CPL = nnnn NOT WITHIN RANGE	The chip coordinates will not permit a full chip to be extracted from the input image, parameters are discarded and execution continues.
ATTEMPT TO ADD nn TH CHIP HAS EXCEEDED CAPACITY	The chip tape is full, no more chips may be added unless others are removed.

5.5.24 RZOMAP Messages

The reseau detection routine will generate a table of nominal and actual reseau locations. The following fatal error messages may also be produced:

Code	Message	Explanation
24007	ESTIMATED RESEAU LOCATION OUTSIDE IMAGE	Specified line or pixel increment between reseaus too large, so that some reseaus are forced outside the input area.
24008	TOO FEW RESEAUS FOUND BY GETRZO	Not enough reseaus were identified to permit finding a least squares fit polynomial of the specified degree.

5.5.25 CORREL Messages

The correlation routine prints out descriptive information about the correlation area. The following advisory messages may also be generated:

Message	Explanation
WARNING--MINIMUM VARIANCE IS AT OR VERY NEAR EDGE OF SEARCH AREA	The correlation may not be reliable due to edge effects.
WARNING--MINIMUM IN VARIANCE IS NOT SHARP	A well defined minimum could not be found, results are questionable.
WARNING--THIS IS NOT A REFERENCE CHIP. NO CENTRAL POINT COORDINATES AVAILABLE FOR STORAGE ON DISK	The mask used was not in reference chip format, disk file data is incomplete.

Message	Explanation
WARNING--CONTROL POINT FILE ON DISK ALREADY FULL. THIS VALUE HAS NOT BEEN ADDED	Disk file is already full and space must be made available before more chips can be added.

In addition, CORREL may output one of these fatal error messages.

Code	Message	Explanation
25007	CORREL MASK OR SEARCH AREA TOO LARGE	The specified mask and search areas are too large for available core.
25008	CORREL SEARCH AREA NOT POSITIVE	The number of columns and/or rows computed from parameters are negative.
25009	MASK EXTENDS OUTSIDE REFERENCE IMAGE	Mask parameters were not entered correctly.
25010	MASK IS ENTIRELY UNIFORM	Mask has no identifying features, no correlation is possible.

5.5.26 RESECT Messages

The spatial program may generate the following warning message:

Message	Explanation
WARNING--OUTPUT MAY REQUIRE EXCESSIVE ROTATION TO ACHIEVE NORTH-SOUTH ALIGNMENT	Image will require rotation through angle greater than eight degrees--GEOMTRAN execution time may be excessive.

These fatal error messages may also be produced:

Code	Message	Explanation
26007	DISK TABLE FOR WRONG IMAGE	The image name in the header of one of the tables on disk is not the same as the specified input image.
26008	INVALID SENSOR TYPE	Specified sensor not RBV.
26009	TOO FEW CONTROL POINTS	Not enough control points were used to permit solving for the resection variables.

Code	Message	Explanation
26010	SP, SL SPECIFY POINT OUTSIDE IMAGE	Value of SP or SL less than 1 or greater than maximum image size.
26011	COEF MATRIX SINGULAR ON FIRST PASS	Most probable cause: control points too close together or three or more on same straight line.

5.5.27 UTMGEO Messages

The UTM/LAT-LONG conversion routine prints the input and output values and one diagnostic message.

Message	Explanation
aaaa IS NOT A KEYWORD	A bad keyword was detected, processing continues with the next set.

5.5.28 FPMULT Messages

The floating point array multiplication routine may generate the following fatal error message:

Code	Message	Explanation
28007	PRIMARY INPUT ARRAY WRONG SIZE	The size parameters on the input tape label do not satisfy NP = 16 *NX, NL = NY.

5.5.29 FPSUM Messages

The floating point array addition routine may generate the following fatal error message:

Code	Message	Explanation
29007	TAPE INPUT ARRAY NOT SPECIFIED SIZE	The size specified in the label (NP = 16*NX, NL = NY) does not agree with the values for NX and NY specified by parameters.

5.5.30 FILTGN Messages

The filter generator may generate the following fatal error messages:

Code	Message	Explanation
30007	INVALID OUTPUT TYPE	Parameter ITYPE not 1 or 2.
30008	INVALID AXIS SPECIFICATION	Alignment axis not specified as X or Y.
30009	ILLEGAL SYMMETRY CODE	Symmetry code ISYM not between 1 and 1000.
30010	ILLEGAL INPUT MODE	Input mode not 1, 2, or 3.
30011	ILLEGAL FREQUENCY VALUE	Frequency value not between 0 and 599 (piecewise-linear case) or not positive (high/low emphasis case).
30012	FREQUENCY VALUES NOT STRICTLY INCREASING	For piecewise-linear input mode, frequency coordinates not strictly increasing.
30013	SPECIFIED FILTER GAIN IS NEGATIVE	For high/low emphasis, high frequency gain has illegal negative value.
30014	CONVOLUTION FILTER TOO LARGE	Dimensions specified for convolution filter exceed 33 by 33.
30015	CONVOLUTION FILTER DIMENSION NOT ODD	Dimensions specified are not both odd.
30016	SUM OF WEIGHTS NOT POSITIVE	Sum of unnormalized convolution weights is zero or negative; normalized filter cannot be generated.

5.5.31 RANDGRAY Messages

The random gray level generator prints illegal values of parameters, if any. There are no fatal error messages.

5.5.32 IMERGE Messages

The ERTS bulk image conversion routine prints out a table of annotation data associated with the image being converted to IDAMS format. The following

operator messages are also typed out:

Message	Explanation
DEMOUNT OVERLAY AND SYSTEM TAPES MOUNT OUTPUT ON LUN nn AND INPUT TAPES ON REMAINING DRIVES (IN ANY ORDER) WHEN READY, PRESS CLEAR	All tape drives are required to handle four input tapes and one output tape.
MOUNT OUTPUT TAPE ON LUN nn WHEN READY, PRESS CLEAR	A new output tape is needed for each spectral band.
REMOUNT RTS AND OVERLAY TAPES WHEN READY, PRESS CLEAR	System and program tapes must be restored when processing is complete.

In addition, one of these fatal errors may be produced:

Code	Message	Explanation
32007	STRIP NUMBER NOT BETWEEN 1 AND 4	One invalid strip number; tape cannot be identified
32008	INPUTS NOT ALL SAME ERTS FRAME	Frame ID (Date and Time) not same for all input tapes.
32009	INPUTS NOT 4 DIFFERENT STRIPS	One or more strips has been duplicated on input.
32010	ILLEGAL SPECTRAL BAND	Specified spectral band number not allowed for specific sensor type.
32011	WRONG LINE LENGTH FOR GIVEN SENSOR	Line length specified by annotation record not appropriate to sensor type.

5.5.33 PMERGE Messages

The ERTS precision image conversion routine prints out a table of annotation data associated with the image being converted to IDAMS format. In addition, the following operator messages are typed out:

Message	Explanation
DEMOUNT OVERLAY AND SYSTEM TAPES MOUNT OUTPUT ON LUN nn MOUNT INPUT TAPES ON REMAINING DRIVES SET OUTPUT TAPE AT 800BPI (Pause)	All tape drives are required to handle four input tapes and one output tape.

Message	Explanation
MOUNT OUTPUT TAPE aaaaaaaa ON LUN nn (Pause)	A new output tape is needed for each spectral band.
REMOUNT RTS AND OVERLAY TAPES (Pause)	System and program tapes must be restored when processing is complete.

5.5.34 PPUDDATE Messages

The precision processing disk file edit program may print all or part of any disk file it maintains.

5.5.35 VPICIN Messages

The VICAR tape conversion routine may print one of the following warnings:

Message	Explanation
PARITY ERROR ON VICAR LABEL	Tape label information may be unreliable.
nnnn PARITY ERROR(S) IN DATA	The total number of parity errors detected on input is printed out before the task exits.

The following fatal error message may also be output:

Code	Message	Explanation
35007	END OF VICAR LABEL NOT FOUND	VICAR tape apparently not in standard format; start of image data could not be identified.

5.5.36 INCREASE Messages

The IDAMS image linear expansion program generates no special messages.

5.5.37 COLOR Messages

The color coding routine may generate one of the following fatal error messages:

Code	Message	Explanation
37007	N NOT LE 11 AND GE 0	The first special parameter contained a value out of range.

Code	Message	Explanation
37008	COORDINATE VALUE GT 63 OR LT 0	An old or new gray level value was beyond the range 0-63.
37009	OLD COORD NOT STRICTLY INCREASING	A specified value of the old intensity was less than or equal to the preceding value.
37010	IMAGE SIZE TOO LARGE FOR DISK	The input image specified is too large for COLOR to process since the image will not fit on disk.

5.5.38 FPLIST Messages

The floating point listing routine generates no messages.

5.5.39 DMDOUT Messages

The program used to convert from IDAMS to Digital Muirhead Display (DMD) format types the following operator messages:

Message	Explanation
USE 556 BP1 OUTPUT, MARK TAPE nnnn --BYTE MODE AND REEL 1 OF 1 WHEN READY, PRESS CLEAR	Set up instructions for the operator.
IF SECOND OUTPUT REEL WAS REQUIRED, MARK TAPES 1 OF 2 AND 2 OF 2 --IF ONLY 1 REEL, MARK IT 1 OF 1	Operator instructions at end of run.

5.5.40 ADDPIX Messages

The picture addition program may generate the following message:

Message	Explanation
IMAGE SIZE EXCEEDS SECONDARY INPUT SIZE	The user specified an image size which is larger than the secondary input tape's image size.

5.5.41 FORMAT Messages

The program which converts an image to IDAMS format generates no messages.

5.5.42 HISTCONT Messages

The histogram-contract routine generates no special messages.

5.5.43 JOYSTICK Messages

The joystick interactive display routine generates no special messages.

5.5.44 MSSCON Messages

The special-purpose convolution program generates no special messages.

SECTION 6 - IDAMS TASK PROGRAM PREPARATION

In order to add new applications programs to the IDAMS system, the following programming procedures must be adhered to within the new applications routine:

1. Include statements for IDAMS COMMON.

2 Avoid use of buffer I/O, use instead calls to IDAMS I/O routines (see general purpose subroutine writeups in the Program Documentation). Check the error code after each call.

3. Pick up input parameters, if any, from ISPACE (1) in COMMON.

4. Equivalence all large arrays to the ISPACE array in COMMON, making sure input parameters will not be destroyed.

5. Use LBLWRT to write an output label if necessary from array LBLOUT. Primary input labels are read automatically; if a secondary input is needed, use LBLRD to read it into LBLIN2.

For temporary routines, one of the existing overlays, TESTnn, may be used when rebuilding the overlay tape. Otherwise, these IDAMS system modifications must be made:

1. Select an overlay number from the relative location of an available entry in array ITSKS in BATCH and ERROR. This number must be punched on the overlay control card for the task being added.

2. Add the new program name to the ITSKS tables in BATCH and ERROR, punch new decks, and replace them in the overlay deck structure. Then, construct an overlay deck for the task being added and rebuild the overlay.