

September 1st, 1990

LAS 1.2

A FLOPPY DISK

STANDARD FOR LOG DATA

BY

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ABSTRACT

The Canadian Well Logging Society's Floppy Disk Committee has designed a standard format for log data on floppy disks. It is known as the LAS format (Log ASCII Standard). LAS consists of files written in ASCII containing minimal header information and is intended for optical curves only. Details of the LAS format are described in this paper.

The purpose of the LAS format is to supply basic digital log data to users of personal computers in a format that is quick and easy to use.

INTRODUCTION

Log analysts who use personal computers have, in the past, been entering log data into their machines mainly through a hand digitizing procedure because most personal computers are unable to handle data from magnetic tapes. The industry was beginning to address this inefficiency by making log data available on floppy disks in a variety of formats. It was at this point that the Canadian Well Logging Society set up the Floppy Disk Committee to design a standard for log data on floppy disks that would meet the needs of personal computer users.

Various standards for digital well log data already exist. The LIS format (Log Information Standard) is one of the more popular standards. A more complete standard is presently being prepared by the American Petroleum Institute which is known as the DLIS format (Digital Log Interchange Standard). Both of these standards are very useful but because of their completeness, and resulting complexity, they do not address the needs of most personal computer users.

Users of personal computers have serious space limitations and are normally only interested in the optically presented curves. They also want to get this data into their machines quickly and easily. The LAS format addresses these needs and can be compared to a "Reader's Digest" version of the LIS or DLIS formats. If more detailed log information is required, then the LIS or DLIS format should be used. The LAS format is intended to complement the LIS or DLIS formats as each has its own specific purpose.

GENERAL DESCRIPTION

The LAS format was designed to be easily understood by the user and at the same time contain enough flags to assist the programmer. The LAS format must always be written in ASCII. If it is written using a compression routine, in binary, or in any other form, an executable program must exist on the floppy disk that will convert the file back to LAS format.

The LAS format consists of files. For example, a repeat section would make up one file and the main pass another. Each of the file names end in ".LAS" so that they can be easily recognized. An individual floppy disk must not contain partial files that continue onto a second floppy disk. Large files that do not fit on one floppy must be split into two or more files.

Each file consists of numerous sections. These sections are not order specific except that the last section must always be the data section. The first section is usually the "VERSION" section containing the version number of the LAS format and identifies whether the data is in wrap mode. The "WELL INFORMATION" section contains information on the well name, location, and the start and stop depths of the data in this file. The "CURVE INFORMATION" section contains the curve mnemonics, units used, and the definitions of these mnemonics, in the order that they appear in the data section. The "PARAMETER" section contains information on parameters or constants (such as mud resistivities) and is optional. The "OTHER" section is also optional and contains any other information or comments. The last section is always the "ASCII LOG DATA" section. Depth values should appear in the first column and each column of data must be separated by a space.

More detailed LAS format specifications can be found in the Appendix.

REFORMAT AND CERTIFY PROGRAMS

To assist users of LAS formatted data, a program was written to modify LAS files into forms that may be more compatible to the user's needs. The program is called REFORMAT and can perform the following tasks:

- 1) Extract a specific depth interval
- 2) Extract specific curves
- 3) Reverse depth direction
- 4) Change sampling interval
- 5) Convert wrap mode to unwrap mode
- 6) Scan for non-standard characters which may be causing difficulties for some programs.

The CERTIFY program was designed to verify that files meet the LAS standard. If the LAS standards are not met, it will identify the errors. In case of disagreement between this program and the printed LAS standard document, the document will be deemed to be correct. The CERTIFY program also includes documentation on the LAS standard.

The REFORMAT and CERTIFY programs were written by Robin Winsor of Gulf Canada Resources Ltd. in ANSI standard "C" and compiled with a Microsoft C 5.1 compiler. These programs are not part of the LAS standard.

The author of these programs does not reserve any rights and does not warrant the program for any specific purpose. An LAS information package is available for \$10.00 through the C.W.L.S. The package includes an executable form of the REFORMAT and CERTIFY programs, source code for REFORMAT, and two test LAS files on a 3.5 inch 720K DOS compatible floppy disk.

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CONCLUSIONS

The latest release of the LAS format is version 1.2 which was released in August of 1989. The CWLS Floppy Disk Committee will monitor the LAS format to address problems and make modifications to the standard as required. Feedback concerning the user's likes or dislikes would be greatly appreciated and should be sent to the CWLS to the attention of the Floppy Disk Committee.

It is hoped that by creating the LAS format, more widespread use will be made of digital log data.

APPENDIX

LAS FORMAT SPECIFICATIONS FOR VERSION 1.2

PART 1 GENERAL DESCRIPTION

The LAS Format is designed to store log data on floppy disks. This standard is intended to simplify the exchange of digital log data between users. The general specifications of this format are as follows:

- 1) The floppy disk size, type, or density is not specified because conversion between them is straightforward.
- 2) It is the intent of this standard to store optically presented log curves although other curves may also be stored. Raw count rates, waveform data etc. are more efficiently stored on magnetic tape using LIS or DLIS format.
- 3) Floppy disks in the LAS format must be MS/DOS or PC/DOS compatible
- 4) The file will be written in ASCII. If the file is written using a compression method, in binary, or in any other form, an executable program must exist on the floppy to convert it back to LAS format.
- 5) An individual floppy disk must not contain partial files that continue onto a second floppy. Large files that do not fit onto one floppy must be split into two or more separate files. This may be achieved by splitting the curves or segmenting the depths.
- 6) All files in LAS format must end in ".LAS" so that they may be easily recognized.

- 7) The LAS format is a minimum standard. It is expected that most users and suppliers will exceed this minimum standard.

PART 2 MAJOR COMPONENTS OF AN LAS FILE

Each LAS file contains numerous sections and each section begins with a tilde (~) mark. The last section in an LAS file must always be the log data section.

The sections that make up an LAS file are as follows:

- V - contains version and wrap mode information
- W - contains well identification
- C - contains curve information
- P - contains parameters or constants
- O - contains other information such as comments
- A - contains ASCII log data

These sections are described in more detail in part four of this appendix.

PART 3 FLAGS

Flags are used to assist computers in identifying specific lines in a file. The following flags are used in the LAS format:

- a) "~" (tilde): The ASCII equivalent of this flag is decimal 126 or hexadecimal 7E. This flag when used will be the first non-space and non-quotation character on a line. It is used to mark the beginning of a section in a file. The first letter directly after the tilde identifies the section. (See part two.) All upper case letters in the space following a tilde mark are reserved for use by the committee. The remainder of the line will be treated as comments.
- b) "#" (pound): The ASCII equivalent of this flag is decimal 35 or hexadecimal 23. This flag when used will be the first non-space and non-quotation character on a line. The Pound sign is used to indicate that the line is a comment line. Comment lines can appear anywhere above the data section.
- c) "." and ":" : In sections other than the data section, dots and colons are used to delimit information within the line. They are usually aligned for ease of reading. Information to the right of the colon is a detailed definition of the mnemonic that is located to the left of the colon. The dot is used to separate two mnemonics. Spaces may occur to the right or left of a dot or colon.

PART 4 DETAILS

The actual format for each of the sections discussed in this part of the paper is best understood by looking at the examples in the boxed areas. The exact spacing is not critical because computer programs will use the dots, colons and spaces to decipher each line.

- 1) -V (Version Information)

-This section is mandatory and usually appears at the very beginning of the

file.

-It identifies which version of the LAS format is being used and whether wrap mode is used.

-This section must contain the following lines:

"VERS. 1.2: CWLS LOG ASCII STANDARD - VERSION 1.2"
Refers to which version of LAS was used.

"WRAP. YES: Multiple lines per depth step"
OR

"WRAP. NO: One line per depth step"
Refers to whether a wrap around mode was used in the data section. If no wrap mode is used the line will have a maximum length of 256 characters (including the carriage return and line feed). If wrap mode is used the depth value will be on its own line and all lines of data will be no longer than 80 characters (including carriage return and line feed).

-Additional lines in the version section are optional.

The following is an example of a Version Information Section.

~Version Information Section

VERS. 1.2: CWLS log ASCII Standard -VERSION 1.2
WRAP. NO: One line per depth step

(II) -W (Well Information)

-This section is mandatory.

-It identifies the well, its location and indicates the start and stop depths of the file.

-This section must contain the following lines with the mnemonics as indicated:

"STRT.M nnn.nn: "
Refers to the first depth in the file. The "nnn.nn" refers to the depth value. The number of decimals used is not restricted. The ".M" refers to meters and can be replaced when other units are used. The start depth can be either greater or less than the stop depth.

"STOP.M nnn.nn: "
Refers to the last depth in the file. The "nnn.nn" refers to the depth value. The number of decimals used is not restricted. The ".M" refers to meters and can be replaced when other units are used.

"STEP.M nnn.nn: "
Refers to the depth increment used. A minus sign must precede the step value if the start depth is greater than the stop depth (ie, from TD to casing has a minus step value). A step value of zero indicates a variable step.

"NULL. -nnn.nn: "
Refers to null values. Two common ones in use are -9999 and -999.25.

"COMP. COMPANY : "
Refers to company name.

"WELL. WELL: "
Refers to the well name.

"FLD. FIELD: "
Refers to the field name.

"LOC. LOCATION: "
Refers to the well location.

"PROV. PROVINCE: "
Refers to the province. For areas outside Canada this line may be replaced by:

"CNTY. COUNTY: "
"STAT. STATE: "
"CTRY. COUNTRY: "

"SRVC. SERVICE COMPANY: "
Refers to logging company.

"DATE. DATE: "
Refers to date logged.

"UWI . UNIQUE WELL ID: "
Refers to unique well identifier. (See References.) For areas outside of Canada this may be replaced by:

"API . API NUMBER: "

-Additional lines in the well information section are optional. There is no limit set on the number of additional lines.

The following is an example of a Well Information Section.

```
-----
~Well Information Section
#MNEM. UNIT       Data Type       Information
#-----
STRT. M           635.0000:
STOP. M           400.0000:
STEP. M           -0.1250:
NULL.             -999.25:
COMP.             COMPANY:        ANY OIL COMPANY INC.
WELL.             WELL:           ANY ET AL A9-16-49-20
FLD .             FIELD:          EDAM
LOC .             LOCATION:         A9-16-49-20W3M
PROV.             PROVINCE:       SASKATCHEWAN
SRVC.             SERVICE COMPANY: ANY LOGGING COMPANY INC.
DATE.             LOG DATE:       13-DEC-86
UWI .             UNIQUE WELL ID: 100091604920W300
-----
```

(III) -C (Curve Information)

-This section is mandatory.
-It describes the curve and its units in the order they appear in the data section of the file.

- The mnemonics used are not restricted but must be defined on the line in which they appear.
- API codes are optional. (See References.)
- The curves described in this section must be present in the data set.
- The first curve described should normally be depth.

The following is an example of a Curve Information Section with API codes.

```
-----
~Curve Information Section
#MNEM. UNIT      API CODE      Curve Description
#-----
DEPTH. M          :      1      DEPTH
RHOB . K/M3       7 350 02 00:      2      BULK DENSITY
NPHI . VOL/VOL    7 890 00 00:      3      NEUTRON POROSITY - SANDSTONE
MSFL . OHMM       7 220 01 00:      4      Rxo RESISTIVITY
SFLA . OHMM       7 222 01 00:      5      SHALLOW RESISTIVITY
ILM . OHMM        7 120 44 00:      6      MEDIUM RESISTIVITY
ILD . OHMM        7 120 46 00:      7      DEEP RESISTIVITY
SP . MV           7 010 01 00:      8      SPONTANEOUS POTENTIAL
GR . GAPI         7 310 01 00:      9      GAMMA RAY
CALI . MM         7 280 01 00:     10      CALIPER
DRHO . K/M3       7 356 01 00:     11      DENSITY CORRECTION
-----
```

(IV) ~P (Parameter Information)

- This section is optional. It defines the values of various parameters relating to this well.
- The mnemonics used are not restricted but must be defined on the line on which they appear.
- There is no limit on the number of lines that can be used.

The following is an example of a Parameter Information Section.

```
-----
~Parameter Information Section
#MNEM. UNIT      Value      Description
#-----
BHT. DEGC        24.0000:   Bottom Hole Temperature
BS . MM          222.0000:   Bit Size
FD . K/M3        999.9999:   Fluid Density
MDEN. K/M3       2650.0000:  Logging Matrix Density
MATR.            1.0000:    Neutron Matrix (1=Sand)
FNUM.            1.0000:    Tortuosity Constant Archie's (a)
FEXP.            2.0000:    Cementation Exponent Archie's (m)
DFD . K/M3       1200.0000:  Mud Weight
DFV . S          50.0000:    Mud Viscosity
DFL . C3         8.0000:    Mud Fluid Loss
DFPH.            10.0000:    Mud pH
RMFS. OHMM       2.8200:    Mud Filtrate Resistivity
EKB . M          566.9700:   Elevati on Kelly Bushing
EGL . M          563.6799:   Elevati on Ground Level
-----
```

(V) -0 (Other Information)

-This section is optional. Its intended use is as a remarks or comments section.

(VI) -A (ASCII LOG DATA)

-The data section will always be the last section in a file.

-Depths should always appear in the first column

-Each column of data must be separated by at least one space.

-A line of less than 256 characters (including a carriage return and line feed) will normally not be wrapped. Wrap mode will be used if the data is longer than 256 characters.

-In wrap mode, depth will be on its own line.

-In wrap mode a line of data will be no longer than 80 characters. This includes a carriage return and line feed.

-If wrap mode is used, the decimal points must be aligned for ease of reading.

-Exponents are not permitted. The curve section can be used to overcome this limitation by changing the units.

References

UWI codes : "Formation Water Resistivities of Canada", CWLS, 1987.

API codes : "Recommended Standard Format for Recording Digital Well Log Data on Magnetic Tape",
API - Bul. D-9, 3rd edition, 1981.

EXAMPLE #1 - ILLUSTRATING THE LOG ASCII STANDARD IN UNWRAPPED MODE

```
-----
~VERSION INFORMATION
VERS.          1.2:  CWLS LOG ASCII STANDARD -VERSION 1.2
WRAP.          NO:  ONE LINE PER DEPTH STEP
~WELL INFORMATION BLOCK
#MNEM. UNIT    DATA TYPE  INFORMATION
#-----
STRT.M         1670.000000:
STOP.M         1660.000000:
STEP.M         -0.1250:
NULL.         -999.2500:
COMP.          COMPANY:   ANY OIL COMPANY LTD.
WELL.          WELL:     ANY ET AL OIL WELL #12
FLD .          FIELD:    EDAM
LOC .          LOCATION:  A9-16-49-20W3M
```

PROV. PROVINCE: SASKATCHEWAN
 SRVC. SERVICE COMPANY: ANY LOGGING COMPANY LTD.
 DATE. LOG DATE: 25-DEC-1988
 UWI . UNIQUE WELL ID: 100091604920W300

~CURVE INFORMATION

#MNEM. UNIT	API CODE	CURVE DESCRIPTION
#-----	-----	-----
DEPT. M		: 1 DEPTH
DT . US/M		: 2 SONIC TRANSIT TIME
RHOB. K/M3		: 3 BULK DENSITY
NPHI . V/V		: 4 NEUTRON POROSITY
SFLU. OHMM		: 5 RXO RESISTIVITY
SFLA. OHMM		: 6 SHALLOW RESISTIVITY
ILM . OHMM		: 7 MEDIUM RESISTIVITY
ILD . OHMM		: 8 DEEP RESISTIVITY

~PARAMETER INFORMATION

#MNEM. UNIT	VALUE	DESCRIPTION
#-----	-----	-----
BHT . DEGC	35.5000:	BOTTOM HOLE TEMPERATURE
BS . MM	200.0000:	BIT SIZE
FD . K/M3	1000.0000:	FLUID DENSITY
MATR.	0.0000:	NEUTRON MATRIX (0=LIME, 1=SAND, 2=DOLO)
MDEN.	2710.0000:	LOGGING MATRIX DENSITY
RMF . OHMM	0.2160:	MUD FILTRATE RESISTIVITY
DFD . K/M3	1525.0000:	DRILL FLUID DENSITY

~Other

Note: The logging tools became stuck at 625 meters causing the data between 625 meters and 615 meters to be invalid.

~A DEPTH	DT	RHOB	NPHI	SFLU	SFLA	ILM	ILD
1670.000	123.450	2550.000	0.450	123.450	123.450	110.200	105.600
1669.875	123.450	2550.000	0.450	123.450	123.450	110.200	105.600
1669.750	123.450	2550.000	0.450	123.450	123.450	110.200	105.600

EXAMPLE #2 - ILLUSTRATING THE MINIMUM REQUIREMENTS
 OF THE LOG ASCII STANDARD IN UNWRAPPED MODE.

```
-----
~V
VERS.          1.2:  CWLS log ASCII Standard -VERSION 1.2
WRAP.          NO:   One line per depth step
~W
STRT. M        635.0000:
STOP. M        400.0000:
STEP. M        -0.1250:
NULL.          -999.25:
COMP.          COMPANY: ANY OIL COMPANY INC.
WELL.          WELL:   ANY ET AL A9-16-49-20
FLD .         FIELD:   EDAM
LOC .         LOCATION: A9-16-49-20W3M
PROV.         PROVINCE: SASKATCHEWAN
SRVC.        SERVICE COMPANY: ANY LOGGING COMPANY INC.
DATE.        LOG DATE: 13-DEC-86
UWI .        UNIQUE WELL ID: 100091604920W300
~C
DEPT. M       :      DEPTH
RHOB. K/M3    :      BULK DENSITY
```

NPHI . VOL/VOL : NEUTRON POROSITY - SANDSTONE
 MSFL. OHMM : Rxo RESISTIVITY
 SFLA. OHMM : SHALLOW RESISTIVITY
 ILM . OHMM : MEDIUM RESISTIVITY
 I LD . OHMM : DEEP RESISTIVITY
 SP . MV : SPONTANEOUS POTENTIAL

~A

635.0000	2256.0000	0.4033	22.0781	22.0781	20.3438	3.6660	123.4
634.8750	2256.0000	0.4033	22.0781	22.0781	20.3438	3.6660	123.4

EXAMPLE #3 - ILLUSTRATING THE WRAPPED VERSION
OF THE LOG ASCII STANDARD

~Version Information

VERS. 1.20: CWLS log ASCII Standard -VERSION 1.20
 WRAP. YES: Multiple lines per depth step

~Well Information

#MNEM. UNIT	Data Type	Information
#-----	-----	-----
STRT. M	910.000:	
STOP. M	901.000:	
STEP. M	-0.1250:	
NULL.	-999.2500:	Null value
COMP.	COMPANY:	ANY OIL COMPANY INC.
WELL.	WELL:	ANY ET AL XX-XX-XX-XX
FLD .	FIELD:	WILDCAT
LOC .	LOCATION:	XX-XX-XX-XXW3M
PROV.	PROVINCE:	SASKATCHEWAN
SRVC.	SERVICE COMPANY:	ANY LOGGING COMPANY INC.
SON .	SERVICE ORDER #:	142085
DATE.	LOG DATE:	13-DEC-86
UWI .	UNIQUE WELL ID:	

~Curve Information

#MNEM. UNIT	API CODE	Curve Description
#-----	-----	-----
DEPT. M		: Depth
DT . US/M		: 1 Sonic Travel Time
RHOB. K/M		: 2 Density-Bulk Density
NPHI . V/V		: 3 Porosity -Neutron
RXO . OHMM		: 4 Resistivity -Rxo
RESS. OHMM		: 5 Resistivity -Shallow
RESM. OHMM		: 6 Resistivity -Medium
RESD. OHMM		: 7 Resistivity -Deep
SP . MV		: 8 Spon. Potential
GR . GAPI		: 9 Gamma Ray
CALI. MM		: 10 Caliper
DRHO. K/M3		: 11 Delta-Rho
EATT. DBM		: 12 EPT Attenuation
TPL . NS/M		: 13 TP -EPT
PEF .		: 14 PhotoElectric Factor
FFI . V/V		: 15 Porosity -NML FFI
DCAL. MM		: 16 Caliper-Differential
RHGF. K/M3		: 17 Density-Formation
RHGA. K/M3		: 18 Density-Apparent
SPBL. MV		: 19 Baseline SP

GRC . GAPI : 20 Gamma Ray BHC
 PHI A. V/V : 21 Porosity -Apparent
 PHI D. V/V : 22 Porosity -Density
 PHI E. V/V : 23 Porosity -Effective
 PHI N. V/V : 24 Porosity -Neut BHC
 PHI C. V/V : 25 Porosity -Total HCC
 RO . OHMM : 26 Ro
 RWA . OHMM : 27 Rfa
 SW . : 28 Sw -Effective
 MSI . : 29 Sh Idx -Min
 BVW . : 30 BVW
 FGAS. : 31 Flag -Gas Index
 PIDX. : 32 Prod Idx
 FBH . : 33 Flag -Bad Hole
 FHCC. : 34 Flag -HC Correction
 LSBW. : 35 Flag -Limit SWB

-A Log data section

910.000000

-999.2500	2692.7075	0.3140	19.4086	19.4086	13.1709	12.2681
-1.5010	96.5306	204.7177	30.5822	-999.2500	-999.2500	3.2515
-999.2500	4.7177	3025.0264	3025.0264	-1.5010	93.1378	0.1641
0.0101	0.1641	0.3140	0.1641	11.1397	0.3304	0.9529
0.0000	0.1564	0.0000	11.1397	0.0000	0.0000	0.0000

909.875000

-999.2500	2712.6460	0.2886	23.3987	23.3987	13.6129	12.4744
-1.4720	90.2803	203.1093	18.7566	-999.2500	-999.2500	3.7058
-999.2500	3.1093	3004.6050	3004.6050	-1.4720	86.9078	0.1456
-0.0015	0.1456	0.2886	0.1456	14.1428	0.2646	1.0000
0.0000	0.1456	0.0000	14.1428	0.0000	0.0000	0.0000

909.750000

-999.2500	2692.8137	0.2730	22.5909	22.5909	13.6821	12.6146
-1.4804	89.8492	201.9287	3.1551	-999.2500	-999.2500	4.3124
-999.2500	1.9287	2976.4451	2976.4451	-1.4804	86.3465	0.1435
0.0101	0.1435	0.2730	0.1435	14.5674	0.2598	1.0000
0.0000	0.1435	0.0000	14.5674	0.0000	0.0000	0.0000

909.625000

-999.2500	2644.3650	0.2765	18.4831	18.4831	13.4159	12.6900
-1.5010	93.3999	201.5826	-6.5861	-999.2500	-999.2500	4.3822
-999.2500	1.5826	2955.3528	2955.3528	-1.5010	89.7142	0.1590
0.0384	0.1590	0.2765	0.1590	11.8600	0.3210	0.9667
0.0000	0.1538	0.0000	11.8600	0.0000	0.0000	0.0000

909.500000

-999.2500	2586.2822	0.2996	13.9187	13.9187	12.9195	12.7016
-1.4916	98.1214	201.7126	-4.5574	-999.2500	-999.2500	3.5967
-999.2500	1.7126	2953.5940	2953.5940	-1.4916	94.2670	0.1880
0.0723	0.1880	0.2996	0.1880	8.4863	0.4490	0.8174
0.0000	0.1537	0.0000	8.4863	0.0000	0.0000	0.0000

 UPDATE AUGUST 14, 1991

The latest versions are as follows:

LAS -version 1.2
 REFORMAT -version 2.0 (correcting errors in resampling and unwrap options)
 CERTIFY -version 1.0

Please address any problems to:

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