

Standards and Geophysical Data

UPSTREAM INTERNATIONAL DATA EXCHANGE FORMATS ON TAPE AND DISK

Not Rocket Science





Low Cost



350 square kilometre 3D seismic survey
on Block L in Brunei Darussalam.

The survey, costing a total of
approximately US\$15.3 million,
is expected to commence in
Q1 of 2008.

Who Do You Know

- SEG
- Energistics



- OGP



OGP, Energistics and SEG

- Standards

- SEG-D
- SPS
- SEG-Y
- Velocity
- P2/90
- P1/90
- WITSML
- PRODML

- Compliance

- Version
- Layout

OGP

Abu Dhabi National Oil
Company

Addax Petroleum

Anadarko Petroleum

BG Group

BHP Billiton

BP plc

Cairn Energy

Chevron Corporation

CNOOC Limited

ConocoPhillips

Devon Energy Corporation

Dolphin Energy Ltd

DONG Energy

Dragon Oil

Eni SpA

ExxonMobil

Fairfield Energy plc

GDF SUEZ

Hess Limited

Hocol

INPEX Corporation

KUWAIT OIL COMPANY

Maersk Olie og Gas AS

Marathon Oil Company

MOL Plc – Hungarian Oil Gas

Mubadala

Nexen Inc.

Oil & Natural Gas Corporation, India

OMV

Papuan Oil Search Ltd

Perenco Holdings Ltd

Petróleo Brasileiro SA

Petróleos Mexicanos (PEMEX)

Petronas Carigali Sendirian Berhad

Premier Oil

PTT Exploration and Production

Qatar Petroleum

Ras Laffan Liquified Natural Gas

Repsol YPF

Safer Exploration & Production

Shell International Exploration

Shtokman Development AG

Statoil

Suncor

Talisman Energy

TNK-BP Management

Total

Tullow Oil

Wintershall AG

Woodside Energy Ltd

Yemen LNG Company Ltd

American Petroleum Institute (API)

Asistencia Recíproca Petrolera

Empresarial Latinoamericana

(ARPEL)

Association of German Oil & Gas

Producers (WEG)

ASSOMINERARIA

Australian Petroleum Production &

Exploration Association

Brazilian Petroleum, Gas and

Biofuels Institute (IBP)

Colombian Safety Council

Energy Institute

International Association of Drilling

Contractors (IADC)

International Association of

Geophysical Contractors (IAGC)

International Petroleum Industry

Environmental Conservation

Association (IPIECA)

Irish Offshore Operators'

Association (IOOA)

Netherlands Oil and Gas

Exploration and Production

Association (NOGEPa)

Norwegian Oil Industry

Association (OLF)

Oil & Gas UK

Energistics

Accenture
American Geological Institute AP
Arizona Geological Survey
AspenTech
Athens Group, Inc.
Atman Consulting
Atos Origin
Austin GeoModeling, Inc.
Baker Hughes
Beijing Yiheng Sunny Tech.
BJ Services
BP
Cavendish Group, Oil & Gas
Chevron
Common Data Access Ltd
Computer Modelling Group
Covisint
UK DECC
US DOI-BLM-MMS
Digital Energy Journal
Digital Oilfield Solutions
India (DGH)
DreiBit
DrillScan
Dynamic Graphics, Inc.
ECCMA
Energy Tribune
Enigma Data Solutions Ltd
ExxonMobil
Geolog SPA
Geologix Ltd
Geoservices
GrooViz
Ground Water Protection
Halliburton
HRH Limited
IBM Corporation

Independent Data Services
Infosys
Institut Francais du Petrole (IFP)
Interactive Network Technologies
International Association of Oil & Gas
Producers (OGP)
IO-hub
JOA Oil & Gas BV
Kongsberg
LIOS Technology
Maersk Oil
Mahindra Satyam
Matrikon
Merrick Systems, Inc.
Microsoft Corporation
Moblize
Nancy School of Geology
National Oilwell Varco
Norwegian Petroleum Directorate
Object Management Group
Offshore Engineer
OFS Portal LLC
Oil & Gas Eurasia
Oil & Gas Vertical
Oil IT Journal
OilTeams S.R.L.
Oilware, Inc.
ONGC
Open Geospatial Consortium (OGC)
OpenSpirit
Oracle
OSIsoft, LLC
Paradigm
Pason

Peloton
Perfomix
Petris Technology, Inc.
PetroComputing
Petroleum Agency SA
PIDX
Petrolink
Petrotechnical Data Systems
Pioneer Natural Resources
Pipeline Open Data Standard
PointCross, Inc.
POSC Caesar Association
PPDM Association
Romanian SocietyGeophysics
Roxar
RPS Energy
Saudi Aramco
Schlumberger
Seismic Micro-Technology
Shell
Sillimanite Software Limited
Smith International
Soyuzneftegazservice (SNGS)
Sristy Technologies LLC
Statoil
Tata Consultancy Services (TCS)
The Open Group
Tieto
Total
Transform Software & Services
Verdande Technology
Weatherford
Wellstorm
Woodside Energy
World Oil
Xerox
Zeus Technology

SEG (Society Exploration Geophysicists)

More than 33000 *members* in 138 countries

Oil Company Workflow

Specification

Contract

Acquire (SEGD) – Storage (QC?)

Processes (SEGY) – Storage (QC?)

Delivery of Data to Oil Company

Project

Interpretation

QUALITY CONTROL

- Data Format (Accessible by applications)
- Data Samples (Valid information)
- Meta-data (e.g. Positioning)
- ?Statistics / Compliance
ETC.....



Exchange Formats

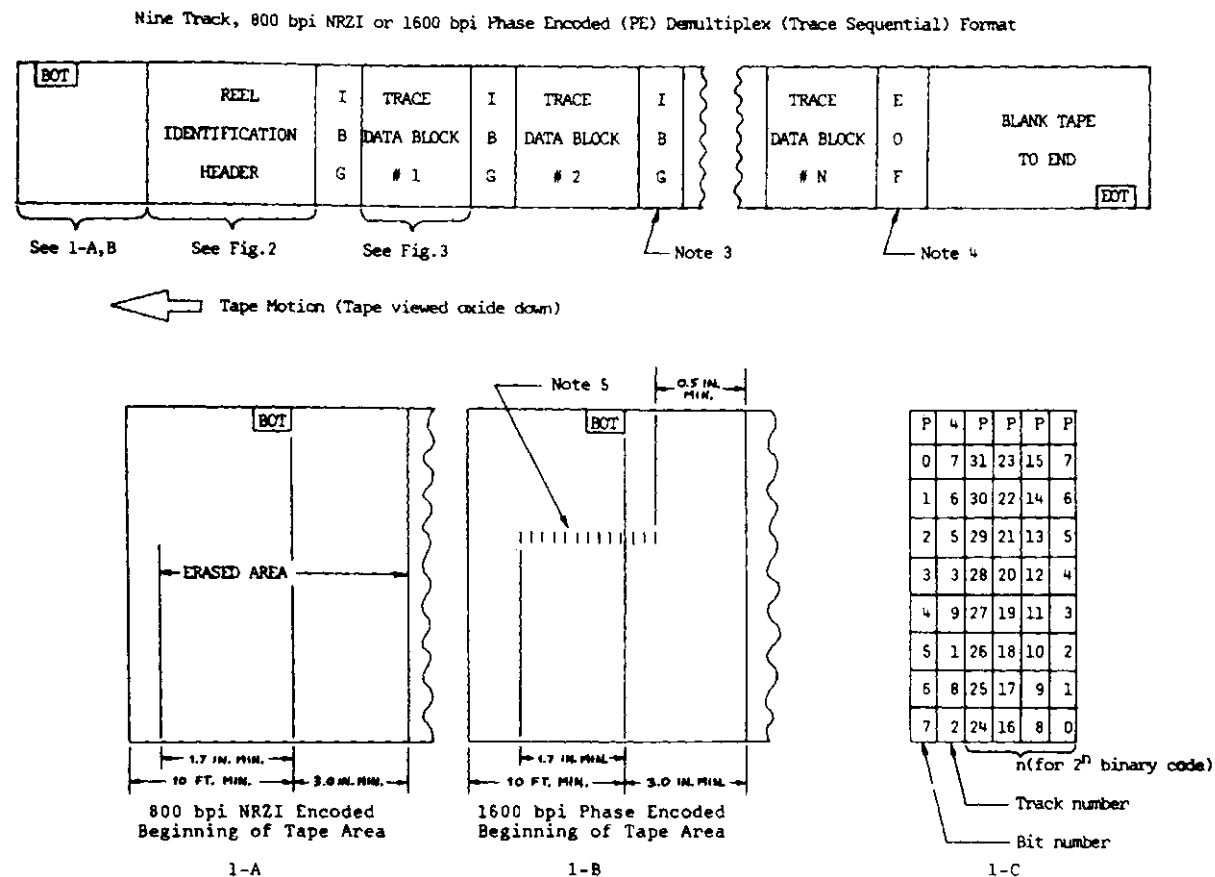
- Data and the Exchange Formats
 - The basis of all, data, information and knowledge

Without Digital Samples You Cannot Find Oil and Gas

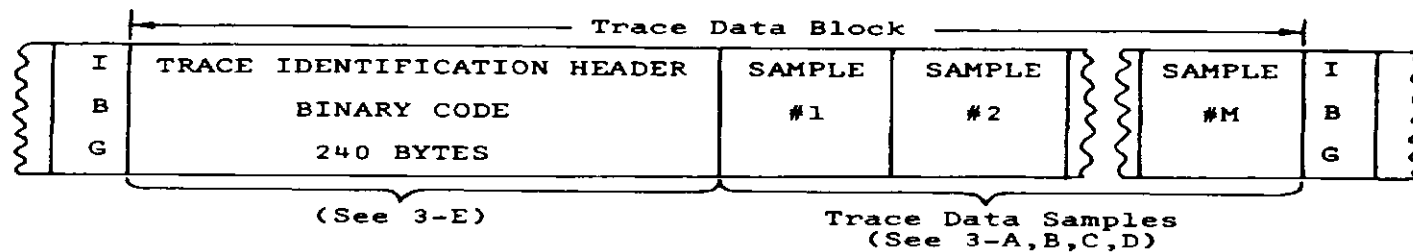
Tape And/Or Disk

TAPE

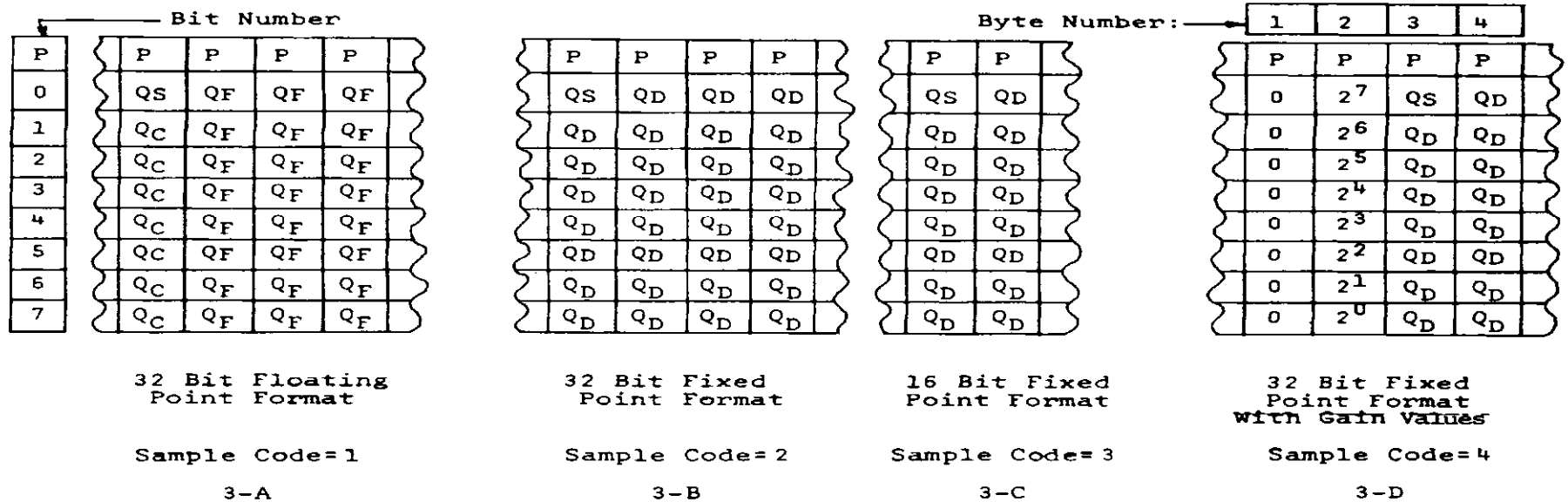
Sample Data Exchange Formats Began As Tape Formats



TAPE MAP



TRACE DATA SAMPLE FORMATS



ENCAPSULATION or NATIVE

SEGD and SEG Y – Native on Disk

Uses information in header record to create byte stream

SEG Y – Binary Header, number of samples per trace

SEGD – Calculates number of samples per trace

SEGY EBCDIC Header

3205-3208	*	Line number (only one line per reel).
3209-3212	*	Reel number.
3213-3214	*	Number of data traces per record
3215-3216	*	Number of auxiliary traces per record
3217-3218	*	Sample interval in μ sec (for this reel of data)
3219-3220	*	Sample interval in μ sec (for original field recording)
3221-3222	*	Number of samples per data trace (for this reel)
3223-3224	*	Number of samples per data trace (for original)
3225-3226	*	Data sample format code
3227-3228	*	CDP fold (expected number of traces per CDP/ensemble).

SEGY Binary Header

3201-3204		Job number: 375860
3205-3208	*	Line number: 1234
3209-3212	*	Reel number: 1
3213-3214	*	Data traces per ensemble: 240
3215-3216	*	Aux traces per ensemble: 2
3221-3222	*	Sample interval (this reel): 2000
3221-3222	*	Samples per trace (this reel): 3072
3225-3226	*	Sample format code: 1 (IBM 32-bit FP)
3229-3230		Trace sort code: 1 (as recorded (field))

SEGY Trace Header

- 1 - 4 * Trace sequence number within line-numbers continue to increase if additional reels are required on same line.
- 9 -12 * Original field record number.
- 13-16 * Trace number within the original field record.
- 29-30 * Trace identification code:
 - 1 = seismic data 4 = time break 7 = timing
 - 2 = dead 5 = uphole 8 = water break
 - 3 = dummy 6 = sweep 9----- N =
 - optional use
- 115-116 * Number of samples in this trace.
- 117-118 * Sample interval in μsec for this trace

SEGD Header

---- Format recognized as SEGDMX ----

File number: 128

SEGD format code: 8024 (16-bit quaternary exponent demultiplexed)

SEGD format revision: 0000

Base scan interval: 2 millise

Record length: 5632 millise

Date and time: 94/049 15:55:14

Record type: 8 (normal record)

Manufacturer code: 22 (Geco/Prakla)

Scan Type	Chan Set	Chan Type	No Chans	Sample Int	Start Time	End Time
1	1	6	27	2	0	5632
1	2	1	960	2	0	5632

Normal {Normal completion}

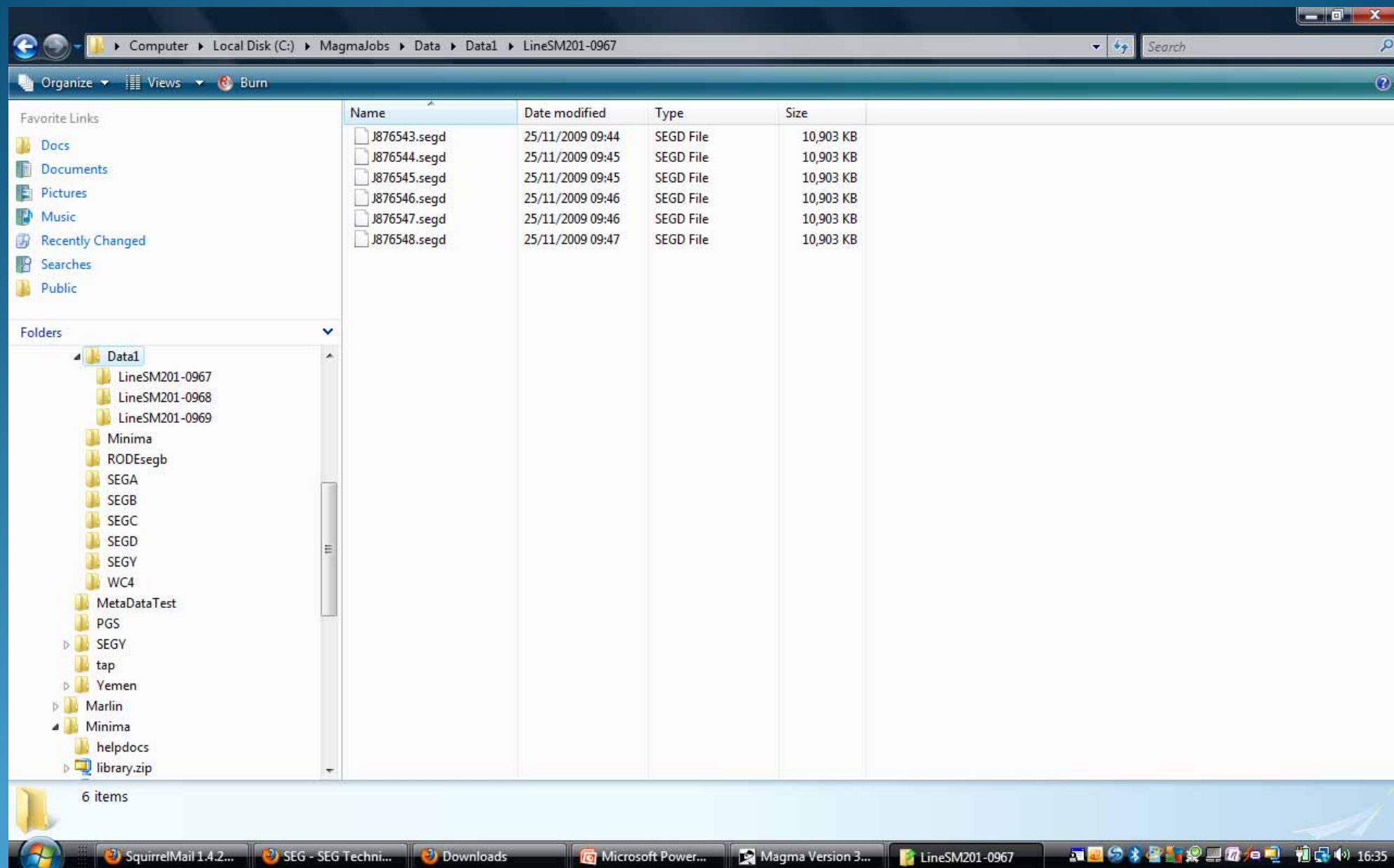
SEGD ON DISK

T-Max	Minus	T – Zero
End Time	Minus	Start Time

DT

First Sample at Time Zero = Extra Sample

SEGD ON DISK - LAYOUT



SEGD ON DISK?

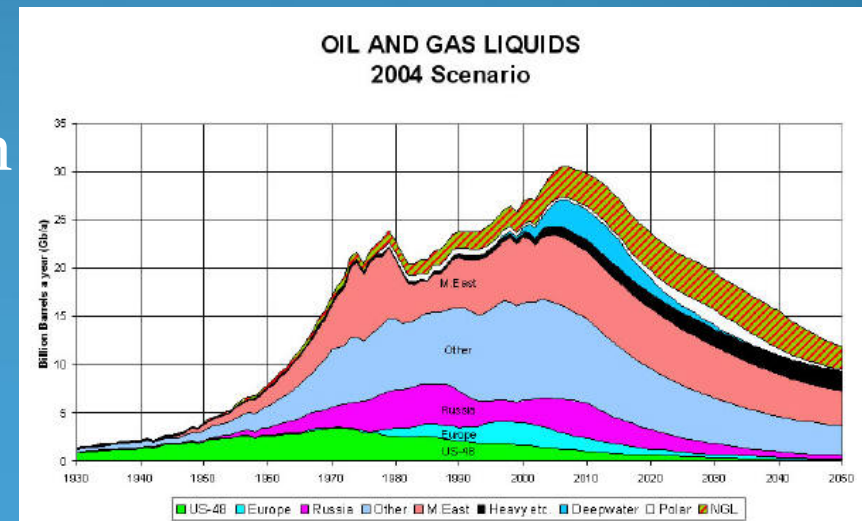
Ramifications of Individual SEG D files

480 channel / 2 mil / 6 second
SEG D 8015 – 20 bit binary

- 100,000 x 3590 cartridges = approx 280 million files

SEGD 3.0

- The Future –
 - Improved Handshake to QC and Processing
 - Measurements Table – (Open Spirit/Energistics)
 - Table of Contents - Survey Information
 - Co-ordinate Reference System- EPSG Compliant
 - Time Stamp GPS Epoch
 - Complex Source Configuration
 - Trailer – Edits etc
 - Increased Flexibility
 - Data on Disk



ENCAPSULATION

TIF - Tape Image File

Baker Hughes method for writing BIT wire line
format data to disk

- Native limit, pointer signed – 2 Gig
- Native limit, pointer unsigned – 4Gig
- Virtual Pointers
- Extended TIF – many versions, not a published or ratified exchange standard

ENCAPSULATION

TAR

Tape ARchive also known as tarball

Standardized by
POSIX.1-1988 and later *POSIX.1-2001*.

Implmentations – Unix TAR, Linux TAR, Windows
WinTar, 32 bit TAR, 64 bit TAR

ENCAPSULATION

RODE

Record Oriented Data Encapsulation

SEG data exchange standard

Meta-data entry fields

Based on RP66 as is DLIS

Complex but published and reliable if using correct
implementation

Standards within Standards

- OGP
 - Surveying and Positioning Committee
- SEG
 - Technical Standards Committee
- “Standards Within Standards”
 - Positioning
 - Measurements Tables
 - Manufacturers Codes



Updates

- OGP – positioning exchange formats
 - Headers in line with SEG D
- Energistics – velocity exchange format
 - Headers in line with OGP “P” formats
- SEG – SPS format
 - Headers in line with OGP and SEG formats
- SEG – Update of SEG D

Enable reading of formats as csv and xml files

Revisit Old Data

Quote from IBM web-site

“Effective September 29, 2006, IBM will withdraw from marketing the 3590 Enterprise Tape Drive.”



- Tape currently 600 Gig 3592
 - High Enterprise Drive (the only one)
 - In Design Phase the 5.5 Terrabyte tape

Contracts

- What do They Say?
 - SEG Compliant
 - SEG D
 - Nothing
- Cut and Paste
- Needle in Haystack
 - How do you organize 600 Gbytes of data
- 4 Hrs to 20 Hrs



In Conclusion

- Use Standards and Good Practices
- Properly specify what you want
- Free advise from professional body
- From TODAY Improve things
- USA Government, real time monitoring
- NPD Mandate SEGD 3.0 for Norwegian Waters

Historic Data – 10 year cycle of proactive
data management

SEG – Guidelines

Geophysical Data Management

Be there or Be Square

Thank You

- Jill Lewis, Managing Director
 - Troika International
- Technical Standards Committee, SEG
- Liaison SEG/OGP
- Co-Chair Global Affairs Committee
 - Europe and FSU
- SEG, PESGB, AAPG, SPE, EI, HGS, GSH, GOSH, EAGE, APSG, SPE