

# Getting unstructured & analogue data within the "mining and analytics" window

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Finding Petroleum Transforming Subsurface Science 18 April 2016



## <u>Getting unstructured & analogue data within the "mining and analytics" window</u>

Oil & Gas Legacy Data - value and challenge for maximising potential

Legacy Data - how big is it

Typical storage, access and analysis workflow

The shared file folder system challenges

File folder system organisation - lack of consistency within each organsiation

Industry cost reduction is increasing the challenges – decreasing manpower efficiency

### Hampton Data Service Solution

1) Map data/information landscape – using proprietary geoscope software (automated data interrogation and classification) radically reducing time of mapping

2) Data clean up and improved DB construction / reconstruction (using geoscope?)





Global oil production by discovery date

What's the % of Data in Digital "Vector" Format





Electronic Live Data on In-House/Hosted Fileservers (Unstructured & Structured ?)





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# The Shared File Folder Systems

Shared LAN file systems continue to be an integral part of most operational E&P project IM/DM environments, and the main file I/O and exchange location.

Even when Master Data Stores & Reference DBs exist, a lot of the E&P data expert's time is spent outside these environments, creating & manipulating files/records, both directly as files on the shared file system and in task specific applications.

These G&G users are seldom experienced or interested data managers and tend to work in a "creative" (to some chaotic) environment, that inevitably creates multiple versions/iterations and more data.



# Shared File Folder Systems

Conversely, Data Managers are seldom G&G subject matter experts, and want things "tidy" and "rationalized"

i.e structured and easy for them to manage

They try and impose order on the data users and creators to "tidy up", database and log their actions (so as to provide auditability) after a hard day's work at the workstation

This is a difficult (mostly impossible) to achieve.



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- Lack of consistent File Folder structure within companies
  - Also within industry
  - every client different

Subsurface and Well Engineering Department (3+223675): 42.13MB+351.76GB

- 02. Wells and Reservoir Surveillance (0+1474): 0+403.62MB
- 03. Short and Long Term Production Forecast (1+329): 294.01KB+219.69MB 04. Production Loss Management (0+165): 0+314.24MB
- 05 Opportunity Register (7+4195) 1 29MR+2 38GR
- Too much data often >> 100,000 data files
- Often 50%+ Duplicated

on "somebody else's idea" of a structured filesystem therefore:

"I do not know what is where... and how much there is of it...

What is the "best/correct data to use"!

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08-Decline curve data-analysis (0)



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Taxonomies often a Mix of Disciplines, **Document Types** Processes Spatial entities:

- Wells
- Fields
- Assets
- Surveys

Personal "special folders"

Long wordy sentences

Temp folders that become Permanent and lost

## Currently in the Era of "Cost Reduction"

- E&P Companies are reducing Capex and Head counts
  - 10 30% head count reduction is very common today !
  - But with this reduction, knowledge & experience also leave the company
    - Including personal knowledge of what's what & where it is ...on File System !
  - Projects & Processes are left orphaned and lost inside "Big Data"
    - Projects are "backed-up en-masse" but not "archived" with key metadata
  - Key validation data is disconnected from knowledge
    - Therefore subsequent due diligence processes are impeded and made inefficient
  - Data searching, gap filling and validation become more difficult
    - Expensive technical "Work" is often redone each time a project is reviewed/reactivated
- But E&P Companies are still at a loss as to how to tackle this:
  - the inherent inefficiencies in the utilisation of their key & expensive technical personnel
  - The deep burial & loss of their legacy knowledge by continual unstructured data sedimentation on the Big Data servers

## Legacy "Data" gets Bigger and more unstructured

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Hampton Data Services– has a Solution

> through a combination of Technology + Service

## **E&P Data Validation & Cleanse 1**

For E&P Data Validation the first step is :

## Map the E&P Data/Information Landscape

This is done by **locating and identifying ALL data in ALL its formats in ALL repositories**, *Therefore establishing the Map of the Data and Information Landscape that actually exists* 

Before starting on the road with data migration or clean up strategies.

To ensure successful data clean up, it is essential :

- > That ALL key data and information has been accounted for (nothing missed)
- To be able to Locate ALL instances of data (physical, hardcopy, electronic, DB records) instantly and on-demand
  - without excessive time spent on "finding the right reference data" for validation
- **To Rank the data** in degrees or relevance and importance
- To Compare Data and Information against each other, so as to establish its :

Quality >>> Integrity >>> Provenance



Hampton Data Services– has a Solution

> through a combination of Technology + Service

## **E&P** Data Validation & Cleanse 2

• The process starts with

Running "Data Mining Tool" that can be configured to index and catalogue ALL E&P data files/objects on the shared file system, as well 'customised' to connect to DB records within OBDC compliant Databases.

- After completing such an index, we will know what we have in all the available formats, what's duplicated and where it is located, prior to embarking on any data collation, migration, or clean-up necessary for populating a high integrity corporate database.
- We "mash up" all this information in a comprehensive metadata catalogue.
- This information can be used to:
  - To ensure efficient data clean up and validation at the Start of a project
  - Manage the Project while it is **Operational LIVE and DYNAMIC**
  - Encapsulate the Project Server Data/Information/Knowledge files for archiving



# The Result are:

- Data Is Mapped "as it is" without "moving" or deleting anything,
  - Where the mapping can be
    - automated to "refresh" on demand/overnight on millions of files
    - Or on just the "new files" that have been added since last run
    - Or just "certain" types/classes" of files based on attributes
  - Where the mapping process uses
    - A manual option to identify , link , tag and metadata capture
    - Or an "open" rules database that can be edited by using ;
      - the "content" of files Text as well as special SEG, LAS, DLIS, etc extractors
      - The file names and filepaths
      - Existing file metadata
      - Existing GIS geodatabase fields
      - Functions to allow for Well/Field/Line ID/name aliasing



## Example of Aggregated Metadata Summary at Map Object Level

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Well 0722	Recent-OIL-Production	X_Section 3,X_Section :	9							Oil	13	5 1799.84	710.949	0 0	0 0	0	0 0	3 4	0 0	0	0 0	0 0	0 0	0 0	0 2
Well 0724											7	5 2997	193	0 0	0 0	0	0 0	1	0 0	0	0 0	0	0 0	0 0	5 0
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Once all the "metadata" is collected, a Graphic Display of the Inventory can be made: We can tell that well Saucepan-1 has:



Similarly – you can show "polygons" representing :

- Spatial data object coverage i.e. Maps , GIS coverage
- Project Data Coverage Petrel / Kingdom / AOI
- Seismic/Geophysical Surveys



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## Case Study 1 GEOEX – BilView Energy – Nigeria



http://www.geoex-international.com/projects/nigeria-well-log-portfolio

- Data preparation & mining for
- Well Data package sales
- on behalf of the DPR in Lagos

Data promoted for sale though :

http://www.geoinfoweb.com/

- Data in Lagos/Port Harcourt
  - Metadata Shared

## Case study 1

What is the challenge

Massive large well database to manage input and continual updates

- ➢ 65,000 analog well log scanned images
- > 20,000+ LAS/DLIS files
- 10.000's of other associated document

To catalogue/index the full well data spectrum To QC the well information and well log digital data Intergrate database with updates arriving on unstructured disk Create a TRUSTED reference database with full AUDITABILITY

What was HDS approach / process initial full data indexing and cataloguing continual monitoring & management to keep database "evergreen" create Gold Standard reference well database for sales process

What was the outcome? How did HDS create value? A comprehensive full catalogue of well information and well data established Full auditability between raw source data and deliverables



## PHASE 1 Legacy Well logs: Analogue Data Capture / Cataloguing

Enhanced products include:

- Comprehensive Catalogue of All Data found on scanned well logs images
- 1 record per curve object displayed on document with interval, units, date, etc



## Well logs: Digital Cataloguing- from 'digital data crawl'

## Original digital files from DPR or Digitising Production process:

ABITEYE_14_4219_8729_NI17600200001564_11446536.las	18/05/2012 14:21	LAS File	736 KB
ABITEYE_14_7096_8610_NI17600200001564_11446753.las	18/05/2012 14:25	LAS File	248 KB
ABITEYE_14_8738_11190_NI17600200001564_11446526.las	18/05/2012 14:27	LAS File	406 KB
ABITEYE_14_8740_11174_NI17600200001564_11446725.las	18/05/2012 14:29	LAS File	475 KB

Are processed by Automated Cataloguing tools that extract : Full Header and Curve information , including statistics and sampling frequency

Name	Links	Filename	Тур	D	Mnemonic	MnemonicDescription	MinDepthWith	MaxDepthWit	InputCu	InputCurve	InputCurv	InputCurveAPICode
🗗 CALI	0/5	\ABITEYE_14_7096_8610_NI17600200001564_11446753.las (253 kb)	H		IN	Caliper	7090.0	8608.0	11.8632	17	14.8676	70 280 01 01
🗗 NPHI	0/5	\ABITEYE_14_7096_8610_NI17600200001564_11446753.las (253 kb)	H		DEC	Neutron Porosity	7090.0	8608.0	0.1266	1	0.3789	42 890 03 01
CORR	0/5	\ABITEYE_14_7096_8610_NI17600200001564_11446753.las (253 kb)	H		G/C3	Correlation Log	7090.0	8608.0	-0.0288	0	0.0525	
🗗 GR	0/5	\ABITEYE_14_4219_8729_NI17600200001564_11446536.las (752 kb)	H			Gamma Ray	4190.0	8750.0	8.4248	100	56.619	01 010 01 01
🗗 RIL	0/5	\ABITEYE_14_4219_8729_NI17600200001564_11446536.las (752 kb)	H		OHMM	Raw Ild Conductivity	4190.0	8740.0	0.1655	1911	11.0699	10 220 01 01
🗗 SP	0/5	\ABITEYE_14_4219_8729_NI17600200001564_11446536.las (752 kb)	H			Spontaneous Potential	4190.0	8750.0	-66.0709	-10	-48.0021	35 310 01 01
🗗 RSN	0/5	\ABITEYE_14_4219_8729_NI17600200001564_11446536.las (752 kb)	H		OHMM	Raw Short Normal Res.	4190.0	8740.0	1.0267	20	4.5307	05 120 46 01
P RHOB	0/5	\ABITEYE_14_7096_8610_NI17600200001564_11446753.las (253 kb)	Н		G/C3	Bulk Density	7090.0	8608.0	2.0835	3	2.3154	42 350 01 01
🗗 GR	0/5	ABITEYE_14_8738_11190_NI17600200001564_11446526.las (415 kb)	H		GAPI	Gamma Ray	8700.0	11200.0	0.8054	110	70.409	35 310 01 01
🗗 SP	0/5	ABITEYE_14_8738_11190_NI17600200001564_11446526.las (415 kb)	Н		MV	Spontaneous Potential	8700.0	11200.0	-98.0872	-41	-62.6889	01 010 01 01
CORR	0/6	ABITEYE_14_8740_11174_NI17600200001564_11446725.las (485 kb)	H		G/C3	CORR	8750.0	11128.0	-0.088	0	0.0263	
🗗 CALI	0/6	ABITEYE_14_8740_11174_NI17600200001564_11446725.las (485 kb)	H		IN	Caliper	8750.0	11178.0	7.6647	15	10.43	70 280 01 01
🗗 GR	0/6	ABITEYE_14_8740_11174_NI17600200001564_11446725.las (485 kb)	H		GAPI	Gamma Ray	8750.0	11178.0	14.5341	115	71.8942	35 310 01 01
🗗 ILD	0/5	ABITEYE 14 8738 11190 NI17600200001564 11446526.las (415 kb)	H			Deep Induction Standard	8760.5	11200.0	0.3822	26	1.8671	10 220 01 01
🗗 SN	0/5	ABITEYE_14_8738_11190_NI17600200001564_11446526.las (415 kb)	H		OHMM	Short Normal	8765.0	11200.0	0.7122	11	2.1466	05 120 46 01
PRHOB	0/6	ABITEYE_14_8740_11174_NI17600200001564_11446725.las (485 kb)	H		G/C3	Bulk Density	8750.0	11128.0	2.1828	3	2.4336	42 350 01 01
P NPHI	0/6	ABITEYE_14_8740_11174_NI17600200001564_11446725.las (485 kb)	H		DEC	Neutron Porosity	8750.0	11128.0	0.1058	1	0.3675	42 890 03 01

- $\sim$  19,000 LAS files , 100's of DLIS files
- INDEX automatic > 1 day computer time > 10 Days manual/review cleanse

Courtesy of GEOEX Bilview Nigeria



## **ANALYTICS STARTS** : Well logs: Digital v Analogue

Enhanced products includes creation of a well data curve map:

- Detailed Catalogue of Analog Data – Graphic Curve Map Display



## ANALYTICS CONTINUES : Similar – but at a National level: Well logs: Analogue Cataloguing – at NDR!



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## Phase 2 –

## New UPDATE Data Disk arrives ! The data contained:

- Was in an unstructured filesystem
- over > 189 Gb of data
- over > 82,000 files
- About 30% of the files are duplicated

M-BEDE\_001 MBEDE\_001 MBD\_028 MBEDE\_028 MBEDE\_028

> Well & Wellbore Names have many conventions, abbreviations and aliases

BONGA-N\_003\_ST\_001 - Bonga North ? BONGA-NORTH\_002\_ST\_001 Bonga-North\_003 Bonga-North 3\_ST\_002

BONGA-NORTH-WEST\_001\_ST BONGA-NW\_001 - Bonga North West ?

BONGA\_009 1 Well , 1 or 2 Sidetracks ?? BONGA\_009\_ST BONGA\_009\_ST\_001

From the data mining, we are identify ~ 1989 "Wells/Wellbores"



## SUMMARY

- File Content of all disk received shows 82,174 files in 189 Gb after unzipping ZIP files and removing Duplicates:
  - > 18,372 PDF files
  - $\sim$  > 7,370 LAS files with "other" LAS files in TEXT (336), PDF (625) XLS (10) formats
  - $^{\circ}$  > 2,394 DLIS files ( & 6 as LIS files )
  - > 3,415 XLS Spreadsheets
  - $^{\circ}$  > 14,419 tif/jpg analogue log plot files
  - $\circ$  > 1,821 ZIP files > all content extracted
- Of the above :
  - > 321 Wells have Final Well Reports
  - > Total of 1989 apparent boreholes
  - > of which 946 appear to be "new" boreholes not in the existing database



## Data Heat Map -

showing the geographical location of the data delivered.

05/ 37

05/12/2007

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The data does not appear to be evenly distributed, There are 2 main clusters :

- Eastern Shallow Offshore
- Mid Central Onshore

And a few isolated data clusters

A

## Sample of data Inventory for each Well/Wellbore created by BILVIEW/GEOEX:

For each Well/Wellbore identified, well locations were assigned from existing Bilview/Geoex Well database or extracted from new LAS/DLIS headers found on the disk were possible.

Process is continuous for validating; Well Name, Position, Operator, Dates etc



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Development (375) Exploration (268+4758) Geochem (4670) Structural (39) Geophysics (4399+1830) 3D (630) Acquisition (1077) Interpretation (17) 🚞 Positioning (15) Processing (156) Proposals (0) 🚞 lanore (356) 🚞 Mapping (1933) Production (16827) 🚞 SMT (0) Surveys (4) Wells (27815+107432) Biostratigraphy (246) 🚞 Completion (543) Coring (13444) Daily Reports (5815) 🛅 Drilling (20209) ◄ 🚞 Final Reports (20978) ┥ Logging & Petrophysics (23792+68210) 🚞 Analog (17751) 🚞 CBL (52) Composite (647) 🚞 Density (69) 🚞 Digital (10529) 🚞 Gamma (1462) 🚞 Image / Dip Log (571) 🚞 LWD (6572) 🚞 Mudlogging (21672) 🚞 MWD (9793) 🚞 Neutron (240) 🚞 Plots (2222) 🚞 Resistivity (2903) 🚞 Sonic (399) Passport (0) Production (16509) 🚞 Proposals & Programmes (630) E Sampling (607) 🚞 Testing (17135) VSP (1077) 🚞 Workover (2) Temp Wally Tags (0+8483) 🚞 LAS as PDF (625) 🚞 LAS as XLS (11) 🚞 LAS format (7683) 🚞 LOGS as ASCII no header (170)

Copyright I

## Analytics of disk data against user defined/desired taxonomies >>>

The "data mining" process has classified the various files into the following Taxonomy/Hierarchy:

-246 files with "Biostratigraphy" information

13,444 files with "Coring" information

20,209 files classified as "Drilling"

20,978 files related to "Final Well Reports"

625 LAS files as PDF
 7683 LAS files as ASCII





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## The results can then be linked to a Data Portal :



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## The results can then be linked to a Corp Data Portal

Typical Data Portal GUI 2:



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i.e. for well AGBAMI 1, we have 1362 files on disk :

Data Content Profile: These 1362 files contain the



🚞 08.01.01 Well Seismic - Checkshot (11) 🗁 08.01.02 Well Seismic - VSP (815)

08.02 Well Seismic Summary (2)

Misc (0)

O

0

216

Search:

Ha



Geoscope - geoex3 File Search View Tools Help

## Data Mining & Metadata Extraction is ongoing :

- Data is being digitised / cleansed / validated / prepared for sales
- Data is alive & active

Respon

501

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Requires Automated Reporting/Analytics for data status & activity

Well Name

<b></b>	ed 04/03/2015 08:31				Category RAW										
	imon Fisher							,,							
Simon Fisher; W	aily LAN_Files Sur aclaw Jakubowicz; Charle	<b>nmary Master was</b> s Hazell; Dean Desmond; F	executed at 04/03/2015 08:30:08		Status	Category	No of Files	Total File Size	No of Files for the	Total File Size for the					
This message w	as sent with Low impo	rtance.							Interval	Interval					
If there are pro	there are problems with how this message is displayed, click here to view it in a web browser.				Total	1	560184	570.68GB	970	2.4GB					
			LAN Files		Changed	1	560184	570.68GB	970	2.4GB					
					V	Vhich Data (		s hav	e heen i	Indated					
No Of Docs Total File Size No Of Docs for the Interval Total File Size for the Interval										apualou					
	560184	570.68GB	970	2.40GB				Map Wells							

Status

Total

Changed

Inchanged

-		-
Εđ	e	vpes

Status	File Type	No of Docs of the File Type	Total File Size	No of Docs of the File Type for the Interval	Total File Size for the Interval
Total	238	560184	570.68GB	970	2.4GB
Changed	4	397637	513.77GB	970	2.4GB
Unchanged	234	162547	56.91GB	0	0B

## 415 91506 984 5231 474578 0

No of Objects

566084

No of Objects for the geom Interval

984

Object Name

5646

## Which Wells have been updated





## Case History 2 – SPECTRUM

http://www.spectrumgeo.com/

## Croatia offshore 2D Multiclient program, supporting well data.



In support of the first Croatia offshore License round.



## <u>Case study 2</u>

What is the challenge

large well database to manage input and continual updates

To catalogue/index the full well data spectrum To QC the well information and well log digital data Integrate database with updates arriving on unstructured disk Create a TRUSTED reference database with full AUDITABILITY Create a Licenec Round Ready database with FINAL WELL COMPOSITES

What was HDS approach / process initial full data indexing and cataloguing continual monitoring & management to keep database "evergreen" create Gold Standard Composite joined log curves for sales process

What was the outcome? How did HDS create value? A comprehensive full catalogue of well information and well data established Full auditability between raw source data and deliverables Composited logs delivered





## Input : 4000 Raw data files for 78 wells - With 1000 duplicates

## Aggregation Summary :

Geoscope - spectrum			X	
File Search View Tools Help				
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▶ J <sub>adran-3</sub> Irma 2alfa		80.00	1942.40	1862.40
► Jadran-3 (Irma 2B	Caliper, Density,	107.00	2100.00	1993.00
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Jelena-1 (Irma 4) Kate-1 Cr	Caliper, Density,	160.00	1600.00	1440.00
Kornati Mc Istra More 3	+ Of FILE IYPES Calibration Digital & Analogue Files	0.00	2305.00	2305.00
▶ Maia-1 (4:	Caliper, Density, DIGITAL & Allalogue I IIES	0.00	2550.00	2550.00
Melita-1 (Istra More 5	Caliper, Density,	80.00	1813.00	1733.00
▶ Mirjana-1 Izabela 1	Array-Induction	35.97	973.84	937.87
Patricija-1	0 02 0 12 12 0 02 12 20 10 10 0 Array-Induction	88.24	932.84	844.60
Perina-1 (Jadran 02		330.00	4630.00	4300.00
Vialar C Jadran 03 (J-3)	0 5 0 2 2 0 5 3 0 0 0 1 Caliper, Density,	352.96	3074.06	2721.10
► - Raw-in-client Jadran 04	0 19 0 5 5 0 19 5 7 0 0 27 Caliper,Density,	700.00	1325.00	625.00
► ₩ Wells_Out (1	0 36 0 7 7 0 36 7 20 0 10 12 Caliper,Density,	235.00	1100.00	865.00
▼	0 33 0 6 6 0 33 6 15 0 0 0 24 Caliper,Density,,	500.00	1720.00	1220.00
lap search complete	0 27 0 7 7 0 27 7 11 0 0 0 16 Caliper, Density, Gamma Ray, Laterolog-Resistivity, Micro-Laterolog, Microlog-Resistivity, Normal-Resist	25.00	1195.00	1170.00
Jadran 09	0 12 0 11 11 0 12 12 0 0 0 0 0 0 Caliper, Density, Gamma Ray, Laterolog-Resisitivity, Micro-Laterolog, Microlog-Resistivity, Sonic, SP	275.00	3230.00	2955.00

## From the aggregated information We can see where and what data exists :



Geoscope - spectrum	
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## Here are the 57 Geochem Analysis docs Listed:



#### Geoscope - spectrum

File Search View Tools Help

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## And here is where the 57 Geochem Analysis files are on the LAN : >>> distributed in many folder locations !!!



Briefcase Mark

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luenilai		

## Hampton

## Results Can be delivered

Via Standard in-house Portal – Server



## accessed though KMZ via Google Earth



## accessed though Web Browser Portal





# What if there is "no existing metadata" – just image/analogue data ?





# What about deep image based metadata extraction ?







Intelligent Facial recognition - its now common !



# What if we could do similar identification/extraction in the E&P data image domain ?



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## Hampton

## Apply Machine Learning - Oil & Gas ?

## Identify Data Areas Al/Neural Networks



Well Log Header Calibration Scales Logs/Tracks Well, Dates



Well: NC 234 A-1 LIBYA Date 23/12/1991

Hampton

**Technical Data** 



Schlumberger IES Survey LOGS:GR SP ILD SN DEPTHS: 1281 -1645 m

This is on its way !! -



Waclaw (Wally) Jakubowicz Managing Director

Hampton Data Services Trident Court 1 Oakcroft Road London KT9 1BD United Kingdom

Mobile: + 44 7785346568 Office: + 44 2083354300 Fax: + 44 2083353863 Email: wj@hamptondata.com Website: www.hamptondata.com

