



UK Defence Spectrum Management

**A Consultation on:
An Implementation Plan for Reform**

Ministry of Defence
Spectrum Management Team

OPENING REMARKS

Mr John CT Taylor
Director General Information
Ministry of Defence

OPENING REMARKS

- The Ministry of Defence is consulting on significant new proposals for how it manages spectrum
- The consultation shows how far the Ministry of Defence has gone to put the ideas of the Audit into practice:
 - Auditing how it uses spectrum in the UK
 - Considering how it will use spectrum in the future
 - Determining how to manage spectrum use in the future

OPENING REMARKS

The Ministry has embraced the new approach to spectrum management with speed, thoroughness and imagination. In terms of spectrum management, this will place the UK at the leading edge, and Defence communities in other countries are likely to pay keen attention to what we are doing. Accordingly we look forward to the results of this important consultation process.

A handwritten signature in black ink, appearing to read 'John C T Taylor', is centered on a white rectangular background.

John C T Taylor
Director General Information
Ministry of Defence

AGENDA

- Opening Remarks
- **Background**
- Key Issues
- MOD's Spectrum Audit
- Defence spectrum demand
- Changing Spectrum Management
- Panel session for questions & answers
- Way Ahead



BACKGROUND

- MOD's radio spectrum supports many uses and users
- Spectrum is a valuable and finite resource and has an important role in generating wealth
- MOD's spectrum supports a very wide range of vital military requirements

PURPOSE

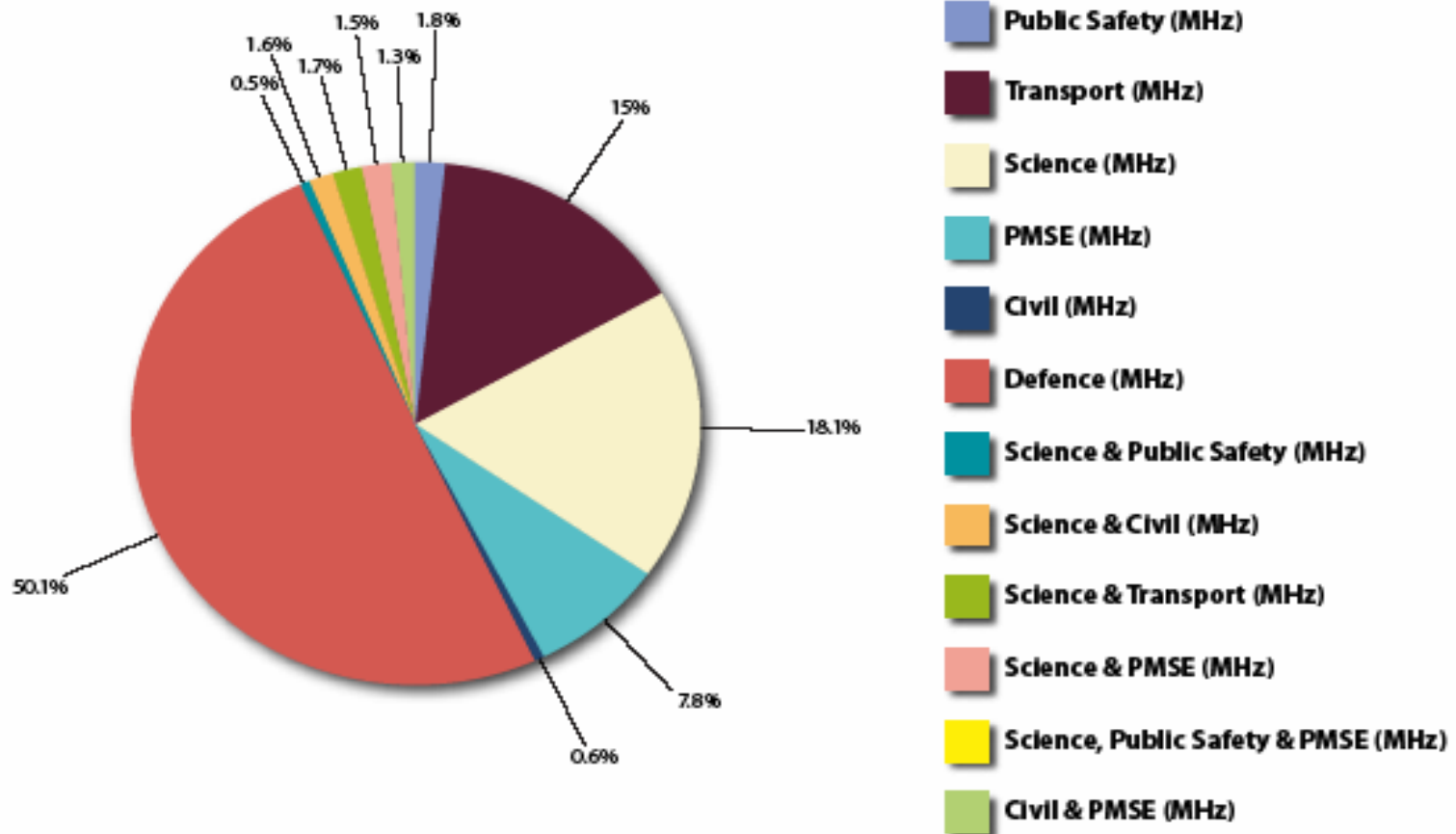
To give key stakeholders:

- An additional opportunity to consider and discuss the MOD's proposals for the reform of UK defence spectrum management and on extending market principles to the MOD's use of the radio spectrum
- An opportunity to hear more about the MOD's audit, demand study and views on third party spectrum management

MOD'S SPECTRUM SUPPORTS MANY USES AND USERS

The MOD already shares a significant proportion of spectrum with the UK information and communications technology sector such as broadband wireless as well as a wide range of non-commercial applications, including safety-of-life, search and rescue, maritime and air-space management, transport infrastructure and the emergency and science services.

MOD'S SPECTRUM SUPPORTS MANY USES AND USERS



THE VALUE OF SPECTRUM

- Spectrum is a valuable and finite resource and has an important role in generating wealth
- Estimated that its use underpins 3% of UK GDP and generates benefits to UK worth over £40bn a year [1]
- Independent Audit estimated in 2005 that the market value of public sector spectrum below 15 GHz ranged from £3bn to over £20bn, depending on the methodology used [2]

[1] http://www.ofcom.org.uk/research/radiocomms/reports/economic_spectrum_use/

[2] *Independent Audit of Spectrum Holdings final report*, page 2:
<http://www.spectrumbaudit.org.uk/pdf/caveaudit.pdf>

MOD'S SPECTRUM SUPPORTS A WIDE RANGE OF MILITARY REQUIREMENTS

The MOD's spectrum supports a very wide range of vital military requirements including peacetime training and operations for UK and allied nations, use for homeland security and preparations for major operations overseas.

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KEY ISSUES

- How does MOD use spectrum and who does it share spectrum with?
- What is the current and future demand for Defence spectrum?
- How to respect spectrum rights and sharing agreements?
- How to implement reform to spectrum management for Defence?
- How to introduce market mechanisms?

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MOD's Spectrum Audit

- The MOD's spectrum use and those bands that it shares are identified in the UK FAT [1]
- The MOD's spectrum audit is designed to capture data for defence systems operating or with a requirement to operate in the UK or UK territorial waters and air space (including Northern Ireland). The audit has been programmed in accordance with the bands identified and prioritised by the Independent Spectrum Audit (the 'Cave Bands').

[1] The UK Frequency Allocation Table

MOD's Spectrum Audit

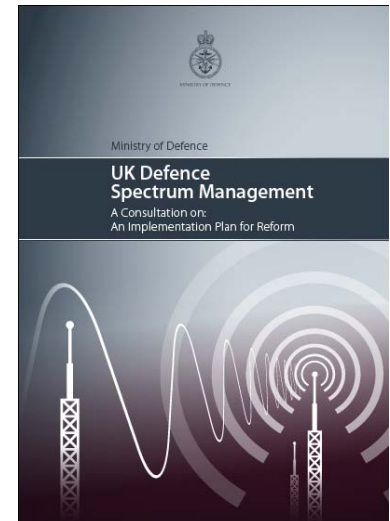
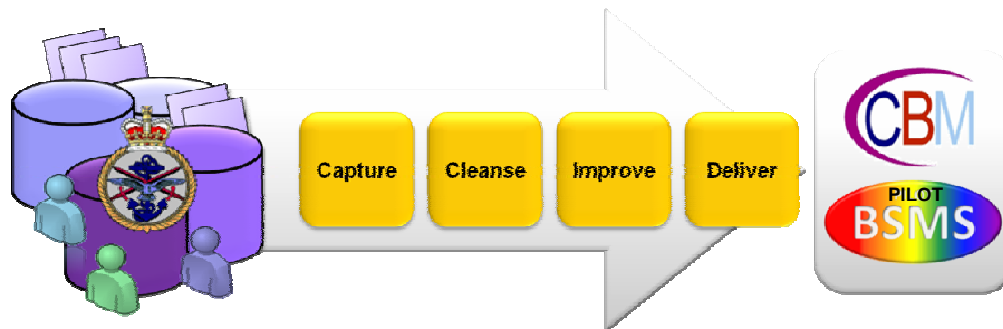
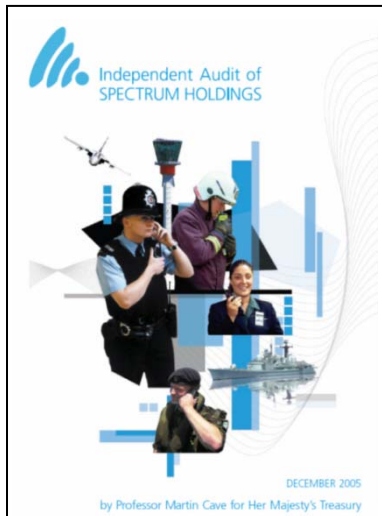
Logica/QinetiQ/ATDI



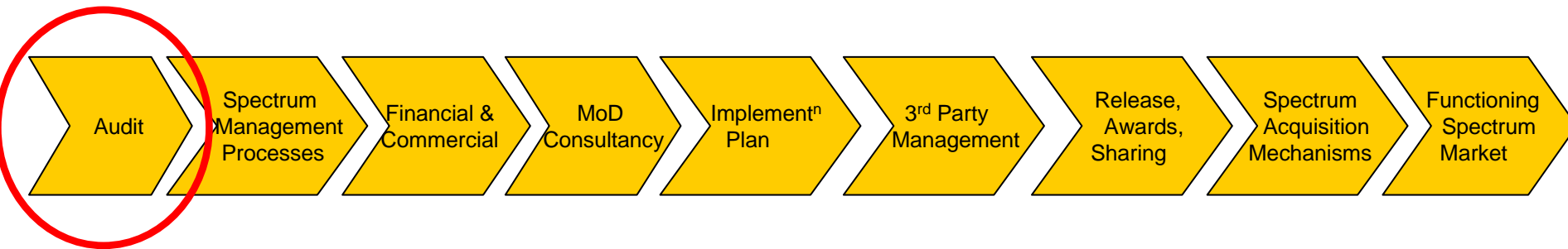


UK Defence Spectrum Management Spectrum Audit Phases 2 & 3

Helen Higgins – Logica



Introduction



Audit phases 1A & 1B considered first 3 Cave bands

Phases 2 & 3 consider the remaining 20 Cave bands

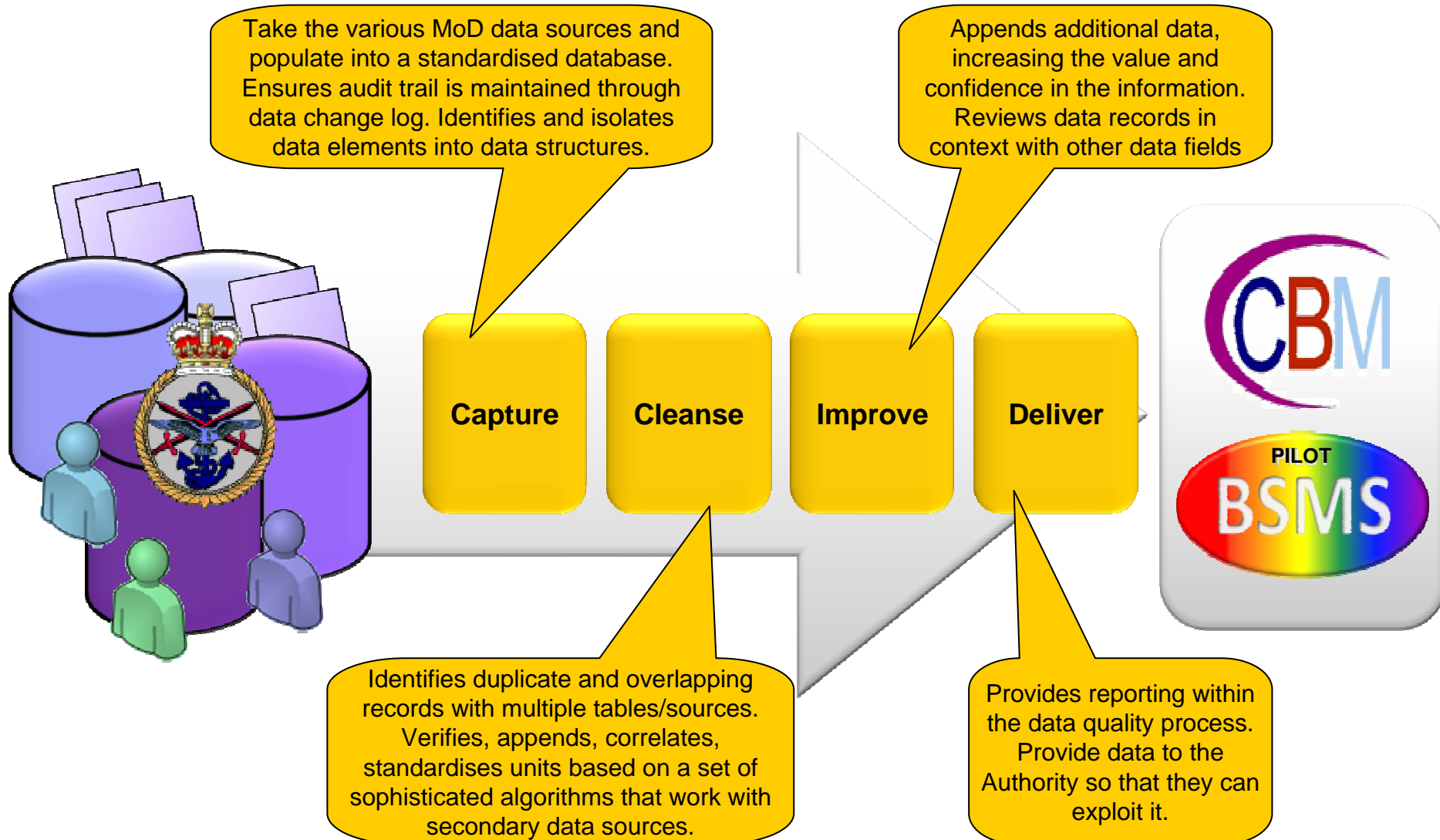
Current use of UK AOR only

- Includes other countries' military use

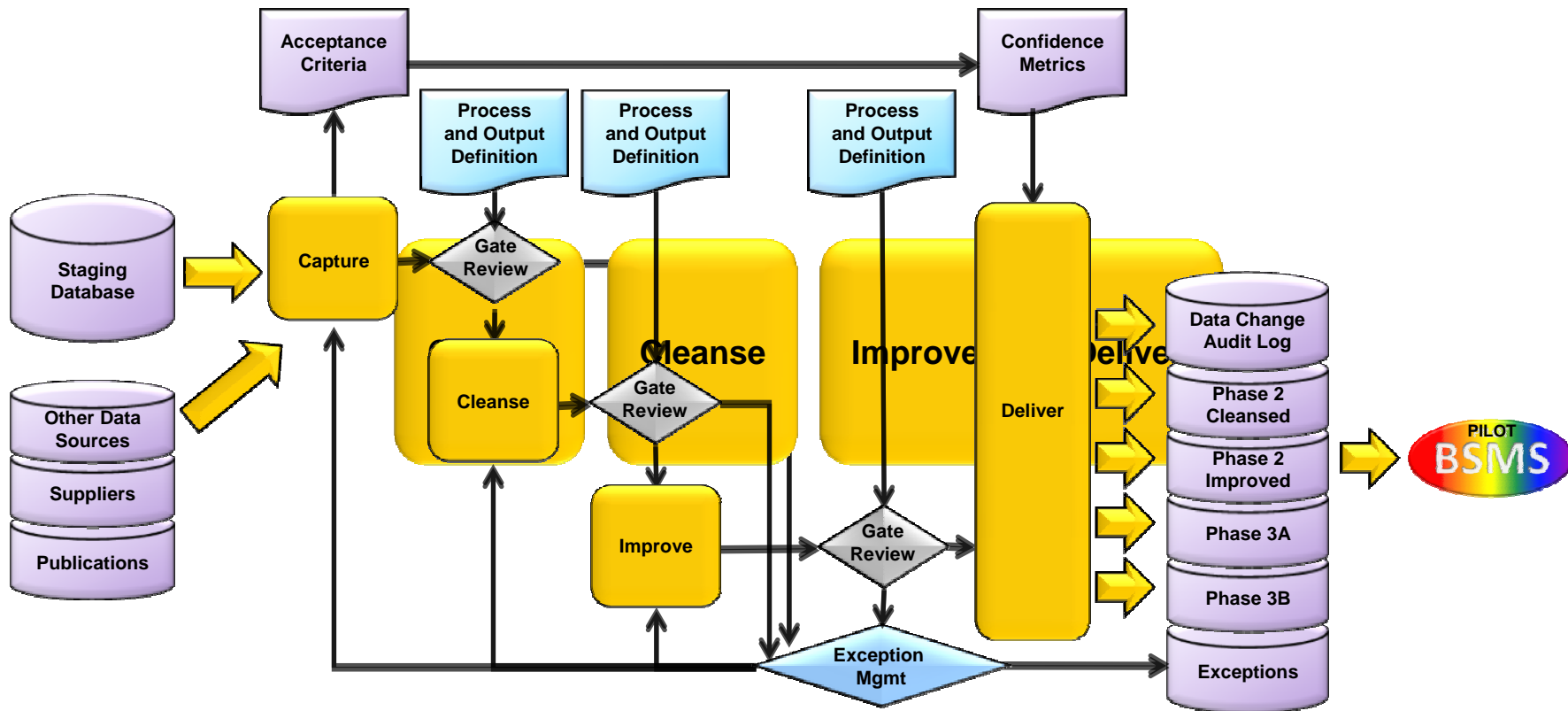
Phase 1A (Completed)	3400 to 3600 MHz
Phase 1B (Completed)	2700 to 3400 MHz
	406.1 to 430 MHz

Phase 2	230 - 400 MHz 400.15 - 406.1 MHz 430 - 450 MHz 8.5 GHz - 10.5 GHz
Phase 3A	137 - 154 MHz 590 - 598 MHz 870 - 1350 MHz 1375 - 1400 MHz 1427 - 1452 MHz 2310 - 2450 MHz
Phase 3B	4200 - 4400 MHz 4400 - 5000 MHz 5000 - 5850 MHz 7900 - 8400 MHz 13.25 - 14 GHz 15.4 - 17.7 GHz

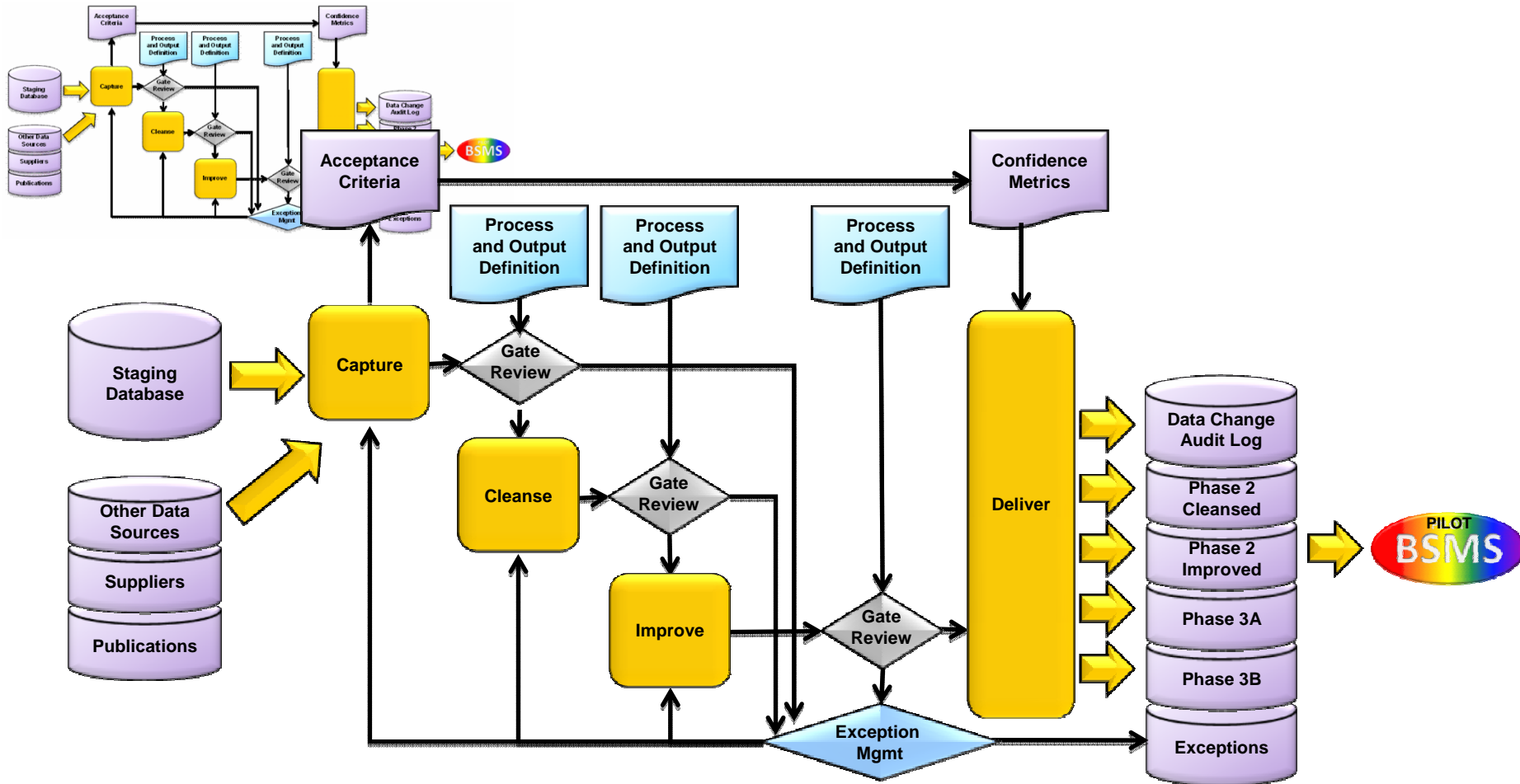
Methodology for Delivery



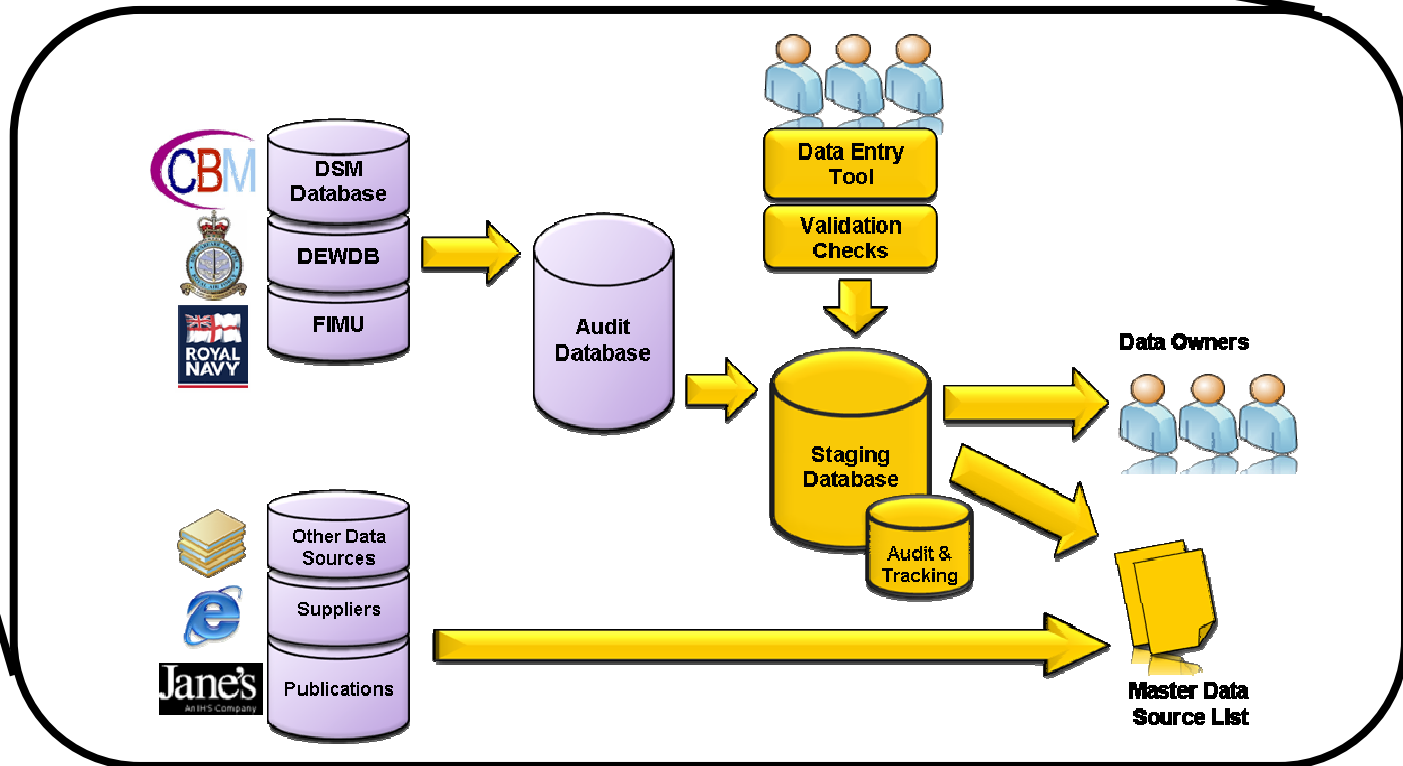
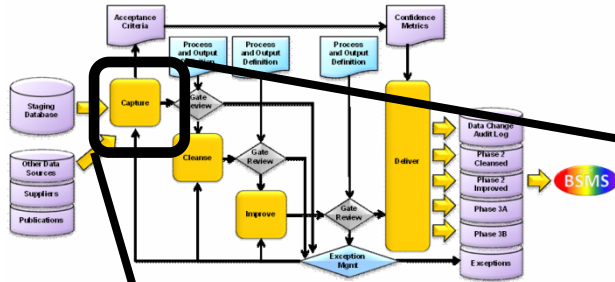
Methodology for Delivery



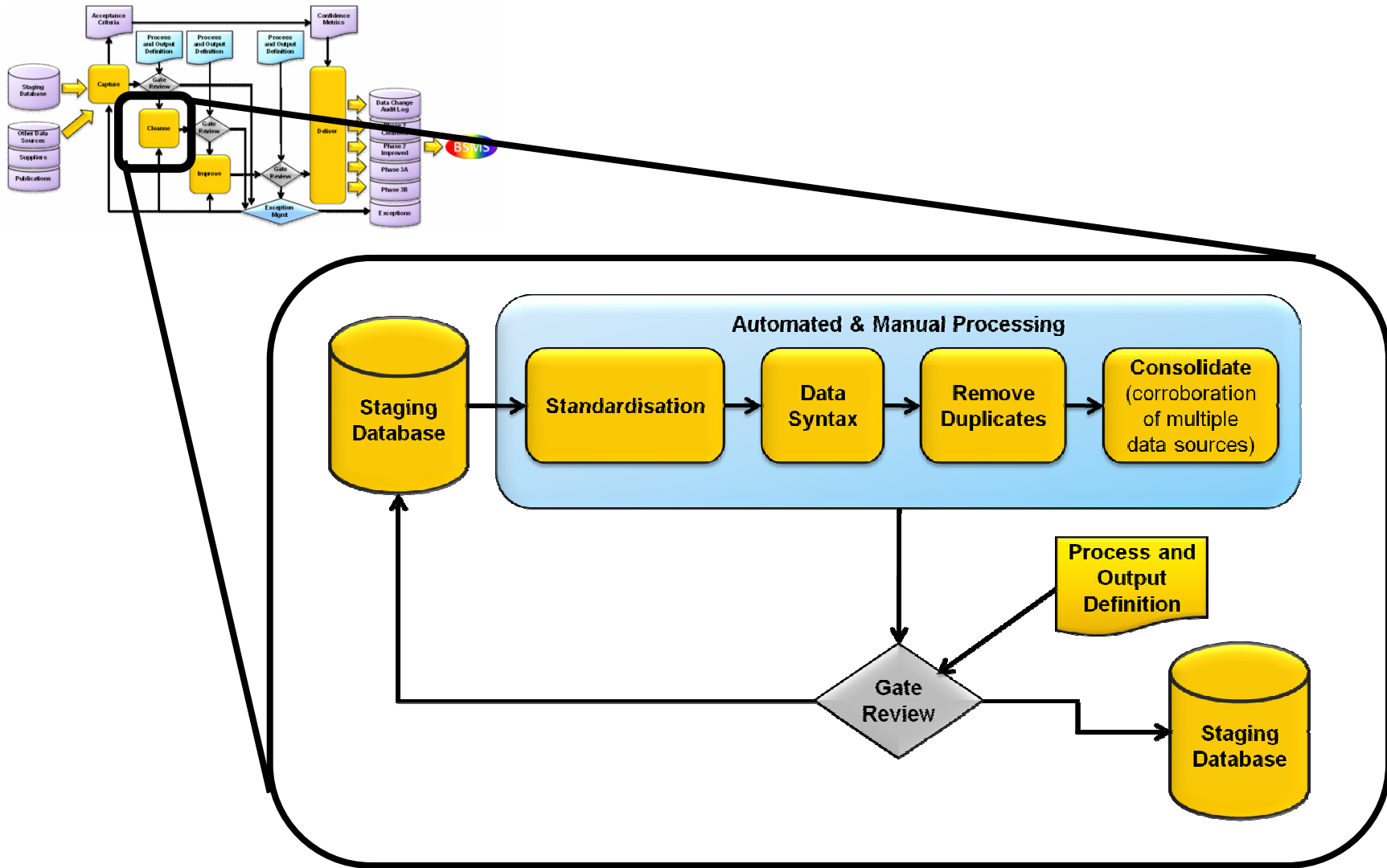
Methodology for Delivery



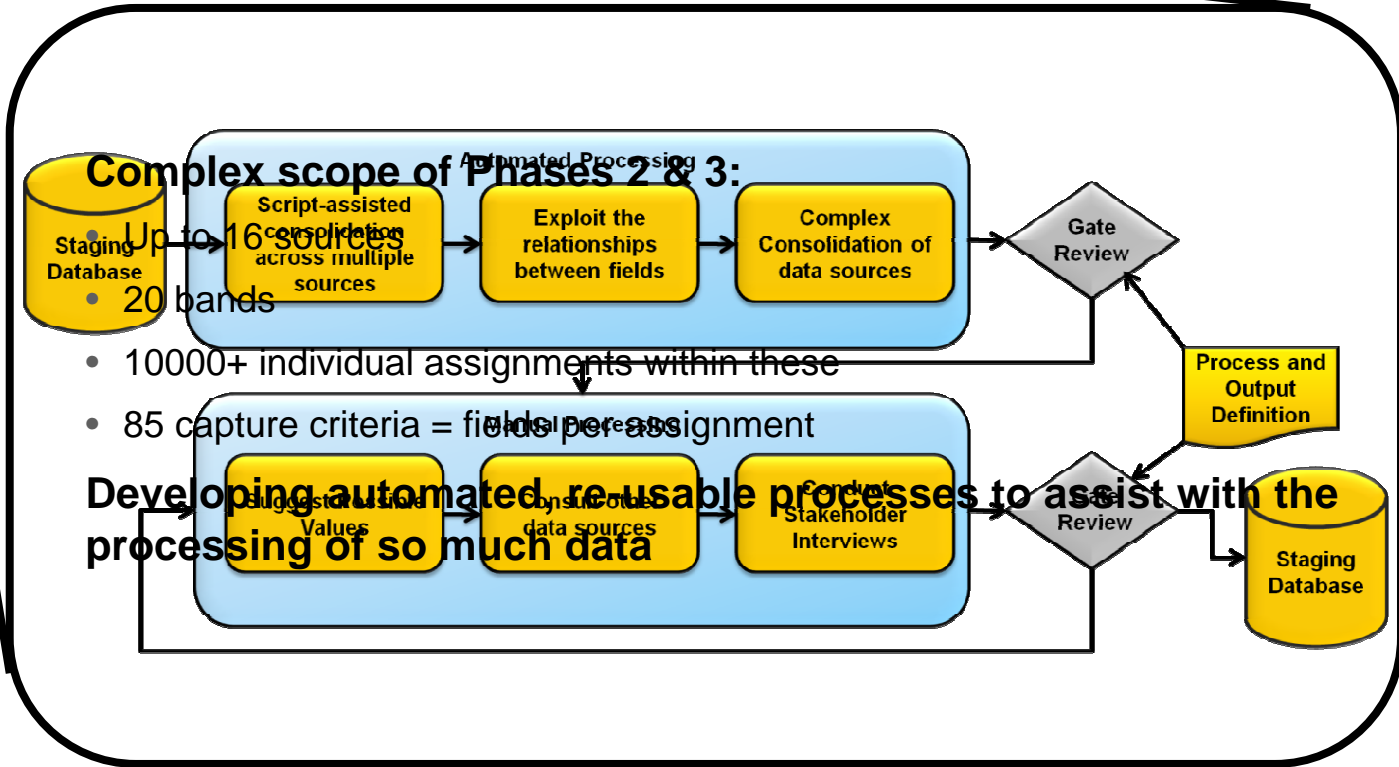
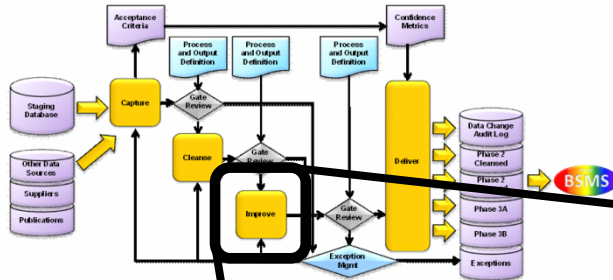
Capture



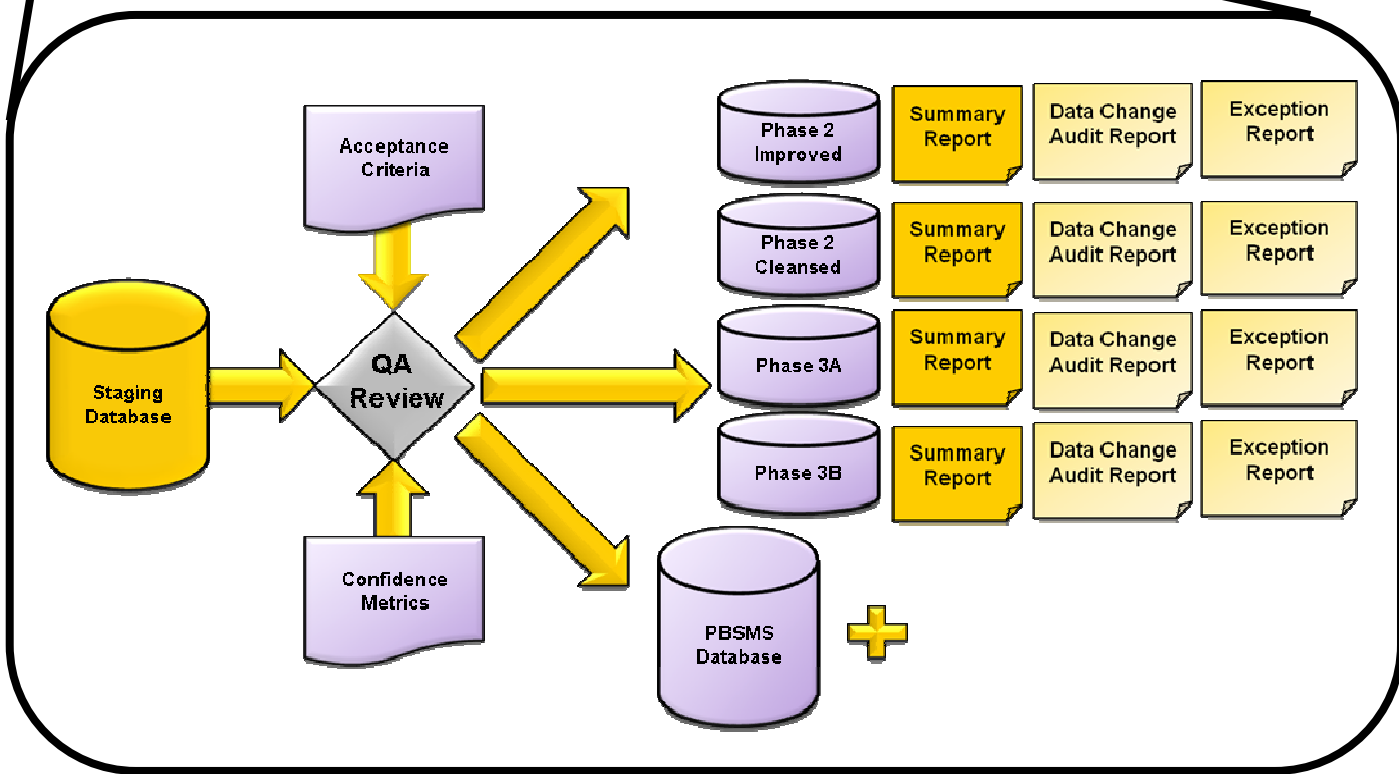
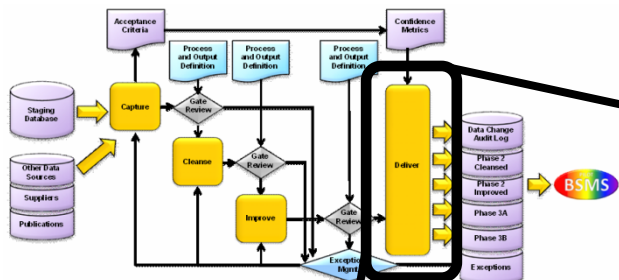
Cleanse



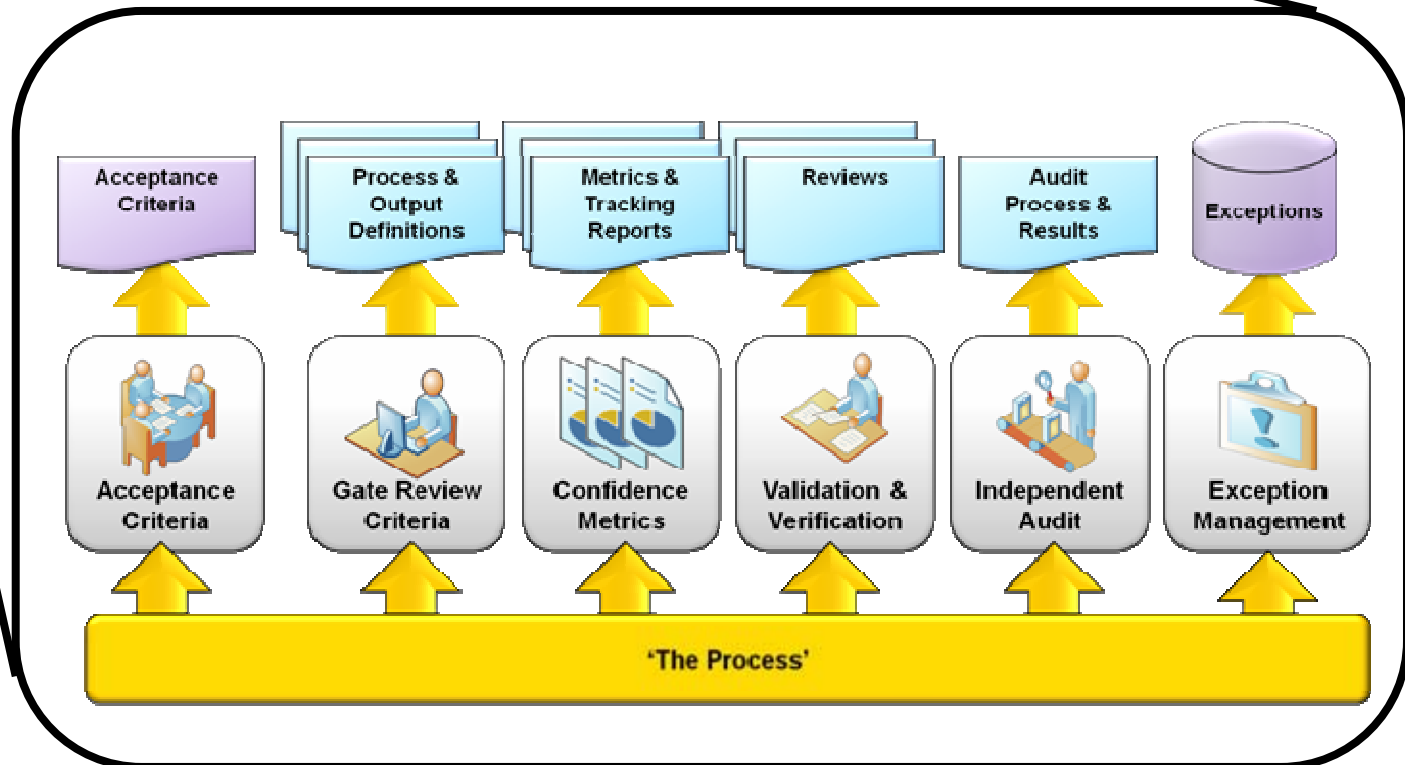
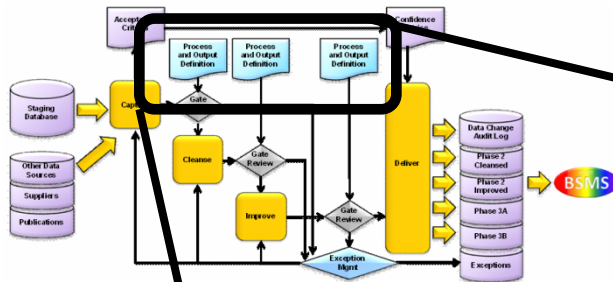
Improve



Deliver



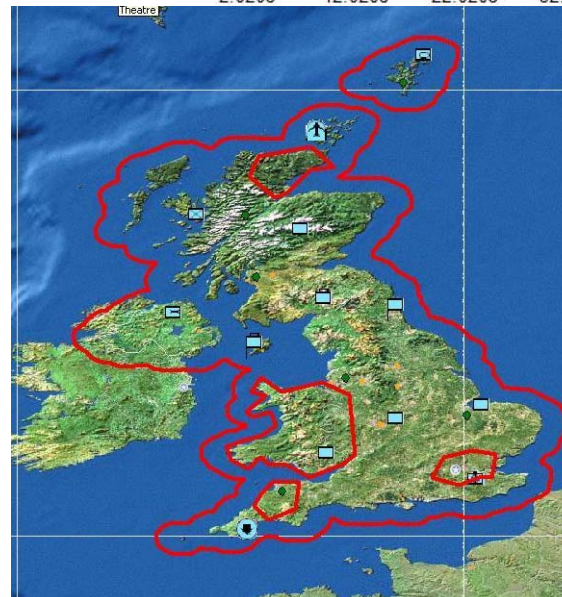
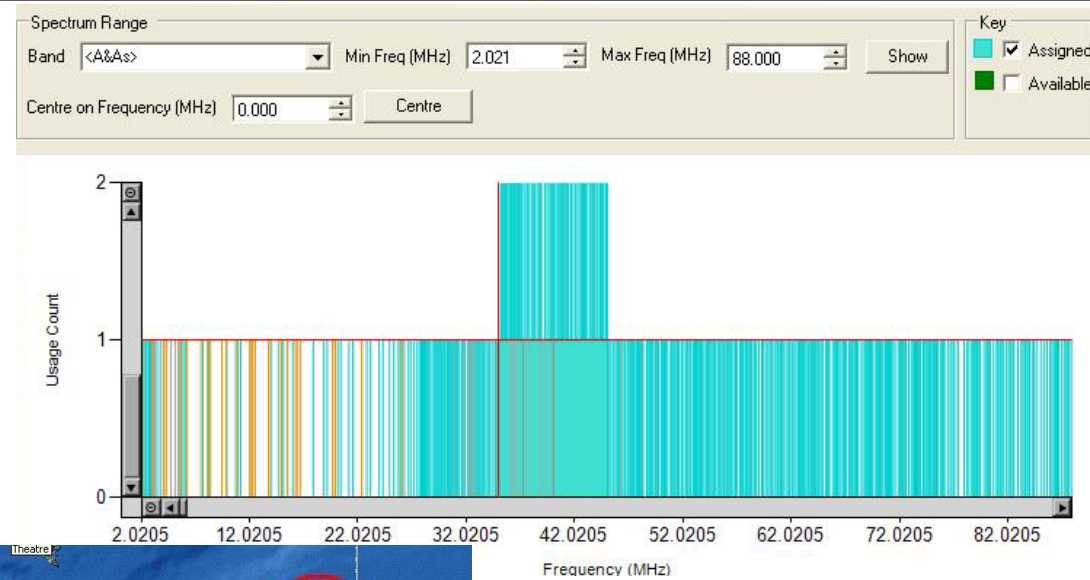
Data Assurance



Output of Audit

No analysis tools are available in the staging database hence delivery and acceptance is taking place through PBSMS

- Provides modelling tool to support transition to information exploitation work
- Provides array of visualisation and analysis functionality
- Benefits directly from PBSMS development
- Handles classified information



Exploitation

Audit Output enables:

- Understanding of MoD's current spectrum holdings and usage
- Efficiencies to be made in utilisation of current holdings
- Recommendations to be made with respect to future procurement of spectrum dependent systems

Demand Study Output enables:

- Understanding of future MoD demand for spectrum
- Informs the future procurement of spectrum dependent systems

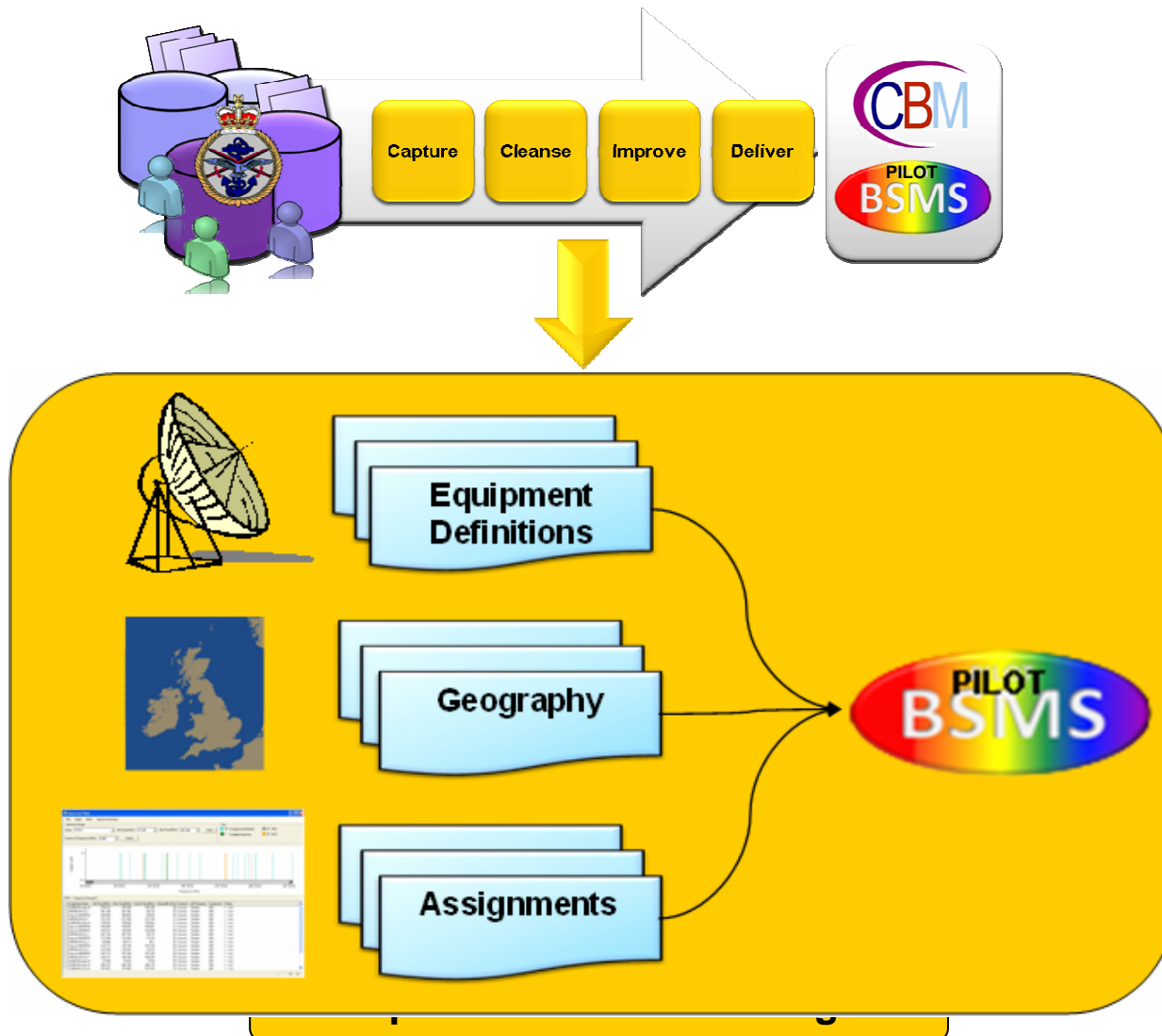
Identify "promising" bands that can be traded through external market

EXPLOITATION

The Exploitation process requires:

- Further, detailed, lower-level analysis of the "promising" bands
- Detailed financial modelling of bands
- Market testing activities

Benefits of Audit



A PHASED APPROACH TO THE MOD'S SPECTRUM AUDIT

Phase 1A (Completed)

3400 to 3600 MHz

Phase 1B (Completed)

2700 to 3400 MHz

406.1 to 430 MHz

A PHASED APPROACH TO THE MOD'S SPECTRUM AUDIT

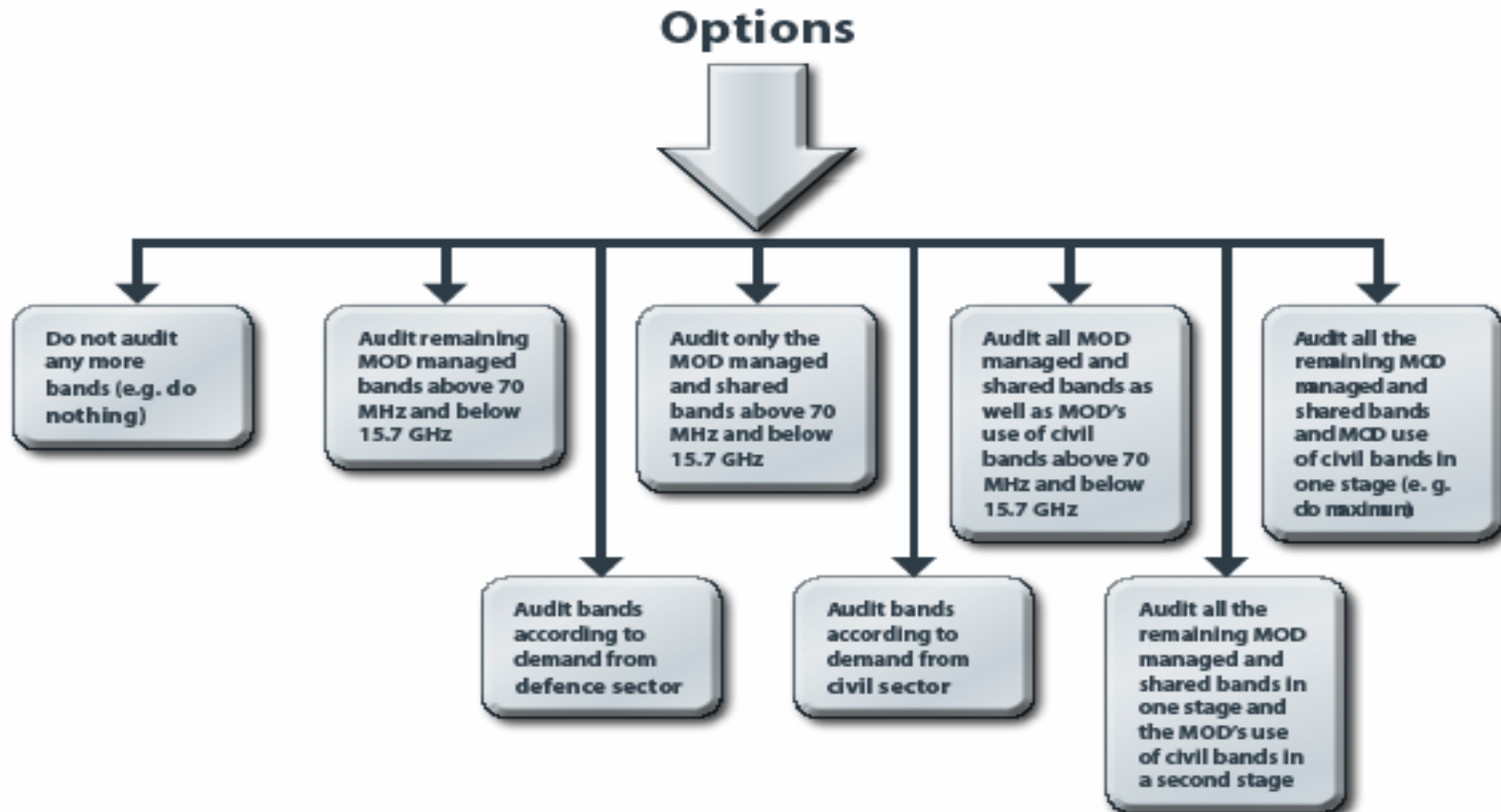
Phase 4 (Decision to audit to be taken in 2008)

Remaining MOD managed bands

Phase 5 (Decision to audit to be taken in 2008)

Civilian managed bands in which MOD
operates

OPTIONS FOR AUDITING BEYOND THE 'CAVE BANDS'



OPTIONS FOR AUDITING BEYOND THE 'CAVE BANDS'

- Question 1 Do you agree that the MOD has identified the options and factors that MOD should consider before deciding whether or not to extend the audit of its spectrum use?
- Question 2 Do you have any views on the priority with which MOD should audit its spectrum use?

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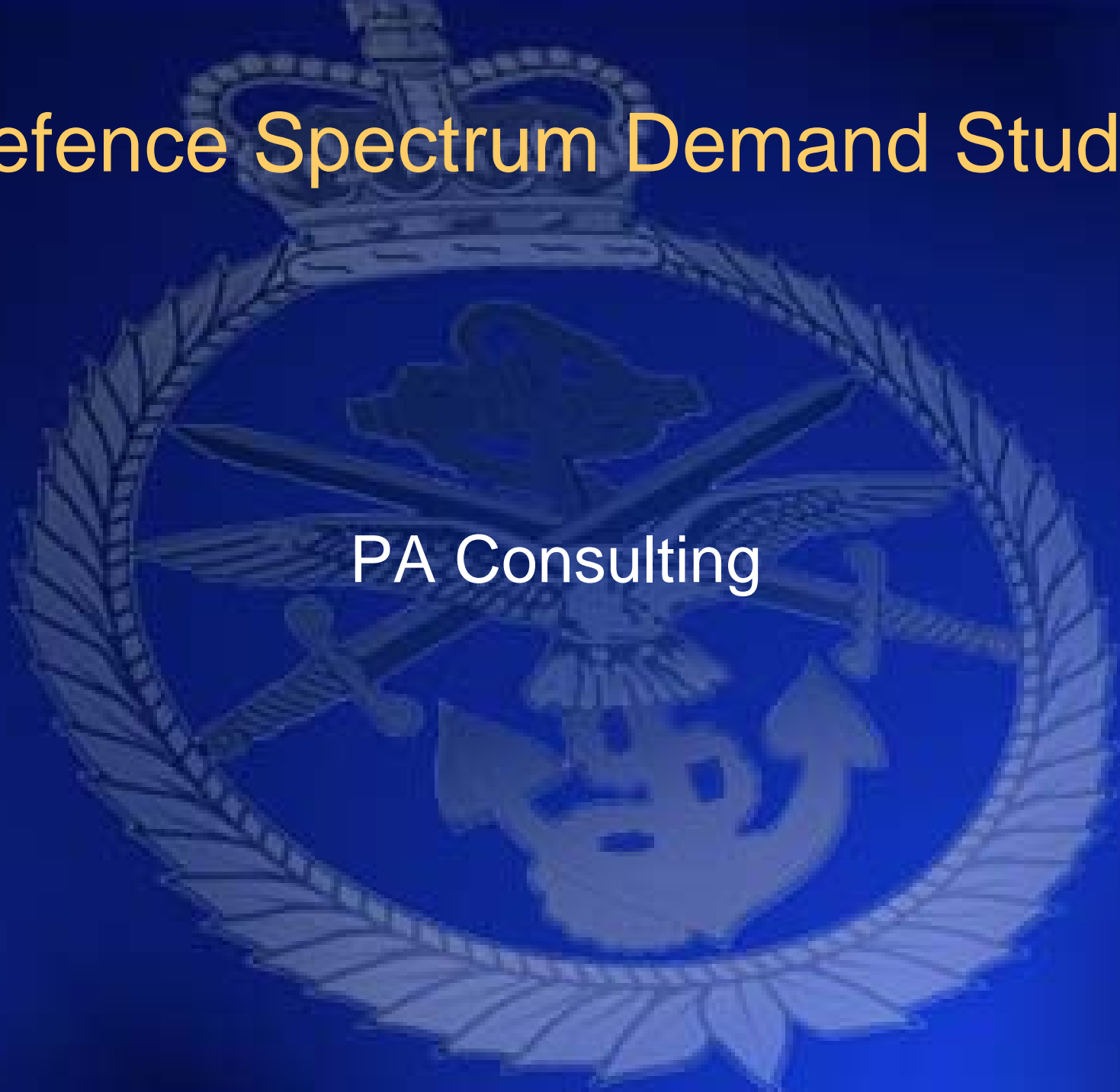


What is the current and future demand for Defence spectrum

- The Defence spectrum demand study will:
 - forecast the military demand for radio spectrum in the UK between 70MHz and 15GHz
 - improve the understanding of the Defence demand and potential uses for the UK military spectrum from an economic, market and technical perspective.
- The study aims to:
 - quantify the current demand for radio spectrum in order to determine the amount of radio spectrum required to maintain military capability and conduct operations in UK and
 - inform assessments of future demand based on emerging technologies, and evolving military capabilities so that the MOD can develop strategies for spectrum management across Defence (and government).

Defence Spectrum Demand Study

PA Consulting



Defence Demand for UK Spectrum

Dr Phil White

10 July 2008

Contents

The objective of the demand study

How we are forecasting demand

Some example outputs

Delivery timeplan

Introducing charging for the MOD use of the Spectrum

“.... public sector spectrum users to make more efficient use of their holdings, by extending spectrum pricing, spectrum trading and admitting new sharers into public sector bands” *Professor Martin Cave*

- MOD needs to understand future demand, likely costs and have strategies for spectrum management in the bands they use
- We need to deliver an initial forecast of spectrum demand in a way that allows for future developments on both supply and demand

Outcomes:

- Demand for defence spectrum forecast – short, medium and long term out to 2025
- Model and analytical framework for estimating demand and supply of spectrum
- Analysis to support decisions on sharing / release / acquisition spectrum

Bands of Interest

In prioritising the following factors were used:-

- Administrative Price (economic value) for band
- Ofcom's aspirations for spectrum in demand in the next 15 years
- MOD's perspective on key spectrum to maintain military capability
- Perceived low use bands
- Military Bands where greater spectral efficiency may release band edges.

We are primarily reviewing 20 bands covering over 80% of the financial value of the Defence managed spectrum, and 80% of the bandwidth.

Band Centre (MHz)	Width (MHz)	AIP (\$M/year)
3,250	300	70
2,900	280	132
3,500	120	28
305	150	60
2,350	80	38
4,700	600	22
420	20	12
440	20	16
5,750	100	4
390	20	4
5,475	175	12
404	6	4
8,212	375	10
8,625	250	6
9,812	625	10
14,925	610	10
7,325	150	4
9,250	250	4
13,325	150	2
13,700	300	4

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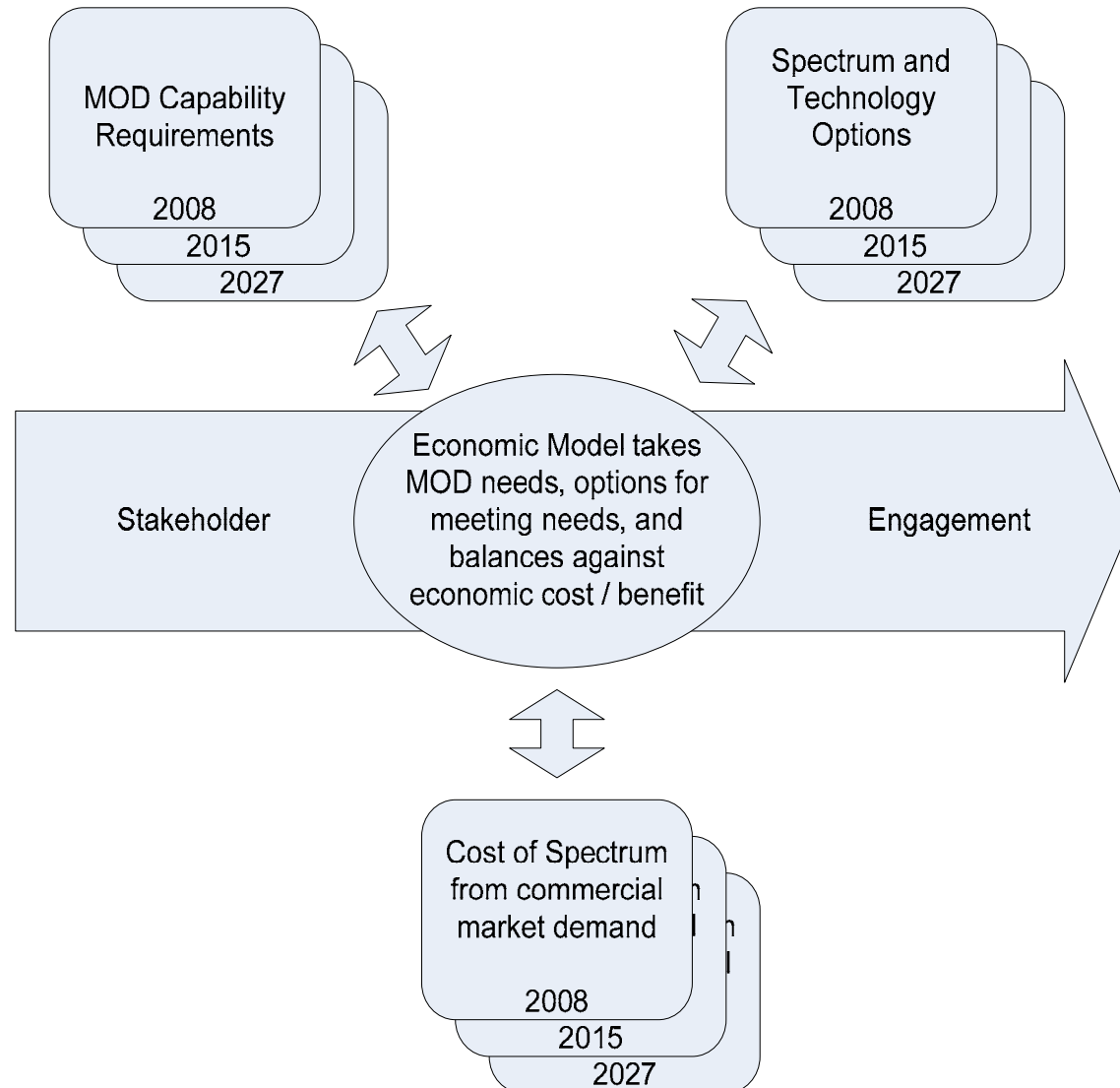
The objective of the demand study

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Some example outputs

Delivery timeplan

This is what we are doing



Key uses of the radio spectrum

- Tactical Voice Communications (VHF)
- Tactical Data Communications (VHF/UHF)
- Air Ground Air Voice and Data Communications (UHF)
- Personal Management Radios (UHF)
- Tactical Data Links (Ground to Air) (UHF)
- Air Navigation Aids (UHF)
- Air Surveillance and Control Systems
- Tactical Surveillance Radar
- Maritime Air Defence Radar
- Weapon Guidance Radar
- Maritime Navigation Aids
- Satellite Communications
- Unmanned Aerial Vehicles (Telemetry and Data Links)

Demand Building Blocks (DBBs)

A LAND (Army) Unit. A discrete unit in one location, 300 - 800 persons with vehicles etc..

Air Base. An operational base e.g. RAF Lossiemouth, the largest RAF base.

Naval Operating base. A discrete port used as a naval operating base e.g. Plymouth.

Special to Role LAND (e.g. Artillery, Signals). Unit with additional demand for its unique role

Radar Station (ASACS). Discrete capability of Air Surveillance, part of NATO early warning.

Naval Dockyards. Locations where vessels are taken for refit, RFA Vessels replenish stocks.

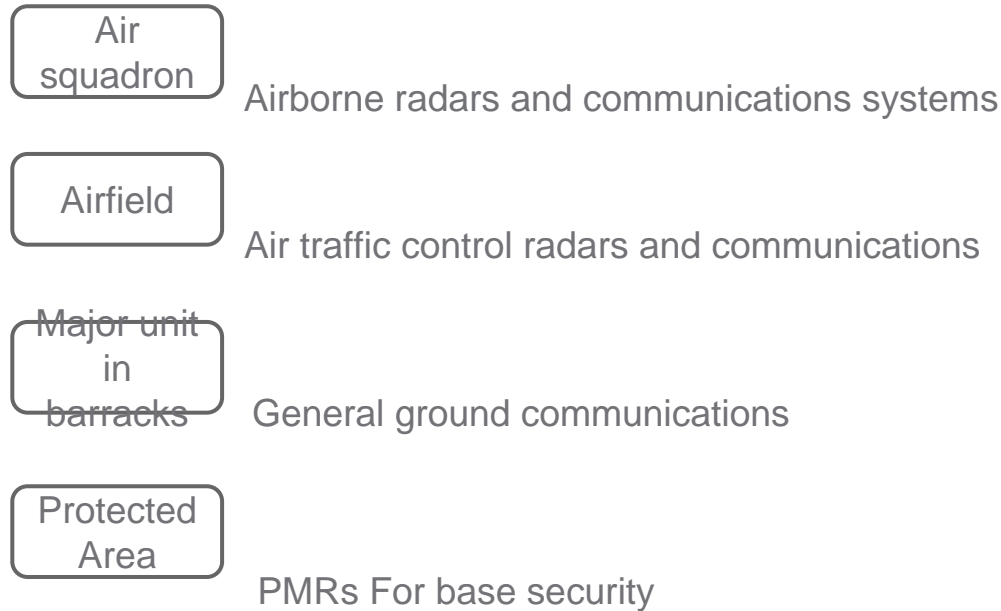
Littoral Water operations. Training areas outside territorial waters may use long range radars

Training Establishments. Establishments for training personnel on equipments that use spectrum.

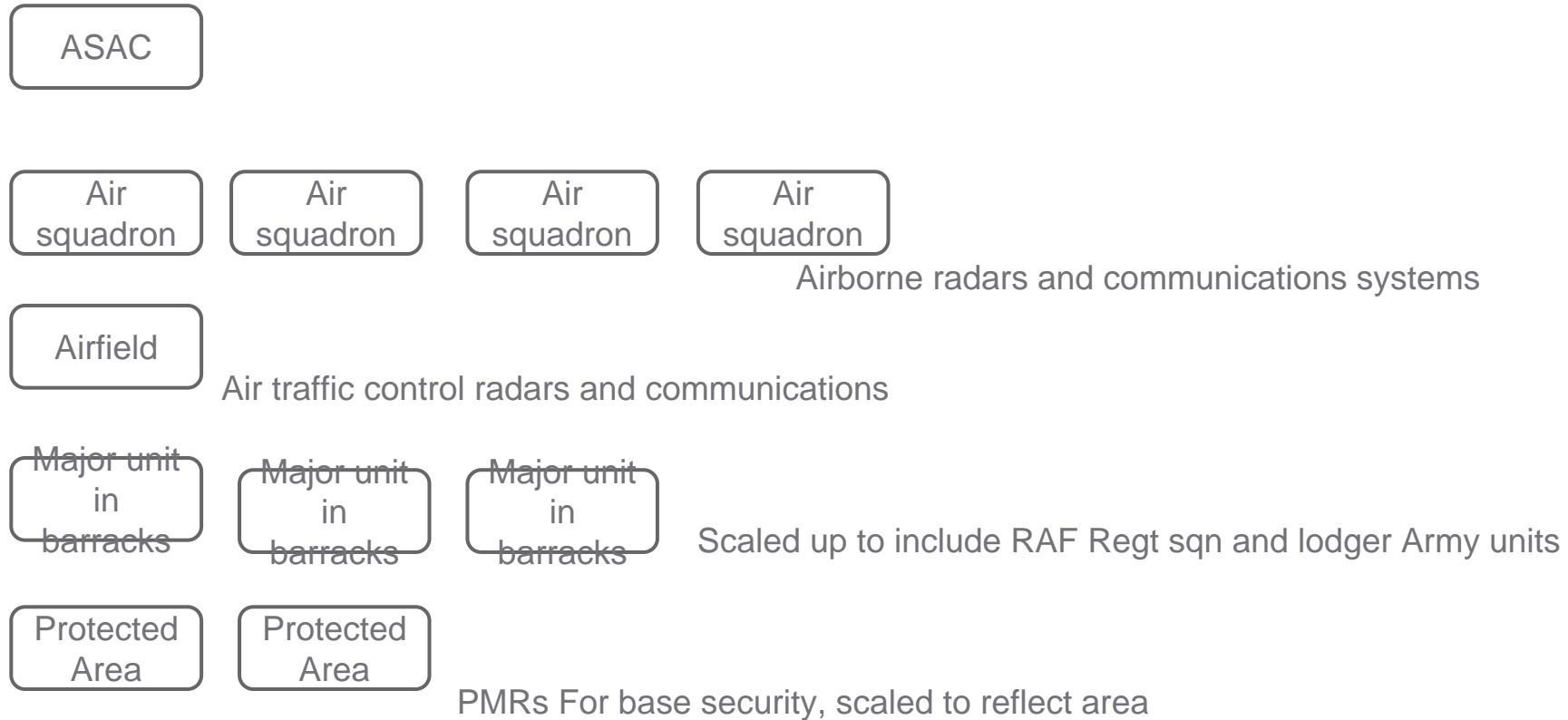
Headquarters/Military Protected Site. Sites with no demand for spectrum usage, except security.

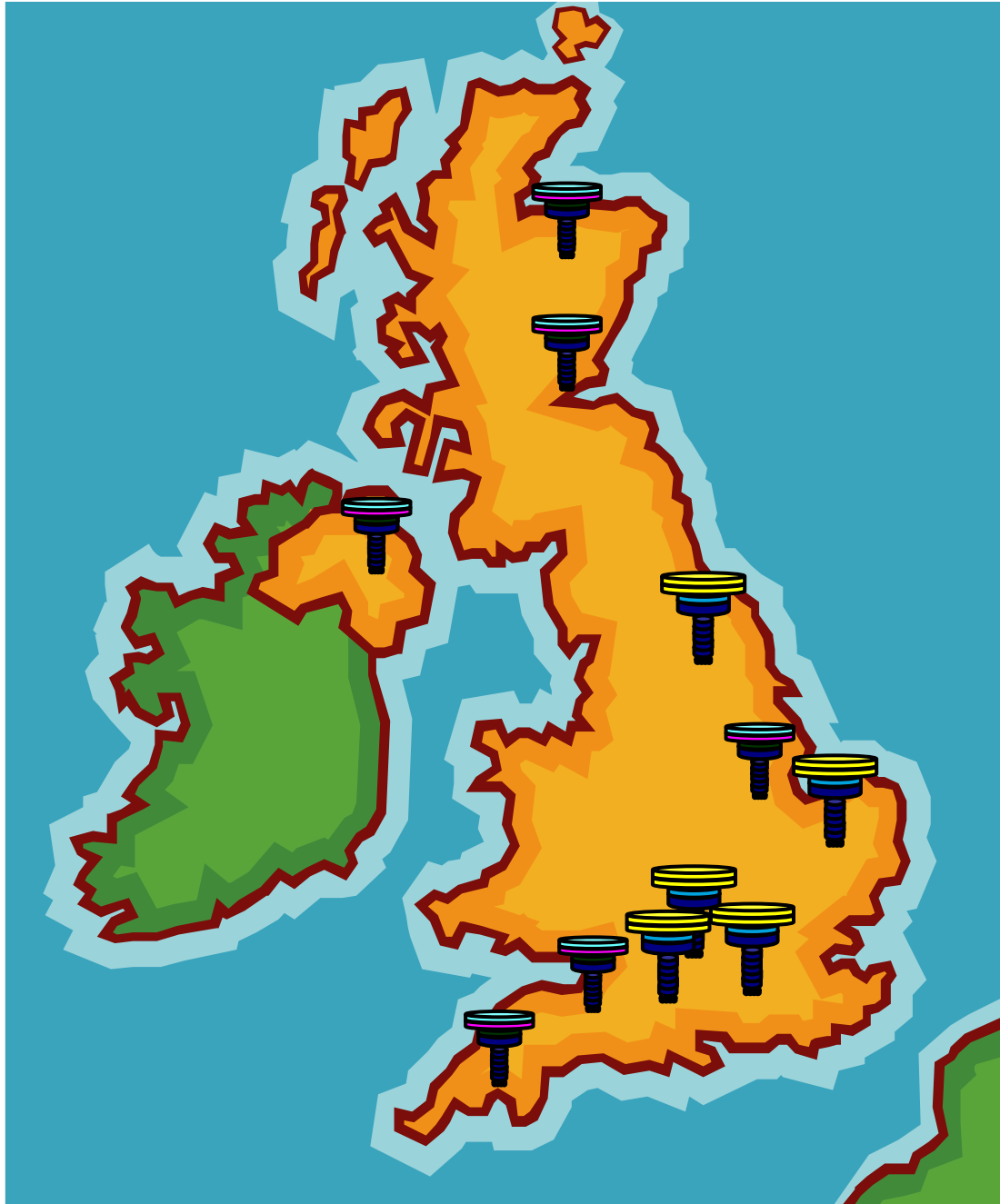
LAND Training Areas. Areas around the UK for unit and formation training (used by visiting units).

Simple Airbase



Typical Complex Airbase





Contents

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How we are forecasting demand

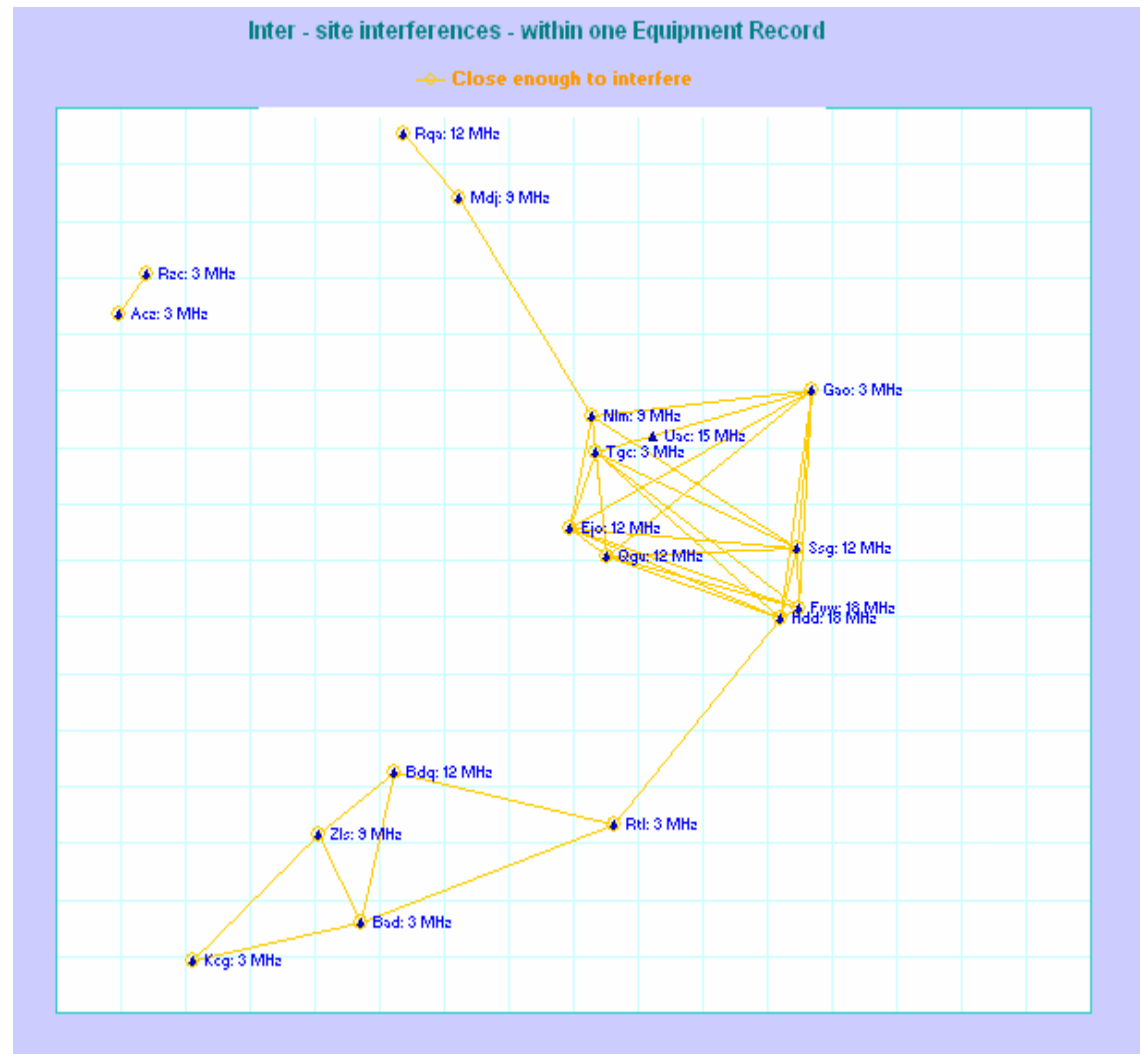
Some example outputs

Delivery timeplan

An example (real) output from the model

Re-use of spectrum

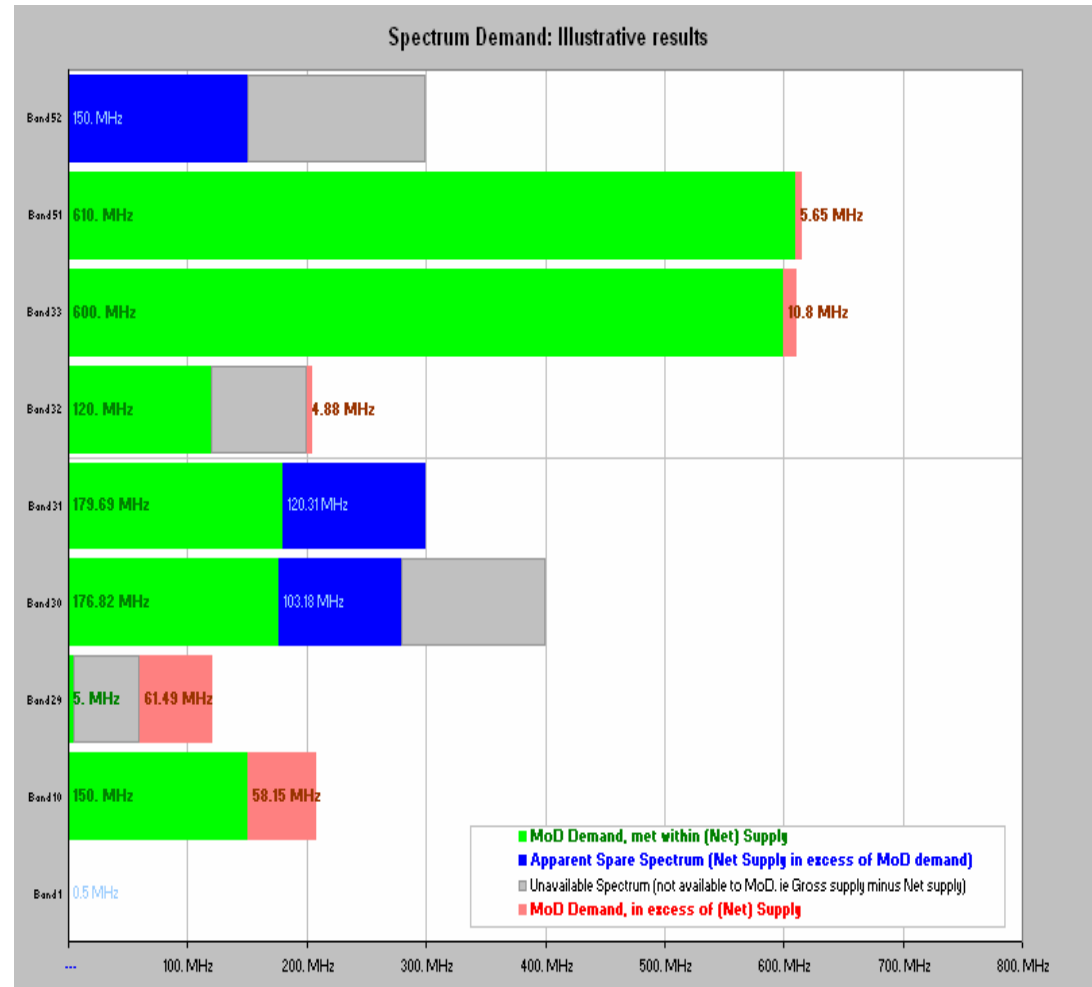
- Map showing interference issues between sites (locations disguised for this presentation)
- Shows where spectrum can be re-used



An example (adjusted) output from the model

Spectrum demand by band

- Graph showing which bands have
 - Excess supply
 - Excess demand
 - Sharing potential



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Some example outputs

Delivery timeplan

Delivery Timeplan

Start	early 2008
Complete	mid-August 2008
Final report	September 2008

Between now the end of the study we will be checking our results with key MOD stakeholders and building in such corrections as may be needed.

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HOW TO RESPECT SPECTRUM RIGHTS AND SHARING AGREEMENTS

- UK Spectrum Strategy Committee (UKSSC) is coordinating the change programme.
- Process to develop new inter-departmental agreements underway that will establish:
 - which public bodies will hold spectrum access rights
 - arrangements for sharing spectrum data and coordinating the use of spectrum that is shared
 - the exploitation and acquisition arrangements for shared spectrum including how costs and income will be shared.

HOW TO IMPLEMENT REFORM TO SPECTRUM MANAGEMENT FOR DEFENCE

- Governed within a common joint framework for Defence
 - Enable timely planning, financing, management and control of spectrum for military use
 - Establish an interface with the market
 - Make military spectrum users accountable for the cost of their spectrum use
 - Make military spectrum use responsive to changes in both military and civil spectrum demand.

*Cave programme is the driver for Defence
spectrum management reform*

CHANGING SPECTRUM MANAGEMENT

- Introducing market mechanisms
 - Broader and deeper use of pricing for public spectrum use to increase consistency with the private sector and offer incentives
 - Introduction of trading to enable public bodies to interact with the market, facilitated through Recognised Spectrum Access (RSA) for Crown bodies
 - Increased sharing of spectrum with other public or private bodies to maximise efficiencies
 - The assumption that public bodies will acquire spectrum through the market in the future

SPECTRUM PRICING

- MOD and Ofcom agreed a Memorandum of Understanding (MOU) that defines the procedures and basis for determination of spectrum fees. This provides:
 - clarity and certainty as to the basis for and determination of fees
 - formalises the process for the determination, adjustment and payment of spectrum fees
 - provides an effective process for resolving issues or disputes

RECOGNISED SPECTRUM ACCESS

- A phased approach:
 - MOD proposes now to apply for RSA within the 406.1 to 430 MHz band
 - and possibly within the 3400 to 3600 MHz band.
- A general principle:
 - Where spectrum is jointly managed with another public body or where there is a shared interest with another public body, suitable arrangements will be put in place for joint decision-making through the existing inter-departmental machinery of the UKSSC.

RECOGNISED SPECTRUM ACCESS

RSA - Likely date for application by MOD	< 1 GHz	1 – 4 GHz	4 – 10 GHz	> 10GHz
April 2008 to March 2009	406.1 – 430 MHz ^{1,8}	3400 – 3600 MHz ^{4,5}		
April 2009 to March 2010			4400 – 4500 MHz 7900 – 8400 MHz ¹⁰ 8500 – 9000 MHz ⁹ 9500 – 10125 MHz	10.125-10.225 GHz 10.225 – 10.5 GHz ⁵ 13.4– 13.75 GHz 14.62 – 15.23 GHz
April 2010 to March 2011			5300 – 5850 MHz ⁶ 7250 – 7300 MHz	
April 2011 to March 2012	230 – 399.9 MHz ^{2,3,7,8} 401 – 406 MHz	2310 – 2450 MHz		
Beyond 2012	72.8 – 74.8 MHz 75.2 -76.7 MHz 78 – 80 MHz 83.5 – 85 MHz ⁷ 141.9 – 143 MHz 149 – 149.9 MHz 153.5 – 154 MHz 430 – 450 MHz 870 – 872 MHz 915 - 917 MHz	1375– 1400 MHz ⁸ 1427 – 1452 MHz	4500 – 5000 MHz ⁸	

RECOGNISED SPECTRUM ACCESS



Question 3 Do you agree with the phased approach to applying for RSA that the MOD is proposing?

SPECTRUM SHARING, RELEASE AND ACQUISITION

- Trading
 - Investment appraisal by MOD
 - Where spectrum is jointly managed with another public body or where there is a shared interest with another public body, suitable arrangements will be put in place for joint decision-making through the existing inter-departmental machinery of the UKSSC.
 - Ofcom provides regulatory framework for trading and licensing
- Acquisition and exploitation
 - In all but exceptional cases the MOD proposes to share, release and acquire spectrum through the market

SPECTRUM SHARING AND RELEASE PROPOSALS

Date when new sharing and release may commence within the bands identified in this table	< 1 GHz	1 – 4 GHz	4 – 10 GHz	> 10GHz
April 2008 to March 2009	406.1 – 430 MHz ^{1,8}	3400 – 3600 MHz ^{4,5,7}		
April 2009 to March 2010			4400 – 4500 MHz 7900 – 8400 MHz ¹⁰ 8500 – 9000 MHz ⁹ 9500 – 10125 MHz	10.125-10.225 GHz 10.225 – 10.5 GHz ⁵ 13.4– 13.75 GHz 14.62 – 15.23 GHz
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SPECTRUM SHARING AND RELEASE PROPOSALS

- Question 4 Do you agree with the MOD's plans for the release and sharing of the spectrum it uses?
- Question 5 Do you agree with MOD's priorities for releasing spectrum?
- Question 6 Do you agree with MOD's outline timetable for initial spectrum releases?
- Question 7 Do you agree that MOD has correctly and fully identified the factors and options that should be considered before deciding to release and acquire spectrum in the market?
- Question 8 Do you agree that MOD has correctly and fully identified the factors and options that should be considered before deciding the best means with which to interact with the market?
- Question 9 Can you identify any different approaches for the MOD to manage the spectrum it uses and engage with the market to deliver better value for money for defence and the taxpayer?

EXPLOITING AND ACQUIRING SPECTRUM THROUGH THE MARKET

Partnerships UK

Third Party Issues

Context

- Concept of a Third Party intermediary to deal with the commercial side of public sector spectrum engagement with the market was suggested by the Independent Audit.
- Concerned here with MOD's engagement with the market and specifically the potential to work with a Third Party.

Four questions we need to answer

1. Does MOD need a Third Party?
2. What would a Third Party be required to do?
3. How would a Third Party Operate?
4. How would MOD establish the Third Party?

Question 1

Does MOD need a Third Party?

- **Where MOD is able to release spectrum it could:**
 1. Cease to hold and manage the spectrum and hand to Ofcom
 2. Establish its own organisation to make the spectrum available in the commercial market
 3. Appoint a Third Party intermediary to make the spectrum available in the commercial market
- The independent audit suggested that Option 3 may be attractive to provide commercial expertise and motivations not present in the public sector.

Question 2

What would a Third Party be required to do?

- **Possible activities include:**
 - Facilitating trades
 - Identifying market opportunities
 - Negotiating specifics of sharing arrangements
 - Band management
 - Collecting information about assignments and usage
 - Monitoring usage
 - Administering a charging regime for sharing
 - Informing revisions of AIP rates
- RSA or licence terms or conditions would continue to be set by Ofcom

Question 2

What would a Third Party be required to do?

- **Scope of spectrum – several options**
 1. Bands used and managed exclusively by MOD
 2. Bands managed exclusively by MOD but with current sharers
 3. Bands managed jointly by MOD and OGDs
 4. Spectrum not managed by MOD but where MOD is a sharer
- **Volume of spectrum for trading**
 - Not yet known but will be central to commercial model for any Third Party.
 - Will be informed by ongoing audits and future demand study.

Question 2

What would a Third Party be required to do?

- Assuming that other public bodies have similar requirements to engage with the market for spectrum trading, what would be the preferred steady state?
 1. MOD and other public bodies each appoint their own Third Parties?
 2. One Third Party for all public sector spectrum exploitation and acquisition?
 3. Multiple Third Parties each serving one or more public bodies?
 4. Multiple Third Parties each serving a particular sector?

Question 3:

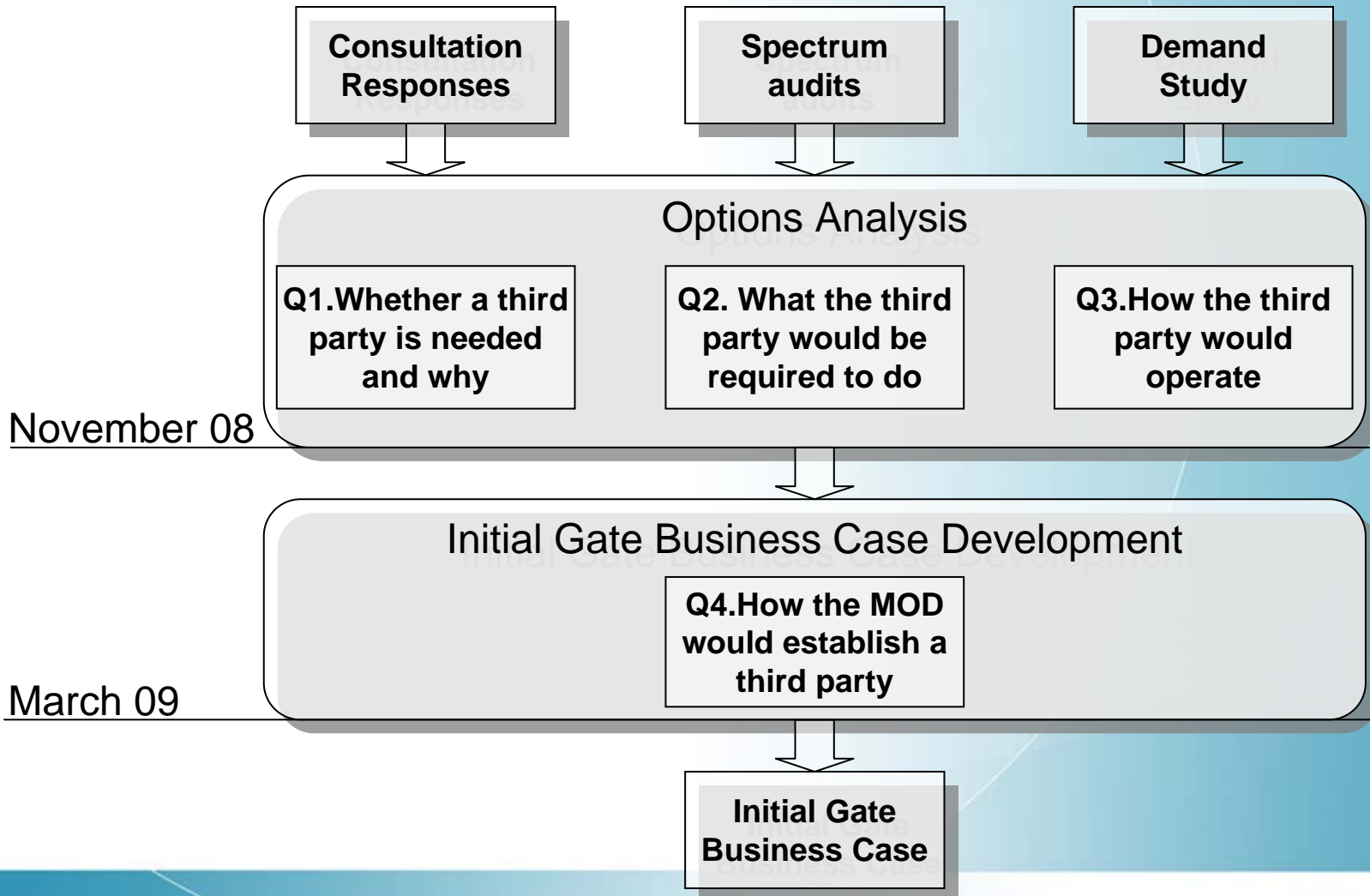
How would a third party operate?

- Definition will need to address at least:
 - Legal entity/commercial structure
 - Powers
 - MOD and OGD obligations
 - MOD customer function
 - Governance arrangements
 - Performance measures and benchmarks
 - Risk transfer
 - Payment mechanisms
 - Incentivisation mechanisms
 - Term of appointment
 - Termination, transition and exit
- **To expedite the trading of specific initial releases of spectrum it may be necessary to establish interim arrangements which differ from the ongoing, steady-state arrangements for engaging with the market.**

Question 4: How would MoD establish the Third Party?

- Procurement route will be considered once we have at least provisional answers for Questions 1 to 3.

How will the four Questions be answered?



EXPLOITING AND ACQUIRING SPECTRUM THROUGH THE MARKET

- Question 10 Which options should be considered, or discounted, and if so why; either in respect of options already identified in this section, or additional options, not identified?
- Question 11 Which issues relating to this section, should be considered when evaluating options, and if so why; either in respect of issues already identified in that section, or additional issues, not identified?
- Question 12 Is the scope of decisions required against each of the four questions sufficient and, if not, how and why it should be extended?

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WAY AHEAD





END