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Key sources:
Everyone at **CORDA**
http://milexdata.sipri.org/
https://www.gov.uk/government/publications/future-character-of-conflict
http://www.theguardian.com/news/datablog/2011/sep/01/military-service-personnel-total

30 Years of O.R. in the UK Defence Industry

A Young Analyst's Perspective

PREPARED BY BEN LUDFORD

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EVENTS

1984

Cold War
- Long, detailed studies
- Heavy focus on warfighting
- Many models based on attrition

Gulf War I
- Use of effects-based assessment to measure against desired outcomes
- Integration of military and non-military instruments
- Analysis of armoured engagements, casualties and casualty evacuation

1984 UK military spend (% of GDP), 5.27%

Total personnel in UK armed forces,1984, 325,900

1994

Bosnia and Kosovo
Peace support operations that require new types of analysis:
- Measuring operational progress using 'return to normality'
- Linking civil and military data analysis
- Studied to help determine routes to a sustainable future in the regions

The rise of non-state actors (throughout)
They can challenge states and borders and operating internationally causes difficulties for states wanting to deal with them.

Front Line First
- Cut manpower by 5%
- Closure of naval and air bases
- Set up Joint HQ

Options for Change
- Cut manpower by approx. 18%
- Cut RAF bases in Germany
- Reduce number of frigates and destroyers

Sierra Leone
Non-combatant Evacuation Operation where quick logistical analysis is needed. Presence of mission creep creates difficulties for Military Planners.

2004

9/11
A single event that changes laws, regimes and doctrine.

NITEWORKS
The MOD establishes Niteworks, a partnership between the MOD, Dstl and industry that enables the MOD quick access to industrial expertise for military capability decision support.

Afghanistan
- Counter insurgency operation with focus on long-term stabilisation
- Actions need to take into account human perception from the population

Delivering Security in a Changing World
Reduce manpower and equipment across the board (bar special forces) but keep the ability to either:
- Support 3 small to medium ops, where one is enduring
- Deploy in large scale op while running a small op concurrently

SDR
- Replace through-desk cruisers with QE Class
- Reduce number of frigates and destroyers
- Integrate Territorial Army with regulars

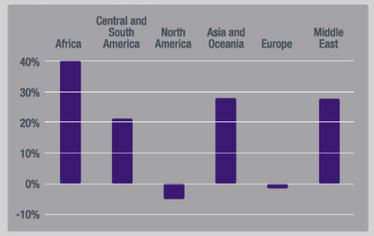
SDSR
- Cut manpower by 10%
- Cut number of tanks by 40%
- Cut number of frigates and destroyers

2014

Arab Spring
Led to uprising and protests in a number of countries and four rulers were forced from power.

Signs of a Shift of Power
Advantages in technology and wealth in the West are declining – defence spend elsewhere is increasing.

Change in Military Expenditure between 2008 and 2013



Total personnel in UK armed forces, 2014, 159,630

2013 UK military spend (% of GDP), 2.30%

TECHNOLOGY

Analysts use hand-written equations. Some models run on mainframe computers.

Fortran 77

Spreadsheets

Increased tempo of operations and portable technology for analysts lead to direct support to commanders.

Simulation packages become less programming based.

Commercial technology overtakes military technology.

USE OF OR

Focus on equipment
E.g. full assessment of army equipment looking over 10 years, analysis of success of anti-submarine warfare technology.

Introduction of COEIAs
The Combined Operational Effectiveness and Investment Appraisal gave OE and IA the same emphasis leading to comprehensive, integrated analysis.

Smart procurement and CADMID cycle
"Faster, cheaper, better". Aim to spend up to 15% of procurement costs before Main Gate to reduce risks – increased demand for analysis.

Introduction of DLoDs
The Defence Lines of Development (equivalent of US DOTMLPF) are introduced as part of wider defence reforms to ensure thinking covers all aspects of capability.

Data generation in conflict
An increasing amount data has been collected allowing for more detailed studies.

Network Enabled Capability
- Driving research into importance of information on the battlefield
- Existing models modified to take this into account

Preparation for SDSR 2015
Research for the Strategic Defence and Security Review is underway to address future challenges and major acquisition decisions.

RECENT TRENDS IN OR

Re-emergence of previous analysis techniques
- Addressing new and complex situations from scratch e.g. manual war gaming
- Supplementing large and complex models e.g. static capability scoring

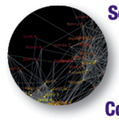
Reduction in Budgets
Reducing budgets mean ensuring value for money through smart procurements, balance of investment, extending in service and regenerating capability.

Sustainable Development
- Ensuring resilience to current and future environmental, social & economic threats
- Maximising positive and minimising negative impacts on the environment, people and economy globally

IVHM/SIE
The use of Integrated Vehicle Health Monitoring/System Information Exploitation is increasing giving a large opportunity for analysis.

Unmanned
A new industry has developed and this is set to increase. Not all analysis can be transferred from manned systems.

Cyber
- Opening up new locations (physical and cyber) to threats
- Requires new types of attack and prevention



Social Network Analysis
Identifying groups and ways of breaking down communication. The techniques are now also being applied in other network types.

Complex conflict
New and complex conflicts and operations involving more human factors have emerged. Fresh analysis has begun on these areas as old models are not applicable. These problems are difficult to model due to the vast variety in human behaviour.

Integrated Defence
Looking at problems holistically from a high level and across DLoDs.

Media and Psychological Operations
Become a recognised part of the Armed Forces. Specialist individuals from industry are brought in for their expertise.

FUTURE

O.R. techniques
Hard techniques have changed little in 30 years, but will continue to increase in complexity and originality of applications. Soft techniques have become widely accepted and will be more and more relied on and valued.

Blurring of military and civil applications
Civilian applications on which military depend will require protection from computer network operations and directed energy weapons.

Computing Power
Increased computer power will give will us more accurate information and reduce reliance on statistical techniques and complex algorithms.

Defence
The fundamentals of defence won't change – to provide security for the nation, it's people and it's interests.

Equipment
- More capable and autonomous unmanned systems
- Directed energy and non-lethal weapons

The World
- Growing instability, opportunities for conflict and state failures
- Claim for resources will drive nations' interests
- Qualitative/quantitative advantage not assured
- Increased interdependence

Technology
- Mobile and wearable technology will allow models to be used and data accessed more easily during operations and in theatre
- More advanced and specialised tools and software will lead non-analysts attempting more analysis themselves
- Model visualisations will advance using 3D or holographic technology

Total Support Force
Industry and reserves are to be integrated into regular military structures.

Environments	
Current	Air, Sea, Land
Emerging	Information, Cyber, Space
Future	Underground, Deep sea