Why Defence Acquisition is Difficult

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Ministry of Defence

SSPD 2021: *International Conference in Sensor Signal Processing for Defence: from Sensor to Decision*, 14/15 September 2021

Ajax

Minister: Doubts continue over Army's troubled Ajax armoured vehicles

The Ajax was intended to be "fully digital" and provide the Army with modern armoured fighting vehicles

Defence Minister Jeremy Quin has said he "cannot 100% promise" that noise and vibration problems with the Army's new fleet of armoured vehicles can be resolved.

He told MPs the programme remains "troubled" and said he could give no deadline for issues to be sorted out.

Outline

- Why defence acquisition is difficult
- Some examples
- Innovation and how to foster it
- Some approaches
- Conclusion

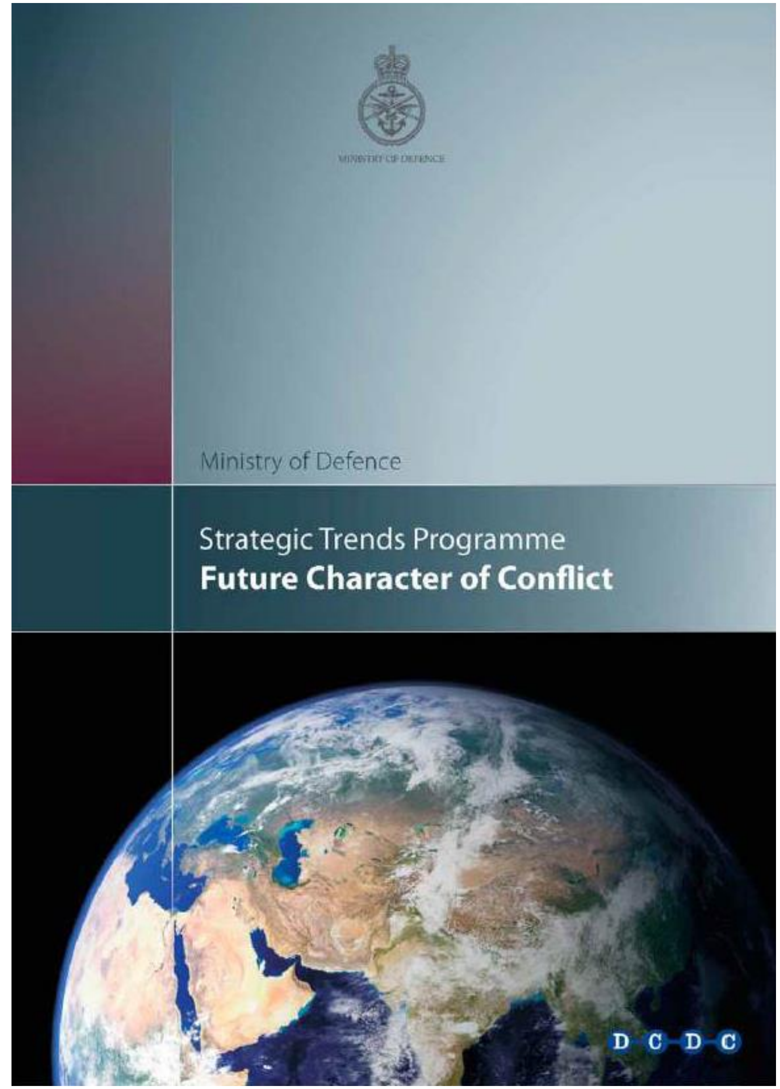
Why Defence Acquisition is Difficult

- The acquisition of defence equipment – whether tanks, aircraft carriers or fast jets – is notoriously difficult.
- On the occasions when it goes wrong we hear of cancelled projects or costly spending overruns, amounting to billions of pounds of taxpayers' money.

1. Because requirements change

- Equipments may have an in-service lifetime of 20 years or more
- 20 years ago we could not imagine the operations that we now pursue
- DCDC
- *Asymmetry*
- Think in terms of *capabilities*
- *Requirements creep*
- *UORs*

Because requirements change

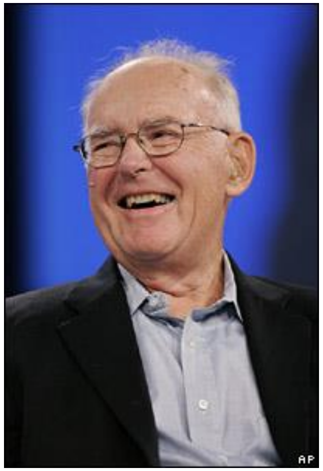


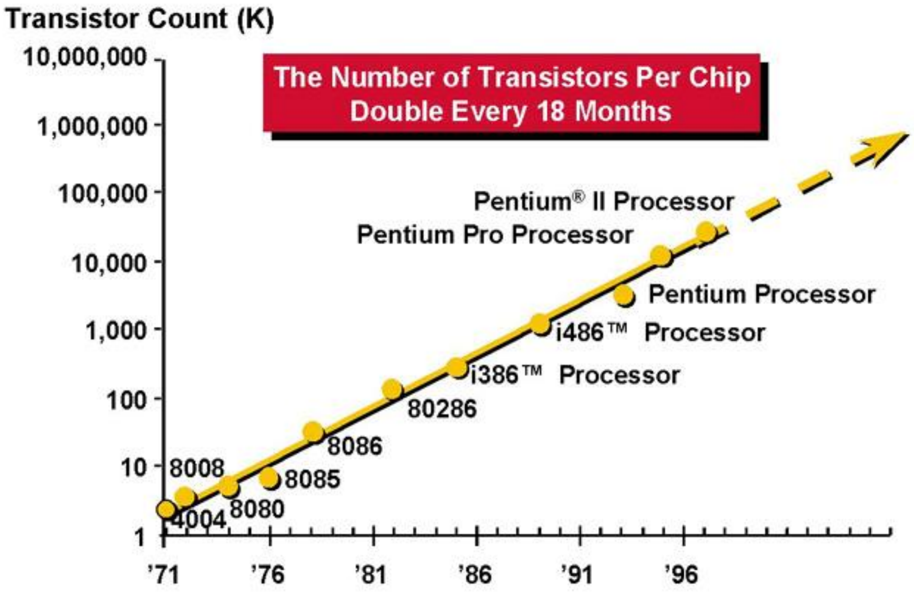
2. Because technology changes

- Equipments may have an in-service lifetime of 20 years or more
- Technology will change hugely in that time – and most defence equipment relies heavily on technology
- Perhaps most evident in advances in computing power (Moore's Law)
- Development of technology can be quantified systematically in terms of *Technology Readiness Levels* (TRLs)

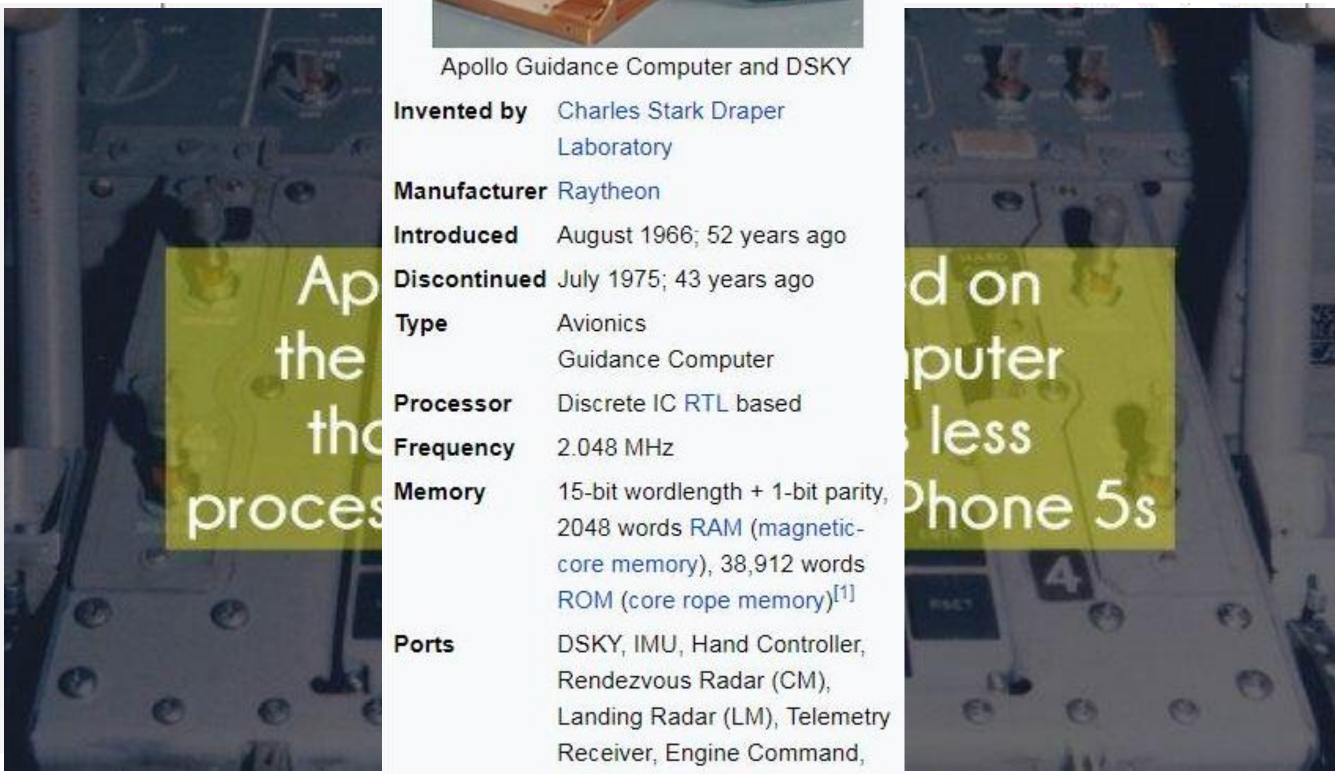
Moore’s Law

Intel already had a robust track record with microprocessor development when IBM* chose the 8088 processor as the heart of the 1981 IBM PC. The 8088 was a 16-bit, third-generation microprocessor that followed "Moore's Law". Gordon Moore made his first observation about the "doubling of transistor density on a manufactured die every year" in 1965, just six years after he invented the planar transistor and four years after he and Bob Noyce produced the first planar integrated circuit. Gordon admits that, initially, he did not expect his law to still be true some 30 years later, but he is now confident that it will be true for another 20 years.





Moore's Law



Apollo Guidance Computer

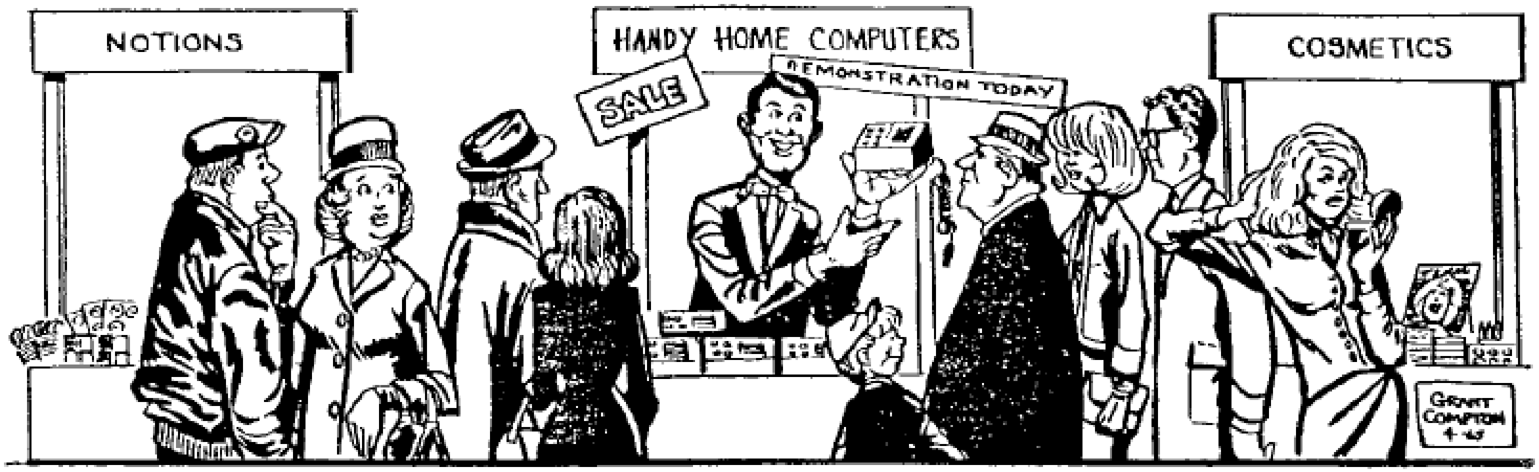
Apollo Guidance Computer and DSKY

Invented by	Charles Stark Draper Laboratory
Manufacturer	Raytheon
Introduced	August 1966; 52 years ago
Discontinued	July 1975; 43 years ago
Type	Avionics Guidance Computer
Processor	Discrete IC RTL based
Frequency	2.048 MHz
Memory	15-bit wordlength + 1-bit parity, 2048 words RAM (magnetic-core memory), 38,912 words ROM (core rope memory)[1]
Ports	DSKY, IMU, Hand Controller, Rendezvous Radar (CM), Landing Radar (LM), Telemetry Receiver, Engine Command, Reaction Control System
Power consumption	55 W[2]:120
Weight	70 lb (32 kg)
Dimensions	24×12.5×6.5 inches (61×32×17 cm)

Moore's Law

Cramming More Components onto Integrated Circuits

GORDON E. MOORE, LIFE FELLOW, IEEE



nologies which are referred to as microelectronics today as well as any additional ones that result in electronics functions supplied to the user as irreducible units. These technologies were first investigated in the late 1950's. The object was to miniaturize electronics equipment to include increasingly complex electronic functions in limited space with minimum weight. Several approaches evolved, including microassembly techniques for individual components, thin-film structures, and semiconductor integrated circuits.

Reprinted from Gordon E. Moore, "Cramming More Components onto Integrated Circuits," *Electronics*, pp. 114–117, April 19, 1965.
Publisher Item Identifier S 0018-9219(98)00753-1.

to use integration because it cuts costs of both manufacture and design.

The use of linear integrated circuitry is still restricted primarily to the military. Such integrated functions are expensive and not available in the variety required to satisfy a major fraction of linear electronics. But the first applications are beginning to appear in commercial electronics, particularly in equipment which needs low-frequency amplifiers of small size.

III. Reliability Counts

In almost every case, integrated electronics has demonstrated high reliability. Even at the present level of pro-

Moore's Law

Cramming More Components onto Integrated Circuits

GORDON E. MOORE, LIFE FELLOW, IEEE

Even in the microwave area, structures included in the definition of integrated electronics will become increasingly important. The ability to make and assemble components small compared with the wavelengths involved will allow the use of lumped parameter design, at least at the lower frequencies. It is difficult to predict at the present time just how extensive the invasion of the microwave area by integrated electronics will be. The successful realization of such items as phased-array antennas, for example, using a multiplicity of integrated microwave power sources, could completely revolutionize radar.

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TRAVEL INFORMATION

This map has been drawn with a calm hand and a kind heart to help people entering the corridors of uncertainty. It is a mind-map for those seeking to explore new landscapes. It takes many perspectives to perceive what is happening now let alone predict what might happen next and this is merely my own modest attempt to do both. Hopefully people will use this map to have courageous conversations about where they are now and where they might wish to travel next. Every care has been taken to ensure that the thinking contained within this map is robust at the time of publication, but it will not be error free and no responsibility can be taken for people blindly following conventional wisdom. Paths are no indication of rights of way and travellers should be careful not to confuse a clear view for a short distance. If in doubt stop moving and quietly sit down and think for a while. Finally, remember that while the future is largely unknowable it is not uninventible. Tomorrow is created from what we decide to do today. We should therefore spend less time worrying about what might happen and far more time discussing where it is that we want to travel and how we'd like to get there.

LOST PERSONS

Persons feeling lost or disorientated, especially those aged fifty plus, can contact the mapmaker for guidance, although it is ultimately each individual's responsibility to find their own way. Guided tours of key sights are available to people that ask politely. Lunch will be provided. Please note that alteration works can take place and some routes will be replaced without notice, in which case replacement shuttle services will operate.

ACKNOWLEDGEMENTS

This map was conceived and created by Richard Watson using material from his website nowandnext.com and various books, notably Future Files and Digital Vs. Human. Invaluable enthusiasm and support has been received from many people most of whom would like to remain anonymous for some reason. Individuals happy to be named include Alan Sekers, Adam Morgan, Alex Ayad, Oliver Freeman, Jolanta Leonaite, Jules Goddard and Dave Birch.

Common sense and final information design by Zeljko Zoricic.

LARGE PRINTED COPIES

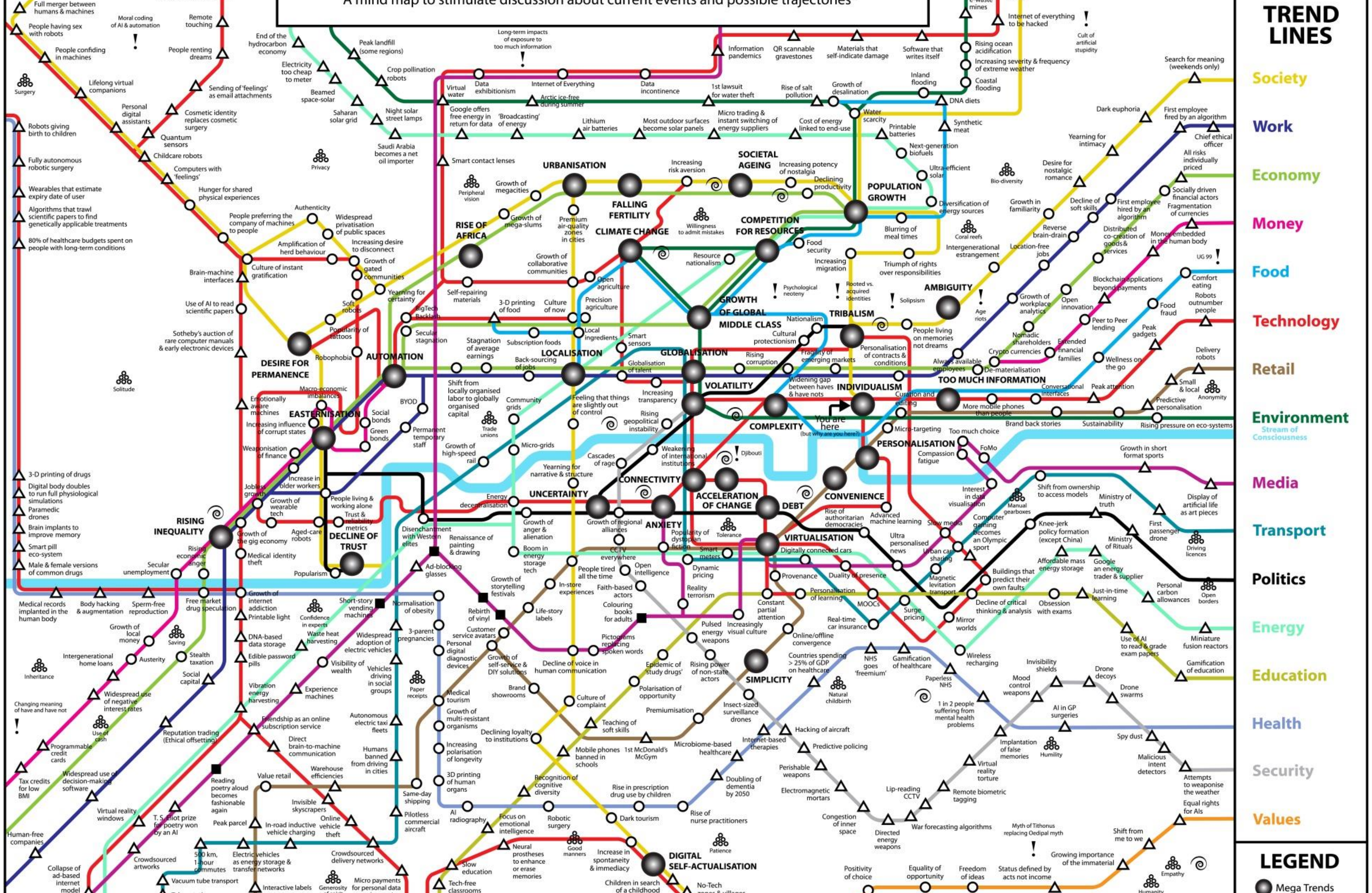
Large colour prints of this roadmap (A3, A1 and the rather magical AO size) can be ordered by contacting Richard Watson via nowandnext.com or LinkedIn. There is no charge for these prints except to cover printing, postage and large cardboard tubes. Please note that shipping AO sized prints to far-flung corners of the world can be rather expensive. If you want to print this map yourself from a digital file found online it is suggested that A3 should be the minimum size unless you have magnificent eyesight or a magnifying glass. If you need a very high resolution file this can be ordered via nowandnext.com and there is no charge, zero, zip, zilch.

http://toptrends.nowandnext.com/2017/05/08/map/

Version one. London, UK. May 2017
* Or thereabouts, who can say?

MEGA TRENDS AND TECHNOLOGIES 2017-2050

A mind map to stimulate discussion about current events and possible trajectories*



GLOBAL GAMECHANGERS (What could possibly go wrong?)

- △ Regulatory change
- △ Systemic financial collapse
- △ Inflation running at > 10%
- △ Rapid rise in US interest rates
- △ Major Chinese slowdown
- △ Global trade collapse
- △ Severe food shortages
- △ Super volcano eruption
- △ Severe space weather
- △ Rogue asteroid
- △ Gamma ray burst
- △ Giant methane burp
- △ Extreme climate change
- △ Major Syn-bio accident
- △ Loss of antibiotic efficacy
- △ Global pandemic virus
- △ Failure to treat obesity
- △ Mental health epidemic
- △ Radiation from mobile devices
- △ Doubling of the Chinese birth rate
- △ Oil price shock
- △ Extended drought
- △ Mass unemployment caused by AI
- △ Biological terrorism
- △ Destabilisation of China
- △ Collapse of EU
- △ Russian expansionism
- △ Water trading & speculation
- △ Collapse of EU pensions funding
- △ Major sovereign debt default
- △ Weaponisation of near space
- △ Collapse of North Korea
- △ US/China war
- △ India/Pakistan war
- △ Blockage of the Strait of Hormuz
- △ Self-replicating killer robots
- △ Decline of human intelligence
- △ Message received from outer space
- △ Finding out the Matrix is real (OMG)
- △ Return of the Messiah (look busy)
- △ People taking these things seriously
- △ Something I haven't thought of

TABLE OF TRENDS & TECHNOLOGIES FOR THE WORLD IN 2020

OTHER IDEAS TO WATCH

1. Avatar assistants
2. Biomimicry
3. Clean coal
4. Comfort eating
5. Contextual deficit
6. Diminishing use of email
7. Decline of voice communication
8. Electrification of transport
9. Facial recognition on mobile phones
10. Gene hacking
11. Holographic telepresence
12. Increasing complexity
13. Local living
14. Mobile money
15. Peak water
16. Peer-to-peer lending/giving
17. Quantum computing
18. Reverse migration
19. Self-tracking
20. Smart infrastructure
21. Slow education
22. Shift from products to experiences
23. Ultra-efficient solar
24. Value redefinition
25. Voluntary simplicity

SOURCES & FURTHER READING

The Future: 50 Ideas You Really Need to Know
by Richard Watson

See www.futuretrendsbook.com
and www.nowandnext.com

PRINTING & PRINTED COPIES

High resolution digital files for this table and ready printed copies can be obtained from: richard@nowandnext.com

ACKNOWLEDGEMENTS

Thanks to Charlie @ Plum Creative

KEY

Society	Technology	Energy	Environment
Economy	Employment	Population	Politics
Identity	Global risk High probability	Global risk Low probability	Uncategorised

MEGATRENDS

Gd Globalisation & deregulation	Um Urbanisation & migration	Cs Climate change & sustainability	P Population & lifespan growth	Lr Localism & re-regulation

H Hyper connectivity																	W Workforce ageing
Eg E-government	Sr Scarcity of resources											Ex Extreme weather events	Mc Expansion of global middle class	Am Resurgence of US manufacturing	Sv Shared value creation	I Focus on the self	Pm Purpose & meaning
Ir Ideological resurgence	Pv Price volatility											Po Population growth	B Loss of bio-diversity	A Rise of Africa	Br Shift to the BRICs	Se Sense of entitlement	Pt Mobile & part time working
Er Erosion of trust	Cf Clean fuels	Na Nano materials	Sb Synthetic biology	Sw Semantic web	Hg Holographics & 3D web	Au Augmented & virtual worlds	Ai Artificially intelligent devices	Uub Ubiquitous sensors & tracking	Db Desert based solar	Tc Technology convergence	Ga Gamification	Fe Fertility decline	Ac Ocean acidification	C Carbon pricing	Sc State capitalism	N Normalisation of obesity	Bh Back homing of outsourcing
V Volatility	Mg Micro-grids & micro-generation	Rb Robotics & smart objects	Md Personalised medicine	Ca Context aware computing	As Autonomous systems & devices	It Internet of things	At Automation	Nfc Near-field communication	Ha Haptic technology	D3 3D printing	Os Open-source discovery & invention	Li Urban living	F Changing family units	Ar Aquifer reduction	Te Top soil erosion	Ce Cosmetic enhancement	In Intensifying competition
Xe Xenophobia	Ne Non conventional reserves	No Secularism	Pd Predictive personalisation	Pg Personal genomics	Cd Personal clouds	Ra Real-time data & analytics	Ge Gestural recognition	Bq Battery life and energy storage	Dm Dematerialisation	Wr Wireless re-charging	Sn Social networks	Age Population ageing	Sph Single person households	Es Ethnic shifts	Ag Precision agriculture	Uuh Blurring of real & virtual worlds	Ic Industry consolidation
Fr Focus on regional & domestic policy	Rn Resource nationalism	Omg Resurgence of religion	He Hedonism	Ci Culture of immediacy	Ti Total information transparency	Mo Mobility & portability	S Sharing	Tm Too much information	Pr Provenance	LoI Search for happiness	U Ubiquitous connectivity		Paw Fragmented attention		Me Individualism		Atm Atomisation

Re Regulatory change	Bt Biological terrorism	Eu European incrementalism	Op Oil price spikes	Np Nationalism & protectionism	Sws Skilled worker shortages	Fp Food price volatility	Fi Fiscal imbalances	Gp Global pandemic	Cw Cyber viruses and data theft	Ua Uneven access to food & water	Si Severe income inequality	Rc Rogue employee	Mq Mega-quake in mega-city	**High probability**
Gg Global governance failure	Nt Nuclear terrorism	Ed European disintegration	Up Unsustainable poulation growth	Mm Poorly managed migration	Kr Explosion of North Korea	Csf Critical systems failure	Ws Collapse of welfare state	Pk Collapse of Pakistan	Pi Pakistan Vs India war	Cn Collapse of China	Oa Failure to treat obesity epidemic	Cc Failure to adapt to climate change	Vol Sure-volcano eruption	**Low probability**

Chart maker: Richard Watson

Technology Readiness Levels (TRLs)

Definitions of TRLs for Components and Subsystems/Systems

The tables below define the nine Offshore Industry TRLs and give a description of each. The overlapping lines on the left-hand table and the cell shading are meant to graphically demonstrate the progression from pure research to pure development as TRLs increase.

Technology Readiness Levels (TRLs)

Generate Knowledge (Research)

Basic Technology Research	Level 1	Basic principles observed and reported
Research to Prove Feasibility	Level 2	Technology concept and/or application formulated
	Level 3	Analytical and experimental critical functions and/or characteristic proof-of-concept
Technology Development	Level 4	Component and/or bench configured subsystem validation in laboratory environment
Technology Demonstration	Level 5	Component and/or bench configured subsystem validation in relevant environment
	Level 6	System/subsystem model or prototype demonstration in a relevant environment
System/Subsystem Development	Level 7	System prototype or system demonstration in an operational environment
System Test and Operation	Level 8	Actual system completed and qualified through test and demonstration
	Level 9	Actual system proven through successful mission operations

Produce Products and Capabilities (Development)

3. Because there are no prizes for coming second

- It has to work !
- Social Media means that more or less anything that happens is on our TV or laptop screens within hours
- Politicians are acutely sensitive to accusations of ‘sending our boys (and girls) out with second-rate equipment’

4. Because the whole thing is run by humans

- Desk officers are typically in-post for 2-3 years
- And senior officers in the UK rarely have a technical background
- Governments have terms of 5 years or less
- Strong personalities
- Issues of investment by Government in UK R&D, access to export markets
- Temptation just to ‘buy American’
- But some Sovereign Capabilities

An example

B-36 Peacemaker


LIBERTY
BELLE

Another example: TSR-2

- Mach 2 tactical strike/reconnaissance aircraft
- Scrapped in 1965

Another example: NIMROD AEW

- Based on NIMROD airframe – too small to accommodate the radar, electronics, power generation and cooling
- British Aerospace and GEC Marconi as joint project leaders
- Cancelled in December 1986

Yet another example: UPHOLDER Class

- 4 x SSKs
- ordered in 1986
- In service June 1990 - October 1994
- Sold to RCN in 1998

Some success stories

Some success stories

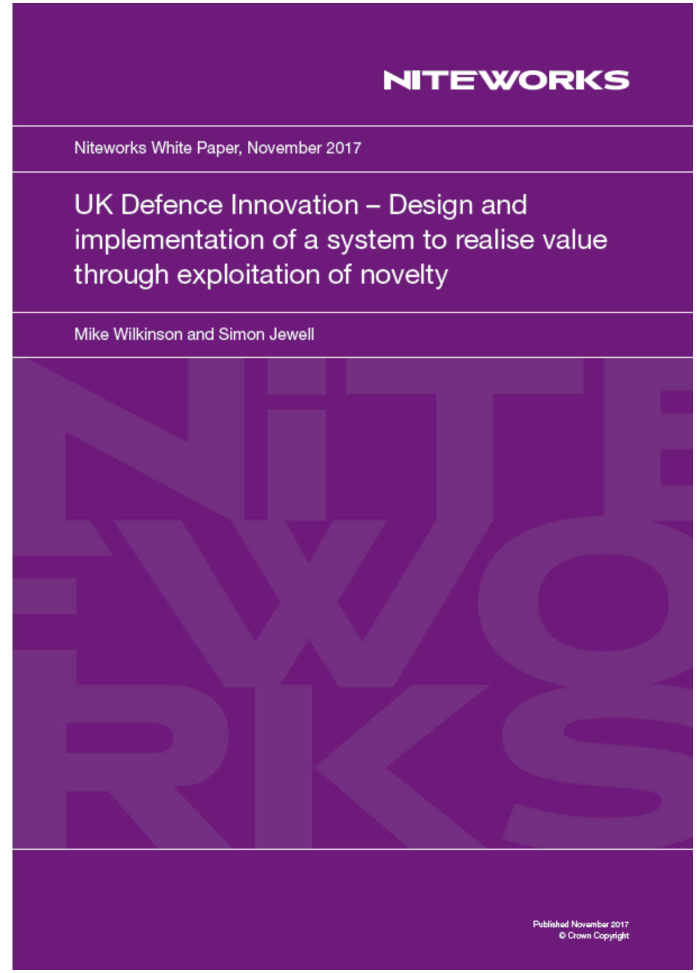
- Harrier and Sea Harrier
- Licensed to USA
- and Spain and Italy

Smart Procurement

- Can we do better ?!
- Defence Industrial Strategy (White Paper, 2005) and Defence Technology Plan
- Smart Procurement -> Smart Acquisition
- COTS technology

Innovation

- Motherhood and apple pie – but what exactly is it ?
- and how do you provide an environment in which it flourishes ?



Mike Wilkinson and Simon Jewell: *UK Defence Innovation – Design and Implementation of a System to Realise Value through Exploitation of Novelty*, Niteworks White Paper, November 2017

Innovation

Historical Perspective

Girard[S1] noted that between the sixteenth and eighteenth centuries in theology, “innovation is practically synonymous with heresy”, and “In politics, innovation is almost tantamount to rebellion and revolution”.

Being called an innovator in Elizabethan England was not intended as a compliment, Francis Bacon observes in his 17th century essay, Of Innovation: “It were good, therefore, that men in their innovations would follow the example of time itself; which indeed innovateth greatly, but quietly, by degrees scarce to be perceived.”

S1 Girard, R. (1990) Innovation and repetition. *Substance.* 19, No.2/3(62/63) pp.7.

the Why?

Innovation is **gaining value** from the **exploitation** of **novelty**

the How? the What?

The reason ‘*why*’ we innovate is to gain value. Here we refer to value in the broadest sense of the word, which might be measured through reduced cost, time or risk, or through increases in performance, efficiency, resilience or agility, amongst others. Rigidly defining value at this stage is unhelpful, as value will vary dependent upon individual perspective and circumstance. What is important is the acceptance that innovation has only occurred once value has been realised.

The ‘*what*’ concerns the generation of novel ideas or, more likely, the combination of existing ideas in novel circumstances. Ideas are not constrained to technology or products; essentially they should be unbounded and will apply equally to processes, organisation, management, market, business model or operations. Innovation should not therefore be confused with research and development or invention as these are only contributors to a much larger enterprise.

The ‘*how*’ of innovation involves the exploitation of novelty requiring change. Despite the alarming simplicity of this statement, it is during this stage that most attempts to innovate fail. The reasons for this are generally well understood and are referred to in this paper as frictional issues, which include a lack of awareness, the unavailability of resources, incoherence of the system elements, or insufficient motivation/rewards. Approaches to reduce their impact are discussed in the paper and are incorporated in the proposed Defence Innovation System design.

Innovation

Disruptive Ideas

Kodak dominated the photographic film market for most of the 20th century. Despite inventing the digital camera in 1975 it exited the digital camera market in 2013, selling off many of its patents to its competitors in the process. Kodak was late to react to the threat posed by digital cameras to its film business. Early digital cameras did not offer the same quality or practicality as film and the virtual absence of mobile phones, home computers and printers meant that their usefulness was restricted and niche at that time.

Combinations

Digital photography is a good example of where the combination of ideas has helped form new capabilities. Without the combination of home computers, desk-top printers and a digital camera, or the mobile phone with an embedded camera, it is doubtful that digital photography would have become so ubiquitous.

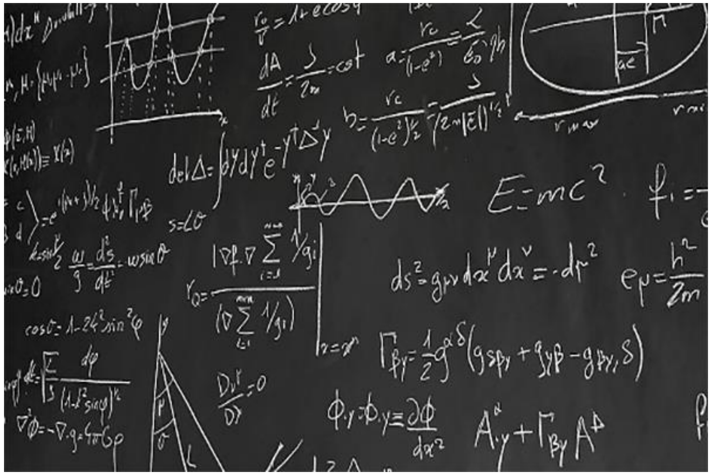
With hindsight such combinations are obvious; the innovator's challenge here was to have the vision to see how existing things combine in novel ways. This can be as demanding as thinking of a new idea itself and requires an extensive awareness of the external environment.

Parable of the Sower

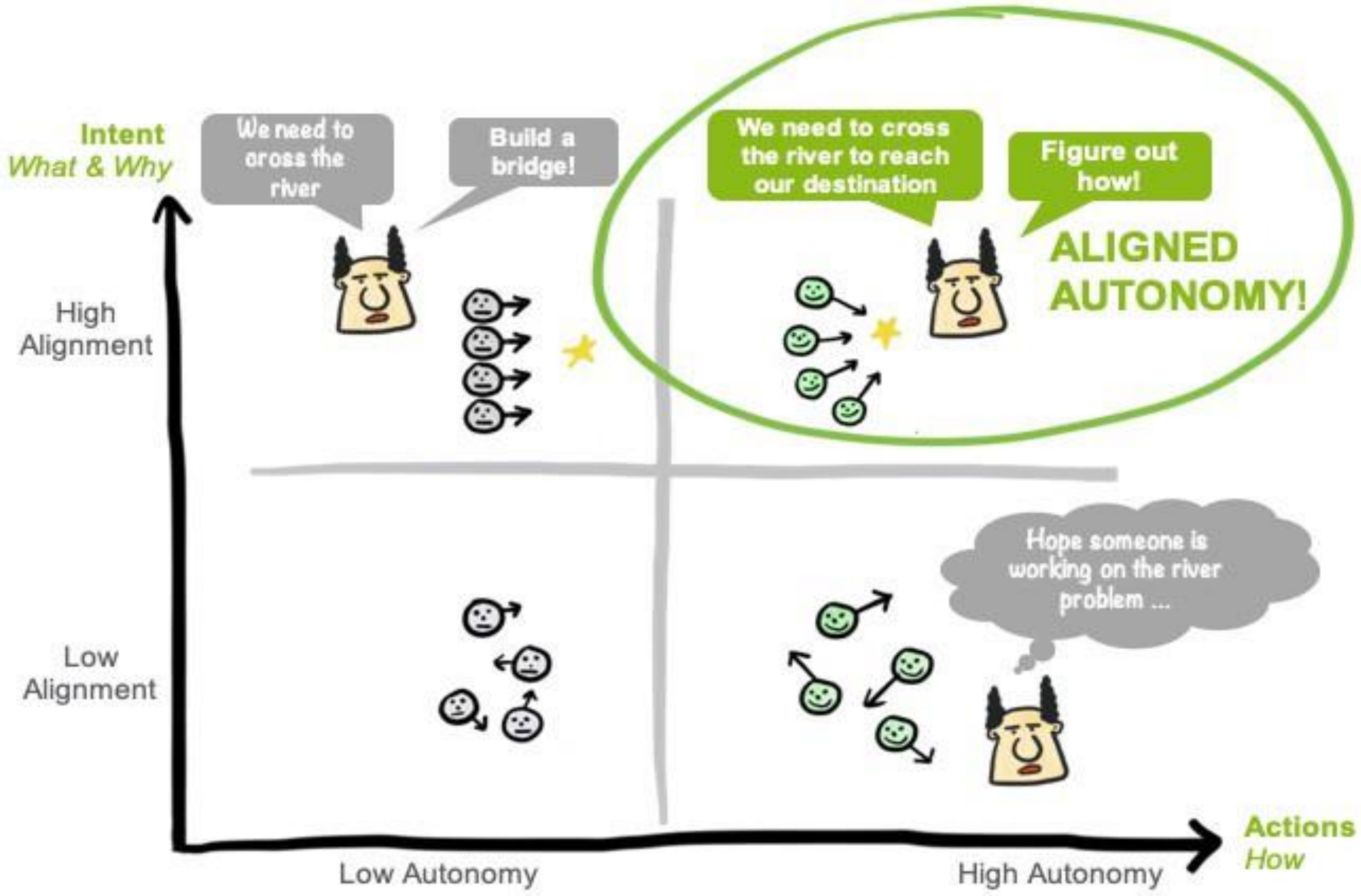
The well-known 'Parable of the Sower' provides a good metaphor for innovation. In the Parable, seeds that fall on stony ground, fall among weeds or are eaten by birds do not develop. Only those that fall on fertile ground, are tended by the farmer, and have sunshine and water bear fruit. In the metaphor, the seeds are ideas, the water and sunshine are essential resources and the tending is everything else that must be done for the realisation of value (fruit).

A Culture of Innovation

- Can we do better ?!
- How do you establish a culture which encourages people to think creatively ?
- Eccentricity !



Mission Command



Stephen Bungay: *The Art of Action*, Nicholas Brealy, 2011

DARPA and ARIA

- Since the 1950s, ARPA / DARPA has focused solely on transformative science and technological research programmes, with a lean structure and a high risk tolerance. This approach has yielded remarkable results. ARPA played a vital role in the creation of ARPANET, forming the basis for the Internet. It also funded a precursor to the Global Positioning System (GPS), and the world's first Weather Satellite: TIROS 1. More recently, it has been behind inventions like voice recognition technology, as used in Apple's SIRI.
- A key factor of this success has been recruiting Program Managers, on a fixed term basis.
- Another factor has been the attitude to risk

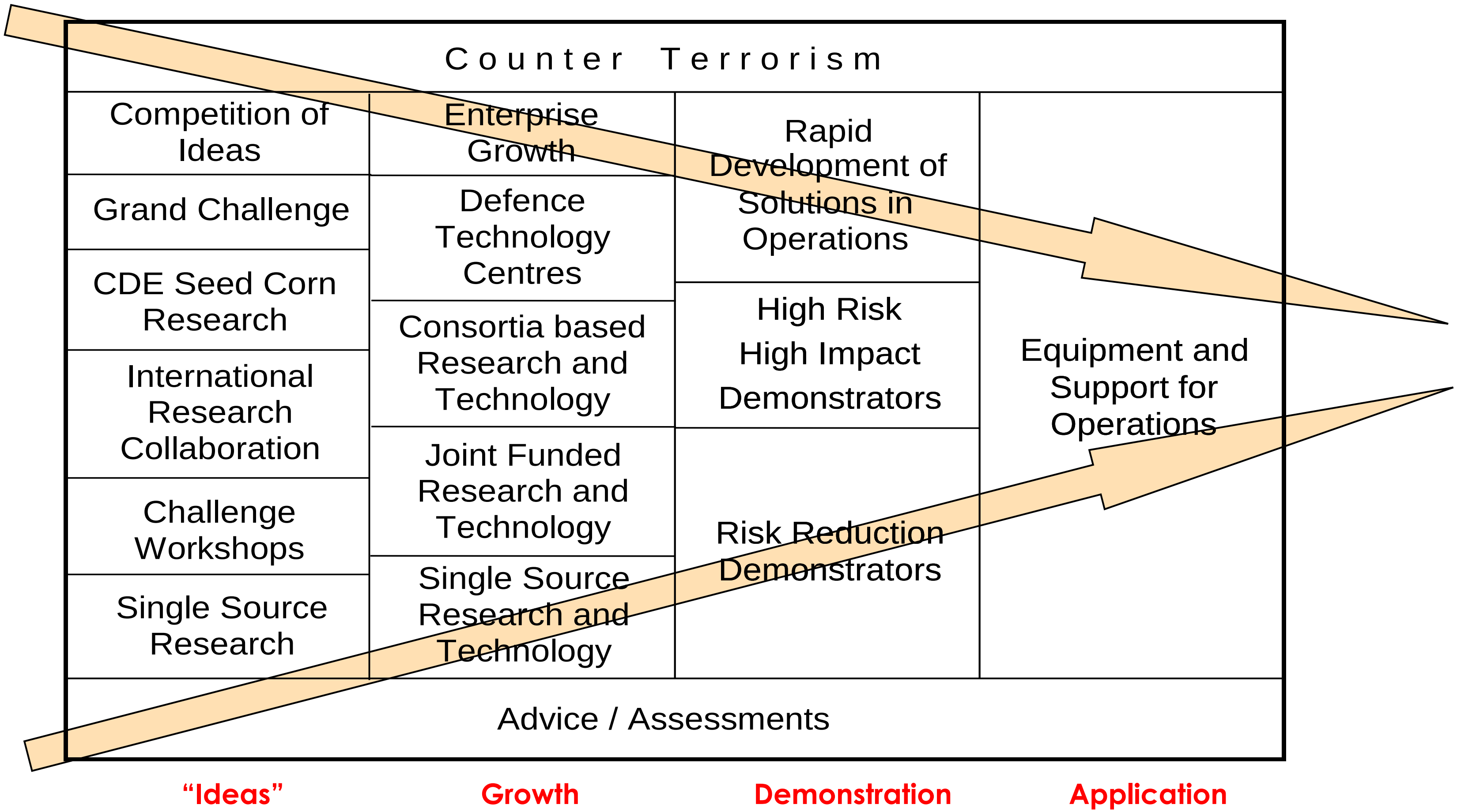
Defence Technology Strategy

MINISTRY OF DEFENCE

- For the first time, we openly provide detail of:
  - Our R&D priorities for the next 20 years
  - What we need to retain in the UK to maintain UK freedom to develop and use technologies
  - Where there are opportunities for collaboration
  - How we shall sustain key S&T skills
- Industry and Academia advisors were a key part of DTS development
  - through the National Defence Industry Council and Defence Science Advisory Council
- Now developing ***Defence Technology Plan***
  - (Defence) industry and academia will play a key role
  - Will provide the next level of detail

MINISTRY OF DEFENCE

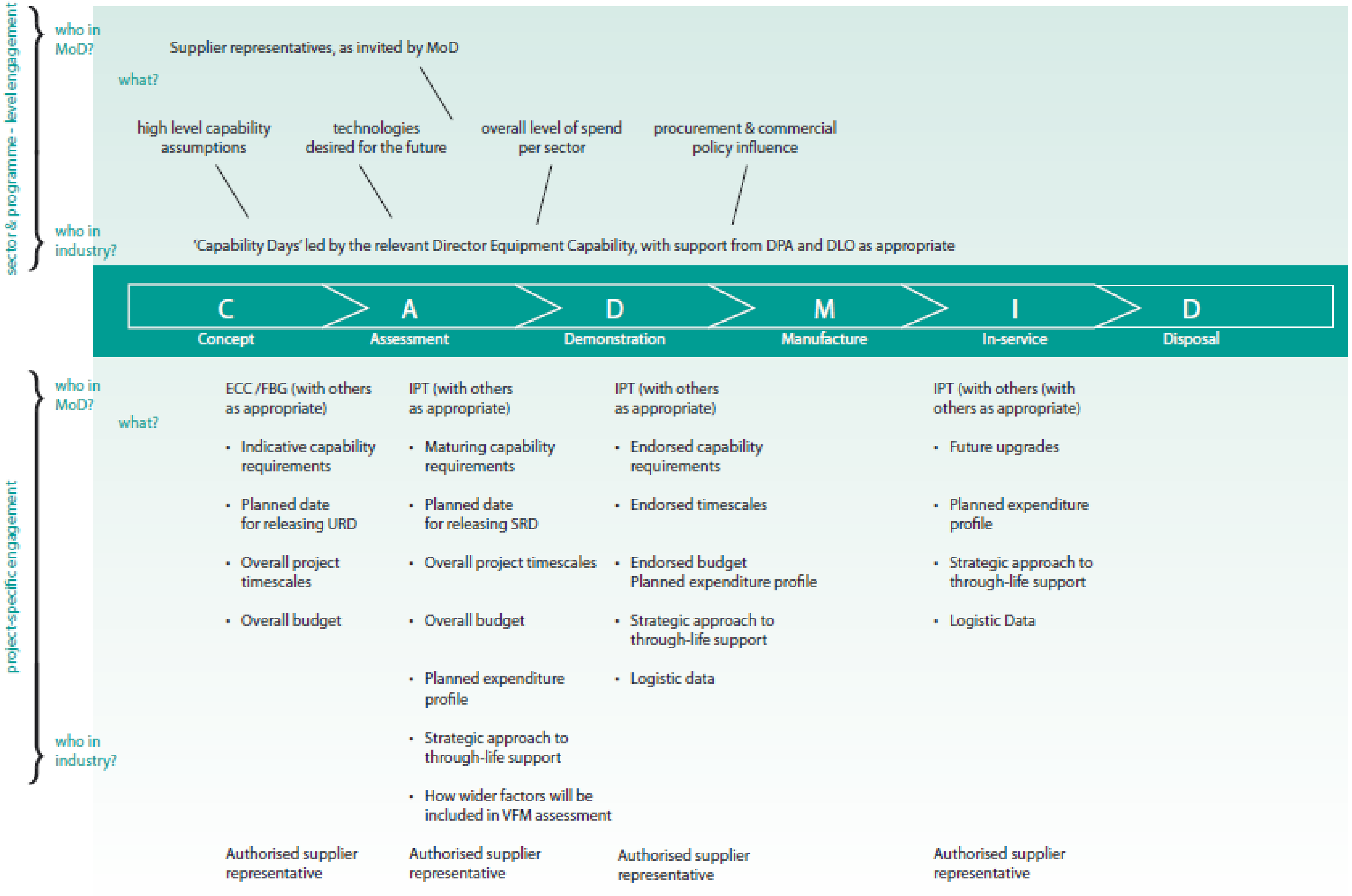
S&T Operations Delivery Model



Defence Science and Technology

MINISTRY OF DEFENCE

- To support armed forces in operations today, tomorrow and the future.
- To create UK-owned technology to benefit equipment:
  - Gives us a battle winning edge (capability)
  - Creates opportunities for industry investment (wealth creation)
- To support intelligence assessments, strategic decision making and the evolution of doctrine
- To support equipment acquisition, support and training


sector & programme - level engagement
who in MoD?
Supplier representatives, as invited by MoD
what?
high level capability assumptions
technologies desired for the future
overall level of spend per sector
procurement & commercial policy influence
who in industry?
'Capability Days' led by the relevant Director Equipment Capability, with support from DPA and DLO as appropriate
C
Concept
A
Assessment
D
Demonstration
M
Manufacture
I
In-service
D
Disposal
project-specific engagement
who in MoD?
what?
ECC /FBG (with others as appropriate)
• Indicative capability requirements
• Planned date for releasing URD
• Overall project timescales
• Overall budget
IPT (with others as appropriate)
• Maturing capability requirements
• Planned date for releasing SRD
• Overall project timescales
• Overall budget
• Planned expenditure profile
• Strategic approach to through-life support
• How wider factors will be included in VFM assessment
IPT (with others as appropriate)
• Endorsed capability requirements
• Endorsed timescales
• Endorsed budget Planned expenditure profile
• Strategic approach to through-life support
• Logistic data
IPT (with others (with others as appropriate)
• Future upgrades
• Planned expenditure profile
• Strategic approach to through-life support
• Logistic Data
who in industry?
Authorised supplier representative
Authorised supplier representative
Authorised supplier representative
Authorised supplier representative

Defence Technology Centre (DTC) in Electromagnetic Remote Sensing (EMRS)

- Low-TRL research in industry SMEs and academia
- Ran from 2003 - 2010
- Annual conference
- Trials (HYDRAVISION)

MINISTRY OF DEFENCE

EMRS DTC

Electro-Magnetic Remote Sensing (EMRS) Defence Technology Centre (DTC)

SELEX GALILEO
A Finmeccanica Company

BAE SYSTEMS

THALES

roke

Roke Manor Research Ltd
a Siemens company

Centre for Defence Enterprise (CDE)

Centre for Defence Enterprise

Themed competitions FY15/16

Theme	Value
Open-source big data insight	£2.25M
Persistent surveillance from the air	£2.25M
Agile, immersive training	£2.25M
What's inside that building?	£1.15M
Understand and interact with cyberspace	£1.00M
Security for the internet of things	£2.00M
Autonomy and big data	£4.00M
Synthetic biology for novel materials	£3.50M
Identification and treatment of tinnitus	£1.00M

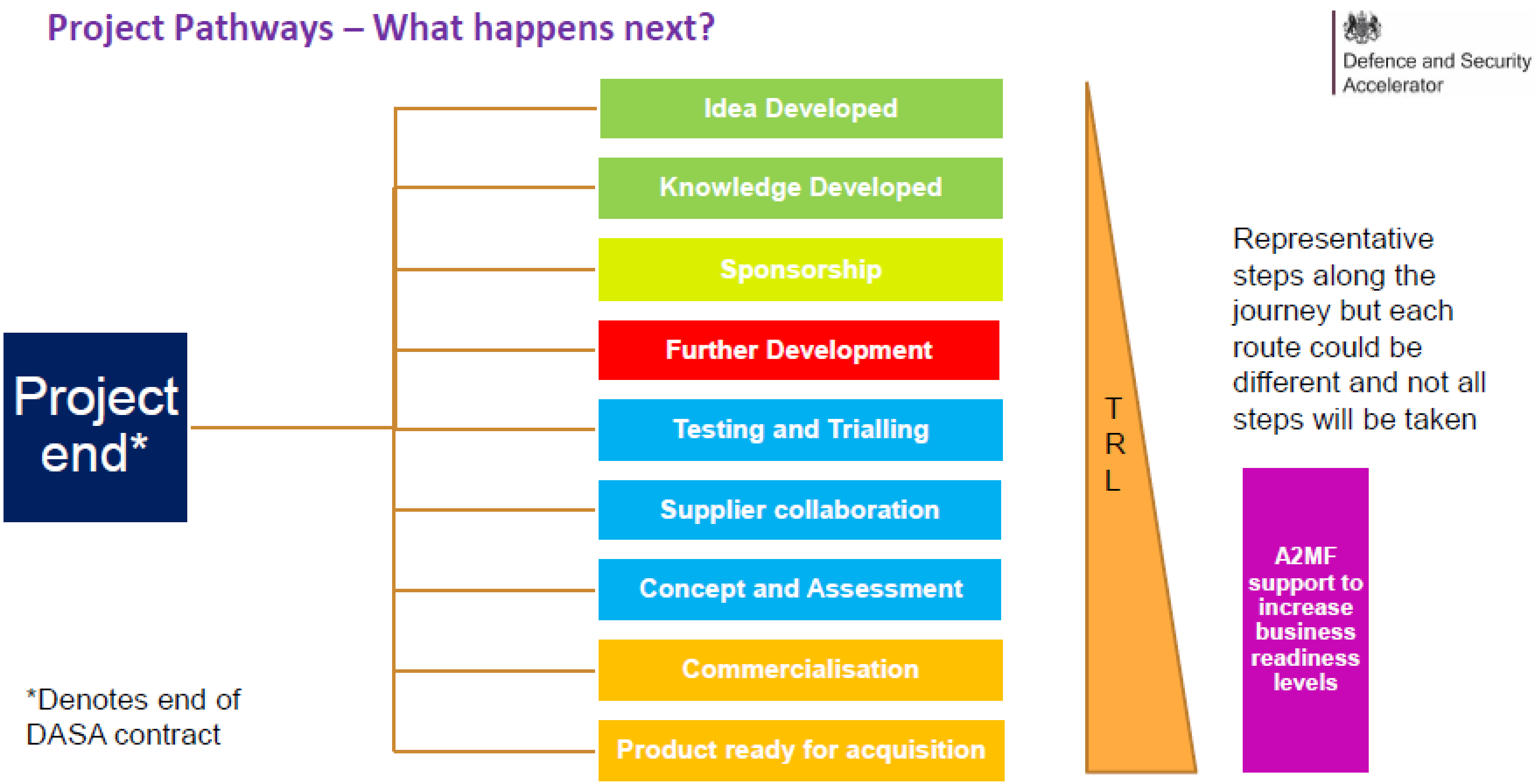
Centre for Defence Enterprise

Themed competitions FY16/17

Theme	Value
Persistent surveillance phase 2 (April 16)	£1.00M
Agile and immersive training phase 2 (April 16)	£1.00M
Seeing through the clouds (Jun 16)	£2.00M
Autonomy and big data phase 2 (Sep 16)	£2.00M
Autonomous Hazardous Scene Assessment (Sep 16)	£2.00M
Many drones make light work (Sep 16)	£2.00M
The future of aviation security	£2.00M

Synthetic biology Beyond battery power

DASA – Defence And Security Accelerator



Ministry of Defence

End to end acquisition process optimised for Agile delivery

Requirements= User Needs

Specifications = system specifications

Governance points

The model moves us *from* a process where **evidence creation** and **assurance** is **front loaded**, commercial process is based on a fixed requirement and focused on **known solutions** and change can be discouraged and difficult to do.

Evidence creation and assurance → Business case approval → Fixed requirement based contracting → Single or serial development

To a process where evidence is created at the **right point**, **assurance is continuous** throughout the lifecycle, **industry partners are integral** to the process and specifications are **developed iteratively** based on the needs of the end user.

Evidence creation and assurance

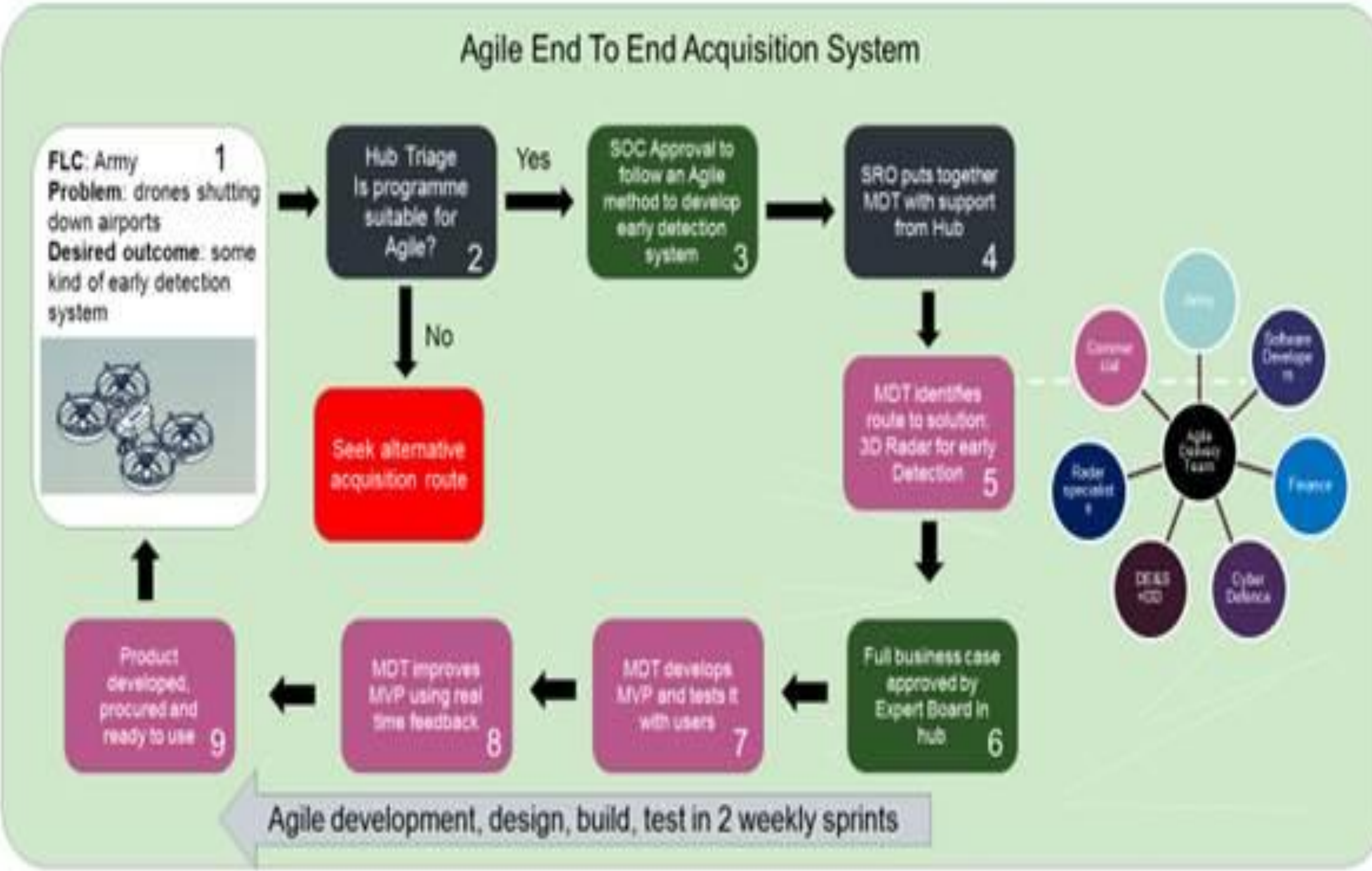
Business case approval → Contracting for skills to develop solution → Iterative development

Cultural change areas: Leadership, Talent, Reward, Support, Industry

And which is underpinned by a comprehensive change in culture and behaviour

Ministry of Defence

Rapid Acquisition Operating Model example walk through



International collaboration

- The academic landscape, with learned societies, conferences and publications, encourages international collaboration
- EU HORIZON, NATO, TTCP, 5EYES, …

DSEC – Defence Science Expert Committee

- A group of ten scientists, all experts in their respective fields, covering science, engineering, medicine and mathematics
- Bottom up and top down; Responsive
- ISTA Register
- DTIB

RF Sensing

- DSEC study, commissioned by CSA
- Think in terms of generation-after-next technology
- ‘The radars of the future will be distributed, intelligent, multistatic, spectrally-efficient’

Spiral development

- Since in-service lifetimes may be long, and since technology changes rapidly, it makes sense to build this philosophy into the periodic upgrading of a platform or equipment – a process known as *spiral development*

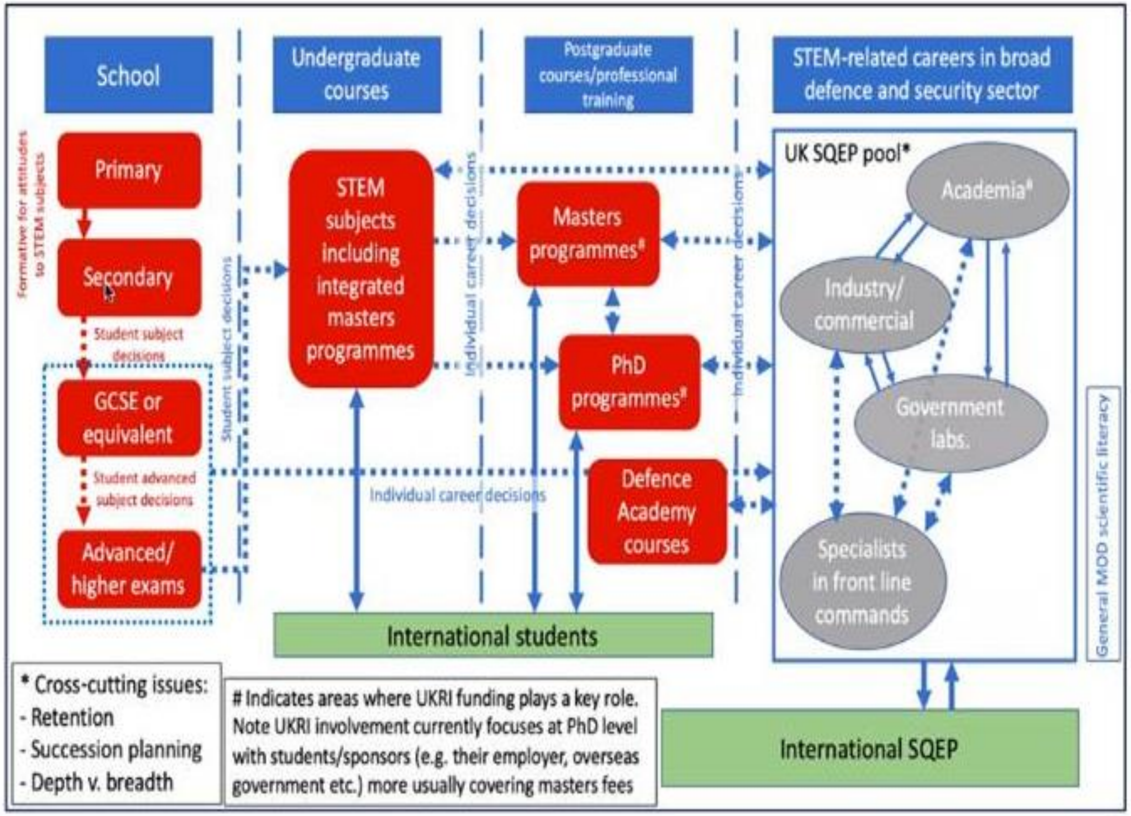
- Can also apply to software – *open architectures*

Suitably Qualified and Experienced Personnel (SQEP)

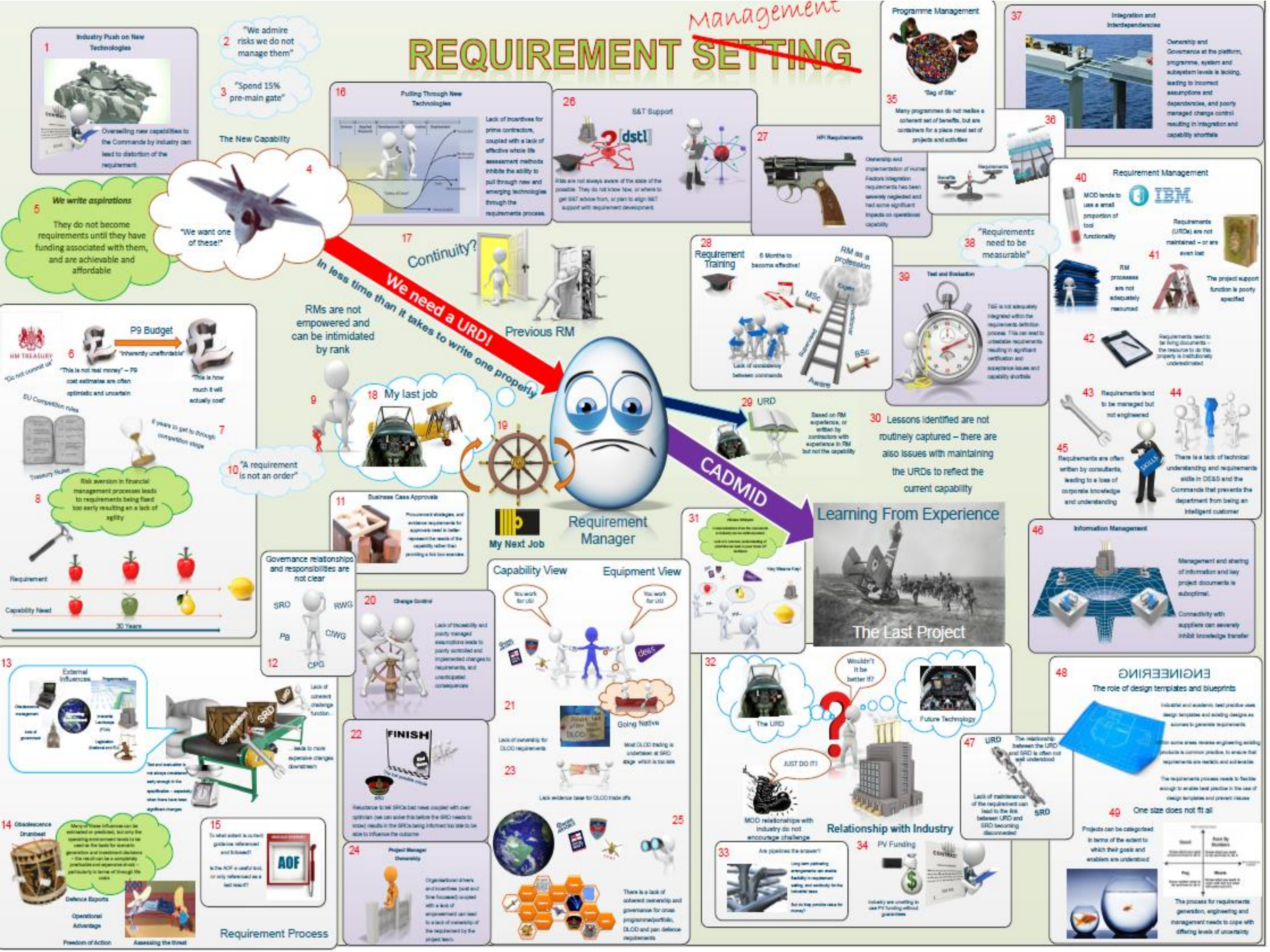
- One of DSEC’s recent studies was into the provision of SQEP – it seems to be a universal issue
- Attract bright young people
- And provide attractive career paths, with continuous professional development (CPD), and exchange opportunities
- Perhaps our profession is male-dominated ….

Summary of issues and recommendations

- General SQEP recruitment via joined-up, high-profile outreach
- Targeted recruitment and skills development following SQEP gap analysis
- Creating wider, accessible SQEP communities outside government
- SQEP retention and development across MOD and government
- General MOD valuing of scientific knowledge and literacy
- Focus on future game-changing SQEP
- Succession planning and knowledge management within MOD/Dstl



Areas of good practice do exist but a strategic, coordinated and long-term overview is required to address the cross-cutting SQEP issue efficiently and effectively.



REQUIREMENT SETTING
Management
1 Industry Push on New Technologies
Overselling new capabilities to the Commands by industry can lead to distortion of the requirement
2 "We admire risks we do not manage them"
3 "Spend 15% pre-main gate"
The New Capability
4 "We want one of these!"
5 We write aspirations
They do not become requirements until they have funding associated with them, and are achievable and affordable
16 Pulling Through New Technologies
Lack of incentives for prime contractors, coupled with a lack of effective whole life assessment methods inhibits the ability to pull through new and emerging technologies through the requirements process
26 S&T Support
RMs are not always aware of the state of the possible. They do not know how, or where to get S&T advice from, or plan to align S&T support with requirement development
27 HFI Requirements
Ownership and implementation of Human Factors Integration requirements has been severely neglected and had some significant impacts on operational capability
Programme Management
"Bag of Bits"
35 Many programmes do not realise a coherent set of benefits, but are containers for a piece meal set of projects and activities
36
37 Integration and Interdependencies
Ownership and Governance at the platform, programme, system and subsystem levels is lacking, leading to incorrect assumptions and dependencies, and poorly managed change control resulting in integration and capability shortfalls
17 Continuity?
Previous RM
We need a URD!
In less time than it takes to write one properly
RMs are not empowered and can be intimidated by rank
28 Requirement Training
6 Months to become effective!
RM as a profession
Lack of consistency between commands
38 "Requirements need to be measurable"
39 Test and Evaluation
40 Requirement Management
MOD tends to use a small proportion of tool functionality
IBM
Requirements (URDs) are not maintained – or are even lost
RM processes are not adequately resourced
41 The project support function is poorly specified
42 Requirements need to be living documents – the resource to do this properly is institutionally underestimated
43 Requirements tend to be managed but not engineered
44
45 Requirements are often written by consultants, leading to a loss of corporate knowledge and understanding
There is a lack of technical understanding and requirements skills in DE&S and the Commands that prevents the department from being an intelligent customer
SKILLS
HM TREASURY
6 P9 Budget
"Do not commit us"
"Inherently unaffordable"
"This is not real money" – P9 cost estimates are often optimistic and uncertain
"This is how much it will actually cost"
EU Competition rules
7 6 years to get through competition stage
Treasury Rules
8 Risk aversion in financial management processes leads to requirements being fixed too early resulting in a lack of agility
Requirement
Capability Need
30 Years
9
18 My last job
19
10 "A requirement is not an order"
Requirement Manager
My Next Job
29 URD
30 Lessons identified are not routinely captured – there are also issues with maintaining the URDs to reflect the current capability
CADMID
Learning From Experience
The Last Project
11 Business Case Approvals
31
Key Means Key!
46 Information Management
Management and sharing of information and key project documents is suboptimal.
Connectivity with suppliers can severely inhibit knowledge transfer
12 Governance relationships and responsibilities are not clear
SRO
RWG
PB
CIWG
CPG
20 Change Control
Lack of traceability and poorly managed assumptions leads to poorly controlled and implemented changes to requirements, and unanticipated consequences
Capability View
Equipment View
You work for us!
You work for us!
21
Lack of ownership for DLOD requirements
Going Native
Most DLOD trading is undertaken at SRD stage which is too late
23
Lack evidence base for DLOD trade offs
32
The URD
Wouldn't it be better if?
Future Technology
JUST DO IT!
MOD relationships with industry do not encourage challenge
Relationship with Industry
47 URD
SRD
48 ENGINEERING
The role of design templates and blueprints
49 One size does not fit all
Projects can be categorised in terms of the extent to which their goals and enablers are understood
The process for requirements generation, engineering and management needs to cope with differing levels of uncertainty
13 External Influences
Lack of coherent challenge function...
...leads to more expensive changes downstream
Specification
SRD
22 FINISH
SRO
25
There is a lack of coherent ownership and governance for cross programme/portfolio, DLOD and pan defence requirements
24 Project Manager Ownership
33 Are pipelines the answer?
34 PV Funding
Industry are unwilling to use PV funding without guarantees
14 Obsolescence Drumbeat
Defence Exports
Operational Advantage
Freedom of Action
Assessing the threat
15 AOF
Requirement Process

Conclusion

- Yes, defence acquisition is difficult – for many reasons
- No magic bullet
- It's a complicated jigsaw with many pieces, but there are some pointers that seem to be important
- **Understanding and fostering innovation is key**

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