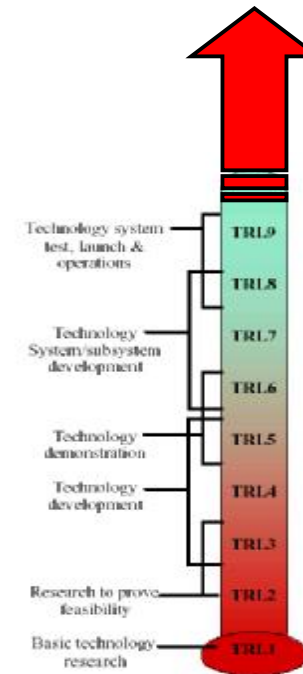


# DE&S Technology Management Presentation

SEAS / EMRS DTC Conference  
Edinburgh 2009

John Yeaman (Technology Assistance)  
James Morris (Programme Delivery)

**Programmes & Technology Group**  
MoD Abbey Wood, Larch #2209  
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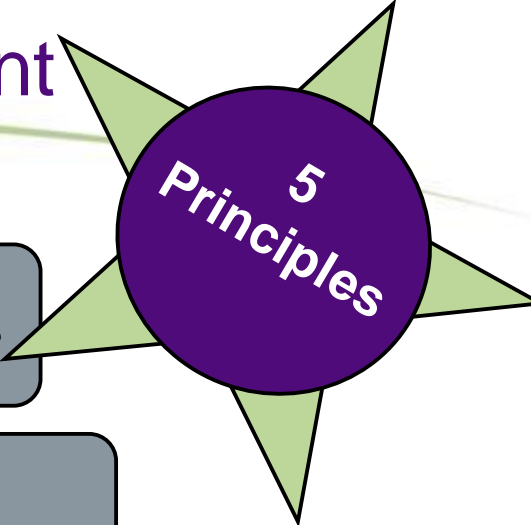
# Aims of Presentation

## To Improve Technology Management Awareness

- Provide an introduction to Technology Management  
Why? What? How?
- Explain role of SIT in Technology Management
- Demonstrate DE&S TM tools & techniques
- Explain where to go for help including assistance and assurance



# The 5 Principles of Technology Management



5  
Principles

1. Understanding Technology Opportunities in Projects

2. Managing Technology Risks in Projects

3. Joint Planning Technology Resources and Outcomes

4. Equipping our Staff for the Job

5. Industry and Teams ~ Working Together



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The logo for de&s, consisting of the letters 'de&s' in a white, lowercase, sans-serif font inside a purple triangle pointing to the right.

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# Technology Management and Innovation

- **“Capability and Technology Road Mapping”** *to understand opportunity:*
  - Increased understanding of MOD capability requirements
  - Identify where to focus effort and apply Innovation (Agility)
  - Clear exploitation road-map in Demonstrator Business Cases
- **“Smarter Systems Engineering”** *to enable Technology Insertion:*
  - Integration of Technologies
  - Upgrade & flexibility, particularly in rapidly evolving Technologies
  - Through Life Capability Management (TLCM) – enhancement through Innovation across other Lines of Development (LOD)
- **“Improved Business Models”** *to encourage Innovation:*
  - Valley of Death (exploitation in Business Case)
  - Encourage financial contribution through recognition of wider markets benefits
  - Alliances between larger and smaller organisations
  - Improved business processes (fit for purpose)



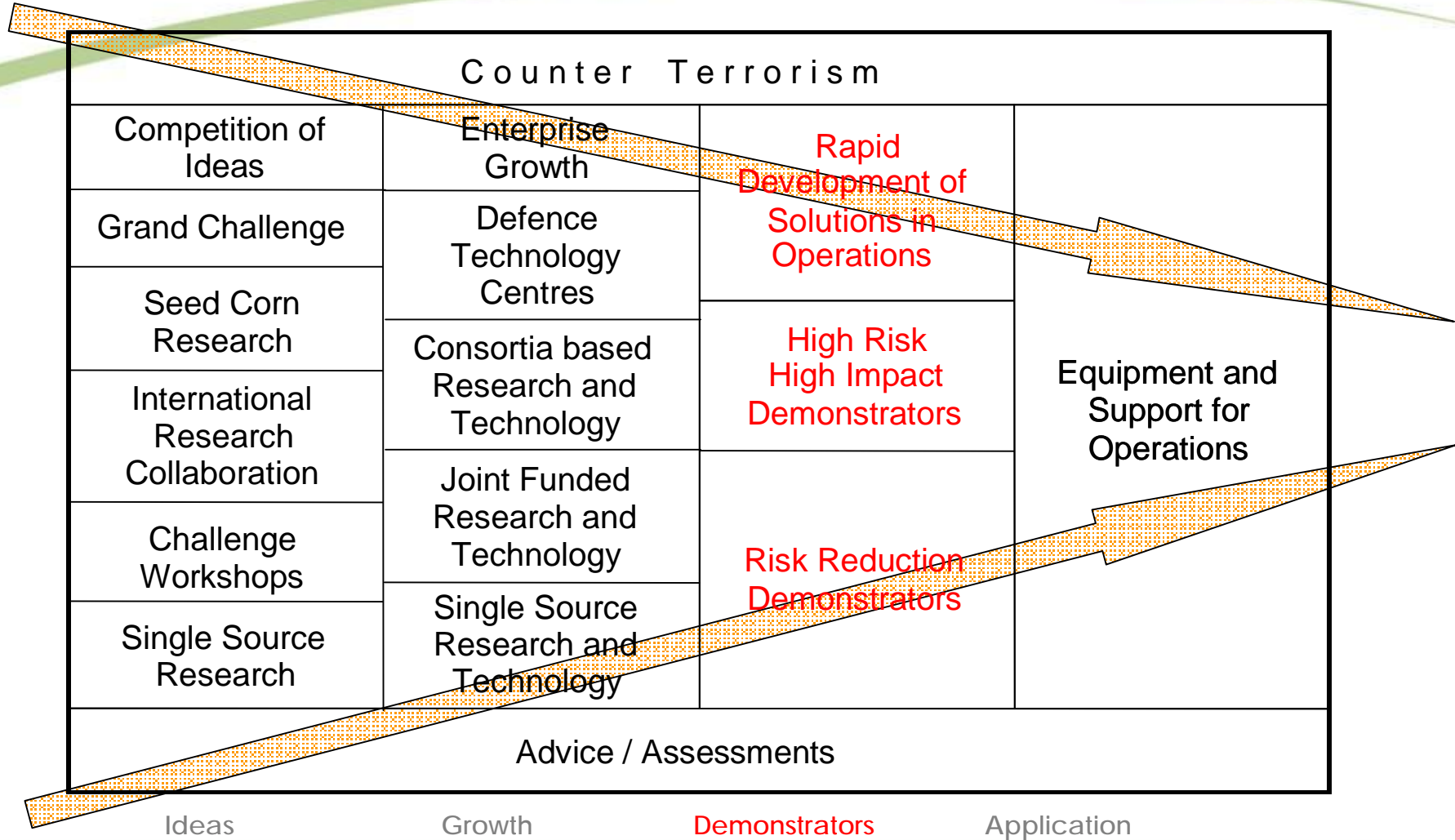
# SIT Research Programme - Strategic Intent

- **Battle winning technology - today and the future**
- **Agility - Rapid technology insertion to support operations is top MOD priority**
- **Open architectures and Speed of response**
- **Pull through / Exploitation is fundamental**
- **Open innovation - aligned with Government Innovation Strategy**
- **Wealth creation - with defence/non-defence industry, attracting BAs/VCs/PV investments**
- **Sustain sovereign capabilities**
- **International collaboration (primarily with US; Fr; Germany, Canada and the Netherlands)**

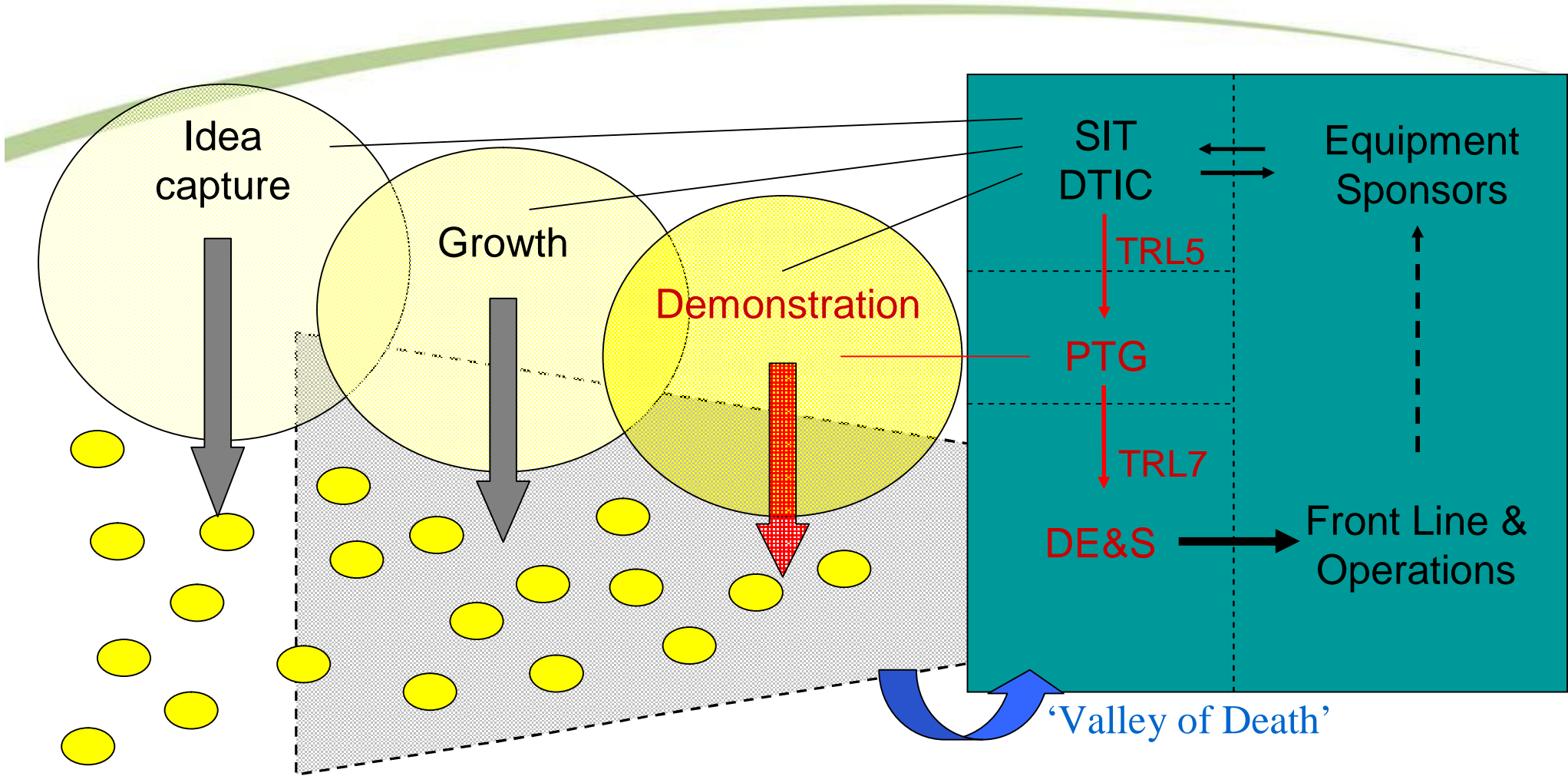


*Battle Winning Technology for the Armed Forces to Support Operations Today and in the Future.*

# S&T Operations Delivery Model



# Supply Chain Framework



Flow of ideas and innovation to the Front Line through the **Supply Chain & Equipment Programme**

# Maximising Technology Demonstrators

## Demonstrator programmes focus on making new technology stick

- Throwing technology ‘over the wall’ to IPTs does not work
- IPTs and Primes understand and accept the risk
- Architectures: embedded within exploitation equipment design and system engineering models
- Supply chain: Build supply chain knowledge and trust to take on technology
- Timing: enable IPTs to plan pace of demonstrator to meet acquisition timescales
- Finance: enable IPTs to plan costs of exploiting demonstrators



# Demonstrator Programme Success

- Investing in the right technologies at the right time for the right projects
- Using technology to deliver capability enhancements and reduce capability costs
- Mix of science input and industrial supply chain, bridges the community
- Alignment with and resources from IPTs offers better exploitation
- Leverage with the EP Programme produces better investment
- Opportunity to exploit cross-cutting opportunities (multiple platforms/clusters) = pay once, use many

**Track record of getting demonstrators into front line is good**



# Establishment of the Programmes and Technology Group (PTG)

- **Ministry of Defence - Major Projects Report 2008 (NAO)**  
**'The main cause of delays continues to be unforeseen issues with the technology'**
- **Development of the Government's Project and Programme Management Profession**
  - OGC's promotion of PPM professionalism across Govt.
  - Establishment of CoE's in each Govt Dept.
  - MOD adoption of the APM Competence Framework
  - MoD adoption of Managing Successful Programmes to delivery of Military Capability
- **Brings together:-**
  - Future Business Group
  - Through-Life Project Management
  - Project Rehabilitation Unit



NAO  
National Audit Office

MINISTRY OF DEFENCE  
Major Projects Report 2008

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL (HC 347) Session 2008-2009 19 December 2008

# Role of PTG

- **Develop and own Standards, Policies and Processes for Project and Programme Management**
- **Deliver the PPM skills agenda**
- **Provide project management monitoring, review and intervention services**
- **Develop the Acquisition Operating Framework**
- **Provide the primary DE&S Science and Technology interface including the DE&S influence on the shape and direction of the SIT programme**
- **Manage high risk and/or cross-cutting technology demonstrator activity that feeds the equipment programme**
- **Provide the UOR Programme Office and ensure the continued develop of best practice in UOR delivery**



# Who are PTG?

Director - Gen Alan Macklin

Technology Delivery

Centre of Excellence

Assistance and Assurance

Acquisition Operating Framework

DE&S UOR Office

Support Functions:-

HQ; Finance; Business Mgt; Commercial



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# Why focus on Technology Management?



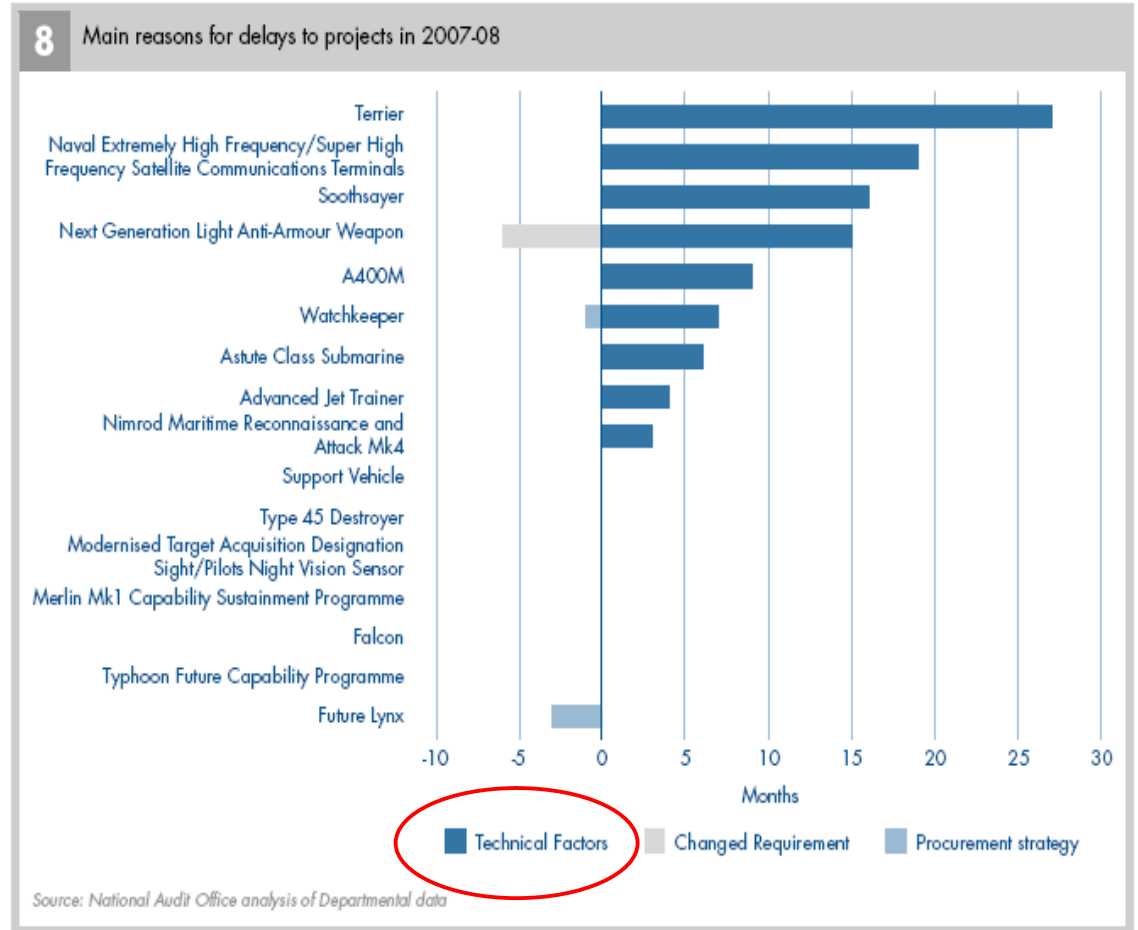
*“Analysis of major projects shows that the most significant weakness is high technical risk at Main Gate” (McKinsey **2001**)*



**MPR 2006** - Technical Factors *“remain the single most significant cause of delays in the last year.”*



**MPR 2008** - *“...the main cause of delays continues to be unforeseen issues with the technology required to deliver these projects.”*



Taken from the 2008 MPR



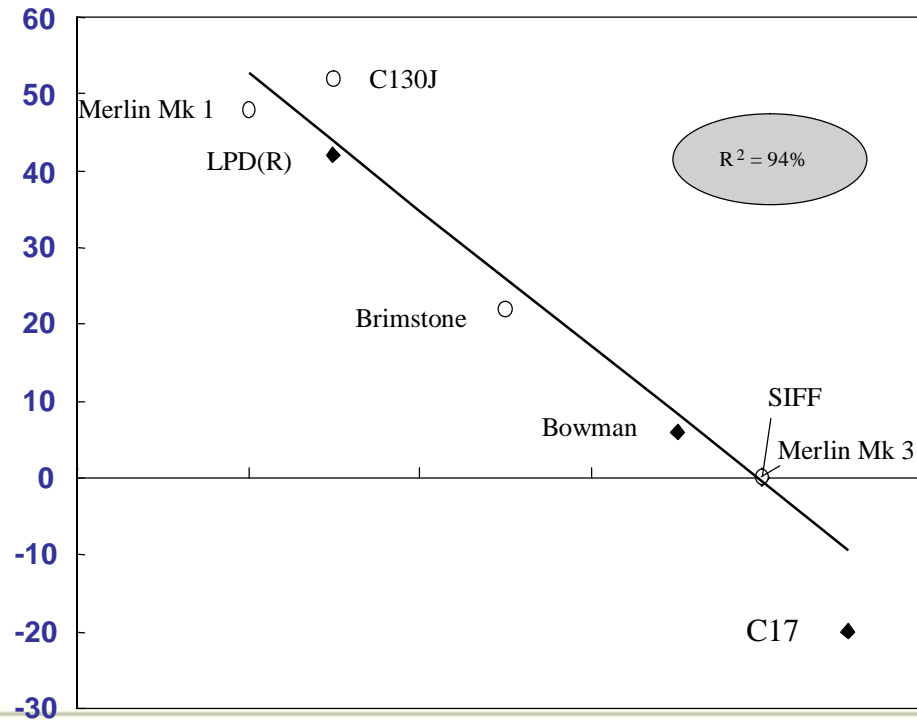
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# Why focus on Technology Management? Cont...

## EFFECT OF TECHNICAL MATURITY ON PROJECT DELAY

Slippage (% project duration)



- Projects considered in prior study
- ◆ Interviewed during this diagnostic



TRL at MG is highly correlated with subsequent project performance on schedule slippage.

# What is Technology Management?

- Part of project management and systems engineering, focussed on understanding and minimising risk of new technology, exploiting technology opportunities and planning for technology maturity
- A through-life activity
- Assessing system and technology maturity through tools available (TRLs, SRLs, Roadmapping)
- Reduces risk of slippage due to immature technology

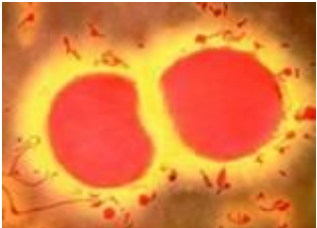


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# PTG Technology Management Role

- Policy à Technology Management Strategy
  - Endorsed by DE&S Boards
  - Integration of 5 Principles of Technology Management into MOD Technology Strategy and Acquisition Operating Framework
- Technology Assistance
  - Technology and System Maturity lead
  - Direct support to DE&S Board, Operating Centres & IPTs
- To raise Technology Management Standards
  - TM Functional competences (in APM framework)
- Technology Management Training & Guidance
  - DA Learning courses
  - Awareness sessions, Practitioner Workshops
  - Assistance to IPTs



# Technology Management Policy

- Defence Industrial Strategy
- Defence Technology Strategy
- DE&S Technology Management Strategy
  - Assurance to senior management that technology is being managed effectively
  - IPTs to provide evidence that technology and system maturity are being effectively managed against Performance, Time and Cost targets.
- IAB – Smart Approvals Guidance (v10 Jan 09)
  - Initial Gate and Main Gate business cases for all projects relying on technology shall contain an assessment of technology risk.

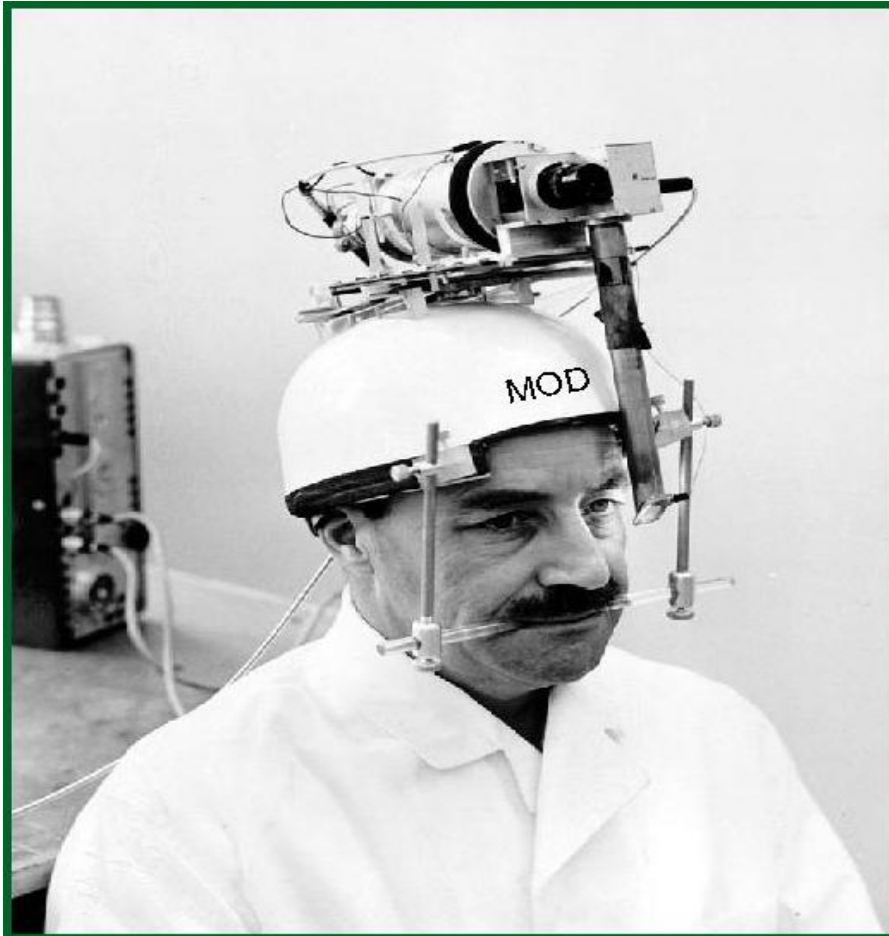


# Technology Management Tools

- Technology Readiness Levels (TRLs) to assess and agree technology maturity at sub-system level.
- Technology Roadmapping to plan and communicate maturity.
- System Readiness Levels (SRLs) to assess and agree system maturity - wider than technology and takes a systems engineering approach to the health of the project.
- Technology Demonstrator Programmes (TDPs) and Concept Capability Demonstrators (CCDs) to generate hard evidence of maturity.
- Other Studies and Research to develop technology options to a manageable stage of maturity in preparation for exploitation.



# Technology in Action?



**“I don’t know about TRLs, but we should be able to deploy it next month !”**



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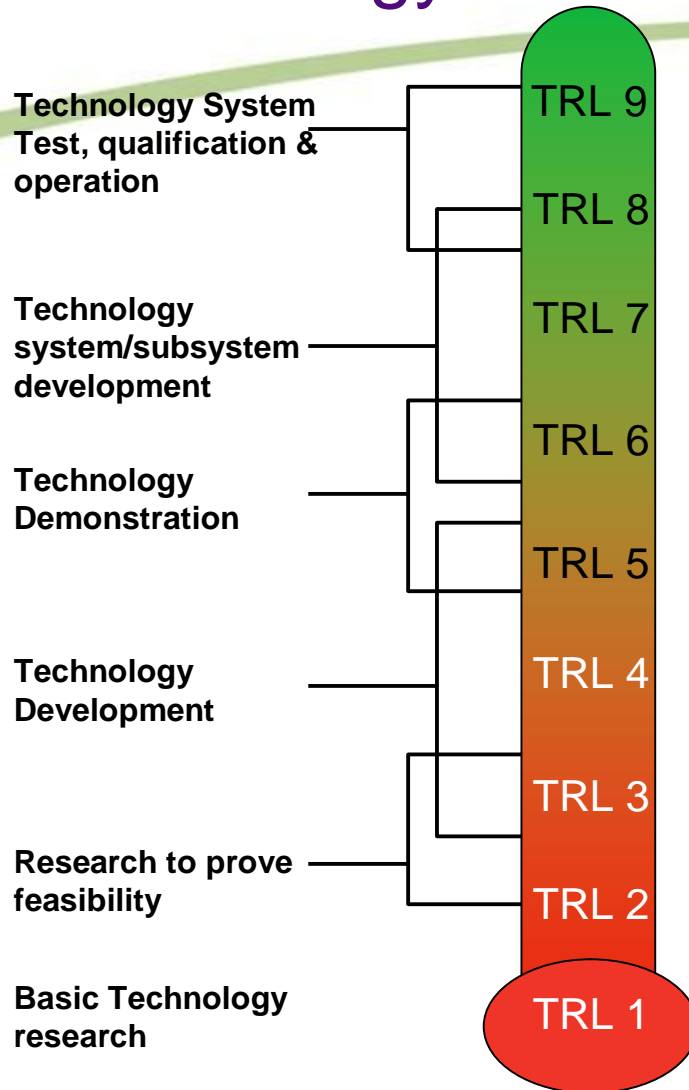


# Technology Readiness Levels



- Tool to measure and communicate technology maturity
- Used to assess and manage risk of achieving technology maturity
- TRL definitions must be tailored to each project to enable unambiguous measure of achievement
- Consider component/system level as appropriate
- Applied bottom-up
- Considers integration of sub-systems within project boundary
- DE&S Delivery Teams must state how successful achievement of each TRL will be measured i.e. linking the TRLs to activities in the ITEAP

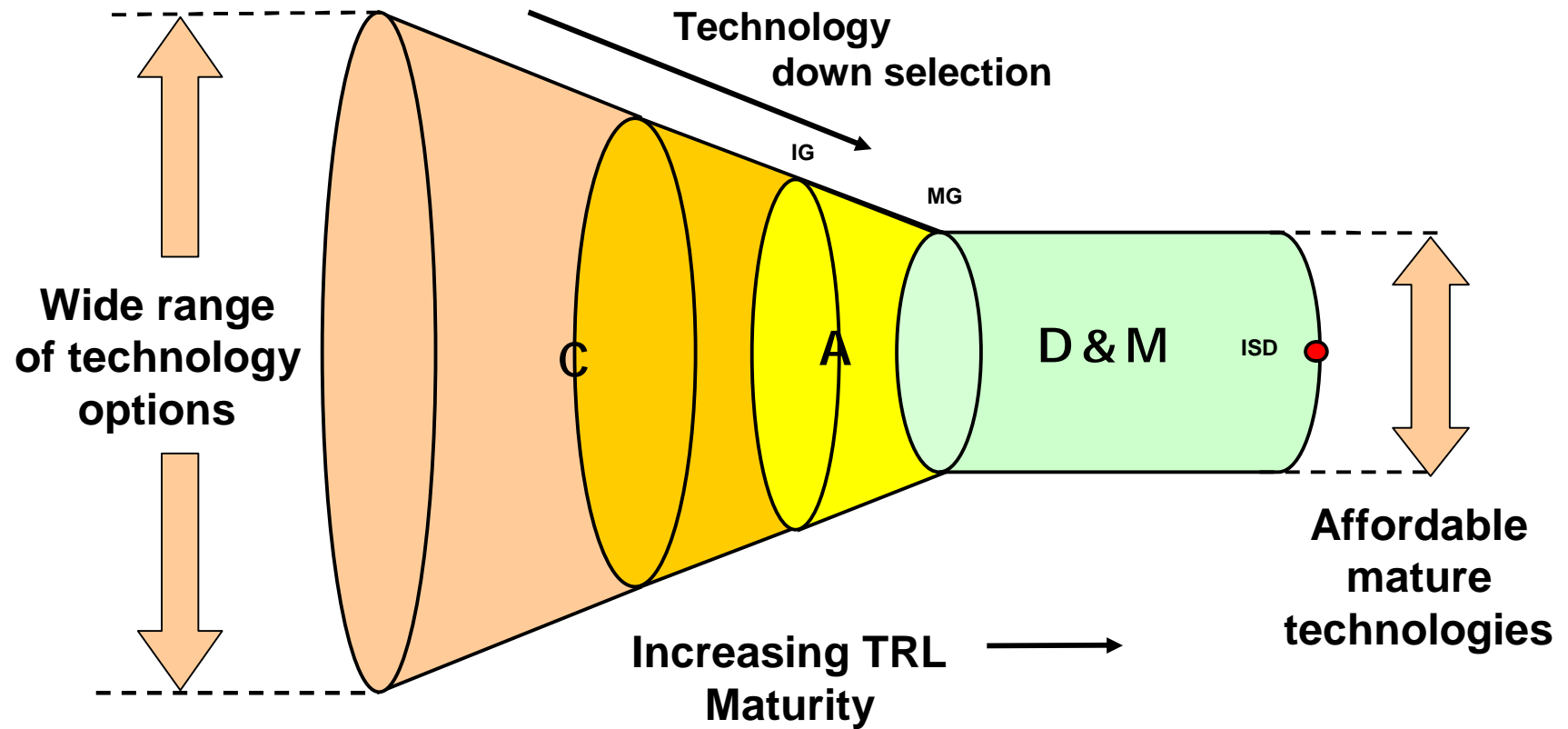
# Technology Readiness Levels Scale



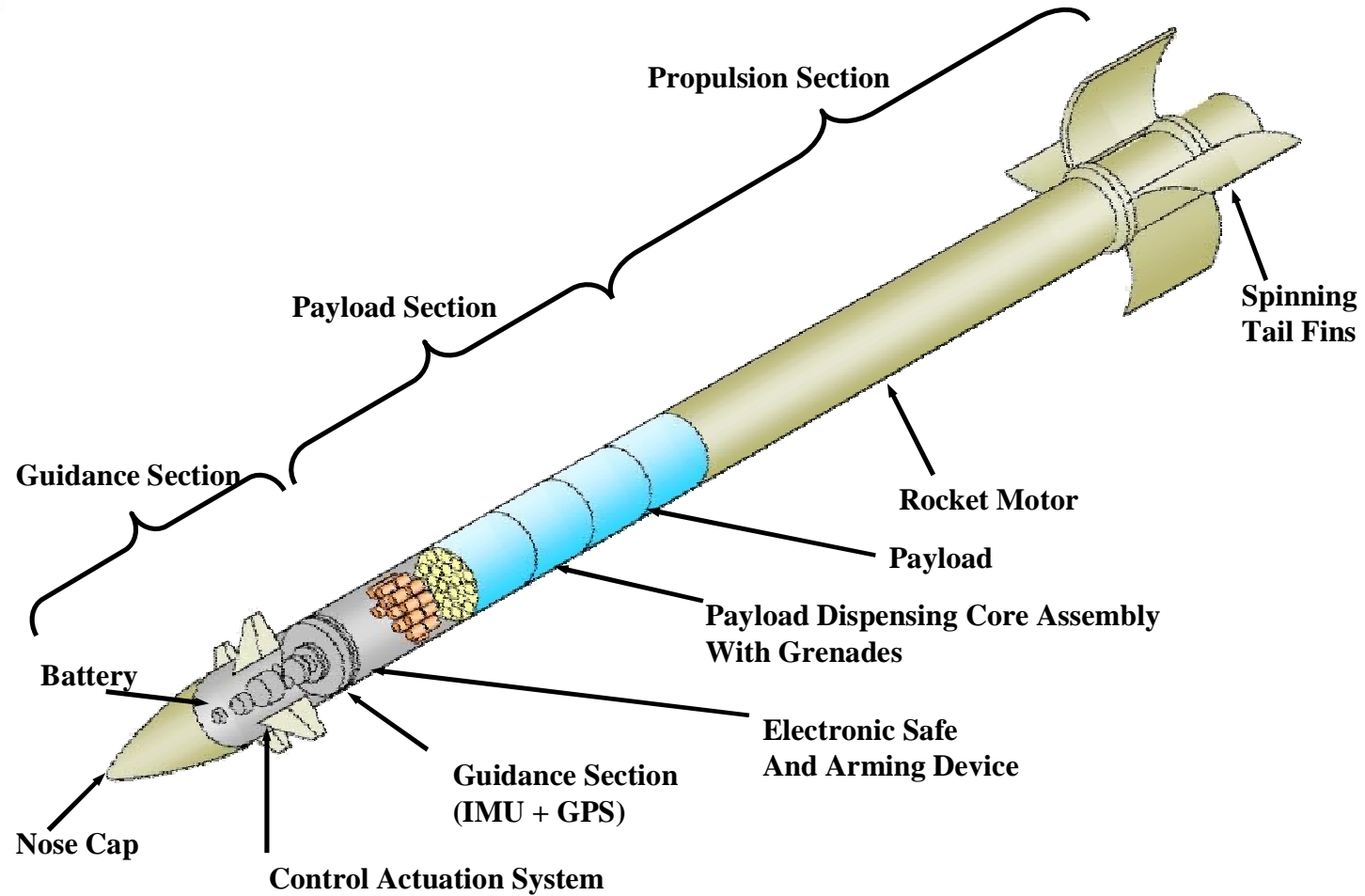
<b>TRL9:</b> Actual Technology system qualified through successful mission operations.
<b>TRL8:</b> Actual technology system completed and qualified through test and demonstration.
<b>TRL7:</b> Technology system prototype demonstration in an operational environment.
<b>TRL6:</b> Technology system / subsystem model or prototype demonstration in a relevant environment.
<b>TRL5:</b> Technology component and/or basic technology subsystem validation in relevant environment.
<b>TRL4:</b> Technology component and/or basic technology subsystem validation in laboratory.
<b>TRL3:</b> Analytical and experimental critical function and/or characteristic proof-of-concept.
<b>TRL2:</b> Technology concept and/or application formulated.
<b>TRL1:</b> Basic principles observed.



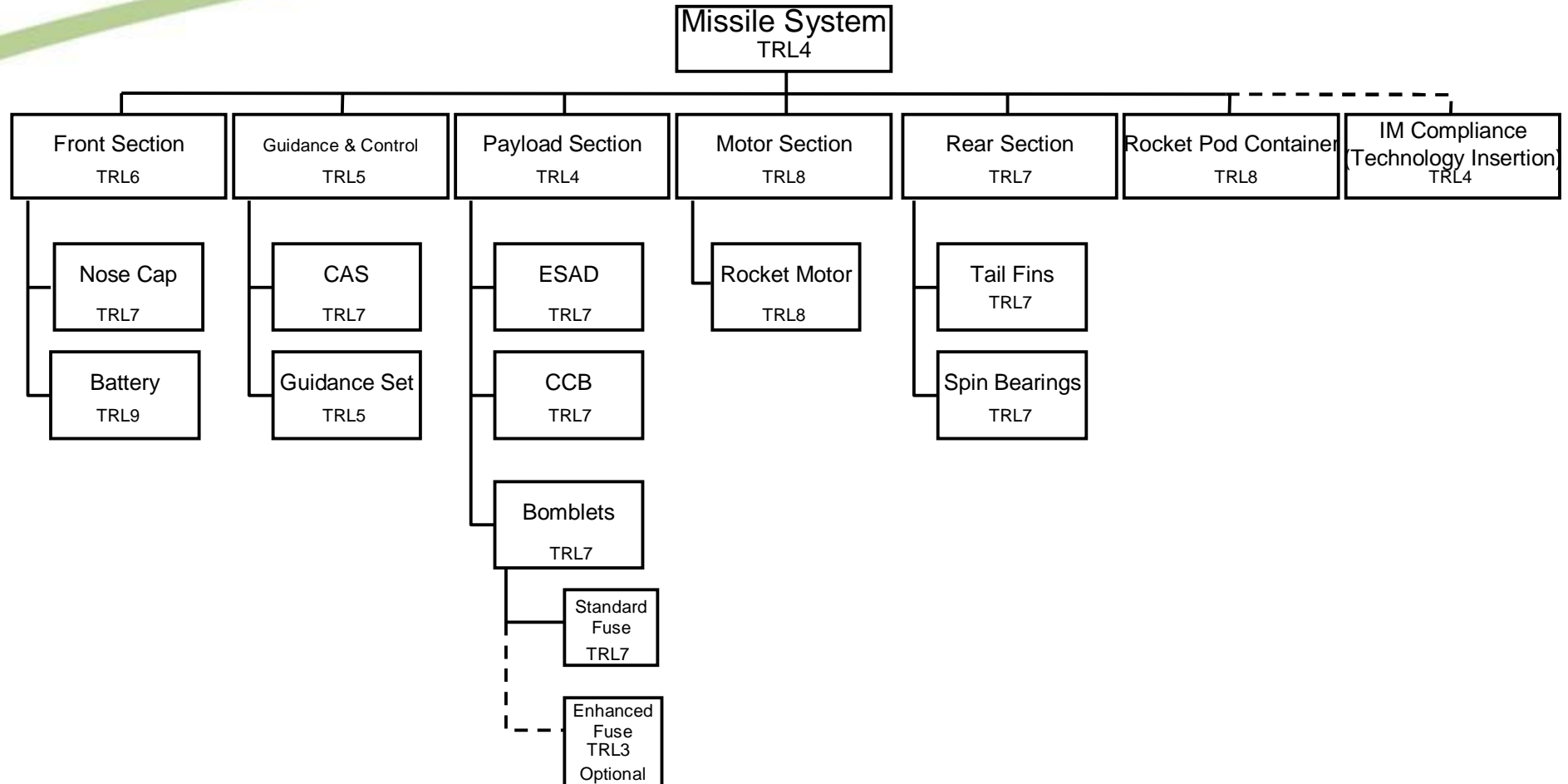
# The Technology Funnel



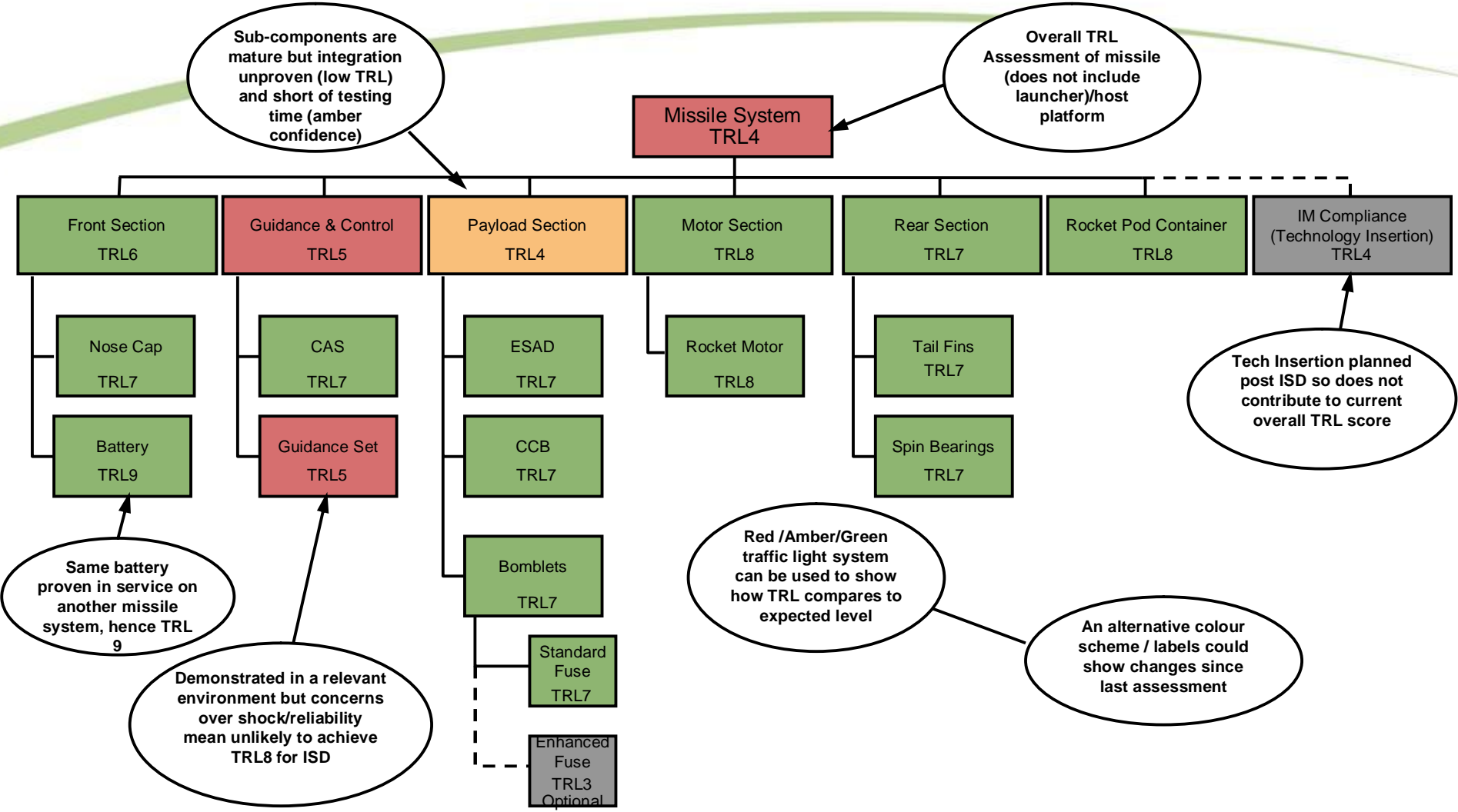
# Example of TRL breakdown



# Example of TRL breakdown



# Example of TRL breakdown



# Benefits of TM for Decision Making

- **Common Communication Tool**
  - TRL/SRL vocabulary
  - TRM depicts projects maturation on a page
- **Recognised Scaling**
  - Generic TRLs published
- **Industry Norms**
- **Tailored/Pragmatic approach**
  - Project TRLs defined and linked to ITEAPs



# TM Informing Decision Taking

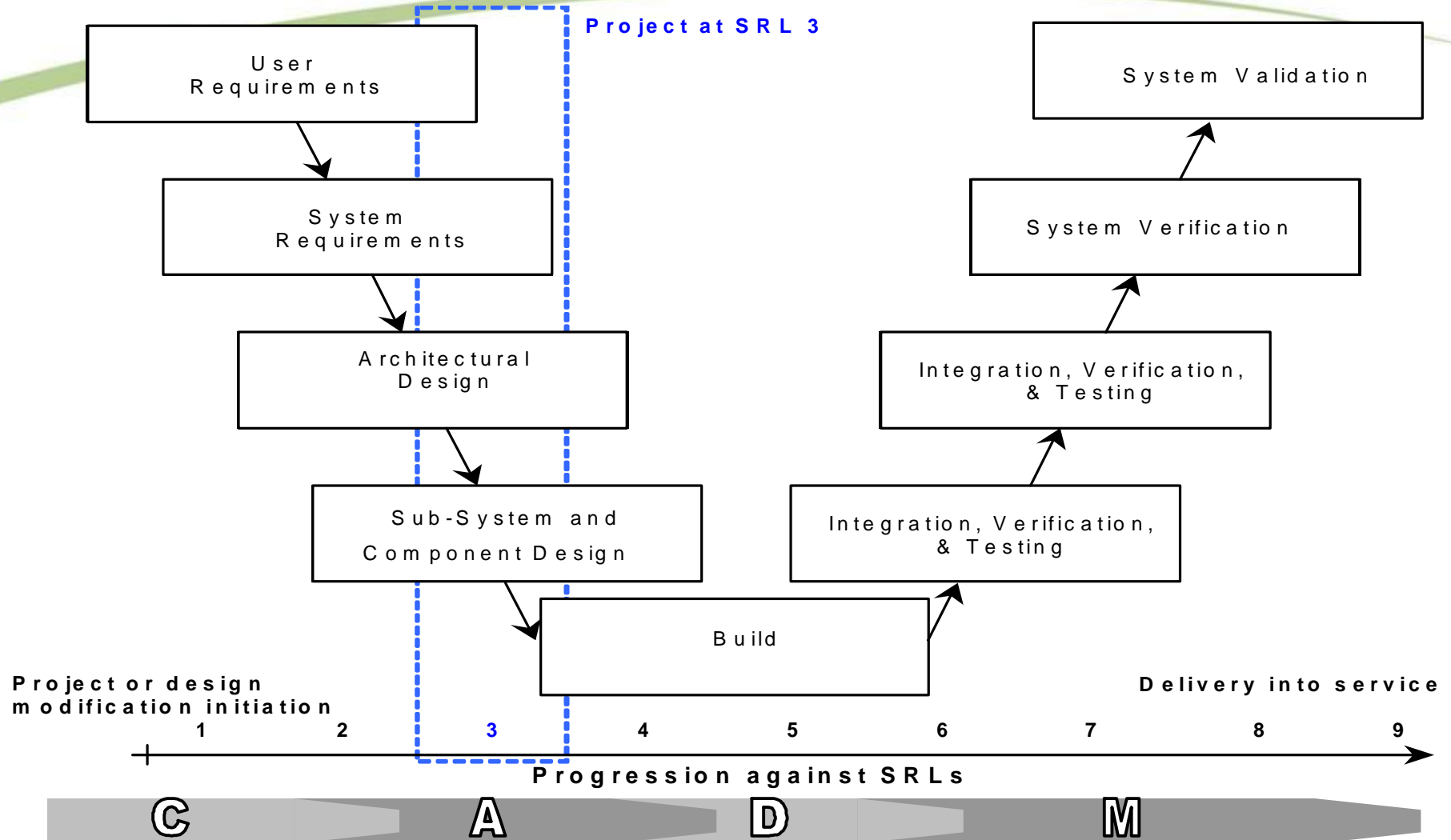
- Known **measure of maturity**
  - Elimination of optimism bias
- Informed **milestone targets**
  - SRL 4 - Informed trade-offs with other DLOD
  - TRL 7 - Production readiness
- Projects **Technology Risks**
  - Sub-Optimal values to be supplemented by Risk plan
- Projects <7 at MG proceed if supported by:
  - Approved Procurement strategy
  - Target of 7 prior to manufacture
  - Contract breaks

# System Readiness Levels

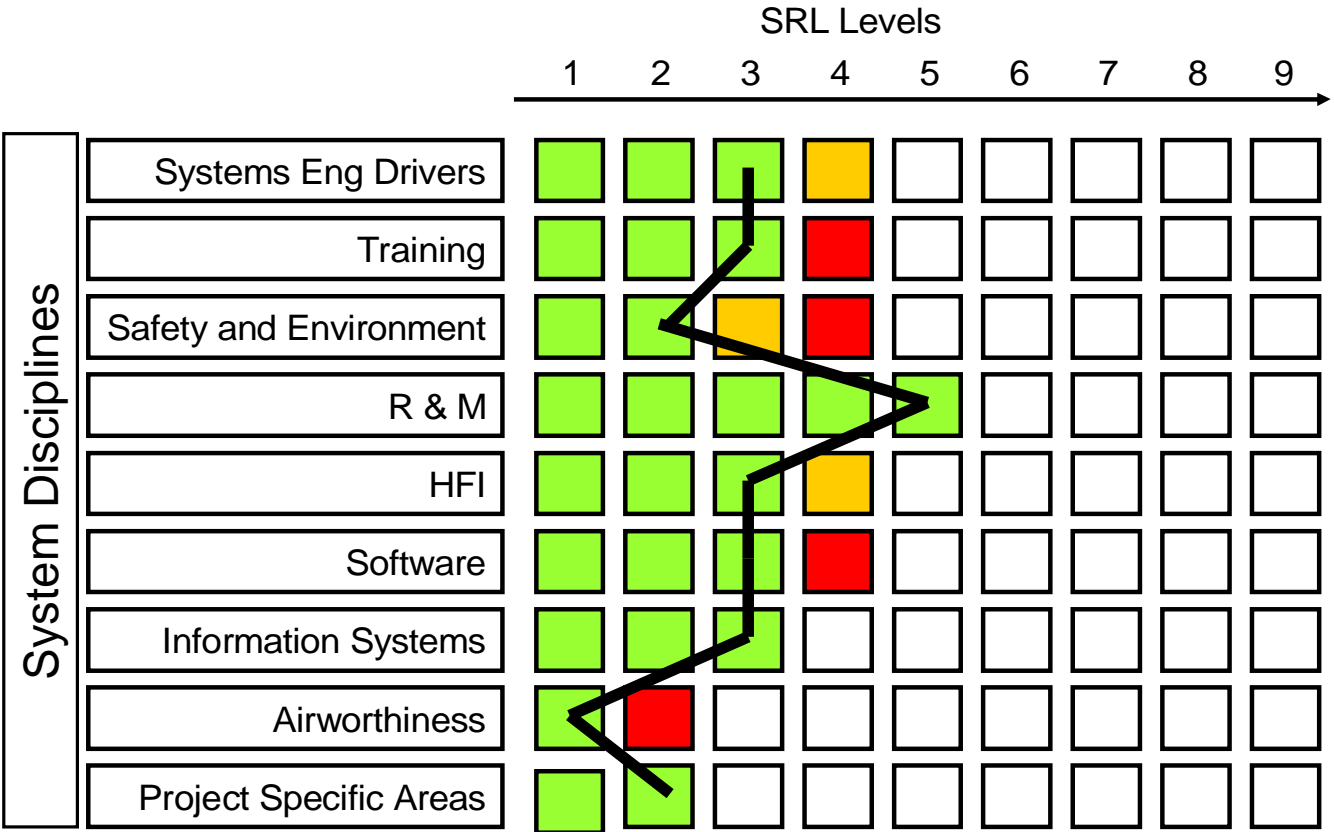


- A tool to assess System Maturity
- Track progress against Systems Engineering V-diagram
- Aim to take a consolidated view of essential steps needed to mature a System
  - i.e. address systems engineering drivers, plus other systems disciplines, such as Training, HFI, R&M, S/W, Information systems.
- Considers external system interfaces
- Can be expanded to address all Defence Lines of Development (DLODs).

# System Readiness Levels



# SRL Matrix : Example Signature



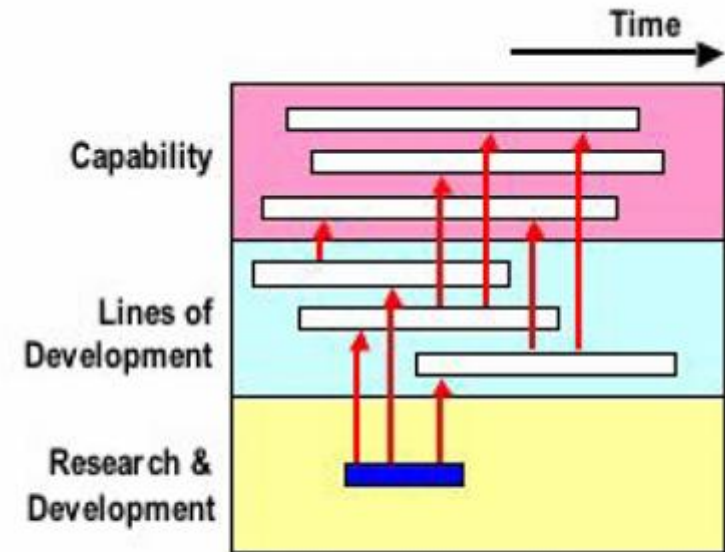
# Guidance.... but every project is different!

Targets	Initial Gate	Main Gate
TRL	3 (proof of concept)	7 (prototype)
SRL	1 (mature URD)	4 (mature design)

- Levels are project dependent
- Key is to demonstrate current maturity and that risk is being identified and managed to ISD

# Technology Roadmaps

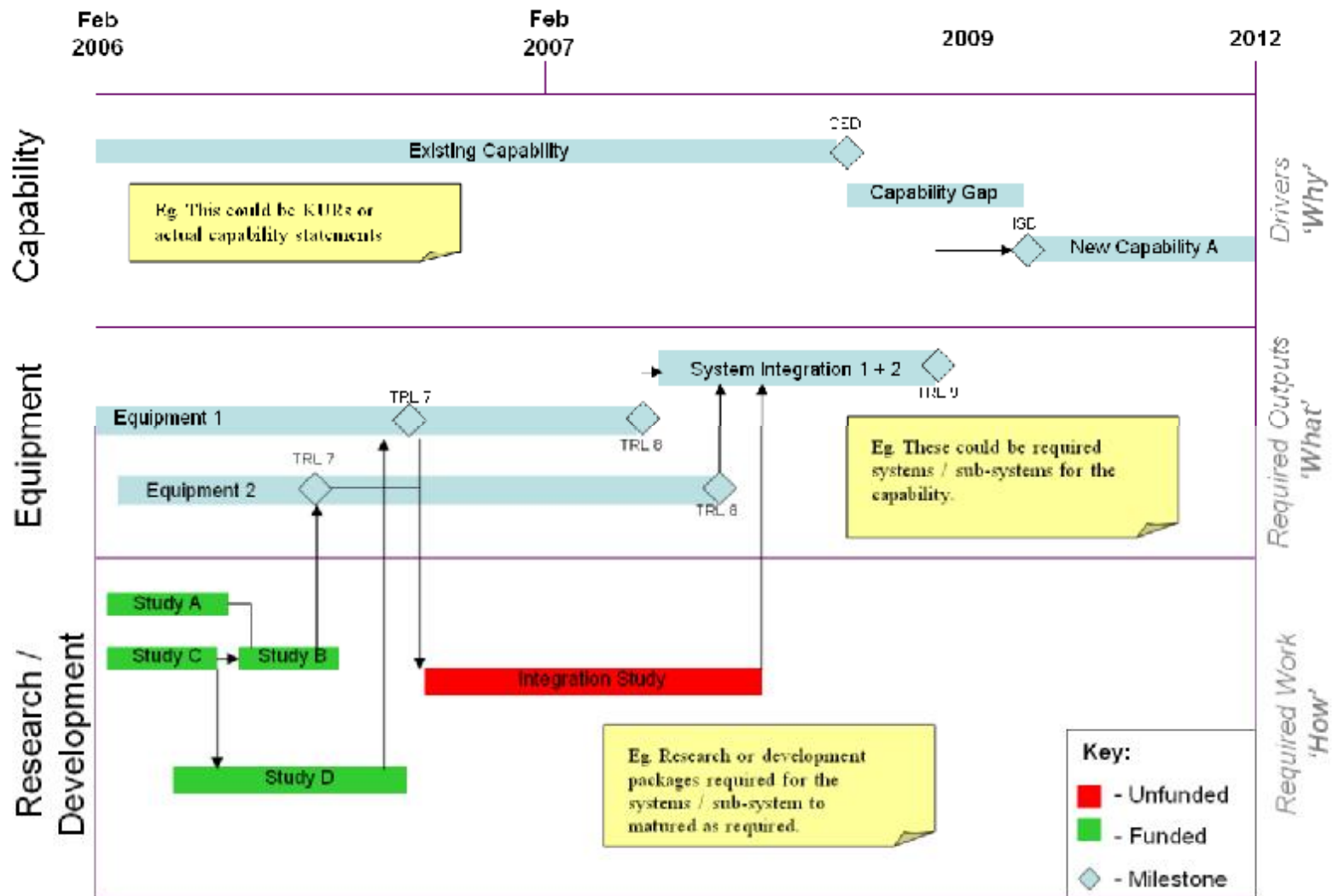
- Graphical communication and planning tool
- Links capability need to equipment projects, research activities and technology dependencies
- Shows technology exploitation routes and technology maturation planning to ISD and beyond
- Helps effective decision making and risk management by exposing gaps and risks



Type 3: Technology roadmap  
(technology-centric)



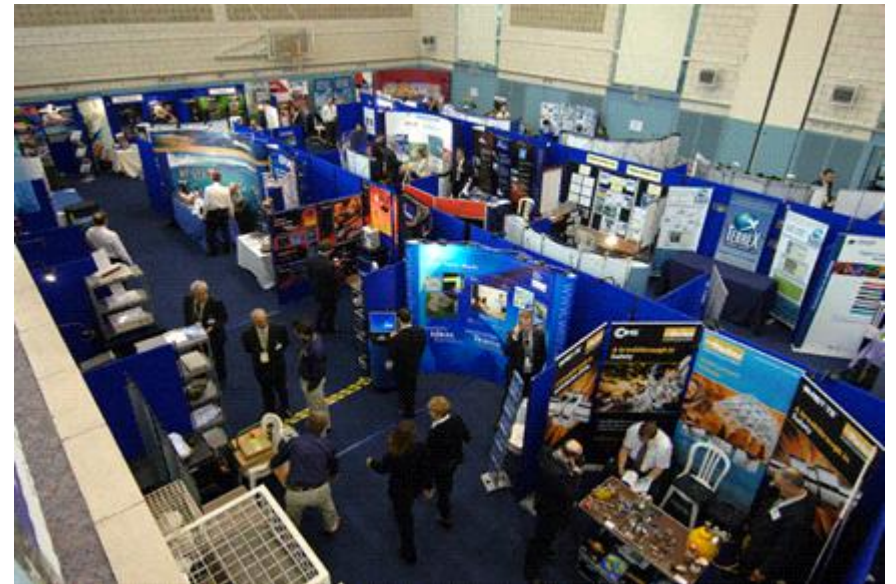
## Simple Example Roadmap – Explained. Issue.. Date.. Owner..





# Training and Advice

- PTG developed training to support Technology Management competences:
  - Overview, summary of TM tools (Awareness)
  - ½ Day workshop, worked examples
  - Experience towards Practitioner/Expert
- AOF under Technology Management (Google search on 'AoF.....' will find it)
- PTG website (via DE&S Intranet)



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High Quality Final Slide @ TRL 2

Questions



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## For further information

Technology Assistance: John Yeaman / Craig Robertson  
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