



# Artificial Intelligence Sub-Working Group

Lust to Dust

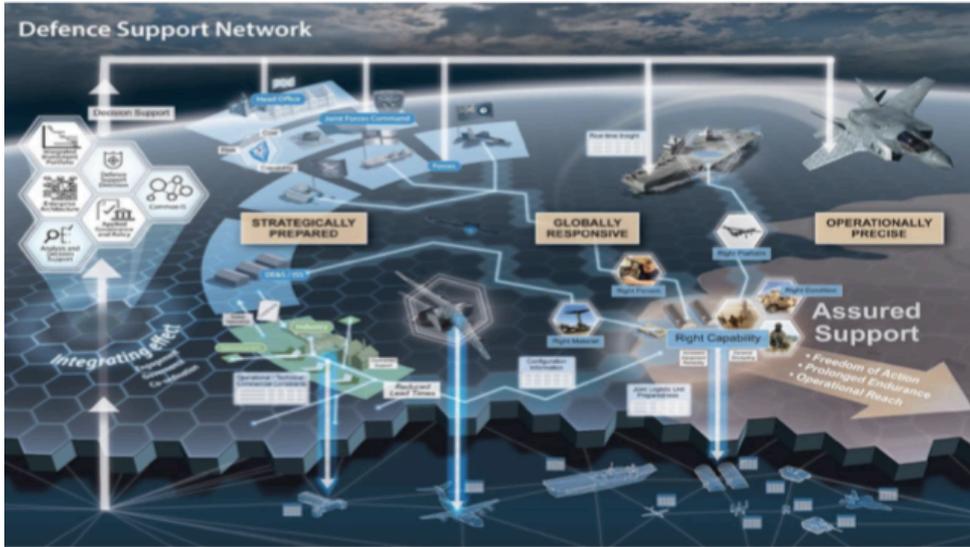
Prepared by Steve Green  
Issue 1.0  
Dated 21 August 2019



Defence Logistics



# Introduction to LOGNET AI Sub WG



A standing, joint MOD-Industry subordinate forum of the Defence Logistic Force Development Board (DLFDB).

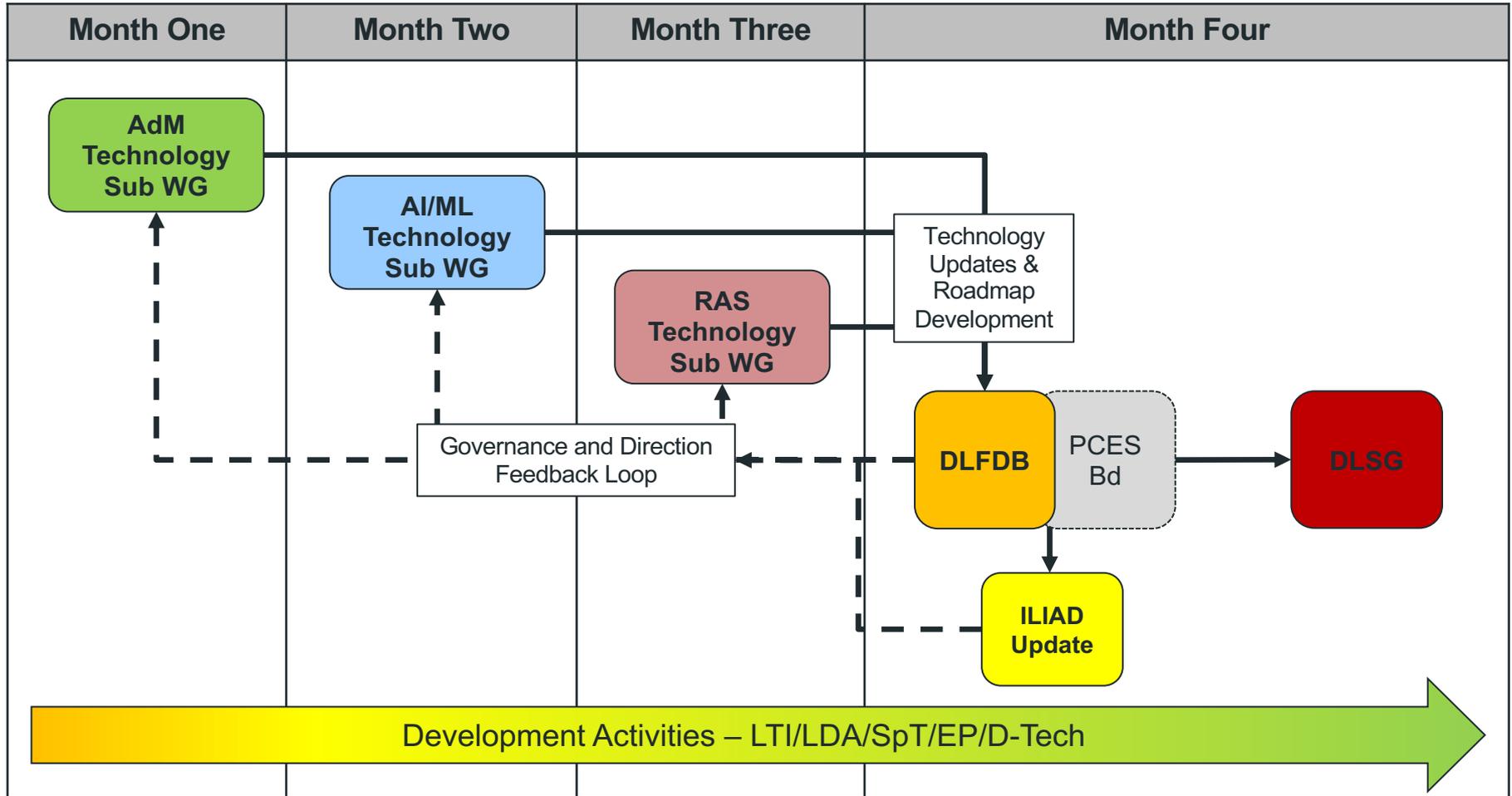
- Support the accelerated development and exploitation of Artificial Intelligence
- Allow Defence and Industry to collectively focus its efforts on proving or disproving the hypotheses and assumptions posed within the AI concept notes
- Guide associated Research, Analysis and Experimentation activity across the Defence Support Enterprise (DSE) and the related R&D efforts of industry.

√Strategy setting in pursuit of the needs of the extended Defence Support Enterprise (DSE) √Sponsorship and oversight of joint work addressing Engineering Support, Equipment Support & Logistic Support objectives  
√Leadership of related joint activity √ Facilitation of communication amongst the DSE on matters of common interest √Capture associated activities and evidence related to the Concept Notes in the Information for the Logistics Innovation Agenda Database (ILIAD) knowledge management system

*Reference: Defence Logistics Enterprise – LOGNET Technology Concept Sub-Working Groups (SWG) - Terms of Reference (TOR)*



# AM Sub-Working Group Battle Rhythm



AdM – Additive Manufacturing. RAS Robotic and Autonomous Systems, DLFDB – Defence Logistics Development Programme Board PCES –Policy, Capability and Enterprise Support ILIAD – Information for the Logistics Innovation Agenda Database DLSG Defence Logistics Steering Group LTI – Logistic Technology Investigations LDA – Logistic Development Agenda, SPT Support Transformation EP – Equipment Programme



# LOGNET Sub-Working Groups – Key Info

Key Personnel				
Topic	CFD Advocate	Lead Command	Dstl Lead	Industry Chair
<b>Additive Manufacture</b>	Maj John Vance	Cdr Con Burns	Rebecca Mangham	Bill Dutton
<b>Robotic &amp; Autonomous Systems</b>	Wg Cdr Andy Hawker	Lt Col Gary Pugh	John Montgomerie	Alex Hyde
<b>Artificial Intelligence</b>	Lt Col Mike Potter	Wg Cdr Adam Blackwood	Dan Stubbins	Neil Morphett
<b>TD Info Facilitation – Steve Green</b>				
<b>DLFDB Chair &amp; AH CFD, Def Logs – Col Edward Corrigan</b>				

2019/20 Indicative Programme Dates				
DLSG (1*)	DLFDB (1/2 *)	AM Sub-WG	AI Sub-WG	RAS Sub-WG
Sep 19	16 Oct 19	24 Jul 19	Sep 19	Oct 19
Jan 20	8 Jan 20	Feb 20	Mar 20	Apr 20
May 20	6 May 20	Jun 20	Jul 20	Sep 20



# Lust to Dust

- ENDS
  - Defence Logistic Vision
- WAYS
  - Future Support Force Concept Vignette
  - AI Concept Note
- MEANS
  - Tactic Hypothesis
- Maturity Framework
- Development Roadmap
- Taskings
- Evidence Capture

## The Process (Strategy to Realisation)

Annex D to  
ACDS(LogOps)/04/0101/48  
dated 31 Oct 17

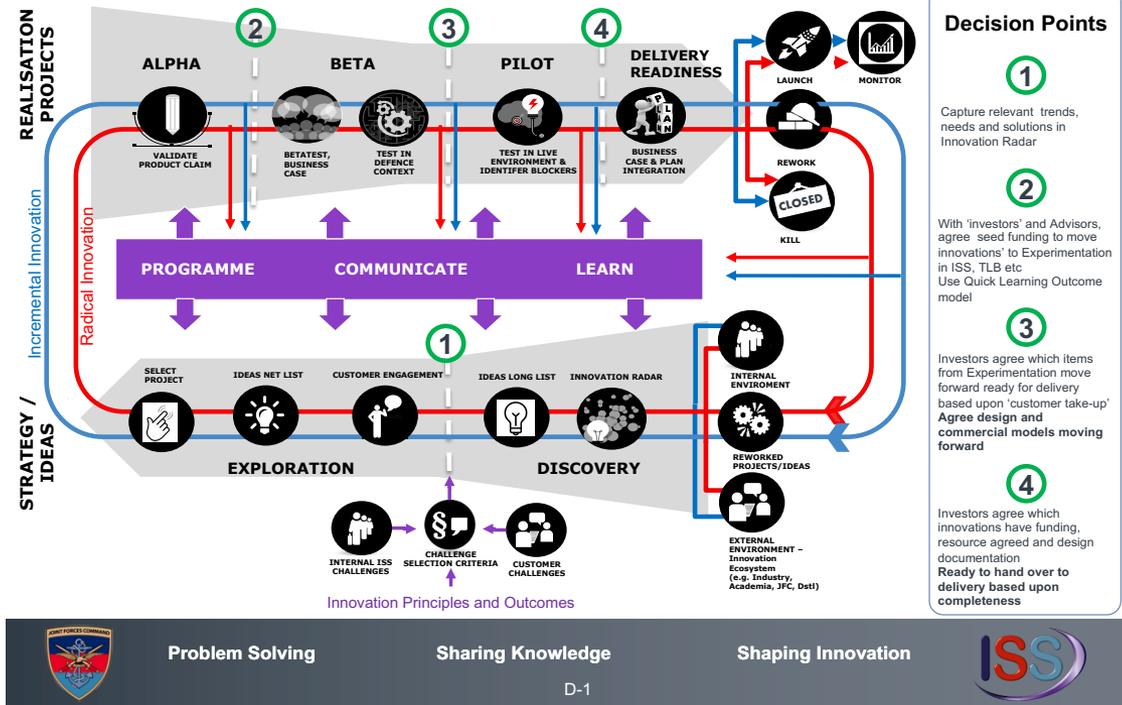


Image Reference: Concepts and Force Development Reset Annex D



# Future Support Force

*The visualisation for the 2030-plus epoch Defence Support Network (DSN) is one that is more **strategically prepared, globally responsive and operationally precise** in the era beyond Defence Support Transformation programme delivery. This future network, in delivering discrete Support functions, must be **information-led, technology-enabled and distribution-driven**, possessing increased agility, higher degrees of real-time asset monitoring and visibility and able to move mass at various operational scales.*

*Reference: Future Support Concept V1.1*



## Future Support Digital Backbone

*.....combined with AI & ML, automated sensor monitoring and reporting technologies, has permitted huge amounts of data and information to be collated, harvested, exploited and then shared through automatically tailored levels of access, at all levels of command, including sharing with allies and partners where appropriate.*

*This has enabled:*

- The generation, at machine speeds, of a complete Real Time Joint Logistics Picture*
- Driven much better-informed Logistics Decision Support (LDS) by offering options on what, where, when and how sustainment can be delivered to meet the commander's intent*
- Faster, more informed decisions through a much-improved predictive capability (covering forecasting and resource planning derived from modelling and simulation)*
- Increased speed of response, providing heightened levels of situational awareness whilst simultaneously lessening cognitive demands on commanders*
- Much greater levels of oversight through real time overlays of filtered information than was previously possible and has helped to achieve more effective C2, encompassing centralised coordination and control but decentralised implementation, at all levels across the spectrum of the operation*

*Reference: Future Support Concept V1.1*



# Artificial Intelligence

## Definition of Artificial Intelligence (AI)

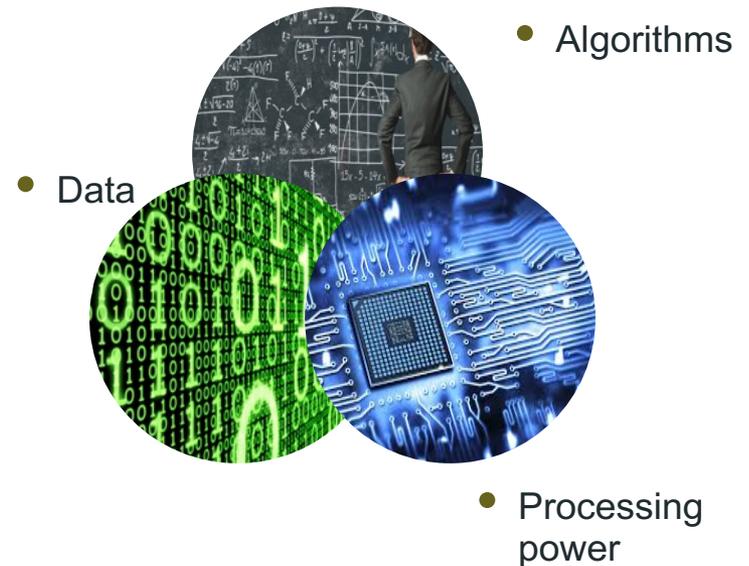
*There are many definitions of Artificial Intelligence and the branches of AI. The definitions used in this note are seen as broad enough to encompass the needs of AI within Defence*

**Artificial Intelligence** - *The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.*

**Artificial Neuron Network (ANN)** – *Is a computational model based on the structure and functions of biological neural networks. Information that flows through the network affects the structure of the ANN because a neural network changes, or learns, in a sense, based on that input and output. ANNs are considered nonlinear statistical data modelling tools where the complex relationships between inputs and outputs are modelled or patterns are found.*

**Machine Learning (ML)** – *Are techniques where the algorithm creates the rules that it will operate on to achieve a given goal.*

**Deep Learning (DL)**– *Is a subset of Machine Learning in Artificial Learning (AI) that has networks capable of learning unsupervised from data that is unstructured and unlabelled.*



Reference: DEFENCE LOGISTICS AI & ML CONCEPT NOTE



# Maturity Framework

	<b>Stage 1 React</b> No central analysis	<b>Stage 2 Anticipate</b> Functional Cost efficiency	<b>Stage 3 Integrate</b> Connecting Core functions	<b>Stage 4 Collaborate</b> Collaborative value driven decisions
<b>Level of Automation</b>	Human in the Loop	Human on the loop	Human out of the loop	Fully Automated
<b>Analytic Maturity</b>	Descriptive Platform/System	Prescriptive Function/Node	Diagnostic Network	Prognostic Business
<b>Focus</b>	Niche tools that can be applied to specific sub-system/system problems	AI applied to optimise whole systems, locations, facilities etc...	Support enterprise wide SC & end to end process optimisation	Outcome focused
<b>Outcome</b>	Project or Business unit cost focus	Functional performance improvement	Integrated SC decision making	Demand driven support fulfilment through wider enterprise collaboration
<b>Organisation</b>	Data science Pockets of Specialist K&U dispersed across the enterprise	Centre of Excellence Shared body of knowledge and pool of expertise to promote emerging best practice and promote capability	Expert User AI tools can be accessed and specialist users across the networks	Integrated AI tools are part of the IS infrastructure service
<b>Process</b>	Ad-hoc Disparate un-coordinated experimentation	localised business unit direction for use and development	Policy driven Defence wide policy for application, development deployment and use of AI	Part of DNA Ai is just integral part of Business as usual
<b>Platform</b>	Standalone Disparate systems with limited functional support	App store Pushing for integration of systems	Enterprise deployment Integrated in wider IS solutions	Automated selection and deployment Most appropriate AI selected and deployed by machine to deliver required insight and best outcome

Note: Any row can be developed independently but a full operating capability requires all development lines to be matured

Reference: Based on concepts from Gartner Maturity Models



# Development Themes/Areas

- Support Network laydown design
- Asset optimisation
- Prognostics
- Reporting optimisation
- Inventory optimisation
- Resource optimisation
- Scaling decisions

## The Value of Analytics

### Align Analytical Capabilities to the Maintenance Maturity

Maintenance Strategy	Tasks				Focus	Question
Optimization Asset Management	Integrate AM, engineering and operations data	Combine decision functions in one operations center	Optimize AM, ops & engineering based on one version of truth		AI, Machine Learning, Optimization, Digital Twin	What's the best that can happen?
Predictive Asset Management	Integrate AM, SCADA and operations data sources	Improve efficiency of performance monitoring	Data driven models to generate early warnings	Asset lifetime prediction	Predictive Modeling	What will happen next?
Living Reliability Centered Maintenance	Criticality ranking on value drivers	Define failure models and asset risks	Optimize maintenance intervals	Close improvement loop using failure codes	Forecasting/ Simulation	What if these trends continue?
Preventive Maintenance Optimization	Optimize maintenance strategy based on bad actor pareto analysis	Reduce consequences	Schedule compliance		Statistical Analysis	Why is this happening?
Condition Based Maintenance	Define root causes of failures	Monitor asset condition	Set warning and alarm levels	Determine p-f interval	Alerts	What actions are required?
Usage Based Maintenance	Introduce timers e.g. run hours, mileage	Logical meters	Nesting of tasks		Query/Drilldown	Where exactly is the problem?
Preventive Maintenance	Time based maintenance	Regulatory tasks	Vendor recommended actions	Operator asset care	Ad hoc Reports	How many, how often, where?
Work Initiation & Prioritizing	Clear notifications	Gatekeeping on work requests	Work request prioritization	Equipment criticality	Standard Reports	What happened?

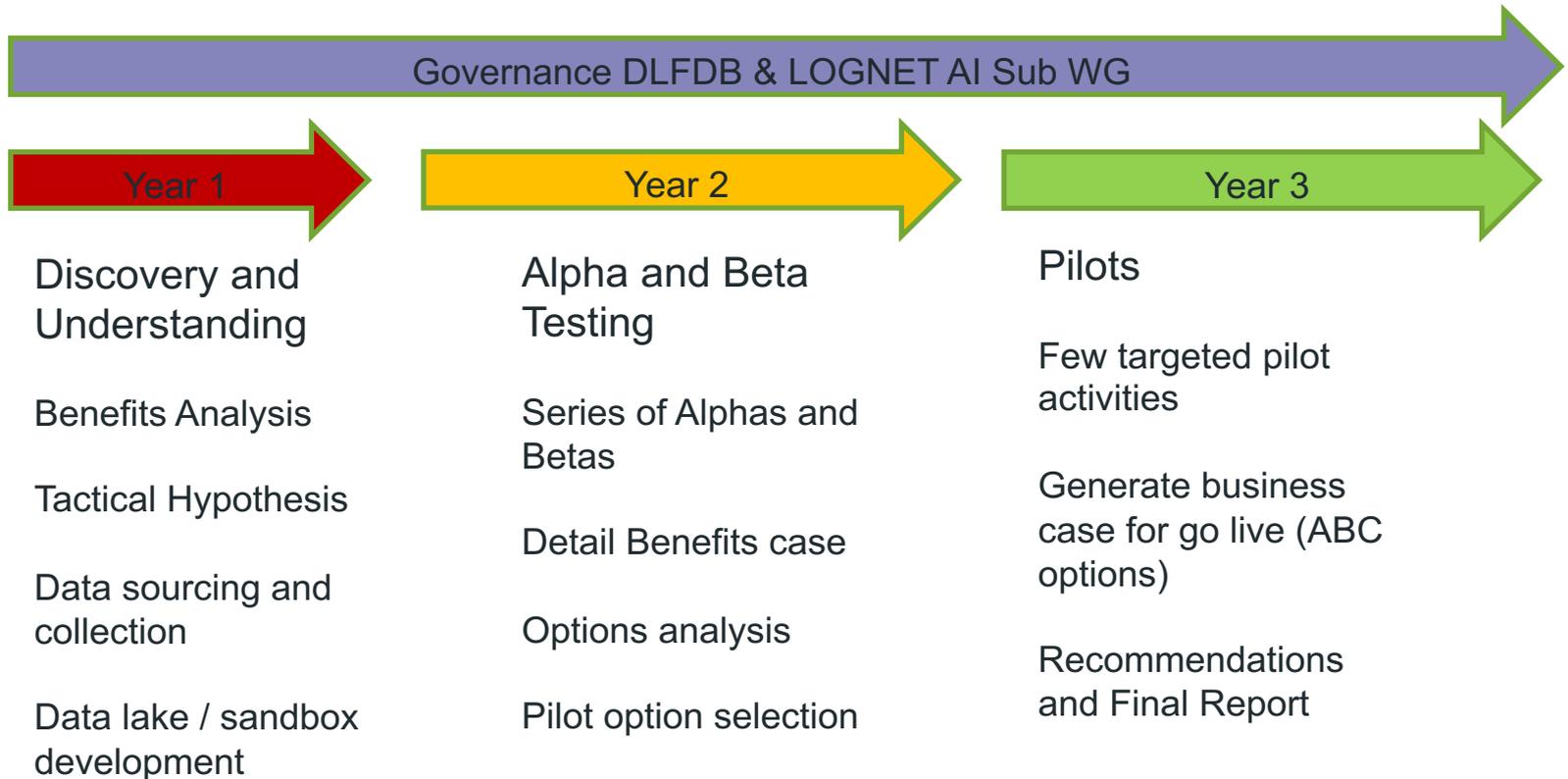
Company Confidential - For Internal Use Only

Reference: LOGNET Sub-Working Group Artificial Intelligence Tactical Hypothesis V1.0 dated 13 June 19

Reference: SAS presentation to Engineering Support Transformation team December 2018



# Logistic Technology Innovation



Reference: LTI Data Science High Level Schematic V5 29 May 2019



# Alpha, Beta and Pilot Activities

An important part of innovation is testing new business ideas with experiments. However, it is also important to note that the goal is not to simply run experiments, but to make progress. The experiments are a tool to provide evidence and answer key innovation questions in support of or disproving the viability of the future concepts.



## Alpha

Challenge the way things are done at the moment  
Explore new approaches  
Try out different solutions to a problem  
Building prototypes and test different ideas

Don't prototype the entire user journey/problem  
Focus on most challenging areas  
Do the minimum to test the assumptions and prove / disprove the hypothesis  
Build just enough complexity to test the idea  
Expect lots of ideas to be thrown out at the end of alpha.

The end of alpha should provide sufficient evidence to decide which ideas are worth taking forward to beta.

Alphas tend to last between 6 and 8 weeks.

## Private Beta

Develop best idea from alpha and starting building it for real  
Thinking about:

- Service integrate or replacing existing services
- Preparing for the transition to live

Structure solution so can roll out the service to real users - while minimising risk and maximising the potential to learn and iterate the service.

Inviting a limited number of people to use your service so you can get feedback and improve it.

Expect Betas to be 12-16 weeks in duration

## Pilot

Once the service is improved and there is confidence that it can run it at scale, then option is to move to a pilot.  
This involves opening up the service to a wider subset of users  
This will run in parallel to any legacy service  
This provides a baseline for analysis and assessment of the new solution

## Live

The live phase is about supporting the service in a sustainable way, and continuing to iterate and make improvements. You'll also:  
continue to address any constraints you identified at pilot and continue to develop the service and work with other organisations providing services that are part of the same journey, so that you're iterating towards solving a whole problem for users transition or integrate any existing transactions that meet a similar need to yours - making sure that what you end up with has a scope that makes sense to users

Reference: <https://www.gov.uk/service-manual/agile-delivery>



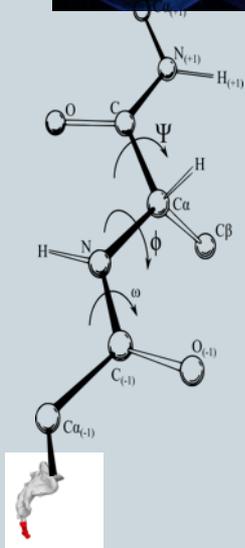
# Development Roadmap:

## SUPPORTing Intelligent Decisions (SID)

AI and the digital backbone



- Governance
- Policy
- Process
- Standards
- Organisation
- People & Skills
- Technology
- Data
- Safety
- Security
- Ethics



## What are the challenges and exploitation paths?

2018		2020	2025		2035+
JEF18	DSOM FOC	NATO Readiness Initiative	JF25	Support Tx End State	Future Operating Environment
Future Brize	TYTAN	HADES	DSNIS/BMFS		Global Strategic Trends
Marchwood	F MSP	Supply Chain Tx	Engineering Support Tx	F35 Sustainment	RAF SSP Future Support Concept
LCST	Warehouse Distribution Optimisation				TEMPEST

ISS CoE

## What are others doing that we can exploit?

Dstl Hub

Wider Defence	Industry	SME	Innovate	Catapults	DASA	Defence Innovation	Academia	Other nations	Other departments
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J4

## What are the priority activities?

- Support Network laydown design
- Asset optimisation
- Prognostics
- Reporting optimisation
- Inventory optimisation
- Resource optimisation
- Scaling decisions

Discovery and Understanding

Benefits Analyses

Tactical Hypothesis

Data sourcing and collection

Data lake /sandbox development

Alpha and Beta Testing

Series of Alphas and Betas

Detail Benefits case

Options analysis

Pilot option selection

Pilots

Few targeted pilot activities

Generate business case for go live (ABC options)

Recommendations and Final Report

Reduced Logistic Tail – Evolution Not Revolution



# Innovation Idea 1/2

Use the business model canvas to describe your AI innovation idea and how it will add value to Defence Support

The Business Model Canvas					Designed for:	Designed by:	Date:	Version:
Key Partners 	Key Activities 	Value Propositions 	Customer Relationships 	Customer Segments 				
	Key Resources 		Channels 					
Cost Structure 			Revenue Streams 					

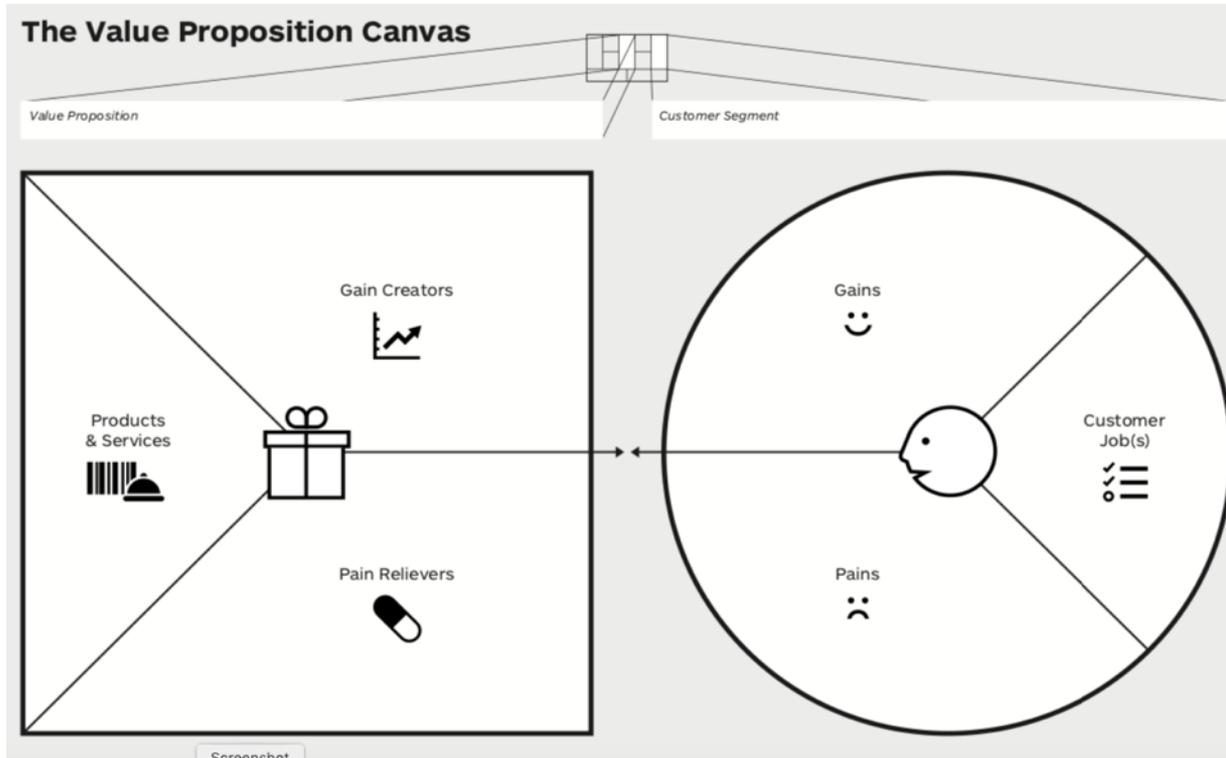
A global standard used by millions of people in companies of all sizes. You can use the canvas to describe, design, challenge, and pivot your business model. It works in conjunction with the Value Proposition Canvas and other strategic management and execution tools and processes.

<https://www.strategyzer.com/canvas/business-model-canvas>



## Innovation Idea 2/2

Use the value proposition to focus in on the pains and gains that your proposal will deliver



A simple way to understand your customers needs, and design products and services they want. It works in conjunction with the Business Model Canvas

<https://www.strategyzer.com/canvas/value-proposition-canvas>



# Innovation Scorecard 1/5

Pitch: \_\_\_\_\_

Completed by: \_\_\_\_\_

## Strategic Fit:

0 No alignment      5 Some alignment      10 Strong alignment

### **Vision & Culture**

*The proposal is aligned to the tactical hypothesis, AI concepts and supports realisation of the long term vision*

### **Innovation Guidance**

*The proposal is compliant with Government Digital Services guidance and BMfS services*

### **Leadership Support**

*The proposal has support from a key sponsor (s)*



*strategic fit, which is a key factor for innovation success within established companies. We have learned that innovation teams often find it difficult to secure ongoing resources and budget if they don't have support from a key sponsor or if their project is not aligned to their company's vision and innovation guidance.*

*As such, part of making an innovation project successful is ensuring that innovation teams are thinking about strategic fit upfront.*

*Reference: based upon Strategyzer templates*



# Innovation Scorecard 2/5

Pitch: \_\_\_\_\_

Completed by: \_\_\_\_\_

## Risk Reduction:

0 Unclear      5 Some evidence      10 Strong evidence

### Desirability

**Customer Segment**

*The proposal is addressing jobs, pains, and gains relevant to our stakeholders*

**Value Proposition**

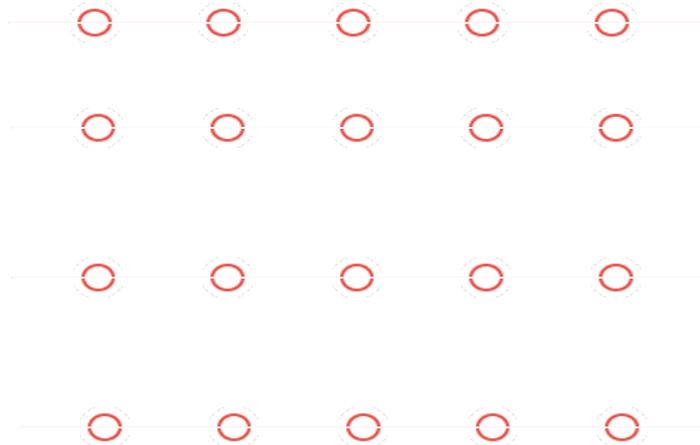
*The proposal resonates with our critical customer segments (J3/.J5, J4 community, DE&S OC etc..)*

**Channels**

*We have know how to reach and engage with the end customer stakeholders to support delivery of the work*

**Customer Relationship**

*We have the buy in and support from the stakeholders to secure future endorsement and exploitation*



The second section of the scorecard focuses on risk reduction around the business model that the team is working on.

We ask whether there is evidence of :

*desirability* e.g. our critical customer segments have the jobs, pains, and gains relevant for selling our value proposition;

*Reference: based upon Strategyzer templates*



# Innovation Scorecard 3/5

Pitch: \_\_\_\_\_

Completed by: \_\_\_\_\_

## Risk Reduction:

0 Unclear      5 Some evidence      10 Strong evidence

### Feasibility

#### Key resources

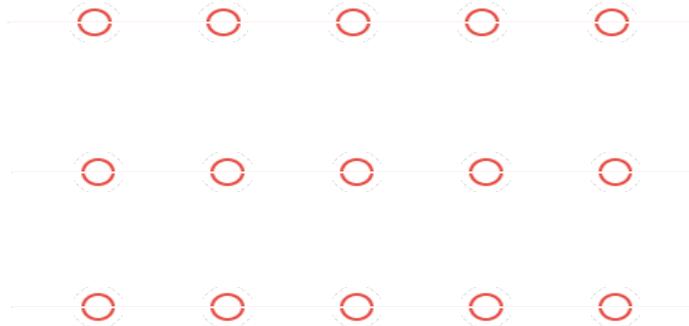
The project team have access to the right technologies, data and resources to deliver the value proposition

#### Key activities

The work package activities described are properly resourced and will develop the right outcomes to achieve the desired outcome

#### Key Partners

The right key partners who are willing to work with the project team to create and deliver the outputs



*feasibility* e.g. we have the right technology and resources to create our value proposition

Reference: based upon Strategyzer templates



# Innovation Scorecard 4/5

Pitch: \_\_\_\_\_

Completed by: \_\_\_\_\_

## Risk Reduction:

### Adaptability

#### Industry Forces

The proposal is new to Defence and there are no other on going or in-service solutions that deliver this solution

#### Market Prices

The proposal considers the critical issues and shifts in the support landscape and the value this proposal offers

#### Key Trends

The proposal identifies the key technology, regulatory, cultural and societal trends that will affect implementation of the business model

#### Macro-Economic Forces

The proposal considers the macro-economic and infrastructure factors that affect the business model.

0  
Unclear

5  
Some evidence

10  
Strong evidence



*adaptability*  
e.g. we understand the competitors and emerging players in our markets

Reference: based upon Strategyzer templates



# Innovation Scorecard 5/5

Pitch: \_\_\_\_\_

Completed by: \_\_\_\_\_

## Risk Reduction:

### Viability

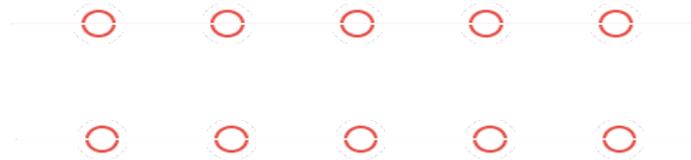
#### Revenues

We know the value this will bring to the end customer

#### Costs

We believe that this can be completed to budget

0 Unclear      5 Some evidence      10 Strong evidence



viability e.g. we know how much our customers are willing to pay us and how they will pay

### Opportunity:

#### Efficiency

This has the potential to deliver cost savings

#### Effect

This will impact the network by

0 <£1M      5 £5m+      10 >£10m



focuses on the potential size of the opportunity. Do we have evidence for the financial value that our new idea will save?

Reference: based upon Strategyzer templates



# Evidence Capture

The screenshot displays the ILIAD web application interface. At the top, the title is "ILIAD: managing information for Force Development in Logistics". Below the title, there is a navigation bar with tabs for "Ends", "Ways", "Challenges", "Concepts & Ideas", "Explore Themes", "Data Management", and "Browse ILIAD Content". The current page is titled "3b. Logistics Concepts Update".

The main content area shows a concept map for the selected concept "@Artificial Intelligence & Machine Learning". The map is organized into four columns: "Concepts", "Challenges", "Hypotheses", and "Develop Activities". A blue oval highlights the selected concept, and a red oval highlights a specific challenge, "Reactive Maintenance". A blue box is present under the "Concepts" column, and a large empty orange box is on the right side of the map.

On the right side of the interface, there is a "Status" section with a progress bar showing a value of 2 out of 4, labeled "Minor Issues". Below this, there is a "DLFDB Commentary for" section with a dropdown menu set to "DLFDB June 2019".

The "dstl" logo is visible in the bottom left corner of the interface.

*"Some items of equipment operate to scheduled maintenance regimes that do not account for the level of type of usage. Consequently, maintenance hours and spares are consumed in reactive repairs or unnecessary interventions (Air)."*



# Evidence Capture

The screenshot displays the ILIAD web application interface. At the top, the title is "ILIAD: managing information for Force Development in Logistics". Below the title bar, there are navigation menus for "ILIAD", "DLFDB", "Ends", "Ways", "Challenges", "Concepts & Ideas", "Explore Themes", "Data Management", and "Browse ILIAD Content". The current page is titled "3b. Logistics Concepts Update".

The main content area shows a concept map for the selected concept "@Artificial Intelligence & Machine Learning". The map is organized into four columns: "Concepts", "Challenges", "Hypotheses", and "Develop Activities". The "Concepts" column contains the selected concept. The "Challenges" column contains several nodes. The "Hypotheses" column contains a central node labeled "Prognostics for Reactive Maintenance" which is circled in red. The "Develop Activities" column contains several nodes. Colored lines connect the nodes between columns, representing relationships. A "dstl" logo is visible in the bottom left corner of the interface.

On the right side of the interface, there are controls for "Element", "Status" (a slider from 0 to 4), and "DLFDB Commentary for" (set to "DLFDB June 2019").

*"Data analytics and AI can be used on existing platform data sets to enable predictive maintenance and reduce maintenance hours and inventory requirements."*



# Evidence Capture

The screenshot displays the ILIAD web application interface. At the top, the title "ILIAD: managing information for Force Development in Logistics" is visible. Below the title, the page is identified as "3b. Logistics Concepts Update". A navigation menu includes options like "ILIAD", "DLFDB", "Ends", "Ways", "Challenges", "Concepts & Ideas", "Explore Themes", "Data Management", and "Browse ILIAD Content".

The main content area shows a concept map. The "Select Concept" dropdown is set to "@Artificial Intelligence & Machine Learning". The map is organized into four stages: Concepts, Challenges, Hypotheses, and Develop Activities. A blue oval highlights the "@Artificial Intelligence & Machine Learning" concept in the Concepts stage. A red oval highlights a specific activity in the Develop Activities stage, labeled "LTIP\_MaintenanceWP".

On the right side, there are controls for "Element" (with a "Go" button), "Status" (a slider from 0 to 4, currently at 2, with a "Minor Issues" warning icon), and "DLFDB Commentary for" (set to "DLFDB June 2019").

The "dstl" logo is visible in the bottom left corner of the interface.

*"Work package within the Logistics Technology Investigations Project [which will] identify the current and anticipated problems and constraints that limit the operational availability of platforms and add unnecessary cost to Maintenance and Repair (M&R)"*



# Evidence Capture

The screenshot displays the ILIAD web application interface. At the top, the title is "ILIAD: managing information for Force Development in Logistics". Below the title, there is a navigation bar with various menu items: ILIAD, DLFDB, Ends, Ways, Challenges, Concepts & Ideas, Explore Themes, Data Management, and Browse ILIAD Content. A search bar and utility icons are also present.

The main content area shows a concept map. On the left, a dropdown menu is set to "@Artificial Intelligence & Machine Learning". The map consists of four columns: Concepts, Challenges, Hypotheses, and Develop Activities. A blue oval highlights the "@Artificial Intelligence & Machine Learning" concept. A blue box highlights a section of the map. A tooltip labeled "LTIP\_MaintenanceWP" is visible over a node in the "Develop Activities" column.

On the right side, there is a panel for "Element LTIP\_MaintenanceWP". It includes a "Status" indicator with a progress bar (0 to 4) and a "Go" button. Below this, a "DLFDB Commentary for DLFDB June 2019" is shown, with a red oval highlighting the text: "Task has just commenced. First LTI Project Board is on 27 June 2019".

The "dstl" logo is visible in the bottom left corner.



# Bibliography

*Available in Kahootz collaborative working area*

1. Global Strategic Trends
2. JCN 1-18 Concepts UK Human Machine Teaming
3. JCN 2-18 Information Advantage
4. FOE 35 Final v29
5. JCN 2-17 UK Future C2
6. JCN 1-17 UK Future Force Concept
7. JDP 4 Understanding and Decision Making
8. D&IT Functional Strategy v1.01
9. LDA CT Report
10. DSL Proritisation Presentation
11. Future Support Concept Vignettes
12. CFD Concept Note
13. LOGNET Technology SWG ToRs
14. AI WG Sub-Hypothesis
15. VCDS Trilat V2.0
16. Craft an Artificial Intelligence Strategy – a Gartner insight report
17. AI Framework Gartner Presentation
18. Big data trends report

*Reference: Future Support Concept V1.1*

