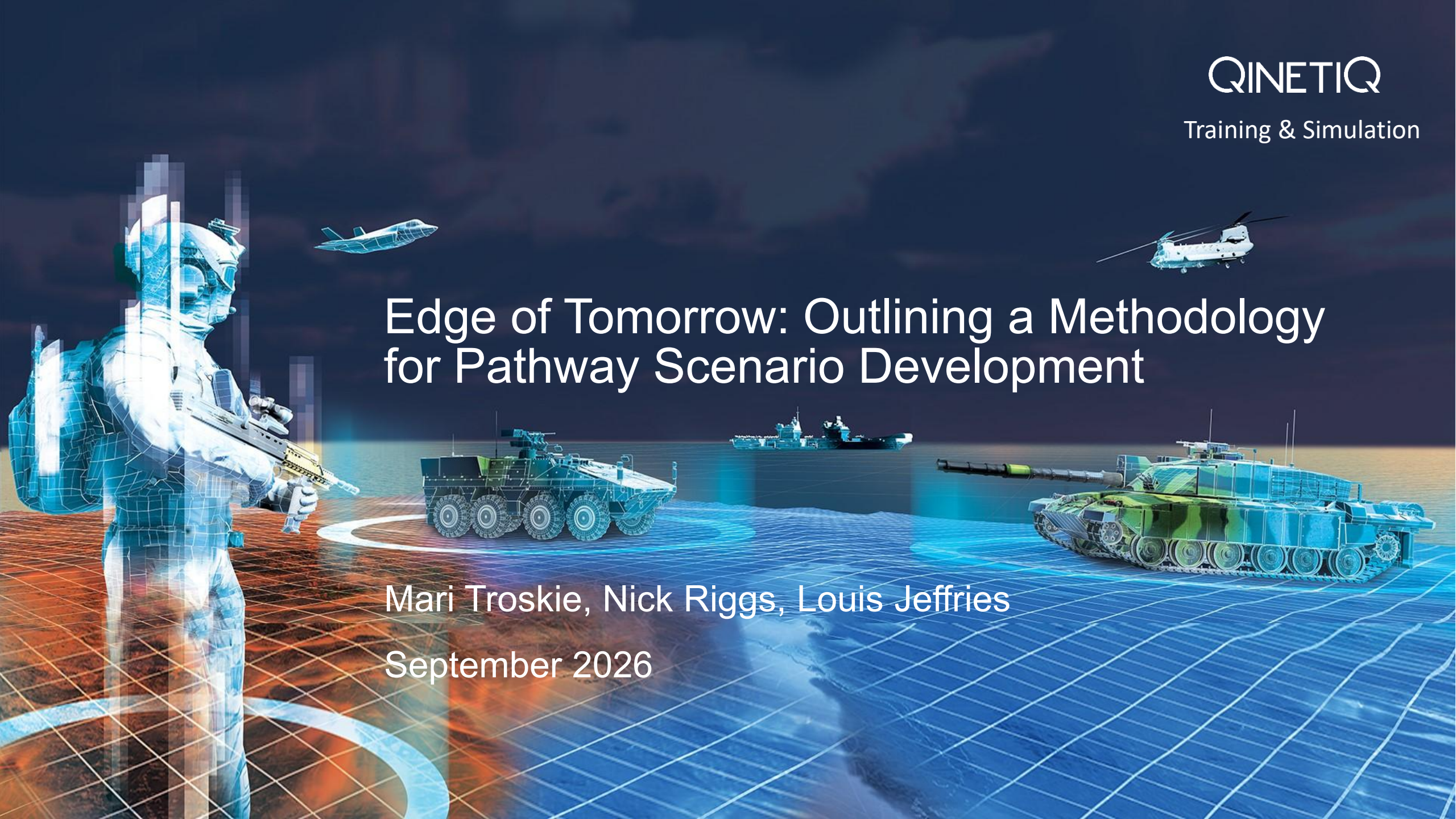


The background of the slide is a composite image representing a military simulation. On the left, a soldier in a white tactical suit and helmet, holding a rifle, stands on a glowing orange grid. In the center, a six-wheeled armored vehicle is on a blue grid. To its right is a main battle tank. In the background, a naval ship is visible on the horizon. In the sky, a fighter jet and a helicopter are flying. The overall theme is advanced military technology and simulation.

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Training & Simulation

Edge of Tomorrow: Outlining a Methodology for Pathway Scenario Development

Mari Troskie, Nick Riggs, Louis Jeffries

September 2026

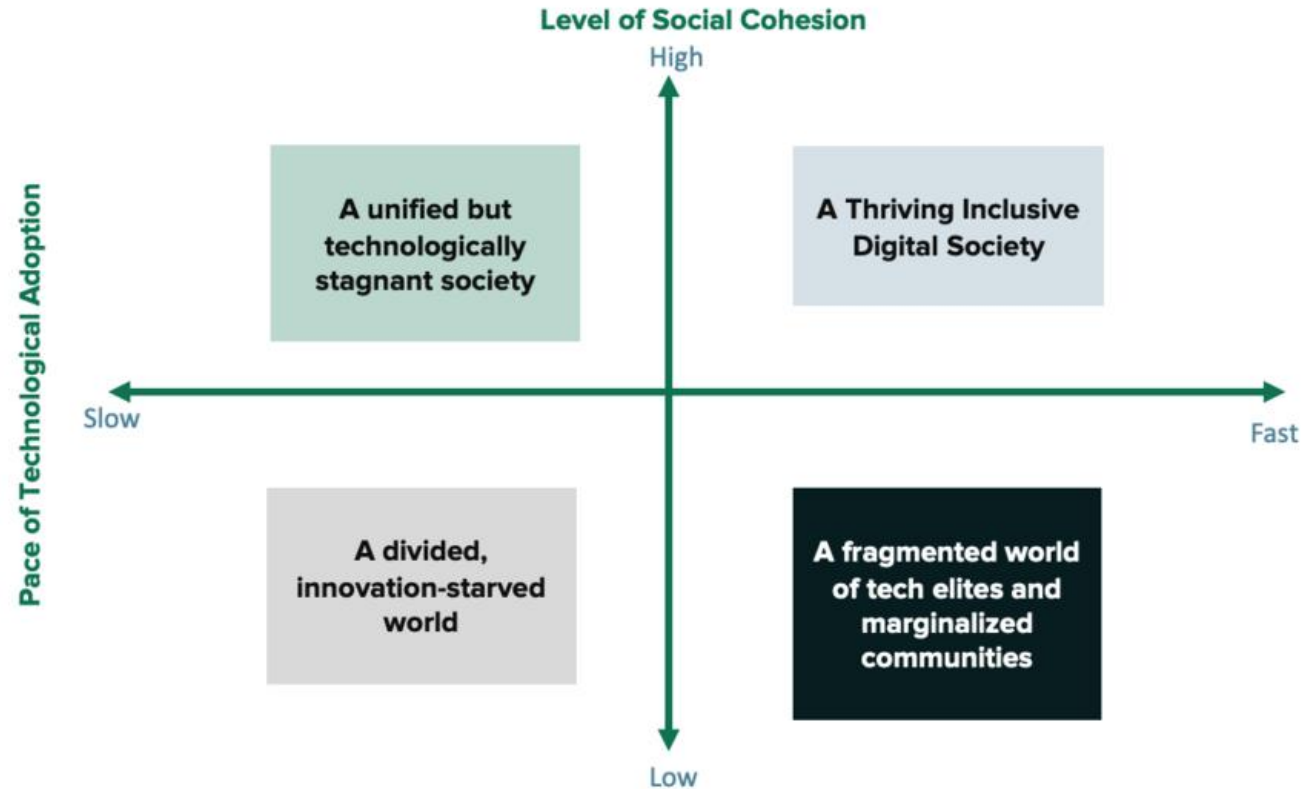
Introduction – The Team

- **Mari Troskie** is an Operational Analysis Consultant in QinetiQ's Operational Analysis and Strategic Consulting (OASC) team. She has extensive experience of leading and coordinating Wargaming and strategic workshop activities, developing and analysing complex technical outputs. She is also a QinetiQ Global Ambassador, and works with partners across the company, Defence, and wider Industry.
- **Nick Riggs** is an Operational Analyst and Game Designer within the QinetiQ Wargaming and OA team. Also a PhD candidate at Bath Spa University under Dr. John Curry, he is exploring the utility of Wargames in professional military education and the representation of modern small-unit combat. He has published several roleplaying games and supplements: in 2025 a book on a 1985 US Army PME wargame (TRAX I), and in 2024 a paper on ArXiv describing AI-player responses recorded during a matrix game on AGI emergence.
- **Louis Jeffries** is an Operational Analyst and Game Designer within the QinetiQ Wargaming and OA Team. He has considerable experience of designing, facilitating and analysing both analytical and training focused Wargames for a range of clients, across Government, Defence and wider Industry. He also provides board-level assistance to Imaginetic, a Canada-based Wargames Consultancy, and sits on the Connections Next Gen Panel and DSET Under-30s Panel, where he supports activities to encourage others to engage with Wargaming and careers in the sector.



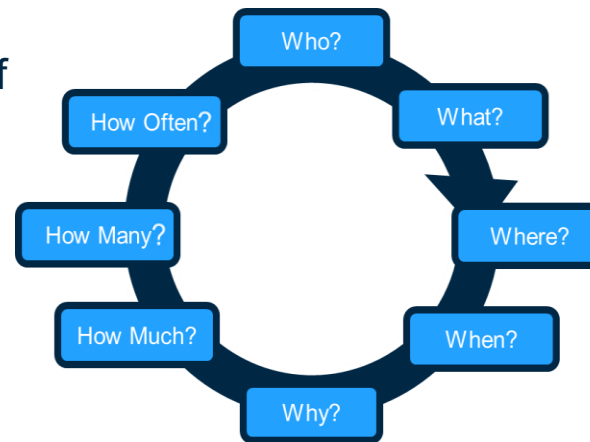
Overview

- Wargames are often Exploratory, Educational, Analytical or for Training purposes – though frequently combining elements of each.
- Wargames require an established objective and initial conditions, defined within a Scenario.
- Multiple methods can be applied to generate multiple possible Scenarios, e.g. the Four Quadrants Method (Rhydderch 2017), shown here.
- Customers usually require a Wargame to help them explore a particular problem. A Scenario is usually developed to enable that, containing the elements to be examined.
 - A Scenario requires a plausible causal chain of events to establish the initial conditions.
- The Methodology for Pathway Scenario Development has been derived to address this requirement. This workshop describes the methodology and guides participants in order to generate a worked example.



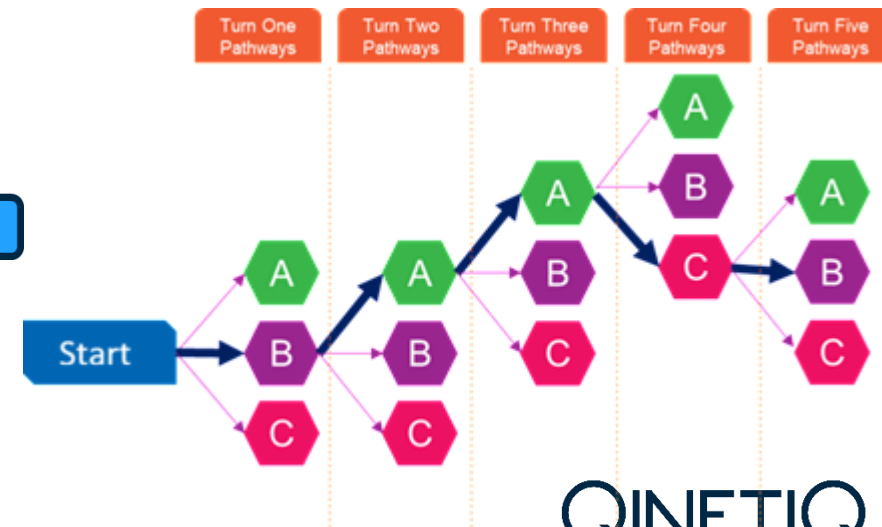
Analytical Wargame Development

- Wargames require the formation of Research Questions to be addressed by the Wargame; these form the focal point for Game Design and data capture.
- Wargames can be designed using the '8 Questions' Approach – answering any one of these questions shapes Game Design choices and affects responses all others.
 - An end point is one defined by not being of suitable analytical use the Wargame Research Questions. The methodology allows the Scenario to be 'steered' past these, whilst highlighting them as return points for future exploration.
- Scenarios usually have a fixed starting point, defined by the 'Road to War'. Our methodology results in the plotting of a timeline and definition of multiple end points, allowing a plausible history to be generated.



STRATEGIC WARGAMING LIFECYCLE OVERVIEW

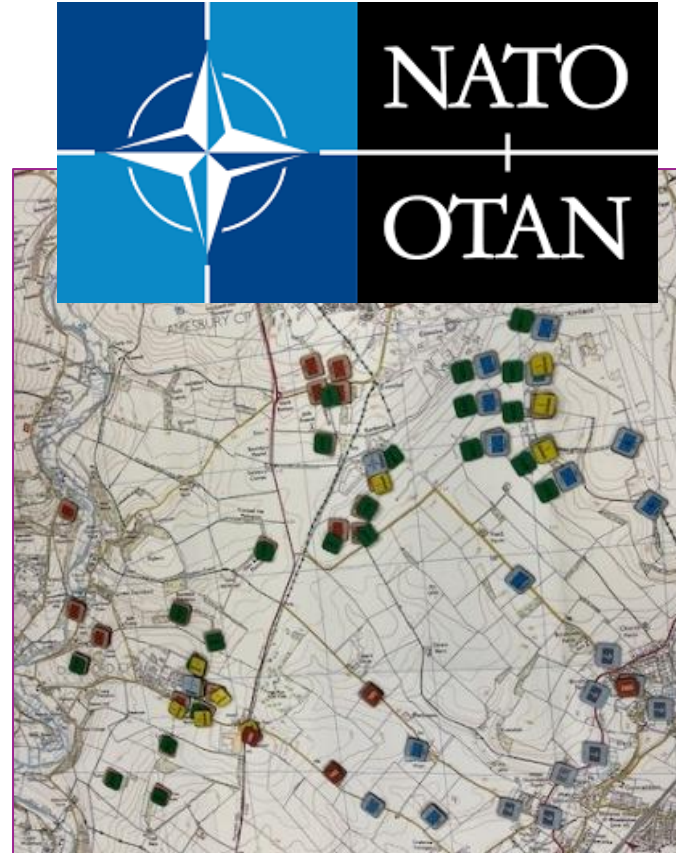
A structured, analysis-led process that turns complex questions into informed decisions.



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The Problem

- For Army Wargame 2025, QinetiQ was tasked to provide research and analysis to support the redesign of the Reserve forces.
- A Wargame was designed using a Defence-validated Scenario and set within a NATO-level threat response. Unusually, the start and end points were pre-defined.
- The team needed a means to have the Scenario progress from A to B whilst retaining the Wargame's important open-ended, qualitative discussion, red-teaming and stress testing.
- The result was the Methodology for Pathway Scenario Development.
 - Those within the Wargame were often pushing at the 'Edge of Tomorrow' – the Scenario end point!

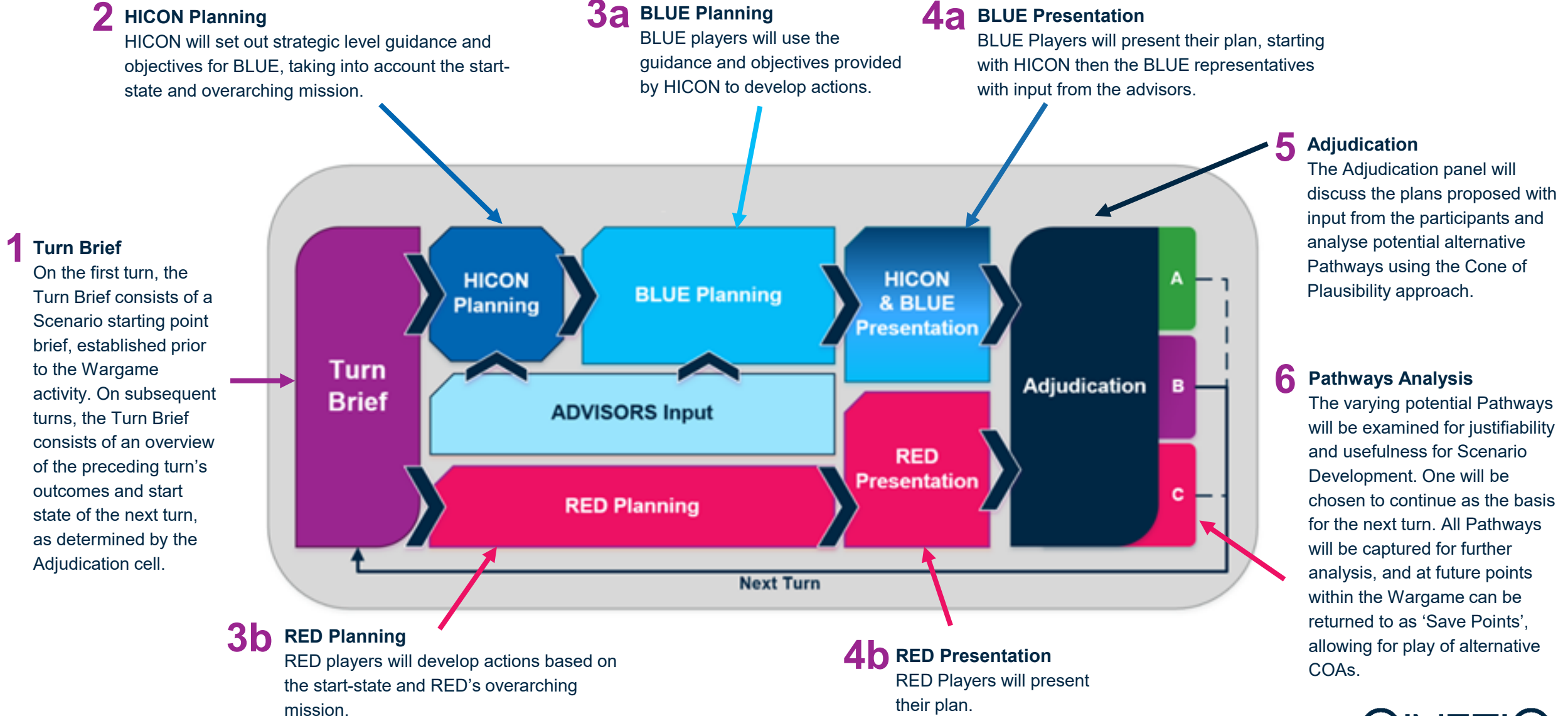


Wargame Cells

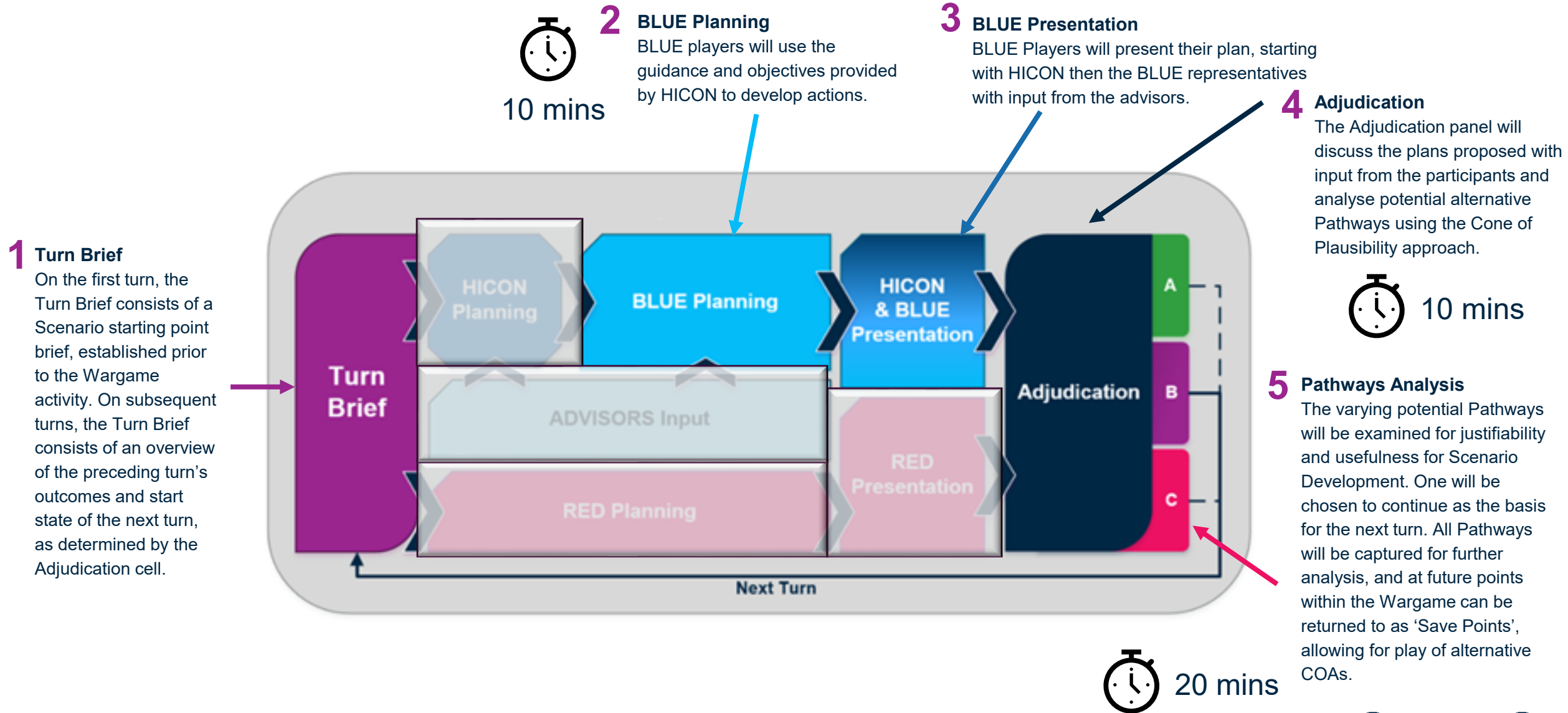
- HICON – the higher command team determining operational goals for BLUE.
- **BLUE** – the team making tactical decisions for the BLUE side (YOU)
- Advisors – providing HICON & BLUE with LEGAD (legal advice – if proposed actions *could* be taken) and POLAD (policy advice – if proposed actions *should* be taken).
- RED – the team making tactical decisions for the RED (adversary) side.
- EXCON – Exercise Control, providing Facilitation, Injects (if necessary) and Adjudication.
- Adjudication Panel – to guide discussion and agree Pathways at the end of each turn.



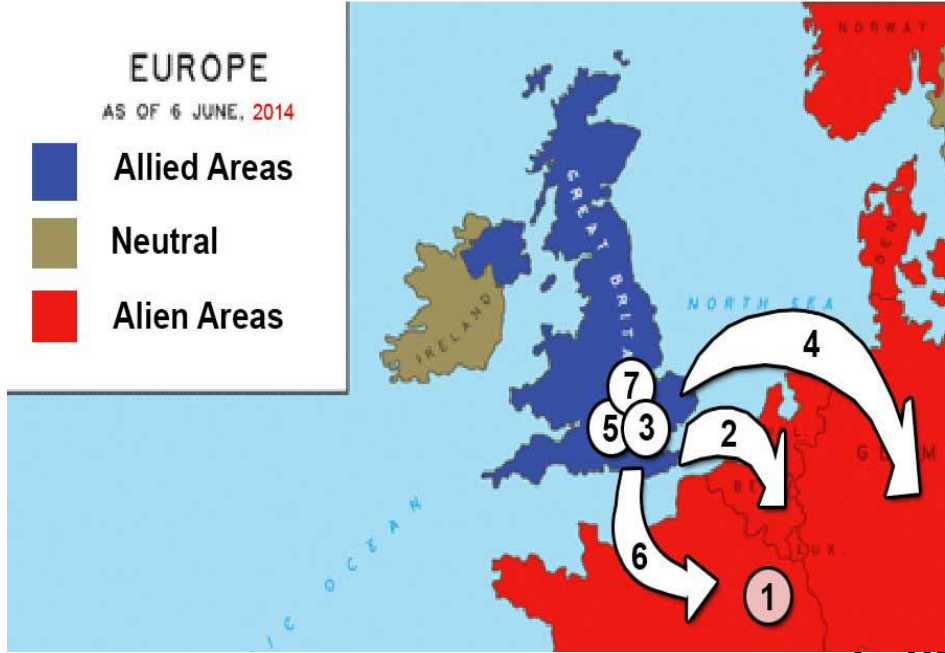
Turn Sequence for Army Wargame



Turn Sequence for Today's Workshop



OPERATION ORDER – UDF HIGH COMMAND	
FROM	UDF HIGH COMMAND
TO	BLUE CELL
SITUATION	Mimic forces hold mainland Europe. Enemy density on the northern French coast is heavy but static.
MISSION	Stage an amphibious and airbourne invasion of northern France, destroy Mimic forces in the area and secure a beachhead.
EXECUTION – INTENT	A decisive victory on European soil is required. The enemy is assessed as defeatable in open battle.
EXECUTION – CONSTRAINTS	H-Hour is fixed; no delay authorised. Force generation from Heathrow. Exosuits to all infantry.
COORD INSTR	Define BLUE's actions on the Actions Worksheet (next slide). ACKNOWLEDGE.



Inject 1: UDF Force Inventory – Pre-Invasion Holdings

EQUIPMENT & FORCE STATE – OP DOWNFALL			
SER	ITEM	QTY	REMARKS
1	Exosuits	12,400	Issued to all infantry; 6 hrs training
2	Suit-mounted 30mm cannon	9,800	Ammunition at 60% of scaling
3	Close-combat blades	3,100	Held at Heathrow armoury
4	Assault infantry	24,000	Incl. J-Squad and reserve intakes
5	Drop transport aircraft	310	Serviceability 78%
6	Landing craft / dropships	145	Beach lodgement lift only
7	Armoured vehicles	220	Follow-on wave
8	Aviation fuel (tonnes)	41,000	Heathrow FMB dispersal sites
9	Field medical sections	36	Sited on beachhead D+0
10	Battlefield comms relays	90	Degraded by Mimic interference



Inject 2: Enemy Force State – Mimic Dispositions

ENEMY FORCE STATE – MIMIC (RED)			
SER	ITEM	EST QTY	REMARKS
1	Mimic drones (basic)	180,000+	Bulk of force; swarm assault
2	Alphas	~1,800	1 per c.100 drones; blue-cored
3	Omega	1 (unlocated)	Assessed hive intelligence – UNCONFIRMED
4	Coastal defensive positions	Heavy	Dug in D-30; static laydown
5	Sub-surface transit tunnels	Extensive	Enables rapid reinforcement
6	Anti-armour capability	High	Effective vs. jacket suits at range
7	Reaction time to landing	< 30 min	Massing observed in prior landings
8	Depth reserves (inland)	Unknown	Believed uncommitted
9	EM interference	Persistent	Degrades BLUE comms and ISR
10	Reported casualty tolerance	Total	No surrender or withdrawal observed

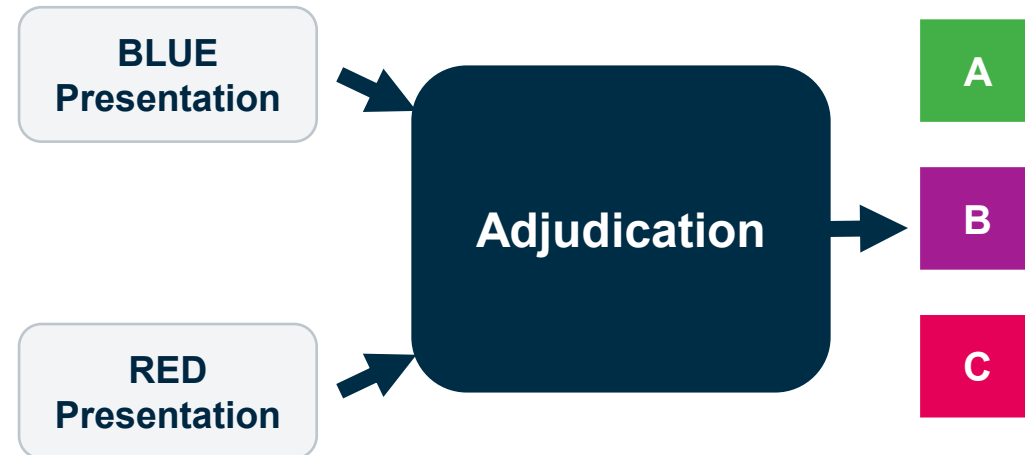


Team Actions Worksheet

Group:				Cell: <u>BLUE</u>
Action	What objective does this attempt to achieve?	How will this action or be accomplished?	What is needed to accomplish this action? What supports its success?	What are the risks associated with this action?
Aircraft required for invasion need collating at Heathrow	Have aircraft assembled at Heathrow ready for invasion to take place	Pilots will receive orders to fly to Heathrow on a specific day/time	Aircraft need fuelling, instructions need to get through to pilots, good weather conditions	Bad weather, pilot errors, misfuelling, lack of fuel, bad communications

Adjudication

- Observe player actions and planning assumptions
- List potential outcomes within the Cone of Plausibility – **could** it happen? How?
- Assess actions against one another – are any exclusive? Where are they dependent on one another or on other aspects/considerations? This provides several actions to be used during Pathways Analysis.
- Assess plans and outcomes within a Cone of Utility – what **should** happen? Why?
- Sense check – will we reach the intended outcome? How?

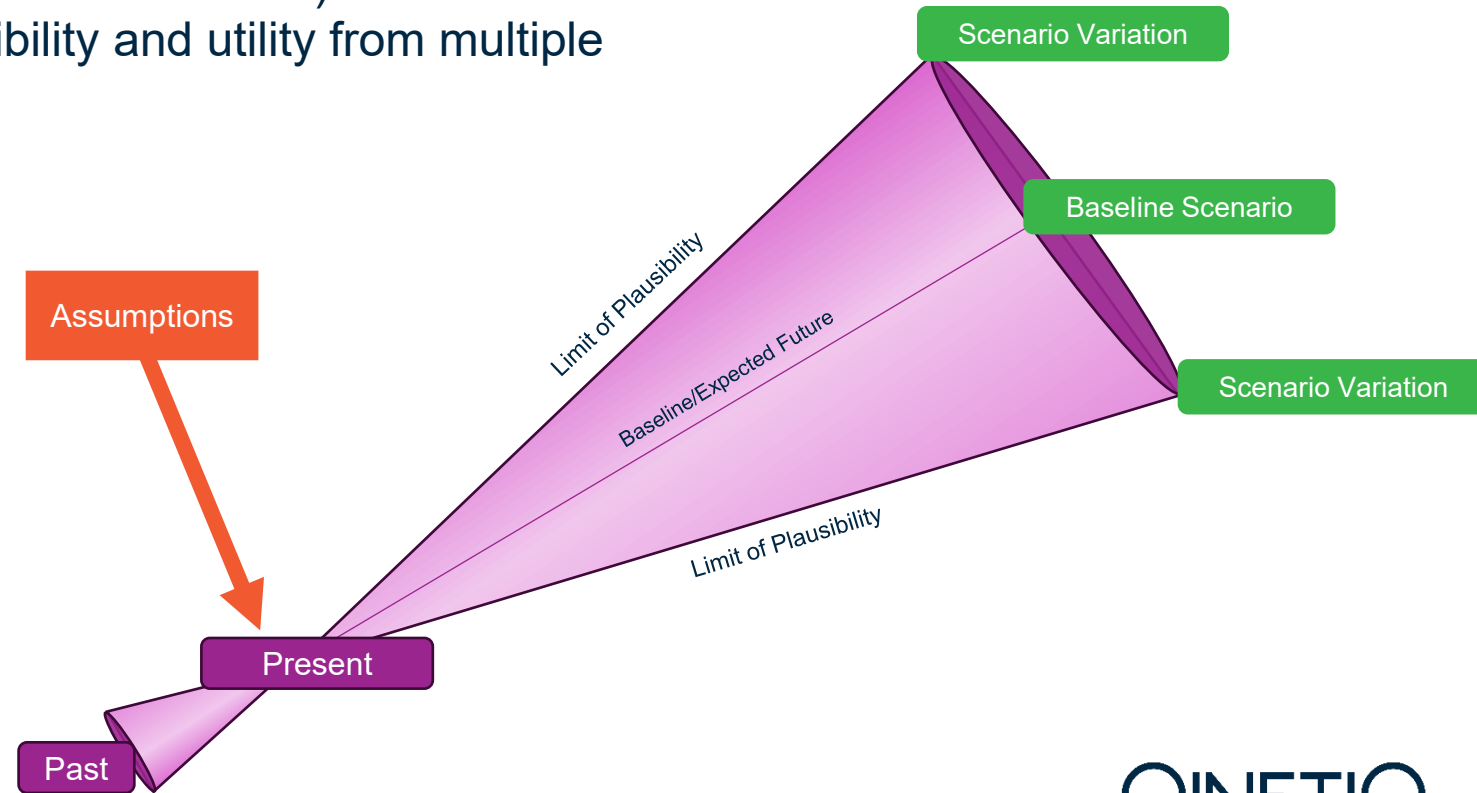


Adjudication converts competing plans into plausible outcomes through application of the Cones of Plausibility and Utility.

Cone of Plausibility/Cone of Utility

- Assumptions will be required (and documented) to bring the Scenario into a timeline. Cone of Plausibility, Cone of Utility and Pathways Analysis will be used to identify potential outcomes.
- Consider Convergence and Divergence.
- Cone of Plausibility – what **could** happen (what is most interesting).
- Cone of Utility – what **should** happen (what is most useful).
- Utilise analysis checklists to consider plausibility and utility from multiple perspectives.

PESTLE	STEEPLEM	PMESII	Constituents of a nation	ASCOPE
Political	Social	Political	Rule of law	Areas
Economic	Technological	Military	Education	Structures
Social	Economic	Economic	Commercial	Capabilities
Technological	Environmental	Social	Humanitarian	Organisation
Legal	Political	Infrastructure	Health	People
Environmental	Legal	Information	Information	Events
	Ethical		Military	
	Military		Economic	
			Diplomacy	
			Administration	
			Governance	



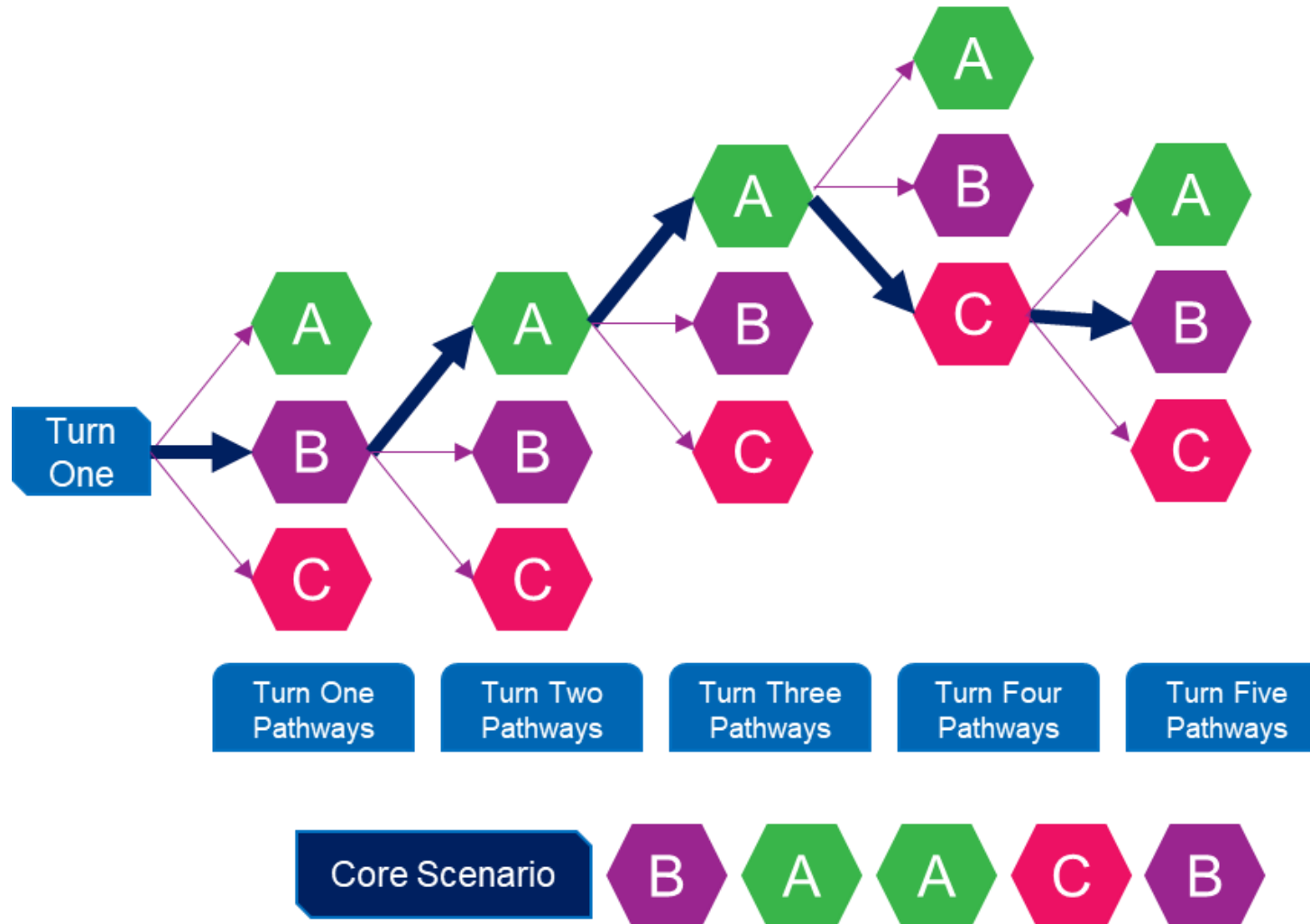
Team Adjudication Worksheet

Group:			
Action	Outcome 1	Outcome 2	Outcome 3
Aircraft required for invasion need collating at Heathrow	Aircraft successfully collated, on time and in the right place	Some aircraft diverted due to bad weather, 70% collated on time and in the right place	Software patch required for aircraft guidance systems, fleet grounded and not collated at Heathrow

Pathways Analysis

Grading	Action 1 - Aircraft required for invasion need collating at Heathrow	Action 2	Action 3
PS	Aircraft successfully collated, on time and in the right place		
PS	Some aircraft diverted due to bad weather, 70% collated on time and in the right place		
CF	Software patch required for aircraft guidance systems, fleet grounded and not collated at Heathrow		
	'Alternative outcome'		

Completed Narrative Branches Graph Showing Developed Pathways

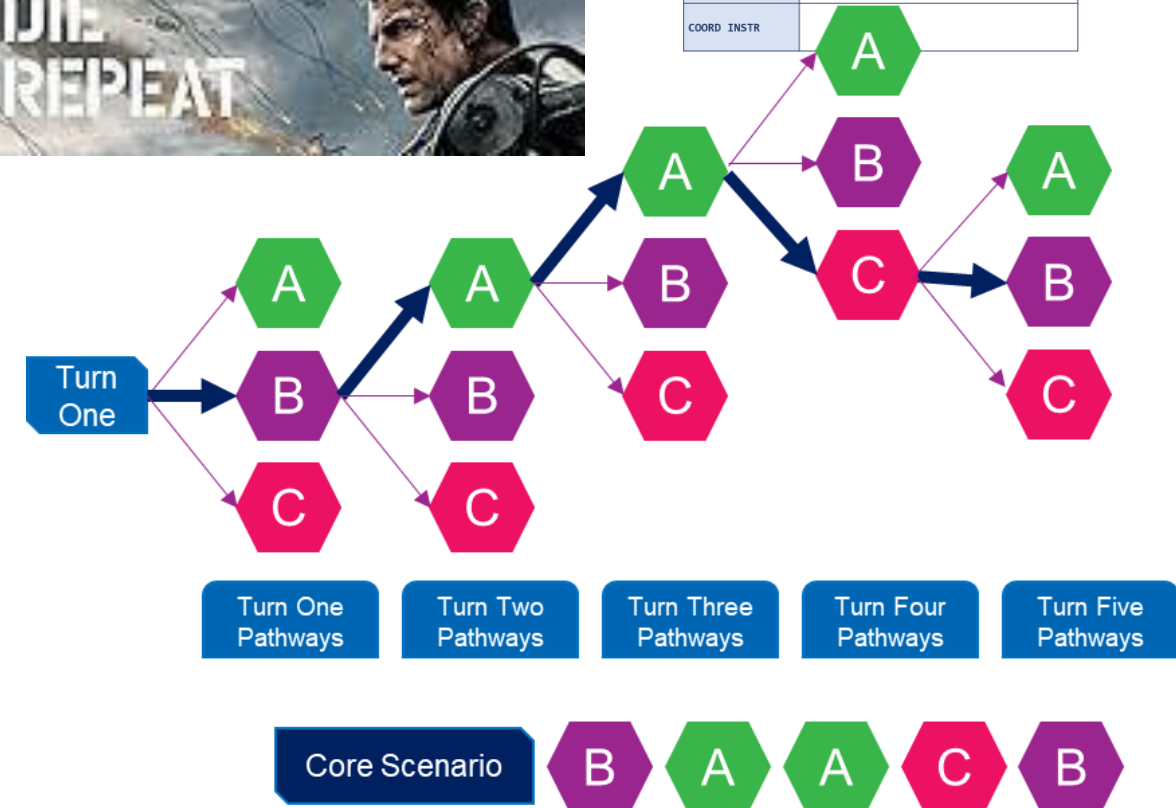


Turn 2

- The chosen Pathway from Turn 1 forms the context for Turn 2.
- A HICON Brief is developed on this basis, setting the conditions for Turn 2.
- An Actions Worksheet for BLUE for Turn 2 can then be completed, followed by Adjudication and Pathways Analysis.
- If the Pathway grinds to a halt, or if Scenario taken forward does not meet the overall Game Requirements, we can revisit previous turn outcomes to find a new Pathway.



OPERATION ORDER – LDF HIGH COMMAND	
FROM	
TO	
SITUATION	
MISSION	
EXECUTION – INTENT	
EXECUTION – CONSTRAINTS	
COORD INSTR	



Team Actions Worksheet

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Pathways Analysis

Grading	Action 1	Action 2	Action 3

Conclusions - Contributors to Successful Pathway Development

- Manual Scenario Development improves participant understanding of a problem set, and develops team skill and integration
- Strong Adjudicators
- Facilitation Skill
- Red teams
- Relevant Data
- Data structure and coherence
- Specialist knowledge
- Consideration of second- and third-order effects and requirements during player decision making, but especially during Adjudication
- **What else?**

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