Team and Collective Training Needs Analysis (TCTNA)

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Learning Objectives

- Identify the areas of complexity of team and collective training that have to be addressed in the training needs analysis process.
- Recognise and describe the elements of the supporting models which underpin TCTNA.
- Describe the purpose and outputs of the key analytical stages of TCTNA, and how these inform subsequent stages of training design.
- Illustrate the interconnections between the main areas of analysis
- Outline how TCTNA can be applied iteratively in the acquisition process and in auditing existing means of training delivery.
Topics

- Introduction
- Team and Collective Task Analysis
- Constraints, Assumptions, Risks and Opportunities Analysis
- Training Environment Analysis
- Training Overlay Analysis
- Training Options Analysis
- Iterative application of TCTNA in Acquisition
- Project Initiation
Introduction: Team Tasks, Task Environments and Training Environments

- Scale and complexity of team tasks and team training
- Viewing tasks as environmental transformations
  - Individual task model
  - Team task model differences
- Environmental challenges
  - Naturalistic environments and team stressors
  - Volatility, uncertainty, complexity and ambiguity in operational environments
- The Team Training Model
- Team and Collective Training Needs Analysis
TNA/Front End Analysis

Major financial decision point

TNA

Analyse → Design → Develop → Implement

Revise

Evaluate

Revise

Revise

Revise
Example of an Individual Task
Environmental Transformations

Initial Environmental State → Task Performance → Task Outcome

Task Environment

Individual

Goal Determination

Goal

goal forms a description of the intended task outcome

Comparison

Goal Maintenance

Goal
Individual Task Model

Other Task-Relevant Transformations

Actions

Sensing

Planning

Doing

Decisions making

Perception SA

Goal Generation Goals

Initial Environmental State

Task Outcome Environmental State

successive stage of activity

(Huddleston and Pike, 2016)
Example of a Team Task
Team Task – Cups of Water
What is teamwork and how do we evaluate it?

- Communication
- Coordination
- Mutual performance monitoring
- Back-up behaviour
- Collaboration
- Conflict management
Team Task Model

Other task-relevant Transformations

Distributed Action (Sensing and Doing)

Collaborative Planning
Team Plan(s)

Communication Command & Control Decision Making

Distributed Perception
Team SA

Goal Generation
Team Goal(s)

Initial Environmental State

Outcome Environmental State

"Conditions"

"Task Outcomes"

(Huddlestone and Pike, 2016)
The Nature of Military Task Environments

- High Stakes
- Performance pressure
- Time constraints
- Time pressure
- Competing goals
- High workload/information load
- Requirement for team coordination
- Multiple players
- Rapidly changing, evolving scenarios
- Dynamic environments
- Multiple information sources
- Shifting goals
- Adverse physical conditions
- Uncertain environments
- Auditory overload/interference
- Ill-structured problems
- Incomplete, conflicting information

Properties of Naturalistic Environments
(Oresanu, 1993)

Environmental Stressors
(Cannon-Bowers & Salas, 1998)
Volatility, Uncertainty, Complexity and Ambiguity (VUCA)

- **Volatility:** The nature and dynamics of change, and the nature and speed of change forces and change catalysts

- **Uncertainty:** The lack of predictability, the prospects for surprise, and the sense of awareness and understanding of issues and events

- **Complexity:** The multiplex of forces, the confounding of issues, no cause-and-effect chain and confusion that surround an organization.

- **Ambiguity:** The haziness of reality, the potential for misreads, and the mixed meanings of conditions; cause-and-effect confusion

Team Training Model

Team Performance Model

Team Task Model

- Individual & Team Attributes
- Team Task Processes
- Training Environment
- Task Outcomes

Training Overlay Model

- Brief Instruct Monitor Evaluate Debrief
- Set-up Monitor Control Record
- Training Delivery & Evaluation
  - Instruction & Exercise Management
  - Training Environment Management

Training Strategy

Training Analysis & Design

(Huddlestone and Pike, 2016)
TCTNA Process Model

Team Performance Model
- Team Task Model
  - Task Outcomes
  - Team Task Processes
  - Task Environment
  - Individual & Team Attributes

Training Overlay Model
- Training Delivery & Evaluation
  - Brief Instruct
  - Monitor Evaluate Debrief
  - Training Strategy
- Training Analysis & Design
  - Direct Inform
  - Training Environment Management
  - Instruction & Exercise Management

Training Options Analysis
- Constraints, Assumptions, Risks & Opportunities Analysis

Training Environment Analysis

Project Initiation
- Team/Collective Task Analysis
- Training Overlay Analysis
Case Study Example:
Maritime Force Protection
Team/Collective Task Analysis Steps

The process steps for Team/Collective Task Analysis are:

- Establish the scope of the task.
- Describe the training audience.
- Identify the range of initial conditions in which the task may be executed.
- Conduct a detailed analysis of the task.
- Identify the teamwork-related Knowledge, Skills and Attitudes (KSAs) required to support task execution.
Also need to consider:
- Numbers
- Locations,
- Throughput
### Team Role Table Entry Examples

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Captain</strong></td>
<td>Overall responsibility for the safety of the ship. Provides guidance to the Principal Warfare Officer (PWO) on tactical decision making and application of ROE.</td>
</tr>
<tr>
<td><strong>Principal Warfare Officer (PWO)</strong></td>
<td>Tactical command of the ship and integrated use of the sensors and weapons systems. Application of ROE. Issuing weapons control orders.</td>
</tr>
<tr>
<td><strong>Weapons Operator</strong></td>
<td>Search for and evaluate threats, prioritise targets. Operate weapons (General Purpose Machine Gun (GPMG), Mini-gun) including loading, firing, re-loading, and conducting stoppage drills.</td>
</tr>
</tbody>
</table>

If you were doing analysis at the collective (team of teams) level, what level would role entries be written at?
# Task Scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Maritime Force Protection of a Type 23 Frigate against an asymmetric threat, whilst at cruising watch in open waters.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Open waters leading to confined waters such as straits, transits and harbour approaches. Variable sea-state and possibility of poor visibility due to local weather conditions.</td>
</tr>
<tr>
<td>Information</td>
<td>Personal role radios and internal command lines on-board. Royal Navy Command Support System chat connection to higher command.</td>
</tr>
</tbody>
</table>
| Human | **Civilian**  
Local shipping, Operators of local shipping (not hostile).  
Possibility of smugglers in fast moving small craft.  
**Military**  
**Friendly forces:** Command Headquarters.  
**Neutral forces:** None  
**Enemy forces:** asymmetric threat of non-conventional forces in small fast craft equipped with small arms, rocket propelled grenades, or operating waterborne improvised explosive devices.  
Possibility of simultaneous attack from multiple craft. |
| Resources: | **Own ship equipment:** Radar and Electro-optical sensors; GPMG x 4; Miniguns x2; Flares, Searchlight and Loudhailer. |
## Task Conditions

**Scenario ctd** | Maritime Force Protection of a Type 23 Frigate against an asymmetric threat, whilst at cruising watch in open waters.

<table>
<thead>
<tr>
<th>Events</th>
</tr>
</thead>
</table>
| • Small, unidentified fast craft heads towards ship on collision heading, does not respond to escalation of force measures, turns to follow ship when ship changes heading and speed, **opens fire on ship with small arms and rocket propelled grenades.**  
  • Small, unidentified fast craft heads towards ship on collision heading, does not respond to escalation of force measures, turns to follow ship when ship changes heading and speed, **maintains collision course with ship (waterborne IED).**  
  • Smugglers in small fast craft heading towards ship, do not respond to escalation of force measures, but maintain their heading.  
  • Fishing vessels on collision heading with the ship respond to escalation of force measures. |
## Task Conditions

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Political** | Political conditions that might impact on task execution. Examples include:  
• Home popular support;  
• UN Security Council Resolution;  
• Host government support;  
• Host population support;  
• Presence of non-state actors;  
• Absence of the rule of law. |
| **Economic**  | Economic conditions that might impact on task execution. Examples include:  
• Economically failing country;  
• Presence of starvation and famine;  
• Economic interests of indigenous security forces;  
• Corruption amongst government and local officials. |
### Task Description Table

**A2.0 Surface Investigate**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Process</th>
<th>Output(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3 Contact heading, range speed and behaviour</td>
<td><strong>Process Participants:</strong> Bridge team &amp; Ops room team&lt;br&gt;<strong>Process Description:</strong> (including modes of action)&lt;br&gt;• Each team member reports the information they have about the contact in accordance with the Surface Investigate SOP, which specifies the sequence of reporting.&lt;br&gt;• OOW synthesises the information and determines the classification.&lt;br&gt;• SPC manually enters contact if not seen on radar and adds classification&lt;br&gt;<strong>Key team interactions:</strong> Coordinated reporting ensuring no over-talk, broadcast of classification so all team members have SA about the contact&lt;br&gt;<strong>Critical Errors and Consequences:</strong> Over-talk leading to information not being heard and potential for incorrect classification</td>
<td>S4 Contact classified as suspect&lt;br&gt;S5 Contact classified as friend, assumed friend or neutral</td>
</tr>
</tbody>
</table>

**Variables affecting difficulty:** Volume of shipping in the area<br>Multiple, simultaneous threats<br>Sea state<br>Visibility

<table>
<thead>
<tr>
<th>Variables affecting difficulty</th>
<th>Process assessment criteria&lt;br&gt;Comprehensiveness of the search though all arcs</th>
<th>Output assessment criteria&lt;br&gt;Timeliness, completeness accuracy of the report, on the correct circuits.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data capture requirements</strong></td>
<td>Observation and recording of team actions and communication</td>
<td><strong>Data Capture Requirements</strong>&lt;br&gt;Recording of contact reports, time and originator. Surface picture</td>
</tr>
</tbody>
</table>
Constraints, Assumptions, Risks and Opportunities Analysis
<table>
<thead>
<tr>
<th>Constraint</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weapons effects cannot be trained live</td>
<td>Weapons effects need to be simulated.</td>
</tr>
<tr>
<td>A simulator system is classified</td>
<td>The simulator cannot be networked with unclassified simulation systems.</td>
</tr>
<tr>
<td>Augmentees are only available for two weeks per year for training</td>
<td>Duration of training with a fully augmented team is limited.</td>
</tr>
<tr>
<td>Instructional Role Players are only available for one week per year</td>
<td>Interactions with specific non-team actors may be limited. Tasks involving these non-team actors should be identified and prioritised.</td>
</tr>
</tbody>
</table>
Assumptions

Any assumptions made in the analysis should be recorded and reviewed periodically. Examples might include:

- Trainee availability
- Training throughput
- Starting date for training
Risks

Typically held in a risk register with entries such as:

- **Risk Description**: Availability of Subject Matter Experts to inform analysis and design
- **Cause**: SMEs not available in time to inform analysis and design
- **Effect**: TNA and training design incomplete; immature training solution
- **Probability**: Low
- **Impact**
  - **Performance**: Medium
  - **Time**: High
  - **Cost**: Low
- **Risk Owner**: TNA Steering Group
- **Mitigation Action**: Steering group to direct SME availability, including industrial SMEs
- **Mitigation Cost**: Minimal (e.g. travel)
<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Description</th>
</tr>
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</table>
| Individual weapons training system due for refresh | Team training solution could be based on an extension of the individual weapons training solution, provided there are:  
• enough weapons stations to cater for team training requirements,  
• suitable communication facilities and  
• adequate red force representation. |
Training Environment Analysis

- Training Environment Model
- Fidelity (physical, functional and task)
- Specifying training environment components
The training environment is a **subset** of the task environment containing **all the features** of the task environment **necessary** for **replicating the required range of credible tasks**.
Training Environment Diagram – Bridge

Capt - Captain
PWO - Principal Warfare Officer
OOW - Officer of the Watch
BM - Bosun's Mate
QM - Quarter Master
Radio Op - Radio Operator

Non Team Actors & Dynamic Natural Features
Sensors, Effectors and Information Environment Interfaces
External Physical and Information Environments
Sensors, Effectors and Information Environment Interfaces
Team Members & Internal Physical Environments
Internal Information Environment

Personal Role Radio
Group Lines: Command Open Line/Armament Broadcast

Sea
Insurgent Crewman
Insurgent Helmsman
Small arms
Helm
Asymmetric Surface Threat Vessel(s)

Own Ship
Local shipping
Bridge Windows
Helm
Radio
Flares
Loud Haler
Searchlight
Training Environment Diagram – Ops Room

- Sea
- Insurgent Helmsman
- Insurgent Crewman
- Helm
- Small Arms
- Local Shipping
- Asymmetric Surface Threat Vessel(s)
- Radar
- ESM Sensor
- GPEOD
- PWO
- SPS
- SPC
- ESM Op
- GPEOD Op

Group Lines: Command Open Line/Armament Broadcast

GPEOD - General Purpose Electro-optical Device
ESM - Electronic Surveillance Measures
SPC - Surface Picture Compiler
SPS - Surface Picture Supervisor
PWO - Principal Warfare Officer
GPEOD Op - GPEOD Operator
ESM OP - ESM Operator

Non Team Actors & Dynamic Natural Features
Sensors, Effectors and Information Environment Interfaces
External Physical and Information Environments
Sensors, Effectors and Information Environment Interfaces
Team Members & Internal Physical Environments
Internal Information Environment
Training Environment Diagram – Upper Deck

- Sea
  - Insurgent Crewman
    - Small Arms
  - Insurgent Helmsman
    - Helm
  - Movement
  - Visual

- Local Shipping
- Own Ship
- Asymmetric Surface Threat Vessel(s)
  - GPMG x 4
  - Mk44 x 2

- LGC-P Local Gun Controller - Port
- LGC-S Local Gun Controller - Starboard
- P2-P5 -Port Battery Weapons Operators
- S3-S5 Starboard Battery Weapons Operators

- Group Lines: Command Open Line/Armament Broadcast
- Personal Role Radios

- Non Team Actors & Dynamic Natural Features
- Sensors, Effectors and Information Environment Interfaces
- External Physical and Information Environments
- Sensors, Effectors and Information Environment Interfaces
- Team Members & Internal Physical Environments
- Internal Information Environment
Specifying Training Environment Requirements to Support Training Tasks

- Physical and Functional Fidelity
- Templates for specifying training environment elements to support training tasks.
Physical and Functional Fidelity

**Physical Fidelity:** the physical attributes of the element, such as look, feel, weight, size and sound.

**Functional Fidelity:** does it respond and behave like the real thing i.e. how the element functions in terms of the responses that it produces to the inputs that it receives.

**Antoinette Trainer**

**Sanders Trainer**
## Specifying Dynamic Natural Features

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<thead>
<tr>
<th>Environment Element</th>
<th>Physical Fidelity</th>
<th>Functional Fidelity</th>
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<tr>
<td>Dynamic Natural Environment Features</td>
<td>Description of the physical attributes of the element of significance for the task being executed: includes shape, size, colour, sound.</td>
<td>Description of the dynamic attributes of the element and its modes of action on other elements in the environment.</td>
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<td>Sea</td>
<td>Colour, appearance, size of waves.</td>
<td>The waves associated with higher sea states cause vessels to pitch and roll. The movement of asymmetric threat vessels is significant because the weapons operators have to shoot at a moving target. The movement of the own ship is significant because upper deck movement affects the weapons operators’ sight picture and the effective arc of the weapons.</td>
</tr>
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### Specifying External Physical Environment Elements

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<td><strong>External Physical Environment Elements</strong></td>
<td>Description of the physical attributes of the element of significance for the task being executed: includes shape, size, colour, sound etc.</td>
<td>Description of the dynamic attributes of the element and its responses to actions from other elements in the environment (e.g. in a car accident, what sorts of damage would be sustained by the vehicles for given impact velocities?).</td>
</tr>
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<td><strong>Asymmetric Surface Threat Vessel</strong></td>
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<td><strong>Asymmetric Surface Threat Vessel</strong></td>
<td>Representative physical appearance and size for types of craft considered to be in use by asymmetric forces.</td>
<td>Speed, acceleration and rate of turn should be representative for each type of craft considered to be in use by asymmetric forces.</td>
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Specifying Internal Physical Environments

<table>
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<th>Internal Physical Environments</th>
<th>The following need to be captured for each working environment identified:</th>
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<td>• The sensor and effector user interfaces in the workspace;</td>
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<td>• Information systems interfaces (internal and external);</td>
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<td>• Other elements required in the workspace (e.g. desks, consoles);</td>
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<td>• Relative orientation and positioning of team-member workstations if</td>
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<td>• Any other physical features of the workspace that are considered relevant</td>
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<td>for task performance (e.g. lighting levels, background noise).</td>
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Whilst the description of the work environment is mainly concerned with physical attributes, there may be functional elements that need to be captured such as control of lighting levels.

<table>
<thead>
<tr>
<th>Upper Deck</th>
<th>Team Members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Interfaces:</td>
</tr>
</tbody>
</table>

@IITSEC

NTSAToday
### Specifying Internal Physical Environments

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### Upper Deck

**Team Members:** 3 starboard weapons operators, 3 port weapons operators.

**Interfaces:** 4 GPMGs on mounts, 2 Mk 44 Miniguns on mounts, personal role radio for each weapons operator.

Each weapon position should be at the correct apparent height above sea level.

Each weapon position should have a representative field of view, including any restrictions to lines of sight that are appropriate relative to its position on the ship.

The weapon operators’ angle of view of the sea and surface vessels, and the alignment of the weapon, should move in response to sea state and ship’s manoeuvre.
# Sensor and Effector Specification: Minigun

<table>
<thead>
<tr>
<th>User Interface Physical Fidelity</th>
<th>User Interface Functional Fidelity</th>
<th>Modes of Action Supported &amp; Functional Fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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Note: applies to non-team actor interfaces too!
## Sensor and Effector Specification: Minigun

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</table>
| Accurate representation of the physical attributes of the weapon and mount to include:  
• shape and size,
• weight,
• trigger,
• safety catch,
• cocking handle,
• loading mechanism,
• sight field of view and adjustment,
• arcs of manoeuvre (lateral and vertical),
• firing arc stops. | • trigger pressure,  
• sight picture,  
• recoil,  
• manoeuvrability on the mount,  
• tracer visibility. | Modes: firing 7.62 rounds and tracer, continuously and in bursts.  
Fidelity: Accurate representation of:  
• rate of fire,  
• range,  
• muzzle velocity,  
• round trajectory, live round/tracer mix,  
• effects of fall of shot on the target. |

Note: applies to non-team actor interfaces too!
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<tr>
<td>Communications systems: hardware requirements for communications systems need to be identified such as control panels, speakers, headsets and visual displays, along with critical aspects of physical fidelity for each.</td>
<td>Communications systems: functional requirements such as channel selection, push to transmit, display adjustment that are critical to the task must be identified.</td>
<td>Communications systems: Modes of action information transmission and reception modes need to be identified (voice, video, data) Functional fidelity: the number of channels that need to be supported, reliability, quality</td>
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Example: Command line interface aboard ship
### Information Environment Specification

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**Example: Command line interface aboard ship**

- Headsets with microphones.
- Control panel with switches to select transmit and receive on each channel.
- Selection of multiple lines to receive (on Left/Right ear phones) and a single line to transmit.
- Transmission to all users with receive selected on a given channel. Reception from all users transmitting on lines which are selected for receive.
### Information Environment Specification

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Information systems:</td>
<td>Information systems:</td>
<td>Information systems:</td>
</tr>
<tr>
<td>Physical hardware requirements</td>
<td>The key aspects of functionality</td>
<td>the required capabilities for</td>
</tr>
<tr>
<td>(often PC-based but may be bespoke)</td>
<td>associated with both the hardware</td>
<td>information transfer in and out of each</td>
</tr>
<tr>
<td>Software applications screen</td>
<td>interface and the applications</td>
<td>application should be identified here,</td>
</tr>
<tr>
<td>interfaces</td>
<td>interfaces for data entry and</td>
<td>including latency</td>
</tr>
<tr>
<td></td>
<td>retrieval</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Image]</td>
<td></td>
</tr>
</tbody>
</table>

**Information Fidelity:** Properties of the information in the system such as:

- Media types
- Content and level of detail
- Perishability
# Non-Team Actor Specification

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Behaviour</th>
<th>Knowledge and Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the actor appears in the physical environment their relevant physical attributes such as their manner of dress and language need to be captured.</td>
<td>The actions which they take and sensors, effectors and information environment interfaces that they use must be defined. This may include cultural aspects of behaviour.</td>
<td>Specific knowledge and skills required to carry out the role (e.g. tactics, doctrine, operating equipment and systems interfaces, terminology)</td>
</tr>
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## Non-Team Actor Specification

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<th>Behaviour</th>
<th>Knowledge and Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the actor appears in the physical environment</td>
<td>The actions which they take and sensors, effectors and information</td>
<td>Specific knowledge and skills required to carry out the role</td>
</tr>
<tr>
<td>their relevant physical attributes such as their manner of dress and</td>
<td>environment interfaces that they use must be defined. This may include</td>
<td>(e.g. tactics, doctrine, operating equipment and systems interfaces, terminology)</td>
</tr>
<tr>
<td>language need to be captured.</td>
<td>cultural aspects of behaviour.</td>
<td></td>
</tr>
<tr>
<td>Dress consistent with the local population.</td>
<td>Manoeuvring of the insurgent craft in response to escalation of force</td>
<td>Ability to helm the insurgent craft.</td>
</tr>
<tr>
<td></td>
<td>measures and direct fire from the ship, consistent with known insurgent</td>
<td>Knowledge of insurgent tactics in response to escalation of force measures and direct</td>
</tr>
<tr>
<td></td>
<td>tactics.</td>
<td>fire.</td>
</tr>
</tbody>
</table>

- Dress consistent with the local population.
- Manoeuvring of the insurgent craft in response to escalation of force measures and direct fire from the ship, consistent with known insurgent tactics.
Training Overlay Analysis

- Training overlay model
- Training strategy
- Training staff capability requirements
- Training overlay interfaces to the training environment
Team Training Model

Team Performance Model

- Individual & Team Attributes
- Team Task Processes
- Training Environment
- Task Outcomes

Team Task Model

- Brief, Instruct, Monitor, Evaluate, Debrief
- Set-up, Monitor, Control, Record

Training Overlay Model

- Training Delivery & Evaluation
- Instruction & Exercise Management
- Direct, Inform
- Training Environment Management
- Training Strategy
- Training Analysis & Design

(Huddlestone and Pike, 2016)
Training Overlay Model
# Training Priorities – Risk Analysis

<table>
<thead>
<tr>
<th>Task</th>
<th>Critical Error</th>
<th>Consequences</th>
<th>L*</th>
<th>S**</th>
<th>R**</th>
<th>Train (Y, N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0  Protect ship from an asymmetric waterborne threat</td>
<td>Ineffective search</td>
<td>Late detection of potential threat</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Contact not correctly categorised as suspect</td>
<td>Upper deck weapons not deployed in time to counter the threat – damage to ship, threat to life</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Contact not correctly categorised as hostile</td>
<td>Contact able to get within range to attack the ship - damage to ship, threat to life</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Inaccurate fire from upper deck weapons</td>
<td>Contact able to attack the ship - damage to ship, threat to life</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>Y</td>
</tr>
</tbody>
</table>
**Training Objectives**

**Overarching conditions applicable to all training objectives:**

With the ship in transit, at cruising watch state, with all existing contacts classified, in an area where there is a potential asymmetric surface threat. (Detailed description provided by the training environment model)

<table>
<thead>
<tr>
<th>Performance</th>
<th>Conditions</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task Execution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 Carry out the Surface Investigate procedure ensuring that:</td>
<td>Given a reported contact which is a potential threat.</td>
<td>Contact correctly classified.</td>
</tr>
<tr>
<td>a. Team member responses are synchronised so that information is not lost and the process is not delayed by over-talk.</td>
<td>Team member responses synchronised in accordance with the Surface Investigate SOP.</td>
<td>Classification broadcast to all appropriate teams.</td>
</tr>
<tr>
<td>b. The resulting contact classification is broadcast to the Bridge, Upper Deck Weapons and Ops Room teams to maintain team situational awareness.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supporting KSAs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 Explain the surface investigate SOP</td>
<td>Given an example of a contact report and the data available to each team member involved in searching for contacts.</td>
<td>In accordance with the Surface Investigate SOP</td>
</tr>
</tbody>
</table>
Training Design

Initial consideration of:

- Training Structure and Sequencing
- Training and Assessment Methods
- Training Duration
- Training System Capacity (Surge and steady state)
- Training Environment Selection
Training Strategy - Part Task Training

Full Task Training Environment
- Sub-Task A Training Environment
- Sub-Task B Training Environment
- Sub-Task C Training Environment

Command Element Training
Force Element Role Players

Cmd Element Role Players
Force Element Training

Whole Force Training
Training Staff Capability Requirements
Examples

- Lieutenant Commander (Lt Cdr) Staff Warfare Officer (Above Water Warfare specialist) to plan the exercise and brief, monitor and debrief the PWOs and the Captain
- Lt Cdr Staff Warfare Officer (Navigation specialist) to brief, monitor and debrief the Bridge Team (with the exception of the PWO and Captain)
- Warrant Officer (WO) / Chief Petty Officer (CPO) Above Water Tactics Instructor to brief, monitor and debrief the Ops Room Team ratings
- WO/CPO Above Water Warfare (Gunner) to brief, monitor and debrief the Upper Deck Team
Training Overlay Connections to the Training Environment

Team Performance Model

- Individual & Team Attributes
- Team Task Processes
- Training Environment
- Task Outcomes

Team Task Model

- Brief
- Instruct
- Monitor
- Evaluate
- Debrief
- Direct
- Inform
- Set-up
- Monitor
- Control
- Record

Training Overlay Model

- Training Delivery & Evaluation
  - Instruction & Exercise Management
  - Training Environment Management

Training Strategy

Training Analysis & Design

@IITSEC  NTSA Today
Training Overlay Requirements

Task fidelity: can credible scenarios be created, run and adapted that require representative task performance?

Can appropriate data be captured and used for providing feedback including After Action Review?
## Specification Template - Overlay Interfaces to the Training Environment

<table>
<thead>
<tr>
<th>Training Environment Element</th>
<th>Training Overlay Requirements to interface to the Training Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Environment Management</td>
</tr>
<tr>
<td>Training Audience</td>
<td></td>
</tr>
<tr>
<td>Asymmetric surface threat</td>
<td></td>
</tr>
<tr>
<td>Sea State</td>
<td></td>
</tr>
<tr>
<td>Upper Deck Weapons</td>
<td></td>
</tr>
<tr>
<td>Training Environment Element</td>
<td>Training Overlay Requirements to interface to the Training Environment</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Environment Management</td>
</tr>
<tr>
<td>Training Audience</td>
<td>N/A</td>
</tr>
<tr>
<td>Asymmetric surface threat</td>
<td>Set up of single or multiple contacts, control of course, speed and actions. View track and current position.</td>
</tr>
<tr>
<td>Sea State</td>
<td>Set the sea state for the exercise.</td>
</tr>
<tr>
<td>Upper Deck Weapons</td>
<td>Set/reset and monitor ammunition levels.</td>
</tr>
</tbody>
</table>
Example of a supporting system

Slide courtesy of 4C Strategies showing their EXONAUT® software product
Training Options Analysis

- Evaluation criteria development
- Training option identification and description
- Comparison of training options
Evaluation Criteria Examples

- **Performance:**
  - Coverage of the training objectives;
  - Provision of the required range of conditions in the training environment;
  - Support for the training overlay functions.

- **Costs:**
- Capacity to support the required training throughput (surge and steady state);
- Flexibility (e.g. adaptability to meet future changes);
- Interoperability (e.g. potential for a synthetic training system to be connected to other synthetic training systems);
- Development time relative to key dates such as In Service Date;
- Staff training requirements
## Sources of Cost

<table>
<thead>
<tr>
<th>Capital Cost Items</th>
<th>Annual Through Life Support Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Media</td>
<td>Live and Workplace Training Instructors</td>
</tr>
<tr>
<td>Integration into Existing Training Solutions</td>
<td>Train the Trainer Courses</td>
</tr>
<tr>
<td>Training Support Systems</td>
<td>Training Support Staff</td>
</tr>
<tr>
<td>First of Class Training</td>
<td>Training Administrators</td>
</tr>
<tr>
<td>Reference Documentation</td>
<td>Travel and Subsistence</td>
</tr>
<tr>
<td>Training Design</td>
<td>Consumables and Utilities</td>
</tr>
<tr>
<td>New or Refurbished Training Infrastructure</td>
<td>Training Design</td>
</tr>
<tr>
<td>IT Infrastructure</td>
<td>Training Publications</td>
</tr>
<tr>
<td>Risk Mitigation</td>
<td>Facilities Management</td>
</tr>
</tbody>
</table>

- ItRand Africa
Training Option Descriptions

- Overview
- Training environment provision
- Staff tasks
- Staff requirements
- Supporting systems
- Resources
- Staff training requirements
- Training linkages (to other components in the individual – collective continuum)

- Equipment
- Infrastructure
- Training information management
- Organisational responsibilities
- Logistics
- Interoperability
### Evaluating the Capability of Existing Systems (Evaluation Matrix)

<table>
<thead>
<tr>
<th>Environment Elements</th>
<th>Live with Ships RIB as the Asymmetric Threat</th>
<th>Live with contracted RIBs as the Asymmetric Threat</th>
<th>Maritime Synthetic Training System (MaST)</th>
<th>Close Range Weapons Trainer</th>
<th>Bridge Trainer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurgent Crewman</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurgent Helmsman</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local shipping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own ship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asymmetric Threat</td>
<td>Limited</td>
<td>Limited</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asymmetric Threat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small arms</td>
<td>Critically Limited – no weapons effects</td>
<td>Critically Limited – no weapons effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPEOD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge Windows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPMG</td>
<td>Critically Limited – no weapons effects</td>
<td>Critically Limited – no weapons effects</td>
<td></td>
<td></td>
<td>Limited – only 2 GPMGs</td>
</tr>
</tbody>
</table>

- **Fully meets the requirement**: Green
- **Partially meets the requirement**: Yellow
- **Does not meet the requirement**: Red
Types of Simulation Mapped onto Training Environment Model Components

```
Virtual Simulation

<table>
<thead>
<tr>
<th>Team Members</th>
<th>Sensors and Effectors</th>
<th>Physical Environment</th>
<th>Sensors and Effectors</th>
</tr>
</thead>
</table>

Live Simulation

Constructive Simulation

<table>
<thead>
<tr>
<th>Sensors and Effectors</th>
<th>Information Environment</th>
<th>Sensors and Effectors</th>
</tr>
</thead>
</table>

Non-Team Members
```
Continual innovation in possible substitutions demonstrated daily on the IITSEC exhibition
Evaluation Criteria Examples

- **Performance:**
  - Coverage of the training objectives
  - Provision of the required range of conditions in the training environment
  - Support for the training overlay functions

- **Costs**
- Capacity to support the required training throughput (surge and steady state)
- Flexibility (e.g. adaptability to meet future changes)
- Interoperability (e.g. potential for a synthetic training system to be connected to other synthetic training systems)
- Development time relative to key dates such as ISD
- Staff training requirements
<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live with Ships RIB as the Asymmetric Threat</td>
</tr>
<tr>
<td>1. Availability</td>
<td></td>
</tr>
<tr>
<td>2. Accessibility</td>
<td></td>
</tr>
<tr>
<td>3. Cost</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Training Objectives</th>
<th>Training Objective Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO 1 Search for Threat</td>
<td></td>
</tr>
<tr>
<td>TOS5 Counter Threat</td>
<td>No weapons effects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment Elements</th>
<th>Evaluation of environment and overlay requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea</td>
<td></td>
</tr>
<tr>
<td>Insurgent Crewman</td>
<td></td>
</tr>
<tr>
<td>Insurgent Helmsman</td>
<td></td>
</tr>
<tr>
<td>Local shipping</td>
<td></td>
</tr>
<tr>
<td>Own ship</td>
<td></td>
</tr>
<tr>
<td>Asymmetric Threat</td>
<td>Limited</td>
</tr>
<tr>
<td>Small arms</td>
<td>Critically Limited – no weapons effects</td>
</tr>
<tr>
<td>GPMG Mode of action</td>
<td>No fall of shot</td>
</tr>
<tr>
<td>GPMG Overlay reqts</td>
<td>No hit indication</td>
</tr>
<tr>
<td>Mk44 HMI</td>
<td></td>
</tr>
<tr>
<td>MK44 Mode of Action</td>
<td>No fall of shot</td>
</tr>
<tr>
<td>Mk44 Overlay Reqs</td>
<td>No hit indication</td>
</tr>
</tbody>
</table>

- Fully meets the requirement
- Partially meets the requirement
- Does not meet the requirement
Iterative application of TCTNA in acquisition

- Issues
- Iteration of TCTNA
Issues

- Information for detailed TNA not usually available until during demonstration/manufacture
- TNA outputs (notably Rough Order of Magnitude costs) required to inform Initial Gate and Main Gate Business Cases

URD - User Requirements Document
SRD - System Requirements Document
Iteration of TCTNA

URD - User Requirements Document
SRD - System Requirements Document

Initial Gate

Main Gate

Ready for Training Date

In Service Date

Concept Assessment Demonstration Manufacture In-Service Disposal

Iterative application of the TCTNA analysis stages
Project Initiation

- Purpose and Output of Project Initiation
- Steering Group Composition
Purpose of Project Initiation

Project management and planning activity to:
- Define the requirement
- Define the deliverables
- Develop a plan to meet the requirement
Output of Project Initiation

The output of this phase is the Project Initiation Document which details:

- Aim of the TCTNA;
- Context of the TCTNA;
- Links to other Training Analyses;
- Required Outputs;
- Key Project Data;
- Management Structure and Process;
- Data Sources and Points of Contact;
- Resources;
- Methodology;
- Plan and Timescales;
- CARO
Steering Group Composition

- **Chair**: It is suggested that the Chair would be a represent the sponsor of the TCTNA.
- **User Representative**: To provide the organisational perspective of the capability requirements.
- **Training Delivery Organisation Representative**: To provide the training delivery organisation perspective on extant training capability and the implications for adopting alternative training solutions, which may include infrastructure requirements and logistics.
- **Human Resources Representative**: To advise on personnel issues.
- **Quality Assurance Personnel**: Ensures coherence with applicable Policy and Guidance.
- **Industry**: At the Chair’s discretion if contracts have been let. Could be prime contractor and / or training solution / analysis contractor.
- **Subject Matter Experts (SMEs)**: As required. It should be noted that many SMEs may not have experience of the new capability, but will have experience of similar legacy capabilities.
- **Acquisition Organisation Human Factors Representative**: To advise on the integration and coordination of TCTNA activity with broader human factors activity associated with system/platform acquisition.
Any Questions?

- Identify the areas of complexity of team and collective training that have to be addressed in the training needs analysis process.
- Recognise and describe the elements of the supporting models which underpin TCTNA.
- Describe the purpose and outputs of the key analytical stages of TCTNA, and how these inform subsequent stages of training design.
- Illustrate the interconnections between the main areas of analysis.
- Outline how TCTNA can be applied iteratively in the acquisition process and in auditing existing means of training delivery.