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ANNEXES TO: COGNITIVE TASK ANALYSIS OF THE HALIFAX-CLASS OPERATIONS ROOM
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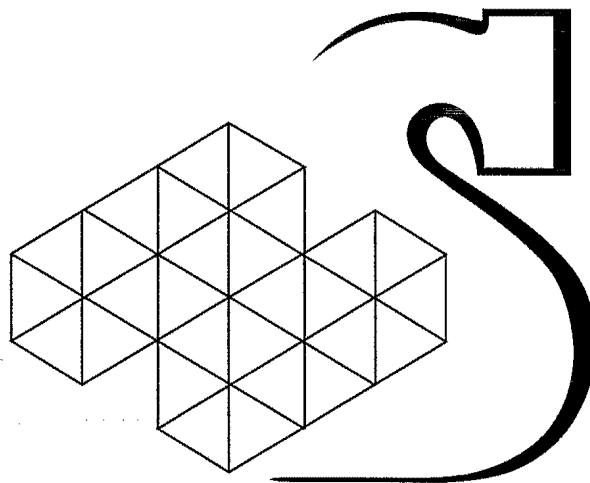Notes:

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March 1999

ANNEXES TO:

COGNITIVE TASK ANALYSIS OF THE
HALIFAX-CLASS OPERATIONS ROOM OFFICER:

DATA SHEETS

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Introduction

Annex A, B, and C contain three sets of data tables organized in terms of ORO goals. Annex D illustrates how ORO goals taken from Annex A-C may be cross-referenced to a specific threat related activity sequence.

- **Coming on watch goals - Annex A**
  These data tables describe the goals of the ORO when coming on watch. This is the time when the ORO must be updated about information that has arrived or events that have occurred since he or she was last on watch. This information must be reviewed and related to likely mission needs during the coming watch. The status and schedule of ongoing tasks must be determined. The capability of the ship and the TG must be reviewed. Critical or complex issues or procedures may need to be refreshed. Members of the incoming watch must be briefed and focussed for the coming watch and the ORO's command presence established.

- **Background (OR management) goals - Annex B**
  These data tables describe the ongoing goals of the ORO that must be pursued during any watch. These goals include managing the OR team, dealing with the information contained in the text or audio messages that come into the OR, building and maintaining awareness of all pertinent information. Successful attainment of these goals prepare the ORO and the OR to face future threats.

- **Foreground (threat related) goals - Annex C**
  These data tables describe the goals of the ORO during a generic threat response. Exactly which goals are pursued will vary with the type and circumstances of the threat. For example, establishing communication with (and warning off) a potentially hostile contact may not be appropriate once more aggressive Rules of Engagement have been established. These goals may also overlap with some background goals. For example, the threat related goal of maximizing, optimizing and correlating information from different sensors concerning one particular threat contact overlaps with the background task of managing the OR team. Conversely, information garnered during the background task of monitoring incoming text messages may affect interpretation of or reaction to a potential threat.

- **Scenario event sequences - Annex D**
  In this Annex, activities for two scenario events requiring active engagement (i.e. firing of weapons) are tabulated and cross referenced to the data tables in Annex A, B, and C.

In the comments section of some data tables ad hoc observations about design or research issues have been inserted. Design and research issues were not systematically reviewed for each ORO goal but these comments were considered worth leaving in.

Key:
RT: Response Time to complete some task or achieve some criterion.
%: The level of completeness and accuracy achieved with respect to an area of interest.
"Marie Celeste": RT to become aware of 'situation' from scratch using only the information accessible through the system and/or % awareness achieved after a given time – using only the resources of the system.

ANNEX A:

ORO Goals for
COMING ON WATCH

Coming on Watch goals:

Introduction

Normal staffing is three qualified OROs, one as Combat Officer plus two junior OROs working watch and watch about. At Action Stations the Combat Officer and off watch ORO work in support of the ORO on watch, performing tasks under his/her direction. The Combat Officer is responsible for longer range planning i.e. days ahead. OROs are involved in earlier mission planning so will bring to the watch a mental model of the overall mission intent and plan, its schedule, activities to date, background intelligence about goals, enemy threats, etc. and the various compromises the plan(s) represent. Each ORO arrives on watch with a mental model of what to expect during the next watch in terms of the mission and for the routine during any watch at that time of day (e.g. certain status reports or forecasts such as the ATO arrive within certain time brackets each day.) Each ORO updates and refines his or her expectations during the process outlined below as he or she comes on watch, looking ahead for 8-12 hours.

The ORO will first check outside (weather, sea-state, other vessels around, coastline, etc) before coming into OR to take over the watch. The ORO wants to be able to visualize what is outside the OR and may go onto bridge to check with OOW. (May also review other sources such as daily orders, or hear rumours before coming to OR.)

Prior to getting a briefing from the outgoing ORO, the incoming ORO walks around the OR to check on particular people and each OR team, look over state boards, review messages that have arrived since last on watch role, etc. The ORO will already have a mental model of capabilities of his or her own OR team, including the OOW. Reviewing messages can be time-consuming and may take 15-20 minutes. During a 2-3 week exercise it was reported that there could be as many as 20,000 text messages coming into the OR, in addition to any voice traffic. A lot of time is spent extracting information from text messages and entering this into briefing notes or aide memoirs. It is very easy to miss relevant information because of volume. The ORO needs to have awareness of context to select relevant items. This awareness of context usually arises from being involved in planning. The ORO may get several 6-8 page messages while on watch. Messages go into a series of binders (about 10) covering different aspects of operations.

The data tables in this Annex deal with the following ORO goals when coming on watch. These may overlap and are only in rough order of performance.

1. *Visualize external environment for the start of the watch.*
2. *Update own knowledge for coming watch from text msg information.*
3. *Establish schedule of anticipated events for watch.*
4. *Update understanding of threats.*
5. *Establish current activity levels and work focus among OR team(s)*
6. *Prepare check-list to monitor progress on required action items during watch*
7. *Review OR system performance (sensors, etc) and rectify or work around as required*
8. *Comprehend items in CO's order book.*
9. *Comprehend brief from outgoing ORO*
10. *Optimize own CCS .*
11. *Focus OR team on issues for coming watch. Establish command presence.*
12. *Review pertinent pre-plans, procedures and ROE for coming watch.*

Annex A:
COMING ON WATCH GOALS

1 - ORO goal(s): Visualize external environment for the start of the watch.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Obtain, picture and retain pertinent details of external environment immediately prior to coming on watch.
- Update this picture as required

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Pertinent features to look for • Visual picture of: - weather, - sea state, - visibility, - cloud cover, - moon phase. - visible ships, - coastline other local factors.	• Select pertinent info.	• Look around, ask bridge team.		SA: • % env details CM: • Comms @ environment: - # - duration - content (?) DM: • % categories covered.	SA: • Freeze probe before watch • Embedded probe (e.g. sitrep)during watch CM: • SME review - real time or video. DM: • Freeze probe before watch • Embedded probes • SME review - real time or video.

Comments:
ORO goes on deck or to bridge 10 minutes before going on watch.
Maybe difficult to simulate for test.
Could ORO get this from within OR with cameras e.g. STIR?

Annex A:
COMING ON WATCH GOALS

2 - ORO goal(s): Update own knowledge for coming watch from text msg information.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Review information in text messages that have arrived since last on watch.
- Select and retain pertinent information (including action required or implied) for use during watch.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Anything affecting:
  - ship or TG capability
  - sensors, wpns,
  - comms, a/c
  - mission plans
  – schedule for watch.
  – decision context
  _ ROE,
  - en threat profiles,
  - political news.)
	• Divide bgr vs action info.
	• Has action item been dealt with?
	• Who has seen msg?
	• Who should see msg?
	• Immediate vs delayed action required.
	• Relevant during watch?
	• Info put on state boards?
	• Short list items to check?
		ORO msg file
		Msg binders
		ORO turnover book.
		Highlighted notes on msg file.
		Outgoing ORO
			Takes 10-20 mins to go through msg file.
			ORO has priority for msg file but others coming on watch also need to see.
				SA:
				• % critical text msg content.
				• % retrieval key info during watch.
				CM:
				• Time to check N msgs.
				• # queries @ msg text..
				DM:
				• % info correctly sorted fo action, retention or retrieval.
					SA:
					• Freeze probe before watch
					• Embedded probe (e.g. sitrep)during watch.
					CM:
					• SME or S# review
					  - real time or video.
					DM:
					• Freeze probe before watch.
					• SME or S# review
					  - real time or video.

Comments:
Msgs follow a daily cycle i.e. certain msgs expected during watch e.g. ATO. Seldom time to get through back volume of msgs. Mission relevant info often missed. Info that may be of use later rather than immediately significant may be overlooked. Try to remember ROEs but usually consult ROE book because so important. Explicit action items in txt messages easier to recognize and record than implicit action items (e.g. to forward info to others, ensure boards updated, etc).

- Cognition:
  OROs have std scanning procedure for text messages. They scan subject line and then priority scan for info based on knowledge of message format or headings under which expect information to be organized. Novice more likely to take notes.
- Mental Models:
  ORO prioritizes search and retention of information using mental model for mission task(s) that will occur during watch.
  Simultaneous scanning for multiple types of relevant information can be error prone.
- Other:
  Research issue: understand more about how scan messages for mission relevant information. Use to improve the message format design to support ORO's needs.
  Help ORO to prioritize parts of msg to attend, retain, distribute based on mission needs for watch?

3 - ORO goal(s): Establish schedule of anticipated events for watch.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Identify, prioritize and retain schedule related information for the coming watch.
- Plan and deploy own and OR tm resources.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Routine events
  – report deadlines
  – incoming reports
• Special events
  – flying program
  – conferences
• Mission events
  – pre-planned actions
• Navigation route plan
	• Prioritize events.
	• Plan deployment
	  – own efforts
	  - OR team efforts
		• State board(s)
		  e.g. Fleet Exercise
		  Program (FLEX)
		• Daily orders?
		• Text messages.
		• Outgoing ORO.
			Use this knowledge to manage own and others workload during watch: i.e. to predict likely workload ahead of time and prepare.	SA:
				• % schedule of events
				• RT to criterion
				CM:
				• Comms @ schedule
				  - # queries
				  – duration
				  – content(?)
				DM:
				• % scheduling decisions
				• % scheduled responses
					SA:
					• Freeze probe before watch
					• Embedded probe during watch
					  – sitrep
					  – missed events
					CM:
					• SME or S# review
					  - real time or video.
					DM:
					• Freeze probe before watch.
					• SME or S# review
					  - real time or video.

Comments:

Could be assessed in a low fidelity simulation environment.
- Cognition:
  Number of items to remember and organize? How do OROs visualize and remember schedule for watch. Is this same for all OR members? How to select and record anticipated events in a way that facilitates recall and/or monitoring completion at appropriate time. Novice more likely to take notes.
- ORO problems:
  Tend to forget scheduled items under high stress. ORO needs to embed schedule related info in other info sources, e.g. own msg binder.

Annex A:
COMING ON WATCH GOALS

<u>4 - ORO goal: **Update understanding of threats**</u>

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Identify, comprehend and retain for future use, any changes to threat related information.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• All threat and threat profiles • Changes to above since last watch • Significance for mission	• Brief anyone? - (CO, OR, TG) • Change anything? – readiness? – sensor settings? – ROE? – Pre plans?	Message binders Threat board Outgoing ORO		SA: • % threats • % threat changes since last watch • %threat info used on watch CM: • RT to criterion • Comms @ threats - # comms – duration – content(?) DM: • % threat implications for watch ahead • % threat data recalled appropriately during watch	SA: • Freeze probe before watch • Embedded probe during watch – sitrep CM: • SME or S# review - real time or video. DM: • Freeze probe before watch. • SME or S# review - real time or video.

Comments:
ORO needs to embed threat related info in other info sources, e.g. msg binders. May be threat info that has not reached threat board.

5 - ORO goal: Establish current activity levels and work focus among OR team(s)

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Identify the current tasking of each OR team.
- Evaluate and re-focus OR team efforts as required to meet mission goals.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Mission related needs for OR effort for watch ahead.
• Current activities in OR.
• OR resources available now and later
	• Task(s) in hand OK?
	• Re-focus task(s)?
	• Who to assign
	• When to assign
		• Overhear OR tms on net
		• Walk @ OR and ask
		• Look @ from ORO CCS.
		• ORS, SWC, etc.
				SA:
				• %OR tm activities
				• % mission needs
				• %OR resource available
				CM:
				• RT to criterion
				• Comms @ tm activities
				  - # comms
				  – duration
				  – content(?)
				DM:
				• % task quality OK
				• % refocussing of tasks
				  – before & during watch
				• RT for decision on watch
					SA:
					• Freeze probe before watch
					• Embedded probe during watch
					  – e.g. new task done
					CM:
					• SME or S# review
					  - real time or video.
					DM:
					• Freeze probe before watch.
					• Embedded probe during watch
					  - SME or S# review real time or video.

Comments:
For evaluation, need scenario with range of activities among OR tm that vary in appropriateness for upcoming watch that ORO has to identify and re-assign.

Annex A:
COMING ON WATCH GOALS

6 - ORO goal: Prepare check list to monitor progress on required action items during watch

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Identify, and retain for use during the watch ahead, information about tasks to be completed.
- Monitor task completion during watch without degrading other ORO tasks (eg threat response).

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• All potential action items for follow up on watch.	• Prioritize items • Create short list. • Confirm status - in hand and OK – in hand not OK – to be assigned • Delegate to? • Establish deadlines.	Msg file. ORO turnover book. Outgoing ORO. OR tm members eg ORS Daily orders Message cycle. Mission plan	Used to manage workload of self and others.	SA: • % action items • % status CM: • RT to criterion • Comms @ action items - # comms – duration – content(?) DM: • % Priorities x item. • % follow up on watch • % delegation OK • % schedule OK	SA: • Freeze probe before watch • Embedded probe during watch – e.g. query on item status CM: • SME or S# review - real time or video. DM: • Freeze probe before watch. • Embedded probe during watch – SME or S# review real time or video.

Comments:
For evaluation need to consider a variety of action items (at various stages of progress) embedded in watch hand-over material. Novice may take notes.

7 - ORO goal: Review OR system performance (sensors, etc) and rectify or work around as required

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Review, understand, and retain for future reference information about the capabilities of systems affecting OR operations. (This includes repair, maintenance schedules, etc)

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Problems @ major systems (sensors, wpns, comms, EW, helo, etc). • General nature of problem & effect on OR performance • Schedule for correction. • Mission related priorities for coming watch	• Match capabilities with likely needs over watch? • Determine action – repair, work around, etc • Prioritize action.	• CSE, outgoing ORO, pertinent supervisor (EWS, ORS, SWC, ASWC, TS, CIO, SAC) State boards. Observation of OR equipment		SA: • % system deficiencies • % effect on OR • % schedule correction CM: • RT to criterion • Comms @ deficiencies - # comms – duration – content DM: • % direction @ deficiency corrections	SA: • Freeze probe before watch • Embedded probe during watch – e.g. query on item status CM: • SME or S# review - real time or video. DM: • Freeze probe before watch. • Embedded probe during watch - SME or S# review real time or video.

Comments:
For evaluation need variety realistic system problems in scenario with varying degrees of significance for upcoming watch.
- Cognition:
  Mostly retain in memory but might take notes. Novice more likely to take notes.

Annex A:
COMING ON WATCH GOALS

<table>
<tr><td colspan="7">8 - ORO goal: Comprehend items in CO's order book.</td></tr>
<tr><td colspan="7">Criteria: An ORO must be able to, in a timely, complete and accurate way:
•   Review, understand and retain for use during the watch, the instructions of the CO for matters under the direction of the ORO .</td></tr>
<tr>
<td>Awareness
needs</td>
<td>Decisions
required</td>
<td>Communication
sources</td>
<td>Workload
issues</td>
<td>Measure
% = complete + accurate</td>
<td>Method</td>
</tr>
<tr>
<td>• Specific instructions
• CO's intent
• Mission goals
• If - then cues</td>
<td>• Action on this watch?</td>
<td>Night order book.
Outgoing ORO.</td>
<td></td>
<td>SA:
• % CO orders
CM:
• RT to criterion
• Comms @ CO orders
  - # comms
  -- duration
  -- content(?)
DM:
• % during watch</td>
<td>SA:
• Freeze probe before
  watch
CM:
• SME or S# review
  - real time or video.
DM:
• Embedded probe during
  watch
  - SME or S# review
    real time or video.</td>
</tr>
</table>

Comments:
Familiar with CO's style. Need to understand intent and relation to mission.

• Cognition:
  Alerts to prompt when related issue occurs during watch – especially when under high workload.

9 - ORO goal: Comprehend brief from outgoing ORO

Criteria: An ORO must be able to, in a timely, complete and accurate way
- Review, query, and retain for use during the watch, information provided by the outgoing ORO.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Info from outgoing ORO
• Questions arising from incoming ORO's checks (see above serials).
	• Queries to outgoing ORO?
	• Accept watch?
		Face to face with ORO. CCS, GOP, JMCIS, ORO handover book	Takes 2-10 minutes depending on situation.	SA:
				• % ORO hand over info
				CM:
				• Comms @ hand over
				  - # comms
				  – duration (total time)
				  – content(?)
				DM:
				• % queries to outgoing ORO
				• % appropriate use on watch
					SA:
					• Freeze probe after brief
					CM:
					• SME or S# review
					  - real time or video.
					DM:
					• SME review
					  - real time or video.
					• Embedded probe during watch
					  – SME or S# review
					  - real time or video.

Comments:
For evaluation, could treat this as an isolated part task.

Annex A:
COMING ON WATCH GOALS

10 - ORO goal: Optimize own CCS.

Criteria: An ORO must be able to, in a timely, complete and accurate way:

- Customize the CCS to be used during the watch ahead according to technical, personal and mission related needs.

(Future CCS may offer options to customize settings to individual needs or preferences. At present, these options are limited to things like brightness, contrast, etc. However, time may come when ORO can set up own short cuts, enable or disable selected alerts (according to own background e.g. SWC vs ASWC or upcoming mission needs), customize certain display settings (e.g. oceanographic information layers) to show different things in different ways according to different tactical situations likely to be met, provide customized cheat sheets, or communication networks, etc, etc. The more options offered by the system, the more demanding and error prone will become the process of setting this up. CCS memory for personal settings that OROs coming on watch can invoke will help.)

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Display options
• Mission needs
  – Notes on pre-plans, ROE
  – info layers (e.g. Oceanog)
• Technical needs
  – Procedure cheat sheets
  – Alarm settings
	• First time set up
	  – What to choose
	• Update for watch
	  – What to choose
		CCS	Less time to fiddle with display settings when high work load. Desirable to have pre-set user profiles for quick set up.	SA:
				• % display options
				• % display choices for watch
				CM:
				• Comms @ CCS settings
				  - # comms (e.g. # key strokes, consult help, ask ORS, etc)
				  – duration set up (total time)
				  – comm content(?)
				DM:
				• % setting choice
					SA:
					• Freeze probe before watch
					CM:
					• SME or S# review
					  - real time or video.
					DM:
					• Post hoc review of settings

Comments:

Categories of information. 1st basic CCS settings (brightness, etc), 2nd mission settings (pre-plans, ROE, threat info, range scales, etc). 3rd personal settings (procedural cheat sheets, prompts, alerts, etc). These overlap.

Useful to have pre-set options for each user.

Irrelevant alarms major source of workload. Need to filter out for particular mission.

11 - ORO goal: Focus OR team on issues for coming watch. Establish command presence.

Criteria: An ORO must be able to, in a timely, complete and accurate way:

- Select information to the OR team to be taken into account during the watch ahead.
- Format and provide this information to the OR team.
- Ensure that petinent information provided has been comprehended by target audience.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Watch handover info
• Sitreps to ORO from SWC, ASWC.
• Mission schedule
• Expected events
• Priorities for watch
• Mood of team
  –Need for re-assurance about events ahead.
• Feedback from tm
  – comprehension
  – mood change
	• What to tell OR
	  - Technical factors
	  – Motivational factors
	• How to tell OR
	  – Mode
	  – Format, level of detail,
	  – Order, etc
		CCS
		Audio
		Face to face
			Less time when high stress	SA:
				• % required info (x ORO)
				CM:
				• RT to criterion
				• Comms @ brief
				  - # queries x OR tm,
				  - # repetitions x ORO
				  – duration brief (total time)
				  – % content
				  – comprehension x OR tm
				  - "tone"
				DM:
				• % content
				• % manner
					SA:
					• Freeze probe before watch
					CM:
					• SME or S# review
					  - real time or video.
					• Freeze probe to OR tm
					  – SME review
					  (real time or video)
					DM:
					• SME review
					• OR team rating?

Comments:

For evaluation, "tone" of ORO difficult to measure. Maybe rating scale by observer or target audience.

- Team management:
  Team(s) may get distracted from display/tasks while doing turnover briefing and need to double check for items overlooked.

Annex A:
COMING ON WATCH GOALS

<u>12 - ORO goal: Review pertinent pre-plans, procedures and ROE for coming watch.</u>

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Identify pre-plans, procedures and other mission related information pertinent to the watch ahead.
– Review the identified material.

(If there is a high likelihood of, say, a submarine engagement, over the watch, ORO may want to re-fresh memory of procedures. Which procedures will likely depend on background of ORO. For example, former SWCs may be more likely to review ASW procedures and vice versa. Novice OROs may want to do this more than experienced OROs. System could facilitate such individual needs. ORO may want to include others in review.)

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Possible events for watc and related: – Procedures - Pre-plans – ROE	• Likely events? • Need to review? • When to review? • How to review? • Others to include?	Procedure check lists, Pre-plan details ROE details GOP, &/or CCS	May need rapid access when implented in a way that is compatible with priority task.	SA: • % events + procedures (etc) for watch ahead CM: • Comms @ review - # – duration brief (total time) –content(?) DM: • % task performance with and without review.	SA: • Freeze probe before watch CM: • SME or S# review - real time or video. DM: • Post hoc SME review • Task specific performance measures taken during watch WL:

Comments:
For evaluation will need to know whether effect of such rehearsal / review benefited performance of target task during watch.

ANNEX B:

**ORO Goals
BACKGROUND TASKS**

Background (OR management) goals

Introduction

The work of the ORO can be described in terms of *background* and *foreground* goals. Background goals/tasks are primarily those associated with the ORO's responsibility to manage the general preparedness of the OR to meet any threat. Foreground tasks are associated with meeting a specific threat using the capabilities of the OR.

In general, the ORO does not usually engage in the detailed response to a particular threat but ensures that the OR responds effectively. However, the exception to this is when OR resources cannot handle simultaneous threats without the ORO taking over the response to one of the threats. Such a situation was viewed as extreme and most likely to involve multiple air threats, with the ORO acting as a second SWC. In such cases the CO might either take on the OR management duties relinquished by the ORO or the response to one of the threats. If, as seems likely, the ship is at Action Stations, with the off-watch OR team and the Combat Officer present in the OR, then the either the off watch ORO or the Combat Officer might assume overall responsibility for the OR team. This choice seems to vary from ship to ship, or rather from CO to CO. The choice seems to hinge on the familiarity of the CO with CCS system and the style of the CO. Some CO's prefer to leave their CCS and stand between the ORO and the SWC so that they can observe both their screens easily (and turn to observe the ASWC screen with little additional effort). This results in there being a "spare" CCS work station which may be assigned to someone other than the CO in such circumstances.

This Annex deals with the ORO *background* goals. These goals share some of the following characteristics and
- are always present (while threat response requirements are intermittent).
- take second priority to threat response but satisfactory completion contributes to effective threat response.
- can be interrupted but a backlog of information will then build up that will have to be dealt later .
- require the ORO to switch among them to monitor their status and stay on top of the information stream,
- Interact.

The data tables in this Annex deal with the following background goals of the ORO. They are not mutually exclusive and are in no particular order.
1. *Monitor and manage the OR team(s).*
2. *Manage information from all sources coming to the ORO position (speech, text, other).*
3. *Monitor and manage OR equipment capability.*
4. *Build, monitor and maintain own awareness of the pertinent surface environment.*
5. *Build, monitor and maintain own awareness of the pertinent air environment.*
6. *Build, monitor and maintain own awareness of the pertinent sub-surface environment.*
7. *Build, monitor and maintain own awareness of integrated picture(s) comprising selected elements of the surface, sub-surface and air environments and other related information.*
8. *Switch attention between different tasks and re-acquire awareness quickly and effectively.*
9. *Maintain awareness of ORO's authority to act.*
10. *Check outgoing message traffic.*

1 - ORO goal: Monitor and manage the OR team:

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Ensure information flows among the OR teams.
- Determine and assign task priorities among OR team.
- Monitor task completion for OR team in terms of a critical path and task quality.
- Recognize or anticipate problems
- Determine and implement a solution with the OR resources available.
- Balance priorities for limited OR resources between several parallel tactical demands.
- Re-allocate OR personnel resources according to tactical needs.

Notes:

The ORO has overall responsibility for the effectiveness of the on watch OR team and monitors OR activities to that end. The purpose is to ensure that the OR team is producing and distributing information and decisions as required (completeness and accuracy) and on schedule (timeliness), in accordance with mission related tactical needs.

Checks are mainly by exception i.e. the ORO assumes everything is satisfactory unless there is evidence to the contrary. The ORO has certain procedural expectations for the OR team that certain things will happen at certain points in certain ways and may wait for cues to the contrary. For example, if an OR group does not exhibit the activity level expected or if information is late, incomplete or ambiguous (such as reports, responses not in the form expected, a lag to produce a symbol on the CCS), then the ORO will notice and follow up. Follow up may be direct, or via the ORS or a warfare director (SWC, ASWC, SAC).

More directly, the ORO assesses information or decision quality by judging the suitability or completeness of a given product. For this, the ORO may use a mental or actual checklist to ensure that, for example, the SWC's plan has covered all the bases. Such mental models are acquired over a career of training and exercising common procedures, refined for the team in question and updated during the work-up and planning for the mission at hand (pre-plans and rehearsals). A dilemma is that the ORO must pick up on the necessary cues yet not become too involved in the detail (i.e. interfering or becoming distracted from other ORO tasks).

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Current mission goals • OR tasks to be done • OR tasks in hand • OR task schedule • Critical path. • OR Resources available	• OR meeting tactical goals? • OR tm members – on task? – on schedule? • Quality OK?	Vis/auditory view of OR. SITREPS from SWC, ASWC, SAC. Feedback from ORS Data on CCS, boards	Avoid too much detail Balance OR management with other ORO tasks.	SA: • % aware OR tasks: – req'd of OR tm – on critical path – deadlines – on schedule – behind schedule – quality • Comms to acquire SA - # - duration - content CM: • Comms @ tasks - # - duration – content (?) DM: • For tasks on crit. Path - % problems anticipated - % problems recognized – RT to problem – % intervene OK . - % deadline(s) met. - % resources idle	SA: • Freeze probe • Embedded probe (e.g. sitrep) CM: • SME review – real time or video. – time line analysis DM: • Freeze probe • Embedded probes • SME review – real time or video.

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Comments:

- Cognition

  Multiple tasking a problem for ORO. Has to balance own tactical tasks with management tasks. (Warfare directors doing same thing for own tms.) Need to "visualize" critical path for tasks along way to achieving tactical goal. ORO needs some but not too much insight into actions of OR teams.

- Potential problems

  Fail to notice critical cues that something going awry. Critical path(s) may change during mission.

- Relevant Experience:

  How long has this team worked together? How well do they know / trust each other.

  Important mental models formed during mission planning and rehearsal. Pre-plans determine tasks to be done to some extent.

- Team issues:

  Information flow among OR teams. ORS and warfare directors key figures.

- Critical Tasks

  Recognize and correct major tasking deficiencies in OR.

  Analyze critical path to anticipate problems and meet deadline(s).

2 - ORO goal: Manage information from all sources coming into ORO position.

- Monitor all information sources and select information for own Situation Awareness.
- Ensure appropriate information flow within OR and ship, and to TG.

Criteria:

For <u>audio traffic</u>, the ORO must be able, in a timely, complete and accurate way, to:
- Monitor all audio traffic and identify (anticipate or recognize) traffic of interest for more detailed attention.
- Attend and interact with different sources of auditory information at will.
- Identify source(s) of pertinent audio traffic.
- Understand, respond, retain and/or redistribute selected information in a timely and accurate manner.

For <u>text traffic</u>, the ORO must be able, in a timely, complete and accurate way, to:
- Monitor all text traffic and identify (anticipate or recognize) traffic of interest for more detailed attention.
- Review, understand, respond, retain and/or redistribute selected information in a timely and accurate manner.

Notes:

The ORO spends a great deal of time managing information coming into the OR. All sources of information are potentially pertinent for the ORO's task of building and maintaining awareness of factors affecting direction of the OR but only two aspects considered here are auditory traffic and text messages. This information must be variously screened, filtered, related to the mission, retained for future use, re-distributed, and acted upon. Incoming information may be:
- Auditory (comms nets, verbal around OR, sound of CHAFF being fired).
- Visual (text messages, CCS screen, plot, JMCS, state-boards, body language of team).
- Tactile (ship movement for course changes) and even olfactory (smoke).

Auditory traffic. This lets the ORO know what is going on in the OR, on the bridge and in the TG and currently involves listening to people talk around the OR, and listening on headphones to various internal and external circuits. While the headphones are on it is difficult or impossible to hear ordinary speech in the OR. OROs manage such auditory information by using the left earphone mainly for the internal ship C2 net (90%) while "bouncing" to other internal circuits at intervals for 10 –15 seconds to snap shot other activity. The ORO will also leave the C2 net when making an announcement to the OR or to the whole ship. The right headphone is used for external TG circuit(s). Cues to bounce to monitor another net (ie. not the internal C2 net) may come from a specialist on the C2 net (eg the SAC), from the ORS, or visual cues in the OR such as sudden activity in one work area or a LINK symbol appearing on screen. (Note: there is about 30 second delay from verbal report by operator to LINK symbol appearing on screen.) Other reasons for "*bouncing*" are to request, or to provide information, or to give direction. Selecting communication circuits (which one to monitor) and extracting and retaining the pertinent information currently forms a large part of the ORO's workload. It is perceived as difficult to manage and error prone.

Text traffic. Managing text traffic during each watch is an important, time consuming and ongoing responsibility of the ORO. Interviewees reported that a 2-3 week exercise may bring as many as 20,000 text messages into the OR, in addition to voice traffic. (More text traffic can be expected during an actual operation than an exercise.) Based on exercise experience, estimates were that text messages may come to the ORO at a rate of 200-300/day i.e. about 8-12/hour. Message length may be a few lines or several pages. May get several 6-8 page messages while on watch. Text messages will often update or cause changes to plans already made. A lot of time is spent extracting information from text messages and making briefing notes or aide memoirs. For example, takes ORO an hour to go through the (daily) ATO (Air Traffic Order – 300 pages/day during Gulf War) with another hour to reformat the relevant material into a table. Interviewees claimed it is easy to miss relevant information because of volume. ORO needs awareness of both message format and mission context to select relevant information. Awareness of context usually arises from being involved in planning and grows over the course of the mission. Messages go into a set of binders (about 10) for different aspects of operations. With the ORS and signaller acting as filters, the ORO must read each message, note (mentally or otherwise) the details he needs and ensure key information reaches the OR team in a timely manner. Priorities for messages are determined by several factors. Partly by a classification assigned by the sender (FLASH are dealt with immediately), partly by ORO workload priorities, and partly by pertinence to the tactical task(s) in hand e.g. threat response. Length may also be relevant since brief messages can be scanned and dealt with quickly. During threat responses, a back log will build up. Use of JMCS, JMARTS still evolving e.g. as e-mail, TG intranet, source of pictures, or graphics. Presently photocopies given to each recipient who extracts own info and puts msg into binder. When coming on watch ORO must review messages that have arrived since previous watch.

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Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•Info flow around OR •Txt msg - structure – content – priority •Audio msg - structure – content – priority. •Mission priorities – information needs •Tactical priorities – information need	• msg content relevance? – immediate? – potential? •Action arising? – immediate? – schedule? - highlight? store? •Distribute? – who? – when?	•Auditory: - Headset(s) – Face to face – Clues from OR activity, CCS. •Txt msgs – read and note - Graphics = JMCS - ORS notes to ORO	•Audio: 90% time on internal. 15 users /net Major source of workload. •Text: High volume of txt msgas. Some very long eg ATO. Most of normal watch is spent reading msgs. Major source of workload.	For all audio and txt msgs that arrived in OR SA: •% msg presence •% content details •% comprehension (i.e. signif for mission) •% retention key details (test at intervals). CM: •Over total scenario) - Time spent on msg(s) # queries @ msg(s) # transcription errors DM: •% re-distribution •% re-action.	(For both audio and txt) SA: •Freeze probe •Embedded probe (e.g.TG query) CM: •SME review - real time or video. – time line analysis – transcription errors DM: •Freeze probe •Embedded probes •SME review – real time or video.

Comments:
- •Cognition: Difficult to translate text based spatial info into graphic or visualized spatial picture. Key info needs to be highlighted in text msgs. Need further analysis of current communication categories and patterns.
- •Memory: claim can remember general content of msgs but need notes for details. Heavy reliance on memory for msg content. Txt msg review competes for attention with other tasks. Familiarity with msg format over long years helps scanning for key information.
- •Visual info: spread all over OR -- must look and/or move around to get it.
  Audio info: fragmented, transient, miss items if not on net. Must transpose to other medium to help retention – e.g. post it notes, state boards, CCS.
- •Potential problems Txt msg backlog difficult to overcome. May contain info critical for current situation.
  Transposition errors common when putting txt based spatial info into system for display on CCS e.g. latitude, course, speed. Etc.
  Important info gets lost or overlooked.
- •Relevant Experience: Knowledge of msg format(s) aid scanning text info.
- •Team issues Rely on ORS to point out key info arriving but ORS has other tasks too. Effectiveness in this task depends heavily on common understanding between ORS, ORO, signallers for text msgs and among other team members to give ORO heads up to listen on audio.
  Need map based framework on which incoming plans, overlays, or related info can be selectively imposed.
- •General: Presentation of information can vary with technology (for example, current text msgs might converted to e-mail)
- •Measurement Issues: Record representative set of incoming traffic (audio and txt) during a scenario or exercise. Feed this to ORO while performing secondary task (e.g. scans CCS). Seed scenario with x-section of errors, priorities, msg lengths.
  Will need SME input to determine what are "correct" responses. Test for ability to recall and/or use msg details after various intervals. Potential metrics: clearing the stack of messages (# read per unit time or # lines per unit time). Identifying relevant/important messages. Routing information to the appropriate people. Land based trainer does not simulate text message aspect well (too brief & too few). Need to know more about existing msg distribution system.
- •Research: attention to multiple audio-sources may be better with 3D audio?

3 - ORO goal(s): Monitor and manage OR equipment capability status

<u>Criteria</u>: An ORO must be able to, in a timely, complete and accurate way:
- Form / maintain a mental picture of capabilities status (priorities, schedule for repair, etc) and tactical significance of any shortfall.
- Select more detail about a particular deficiency as required.
- Determine and communicate priorities for repair or work around solution(s).

<u>Notes:</u>
Equipment status frequently changes. This may be for reasons of routine maintenance, malfunction, or enemy action. Major changes that can occur as a result of enemy action will coincide with the greatest urgency for returning the capability to be fully functional and the greatest conflict with other demands on the ORO. Consequently, the ORO must be able to acquire and maintain awareness of or at least have ready access to information about pertinent equipment and sensor status and capability. This means knowing what works on the ship (and in the TG) and what does not (in whole or in part), and when a lost capability will return and in what manner (incremental, all or none, etc). The ORO must made aware promptly and accurately of changes in status and the tactical significance of such changes. The ORO must then be able to prioritize efforts to regain any lost capability. Categories of interest include weapons (functionality, ammunition, readiness); sensors (functionality, readiness, tuning); ship maneuver (engines, steering, current evolutions such as helo operations), personnel (skill, fatigue, casualties). The ORO needs to remember key areas of deficiency, and to get pertinent details quickly and easily, when required.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•Current status of major eqpt items (wpns, sensors, comms, helo, etc) •Schedule for repair •Tactical implications •Changes in status.	•Status acceptable? •Meet mission eqpt needs •Priority for repair? •Tactical significance of shortfall?	State boards CSE, ORS, SAC, SWC, ASWC CCS data quality	May be very high	SA: •% capability status CM: •RT status change •Comms @ status - # - duration - content (?) DM: •% signif status change •% response – repair priority – notify others, etc – work around chosen	SA: •Freeze probe •Embedded probe (e.g. CO's query) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •Freeze probe •Embedded probes •SME review – real time or video.

<u>Comments:</u>
- Evaluation
  What is relationship of this to damage control?
- Cognition:
  Equipment malfunction or damage tends to be unpredictable – requires creative solutions at very short notice often under stress.
- Relevant Experience:
  Career path affects relative comprehension of different technical issues. For example, former SWCs less likely to understand ASW deficiencies.

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4 - ORO goal(s): <u>Build and maintain awareness of surface environment –</u>
(surface traffic contacts, lanes/limits, coastline, tides, sea state, navigation, etc)

<u>Criteria</u>: An ORO must be able to, in a timely, complete and accurate way:
- Acquire and maintain awareness of significant surface issues to the desired level of detail.
- Integrate related data elements into a meaningful view as required.
- Detect pertinent changes in key elements of surface picture promptly and accurately.
- Project surface picture into the near future to support navigational and tactical decision making.
- Retrieve and comprehend stored details on specific issues in a timely and appropriate manner.
- Identify hostile contacts beyond own weapon range and preparation time.
- Re-acquire awareness (detect changes since last view and comprehend tactical significance) of the surface situation after switching from another task, view or level of detail.

<u>Notes:</u>
The ORO has to detect and comprehend the various surface issues that may affect the ship and/or the TG in the conduct of the mission. Elements include all other vessels within range of own or TG sensors (other TG ships, helos, MPA, etc). This includes own force, enemy and civil contacts. Other factors include territorial limits and political implications, coastline and related navigational hazards, tactical limits (minefields, weapon ranges – own and enemy). The ORO must be able to build, maintain and use this awareness with the least effort and timely comprehension of the issues which arise for the mission, for impending tactical decisions and for management of the OR team.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•All surface contacts within relevant range. •Current contact status (fr, en, neutral, civil) •Zones (channels, traffic patterns, territory limits) •Hazards (wrecks, shallows, etc) •Threat profiles – relative wpn ranges. •Changes in contact or track status. •Time lines for approach •Pertinent int – threat profile – likely en locations - etc •Relative information - routes – CPA, etc	•Contact valid? •All contacts classified? •Threat analyzed? – inside wpn range? – worst case? – priority to investigate •SWC dealing OK?	CCS, GOP, JMCS Threat board, notes SWC, ORS TS and team TG	New contacts usually embedded in a contact data stream that may be as many as 20-30 at any give moment, with new contacts appearing every few minutes – or – Picture slow to build hence = vigilance problem. May get distracted by other tasks.	SA: •% current surface info. – contacts, limits, etc •% contact details – approach, threat, etc. CM: •RT contact change(s) (or # changes responded by ORO within N seconds) •RT to query @ contact (e.g. from TG) •Comms @ surf picture (over scenario or per contact). - # - duration – content (?) - # actions or time to access contact info required. DM: •RT + % tactical significance •RT + % tactical response •RT + % match threat profile	SA: •Freeze probe •Marie Celeste sitrep •Embedded probe (e.g. sitrep request) CM: •RT = Embedded probe •SME review – real time or video. – time line analysis DM: •Freeze probe •Embedded probes •SME review – real time or video.

Comments:

- Evaluation:

    Measure ability of S# to walk into OR, sit down at CCS, and start reporting picture to other (e.g. CO) e.g. time to reach desired knowledge state, or knowledge state achieved within given time. Data to be in system database and accessible.

    Also compare with and without access to system to help generate answer to probe questions e.g. answer probe without access, vs probe with access to any OR data source.

- Cognition

    May require skill at building mental picture and to switch between local and global perspectives.

- Potential problems

    Currently hard to integrate separate elements required for a classification.

    New ship to ship missiles have longer ranges therefore time frame shortening.

    Relevant info spread around OR and can go to ground.

    Surface picture takes 2nd priority to air picture.

    Surface picture neglected if SWC busy with air picture, in which case ORO may act as back up. This affects ORO oversight of other threat areas or global picture.

- Relevant Experience:

    Takes experience to be able to bring to together elements into visualized picture.

- Team issues

    SWC does 80% work, ORO rest.

    Smart tool to assist contact classification e.g. what info needed, what info available

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5 - ORO goal(s): Build and maintain awareness of air environment –
(air traffic contacts, air traffic lanes/limits/schedules, flight program, coastal terrain, etc)

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Acquire and maintain awareness of significant air issues to the desired level of detail.
- Integrate related data elements into a meaningful view as required.
- Detect pertinent changes in key elements of air picture promptly and accurately.
- Project air picture into the near future to support navigational and tactical decision making.
- Retrieve and comprehend stored details on specific issues in a timely and appropriate manner.
- Identify hostile contacts beyond own weapon range and preparation time.
- Re-acquire awareness (detect changes since last view and comprehend tactical significance) of the air situation after switching
  from another task, view or level of detail.

Notes:
The ORO must be able to detect, comprehend and/or recall the various air issues that may affect the ship and/or the TG. Elements include all air contacts within range of own or TG sensors. This includes own force, enemy and civil contacts, territorial limits and political implications, coastline terrain, weapons ranges – own and enemy, and others. The ORO must be able to build, maintain and use this awareness with the least effort and timely comprehension of the issues which arise for the mission, for impending tactical decisions and for management of the OR team. Monitoring information currently in ATO a major concern – during Gulf War, ATOs could run to several hundred pages. Other air traffic activity includes scheduled airline routes and local flights (e.g. oil platforms and general aviation) for which flight plans may or may not have been submitted and available.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•All contacts within sensor or weapon range of ship or TG. •ATO, TG program, airline schedules. •Differentiate fr, en, neutral, civil, unknown. •Zones (air lanes, traffic patterns eg oil helos) •Changes in contact status or tracks, altitude, etc. •Threat profiles – relative wpn ranges - Pertinent int. •Pertinent int – threat profile – likely en locations - etc Relative information – approach rate - routes – CPA, etc	•Contact valid? •All contacts classified? •Threat analyzed? – inside wpn range? – worst case? – priority to investigate •SWC dealing OK?	CCS, GOP, JMCS Threat board, notes SAC SWC, TS and team ORS. TG	New contacts usually embedded in a contact data stream that may be as many as 20-30 at any give moment, with new contacts appearing every few minutes.	SA: •% current air data •% contact timelines CM: •RT contact change(s) (or # changes responded by ORO within N seconds) •RT to query @ contact (e.g. from TG) •Comms @ air picture (over scenario or per contact). - # - duration – content (?) - # actions or time to access contact info required. DM: •RT + % tactical significance •RT + % tactical response •RT + % match threat profile	SA: •Freeze probe •Marie Celeste sitrep •Embedded probe (e.g. sitrep request) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •Freeze probe •Embedded probes •SME review – real time or video.

Comments:
- •Method:
  Marie Celeste – see surface awareness entry above.
  Range of interest depends on sensor wpn technologies of the day.
  , Sub, surf and air related since missile may come from either source.
- •Cognition:
  Accuracy of spatial details in mental models and ability to communicate these effectively (quickly and accurately) important for all warfare areas.
  If complex manipulation of CCS required to modify picture or access information, distracts attention of user away from primary task.

6 - ORO goal(s): Build and maintain awareness of sub-surface environment –
(sub-surface contacts (mines, submarines, torpedos, obstacles), underwater terrain, currents, thermal conditions that affect underwater sensors, etc)

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Acquire and maintain awareness of significant sub-surface issues to the desired level of detail.
- Integrate related data elements into a meaningful view as required.
- Detect pertinent changes in key elements of sub-surface picture promptly and accurately.
- Project sub-surface picture into the near future to support navigational and tactical decision making.
- Retrieve and comprehend stored details on specific issues in a timely and appropriate manner.
- Identify hostile contacts beyond own weapon range and preparation time.
- Manage water space.
- Re-acquire awareness (detect changes since last view and comprehend tactical significance) of the sub-surface situation after switching from another task, view or level of detail.

Notes:
The ORO must be able to detect, comprehend and/or recall the various sub-surface issues that may affect the ship and/or the TG. . Elements include all sub-surface contacts within range of own or TG. This includes mines and minefield areas, submarines, torpedos, underwater terrain, territorial limits and political implications, underwater navigational hazards, underwater and surface noise such as engine, , weapon ranges – own and enemy, and others. The ORO must be able to do this with the least effort and rapid comprehension of the issues which arise for the mission, for impending tactical decisions and for management of the OR team.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•All potential contacts •Underwater topology – obstacles – thermal conditions. •No go zones (eg joint action areas, sub-action areas) and duration. •Hazards (wrecks, shallows, etc) •Changes in data •Threat profiles – relative wpn ranges - Pertinent int	•ASWC dealing OK? •Contact valid? •All contacts classified? •Threat analysis – inside wpn range? – worst case – priority investigation? •Location wrt zone(s)?	CCS, GOP, JMCS. Threat board, notes ASWC. OR tm	Must actively plot sub-surface changes into CCS and GOP. May be a lot of underwater data to comprehend in littoral area because of surface traffic noise.	SA: •% current sub surf data •% contact timelines CM: •RT contact change(s) (or # changes responded to by ORO within N seconds) •RT to query @ contact (e.g. from TG) •Comms @ sub picture (over scenario or per contact). - # - duration – content (?) - # CCS keystrokes to access contact info. DM: •RT + % tactical significance •RT + % tactical response •RT + % match threat profile	SA: •Freeze probe •Marie Celeste sitrep •Embedded probe (e.g. sitrep request) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •Freeze probe •Embedded probes •SME review – real time or video.

Comments:
- Potential problems
  Biggest source of error is failure to update water space management boxes
- Relevant Experience:
  Sub-surface issues difficult to comprehend and visualize for ORO without sub-surface background.

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7 - ORO goal(s): Build and maintain awareness of integrated picture(s) –
(sub-surface, surface, air, resource availability, threat profiles, mission time lines, etc)

<u>Criteria</u>: An ORO must be able to, in a timely, complete and accurate way:
- Acquire and maintain integrated global awareness to the desired level of detail.
- Integrate related data elements into a meaningful view as required.
- Detect pertinent changes in key elements of integrated picture promptly and accurately.
- Project integrated elements into the near future to support navigational and tactical decision making.
- Retrieve and comprehend stored details on specific issues in a timely and appropriate manner.
- Identify and track hostile contacts from beyond own weapon range and preparation time.
- Switch in terms of area of focus and level of detail.
- Re-acquire awareness (detect changes since last view and comprehend tactical significance) of the integrated situation after switching from another task, view or level of detail (zoom in or out).

<u>Notes:</u>
At a high level, the ORO tries to maintain as current as possible an integrated view of all pertinent mental models or "pictures" (warfare areas, capability, related threat profiles, ROE). OROs may have to iterate between several "views" to do this. ORO wants to become aware of changes and relationships in time to respond to any emerging threat. This is done by forming and then reviewing the integrated high level picture for concerns using whatever technology is available either pro-actively (the ORO goes looking) or passively (the system alerts the ORO to pay attention). Passive alerts include being made aware by other members of the OR team. The "picture" may be organized graphically, spatially or in some other way. For instance, the graphic element may be to imagine actual coastline or to have it represented by the technology of the day (eg lines on a CCS screen). Issues affecting the ship and the TG need to be projected in time out to the end of the watch. OROs want to select the various issues to be kept under review.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•Features (above) of all warfare areas but at limited level of detail. •Relative importance of different items of information (based on imminence, risk, etc) •Important rel'ships among warfare areas. •Other related areas such as: - ship capability – TG capability – ROE •Emerging situation(s)	•When and how to switch focus in terms of area or detail? •Important rel'ships among warfare areas? •What to attend?	OR tm (voice), TG tm (voice) CCS, GOP, JMCS State boards		SA: •% *other* w'fare area(s). % integration issues •% *other* timelines CM: •RT other change(s) (or # changes responded to by ORO within N seconds) •RT to query @ other (e.g. from TG) •Comms @ other (over scenario). - # - duration – content (?) - # CCS keystrokes to access other info. DM: •RT + % tactical significance other •RT + % tactical response other •RT + % match threat profile other WL: •% other areas as WL in main area increases. •Subjective WL ratings	SA: •Freeze probe •Marie Celeste sitrep •Embedded probe (e.g. sitrep request) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •Freeze probe •Embedded probes •SME review – real time or video. WL •Freeze probes •Embedded probes •Rating scale

Comments:
- Evaluation:
  Scenario will need plenty of "other" data on which to probe.
  Run scenario with focus in one threat area and probe for knowledge in others.
  Cognition Information overload and data clutter is a problem
- Questions:
  Does the ORO want access to separate mental pictures for air, surface, and subsurface or just one integrated picture? Or all three?) In a multi-threat scenario (e.g. surface and air), can the ORO relate different pictures to judge priorities? How do people link the different pictures in their minds?
  Does the ORO need one picture or several? If the ORO has some integrated mental model or picture, what are the elements? Maintaining multiple mental representation has greater consequences for mental resources than maintaining a single, more complex model. This is a research issue: what are implications of maintaining multiple mental models, A single model has advantages for seeing relationships between elements but management of level of detail required will be a key. Can ORO pay attention to all aspects of situation at once (geo, political, civilian/neutral, task force). OROs from different backgrounds may want to configure threat pictures from different warfare areas differently.

Annex B:
BACKGROUND GOALS

---

8 - ORO goal(s): Switch attention between different "pictures" and acquire awareness with minimum delay.

<u>Criteria</u>: An ORO must be able to, in a timely, complete and accurate way:
- Delimit global or local picture(s) as required (select elements to include- warfare area, equipment status, OR tasks, etc).
- Switch attention at will quickly and easily between global picture to local picture, or local to local.
- Zoom in or out of any given picture quickly and easily without distraction.
- Cross reference between pictures quickly and accurately without distraction.
- Acquire awareness (detect changes since last view and comprehend tactical significance) of newly attended picture.

<u>Notes:</u>
The ORO needs to switch focus between pictures and to ""zoom" in and out at will as events evolve. Examples include: to oversee the threat of the moment from the perspective of the warfare director responsible. Zoom out in terms of time or range and bearing to a new contact or look for new contacts, or as a missile progresses along its path towards its target. To check on some capability status issue or the progress of some task within the OR. The ORO needs control over the way in which information is layered, combined and presented.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•<u>Global picture:</u> - Factors affecting and linkages among three warfare areas. – Data + events @ broad time/space horizon. •<u>Local picture:</u> one warfare area or one part of one area. (see serials above) •<u>Picture of others in OR</u> – consistency – focus. – details •<u>Other related info</u> – resources - OR taskings – etc.	•Where to focus? •What to select for combination? •How much detail? •When to switch? •What's new? •What's significant?	All mission related sources of information See serials above		SA: •% new picture after std inspection time (e.g. 5 seconds). •% + RT detect data changes in one picture while attending other. •% relational data. CM: •<u>Time to:</u> - detect need to switch from onset new data in other picture - switch to new picture - report on new picture – fine tune new picture •# comms to: - clarify new picture. DM: •% switches. •#/type switch errors	SA: •Freeze probe •Embedded probe (e.g. sitrep request) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •Embedded probes •SME review – real time or video. WL •Freeze probes •Embedded probes •Rating scale

<u>Comments:</u>
Need better CCS navigation skills trg.
- Evaluation Method:
  Direct ORO to go to particular focus with particular levels of detail – eg when asked by CO.
- Cognition
  Problem to re-establish "picture" as switch attention. May take several minutes. Need to know when to switch.
  Miss changed info (updated or new) when switch to new picture.
  Confusion of elements across pictures.
  Interference between pictures.
- Potential problems
  Regain focus after switch.
  Ranges often mistaken.
  Sometimes forget some info layers suppressed.
- Relevant Experience:
  Keeping straight in one's mind an evolving situation and its related non-spatial elements (resources, tasking, etc) is a skill that takes on-task experience.
- Team issues
  The need to interact with other team members (ship or TG) about same problem and to have the same elements in mind. Confusing if other person has different image (focus, elements, range, etc).
- Design/Research issues
  This goal might be achieved by changing pictures on a single screen or switching gaze between pictures presented simultaneously on adjacent displays.

---

9 - ORO goal(s): Maintain awareness of ORO's authority to act.

<u>Criteria</u>: An ORO must be able to, in a timely, complete and accurate way:
- Acquire and maintain awareness of limits to own authority to act independently of any superior authority.
- Know how limits to authority are changed by circumstances.

Notes:

The ORO needs to know at any time his freedom of action without reference to superior authority. This understanding will be based on information about ROEs, the CO's instructions (long standing and for the immediate events in the period ahead), and pre-plans prepared during mission planning to deal with anticipated events. There will also be standardized procedures determined during training and work ups such as ZIPPO procedures. Some aspects of authority are affected by circumstances. For example, ROEs can change automatically from defensive to aggressive as a result of a hostile act on the part of a contact – such as opening fire on one's own ship or another ship in the TG. Freedom of action for the ORO will also be constrained to some extent by procedures. (If long standing procedures are changed at short notice there is potential for confusion among other team members, especially under stress or time pressure.)

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•CO's current orders about freedom to act. •Current ROE •Factors changing ROE.	•Free to act? •ROE changed?	CO night book, state board, notes. CO, TG ROE manual Text messages Mission briefing	Knowledge usually needed when under pressure of high workload and combat stress.	SA: •% freedom to act at given points in scenario CM: •Comms @ freedom (over scenario or per contact). - # - duration – content (?) DM: •% action	SA: •Freeze probe •Marie Celeste •Embedded probe (e.g. sitrep @ ROE TO OR) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •Embedded probes •SME review – real time or video.

Comments:

Annex B:
BACKGROUND GOALS

10 - ORO goal(s): Check outgoing message traffic.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Call up back log of outgoing message traffic by message category and schedule
- Check selected messages for completeness and accuracy.

Notes:
The ORO is responsible for ensuring that messages sent from OR go on time, are correctly addressed, and have correct content. The ORO must monitor activity of OR comms team responsible for this and intervene if not satisfactory. The ORO requires outline status of message traffic so can detect and diagnose problems.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
•Backlog in msg traffic by msg priority.	•Urgent msgs gone? •No back log? •Follow up needed?	ORS, CIO(?) Message binder?		SA: •% status out msgs CM: •Comms @ out msgs - # - duration – content (?) DM: •% out problems	SA: •Freeze probe •Marie Celeste •Embedded probe (e.g. sitrep @ msgs) CM: •RT = Embedded probe •SME review - real time or video. – time line analysis DM: •SME review – real time or video.

Comments:
 Mostly a problem for flagship.
•Evaluation Method:
  Generate a set of outgoing msg traffic.
  Have signallers omit to send x-section of msgs during scenario and check if ORO realizes.

ANNEX C:

ORO Goals for
FOREGROUND TASKS

Foreground (threat related) goals

Introduction

This Annex deals with generic ORO responsibilities for a threat requiring active engagement. In outline this sequence involves the following: the ship (or TG) detects a threat amongst the ongoing stream of contacts coming into the OR, prepares and implements a planned response which may involve communicating with the contact, comes to Action Stations, fires the ships weapons, sustains and deal with damage to the ship, assesses damage to the target, prepares and submits reports and stands down. There may or may not be a requirement to deal with a second threat that emerges during implementation of the planned response to the original threat. The data tables that follow describe goals and awareness needs at a level that is common to all three warfare areas: sub-surface, surface and air. Note that aspects of one or more "Background Tasks" (described in Annex B) may be required during the threat response. These have not been repeated but do overlap with some of the tasks in this Annex. Likely examples include building and maintaining global awareness, managing the OR team, coordinating with other TG members, and switching attention between different tasks and re-acquiring awareness (i.e. coming up to speed quickly after each switch). In particular, there will be a need to regain global awareness after focussing on a particular threat.

The following assumptions are made.

- The ORO is working in a OR team that has worked up together, and shares common mental models about procedures, pre-plans, expected threats (etc) derived from active participation in the planning, training and rehearsals for this mission.

- The ORO has been through the coming on watch tasks and is presently attending to a range of background tasks.

- The OR team is busy with a stream of air, surface and subsurface contacts that are being resolved and classified. Air and surface contacts could each be as frequent as 10- 20/hour in a busy coastal setting. Subsurface work will relate more to oceanographic issues, surface contacts, and other noise, rather than a high volume of actual contacts.

- The ORO only pays attention to a particular contact if the OR team in question draws his attention to that contact, based on certain contact features (established for the mission in question). In the absence of such an announcement, the ORO gets on with background tasks, occasionally refreshing his global picture by consulting his CCS, or contacting (audio or visit) individual warfare departments or the GOP. The threat response sequence starts once the attention of the ORO is drawn to a particular contact by the SWC or ASWC.

For any contact, there will be a number of features about which information is needed (course, speed, bearing, distance, image strength, correlation with data from other sensors, distance from known enemy bases, match with known threat profiles, electronic emissions, related radio chatter, etc). At the initial contact, there will be only a limited set of data available to address such factors. Once there is sufficient evidence to suggest/confirm a possible threat, the ORO will be formally notified by the SWC or ASWC (though informal awareness that something is happening may precede this). The ORO will assume (but want to confirm) that the OR team is working to activate all potential data sources, to refine the data from these sources as it becomes available (e.g. by fine tuning the sensors), and look for complementary information among potentially related data sources. (For example, interpretation of subsurface data on engine noises to relate to a surface contact to narrow down possibilities about vessel type.)

Once the contact is identified as having sufficient threat potential to claim more of the ORO's attention, ongoing background tasks conducted by the ORO may continue but with a different distribution of the ORO's effort. For example, tasks such as reviewing incoming text messages may be dropped and a backlog allowed to build, except for threat related messages. This re-distribution of effort will depend on supplementary resources available within the OR at the time. Depending on the state of readiness (e.g. whether the ship is at Action Stations), time of day, and other factors, other personnel may be in the OR and available to take over appropriate tasks. For example, the CO and/or the Combat Officer may be on ad hoc visits or all off watch OR personnel may be there if the ship is at Action Stations.

Annex C:
FOREGROUND GOALS

The following ORO goals are considered in this Annex, shown in rough order of implementation. Not all items may be required for any given threat response. For example, depending on the status of ROE, the clarity of the classification of the threat, and the risk to collateral damage to white shipping, there may not be any need to attempt to communicate with the contact. In keeping with the need for the ORO to multi-task, many of the goals below will be pursued in parallel, with frequent switches between several tasks. The sequence may also vary.

A: Classify contact and establish threat levels
1. *Integrate new contact information with own global picture*
2. *Ensure OR prepares quick first response, broad plan for worst case.*
3. *Optimize work among OR team(s)*
4. *Optimize information flow within and outside OR.*
5. *Maximize number of information sources concerning contact*
6. *Optimize data quality for each information source*
7. *Establish communication with contact to resolve identity and intentions*
8. *Conduct warnings in accordance with TG tasking.*
9. *Ensure contact classified correctly*

B: Prepare plan
10. *Ensure OR detects if en. missile (etc) fired and establish firm track.*
11. *Ensure detailed viable tactical plan prepared.*
12. *Check warfare directors (WD) plan.*
13. *Make CO aware of all relevant components of the plan. Get feedback from CO.*
14. *Ensure all OR team aware of plan. Emphasize key points.*

C: Implement plan
15. *Supervise execution of plan by OR team.*
16. *Ensure standard procedures completed correctly (Greyhound, ZIPPO, Action stations, ASMD, etc).*
17. *Stay on top of global picture during threat response.*
18. *Back up WD director as required.*
19. *Maneuver ship as required.*
20. *Check for other threats*
21. *Respond to second threat*

D: Assess engagement outcome
22. *Confirm enemy target destroyed*
23. *Assess damage to own ship from missile (etc) hit.*

E: Return to surveillance role
24. *Regain awareness of the global picture following period of concentration at threat level.*
25. *Re-focus team. Establish command presence.*
26. *Stand down weapons*
27. *Stand down ship*
28. *Complete and send reports.*

1-ORO Goal(s): Integrate new contact information with own global picture

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- integrate contact information into global awareness quickly and accurately.
- establish potential threat to ship, TG, and mission.
- determine priorities for OR attention (including own) by comparison with on-going tasks in OR

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• Global picture:
  (See bgr tasks)
• Contact details
  – co, spd, bearing, etc
  – range, CPA, etc
  - rel'n to ship, TG, etc
• Threat profiles
• Mission
  – goals
  – ROE
• Current OR tm tasks
  – priority
  – schedule
	• Initial assessment
	  – worst case?
	  – any action?
	• Flag to attend later?
		-CCS
		-Threat board
		– SWC, ASWC, SAC
		– TG
		– ORS
		– GOP, JMCIS.
				SA:
				• RT to contact
				• % known contact inf
				• % fit contact & global picture.
				CM:
				• comms @ BP:
				  - #
				  - duration
				  - content (?)
				• comms @ contact:
				  - #
				  - duration
				  - content
				DM:
				• % 1st assessment
				• % action required
				• % in establishing prioritie
				• RT 1st assessment
					SA:
					• Embedded probe(s)
					• Freeze probe(s)
					• SME review
					  - real time or video.
					CM:
					• SME review
					  - real time or video.
					DM:
					• Embedded probes
					• SME review
					  - real time or video.

Comments:
- **Cognition:**
  Significant memory load for all that has to be kept in mind:- threat profiles,- eqpt , resource status, - recent events
  Problem to visualize various weapon ranges (enemy and friendly).
  Attention – OROs develop a scanning strategy to take in relevant inforamtion.
  Multi-tasking a challenge for ORO.
- **Potential Problems:**
  Currently too much verbal description of spatial info among OR team members. This risks transposition errors and is slow to visualize.
- **Experience:**
  Experience required to establish appropriate level of attention/ workload to this task.
  Inexperienced ORO could take too much time at this stage.
- **Evaluation**
  May need to pre-load with ongoing secondary task to mimic background workload from which switch attention to contact.
- **Research / design issues**
  How do OROs form and manage multiple global picture and local picture(s).
  ORO wants better frame of reference for SA of location – land, islands, seabed features, wrecks, magnetic anomalies, etc.
  Want to be able to select layers of information

Annex C:
FOREGROUND GOALS

2-ORO goal(s): <u>**Ensure OR prepares quick first response, broad plan for worst case.**</u>

<u>Criteria:</u> An ORO must be able to, in a timely, complete and accurate way:
- Anticipate the worst case implications as quickly as possible.
- Determine at least first steps for broad plan to cover worst case.
- Implement immediate emergency action required, if any.
- Identify deadline for detailed plan preparation and implementation
- Initiate detailed planning.

<u>Note:</u>
While the generic sources of information for the broad plan are the same as those for the more detailed tactical plan, only selected information is typically used to arrive at a speedy solution that looks at the worst case only.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• All contact info – CPA, schedule, etc • All threat info – capability – wpn ranges – apparent intent – possible tactics • Mission information - TG/CO intent/tasking – ROE. – COA & pre-plans – procedures • Own resources – availability – capability (e.g. wpn ranges) – time available • WD's estimate	• Worst case? • COA? – fits pre-plan? – alternatives? • Immediate action? – maneuver? – change readiness? • Ship / OR ready? – need to do? • Free to act? – obtain tasking – ask for new ROE? • Deadline(s)? – time appreciation? • WD's estimate OK? • Need to brief? – CO, OR, OOW, TG.	CCS, State boards, GOP, JMCS OR w'fare tm leader(s) CO, TG.	Need to do this as rapidly as possible. Very little time. Start OR/ship moving in right direction and refine as moving.	SA: • % contact info • % threat info • % mission, TG intent • % COA • % pre-plans • % fr capability CM: • comms @ plan - # - duration - content (?) DM: • RT to plan • % plan correct	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes - real time • SME review – real time or video. • Planning duration from ORO alerted to contact t start of brief to CO.

<u>Comments:</u>
Immediate action required to get ship moving in right direction and other broad preparation, just in case, then refine details.
OR team uses TAC talk that all know to save time and achieve precision.
May be 5-8 pre-plans to consider. Will use cheat sheets to cover off pre-plan details.
ORO might not start some tasks until later, depends on time apprecetiation.
- **Experience:**
  ORO will have understanding with CO of need to consult.
  Familiarization with pre-plans and procedures during mission planning and rehearsal.
  Experience teaches what information to gather to satisfy all critical Situation Awareness needs.
- **Challenges:**
  Calculate CPA

3-ORO goal(s): Optimize work among OR team(s)

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- acquire and maintain awareness of tasking of all OR resources (task, priority, schedule, workload, spare capacity, etc)
- re-assign OR resources appropriately as circumstances change (i.e. to under-resourced and overloaded areas)
- anticipate resource allocation needs in the near future (duration of watch).

Note:
This can be seen as a particular case of the ORO background task of monitoring and managing the OR team. Ongoing throughout threat response.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• New contact related tasks • Ongoing tasks in OR – Relative priorities • Present workload in OR • OR spare capacity • OR resource needs – now – later • Critical path for all tasks	• OR tm(s) OK? – on right tasks? - re-task? – on schedule? • ORO drop bgr tasks? – focus on contact? – continue existing task? • Brief OR yet?	SWC, ASWC, SAC, ORS, Audio, visual check in OR. CCS	Depends on: - contact volume - other OR tm tasks. - own bgr tasks - OR readiness - who is in OR. *May not pay much attentio when initial contact info comes in – waits for more details.*	SA: % tasks required % critical path. % work load all OR tms. % spare OR capacity % resource needs CM: comms @ OR task status: - # - duration - content (?) DM: % schedule solutions % resource solutions % task drop/add. % task assignment RT for problem on critical path RT to missed task deadline	SA: • Freeze probes • SME review - real time or video. CM: • SME review – real time or video. DM: • Embedded probes • SME review – real time or video.

Comments:
May want to review TADMUS OR management module.
- **Cognition:**
  Rely on memory for timelines and tasks.
- **Challenges:**
  Other, higher priority needs may interfere
- **Team Management**
  Team already busy with contact stream in busy coastal waters. Tend to manage OR by absence of action or report: prompt if no report when expected.
- **Experience:**
  ORO will be familiar with strengths and weaknesses of different members of OR team.
  Common mind set among OR team based on mission planning and rehearsals. All familiar with pre-plans and procedures.
  Critical path analysis involves:
  - goal(s)
  – task(s) required in series / parallel
  - resources / task
  - task schedule/deadlines
  - risk points
  - task progress

Annex C:
FOREGROUND GOALS

<table>
<tr><td colspan="6">4–ORO goal(s). Optimize information flow within and outside OR.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
•   identify who requires what information and when (inside and outside OR).
•   monitor and rectify omissions, errors, and delays in information flow.</td></tr>
<tr><th>Awareness
needs</th><th>Decisions
required</th><th>Communication
sources</th><th>Workload
issues</th><th>Measure
% = complete + accurate</th><th>Method</th></tr>
<tr>
<td>• What info needed.
• Who needs info
• Info transmitted
• Info comprehended</td>
<td>• Info exchange OK?
• ORO action required?</td>
<td>OR tm
OOW
TG
CO
Ship</td>
<td># queries or double handling @ info will increase workload.</td>
<td>SA:
• % Info needed.
• % Who needs info
• % Info transmitted
• % Info comprehended
CM:
• comms @ info flow:
  - #
  - duration
  - content (?)
DM:
• RT to info exch problem.
• % info exch problems</td>
<td>SA:
• Freeze probes
• SME review
  - real time or video.
CM:
• SME review
  - real time or video.
DM:
• Embedded probes
  - real time
• SME review
  - real time or video.</td>
</tr>
<tr><td colspan="6">Comments:
Critical information often "goes to ground" (e.g. buried in a message in-tray).</td></tr>
</table>

5-ORO goal(s): Maximize number of information sources concerning contact

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- check information source options.
- check access to information from available sources.
- re-direct OR team(s) to ensure all available information sources being used.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Info *'matrix'* for contact – co, spd, bearing, etc – range, CPA, etc - rel'n to ship, TG, etc • Data status of matrix – obtained vs required.	• OR tm OK? - working on matrix? • ORO action required? – prompt tm? – allocate resources?	CCS, GOP, JMCS OR team leaders ORS, OOW Other TG assets Cheat sheets Status boards		SA: • % info required for matrix • % matrix status • % OR matrix activity CM: • comms @ info matrix: - # - duration - content (?) DM: • RT matrix problem • % matrix problems • % matrix reactions	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes - real time • SME review - real time or video.

Comments:
Concept of information 'matrix" shorthand for *"all the information needed and sources that can contribute"*.
This and next step should take no longer than 60 sec.
OROs presently use cursor to locate items of interest (e.g. helo and contact) and to help visualize spatial relationship with ship.

Annex C:
FOREGROUND GOALS

<table>
<tr><td colspan="6">6 - ORO goal(s): Optimize data quality for each information source</td></tr>
<tr><td colspan="6">Criterion: An ORO must be able to, in a timely, complete and accurate way:
• monitor acceptability of data quality for each data source.
• identify options to improve data and information quality.
• direct and monitor improvement data quality.</td></tr>
<tr>
<th>Awareness
needs</th>
<th>Decisions
required</th>
<th>Communication
sources</th>
<th>Workload
issues</th>
<th>Measure
% = complete + accurate</th>
<th>Method</th>
</tr>
<tr>
<td>• Data quality
- completeness
-- accuracy
• Data sources
– technical factors
(e.g. sensor capability)
– environmental factors
(e.g. oceanography)
• OR team actions</td>
<td>• Data OK?
– complete?
– accurate?
• Sensors OK?
– technically?
– environmental?
• OR tm OK?
- working as req'd?
• ORO action required?
– prompt tm?
- maneuver?
– more resources?</td>
<td>CCS, GOP, JMCS
OR tm leaders
ORS, OOW
Other TG assets</td>
<td></td>
<td>SA:
• % data quality x source
• % OR fine tune options
CM:
• comms @ fine tuning:
- #
- duration
- content (?)
DM:
• RT fine tune problem
• % fine tune problems</td>
<td>SA:
• Freeze probes
• Embedded probes
• SME review
- real time or video.
CM:
• SME review
- real time or video.
DM:
• Embedded probes
- real time
• SME review
– real time or video.</td>
</tr>
<tr><td colspan="6">Comments:
•Team mgt:
May share responsibility for global vs threat awareness with other ships on TG. That is, one ship will concentrate on contact, others will "watch its back" in other warfare areas.</td></tr>
</table>

7 - ORO goal(s)   Establish communication with contact to resolve identity and intentions

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- identify communication options
- determine communication plan
- implement, monitor and modify plan according to circumstances

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Pre-plan options • Warnings required • ROE • Contact options • Contact attempts • Contact response –verbal – behaviour	• How to communicate? – means? – who? – timeline? – warning text? – relay? • Comms tech OK?	Contact CCS, State boards OR tm members ORS, OOW Other TG assets ORO notes		SA: • % comms options • %contact response(s) CM: • comms @ warnings - # - duration - % content DM: • %contacts • RT comms problems • % decisions – comms choice – warning schedule – warning evaluation	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes - real time • SME review – real time or video.

Comments:
Standard warning text to be read.
TG command ship may undertake or delegate.

Annex C:
FOREGROUND GOALS

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8 - ORO goal(s) Conduct warnings in accordance with TG tasking.

Criterion: An ORO must be able to, in a timely, complete and accurate way:
* prepare warning plan.
* assign responsibilities for plan implementation within OR.
* monitor implementation of warning plan (assess communication quality, contact responses, etc) and re-direct as necessary.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Warnings required – pre-plans • Contact response(s) – verbal – behaviour • ROE • Global picture	Warning plan OK? OR resources OK? OR team ready? Implementation OK? • . Evaluate response – repeat? – accept? – raise warning level? – correlate with contact behaviour? – change own tactics? – pass on to TG, etc.	TG ASWC, SAC, ORS CCS, State boards Threat board SAC – helo comms CO OOW	Could take 30 mins. Depends on: - team experience (if junior so need to watch) Traffic vol. Multi-tasking	SA: • % TG tasking • % warnings • % schedule • % contact responses CM: • comms @ warnings - # - duration - content (?) DM: • RT to plan • % deadlines • % warnings	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes - real time • SME review – real time or video. • Analysis of msg log

Comments:
OR will start audio recording? Warnings may be delegated to a warfare director, who may be inexperienced. TG may direct which warnings and when.
* **Cognition:**
  Attention: rapid switches. Minimal processing time at each switch.
  Memory: Several high memory load issues plus status change detection as switch from task to task.
* **Team management:**
  Smooth co-ordination required to time warnings, evaluate, and check risk as contact closes.
  Review ROE for appropriate warning.
* **Challenges:**
  ORO may need cheat sheet if weak in any warfare area, especially if warfare director is also inexperienced.
  May miscalculate capability of unit giving warning (e.g. helo)
  May select wrong wng.

9 - ORO Goal(s) : - Ensure contact classified correctly

Criterion: An ORO must be able to, in a timely, complete and accurate way:
- access all info available on contact.
- check contact info maximized (quality and quantity).
- conduct own classification and/or.
- validate WDs classification (check alternatives, probe potential weaknesses, recognize inconsistencies or incompleteness among data or with conclusions.)

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Threat profiles • Classification criteria • All classification info – confirming – disconfirming – correlation • Potential error sources- - sensor limits – team experience – ambiguos data – other options • All contact info – IFF - Visual features – recent behaviour – sensor data quality	• Match threat type? – confidence level? – other explanations? (friendly or neutral, sensor error, interpretation error? – verification needs? • Intended en tactics? – en intent? – en maneuver plan? – en schedule plan? • Classification correct? - Need more data?	CCS, GOP, JMCS Threat board WDs & OR tm members ORS, OOW Other TG assets	Comfortable but tense Frequent switching among different "pictures" global picture, threat picture, and various resource picture.	SA: • % classification criteria • % contact info • % threat info • % alternatives • % error sources CM: • comms @ classification - # - duration - content (?) DM: • RT to classify • % classification errors	SA: • Freeze probes • Embedded probes – incorrect data – wrong classification • SME review - real time or video. CM: • SME review - real time or video. • Timeline analysis DM: • Embedded probes - real time • SME review – real time or video.

Comments:
In practice ORO tends to rely on positive confirming correlation evidence rather than look for negative disconfirming evidence. However, this can lead to errors. To evaluate this may need to set up evaluation situation in which negative disconfirming evidence is required to classify contact unambiguously.
OROs may guess about en tactics, infer from en doctrine, or past patterns.
Tendency for ORO to lose awareness of global picture (and possibly emerging threats) while focussed on local threat picture.
OROs may fail to integrate current threat into global picture and hence miss patterns such as decoy.
OR plotting, reporting, transcription errors common.

10 - ORO Goal(s): Ensure OR detects missile firing and establish firm radar track

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Monitor recon track
– Confirm radar image OK.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Location and time of firing • Recon track co, spd, tk. • Radar image • Helo location • Threat profiles	• Confirm threat profile • Tgt of missile in TG? • Helo safe? • Reckon track OK? • Radar image OK?	CCS, SWC, SAC, ORS	May "switch off" ASWC to reduce overload.	SA: • % Recon track info CM: • comms @ track comms @ radar image – # - duration – content x class DM: % related decisions	SA: • Embedded probe(s) • Freeze probe(s) • SME review - real time or video. CM: • SME review - real time or video. DM: • Post hoc freeze probe • SME review - real time or video.

Comments:

11- ORO goal: Ensure detailed and viable tactical plan prepared.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Correctly analyze critical features of the WD's tactical plan and identify errors or omissions; or
- Produce plan of own if WD already fully engaged.

Notes:
This can be viewed as a special case of the ORO background task of acquiring and maintaining situation awareness.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• All contact info – CPA, schedule, AOP • All threat info – capability – wpn ranges – apparent intent – possible tactics • Mission information - TG/CO intent/tasking – ROE. – COA & pre-plans – procedures – competing req'ments – impending req'ments • Own resources – availability – capability (e.g. wpn ranges) • Timeline • Global picture – other contacts – territorial limits – waterspace mgt – nav hazards – collateral damage?	• Main issues to check? – tasking from TG? • COA? – fits pre-plan? – alternatives? • 1st re-actions OK? – maneuver? – change readiness? • Ship / OR ready? – tasks TBD? – OR tms OK? • Free to act? – obtain tasking – ask for new ROE? • Deadlines(s)? – for plan elements	CCS, State boards, GOP, JMCS ORS, OOW WD CO, TG.		SA: • % contact info • % threat info • % mission info • % timeline • % pre-plans • % Global picture CM: • comms @ prepare - # - duration - content (?) • Comms flow – timeliness – queries – tracking outcome DM: • % ready to check • % plan options selected • Decisions on critical path	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes - real time • SME review – real time or video.

Comments:
- **Cognition:**
  ORO tries to visualize the plan(s) and options.
  ORO now likely to have dropped background tasks. Tend to focus on this single event and neglect big picture. May miss other surface or air threats
  May forget background information such as recent int messages or equipment malfunction.
- **Team mgt.:**
  Additional resources may be available depending on state of readiness e.g. at Action Stations.
- **Potential challenges:**
  May be discrepancies between audio tasking order from TG and txt message back up that follows later. De-coding / transcription errors occur @ 5%. If so, queries needed on voice to TG to double check. (2-3 minutes between first audio tasking command and text tasking message from TG.)

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FOREGROUND GOALS

<table>
<tr><td colspan="6">12 - ORO goal(s): Check warfare directors (WD) plan.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
•   Comprehend WD plan
•   Evaluate WD plan in terms of all strategic and tactical factors
•   Interact with WD about plan (query, re-direct).</td></tr>
<tr>
<th>Awareness
needs</th>
<th>Decisions
required</th>
<th>Communication
sources</th>
<th>Workload
issues</th>
<th>Measure
% = complete + accurate</th>
<th>Method</th>
</tr>
<tr>
<td>• Warfare director's:
- Global picture
– Mission & ROE
– Threat picture
– Contact picture
– Immediate goals
– Timelines
– Resource picture
– COA considered
– COA chosen
– Computations
– Preparatory tasks
– Risk assessment
• Global picture:
- all pertinent factors
• Local picture:
- all pertinent factors</td>
<td>• WD?
– cover all factors?
– info correct?
– info complete?
– considered all COA?
– calculations OK?
– timeline OK?
– risks OK?</td>
<td>WD</td>
<td>Many others want OROs attention.</td>
<td>SA:
%Warfare director's:
- Global picture
– Mission & ROE
– Threat picture
– Contact picture
– Immediate goals
– Timelines
– Resource picture
– COA considered
– COA chosen
– Computations
– Preparatory tasks
– Risks
CM:
• Comms @ WD plan
- #
- duration (total)
- content/type (?)
DM:
• % plan errors detected
– WD picture
– WD assessment
• % corrections made</td>
<td>SA:
• Freeze probe after WD briefing.
• SME review
- real time or video.
CM:
• SME review
- real time or video.
DM:
• Embedded probes
- real time
• SME review
– real time or video.</td>
</tr>
<tr><td colspan="6"><u>Comments:</u>
•ORO and Warfare Director need to see same picture to interact effectively. Need common picture with no ambiguity and minimal delays or errors in understanding.
•Face to face contact important for body language. At present, ORO may leave own CCS to confer at WD's CCS or GOP.
  If not face to face, need "pointers" on each screen to complement voice discussions i.e. so ORO can point on WD screen & vice-versa.
  Preference expressed for round table configuration.
•Style and level of interaction varies with experience as a team e.g. .trust in others judgement.
•Interaction between ORO and WD prone to interruption from various voice sources. Interaction and audio communicationss now more error prone.
•OR tm use hand signals to conduct internal communication traffic (eg point to headphone to indicate want to speak or other to listen in.)
•Experience needed to multi-task speaking and listening (to different nets, or net + voice) without cross talk or omission errors.
•Interaction will vary with different ORO and WD backgrounds. Former SWC will have different mental model and ask different questions from former ASWC
  depending on warfare type involved.
•ORO will sometimes miss internal OR voice communication because on different net or attention to CCS or text.
•May turn down volume on radio nets to listen to voices in OR and forget to turn up volume later.</td></tr>
</table>

13 - ORO Goal(s):   Make CO aware of all relevant components of the plan. Get feedback from CO.

Criterion: An ORO must be able to, in a timely, complete and accurate way:
- Brief CO on all critical plan details clearly in shortest possible time, with as few requests for clarification as possible.
- Receive feedback / direction from CO quickly and clearly.

Notes:
Commonly will brief CO and OOW at same time. CO and ORO will be in OR together around one CCS with OOW on the bridge, observing on a slave CCS terminal. Need common visual picture to get information across as quickly and effectively as possible.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Info required by CO/OOW – TG tasking + goals – Key factors – Major options – Outline plan – Timeline – Risks • Likely queries	• What info to choose. • Time to brief? – when, how long? • CO, OOW understood?	• CO, OOW. • Need common picture Usually use CCS or GOP	• Very limited time? • Interruptions likely	SA: (x ORO) • %– key briefing info • % - CO queries SA: (CO, OOW) • %– key briefing info CM: • Comms @ brief - # queries - duration of brief - content/type/errors DM: • % key info chosen	SA: • Freeze probe - pre-brief – post-brief (to CO) • SME review - real time or video. CM: • SME review - real time or video. DM: • SME (CO) review – post hoc, real time, or video.

Comments:
CO may not be in OR to view screen so ORO may have to paint visual picture verbally. Such verbal info prone to error.
Need to confirm that OOW has understood all points. Will select information to match CO and OOW style, experience, etc.
•Research question:
 how best to rapidly communicate critical plan information among team.

14 - ORO Goal (s)   Ensure all OR team aware of plan. Emphasize key points.

Criterion: An ORO must be able to, in a timely, complete and accurate way:
- make OR team members aware of critical plan details quickly and clearly
  (i.e. in shortest possible time, with as few requests for clarification as possible.)
- confirm that OR team comprehends.

Notes:
Currently everyone in the OR who is not on a critical task has to remove headset from at least one ear and attend to the ORO as briefing is provided. Some OR members may continue to watch screen or monitor a communication network with one ear. Likely to be a time of stress. Used to focus the OR, provide specific information, and to confirm 'command presence'.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• All attending?
• Info required by OR
– TG tasking
– Ship's goal
– Outline plan
– Timeline
– Key OR task points
• Likely queries
• Comprehension
	• What info to choose?
	• Time to brief?
	– when, how long?
	• OR tm(s) understand?
		• OR tm:
		Face to face – voice.
		All attend with head phones off.
			• Pick 'quiet' moment.
			• Limited time
			• Takes 30-40 seconds
				SA: (x ORO)
				• % key briefing info
				• %OR attending
				• % comprehending
				SA: (OR tm members)
				• %– key briefing info
				CM:
				• Comms @ brief
				  - duration of brief
				  - # queries
				  - content/type(?)
				DM:
				• % info chosen
					SA:
					• Freeze probe:
					  - pre-brief (ORO)
					  – post-brief (OR tm)
					• SME review
					  - real time or video.
					CM:
					• SME review
					  - real time or video.
					DM:
					• SME (OR tm?) review
					  – post hoc, real time, or video.

Comments:
Typically only required for refocusing team and setting priorities in multi-threat contexts.
Standard procedure for briefing learned during training.
Graphics quickest
Verbal briefings prone to error.
Interruptions likely. OR team members may be distracted with ongoing tasks.
•**Evaluation**
  Need to rate "style" as well as content. To establish how well content transformed could use 'back briefing' approach.

15 - ORO Goal(s): Supervise execution of plan by OR team.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Know the plan and the status of its implementation (completeness, quality, appropriateness).
- Recognize errors or need for change and correct promptly.
- interact with OR tm members as appropriate .
- Recognize overload within the OR promptly and re-direct OR team efforts.
- Be able to provide back up personally when required (e.g. second threat emerges.).

Notes: While monitoring plan execution, the ORO needs to maintain global awareness in order to be able to redirect the plan if the big picture dictates, and to be ready to react to other threats or tasking. See 'Background tasks' for more information. ORO tries to anticipate and recognize problems and intervene or assist but avoid interference.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Plan – goal(s) – tasks to be done *(pre-plans, procedures)* – schedule – task completion – task quality - OR wkload problems • Global picture – new int, contacts – effect on plan – emerging risks – emerging threats	• Planned tasks – on schedule? – qualiiy OK? - outcome OK? • Intervene? – change plan? – add resources? – give guidance? • Report required? – from OR tm – to TG, CO, etc. • Global picture OK?	CCS, State boards, GOP, JMCS WD ORS, OOW, SIGS, CSE CO, TG.	Multi-tasking High stress High workload	SA: (x ORO) • **% Plan** – goal(s) – tasks to be done – schedule – task completion – emerging problems • **% global picture** – new int, contacts – effect on execution – emerging risks – emerging threats CM: • Comms @ implementation – duration - # - content/type(?) DM: • % problems identified. • % solutions OK?.	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes – real time • SME review – real time or video. WL: • WL scale - S# after action. – SME (real time or video)

Comments:
Feedback from "feel" of ship (heel, speed, etc) very important now. ORO needs "sense" of movement in space. May need reminders for course changes due (e.g. route, search, or zig zag). Lost contact can occur, and need search plan templates when this happens. May need to revise search plans for local conditions - e.g. territorial. limits, civil traffic, collateral damage potential.
Tries to visualize underwater or external picture. May query the OOW, or use STIR cameras if available. External 360 degree picture would help.
ORO needs to know when change occurs in plan and update system as these occur, e.g. schedule changes? Will these be automatic?
Current CCS plot frequently incorrect: always look for anomalies between sensors as a cue. Symbol transcription errors common.
Team can omit pre-plan step in excitement. Smart prompts on possible actions would help memory.
Tunnel vision more associated with ASW during this time as more ambiguities.

Annex C:
FOREGROUND GOALS

<table>
<tr><td colspan="6"><u>16 – ORO Goal(s): Ensure standard procedures completed correctly (ZIPPO, AIR RED, Action Stations, Greyhound, etc)</u></td></tr>
<tr><td colspan="6"><u>Criteria:</u> An ORO must be able to, in a timely, complete and accurate way:
- Decide when to start implementation
- Check that procedures are completed
– Identify and deal with problems as they occur.</td></tr>
<tr>
<td>Awareness
needs</td>
<td>Decisions
required</td>
<td>Communication
sources</td>
<td>Workload
issues</td>
<td>Measure
% = complete + accurate</td>
<td>Method</td>
</tr>
<tr>
<td>• Factors affecting:
- Deadline(s)
– Resources
– Distractions
• Procedures required
• Progress
– Schedule
– Quality</td>
<td>• Tailor procedure?
• Tasks OK?
- on schedule?
– complete?
• Problems?
– Solution?</td>
<td>- SWC, ASWC
- ORS,
- Visual x OR
– OR net,
- Checklist
- CO, TG when complete</td>
<td>Must also maintain focus on threat.
Time to implement procedure may be very short.</td>
<td>SA:
• % Procedure
– Tasks
– Schedule
– Completion
– Delays
– Problems
CM:
• Comms @ Zippo (etc)
- #
- duration
– content x class
DM:
• % problems identified
• % solutions identified</td>
<td>SA:
• Embedded probe(s)
• Freeze probe(s)
• SME review
- real time or video.
CM:
• SME review
- real time or video.
DM:
• Post hoc freeze probe
• SME review
- real time or video.</td>
</tr>
<tr><td colspan="6"><u>Comments:</u>
• Cognition:
  Memory
  - procedures form a significant memory load. Sometimes miss steps under stress.
• Potential Problems:
  - OR task management (steps OK, reports OK).</td></tr>
</table>

17 - ORO Goal (s)   Stay on top of global picture.

Criteria: An ORO must be able to, in a timely, complete and accurate way:

- Switch readily between monitoring threat response and the global picture.
- Cross reference changes or occurrences in either.
- Deal with other occurrences (e.g. another threat, equipment failure, unexpected navigation hazard)without losing either the threat or global picture.

Notes: This can be regarded as part of the background task of maintaining background and foreground awareness.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Plan – elements – schedule • Ship movement: – co, spd (repeaters), - OOW response – response (feel) • Environmental effects: - underwater, - surface – coastal terrain – relative wind • Target details – current position – current co, spd, etc – projected details – any changes • Relative locations: - target –contacts in area, TG, - nav hazards – limits (territorial, etc) • Emerging threats	• Desired co & spd. – Helm orders (?) - Ship safe? – Aim being achieved?	CCS, OR repeaters – co, spd rel wind OOW OR tm ldrs (for info)	Frequent switching between BP and threat picture(s). WL= comfortable but tense. May continue for hours. May split con with CO. Others in OR alert ORO if something else.	SA: • % plan elements • % timeline • % target details • % en intent • % ship response • % environment • % contact locations • % procedures • % global picture CM: • comms @ maneuver: - # - duration - content (?) DM: • RT significant changes • % significant changes • % reactions correct WL: • Red line: - # exceed – duration exceed – effect on other tasks	SA: • Freeze probes • SME review - real time or video. CM: • SME review - real time or video. DM: • Embedded probes – real time • SME review – real time or video. WL: • WL scale - S# after action. – SME (real time or video)

Comments:

Annex C:
FOREGROUND GOALS

<table>
<tr><td colspan="6">18 - ORO Goal(s): Back up Warfare Director (WD) as required</td></tr>
<tr><td colspan="6">Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Monitor what the WD is doing.
– Check WD's actions.
- Intervene as required.</td></tr>
</table>

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Contact details • Procedural steps • WDs progress • VETO set up • Chaff release plan • TG plan and capabilities (eg ATH = long range missile defence.) • WD workload	• WD progress OK? • Take over from WD? • Ask TG to take if in range? • Enable VETO	WD CCS TG		% Detection and correction of WD errors.	Video analysis of scenario.

Comments:
- Cognition:
  Currently, too much attention on mechanics of display management. Distracts from main awareness
- Potential Problems:
  Need to range down CCS to cover missile approach on screen This does not always happen smoothly. Can become disoriented as switch takes place.
  Error diagnosis for SWC: freezes, misses key diagnostic point, wrong QAB activated (eg single vs salvo), keying error.
- Relevant Experience:
  Novices forget VETO. Know TG capabilities e.g. ATH has longer range for radar and missiles.

19 - ORO Goal(s): Maneuver ship as required.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Determine desired course and speed
- Check suitability (hazards, objectives, etc)
- Direct desired course and speed
- Monitor actual course and speed and confirm OK

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Global picture – current pos'n / track – future pos'n /track • Threat picture – current pos'n / track – future pos'n / track • Feedback @: - Orders understood – Course changes - Speed changes	• Co & spd to take – now –future	• OOW • CCS • Indicators – Turn and course – speed – ship movement	Takes @ 2 minutes to set on new course. WL = High when maneuvering. Can,t maintain level longer than an hour. With 6 other ships at high speed becomes major priority – esp at night and bad sea state. White shipping #1 priority.	SA: • % Maneuver goals • % current track • % future track • % change – course – speed - schedule CM: • Comms @ maneuver - # - duration – content x class DM: • % co spd chosen. • % react to hazard(s).	SA: • Embedded probe(s) • Freeze probe(s) • SME review – real time or video. CM: • SME review – real time or video. DM: • Embedded probe. - RT: maneuver errors • SME review - real time or video.

Comments:
•Evaluation Methods:
  Need to Insert errors in co, speed or schedule into evaluation scenario to evaluate response to such problems, and measure

Annex C:
FOREGROUND GOALS

<table>
<tr><td colspan="6"><u>20 - ORO Goal(s): Check for other threats</u>
See "Background" and "Generic Threat" tasks

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Detect any other risk or threat to the ship or to the mission</td></tr>
<tr><td>Awareness needs</td><td>Decisions required</td><td>Communication sources</td><td>Workload issues</td><td>Measure
% = complete + accurate</td><td>Method</td></tr>
<tr><td>• Global picture
• Any 2nd threats.
• Any other risks</td><td>• Switch to big picture?
• Start 2nd soln?</td><td>TG, external AAW, CCS screen.</td><td>Likely to be very high if threat under way. Stress levels high too.</td><td>See previous serials</td><td>See previous serials</td></tr>
<tr><td colspan="6">Comments:</td></tr>
</table>

21 - ORO Goal(s): Respond to second threat

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Respond in the same way as for threat #1. See items 1 – 20 above.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

Comments:
- Cognition:
  Time sharing between 2 warfare areas. Likely to lose focus. Frequent switching.
- Potential Problems:
  ORO multi tasking under stress. Must be able to focus on new threat, monitor existing threat, and maintain awareness of global picture.
- Team issues:
  May handover one or more tasks to others in OR for example CO, off watch ORO, Combat Officer, ASWC if capable and not already busy.
  Problem that not enough consoles.

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22 - ORO Goal(s): Confirm enemy target destroyed

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Determine that enemy target has been destroyed
- Confirm that no further threat exists.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Engagement details • All sources of data. -- EW, radar, visual.	• Threat gone? • Correlate EW, radar, visual info? • Fire own solution? • Further action	WD, CCS, OOW, TG.	Very little time.	SA: • % engagement details • Correlation pattern CM: • Comms @ engagement - # - duration -- content x class DM: % Assessment	SA: • Embedded probe(s) • Freeze probe(s) • SME review - real time or video. CM: • SME review - real time or video. DM: • Post hoc freeze probe SME review - real time or video.

Comments:
May need to continue to monitor capability of partially neutralized threat.

23- ORO Goal(s): Assess damage to own ship from missile (etc) hit

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Determine pertinent damage.
– Assess functional impact on OR capabilities
– Assess repair schedule and completeness
- Determine work required / possible
– Determine impact on current TG tasking
– Make recommendations

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Lost capability – sensors – weapons – personnel – communications • Consequence for task(s) • Repair schedule	• Work around ship or TG? – sensors – weapons – personnel – communications • Continue tasking? • Recommendations? – CO – TG.	WD, OOW, ORS, CSE CCS, Comms panel CO, TG.	Very little time.	SA: • % capability lost • Comms @ damage - # - duration – content x class DM: % effect on tasks % recommendations	SA: • Embedded probe(s) • Freeze probe(s) • SME review - real time or video. CM: • SME review - real time or video. DM: • Post hoc freeze probe SME review - real time or video.

Comments:

24 - ORO Goal(s) - Regain awareness of the global picture following period of concentration at threat level.

ORO Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Recognizes when to switch to global picture.
- Regain global Situation Awareness.
- Recognize changes in Situation since last attended, and their significance.

Notes: The need to re-acquire awareness in one domain after a period of intense concentration in another frequently occurs and is not peculiar to the ORO. For the ORO this may be a switch from threat area to threat area, after 'zooming' out or in, or when changing focus from the global to the threat picture, or some other aspect such as equipment capability, an incoming flash message, a damage report from somewhere else in the ship that imposes limitations on plan implementation.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• When to switch to global picture. • Changes since last inspected.	• Where to attend. • Significance of changes	• CCS, GOP, JMCS, SWC, ORS, ASWC TG As required		SA: • spatial, content and temporal information %TG, • % all warfare areas, • % relationship of new to existing • %comm traffic. • RT to recover information. M: • %sources consulted • %data selected	SA: • Probe-active/passive • SME review of overt task behaviour.

Comments:
- **Cognition:**
  When switch attention to global picture (or vice-versa). Need to comprehend pertinent changes since last 'view' as quickly as possible.

25- ORO Goal(s): Re-focus OR team. Calm everyone down. Re establish command presence.

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Pick key items to brief OR team.
– Re-focus ongoing surveillance
– Ensure that OR back on task (see "Manage OR")

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Way forward • Tasks in hand	• What to brief – new ROE – active pre-plans – political changes. • Lessons learned	• OR • Back row team • OOW		SA: • % Briefing needs CM: • Comms @ to re-focus - # - duration – content x class DM: % briefing content Rating briefing presence? RT – start briefing RT – OR back on task	SA: • Embedded probe(s) • Freeze probe(s) • SME review - real time or video. CM: • SME review - real time or video. DM: • Post hoc freeze probe SME review - real time or video.

Comments:
Could change several ROE because have now been fired on.

Annex C:
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<table>
<tr>
<td colspan="6">26 – ORO Goal(s): Stand down own weapons</td>
</tr>
<tr>
<td colspan="6">Criteria: An ORO must be able to, in a timely, complete and accurate way:
- confirm that there are no other threats
– stand down own missiles or destroy in air.</td>
</tr>
<tr>
<td>Awareness needs</td>
<td>Decisions required</td>
<td>Communication sources</td>
<td>Workload issues</td>
<td>Measure
% = complete + accurate</td>
<td>Method</td>
</tr>
<tr>
<td>• Other threats
• Own weapons fired
 – details</td>
<td>• Confirm no threats?
• Switch to other threats?
• Own weapons
 – destroy missiles in air?
 – stand down wpns?
• Stand down?
 – which?
 - when?</td>
<td>WD, ORS, OOW, TG
CO</td>
<td></td>
<td>SA:
• % other threats
• % own weapons fired
CM:
• Comms @ fr weapons
 - #
 - duration
 – content x class
DM:
• % destroy own missiles
• % stand down decision
• RT - appropriate decision</td>
<td>SA:
• Embedded probe(s)
• Freeze probe(s)
• SME review
 - real time or video.
CM:
• SME review
 - real time or video.
DM:
• Post hoc freeze probe
• SME review
 - real time or video.</td>
</tr>
<tr>
<td colspan="6">Comments:
May need to monitor partially neutralized threat.</td>
</tr>
</table>

27 - ORO Goal(s): Stand down ship

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Anticipate immediate needs
- Forecast related readiness required
- Establish any changes in current capability
- Return ship to previous capability state.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method

• TG intent
• Readiness in place
• Tasks to be done
• Task progress?
	• Replenishment needs?
	• Repair needs?
	• Readiness needed?
	• Return to original course
	• Report to CO?
	• Sitrep to ship?
		CCS, stateboards
		TG, SWC, ASWC, OR,
		OOW, ship, CSE, CO
				SA:
				• % Stand down issues
				CM:
				• Comms @ stand down
				  - #
				  - duration
				  – content x class
				DM:
				% stand down decisions
				RT – stand down decision
					SA:
					• Embedded probe(s)
					• Freeze probe(s)
					• SME review
					  - real time or video.
					CM:
					• SME review
					  - real time or video.
					DM:
					• Post hoc freeze probe
					SME review
					  - real time or video.

Comments:
May be difficult to focus after stress of engagement.

Annex C:
FOREGROUND GOALS

28 - ORO Goal(s): Report to/from TG

Criteria: An ORO must be able to, in a timely, complete and accurate way:
- Determine and schedule all reports required (internal and external).
- Collate and check information required by reports.
- Assemble and transmit reports according to schedule.

Awareness needs	Decisions required	Communication sources	Workload issues	Measure % = complete + accurate	Method
• Reports required • Report schedule • Report content.	• Report list complete? • Report schedule OK? • Report OK for TX? – content – format.	TG WD ORS, Comms staff/		SA: • % report requirements CM: • Comms @ reports - # - duration – content x class DM: % reports missed / late % content incorrect RT – report preparation	SA: • Embedded probe(s) • Freeze probe(s) • SME review - real time or video. CM: • SME review - real time or video. DM: • Post hoc freeze probe SME review - real time or video.

Comments:
Currently have to transcribe most information by hand from various screens around OR.

ANNEX D:

**ORO Goals for
SCENARIO EVENT
SEQUENCES**

Scenario event sequences

Introduction

In this Annex, activities for two scenario events requiring active threat engagement (i.e. weapons are fired) are tabulated and cross referenced to the data tables in Annex A, B and C. Note that the description of the goals in these tables sometimes differ slightly and, in many cases, cross-reference to more that one item in the data tables. This is because the goals related to scenario event items may have been expressed differently during interviews. Nonetheless the underlying intent appeared to be the same as that expressed in the generic goals in the data tables. When setting up measurement profiles for a given scenario, generic descriptions and measurements taken from the data tables will need to be customized and brought into focus for the specific circumstances set up in the scenario (time, place, environment, threat specifics, etc).

Table D1 collates all ORO goals from Annex A, B and C. Table D2 cross-references goals to event activities for Event # 6 –engagement with a shore missile battery. Table D3 cross-references goals to event activities for Event #7 – engagement with an enemy surface action group.

Annex D:
SCENARIO EVENT SEQUENCES

Generic ORO goals / tasks		
(Not all needed, & sequence only approximate. Row entries are not related across columns.)		
Annex A. Coming On watch	**Annex B. Background**	**Annex C. Generic threat response**
1. Visualize external environment for the start of the watch.	1. Monitor & manage OR team(s).	1. Integrate new contact information with own global picture
2. Update own knowledge for coming watch from text msg information.	2. Manage information from all sources coming to ORO position (speech, text, other).	2. Ensure OR prepares quick first response, broad plan for worst case.
3. Establish schedule of anticipated events for watch.	3. Monitor & manage OR equipment capability.	3. Optimize work among OR team(s)
4. Update understanding of threats.	4. Build, monitor & maintain own awareness of pertinent surface environment.	4. Optimize information flow within & outside OR.
5. Establish current activity levels & work focus among OR team(s)	5. Build, monitor & maintain own awareness of pertinent air environment.	5. Maximize number of information sources concerning contact
6. Prepare check-list to monitor progress on required action items during watch	6. Build, monitor & maintain own awareness of pertinent sub-surface environment.	6. Optimize data quality for each information source
7. Review OR system performance (sensors, etc) & rectify or work around as required	7. Build, monitor & maintain own awareness of integrated picture(s) comprising selected elements of surface, sub-surface & air environments & other related information (e.g. resources).	7. Establish communication with contact to resolve identity & intentions
8. Comprehend items in CO's order book.	8. Switch attention between different tasks & acquire awareness quickly & effectively.	8. Conduct warnings according to TG tasking.
9. Comprehend brief from outgoing ORO	9. Maintain awareness of ORO's authority to act.	9. Ensure contact classified correctly
10. Optimize own CCS .	10. Co-ord with other TG members	10. Ensure OR detects if en. missile (etc) fired & establish firm track.
11. Focus OR team on period ahead. Establish command presence.	11. Check outgoing message traffic.	11. Ensure detailed viable tactical plan prepared.
12. Review pertinent pre-plans, procedures & ROE for period ahead.		12. Check warfare directors (WD) plan.
		13. Make CO aware of all relevant components of plan. Get feedback from CO.
		14. Ensure all OR team aware of plan. Emphasize key points.
		15. Supervise execution of plan by OR team.
		16. Ensure standard procedures completed correctly (Greyhound, ZIPPO, Action stations, ASMD, etc).
		17. Stay on top of global picture during threat response.
		18. Back up WD director as required.
		19. Maneuver ship as required.
		20. Check for other threats
		21. Respond to second threat
		22. Confirm enemy target destroyed
		23. Assess own ship damage from missile hit.
		24. Regain awareness of global picture following period of concentration at threat level.
		25. Re-focus team. Establish command presence.
		26. Stand down weapons
		27. Stand down ship
		28. Complete & send reports.

Table D1: Generic Coming on Watch, Background and Threat related ORO goals

Annex D:
SCENARIO EVENT SEQUENCES

Scenario Event Item	ORO Goal(s)		Data Table #
Event #6: Shore missile battery engagement			
1. TORONTO detects EW racket. Classifies as RICEBOWL in search mode. EWS reports to SWC.	1.	Prioritize own effort.	C3
	2.	Optimize OR info gathering @ contact.	C4,5,6
	3.	Prepare for worst case.	C2
	4.	Ensure OR team members remain focussed on own tasks.*	C3,C4
2. TG/EWC correlates with known battery location.	5.	Cross check data from TG with own threat picture	C5
3. RICEBOWL EW racket changes to target mode.	6.	Ensure OR detects missile firing & establish firm radar track.	C10.
	7.	Monitor key issues & changes in global picture.	B4-7
	8.	Supervise execution of pre-plan	C15
4. TG/AAWC directs ZIPPO3 and AIR THREAT RED.	9.	Ensure procedures completed correctly	C16
	10.	Maneuver ship as required.	C19
5. TORONTO goes to ACTION STATIONS.	11.	Ensure Action stations procedures completed	C16
	12.	Brief ship about reason for going to Action Stations (etc).	A11, C14 C17
6. ORO checks OR response to ZIPPO requirements. ORO waits for CHAFF report	13.	Ensure procedures completed correclty	C16
	14.	Check SWCs Fire control solution.*	C12
	15.	Check ASMD (Anti Ship Missile Defence)	C16
	16.	Maneuver ship for ASMD.	C19
7. Radar shows two contacts.	17.	Confirm contact.	C9
8. SWC resolves tracks	18.	Check SWC resolve & fire control solution.	C12
9. SWC assess tracks as incoming missiles Recommends solution to ORO	19.	Brief CO and OOW	C13
	20.	Brief OR	C14, A11
	21.	Check that OR & OOW all OK.	B1, C14
	22.	Co-ord with TG.	B7, B10
	23.	Back up SWC while implementing firing solution.	C18
10. Athabascan engages both missiles	24.	Track missiles fired from ATHABASKAN. Maintain readiness of own ship solution.	C10, C11
	25.	Check for second threat.	B7, B8
11. Missiles destroyed	26.	Confirm enemy missiles destroyed.	C5, C6
	27.	Stand down own weaponsmissiles.	C26
	28.	Recapture big picture.	B7,8
12. TG/AAWC cancels ZIPPO	29.	Re-focus OR team. Re establish command presence.	C14, A11
13. Toronto stands down from Action Stations.	30.	Stand down ship.	C27
	31.	Report to/from TG	B11, B28

Table D2: Scenario Activities for Event # 6, ORO Goals, and related data tables
(Data Table #'s refer to goals in Annex A, B, or C)

Scenario Event Item	ORO Goal(s)	Datat Table #
Event #7: Surface Action Group	•	
1. TORONTO receives LINK from MPA. Two unknown tracks @ 80 nm from ship.	• Prioritize own efforts • Optimize OR information gathering • Prepare broad plan for worst case	C1, C2, B4, B7 C4, C5, C6 C2
2. TG/ASUWC tasks MPA to further investigate.	• Wait for MPA data	NA
3. MPA: verbal report that tracks 3 nm apart at 25 kts heading to TG.	• Classify contact • Brief OR tm	C9 A11, A14
4. MPA verbal report: EW racket for air search radar from one contact.	• Re-classify contact	C9
5. TG/ASUWC classifies trks as hostile. MPA responsible for LINK.	• Continue preparation	NA
6. TG comdr directs AIR and SURFACE threat warning RED.	• Start AIR and SURFACE RED • Ensure weapons ready	C17 C15
7. ORO recommends ACTION STATIONS. ORO monitors and checks status as ship goes to AS.	• Implement ACTION STATIONS	C17
8. TG: tasks TORONTO + VDQ as SAG + MPA as Tgt Report Unit (TRU).	• Brief TRU	C14, A11
9. ORO informs CO + SWC + ORS. TRU follows Greyhound procedures. ORO monitors G-hound.	• Implement Greyhound • Estimate times to missile firing	C17 C11
10. SWC prepares plan. SWC briefs ORO and CO then OR and TRU	• Check SWCs plan	C12
11. ORO conducts own checks.	• Check safety issues • Solution checks to backup SWC fire soln. • Plan after missiles fired.	C12, C15 C11, C12 C11, C12
12. SWC confirms ready to fire. CO gives permission. SWC fires missiles at en ships.	• Ensure missiles launched • Back up SWC. • Maneuver ship as required • Track own missiles	C15 C18 C19 C10
13. MPA: SLAMEYE report = 2 missiles from en SAG.	• Ensure RECKON track in place. • Prepare fire solution to back up SWC • Coord TRU	C10 C12, C18 B7, B8, B10
14. TG/AAWC calls ZIPPO4.	• Implement and check ZIPPO4	C15, C17
15. ORO monitors ZIPPO4, readiness reports from ORS, SWC, EWS. Reports Z4 complete to CO.		
16. Ships radar paints missiles at 20 nm. Establish track (from SG150). OOW reports visual contact with missiles at 10 nm.	• Evaluate track.	C10, C11
17. SWC resolves contact and calculates CPA. Final check with ORO. SWC asks permission to fire from CO (via ORO)	• Double check SWC solution • Back up SWC firing actions.	C12 C18
18. EWS detects missile lock on radar. ORO checks chaff gone.	• Back up SWC	C18
19. SWC confirms permission to fire. Fires two Sea Sparrow missiles.	• Back up SWC	C18
20. ORO monitors engagement. One en. missile destroyed. Second en. missile not destroyed.	• Monitor incoming missile. • Plan for worst case.	C4, C5, C6 C2, C11
21. MPA reports SNOOPTRAY EW racket.	• Maximize info @ contact, B7,B8 • Plan for worst. • Coord OR response.	C4, C5, C6, B6. C2 B1, B10
22. CIWS automatically engages @ 1500 yds.	• Focus on ASW problem.	C4, C5, C6
23. CIWS succesful. Damage = UHF: 405 (AAW coord). 210 (TG tac net). 213 (MPA task gp report + LINK net). Reconfigure comms.	• Assess damage • Work around damage • Assess ability to fulfill SAG task. • Maintain OR focus on ASW threat	C23 C23 C23 C10, B10, B11
24. MPA reports DAMCAT on own missile firing: both en SAG contacts dead in water, smoke from one. 25. Pass DAMCAT to TG/ASUWC.	• Prepare DAMCAT • Check DAMCAT • Recommendations to TG.	B2, B11 B2, B11 C10, B10, B11
26. TG/SWC terminates SAG and Greyhound.	• Recapture big picture • Calm & re-focus OR. Establish command presence. • Stand down ship	B7, B8 A11, C14 C27, C26
27. ORO prepares reports. Voice and hard copy.	• Check reports complete and accurate	B2, B11

Table D3: Scenario Activities for Event #7, ORO Goals, and related data tables
(Data Table #'s refer to goals in Annex A, B, or C)

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