Coastguard Programme

HM Coastguard

COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.1
SESSION NAME	Introduction

SCHEDULED SESSION TIME	00:10

RESOURCES NEEDED	Chart Room Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Welcome to the course, course outline, aim and objectives of the course.
Learning Outcomes	Delegates aware of the course outline.

Maritime Search 1 – Trainer Notes [V1]   1

Session 1.1: Introduction

Explain

Site layout, toilet facilities, health and safety, smoking facilities, fire alarm and drill.

Search Planning has a language all of its own, there are lots of acronyms and definitions. These are internationally recognised, and therefore it is important to know and use the terms appropriately. There are also lots of questions in the MS1 examination on these, so learn them now!! Trainer will capture all these on flipchart throughout the module and paper the walls with them – be sure to take note of them in your folders.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.2
SESSION NAME	What is Search Planning?

SCHEDULED SESSION TIME	00:25

RESOURCES NEEDED	Chart Room
	SAR G+T
	Calculators
	Parallel Rules
	Dividers
	2b Pencils
	SAD Worksheets
	Tidal Vector Worksheets
	Charts
	Exercises
	Projector
	Paper
	Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	What search planning is, when we do it and an overview of maritime search.
Learning Outcomes	Delegates will be able to;
	Define what search planning is.
	Define when we search plan.
	Start to identify search planning terminology.

Maritime Search 1 – Trainer Notes [V1]   3

Explain

Search and Rescue (SAR) is a much bigger thing than Search Planning (SP) – SP is an activity carried out during SAR action. Search Planning is a subset of SAR Planning.

Draw on whiteboard;

Search Planning is however a skill that few in the UK possess other than HMCG, that is one of the reasons it is so important to us. If we don't do it, and more importantly, do it right – then who will?

Activity - When do we do it? – 5 mins

In small groups, come up with a statement which defines when we do search planning.

Answer – "whenever there is or *potentially* is a need to locate an object, the position of which is unknown."

Basically we look for either a shore target (missing coastal walker) or a drifting maritime object, such as a vessel or even a ditched aircraft.

HMCG must stay one step ahead of the game, don't get caught out e.g. ILB goes after a windsurfer, finds the board and sail after 30 minutes, but not the person – where is the ILB going to search? This is a classic failure of HMCG – let's stamp it out!!

Note I talk about search *objects*, and drifting *objects*. The result of a preference by IMO to drop the connotation of something we shoot at (targets) rather than rescue!!

Explain

Maritime SP is about looking for a **drifting** object. We cannot easily allow for other eventualities, such as a person in the water swimming or a craft being propelled in some way – we call this "casualty assisted failure" (unofficial definition) – where the survivor is frantically moving by whatever means out of our expertly calculated area! We must however bear in mind that this could be happening!!

Basically, there are two elements involved…….

Firstly: To work out the area in which we expect a drifting target to be located at a pre-determined time.

In other words "**Search Area Determination**" (**SAD**).

There are various types of SAD model in use, namely Rapid Response, Datum Point, Datum Line, Backtrack and Datum Area. This module focuses on Rapid Response, the others will be covered in the next module.

Secondly: Once we have determined our search area, how are we going to search it given the SRUs available?

In other words "**Search Area Coverage**" (**SAC**)

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.3
SESSION NAME	SAD – Rapid Response

SCHEDULED SESSION TIME	00:25

RESOURCES NEEDED	Chart Room Whiteboard Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	An introduction to SAD – Rapid Response
Learning Outcomes	Delegates will be able to; Identify what information is required for a Rapid Response and what data is outputted.

Session 1.3: SAD – Rapid Response

Explain

Use the simple model approach here – Data in – Process – Data out. Note the process is either delivered by a human or SARIS – using SARIS reduces the chance of error creeping in. Try and get the delegates to suggest the input & output data elements as per the diagram below. Don't attempt to explain each one – simply capture the elements and explain each item as they arise throughout the course.

SAD Simple Model (Rapid Response)

Data In	Manual calculations AND Chart Plot	Data Out
LKP & Time		
DSP & Time		
DR Error		Search Area
Fix Error		Location
Target characteristics		Size
Leeway drift rate		Datum Position
Datum Time		Resultant drift
Tide / Current		Direction
Direction		Rate
Rate		
Wind		
Speed		
Direction		
Drift Error Factor		

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.4
SESSION NAME	SAD – Rapid Response input and construction

SCHEDULED SESSION TIME	01:10

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A step by step walk through of the construction of a Rapid Response search plan
Learning Outcomes	Delegates will be able to; Identify the process of constructing a Rapid Response.

Explain

Let us return to the input data first of all and discuss each element in detail and how or where we find the information to enter into our calculation…….

Note that some of this input data has an important link back to "information gathering" at the outset of an incident. Right at the outset of the incident, if you think search planning might become a feature, now you will gain an insight into the type of information you need to establish.

DRIFT START POSITION (DSP) & TIME (DST)

The position and time that we either know, or estimate, the target started drifting from. Information about this will be gathered directly from the casualty or from a first informant having sighted an incident occur.

**Fix**   (e.g. Mayday, visual sighting) – Bearing & distance or Lat & Long.

or

DR   (e.g. Last "fix" 30 minutes ago) – Bearing & distance or Lat & Long +
               Course & Speed steamed since the fix.

Once we have this, we plot it on a paper chart – we have started the model and apply our drift elements from it.

Explain

Start to draw this construction of a Rapid Response up on a whiteboard whilst explaining each element.

**LKP
Sally
1035UTC** ⊕

5kts

167°T

**DSP
Sally
1135UTC**
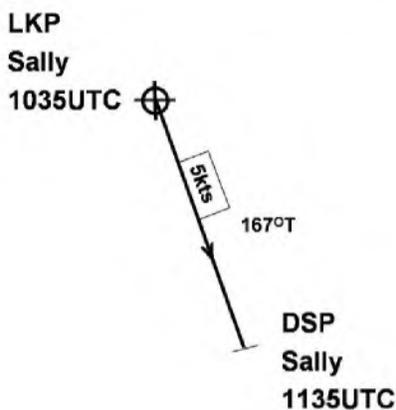
DATUM TIME

A search area can only be calculated for one instant in time. It is not possible to create a truly "dynamic" area manually, as it would be constantly changing in size and shape – impossible to search. (SARIS goes some way towards generating a dynamic visual, but it is far from perfect!!).

What we have to do is decide at what time we wish the search area to be 'valid'. This is known as the Datum time.

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In Rapid Response search planning the Datum time is *always* the same as the on-scene arrival time of the first SRU. This is because as we will discover shortly, the time adrift will be short, inaccuracies inherent in the planning process will be small, and at the Datum time we are justified in expecting the search object to be very close to the Datum position. If the first SRU arrives over the datum at precisely the datum time, then we would expect to have a high probability of finding the object without further ado! Even if the object is not visual immediately, we will start search from the centre datum position outwards – that is starting with the highest probability area and moving out to the periphery. (This choice of datum time is not relevant to other model types, but you will learn about this on Part 3).

Drift Elapse Time (DET)
This is the time period between the Drift Start Time and Datum Time. Rapid Response models are used only for relatively short DETs. We use a "rule of thumb" which indicates that anything beyond *1 hour* is too long and not suitable for a Rapid Response solution.

 In practise it is not sensible to have a black and white cut off time set at one hour. As you will experience, we are keen on having an accurate datum that is one where very little error has crept into the equation by the datum time. The errors relate to drift error inherent in the search planning methodology, and the size of that error is anchored to the drift distance. Therefore, if the object is drifting slowly, going a short duration beyond the hour cut off time can be irrelevant, whereas, if the object is drifting fast, (e.g. upper reaches of the Bristol Channel, Pentland Firth etc) 45mins might be too long!

Explain
DRIFT ELEMENTS
All drifting targets are affected by the **horizontal movement of the sea** and the **wind**. We apply the sea current first in our Rapid Response model

HORIZONTAL MOVEMENT OF THE SEA
The body of the sea moves horizontally relative to the land. A free-floating target is sitting in the sea and therefore moves with it, in the same direction and at the same rate.

- Ocean Current
- Tidal Stream
- Wind Driven Current

Ocean Current
The movement of ocean waters

Sources of info...Ocean routing charts, Internet

Tidal Stream

Horizontal movement of the sea around the coast caused by the tidal ebb & flow.

Ocean current is **included** in observed Tidal Stream data.

Sources of info....

- Tidal Diamonds   Survey data
- Tidal Stream Atlas   Compiled from tidal diamond/survey data
- SARIS   Computer model using all available source data
- Internet   e.g. actual info (ODIS buoys), research institution
  data
- Computer software   e.g. navigation programmes
- Local Knowledge   Harbour Master, Coxswain, Fisherman

If not using SARIS, we would normally use **Tidal Diamond** info and the **Tidal Vector Worksheet** to determine tidal vector(s). This will be demonstrated shortly.

 The best source of data will always be from an observation on scene. Fishermen, Pilots, Lifeboat Cox etc know their areas and could be considered "experts". SARIS data is good offshore, but within approx. 5nm of the coastline is not reliable. This is because SARIS cannot take into account the outflow from river estuaries, long shore drift and other residual effects.

Wind Driven Current
Current generated by the wind acting upon the surface of the water for a period of time. We need wind history for this, which we get at the moment from the Met Office at RAF Kinloss, via ARCC. Takes up to 40 minutes – too long to wait, so is **not included in Rapid Response**.
You will learn more about WDC when you return for MS2.
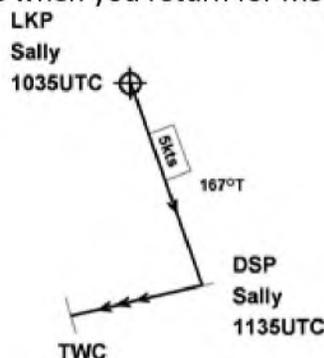
Explain
WIND (or LEEWAY)
A drifting target will be affected by the wind blowing on its exposed surface.

How, depends on the above-water profile (shape and height etc) and underwater 'drag'.

E.g.   An airbed which floats **on** the water will be affected more by the wind than a deep draught vessel which floats **in** the water.

Note: Both will be affected in the same way by the water, but there is much more resistance to wind movement in the case of the boat.

Unlike a yacht sailing, the leeway experienced by a drifting object is measured in terms of the **direction** (e.g. downwind) and **rate**, rather than a *deflection* from course steered.

Leeway Direction

The direction in which a drifting target will be blown is in a generally "downwind" direction i.e. the reciprocal of the wind direction. There may be an element of deviation from the pure downwind direction due to a number of factors sliding off waves, spinning etc). This phenomena is known as **Divergence** (we will learn more about divergence in Part 5) and is expressed in degrees either side of "downwind". As for WDC, *Divergence is not used when preparing a Rapid Response model.*

Leeway Speed (or Rate)

The speed at which a target travels **through the water** due to the force of the wind.

- Depends on target type and wind speed.
- Taken as percentage of wind speed
- Formulae in SAR Graphs and Tables (Introduce to SAR G&T at this time)
- Leeway vector arrived at by multiplying speed by time (DET)
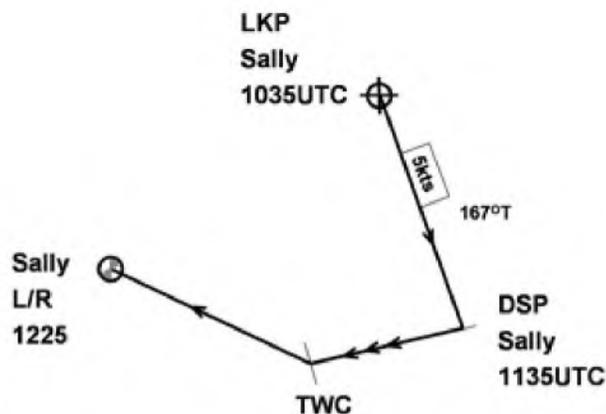
Explain

DATUM ERRORS

As mentioned earlier, in an ideal world, our target would be at the datum position.

Unfortunately, life's not like that and there are inaccuracies, or errors, that we need to take into account. These errors give rise to there being a search area, rather than a "Casualty Location Position".

INITIAL POSITION ERROR (X)
This is the sum of the *Navigational Fix Error* plus any *DR Error*

$$X = FIXe + DRe$$

Navigational Fix Error (FIXe)
The LKP or DSP was a fix, but how accurate was it?

Apart from maybe satellite inertial position-fixing, there will be inaccuracies associated with position fixing. To allow for this, we apply an "Initial Position Error" (IPE), based on way the DSP was "fixed".

E.g.   GPS fix X = 0.1nm
         Radar fix X = 1.0nm

Guide the group to SAR Graphs & Tables

Some of you will be asking why GPS fix error is taken as 0.1nm. We know that differential GPS can fix a position to within 2.5cm!! But 0.1 is a figure that can be guaranteed, sometimes satellites go off line, sometimes operator error can creep in, therefore we should not rely on an accuracy better than this.

You will note in the tables "visual fix" value given as 1.0nm. This is for a visual three line fix taken by compass bearing. Frequently you will be faced with a scenario whereby the position is offered by a member of the public observing a situation at sea. This will result in a "visual estimate" as opposed to "visual fix" and therefore the error value of 1.0nm is not appropriate.

Explain
Talk about a visual estimate offered by an MOP observing from a cliff top – how accurate is the direction? How accurate is the distance? You have to "build" up a fix error based on the information gathered. Is the person local or a visitor, the direction offered by a local might be more accurate. Is it possible to create a transit with the observed object and two land based features which are marked on the chart? Is there an island or rocks in the vicinity which the observer could use to gain an angular reference? What is the size of the object being observed, is it likely to be visible at the range offered by the observer? Is there an island in the vicinity whose distance from the observer is known, and could be used to help pin down the distance of the observed object?

Draw this diagram on the whiteboard to assist in understanding.
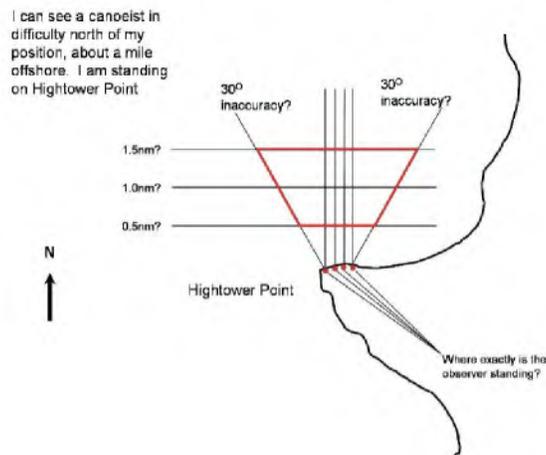
DR Error (DRe)

If DSP was a DR (or EP), as well as applying an IPE, we add in a percentage of the distance from the last fix (the DR distance) as the DR error (DRe). The percentage used depends on the type of vessel concerned.

E.g.   Ship   DRe = 5% DR distance
   Boats   DRe = 15% DR distance

DRIFT ERROR

This is an allowance for the inaccuracies of the data used to determine the tidal and wind vectors.

It is taken as a percentage of the total (or resultant) drift distance i.e. the straight-line distance between the DSP and Datum position.

The percentage used as a norm is 30%. This figure has been reasonably verified over many years of search planning.

The SMC can vary this 30% figure to allow for better or worse than average data or the rotary tide "flaw" (If a long drift time, the direct-line distance between DSP & Datum can be significantly less than the actual distance the target has drifted).

Explain
Rotary Tide Flaw
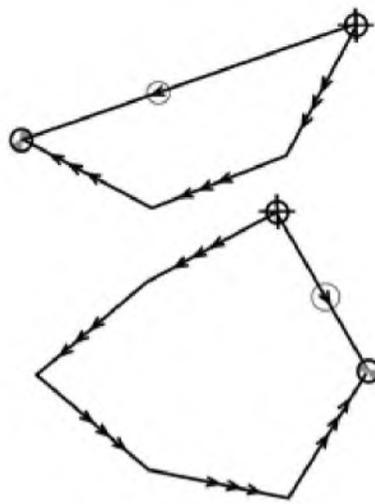
The drift error then is obtained by multiplying the drift distance by the error factor. If using 30%, the error factor is 0.3.

So for a drift distance of say 10nm, the Drift Error will be 10 x 0.3 = 3nm.

Explain

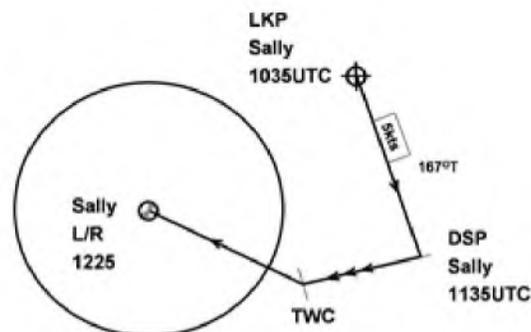**TOTAL ERROR RADIUS (R)**

The Initial Position Error and Drift Error values are added together.

E.g.
X	=	0.5nm
De	=	0.3nm
R	**=**	**0.8nm**

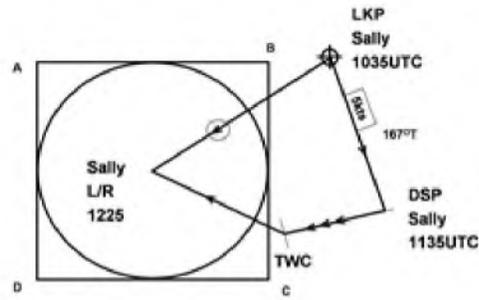**This radius is applied to the Datum Position to give us our search area**

The "pure" search area is a circle, we may "box it off" to make it easier to search but it depends on the type of search pattern we are going to use. More on search patterns later….

That's it – a Rapid Response search area!   **No WDC or Divergence**

Explain
Boxing Off

The orientation of the square should be such that it makes it easy for the SRUs to navigate. The easiest orientation for units to follow is North/South/East/West.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.5
SESSION NAME	SAR Graphs and Tables – SAD section

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room SAR G+T Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Introduction to SAR graphs and tables
Learning Outcomes	Delegates will be able to; Gain correct information for SAD within SAR G+T.

Explain

Go through SAR graphs and tables with the delegates explaining the use and application of each section.

COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.6
SESSION NAME	Leeway speed exercise

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room Leeway exercise Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	An exercise on leeway drift rates.
Learning Outcomes	Delegates will be able to; Select appropriate leeway values for different search objects.

Explain

Group leeway speed exercise; Divide the course into Max 5 sub-groups and give out the encapsulated "Target Types" exercise sheet. 5 mins to agree appropriate Leeway speed formula relevant to each picture. Refer to SAR Graphs and Tables

Notice in the SAR Graphs and Tables the max and min leeway formulae, (0.5 – 8%) suggesting that all drift objects should fall within these boundaries. We do not have data to support this assertion. You do not have to opt for a formula that is listed, but bracket an estimation e.g. 1-2% or 4-6% etc.

Suggested answers;	Passenger Ferry	Shallow draft Large exposed surface area Relatively fast leeway speed	**5-6%**
	Tanker (loaded)	Deep draft Low freeboard But ... Accommodation aft Relatively slow leeway speed	**2-3%**
	Windsurfer (with sail)	No draft, but drag from fin(s) Similar to surfboard Sail will fill with water – act as drogue	**2-3%**
	Lifebelt	No draft Very little windage	**2-3%**
	Sea kayak	Small v hull draft Little windage	**2-3%**
	PIW	Entire body underwater – large drag Little windage Relatively slow leeway speed	**1-2%**
	Warship	Shallow draft Intermittent high sided Relatively slower than ferry	**4-5%**
	Open Lifeboat Shallow draft 	Low sided – heavy wooden Relatively faster than canoe	**3-4%**
	General Cargo (in ballast)	Medium draft	

Higher sided than tanker
Relatively faster than tanker

3-4%

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.7
SESSION NAME	SAD exercise 1

SCHEDULED SESSION TIME	00:45

RESOURCES NEEDED	Chart Room SAR G+T Calculators Parallel Rules Dividers 2b Pencils SAD Worksheets Tidal Vector Worksheets Charts Exercises Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A walk through of the delegates 1st SAD Rapid Response exercise
Learning Outcomes	Delegates will be able to; Complete a SAD worksheet and plot the information on a chart.

Activity

Walk through the first exercise with the delegates step by step introducing the forms as you go.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search Planning Part 1

SESSION NUMBER	1.8
SESSION NAME	SAD exercises

SCHEDULED SESSION TIME	01:45

RESOURCES NEEDED	Chart Room
	SAR G+T
	Calculators
	Parallel Rules
	Dividers
	2b Pencils
	SAD Worksheets
	Tidal Vector Worksheets
	Charts
	Exercises
	Projector
	Paper
	Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Consolidation for the delegates on Rapid Response
Learning Outcomes	Delegates will be able to; Consolidate their skills in SAD Rapid Response.

Activity
SAD EXERCISES 2 onwards (keep an exercise back for start of day 2)

Let the delegates go at these exercises on their own. The Trainer should be in attendance to sort of difficulties and answer questions. There is an overlay by which each answer can be assessed by the trainer on a one to one basis and feedback given. Delegates will sometimes choose a different leeway rate to the one used by the overlay. Trainer will need to use judgement in this case as to whether the delegate's answer is reasonable or not. I tend to think of the bracketing process used in the previous leeway exercise and if the formula used by the delegate falls within this bracket then I give it the OK.

There is no race involved in these exercises. Yes speed is important but at this early stage accuracy is more important. Get the accuracy right first then work on the speed. A target time to complete a manual RR SAD exercise is 15minutes.

Do not ignore correct plotting symbology in the process of carrying out these exercises. It is important that your plots are clear and correctly marked so that others can understand your work.

It is useful if the exercises are not completed on day 1. In training terms it is good reinforcement if the delegates are able to successfully deliver a RR SAD plan on the morning of day 2 after the overnight break away from it!

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.1
SESSION NAME	Recap of elements covered

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room SAR G+T Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	To confirm learning and reinforce key learning points covered on day before.
Learning Outcomes	To allow delegates to clear up any ambiguity before continuing with new subjects.

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Session 2.1: Recap of elements covered

Activity

Using the notes from day one briefly refresh the following topics, questioning and probing as necessary to confirm understanding of;

Elements affecting a free floating object. Run through the construction of a RR model from DSP to Datum. Plot on board asking delegates to provide relevant information.

Plotting on a chart the RR model from DSP to Datum, confirm correct use of symbols and annotation. Reinforce the need for accuracy.

Confirm the understanding of the errors inherent in any SP model, the values applicable to each and how they are applied. This will lead to a suitable error radius around the Datum position.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.2
SESSION NAME	SAD Rapid Response Exercise

SCHEDULED SESSION TIME	00:45

RESOURCES NEEDED	Chart Room
	SAR G+T
	Calculators
	Parallel Rules
	Dividers
	2b Pencils
	SAD Worksheets
	Tidal Vector Worksheets
	Charts
	Exercises
	Projector
	Paper
	Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A further Rapid Response exercise 15-20 min target
Learning Outcomes	Delegates will be able to; Consolidate their skills in SAD Rapid Response.

Session 2.2: SAD rapid response exercise

Activity
Delegates to complete a further SAD exercise to confirm learning and to try and reach a 15-20 min target for completion of the worksheets and plotting.

COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.3
SESSION NAME	SAC input

SCHEDULED SESSION TIME	00:20

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

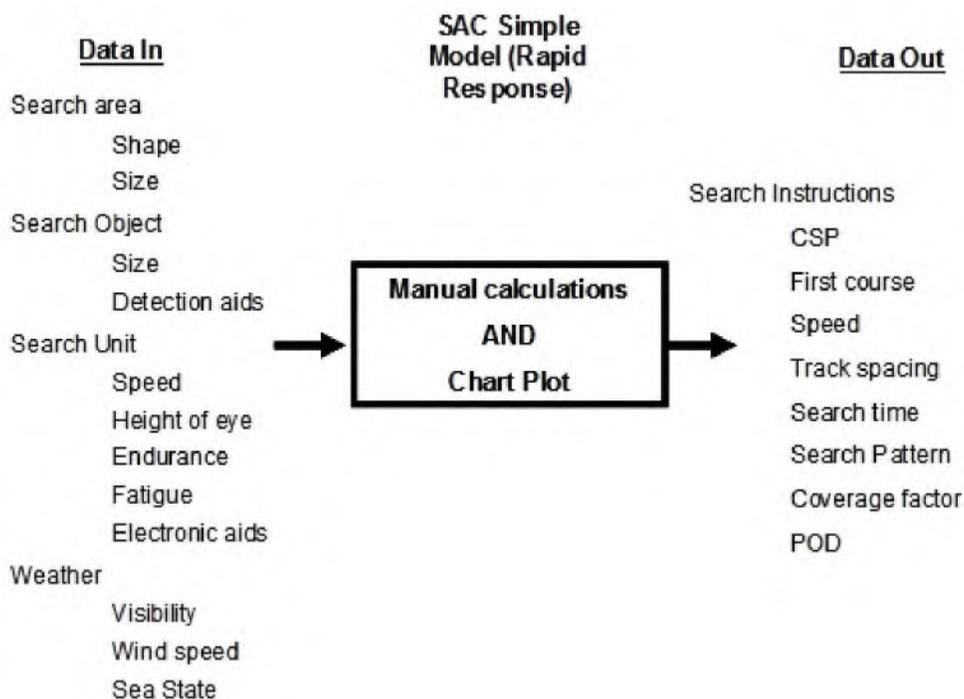| OVERVIEW	Group discussion on the input and outputs of data with SAC
Learning Outcomes	Delegates will be able to; Identify what information is required for SAC and what data is outputted.

Explain

SEARCH AREA COVERAGE

Once we have determined the search area, we must decide how best to deploy the available search units to cover the area. This is known as **Search Area Coverage**.

Use the simple model approach here – data in – process – data out. As for SAD the process is delivered manually or by SARIS. Try to get the delegates to identify the input and output elements as per the diagram below. Don't attempt to explain them at this time, capture their ideas on whiteboard and return to each element in turn later.

Data In

Search area
   Shape
   Size
Search Object
   Size
   Detection aids
Search Unit
   Speed
   Height of eye
   Endurance
   Fatigue
   Electronic aids
Weather
   Visibility
   Wind speed
   Sea State

SAC Simple Model (Rapid Response)

Manual calculations AND Chart Plot

Data Out

Search Instructions
   CSP
   First course
   Speed
   Track spacing
   Search time
   Search Pattern
   Coverage factor
   POD

Coastguard Programme

COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.4
SESSION NAME	Sweep width and track spacing

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A session on sweep width and track spacing and their relationship.
Learning Outcomes	Delegates will be able to; Identify the differences between sweep width and track spacing and their relationship to coverage factor.

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Session 2.4: Sweep width and track spacing

Explain

All of the factors below are taken into account when determining the *theoretical maximum distance* at which a target could be detected.

Sweep Width (W)

The detection range is of course to *either side of the search unit*. The width the unit can therefore *sweep* will be *twice the detection range*. This is known as the **Sweep Width**.

The visual Sweep Width is found by taking the theoretical maximum detection distance of a target by a particular SRU from the SAR Graphs and Tables and making corrections for SRU speed (if aircraft), weather and fatigue. *More on this later.*
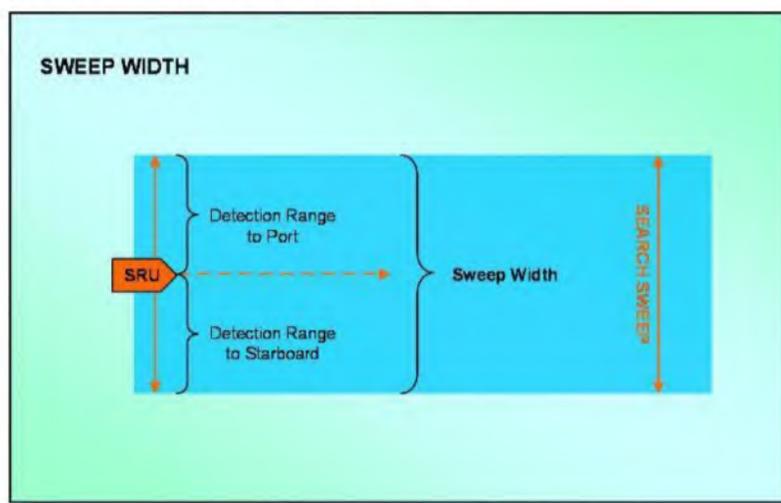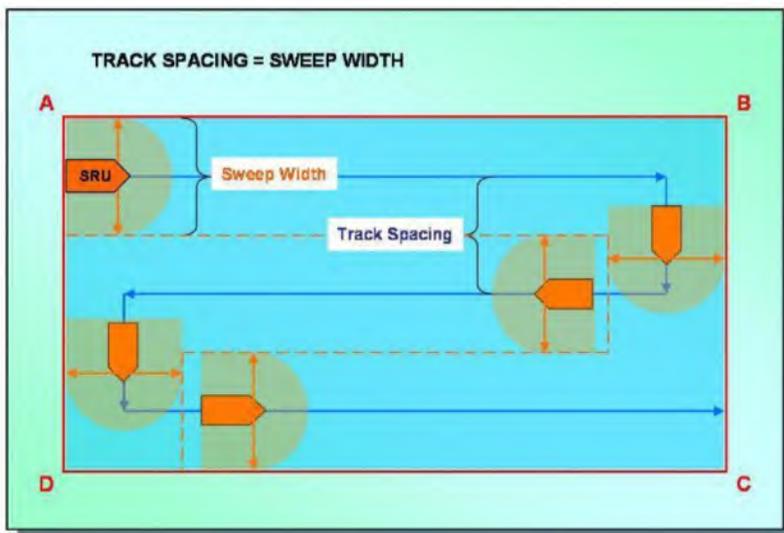
Track Spacing (S)

The Track Spacing is the distance apart of consecutive search legs and depends on

- Size of search area
- Time SRU can be on scene
- Speed of SRU
- Number of SRUs

Ideally, so that no area is left uncovered, the Track Spacing should equal the sweep width.

Draw the diagrams below to aid in understanding.

TRACK SPACING

SRU — Track for SRU to Follow — Track Spacing (S)

Track Spacing (S)

TRACK SPACING = SWEEP WIDTH

A B

SRU — Sweep Width

Track Spacing

D C

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.5
SESSION NAME	Coverage factor and POD

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A session on coverage factor and POD and their relationship.
Learning Outcomes	Delegates will be able to; Identify what coverage factor and POD is and their relationship.

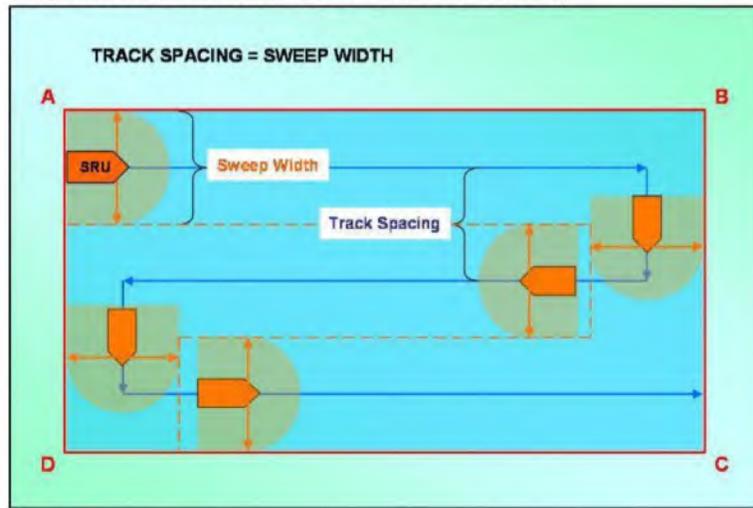**Explain**

COVERAGE FACTOR & PROBABILITY OF DETECTION (POD)

Coverage Factor (C)

The relationship between the Sweep Width and Track Spacing is known as the Coverage Factor.

Coverage Factor = Sweep Width $C = W$
                Track Spacing S

Therefore, if the two are the same, the Coverage Factor = 1
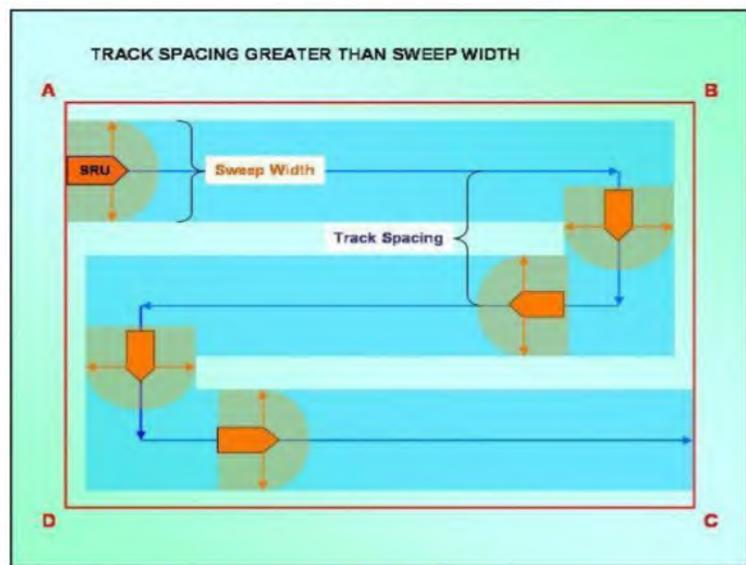
Draw a simple diagrams like these to aid in understanding;

Example:

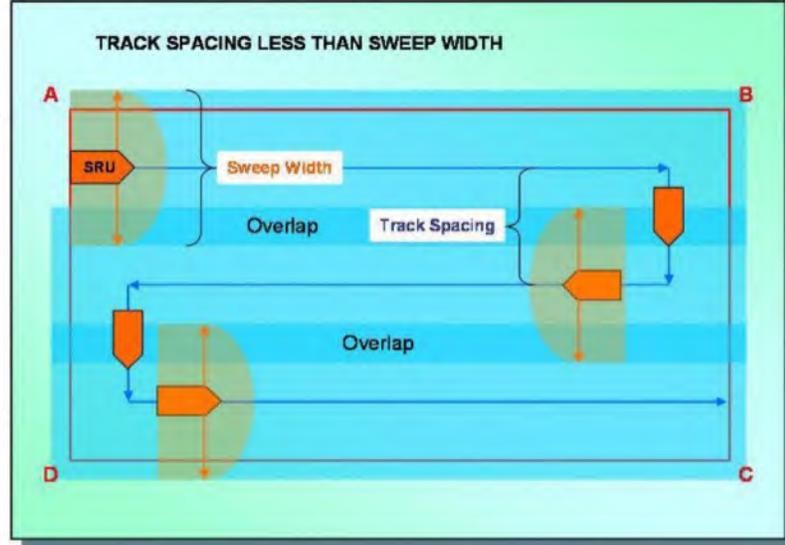Corrected Sweep Width (Wc) = 2.4 NM
Track Spacing (S) = 3.2 NM

Coverage Factor C = 2.4 / 3.2 = 0.75   (i.e. 75% coverage)

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TRACK SPACING LESS THAN SWEEP WIDTH

Example:

Corrected Sweep Width (Wc) =
3.2 NM
Track Spacing (S) = 2.4 NM

Coverage Factor C = 3.2 / 2.4 =
1.33   (i.e. 133% coverage)

PROBABILITY OF DETECTION (POD)

In simple terms, Probability of Detection is a measure of search results.

It is expressed as a percentage and refers to the odds of success or failure.

E.g. a POD of 67% = two out of three chance of detecting the target

POD is mathematically derived and is directly related to the Coverage Factor

There is a graph in the SAR G & T to which we refer.

Armed with the Coverage Factor, we enter the graph, refer to the appropriate curve and extract the figure representing the POD of the target.

We can see that if C = 1, using the first search curve (A), POD = 79%.

This is what we aim for as a minimum.

You can see that the greater the value of C, the better the POD and vice versa.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.6
SESSION NAME	SAR Graphs and Tables SAC section

SCHEDULED SESSION TIME	00:20

RESOURCES NEEDED	Chart Room SAR G+T Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A walk through of the SAC section of SAR Graphs and Tables.
Learning Outcomes	Delegates will be able to; Gain correct information required for SAC calculations.

Session 2.6: SAR G+T SAC section

Explain

Go through SAR graphs and tables with the delegates explaining the use and application of each section.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.7
SESSION NAME	Determining Sweep Width

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room Whiteboard SAR G+T Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	How to determine a corrected sweep width and the corrections applied.
Learning Outcomes	Delegates will be able to; Identify the corrections applied to an uncorrected sweep width.

Explain

DETERMINING SWEEP WIDTH

VISUAL SEARCH

The optimum Corrected Sweep Width (Wc) for a visual search for a target type without detection aids is determined by first extracting the Uncorrected Sweep Width (Wu) relevant to the target & SRU type and then applying correction factors based on weather, speed (aircraft) & crew fatigue.

Wc = Wu x **Weather** corr^n. x **Speed** corr^n (a/c only) x **Fatigue** corr^n.

Uncorrected Sweep Width (Wu).

- Enter the table for the **SRU type** (Vessels, Helicopter or Fixed Wing aircraft).

- For **aircraft**, enter the column for the appropriate **altitude** and **visibility**. (If not tabulated, go to **nearest altitude** for height and **interpolate for visibility**).

- For **surface craft** enter the column for the appropriate **visibility**, interpolating as necessary.

- Read down this column until the **target type** that most closely matches your search object is found.

- The value extracted is the **Uncorrected Sweep Width**.

Nb. For search targets **over 90 ft** use "LARGE VESSELS".

If target is a yacht under 'bare poles', use figure for Power Boat of similar size.

Weather Correction

- A weather correction factor is only applied if winds are **over 15 knots** and/or **seas are 2ft or more** in height

- The weather correction table is divided into two columns. If conditions of both columns apply, use the correction factor in the right hand column.

Speed Correction (Aircraft only)

- The table is entered for the appropriate SRU and target type and the tabulated value is the factor to be applied.

- If the search speed is between those tabulated, **interpolate**.

- For speeds below 150 kts (F/W) and 60 kts (Helo), use columns for 150 and 60 knots respectively.

Fatigue Correction

- A fatigue correction is only applied if search crews are **excessively** tired.

- If a correction for fatigue is to be applied, then the sweep width values should be reduced by a factor of 10% (i.e. **multiply by 0.9**).

A Worked Example

A fixed wing aircraft flown at 1000 ft at a speed of 150 kts is searching for a 25 ft sail boat. Winds are 20 kts with 2.5 ft seas. Visibility is 20 miles. The aircraft commander determined that his crew was unusually fatigued.

1. From the FIXED WING Uncorrected Sweep Width tables, find the column for 1000 ft altitude and 20 mile visibility. Read down this column to the 25 ft sailboat row to obtain an **Uncorrected Sweep Width** of **7.1** NM.

2. Enter the Weather Correction table in the column for WINDS MORE THAN 15KTS/ SEAS 2-3 FT and the small target row to obtain a **Weather** Correction factor of **0.5**.

3. Enter the Search Craft Speed Correction table for FIXED WING speed of 150 kts. Read down this column to the 25 ft sailboat row to obtain a **Speed** Correction of **1.1**.

4. As the aircraft crew are excessively fatigued, use a **Fatigue** Correction of **0.9**.

5. Multiply the Uncorrected Sweep Width value by the three correction factors to obtain the final Corrected Sweep Width.

Wc = 7.1 x 0.5 x 1.1 x 0.9 = 3.5 NM

VISUAL DETECTION AIDS
Use of visual **Detection Aids** will greatly enhance the target's chances of being spotted by a search unit. SAR G+T give estimated **CORRECTED** SWEEP WIDTHS for daytime and night time detection aids respectively.

ELECTRONIC DETECTION AIDS
SAR G+T gives recommendations on developing **CORRECTED** SWEEP WIDTHS for a search based on electronic detection aids.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.8
SESSION NAME	Search area coverage quiz

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	SAR G+T SAC Quiz Calculators Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A quiz on SAC which will exercise the delegates into selecting correct sweep widths and applying the applicable corrections.
Learning Outcomes	Delegates will be able to; Gain skills in sweep width correction.

Session 2.8: Search area coverage quiz

Activity

Delegates to take the search area coverage quiz and trainer to go through the answers as a group.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.9
SESSION NAME	AVNST and SAC worksheet

SCHEDULED SESSION TIME	01:00

RESOURCES NEEDED	Chart Room Whiteboard SAR G+T SAC Worksheet Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	An explanation of AVNST and a walkthrough of the SAC worksheet.
Learning Outcomes	Delegates will be able to; Identify each element of AVNST and their relationship. Identify each element of the SAC worksheet.

Explain

AVNST

The area (**A**) that can be covered by an SRU is directly related to its speed or velocity (**V**), the Track Spacing (**S**) and time spent searching (**T**).

The relationship is: ***Area = Velocity x Track Spacing x Time   A = VST***

Note: **T** is time spent actively searching. To allow for end-of-leg turns, investigating etc, a value of 85% of on scene endurance is taken. ***T= OSE x 0.85***

If we have a number of **similar** SRUs (e.g. lifeboat/40ft fishing boat), we can include that number (**N**) in the formula, but only as long as the other values (S, V & T) are the same. The formula in this case is   ***A = VNST***

Transposing the formula will allow us to find any one value, if we know the others.

e.g. $A = 120 \text{ nm}^2$

   $V = 10 \text{ kts}$

   $N = 2$

   $T = 3 \text{ hours}$

   $S = ?$

$$S = \frac{A}{VNT} = \frac{120}{10 \times 2 \times 3} = \frac{120}{60} = \textbf{2 nm}$$

There is a CG form to help with this formula and its manipulation

Explain

The MCA(TC) Form 6303 – the Search Area Coverage Worksheet.

Explain the use of the form and how each section should be filled out. The form does not need to be completed in full each time for example; if you fill out the number of units required and you only need one more unit to complete the area if there is one available you do not need to continue, similarly if the unit only needs to increase its speed by one or two knots and this is feasible then no need tom complete the whole form.

Particular time should be spent on explaining section G – this is to gain an assignable track spacing based on the figures derived in section F 4 – NOT RANDOM FIGURES!!!

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.10
SESSION NAME	SAC exercise 1

SCHEDULED SESSION TIME	00:20

RESOURCES NEEDED	Chart Room SAR G+T Calculators SAC Worksheets Exercises Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A walk through of the delegates 1st SAC exercise.
Learning Outcomes	Delegates will be able to; Complete a SAC worksheet.

Session 2.10: SAC exercise 1

Activity

Walk through the first exercise with the delegates step by step introducing the forms as you go.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	2.11
SESSION NAME	SAC exercises

SCHEDULED SESSION TIME	01:05

RESOURCES NEEDED	Chart Room SAR G+T Calculators SAC Worksheets Exercises Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Consolidation of further SAC exercises.
Learning Outcomes	Delegates will be able to; Consolidate their skills in SAC.

Activity
SAC EXERCISES 2 onwards (keep an exercise back for start of day 2)

Let the delegates go at these exercises on their own. The Trainer should be in attendance to sort of difficulties and answer questions. There is answers to each exercise which can be assessed by the trainer on a one to one basis and feedback given.

It is useful if the exercises are not completed on day 1. In training terms it is good reinforcement if the delegates are able to successfully deliver a SAC plan on the morning of day 2 after the overnight break away from it!

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.1
SESSION NAME	Recap of elements covered

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room SAR G+T Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	To confirm learning and reinforce key learning points covered on day before.
Learning Outcomes	To allow delegates to clear up any ambiguity before continuing with new subjects.

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Session 3.1: Recap of elements covered

Activity

Using the notes from day two briefly refresh the topics covered, questioning and probing as necessary to confirm understanding.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.2
SESSION NAME	SAC exercises

SCHEDULED SESSION TIME	01:00

RESOURCES NEEDED	Chart Room
	SAR G+T
	Calculators
	SAC Worksheets
	Exercises
	Projector
	Paper
	Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Further SAC exercises to confirm learning.
Learning Outcomes	Delegates will be able to; Consolidate their skills in SAC.

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Session 3.2: SAC exercises

Activity
Delegates to complete a further SAC exercise to confirm learning.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.3
SESSION NAME	Advantages and Disadvantages of Rapid Response

SCHEDULED SESSION TIME	00:10

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A session explaining and identifying the advantages and disadvantages of Rapid Response.
Learning Outcomes	Delegates will be able to; Identify the advantages and disadvantages of Rapid Response.

Session 3.3: Advantages and Disadvantages of Rapid Response

Activity
Try to get the delegates to come up with the correct answers for this, if not:

Explain
Advantages

- quick to calculate and can be produced manually with ease
- data readily available - does not require wind history
- datum established with high degree of confidence
- small search area produced - generally good coverage
- allows for a dynamic through the water search, which follows target drift
- initial good quality search - i.e. high probability of detection (POD)
- SMC retains control
- provides the basis of future plan(s) if required

Disadvantages

- Divergence not considered
- WDC not considered
- not appropriate for long drift elapse times, unless total water current and leeway are minimal throughout

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.4
SESSION NAME	Search Patterns

SCHEDULED SESSION TIME	00:20

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A session explaining the different search patterns and their application.
Learning Outcomes	Delegates will be able to; Identify different search patterns and their application.

Session 3.4: Search patterns

Open the PowerPoint 3.4 search patterns.

Slide number 2
Explain

These are all of the different type of search pattern that are conducted. If you head to OmS – within the Maritime Search operational detail section you can see animations of all the different types of pattern.

Slide number 3
Explain

The search pattern commences at and rotates around the Datum position. It is therefore essential that the Datum is marked, so that it can clearly be identified as such by the search unit. If there is wreckage or a free-floating object already at the Datum, this should be left where it is and not recovered, unless essential for identification purposes or to aid the recovery of survivors. If recovered, it should be returned as soon as possible if a Sector search is to be conducted. The marker must be free-floating and able to drift with the elements in order that the search pattern and search units can follow the drift of the target(s)

If the Datum is not marked naturally, the search unit should deploy a highly visible free-floating marker and if possible one which has the same drift characteristics as the target. A highly visible marker is beneficial so that the unit can still see it when out at the extremity of the area

Any Rapid Response search needs to drift with the target. A Sector search should therefore be conducted as a through the water search

The target is drifting with the elements and so the search unit should allow itself to do likewise by not countering the effects of tide and wind

The search should not be conducted around a fixed GPS position as this will not allow the search to drift

The area will also normally be small with short legs and tight turns. For this reason, it is more suitable for surface craft than air craft. Surface craft are also more able to conduct a through the water search

Following the Pattern - Theory

1. the unit commences from the Datum and completes leg 1
2. at the end of leg 1, it turns 120° to the right and completes leg 2
3. at the end of leg 2, it turns 120° to the right and completes a double leg (legs 3 & 4) passing through the Datum
4. At the end of leg 4, it turns 120° to the right and completes leg 5
5. ….and so on until it has completed all 9 legs and is back at the Datum.

Explain

If a second pattern, oriented 30° to the right of the first, is undertaken immediately following completion of the first, the leg length can be up to twice the Sweep whilst still maintaining a minimum POD of 79% at the circumference. This second rotation will in effect cover the gaps in the area left by the first.

Slide number 5
Explain
Following the Pattern - Practice

1. the unit starts from the Datum on a course of 360° C and completes Leg 1
2. at the end of leg 1, it turns onto a course of 120° C and completes leg 2
3. at the end of leg 2, it turns to the right, sights the Datum marker and heads towards it on leg 3
4. at the Datum the unit steers 240° C on leg 4
5. at the end of leg 4, it turns to the right onto a course of 360°C and completes leg 5
6. ....and so on until it has completed all 9 legs and is back at the Datum

Note: If the marker is not in sight at the beginning of Legs 3, 6 and 9 for any reason, the unit will steer the appropriate compass courses (i.e. 240°, 120° or 360°) until it sights the marker, at which point it will alter course, if necessary, to head towards it

In reality it is unlikely that the actual search track will describe the perfect Sector shape, but one distorted by drift.

Slide number 6
Explain
An Expanding Square search pattern is used when the target is confidently anticipated to be within a relatively small area and the search needs to commence at the Datum. It is most commonly employed as an alternative to the Sector search in a Rapid Response search scenario. It could also be used to cover a Datum Point search area, but only where there is little or no leeway divergence

Unlike the Sector search, the Expanding Square is not limited by size and can, in theory, expand to cover any size of area

An Expanding Square search is conducted around the Datum and should drift with the target. Although it can be conducted without, it is best if there is a marked Datum to which the unit can visually refer

Navigating the Pattern
Commence Search Position
The commence search position is the centre of the area i.e. the Datum Position

Leg Lengths

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The leg lengths of an Expanding Square pattern are based on the Track Spacing (S). The first two leg lengths are equal to the Track Spacing. Successive pairs of legs increase by one Track Spacing distance

To achieve a Coverage Factor of 1 and overall area POD of 79%, the leg length of the first two legs (i.e. the Track Spacing) should be equal to the Sweep Width.

Orientation
The first leg is usually orientated, as with the Sector search, to simplify navigation for the SRU (e.g. 360° C). All turns are 90° to the right.

Slide number 7
Explain
Simultaneous or second expanding square searches of the same area should be orientated at 45° to each other.

It would not be advisable for two surface units to conduct a simultaneous search as this would severely compromise navigational safety. This option would only really be appropriate using a surface unit and an air unit.

Slide number 8
Explain
Parallel Track patterns are used to cover rectangular search areas determined in the SAD phase for any one of the non-Rapid Response models. The pattern follows the long side of the search area, rather than the short side and can be conducted by a single or by multiple units.

Single Unit Search

The search vessel proceeds to the Commence Search Position (CSP) and simply steers straight legs parallel to the long side of the search area, turning 90° at each end onto a short leg equal to the Track Spacing and then 90° again, onto the next long leg.

To allow for the fact that the search sweep is to either side of the craft, the CSP is one half a Track Spacing in from each edge of the search area. For the same reason, the end/start position of each leg is also one half a Track Spacing in from the edge.

Each leg is one Track Spacing apart

Commence Search Position (CSP)
The CSP can theoretically be at any corner of the search area. The choice of CSP will depend on a number of factors such as the direction from which the unit is coming, the wind and sea/swell direction and the probable drift direction and speed of the target The CSP will also determine the direction of advancement, or the Mean Line of Advance (MLA), of the search pattern. This has direct relevance to the target drift direction and whether the search pattern will be [HYPERLINK

"http://oms.mcga.gov.uk/oms_operational_detail/sac_-_datum_point.htm" \l "up-drift_or_down-drift_search"].

Explain

The Creeping Line search is the same as the Parallel Track search except that the legs are parallel to the short side rather than the long side

This pattern would be used when a) there is a strong possibility that the target could be nearer one end of the search area than the other or b) if the target drift was along, rather than across the area. This could be the case if for example the area is a containment area defined under the [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sad_-_datum_area.htm"] principle The Commence Search Position will depend on
   a) which end it is expected that the target is most likely to be or
   b) whether the SMC requires an [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_datum_point.htm" \l "up-drift_or_down-drift_search"] search

Mean Line of Advance (MLA)
The MLA is simply the direction in which the search coverage is progressing, which will be the direction of the short legs.

Explain
A Track Line Search is used for example when a vessel is reported missing without trace whilst on passage. The search concentrates on the vessel's intended or likely track and is a useful form of Rapid Response search prior to the undertaking of a more thorough Datum Line search of what is likely to be a large search area.

The search may consist of a single sweep along the length of the track or, if there is time, a double (track line return) or even successive expanding sweeps based around the track line.
The actual track line may not be as simple as a straight line (as depicted in the diagrams), but consist of a number of legs. In any event, the search must be based along/around the actual track.

Single Track Line Search
A single sweep simply follows the track line of the missing craft. The area is defined by the Sweep Width and length of track.

Explain
Double (or Return) Track Line Search
If there is time, a double, or Return, track line sweep can be conducted. In this case, the search unit commences the search from one end of the track along a leg displaced to

one side of the track by half a Sweep Width. The unit follows this leg parallel to the track until half a Sweep Width in from the end. It then turns across the track for a distance of one Sweep Width then turns again to proceed back parallel to the track, but this time displaced one half a Track Spacing to the other side. The search area is defined by the double Sweep Width and the track line distance

Slide number 12
Explain
Estuary (or Keyhole) Search

An Estuary, or Keyhole search is very simply a Creeping Line or Parallel Track (depending on orientation) search conducted in a non-uniform area, the boundaries of which are defined for example by the contours of an estuary or other geographical feature. The direction of search advance will depend on the drift direction of the target and whether the SMC requires an [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_datum_point.htm" \l "up-drift_or_down-drift_search"] search

Slide number 13
Explain
The idea of a Barrier Search is to have a unit, or units, patrolling back and forth across the down-drift end of a search area, acting in a 'goal keeping' capacity. The principle is that the unit(s) act as a barrier and will hopefully catch any target that might be drifting more rapidly than anticipated and drift out of the area before being detected by the main search units.

This technique is particularly useful and effective when the area is contained by land as in the case of a river or estuary search. If a number of units can be used the barrier effect will be greatly enhanced.

A Barrier Search should be considered as a safety net across the down-drift end of the area if:

- if the SMC is employing an Up-Drift search or...
- if the SMC has any doubts as to the speed of target drift versus the speed of search advancement when using a Down-Drift search

Slide number 14
Explain
Herringbone Pattern

This pattern requires a mother craft and one or more daughter units and the ability for them to work very closely in a co-ordinated way.

The mother unit commences a search along the main search track or leg. A daughter craft runs out at right angles to one side of the Mother unit and to a pre-determined distance, then turns back towards the track and steers on a course to meet up with the mother craft back at the track. This 'out and back' pattern is repeated until the mother craft has completed the track. If there are two daughter craft, they deploy either side of the mother in a double herringbone pattern.

It is not really possible to work out an actual overall [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_search_patterns.htm" \l "probability_of_detection"] for the search. If used along a track line, the [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_search_patterns.htm" \l "probability_of_detection"] of the areas swept by the Mother and Daughter units individually will be 79% - there is no Track Spacing and the areas are being defined by the Sweep Width. Where the Mother/Daughter sweeps overlap, there will in effect be two simultaneous searches of the same area occurring and so the [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_search_patterns.htm" \l "probability_of_detection"] will increase to 95% accordingly (C = 1, POD Curve B).

Explain
Multiple Unit Sweep
A Parallel Track search can be conducted by multiple units in line abreast. It is particularly useful when there are no, or limited SAR resources available, but there are a number of non-SAR craft (e.g. fishing vessel, pleasure cruisers etc.) able to assist.

The units can be instructed by the MRCC to for a line and sweep through the area or they could be lined up either side of a SAR unit (e.g. lifeboat) which could co-ordinate a more controlled sweep.

In any event, each leg is swept consecutively by vessels proceeding from one side of the area to the other. The concerns regarding the use of a 'following' or a 'closing' search is not relevant, the only major consideration for the SMC being which side of the area to start from.

Explain
An escaping target can be quite problematic for a search planner, what if as is displayed in this slide the search object misses the SRU on each leg?

There are many options to try an accommodate this;
Sending an SRU up or down drift – many cautions with this (further reading on OmS [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_datum_point.htm" \l "up-drift_or_down-drift_search"])

Multi layered search – easiest option if SRU's available

Goalkeeper SRU – again if available

Mid search compromise – keeps your search area valid for longer – more on this on MS2!
Explain
This slide illustrates the fact that all SRU's conducting any search pattern not for a Rapid Response must counteract the tidal and wind conditions in order to stay within the search area effectively.

Explain

If there are sufficient resources available, an area can be divided into sub-areas with a separate search unit allocated to each.

Slide number 19

Explain

Another possible option available to the SMC given the available resources, is the multi-layered search.

The term multi-layered is normally thought of as meaning at different heights i.e. surface units plus air units. Whilst this is true, the term can also be attributed to searches conducted on the same level. Two or more surface units covering some or all of the same area together are in effect conducting a multi-layered search, the layers just happen to be at the same height.

The illustration below depicts a multi-layered, multi-level search where five SRUs, namely a Nimrod aircraft, a Coastguard helicopter, Fa warship and a merchant vessel, are searching simultaneously.

All of the area is being covered, but to varying degrees by each layer. Some of the area is being covered twice (i.e. Nimrod + warship), some of it three times (Nimrod + warship + CG helicopter) and some of it four times (Nimrod + warship + CG helicopter + merchant vessel). The POD's of these areas will therefore vary and can be calculated using the multiple unit combined POD methods described earlier.

If the SMC considers that the target could be in one particular part of the search area, the layers can be manipulated to concentrate effort on that area, whilst still ensuring an acceptable coverage and POD overall.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.5
SESSION NAME	Search Instructions

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A session on search instructions and signposting to OmS on where to find the tasking forms for each type of unit.

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Learning Outcomes	Delegates will be able to; Identify where to find tasking forms on OmS.

Session 3.5: Search instructions

Open the PowerPoint 3.5 Search Instructions

Slide number 2
Explain
Search instructions have to been given differently to different types of SRU, this presentation will show you the different forms and protocols for tasking.
We will look at; RNLI, MCA counter pollution aircraft, MOD SAR and MCA contract helicopters, TAPSIC and Non declared units.

Slide number 3
Explain
This is the tasking form for an RNLI ALB, talk through the form and explain it is this format so that it is easy for them to enter into their on-board computer.

Slide number 4
Explain
This is the tasking form for an RNLI ILB, talk through the form and make sure the delegates take on the point that this will be filled in manually and it is difficult to write down information on an ILB!

Slide number 5
Explain
This is a tasking form for an RVL (Reconnaissance Ventures Limited) aircraft, their primary role is for counter pollution but can be used for SAR for searches and top cover (ACO) duties. The search instructions must be given in a coded format and the pilot will decode the information to act upon. On the bottom right of the form is an example of a coded message which has been decoded beneath.

Slide number 6
Explain
This is the tasking form for MOD SAR and MCA contract helicopters.

Explain

TAPSIC is a standard format of passing search instructions which consists of;

Target;
The SRU must be given as much information as possible on the target or targets that the unit is to search for.

Area;
Each SRU must be given the identity e.g. 'Melita Sub Area A3' and the co-ordinates of the area they are required to search. If the unit is being tasked to search a sub-area, it will be helpful to provide brief information to the unit on the extent of the whole area coverage. Co-ordinates can be passed in a variety of ways, depending on the shape of the area(s) to be searched.

Pattern;
The type of pattern required must be passed to each SRU. If the unit is not a SAR resource then reference may need to be made to the relevant section of IAMSAR or the pattern explained to the unit.

Search;
The SRU needs to be told exactly where to go and what to do.
- Commence search position – latitude & longitude, bearing & distance, navigational mark etc.
- Direction of first leg
- Length of first leg (see *Note* below)
- Number of Legs (See *Note* below)
- Track Spacing / Detection Range
- Speed
- Height (if aircraft)

Information;
- Weather on scene and forecast
- Co-ordinating station
- On Scene Co-ordinator (if appointed)
- Air Co-ordinator (if appointed)
- Other SRUs / search facilities involved
- The big picture

Communications;
- SMC to OSC frequency (if OSC appointed)
- On scene channels
- Surface to air channels
- Contact/safety check schedules
- Relay units (if any)

Slide number 8

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Explain

Pass search instructions to non-declared resources, e.g. merchant vessels assisting in a search, using the Search Action Plan Message as described in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual. The message consists of six parts and should include a situation summary of the on-scene situation, including:

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.6
SESSION NAME	GMDSS and Search Planning

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	A session identifying the uses of GMDSS with regard to search planning.
Learning Outcomes	Delegates will be able to; Identify how to apply GMDSS

Session 3.6: GMDSS and search planning

Explain

Under GMDSS there are a number of devices and communications options that vessels are required to carry which can greatly aid the detection and subsequent recovery of survivors.

Electronic Positioning Indicating Radio Beacon (EPIRB).
An EPIRB transmits a data signal on 406MHz and a steady tone homing signal on 121.5MHz. Detection of the homing signal is a prime factor when considering search [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sac_-_basic_principles.htm" \l "area_coverage_and_search_effectiveness"].

All EPIRBs send data which includes a unique identity number. Some identify the beacon's position in Latitude and Longitude.

The positional accuracy of 406 beacons is:

- GEOSAR: 0.6NM radius
- LEOSAR: 2.7NM radius

EPIRB Search Area Determination.
Although EPIRBs are equipped with homing devices, there is a need to produce a search area around the beacon in case the homer is not functioning and needs to be searched for, or the survivors are not with the beacon when located and a search for them has to be conducted around the found beacon.

A free-floating EPIRB beacon is not affected by leeway and so the most appropriate search area determination model to use is the [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sad_-_rapid_response.htm"] model. Wind driven current (WDC), if felt appropriate, can be accounted for and included within the model

If the SMC knows, or believes, that the beacon is not free-floating but is still attached to the drifting host vessel, a [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sad_-_datum_point.htm"] model can be used to determine the search area and a mid-time datum area or an all-inclusive area search conducted if necessary.

An EPIRB distress alert comprises a distress position and a time for that position. The distress position is the Drift Start Position (DSP), the distress alert time is the Drift Start Time (DST) and the 2.7NM LEOSAR positional accuracy is used as the Fix Error. This information is used to construct the [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sad_-_rapid_response.htm"] or [HYPERLINK "http://oms.mcga.gov.uk/oms_operational_detail/sad_-_datum_point.htm"] area

EPIRB Detection
The initial target is the beacon. If the integral 121.5 MHz homer is functioning, the search units should be able to locate it without difficulty once in the area and within detection range.
The unit(s) should be tasked to the Datum Position with the expectation that they will pick up the homing signal en route. Detection ranges of the homing signal of individual beacons will vary and depend on the type and make of beacon.
It is worth noting that modern CG helicopters can home in on the main 406MHz transmission as well as the 121.5 homing signal.
Guidance on determining the Sweep Widths for EPIRBS & Emergency Locating Transmitters (ELTs) is given in Table 9 of SAR Graphs & Tables.

EPIRB Battery Life
The specification for an EPIRB states that it should transmit for at least 48 hours. This is the specification to which the beacon manufacturers must conform but in practice most beacons have sufficiency built into them to operate for 96 hours.

Search and Rescue Transponder (SART)
Facility is made under GMDSS for the electronic location of survivors. This comes in the form of a Search and Rescue Transponder (SART), an electronic device which responds to interrogation by radar. The potential detection range of a SART beacon is a key factor when considering the Sweep Width to use if searching for such a device.
Guidance on the detection ranges applicable to a SART in various positions within the survival craft is given in Table 9 of SAR Graphs & Tables.

Detection Range
The IMO recommended performance standard for SARTs is for a detection range of 5NM when the aerial is 1m above sea level and it is being interrogated by a radar with a scanner height of 15m above sea level. In practice a SART beacon has been located by aircraft at a distance of up to 48nm. This is unusual and is far beyond the specification for the device but it does demonstrate the value of the beacon, particularly when searching a very large area.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.7
SESSION NAME	Search Termination

SCHEDULED SESSION TIME	00:30

RESOURCES NEEDED	Chart Room

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	Whiteboard Projector Paper Pens

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Outlining the criteria for search termination.
Learning Outcomes	Delegates will be able to; Identify the circumstances and criteria of search termination

Session 3.7: Search termination

Explain

If the circumstances require or dictate then you may need to suspend or terminate a search.

Suspend = The temporary halting of searches to be continued at a later time.

Terminate = The halting of searches that are concluded unsuccessfully.

When incidents are concluded, regardless of success, they are "Closed".

Searches may be *terminated* even if the incident remains open.

[INCLUDEPICTURE "http://oms.mcga.gov.uk/importantinfov3.jpg" * MERGEFORMATINET] Night Searches - Do not stop searching just because it has become dark.

The added risk to rescuers may justify suspending a search, however the POD is not reduced to zero.

[INCLUDEPICTURE "http://oms.mcga.gov.uk/goodideav4.jpg" * MERGEFORMATINET] Closed incidents may be re-opened if significant new information comes to light.

Before searches are terminated or suspended, or unsuccessful incidents are closed, you must:

Consider

The possible ramifications of suspending searching (e.g. political involvement, impact on the maritime community)

- Is it safe to continue searching

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- Is there any chance of finding the casualty alive
- Is there a high or potentially adverse media interest
- Informing the Press Office
- Is there a need for welfare support due to the effect on individuals

Consult

[INCLUDEPICTURE "http://oms.mcga.gov.uk/importantinfov3.jpg" * MERGEFORMATINET] You must always make the decision together with the DAO or DNSARO as appropriate and consult:

- the Ops team
- the facilities involved
- other authorities involved
- the OSC
- the Next Of Kin
  - have the NOK / family been given advanced warning of termination?
  - provide relatives with as much notice of your intention to terminate the search as possible

Review

Before a decision can be reached you must review the incident to ensure it has been conducted correctly

A review of the incident should include:

- Search decisions (for proper assumptions and reasonable planning scenarios)
- Certainty of initial position and any drift factors used to determin the search area
- Significant clues and leads
- Data computations
- Accuracy of information
- Error Margins and other Variables
- The Search Plans and POD
- What was the Coverage Factor and POD for the planned / completed searches
- Survivability

[INCLUDEPICTURE "http://oms.mcga.gov.uk/importantinfov3.jpg" * MERGEFORMATINET] The reasons for suspending a search must be clearly recorded.

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COURSE	FOUNDATION PROGRAMME

MODULE	D

UNIT NUMBER	?
UNIT NAME	Maritime Search 1

SESSION NUMBER	3.8
SESSION NAME	Further SAD and SAC exercises

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SCHEDULED SESSION TIME	02:15

RESOURCES NEEDED	Chart Room
	SAR G+T
	Calculators
	Parallel Rules
	Dividers
	2b Pencils
	SAD Worksheets
	Tidal Vector Worksheets
	Charts
	Exercises
	Projector

LINKS TO OTHER UNITS/ MODULES	

OVERVIEW	Further SAD and SAC exercises for the delegates to complete to consolidate their learning.
Learning Outcomes	Delegates will be able to; Consolidate their skills in SAC. Consolidate their skills in SAD Rapid Response.

Session 3.8: Further SAD and SAC exercises

Activity
Delegates to complete a further SAD and SAC exercises to confirm learning.