NATO STANDARD

MTP-24 VOLUME I

NAVAL MINE COUNTERMEASURES TACTICS AND EXECUTION

Edition D Version 1

SEPTEMBER 2016

NORTH ATLANTIC TREATY ORGANIZATION

MULTI-NATIONAL TACTICAL PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

26 September 2016

1. The enclosed Multinational Tactical Publication MTP-24, VOLUME I, Edition D, Version 1, NAVAL MINE COUNTERMEASURES TACTICS AND EXECUTION, which has been approved by the nations in the Military Committee Maritime Standardization Board (MCMSB), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 1132.

2. MTP-24, VOLUME I, Edition D, Version 1 will come into effect on 16 January 2017 and supersedes MTP-24(C) VOLUME I which shall be destroyed in accordance with the local procedure for the destruction of documents.

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Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

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NATO NATIONS

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Note. *The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Database for the complete list of existing reservations.*

RECORD OF RESERVATIONS

NATION	SPECIFIC RESERVATIONS
Note. *The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Database for the complete list of existing reservations.*	

RECORD OF CHANGES

Identification of Change, Reg. No. (if any), and Date	Date Entered	NATO Effective Date	By Whom Entered (Signature; Rank, Grade or Rate; Name of Command)

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REFERENCES

1. NATO STANDARDISATION COVERING DOCUMENTS

a. STANAG 1132 - Naval Mine Countermeasures and Execution

2. NATO POLICIES, DIRECTIVES AND GUIDANCE

To be inserted

3. RELATED DOCUMENTS

a. Operations (Mine Warfare)

(1) NOT RELEASABLE

(2) NOT RELEASABLE

(3) NOT RELEASABLE

(4) NOT RELEASABLE

(5) NOT RELEASABLE

(6) NOT RELEASABLE

(7) APP-11 - NATO Message Catalogue (STANAG 7149 IERH)

(8) ADivP-1 - Allied Guide to Diving Operations (STANAG 1372)

b. Hydrographic

(1) NOT RELEASABLE

(2) NOT RELEASABLE

(3) NOT RELEASABLE

(4) NOT RELEASABLE

(5) NOT RELEASABLE

c. NOT RELEASABLE

d. NOT RELEASABLE

e. Other Warfare Publications.

(1) ATP-8 - Doctrine for Amphibious Operations (STANAG 1149)

(2) NOT RELEASABLE

f. Navigation, Routing etc.

(1) AAP-8 - Naval Co-ordination and Guidance to Shipping, Information on Ports, Authorities and NCAGS Publications (STANAG 1212)

(2) NOT RELEASABLE

g. Other Warfare Operations.

(1) NOT RELEASABLE

(2) NOT RELEASABLE

h. Logistics.

(1) ALP-1 - Procedures for Logistic Support between NATO Navies and Naval Port Information (STANAG 1200)

i. Additional.

(1) AAP-6 - NATO Glossary of Terms and Definitions (English and French) (STANAG 3680)

(2) AAP-15 - Glossary of Abbreviations Used in NATO Documents.

Multi-National Manuals

(1) MTP-1 Vol I - Multi-National Maritime Tactical Instructions and Procedures

(2) MTP-6 Vol I - Naval Mine Warfare Principles

(3) MTP-6 Vol II - Naval Mine Countermeasures Planning and Evaluation

(4) ADivP-1 - Multi National Guide to Diving Operations

(5) ADivP-2 - Multi National Guide to Diving Medical Disorders

CONVENTIONS

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this publication refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

1. Purpose. (NU) The purpose of MTP-24, Volume I, is to provide common tactical procedures for Allied forces conducting mine countermeasures operations.

2. Scope. (NU) MTP-24, Volume I, is written to complement, and when necessary expand into procedures, the common mine countermeasures doctrine contained in MTP-6, Volume II.

3. (NU) International Units System.

1. **(NU)** The International Units System (Système International d'Unités - short title `SI Units') is the standard NATO system of measurement. A conversion table is included for convenience in converting from SI Units to Centimetre-Gram-Second (CGS) and other units, and vice versa, since many equipments will be based on the old systems until the turnover to SI Units has been completed. Where other units are, by necessity, used, eg yards or fathoms, equivalent values in SI Units will be shown in brackets ( ) alongside in the text, in figures and by showing both scales together. Where sound levels are expressed in decibels, unless otherwise stated, the reference is 1 μPa. The relation of this level to a reference of 1 microbar is as follows:

a. **(NU)** Value in dB (re 1 μPa) = value in dB (re 1 μ bar) + 100dB. Spectrum level shall be quoted in dB (re 1 μPA) for 1 Hz bandwidth.

b. **(NU)** Unless otherwise stated the following units of measurement are used in the Mine Warfare Publications MTP-6 and MTP-24:

Aircraft Altitude in Feet
Water Depth in Metres
Distance in Nautical Miles (2025 yd)
Land Heights in Metres
Speed in Knots
Weight in Newtons
Mass in Kilograms
Range in metres or yards
Track Spacing metres or yards
Channel Width metres or yards
SDNE metres or yards
Actuation Width metres or yards
Buoy Spacing metres or yards
Underwater Visibility metres or yards
Offset Distance metres or yards
Damage in metres.

c. **(NU)** For intranational use, the units of measurement of the nation concerned may be used. Some data within this book has been devised and collected in Imperial and/or Metric Units of measurement. Where this is so the NATO Agreed Conversion Factors in the following conversion table are to be used.

CONVERSION TABLE - CGS UNITS TO SI UNITS

Quantity	cgs units	SI units	Conversion factors
Force	dyne (dyn)	newton (N)	dyn = 10^{-5}N 1N = 10^{5} dyn
Pressure	microbar (µbar) 1 µbar = 1 dyn/cm^{2}	pascal (Pa) 1 Pa = 1 N/m^{2}	1 µbar = 10^{-1}Pa 1 Pa = 10 µbar 1 µbar = 10^{5} µPa
Magnetic field	oersted (Ce)	ampere/metre (A/m)	1 Oe = $10^{3}/_{4}$ π A/m = 80 A/m 1 mOe = 0.08 A/m 1 A/m = 4 π/10^{3} Oe = 12.6 mOe
Magnetic moment	cgs (equivalent unit is erg/gauss)	ampere metre^{2} (A.m^{2}) (equivalent unit is joule/tesla (J/T))	1 cgs = 1/10^{3} A.m^{2} 1A.m2 = 10^{3} cgs
Magnetic flux	maxwell (Mx)	weber (Wb)	1 Mx = 10^{-8} Wb 1 Wb = 10^{8} Mx
Magnetic flux density (magnetic induction)	gauss (Gs) 1 Gs = 1 Mx/cm^{2}	tesla (T) 1T = 1 Wb/m^{2}	1 Gs = 10^{-4}T 1 mGs = 100nT 1 gamma = 1 nT 1 T = 10^{4} Gs

4. NOT RELEASABLE**.**

5. CAUTIONS AND NOTES

The following definitions apply to cautions and notes used throughout this publication.

A warning is used to highlight to the reader, any operating procedure, practice or condition that may result in injury or death if not carefully observed or followed.

A caution is used to highlight to the reader, any operating procedure, practice or condition that may result in damage to equipment if not carefully observed or followed.

Note

A note is used to highlight to the reader, any operating procedure, practice or condition that requires emphasis.

6. CHANGE SYMBOLS

Revised text in this document is indicated by a black vertical line in the outside margin of the page. The change symbol indicates added or restated information. A change symbol adjacent to the chapter number, annex number or appendices number and title indicates a new or completely revised chapter, annex or appendices.

7. WORDING

Word usage and intended meaning throughout this publication is as follows:

'Shall' indicates the application of a procedure is mandatory.

'Should' indicates the application of a procedure is recommended.

'May' and 'need not' indicates the application of a procedure is optional.

'Will' indicates future time. It never indicates any degree of requirement for application of a procedure.

CHAPTER 1 - GENERAL MINE COUNTERMEASURES (MCM) TACTICAL INFORMATION

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0101 (NU) Responsibilities

1. (NU) Command Authorities. Responsibilities of the various command authorities for the conduct of MCM operations are laid down in MTP-6, Volume I and MTP-1, Volume I.

2. (NU) The Tactical Command (OTC, Officer in Tactical Command)

a. (NU) The authority delegated to a commander to assign tasks to forces under his command for the accomplishment of the mission assigned by higher authority is called 'Tactical Command'. The OTC will normally be under the operational control of a higher authority.

b. (NU) The OTC of an MCM force is the commander named in the order creating the tasking organisation. When a task organisation has not been established and the higher authority has not selected the OTC, the senior officer present eligible to command will act as OTC. His duties are described in MTP-6 Volume I and include those listed below.

(1) (NU) Issuing MCM task orders in accordance with the concept of operations (OPTASK NMW/OPDIR, MCM OPORD), modifying these instructions as necessary to meet the mine threat.

(2) (NU) Order the appropriate preparation of the battlespace.

(3) (NU) Order the appropriate task cycle if necessary for each type of MCM unit.

(4) (NU) Giving any information not provided in the task order.

(5) (NU) Detailing the information about sweeps or other equipment or weapons to be used.

(6) (NU) Choosing the method of navigation of MCM forces (including MCM buoy laying policy).

(7) (NU) Request establishment, modification and cancellation of MDAs as deemed necessary from the OPCON authority.

(8) (NU) Giving advice or recommending on the establishment of diversion routes.

(9) (NU) Issuing lead-through instructions as necessary.

(10) (NU) Giving advice or recommending on the temporary, partial or total closure of mined ports and anchorages and on the issue of sub-area warnings.

(11) (NU) If necessary issuing coordination instructions to prevent mutual interference within the MCM group or with other units.

(12) (NU) Coordinating the logistic support of the MCM units.

(13) (NU) Compiling reports and records in order to:

-follow on the MCM situation and issue the required reports to the OPCON authority.

-exert subsequent control of the action of individual MCM units.

(14) (NU) Collating and analysing reports, records and intelligence so as to obtain the newest information on the mine threat and its evolution and despatch it as necessary.

(15) (NU) Devoting full attention to the risk sustained by MCM units and following its evolution.

(16) (NU) Assuming any responsibility which could be delegated to him by the higher authority (MTP-6 Volume I, paragraph 0104.3)

c. (NU) Tactical Control (TACON). When delegating tactical control of MCM forces, the OTC must state clearly the extent of the authority delegated. The delegated responsibilities will normally be those listed in MTP-6 Volume I, paragraph 0104.3(e) or those listed in the foregoing sub-paragraph. But depending on the circumstances those lists should not be regarded as exhaustive. The TACON should be kept aware of the intentions and policies of the higher authority in order to act accordingly when faced with unexpected circumstances. The OTC will also specify how the reports should be sent.

d. (NU) The OTC of MCM forces will allocate tasks to ships or task units according to their capabilities. This may require that, when formation sweeping, sweepers of the same nationality work in task units with their own ships and that the senior officer of each national group be consulted as to national procedures, formations and sweeping methods for the assigned task(s).

0102 (NU) MCM Orders

1. (NU) Mine countermeasures orders consist of:

a. (NU) Operations Plan (OPLAN) and/or MCM Operation Order (MCM OPORDER).

b. (NU) NMW Operational direction and guidance (OPTASK NMW/OPDIR).

c. (NU) Tasking for NMW Operations (OPTASK NMW/TASK).

2. (NU) The operation order is the means by which the planner distributes and assigns the forces available to him in the most effective way. Operation orders may already exist in peacetime, giving standing operational procedures to execute the MCM operations. In such cases, amplifying orders or task orders are sufficient to start MCM operations.

Note. (NU) *The development of this para may be found in Chapter 2, Annex C of MTP-6 Vol II.*

0103 (NU) MCM Risk Directives

1. (NU) In ordering MCM operations, Risk Directives are used as described in MTP-6 Vol I Chapter 3 and MTP-6 Vol II Chapter 1.

0104 (NU) Standard Letter Suffixes and Associated Stages

1. (NU) The Standard Letter Suffixes (SLS) are used in assembling the task order number (see para 0203c (2)). SLS indicate the state or combination of stages, which must be executed in that particular task, within the framework of an MCM operation. Table 1-1 shows the suffixes available.

2. (NU) The SLS may be found in the table in the following paragraph. If no MCM operation is specified, the SLS ‘ZZ’, or one of the spare suffixes must be stated in the operation order.

3. (NU) If other stages as given in the standard list are required, this must be mentioned in MCM task order.

4. (NU) The list of mine countermeasures stages may be found in para 0105. An MCM stage indicates the use of a specific MCM technique to counter a particular type or types of mine.

Table 1-1. Standard Letter Suffices to Task Order Numbers

	1st LETTER	**OTHER LETTERS**						
		SWEEPING				**HUNTING**	**CLEARANCE DIVING TEAM**	**OTHERS** NOT RELEASABLE
		Mechanical	**Magnetic**	**Acoustic**	**Combined**			
OPERATIONS		11 to 13 and 61 to 63	21 to 25 and 71 to 75	31 to 39 and 81 to 89	71 to 75 in conjunction with 81 to 89	14 and 50 to 59	41 to 49	
Precursor	P	M	G	A	C	H		
Exploratory	E	M	G	A	C	H	D	
Clearance	C	M	G	A	C	H	D	
Time Constrained Time Limit Unknown	A	M	G	A	C	H	D	
Check	V	M	G	A	C	H	D	
Reconnaissance	R	-	-	-	-	H	D	
Time Constrained Time Limit Known	S	M	G	A	C	H	D	
Route Survey	U					H		
Buoy laying	B							
Rapid Environment Assessment	W							
Others	Z							
NOT RELEASABLE								

0105 (NU) MCM Stages

(NU) Tables 1-2 to 1-10 contain the necessary matrices that constitute the various MCM stages available. The necessary explanations are given in MTP-6, Volume II.

Table 1-2. (NU) Precursor Stages Against Moored Mines

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
11	Shallow moored mines (or antennae close to the surface)	Helicopter Minesweeper Inshore (MSI). Specially fitted small craft	Wire sweep	Sweeping techniques must be especially modified if used against antennae mines to ensure that these mines are not detonated close to the sweepers.
12	Antennae mines	All sweepers	Modified wire sweeps	
13	Snagline mines	Helicopter MSI. Specially fitted small craft.	Snagline sweep	
14	Moored mines	Hunters/Drone Control Vessels	MH Sonars/Mine detection sonars	
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Table 1-3. (NU) Precursor Stages Against Magnetic Mines

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
21	Sensitive magnetic mines	All sweepers fitted	Magnetic solenoid sweep	
22	Sensitive magnetic mines	All sweepers fitted	Magnetic electrode (straight-tail) sweep	
23	Sensitive magnetic mines	All sweepers fitted	Magnetic electrode (open-loop) sweep	
24	Sensitive magnetic mines	All sweepers fitted	Closed-loop magnetic sweep	
25	Sensitive magnetic mines	MSD	Magnetic solenoid sweep	Remote controlled self propelled sweep. May be used in conjunction with other stages (38/39).
NATO-UNCLASSIFIED				

Table 1-4. (NU) Precursor Stages Against Acoustic Mines

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
31	Acoustic mines	Aircraft or surface ships	Depth-charges or bombs	Precursor sweeping of simple acoustic mines.
32	Acoustic mines	Helicopter - Any ship so fitted	Explosive sweep	Precursor sweeping of simple acoustic mines.
33	Acoustic mines	Helicopter Sweepers so fitted	Mechanical Noise Makers	Precursor sweep. May be used in conjunction with other stages.
34	Acoustic mines	All sweepers fitted	AF sweep (hammer) at long stay astern	Precursor sweep. May be used in conjunction with other stages.
35	Acoustic mines	All sweepers fitted	LF sweep at long stay astern	Precursor sweep. May be used in conjunction with other stages.
36	Acoustic mines	All sweepers or MSD so fitted	Multi-Frequency sweep at long stay astern	Precursor sweep. May be used in conjunction with other stages.
37	Acoustic mines	All sweepers fitted	Unified LF/AF Sweep towed at long stay	Precursor sweep. May be used in conjunction with other stages.
38	Acoustic mines	MSD	AF sweep (hammer) installed in MSD	Remote controlled self-propelled sweep. May be used in conjunction with other stages (25/39).
39	Acoustic mines	MSD	LF sweep towed by MSD	Remote controlled self-propelled sweep. May be used in conjunction with other stages (25/38).
NATO-UNCLASSIFIED				

Table 1-5. (NU) Clearance Diving Stages

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
41	All mines	Clearance divers	Progressive grid search	May be used by day or night.
42	All mines	Clearance divers	Jackstay snagline search	May be used by day or night.
43	All mines	Clearance divers	Circular snagline search	May be used by day or night.
44	All mines	Clearance divers	Enclosed-water grid search	May be used by day or night.
45A	All mines	Clearance divers	Towed free diver	Daytime only. These searches are only effective if underwater visibility is at least 5 metres.
45B	All mines	Clearance divers	Diver on under-water sled	Daytime only. These searches are only effective if underwater visibility is at least 10 metres.
46	All mines	Clearance divers	Diver on a Self Propelled Vehicle	Daytime only. These searches are only effective if underwater visibility is at least 5 metres.
47	All mines	Clearance divers	Running jackstay search	Daytime only
48	All mines	Clearance divers and small craft	Bottom team sweep.	A search using MCM divers and small craft.
49	VSW mines	Clearance Divers	Area underwater search with sonar	May be used by day or night. Most Effective for VSW.
49A	Ground mines	Marine Mammal System (MMS)	MMS - EOD escorted search	
49B	Moored mines	MMS	MMS-EOD escorted search	
49C	VSW mines	MMS	MMS-VSW Det escorted search	
49D	VSW mines	MMS and divers	MMS and VSW diver	Used for combined MMS/diver tactics.
49E	All mines	EOD/clearance divers and MMS	Diver sonar MMS escorted search	
NATO-UNCLASSIFIED				

Table 1-6. (NU) Minehunting stages

STAGE No	BY	USING	REMARKS
50	Minehunters	Acoustic M/H Systems	Classify and plot.
50A	AMCM, USV	Towed SSS/SAS	Classify and Plot . Determine Sonar Contact Confidence Level (SCCL).
50B	AUV	SSS/SAS	Classify and Plot. Determine SCCL.
51	Minehunters EOD Diving Unit	Acoustic M/H Systems	Identify and plot.
52	Minehunters	Acoustic M/H Systems	Classify and mark.
53	Minehunters EOD Diving Unit	Acoustic M/H Systems	Identify and mark.
54	Minehunters	Acoustic M/H Systems	Classify and neutralize.
54A	SMCM/EOD/MMS	Acoustic M/H Systems	Re-acquire AMCM/SMCM/UMCM contacts, classify and neutralize / dispose.
54B	SMCM/EOD/MMS	Acoustic M/H Systems	Re-acquire AMCM/SMCM/UMCM contacts, classify, recover/investigate.
55	Minehunters EOD Diving Units	Acoustic M/H Systems	Identify and neutralize.
56	Minehunters	Acoustic M/H Systems	Classify and countermine.
57	Minehunters EOD Diving Units	Acoustic M/H Systems	Identify and countermine.
57A	Minehunters EOD Diving Units	Acoustic M/H Systems	Identify and render safe.
57B	Minehunters EOD Diving Units	Acoustic M/H Systems	Identify and remove.
57C	Minehunters EOD Diving Units	Acoustic M/H Systems	Identify and recover.
58	In Stride	Multi-Systems	Identify and Countermine.
59	Include AUVs??	Any other system	Reacquire Eg. Optical M/H Systems Combined with one of the stages above.
NATO-UNCLASSIFIED			

Table 1-7. (NU) Mechanical Sweeping Stages

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
61	Moored mines	All sweepers fitted	Wire sweep	Conventional wire sweep using fixed depth setting. May be used in conjunction with other stages.
62	Moored mines	All sweepers fitted	Wire sweep	Wire sweep with variable depth setting (team sweep).
63	Deep moored mines	All sweepers fitted	Wire team sweep	Wire sweep with variable depth setting (deep sweeping with team sweep).
NATO-UNCLASSIFIED				

Table 1-8. (NU) Magnetic Sweeping Stages

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
71	Magnetic mines	All sweepers fitted	Magnetic solenoid sweep	May be used in conjunction with other stages.
72	Magnetic mines	All sweepers fitted	Magnetic electrode (straight-tail) sweep	May be used in conjunction with other stages.
73	Magnetic mines	All sweepers fitted	Magnetic electrode (open-loop) sweep	May be used in conjunction with other stages.
74	Magnetic mines	All sweepers fitted	Closed-loop magnetic sweep	May be used in conjunction with other stages.
75	Magnetic mines	MSD	Magnetic solenoid sweep	Remote controlled self propelled sweep. May be used in conjunction with other stages (88/89).
NATO-UNCLASSIFIED				

Table 1-9. (NU) Acoustic Sweeping stages

STAGE No	EFFECTIVE AGAINST	BY	USING	REMARKS
81	Acoustic mines	All sweepers fitted	AF sweep abeam	The risk from coarse acoustic and sensitive magnetic mines must always be considered.
82	Acoustic mines	All sweepers fitted	LF sweep abeam	May be used in conjunction with other stages.
83	Acoustic mines	All sweepers fitted	Mechanical Noise Makers	May be used in conjunction with other stages.
84	Acoustic mines	All sweepers fitted	AF (hammer) sweep at long stay astern	May be used in conjunction with other stages.
85	Acoustic mines	All sweepers fitted	LF sweep at long stay astern	May be used in conjunction with other stages.
86	Acoustic mines	All sweepers fitted	Multi-Frequency Sweep towed at long stay astern	May be used in conjunction with other stages.
87	Acoustic mines	All sweepers fitted	Unified LF/AF sweep towed at long stay	May be used in conjunction with other stages.
87A	Influence Mines	All sweepers fitted	Influence Sweeps Mine Setting Mode	Exploratory MSM
87B	Influence Mines	All sweepers fitted	Influence Sweeps Mine Setting Mode	Clearance MSM
87C	Influence Mines	All sweepers fitted	Influence Sweeps Target Simulation Mode	Exploratory TSM
87D	Influence Mines	All Sweepers fitted	Influence Sweeps Target Simulation Mode	Clearance TSM
88	Acoustic mines	MSD	AF sweep in MSD	May be used in conjunction with other stages (75/89).
89	Acoustic mines	MSD	LF sweep towed by MSD	May be used in conjunction with other stages (75/88).
NATO-UNCLASSIFIED				

Table 1-10. NOT RELEASABLE

0106 (NU) Communications

1. (NU) Use of MW Signals and Formatted Messages. Within the task unit/task group communications will normally consist of Message Text Formats (MTFs) from APP-11 and if appropriate, tactical signals from ATP-1, Volume II. Detailed information is contained in Chapter 2 of this publication.

2. (NU) Romeo Procedures. Romeo Procedures are used in Mine Sweeping Operations and are detailed on Chapter 8 of this publication.

3. (NU) Record and Reports. The required records and reports are detailed in Chapter 2 and in MTP-6 Vol I Chapter 1 Annex A

0107 (NU) Degree of Readiness

1. (NU) General. The degrees of readiness for MCM vessels are those of all warships and are described in MTP-1, Volume I. They aim at ensuring the highest possible degree of safety both to personnel and equipment.

2. (NU) MCMV Safety Measures. When carrying out MCM operations against live mines, the following safety measures should be taken:

a (NU) Personnel should not be allowed below the MCMVs main deck or under an overhanging structure for longer than necessary.

b. (NU) Absorbent material, eg Styrofoam should be placed on decks and shock-absorbent mats fixed to the deckheads of occupied compartments, eg operations rooms and communications centres.

c. (NU) All personnel on the upper deck are to wear self-buoyant life-jackets, eg Kapok filled or automatic inflating life-jackets. Personnel between decks are to wear or to have readily available to hand, manually inflated life-jackets.

d. (NU) All personnel should wear head protectors, shirts with long sleeves and trousers of non-inflammable material with cuffs and all buttons fastened.

e. (NU) Off watch personnel should adopt a lying down (prone) position.

f. (NU) All armament should be in a ‘Set to safe’ position, in accordance with national procedures and weapon drills.

g. (NU) First-aid and damage control parties should be ready for action with equipment ready for instant use.

h. (NU) The ship should be secured for action, in particular all potential projectiles and loose gear should be stowed away or secured.

i. (NU) The highest state of watertight integrity must be maintained.

0108 (NU) Course of Action in Special Cases

1. (NU) Attack by Enemy Forces. The armament of mine countermeasures vessels can be inadequate to counter enemy attacks efficiently. MCM vessels can only take safety measures and man their self-defensive weapons. The defence of MCMVs may be, depending on the regional organization of forces, the responsibility of the OPCOM or OPCON Authority. Single or simultaneous terrorist attacks by light craft should be considered in some foreign waters (especially in the vicinity of harbours).

2. (NU) Ship Breakdown due to a Mine Explosion.

a, (NU) MCM operation orders should include instructions for the following (see also MTP-1 Vol I Chapter 13, para 13060.e):

(1) (NU) MCMVs sunk or damaged during sweeping or hunting operations (eg. re-routing, evacuation routes, impact on MCM effort, intel on mine settings).

(2) (NU) The location of mines by non-MCMVs, or the damage or sinking of a vessel hit by a mine. (eg. reports, establishment of an MDA, activation of routes, SAR, AWNIS).

(3) (NU) The aid to be given to ships sunk or damaged, and the use of influence sweeps in the vicinity of a damaged vessel. Depending on the tactical situation, the detachment of an MCMV may be ordered by the OTC to recover survivors.

b. (NU) The OTC must render an immediate report on the nature and extent of breakdowns caused by mine explosions to the OPCON Authority in case it becomes necessary to change the orders for subsequent operations. The following should be included in the report:

(1) (NU) Position of the explosion in relation to the MCMV.

(2) (NU) Importance of the breakdown.

(3) (NU) For Mine Sweeping, acoustic and magnetic pulse cycles at the time of the explosion.

(4) (NU) Technical accidents likely to have caused the explosion, such as abnormal function of a sweep, breakdown in degaussing coils etc. This information may be of paramount importance, it should reach the OPCON Authority in the form of amplifying reports as the information becomes available.

3. (NU) Fog.

a. (NU) In Peacetime

(1) (NU) *Mechanical Sweeping*. The OTC orders sweeps to be recovered, maintaining the sweeping formation.

(2) (NU) *Influence Sweeping*. The OTC orders the sweeps to be recovered if considered necessary (untrained ships, volume of traffic etc).

b. (NU) In Wartime. Operations should be continued as long as safe navigation permits. If the OTC considers that it is not possible to continue the operation, the formation must manoeuvre in time for sweeps to be recovered with the maximum of safety.

4. (NU) Man Overboard during Sweeping

a. (NU) Measures to be Taken immediately. In addition to the actions listed in MTP-1 Volume 1, Chapter 2, Mine Sweepers should de-energise influence sweeps.

b. (NU) Wheel and Engine manoeuvring. The short length of the MCM vessel and the reduced effect of the rudder while sweeping render manoeuvring with rudder and engines unprofitable for swinging the stern clear of the man overboard and may well endanger the sweep. However, depending on conditions prevailing and operational circumstances permitting, a sweeper can be manoeuvred to recover the man. Provided the water is deep enough to prevent bottoming of the gear, the ship should be turned and brought to rest upwind of the man in the water.

c. (NU) During Peacetime. Two cases may be considered, the OTC should always plan for detailing a recovery ship taking the following into account depending on whether the division includes a buoy layer/mine recovery vessel or not:

(1) (NU) If there is a buoy layer/mine recovery vessel this should immediately proceed to the man's assistance.
(2) (NU) If there is no buoylayer:

(a) (NU) Line ahead or line of bearing. The best-placed ship should manoeuvre to rescue the man while taking such sweep-handling action as may render her manageable enough to lower a boat or raft near the man.

(b) (NU) Single line abreast. The ship which lost the man should haul out of the formation and manoeuvre as above.

(c) (NU) Team sweeping. The rear team or (in line abreast) the wing ship nearest to the man should recover its sweeps and proceed to his assistance.

d. (NU) During Wartime.

(1) (NU) Manoeuvres are the same as in peacetime. The sweepers, passing close to the man overboard, de-energize their influence sweeps.

(2) (NU) It may be necessary to order, in certain cases, that no attempt will be made to recover a man fallen overboard.

(3) (NU) Man overboard lights are only to be lit on the instructions of the OTC.

5. (NU) Diving Incidents. The action required is stated in ADivP-1 and in Section 5 of Chapter 5 of this publication.

6. (NU) Emergency Cutting or Slipping Sweeps. Ships should be prepared at all times to cut or slip sweeps in an emergency situation. National policy should be followed.

0109 (NU) Coordination of MCM Operations

1. (NU) General

a. (NU) The authority responsible for writing the operation order must clearly specify:

(1) (NU) The safety distance to be observed between the different MCM systems.

(2) (NU) The authority responsible for implementing the coordinating regulations.

b. (NU) Coordinating Authority. In principle, the Tactical Commander (the OTC) conducting the operation will be the coordinating authority but in some circumstances (distance for example) may not be able to fulfil this responsibility. In such cases, OTC may appoint a local coordinator whose role is to ensure the application of the appropriate regulations on behalf of the OTC. This local coordinator may be the one who has the greatest difficulty in ensuring the safety of the unit. When selecting a local coordinator it is generally appropriate to select in the following order:

(1) (NU) CTU of clearance diver units.

(2) (NU) CTU of minehunters.

(3) (NU) CTU of minesweepers.

2. (NU) Safety Distances.

a. (NU) Safety distances, including those for protection of clearance divers, are discussed in MTP-6 Vol II Chapter 1 and may also be IAW national requirements. In the event of joint operations involving the use of different techniques, the maximum safety distances are to be used.

b. (NU) The safety distances should be selected taking the following factors into account:

(1) (NU) Uncertainty regarding the propagation of sound pressure waves due to explosions and acoustic sweeps.

(2) (NU) The characteristics of the detonating systems for mine disposal charges.

(3) (NU) Any available information regarding the mine’s detonating system.

3. (NU) Measures to Prevent Mutual Interference and Principles Governing Priorities Between Units.

a. (NU) The measures are not intended to cancel or supersede the International Rules for the Prevention of Collision at Sea. The measures are only to avoid interactions between different MCM Systems operating in close vicinity. They are not to be used as long as MCMV/Helo are not handling their equipment or diving operations are conducted.

b. (NU) To find the right of way for one system with respect to another, all systems are divided into a list of priorities shown in Table 1-11:

c. (NU) The unit with the highest priority has the right of way. This unit has to inform the unit with lower priority in due time in case of possible interference. The unit with lower priority must take action to avoid interference.

d. (NU) The appropriate signals and lights are to be shown at all times while conducting MCM operations. Diving signals are to be shown only when diving operations are actually in progress. At night, a white light is to be shown by dive boats during diving operations. During wartime, the use of navigational lights is at the OTC's discretion.

e. (NU) OTC's might consider ordering a buffer zone of an appropriate distance between different MCM systems when operating simultaneously in the same objective area.

Table 1-11. (NU) System Right of Way Priority List

Priority	**System**
1	MH(D)/MCD - Minehunter/Clearance diving vessel, with divers in the water.
2	MH(TSS) - Minehunter with towed side-scan sonar or streamed SPVDS.
3	MH(RV) - Minehunter, while operating ROV in the water.
4	MS(T) - Minesweepers with streamed team sweep.
5	MS(F) - Minesweepers in formation with streamed gear.
6	MS(I) - Minesweeper independent with streamed gear.
7	MSD - Minesweeping or Minehunting drones (including SSV) operating.
8	H(H) - Minehunter, while hunting (no ROV/diver in the water).
9	H/C - MCM - Helicopter with streamed gear.
10	MSCD/MHCD -Minesweeping or Minehunting Control Vessel operating drones (including SSV)
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f. (NU) Co-operation Between Minehunting Vessels and Divers. Radio communication is required between the minehunters and the minehunting diving craft, eg dive boats. Minehunters should normally operate independently at least one nautical mile apart (or as ordered by the OTC) to:

(1) (NU) Work at the optimum rate.

(2) (NU) Eliminate sonar mutual interference.

(3) (NU) Reduce the danger to ships and divers due to underwater shock from an unexpected detonation.

g. (NU) Safety of Divers from Explosions. The separation should be the minimum acceptable separation of divers from a mine explosion (see Table 1-12).

Table 1-12. Minimum Acceptable Separation Distances

TOTAL MASS OF EXPLOSIVE IN TNT EQUIVALENT		DISTANCE IN NAUTICAL MILES
less than	225 kg	$^{3}/_{4}$
from	225 to 550 kg	1
from	551 to 900 kg	$1^{1}/_{4}$
from	901 to 1800 kg	$1^{1}/_{2}$
NATO-UNCLASSIFIED		

h. (NU) Coordination Between AUVs and Other MCM Units/Assets. The Tasking Authority must coordinate the employment of AUVs and MCM operations in order to avoid interference. National safety distances must be taken into account.

0110 (NU) Risk and Self Protective Measures (SPM) for MCM Vessels

1. (NU) SPMs for Minesweepers

a. (NU) Self Protection Depth for Minesweepers. When carrying out a minesweeping technique, the ‘self protection depth’ is the depth where the Dangerous Front relative to mines affected by the technique is zero. For details see MTP-6, Volume I Chapter 5 and Volume II Chapter 10.

b (NU) Effect of Speed. Reduction in speed reduces the pressure signature of a ship and generally the acoustic signature as well and will lessen the chances of detonating mines using these influences. A ship may in principle avoid actuating a simple pressure mine by either travelling so slowly that the pressure requirement is not met, or so fast the time requirement is not met. There will usually exist a range of particularly dangerous intermediate speeds. In practice only speeds below this range would normally be safe, and then a margin would have to be allowed for the uncertainties of mine parameters.

(1) NOT RELEASABLE

(2) (NU) The rate of change of the magnetic field at a mine will decrease as the speed of a given ship is decreased, and therefore magnetic induction mines will be less likely to be actuated by slow ships than by fast ones. In general, however, no practical safe speed can be laid down for a particular ship for general use against magnetic mines.

c. (NU) Reduction of Risk - Technical Measures.

(1) (NU) General. Standard tactical and technical procedures and measures should be implemented to reduce the risk to the sweepers. These measures may be modified during the operation as a result of the observed efficiency of the sweep or as a result of intelligence gained after the recovery of a mine.

(2) (NU) Magnetic Sweeping. The sweeper runs a risk mainly from sensitive mines. When a magnetic sweep is towed, it may create a strong magnetic field within the sweeper's damage area and thus expose it to danger from even mid-sensitivity mines. The best way of reducing the risk of magnetic sweepers is to forgo making full use of the sweep, that is to say, supply it with reduced current.

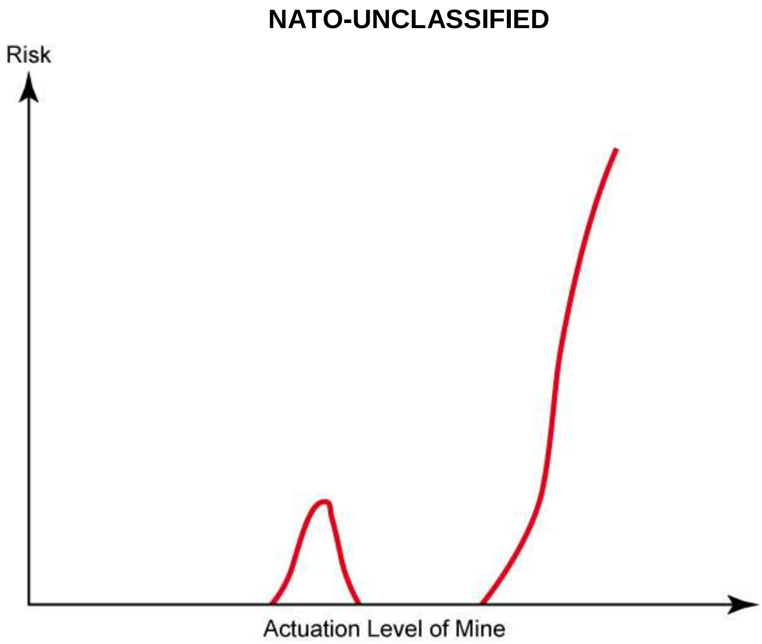
(a) NOT RELEASABLE

(3) (NU) Acoustic Sweeping. When streaming an acoustic sweep to long stay, the risk may be decreased since most of the mines will be actuated by the sweep at a safe distance from the sweeper. When sweeps are streamed abeam, the risk from coarse acoustic mines becomes very great.

(a) (NU) Risks with a Sweep Towed Abeam or at Short Stay. The noise of the sweep drowns that of the sweeper and the sound-pressure isobars are roughly circular. All mines, whatever the ship-count, which have an actuation level above a certain value are a danger to the sweeper. As actuation level decreases, there will be a zone where only some mines will endanger the sweeper. Sensitive mines may, in certain conditions of propagation, create a small risk. The variation of danger with mine actuation level is shown in Figure 1-1.

Note. *This also applies to Minesweeping drones but because they are unmanned and constructed with a higher degree of shock hardening, the impact on operations is less restrictive.*

Figure 1-1. Variation of Danger with Mine Actuation for Sweeps Towed Abeam or at Short Stay Astern



(b) (NU) Risks with a Sweep at Long Stay. The noise under the sweeper is a combination of the noise due to the sweep and that due to the sweeper. The isobars in this case are no longer circular. The amount of noise under the sweeper due to the sweep obviously depends on the length of the tow. The sweeper now occupies only a small part of the 'noise area' instead of being the centre of it. Thus, even if the actuation level of the mine corresponds to the sound level under the ship, it will not necessarily explode under her in the course of the various runs. Instead of having, as in the previous case, 100 per cent risk from a given actuation level, there are now sets of actuation levels with a much smaller percentage risk (Figure 1-2). Therefore, sweeps should, whenever possible, be streamed astern. The length of tow cannot at present be specified in advance. The conditions of sound propagation make this a complex problem, but the length of tow undoubtedly affects the risk. A length of 400 to 500 metres (yards) will usually be satisfactory. From observation of explosions, it may be possible to select the optimum length.

Figure 1-2. Variation of Danger with Mine Actuation for Sweep Towed Astern

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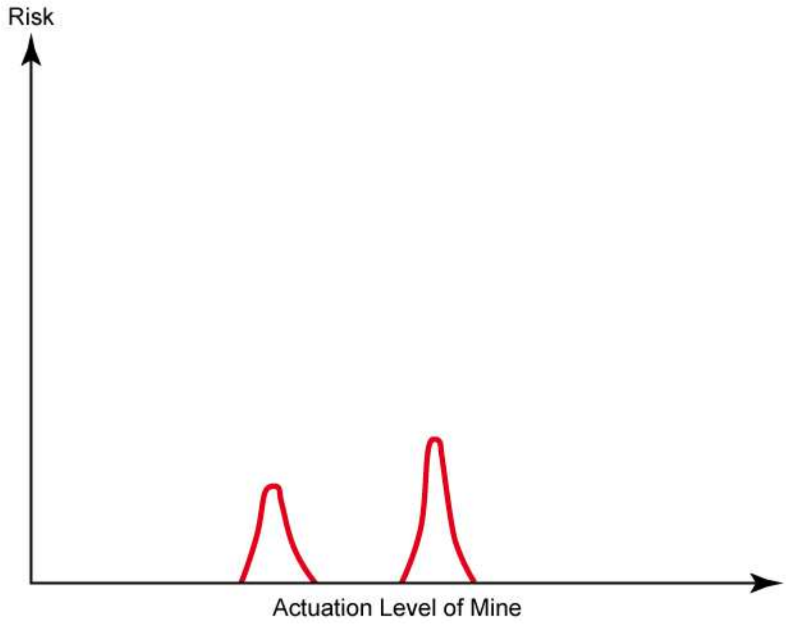


(4) NOT RELEASABLE

d. (NU) Reduction of Risk - Tactical Measures

(1) (NU) Magnetic Sweeping.

(a) (NU) Splitting up the sweeping operation and proceeding first with the sweeping of the sensitive mines (stages 21 to 24) and afterwards for the higher actuation levels (stages 71 to 74). The measures that should be taken are detailed in MTP-6, Volume II as a function of the objective, or of the Risk Directive in force, or are given in national instructions.

(b) (NU) Executing Minesweeping Plans. When the sweepers are not using safe current, it is advisable to carry out all the runs in one track before passing to the next track. This method improves the safety only after all passages on the first track have been carried out (except in the rare cases where the sweepers can use swept waters for the first track and when the assumptions made on the values of the highest ship-counts are correct).

(2) (NU) Acoustic Sweeping

(a) (NU) Application of Sweeping Technique. Only ‘sweeping with safe lateral distance’ (see MTP-6 Volume II, Chapter 10) makes it possible to reduce these risks, which at present are mainly due to the characteristics of the sweepers and the inability to vary the acoustic output of some sweeps. Since, in the majority of cases, the sweepers’ task will be to open up a channel in a mined area, it will seldom be possible to use the ‘sweeping with safe lateral distance’.

(b) (NU) Execution of Stages. Instructions already given are summed up below.

(i) (NU) Any minesweeping operation not preceded by stages carried out by helicopters should start with stage 32.

(ii) (NU) Stages from the 80 series should, whenever possible, be preceded by stages 33 to 37 to be carried out by helicopters or silent sweepers, since the mines most dangerous to the sweeper with sweeps astern are those most likely to be swept in precursor sweeping.

(3) (NU) Combined Sweeping. Firing systems with arming delays, intermittent arming or ship-counts, may cast doubts on the efficiency of the precursor stages. However, these should be carried out as often as possible, and for as long as possible.

(4) (NU) Minesweeping Drones. Unmanned Minesweeping Drones should be used in preference to other means of minesweeping.

2. (NU) Self-Protective Measures - Minehunting.

a. (NU) Special self-protective measures for each type of minehunter or Minehunting Drones are laid down in national instructions. They aim principally at :

(1) (NU) Giving guidance on speeds so that a hunter does not unduly approach a possible mine contact.

(2) (NU) Reducing the noise of the hunter by employing appropriate noise quiet states.

(3) (NU) Probability of interaction between sonars and certain mine sensors (including Homing Mines).

b. (NU) The risk to minehunters also includes the risk to their divers, ROVs or AUVs.

0111 (NU) Lead-through Operations (LTO)

1. (NU) Transitting ships equipped with modern navigation systems are perfectly capable of transitting cleared channels or areas independently given that the channel width is at least 6 x SDNE of the transitor plus the largest Damage Width of the mine threat (W_d).

2. (NU) In cases where navigation systems are affected (eg, jammed), or on request of the transitor suitable units can be tasked to perform lead-through operations providing they are equipped with inertial navigation systems or any other suitable navigation systems.

3. (NU) Although Lead-through is not a MCM operation, generally responsibility is given to the OTC of an MCM force to conduct this special type of operation.

a. (NU) The aim of lead-through is to give navigational support to transiting ships for staying as close as possible to the centreline of a channel or any track ordered in an area.
b. (NU) Instructions for the transit of merchant and naval ships through mined areas are given in MTP-1 Volume I and MTP-6 Volume II, Chapter 8. Commanding Officers of Lead-through Vessels (LTV) must be aware that masters of merchant ships only hold ATP-02.1, which provide the necessary instructions for merchant ships passing through mined areas.

c. (NU) Once the OPCON Authority of the MCMVs has decided to allow ships to transit through a mined area, the OTC of the force ordered to conduct the lead-through must endeavour to make the passage as safe as possible. Exchange of information as laid down in MTP-1 Volume I, is a prerequisite. Further details on Lead-through Messages are contained in APP-11.

d. (NU) For EMCON reasons, the primary method of communications is by light or signal hoist, however, rapid tactical communications by light or flag with merchant vessels is likely to be difficult or impossible. The following secondary methods can be employed:

(1) (NU) UHF Voice.

(2) (NU) VHF Voice.

(3) (NU) Mobile Phone.

(4) (NU) SATCOM

e. (NU) Use can also be made of signal groups from ATP-1, Volume II, when operating with warships, or ATP-02.1, and the International Code of Signals when operating with merchant ships. It should be noted that the International Flag outfit, held by merchant ships contains numerical pennants, not flags.

f. (NU) To reduce the risk of actuating an influence mine, slow speed and minimum feasible separation distance between transitors is essential. The reduction of speed reduces the pressure and the acoustic signature, it will also reduce the rate of change of the magnetic signature. However, the ship being led must never be forced to conduct excessive alterations to maintain station. Therefore the speed and distance ordered will always be a compromise, and must take into account the manoeuvrability of the ship and the experience of its crew.

g. (NU) It is advisable to conduct a Check Operation prior to a Lead-through if the time between completion of MCM and transit of ships is more than 24 hours or there is indication of new mining.

h. (NU) Active mine countermeasures will not normally be carried out during Lead-through operations since evasive manoeuvring in reaction to a MILEC is not practical due to time, speed, manoeuvrability of the VTM and the channel width. The ‘minimum manoeuvring speed’ of the VTM is normally too high for effective sonar operation by the LTV.

i. (NU) In extreme circumstances and where permitted, the aim must be to pass as many ships as possible over the position of a mine during its Intercount Dormant Period (ICDP).

0112 (NU) Protection of MCM Forces

1. (NU) During MCM operations an MCM force may require AAW, ASuW, ASW, AASYW protection as well as protection from land based threats. When operating in mined waters, MCM forces are limited in their ability to manoeuvre in channels and avoiding action cannot be taken whilst engaged in MCM operations. This makes the MCM force vulnerable to enemy attack. Warning should be issued in due time in order to enable the MCM force to take avoiding action. The commander ordering the support will specify the support operation situation (A, B or C). Normally Situation C applies. See MTP-1 Vol I, Chapter 1 Article 1281. The OTCs must ensure that there is a clear understanding between the two forces as to their relative movements, communications, tactical limitations, and so forth.

2. (NU) However, it is unlikely that AAW, ASuW, ASW and AASYW forces will be able to operate in close proximity to the MCM Forces due to the mine threat and the lack of free manoeuvrability . Therefore, emphasis should be placed on self protection capabilities.

ANNEX A - MINE INDEX

1A01 (NU) Introduction

1. (NU) The Mine Index is a code to indicate a certain mine type, for use in task orders and in the MCM reporting system. When the code from the Mine Index is used in other messages or circumstances, the code should be prefixed by 'MINE INDEX'.

2. (NU) The Mine Index is composed of 2 to 4 alpha-numeric's giving an indication of the mine case and the firing system.

Example: 4GIU means
4 - Ground Mine
G - Acoustic (low-frequency) firing system
I - combined with a Magnetic firing system.
U - Multi-look Mine.

1A02 (NU) Mine Index List

a. Mine Case

0 - No information on the mine body
1 - Moored mine
2 - Shallow moored mine
3 - Deep moored mine
4 - Ground mine
5 - Stealth Mine
6 - Self Propelled
7 - Rising
8 - Unexploded Explosive Ordnance (UXOs) or Underwater-IEDs (UW-IEDs)
9 - Obstructors

b. Firing System

A - Contact
B - Antenna
C – Snagline
D - Influence
E - Acoustic
F - Acoustic audio frequency
G - Acoustic low frequency
H - Acoustic high frequency
I - Magnetic
J - Pressure
K - Seismic
L – Extreme Low Frequency Electric (ELFE)
M – Underwater Electric Potential (UEP)
N - Combination (overlap)
O - Sensitive for normal target
P - Very sensitive (anti-sweeper)
Q - Coarse (anti-sweep)

R - Passive
S - Active
T - Sequence
U - Multi-look mines
V - Fitted with ship counter
W - Fitted with delayed arming or rising mechanism
X - No information on firing system
Y - Exercise
Z - Minehunting sonar decoy

ANNEX B - PLOTTING SYMBOLS USED IN NAVAL MINE WARFARE

1B01. NOT RELEASABLE

Table 1B-1 NOT RELEASABLE

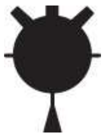
Table 1B-1. NOT RELEASABLE

Table 1B-1 NOT RELEASABLE

1B02. (NU) Plotting Symbols Used in Automated Systems

APP-6 (NATO Joint Military Symbology) (STANAG 2019) provides the details of common operational symbology used in NATO. Table 1B-2 lists the NMW symbology used in.

Table 1B-2. Automated Systems NMW Symbology

Definition	Symbol	Definition	Symbol
Sea Mine		Sea Mine Neutralised	
Sea Mine (Bottom/Ground)		Sea Mine (Bottom/Ground) Neutralised	
Sea Mine (Moored)		Sea Mine (Moored) Neutralised	
Sea Mine (Floating)		Sea Mine (Floating) Neutralised	
Sea Mine (In Other Position)		Sea Mine (In Other Position) Neutralised	
Sea Mine (Rising)		Sea Mine (Rising) Neutralised	
Unexploded Explosive Ordnance		Diver (Military)	
Sea Mine Decoy		Sea Mine Decoy (Bottom Ground)	
Sea Mine Decoy (Moored)			
NATO-UNCLASSIFIED			

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CHAPTER 2 - TASKING AND REPORTING

SECTION I - TASKING

***Note**: (NU) All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0201 (NU) General

The Officer in Tactical Command (OTC) normally issues information and orders (OPTASK NMW/OPDIR, MCM OPORDER). However this can also be delegated. The MCM Commander/Coordinator will issue task orders (OPTASK NMW/TASK) for the units under his tactical command (TACOM). MCM operations as a whole are divided into different tasks. An MCM task is a stage or a combination of stages related to a specific route/channel/area of execution with time factor and MCM means for the execution The OTC is responsible for adequate reporting in accordance with the orders of the Higher Authority - For further details see para 0101.2.

0202 (NU) Distribution of Orders

The MCM OPORDER and/or OPTASK NMW/OPDIR are promulgated to all ships. However, these orders cannot give the ships all the necessary information, and it is the responsibility of the MCM Tasking Authority (MCMTA) to amplify the instructions in the task orders (OPTASK NMW/TASK) as required.

0203 (NU) Instructions for Drafting Task Orders

1. (NU) General. The following instructions are valid for drafting and signalling of task orders in order to keep them short and concise. Though many MCMVs are equipped with on-line communication equipment, one should be aware of the limited number of operators available on board, so different levels of command must apply strict rules to the filtering and passing of signals to ensure that no ship or authority is overloaded. Task orders may be drafted as:

a. (NU) Formatted OPTASK NMW message from APP-11.

b. (NU) A MW tactical signal from ATP-1, Volume II.

2. (NU) Detailed Instructions for Tasking.

a (NU) Action addressees are to be the task unit(s) or the ship detailed to execute the task; information addressees are to be other authorities concerned.

b. (NU) Numbering of tasks.

(1) (NU) A MCM standard task order is numbered by a task order number, which is composed of alpha-numerics and when required a combination of alpha-numerics and symbols:

(a) (NU) 3 or 4 numbers issued from the operation order giving the designator of the area or route. Anchorages and MCM areas should be designated with 4 digits maximum and not with letters to avoid confusion with SLS following in the task order number. In OPTASK NMW/TASK this number will be assigned by the originator. An area can also be described by name.

(b) (NU) Two letter (standard letter suffixes) issued from Table 1-1, giving the type of MCM operation (stage or combination of stages).

(c) (NU) 2 digit numbers giving the sequence number of the task of that type in that area.

Notes:

1. (NU) For an area described by name, the description must be separated from the SLS by a hyphen (see Example 2(b).

2. (NU) If a route number is prefixed by Q-Zone letters it is assumed to be described by name (see Example 2(c) below).

(2) (NU) Examples.

(a) (NU) Task Order Number 1045CH01 means: First task - clearance hunting in area 1045.

(b) (NU) Task Order Number AREA DEAN-EH02 means; the second task exploratory hunting in Area Dean.

(c) (NU) Task Order Number QQR900-CH01 means: the first task clearance hunting on QQR900.

c. (NU) For the execution of a particular task order, the time of commencing the task is the time at which the first ship of the unit enters the track at the beginning of this task. The time of completing this task is the time at which the last ship of the task unit leaves the track at the end of the task. The time to commence the task is given as a date-time group. When the time of commencement of the task is on completion of the preceding one, it is indicated by the number of that task. When the start time of the task is not signalled, it is at the discretion of the tasked units.

d. (NU) Tasked units are authorised to deviate from the ordered MCM task if the existing situation or environmental conditions should so require, but these changes or any change that affect the ordered task must be reported to the OTC.

3. (NU) Classification and Security Information

a. (NU) The classification of the OPTASK NMW and OPREP NMW indicates the degree of protection required for the information contained in these messages. Thus the classification given is normally fixed. However, other considerations need to be taken into account, such as:

(1) (NU) The degree of urgency of the information.

(2) (NU) The method of transmission of the information.

(3) (NU) Whether plain language can be used, groups can be encoded, or whether encryption is necessary.

b. (NU) Although no set rules can be given, as a guide the following types of information should be safeguarded at all times:

(1) (NU) Geographical positions whether these designate important areas, eg route positions, limits of anchorages etc.

(2) (NU) Status of MCM operations at a given time.

(3) (NU) MCM procedures being used.

(4) (NU) Techniques being carried out and their effectiveness.

c. (NU) Tactical information which would be out of date within 24 hours need only be given limited protection.

d. (NU) The following should also be used for guidance in deciding on the transmission of classified information:

(1) (NU) The use of transmission means which permit handling of classified information by plain language should be used whenever possible. This means:

(a) (NU) Hand transmission (courier), helicopter, boat etc.

(b) (NU) Visual transmission (directional light).

(c) (NU) SATCOM

(d) (NU) UHF/VHF radio circuits.

e. (NU) The use of operational brevity codes, tactical codes and disguised positions should be considered, especially on UHF/VHF circuits, not only to reduce the content of report but to give a limited degree of security.

4. (NU) Designating Positions

a. (NU) Latitude and longitude are normally expressed in degrees, minutes and decimals of minutes. Leading zeros are required to fill degrees and minutes in latitude to four and longitude to five digits. Decimal minutes are expressed to three decimal places. Entries are to be separated by a hyphen (-).

Example: 3517.351N-00937.877E.

b. (NU) Universal Transverse Mercator (UTM) Grid.

(1) Full position expressed in UTM-grid co-ordinates is given in:

GRID ZONE DESIGNATOR eg 3.1
100 KILOMETRE SQUARE IDENTIFIER eg ET
EASTING 2-5 DIGITS eg 36630
NORTHING 2-5 DIGITS eg 56861

(2) The grid zone designator, separately or together with the 100 kilometre square identifier, may be omitted in local operations where ambiguity is not likely to occur. (eg ET 3663056861).

c. (NU) Bearing and Distance from a Reference Point. A position expressed in bearing and distance from a reference point is given in True bearing in degrees as three digits, reference point (may be secure) as two letters, Distance in nautical miles (eg 170EE12.5). The distance may be expressed in metres (or yards) provided that the figures are followed by the letter(s) M (or YD).

d. (NU) Position on the Route. The position on the route (or channel centre line) is expressed by an alpha-numeric group (eg 250A is the position of point A of route 250). Parts of the route (or channel centre line) are expressed by the position on the route, followed by the distance along the route (or channel centre line), in nautical miles, going in alphabetical directions. (eg 60A2.5 to 60B2 means the part of Route 60 that is 2.5 nautical miles past position 60A to a point 2 nautical miles past position 60B).

(1) **NOT RELEASABLE**

0204 (NU) Mine Reference Numbers (MRN)

1. (NU) In mine countermeasures to facilitate subsequent reference and to avoid confusion and duplication in reports, every mine swept, hunted, destroyed, washed ashore or otherwise accounted for, should be allocated a Mine Reference Number (MRN). This number should then appear in all references to that mine, eg MCM Reports. The actual allocation of MRNs to individual mines should be carried out by the MCM Unit concerned for mines disposed of during MCM operations, and by the appropriate command for all other mines, ie mines broken adrift, washed ashore etc. The following method, which is taken from track numbering described in MTP-1, will be applied. The Mine Reference Number (MRN) will consist of:

a. (NU) The last two or three letters of the unit's international callsign (see notes 1 and 2).

b. (NU) A two figure number allocated by the MCM Unit.

Notes:

1. (NU) Three letters are used when two units have the same last two letters.

2. (NU) Units having no international call sign (eg. Diving Units) will be assigned a two letter group by their OPCON Authority or may use their operational call sign eg CTU, TU.

c. (NU) When call signs are encrypted and the MRN is transmitted by an unprotected means, it must be encoded. Through the use of this method, an artificial distribution of serial numbers for various TUs, routes, mine types etc is avoided.

d. (NU) Example; MRN ‘PO07'. This MRN designates the seventh mine hunted by ‘CAPRICORNE’ whose call sign is FAPO.

0205 (NU) Contact Reference Numbers (CRN)

1. (NU) A common standard of assigning Contact Reference Numbers (CRNs) is required to facilitate reporting MILCOs and to report the results of subsequent positive identification (reacquisition) of previously located MILCOs. When they have been located during MCM operations, but not positively identified (mine vice non-mine), they are reported by the MCM unit which located them to the MCM OTC. The MCM OTC mat then task a different (or the same) MCM Unit with reacquiring the MILCO and positively identifying it as either a mine or non-mine.

2. (NU) A CRN should be assigned to any contact classified as minelike and not immediately identified as mine or non-mine by the initial prosecuting unit.

3. (NU) A CRN consists of two sets of digits separated by a hyphen and is assigned to each MILCO as follows:

a. (NU) The first set of digits identifies the reporting unit and consists of the last two digits of the reporting units pennant number / squadron number/EOD mobile unit number. In cases where two reporting units have the same last two digits, the MCM OTC will assign a unique leading digit to the CRN reporting number for each unit. The first units CRN should begin with a ‘1' and the second begin with a ‘2'

b. (NU) The second set of digits is a three figured ‘one up’ sequence number assigned by the MCM unit initially reporting the MILCO. All MILCOs subsequently reported by the same MCM unit during the same operation/exercise, regardless of MCM area change (ie. different routes, MDAs) will be assigned a sequential CRN.

(1) (NU) Example: CRN 24-001 means the first MILCO classified by BNS PRIMULA whose pennant number is M924.

0206 (NU) Correlation of CRN's to MRN's

1. (NU) The CRN is assigned by the MCM unit which initially located the MILCO. When this MILCO is re-acquired, the CRN does not change. When a MILCO is located and reported by one MCM unit and then identified as a mine based on reacquisition by a second MCM unit, then the second unit (unit identifying the MILCO as a mine) assigns the MRN.

a. (NU) Example: HM-15 reports an AN/AQS-14/14A sonar contact as CRN 15-027 (27th MILCO reported by HM-15). This MILCO is re-acquired by USS AVENGER (International Callsign NAHC) and positively identified as a mine. AVENGER has previously reported two other MILCOs generated by its SQQ-32 sonar identified by MNV as mines to the MCM OTC as MRNs HC01 and HC02. When AVENGER reports the positive identification of HM-15 CRN 15-027 as a mine, it would be reported as AVENGER MRN HC03.

2. (NU) When a MILCO or mine is prosecuted by an EOD/UUV detachment embarked in an MCMV, then the CRN / MRN is assigned by the host ship. When an EOD/UUV detachment operating from a location other than an MCMV (i.e. from ashore or from a non-MCMV Command Ship), then the CRN / MRN is assigned by the EOD/UUV detachment.

3. (NU) When a MILCO which has been assigned a CRN is subsequently identified as non-mine, then no MRN is assigned and the non-mine is only reported with its initially assigned CRN. When an MCM unit immediately identifies a MILCO as a mine, either by MNC or diver, then no CRN is assigned; only and MRN is assigned. When a MILCO previously assigned a CRN is subsequently identified as a mine, then both the CRN and MRN should be retained and reported in all messages reporting the mine to ease confusion and aid in data base rectification.

4. (NU) The MRN / CRN Naming Convention for a given exercise / operation should be stated in the appropriate documents / messages (OPORD / EXOPORD, OPTASK NMW/OPDIR, OPTASK NMW/TASK, MCM CONOPS etc.).

a. (NU) Example

UNIT	HULL	C/S	CRN	MRN
HM-15	15	-	15-001	XX01
AVENGER	01	NAHC	01-001	HC01
DEVASTATOR	06	NDEV	106-001	EV01
EODMU SIX	06	BBCR	206-001	CR01

0207-0210 Spare.

SECTION II - REPORTING

0211 (NU) General

1. (NU) In addition to NATO Command and Control Information Systems (NATO CCIS), MCM reports are a means that various levels of command have of obtaining up to date information on the state of own MCM Forces and progress of MCM operations. A full list of MCM reports is given in para 0214. MCM Records are detailed in MTP-6 Volume II Chapter 1.

2. (NU) Reports from units are needed by the OTC to complete its reports required by the Operational Control Authority and higher commands to evaluate current operations and tasks and to be able to assess the risk to follow-on traffic. It is very important that complete and up-to-date records of enemy minefields and the progress made in dealing with them is maintained. The effectiveness of the countermeasures taken can thus be determined and the pattern of enemy mining tactics gauged. Proper use of this information will enable available countermeasures forces to be used in the most effective way and the shipping casualties to be reduced to a minimum.

3. (NU) Authorities charged with the responsibility for making a report should remember that because a particular report is available, its use is not necessarily mandatory. Operational Commanders at the various levels should indicate as a matter of policy which reports are definitely required and which may be left to the discretion of those responsible for rendering them. The aim at all command levels should be to provide the maximum relevant information, using the means of communication appropriate to its priority and classification, whilst paying due regard to the need to minimize signal traffic.

4. (NU) In case a detailed analysis of MCM operations is intended, the responsible authority will order the application of manuscript reports from the Maritime Analysis Handbook (MAH) These FORMEXs will satisfy all needs for an analysis, although having been prepared for exercises.

0212 (NU) Types of Reports

1. (NU) Formatted Messages. Similar to NMW tasking, all NMW reports have been put into a message format that is man and machine manageable to simplify and speed up handling and transmission of signalled reports. These so called Message Text Formats (MTFs) are contained in APP-11 and described in MTP-6 Vol I Annex 1A.

2. (NU) MW Signals. One category of MCM reports are tactical MW Signals which are to be found in ATP-1, Volume II Chapter 26. They should only be used in signalling (flashing and flag hoist) and on tactical voice circuits within a MCM Task Group and by Clearance Diving Teams (CDT). The only advantage of these MW signals is that they are short compared with other MCM reports as only relevant letters and/or figures only have to be transmitted and describing text will be omitted making them suitable for fast reporting

3. NOT RELEASABLE

0213 (NU) Guidelines for Completing Reports

1. (NU) Levels of Reporting. The levels of reporting are described in MTP-6 Volume I Annex 1A.

2. (NU) Originator. This may be the CTU when more than one MCM unit is on the same task, or may be a single MCM unit, eg minehunter.

3. (NU) Action Addressee. This must always be the next highest authority. There should be only one action addressee to any report. The action addressee is responsible for passing the information to other addressees when necessary

4. (NU) Information Addressees. OPCON authorities should state the occasions on when information should be copied to other MCM Units or authorities.

5. (NU) Classification and Security of Information. See Tables in para 0214 or in the appropriate OPORDER.

6. (NU) Precedence. The precedence given indicates the time scale within which the recipient requires to be informed after the actual event has taken place. Thus, again, it is for guidance only and may be changed at the discretion of the originator.

7. (NU) Time When Reports are to be Sent. The times given are those to ensure that information reaches the destination in a timely manner. Local conditions, eg physical separation of command levels, may require different times and should be ordered as necessary in the OPORDER/OPLAN or task orders.

8. (NU) Mine Status. Status codes for mines may be used to shorten signals/reports. The codes are listed in Table 2-1 (overleaf) and are also listed in APP-11 for use with OPREP NMW.

Table 2-1. Mine Status

STATUS	DESCRIPTION
LIPLA	Status of any mine left in place eg. for further prosecution.
FLOAT	Status of any mine detected on the surface for undetermined reasons. Where the reason can be determined the appropriate status should be used eg, DRIFT, FREE.
DRIFT	Status of any mine drifting with wind, current and tide.
FREE	Status of a moored mine whose mooring has parted or been cut.
POS SUNK	A damage assessment of a floating mine seem to be sunk in circumstances which lead to the conclusion that it must be sunk although it is not actually verified to be on the bottom.
SUNK	The status of a moored, free or drifting mine sunk by a mine disposal vessel and verified to be on the seabed.
DISP	Status of a mine which was rendered safe, neutralised, recovered, removed or destroyed.
FOULED	Status of a moored mine, which fouled a sweep during mine sweeping.
EXPLD	Status of a mine being fired or detonated by causes known or unknown.
CMINED	Status of a hunted mine, which was countermined.
NEUTR	Status of a hunted mine, which was neutralised.
RSAFE	Status of a hunted mine, which was rendered safe.
RECVD	Status of a mine, which was recovered for the purpose of further investigation for intelligence and/or evaluation purposes.
RMVD	Status of a mine, which was removed out of an area where its detonation would be unacceptable.
NDEALT	Status of a mine not dealt with during MCM operations.
MARK	Status of any mine that has been marked.
NATO-UNCLASSIFIED	

0214 (NU) Summary of MCM Tasks, Reports and Records

1. (NU) Introduction. Tables 2-2 to 2-5 list the MCM tasks, reports and records available in different publications. This summary is also to be found in MTP-6, Volume I, Annex 1A.

2. (NU) OPTASK NMW. The purpose of the OPTASK NMW is to enable the appropriate authority to promulgate detailed tasks, instructions and/or information for all aspects of NMW.

Table 2-2. Types of Operational Tasking

Title	Description
OPTASK NMW / STANDING	A Standing OPTASK NMW is used to disseminate standard operational procedures with respect to the conduct of NMW operations in general.
OPTASK NMW / OPDIR	An OPDIR is the OPTASK NMW message, which orders the general execution of MCM or Mine Laying operations by subordinate tasking authorities.
OPTASK NMW / TASK	A Task Order provides detailed instructions to units or elements on execution of a NMW Task.
OPTASK NMW / MLTASK	A Mine Laying Task Order provides detailed instructions to units or elements on execution of a Mine Laying Task.
OPTASK NMW / SUPP	Supplements a former OPTASK NMW message.
OPTASK NMW / UPDATE	Updates or Amends an OPTASK NMW message.
NATO UNCLASSIFIED	

3. (NU) OPREP NMW. The purpose of the OPREP NMW is to provide an operational report on NMW operations and the areas impacted by present or future NMW Operations. The formats are available in MPP-11.

Table 2-3. Types of Operational Reporting (OPREP)

Title	Description
OPREP NMW / SITREP	A situational report which provides information on the NMW progress (includes consolidated periodical reports (PERREPs)) from the NMW Tasking Authority or higher authorities.
OPREP NMW / PERREP	A periodical report which provides information on the NMW progress from the NMW Unit or element to the NMW Tasking Authority.
OPREP NMW / TASKREP	A report which provides the status of an ongoing NMW task (Start, Stop, Interrupt, resume, complete) by the NMW unit or element to the NMW Tasking Authority.
OPREP NMW / MINEREP	A report which provides information on a mine, explosive ordnance or a underwater IED found by a NMW unit or element.
OPREP NMW / RELIEFREP	A report which hands over the parameters of an uncompleted task to the relieving unit.
OPREP NMW / UPDATE	A report which provides an update or amendment to a former OPREP message.
OPREP NMW / MLREP	A report which provides the status of an executed mine laying task from the unit or element to the NMW Tasking Authority.
NATO-UNCLASSIFIED	

4. (NU) Special NMW Reports. Special NMW Reports are listed in Table 2-4.

Table 2-4. Special NMW Reports

Title	APP-11	MTP-24 Vol 1	Occasion	Sent by	Sent to (info)	Precedence (Classification)
OPSTAT UNIT	x		To provide MCM planners with the most accurate and up to date information on the MCM units' capabilities	MCM Units	OTC	R(CONF)
NOT RELEASABLE						
ROUTE SURVEY REPORTS (RS 1 to RS 7)		x	As required by MTP-24 Vol I Annex 4A	UNIT	OTC (none)	(As Required)
NATO-UNCLASSIFIED						

5. (NU) FORMEXs

Table 2-5. List of FORMEXs

Title	MTP-24 Vol 1	MAH	Occasion	Sent by	Sent to (info)	Precedence (Classification)
COMMANDERS COMMENTS AND RECOMMENDATIONS (FORMEX 100)		x	Provides an opportunity for commanders to express comments and recommendations of personal interest.	OTC / CTG	OPCON	R (As Required)
CHRONOLOGICAL NARRATIVE OF EVENTS (FORMEX 101)		x	When ordered	CO (OTC)	OPCON	R (CONF)
MCMV TRACK CHARTS (FORMEX 109)		x	When detailed information on MCM effort in areas or channels is required	CO	OTC	R (CONF)
DEGRADED PERFORMANCE OF MINEHUNTING SONAR (FORMEX 186)		x	When a degraded performance of a minehunting sonar has occurred	CO	OTC (none)	R (CONF)
MINEHUNTING EMPLOYMENT RECORD (FORMEX 187)		x	When evaluation of Minehunting is required	CO	OTC	R (CONF)
MINESWEEPING EMPLOYMENT RECORD (FORMEX 188)		x	When evaluation of Minesweeping is required	CO	OTC	R (CONF)
MCM Equipment Loss (FORMEX 189)		x	When ordered	CO	OTC	R (CONF)
NATO-UNCLASSIFIED						

CHAPTER 3 - MINE SWEEPING

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0301 Introduction

1. (NU) Definition. Mine Sweeping is the technique of countering mines by MCM Units using mechanical gear, which physically removes or destroys the mine, or using influence gear by producing, in the volume, the influence field necessary to actuate it.

2. (NU) Mine Sweeping Operations to be carried out by MCMVs are listed and described in MTP-6, Volume II, Chapter 3.

3. (NU) This Chapter deals with the conduct of these operations by the various MCMVs in service. Annex A details the tactical procedures for Mechanical Mine Sweeping and Annex B details the same for Influence Mine Sweeping

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ANNEX A TO CHAPTER 3 - MECHANICAL SWEEPING

SECTION I - EXECUTION OF MECHANICAL SWEEPING OPERATIONS

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

3A01 (NU) Speeds and Scopes

1. (NU) Scope of Sweep Wire. The scope of the sweep-wire determines the characteristic sweep path width for standard mechanical sweeps. For standard team sweeps the characteristic sweep width depends on the lateral distance between the kites of the wing sweepers making up the team sweep. For antenna team sweeps, when no kites are used, the sweep width depends only on the lateral distance between the wing sweepers. For other types of team sweeps such as bottom chain or net sweeps the swept path is based upon the type of gear being towed, the sweeper separation and the water depth.

2. (NU) It is self-evident that the greater the scope, the more economical is the use of the sweepers. It is however not always possible to choose great scopes, for geographical and topographical reasons such as lack of sea-room or water depth at the shore end of channels. MWDCs and Mission Support Centres (MSCs) can provide digital environmental data, which may assist in determining mission parameters.

3. (NU) Sweep speeds are given in national supplements and are related to the scope of the sweep wire and the speed through the water which gives negligible sag or lift.

3A02 (NU) Sweep Depth

1. (NU) Sweep Depths. Various depths of sweeping are discussed in MTP-6, Volume II, Chapter 6. They are mainly used for evaluation purposes as, unless otherwise ordered, sweepers use the settings giving the maximum depth compatible with the general situation (depths, segmentation, turning areas, capabilities of the sweeps etc). The choice of the settings and of segmentation is normally the responsibility of the CTU. However, when the OTC specifies a sweeping depth, it must be considered as a depth and the CTU must convert it into settings, taking into account tidal range.

   a. NOT RELEASABLE

2. (NU) Sag and Lift. The sweep towing speed, the scope of sweep wire and the amount of arming determine the amount of sag and lift present in the sweep wire of the standard moored sweeps and deep sweeps. Sag and lift are both undesirable because sag increases the possibility of snagging the gear on the bottom, and lift increases the chance of passing above the mine or being defeated by a cutter type of obstructor. By choosing the speed and scope of sweep wire together for a particular arming state, sag or lift of the sweep wire can be kept to a minimum.

3A03 (NU) Sweep Arming and Rearming

1. (NU) Types of Cutters and their Characteristics. Two basic types of cutters are used, mechanical and explosive. Characteristics of mechanical and explosive cutters, and the maximum number of cutters per side of sweep for the various sweeps and cutter types, are given in national data.

a. (NU) Mechanical (Static) Cutters. These sever the mine mooring between their jaws, using two steel cutting blades. When the sweep wire contacts the mine mooring, it slides along until the mooring enters the cutter. Mechanical cutters can snag the mooring and drag the mine case some distance before cutting the mooring. This type of cutter cannot cut chain moorings.

b. (NU) Explosive Cutters. These employ an explosive charge for cutting the mine mooring and are effective at all speeds. Explosive cutters are of the chisel or shaped charge type and they may be either single or multiple-shot types.

(1) (NU) Chisel Type. The chisel type cutter severs the mine mooring by means of a chisel propelled by an explosive.

(2) (NU) Shaped Charge Type. The shaped charge type severs the mine mooring by means of the effect produced by the firing of an inverted wedge-shaped charge.

c. (NU) Limitations. The size of the cutter limits the size of the mooring that can be cut. An undersized cutter can snag a mooring instead of cutting it. All cutters on the sweep must therefore be capable of cutting the largest size and type of mooring expected in the field.

2. (NU) Sweep Arming.

a. (NU) Sweep arming refers to the type, number and position of cutters attached to the sweep wire.

b. (NU) The type of cutter depends on the type and size of the mine mooring to be severed.

c. (NU) The maximum number of cutters depends on the type of cutter and the type of sweep gear.

d. (NU) The number of cutters required for a particular operation depends on the density of the minefield and the depth of the sweep below the clearance depth. That is, the closer the sweep depth is to the clearance depth, or the denser the minefield, the larger the number of cutters required. Detailed instructions for determining the type and number of cutters required for arming a mechanical sweep against known or assumed mine types are contained in national publications.

3. (NU) Choice of Cutters. Both single and double Oropesa sweeps are usually armed with explosive cutters (except snagline sweeps which are fitted with grips or mechanical cutters). The nature of the minefield, the strength of the currents, the speed over the ground of the sweepers and the ability of the sweeps, are the factors affecting the choice between mechanical and explosive cutters. Mechanical cutters are ineffective at slow speeds. At speeds of less than eight knots explosive cutters should always be used.

4. (NU) For helicopter sweeps, cutter loading is determined by the water and mine case depth, obstructors and mine density.

5. NOT RELEASABLE

(1) (NU) Re-arm more frequently than indicated by sighted swept mines, in order to maintain the desired probability of cutting.

(2) NOT RELEASABLE
(3) NOT RELEASABLE

3A04 (NU) Countering Obstructors

1. (NU) The most effective measures for countering anti-sweep devices are to set the sweep depth as deep as possible, and to use heavy arming so as to cut obstructor moorings before the sweep wire comes into contact with the obstructor case. If sweep gear is destroyed despite these measures, it may indicate that obstructors and anti-sweep devices are located considerably below the mine case. The sweep depth then should be adjusted to pass above the obstructor but below the mine. The higher towing speed and lightweight gear towed by helicopters make them more vulnerable by obstructors.

2. NOT RELEASABLE

3. NOT RELEASABLE

3A05 NOT RELEASABLE

3A06 NOT RELEASABLE

3A07 (NU) Choice of Formation or Disposition

1. (NU) The choice of the formation or disposition depends primarily on the Risk Directive and the following factors:

a. (NU) The risk from moored contact mines will be a function of the choice of formation, for example:

(1) (NU) Independent sweeping.

$$Risk_1 = \frac{\text{Beam width of sweeper}}{\text{Swept path}}$$

(2) (NU) Formation G.

$$Risk_2 = \frac{\text{Beam width of first sweeper}}{\text{Formation swept path}}$$

(3) (NU) Formation I.

$$Risk_3 = \frac{\text{Sum of beam widths of sweepers}}{\text{Formation swept path}}$$

(4) (NU) Thus when using the same number of sweepers with the same gear the following applies:

$$R_2 < R_1 < R_3$$

b. (NU) The type of minesweeping operation is dictated by the orders of the command. The following may be mentioned as the principle types.

(1) (NU) Exploratory sweeping (which aims at determining the presence or absence of mines in a given area or channel).

(2) (NU) Clearance sweeping (which aims at higher percentage clearance, normally by achieving a 'blank run' in a final check sweep (see Note).

Note. *A 'blank run' is a run where no mine/gear interaction takes place.*

2. (NU) When independent methods are used a flexible distance between sweepers can be laid down so as to facilitate turning or to avoid the necessity for sweepers to pass in a channel or to make easier the destruction of mines by the appointed ship.

3A08 (NU) Clearance Sweeping

1. (NU) Mechanical clearance sweeping may be achieved by either independent or formation sweeping.

2. (NU) It should be borne in mind that calculated percentages are reasonably accurate only so far as the assumptions are verified and the cutters work properly.

3. (NU) The use of independent methods allows minesweepers to operate at a greater speed than they would in formation. Independent methods are particularly recommended when only a small number of sweepers are available, when there are acute bends in the channel or when the turning areas are restricted.

4 (NU) Independent method.

a. (NU) Ships navigate independently, maintaining a longitudinal separation as indicated by the OTC. The track to be followed by any sweep is obtained by making allowances for the physical shape of the sweep (in the case of asymmetrical sweeps) and for cross-tide, to ensure that the sweep, rather than the ship, remains on the track.

b. (NU) Track Spacing. Considerations and calculations of the track spacing are given in MTP-6, Volume II. It must be noted that the track spacing depends on Angle E (see Chapter 8).

c. (NU) When sweeping moored contact mines, and the safety of the MCMVs is paramount, independent sweeping is not usually used unless it is certain that the mine cases are at a depth greater than the draughts of the MCMVs. When the risk to the MCMVs is less critical, independent methods may be used.

5. (NU) Formation Method.

a. (NU) When clearance sweeping in formation using mechanical sweeps against moored contact mines, a 'blank run' indicates with a high probability that all mines are swept (this is true only if B equals or approaches 1). It should also be noted that against a moored contact mine, a protected echelon formation does not necessarily ensure safety of the MCMV, as floating mines may still pose a danger.

b. (NU) Choice of Formation with respect to the Risk Directive Matrix (RDM) is detailed in MTP-6 Vol II Annex 1A.

3A09 (NU) Check Sweeping

A check operation is ordered, when necessary, to make sure that all mines have been swept. It is carried out by sweepers or by hunters.

3A10 (NU) Exploratory Sweeping

1. (NU) Mechanical exploratory sweeping may be carried out by either independent or formation sweeping. The choice of method will depend upon the risk to which the MCMV may be subjected as detailed in the RDM in force (see MTP-6 Vol II Chapter 1 Annex A). Stage 61 is normally carried out. However, Stage 62 can be used in particular cases. When using Stage 61, sweeps are armed, preferably as heavily as possible and, in most cases, the depth of the sweep is as deep as possible.

2. NOT RELEASABLE

3. (NU) When safety of the MCMV is of primary consideration, Formation G should be used.

4. (NU) When a degree of risk to the MCMV must be accepted and balanced against the accomplishment of the task;

a. (NU) Ships in formation should use Formation I, which can be rapidly changed into Formation G.

b. (NU) In independent exploratory sweeping Double Oropesa is streamed. Normally one run per track will suffice.

5. (NU) The OTC will end the exploratory operation when the channel/area/route has been covered to the extent ordered, irrespective of whether or not mines have been found.

3A11 NOT RELEASABLE

3A12 (NU) Use of Sonars

1. (NU) Minehunters, drones and UUVs use hull-mounted and various types of variable depth sonar to detect moored mine cases and/or mine anchors. Some minesweepers are equipped with a Mine Avoidance capability for the detection and classification of moored mine cases in the water column used when mechanical gear is streamed. The possibility of detection will depend very much on the prevailing sea state.

2. NOT RELEASABLE

3A13 (NU) Mechanical Sweeping at Night

1. (NU) Mechanical sweeping at night involves particular difficulties and risks for MCMVs, due to the difficulty in locating and destroying mines which come to the surface. However, there are situations such as urgent operations, or operations carried out under threat of enemy air attack, when mechanical sweeping at night is essential. The following should be considered when ordering night sweeping:

a. (NU) Tasking AMCM units to conduct night sweeping operations.

b. (NU) MCM Formation I is generally used. Independent formations may be used, however only when a small number of sweepers is available.

c. (NU) At dawn, MCM vessels or (preferably) helicopters inspect the swept channels and adjacent areas with a view to locating and destroying mines that have surfaced.

d. (NU) Equipment, such as cutter firing indicator lights, infra-red, light intensification etc should be used if available.

3A14 (NU) Preparation of a Mechanical Sweeping Task

Chapter 2 provides the necessary instructions for drafting the ‘Particular Order from CTU’.

3A15 (NU) Reduction of Risk

1. (NU) General. Moored mines dangerous to the sweepers include very shallow contact mines, snagline mines, and mines fitted with grappling devices, as well as mines rising to the surface after they have been swept. However, the minefield may also include ground mines. Although the low magnetic signature of the sweeper, her size and slow speed, normally ensure her safety from magnetic or pressure ground mines, she remains vulnerable to acoustic mines, and very sensitive magnetic mines.

2. NOT RELEASABLE

3. (NU) Mines Entangled in the Sweeps

a. (NU) A mine may become entangled in a sweep, in the kite or in an otter. This may cause any of the following:

(1) (NU) Abnormal traction on a tension meter.

(2) (NU) The sinking of a kite.

(3) (NU) Excessive vibration of a sweep-wire.

(4) (NU) Abnormal diversion.

b. (NU) It is essential to exercise caution when recovering sweeps, and to watch the gear carefully.

c. (NU) It is sometimes possible to clear a sweep by veering it rapidly and then applying the brake sharply. If this is not successful it may be possible:

(1) (NU) To drag the mine towards shallow water (this should be done only if the shallow water is clear of mines).

(2) (NU) To cut the sweep, marking the place where it is cut, for further sweeping.

d. (NU) Whenever possible, it is advisable to wait until the end of a track before trying to clear a sweep. Other sweepers of the formation should be informed as soon as possible when a mine is fouled in a sweep. In the sweeper with the foul sweep, the sweep deck is cleared of all but essential personnel. Everybody on the upper deck should take what cover they can, as a mine fouled in the sweep is likely to explode, particularly when the brake is applied sharply.

3A16 - 3A20 Spare.

SECTION II - MINE DISPOSAL

3A21 (NU) Methods in Use

1. (NU) The various methods of dealing with drifting or floating mine cases are set out in the following publications:

a. (NU) MTP-6, Volume II.

b. NOT RELEASABLE.

3A22 - 3A30 Spare.

SECTION III - SWEEP PATH SETTINGS AND SPREAD OF SWEEPS

3A31 (NU) Oropesa Sweeps

1. (NU) Sweep Paths. The swept paths of sweeps are given in national supplements in relation to Angle E and length of wire streamed. In the case of an unfavourable cross-tide, sweeping with a single Oropesa should not be carried out with an unfavourable Angle E of more than 6º for MSO, 10º for MSCs, and 8º for MSIs. The additional overlap required with greater values of Angle E would make sweeping unprofitable. The cross-tide offsets the sweep path relative to the sweeper's track. National supplements provide information to make allowance for this effect.

2. (NU) Settings and Spread of Sweeps. National supplements give instructions for sweep settings (lengths of kite wire and float wire) in relation to the depth of the sweep and the speed through water.

3A32 (NU) Team Sweeps

1. (NU) Sweep Paths. The sweep path is assumed to be independent of drift and is equal to the distance apart of kites. In a cross-tide, the sweep path will be offset; the value of the offset in relation to the depth settings is given in national supplements.

2. (NU) Settings. National supplements provide information on:

   a. (NU) The lengths of kite wire to be veered in relation to the required depth of the sweep and the speed through the water.

   b. (NU) The average sag of sweeps.

3A33 - 3A40 Spare.

SECTION IV - TEAM SWEEPING

3A41 (NU) General

1. (NU) The distance apart of ships connected together in the same team, and the longitudinal separation of the teams, are given in national supplements to this publication for the different types of sweepers.

2. (NU) The overlap depends on the type of sweeper or sweep and formation. The overlap is also indicated in the national supplements for the different types of sweepers. Guides of teams are responsible for maintaining that overlap.

3. (NU) If mines have been cut during a passage, the sweeps must be sighted at the end of each run to make sure that they are clear before commencing the turn.

4. (NU) When there are more than two ships in a team, it is not advisable to wheel more than 90º at a time.

3A42 NOT RELEASABLE

3A43 (NU) Order to Take Up Team Sweeping Formation

1. (NU) Before taking up a team-sweeping formation, the OTC should normally:

   a. (NU) Order the track-course, if other than the course steered at the time of taking up the formation.

   b. (NU) Assign ships to stations.

   c. (NU) Order the distance apart of subdivisions when applicable.

   d. (NU) Order the depth to which sweeps are to be streamed.

   e. (NU) Order the arming of sweeps if required by the method used.

   f. (NU) Order the amount of sweep-wire to be used if other than normal.

   g. (NU) Order the overlap if applicable.

3A44 (NU) Formation and Manoeuvring in Team Sweeping

1. (NU) Taking up Formation and Manoeuvring of the Sweeps. The normal team comprises of two ships but it is possible to use more ships.

   a. (NU) Taking up Formation. To take up formation, ships form column by subdivisions at 135 metres. The guides for each subdivision form either into a line of bearing (MCM FORM E) or column (MCM FORM F), 1000 metres apart. On hauling down first flag ROMEO, consorts take up station abeam of their guide on the appropriate side.

b. (NU) Passing Sweeps. To pass the sweeps, each ship supplies half of the sweep, the two halves being connected by a shearing link. In a team of three ships, the central ship number 1 is guide for passing the sweep to port and starboard, the two wing ships numbers 2 and 3 being consorts. The guide should choose such a course as will ensure that, when the sweeps have been passed and the ships are stationed at their sweeping distance apart, the navigation guide will be on her track. Standard procedure MCM FORM J - alternative method 2 is recommended. With teams of four, the first three ships manoeuvre in the same way as with teams of three. Ship number 4 takes up her station to port and acts as consort to ship number 2, who will be her special guide. Ship number 1 should choose a course that will ensure that when the sweeps have been passed and the ships have opened out, the navigation guide will be on her track. Ship number 1 orders the navigation guide to take over when the last ship has secured her sweep.

c (NU) Slipping Sweeps. When slipping sweeps, the guide slips the consort's wire and the consort increases speed and hauls out while recovering the sweep. With teams of three, the central ship, which has acted as a guide when passing the sweeps, maintains her course and the two wing sweepers manoeuvre simultaneously. With teams of four, the two wing ships close in on their respective guides and manoeuvre simultaneously following the same procedure as with teams of two. The two central ships then manoeuvre in the same way.

2. (NU) Track-turns. For any alteration of course of more than 30º sweepers reduce speed in order to raise kites, close in to 135 metres, and shorten in sweeps to 183 metres. In all track-turns, the pivot ship should reduce speed to 6 knots and signal her successive headings every 20º. While turning, the other ships proportion their speeds to their stations by maintaining a speed about 1.5 knots more than that of the next ship on the pivot ship's side, and endeavour to maintain an advance of 5º in heading and 5º in relative bearing over the pivot ship. Sweep decks should stand by to slip the sweep-wire without orders if this forms an angle of more than 45º with the fore and aft line of the ship. Paras 0445 to 0447 give general instructions concerning the execution of track-turns; more detailed instructions for each type of sweeper are contained in national supplements.

3. (NU) Method of Opening in Team-sweeping Formation

a. (NU) The ship (or ships) next to the guide steers out 25º from the guide's course and increases speed $1^1/_2$ knots above guide's speed.

b. (NU) All other ships steer out 50º and increase speed $2^1/_2$ knots above guide's speed, reducing to 25º and 1 knot when next inboard ship alters back to guide's course.

c. (NU) All ships must maintain true bearings from the guide while opening.

d. (NU) Wheel for the turn is applied when the red or green flag is seen in the next outboard ship.

4. (NU) Method of Closing in Team-sweeping Formation

a (NU) Ships alter 35º and close on the guide on parallel courses at $1^1/_2$ knots above guide's speed.

b. (NU) Each ship is to wait for the next outboard ship to turn in before she herself does so. Hand flags are to be used.

c. (NU) When ships are sweeping in pairs, the ship closing in may use the maximum converging course and speed allowed by winch speed, bearing in mind the necessity of not allowing more sag in the sweep than the depth of water permits. In water under 50 metres, a converging course not exceeding 25º is advised.

***Note**. **(NU)** Speed should not be allowed to fall below 8 knots when the depth of water is less than 50 metres*.

3A45 (NU) MCM Formation E

1. (NU) Romeo Procedure. Examples of preliminary MCM Formation E (Figure 3A-1) and MCM Formation E (Figure 3A-2) are shown on the next two pages.

a. (NU) Procedures:

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD/PORT DESIG E	Take up preliminary formation to STBD/PORT, guide proceeds at streaming speed.	R(1)
2	R(1)	Consort ship(s) take up station at a suitable distance on side indicated of subdivisional guide to pass sweep. Consort ship(s) pass sweep. Consort ship(s) take up station at 135 metres.	R(2)
3	R(2)	Open out from subdivisional guides to sweeping distance, veering sweeps to sweeping length.	R(3)
4	R(3)	Down kites to depth ordered.	R(4)
5	R(4)	Guide proceeds at sweeping speed.	Speed flag

b. (NU) If there is an odd number of ships, the rear division is to be made up of three ships. This will cause no change in the preliminary formation.

c. (NU) Formation E can be executed with 3 ships in each subdivision if required.

d. (NU) If the Preliminary course deviates from the track course by more than 30°, the guide is to alter course to the Track course before executing phase 3.

e. (NU) Whenever possible the actual course should coincide with the Track course in order to avoid unnecessary and/or confusing manoeuvres.

Figure 3A-1. Example of Preliminary MCM Formation

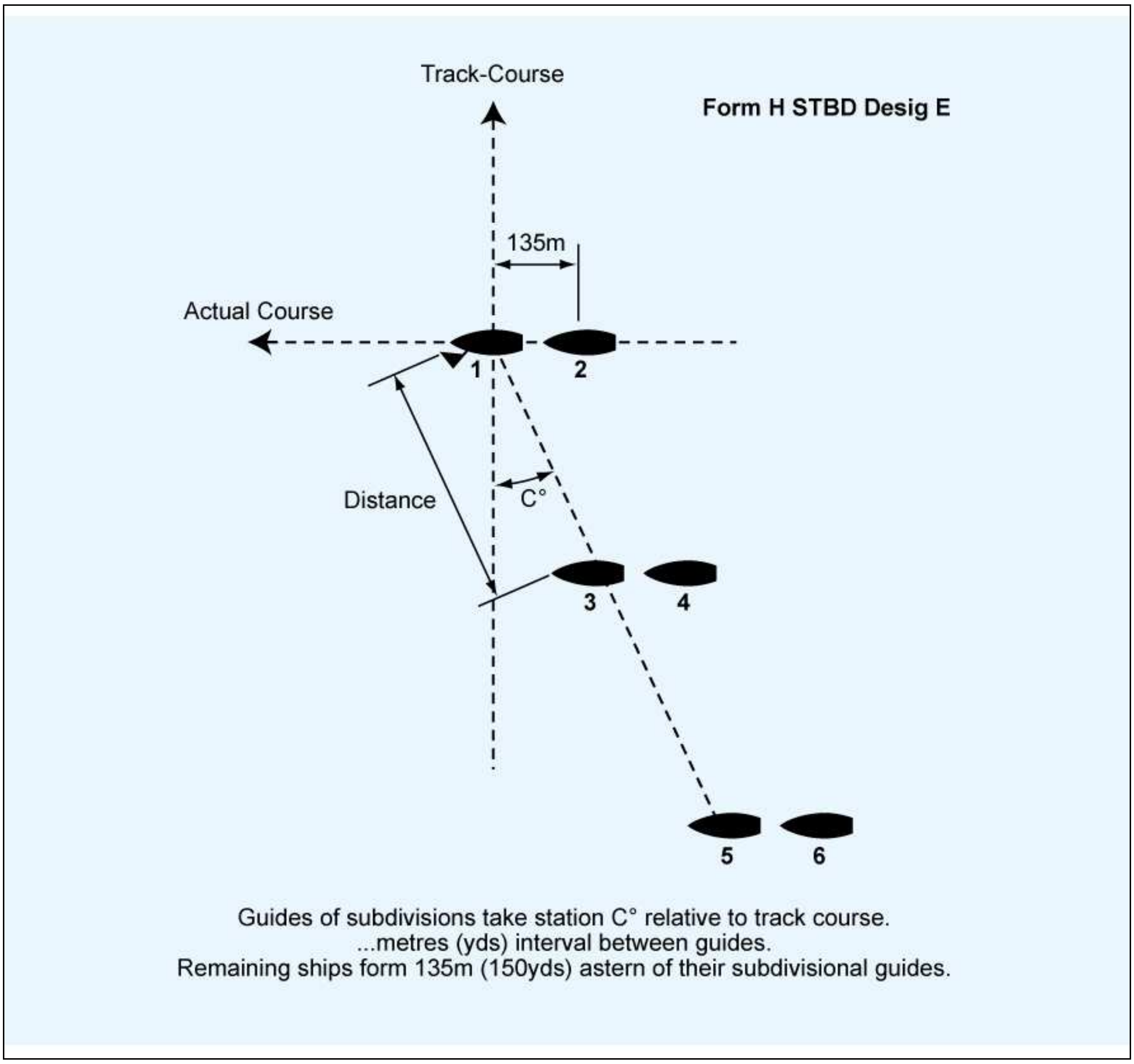

Figure 3A-2. Example of MCM Formation E

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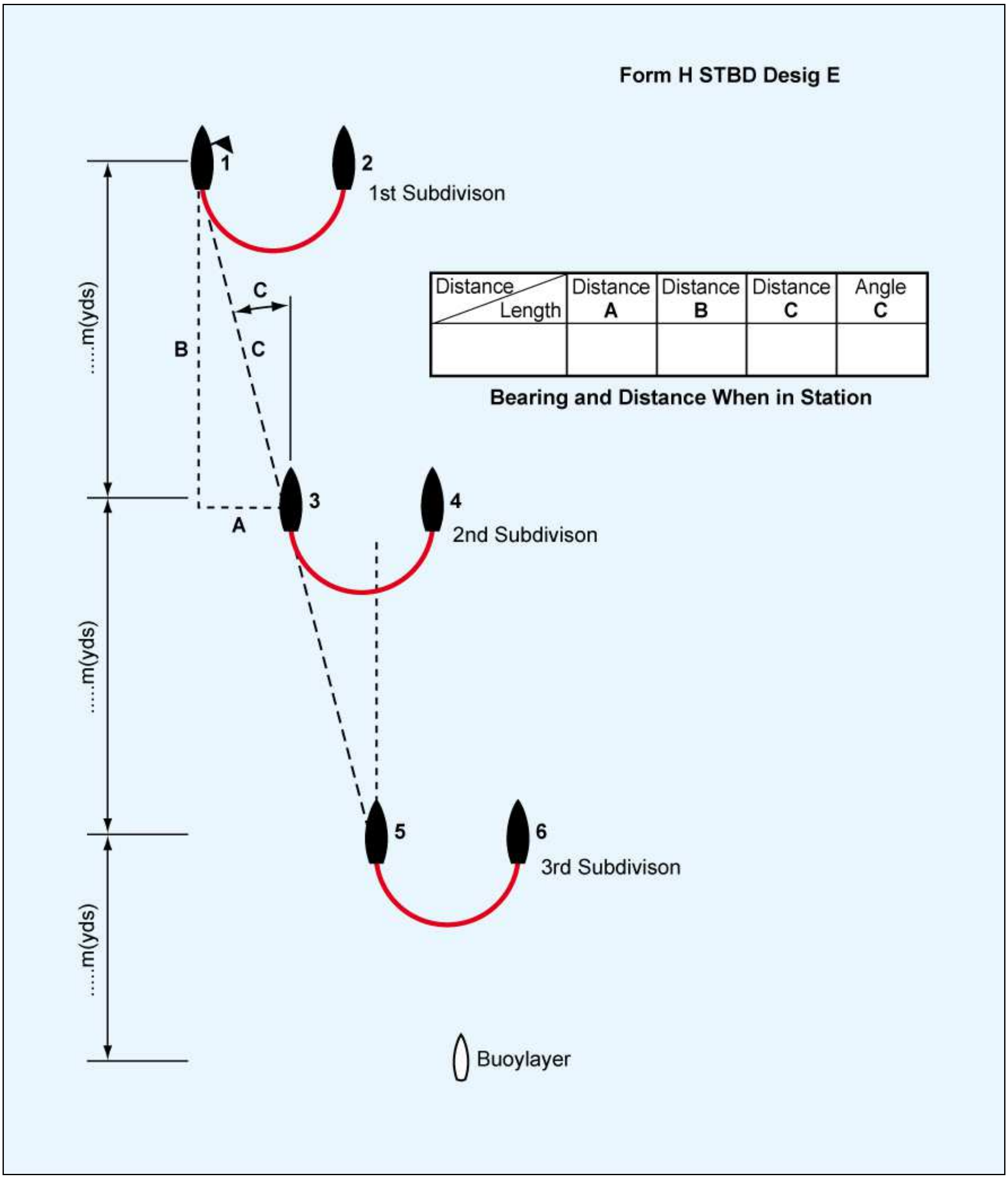

2. (NU) Standard Track-turn Methods. The following track-turns are available when sweeping in MCM Formation E:

a. (NU) Standard Track-turn Method No 1 (STTM 1):

(1) (NU) Purpose. To sweep an adjacent track wheeling towards the former line of bearing.

(2) (NU) Execution. (see also Figure 3A-3).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	CORPEN L STBD/PORT ____ DESIG 1	Reduce speed to recover kites.	R(1)
2	R(1)	Ships close in to 135 metres on their subdivisional guides, sweeps being hove in to turning length and sighted. Subdivisional guides steer in during this manoeuvre so as to get into the wake of leading division. Work own turning signals.	R(2)
3	R(2)	Pivot ship becomes Guide and remains so for next track. Subdivisions separately alter course 120º in the direction indicated.	R(3)
4	R(3)	Guides alter course as necessary, Squadron Guide for the end buoy, subdivisional guides so as to resume formation on the new track-course. Ships open out to sweeping distances veering sweeps to sweeping length.	R(4)
5	R(4)	Down kites to same depth as in previous track unless otherwise ordered.	R(5)
6	R(5)	Guide proceeds at sweeping speed.	-

***Note.* (NU)** *Guides on next track are different from those on former track.*

Figure 3A-3. Example of MCM Formation E - Standard Track-Turn Method No 1

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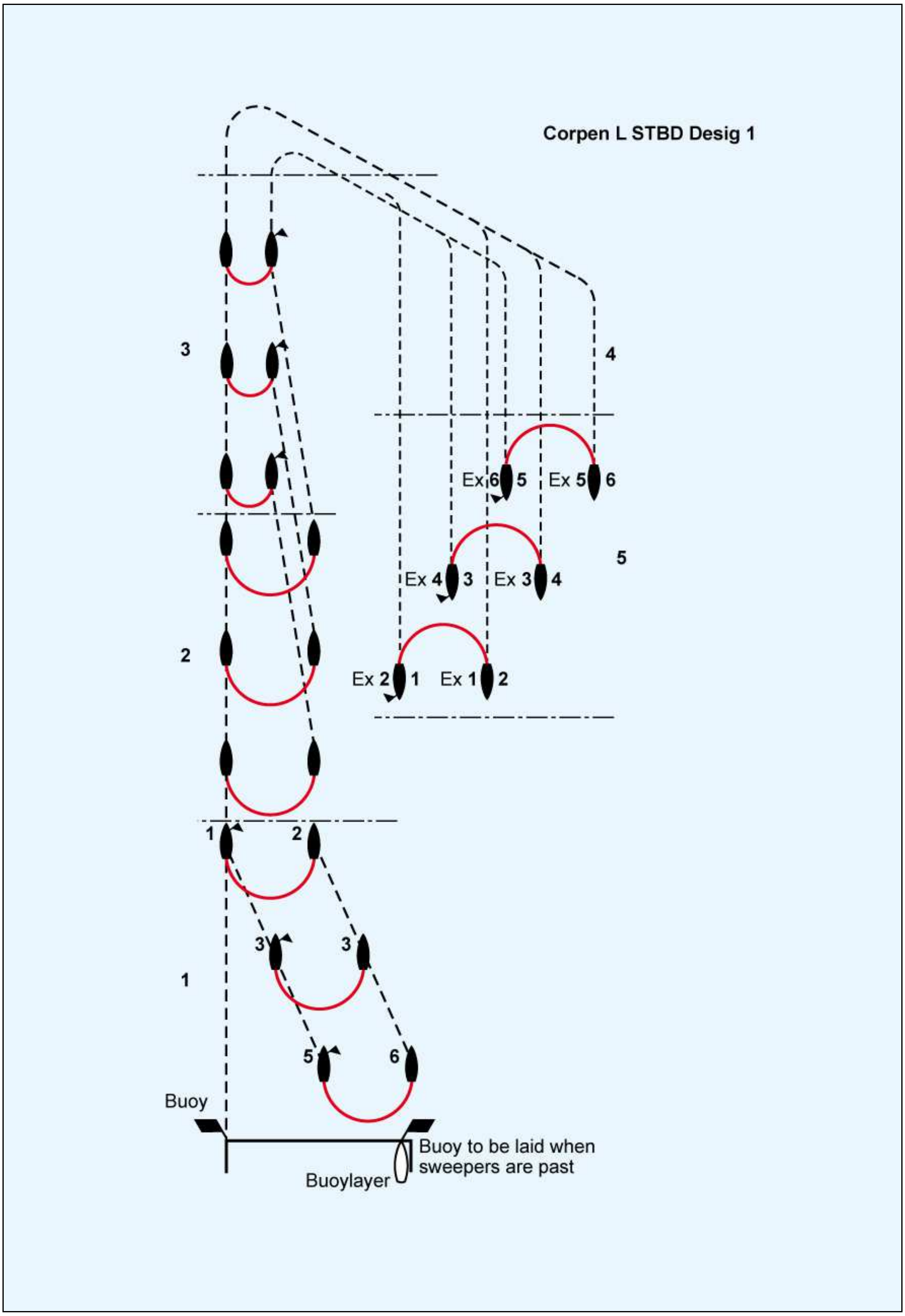


3. (NU) Standard Track-turn Method 2 (STTM 2):

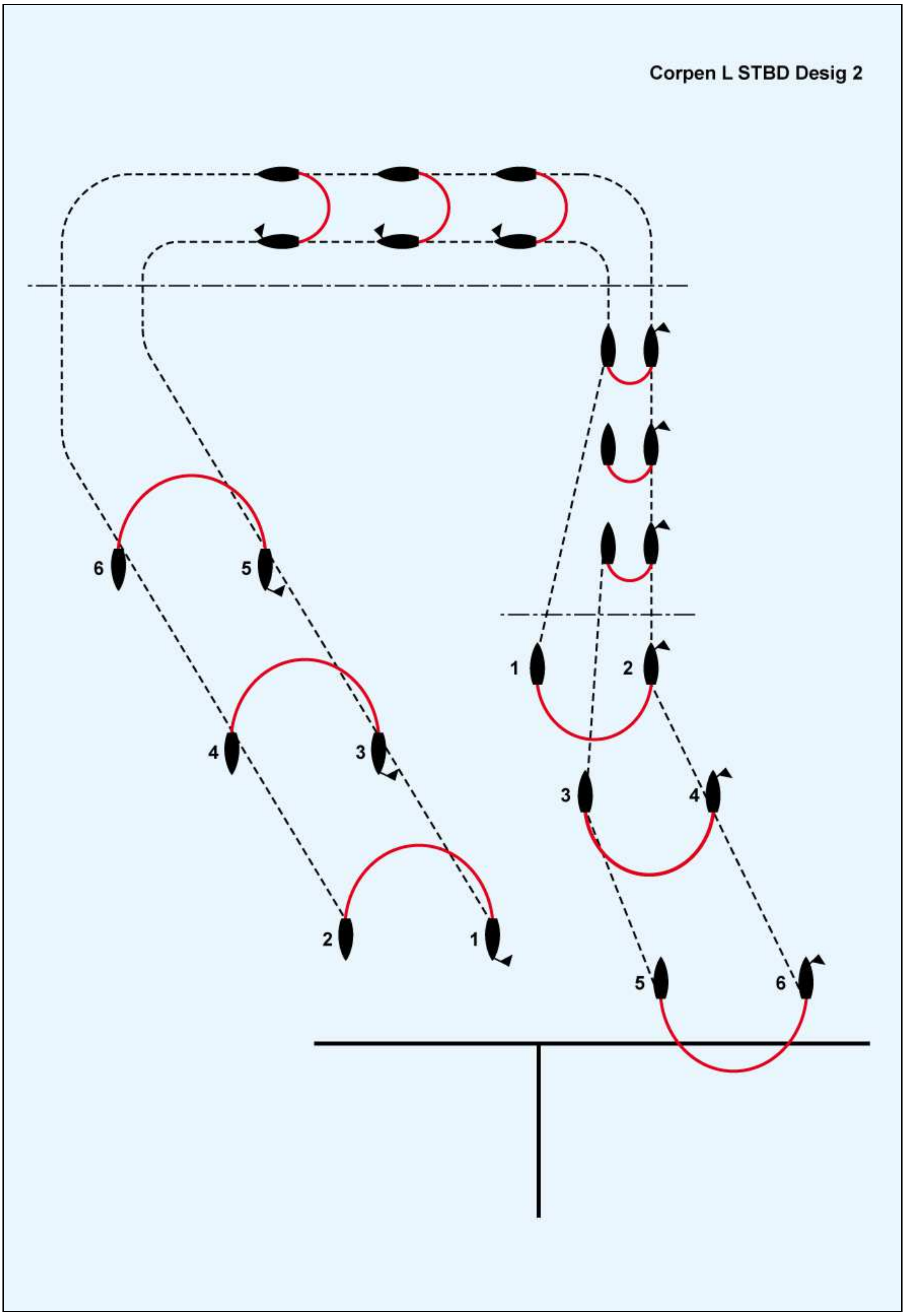
a. (NU) Purpose. To sweep an adjacent track wheeling away from the former line of bearing.

b. (NU) Execution. (see also Figure 3A-4).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	CORPEN L STBD/PORT ____ DESIG 2	Reduce speed to recover kites.	R(1)
2	R(1)	Number 2 becomes guide. Ships on the side towards which the turn is to be made close in to 135 metres. Sweeps are hove in to turning length and sighted. Subdivisional guides steer in during this manoeuvre to get into the wake of the guide.	R(2)
3	R(2)	Pivot ship becomes guide and remains so for next track. Subdivisions separately wheel 90º in the direction indicated.	R(3)
4	R(3)	Subdivisions separately wheel a further 120º wing ships open out from their subdivisional guides by altering only 90º veer sweeps to sweeping lengths. Subdivisional guides alter course 30º back to the new track course as requisite.	R(4)
5	R(4)	Down kites to same depth as in previous track.	R(5)
6	R(5)	Guide proceeds at sweeping speed.	-

Figure 3A-4. Example of MCM Formation E - Standard Track-Turn Method No 2

NATO-UNCLASSIFIED



4. (NU) Slipping Procedure. The following slipping procedure is executed when sweeping in MCM Formation E:

a. (NU) Procedure.

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	MW 120 DESIG E	Proceed at xxx knots. Heave in kites.	R(1)
2	R(1)	Reduce speed to xxx knots. Heave in the sweeps. Consort ship(s) closes to xxx metres. Guide heave in to slip hook.	R(2)
3	R(2)	Guide slips consort's wire. Consort ship(s) increases speed to xxx knots and heaves in sweep.	

b. (NU) Two-Ship Teams. When MW 120 DESIG E is executed, each subdivision manoeuvres independently and slips sweeps in accordance with the procedure above.

c. (NU) Three-Ship Teams. With teams of three, the central ship, acting as guide, maintains course. The two consorts manoeuvre simultaneously following the procedure above.

5. (NU) Breakdown Procedure (MCM Formation E). The damaged team hauls out towards swept waters. Teams astern of it close in on the guide, and try not to leave holidays.

3A46 (NU) MCM Formation F

1. (NU) Romeo Procedure. An example of MCM Formation F is shown in Figure 3A-5.

a. (NU) Procedure.

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD/PORT DESIG F	Take up preliminary formation to STBD/PORT. Guide proceeds at streaming speed.	R(1)
2	R(1)	Consort ship(s) pass sweeps and take up station at 135 metres.	R(2)
3	R(2)	Open out from subdivisional guides to sweeping distance, veering sweeps to sweeping length.	R(3)
4	R(3)	Down kites to depth ordered.	R(4)
5	R(4)	Guide proceeds at sweeping speed.	Speed flag

b. (NU) MCM Formation F can be executed with 3 ships in each subdivision if required.

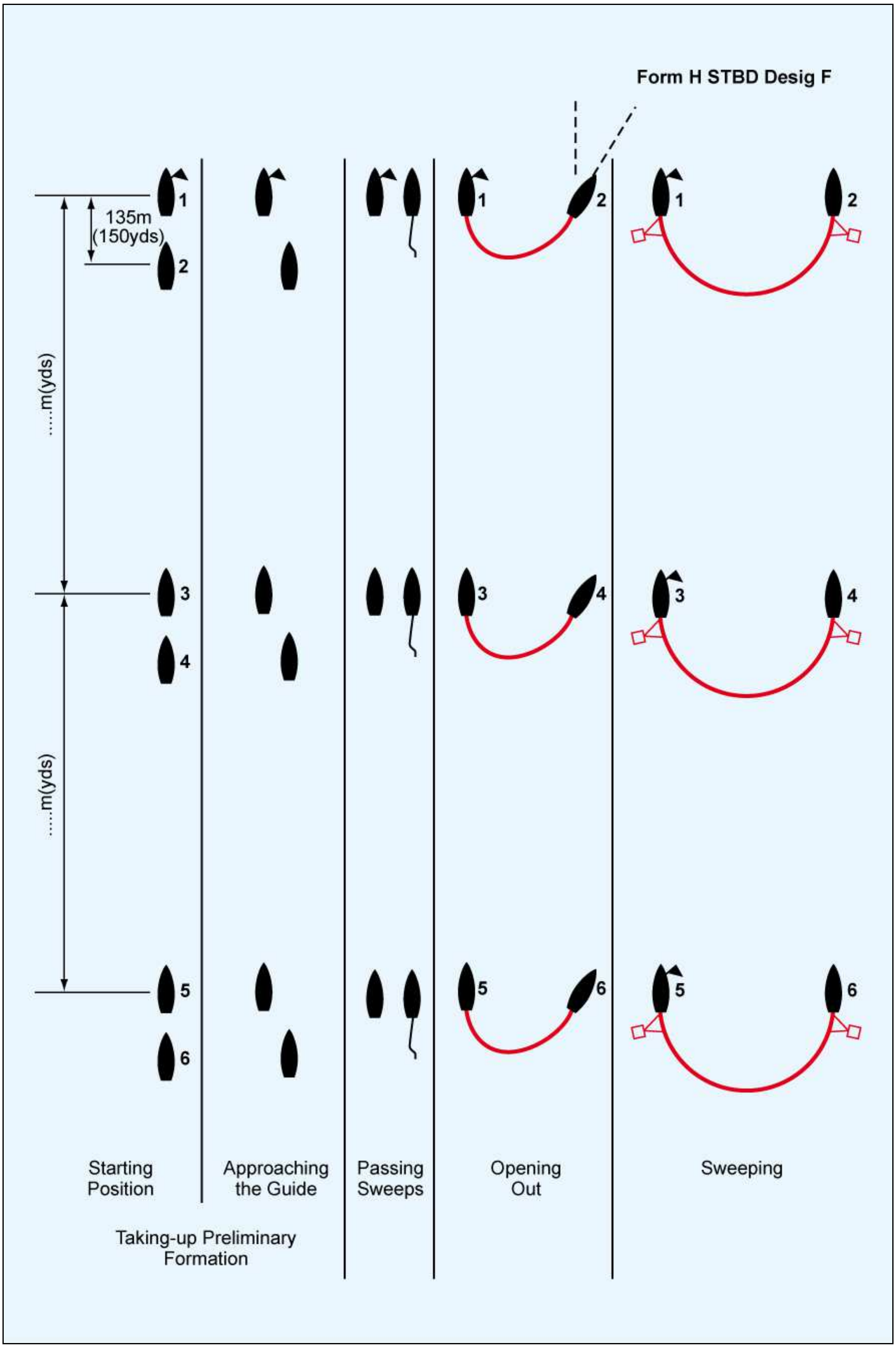
2. (NU) Standard Track-turn Methods. STTMs 1 and 2 are also recommended for MCM Formation F. The manoeuvre of each subdivision in MCM Formation F is the same as that of the leading subdivision in MCM Formation E.

3. (NU) Slipping Procedure. The slipping procedure is identical to that of MCM Formation E.

4. (NU) Breakdown Procedure (MCM Formation F). The damaged team hauls out towards swept waters. If this team is that of the general guide, the guide of the second team becomes general guide. In the case of an ordinary team, the teams astern of it close in on the guide.

Figure 3A-5. Example of MCM Formation F

NATO-UNCLASSIFIED



3A47 (NU) MCM Formation J

1. (NU) Romeo Procedure. Examples of MCM Formation J and some alternatives of this MCM Formation are shown in Figures 3A-6 to 3A-8.

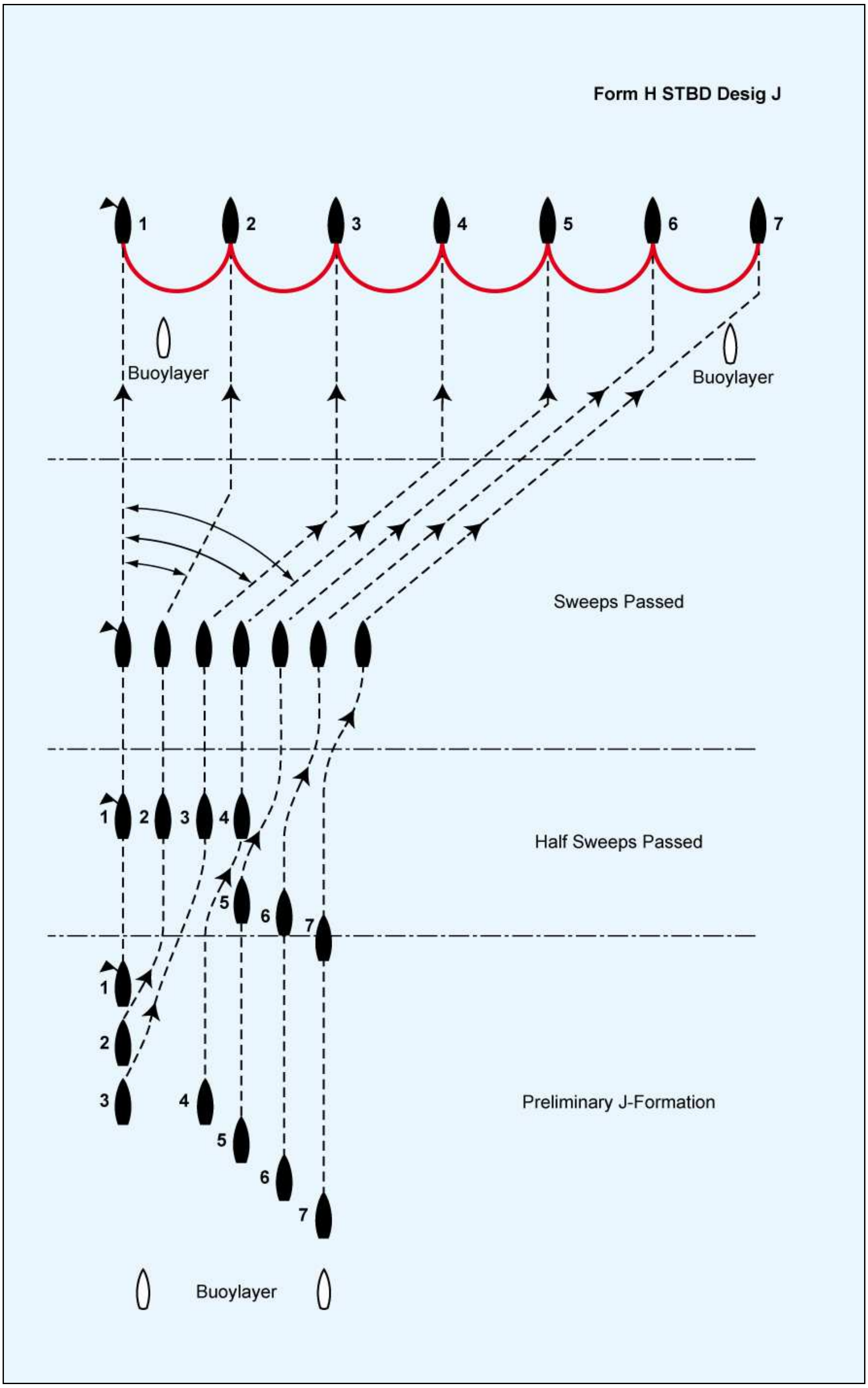
a. (NU) Normal Method (Figure 3A-6).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD/PORT ____ DESIG J	Guide proceeds at streaming speed. Take up preliminary MCM FORM J to starboard (or port). Numbers 2 and 3 close to 135 metres apart on their next ahead. Remainder form quarterline to starboard (or port), 135 metres apart on number 4 who takes station 275 metres on starboard (or port) beam of number 3.	R(1)
2	R(1)	Pass sweeps, take up station at 135 metres to starboard (or port) as indicated.	R(2)
3	R(2)	Open out from guide to sweeping distance, veering sweeps to sweeping length.	R(3)
4	R(3)	Down kites to depth ordered.	R(4)
5	R(4)	Guide proceeds at sweeping speed.	-

Note. **(NU)** *It is customary for the senior officer to be on one wing, and the second senior officer on the other wing in this formation, so that they can run the line of MCM buoys alternately if required.*

Figure 3A-6. Example of MCM Formation J (Normal Method)

NATO-UNCLASSIFIED



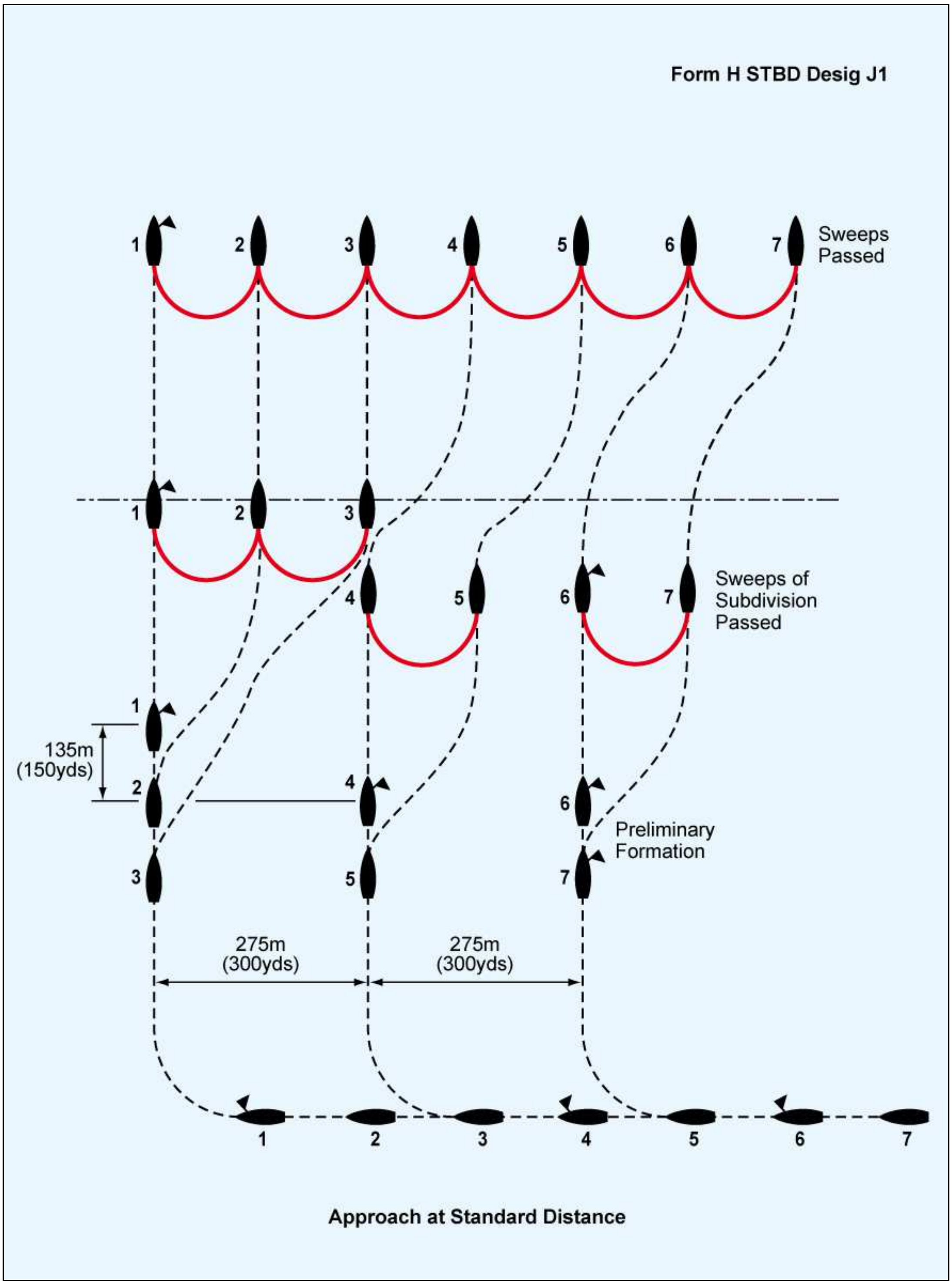
b. (NU) MCM Formation J - Alternative Method No 1 (Figure 3A-7).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD (PORT) DESIG J1	Take up preliminary J Formation to starboard (or port) as in Figure 3A-6. Guide proceeds at streaming speed. Numbers 2 and 3 follow number 1. Numbers 5 follows number 4, who takes station on the beam of number 2. Number 7 follows number 6, who takes station on beam of number 4.	R(1)
2	R(1)	Pass sweeps, take up station at 135 metres to starboard or port as indicated.	R(2)
3	R(2)	Open out from guide to sweeping distances. Veer sweeps to sweeping length.	R(3)
4	R(3)	Down kites to depth ordered.	R(4)
5	R(4)	Guide proceeds at sweeping speed.	-

Note. **(NU)** *It is customary for the senior officer to be on one wing, and the second senior officer on the other wing to this formation, so that they can run the line of MCM buoys if required.*

Figure 3A-7. Example of MCM-Formation J (Alternative Method No 1)

NATO-UNCLASSIFIED



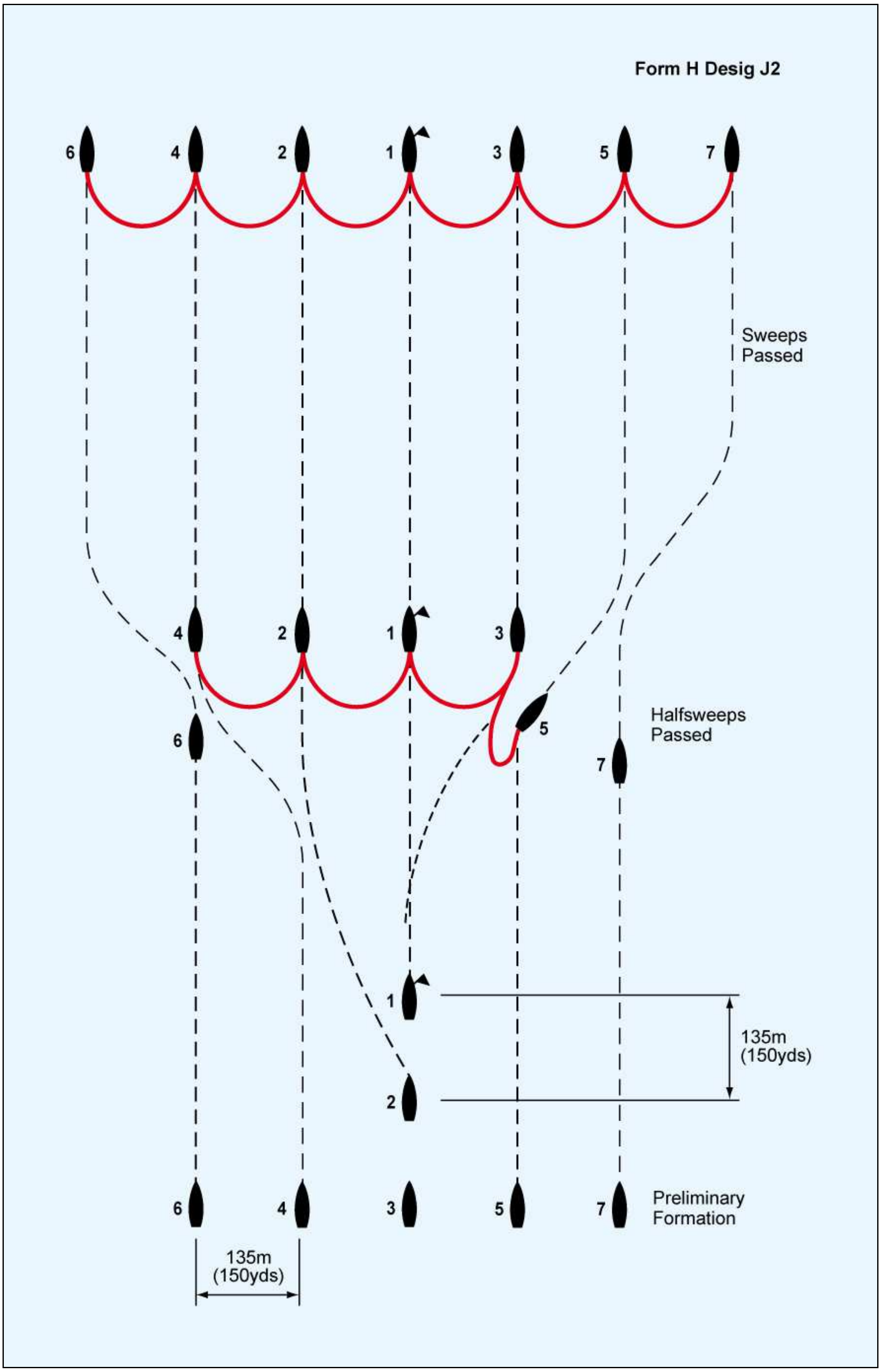
c. (NU) MCM Formation J - Alternative Method No 2 (Figure 3A-8).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H DESIG J2	Take up preliminary MCM FORM J. Guide proceeds at streaming speed. Numbers 2 and 3 follow guide, 135 metres apart; of remaining ships, odd numbers take station on starboard beam of number 3, and even numbers on port beam, 135 metres apart.	R(1)
2	R(1)	Pass sweeps, take up station at 135 metres apart, opening from the centre.	R(2)
4	R(2)	Down kites to depth ordered.	R(3)
5	R(3)	Guide proceeds at sweeping speed.	-

Note. **(NU)** *If this method of joining up is used with UK Team sweeps, opening and closing must be from the centre, as the guide has no control over his wires, being a double-slip ship.*

Figure 3A-8. Example of MCM Formation J (Alternative Method No 2)

NATO-UNCLASSIFIED



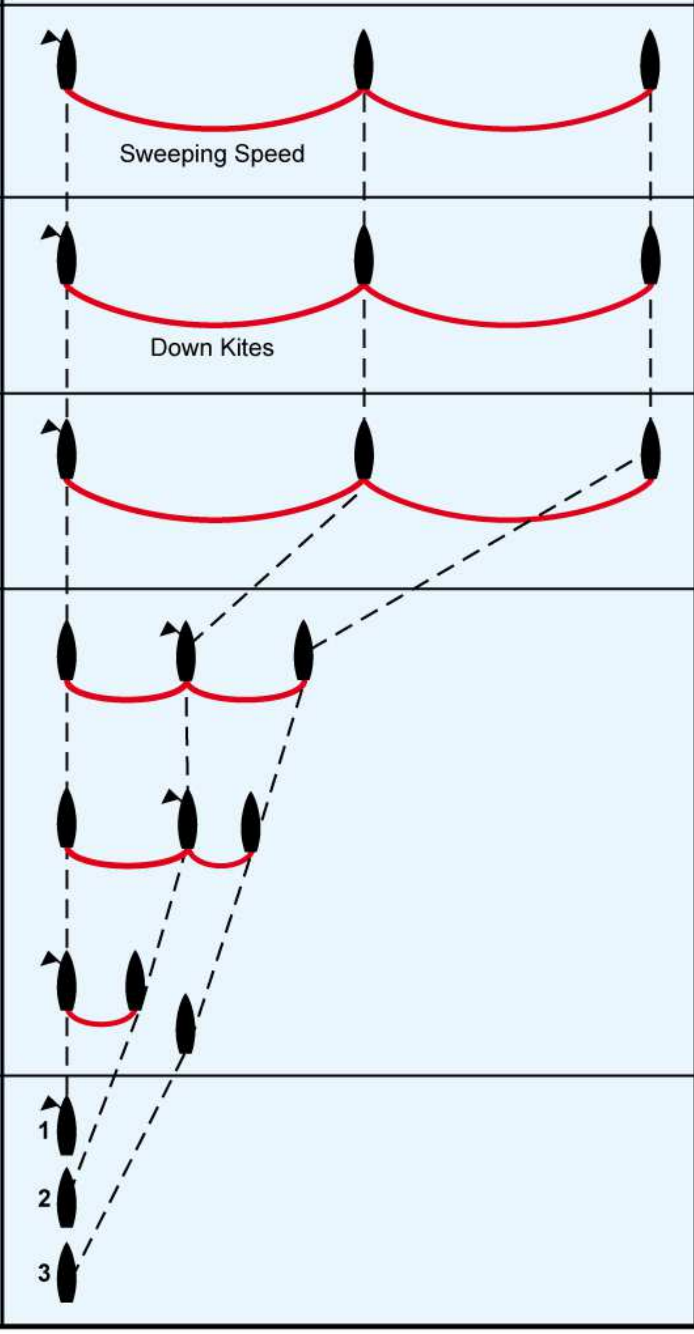
d. (NU) MCM Formation J - Alternative Method No 3 (Figure 3A-9).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H DESIG J3	Guide proceeds at streaming speed. Take up preliminary MCM FORM J to starboard (or port), as in Figure 3A-6.	R(1)
2	R(1)	Close and pass sweep by heaving line in succession. As soon as sweep is on slip, but not before, open to `turning distance'. Remaining ships should close so that they are in position to pass their sweep as soon as the next inboard has opened out.	R(2)
3	R(2)	Open out from guide to sweeping distance, veering sweeps to sweeping length.	R(3)
4	R(3)	Down kites to depth ordered.	R(4)
5	R(4)	Guide proceeds at sweeping speed.	-

Figure 3A-9. Example of MCM Formation J (Alternative Method No 3)

NATO-UNCLASSIFIED

Form H STBD Desig J3



Phase No.	On Completion of Phase: Distance m (yds)	Wire m	Signal
5	365 (400)		
4	365 (400)		R(4)
3	365 (400)	365	R(3)
2	135 (150)	128	R(2)
	135/30 (150/30)	126/27	
	30	27	
1	135 (150)		R(1)

e. (NU) MCM Formation J - Alternative Method No 4 (Figure 3A-10).

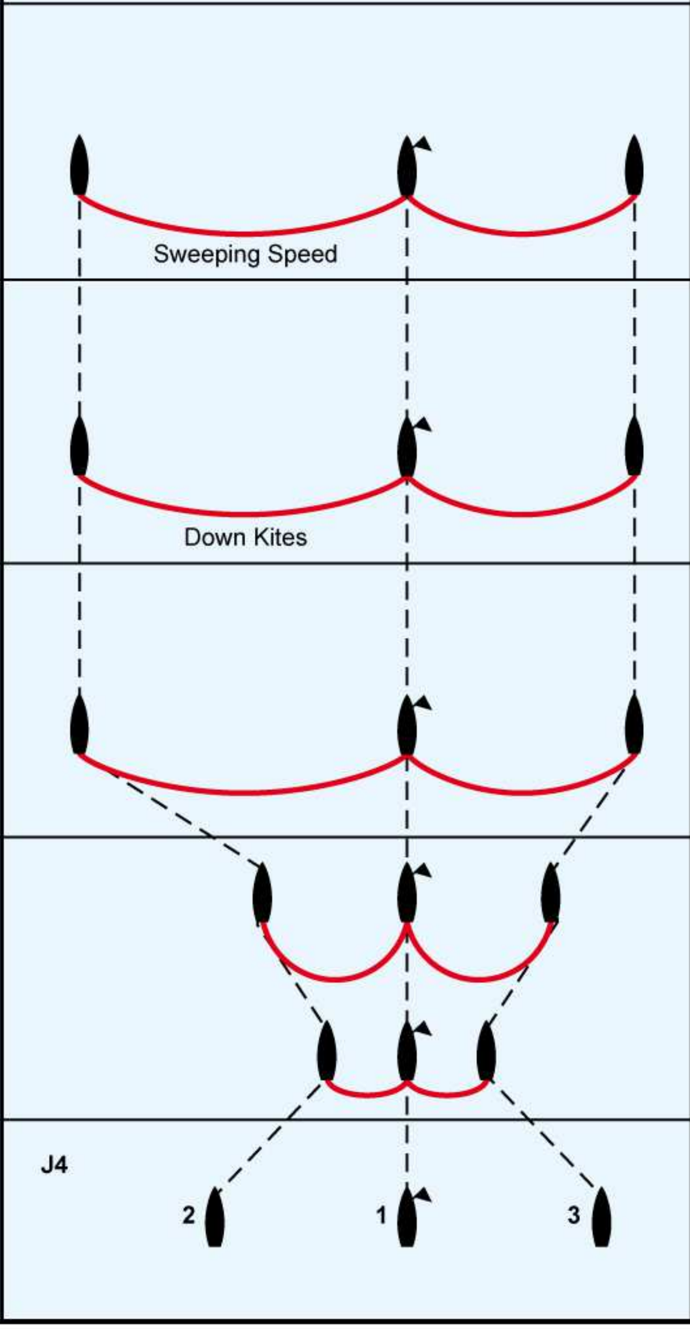
PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H DESIG J4	Guide proceeds at streaming speed. Take up preliminary MCM FORM J as in Figure 3A-10, odd sequence numbers to starboard, even to port.	R(1)
2	R(1)	Both adjacent ships close the guide and pass sweeps by heaving line. As soon as sweep is on slip, but not before, opening to `turning distance'. Remaining ships should close so that they are in position to pass their sweeps in succession as soon as the next inboard has opened out.	R(2)
3	R(2)	Open out from guide to sweeping distance, veering sweeps to sweeping length.	R(3)
4	R(3)	Down kites to depth ordered.	R(4)
5	R(4)	Guide proceeds at sweeping speed.	-

Note. **(NU)** *Guide is double-slip ship.*

Figure 3A-10. Example MCM Formation J (Alternative Method No 4)

NATO-UNCLASSIFIED

Form H Desig J4



Phase No.	On Completion of Phase: Distance m (yds)	Wire m	Signal
5	365 (400)		
4	365 (400)		R(4)
3	365 (400)	365	R(3)
2	135 (150)	128	R(2)
	30 (30)	27	
1	135 (150)		R(1)

2. (NU) Standard Track-turn Methods. The following track-turn methods are available when sweeping in MCM Formation J:

a. (NU) Standard Track-turn Method No 6 (STTM 6).

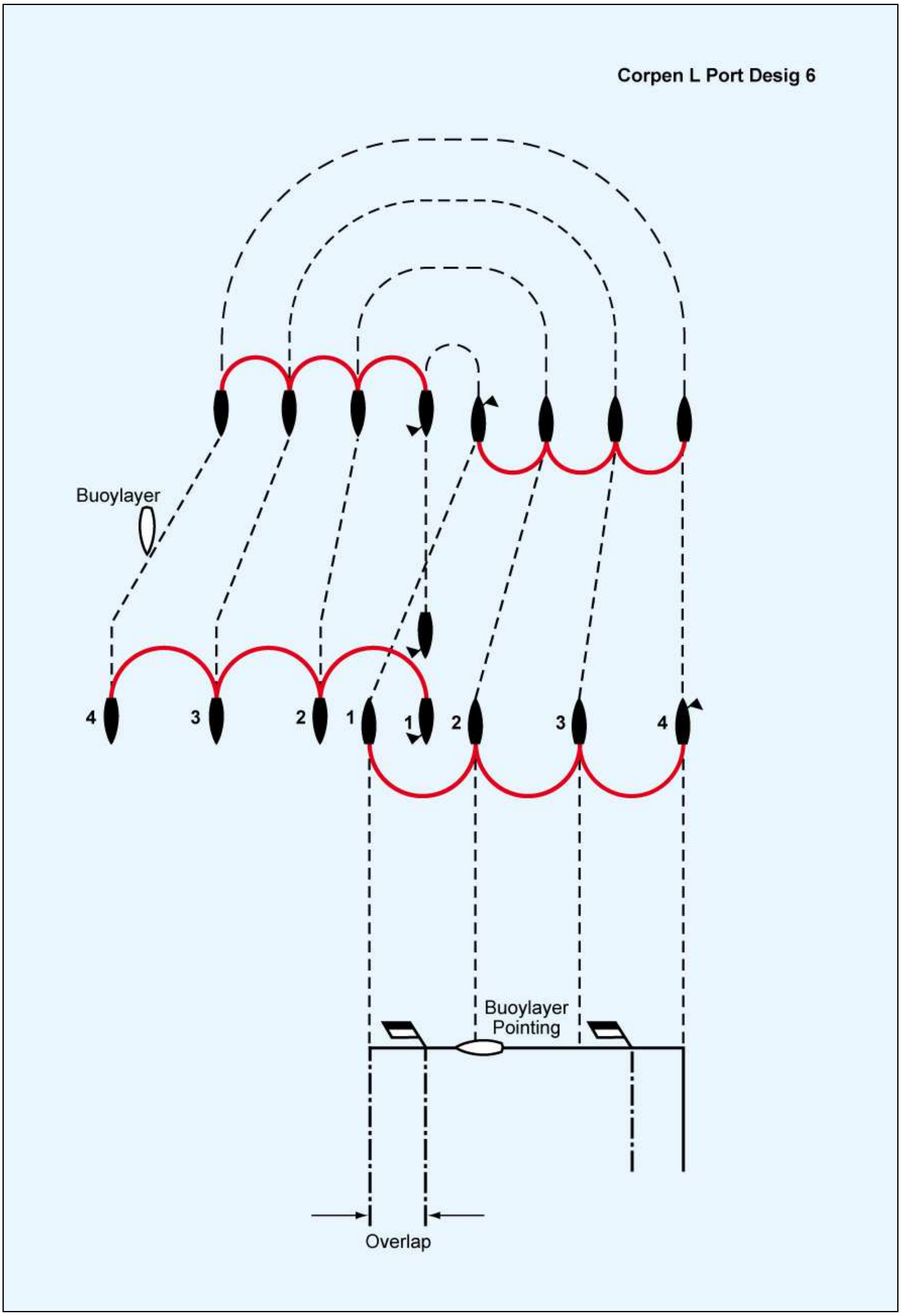
(1) (NU) Purpose. To sweep an adjacent track, closing on wing ship.

(2) (NU) Execution. (see also Figure 3A-11).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	CORPEN L STBD (PORT) ____ DESIG 6	Reduce speed to recover kites.	R(1)
2	R(1)	Wing ship on side away from turn assumes guide. Ships close on guide to 135 metres apart. Sweeps are hove in to turning length and sighted.	R(2)
3	R(2)	Pivot ship assumes guide and remains so for next track. Alter course by wheeling 90º in direction indicated.	R(3)
4	R(3)	Alter course by wheeling a further 90º.	R(4)
5	R(4)	Ships open out from guide to sweeping distances. Veer sweeps to sweeping length.	R(5)
6	R(5)	Down kites to same depth as in previous track unless otherwise ordered.	R(6)
7	R(6)	Guide proceeds at sweeping speed.	-

Figure 3A-11. Example of MCM Formation J - Standard Track-Turn Method No 6

NATO-UNCLASSIFIED



b. (NU) Standard Track-turn Method No 7 (STTM 7).

(1) (NU) Purpose. To sweep an adjacent track, closing on the centre ship.

(2) (NU) Execution. (see also Figure 3A-12).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	CORPEN L STBD (PORT) ____ DESIG 7 G2	Reduce speed to recover kites. Number 2 (or ship indicated) takes guide.	R(1)
2	R(1)	Ships close on guide to 135 metres apart, sweeps are hove in to turning length and sighted.	R(2)
3	R(2)	Pivot ship takes guide and remains so for next track. Alter course by wheeling 90º in direction indicated.	R(3)
4	R(3)	Alter course a further 90º by wheeling. Ships open from the pivot ship to sweeping distances. Veer sweeps to sweeping length.	R(4)
5	R(4)	Down kites as in previous track, unless otherwise ordered.	R(5)
6	R(5)	Guide proceeds at sweeping speed.	-

c. (NU) Slipping Procedure. The following slipping procedure is executed when sweeping in MCM Formation J:

(1) (NU) Procedure.

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	MW 120 DESIG J	The four ships proceed at xxx knots heaving in kites.	R(1)
2	R(1)	The four ships slow down again to xxx knots heaving the sweeps in to xxx metres and close to xxx metres.	R(2)
3	R(2)	Both wing ships close in on respective guides and manoeuvre simultaneously according to standard method for two ships.	R(3) (like R(2) in standard method for two ships)
4	R(3)	Both central ships manoeuvre according to standard method for two ships.	R(4) (like R(2) in standard method)
	R(4)	Slipping.	

(2) (NU) Three-ship Team. With teams of three, the central ship, acting as guide, maintains course. The two consorts manoeuvre simultaneously following the Romeo-procedure above.

(3) (NU) Four-ship Team. Standard Romeo-procedure as described above; stand by to slip the sweeps.

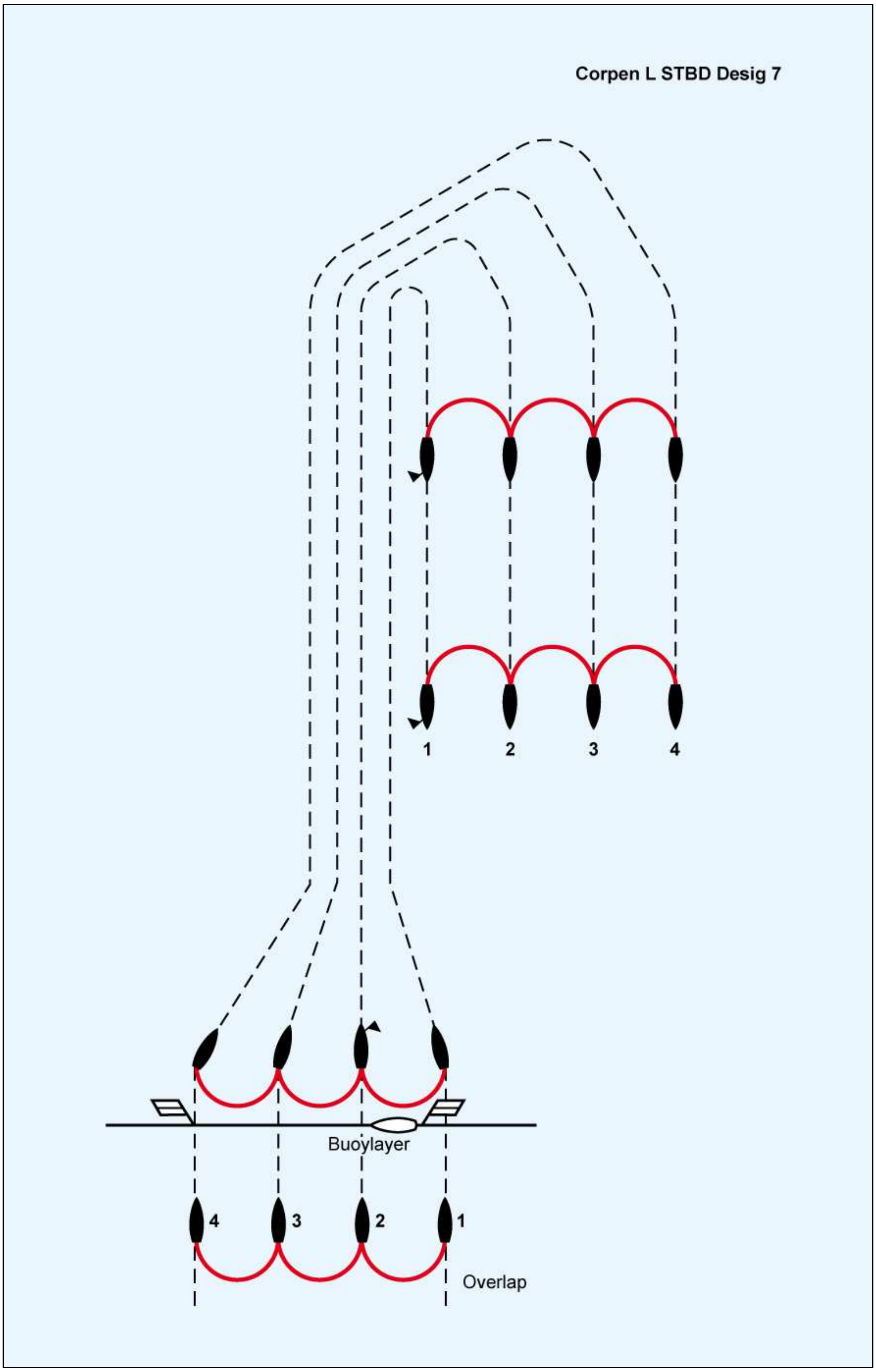
d. (NU) Breakdown Procedure (MCM Formation J).

(1) (NU) MCM Formation J, although attractive at first sight, loses much of its attraction when breakdowns are to be expected. If a sweep suffers damage, the whole formation reduces speed so as to enable the two ships concerned to recover their kites and sweep. The formation is then readjusted.

(2) (NU) In case of a breakdown of a ship, the sweep almost invariably parts, and action should therefore be taken as in (1).

Figure 3A-12. Example of MCM Formation J - Standard Track-Turn Method No 7

NATO-UNCLASSIFIED



3A48 NOT RELEASABLE

3A49-3A50 Spare

SECTION V - OROPESA SWEEPING

3A51 (NU) General

1. (NU) Limitations. The limitations imposed on turns with the sweeps streamed are as follows:

a. (NU) 30º or less. No restrictions.

b. (NU) More than 30º. Inner sweep must be shortened in before commencing the turn. Outer float must be kept outside ship's wake by adjusting the amount of wheel used. Depending on speed, depth of water and depth of sweeps, it may be necessary to raise kites.

2. (NU) Sweep Breakdown.

a. (NU) If two sweepers in the same formation part their sweeps at the same place, the following sweeper(s) haul out towards swept waters or shorten in their sweeps. The CTU minesweepers should then endeavour to determine the causes of the partings and decide what steps to take.

b. (NU) Care must be taken to avoid further losses of gear by fouling the parted sweeps of other ships.

3. (NU) Scope of the Sweep-wire. During streaming and recovery of single or double Oropesa sweeps and during turns the sweeps are veered or recovered to nationally recognized standard positions. The actual length of sweep-wire which corresponds to these positions is given in national publications. These positions are:

a. (NU) Short-Stay. When streaming the sweep, veering is stopped when the sweep wire is at short-stay to verify that the otter is running correctly. When streaming a double Oropesa the first sweep streamed (the uptide one) is kept at the short-stay position until the second sweep is also successfully streamed to short-stay. During recovery both sweeps are normally recovered to the short-stay position before completing the evolution.

b. (NU) Shortened-In. During turns of more than 30º the inner sweep must be recovered to a shortened-in position before commencing the turn. This shortened-in position may also be the short-stay position.

c (NU) Long-Stay. The sweep is said to be at long-stay when it is fully streamed. This is the position and basis on which sweep paths are normally calculated.

3A52 (NU) Ordering an Oropesa Sweeping Formation

1. (NU) Before taking up a formation, the CTU of minesweepers:

a. (NU) Orders the track-course, if other than the course steered at the time of taking up the formation.

b. (NU) Assigns ships to stations.

c. (NU) Orders the distance apart of subdivisions, when applicable.

d. (NU) Orders the depth to which sweeps are to be streamed.

e. (NU) Orders the sweeps to be armed, when applicable.

f. (NU) Orders the amount of sweep-wire to be used if other than normal.

g. (NU) Orders the action to be taken in the event of partings, if other than normal.

3A53 (NU) Formations and Manoeuvres in Oropesa Sweeping

1. (NU) MCM Formations G and I are used and may be taken up on any course. If the course deviates from the track-course by more than 30º, the CTU of minesweepers should take care to keep the sweep shortened in on the side towards which the formation is to alter course. Instructions on preliminary formations and station-keeping are given in national supplements.

a. (NU) MCM Formation G

(1) (NU) The method of station-keeping is overlap and longitudinal separation (method 6). National supplements give the relevant instructions as well as instructions on preliminary formations.

(2) (NU) Cross-tides.

(a) (NU) Cross-tides have an effect on the distance and angle from track course of the next-ahead's float (see national supplements).

(b) (NU) Cross-tides make it necessary to offset the tracks to be followed.

b. (NU) MCM Formation I

(1) (NU) There are two station-keeping methods:

(a) (NU) Overlap and angle from track-course (method 5); if the guide is downtide or uptide and Angle E is less than 6º.

(b) (NU) Overlap and longitudinal separation (method 6); if the guide is uptide and Angle E is more than 6º. National supplements give the relevant station-keeping information as well as information on preliminary formations.

(2) (NU) Cross-tides

(a) (NU) Cross-tides have an effect on the distance and angle from track-course of the next-ahead's float (tables in national supplements for three different speeds and three different lengths of wire).

(b) (NU) Cross-tides offset the centre of the swept-path (see national supplements).

(3) (NU) It will be noticed that the tables do not allow for more than a certain Angle E, for the reasons given in para 3A31, and that in the case of method 6, the angle from track-course is reckoned as positive when the ship is downtide of the next ahead's float and negative in the opposite case. This angle from track-course is reckoned from -90º to +90º. Bearing of float is equal to track-course minus angle C when in STARBOARD formation, plus angle C when in PORT formation.

c. (NU) Track-turns. Paras 3A54 to 3A56 give general instructions concerning the execution of track-turns. These instructions are given in detail for each type of sweeper in national supplements.

3A54 (NU) MCM Formation G

1. (NU) Romeo Procedure. Example of preliminary MCM Formation G is shown in Figure 3A-13. For an example of MCM Formation G see Figure 3A-14.

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD (PORT) DESIG G	Take up preliminary formation.	R(1)
2	R(1)	Guide proceeds at xxx knots. Sweeps are veered to short-stay.	R(2)
3	R(2)	Guide increases speed to xxx knots. Sweeps are veered to long-stay.	R(3)
4	R(3)	Ships take up station relative to float of next ship ahead.	R(4)
5	R(4)	Kites streamed.	R(5)
6	R(5)	Guide takes up sweeping speed when guide is at sweeping course.	-

Figure 3A-13. Example of Preliminary MCM Formation G

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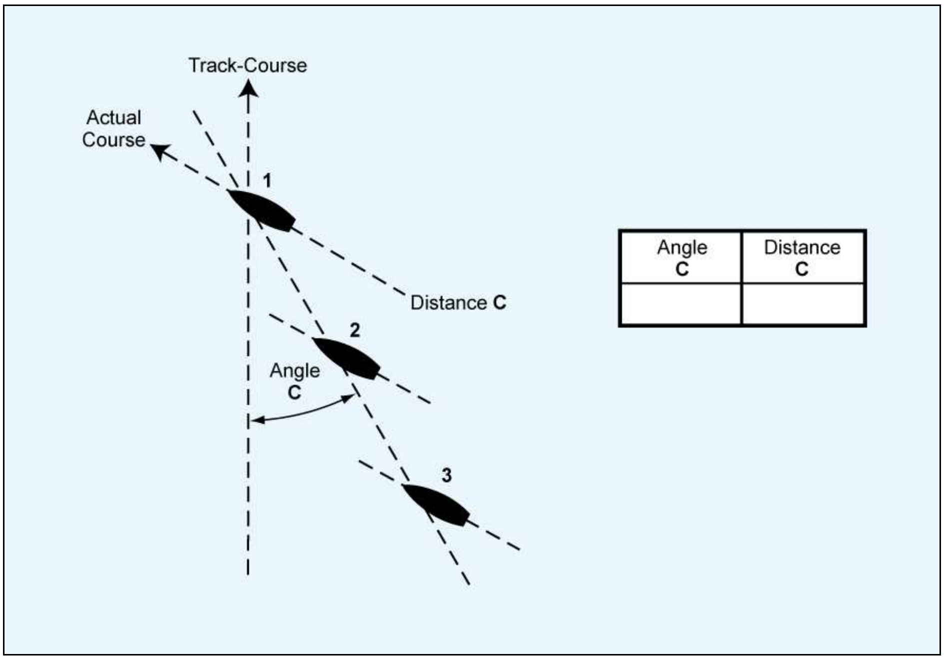

Figure 3A-14. Example of MCM Formation G

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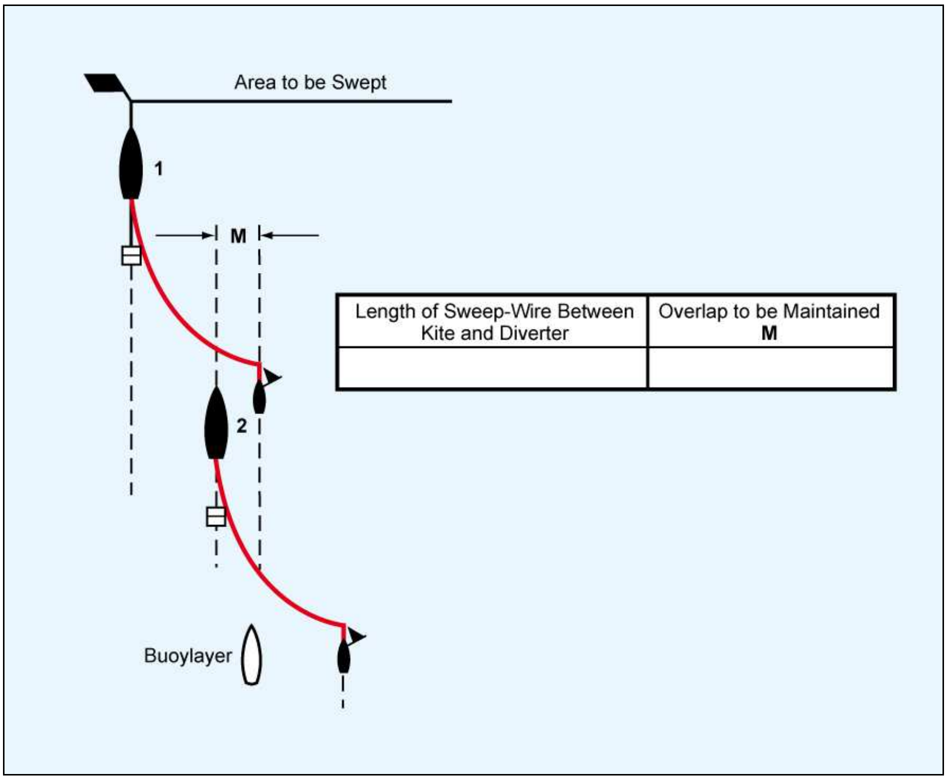

2. (NU) Standard Track-turn Methods. Quite a number of track-turn methods are made available for use in MCM-Formation G. For easier selection they are collated in Table 3A-1.

Table 3A-1. Standard Track-turn Methods for MCM Formation G

Standard Track-turn Method Number	Purpose
20	To sweep an adjacent track on an adjacent buoyline, changing side of the sweep. Same guide.
21	To sweep an adjacent track, changing the side of the sweep. New guide.
22	To sweep an adjacent track on the same buoyline, turning away from the sweep. Same guide.
23	To sweep a non-adjacent track turning away from the sweep. Same guide.
24	To sweep an adjacent track on the same buoyline, turning away from the sweep. New guide.
25	To sweep a non-adjacent or adjacent track, turning towards the sweep. Same guide.
39 (see Note)	To sweep any track in the opposite direction in either MCM Formation G or I. Same guide.
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Note: *(NU) STM 39 to be found in paragraph 3A56.*

a. (NU) Standard Track-turn Method No 20 (STTM 20)

(1) (NU) Purpose. To sweep an adjacent track on an adjacent buoyline, changing the side of the sweep. Same guide.

(2) (NU) Execution. (see Figure 3A-15).

(a) (NU) PHASE 1: When CORPEN L STBD (PORT) _____ DESIG 20 is executed, as his float comes clear of the track the guide alters course 20º towards the sweep and increases to stationing speed. When ahead of the next astern the guide turns back to the sweeping course. All odd-numbered ships conform in succession when float is clear of the track. When float is clear of the track, Number 2 alters course 25º away from the sweep and increases to stationing speed. When clear of the next ahead, Number 2 turns back to the sweeping course. All even-numbered ships conform in succession when float is clear of the track.

(b) (NU) PHASE 2: On altering back to the sweeping course, the guide reduces speed, gets up kite and recovers the sweep. Remaining ships conform in succession.

(c) (NU) PHASE 3: When the guide has recovered sweep, and at about 1 mile clear of the track, he increases speed and alters course 180º, adjusting wheel as necessary for the next track. Remaining ships conform in succession (see Note 2).

(d) (NU) PHASE 4: When steady on the next track-course, the guide reduces speed and veers the opposite sweep, hoisting Flag R (1) when kite is down. Remaining ships conform in succession and work Flag R (1).

(e) (NU) PHASE 5: Speed is increased to sweeping speed on hauling down Flag R (1), when all ships are in station with kites down (see Note 3).

Notes.

1. (NU) Ships should use signal MW 37-1 when approaching end of track.

2. (NU) This manoeuvre entails ships working in pairs, ie one and two, three and four, etc. The effect of odd-numbered ships altering towards the sweep and even-numbered ships away from the sweep is to put even-numbered ships on the opposite quarter of their next ahead for the next track. If the total of ships is an odd number, the rear ship must manoeuvre so as to clear the guide approaching for the next track.

3. (NU) When ships are coming round to the next track, it is important that they should adjust course and speed so as to get to a position inside station before streaming the opposite sweep. This will enable the guide to increase to sweeping speed before all ships have hoisted Flag R (1).

Figure 3A-15. Example of MCM Formation G - Standard Track-Turn Method No 20

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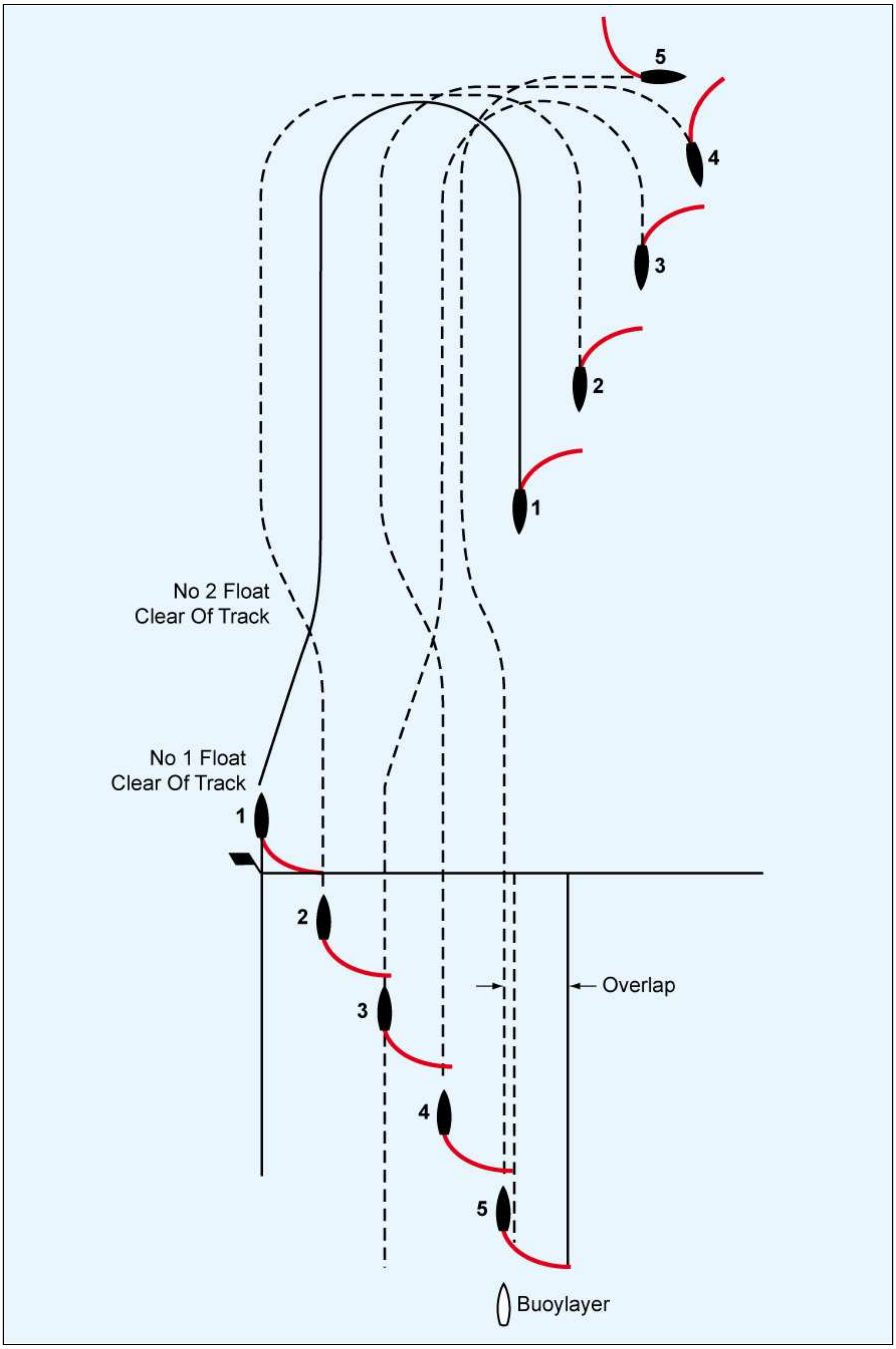

b. (NU) Standard Track-turn Method No 21 (STTM 21)

(1) (NU) Purpose. To sweep an adjacent track changing the side of the sweep. New guide.

(2) (NU) Execution. (see Figure 3A-16):

(a) (NU) PHASE 1: When CORPEN L STBD (PORT) _____ DESIG 21 is executed, as his float comes clear of the track the guide alters course 20º away from the sweep and maintains sweeping speed on that heading for a time in minutes equal to the number of ships in the formation. The guide then turns back to the sweeping course, reduces to 4 knots, heaves in to short stay on the previously-engaged side, and veers the other sweep. Remaining ships, when their float is clear of the track, turn 20º away from the sweep and maintain sweeping speed on that heading for a time one minutes less than the ship ahead. They then reduce speed to 4 knots, heave in to short stay the sweep on the previously-engaged side, and veer the other sweep. When astern of the guide, they alter back to the sweeping course.

(b) (NU) PHASE 2: As soon as the ships have their gear at short stay on the previously-engaged side, or as soon as they are back on the sweeping course astern of the guide, whichever is later, they work Flag R (1).

(c) (NU) PHASE 3: When the guide executes Flag R (1), ships turn together away from the gear which is (being) streamed and increase to streaming speed. The rear ship on the old course becomes guide.

(d) (NU) PHASE 4: The new guide manoeuvres to enter his next track and other ships proceed to their new stations. Ships complete streaming their gear and work Flag R (2) when kite is down.

(e) (NU) PHASE 5: When the new guide executes Flag R (2), ship increases to sweeping speed.

Notes.

1. (NU) This method is an alternative to STTM 20.

2. (NU) On the first track, ships will only have the engaged sweep streamed. They should therefore heave in this sweep at the end of this track to short stay and stream fully the sweep on the new engaged side.

3. (NU) If running buoylines, the new guide must recover his disengaged sweep.

Figure 3A-16. Example of MCM Formation G - Standard Track-Turn Method No 21

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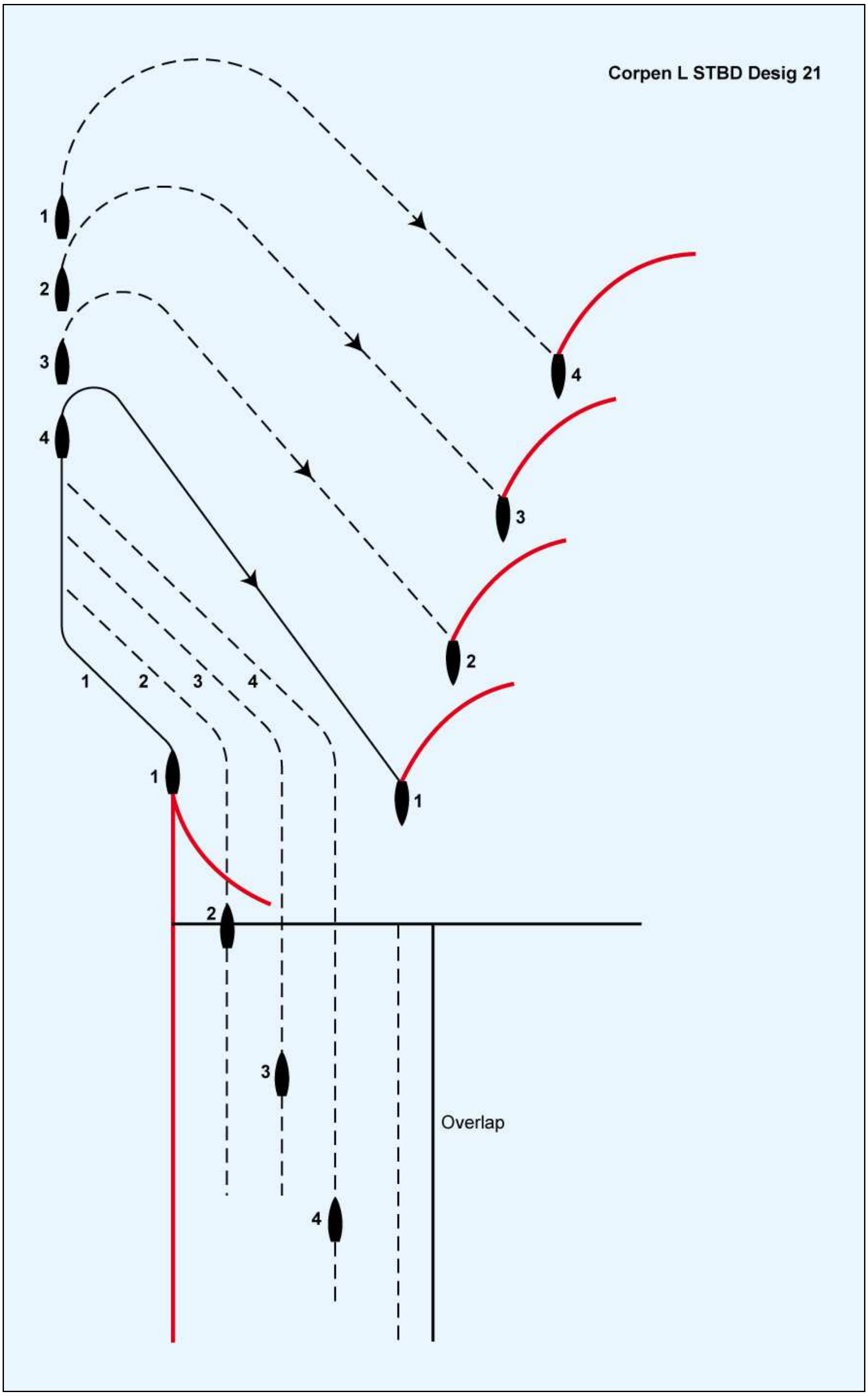

c. (NU) Standard Track-turn Method No 22 (STTM 22) and Standard Track-turn Method No 23 (STTM 23):

(1) (NU) Purpose

(a) (NU) STTM 22: To sweep an adjacent track on the same buoyline, turning away from the sweep. Same guide.

(b) (NU) STTM 23: To sweep a non-adjacent track, turning away from the sweep. Same guide.

(2) (NU) Execution. (see Figures 3A-17 and 3A-18). Ships alter course in succession as follows:

METHOD 22	METHOD 23
(a) Numbers 1 to 5 alter course 220º, Number 6 alters course 200º, Number 7 and 8 alter course 175º in the direction indicated.	Guide alters course 90º in the direction indicated. When their floats are clear of the track, remaining ships steer for the turning point of the guide, then alter course in succession to follow in his wake.
(b) Guide alters course as requisite for the next track. Remaining ships alter so as to take station for the next track	Guide alters course a further 90º as required for the next track. Remainder alter course 60º in succession then as required to take up station for his next track.

***Notes**:*

1. (NU) The turn should be executed when the guide is xxx metres clear of the track. This can be judged by the dipping of the appropriate MW-Signal in the fourth ship of the formation.

2. (NU) Kites are left down for this turn except when in Method 23 tracks are distant. With kites down speed must not exceed xxx knots.

3. (NU) It is essential that ships keep closed up during the turn so as to give the rear buoylayer time to get steadied before laying the first buoy of the new track.

4. (NU) Guide should not increase speed until all ships are in station.

Figure 3A-17. Example of MCM Formation G - Standard Track-Turn Method No 22

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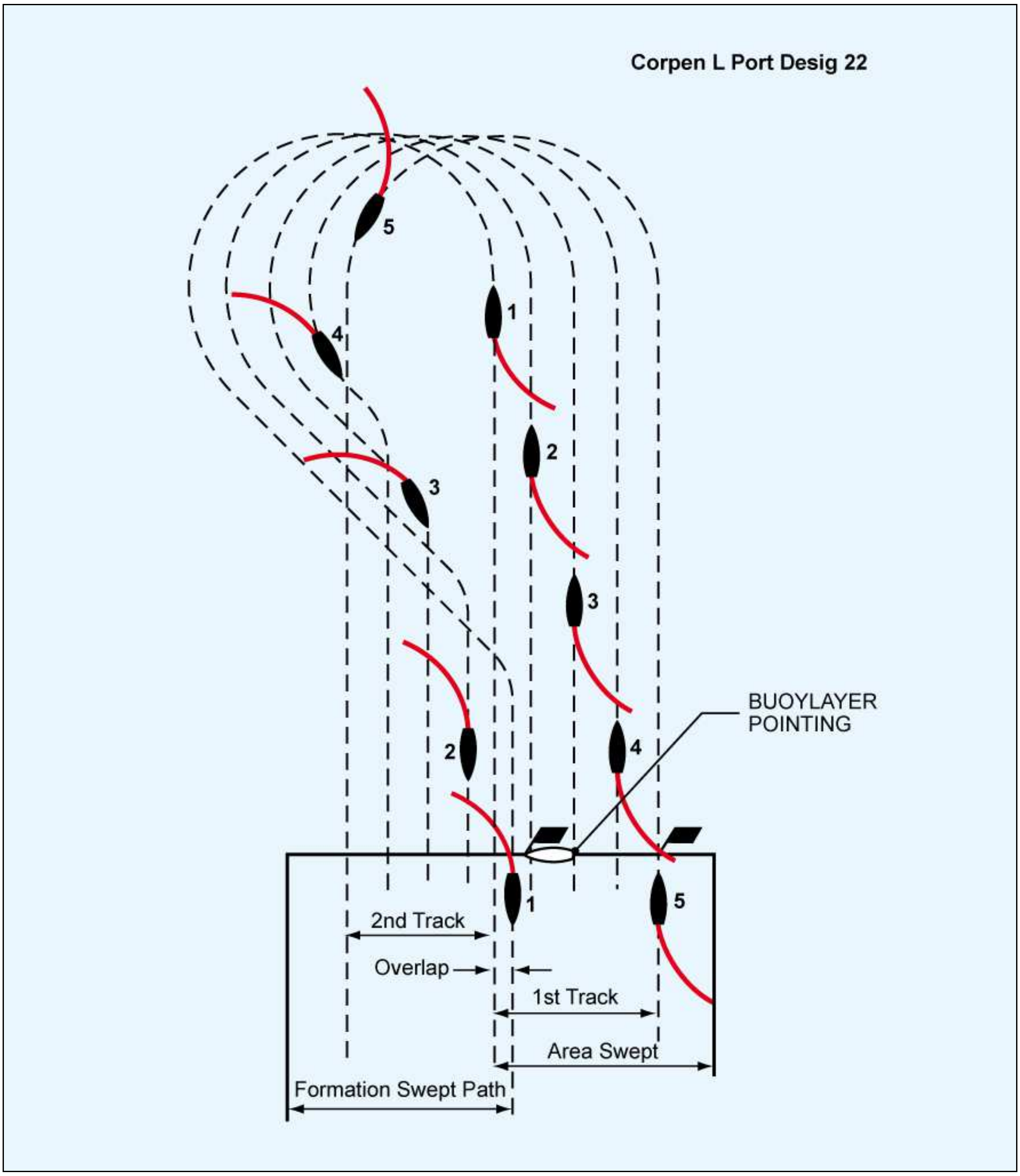

Figure 3A-18. Example of MCM Formation G - Standard Track-Turn Method No 23

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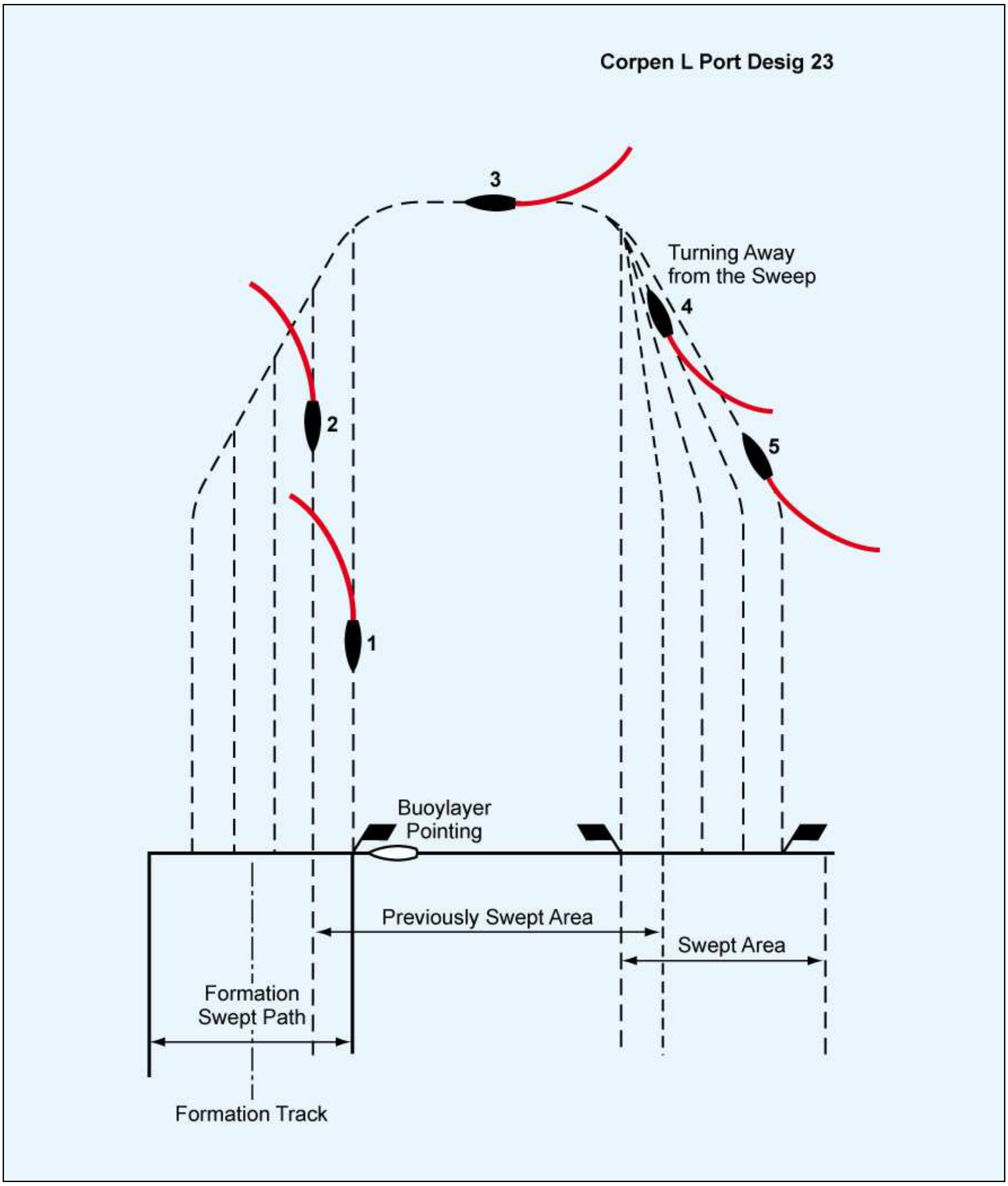

d. (NU) Standard Track-turn Method No 24 (STTM 24)

(1) (NU) Purpose. To sweep an adjacent track on the same buoyline turning away from the sweep. New guide.

(2) (NU) Execution. (see Figure 3A-19).

(a) (NU) PHASE 1: When CORPEN L STBD (PORT) _____ DESIG 24 is executed, as his float comes clear of the track the guide maintains course and speed. When the rear ship is 650 metres clear of the track, all ships turn simultaneously 30º in the direction of turn indicated, hoisting Flag R on completion.

(b) (NU) PHASE 2: The rear ship assumes guide and executes Flag R when in position to turn for the next track. On execution of Flag R all ships turn 150º in the direction indicated. The guide alters to the new course as requisite and remaining ships alter so as to take up their correct station for the new track.

Figure 3A-19. Example of MCM Formation G Standard Track-Turn Method No 24

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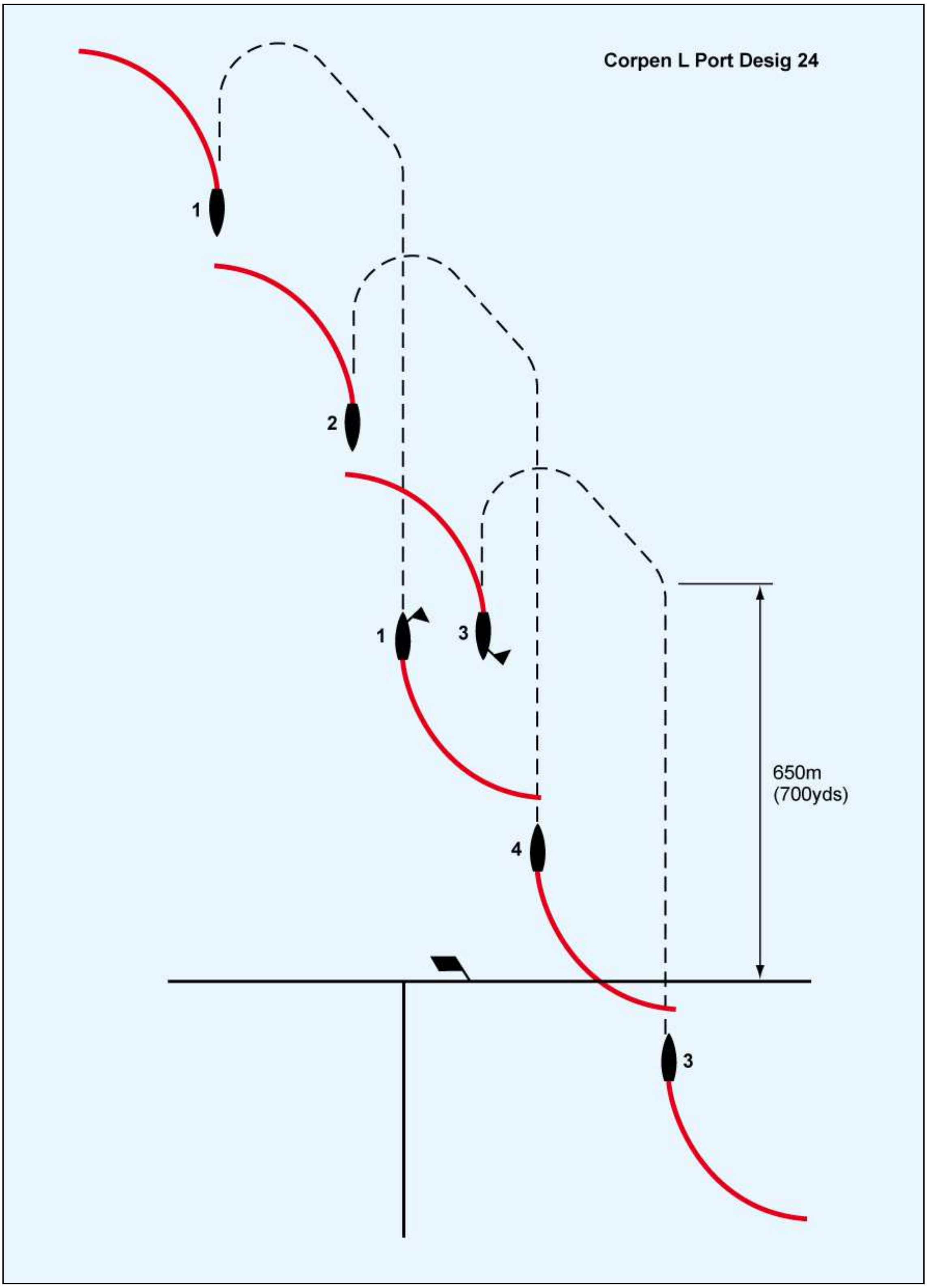

e. (NU) Standard Track-Turn Method No 25 (STTM 25)

(1) (NU) Purpose. To sweep a non-adjacent track turning towards the sweep. Same guide.

(2) (NU) Execution. (see Figure 3A-20).

(a) (NU) PHASE 1: When CORPEN L STBD (PORT) _____ DESIG 25 is executed, as his float comes clear of the track, the guide alters course 20º towards his sweep and increases to stationing speed, altering back to the sweeping course when ahead of his next astern. Remaining odd-numbered ships conform in succession. When clear of the track, Number 2 and all even-numbered ships turn 25º away from the sweep when float is clear of the track, and back to the sweeping course when clear of the next ahead.

(b) (NU) PHASE 2: On altering back to the sweeping course, ships reduce speed as required to get up kites and bring sweeps to the shortened-in condition.

(c) (NU) PHASE 3: When the guide has shortened in, he alters by two 90º turns to the new track-course. Remaining ships conform in succession and resume previous stations.

(d) (NU) PHASE 4: The guide then veers sweep and hoists Flag R (1) when his sweep is fully veered.

(e) (NU) PHASE 5: Kites are put down when Flag R (1) is hauled down, and Flag R (2) is hoisted on completion.

(f) (NU) PHASE 6: When all ships are in station with kites down, the guide hauls down Flag R (2) and increases to sweeping speed.

Note. **(NU)** *When ships are coming round to new track it is important that they should adjust course and speed so as to get to a position inside station before veering the sweep. This will enable the guide to increase speed at the earliest possible moment.*

(3) (NU) Breakdown Procedures (MCM Formation G):

(a) (NU) The damaged sweeper (sweep or ship) hauls out to swept waters, if possible.

(b) (NU) Ships following astern manoeuvre so as:

(i) (NU) Not to foul their own sweep in that of the damaged ship.

(ii) (NU) Not to risk damaging their sweep by violent manoeuvres.

(iii) (NU) To stay as short a time as possible in unswept waters.

(iv) (NU) To close in on the guide as soon as possible.

Figure 3A-20. Example of MCM Formation G - Standard Track-Turn Method No 25

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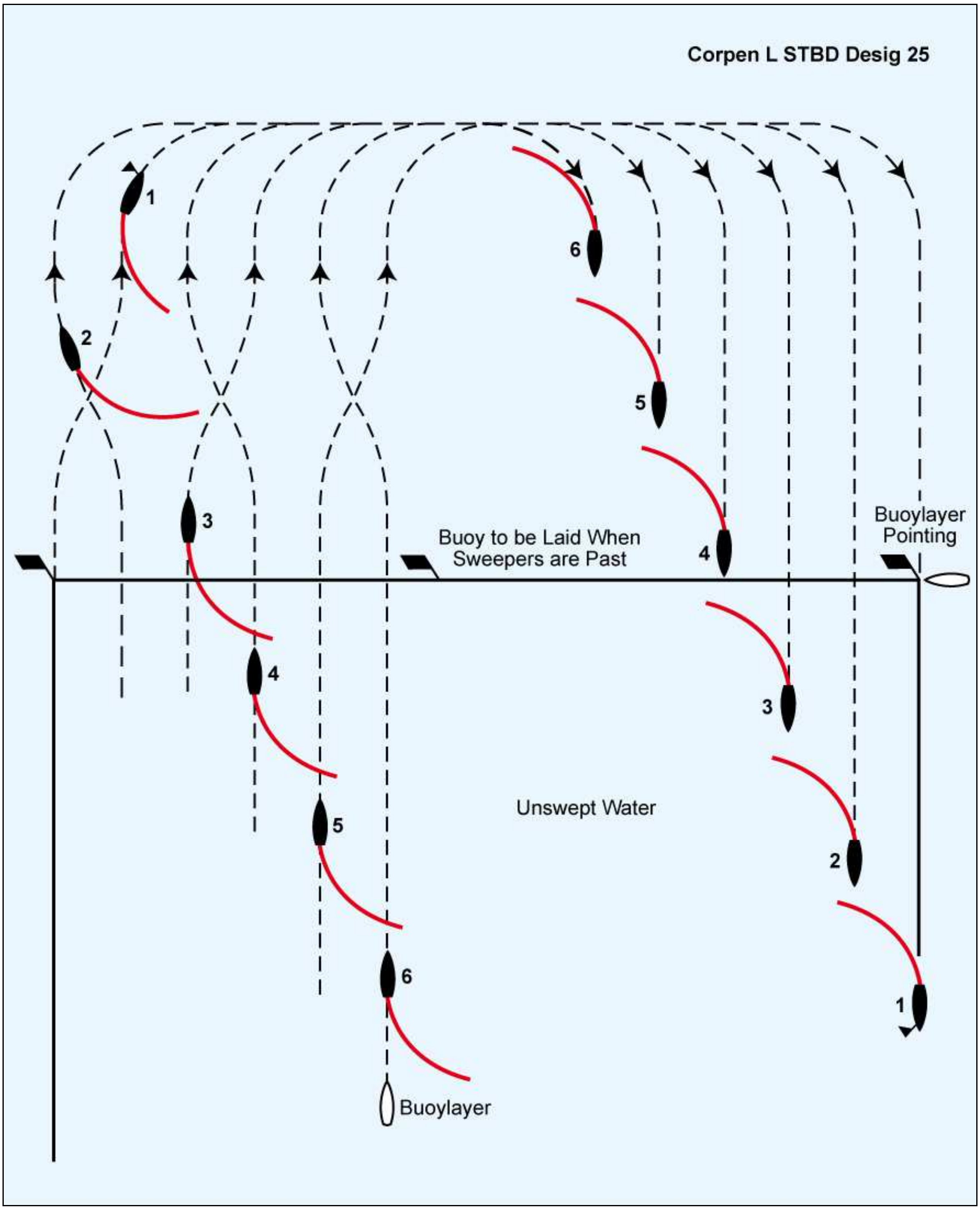

(c) (NU) These requirements are generally conflicting and it is not possible to give hard and fast rules.

(d) (NU) In most cases the formation will have left holidays and it will usually be necessary to sweep the track again.

3A55 (NU) MCM Formation I

1. (NU) Romeo Procedure. Example of preliminary MCM Formation I is shown in Figure 3A-21. For an example of MCM Formation I see Figure 3A-22.

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD (PORT) DESIG I	Take up preliminary formation.	R(1)
2	R(1)	Guide proceeds at xxx knots. Sweeps are veered to short-stay.	R(2)
3	R(2)	Guide increases speed to xxx knots. Sweeps are veered to long-stay.	R(3)
4	R(3)	Ships take up station relative to float of next ship ahead.	R(4)
5	R(4)	Kites streamed.	R(5)
6	R(5)	Guide takes up sweeping speed when guide is at sweeping course.	-

Figure 3A-21. Example of Preliminary MCM Formation I

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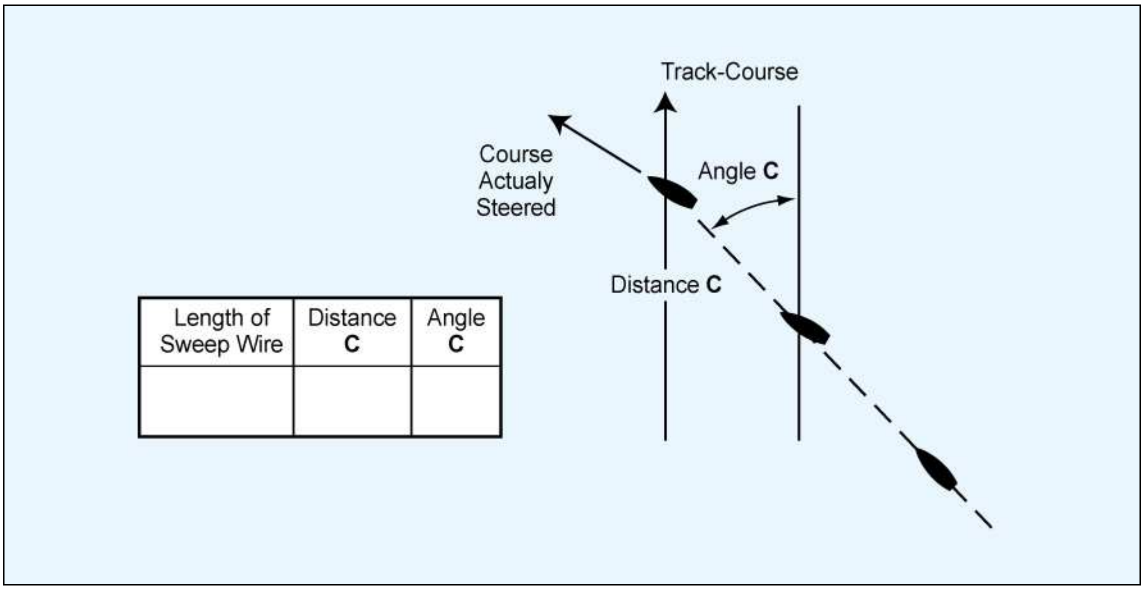

Figure 3A-22. Example of MCM Formation I

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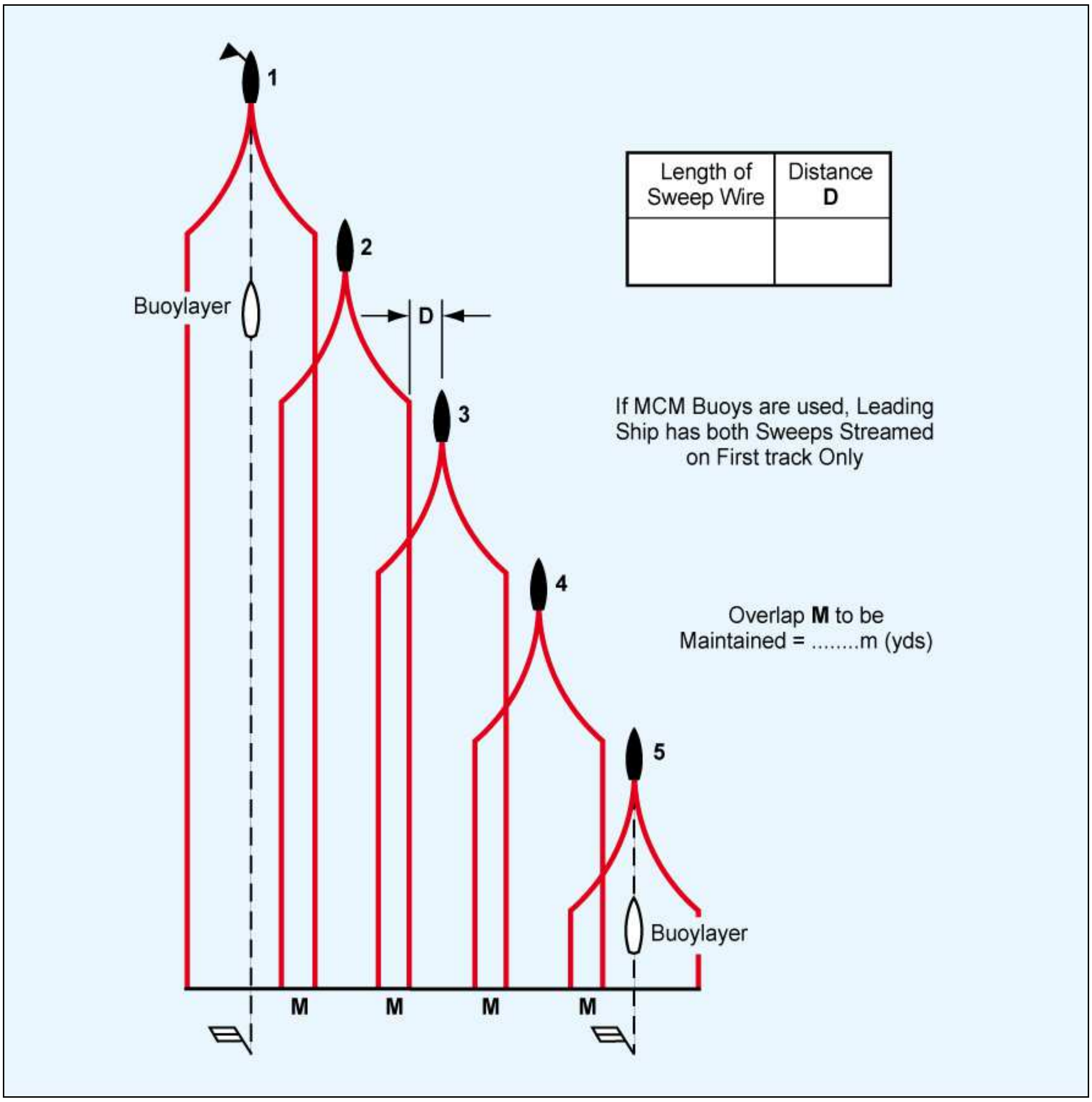

2. (NU) Standard Track-turn Methods. Several track-turn methods are available to suit different purposes when sweeping in MCM Formation I. They are collated in Table 3A-2.

Table 3A-2. Standard Track-Turn Methods for MCM Formation I

Standard Track-turn Method Number	Purpose
30	To sweep an adjacent track on the same buoyline, wheeling away from the side of the formation. Same guide.
31	To sweep a non-adjacent track, wheeling away from the side of the formation. Same guide.
32	To sweep an adjacent track or along an adjacent buoyline, wheeling towards the former side of the formation, and changing the formation. Same guide.
33	To sweep a non-adjacent track, wheeling towards the side of the formation. No change in the side of the formation. Same guide.
39 (see Note)	To sweep any track in the reverse direction in either MCM Formation G or I. Same guide.
NATO-UNCLASSIFIED	

***Note.* (NU)** *STTM 39 to be found in paragraph 3A56.*

a. (NU) Purpose. See Table 3A-3.

b. (NU) Execution

(1) (NU) Guide reduces to xxx knots, recovers kite and shortens in the sweeps. If necessary for running next buoyline guide recovers the appropriate sweep. Remaining ships get up kites and bring sweeps to the shortened-in condition.

(2) (NU) Ships form column at xxx metres apart.

(3) (NU) Guide alters course as follows in the direction indicated.

STTM 32	STTM 30	STTM 31 AND 33
180º	220º and then back 40º.	90º and then a further 90º as requisite for the new track.

(4) (NU) Remaining ships alter course as follows:

STTM 32	STTM 30	STTM 31 AND 33
150º and then 30º	In succession.	In succession in the water in which the guide turned, and after the second turn.

In order to take up MCM Formation I on the new track-course, formation is formed:

In STTM 32 - on the opposite side.
In STTM 30, 31 and 33 - on the same side.

(5) (NU) When steady on the new track-course, the guide veers sweep(s), hoisting Flag R (1) close up on completion. Remaining ships conform in succession, working Flag R (1) on completion.

(6) (NU) Guide puts down the kite on hauling-down Flag R (1) and increases to xxx knots. Remaining ships conform in succession. Flag R (2) is hoisted when kites are down.

(7) (NU) Speed is increased to sweeping speed on hauling down Flag R (2) when all ships are in station with kites down.

3. (NU) Breakdown Procedure (MCM Formation I):

a. (NU) The damaged sweeper (ship or sweep damage) hauls out, if possible towards swept waters.

b. (NU) Ships following manoeuvre so as:

(1) (NU) Not to foul their own sweep in that of the damaged ship;

(2) (NU) Not to run the risk of damaging their own sweep by violent manoeuvres.

(3) (NU) To close in on the guide as rapidly as possible.

c. (NU) As in MCM Formation G it is not possible to give hard and fast rules, and ships should be guided by circumstances.

d. (NU) In most cases the formation will have left ‘holidays’ and it will usually be necessary to sweep the same area again.

3A56 (NU) MCM Formation G or I, Standard Track-Turn Method No 39 (STTM 39)

1. (NU) Purpose. To sweep any track in the reverse direction in either MCM Formation G or I. Same guide.

2. (NU) Execution. (see Figure 3A-23).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	CORPEN L STBD/PORT ____ DESIG 39 T CORPEN ____ M FORM STBD/PORT	Guide increases speed by 1 knot and alters to the throw-off course (T CORPEN). Remaining ship(s) follow in succession on clearing the track.	R(1)
2	R(1) SPEED ____	Ships reduce to xxx knots, raise kites and bring the sweep to shortened-in condition on the side of the turn. Guide increases to sweeping speed without signal when the kite is raised. Other ships conform, adjusting to remain about 200 metres astern of the next ahead's float (on the side at long stay). Guide wheels to approach course for the next track, without signal. Other ships conform in succession, adjusting the wheel to take station in the new formation. Guide can give his approach course using G CORPEN. Ships veer shortened-in sweep to long stay when on approach course.	R(2)
3	R(2) SPEED ____	Ships reduce to xxx knots and lower kites. On completion, speed may be increased to preserve the formation and to take station on the float of the next ahead.	R(3)
4	R(3)	Guide increases to sweeping speed, other ship(s) maintain formation.	

Notes:

1. (NU) For the meaning of CORPEN L. STBD/PORT see ATP 1 Vol II.

2. (NU) The throw-off course (T CORPEN) is not to be more than 30º from the track course.

3. (NU) When the guide is throwing-off away from the formation, other ships adjust to follow in the wake of the guide. When the guide is throwing-off across the formation, ships will be unable to fall-in astern when in MCM Formation I but must remain displaced and maintain a track parallel to the guide.

3A57 - 3A60 Spare.

Figure 3A-23. Standard Track-turn Method No 39

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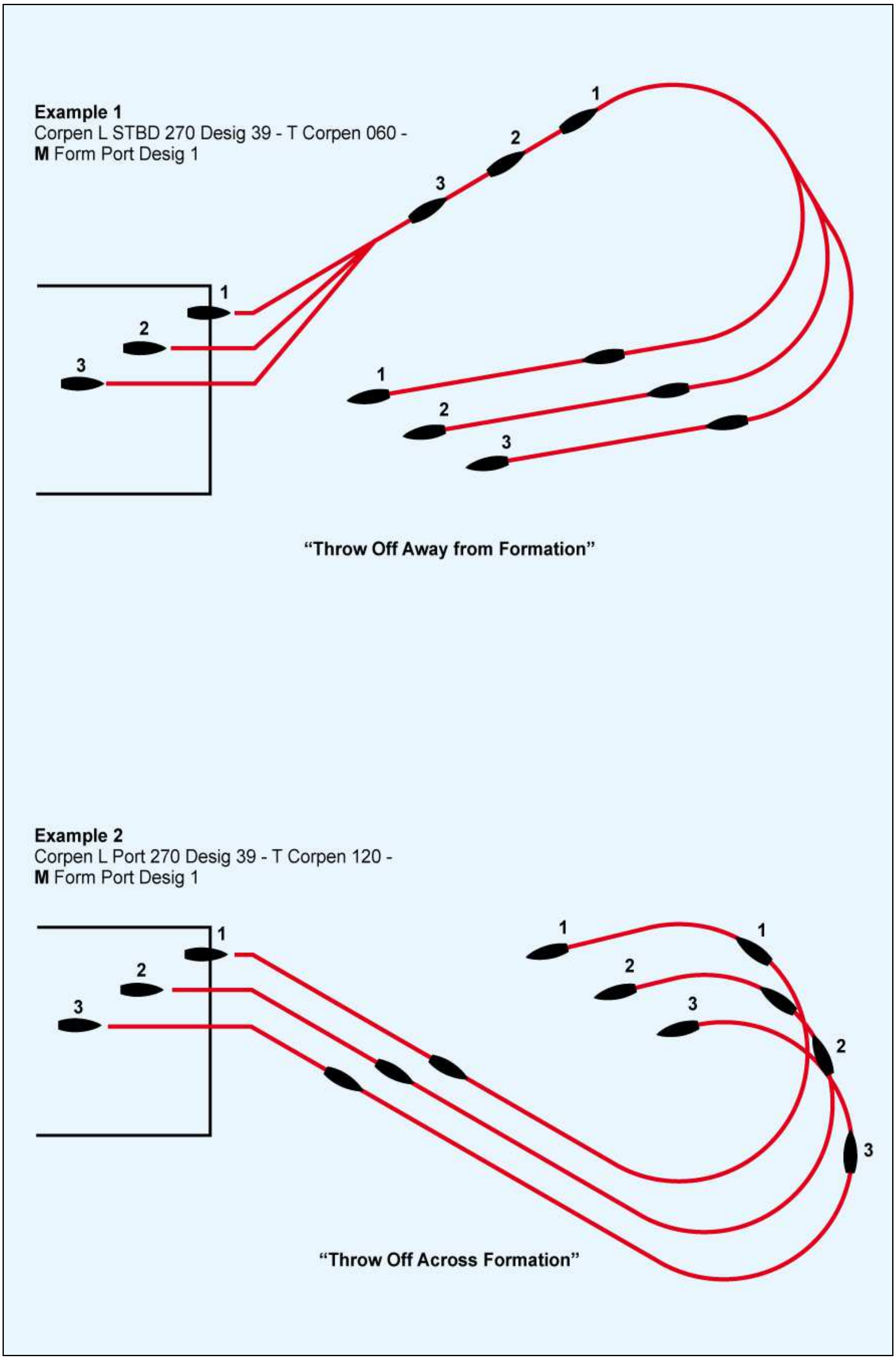

SECTION VI - NOT RELEASABLE

0361 NOT RELEASABLE

0362 NOT RELEASABLE

SECTION VII - ARMED TEAM SWEEPING PROCEDURES FOR USE BY MCMVS OF DIFFERENT TYPE/NATIONALITY

3A63 (NU) Formation and Manoeuvring in Team Sweeping

1. (NU) Taking up Formation and Manoeuvring of the Sweeps

a. (NU) Taking up Formation. To take up formation, ships form a column at 135 metres distance between ships. The normal team will include two ships but it is possible to use teams of three, four or even more ships. On hauling down flags ROMEO ONE, consorts take up station abeam of their guide on the appropriate side.

b. (NU) Passing Sweeps. To pass the sweeps, each ship supplies half of the sweep, the two halves being connected by a shearing link. In a team of three ships, the central ship (number 1) is guide for passing the sweeps to port and starboard, the two wing ships (numbers 2 and 3) being consorts. After passing the wire, normally one of the wing ships will become the new guide. Ship number 1, presently being the guide has to order a course that will be on her allocated track. Ship number 1 orders the new guide to take over when the last ship has secured her sweep.

c. (NU) Slipping Sweeps. When slipping sweeps, the guide slips the consort's wire and the consort increases speed and hauls out while recovering the sweep. With teams of three, the central ship will become the guide again. She maintains her course and the two wing ships close in simultaneously. With teams of four, the two wing ships close in on the inner ships and manoeuvre simultaneously following the same procedure as with teams of two. The two inner ships then manoeuvre in the same way.

2. (NU) Track Turns

a. (NU) For any alteration of course of more than 30º sweepers reduce speed in order to raise kites, close in to 135 metres and shorten in sweeps to 135 metres. In all track-turns, the guide ship should reduce speed and signal her successive headings every 20º.

b. (NU) While turning, the other ships proportion their speeds to their stations by maintaining a speed of about 1.5 knots more than that of the adjacent ship on the pivot ship's side, and endeavour to maintain an advance of 5º in relative bearing over the pivot ship.

c. (NU) Sweep decks should stand by to slip the sweepwire without order if this wire forms an angle of more than 45º with the fore and aft line of the ship.

3. (NU) Method of Opening in Team-Sweeping Formation

a. (NU) The ship(s) next to the guide steer(s) out by 25º from the guide's course and increases speed by 1.5 knots.

b. (NU) All other ships steer out 50º and increase speed by 2.5 knots, reducing to 25º and to the guide's speed plus 1 knot, when the adjacent inboard ship alters back to the guide' s course

c. (NU) All ships must maintain true bearing from the guide while opening.

d. (NU) An indication for manoeuvring to port or starboard can be given by using red or green flags. In that case wheel for the turn is applied when the red or green flag is shown in the next outboard ship.

4. (NU) Method of Closing in Team-Sweeping Formation

a. (NU) Ships alter 35º and close on the guide on parallel courses at 1.5 knots more than the guide's speed.

b. (NU) Each ship is to wait for the adjacent outboard ship to turn in before she does so herself. Red and green hand flags are to be used.

c. (NU) When a team consists of two ships only, the ship closing in may use the maximum converging course and speed allowed by the winch speed, bearing in mind the necessity of not allowing more sag in the sweep than the depth of the water permits. In water depths of less than 50 metres, the converging course should not exceed 25º.

d. (NU) Speeds should not be allowed to decrease below 7 knots when the water depth is less than 50 metres.

3A64 (NU) Amplifying Instructions

1. (NU) Sweep and Kite Wires

a. (NU) Length of Sweepwire. The standard length of sweepwire in team sweeping is 365 metres for each ship. Commanding officers are reminded that the length of sweepwire is measured from the kite. The total length of sweepwire in team sweeping is the standard length plus the length of the kite wire required.

b. (NU) Depth Setting of the Sweep. Depth setting will be ordered by the CTU of minesweepers and is the depth at which the kite should be running when proceeding at sweeping speed. If the ordered depth cannot be adhered to, the OTC should be informed accordingly.

c. (NU) Length of Kite Wire. Lengths of kite wires are to be calculated based on the ordered depth of the sweep using national publications. If national data is not available the kite wire length should be obtained from sub-para h below, where kite wire length is given as a function of swept depth and speed through the water.

d. (NU) Sag. The maximum sag of the sweepwire as function of the speed through the water is stated in sub para i below.

2. (NU) Speeds in Team-Sweeping

a. (NU) Speeds to be used during team-sweeping are those which give the lowest speeds for the different types/nationalities of ships actually involved in the team-sweeping operation.

b. (NU) ‘Signalled speed’ is the speed at which a ship should proceed through the water for any given engine revolutions/propeller pitch combination without gear streamed.

3. (NU) Signals

a. (NU) Flag ROMEO will be used in accordance with the procedure laid down in para 3A63.

b. (NU) On execution of signal R(1), black balls to be hoisted close up.

c. (NU) Speed flags are to be used throughout the team sweep procedures.

d. (NU) Flag VICTOR (held up: I am veering the sweep wire) and flag HOTEL (held up: I am heaving the sweep wire) are to be used on the sweepdeck, clearly visible for the ship(s) in company.

4. (NU) Passing Gear

a. (NU) The consort is always the delivering ship and is to provide:

(1) (NU) Initial heaving line.

(2) (NU) 55 metre rope messenger.

(3) (NU) Sliphook.

(4) (NU) Break coupling.

b. (NU) In marginal sea conditions initial contact may be made by the guide streaming the messenger, fitted with pellets at its outboard end, astern for the consort (becoming receiving ship now) to grapple.

c. (NU) Sweep wires are always to be veered off the brake. When sweeps have been fully streamed, wires should be held by the brakes only. Stoppers should not be put on the sweepwires unless required by national regulations.

5. (NU) Arming. Sweeps are to be armed with explosive cutters only, spaced at the following intervals from the outboard end of each sweepwire:

Cutter 1: 27 metres
Cutter 2: 55 metres
Cutter 3: 91 metres

6. (NU) Distance

a. (NU) The distance between ships should always be half the total length of sweep wire streamed from both ships. Table 3A-3 details the amount of sweep wire streamed versus distance apart.

b. (NU) The guide is to inform the consort(s) regularly concerning the amount of sweep wire streamed. If silent procedures are preferred or in force, the rate of opening or closing between ships can be controlled by the guide using distance indicator flags on the ship's relevant side as shown in Table 3A-3:

Table 3A-3. Indicator Flags, Sweep Wire Veered Vs Distance Apart

Indicator Flag	Wire Streamed (metres)	Distance Apart (metres)
ALPHA	135	135
BRAVO	183	183
CHARLIE	229	229
DELTA	274	274
ECHO	320	320
FOXTROT	366	366

c. (NU) The intention or the order to use distance indicator flags should be given by the CTU of, minesweepers well in advance of the streaming/recovering procedures.

7. (NU) The Guide

a. (NU) In general the CTU of minesweepers will act as Guide during streaming and recovering sweeps.

b. (NU) During track-turns, and especially when operating team sweeps with more than two ships, one of the pivot ships will become guide, whereas the original guide will remain responsible for the execution of the track-turn.

c. (NU) Circumstances might occur in which it is advisable to execute a track-turn in which a ship not being pivot-ship is allocated the guide, for instance when a ship is considerably slower than her consort in turning. In that case the guide should state well in advance his guide-allocation policy and mention in detail his intentions for executing the track-turns.

8. (NU) Kite wire length, which is a function of swept depth and speed through the water, is shown in Table 3A-4 for a total of 366 metres of sweep wire veered.

Table 3A-4. Swept Depth and Kite Wire Lengths for 366 Metres of Sweep Wire

		KITE WIRE LENGTH (metres)		
		6 Knots through water	**8 Knots through water**	**10 Knots through water**
SWEPT DEPTH (m)	9.1	18.3	22.0	23.8
	11.0	22.0	25.6	29.2
	12.8	25.6	29.2	34.8
	14.6	29.2	34.8	38.4
	16.5	32.9	38.4	42.1
	18.3	36.6	42.1	49.4
	20.1	42.1	47.6	54.9
	22.0	45.7	51.2	58.5
	23.8	49.4	56.7	64.0
	25.6	53.0	62.2	69.5
	27.4	56.7	65.8	75.0
	29.2	60.4	71.3	80.5
	31.1	64.0	76.8	86.0
	32.9	69.5	82.3	91.4
	34.8	73.2	86.0	98.8
	36.6	76.8	91.4	104.2
	38.4	80.5	96.9	109.7
	40.2	86.0	102.4	117.0
	42.1	89.7	107.9	124.4
	43.9	95.1	115.2	129.9
	45.7	98.8	120.7	137.2

9. (NU) Sag of sweep wire and load in kite/sweep wire is a function of speed through the water and is tabulated in Tables 3A-5 & 3A-6 respectively.

Table 3A-5. Maximum Sag of Team Sweep
(With 366 metres of Seep Wire Veered))

6 knots through water	**8 knots through water**	**10 knots through water**
36 +/- 5.5	23.8 +/- 3.7	9.1 +/- 1.8

Table 3A-6. Team Sweep Loads

	6 knots		**8 knots**		**10 knots**	
	Tons	**Mg**	**Tons**	**Mg**	**Tons**	**Mg**
Kite Wire	0.9	0.91	1.5	1.52	1.6	1.63
Sweep Wire	1.3	1.32	2.1	2.13	3.3	3.35

10. (NU) The amount of sweep wire veered versus the MCMVs distance apart is shown in Table 3A-7.

Table 3A-7. Sweep Wire Veered Versus MCMV Distance Apart

MCMV Distance Apart	Sweep wire veered
55	55
91	91
135	135
183	183
230	230
275	275
366	366

3A65 (NU) DOGGO Drill

1. (NU) General

a. (NU) Going ‘DOGGO’ (stern to stern and unmanoeuvrable) causes considerable loss of sweeping time and entails a high risk of parting gear. It is avoided by accurate station keeping at all times.

b. (NU) All ships should stop immediately on receipt of the signal "DOGGO - DOGGO - DOGGO".

c (NU) It may be possible for ships to regain station without completely recovering the gear. If so, sweeps should be shortened in and sighted and, if possible, cutters should be checked.

2. (NU) Symptoms and Preventive Action

a. (NU) Sweep wire taut and growing out on quarter at an increasing angle - large amount of wheel required to maintain course:

(1) (NU) Pass on UHF "DOGGO - Warning".

(2) (NU) Stop inboard engine.

(3) (NU) Increase speed on outboard engine.

(4) (NU) Put on maximum inward wheel.

(5) (NU) Veer sweepwire at maximum speed.

(6) (NU) Steady (if possible) on 15 - 20º closing course.

(7) (NU) Regain bearing if required.

b. (NU) Sweep wire very taut and growing out at a large angle on quarter despite previous action - ship's head paying off:

(1) (NU) Pass on UHF "DOGGO - DOGGO - DOGGO - MIKE SPEED ZERO".

(2) (NU) Stop both engines.

(3) (NU) Apply astern power very cautiously to stop ship.

(4) (NU) Ease strain on wires by veering as necessary.

(5) (NU) When strain permits, recover kite.

(6) (NU) Start recovery of sweeps.

3A66 (NU) MCM Formation E

1. (NU) Taking up formation

a. (NU) Procedure

Phase	Signal Executed by Guide	Action Taken	Signal o/c
1	Form H Stbd/Port Desig E	Take up preliminary formations to STBD/PORT 20 metres apart, guide to proceed at streaming speed.	R1
2	Romeo One	Pass sweeps. Then consort ship open to 30 metres on side indicated, both ships veering 30 metres of wire, Attach cutter 1.	R2
3	Romeo Two	Consort ship open to 55 metres . Both ships veer to 55 metres wire. Attach cutter 2.	R3
4	Romeo Three	Consort ship open to 91 metres. Both ships veer to 91 metres wire. Attach cutter 3.	R4
5	Romeo Four	Consort ship open to 366 metres. Both ships stream wire to 366 metres. Use distance indicator flags if ordered by guide.	R5
6	Romeo Five	Down kites and stream kite wire to depth ordered.	R6
7	Romeo Six	Proceed at sweeping speed.	Speed flag

b. (NU) If sufficient ships are available for team-sweeping in pairs (Formation E), subdivisions can be formed at an intership distance of 100 metres. In this case the OTC must order values for distance C and angle C in order to allow subdivision guides to keep station on the guide (see Figure 3A-24).

Figure 3A-24. Example of MCM Formation E

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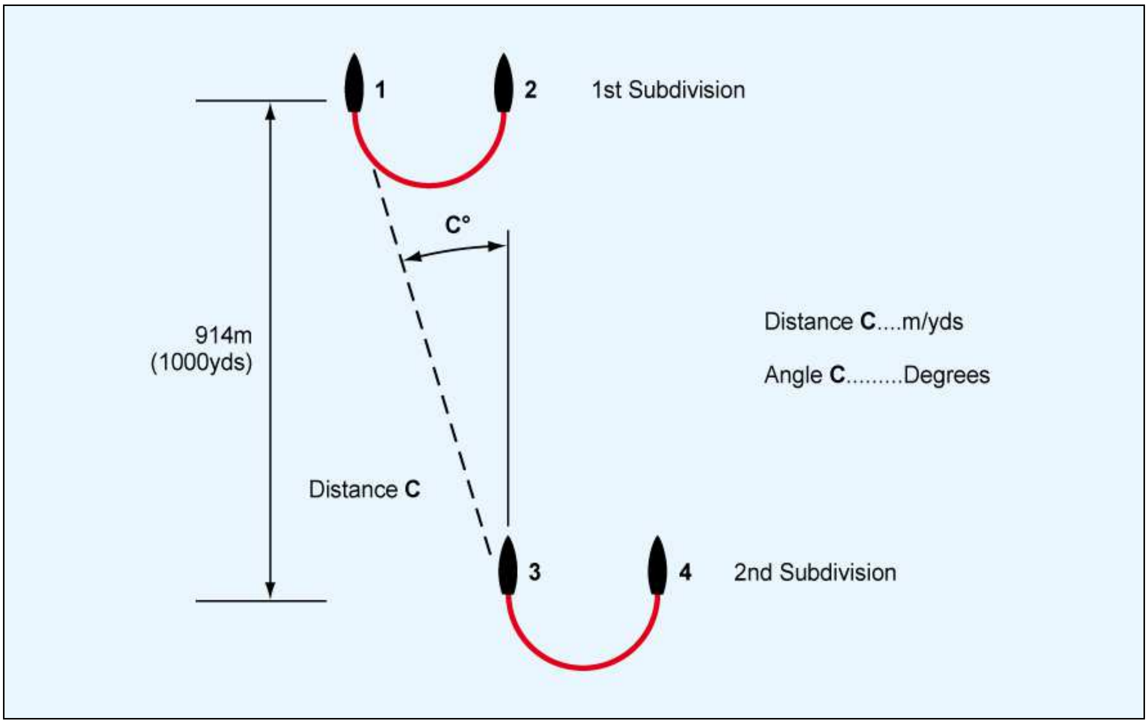

2. (NU) Track Turns

a. (NU) Procedure (see Figure 3A-25)

Phase	Signal Executed by Guide	Action Taken	Signal O/C
1	Corpen L Stbd/Port	Reduce speed and raise kites.	R1
2	Romeo One	Outer ship becomes the new guide. Ships turn (not more than) 30º away from the next track.	R2
3	Romeo Two	Ships on the side towards which the turn is to be made close in 135 metres; sweeps are hove in to 135 metres and sighted. Use distance indicator flags if ordered by guide.	R3
4	Romeo Three	Inner ship becomes the new guide. Ships turn back towards the former track course. Subdivisional guides steer so as to get into the wake of the new guide.	R4
5	Romeo Four	Subdivisions separately wheel (not more than) 90º in the direction indicated.	R5
6	Romeo Five	Subdivisions separately wheel (not more than) 120º in the direction indicated.	R6
7	Romeo Six	Wing ships open to 366 metres from their subdivisional guides. Veer sweeps to 366 metres use distance indicator flags if ordered by OTC.	R7
8	Romeo Seven	Subdivisional guides alter course (not more than 30º) back to the new track course as requisite.	R8
9	Romeo Eight	Down kites and stream kite wire to depth ordered.	R9
10	Romeo Nine	Proceed at sweeping speed.	Speed flag

b. (NU) All signals will be executed by the guide (normally the OTC will be the guide).

c. (NU) The new guide will be responsible for maintaining the ordered speed and for adjusting course so as to follow the right track.

d. (NU) The guide on the next track may be different from the one on the former track.

Figure 3A-25. Example of MCM Formation E - Standard Track Turn

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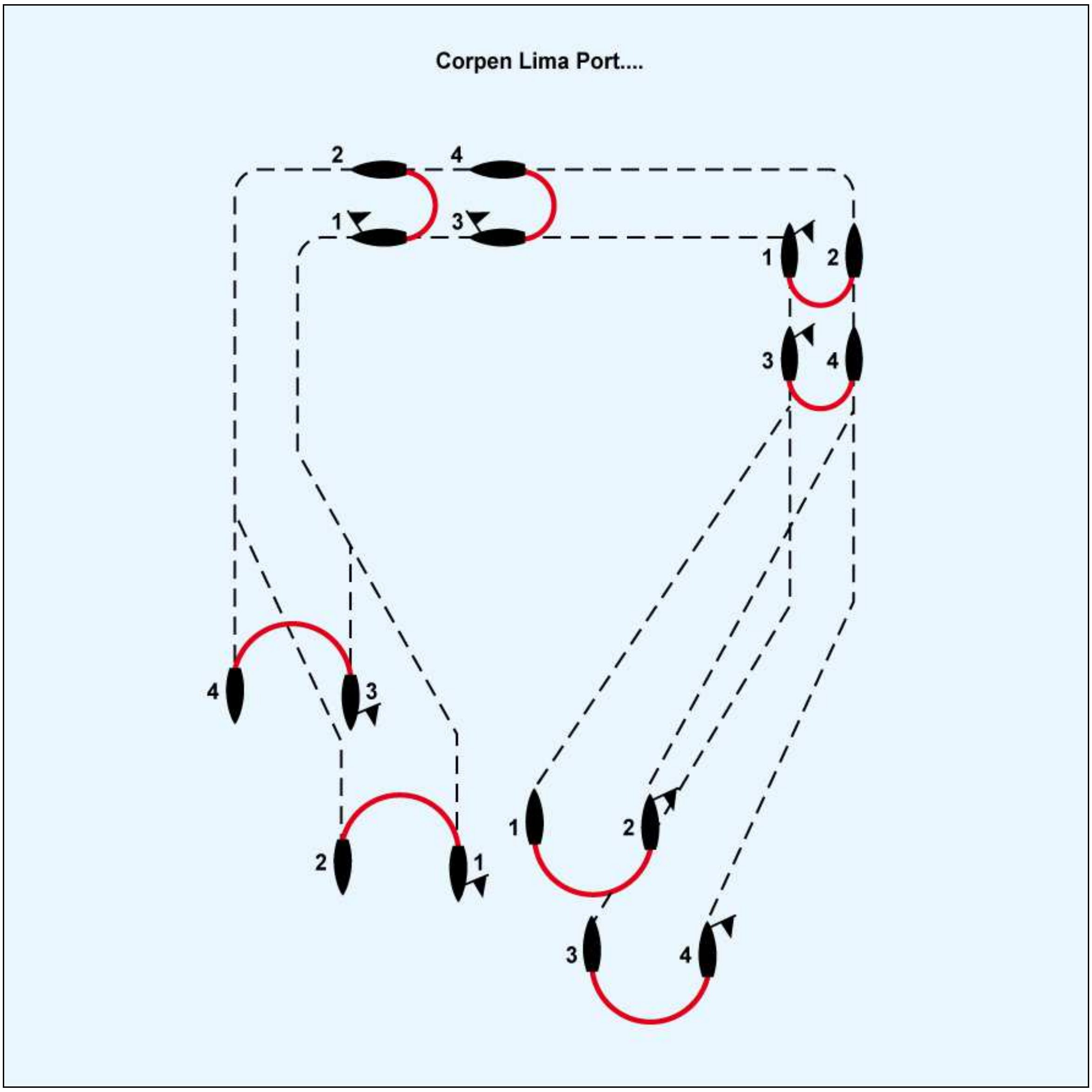

3. (NU) Recovering Sweeps

a (NU) Procedure:

Phase	Signal Executed by Guide	Action Taken	Signal O/C
1	MW 120	Reduce speed and raise kites.	R1
2	Romeo One	Ships heave in to 91 metres. Consort ship to close gradually to 91 metres. Use distance indicator flags if ordered by OTC. Remove cutter 3.	R2
3	Romeo Two	Consort ship to close in to 55 metres. Ship heave in to 55 metres. Remove cutter 2.	R3
4	Romeo Three	consort ship to close in to 30 metres. Ships heave in to 30 metres. Remove cutter 1.	R4
5	Romeo Four	Guide ship heave in until slip-hook is on sweepdeck. Consort veer as required.	R5
6	Romeo Five	Guide ship slips by surging the messenger attached, consort increases speed to 10 knots and recovers sweep wire.	---

3A67 (NU) MCM Formation J

1. (NU) Taking up formation:

a. (NU) Procedure (see Figure 3A-26)

Phase	Signal executed by		Action Taken	Signal
	Guide	Each guide ship on receiving side		
1	Form H Desig J		Take up preliminary J formation Guide proceed at streaming speed. Number 2 and 3 follow the guide, 135 metres apart. Remaining ships take station on number 3, odd numbers on stbd beam, even numbers on port beam 135 metres apart.	R1
2		Romeo One	Each consort ship in turn to take up station 20 metres abeam of her guide ship on side indicated and pass sweep. Then consort ship open to 30 metres on side indicated. Both ships veering 30 metres wire. Attach cutter 1.	R2
3		Romeo Two	Consort ship open to 55 metres. Both ships veer to 55 metres wire. Attach cutter 2.	R3
4		Romeo Three	Consort ship open to 91 metres. Both ships veer to 91 metres wire. Attach cutter 3.	R4
5		Romeo Four	Consort ship open to 366 metres. Both ships stream wire to 366 metres. Use distance indicator flags on appropriate side if ordered by OTC.	R5
6	Romeo Five		Down kites and stream kite wire to depth ordered.	R6
7	Romeo Six		Proceed at sweeping speed.	Speed flag

Figure 3A-26. Example of MCM Formation J

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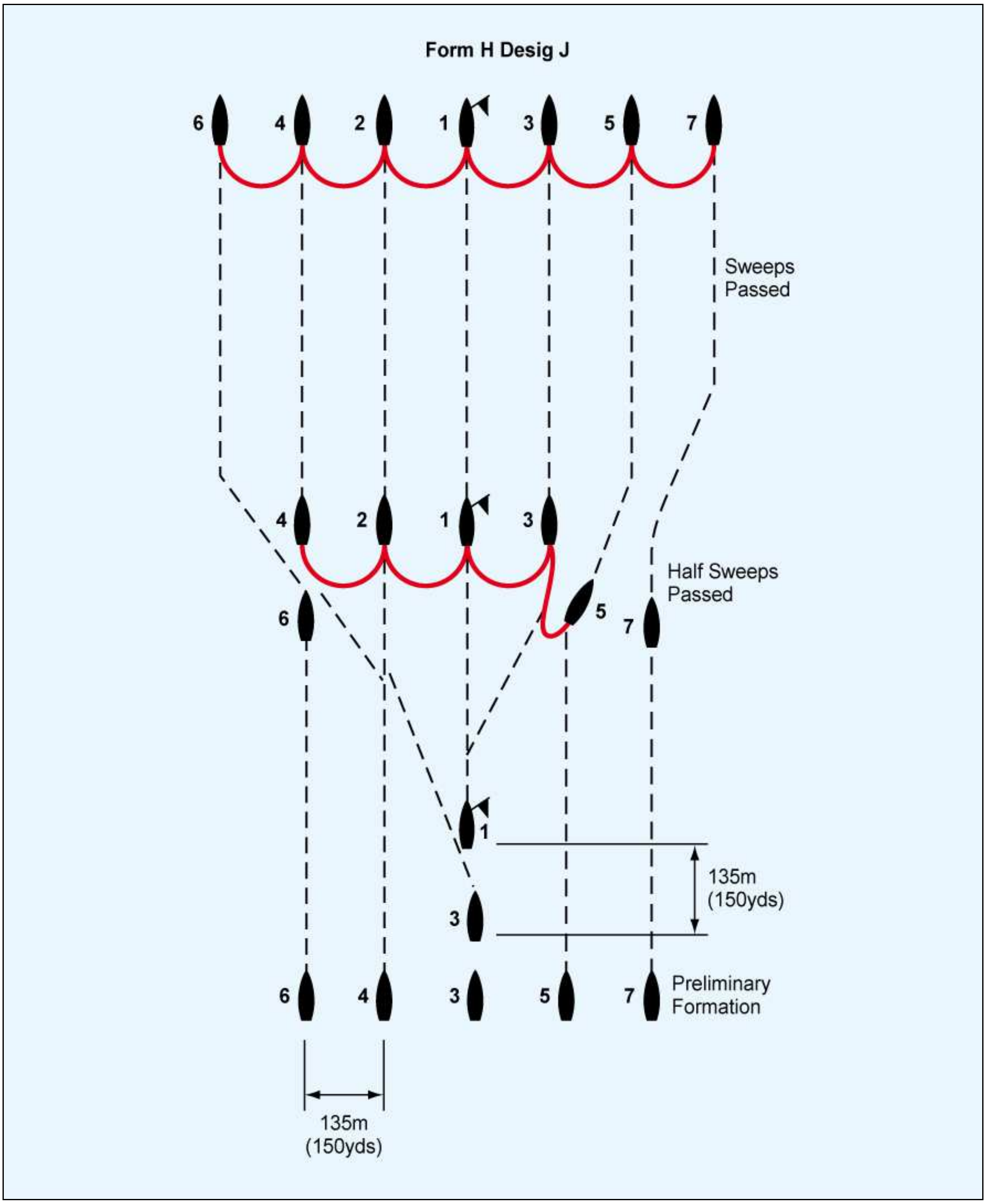

b (NU) Each next consort will be ordered to take station abeam of the receiving ship for passing sweeps when the receiving ship has finished streaming her other sweepwire to 366 metres and has an abeam distance of 366 metres from the ship on her engaged side.

c. (NU) The signal ROMEO ONE is to be hoisted by each ship on the receiving and the delivering side. When a consort (delivering) ship starts her approach on order of her guide (receiving) ship. ROMEO ONE on the delivering side is hauled down. ROMEO ONE on her own receiving side is kept hoisted until she orders the next delivering ship to start the approach on her.

2. (NU) Track-turns

a. (NU) Procedure (see Figure 3A-27)

Phase	Signal Executed by Guide	Action Taken	Signal O/C
1	Corpen L Stbd/Port ...	The OTC (or ship no ...) act as the new guide. Reduce speed and raise kites.	R1
2	Romeo One	Outer ships close in to 135 metres to inner ships one by one, sweeps are hove in to 135 metres and sighted. Use distance indicator flags if ordered by OTC. Guide maintain course an speed.	R2
3	Romeo Two	Outer ships become the new guide. Ships turn (not more than) 30º away from the next track.	R3
4	Romeo Three	Inner ship becomes the new guide. Ships turn back towards the former track course.	R4
5	Romeo Four	The formation wheels 90º in the direction indicated.	R5
6	Romeo Five	The formation wheels again 90º in the direction indicated.	R6
7	Romeo Six	The OTC (or ship no ...) becomes the guide. Outer ships open to 366 metres from the inner ships. Veer sweeps to 366 metres use distance indicator flags if ordered by guide. Guide to maintain course and speed.	R7
8	Romeo Seven	Down kites and stream kite wire to depth ordered.	R8
9	Romeo Eight	Proceed at sweeping speed.	Speed flag

Figure 3A-27. Example of MCM Formation J - Starboard Track Turn

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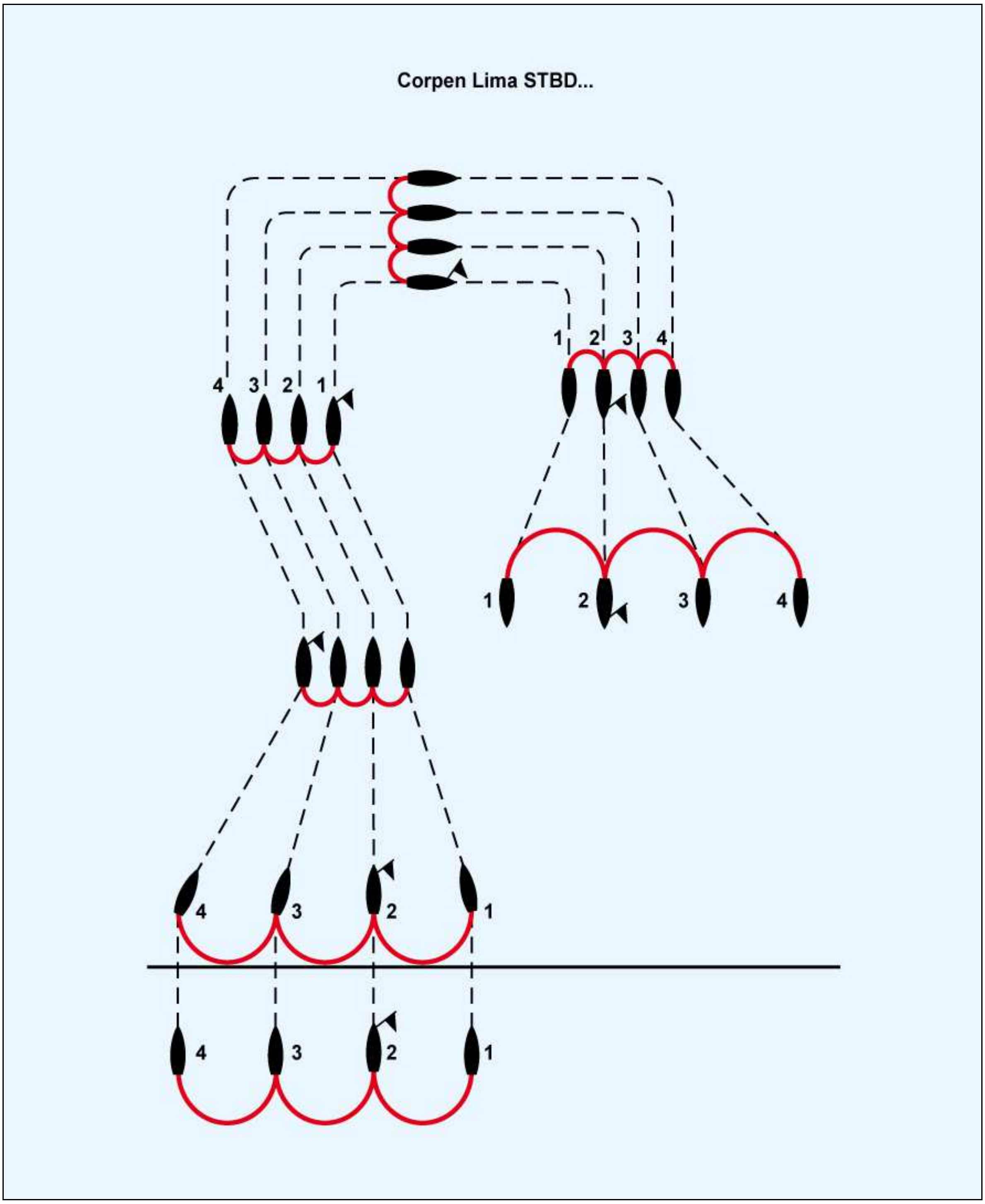

b. (NU) All signals will be executed by the guide (normally the OTC himself will be the guide).

c. (NU) The guide will be responsible for maintaining the ordered speed and for adjusting course so as to follow the right track.

d. (NU) The guide on the next track may be different from the one on the previous track.

3. (NU) Recovering Sweeps

a. (NU) Procedure:

Phase	Signal Executed By		Action Taken	Signal
	Guide	Each guide ship on receiving side		
1	MW 120		The OTC (or ship no ...) act as the new guide. Reduce speed and raise kites.	R1
2		Romeo One	Both outer ships close their inner ships gradually to 91 metres, ships heave in sweeps to 91 metres. Use distance indicator flags if ordered by OTC. Remove cutter 3.	R2
3		Romeo Two	Consort ships close in to 55 metres ships heave in to 55 metres. Remove cutter 2.	R3
4		Romeo Three	Consort ships close in to 30 metres, ships heave in to 30 metres. Remove cutter 1.	R4
5		Romeo Four	Guide ships heave in until sliphook is on sweepdeck, consorts veer as required.	R5
6		Romeo Five	Guide ship slips by surging the messenger attached, consorts to increase speed to 10 knots and recover sweepwires.	

b. (NU) During the slipping procedure of both outer ships, all inner ships will remain at an abeam distance of 366 metres to each other. On slipping of the outer ships, the next two ships start their slipping procedure accordingly.

c. (NU) The ships involved in recovering their sweeps, will have ROMEO ONE hauled down on the recovering side, but will keep ROMEO ONE close up on the side where recovering the sweeps has not yet commenced.

4. (NU) Breakdown Procedure

a. (NU) MCM Formation J, although attractive at first sight, loses much of its attraction when breakdowns can be expected. If a sweep suffers damage, the whole formation reduces speed so as to enable the two ships concerned to recover their kites and sweep. The formation is then readjusted.

b. (NU) In case of breakdown of a ship, the sweep almost invariably parts, and action should therefore be taken as stated above.

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APPENDIX 1 TO ANNEX A TO CHAPTER 3 - NOT RELEASABLE

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

ANNEX B TO CHAPTER 3 - INFLUENCE MINE SWEEPING

SECTION I - (NU) TYPE OF SWEEP

Note: **(NU)** *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

3B01 (NU) General

1. (NU) Influence sweeping is the sweeping of influence mines by detonation through the actuation of their firing systems by providing the appropriate influence field or combination fields. This may be accomplished by one of two methods:

   a. (NU) By towing an influence sweep astern to produce either an influence field of sufficient strength to detonate mines at a safe distance astern, whilst not directly endangering the sweeper, or an influence field extending over such a wide area that, although mines may be detonated inside the damage area of the sweeper, the chances of this occurring are so small as to be acceptable in the interests of rate of sweeping an area.

   b. (NU) By projecting a sufficiently strong influence field, from gear fitted in or towed beneath or behind a drone controlled by a control unit, to detonate mines at a safe distance ahead or abeam.

2. (NU) Influence sweeps may be divided into three principal types according to the influence they produce; magnetic, acoustic, or pressure. They can be used concurrently for sweeping combination mines.

3. (NU) Special consideration must be given to countering mines with seismic, UEP or ELFE sensors.

4. (NU) The information in the following paragraphs concerns the Mine Setting Mode(MSM). Information on Target Simulation Mode (TSM) is contained in MTP-6 Vol II.

3B02 NOT RELEASABLE

3B03 NOT RELEASABLE

3B04 NOT RELEASABLE

Table 3B-1. **NOT RELEASABLE**

Figure 3B-1. **NOT RELEASABLE**

3B05 - 3B10 Spare

SECTION II - (NU) GENERAL INSTRUCTIONS

3B11 (NU) Track Spacing

Considerations and calculations of the track spacing are given in MTP-6, Volume II, in standing operational procedures, national publications or in national instructions.

3B12 (NU) Off-Set Distance

Off-set of the sweeper in relation to Angle E in order to have the centre of the influence of the gear (or combination of gears) following the track are given in national supplements.

3B13 (NU) Distance Between MCM Vessels

1. (NU) When influence sweepers pass close to each other or to other ships there is a danger that the acoustic and/or magnetic output from both the influence sweeps and the ships may combine to cause an unacceptable increase of the influence levels within the damage area of the MCM Unit. To minimize the danger of this occurring, standard safety distances are used.

2. (NU) Sweeps must be de-energized or switched off when the sweeper is at, or within the safety distance from any other ship or MCM unit. For discussion of safety distances see Chapter 1.

3. (NU) Magnetic Sweeps. When only magnetic sweeps are operated the safety distance may be equal to twice the aggregate actuation width of the sweep against the most sensitive mine of this type. If intelligence information is not available the standard safety distance should be calculated assuming a single-look mine with a 50 nT actuation level and a sweep operating at maximum output.

4. (NU) Acoustic Sweeps. When using acoustic sweeps either alone or in combination, a standard safety distance of 1.5 nautical miles is used. This may however be reduced by the OTC in the light of results from former operations or if there is an operational requirement to do so.

3B14 (NU) Execution of the Turn

Track turns are used as described in paragraph 3B22. Where they are executed in waters which may be mined, it is advisable to keep the acoustic sweeps working and the magnetic pulse stopped. In this case it is necessary to avoid sweepers endangering each other by passing too close with their sweeps operating. Whenever possible, turns are to be conducted in such a way that sweepers do not pass each other within influence actuation width with their sweeps energized.

3B15 (NU) Manoeuvring with Sweep Gear

Instructions and information concerning manoeuvring and handling of the different types of sweep gear can be given as national supplements to MTP 24.

3B16 (NU) Sweep Breakdown

1. (NU) When Repairs of Sweep Beyond Ship's Capacity. The CTU of minesweepers orders the MCMV concerned to leave the area or channel to be swept, trying not to hinder the other ships, and proceeding if possible through clear waters.

2. (NU) When Repairs are Within Capacity of Ship's Staff. The CTU of minesweepers may order the MCMV concerned to either continue the task with the other sweeper(s) whilst taking into account the reduction in sweeping effort during the period when the sweep is inoperative or to stop the task and proceed through clear waters towards a favourable area to repair the sweep.

3B17 - 3B20 Spare.

SECTION III - INFLUENCE SWEEPING FORMATIONS

3B21 (NU) General

Formation is the ordered arrangement of two or more MCMVs proceeding together. MCM formations are of two types; the first requires the MCMVs to maintain station on each other, while the second requires the MCMVs to stream and navigate independently. Both types of formation require that each MCMV be responsible for her own safe navigation. The primary difference between the two formations is that for the first type, the guide is responsible for navigation in order to maintain the sweep of the formation on the sweep track. The second type of formation requires that each MCMV navigates to ensure that her own sweep is on the sweep track.

3B22 (NU) Close Formation Sweeping

1. (NU) Station Keeping. In Formations P and Q, there is no station-keeping since the sweepers navigate independently in loose formation, taking care to keep at the indicated distance apart.

2. (NU) Track-turns

   a. (NU) In Formation P, there is no standard track-turn method. The CTU of minesweepers will manoeuvre his forces using CORPEN and TURN signals so as to bring back the formation to the track to be swept as rapidly as possible, taking local geographical features into account.

   b. (NU) In Formation Q:

      (1) (NU) The formation being loose, standard track-turns are not usually used.

      (2) (NU) The CTU of minesweepers allocates tracks to the MCMVs and if necessary, manoeuvres his forces with TURN and CORPEN signals, after having formed the formation Q signals into a column formation taking local geographical features into account. Each MCMV aims individually at her track.

3. (NU) Taking-up Formation

a. (NU) MCM Formation P:

(1) (NU) Taking-up Formation (Figure 3B-2).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H DESIG P	Take up MCM Formation P (see Note 1).	R(1)
2	R(1)	Reduce to streaming speed and stream sweeps, increasing speed in accordance with instructions for the sweeps.	R(2) Red flag and/or black flag at dip when sweeps are ready to energize.
3	R(2)	Guide proceeds at sweeping speed.	
4	Red flag and/or black flag close up	Energize sweeps when entering the track.	

Notes.

1. (NU) Port or Starboard added indicates the side which sweeps are to be streamed. If not signalled, magnetic sweep has to be streamed on port side.

2. (NU) There are no standard track-turn methods for this formation. Track turns should be ordered by using CORPEN or TURN pennants in the normal way.

Figure 3B-2. Example of MCM Formation P

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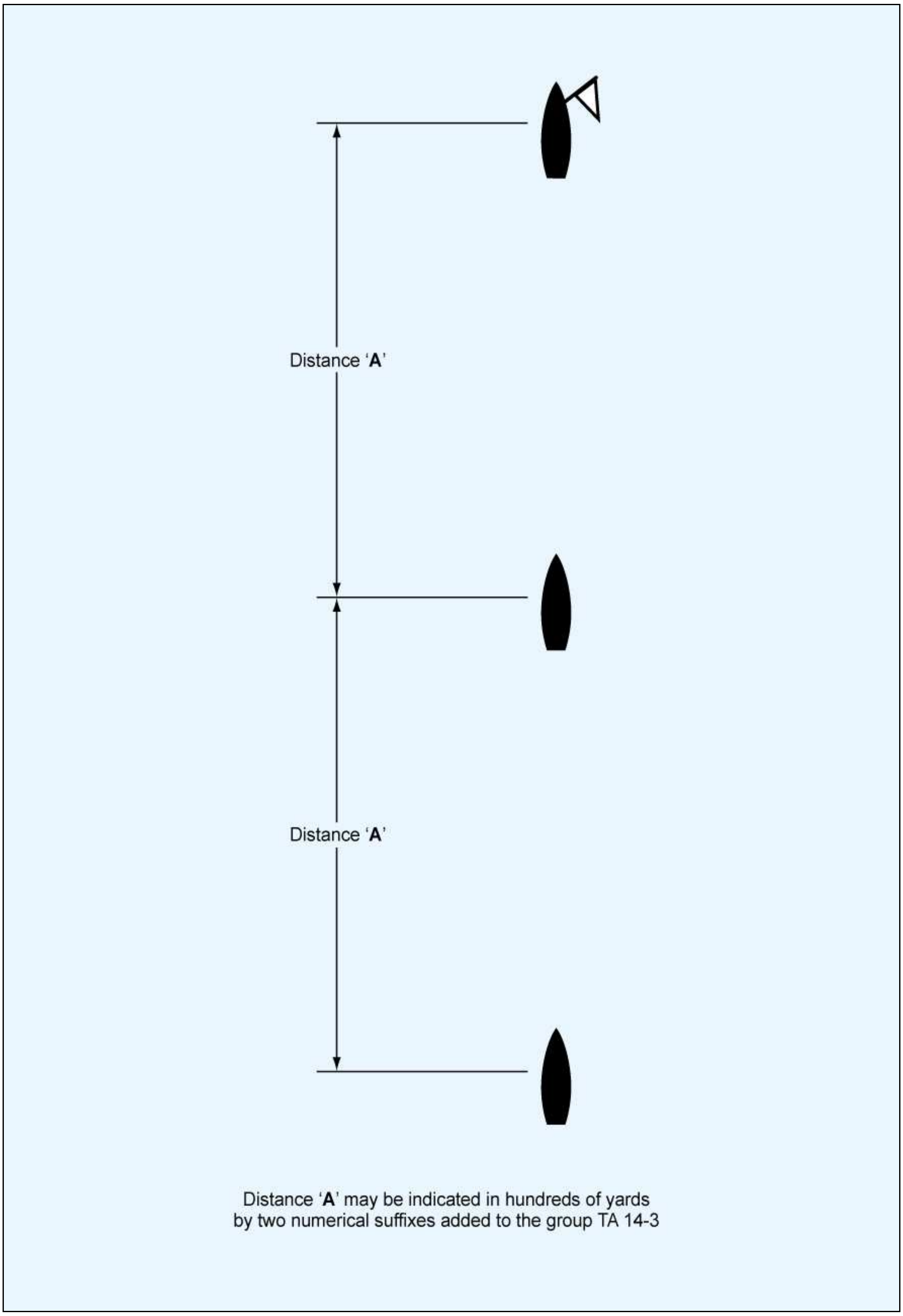

b.(NU) Formation Q:

(1) (NU) Taking-up Formation (Figures 3B-3 and 3B-4).

PHASE NO	SIGNAL EXECUTED BY GUIDE	ACTION TAKEN	SIGNAL ON COMPLETION
1	FORM H STBD (PORT) DESIG Q xy	Take up preliminary Formation Q to starboard (or port).	R(1)
2	R(1)	Reduce to streaming speed and stream sweeps, increasing speed in accordance with instructions for the sweeps.	R(2) Red flag and/or black flag at dip when sweeps are ready to energize.
3	R(2)	Guide proceeds at sweeping speed. Adjust station.	
4	Red flag and/or black flag close up	Energize sweeps when entering the track.	

Notes.

1. (NU) The senior officer must inform ships of angle C and distance A, as the lateral separation of tracks depends on the sweep current used and the mines to be swept.

2. (NU) The suffixes x and y indicate the distance between adjacent ships tracks in tens of metres.

(2) (NU) MCM Formation Q - Track Turns. As indicated in para 3B22.1a. The OTC manoeuvres the formation, in most cases, with CORPEN and TURN.

Figure 3B-3. Example of Preliminary MCM Formation Q

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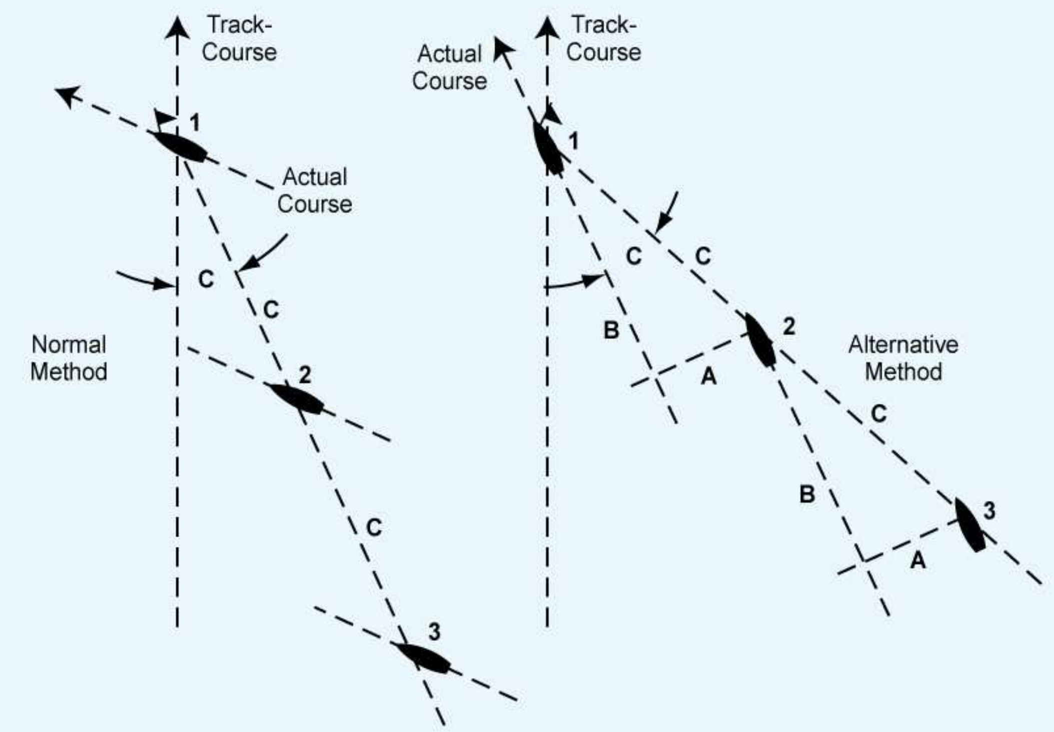

Distance **A** m/yds	Distance **B** m/yds	Distance **C** m/yds	Angle **C°**	Remarks

Figure 3B-4. Example of MCM Formation Q

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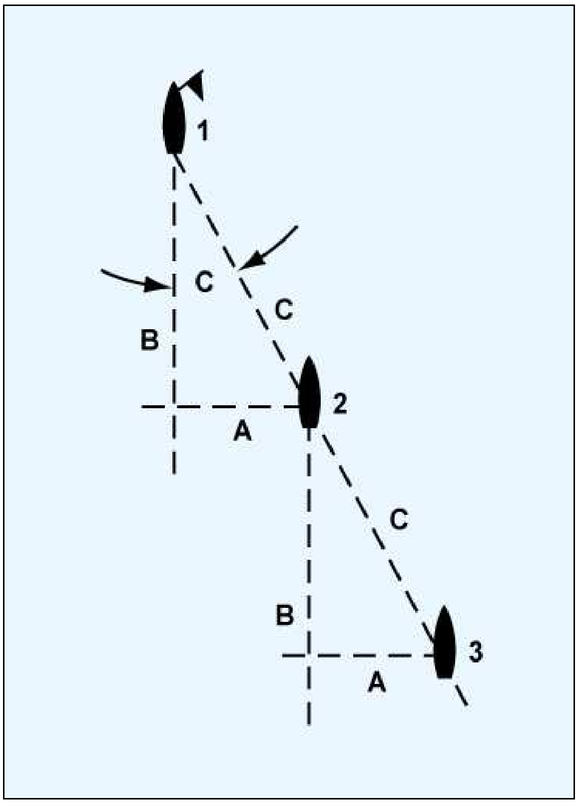

3B23 (NU) Breakdown Procedures

After a breakdown formations are generally re-formed at the end of the track. When the damaged sweeper is the guide, and when he has to leave the formation, the functions of the guide are taken by the next ship astern.

3B24 (NU) Independent Sweeping

1. (NU) The following type formations are established to simplify the preliminary manoeuvring for independent or loose sweeping formations. Distance apart of ships may be varied by separate signal.

2. (NU) FORM H - M 21. Form column in present sequence (or sequence indicated), distance apart as ordered in accordance with paragraph 3B13. When ready, stream sweeps required for next stages. Course will be adjusted by leading ship to enter track in accordance with sweeping plan. Remaining ships conform, each ship being responsible for own navigation.

3. (NU) FORM H - M 22. Ships are to act independently to pass point N (or position indicated) at intervals as ordered in accordance with paragraph 3B13 in order of sequence numbers (or in sequence indicated), on course to take up track in accordance with sweeping plan, with sweeps streamed.

***Note.* (NU)** *FORM H - M 22 should be executed at the same time as ordering 'stream sweeps'.*

4. (NU) FORM H - M 23. Ships are to act independently and stream sweeps, reporting intended time of passing Point N (or other position indicated).

Notes.

1. (NU) Reports should be made between 40 and 20 minutes before the anticipated time of passing point N, and should allow a separation of one mile at sweeping speed from any time of passing already reported by another ship.

2. (NU) The object of this method is to allow maximum flexibility by enabling ships to begin useful sweeping as soon as possible after streaming their gear, without waiting for other ships to complete streaming.

3. (NU) Point N is situated on the route (centreline) 1 nautical mile off the channel entrance (see para 0841.4).

3B25 - 3B30 Spare.

SECTION IV - PRECURSOR ACOUSTIC SWEEPING

3B31 (NU) General

Seven precursor stages against acoustic mines are stated in Chapter 1 of this publication and in MTP-6, Volume II. Two are generally used; 32 alone and 34 in conjunction with one against moored mines (10 or 60 series).

3B32 (NU) Explosive Sweeping (Stage 32)

1. (NU) General. An explosive sweep should, as a general principle, be carried out prior to any minesweeping operation, unless experience has proved it to be inefficient. When a first run in stage 32 has proved successful, it is advisable to carry out at least one more run immediately. In the same way, providing results are still being achieved, it may be desirable to carry out stage 32 from time to time during the course of the operation. Frequent execution of stage 32 will pose serious logistic problems, especially if sweepers are not working close to their bases. Stage 32 is carried out by a single sweeper (with a spare sweeper keeping in her wake at about 150 metres so as to be ready to take over in case of accident to the sweeper or failure of the sweep). Stage 32 should only be carried out simultaneously with a mechanical stage if it is certain that the whole formation is in the safe area. This is not normally the case.

2. (NU) Procedure. The following procedure should be adopted:

a (NU) Speed and sequences should be so adjusted as to allow grenades to be fired approximately every 350 metres in waters of less than 15m and every 700 metres in depths greater than 15 metres.

b. (NU) Sweeping should begin four nautical miles from the mined area, proceeding from deepest to shallowest water and should where possible end four nautical miles beyond the area.

c. (NU) Sweepers should avoid passing over shallows, or too close to rocks or sandbanks, as these impede the propagation of sound.

d. (NU) Off a harbour, runs should be made at right angles to the axis of the approach channel, progressing gradually towards the entrance, and taking possible screens (such as piers, jetties, breakwaters etc) into account.

e. (NU) The OTC orders this stage to be carried out by an individual MCMV escorted by a spare. One of these two MCMVs may be charged with the preliminary buoying of the area.

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CHAPTER 4 - MINEHUNTING BY MCM UNITS

SECTION I - (NU) GENERAL ASPECTS OF MINEHUNTING

***Note:* (NU)** *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0401 (NU) Minehunting Operations

1. (NU) Operations to be carried out by minehunting units are listed and described in MTP-6, Volume II, Chapter 4.

2. (NU) This Chapter deals with the conduct of these operations by the various minehunting assets in service.

0402 (NU) Minehunting Conditions and Procedures

1. (NU) It is important to stress that assessments of minehunting conditions are normally unique to a given type of sonar and are not necessarily the same when other types of sonar/sensors are used.

2. (NU) The choice of procedure can only be made in the minehunting area. The following can assist the commanding officer in determining the correct procedure:

a. (NU) Sonar Conditions Check (SCC) (See Note). Used to assess the environmental conditions in the operations area to check and optimise the performance of the ships minehunting sonar. This can be achieved by purpose built equipment or laying a dummy mine or another object whose sonar characteristics are known and match those of the threat mine or mines .

b. (NU) Sonar Confidence Check (See Note). This check can be conducted against a dummy mine or other object whose sonar characteristics are known and match those of the threat mine or mines. Carried out when confidence in the detection range or other function of the sonar is questionable.

Note. *(NU) Specific procedures vary according to national requirements and equipment.*

c. (NU) Assessment of the reverberation level either by the strength of an echo from a sonar reflector, or by injecting a dummy signal, or using a device for measuring the bottom reverberation.

d. (NU) Assessing Environmental Parameters

(1) (NU) If divers are embarked or are available**,** periodic dives should be conducted to assess environmental parameters as considered necessary and as follows:

(a) (NU) Sonar Conditions Check (SCC) as described in MTP-6 Vol II.

(b) (NU) Any other dive (eg. ID of a MILCO).

(2) (NU) Where no divers are available UUVs can be used to assess environmental parameters such as mine burial, seabed characteristics, visibility, tidal stream and direction.

e. (NU) Knowledge of the area stored in local MWDCs and in Mine Warfare Pilots, sonar data sheets, charted information on a large scale chart including REA information and AMLs.

3. (NU) If, on arrival in the area, the minehunting sonar conditions are considered bad, the Commanding Officer should signal this fact to the next highest authority.

0403 (NU) Plotting for Reacquisition of Contacts in Minehunting

1. (NU) The advantages of precise location allows action to be taken, with a high degree of accuracy, whenever it is not possible or practical to investigate a detected contact immediately. Navigational accuracy of contacts is detailed in MTP-6 Vol II, Chapter 8 para 0801

2. (NU) When using towed sonars a precise location is difficult with cross-tide or cross-wind. Knowledge of Angle Echo may be important. (See Chapter 3, Section 2). Sometimes the currents close to the bottom are different from those near the surface (used to calculate Angle E) and an allowance for this must be made during the analysis of the results obtained during the operation.

0404 (NU) Environment in Minehunting

1. (NU) Bottom Characteristics

a. (NU) Mine Burial. Mines laid on mud or sand bottoms may be subject to burial under certain environmental conditions. Burial causes a reduction in the detection capability of minehunting sonars, which ultimately influences the effectiveness of a mine countermeasures operation (see MTP-6 Vol II Chapter 7, Annex B).

b. (NU) Composition. The composition of the seabed may be mud, sand or rock, or various combinations of these. Minehunting sonar performance will be degraded in areas of rock bottoms and wherever there is a mine burial in a mud or sand bottom.

c. (NU) Profile. Smooth flat bottoms pose no significant problems to minehunting equipment. However, if the bottom contains tall obstructions, deep holes, or sharply sloping regions, the effectiveness of minehunting gear may be greatly reduced. Mines may be hidden in holes or behind rocks, and towed gear may snag on underwater obstacles. Such areas should be noted and marked on a chart. Bottom profiles are grouped into three types, defined as follows:

(1) (NU) Smooth. Very few craters, gullies, or ridges which would conceal or partially obscure mine-sized targets (5 per cent or less of the area), or sand ripples 15 cm (6 inches) high or less.

(2) (NU) Moderately Rough. Considerable number of craters, gullies, ridges, seaweed patches or 15-30 cm (6-12 inch) sand ripples which may conceal or partially obscure mine-sized targets (5 to 15 per cent of the area).

(3) (NU) Rough. Extensive areas where craters, gullies, ridges, large sand ripples, etc would conceal mine-sized targets (over 15 per cent of the area).

2. (NU) Description of Minehunting Sonar Echoes

a. (NU) Operational Minehunting Clutter (OPS MH CLUTTER). During the detection phase all echoes detected by a minehunting sonar/sensor which are repeatedly above the noise or the average reverberation background are referred to as Operational Minehunting Clutter. In general as clutter increases minehunting operational performance decreases. It is emphasized that clutter as well as the impact of clutter depends on the type of sonar being used.

b. (NU) Minelike Echoes (MILEC). These are echoes, which are, during the detection phase, selected within the clutter by sonar operator or automatic processing as being Minelike by criteria depending on the type of sonar being used and also on the experience such operators have in the use of their sonar. A minelike echo can be a source for:

(1) (NU) A minelike contact (MILCO).

(2) (NU) A non minelike contact (NONMILCO).

c. NOT RELEASABLE

Notes:

1. NOT RELEASABLE

2. NOT RELEASABLE.

Table 4-1. NOT RELEASABLE

d. (NU) Minelike Contacts (MILCO). A minelike echo selected during the classification phase is referred to as a minelike contact. Contacts are selected by sonar operators by assessment of their shape, size, shadow, structure, persistency and other criteria depending on the type of sonar being used and also on the experience such operators have in the use of their sonar. A minelike contact can be the source for:

(1) (NU) A mine.

(2) (NU) A non mine minelike bottom object (NOMBO).

e. (NU) Sonar Contact Confidence Level. The classification MILCO can be amplified by adding the Sonar Contact Confidence Level (SCCL), see MTP-6 Vol II para 0402.3.

f. (NU) Non Mine Minelike Bottom Objects (NOMBOs). Non mine minelike bottom objects are objects which are identified as non mine. They emanate from rock, reef, man made debris and may give minelike responses on minehunting sonars. In general as NOMBO Density increases minehunting performance decreases.

(1) NOT RELEASABLE

g. (NU) A diagrammatic representation of this decision process is given in the flow chart at Figure 4-1.

3. (NU) Bottom Classification. Bottom classifications are characterised with an alphanumeric combination of a letter and figure in which the letter represents the Bottom Type (see Table 4-2) and the figure represents the MILEC Density (not releasable). An exception is made for a D type Bottom in which the figure is replaced with a second letter to indicate the reason why this type of bottom is unhuntable (see Table 4-3).

Figure 4-1. Minehunting Flow Chart

NATO-UNCLASSIFIED

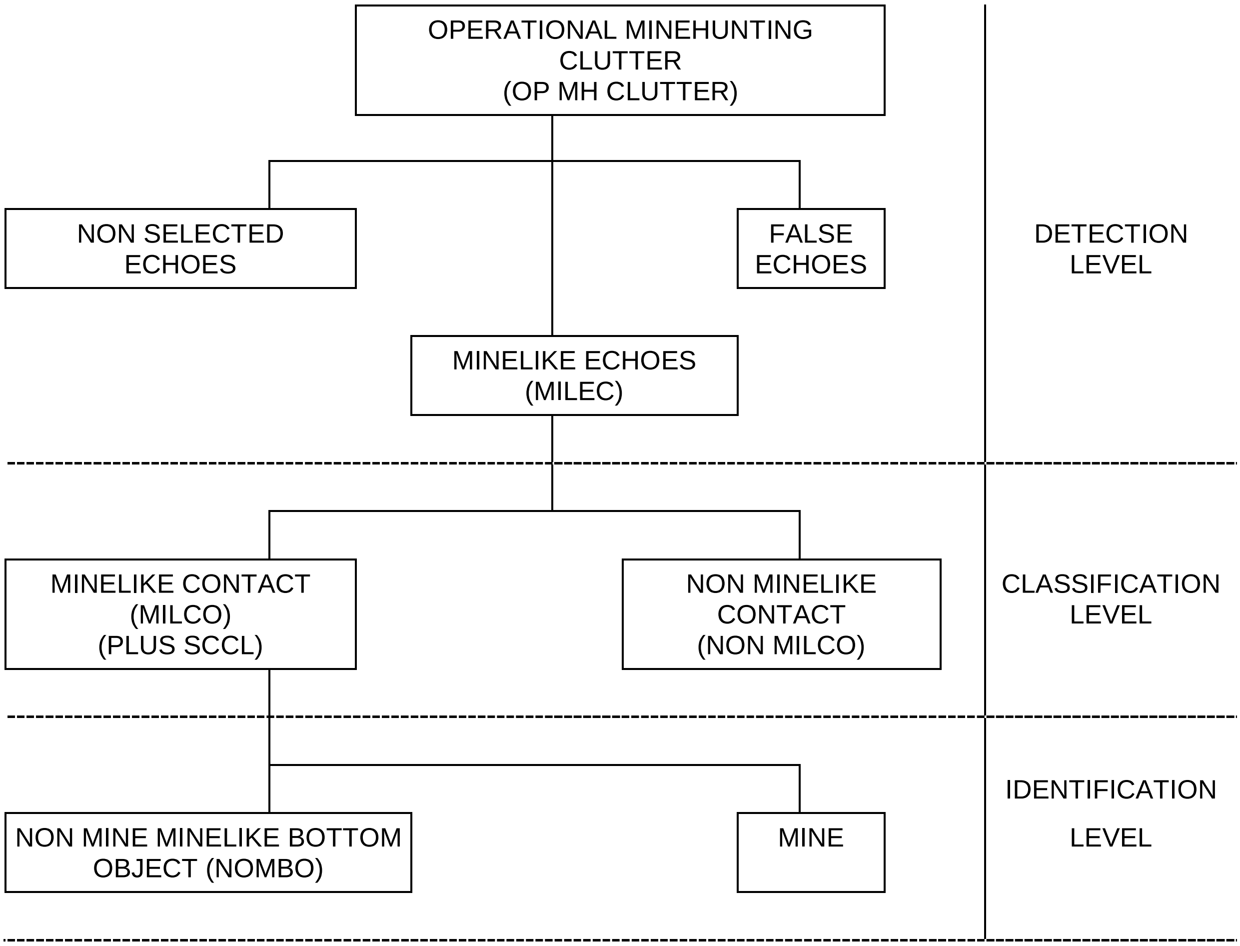

Table 4-2. Bottom Profile

BOTTOM PROFILE	RIPPLES/HOLES/BUMPS/RIDGES/FOLDS
Smooth	≤ 15cm
Moderately Rough	≤ 30cm
Rough	> 30cm
NATO-UNCLASSIFIED	

Table 4-3. Bottom Types

BOTTOM COMPOSITION	MINE BURIAL	BOTTOM PROFILE	BOTTOM TYPE *(See Table 4-4)*
Mud/Sand/Gravel	0cm - 15cm	Smooth	A
		Moderately Rough	B
		Rough	C
	16cm - 30cm	Smooth	B
		Moderately Rough	B
		Rough	C
	31cm - 45cm	Smooth	B
		Moderately Rough	C
		Rough	C
	> 45cm	Smooth	C
		Moderately Rough	C
		Rough	C
Rock	0cm	Smooth	B
		Moderately Rough	C
		Rough	C
Mud/Sand/Gravel/Rock	D (See Table 4-5)	All	D
NATO-UNCLASSIFIED			

Table 4-4. Bottom Types Vs Minehunting Conditions

TYPE	MINEHUNTING CONDITIONS
A	Good area for minehunting. Covering the area once with parallel tracks is normally sufficient.
B	Minehunting is possible. Minehunting effectiveness may be improved by covering the area twice with tracks at different aspect angles to each other eg. 60˚.
C	Minehunting is difficult. Covering the area twice at differing aspect angles is necessary but, even so, the detection probability will be low.
D	Effective minehunting is not possible.
NATO-UNCLASSIFIED	

Table 4-5. Causes for Hidden Mines

CAUSE	BOTTOM TYPE
(a) By irregularities of the bottom	**DR** (R for rock)
(b) By seaweed	**DV** (V for varec)
(c) Owing to complete burial (mines may be buried permanently or break surface from time to time)	**DB** (B for burial)
(d) In deep hollows or crevasses or by cliffs	**DH** (H for hollow)
(e) For other reasons	**DZ**
NATO-UNCLASSIFIED	

0405 (NU) Minehunting Speeds

1. (NU) The choice of speeds used in minehunting operations is a function of a number of factors including:

a. (NU) The technical characteristics of the equipment.

b. (NU) Environmental conditions.

c. (NU) The number of mine-like contacts.

d. (NU) The efficiency of previous surveys.

e. (NU) The experience and performance of the sonar operator.

f. (NU) The target strength of the expected mine threat.

g. (NU) The ordered task.

0406 (NU) Risk Directive for Minehunting Operations (See MTP-6 Vol II Chapter 1, Annex A)

1. (NU) When minehunting, an MCMV has more freedom to manoeuvre than an MCMV which is minesweeping. Therefore, the use of Risk Directives may be more useful for minehunting than for minesweeping. However, if they are to be used, Risk Directives must be stated in national supplements or standard orders.

2. NOT RELEASABLE

0407 (NU) Mine Disposal and Recovery

1. (NU) Once a mine has been detected, the physical disposal of the mine may be ordered. The Minehunter will use a Remote Operated Vehicle (ROV) or clearance divers. Some physical disposal methods are given in ATP-6, Volume II, Chapter 7.

2. NOT RELEASABLE

3. NOT RELEASABLE

4. NOT RELEASABLE

Note. NOT RELEASABLE

0408 NOT RELEASABLE

0409 NOT RELEASABLE

0410 Spare.

SECTION II - CONDUCT OF OPERATIONS BY MINEHUNTERS USING VARIABLE DEPTH OR HULL-MOUNTED SONARS

0411 NOT RELEASABLE

0412 (NU) Exploratory Operations

Exploratory Operations consist of hunting a route or area to determine the presence or absence of mines and to establish the picture of the mine threat, after which further operations may be undertaken. The procedure for calculating track spacing and number of runs is detailed in MTP-6, Volume II, Chapter 11.

0413 (NU) Reconnaissance Operations

1. (NU) A reconnaissance operation is an operation designed to make an assessment of the limits of a mined area and if appropriate to establish a diversion route

2. (NU) In a reconnaissance operation minehunters do not necessarily follow parallel tracks, but select the best route for their task.

0414 (NU) Clearance Operations

1. (NU) In clearance operations the minehunting unit follows parallel tracks; the separation of which is calculated as detailed in MTP-6, Volume II, and depends on the percentage clearance required. In some environmental conditions and to compensate for unfavourable mine aspects, some additional effort may be appropriate. This might be:

   a. (NU) The use of additional tracks parallel to and between those already hunted.

   b. (NU) The use of side-scan mode along the same track.

   c. (NU) The use of additional tracks at differing aspect angles (eg. 60˚) to those already hunted (This is only practicable in areas or wide channels).

0415 (NU) Time Constrained Operations

General information on such operations can be found in MTP-6, Volume II, Chapter 11.

0416 (NU) Check Operations

A check task may be ordered to check and confirm as far as possible, that no mines are left after a previous MCM operation. Check operations are planned and evaluated in the same way as exploratory operations.

0417 - 0420 Spare.

SECTION III - NOT RELEASABLE

0421 NOT RELEASABLE

0422 NOT RELEASABLE

0423 NOT RELEASABLE

0424 NOT RELEASABLE

0425 NOT RELEASABLE

0426 NOT RELEASABLE

0427 - 0430 Spare.

SECTION IV - NOT RELEASABLE

0431 NOT RELEASABLE

0432 NOT RELEASABLE

0433 NOT RELEASABLE

0434 - 0440 Spare.

SECTION V - CO-OPERATION

0441 (NU) Co-operation Between Minehunters

1. (NU) Minehunters should normally operate independently at least one mile apart to eliminate sonar mutual interference. The potential danger to ships, divers and UUVs, from underwater shock following detonations must also be considered and safe distances are listed in Table 1-12 in Chapter 1.

2. (NU) It is the responsibility of the Commanding Officer of the ship conducting mine disposal to inform ships in adjacent areas prior to detonation of a charge

3. (NU) Formation searching is normally impractical, and the Tasking Authority should allocate specific tasks to each minehunter.

4. (NU) Communications are required between minehunters, and separate VHF channels need to be allocated for controlling dinghies.

0442 (NU) Coordination Between Minehunters and Minesweepers

1. (NU) The Tasking Authority of a combined minehunting/sweeping force should be embarked in a minehunter if there is no command ship available, and should assess the nature of the environmental conditions and the mining intelligence in order to decide which areas are most suitable for the different types of operations. The following factors should be borne in mind:

   a. (NU) Minehunters should not operate within a distance of sweepers equal to the sweepers' maximum possible actuation range.

   b. (NU) Divers should not operate within a distance of sweepers equal to the sum of 1.5nm plus the sweepers' maximum actuation range. (See also MTP-6 Vol II Chapter 1, Table 1-1).

0443 (NU) Co-operation Between Minehunters and Clearance Divers

1. (NU) Co-operation between minehunters and clearance divers not embarked onboard need good communications to ensure the safety of divers. The following paragraphs list the possible tasks of divers to assist the minehunter:

   a. (NU) When the number of mines is too large for the minehunter's disposal capability.

   b. (NU) When employment of mine disposal weapons is dangerous to units, personnel or critical infrastructure in the vicinity.

   c. (NU) If the minehunter can only locate, classify and mark (with precision), the clearance divers will then identify, dispose, recover or remove the mine as ordered.

   d. (NU) If the hunter can locate and classify, but cannot mark, clearance divers have to relocate the contact before further work can be progressed.

2. (NU) Minehunters can assist diving teams in cases where strong currents or bad visibility are hampering diving operations but when the water is deep enough to conduct minehunting.

3. (NU) Beach clearance as part of amphibious operations is an additional consideration.

4. (NU) A minehunter can provide data to divers from REA operations in preparation for a VSW MCM task.

ANNEX A TO CHAPTER 4 - NOT RELEASABLE

4A01 NOT RELEASABLE

4A02 NOT RELEASABLE

4A03 NOT RELEASABLE

Figure 4A-1. NOT RELEASABLE

4A04 NOT RELEASABLE

4A05 NOT RELEASABLE

4A06 NOT RELEASABLE

Figure 4A-2. NOT RELEASABLE

4A07 NOT RELEASABLE

Figure 4A-3. NOT RELEASABLE

4A08 NOT RELEASABLE

Figure 4A-4. NOT RELEASABLE

4A09. NOT RELEASABLE

Figure 4A-5. NOT RELEASABLE

4A10 NOT RELEASABLE

Figure 4A-6. NOT RELEASABLE

4A11 NOT RELEASABLE

Figure 4A-7. NOT RELEASABLE

4A12 NOT RELEASABLE

Figure 4A-8. NOT RELEASABLE

4A13 NOT RELEASABLE

Figure 4A-9. NOT RELEASABLE

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ANNEX B TO CHAPTER 4 - NOT RELEASABLE

4B01 NOT RELEASABLE

4B02 NOT RELEASABLE

4B03 NOT RELEASABLE

4B04 NOT RELEASABLE

Figure 4B-1. NOT RELEASABLE

Figure 4B-1 NOT RELEASABLE

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CHAPTER 5 - CLEARANCE DIVING OPERATIONS

SECTION I - GENERAL

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0501 (NU) Introduction

1. (NU) Clearance diving is the independent use of divers for the location, identification and disposal of mines and of underwater ordnance.

2. (NU) Clearance diving operations are ordered by the appropriate naval authority, as for minesweeping and minehunting.

3. (NU) The following instructions contain the broad principles governing the use of existing equipment and the methods applied.

4. (NU) This chapter is to be applied in conjunction with ADivP-1(A) (Allied and Multi-National Guide to Diving Operations).

5. (NU) The US uses trained dolphins, either independently or in conjunction with EOD MCM divers to locate, identify and dispose of mines.

0502 (NU) Clearance Diving Techniques

1. (NU) Location of mines.

2. (NU) Identification of mines.

3. (NU) Disposal of mines.

0503 (NU) Endurance of Divers

1. (NU) The endurance and efficiency of divers is affected by:

   a. (NU) Surface Conditions

      (1) (NU) Sea state.

      (2) (NU) Weather.

      (3) (NU) Temperature.

      (4) (NU) Amount/type of support.

b. (NU) Sub-surface Conditions

(1) (NU) Water temperature.

(2) (NU) Current.

(3) (NU) Depth.

(4) (NU) Type of bottom.

(5) (NU) Method of propulsion.

2. (NU) The endurance of divers is also effected by the equipment they are using, and the gas mixture in use. Factors to be considered are dealt with in ADivP-1(A) as follows:

a. (NU) Section One. Chapter 1: General Considerations on the Use of Divers.

b. (NU) Section Two. Chapter 11: Diving Breathing Gases and Interoperability of Gas Supplies.

3. NOT RELEASABLE

0504 (NU) Risk Directive Matrix for Diving Operations

1. (NU) The safety measures to be taken by divers are a national responsibility. The OPCON Authority must, therefore be provided with national regulations for the divers (time tables, directives etc).

2. (NU) Further detailed information on MCM Risk Directives is given in MTP-6 Volume II Chapter 1. para 0106 and Annex 1A. Detailed information on the Diving related aspects of the Risk Directives is also contained in MTP-6 Volume II, Annex 1A.

0505 (NU) Communications

Clearance diving teams (CDT) should have organized communications with their tasking authority and portable communications sets with appropriate frequencies to communicate with other units.

0506 (NU) Environmental Factors

Environmental factors which have to be considered when planning clearance diving operations are dealt with in MTP-6 Volume II, Chapter 7.

0507-0510 Spare.

SECTION II - NOT RELEASABLE

0511 NOT RELEASABLE

0512 NOT RELEASABLE

0513 NOT RELEASABLE

0514 NOT RELEASABLE

0515-0520 Spare.

Figure 5-1. NOT RELEASABLE

Figure 5-2 NOT RELEASABLE

Figure 5-3. NOT RELEASABLE

Figure 5-4. NOT RELEASABLE

SECTION III – NOT RELEASABLE

0521 NOT RELEASABLE

0522 NOT RELEASABLE

Figure 5-5. NOT RELEASABLE

Figure 5-6. NOT RELEASABLE

Figure 5-7. NOT RELEASABLE

0523 NOT RELEASABLE

Figure 5-8. NOT RELEASABLE

Figure 5-9. NOT RELEASABLE

Figure 5-10. NOT RELEASABLE

Figure 5-11. NOT RELEASABLE

Figure 5-12. NOT RELEASABLE

Figure 5-13 NOT RELEASABLE

0524 NOT RELEASABLE

0525 NOT RELEASABLE

0526-0530 Spare.

Figure 5-14. NOT RELEASABLE

SECTION IV - (NU) MINE DISPOSAL AND EXPLOSIVE ORDNANCE DISPOSAL (EOD)

0531 (NU) Defintions

1. (NU) Mine disposal is defined in AAP-6 as the operation, by suitably qualified personnel, designed to render safe, neutralize, recover, remove or destroy mines.

2. (NU) Explosive ordnance disposal is defined as the detection, identification and field evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.

3. NOT RELEASABLE

0532 (NU) Stages of Disposal

1. (NU) Explosive ordnance disposal may be carried out in two stages:

   a. (NU) Disposal Stage 1. Making the ordnance no longer dangerous to shipping or to other activities which normally take place in the area in which the device is left. This is achieved by deliberate destruction in situ, rendering safe, neutralization or removal of the ordnance other than by actuation and consequent firing of the main charge.

   b. (NU) Disposal Stage 2. Making the ordnance no longer a danger to anyone. This less urgent stage involves disposal of all explosives and fittings which may cause harm; eg cocked strikers, acid containers, high voltage batteries etc.

2. (NU) When ordnance is found in the sea, the first stage will normally be adequate.

0533 (NU) Organisation

1. (NU) The organization for explosive disposal is a national commitment within the terms of STANAG 2143 EOD, the duty normally being carried out by specially trained personnel formed into explosive ordnance disposal units or clearance diving teams.

2. NOT RELEASABLE

0534-0540 Spare.

SECTION V - DIVING SAFETY DURING CLEARANCE DIVING

0541 (NU) Diving Safety

In Section One, Chapter 2, of Allied Guide to Diving Operations (ADivP-1) all aspects of diving safety are covered.

0542 (NU) Coupling Compression Chambers

In ADivP-1 Section Two, Chapter 12, the standard adaptor set for compression chambers is specified. In para 1215 the required horizontal clearance for coupling compression chambers is listed.

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CHAPTER 6 - AIRBORNE MINE COUNTERMEASURES

SECTION I - GENERAL

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0601 (NU) Introduction

This Chapter contains general information about AMCM equipment, MCM configurations currently in use and basic tactical information which may be of value to the Officer of the Watch on the bridge of a surface vessel. No attempt is made to describe in detail particular AMCM techniques, methods, or procedures. AMCM can be a highly effective mine countermeasures asset. The advantages of AMCM are the high transit speed to the minefield, the high speed towing in the minefield, and the fact that the MCM platform is not physically in the minefield. AMCM is sometimes limited by it's sweep depth and it's inability to identify mine like contacts as mines. Additionally, AMCM can only be conducted during daylight hours. AMCM is best used in conjunction with Surface MCM ships and Explosive Ordnance Disposal (EOD) assets. AMCM aircraft can deploy from shore, or from large support ships.

0602 (NU) Air Visual Minehunting

1. (NU) A factor for consideration in MCM operational planning is that mines can sometimes be sighted visually by observers in low flying aircraft, particularly helicopters. However, an area searched visually with negative results should not be considered free of mines. The principal advantage of this technique, which is described in this paragraph, is that large areas may be searched in a relatively short time. A principal disadvantage is that the confidence level must remain very low.

a. (NU) Aerial Visual Search Techniques. The general search and disposal procedures for this technique are as follows:

(1) (NU) Several longitudinal and lateral runs are made over an area by the search aircraft, which can be helicopters or slow-moving fixed-wing aircraft.

(2) (NU) A plot of all contacts sighted in the area being searched is maintained.

(3) (NU) Mine-like contacts are marked with mini-buoys or other semi-permanent markers.

(4) (NU) Selected sites are subjected to swimmer investigation.

b. (NU) Observers in the search aircraft will normally be able to detect floating mines and mines at shallow depth. Under optimum conditions ground mines and moored mines at deeper case depths may be observed. These optimum conditions are:

(1) (NU) Clear water with good bottom-mine contrast.

(2) (NU) Clear sky.

(3) (NU) Sun between 40 and 70 degrees.

(4) (NU) Calm sea (sea state 1 or less).

c. (NU) The lack of any one of the foregoing conditions usually precludes effective aerial visual search. However, since these conditions are highly variable, an aerial exploratory search should be included in any MCM operational plan or operation in which aerial assets are available.

d. (NU) Speed. The optimum search speed is sensitive to the environmental conditions and is, therefore, that which is best for the observer.

e. (NU) Altitude. When searching for individual mines, altitude is maintained between 500 and 600 feet. When searching for minefield patterns, altitude of about 1200 feet is maintained.

f. (NU) Solar Attitude. Optimum search conditions exist when the sun is behind the observer and between 40 and 70 degrees from the horizon.

g. (NU) Scan Angle. The observer should scan the water from directly below to within 40 degrees of the vertical.

h. (NU) Marking Technique. The searcher should mark mines and minefields by dropping buoys, acoustic markers, or other markers directly after detection.

i. (NU) Disposal Technique. Swimmer disposal may be used selectively to investigate and dispose of marked contacts.

2. (NU) Precursor Search of Anchorages. Consideration should be given to tasking a helicopter to conduct a visual search for floating mines upstream of an anchorage that is to be used by the Task Group/MCM Force.

0603 - 0610 Spare.

SECTION II - (NU) EQUIPMENT DESCRIPTION AND CONFIGURATION

0611 (NU) Helicopter (US)

1. (NU) The helicopter presently used in AMCM operations in the US is the MH-53(E). The MH-53(E) is a three engine, single rotor helicopter.

2. NOT RELEASABLE

0612 (NU) Mechanical Mine Sweeping Equipment (see Figure 6-1)

1. (NU) The most common airborne mechanical sweep system in use today is the US Mk 103 system. The Mk 103 system consists of four otters and one depressor, each with 3-6 square feet of wing area, four Mk 19 support floats, one Mk 19 lead float, 229 m (750 ft) of 1.11 cm (7/16 inch) tow wire, four 198m (650 ft) lengths of 0.71 cm (1/4 inch) corrosion resistant steel sweep wire, and associated pendant and link assemblies.

2. (NU) The Mk 103 Mod 2 system has four different assemblies that can be deployed at four separate depths. The gear is specially designed to be light weight and compact for airborne transport and rapid deployment. The overall length of a particular sweep configuration can be computed by adding the length of the tow wire 229m (750ft) to the length of the sweep wire 198m (650 ft). Sweep widths will vary based on the assembly. The characteristic sweep width of a full-set assembly (02) is approximately 288.5m (750 ft). The half-set assembly (04) has a sweep width of 137m (450 ft). The sweep wire of all the assemblies are fixed in length and have small steel cylinders crimped onto the sweep wire, A.K.A. “Chipper Wire”. These slugs have sharp cutting faces on the forward end and provide additional cutting ability for the sweep gear. The primary cutting unit is the powder-actuated MK 17 Mod 1 cutter. However, the combination of the chipper wire and the MK 17 Mod 1 cutter provide for maximum sweep efficiency. The use of the other two assemblies (06 and 08) may be required due to confined space or obstructions in the area to be swept.

3. NOT RELEASABLE

4. NOT RELEASABLE

5. NOT RELEASABLE

Figure 6-1. Mechanical Sweep Assemblies Mk 103 (US)

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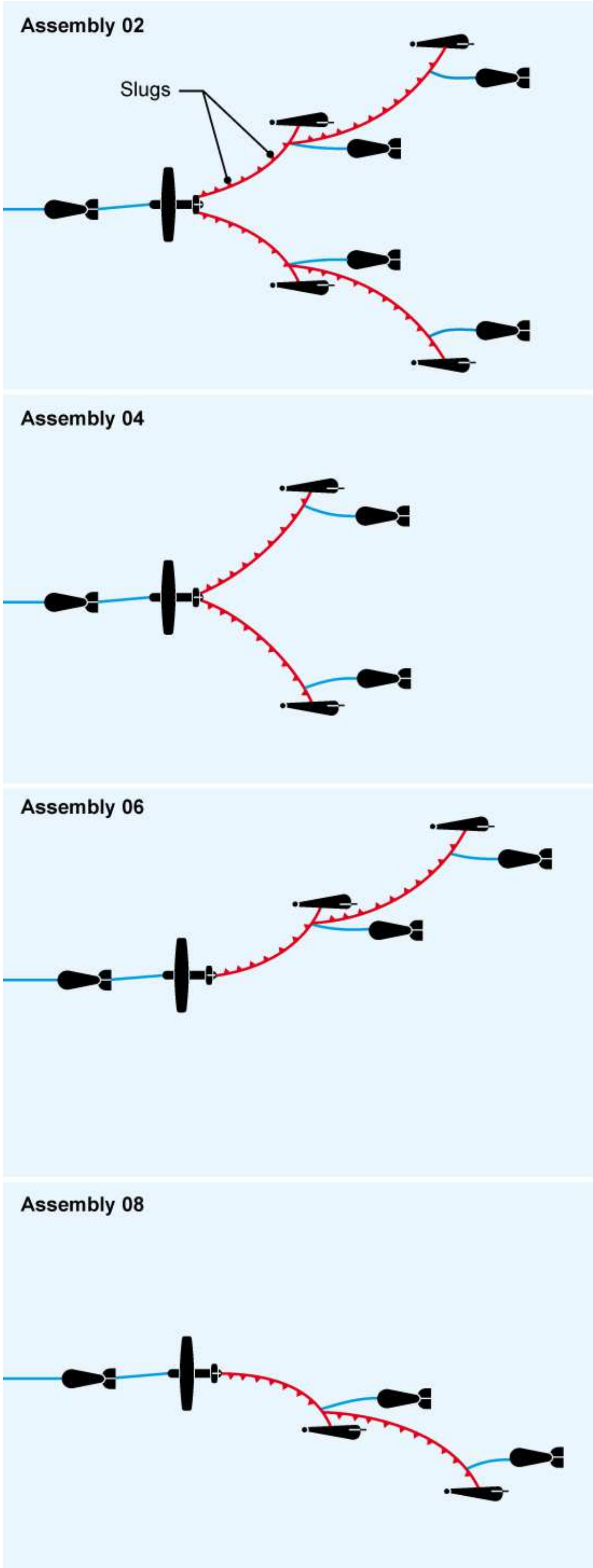

Figure 6-2. (U) Mk 17 Mod 1 Cutter (US)

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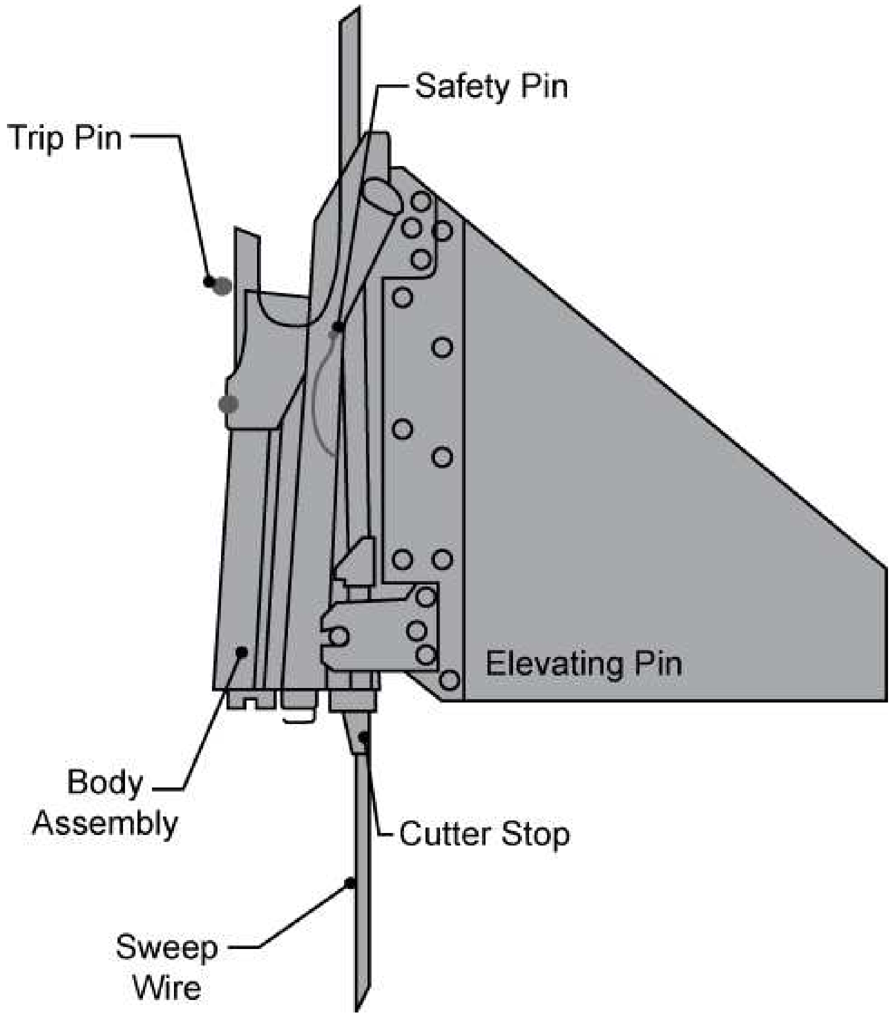


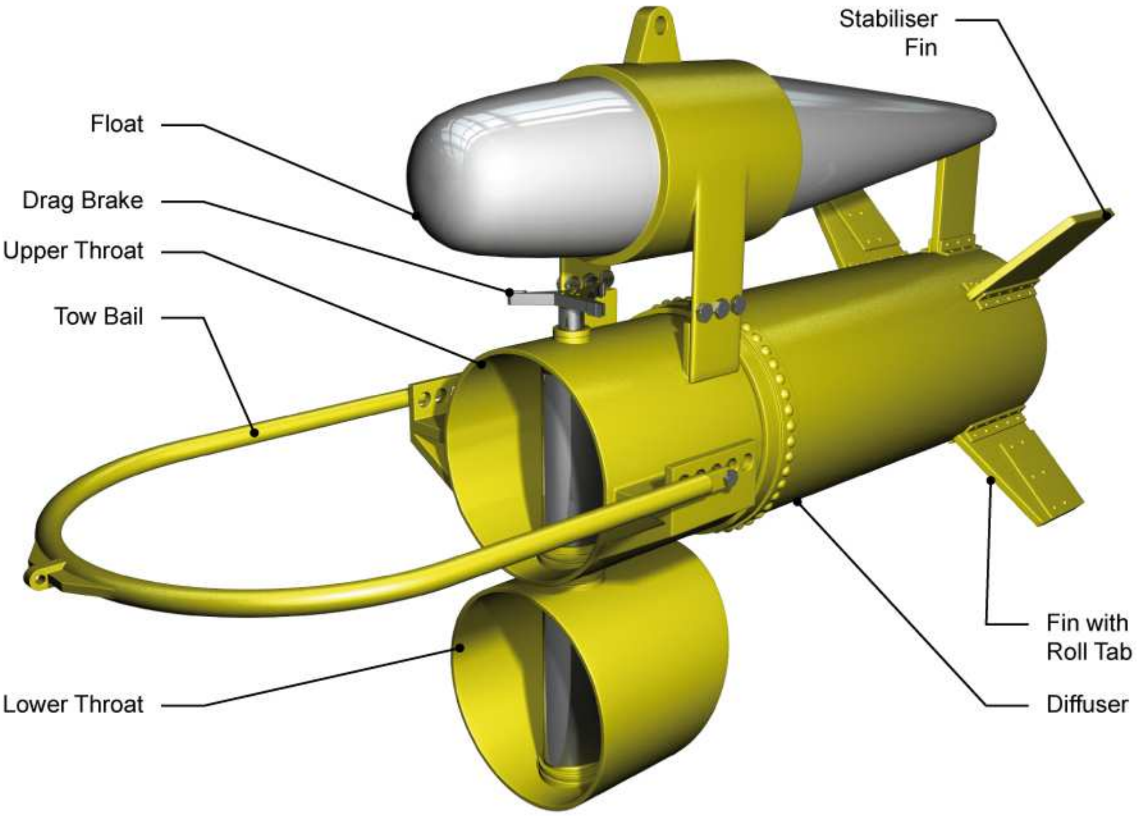
0613 (NU) Acoustic Mine Sweeping Equipment (See Figure 6-3)

1. (NU) Airborne acoustic minesweeping is accomplished by the Mk 104 Mod 3 (US) acoustic device which is streamed, towed, and recovered by the MH-53 (E) helicopter. It is a lightweight, self-contained cavitation device capable of being towed at high speeds. An unmodulated acoustic output is produced by the formation of cavities in the water-flow through a cylindrical throat. An 240m (800 ft) polypropylene tow line terminates in a 10 cm (4-inch) tow ball which is held by the aircraft tow hook. Figure 6-3 presents an illustration of the Mk 104 Mod 3 device. The device weighs about 45 kg (98 lbs) and the entire unit including the tow cable weighs approx. 67.14 kg (180 lbs).

2. NOT RELEASABLE

Figure 6-3. Acoustic Minesweeping Equipment MK-104 (US)

NATO-UNCLASSIFIED



0614 (NU) Magnetic Mine Sweeping Equipment (See Figure 6-4)

1. (NU) Airborne magnetic minesweeping is accomplished by the MK 105 (US) magnetic minesweeping gear towed by the MH-53(E) helicopter. The gear is towed from a tow hook in the helicopter, and the crewman/operator is provided with a control console from which certain Mk 105 platform, turbine and sweep functions can be remotely monitored and controlled. The Mk 105 gear itself consists of a hydrofoil platform towed by a 137 m (450 ft) tow cable containing both electrical control leads and fuel transfer line. The platform is a wing-type, load-bearing platform spanning two long cylindrical floats. Each float carries fore and aft struts upon which the hydrofoils are mounted. The forward struts each support a super-cavitating and a sub-cavitating hydrofoil. All struts retract hydraulically for stowage and shipboard/ground handling. Retraction is accomplished by rotating the struts outboard through about 180 degrees.

2. NOT RELEASABLE

3. (NU) Figure 6-4 includes a sketch of the general configuration of the hydrofoil platform and magnetic minesweeping configuration.

4. (NU) The magnetic field is generated by the standard practice of applying high current, low voltage DC through the sweep tail and using sea water as the conducting medium between the two electrodes in the sweep tail. The Mk 105 is normally operated as a 2000-ampere constant-current system towed at high speed, but may be programmed for various pulses and wave forms for slow-speed sweeping. When operated normally as a constant-current sweep system, the sweep range is from 15 to 30 knots with an optimum speed of 25 knots.

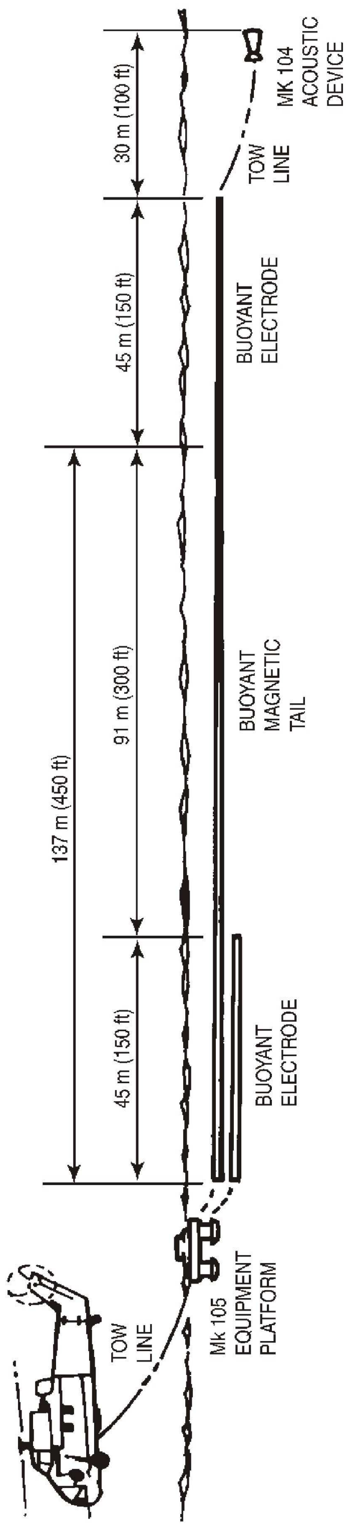
0615 (NU) Combination Magnetic/Acoustic Mine Sweeping

1. (NU) The Mk 105 magnetic sweep system may be used as a combination magnetic/acoustic sweep system by attaching the Mk 104 acoustic device to the sweep tail with a 7.6m (25ft) or a 30.48m (100ft) tow line (see Figure 6-5). This combined configuration is known as the Mk 106 (US) Influence Minesweeping System.

2. NOT RELEASABLE.

Figure 6-4. Acoustic/Magnetic Sweep Mk 106(US)

NATO-UNCLASSIFIED



0616 (NU) Minehunting Equipment - AN/AQS-24A Mine Detecting Set

1. Introduction.

a. (NU) The AN/AQS-24A mine detecting set, as shown in Figure 6-5 is an acoustic minehunting system. The entire system, which is contained in a compact towed vehicle, is operated from an MH-53E helicopter and is primarily used for high-speed minehunting in waters with a suspected mine threat. The system’s acoustic sensors are designed for the detection, classification, and localization of bottom and moored contacts. The system may be outfitted with an onboard laser imaging package (known as the laser line scan (LLS)), as shown in Figure 6-6 for the identification of bottom MILCOs IAW US National doctrine.

b. (NU) The AN/AQS-24A is transported internally to the mission area by the MH-53E. Once at the mission area, the AN/AQS-24A towed vehicle is streamed, planned tracks are flown, and then the towed vehicle is recovered. During the mission, sonar data is saved onto a removable hard drive called the Disk Drive Assembly (DDA). After the mission, the data from the DDA is transferred to a Common Post-Mission Analysis (CPMA) station in order to facilitate post-mission analysis (PMA). After analysis is conducted, the contact list, consisting of MILCOs detected, classified and localized by the AN/AQS-24A, is provided to the MCM Commander so that the MILCOs can be assigned for reacquisition and identification. The AN/AQS-24A may then be re-tasked to prosecute bottom MILCOs to identify them as mines or non-mines.

c. (NU) The vehicle is towed directly behind the helicopter. The tow cable is 305 m in length. It has two ball stops, or tow length positions: one is 122 metres from the vehicle end; the other is 290 metres from the vehicle end. Its maximum tow speed is

Figure 6-5. AN/AQS-24A Airborne Minehunting Sonar

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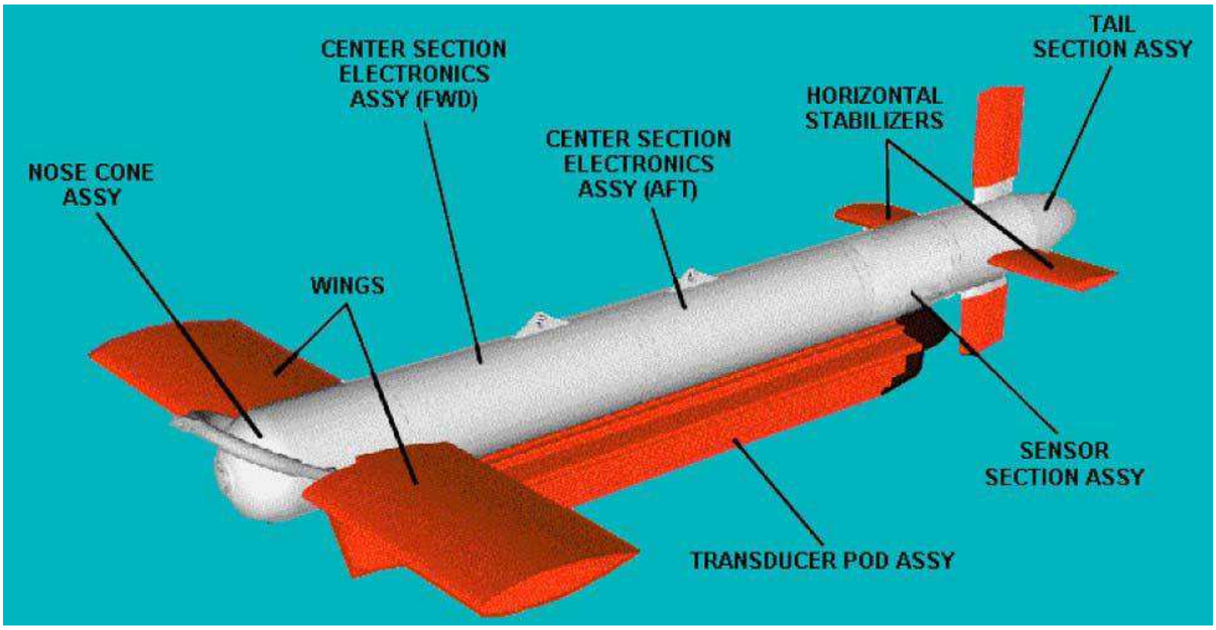
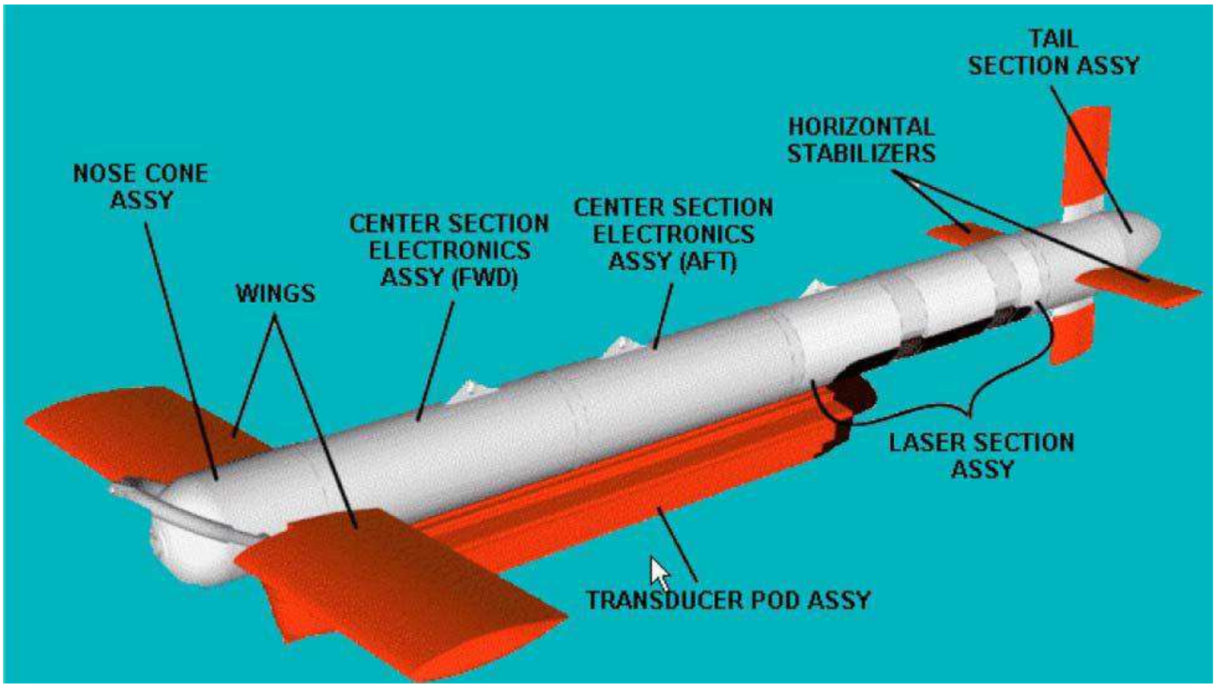


Figure 6-6. AN/AQS-24A Airborne Minehunting Sonar with LLS Assembly Installed

NATO-UNCLASSIFIED



2. (NU) Modes of Operation**.** Several modes of operation are available for selection. If the OFF mode is selected, sonar and laser modes are shut down, but the device is still capable of 'flight'.

a. (NU) Side Look Sonar (SLS). Utilized to detect mine cases and mine anchors resting on the bottom, as well as close-tethered moored mines in the volume. Device is “flown” at a predetermined altitude above sea bottom. Does not employ the laser.

b. (NU) Volume Search Sonar (VSS). Utilized to detect moored mines “in the volume”. Device is “flown” at a predetermined depth below the sea surface. Does not employ the laser.

c. (NU) Explore. TBD.

d. (NU) Target Identify (TGT IDENTIFY). Combines the sonar and the laser in a split-screen to reacquire targets and positively identify previously reported mine-like contacts.

3. (NU) The operating characteristics of each mode and tow stop combination are shown in Table 6-1.

Table 6-1. NOT RELEASABLE

0617 - 0620 Spare.

SECTION III - (NU) NAVIGATION OF HELICOPTERS

0621 (NU) Precise Minefield Navigation of Helicopters

1. (NU) In addition to the normal point-to-point navigation system for transit from a base to a minefield and for routine flying, the MCM helicopter also requires precise minefield navigation. This requirement may be satisfied by one of these three different methods:

a. (NU) The primary means of minefield navigation for the MH-53E mine countermeasures helicopter is the Global positioning system (GPS). GPS provides the helicopter with an extremely accurate, three-dimensional source of navigation information. This information is accurate enough to provide positional repeatability of mine like contacts. Another major advantage of GPS is the fact that it does not require ground stations in the immediate area. It also provides the aircraft with highly accurate time and speed.

b. (NU) The AMCM helicopter may also be navigated through the minefield by the use of an external electronic system which is monitored by the pilots of the helicopter. There are numerous systems that exist, however, a network of ground stations must be in place in order for these systems to be used. Most of these navigation systems use some form of phase-comparison of hyperbolic continuous-waves transmitted from fixed ground stations. The aircraft must also be modified in order to facilitate the use of these systems. Besides requiring ground stations, these systems are not as accurate as GPS and should not be used as a primary source of navigation for MCM helicopters, unless GPS is not available.

CHAPTER 7 - NOT RELEASABLE

SECTION I - NOT RELEASABLE

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0701 NOT RELEASABLE

0702 NOT RELEASABLE

0703 NOT RELEASABLE

0704 NOT RELEASABLE

0705 NOT RELEASABLE

0706 -0710 Spare.

SECTION II - NOT RELEASABLE

0711 NOT RELEASABLE

0712 NOT RELEASABLE

0713 NOT RELEASABLE

0714 NOT RELEASABLE

0715 NOT RELEASABLE

0716 - 0720 Spare

SECTION III - NOT RELEASABLE

0721 NOT RELEASABLE

0722 NOT RELEASABLE

0723 NOT RELEASABLE

0724 NOT RELEASABLE

0725 NOT RELEASABLE

CHAPTER 8 - MCM TACTICAL INSTRUCTIONS AND MANOEUVRING

SECTION I - MCM PATTERNS

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this chapter refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0801 (NU) General

1. (NU) Parameters for planning and evaluation to be considered are listed in MTP-6 Vol II Chapter 11. MCM patterns should also be taken into account in the execution of MCM operations.

2. (NU) General information on minesweeping formations is stated in sections below and Chapter3.

0802 (NU) Types of MCM Pattern

1. (NU) A mine countermeasures pattern is a way of distributing sweeping or hunting tracks within an area or a channel. The term distribution, as used here, includes the general procedure for laying out tracks and the sequence and distribution of runs on the various tracks. For minesweeping, the selection of an appropriate pattern will depend on the objective of the operation. The patterns are described overleaf.

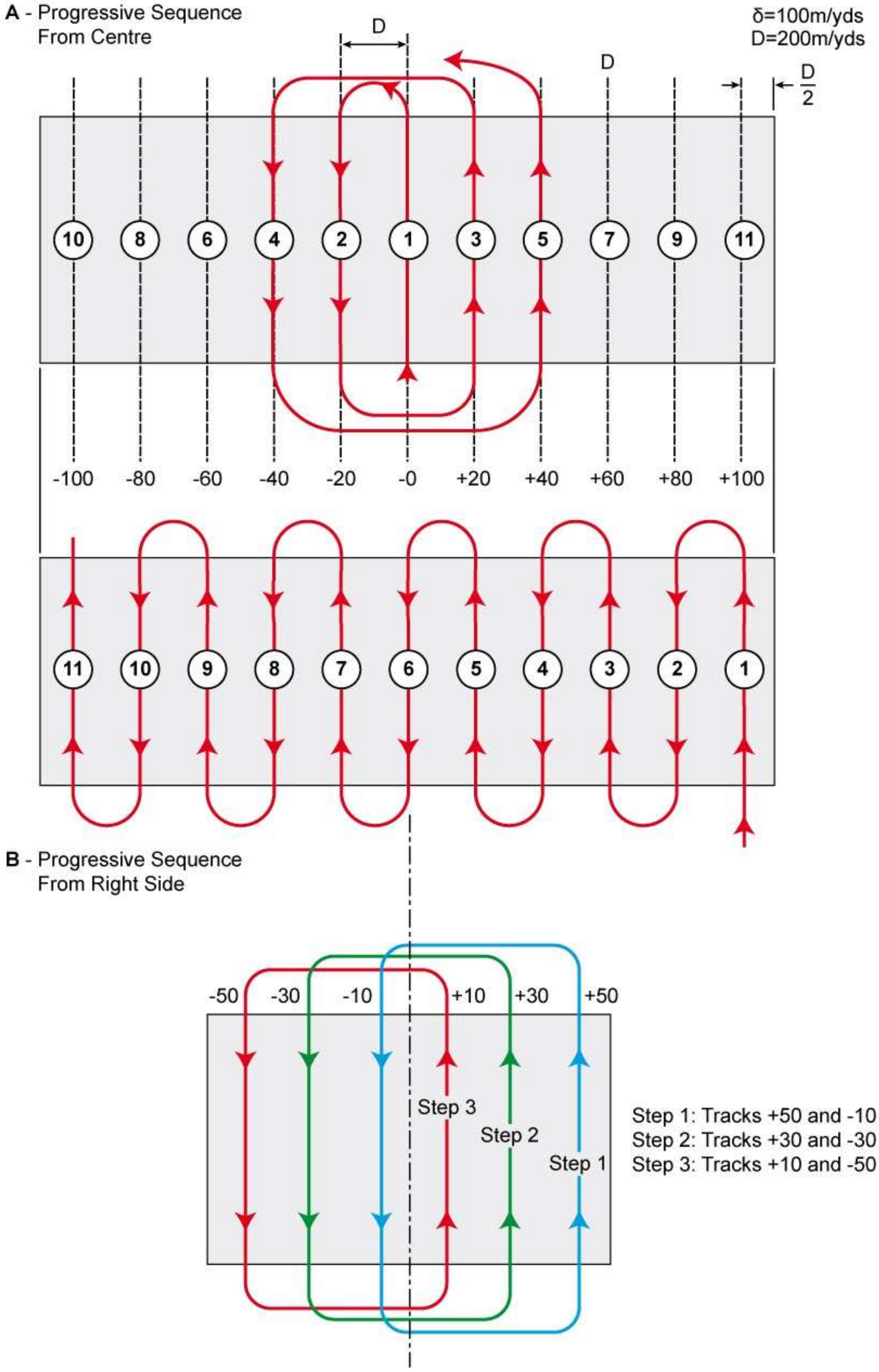
2. (NU) Uniform Pattern. In this pattern, runs are made along a series of tracks equally spaced across a channel or throughout an area. The same number of runs is made on each track. The order in which tracks are swept or hunted will not affect the ultimate degree of clearance. However, it will affect the risk to the MCMV in some operations and it may affect the degree and uniformity of clearance at times during the operation. Three track sequences which might be selected are:

   a. (NU) Progressive Sequence. Any track may be selected as the first track, but subsequent tracks either side of it are swept or hunted in order of their distance from the first track (see Figure 8-1). All runs to be made on a given track or on two opposite tracks (modified progressive sequence) are completed before making any runs on the adjacent track.

   b. (NU) Free-Track Sweeping. The number of runs on each track is uniformly distributed throughout the operation. To achieve this, at each track-turn, the Tasking Authority orders the sweepers to their next track, taking into account the number of runs already made over the various tracks. This method has the advantage of ensuring uniform sweeping at intermediate times during the operation.

Figure 8-1. MCM Patterns

NATO-UNCLASSIFIED



C – Skip-track Sequence for a channel

3. (NU) Non-Uniform Pattern. The non-uniform pattern is every pattern not matching the uniform pattern. Normally it concentrates the MCM effort on the central part of the channel. The aim of this pattern is to reduce the risk in that position of the channel where the threat for passing ships is highest. After having achieved the maximum attainable threat reduction further MCM effort may be extended progressively towards the channel edges. It is recommended to use the progressive sequence analogous for the uniform pattern unless there are tactical reasons for not doing so (eg. Operations in anchorages or areas).

4. Both the uniform and non-uniform patterns are calculated using MCM EXPERT (see MTP-6 Vol II, Chapter 11).

0803 - 0810. Spare.

SECTION II - NAVIGATION

0811 (NU) General

The special requirements of accurate navigation in mine countermeasures is specified in MTP-6, Volume II. The aim of this section is to provide MCM tactical information.

0812 (NU) Choice of Method of Navigation

The navigational method chosen for all MCM operations must be that which provides the best accuracy of which GPS offers the best solution. Other means such as terrestrial methods, inertial navigation systems (INS), underwater reference marks etc. may be considered but varying degrees of inaccuracy will be incurred.

0813 (NU) Effect of Drift

1. Minesweeping

a. (NU) Angle F. Wind and cross-tide effects are illustrated in Figures 8-2, 8-3 and 8-4. In order to keep on the track, the MCM units course has to be offset from the direction of this track by an Angle F which allows for the drift due to wind and current. Angle F is to starboard and positive when the sweep is drifting to port, and to port and negative when drifting to starboard. Angle F is determined by national methods.

***Note**. This is also applicable to conventional minehunting with hull mounted sonars and similar systems.*

b. (NU) Angle E. The sweep, on which the wind normally has no effect, is offset down-tide by an Angle E. Angle E is to starboard and positive when the current runs from starboard to port, to port and negative when the current runs from port to starboard. In Oropesa sweeps, this offset results in an increase in the swept path of the down-tide wire and a reduction in that of the up-tide wire. In addition, the kite follows a track offset from that of the sweeper while the float follows a track different from that of the otter. With influence sweeps, the swept path over the ground does change but the change is so slight that it is normally disregarded. For practical purposes, the interception area is taken as circular, when the swept path does not change but is offset down-tide. To allow for this offset, it may be necessary to adjust the sweeper's track in proportion.

c. (NU). Angle E may be determined by the following methods (see also Figure 8-3):

(1) (NU) Symmetrical Sweeps. The bearing of the centre of the sweep is the mean of the bearings of the symmetrical floats. Without drift, we have bearing of centre of sweep = track course + 180º. In the event of drift we have bearing of centre = track course + 180º + Angle E, when Angle E = bearing of centre with drift + bearing of centre without drift.

(2) (NU) Asymmetrical Sweep. If the relative bearing of a particular point in the sweep such as a float when there is no drift, is known, then the bearing of this point is bearing without drift = track course + relative bearing. With drift, we have bearing with drift = track course + Angle E + relative bearing, when Angle E = bearing with drift - bearing without drift.

d. (NU) Offset (h). The perpendicular distance between the centre of the characteristic width (A) and the track of the MCM Unit. The intended track of the MCM Unit must be displaced from the intended track of the towed gear by the amount of the offset (see MTP-6 Vol II, Chapter 3).

2 (NU) Effect of Drift on Towed Sensors. Vessels with towed sensors such as minehunters with towed sonars and craft towing divers have to keep the middle of the detection width on the track (see Figure 8-4). But it is very important to note all the parameters (E and h) to be able to construct the location of all bottom objects.

Figure 8-2. Effect of Wind and Cross-Tide on Minesweepers

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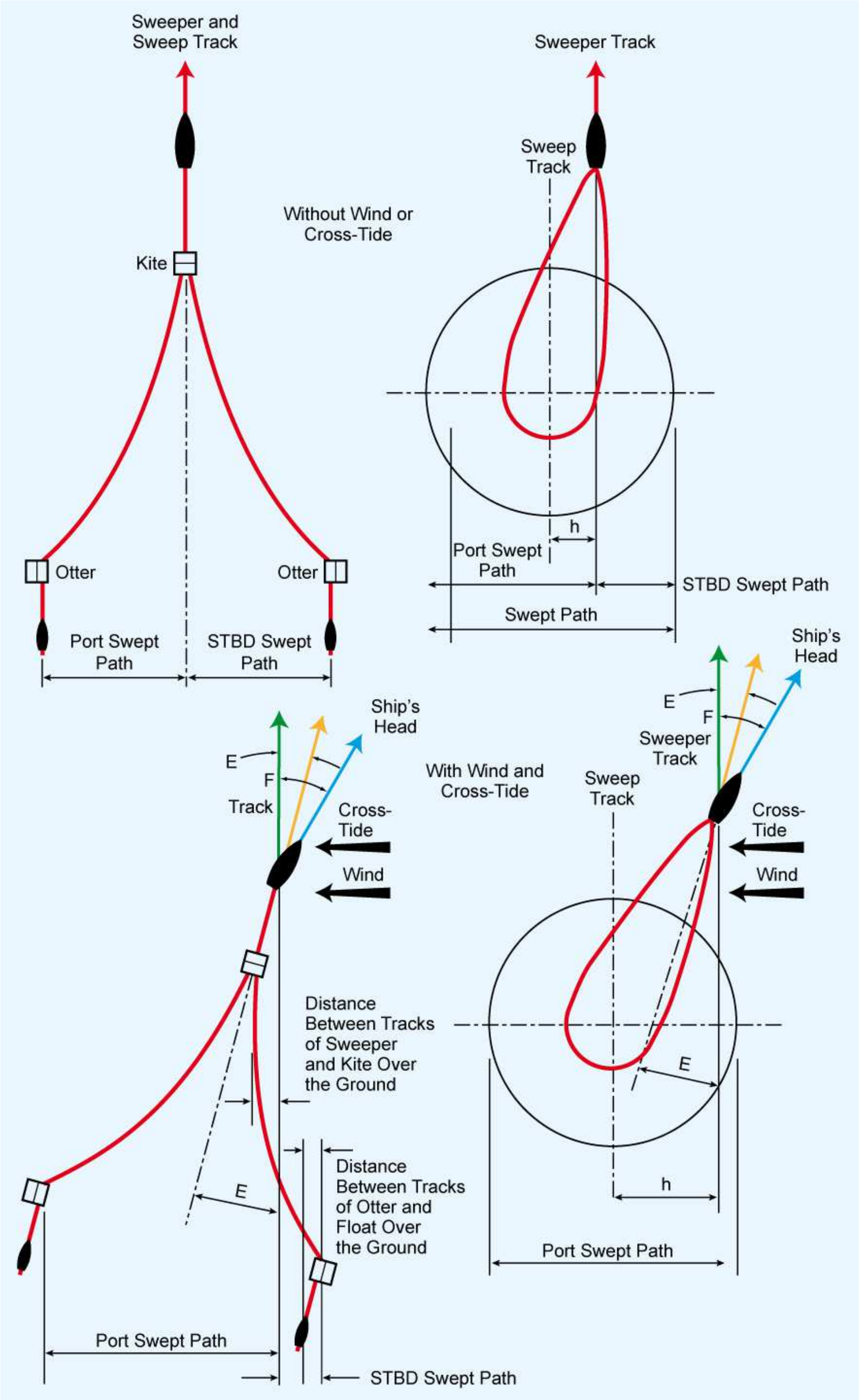

Figure 8-3. Finding Angle ‘E’

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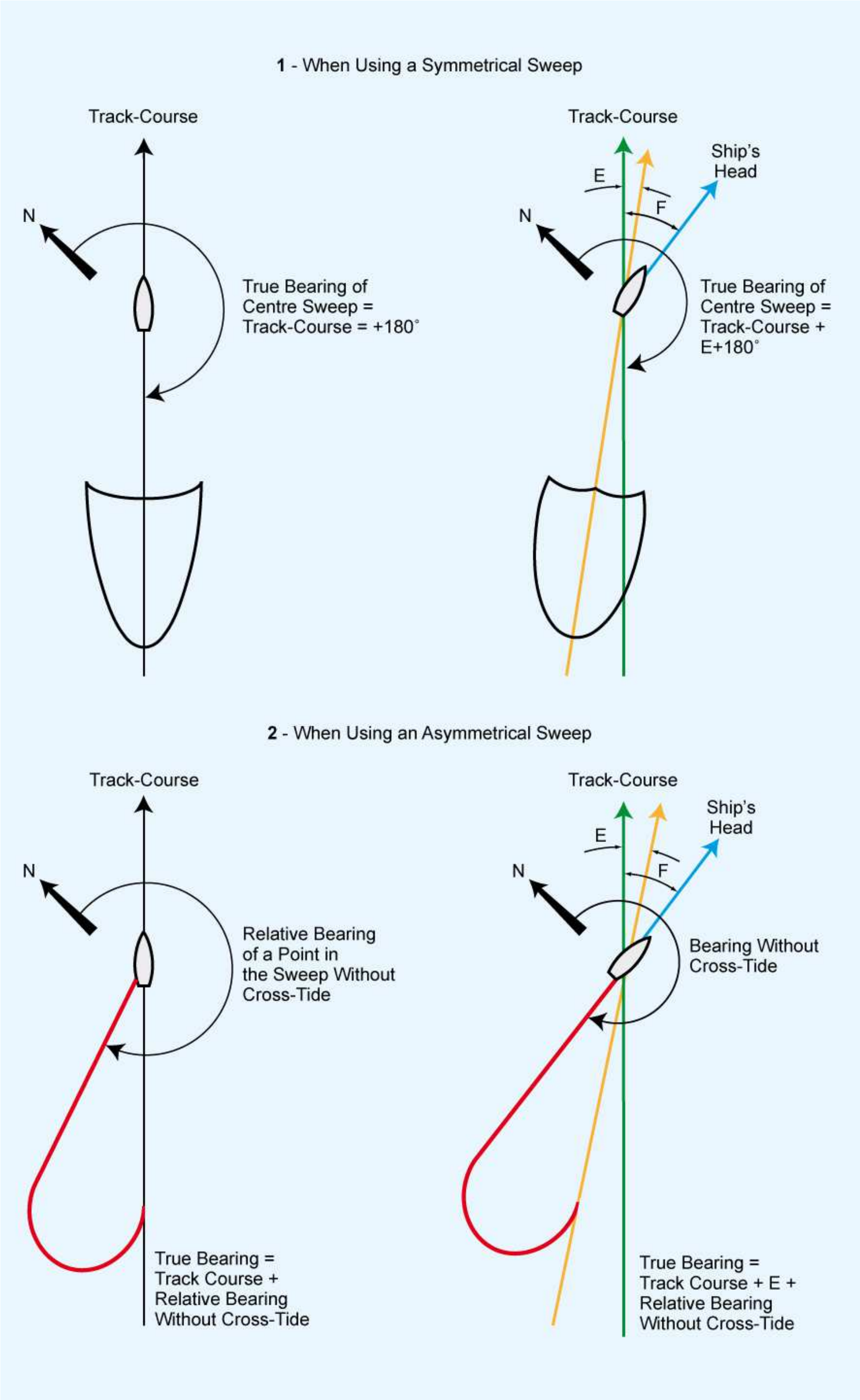

Figure 8-4. Navigation and Location with Towed Sonars

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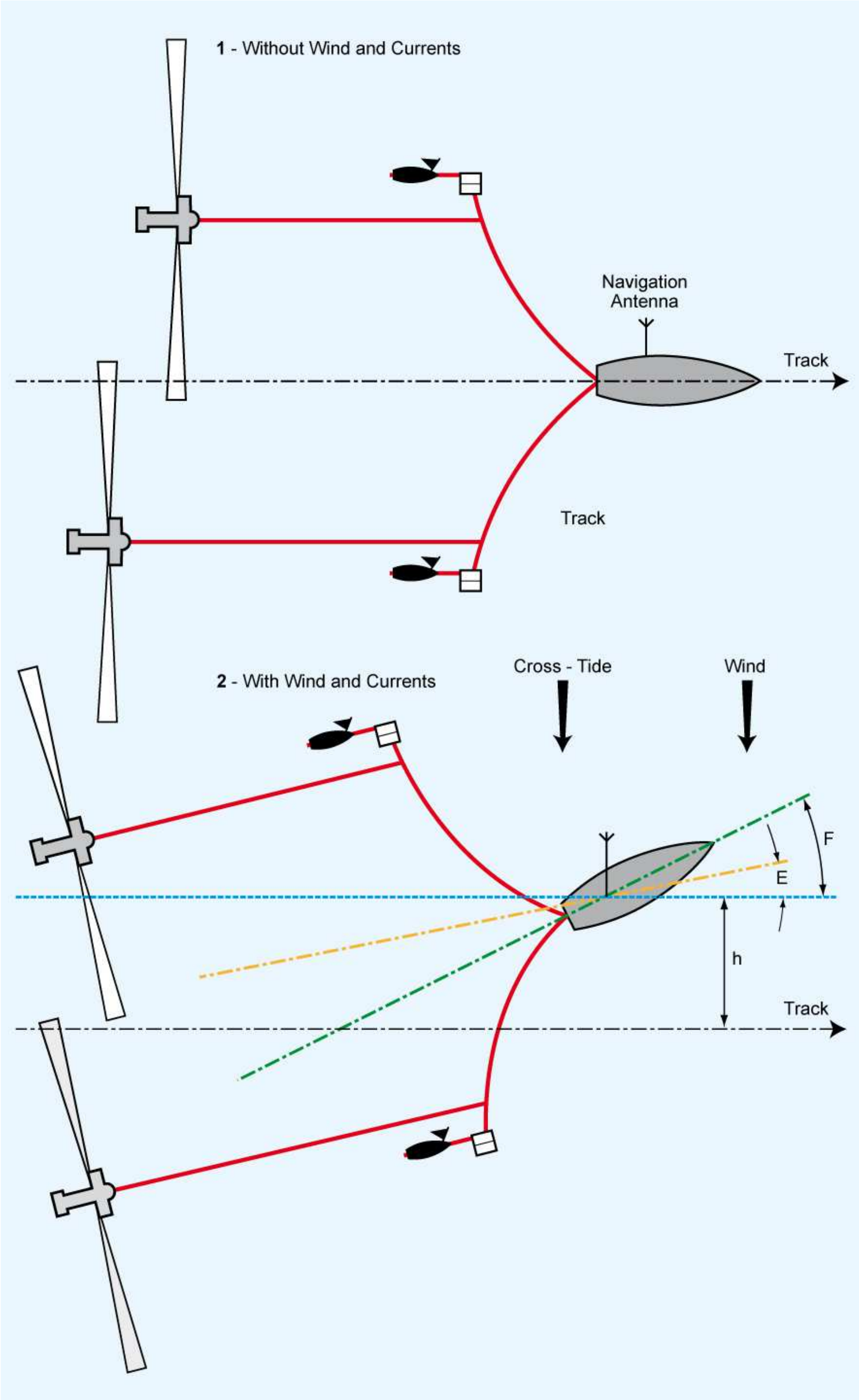

0814 (NU) Marking Routes and Channels

1. Routes and channels can be marked with permanent buoys (eg. In the event of GPS Jamming). In time of conflict it is a matter for national procedures to mark routes or channels as necessary.

a. (NU) Types of Buoys.

(1) (NU) Permanent Buoyage. Routes and channels are usually marked with permanent buoys prior to or after mine countermeasures operations. Permanent buoys are able to withstand heavy weather for prolonged periods, whereas MCM buoys are inadequate for long periods of time. Distance between buoys is governed by local conditions and, sometimes, the number of available buoys.

(2) (NU) MCM Buoys. Even with modern day precise navigation systems, MCM buoys must not be overlooked as an alternative means of marking areas of past, present, or future MCM operations.

b. (NU) Methods of Marking

(1) (NU) Centreline Buoys. Buoys laid on the centreline of a route or channel are most useful for long distances. The centreline buoy method offers the advantages that it is easier for shipping to follow and lessens the likelihood of collisions between ships proceeding in opposite directions. It suffers from the disadvantage that it is difficult to sweep (but not hunt) close to a buoy, which can cause holidays in the centre of the channel.

(2) (NU) Offset Buoys. Buoys laid on one side of a route or channel may be the most useful to minesweepers because they can then operate without fouling gear in buoy moorings.

0815 (NU) MCM Buoy Laying

1. (NU) MCM buoy-laying can be conducted either before, during or after MCM operations have been completed. Buoy-laying before and during the operation is usually designed to assist the MCM forces when no GPS is available. Buoy-laying after operations are completed is usually confined to more permanent marking of the channel or area to assist transiting shipping (see para 0814).

2. (NU) The requirement to lay navigational buoys for MCM operations imposes a degree of risk. Consequently some form of precursor operation may be required and the buoy-laying phase must be planned and conducted with the same care that is given to any MCM operation

0816 (NU) Navigation of MCM Vessels with MCM Buoys

Some nations retain the capability of MCM navigation using MCM Buoys and normally employ this method in the event of GPS jamming and national procedures will then apply.

0817 (NU) Channel Extension

1. (NU) In case of major turns or bends along a route (course changes greater than 60 degrees) large ships (50,000 TDW and above) have difficulties staying within the limits of an established channel. This involves the danger of coming into unsearched waters by overshooting or a premature turn, thereby activating a mine within the damage range. To permit large ships to navigate safely in an established channel when changing course, the channel has to be extended.

2. (NU) The channel extension is determined by a step back and forward distance of 1,000m on the inner edge of the channel, e.g at that side of the channel to which the channel course is changing by more than 60 degrees and a line connecting the start position of the step back with the end position of the step forward distance. The Tasking Authority of transiting units will notify names and displacement of large ships in the Lead-through Order. The OPCON of MCM Forces will determine the additionally searched area, provide information on, and order MCM effort in the area. Military units/Convoy commodores will be informed by Lead-through Transit Instructions.

3. (NU) Lead-through vessels stay a minimum distance of 300m off the edge of the additionally searched area when changing course.

Figure 8-5. Example of the Development of an Additionally Searched Area

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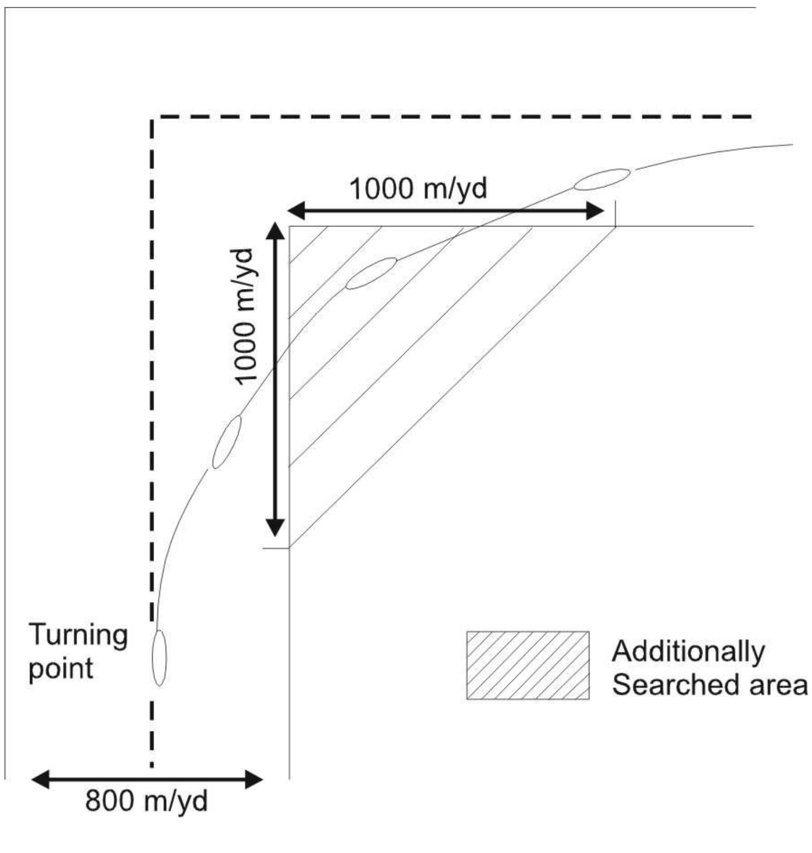

0818-0820 Spare.

SECTION III - STATION KEEPING OF MCM VESSELS

0821 (NU) General

1. (NU) Definition of Stations. The stations of MCMVs in a team, a formation, or a disposition are determined successively from the guide, the following being known:

a. (NU) Track course.

b. (NU) Lateral separation of tracks.

c. (NU) Longitudinal separation of MCMVs.

d. (NU) Stationing of Sweepers. This is shown in the team, formation or disposition diagram. Every MCMV must, when taking up formation, occupy the station shown on the diagram indicated by the number allocated.

Note. *(NU) This section has been written for minesweepers, but it is also applicable to all MCMVs with towed equipments.*

2. (NU) Station-keeping

a. (NU) As a rule, station is kept relative to a ship or float by bearing or bearing and distance. Owing to the drift, these may have to be altered while sweeping in order to maintain the prescribed coverage. The Officer of the Watch must know how to calculate these alterations. Station-keeping methods which may be adopted in a formation carrying out a given sweeping technique are governed by the following:

(1) (NU) True Heading. This is the angle between the ships heading and true north.

(2) (NU) True Bearing. The angle between the bearing to a reference ship or float and true north.

(3) (NU) Relative Bearing. This is the angle between the bearing to a reference ship or float and the ships heading.

(4) (NU) Distance to forward station-keeping reference. The distance between the ship and a forward reference ship or float.

(a) (NU) Distance off the adjacent ship, C.

(b) (NU) Distance off the float, C'.

(5) (NU) Longitudinal Separation. The distance, along the track, between the reference ship or float and the trailing ship.

(6) (NU) Lateral Separation. The perpendicular distance between the tracks of the ship and the reference ship or float.

(7) (NU) Angle From Track-Course. This is the angle between the track-course and the bearing of a reference ship or float, measured from 0° to 180° from the track-course, positively to the right and negatively to the left.

(a) (NU) Angle from Track Course to reference ship C.

(b) (NU) Angle from Track Course to reference float, Angle C'.

(8) (NU) Corrected Relative Bearing. This is the bearing of a reference ship or float relative to the sweep and is measured from the course of the sweep through the water.

(9) (NU) Overlap. When wire sweeping in line-of-bearing formation and when the fraction of area to be covered is unity, the overlap should be greater than the maximum likely station-keeping errors.

(a) (NU) True Overlap. The lateral distance between the track of the aft multiplane of the forward ship and the track of the nearest multiplane of the following sweeper (see Figure 8-12).

(b) (NU) Apparent Overlap. The lateral distance between the track of the aft float of the forward ship and the track-course of the following sweeper (see Figure 8-12)

(10) (NU) Float Offset, 'e'. In Mechanical Sweeping, the lateral distance between the otter and the float.

(11) (NU) Depressor Offset 'e'. In Mechanical Sweeping, the lateral distance between the sweeper Track Course and the depressor.

b. (NU) The following formulae connect these various measurements (Figure 8-6).

(1) (NU) Longitudinal Separation:

= Lateral Separation / tan (track course-true bearing)
= Lateral Separation / tan [angle from Track Course (Angle C')]
= $\sqrt{(dis\tan ce)^2 - (Lateral\ Separation)^2}$
= Distance x cos [angle from Track-Course (Angle C')]

(2) (NU) Lateral Separation:

= Distance x sin (track-course-true bearing)
= Distance x sin(Angle from Track-Course)
= $\sqrt{(dis\tan ce)^2 - (Longitudinal\ Separation)^2}$
= Longitudinal Separation *tan(angle from Track-Course)

(3) (NU) Angle from Track-course:

= true bearing - Track Course
= true heading + relative bearing - Track Course
= relative bearing + Angle F
= Corrected relative bearing + Angle E
= $\tan^{-1}$ (Lateral Separation / Longitudinal Separation)

(4) (NU) Corrected Relative Bearing:

(5) (NU) Relative Bearing

= True Bearing - True Heading

(6) (NU) True Bearing:

= Track Course + Angle E + corrected relative bearing
= Track Course + Angle C'.

c. The measurements can thus be deduced from one another by calculation, diagram or special calculating boards.

Note. *Care must be taken with the units of angles (degrees and radians) in the formulae.*

Figure 8-6. Station-Keeping Measurements

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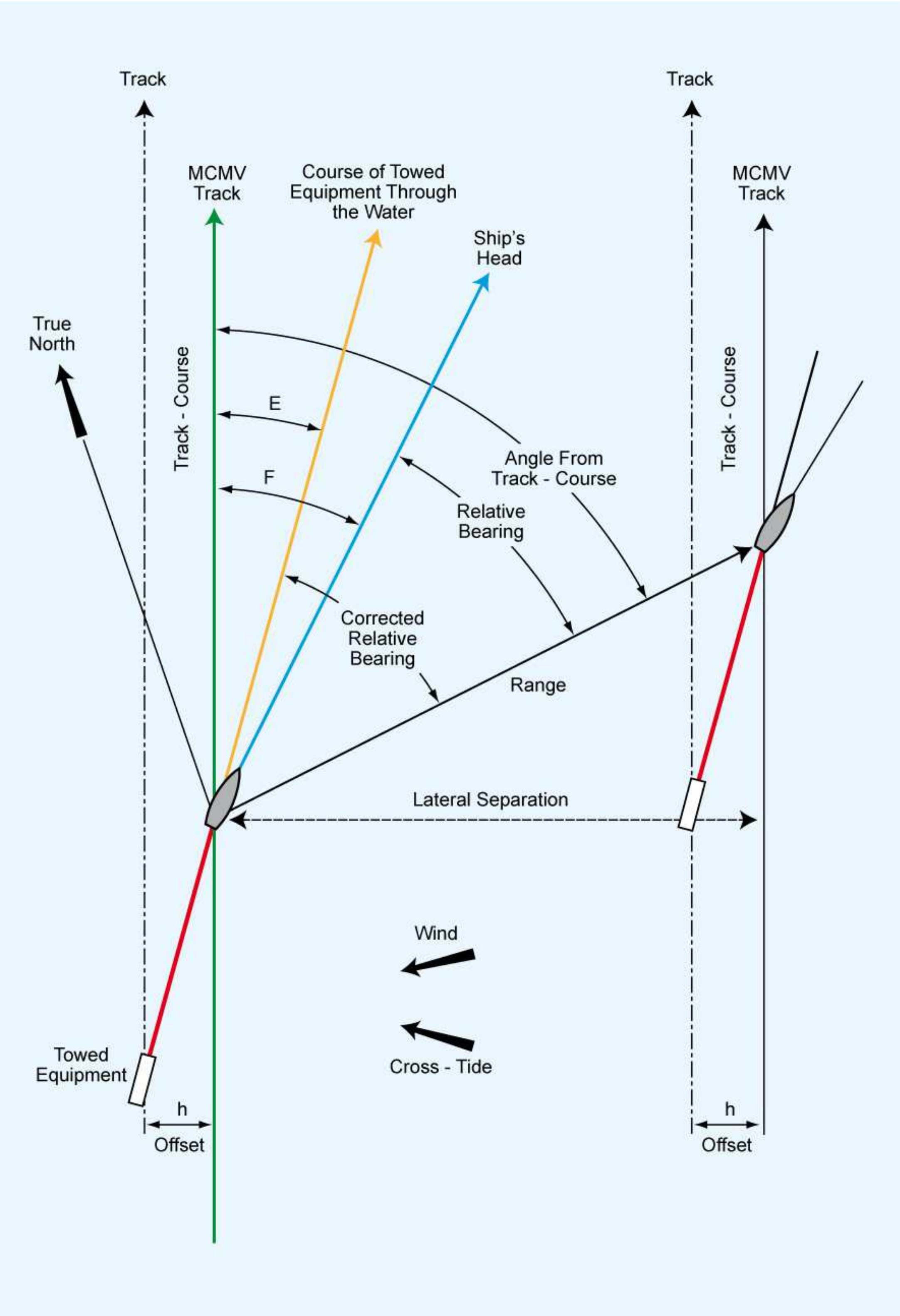

Note. *Example of LONGITUDINAL SEPARATION = 0*

0822 (NU) Mechanical Sweeping

1. (NU) Station-Keeping Methods. Six different methods of station-keeping in a formation are in general use:

a. (NU) Method 1.

(1) (NU) Corrected relative bearing and distance (Figure 8-7). In this method, corrected relative bearing and distance are kept constant but the lateral separation between the guide (or adjacent sweep) and the trailing sweeper varies, impacting the percentage coverage.

(a) (NU) True Bearing:

= Track Course + Angle E + corrected relative bearing
= Track Course + Angle C'.

(b) (NU) Distance off the float C', where C' is given by

$$C' = \frac{\textit{Lateral Separation}}{\sin(\textit{Corrected Relative Bearing} + \textit{Angle E}}$$

$$= \frac{\textit{Lateral Separation}}{\sin(\textit{Angle C}')}$$

(2) (NU) As Angle E alters, true bearing changes but corrected relative bearing and distance off the float remain constant. These measurements may be used to determine lateral separation by multiplying distance off the float (C') by sin (Angle C').

b. (NU) Method 2.

(1) (NU) Corrected relative bearing and lateral separation (Figure 8-8). In this method, corrected relative bearing and lateral separation are kept constant, but the distance between the guide (or adjacent ship) and the trailing sweeper varies. If the swept path remains constant, percentage coverage does not vary. Practical station-keeping measurements are:

(a) (NU) True bearing

= track course + Angle E + corrected relative bearing
= Track Course + Angle C'

(b) (NU) Distance off the float C', where C' is given by

$$C' = \frac{\text{Lateral Separation}}{\sin(\text{Corrected Relative Bearing} + \text{Angle E})}$$

$$= \frac{\textit{Lateral Separation}}{\sin(\textit{Angle C}')}$$

(2) As Angle E alters, true bearing changes but the corrected relative bearing and lateral separation remain constant. These measurements may be used to determine distance off the float

c. (NU) Method 3.

(1) (NU) Angle from track-course and lateral separation (Figure 8-9). In this method, angle from track-course and lateral separation are kept constant consequently, the distance between the guide (or adjacent ship) and the trailing sweepser remains constant. If the swept path remains constant, percentage coverage does not vary. Practical station-keeping measurements are;.

(a) (NU) True bearing = Track-course + Angle C'

(b) (NU) Distance off the float, C', where C' is given by.

$$C' = \frac{\text{lateral separation}}{\sin(\text{Angle } C')}$$

(2) (NU) These two measurements are kept constant irrespective of drift.

Figure 8-7. Station-Keeping Method 1: Corrected Relative Bearing and Distance

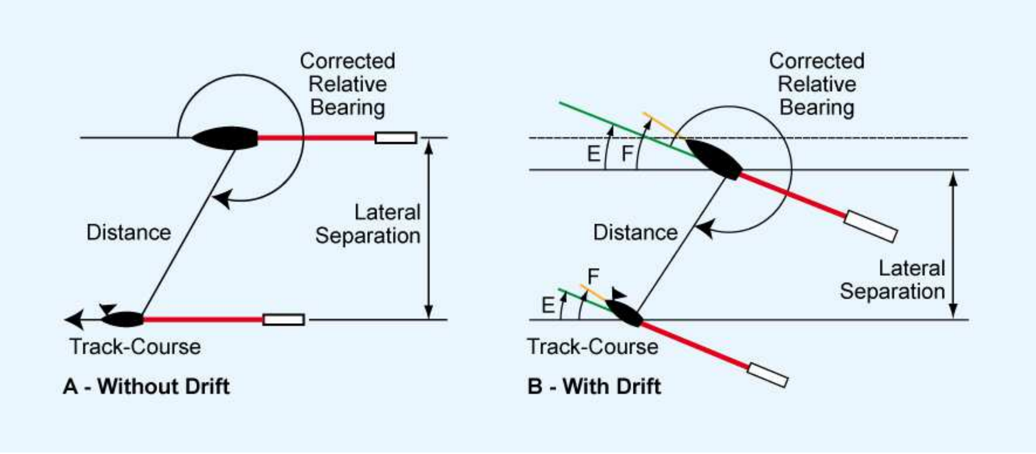

Figure 8-8. Station-Keeping Method 2: Corrected Relative Bearing and Lateral Separation

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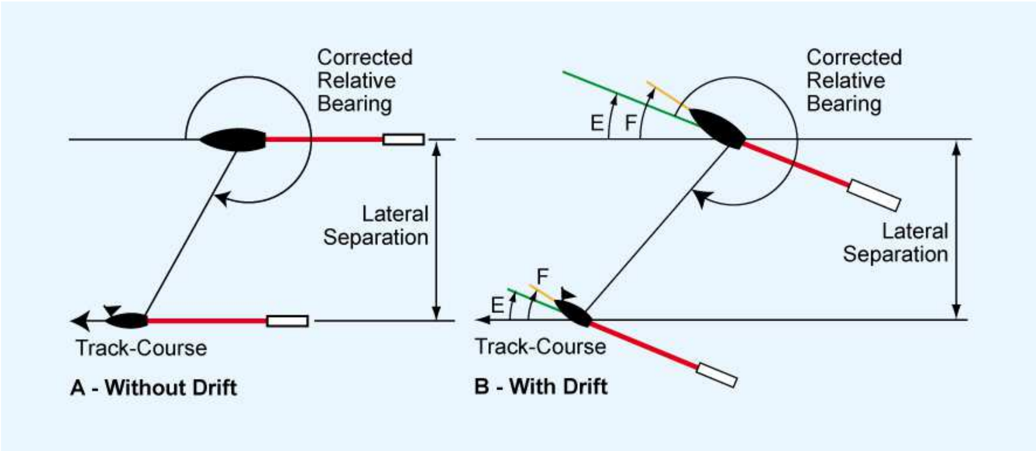

Figure 8-9. Station-Keeping Method 3: Angle From Track-Course and Lateral Separation

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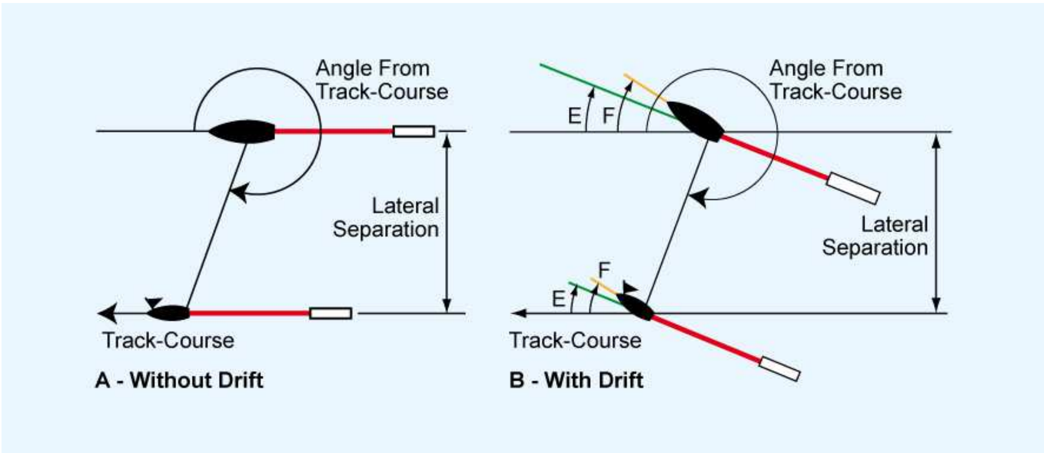

d. (NU) Method 4.

(1) (NU) True overlap and distance (Figure 8-10). In this method, true overlap and distance off a float representing approximately the limit of the swept path, are kept constant, but the angle from track course changes (Angle C') as Angle E varies. Practical station-keeping measurements are;

(a) (NU) True bearing

= track course + Angle E + corrected relative bearing
= track course + Angle C', where Angle C' is calculated by

$$Angle\,C' = \cos^{-1}\left(\frac{Longitudinal\,Separation}{C'}\right)$$

(b) (NU) Distance off the float, C' which is based on diversion of the sweep gear downstream or upstream, can be calculated as:

$$C' = \sqrt{(Longitudinal\ Separation)^2 + (Lateral\ Separation)^2}$$

(i) (NU) If the sweep gear is diverted down-tide;

Lateral Separation = True Overlap -(e'+e'')

(ii) (NU) If the sweep gear is diverted up-tide;

Lateral Separation = True Overlap +(e'+e'')

(iii) (NU) The formulae for determining float offset (e') and depressor offset (e'') are given below:

$$e' = [\sin(Angle\ E)] * \sqrt{(Float\ Pendant\ Length)^2 - (Sweep\ Depth)^2}$$

$$e'' = [\sin(Angle\ E)] * \sqrt{(Depresso\ Wire\ Length)^2 - (Sweep\ Depth)^2}$$

(2) (NU) While distance remains constant, the angle from track course will change as Angle E alters, and its value may be obtained from diagrams, tables or by calculation.

e. (NU) Method 5.

(1) (NU) True overlap and angle from track-course (Figure 8-11). In this method, true overlap and angle from track course of a float, representing approximately the limit of the swept path, are kept constant but the distance off the float changes as Angle E varies. Practical station-keeping measurements are:

(a) (NU) True bearing

= track-course + Angle E + corrected relative bearing
= track course + Angle C', where the latter is calculated as;

$$Angle\ C' = \cos^{-1}\left(\frac{Longitudinal\ Separation}{C'}\right)$$

(b) (NU) Distance off the float., C', which is based on diversion of the sweep gear downstream or upstream, can be calculated as follows:

$$C' = \sqrt{(Longitudinal\ Separation)^2 + (Lateral\ Separation)^2}$$

(2) (NU) While true bearing remains constant, the distance off the float will change as Angle E alters, and its value may be obtained from diagrams, tables or by calculation.

f. (NU) Method 6.

(1) (NU) True overlap and longitudinal separation (Figure 8-12). In this method, true overlap and longitudinal separation between the trailing sweeper and the float of the leading sweeper are kept constant but true bearing and distance off the float vary. Practical station-keeping measurements are:

(a) (NU) True bearing

= track-course + Angle E = corrected relative bearing
= track course + Angle C', where Angle C' is calculated as follows:

$$Angle\,C' = \cos^{-1}\left(\frac{Longitudinal\ Separation}{C'}\right)$$

(b) (NU) Distance off the float, C', which is based on diversion of the sweep gear downstream or upstream, can be calculated as;

$$C' = \sqrt{(Longitudinal\ Separation)^2 + (Lateral\ Separation)^2}$$

(i) (NU) If the sweep gear is diverted down-tide;

Lateral Separation = True Overlap -(e'+e'')

(ii) (NU) If the sweep gear is diverted up-tide;

Lateral Separation = True Overlap +(e'+e'')

(iii) (NU) The formulae for determining float offset (e') and depressor offset (e'') are given below:

$$e' = [\sin(Angle\ E)] * \sqrt{(Float\ Pendant\ Length)^2 - (Sweep\ Depth)^2}$$

$$e'' = [\sin(Angle\ E)] * \sqrt{(Depresso\ Wire\ Length)^2 - (Sweep\ Depth)^2}$$

(2) (NU) These measurements will change as Angle E alters, and their values may be obtained from diagrams, tables or by calculation. (Note that these will not be the same diagrams, etc as were used for Method 5).

2. (NU) The methods of station-keeping to be adopted in a formation of sweepers towing a given sweep are laid down in national supplements.

3. (NU) The illustrations in the 'supplements' give the details of station-keeping for each type of sweeper. Diagrams may also be used, Figure 8-13 gives an example of a diagram that may be used in Method 6. For practical use at sea, enlarged copies of this diagram would be required, showing angles from the float every degree and distances every 25 metres. The method of using the diagram is as follows:

a. (NU) Knowing the true overlap ordered, find apparent overlap by reference to the additional overlap table. Plot own ship's bridge on the diagram according to the apparent overlap and the ordered longitudinal separation between own ship and leading float (ie station-keeping distance astern of float). Plot the bridge of the leading sweeper on upper part of diagram according to ordered depth of sweep and Angle Echo.

b. (NU) The following can be measured from the diagram:

(1) (NU) Bearing and distance of the leading float from own bridge.

(2) (NU) Bearing and distance of the bridge of the leading sweeper from own bridge.

c. (NU) To avoid having to refer back to the diagram each time Angle E is altered, tables can be made out from the diagram to give the required station-keeping measurements for all likely values of Angle E for the sweep conditions chosen.

Figure 8-10. Station-Keeping Method 4: Overlap and Distance

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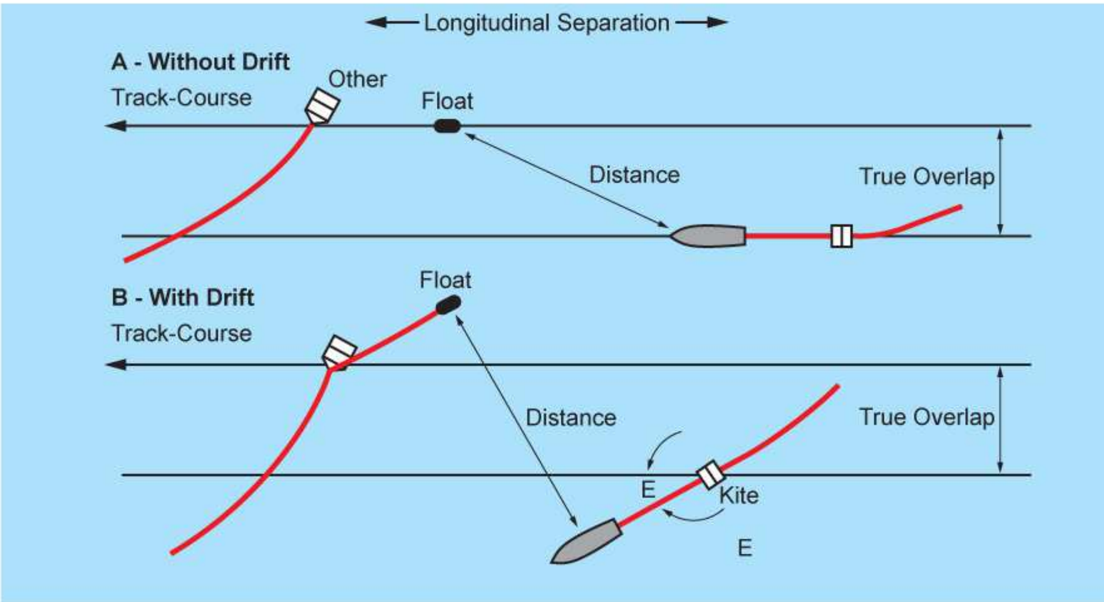

Figure 8-11. Station-Keeping Method 5: Overlap and Angle from Track-course

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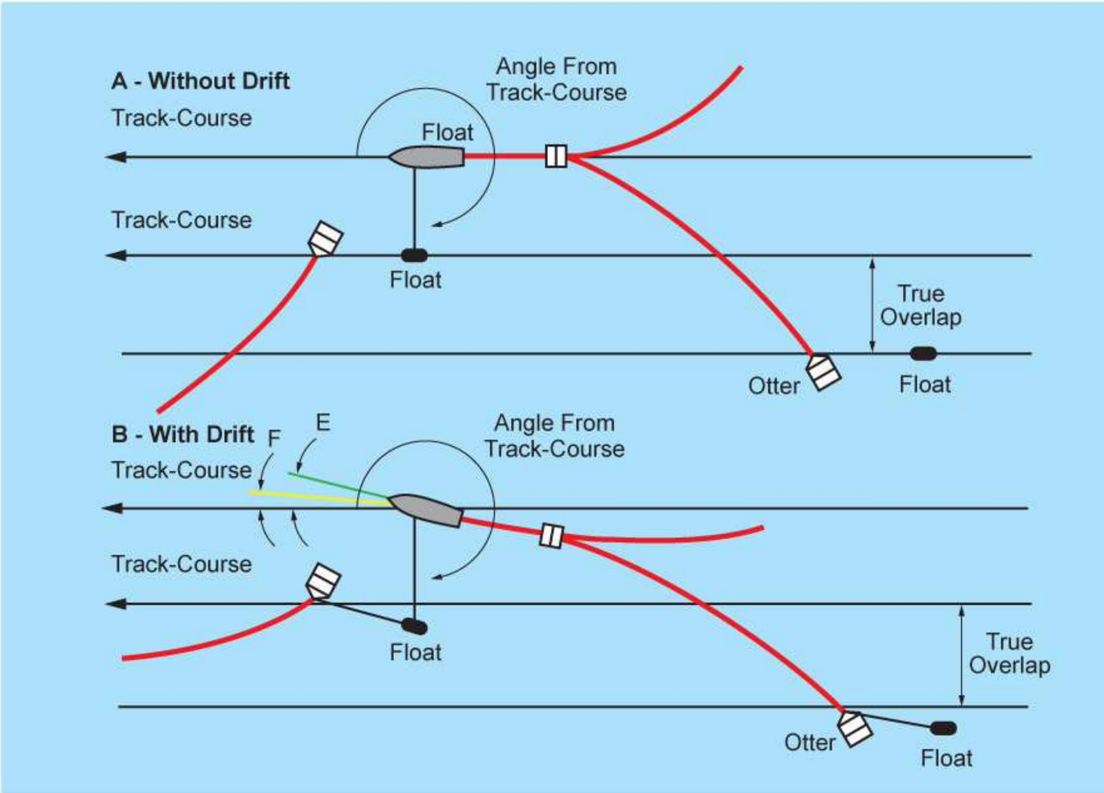

Figure 8-12. Station-Keeping Method 6: Overlap and Longitudinal Separation

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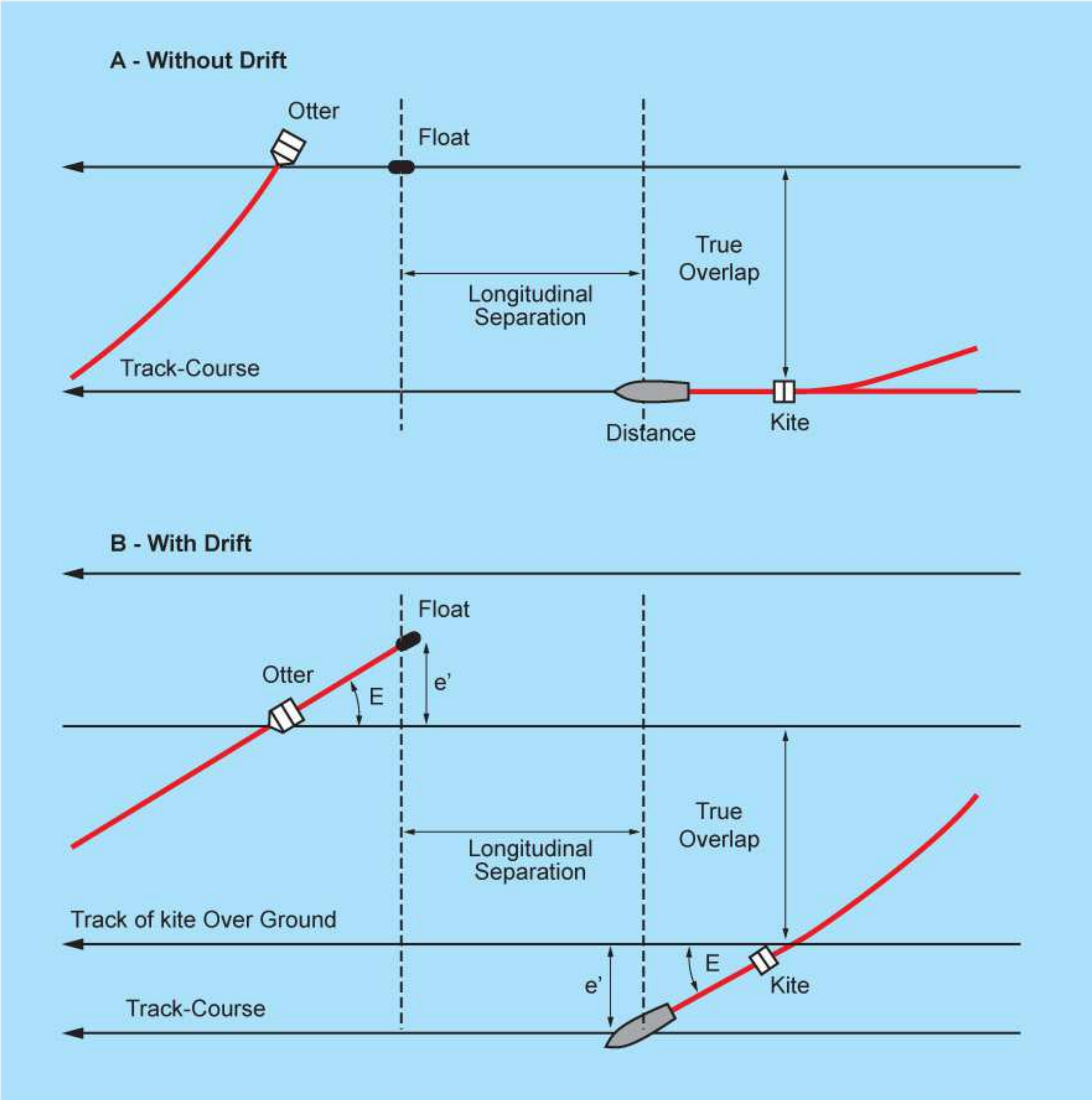

Figure 8-13. Station-Keeping in Oropesa Sweep Formation

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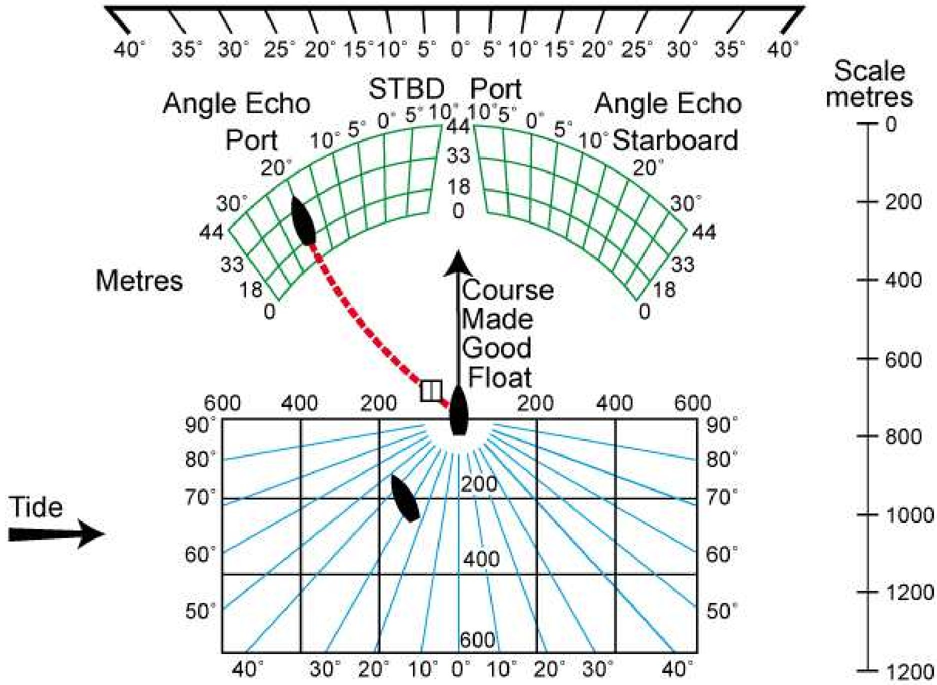
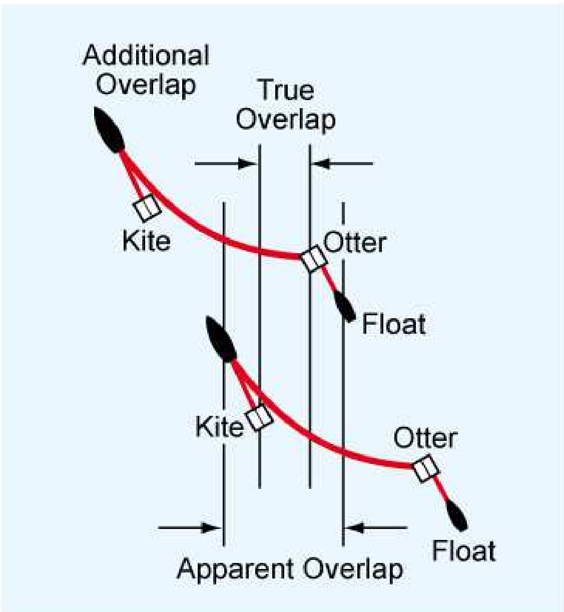


Example
Formation G to starboard, depth of sweep 33m, true overlap 73m, angle E is 20° port station keeping distance, asternof float is 183m, additional overlap is 54m.



4. (NU) Choice of Station-keeping Method

a. (NU) Mechanical Team Sweeping.

(1) (NU) There are two possible methods of station-keeping in the formation; angle from track-course and lateral separation (Method 3), or corrected relative bearing and distance (Method 1).

(a) (NU) Method 3 has the disadvantage of altering the shape of the sweep, the effect being pronounced when there is a strong cross-tide. It has the advantage of keeping the swept path constant, as measured between the kites of the wing sweepers. This method of station-keeping is recommended.

(b) (NU) Method 1 has the advantage of not altering the shape of the sweep but reduces the swept path in a cross-tide. The effective swept path width is equal to:

the distance apart of wing ships x cos(Angle E).

(c) Method 1 is seldom used.

(2) (NU) Station-Keeping Between Teams of Sweepers.

(a) (NU) If Method 3 is being used in the various formations, the team guide keeps station on the guide of the group (or other suitable team guide).

(b) (NU) If Method 1 has been adopted in the various formations, the team guide keeps station by means of Method 3 on the nearest outside ship in the next team ahead.

b. (NU) Mechanical Sweeping with Oropesa Sweeps.

(1) (NU) Single Oropesa.

(a) (NU) Line-of-Bearing Formation. The intent is 100% coverage within the formation. Station is normally kept on the float of the nearest ship ahead using overlap and distance (Method 4) or overlap and longitudinal separation (Method 6). With Method 4, a strong cross-tide may bring the sweeper dangerously close to the sweep wire of the nearest leading ship.

(b) (NU) Line-Abreast Formation. This formation is used when search sweeping to a low fraction of coverage. Station is normally kept using Method 3. In the event of drift, the ordered fraction of coverage can only be maintained by altering the lateral separation of tracks.

(2) (NU) Double Oropesa.

(a) (NU) Line-of-Bearing Formation. The intent is 100% coverage is when using this formation. Station is normally kept on the float of the nearest ship using Method 5 or Method 6. It is better to use Method 6 when the guide is up-tide of the formation and Method 5 when the guide is down-tide. When search sweeping to less than 100% coverage, with the swept path due to the tide only slightly reduced, it may be convenient to keep station using Method 3 in relation to the next ship ahead.

(b) (NU) Line-Abreast or Multiple-Line-Abreast Formation. Method 3 is recommended. If aiming at 100 per cent coverage, it is advisable to use a large overlap to cover variations of the swept path due to cross-tides.

c. (NU) The use of these methods is summarized in the Table 8-1.

Table 8-1. Formations and Station Keeping Methods

FORMATIONS	STATION-KEEPING METHOD
E-F-J	Method 3 for ships of a same team and between guides of the fronts
G	Method 6
I	Method 5 if the guide is down-tide of the formation or if, in the opposite case, Angle E is less than 6º. Method 6 if the guide being up-tide of the formation, Angle E is more than 6º.

0823 (NU) Influence Sweeping

1. (NU) Line-abreast formation (Figure 8-14). The distance apart of tracks must still be kept constant but, in this case, two methods of station-keeping may be used:

a. (NU) Method 3. This method is recommended provided sweepers are not endangered by the sweeps of adjacent sweepers because of drift.

b. (NU) Method 2. This is the only possible method when, owing to cross-tide, sweepers are likely to be endangered by the sweeps of adjacent sweepers.

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Figure 8-14. Station-Keeping When Influence Sweeping: Line-Abreast Formation

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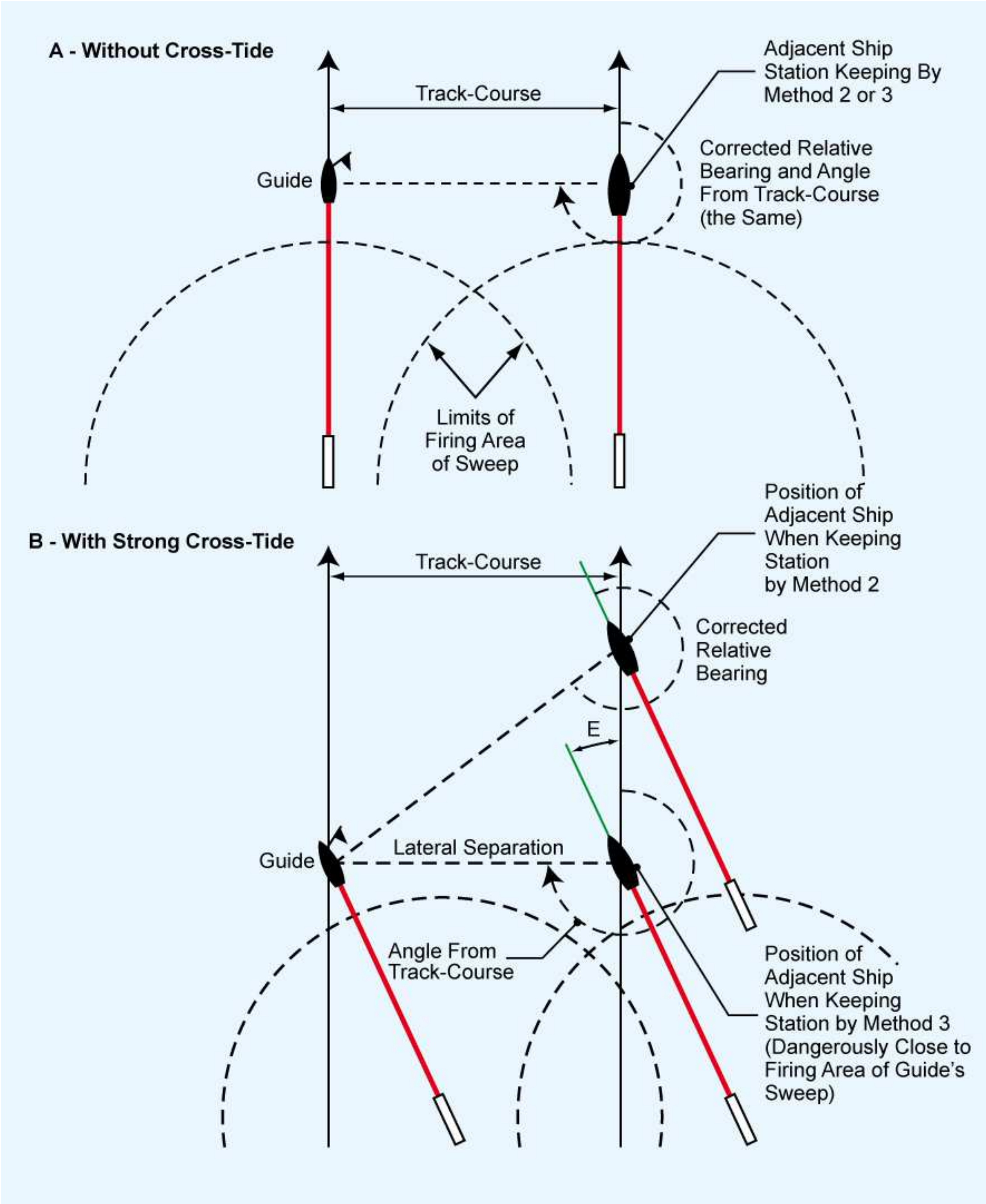

SECTION IV - FORMATIONS AND TURNS IN MINESWEEPING

0831 (NU) General

1. (NU) The problems peculiar to sweepers are those concerned with taking up formation while veering sweeps, 180º track-turns, changes in track-course and changes in formation.

2. (NU) The characteristics of the types of allied minesweepers and their sweeping equipment vary and are subject to change. In addition, the development of navigational aids introduces new manoeuvring methods from time to time.

3. (NU) Preliminary MCM formations are formations in which the execution of various phases, such as taking up formation, station-keeping, veering/streaming sweeps, and speed changes lead into the ordered MCM formations.

4. (NU) For these reasons the instructions in Chapters 4 and 5 do not include precise details of the manoeuvres described. They contain the signal to order the manoeuvres. The detailed procedures applicable to each type of sweeper are given in national supplements and are based on the general principles in Chapter 3.

0832 (NU) Track-Course and Speed

1. (NU) In accordance with MTP-1, Volume I, and supplemented as necessary, the following course and speed definitions are applicable in MCM:

a. (NU) The Track Course. The true course of the track.

b. (NU) Operational Speed. The highest speed at which ships will be required to proceed during a particular operation or during a stated period.

c. (NU) Signalled Speed. The speed in knots at which the guide has been ordered to proceed. In mine warfare the signalled speed is reached by using the normal number of revolutions/value of pitch for the ordered speed, adjusting as necessary for foul bottom and damage, but not adjusting for sweep-gear streamed.

d. (NU) Sweeping Speed. The SPEED THROUGH THE WATER, which is the result of the effect of the gear on the signalled speed.

e. (NU) Stationing Speed. A speed slower than operational speed, specified for reasons of fuel economy. Stationing speed should be ordered or included in the operation order.

f. (NU) Optimum MCM Speed. The speed made good over the ground for a given set of conditions which provides the greatest sweeping/hunting rate.

g. (NU) Minimum Towing Speed. The slowest speed through the water at which it is possible to proceed with towed gear.

h. (NU) Maximum Towing Speed. The speed through the water which may not be exceeded without causing damage to the gear or the towing vehicle.

i. (NU) Standard Speeds. All speeds to be ordered during mine warfare operations; including speeds through the water whilst streaming, recovering and turning, for each type of MCM gear are indicated in the relevant tables of the national supplements to this publication.

(1) (NU) When independent methods are used in mechanical sweeping operations, sweeping speed is 1 knot more than the speed indicated, as in the tables in the national supplements.

(2) (NU) Particular conditions (weather, current) may cause the tactical commander of minesweepers to alter the standard speeds as given in the appropriate tables.

0833 (NU) Guide

1. (NU) In addition to the responsibilities of the formation guide as listed in MTP-1, Volume I, the guide in MCM Formations assumes the following duties:

a. (NU) Responsibility for the navigation of the ordered sweeping track sequence.

b. (NU) Providing ships in the formation with information which may make station-keeping easier, in particular details of mean course steered to maintain the track.

c. (NU) Directing the execution of the component manoeuvres given in standard methods ordered by the Tasking Authority.

0834 (NU) Subdivisions

When subdivisions are referred to in the diagrams of instructions for formations and turns, they refer to subdivisions in the particular formation and do not necessarily bear any relation to the administrative organization of the squadron.

0835 (NU) Choice of Formation

1. (NU) When several formations are possible, the following factors may govern the choice made by the Tasking Authority.

a. (NU) Problems of station keeping.

b. (NU) Area required and available for track-turns.

c. (NU) Time required for track-turns.

d. (NU) Required swept depth for mechanical minesweeping formations.

2. (NU) It is sometimes preferable to use a disposition consisting of two manoeuvrable formations rather than a single formation which may be difficult to manoeuvre.

0836 (NU) Taking up Formation

1. (NU) The standard minesweeping formations are lettered, the letter being followed as necessary by PORT or STBD to indicate the side of the formation. The standard formations are illustrated in Figure 8-14.

2. (NU) In the formation diagrams in Chapter 3, Annexes A & B the numbers represent station numbers unless otherwise indicated. Lateral separation may be changed by signal. In minesweeping operations, ships may automatically change their station numbers.

3. (NU) Ships normally take up formation and stream sweeps in consecutive phases as described in the following chapters. Further details such as speeds and distances, which are peculiar to the types of MCMVs, are given in national supplements.

4. (NU) In some circumstances it may be desirable to stream sweeps before taking up formation, eg when approaching a minefield along a narrow channel. In such cases suitable formations are taken up and sweeps streamed using signals from ATP-1, Volume II.

5. (NU) Formations are normally to be taken up relative to the signalled track course (L CORPEN), but it may be preferable in certain circumstances to take up a formation relative to another course. In this case, the signal P FORM 3 has to be used:

0837 (NU) Rearrangement of the Formation

1. (NU) A formation may have to be rearranged either after a modification of the lateral separation of tracks or in the event of a breakdown to one or more minesweepers.

2. (NU) A modification of the lateral separation of tracks will be signalled by the guide's hoisting the corresponding formation signal.

3. (NU) Breakdown procedures are indicated in Chapter 3, Annexes A & B.

0838 (NU) Altering Course During a Run

1. (NU) The course followed by a formation on a track may have to be altered:

   a. (NU) To follow a line of MCM buoys which is not straight.

   b. (NU) Because of a bend in the channel.

2. (NU) For temporary alterations from the track-course (eg because the buoy line is not straight, or to sweep round obstructions), the temporary course may be signalled by the use of G CORPEN or K CORPEN depending on whether course through the water or course over the ground is required. Sweepers in the formation adjust station accordingly.

3. (NU) Alterations of course for bends in the channel are normally carried out by wheeling, but the use of signals CORPEN J or CORPEN K may be more convenient in certain circumstances. As these courses are 'through the water', L CORPEN should be signalled as soon as possible after completion of the alteration.

4. (NU) When ships are in column or line-of-bearing formation they should begin to take up their new stations individually when they reach the turns in their tracks.

5. (NU) When ships are in line-abreast formation the manoeuvre is made by wheeling.

6. (NU) When ships are in multiple-line-abreast formation, manoeuvring is carried out by successive wheeling of lines, each line manoeuvring by order of its own guide.

7. (NU) Necessary alterations of speed will be signalled by the guide, using appropriate speed signals.

Figure 8-15. MCM Formations

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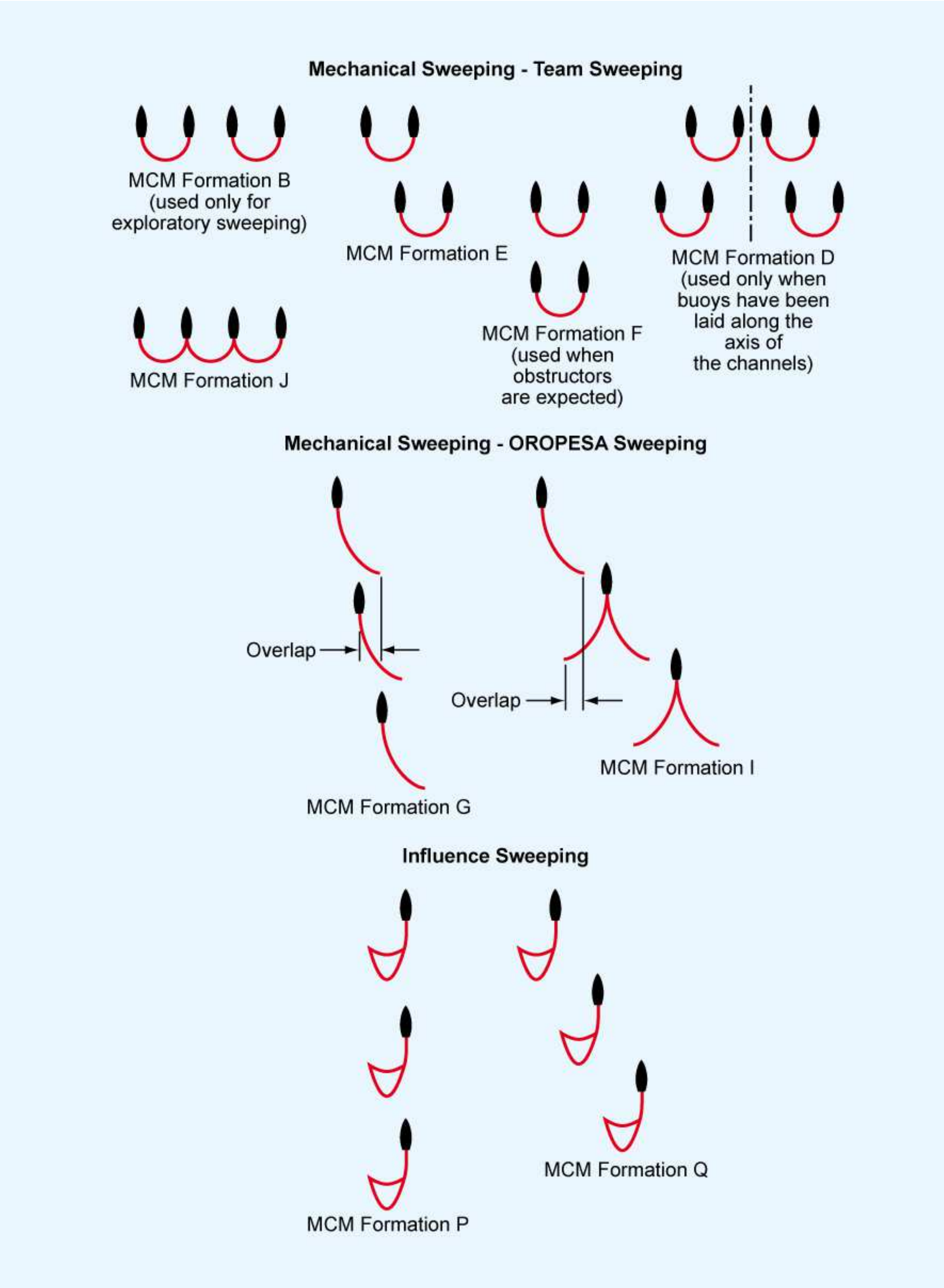

0839 (NU) Track-Turns

1. (NU) Turns at the end of runs are normally carried out in accordance with the instructions for the standard track-turn methods (STTMs) in Chapter 3, Annexes A & B, amplified by national supplements.

2. (NU) The Standard Track-Turn Methods. These are numbered in accordance with the lists in Table 8-2.

Table 8-2. Relation of Formation and Standard Track-Turn Method

TYPE OF SWEEP	FORM H	METHOD OF TAKING UP FORMATION	STANDARD TRACK-TURN METHOD (STTM)	STATION-KEEPING METHOD
TEAM	B	B	No STTM exists OTC to describe method to be used	Line of bearing/distance
	D	D	1-2 (for each subdivision separately)	Line of bearing/distance
	E	E	1-2	Line of bearing/distance
	F	F	1-2	Line of bearing/distance
	J	J-J1-J2-J3-J4	6-7	Line of bearing/distance
OROPESA	G	G	20-21-22-23-24-25-39	Method 6 - overlap and longitudinal separation
	I	I	30-31-32-33-39	Method 5 - overlap and angle from track course Method 6 - overlap and longitudinal separation
INFLUENCE	P	P	CORPEN and TURN signals	Independent navigation
	Q	Q	CORPEN and TURN signals if required by OTC	Independent navigation
		M 21 M 22 M 23	Independent	Independent navigation
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3. (NU) STTM Signals. STTMs are ordered by signal, as follows (see also ATP-1, Volume II).

CORPEN LPORT (or STARBOARD)...(3 Numerals) DESIG ... (2 numerals)

4. (NU) The STTM diagrams show the course over the ground. Allowance must therefore be made for wind and cross-tide.

5. (NU) In some circumstances it may be impossible to use the STTMs provided. In such cases, the OTC should order track-turns using suitable signals from ATP-1, Volume II.

6. (NU) Altering 360º Course. No STTMs are provided for altering course 360º to enable a track to be swept in the same direction as before. Normal manoeuvring signals, or two successive 180º STTMs, should be used.

7. (NU) Ship Numbers after a Track-turn. After a track-turn, stations kept by ships in the formation may be different from those kept before turning. Ships automatically take the number of the station they keep in the new formation, as shown in the diagram.

0840 (NU) Recovering the Sweeps

Sweepers normally manoeuvre independently when recovering the sweeps for maintenance or small repairs or when the sweeping task is completed.

SECTION V - TRACKS

0841 (NU) Track Designation

1. (NU) The track designation is shown in Figure 8-16.

2. (NU) Reference Track. The reference track is the track lying on the centre line of the channel or area unless otherwise ordered.

3. (NU) Designation. Additional tracks are designated in metres either side of the reference track, those to the right ‘plus’ and those to the left ‘minus’ when proceeding along the reference track in the direction of the alphabetical sequence of the route. Thus, the designation ‘plus 440' means a track centred 440 metres to the right of the reference track while ‘minus 440' indicates the track 440 metres to the left of the reference track.

4. (NU) Point N. Point N is situated on the reference track, one mile outside the MCM operation area (see Figure 8-16).

Figure 8-16. Buoys and Tracks Designation

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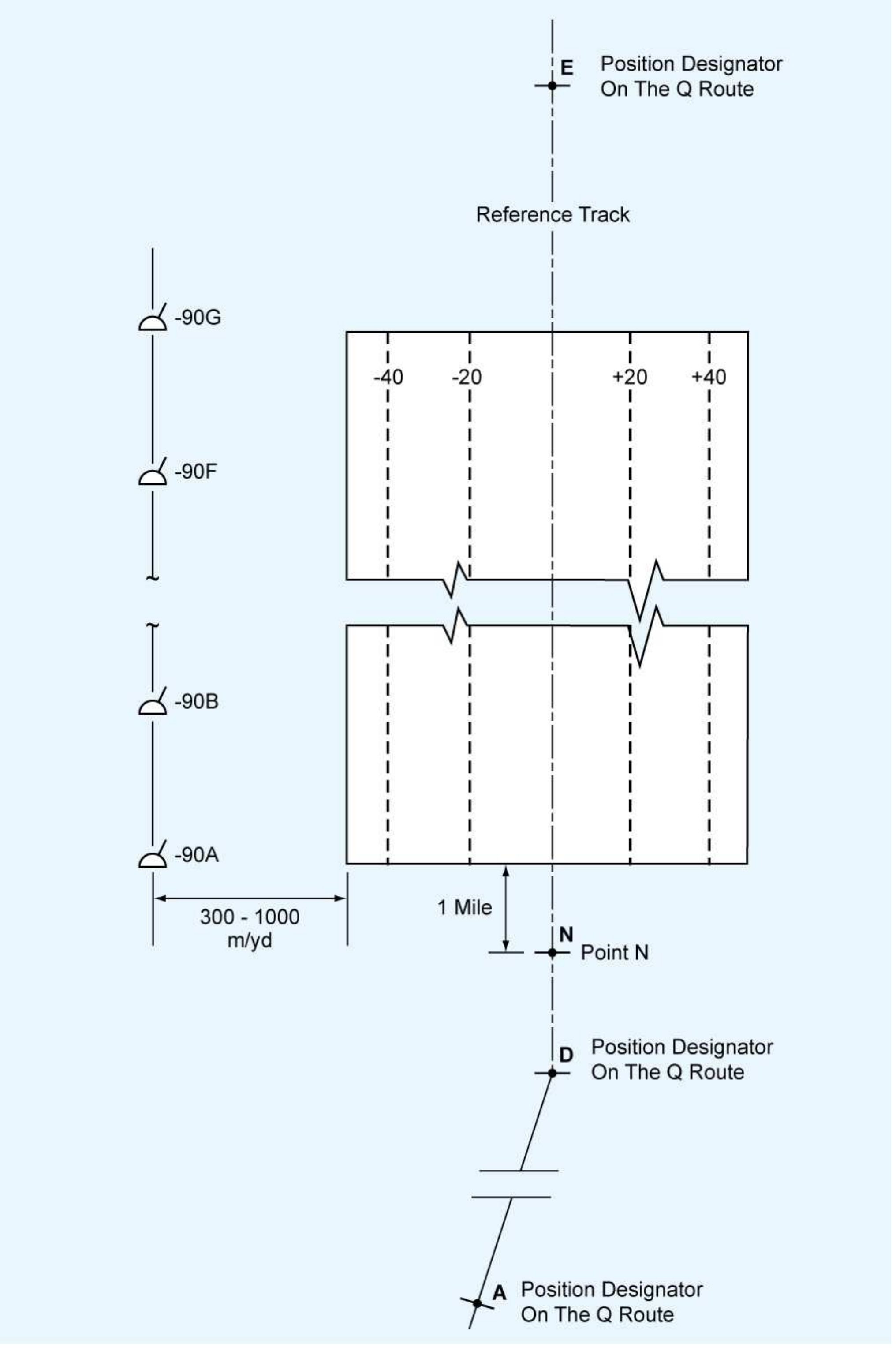


0842 (NU) Run Tote

1. (NU) Each effective sweep passage constitutes a run on that particular track. For reporting purposes runs are numbered consecutively from 1 on each track, and each ship must maintain a tote of the run numbers of his group. If sweeps do not function throughout a run, it is ineffective and a number must not be allocated to it. To avoid confusion, each ship should broadcast to the unit, at the beginning and end of each run, the track number. From time to time, and when a ship joins the unit during the task, the CTU of minesweepers must confirm the 'run tote' by signalling the numbers of the runs actually in progress, or by signalling the totals of the run tote.

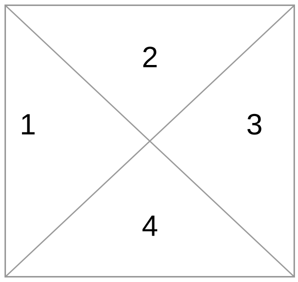
2. (NU) Instructions for Completing the Run Tote (see Figure 8-17).

a. (NU) Part 1: Time of entering track.

Part 2: E (for 'effective') followed by the run number. If the run is not fully effective then one of the following letters must be entered

M In combined sweeping, Effective only for magnetic sweeping.

A In combined sweeping, Effective only for acoustic sweeping.



Part 3: Time out of track.

Part 4: International call sign of ship making run

b. (NU) If the run is ineffective, the appropriate rectangle will be shaded blue (see examples in Figure 8-17).

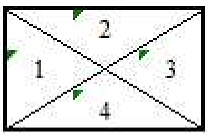
c. (NU) An electronic version of the Run Tote is available in the electronic version of this publication

Figure 8-17. Example of Run Totes (Influence Sweeping)

NATO-UNCLASSIFIED

Date	01/11/11
Name of Area / Channel	QQR 501 A-B
Unit / Task Unit	FGS Hameln / Drones 1,2,3,11

-512	-256	0	256	512
A1 08:57 09:51 SH3	07:30 08:31 SH1	E1 07:25 08:22 SH2	E1 07:36 08:40 SH11	M1 07:45 08:45 SH3
11:40 12:36 SH1	E1 09:03 10:04 SH2	E2 08:53 09:56 SH11	M1 09:13 11:10 SH1	E1 10:30 11:29 SH11
A2 13:15 14:20 SH1	E2 11:55 12:54 SH11	M1 10:34 11:40 SH2	10:40 11:45 SH3	M2 12:01 13:02 SH2
E1 13:30 14:30 SH3	E3 13:25 14:30 SH2	E3 14:50 15:52 SH1	E2 13:20 14:25 SH11	12:05 13:10 SH3
	E4 14:55 16:00 SH2	E4 14:59 16:04 SH11		
		A1 15:08 16:13 SH3		



1: Time of entering track
2: E : Acoustic Deep Frequency, Magnetic 60A
3: Time out of track
4: Name or callsign of unit making run

OPREP NMW/TASKREP/001/FGS HAMELN/012345ZNOV2011Refers:

Figure 8-18. Example of Run Totes (Mechanical Sweeping)

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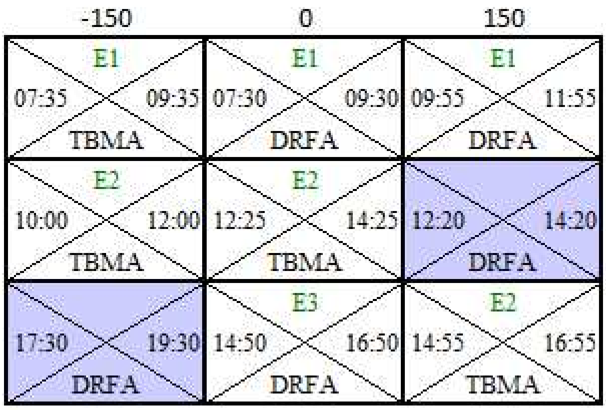
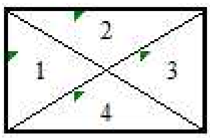
Date	1/11/11
Name of Area / Channel	QQR 501 C-D
Unit / Task Unit	TCG Silifke / FGS Spica





1: Time of entering track
2: E : Double Oropesa A=256m, B=1, DS=25m
3: Time out of track
4: Name or callsign of ship making run

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SECTION VI - SPECIAL SIGNALS IN MINE COUNTERMEASURES

0851 (NU) General

Mine Warfare signals are given in the Chapter 'Mine Warfare' and other relevant chapters of ATP-1, Volume II. However, some special signals which only apply to MCMVs are listed and described in paras 0852 and 0853 below.

0852 (NU) Special Non-alphabetical Signals for Use in MCM

1. (NU) Black Balls. The black balls referred to in this publication should be between 0.6 and 1.2 metres in diameter.

2. (NU) Red Flag. A large red flag is used to indicate the state of magnetic sweeps. The working of this flag is laid down in Table 8-3.

3. (NU) Black Flag. The working of the black flag during acoustic sweeping is described in Table 8-3. Ships which do not carry a black flag will need to locally produce one for use as described.

4. (NU) Speed Flags. Speed flags may be used during minesweeping.

5. (NU) Signals for use between bridges when manoeuvring in team sweeping formations. A red or green flag, fitted on a stave, is held up as soon as the wheel is put over when turning to port or starboard respectively; kept up while the ship is turning, then waved and taken down when the ship is steady.

6. (NU) Special signals for heave and veer.

   a. (NU) Heave In

      By day: Flag H waved from sweep deck
      By night: Short white flashes

   b. (NU) Veer

      By day: Flag V waved from sweep deck
      By night: Long white flashes

7. (NU) Signals Displayed for MCM Operations

   a. (NU) When engaged in any type of MCM operation vessels shall display signals as prescribed by Rule 27f of the International Regulations for Prevention of Collisions at Sea (IRPCS). (see Table 8-2 and Table 8-3)

   b. (NU) Influence Minesweeping. In influence minesweeping, flags also indicate the type of sweep operated, and their status of energizing. A red flag is hoisted whenever magnetic sweeps are energized for sweeping and test pulsing. A black flag is hoisted whenever acoustic sweeps are energized for sweeping or testing. (See Table 8-3)

c. (NU) Minehunters Operating Divers. The minehunter will display Flag A by day. See Table 8-4.

8. (NU) Signals Displayed by Diving Dinghies. When operating divers or conducting mine disposal operations, the dinghies:

a. (NU) By Day. Have to display/be prepared to display flag A or flag B of the international code of signals, as appropriate, when approached by other vessels.

b. (NU) By Night. Are required to display/be prepared to display an all-round white light and are required to be prepared to show a signal to attract attention.

c. (NU) See Table 8-4.

0853 (NU) Romeo Procedure

1. (NU) The purpose of the Romeo Procedure is to facilitate the dissemination of orders and information in MCM manoeuvring.

2. (NU) Flag R singly, or preceding a numeral, is hoisted to denote the completion, or the completion of a numbered phase, of certain manoeuvres described in Chapter 3. When it is hauled down it is the executive signal to carry out the next phase of the manoeuvre. For general information see Table 8-5.

3. (NU) The instructions for the execution of the manoeuvres concerned include instructions for the working of Flag R.

4. (NU) The numeral shown in brackets may be omitted when, in the opinion of the officer with TACON, no confusion can arise.

5. (NU) On completion of a manoeuvre, or a phase of a manoeuvre, Flag R (with numeral flag) is hoisted at the dip by all ships. When the guide’s Flag R is hoisted close up, all other ships hoist their flags close up. Alternatively, the officer with TACON may prescribe that the last ship in the line hoists Flag R close up as soon as that ship is ready, and in these circumstances other ships should then hoist Flag R close up in succession towards the guide.

6. (NU) It may be necessary for the guide to hoist his flag R close up and execute the next phase without warning. When the next phase is an increase of speed, this can often be achieved more conveniently by another system of signalling.

Table 8-3. Signals When Minesweeping

TYPE OF SWEEP	SIGNAL	OCCASION	WHERE DISPLAYED	MEANING
Magnetic sweeping	*By day* 3 black balls *By night* 3 green lights	From beginning of streaming to end of recovery	One at masthead, one at both yardarms	Sweeping operations in progress
	Red flag	Streaming	Where best seen	
			At dip	Sweep streamed, ready to energise
			Close up	Sweep energised (including test pulse)
		Running	At dip	Sweep temporarily de-energised
		Recovery	At the dip	Sweep de-energised
			Hauled down	Gear disconnected
Acoustic sweeping	*By day* 3 black balls *By night* 3 green lights	From beginning of streaming to end of recovery	One at masthead, one at both yardarms	Sweeping operations in progress
	Black flag	Streaming	Where best seen	
			At dip	Sweep streamed, ready to energise
			Close up	Sweep energised
		Running	At dip	Sweep de-energised
		Recovering	At the dip	Sweep de-energised
			Hauled down	Gear disconnected
Mechanical sweeping (Oropesa and team)	*By day* 3 black balls *By night* 3 green lights	From beginning of streaming to end of recovering	One at masthead, one at both yardarms	Sweep operations in progress
NATO-UNCLASSIFIED				

Table 8-4. Signals by Minehunters and Diving Dinghies

TYPE	SIGNAL	OCCASION	WHERE DISPLAYED	MEANING
Minehunter	*By day* 3 black balls *By night* 3 green lights	During the whole operation	One at masthead, one at both yardarms	Minehunting in progress, (Underwater Vehicle Possibly in Operation)
	By day Flag A	When diving	Yardarm(s)	Divers in the water
Diving dinghy	*By day* Flag A or Flag B *By night* 1 white light	When approached by vessels	On board the dinghy	Divers in the water
NATO-UNCLASSIFIED				

Table 8-5. Signalling of Flag R

BY FLAGS	BY VOICE	BY LIGHT
Flag R (numeral) at dip Flag R (numeral) close up by Guide Flag R (numeral) close up by others Flag R (numeral) hauled down by Guide	Romeo at the dip Execute to follow - Romeo (numeral) - Over Romeo (numeral) - Close up - Out Stand by - Execute - Over	- IX BT Romeo (numeral) BT K Romeo (numeral) AR IX (5-second flash) K
NATO-UNCLASSIFIED		

LEXICON OF MINE WARFARE ABBREVIATIONS, TERMS AND DEFINITIONS

SECTION I - NAVAL MINE WARFARE ABBREVIATIONS

Abbreviations and Definitions from AAP-15 are in italics

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this lexicon refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

0-9

7QMTE	7 Question Maritime Tactical Estimate

A

AAA	Anti-Aircraft Artillery
AAM	Air to Air Missile(s)
AAP	Allied Administrative Publication
AAW	Anti-Air Warfare
ACC	Air Component Commander
ACP	Allied Communications Publication
AD	Actual Depth
ADivP	Allied Diving Publication
AEODP	Allied Explosive Ordnance Disposal Publication
AF	Audio Frequency/Advance Force
AGO	Reference Acoustic Goal
AHP	Allied Hydrographic Publication
ALP	Allied Logistic Publication
AMCM	Airborne Mine Countermeasures
AMNS	Airborne Mine Neutralization System
AMP	Allied Mine Warfare Publication
AOA	Amphibious Objective Area
AOR	Area of Responsibility
AP	Allied Publication
APP	Allied Procedural Publication
APPS	Analytical Photogrammetric Positioning System
ASW	Anti-Submarine Warfare
ATL	Allowable Transmission Loss
ATP	Allied Tactical Publication
AUV	Autonomous Underwater Vehicle
AWNIS	Allied Worldwide Navigational Information System
AWW	Above Water Warfare
AXP	Allied Exercise Publication

B

BAE	Battlespace Area Evaluation
BSP	Battle Space Profiler

C

C2I	Command, Control and Intelligence
C3	Command, Control and Communications
C4I	Command, Control, Computers, Communications & Intelligence
CATF	Commander Amphibious Task Force
CBRN	Chemical, Biological, Radiation and Nuclear
CC	Component Commander
CCIR	Commanders Critical Information Requirements
CCIS	Command and Control Information System
CCTV	Closed Circuit Television
CDT	Clearance Diving Team
CGS	Centimetre-Gram-Second
CL	Confidence Level
CLF	Commander Landing Force
CO	Commanding Officer
COA	Course(s) of Action
COE	Centre of Excellence
COMOMAG	Commander, Mobile Mine Assembly Group
COMPLAN	Communications Plan
COMSEC	Communications Security
CONOPS	Concept of Operations
COOP	Craft of Opportunity
COPD	Comprehensive Operational Planning Directive
CPG	Command Planning Group
CRN	Contact Reference Number
CRRC	Combat Rubber Raiding Craft
CRS	Crisis Response Shipping
CSAR	Combat Search and Rescue
CSM	Continental Shelf Mine
CTE	Commander Task Element
CTF	Commander Task Force
CTG	Commander Task Group
CTU	Commander Task Unit
CTW	Course Made Good Through the Water
CWC	Composite Warfare Commander

D

DARE	Decision Aid for Risk Evaluation
DC	Damage Control or Direct Current
DDA	Disk Drive Assembly
DG	Degaussing
DGPS	Differential Global Positioning System
DP	Decision Point(s)
DR	Dead Reckoning
DSO	Decision Support Overlay
DSOM	Decision Support Overlay Matrix

E

E&R	Evasion and Recovery
ECCM	Electronic Counter Countermeasures
ECM	Electronic Countermeasures
EEFI	Essential Elements of Friendly Information
ELFE	Extreme Low Frequency Electric
ELF	Extreme Low Frequency
EMCON	Emission Control
EOD	Explosive Ordnance Disposal
EODMU	Explosive Ordnance Disposal Mobile Unit
ES	End State(s)
ESPRESSO	Extensible Performance and Evaluation Suite for Sonar
EW	Electronic Warfare
EXOPORD	Exercise Operation Order

F

FACES	Feasibility, Acceptability, Completeness, Exclusivity, Suitability
FFIR	Friendly Forces Information Requirements
FIC	Fast Insertion Craft
FLS	Forward Logistic Site or Forward Logistic Support
FMA	Former Mined Area
FOL	Fraction of Losses
FORMEX	Formalised Exchange
FORMETS	Message Text Formatting System
FP	Force Protection
FS	Fire Support

G

GDP	General Defence Plans
GPGM	General Purpose Ground Mine
GPS	Global Positioning System
GRT	Gross Registered Tonnage
GSM	Global System for Mobile Communications
GUI	Graphical User Interface

H

HE	High Explosive
HF	High Frequency
HOD	Head of Delegation
HQ	Headquarters
HSA	Horizontal Sextant Angle
HUMINT	Human Intelligence
HVU	High Value Unit
HWM	High Water Mark

I

I&W	Indicators and Warnings
ICDP	Inter-Count Dormant Period
IED	Improvised Explosive Device
IFF	Identification Friend or Foe
ILDP	Inter Look Dormant Period
INCOPE	Improved Non-uniform Coverage Operation and Evaluation
INS	Inertial Navigation System
INTERCO	International Code of Signals
IP	Initial Point
IPB	Intelligence Preparation of the Battlefield
IPOE	Intelligence Preparation of the Operational Environment
IR	Infra-Red
IRPCS	International Regulations for Prevention of Collisions at Sea
ISR	Intelligence, Surveillance, Reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance

J

JABS	Joint Direct Attack Munition Assault Breaching System
JCS	Joint Chiefs of Staff
JISR	Joint Intelligence, Surveillance, Reconnaissance
JOPG	Joint Operational Planning Group

K

KSF	Keel Shock Factor

L

LBL	Long Baseline
LER	Low Frequency Electro-magnetic Radiation
LF	Low Frequency
LOP	Line of Position
LRN	Lay Reference Number
LTO	Lead Through Operation
LTV	Lead Through Vessel
LWM	Low Water Mark

M

MAD	Magnetic Anomaly Detector
MAH	Maritime Analysis Handbook
MAL	Mine Actuation Level
MARCOM	Maritime Commander
MAROPS	Maritime Operations
MAS	Mine Avoidance Sonar
MATL	Maximum Allowable Transmission Loss
MC	Military Committee

MCCIS	Maritime Command & Control Information System
MCCM	Mine Counter Countermeasures
MCCS	Mine Countermeasures Command and Support Ship
MCD	Mine Countermeasure Vessel, Diving
MCM	Mine Countermeasures
MCM EXPERT	Mine Countermeasures Exclusive Planning, Evaluation Risk Assessment Tool
MCMOPDIR	MCM Operations Directive
MCMOPORD	Mine Countermeasures Operation Orders
MCMR	Mine Countermeasures Reports
MCM RDM	MCM Risk Directive Matrix
MCMTA	Mine Countermeasures Tasking Authority
MCMV	Mine Countermeasures Vessel
MDA	Mine Danger Area
MDCOA	Most Dangerous Course of Action
MDR	Mine Damage Radius
ME	Main Efforts
MEDEVAC	Medical Evacuation
MEDS	MCM EXPERT Data Sheet(s)
MF	Medium Frequency
MH	Mine Hunting
MHC	Minehunter Coastal
MIE	Mine Investigation and Exploitation
MIED	Maritime Improvised Explosive Device
MLCOA	Most likely Course of Action
MILCO	Minelike Contact
MILEC	Minelike Echo
MLREP	Minelaying Report
MLTASK	Minelaying Task
MMS	Marine Mammal System
MMOE	Minefield Measures of Effectiveness
MNC	Major NATO Commander
MNV	Mine Neutralisation Vehicle
MOC	Maritime Operations Centre
MOE	Measure of Effectiveness
MOP	Magnetic Orange Pipe
MOU	Memorandum of Understanding
MPA	Maritime Patrol Aircraft
MPO	Minefield Performance Objective
MPP	Minefield Planning Programme
MPRA	Maritime Patrol and Reconnaissance Aircraft
MREPREQR	Mine Warfare Reporting Requirement
MRN	Mine Reference Number
MS	Mine Sweeping
MSA	Maritime Situational Awareness
MSC	Minesweeper Coastal
MSCD	Minesweeper Coastal, Drone Guide Unit
MSD	Minesweeper Drone
MSI	Minesweeper Inshore
MSM	Mine Setting Mode
MSO	Minesweeper Ocean
MSS	Mine Setting Sheet

MTA	Mine Threat Area
MTF	Message Text Format
MTMS	Maritime Tactical Message System
MW	Mine Warfare
MWDC	Mine Warfare Data Centre
MWP	Mine Warfare Pilot
MWSO	Mine Warfare Staff Officer

N

NAC	North Atlantic Council
NAI	Named Area of Interest
NAL	Normal Actuation Level
NAVAID	Navigational Aid
NAVSTAR	Navigation System Using Timing and Range
NCAGS	Naval Co-operation and Guidance for Shipping
NCIA	NATO Communications & Information Agency
NEPS	NATO EOD Publication Set
NEQ	Net Explosive Quantity
NFB	Nominal Frequency Band
NFO	NATO FORACS Office
NMCM	Naval Mine Countermeasures
NMFPF	NATO Minefield Planning Folder
NMFPG	NATO Minefield Planning Guidance
NMW	Naval Mine Warfare
NMWC	Naval Mine Warfare Coordinator
NMWTTEP	Naval Mine Warfare Tools, Tactics & Evaluation Procedures
NMWWG	Naval Mine Warfare Working Group
NOMBO	Non Mine Minelike Bottom Object
NSO	NATO Standardisation Office
NTM	Notice to Move
NUCEVL	Non-Uniform Coverage Evaluation
NATO FORACS	NATO Naval Forces Sensors and Weapons Accuracy Check Site

O

OAP	Offset Aim Point
OCA	Operational Control Authority
OCE	Officer Conducting the Exercise
OD	Omni-Directional
OFFTASK	Off-Task Cycle
OIC	Officer-in-Charge
ONTASK	On-Task Cycle
OOA	Out of Area
OPAREA	Operational Area
OPCOM	Operational Command
OPCON	Operational Control
OPDIR	Operational Directive
OPGEN	Operational General Matters
OPLAN	Operation Plan
OPORD	Operation Order
OPP	Operational Planning Process

OPREP	Operational Reporting
OPSTAT	Operational Status
OPTASK	Operational Tasking
ORBAT	Order of Battle
ORBATTOASEA	Order of Battle Transfer of Authority Sea
OSE	Officer Scheduling the Exercise
OTC	Officer in Tactical Command
OTH	Over the Horizon
OTT	On Task Time

P

PERREP	Periodic Report
PIR	Priority Information Requirements
PMA	Post Mission Analysis
PMI	Prevention of Mutual Interference
POC	Point of Contact
PPI	Political Policy Indicator
PPS	Precise Positioning System
PSYOPS	Psychological Operations

R

RC	Remote Control
RDM	Risk Directive Matrix
REA	Rapid Environmental Assessment
RFI	Request for Information
RHIB	Rigid Hull Inflatable Boat
RID	Reacquisition and Identification
RMP	Recognized Maritime Picture
ROA	Radius/Radii of Action
ROE	Rules of Engagement
ROV	Remote Operated Vehicle
RPC	Recommended Pulse Cycle
RSP	Render Safe Procedure
RTSV	Route Survey
RV	Rendezvous Point

S

SAL	Sweeping Actuation Level
SAM	Surface to Air Missile
SAR	Search and Rescue
SATCOM	Satellite Communications
SAS	Synthetic Aperture Sonar
SC	Strategic Command(er) or Shaped Charge
SCC	Sonar Confidence Check
SCCL	Sonar Contact Confidence Level
SCUBA	Self Contained Underwater Breathing Apparatus
SDNE	Standard Deviation of Navigational Error
SECDEF	Secretary of Defense
SEV	Surface Effect Vehicle
SF	Special Forces

SHAPE	Supreme Headquarters Allied Powers Europe
SIT	Simple Initial Threat
SLOC	Sea Lines of Communication
SLS	Standard Letter Suffix or Side Look Sonar
SMCM	Surface Mine Countermeasures
SN	Sending Nation
SOA	Speed of Advance
SOG	Speed Over the Ground
SOM	Scheme of Manoeuvre
SOP	Standard Operating Procedures
SPA	Submarine Patrol Areas
SPC	Standard Pulse Cycle
SPM	Self Protection Measure(s)
SPOD	Sea Port of Debarkation
SPPD	Stopped Penetrator Probability Density
SPVDS	Self-Propelled Variable Depth Sonar
SRCD	Self-Rotating Cavitation Disks
SSB	Single Sideband
SSS	Side Scan Sonar
SSV	Semi-Submerged Vehicle
STANAG	Standardisation Agreement
STBD	Starboard
STTM	Standard Track Turn Method
STUFT	Ships Taken Up From Trade
STW	Speed Made Good Through the Water
SUBOPAUTH	Submarine Operating Authority
SVP	Sound Velocity Profile
SZ	Surf Zone

T

TA	Tasking Authority
TACOM	Tactical Commander
TACON	Tactical Control
TACSIT	Tactical Situation
TAI	Target Area of Interest
TAS	True Air Speed
TASKORG	Task Organization
TE	Task Element or Threat Evaluation
TF	Task Force
TG	Task Group
TI	Threat Integration
TL	Transmission Loss
TNT	Trinitrotoluene
TSM	Target Simulation Mode
TTEP	Tactics and Tools Evaluation Panel
TTP	Tactics, Techniques & Procedures
TTW	Territorial Waters
TU	Task Unit

U

UAV	Unmanned Aerial Vehicle
UCPLN	Uniform Coverage Planning
UEP	Underwater Electric Potential
UHF	Ultra-High Frequency
UMCM	Underwater Mine Countermeasures
URM	Underwater Reference Mark
USAF	United States Air Force
USBL	Ultra Short Baseline
USV	Unmanned Surface Vehicle
UTM	Universal Transverse Mercator
UTMG	Universal Transverse Mercator Grid
UUV	Unmanned Underwater Vehicle
UWDC	Underwater Data Centre
UWIED	Underwater Improvised Explosive Device
UWW	Underwater Warfare
UXO	Unexploded Explosive Ordnance

V

VDDS	Very Deep Draught Ship
VDS	Variable Depth Sonar
VERTREP	Vertical Replenishment
VHF	Very High Frequency
VSS	Volume Search Sonar
VSW	Very Shallow Water
VTM	Vehicle Transiting the Minefield
VTMS	Vessel Traffic Management System

W

WGS	World Geodetic System
Wi Fi	Wireless Fidelity
WNGO	Warning Order
WSM	Water Space Management
WWNWS	World-Wide Navigation Warning Service

SECTION II - NAVAL MINE WARFARE TERMS AND DEFINITIONS

Terms and Definitions from AAP-6 are in italics

Note: (NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this Glossary refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

A

Acoustic Circuit. In Mine Warfare, an influence mine circuit which responds to the change of noise level caused by an approaching ship, submarine or sweep.

Acoustic Goal (AGO). The reference acoustic level corresponding to the actuation level of the existing potential sea mine

Acoustic Goal Line. NOT RELEASABLE

Acoustic Merit Index. Parameter used to qualitatively compare the acoustic measurements of individual ships or ships of different classes.

Acoustic Mine*.* *A mine with an acoustic circuit which responds to the acoustic field of a ship, submarine or sweep*.

Acoustic Minehunting. The use of sonar to detect and classify mine-like objects which may be in the water volume, on or protruding from the seabed, or buried in the seabed.

Active Mine*. A mine actuated by the reflection from a target of a signal emitted by the mine.*

Active Defensive Mine Countermeasures. Actions taken to counter the mine after it has been laid.

Actuate. *To operate a mine firing system by an influence or a series of influences in such a way that all the requirements of the mechanism for firing, or for registering a target* [In NMW; ship] *count, are met.*

Actuation Level. See 'Mine Actuation Level' and 'Normal Actuation Level'

Aggregate Width (W). The cumulative area under the lateral range curve, plotting the probability (P) as a function of the athwartship distance (y) also called the P(y) Curve.

a. **Aggregate Actuation Width.** For influence sweeping, P(y) is the probability of actuating a mine at least once (or registering a ship count) at the lateral offset y from the sweep during a single pass of the sweep.

b. **Aggregate Detection Width**. For minehunting, P(y) is the probability of detecting (and/or classifying) a mine at lateral offset y from the sonar during a single pass of the sonar.

c. **Aggregate Sweep Width.** For mechanical sweeping, P(y) is the probability of cutting a mine mooring at lateral offset y from the sweep during a single pass of the sweep. It should be noted that P(y) curves are not normally developed for mechanical sweeps.

Aggregate Damage Width. The integral of the probability of actuation of a mine under specified conditions, integrated only over those values of athwartship distance for which the explosion of the mine is likely to inflict at least a specified amount of damage.

Aggregate Danger Width. See Dangerous Front

All Poised Risk. After MCM Operations the probability of damage to the first transitor where all remaining mines are considered to be on ship count 1.

Allowable Transmission Loss (ATL). See Maximum Allowable Transmission Loss

Antenna Mine. *A contact mine fitted with antenna which, when touched by a ferrous object, set up galvanic action to fire the mine*

Antenna-Sweep. A Sweep System to counter antenna fitted mines.

Anti-Air Warfare. *Measures taken to defend maritime force against attacks by airborne weapons launched from aircraft, ships submarines and land based sites*

Anti-Countermining Device. A device fitted in a mine to prevent its actuation by shock.

Anti-Hovercraft / Anti-Helicopter Mine. A mine which is laid or whose mechanism is specifically designed or adjusted with the object of sinking or damaging hovercraft or helicopters.

Anti-Mine Hunter Mine. A mine which is laid or whose mechanism is specifically designed or adjusted with the object of sinking or damaging Mine Hunters.

Anti-MCMV Mine. A mine which is laid or whose firing system is designed or adjusted, with the specific object of damaging MCM vessels.

Anti-Mine Sweeper Mine. A mine which is laid or whose firing system is specifically designed or adjusted with the object of sinking or damaging Mine Sweepers.

Anti-Recovery Device. *Any device in a mine designed to prevent an enemy discovering details of the working of the mine firing system.*

Anti-Surface Effect Vehicle Mine (ASEVM) A mine used against Surface Effect Vehicles (SEV).

Anti-Submarine Minefield. *A field laid specifically against submarines. It may be laid shallow and be unsafe for all craft, including submarines, or laid deep with the aim of being safe for surface ships.*

Anti-Sweep Device. *Any device incorporated in the mooring of a mine or obstructor, or in the mine circuits to make the sweeping of the mine more difficult.*

Anti-Watching Device. *A device fitted in a moored mine which causes it to sink should it watch, so as to prevent the position of the mine or minefield being disclosed. See also **Watching Mine.***

Approach Lane. *An extension of a boat lane from the line of departure toward the transport area. It may be terminated by marker ships, boats or buoys*.

Approach Route. *A route which joins a port to a coastal or a transit route.*

Area Minefield. A type of minefield which is established by scattering mines over a large area with the aim of causing attrition to ships moving within that area

Armed Mine. *A mine from which all safety devices have been withdrawn and, after laying, all automatic safety features and/or arming delay devices have operated.* Such a mine is ready to receive a target signal, influence or contact.

Armed Sweep. *A sweep fitted with cutters or other devices to increase its ability to cut mine moorings.*

Arming Delay Device. *A device fitted in a mine or any autonomous munition designed to prevent it from being armed for a pre-set time after laying or delivery*.

Arming Lanyard. A line or tape attached to a safety device which enables removal of the device prior to mine lay.

Asymmetrical Sweep. *A sweep whose swept path under conditions of no wind or cross tide is not equally spaced either side of the sweeper's track.*

Aspect Change. The different appearance of the reflecting object viewed by sonar from varying directions

Attenuation.

a. Decrease in density of a signal, beam, wave or influence as a result of absorption of energy and of scattering out of the path of a detector, but not including the reduction due to geometric spreading, ie. the inverse square of distance effect

b. In Mine Warfare, the reduction in the intensity of an influence as distance from the source increases.

Attrition Minefield. A minefield intended primarily to cause damage to enemy ships and maintain a constant level of threat over an extended period of time. The minefield may either be sustained or un-sustained.

Autonomous Underwater Vehicle. Type of unmanned underwater vehicle capable of executing its mission without external positive control

Average Characteristic Actuation Area. The integral, over a plane perpendicular to the centre line of the target ship, of the probability P(y, z) of actuation of a mine under the specified conditions.

Average Characteristic Actuation Width. The integral, over athwart ship distance between the mine and the keel of the target ship, of the probability P(y) of actuation of a mine at a given depth and under specified conditions.

B

Boat Lane. *A lane for amphibious assault landing craft, which extends seaward from the landing beaches to the line of departure.*

Bottom Composition. Composition of the seabed (ie Mud, Sand, Shingle etc.)

Bottom Mine. A mine that is negatively buoyant; rests on, or can become buried in, the sea bed and is held there by its own mass. (See **Ground Mine and Mine)**.

Bottom Profile. In Naval Mine Warfare bottom profile includes descriptions of the gradient and roughness (ie, Ripples, holes, bumps, ridges and folds).

Bottom Sweep. Two ship wire or chain sweeps used either to sweep mines close to the bottom and to sweep heavy obstructers or to remove such mines and obstructers from a channel by dragging them to a designated area and releasing them.

Bottom Type. Characterisation of the seabed based on Bottom Profile, Bottom Composition and mine burial.

Bouquet Mine. *A mine in which a number of buoyant mine cases are attached to the same sinker so that when the mooring of one mine case is cut, another mine rises from the sinker to its set depth.*

Breaching. An operation specifically designed to overcome anti-landing defences in order to conduct an amphibious assault.

C

Casualty. (See **Loss**)

Change Detection. The detection of any new object in an area, channel or route which has been surveyed previously.

Channel. The whole or part of a route specified by a width in which MCM operations will be or have been conducted.

Channel Conditioning. Channel conditioning is the operation of removing minelike objects from channels, harbour approaches and Q-Routes to reduce the Non-Mine Minelike Bottom Objects (NOMBOs) detected by minehunting systems.

Characteristic Width. The width of the trapezoid measured at one-half the characteristic probability or the width of the rectangle.

a. **Characteristic Actuation Width.** *In influence minesweeping, the width of path over which mines can be actuated by a single run of the sweep gear*.

b. **Characteristic Cutting Width**. In mechanical minesweeping, *the* width of path over which mines can be cut by a single run of the sweep gear.

c. **Characteristic Detection Width.** *In minehunting, the width of path over which mines can be detected on a single run.*

Characteristic Probability. Height of a trapezoid or rectangle that most closely fits the curve of P(y).

a. **Characteristic Actuation Probability.**

(1) In influence minesweeping, the average probability of a mine of a given type being actuated by one run of the sweep within the characteristic actuation width

(2) In mining, the average probability of a mine of a given type being actuated by a target in one single pass

b. **Characteristic Cutting Probability.** In mechanical minesweeping, the average probability of a mine of a given type being cut by one run of the sweep within the characteristic cutting width.

c. **Characteristic Detection Probability.** *In minehunting, the ratio of the number of mines detected on a single run to the number of mines which could have been detected within the characteristic detection width.*

Characteristic Disposal Probability. The probability of disposing of a mine by applying a specific disposal technique

Check Operation. An MCM operation to confirm no mines are left after a previous MCM operation or that re-mining has not taken place.

Chemical Horn. *A mine horn containing an electric battery, the electrolyte for which is in a glass tube protected by a thin metal sheet.*

Circular Error Probable. A radius of a circle within which the location of half of the detections of a single contact are expected to fall.

Circular Snagline Search. A diver dragging a lightly weighted line in a circle around a sinker/anchor so that it is caught or 'snagged' by objects which are protruding from or laying on the seabed.

Classification. In Minehunting, the process of evaluating a detected contact as minelike or non-minelike.

Classification Range. The range at which a contact is classified.

Clearance Diver. Diver who is qualified to carry out tasks in mine/ordnance search, investigation, disposal, render safe, recovery and removal, underwater and ashore.

Clearance Diving. *The process involving the use of divers for locating, identifying and disposing of mines*

Clearance Diving Team (CDT). Group of clearance divers established to conduct clearance diving tasks.

Clearance Operations. An MCM operation intended to achieve a high probability of countering any mine in a given area, route or channel.

Clearance Rate. The rate at which an area would be cleared with a stated minimum percentage clearance, using specified MCM procedures.

Closed Mine Danger Area. A Mine Danger Area declared closed by the appropriate authority after an acceptable level of clearance has been achieved.

Closure Minefield. *In naval mine warfare a minefield which is planned to present such a threat that waterborne shipping is prevented from moving.*

Cluster Mining. *In naval mine warfare a number of mines laid in close proximity to each other as a pattern or coherent unit.*

Close Projection. Operations constitute the traditional and principal tasks of power projection with the general and positive aim of establishing and/or maintaining control of a given land area through the ability to deploy own military sources and sustain the operations.

Clutter. All echoes detected by a minehunting sonar system which are repeatedly above the noise or the average reverberation background.

Coastal Route. A route, normally following the coastline, which joins adjacent approach routes.

Cocking Circuit. A subsidiary circuit which requires actuation before the main circuits are enabled.

Combination Influence Mine. A mine designed to actuate only when two or more different influences or different types of the same influence are received simultaneously or in/at a pre-ordained order or interval. Also known as a 'Combined Influence Mine'.

Combination Sweep. An influence sweeping system generating the required signature to actuate combination influence mines.

Complex Threat. The threat posed by an armed mine of a given type to the first or subsequent targets transiting a channel taking into account the initial ship count distribution, the MCM effort expended and the likely location with respect to the channel centreline of the transits.

Confidence Level. The probability that the conclusion drawn about the number of mines remaining in the channel after a negative result of an exploratory operation (ie no mines countered) is correct.

Contact. *Any discrete airborne, surface or sub-surface object detected by electronic, acoustic, and/or visual sensors*

Contact Mine. A mine which is designed to fire by physical contact between the target and the mine case or its appendages.

Contact Reference Number. A reference number assigned to mine-like contacts (MILCOs) for reporting purposes.

Corrected Maximum Allowable Transmission Loss. The maximum allowable transmission loss adjusted for length of time the mine has been in the water.

Countermine. *The process of detonating the main charge in a mine by the shock of a nearby explosion of an independent explosive charge or another mine.*

Creeping Mine. *A buoyant mine held below the surface by a weight usually in the form of a chain which is free to creep along the seabed under the influence of the stream or current*.

Cutter. *In naval mine warfare a device fitted to a sweep wire to cut or part the mooring of mines or obstructors; it may also be fitted in, or to, the mooring of a mine or obstructors to part a sweep*.

D

Damage Area. The plan area around a vessel inside which a mine explosion is likely to interrupt operations.

Damage Criteria. The specified effects on a vessel of an explosion

Damage Level. The effects of underwater shock from mines.

Damage Probability. The probability that a vessel sustains damage if it actuates a mine within its Dangerous Front.

Damage Radius. *The average distance from a vessel within which a mine containing a given mass and type of explosive must detonate if it is to inflict a specified amount of damage.*

Damage Width. See **Aggregate Damage Width**

Dangerous Front. The width of the intersection of two circles defined by the vessel's damage area and the mine's firing area

Decoy. *An imitation of a person, object or phenomenon which is intended to deceive hostile surveillance or detection systems or mislead the adversary.* A device designed to mimick a mine or the acoustic properties of a mine to increase the opponents required Minehunting effort

Deep Water Minefield. An anti-submarine minefield which is safe for surface vessels to cross.

Deep Water. Water having a depth greater than 200 metres.

Defensive MCM. *Countermeasures intended to reduce the effect of enemy minelaying*.

Defensive Mining. *A minefield laid in international waters or international straits with the declared intention of controlling shipping in defence of sea communications.*

Degaussing. The process whereby a vessel's magnetic field is reduced by the use of electromagnetic coils, permanent magnets or other means.

Depressor. See 'Kite'.

Detection. *The discovery by any means of the presence of a person, object or phenomenon of potential military significance.* In NMW the action of operating minehunting sensors to find objects on or in the seabed which distinguish themselves from the general structure of the bottom, or to find objects in the water volume.

Detecting Circuit. That part of a mine circuit which responds to a change in the physical conditions at the mine.

Detonator. *A device containing a sensitive explosive intended to produce a detonation wave.*

Degaussing Code Number & Code Depth. The peak vertical component of the magnetic field in nanotesla is the Degaussing Code Number and measured under a ship on the worst heading at the specified Degaussing Code Depth.

Dip. *The amount by which a moored mine is carried beneath its set depth by a current or tidal stream acting on the mine casing and mooring.*

Dip Needle. *In naval mine warfare the device within a firing system which responds to a change in the magnitude of the vertical component of the total magnetic field.*

Discriminating Circuit. *That part of the operating circuit of a sea mine which distinguishes between the response of the detecting circuit to the passage of a vessel and the response to other disturbances, (eg influence sweep, countermining etc).*

Distant Projection. TBD

Diversion Route. A route which bypasses a section or the whole of a transit, coastal, or approach route or link.

Dormant Mine. A mine whose firing system is, by design, prevented temporarily from operating thus preventing actuation.

Drifting Mine. *A buoyant or neutrally buoyant mine that is not tethered to the seabed intentionally laid to be free to move under the influence of wind, waves, current or tide.*

Drill Mine. *An inert-filled mine, or mine-like body, used in loading, laying or discharge practice and trials.*

Drone. A vehicle used in mine sweeping or mine hunting, normally unmanned, which is remotely or automatically controlled.

Dummy Minefield. *A minefield containing no live mines and presenting only a psychological threat.*

E

Edge Runs. Extra runs made on the outer most tracks of the plan in order to increase the percentage clearance at the edges of a channel or area.

Electrode Sweep. *A magnetic sweep cable in which the salt water and the seabed form part of the electric circuit.*

Exercise Mine. *A mine containing an inert filling and an indicating device.*

Exercise and Training Mine. A reusable inert mine configuration designed for exercise, training and/or evaluation. This can include drill and practice mines

Exercise Route. A route used solely for exercise purposes or to maintain the integrity of dormant wartime routes.

Exploratory Operations. An operation to determine the presence or absence of mines in a sample of a route or area and to assess whether portions of the routes / anchorages / areas are mined.

Explosive Ordnance Disposal. *The detection, identification, onsite evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.*

F

Fire. *To detonate the main explosive charge by means of the firing system.*

Firing. *Actuation of the firing system* (see also **Firing System**).

Firing Area. For any influence sweep system, it is the horizontal area at the depth of a particular mine in which the mine will detonate.

Firing System. *A system designed to initiate an explosive, electric or other train in order to cause the explosion of a charge.* (*see also Firing*).

Floating Mine. *A mine visible on the surface.* Whenever possible it should be more exactly defined by the term, Drifting Mine, Free Mine or Watching Mine.

Flooder. *A device fitted to a buoyant mine which, on operation after a preset time, floods the mine case and causes it to sink to the bottom.*

Former Mined Area. A former minefield in which the risk to shipping has been reduced.

Free Mine. *A moored mine whose mooring has parted or been cut.*

G

Gap. An area within a minefield or obstacle belt, free of live mines or obstacles whose width or direction will allow a friendly force to pass through in tactical formation.

Grapnel. *A device fitted to a mine mooring designed to grapple the sweep wire.*

Ground Mine. (See **Bottom Mine and Mine)**.

Guinea-Pig. A ship converted or designed to sweep mines by its own characteristics or to transit an already swept channel before or ahead of the passage of follow-on shipping.

H

Historic Ordnance. Ordnance relating to a previous conflict, operation or event.

Holding Area. A geographically defined location used in stationing vessels in a pre-determined pattern or order.

Holiday. *A gap in MCM coverage left unintentionally during MCM operations due to errors in navigation, station keeping, buoy laying, breakdowns or other causes.*

Homing Mine. *A mine fitted with propulsion equipment which homes onto a target.*

Horizontal Component. That component of the total magnetic field in the horizontal plane.

Horn. *A projection from the mine shell of some contact mines which, when broken, or bent or by contact, causes the mine to fire.*

Hostile Environment. *An environment in which an adversary has the capability and intent to oppose or disrupt operations of friendly forces.*

Hull Shock Factor. Figure of Merit for estimating the amount of shock experienced by a naval vessel from an underwater explosion as a function of explosive charge mass, slant range between the vessel and explosive charge.

Hunting Rate. The area cleared per unit time with a stated minimum percentage clearance, using minehunting procedures

I

Identification. The determination of the exact nature of a Mine-like contact (MILCO).

Igniter. *A device designed to produce a flame or spark to initiate an explosive train.*

Induction Circuit. *A circuit actuated by the rate of change of a magnetic field due to the movement of a vessel or the changing current in the sweep.*

Inert Filling. A prepared non-explosive filling ideally of the same mass and density as the explosive filling of the mine.

Inertial Navigation System. *A self contained navigation system using inertial detectors which automatically provides vehicle position, heading and velocity.*

Influence Field. The distribution of the underwater signatures of a surface vessel, submarine or minesweeping equipment in the volume.

Influence Mine. *A mine actuated by the effect of a target on some physical condition in the vicinity of the mine or on radiations emanating from the mine.*

Influence Sweep. A sweep designed to produce influence(s) to actuate mines.

In-Stride. An MCM stage that utilizes multiple successive MCM systems.

Integrating Circuit. *A circuit whose actuation is dependent on the time integral of a function of the influence.*

Integrated Minehunting Operations. Operations that apply the combination of different MCM assets to complete an MCM task.

Intermittent Arming Device. *A device included in a mine so that it will be armed only at set times.*

Intermittent Arming Mechanism. (See **Intermittent Arming Device**)

J

Jackstay Search. A method employed by divers using a wire or rope secured firmly between two points to systematically cover an area.

Jettisoned Mines. *Mines which are laid as quickly as possible in order to empty the minelayer of mines..*

K

Keel Shock Factor. Figure of Merit for estimating the amount of shock experienced by a naval vessel from an underwater explosion as a function of explosive charge mass, slant range and angle between the vessel and explosive charge.

Kite. *A device which when towed submerges and planes at a predetermined depth without sideways displacement (see* ***Depressor****)*.

L

Landing Site. *In amphibious operations, a continuous segment of coastline over which troops, equipment and supplies can be landed by surface means*

Lateral Range Curve. A P(y) curve as a function of the athwartship distance from the ship, which combines the characteristic detection/actuation/cutting performance of the MCMV with its SDNE.

Lateral Separation.

(1) The perpendicular distance between the tracks of the ship and the reference ship or float.

(2) The perpendicular distance between two adjacent tracks. (See **Track Spacing**).

Lay Reference Number. *A number allocated to an individual mine by the minefield planning authority to provide a simple means of referring to it.*

Lead Through Operations. .A maritime (not an MCM) operation in which a guide ship (Lead-through Vessel (LTV)) leads other ships or submarines (VTMs) in their passage through channels established in a mined area.

Limited Clearance Operations. An MCM Operation intended to achieve a high probability of countering specific mine types in a given route/anchorage/area.

Link Route. A route, other than a coastal route, transit route or local route which links two or more routes.

Live Mine. A mine with an explosive filling and a means of firing the explosive charge.

Live Period. The maximum time after the first look to satisfy all the subsequent looks and mine logic to cause an actuation.

Local Route. A route that connects the Fairway Buoy to the harbour.

Localization Error. The difference between the coordinates generated for a target and the actual location of the target.

Look. *A period during which a mine circuit is receptive of an influence.*

Loop Sweep. A magnetic cable sweep in which the current carrying conductors are insulated from the water throughout.

Closed Loop. The sweep current is carried entirely by insulated electrical conductors.

Open Loop. The sweep current uses the sea water to complete the circuit.

Loss. A target which is damaged to a specified level when transiting a minefield. (Also known as **Casualty**).

M

Magnetic Anomaly Detector. A magnetometer used to detect the variations in the earths magnetic field caused by ferro-magnetic material.

Magnetic Mine. A mine with a magnetic influence circuit which responds to the magnetic field of a ship, submarine or sweep.

Magnetic Induction Mine. A mine actuated by the rate of change of a magnetic field due to the movement of a vessel or the changing current in the sweep.

Magnetic Minehunting. *The process of using magnetic detectors to determine the presence of mines or minelike objects which may be either on, or protruding from, the seabed, or buried.*

Mark. To deposit a marker next to a classified or identified contact.

Married Failure. *A moored mine laying on the seabed connected to its sinker from which it has failed to release owing to a defective mechanism.*

Maximum Allowable Transmission Loss. In the nominal frequency band, the maximum loss in sound pressure level from the sweep to the mine that still permits mine actuation.

Maximum Current. Magnetic sweep set to utilize the maximum possible sweep current.

Maximum Output. Sweeping carried out employing the full output of the generating source(s).

Maximum Towing Speed. The speed through the water which may not be exceeded without causing damage to the MCM gear or the towing vehicle.

MCM Commander. The officer delegated command of all assigned MCM Forces.

MCM Risk Directive Matrix. A series of tables listing specific measures or actions allowed by MCM Forces in an operation taking into account the acceptable exposure to risk.

MCM Objective. A clearly defined goal for an MCM operation that supports the maritime commander's plan.

MCM Stage. An MCM Stage is the use of a specific MCM technique to counter a particular or several types of mine.

MCM Tasking Authority The Mine Countermeasures Tasking Authority is the entity within the MCM Commander/Coordinator function that directs and tasks the assigned MCM forces in the execution of the Operational Commander's MCM plan.

Measure of Effectiveness. A criterion used to assess changes in system behaviour, capability or operational environment that is tied to measuring the attainment of an end state, achievement of an objective or creation of an effect.

Mechanical Sweep. *Any sweep used with the object of physically contacting the mine or its appendages.*

MILEC Density. The number of Mine-like Echoes (MILECs) per square nautical mile of seabed. By convention MILEC Densities are categorized in five classes 0 to 4, 0 having the lowest and 4 the highest density.

Mine. *An explosive device laid in the water with the intention of damaging or sinking vessels or deterring them from entering an area. The term does not include devices attached to the bottoms of vessels or to harbour installations by personnel operating underwater nor does it include devices which explode immediately on expiration of a predetermined time after laying.*

Mineable Waters. Waters where mines of a given type may be effective against a given target.

Mine Actuation Level. The level at which the received influence equals that necessary to actuate the mine.

Mine Actuation Width. See Aggregate Actuation Width

Mine Avoidance Sonar. A sonar designed to detect and classify contacts in the water column. (See also Obstacle Avoidance Sonar)

Mine Burial. The process of a mine sinking into the sediment of the seabed the result of which is expressed as a percentage (see also **Plastic Flow** and **Scour**)

Mine Clearance Depth. The depth to which moored mines are to be swept or cleared and must be corrected for dip.

Mine Cluster. A group of mines laid or jettisoned closely together

Mine Countermeasures (MCM). *All methods for preventing or reducing damage or danger from mines*

Mine Countermeasures Pouncer Procedure. *The delivery of explosive ordnance disposal divers, by helicopters or, occasionally, small surface vessels, to previously swept drifting mines or shallow.*

Mine Countermeasures Stage. The use of a specific MCM technique to counter a particular or several types of mines.

Mine Countermeasures Task. An MCM Task is a portion of the MCM mission consisting of a stage or combination of stages related to a specific route, channel or area, time and technique.

Mine Countermeasures Tasking Authority. The Mine Countermeasures Tasking Authority is the entity, normally the MCM Commander/MW Coordinator, that directs and tasks the assigned MCM forces in the execution of the Operational Commander's MCM plan

Mine Countermeasures Technique. the operation of a specific system or platform (ie. vessel, vehicle,aircraft, diver or marine mammal) and its MCM equipment in a particular way.

Mine Damage Radius. The horizontal range from a specified mine within which a specified level of damage will be sustained by a specified vessel

Mine Danger Area (MDA). An area established around the position of suspected or known mines, mine lines and minefields to bound the limits of the danger.

Mine Density. The number of mines per square nautical mile.

Mine Disposal. *The process of rendering safe, neutralizing, recovering, removing or countermining mines.*

Minefield. *A number of mines laid, or declared to be laid, in a maritime area.*

Minefield Measure of Effectiveness (MMOE). In minefield planning a quantitative statement defining a specific effectiveness level towards which the mining effort can be planned. In evaluation the MMOE is a qualitative statement for a given mining effort.

Minefield Performance Objective (MPO) A qualitative statement defining the aim of a minefield.

Minehunting. The employment of ships, airborne equipment, unmanned vehicles/systems, marine mammals and/or divers to locate and dispose of mines.

Minehunting Phases. Includes detection, classification, identification, and disposal.

Mine Investigation and Exploitation (MIE). The process of recovering and rendering safe and analysing the mine, its sensors and system to determine the MCM necessary to sweep or hunt mines. (see **Recovery** and **Removal**).

Mine Jamming. The deliberate radiation, re-radiation, alteration or reflection of underwater energy with the aim of impairing the effectiveness of mines.

Mine Lifting Bags. Remotely operated gas filled bags attached to mines in order to lift them from the seabed for subsequent removal to another location.

Mine Reference Number (MRN). A four to seven character alpha-numeric allocated to an individual mine by the MCM unit responsible for identifying, actuating or cutting the mine.

Mine Row. *A single row of mines or clusters.*

Mine Setting Mode (MSM). The transmission of underwater energy by influence sweeps with the aim of actuating mines with a specific or known logic algorithm.

Mine Spacing. The distance between mines in Minelaying

Minesweeping. *The technique of countering mines by minesweeping systems using mechanical, explosive or influence gear, which physically removes, destroys or actuates the mine.*

Mine Threat Area (MTA). *An area declared dangerous due to the presence or suspected presence of mines.*

Mine Warfare. *The strategic and tactical use of mines and their countermeasures.*

Mine Watching. *The mine countermeasures procedures to detect, record and, if possible, track potential minelayers and to detect, find the position of, and/or identify mines during the actual minelaying*.

Mining. The strategic and/or tactical use of sea mines.

Mission Abort Damage. Damage to a target vessel such that it is incapable of performing or completing its primary mission.

Mixed Minefield. *A minefield containing mines of various types, firing systems, sensitivities, arming delays and ship counter settings.*

Mobile Mine. See Stand Off/Stand Off Delivered mine.

Moored Mine. *A mine of positive buoyancy held below the surface by a mooring attached to a sinker or anchor on the bottom*.

Moving Mines. *The collective description of mines that are not stationary, such as floating, oscillating, creeping, rising and propelled mines***.**

Multiple Coverage. MCM effort applied to the same channel, area or segment more than once during a single operation.

N

Nadir Region. The area directly below a side scan imaging sonar where no useful imaging occurs.

Net Explosive Quantity (NEQ). The mass of TNT equivalent of explosive mixtures or compounds.

Net Sweep. A two ship sweep designed to collect mines and either detonate them by contact or dispose of them by dumping

Neutralisation. *A mine is said to be neutralised when it has been rendered, by external means, permanently incapable of firing on passage of a target, although it may remain dangerous to handle*

Nominal Frequency Band (NFB). Specified band of frequencies in which most of the acoustic energy is transmitted from the sweep to the mine.

Non-Uniform Coverage. A plan developed where the effort is concentrated on the most likely track(s) of the follow-on traffic.

Normal Actuation Level (NAL). The sensitivity of a mine in relation to the general run of shipping, measured with reference to a representative ship-like signature and is applicable to all influences.

Nuisance Minefield. A minefield which is planned to force the opponent into taking countermeasures which adversely affect their operational effort.

O

Obstructor. *A device laid with the sole object of obstructing or damaging mechanical minesweeping equipment.*

Offensive Mine Countermeasures. *Measures intended to prevent the enemy from successfully laying mines.*

Offset (h). The perpendicular distance between the centre of the characteristic width 'A' (the sweep/hunting gear track) and the track of the MCMV.

One-Look Circuit. *A mine firing system which requires actuation by a given influence once only.*

Optical Minehunting. *The use of an optical system (eg electro optical device or towed diver) to detect classify **and identify** mines or minelike objects on or protruding from the seabed**, or in the water column.***

Optimum MCM Speed. The speed over the ground for a given set of conditions which provides the greatest sweeping/hunting rate.

Oropesa Sweep. A form of mechanical sweep towed by a single ship.

Oscillating Mine. A mine hydrostatically controlled, which fluctuates within a preset depth range below the surface of the water independently of the rise and fall of tide.

Otter. *A device used in minesweeps which, when towed, displaces itself sideways to a predetermined distance.*

Overlap. *The width of that part of a swept or hunted area which is also covered by an adjacent swept or hunted area.*

P

Passive Defensive MCM. Measures intended to localise the threat, locate the minefield and reduce the risk to shipping without actively countering the threat.

Pattern Mining . *The laying of mines in a fixed relationship to each other*.

Percentage Clearance. The estimated percentage of mines of specified characteristics which have been cleared from an area or channel

Average Percentage Clearance (P). The average percentage clearance is the average value across the whole channel width.

Required Percentage Clearance (P_{req}). The required percentage clearance is the value necessary for planning an MCM operation as ordered by a higher authority.

Weighted Percentage Clearance (F). The average percentage clearance across the channel, weighted according to the probability density function of shipping.

Maximum Percentage Clearance (P_{max}). The maximum achievable percentage clearance due to undetectable and unsweepable mines.

Desired Percentage Clearance (P_{des}). The mathematical expectation of the fraction of sweepable or detectable mines that can be cleared.

Permissive Environment. *An environment in which friendly forces anticipate no obstructions to, or interference with, operations. Note: A permissive environment does not necessarily imply absence of threat.*

Plastic Flow. Penetration of a mine into the seabed when sediments are forced from under the mine by the weight of the mine.

Plot. In NMW the construction of a record by which the result of detection, classification, and/or identification can be operationally exploited.

Poised Mine. *A mine which is ready to detonate at the next actuation.*

Post Mission Analysis (PMA). The processing and analysis of sensor data after a mission is completed.

Practice Mine. *An inert filled mine but complete with assembly, suitable for instruction and for practice in preparation.*

Precursor Operations. MCM in an area by relatively safe means in order to reduce the risk to MCM Units in subsequent operations in the same area.

Pressure Mine. A mine whose circuit responds to the hydrodynamic pressure signature of a target.

Prevention of Stripping Equipment. A device included in a mine to fire the main or an auxiliary charge when an attempt is made to open the mechanism chambers.

Propelled Mine. A mine which **once laid** actively moves by any means of propulsion system. See **Moving Mine, Stand-off Mine** or **Stand-off Delivered Mine.**

Protective Mining. A *minefield laid in friendly territorial waters to protect ports, harbours, anchorages, coasts and coastal routes.*

Pulse Cycle. The time interval between the beginning of one pulse and the beginning of the next similar pulse in the same direction.

Pulsing. *A method of operating magnetic and acoustic sweeps in which the sweep is energised by current which varies or is intermittent in accordance with a predetermined schedule.*

Q

Q-Anchorage. A wartime anchorage which is designated as a Q-Anchorage for use by Q-Route shipping.

Q-Message. *A classified message relating to navigational dangers, navigational aids, mined areas, and searched or swept channels*.

Q-Route. A pre-planned, dormant channel or route, surveyed during peacetime, for use by allied shipping during tension or conflict.

Q-Zone. A geographical sea area with boundaries agreed by NATO with the aim of identifying sea areas of navigational safety responsibility.

R

Random Mining. A minefield of practically uniform density but with no recognizable pattern of mine distribution.

Rapid Environmental Assessment (REA). The collection of data to provide environmental information to Mine Warfare Commanders in a timely manner for planning and conduct of operations

Reacquire. In NMW a process to revisit a reported contact for the purpose of subsequent prosecution.

Reconnaissance Operation. An MCM operation designed to assess the limits of a mined area.

Recovery. In NMW those actions taken to recover unexploded mines.

Remote Controlled Mine. *A mine which after laying can be controlled by the user.*

Removal. The relocation of a mine to a position where exploitation or disposal can be safely affected.

Render Safe Procedure (RSP). The action to make a mine inoperative by direct interference with its firing system or explosive train.

Rising Mine. A mine which rises from its deployed position, either using its own positive buoyancy or by means of a propulsion system.

Risk.

a. **Transitors.** The probability of a mine being exploded by a transiting ship

b. **MCM Systems.** The probability that a mine of given characteristics, actuated/countermined by the system in use, will explode within the damage area of the MCM system.

Risk Directive. The authorised levels of risk to which units can be exposed, when conducting NMCM operations (see **MCM Risk Directive Matrix**)

Route Survey (RTSV). The collection of contact and environmental data for use in future MCM operations.

Run. *A single transit of MCM systems operating MCM equipment along a track.*

S

Safe Current. *The maximum current that can be supplied to a sweep in a given waveform and pulse cycle that does not produce a danger area to the MCMV with respect to the mines being swept for.*

Safe Depth. The shallowest depth of water in which a specified vessel travelling at a specified speed will not actuate a given specific influence mine. Also referred to as Safe Operating Depth.

Safe Distance. NOT RELEASABLE

Safe Speed. *The speed at which a specified vessel operating in a given depth can proceed without actuating a specified influence mine.*

Safety Range. The distance at which a specific vessel is unaffected by an underwater explosion of a specified magnitude. Also referred to as Safety Distance.

Scour. The removal of bottom sediment from the vicinity of the mine by wave and/or current action.

Searched Channel. *The whole or part of a route or a path which has been searched, swept or hunted, the width of the channel being specified*.

Segmentation. The sub division of an MCM Area based on capabilities and performance parameters of MCM units and/or environmental conditions and/or tactical considerations.

Self Protection Depth. The depth where there is no overlap between the firing area and the sweeper damage area (Dangerous Front).

Self Protective Measures. Passive Defensive Measures taken by vessels and divers to reduce the risk from mines.

Sensitivity. The liability, which is varied, of an influence mine circuit to actuation by an influence field.

Sequence Circuit. *A circuit which requires actuation by a predetermined sequence of influences of predetermined magnitudes.*

Shallow Water. *Water having a depth between 10 metres and 200 metres.*

Ship Count. The number of times the mine mechanism must be actuated in order to detonate**.**

Ship Count Distribution. The fraction of mines initially set on a certain ship count.

Ship Counter. *A device in a mine which prevents the mine from detonating until a preset number of actuations has taken place***.**

Ship Influence. *The electro-magnetic, acoustic, pressure or other effects of a vessel, or a minesweep simulating a vessel, which is detectable by a mine or other sensing devices.*

Shock Factor (SF) A figure of merit that defines the shock resistance of a material against an underwater explosion.

Simple Initial Threat (**SIT**). The threat posed to the first ship to transit a minefield

Single Coverage. One application of a single MCM technique to a channel, area or segment

Sinker. *A heavy weight to which a mine is moored.*

Snagline Mine. *A contact mine with a buoyant line attached to one of the horns or switches which may be caught up and pulled by the hull or propellers of ship.*

Snagline Search. Two divers dragging a weighted line along the bottom so that it is caught or 'snagged' by objects which are protruding from or laying on the seabed.

Snagline Sweep. Mechanical MCM gear especially fitted to counter **Snagline Mines**.

Solenoid Sweep. *A magnetic sweep consisting of horizontal axis coils.*

Sonar Contact Confidence Level (SCCL). A value assigned to a minelike contact (MILCO) based on attributes from a list of key criteria.

Sprocket. *An anti-sweep device included in a mine mooring to allow a sweep wire to pass through the mooring without parting the mine from its sinker.*

Stand-Off or Stand-Off Delivered Mine. A mine designed to be launched from a stand-off position and then navigate to its intended lay position. **(see also Moving Mine) (**

Sterilise. *To permanently render a mine incapable of firing, by means of a device (e.g. steriliser) within the mine.*

Steriliser. *A device included in mines to render the mine permanently inoperative on expiration of a predetermined time after laying*.

Strategic Mining. Mining operations intended to reduce and impede the enemy's war potential.

Surf Zone. Area at sea from where waves begin to break, up to the high water mark

Sustained Minefield. A minefield which is replenished to maintain the threat to the enemy in the face of countermeasures.

Surveillance Operations. MCM Operations intended to detect any new object in an area, channel or route which has been previously subjected to Route Survey. Also known as Change Detection.

Sweeping Rate. The area cleared per unit time with a stated minimum percentage clearance, using minesweeping procedures.

Swept Channel. See **Searched Channel**

Swept Path. The width of the lane swept down to the sweep depth.

T

Tactical Mining. *Mining conducted in support of a limited military objective generally in a specified area of immediate tactical interest.*

Target Simulation Mode. The radiation of underwater energy by influence sweeps with the aim of actuating influence mines constituting a threat against a given ship or class of ships

Task Cycle. Timeframe of an individual unit in a MCM Operation (On-Task / Off-Task) available for the Tasking Authority to pre-plan the different MCM tasks.

Team Sweep. Two or more sweepers linked together by a mechanical sweep.

Threat Profile. A MMOE describing the average threat to the *m*-th transitor in a sequence of τ transits.

Time Constrained Operation. An MCM operation designed to achieve the maximum reduction in risk to follow-on traffic using as much MCM effort as possible. Two types of Time Constrained operations are possible:

Time Limit Known: An operation where the estimated number of runs can be executed in the time available.

Time Limit Unknown: An operation carried out on a run-by-run basis until no further time is available.

TNT Equivalent. A measure of the energy released from the explosion of a given quantity of fissionable material, in terms of the amount of TNT (Trinitrotoluene) which could release the same amount of energy when exploded.

Track (N). The planned line over the ground along which the centre of the MCM effect is applied throughout the desired area. Also known as MCMV Track.

Track Course. The true course of the track.

Track Runs (J). The number of times the countermeasures gear must follow a track.

Track Spacing (D). The lateral separation between two adjacent tracks.

Track Turn. The method of completing the end of a run on one track and preparing to commence the next run.

Two-Look Circuit. A firing system in which the influence must be detected twice before actuation occurs.

U

Ultra-Short Baseline (USBL). An Acoustic tracking technique which may be used to provide positional information of underwater assets for C2, and/or for in-water navigation.

Undetectable Mine. A mine which cannot be detected using mine hunting techniques.

Uniform Clearance. Achieving the same level of clearance across the entire width of the channel by the addition of edge runs.

Uniform Coverage. A plan where the effort is distributed evenly across the channel and the required percentage clearance is only achieved or exceeded in the ‘central part’ of the channel. (See also **Non-Uniform Coverage**)

Uniform Pattern. A series of tracks equally spaced across a channel or throughout an area.

Unsustained Minefield. A minefield which is not replenished.

V

Very Shallow Water. *Water having a depth between 10 metres and the Surf Zone*

Very Shallow Water MCM (VSWMCM). *Searching for, detecting, locating, neutralizing and/or disposing of explosive ordnance and/or obstructions in very shallow water.*

W

Watching Mine. *A mine secured to its mooring but showing on the surface, possibly only in certain tidal conditions.*

INDEX

Note:* *(NU) *All references to 'Mine Warfare', 'Mine Countermeasures' and 'mines' throughout this index refer to 'Naval Mine Warfare', 'Naval Mine Countermeasures' and 'sea mines' respectively.*

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