EXTAC 1014 METEOROLOGICAL SUPPORT MANUAL

OCTOBER 1996

0410-LP-010-3340

October 1997

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for Dr. J. Blödorn
MCMG Chairman
President
German Military Geophysical Office

RECORD OF CHANGES

Change Date	Date Entered	Effective Date	By Whom Entered

DEPARTMENT OF THE NAVY
NAVAL DOCTRINE COMMAND
1540 GILBERT STREET
NORFOLK, VA 23511-2785

October 1997

U.S. LETTER OF PROMULGATION

1. EXTAC 1014, METEOROLOGICAL SUPPORT MANUAL, is one of a series of publications designed for use in operations between NATO and non-NATO navies. It is a stand-alone document.

2. EXTAC 1014 is effective upon receipt.

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G. S. HOLDER
Rear Admiral, U.S. Navy
Commander, Naval Doctrine Command

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FOREWORD

1. EXTAC 1014, Meteorological Support Manual, is designed for use by NATO nations when conducting exercises or operations with non-NATO military forces. It contains standardized NATO meteorological procedures and guidance which will also be useful for military staffs and meteorological personnel of non-NATO nations to promote interoperability and familiarity with NATO forces.

2. EXTAC 1014 is UNCLASSIFIED and does not require security protection. It may be released to non-NATO nations independently by member nations and NATO commands and agencies as required.

3. This EXTAC is sponsored by the Military Committee Meteorological Group (MCMG). The MCMG Secretary is designated the Custodian. Comments and recommended changes to this document should be sent directly to the address listed below:

Staff METOC Officer Operations Division International Military Staff NATO Headquarters Avenue Leopold III B-1110 Bruxelles, Belgium	or,	(from the US or Canada) Staff METOC Officer IMS/OPS PSC 80, Box 36 APO AE 09724

CHAPTER 1

INTRODUCTION

References: A. Guidelines for Meteorological Support to NATO and PfP Nation Forces (Draft MCMG + CP Document)
B. AWP-4, NATO Meteorological Codes Manual

101. Skilled meteorological advice on both actual and predicted parameters enhances the quality of many military command, control, consultation and information (C^3I) decisions concerning the conduct of current operations and the planning of future operations. Meteorological information is also vital to the proper development of future weapon and support systems. Effectively applied, meteorological information can also be used at the tactical level to improve the capability of:

a. Operational units to carry out their missions, and

b. Weapon and sensor systems which are sensitive to certain meteorological conditions.

102. In order to obtain the greatest military advantage from the meteorological conditions, there is a requirement for:

a. Accurate and timely advice to be

(1) readily available to:

(a) all levels of command and control, and

(b) all operational units that require it.

(2) tailored to the specific requirements of:

(a) the commanders' missions,

(b) the missions of operations centres controlling NATO forces, and

(c) operational units' tasks, weapons and sensors.

b. Meteorological impact to operations, on both sides of the battlefield, to be fed back to meteorological offices up the chain, in order to better tailor their meteorological support.

103. There is a NATO requirement for:

a. An administrative organization to coordinate the necessary planning and organization of meteorological support to NATO forces.

b. An organization to link national weather analysis centres (WACs) to ensure the provision of meteorological support to NATO forces.

104. NATO forces in the context of this manual comprise:

a. National operational units which have been assigned by their respective nations to support NATO operations in peacetime and in times of crisis and war;

b. NATO Commanders and their Staffs; and

c. Operations centres which control NATO maritime, air and land operations.

105. The term NATO + CP forces can be used interchangeably with the term NATO forces throughout this manual, and specifically includes the components listed in para. 104 plus contributions from PfP nations and other non-NATO nations for exercises or assigned to peace support operations under the authority of the UN or the responsibility of the OSCE.

106. This document is based on the guidance in Reference A. The aim of the manual is to achieve the necessary standardisation and interoperability among all the constituent parts of the overall organization which will provide meteorological support to NATO forces. It is intended as a reference for:

a. NATO and national staff planning officers and

b. Officers-in-charge of weather centres in the organization which develops and provides meteorological support to NATO forces.

c. Staffs and meteorological personnel of Cooperating Partner nations to assist in familiarity with NATO procedures.

107. This manual does not affect national plans and procedures for provision of meteorological support to their own national forces. It is intended as a guide for national planners and should be used as a basis for the development of national plans and procedures for the provision of meteorological support to NATO forces as defined in Para 105.

108. This document refers to meteorological support to NATO forces in the areas of Allied Command Europe (ACE) and Allied Command Atlantic (ACLANT), but not in the United States or Canada.

109. Chapter 2 introduces NATO meteorological planning and administration and Chapter 3 discusses the overall meteorological organization supporting NATO. Chapters 4 through 7 describe meteorological support to NATO headquarters, maritime, air and land operations, respectively. Each of these chapters is divided into four sections:

a. Introduction, which describes relevant aspects of the NATO command and control structure,

b. Requirements, as defined in Para 212,

c. Organization, which describes the relevant parts of the meteorological organization supporting NATO, and

d. Implementation, which describes how the support will be provided.

Chapters 8 briefly outlines NATO meteorological communications. Chapter 9 discusses meteorological data, with the details of meteorological codes residing in Reference B, and Chapter 10 describes meteorological support to NBC operations.

110. The Staff Meteorological Officer, IMS is responsible for maintaining and amending this Manual with the assistance of the MCMG/WG-OPC, on behalf of the Military Committee Meteorological Group (MCMG).

CHAPTER 2

NATO METEOROLOGICAL PLANNING AND ADMINISTRATION

Reference: A. Guidelines for Meteorological Support to NATO and PfP Nation Forces (Draft MCMG + CP Document)

INTRODUCTION

201. The provision of meteorological support requires international cooperation and coordination to ensure the essential exchange of data and products on a global scale. In peacetime, the World Meteorological Organization (WMO) and the International Civil Aviation Organization (ICAO) are the principle organizations responsible for the necessary planning and coordination to achieve these objectives. In most NATO nations, meteorological support to military forces involves extensive use of WMO and ICAO procedures and systems.

202. In accordance with Reference A guidance, meteorological support to NATO forces should be provided, wherever possible, by national facilities. National meteorological facilities will not be assigned to NATO in the same way as operational forces, but remain at all times under national command and control. However, to achieve maximum efficiency and effectiveness of the overall organization which will provide meteorological support to NATO forces, it will be necessary to:

a. Coordinate the use of national meteorological facilities by:

(1) developing and maintaining procedures in peace, and

(2) coordinating the implementation of those procedures in times of crisis.

b. Establish NATO facilities, using infrastructure funds provided by the member nations, for the support of multinational NATO forces where existing, or planned, national facilities cannot meet the operational requirements.

203. NATO forces and/or national forces of NATO members may be tasked for missions in crisis and war, peacekeeping and peace enforcing operations or humanitarian operations. Therefore, worldwide tasking is possible. As a result, there is a requirement for worldwide METOC information to be provided by the (overall) NATO METOC organization.

204. Not all NATO OPLANs require meteorological support. Those that do require it contain an annex which provides information on the environmental support required. See Annex A for more details.

205. The development and regular updating of NATO OPLANs is a complex procedure because it involves consideration of the following factors, all of which are subject to constant change for a variety of reasons:

a. The threat, and

b. The availability of assets, including weapons, weapon platforms, manpower, and support facilities.

206. Virtually all the assets listed in Para 205b are national assets which are assigned to NATO. It is therefore an essential part of the procedure that appropriate national authorities are consulted at all stages of the planning process, and that approval of a final plan is obtained from the nations whose forces and/or territories are involved in each plan.

207. There is a requirement for a NATO meteorological administrative organization to carry out the following functions:

a. Identify and establish the requirements for meteorological support to NATO forces,

b. Coordinate the production of plans to ensure the most efficient and effective use of the assets available, for:

(1) support to NATO forces,

(2) the use of national and NATO assets to develop and provide support,

(3) data collection in times of crisis and war.

c. Coordinate the plans between nations and NATO commands,

d. Promulgate plans so that:

(1) personnel involved in the development and provision of support know what they have to do, and

(2) those NATO forces requiring support know:

(a) what support will be provided,

(b) what centre(s) will be providing the support, and

(c) how the support will be provided to them.

e. Meet the changing requirements of NATO planning by:

(1) monitoring developments in NATO policies, concepts and plans,

(2) assessing the requirements for changes in meteorological support resulting from those developments, and

(3) modifying existing meteorological plans or developing new ones to meet the changed requirements.

f. Assess the requirements for NATO funded meteorological centres and facilities, arranging procurement and monitoring operations,

g. Coordinate implementation of NATO meteorological plans in times of peace and crisis,

h. Plan and coordinate meteorological aspects of NATO exercises,

i. Liaise with other NATO groups and agencies on matters of common interest,

j. Encourage research and development to improve the capability and quality of meteorological support to NATO forces, and

k. Encourage liaison between national meteorological organizations which support NATO forces.

208. The overall requirements for the provision of meteorological support to NATO forces based on the operational requirements can be established by the meteorological support requirement chain shown in Figure 2-I. They will comprise requirements for:

a. Data and products,

b. Weather centres,

c. Communications facilities, and

d. Data collection capability.

209. The requirements for data and products need to be established under three headings:

a. The military requirement, which is the specific meteorological information required by each individual type of military mission. These are defined in this document. The requirements stated are a mean assessment for planning purposes. In practice, there will be some variations, e.g. two different types of aircraft with different weapon systems on the same type of mission may well need meteorological support which differs in certain details. If highly detailed and accurate information is required, it may be necessary to establish the requirements on a case-by-case basis.

b. The meteorological requirement, which is the data and/or products required by the different meteorological centres in order to carry out their particular mission within the NATO meteorological support organization. These are defined in this document, again as a mean assessment, for the different types of weather centres.

c. The operational requirement, which is the meteorological information required to support:

(1) NATO headquarters, this is defined in this document;

(2) operations centres, this is defined in this document; and

(3) the operational units involved in specific NATO operations, this is not defined in this document because the requirement will be unique for each individual operation. It has to be defined for each one by reference to:

(a) the appropriate NATO OPLAN to establish what forces are involved, and

(b) the appropriate chapter(s) of this document to establish the specific military requirements of those forces.

210. Meteorological support to forces operating in, or from, their own national territory will normally be provided by their own national meteorological organization in accordance with their own national plans and procedures. The only aspects which will require the attention of the NATO meteorological organization will be:

a. The provision of the necessary data and products to the national weather centres in all scenarios, and

b. Back-up capabilities in case of major outages.

211. To ensure that all NATO forces operating outside their own national territory can receive the support they require, in the most efficient and effective manner, it will be necessary for the NATO meteorological administrative organization to address each individual OPLAN using the meteorological support requirements chain shown in Figure 2-I to establish:

a. Which of the following will provide the support:

(1) the meteorological organization of the NATO country in, or from which they are operating (host nation support), or

(2) units of their own national meteorological organization which have been established in the NATO country in, or from which they have been operating, or

(3) the national meteorological organizations of their own, or another NATO nation other than the one in, or from whose territory they are operating, or

(4) a NATO funded weather centre which has been established to provide support in an area where national facilities cannot meet the full operational requirements.

b. What communications system will be used.

ORGANIZATION

212. The NATO meteorological support planning and administrative organization comprises:

a. The Military Committee Meteorological Group (MCMG), which reports directly to the Military Committee (MC), and its two MCMG Working Groups (WG),

b. The Command Meteorological Committees, and

c. The Staff/Senior Meteorological Officer (SMetO) on the staffs of some NATO Commanders.

213. Figure 2-II shows how the MCMG and the Major NATO Commanders (MNCs), SACEUR and SACLANT, fit into the NATO Military Structure. Figure 2-III gives details of the NATO commands which have a Staff Meteorological Officer, who will be one of the following:

a. A national officer detached for a fixed tour of international duty on a NATO staff with responsibility for:

(1) meteorological matters only, or

(2) meteorological and other matters, e.g. oceanography.

b. A national officer with dual-hatted national and NATO appointments on collocated national and NATO staffs, also with responsibilities for either of categories (1) or (2) above, or

c. A national officer appointed to a national staff who carries out some, or all of the duties of a Smeto for a NATO Commander, but does not have a NATO appointment.

214. SMetOs may:

a. Also be officer-in-charge of a Command meteorological centre.

b. Have a title other than Staff Meteorological Officer. The title may be different because:

(1) it incorporates collateral duties, e.g. Staff Meteorological and Oceanographic Officer, or

(2) it is related to his position in the headquarters staff structure, e.g. Chief Meteorological Officer. This does not necessarily imply that he has any additional responsibilities or status above those of a Staff Meteorological Officer.

IMPLEMENTATION

215. The Terms of References (TORs) of the MCMG + CP is given in Reference A, which is very similar to the TORs of the MCMG and its Working Groups. The TORs of Command Meteorological Committees and other related groups are given in the appropriate command documents. The work of these groups and committees is coordinated to ensure the overall objectives are met.

216. Responsibilities of NATO SMetOs. A NATO SMetO should be responsible to his Commander for the following functions:

a. To determine the requirements for, and arrange provision of, meteorological support to:

(1) his commander and staff and

(2) subordinate commanders who do not have an SMetO.

b. In accordance with the procedures shown in Figure 2-IV, to determine the requirements for, and ensure provision of, meteorological support to all forces allocated for NATO OPLANs originated by his commander and subordinate commanders. This responsibility may be delegated to the SMetO of a subordinate commander, if more appropriate.

c. To develop and maintain the meteorological appendices of the environmental annex of NATO OPLANs originated by his commander, in accordance with the guidance provided in Annex A of this chapter.

d. To determine requirements for, and ensure provision of, meteorological support to operations centres for which his commander has responsibility.

e. To coordinate implementation within the command area of NATO meteorological plans in peace and in times of crisis.

f. To monitor developments in NATO operational policies, concepts and plans; assess the impact of any developments on the requirements for meteorological support within the command area; and initiate appropriate action.

g. To assess the requirements for, arrange procurement of, and monitor operation of equipment and facilities provided by NATO infrastructure for the provision of meteorological support in the command area.

h. To plan and coordinate meteorological aspects of NATO exercises for which his commander is the officer scheduling the exercise (OSE) or officer controlling the exercise (OCE).

i. To coordinate the work of SMetOs of subordinate commanders, providing direction and guidance, when necessary.

j. To carry out technical inspections of NATO-funded weather centres.

k. To liaise with national authorities and other NATO commands to coordinate plans and procedures.

l. To liaise with national authorities, through the MCMG, to arrange for provision of meteorological services from national weather centres to meet specific requirements of the command, including where necessary, support to:

(1) NATO weather centres,

(2) NATO headquarters,

(3) operations centres controlling NATO operations, and

(4) forces allocated for NATO OPLANs originated by his commander.

m. To promulgate plans and procedures in appropriate NATO documents.

n. To represent the command at appropriate NATO meetings.

PROCEDURES TO ESTABLISH THE METEOROLOGICAL SUPPORT REQUIREMENTS CHAIN

STAGE	DECISION	REQUIREMENT
1	What are the forces that require support?	
2	What meteorological support do these forces require?	Data/Products
3	What weather centre(s) will provide the support identified at Stage 2 to the forces identified at Stage 1?	Weather Centre(s)
4	What communications system(s) will transmit the support identified at Stage 2 from the weather centre at Stage 3 to the forces at Stage 1?	Communications
5	What are the meteorological requirements of the weather centre(s) at Stage 3 in order to provide the support at Stage 2?	Data/Products
6	What weather centre(s) will provide the support defined at Stage 5 required by the weather centre(s) at Stage 3	Weather Centre(s)
7	What communications system(s) will transmit the support identified at Stage 5 between the weather centres identified at Stage 3 and Stage 6?	Communications
8	What are the meteorological requirements of the weather centre(s) at Stage 6 in order to provide the support at Stage 5?	Data/Products
	Stages 6 to 8 will be deleted if there is only one weather centre in the chain, or they will be repeated if there are more than two weather centres in the chain.	
9	How will the data identified at Stages 5 and 8 b collected?	Data Collection Capability
10	What communications system(s) are required to transmit the data from the collecting sites to the weather centres	Communications

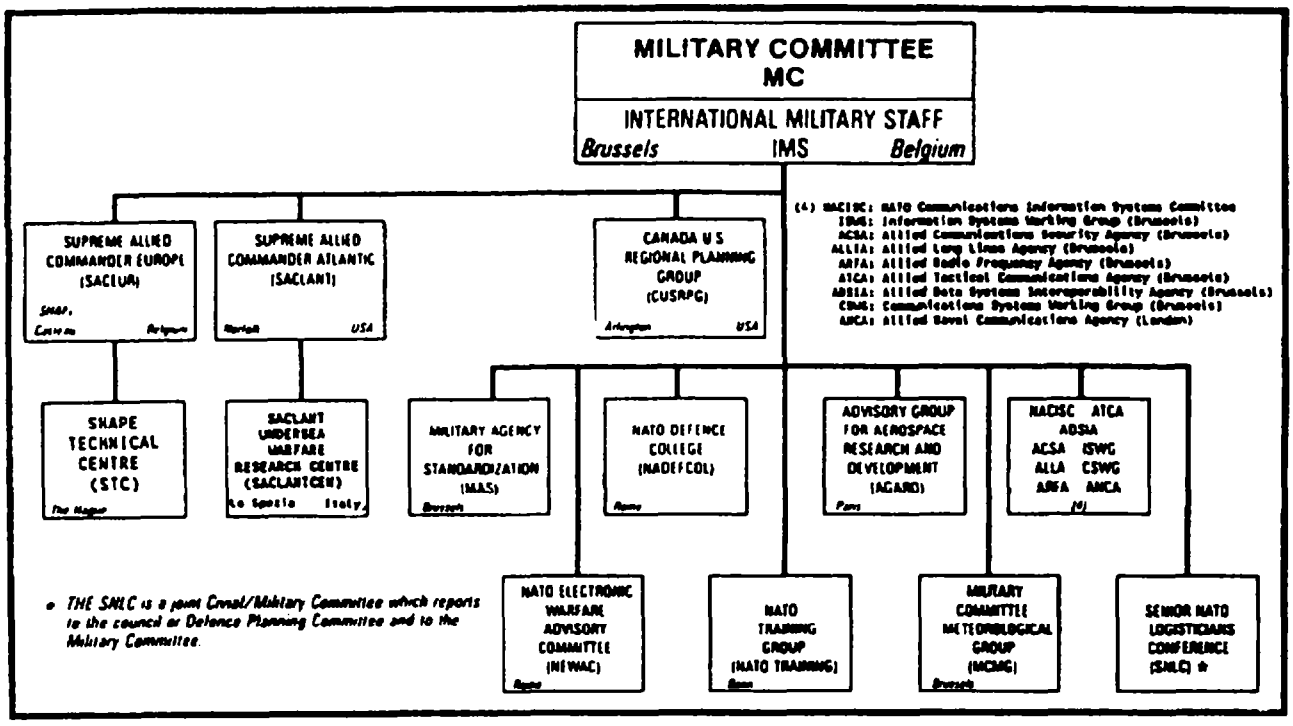
NOTES.

1. Centres at Stage 3 will provide support directly to NATO forces. (Direct Support) Centres at Stage 6 may not provide support directly to NATO forces, but all national centres which fulfill the function of Stage 6 are an essential part of the NATO meteorological support organisation. (Indirect Support)

2. Stages 3 and 4 may be revised in some cases where the availability of suitable communications system(s) will dictate which centre(s) will provide the required support. This is particularly true when providing support to maritime forces.

Figure 2-1

NATO MILITARY STRUCTURE



Source: The NATO Military Guide, Jan 90

Figure 2-II

LIST OF NATO SMETO POSTS

COMMAND	NATION	SERVICE	RANK	MEMBER-SHIP OF NATO MET MEETINGS	DEDI-CATED NATO POST	TASK IN ADDITION TO NATO POST
IMS	US	AF/NAVY	COL/ CAPT	a,b,c,d,e	Yes	No
SHAPE	Any	AF	COL	all	Yes	No
SACLANT	US UK	NAVY NAVY	CAPT CDR	a b,c	Yes Yes	No No
CINCNORTH-WEST	UK	CIV	-	d,e	No	Yes
COMNORTH	NO	CIV	-	d,e,f	No	No
CINCENT	GE	CIV	-	d,e,g	Yes	No
COMBALTAP	DE	CIV	-	d*,e,g	No	Yes
COMAIRCENT	US	AF	MAJ	d*,e,g	No	Yes
COMLANDCENT	US	AF	MAJ	d*,e,g	No	Yes
CINCSOUTH	IT	AF	COL	d*,e,h	Yes	No
COMNAVSOUTH	UK	NAVY	CDR	d*,e,h	Yes	No
5ATAF	IT	AF	LTC	d*,e,h	Yes	No
6ATAF	TU	CIV	-	d*,e,h	Yes	No
CINCIBERLANT	UK	NAVY	CDR	-	Yes	Yes
CINCWESTLANT	US	NAVY	LCDR	-	No	Yes
COMSTRIKE-FLEET	US	NAVY	LCDR	-	No	Yes

Routine NATO Meteorological Meetings:

a.	MCMG Main Group	(3 days)
b.	MCMG/WG-OPC	(3 days, twice a year)
c.	MCMG/WG-BMSS	(3 days, twice a year)
d.	SHAPE Met Committee	(2 days)
d*	Advisor to SHAPE Met Committee	(2 days)
e.	ACE SMetOs	(1 day)
f.	AFNORTHWEST Met Committee	(3 days)
g.	AFCENT Met Committee	(3 days)
h.	AFSOUTH Met Committee	(3 days)

Figure 2-III

PROCEDURES TO DEVELOP AND PROMULGATE PLANS FOR PROVISION OF METEOROLOGICAL SUPPORT TO NATO OPERATIONS PLANS

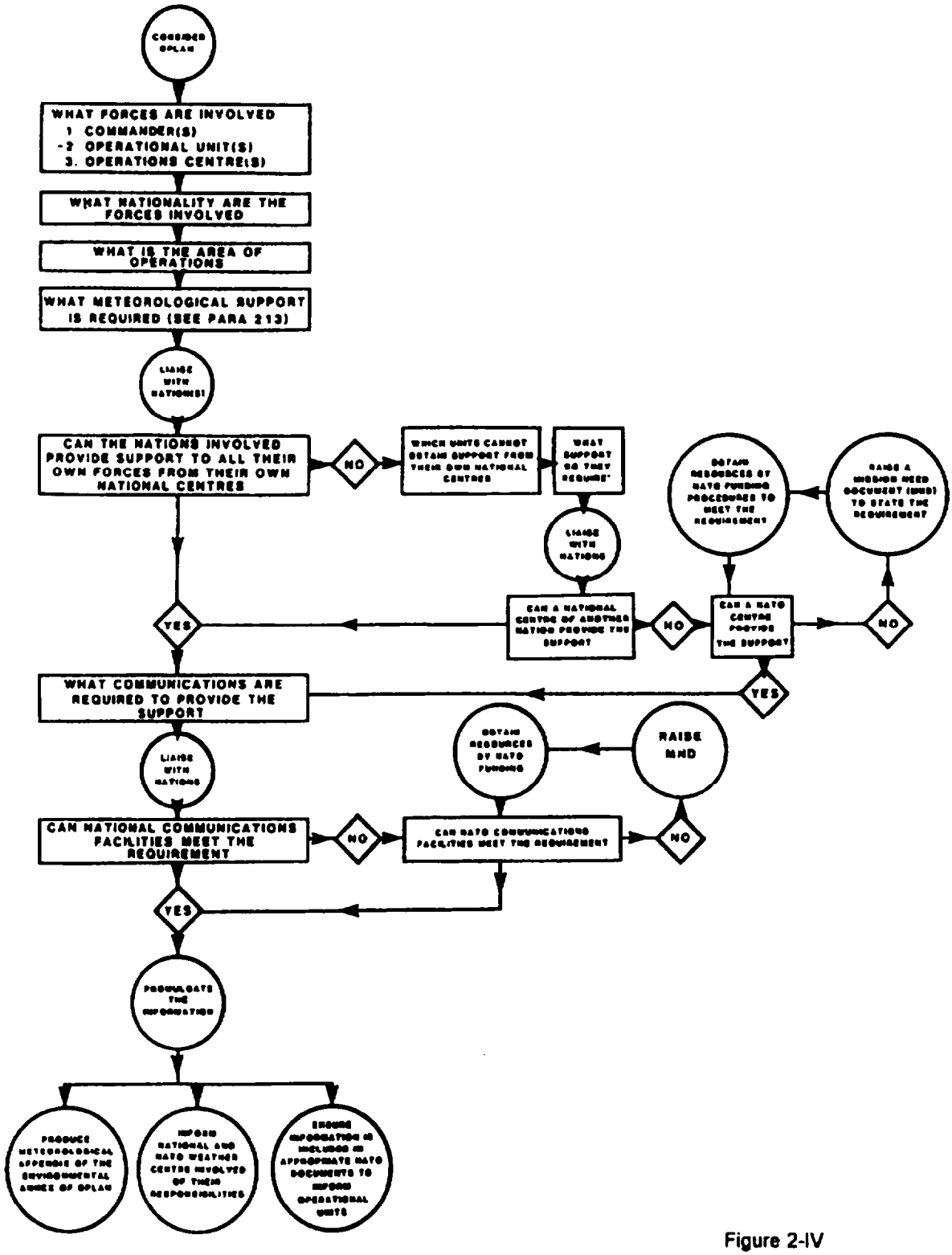


Figure 2-IV

METEOROLOGICAL SUPPORT ANNEXES TO NATO OPERATIONS PLANS (OPLANS)

1. Where a NATO OPLAN requires meteorological support, details of how that support will be provided should be set out in ANNEX M, O or W (Environmental Support) or an appendix to the Annex M, O or W of the OPLAN. Many OPLANs will not need such an annex, but MNC SMetOs should ensure that meteorological annexes are included, when necessary, and kept up to date in all OPLANs which require them.

2. The meteorological support annex should be written in such a way that minimum reference to other documents is required by:

a. Weather centres producing the support, and

b. Operational forces to be provided with support.

3. In order to achieve uniform standards and to ensure that all essential information is included, meteorological annexes should be written using the standard format at Appendix 1, and the example at Appendices 2 and 3.

Appendix 1	Standard Format
Appendix 2	Example of Real-World OPLAN
Appendix 3	Example of Exercise OPLAN

STANDARD FORMAT OF METEOROLOGICAL ANNEX OF A NATO OPERATIONS PLAN

Annex M
OPLANxxxx

METEOROLOGICAL SUPPORT

References:

1. Concept of Meteorological Support

General description of how meteorological support will be provided to the forces involved in the OPLAN, including primary and alternate methods, if applicable. National meteorological services will provide support to their own national forces, as required, except as noted herein. For exercise OPLAN, if artificial weather is to be used, this must be made clear and clear guidance on when and how the artificial scenario is to be used must be included. For Exercise OPLANs, an "Objectives" section should be included outlining new ideas or systems being evaluated during the exercise.

2. Requirement for Meteorological Support

a Units/Locations to which support will be provided.

b. List of products required. This should not give detailed content of each product, but should include period of validity, if required.

c. Time of activation of support and time of deactivation of the support.

d. Reports:

(1) Routine situation reports from operational forces.

(2) Reports on impact of weather on current operations.

e. Procedures for special reports.

3. Facilities providing support

List of all national and NATO weather centres which will be providing support directly to forces involved in the OPLANs.

4. Responsibilities

a. National centres

b. NATO centres

c. Meteorological support units with forces involved in the operation.

5. Communications

a. Detailed statement of the communications system(s) which will be used to provide support to forces involved in the OPLAN.

b. Schedules of products.

c. Procedures for coordinating forecasts, as necessary, should be described.

6. After-action Reports

After-action Reports will be provided as per Annex Romeo of the OPLAN.

Appendix 2
Annex A
Chapter 2

EXAMPLE OF A METEOROLOGICAL ANNEX TO A NATO OPERATIONS PLAN

Annex O
OPLAN 10405

METEOROLOGICAL AND OCEANOGRAPHIC SUPPORT

References:
A. MC 115/24, MC Directive for Meteorological Support to NATO Forces
B. MC 126/10, Policy for the Provision of Military Oceanographic Services to NATO Forces
C. Reaction Force Concept (SHAPE Paper) - Meteorological Support for ACE Reaction Forces

1. SITUATION.

a. GENERAL. This Annex applies for the planning and conduct of Meteorological and Oceanographic (METOC) Services to support the plan for peace implementation B-H. METOC Support will be conducted at the strategic, operational and tactical level as part of operations to assist in achieving all IFOR objectives.

b. ASSUMPTIONS

(1) IFOR METOC issues will be coordinated and directed by the SHAPE Chief Meteorological Officer and Oceanographic Officer for their respective disciplines.

(2) The Chief Meteorological Officer (C Met O), AFSOUTH, is responsible for the continued operations at the AFSOUTH Met Office and for organizing the manning, equipment and communications for the NATO Combined METOC Element (CME) deployed in support of HQ IFOR in Zagreb.

(3) The Oceanographic Officer, COMNAVSOUTH, is responsible for the continued support services currently provided to maritime forces in the AOR.

(4) The Staff Meteorological Officer, ARRC, is responsible for organizing the manning, equipment and communications for the Mobile Met Unit (MMU) deployed in support of HQ ARRC and for coordinating tactical weather support for the Troop Contributing Nations.

(5) National Meteorological and Oceanographic forces under national command will cooperate under the operational control of CINCSOUTH.

c. FRIENDLY. Assets to execute this plan will be requested by SACEUR from the nations and in accordance with Reference C. A Combined METOC Element (CME) will be formed from the assets provided by the nations and be deployed at HQ IFOR. An MMU, in support of HQ ARRC, will be formed in accordance with Reference C.

2. MISSION. CINCSOUTH is to conduct Meteorological and Oceanographic Support in the IFOR TAOO, in order to ensure the impact of weather is properly considered at all levels of operational decision making, including strategic and tactical planning forecasts as appropriate.

3. EXECUTION.

a. CONCEPT OF OPERATIONS.

(1) General.

(a) In accordance with policy in References A and B, national Weather Analysis Centres and Fleet Weather and Oceanographic Centres will provide weather and oceanographic data and products as available.

(b) To ensure a unified (coordinated) weather forecast (UWF) service is used for operational planning by IFOR Commanders, AFSOUTH MET OFFICE will continue to produce a UWF out to 5 days ahead. This forecast will describe the evolution of the main weather systems expected to effect the TAOO.

(c) The deployed Met cells, CME at HQ IFOR, and MMU at HQ ARRC, will use the UWF and military weather data and products to produce more detailed mission specific and shorter period forecasts as required.

(2) Phase I: Preparation and Deployment of Theatre Enabling Forces

(a) C Met O SHAPE will continue to develop and coordinate a METOC support plan and identify support requirements and assets. Critical assets will be pre-positioned in the TAOO and advance parties and assessment teams deployed as required and authorised.

(b) The CME manning and equipment for supporting HQ IFOR will assemble at HQ AFSOUTH in order to conduct equipment and procedural training prior to deployment.

(c) A small UK MMU is already well established at Split in Croatia, and this will form the core of the new ARRC requirement for a deployed MMU.

(3) Phase II: Entry. The CME manning and equipment for supporting HQ IFOR will deploy as soon as possible after the reception of ACTORD. A 2-man element of the team is expected to be deployed within the first 96 hours of authorization. The MMU additional manning and equipment, see para (2)(c) above, will deploy in accordance with the ARRC deployment plan.

(4) Phase III: Implementation. This phase includes fully operational weather support services for all forces under NATO Command and Control.

(5) Phase IV: Transition To Peace. As for Phase III but in addition there is the possibility to facilitate the reestablishment of the former B-H weather observing network in order to contribute to the rebuilding of the nation and to greatly enhance the weather data supply in a weather region of great spatial variability.

(6) Phase V: Exit. This phase will feature the orderly transfer of residual commitments to the appropriate civilian organizations.

b. RESPONSIBILITIES.

(1) C MET O AFSOUTH

(a) Exercise approval authority for all METOC programs, actions, and products produced in accordance with the approved concepts and requirements of this Annex. Authority for product approval is effective upon receipt of this OPLAN. Authority to initiate METOC deployments is granted upon receipt of the ACTORD.

(b) Ensure that METOC services are fully coordinated at the operational and tactical levels with Operations, Intelligence, Civil-Military Operations and other relevant functional areas.

(c) Submit requests for changes to approved concepts and requirements to SHAPE for approval.

(d) Through the national representatives in HQ IFOR, coordinate and deconflict METOC services with national METOC support activities.

(2) S MET O ARRC

(a) Direct and coordinate meteorological support to forces with and under the command of COMARRC.

(b) Coordinate with C Met O AFSOUTH to ensure consistency of advice on significant weather impact on operations.

4. LOGISTICS AND ADMINISTRATION. (Annex J, Admin and Logistics Support)

a. LOGISTICS. The C Met O AFSOUTH, deployed with the CME in support of HQ IFOR, will be responsible for identifying shortfalls and coordinating with SHAPE to overcome these. A key requirement is to avoid duplication of effort and avoid competition with Host Nation Support.

b. ADMINISTRATION. METOC services will be provided in accordance with References A and B, and ACE Directive 80-34.

5. COMMAND AND SIGNAL.

a. COMMAND. See Annex B (Command Arrangements).

b. SIGNAL. See Annex G (Communications and Information Systems Support).

Appendix 3
Annex A
Chapter 2

EXAMPLE OF A METEOROLOGICAL ANNEX TO A NATO EXERCISE PLAN

Annex W
RAFG/84003/31/2/OPS
Dated Dec 89

Meteorology - Fast Buck 90

Objectives

1. The objectives of meteorological play are to:

   a. Exercise the procedures and organisation for the provision of meteorological support to national forces throughout a period of tension, crisis and war.

   b. Test the communications network of permanent and reserved circuits.

   c. Include weather factors in the decision-making processes, when appropriate.

   d. Simulate denial of meteorological data by the enemy and the effects of METCON on our own forces.

General

2. In order to meet these objectives, meteorological staffs will conduct their activities using real weather. Elsewhere, weather will be dealt with as follows:

   a. Weather for Conventional Operations. Real weather will be briefed to exercise staffs, but weather will not be allowed to affect operations unless pre-scripted in the Combined Events List. DISTAFF may also impose temporary weather limitations to enable exercise objectives to be met.

3. Exercise play must not interfere with peacetime meteorological services or procedures nor jeopardise with safety of any live forces.

Execution

4. The meteorological offices at Detmold and at RAFG airfields will meet all local requirements for live meteorological support during their normal manning periods. The meteorological office at RAF Wildenrath will provide the necessary support to HQ BSF (Main) and HQ BSF (Alternate). Ops room staff of BSF (Main) or (Alt) will transfer FAX Meteorological Information onto ASMA/GASMA for use by staffs. RAF Wildenrath will provide support to the meteorological offices at RAF Bruggen and Laarbruch when those on-base offices are closed. The meteorological offices at RAF Gutersloh will provide data to HQ I (BR) Corps when the Detmold office is closed.

5. A DISTAFF/PLAYER Meteorological Cell will be established at ICAOC xxxx in Room 1647, T corridor (Tel Ext 4453/4452). The Cell will be manned from 0600Z to 2000Z daily throughout the exercise. Outside of these hours Staff may be contacted on 0318-316.

6. Post-Exercise Reporting. Post-Exercise reports are to be submitted in accordance with Annex R.

7. Ephemerides. Data will be as appropriate for the period of the exercise.

Appendix:

1. Astronomical Data.

CHAPTER 3

METEOROLOGICAL ORGANIZATION SUPPORTING NATO

References:
- A. Guidelines for Meteorological Support to NATO and PfP Nation Forces (Draft MCMG + CP Document)
- B. WMO Publication #306, Manual on Codes
- C. WMO Publication #386, Manual on GTS
- D. WMO Publication #544, Manual on GOS
- E. STANAG 2103, Reporting Nuclear Detonations, Biological and Chemical Attacks, and Predicting and Warning of Associated Hazards and Hazard Areas

INTRODUCTION

301. Each NATO nation has its own unique organization for the provision of meteorological support to its own military forces when they are employed on national activities. Some nations have a single meteorological organization to meet both military and civil requirements. Other nations separate their civil and military organizations.

302. By Reference A, meteorological support to NATO forces will be provided, whenever possible, by national facilities. Most NATO nations have agreed that some, or all, of their national meteorological organizations will support NATO forces as defined in Para 104. In places where national facilities are unable to provide the necessary level of support to meet the NATO minimum military requirement, NATO meteorological centres have been established. The overall organization to provide meteorological support to NATO forces comprises, therefore, a combination of national and NATO centres.

REQUIREMENT

303. The requirement is to:

a. Provide in a timely manner, coordinated, tailored, meteorological support to NATO headquarters, operations centres and all NATO maritime, air and land operational forces that require it, in times of peace, crisis and war.

b. Make the best use of assets available and avoid unnecessary duplication of effort by NATO and national weather centres.

c. Whenever possible, use standardised practices and procedures.

d. Be capable of a smooth transition from peacetime operation to full wartime capability.

e. Be survivable in wartime.

ORGANIZATION

304. National Meteorological Centres

a. These are centres which have been established by nations to provide meteorological support to meet their own national requirements, in accordance with national plans and procedures. The nations concerned have agreed that these centres will provide support, either directly or indirectly, to

(1) NATO forces as defined in Para 105, and/or

(2) NATO meteorological centres as defined in Para 305.

b. Some national centres in the organization provide support directly to NATO forces. Others which do not, have been included in this Manual because they provide essential support to lower echelon national centres where it is then used as a basis to provide support directly to NATO forces.

c. The support provided by national centres to NATO organizations is usually limited to products which are developed on a routine basis for national purposes. However, at the discretion of the nation concerned, additional products may be provided to meet specific NATO requirements. Arrangements for the provision of routine and special products are established by negotiation between the appropriate national authority and the SMetO of the NATO command concerned and/or the officer-in-charge of a NATO centre. A memorandum of understanding (MOU) may be raised to formalise the arrangements.

d. National Centres remain under national command and control at all times when providing support to NATO organizations. This includes responsibility for:

(1) manpower, including augmentees in times of crisis and war;

(2) equipment, including telecommunications circuits and terminal equipment (except as described in sub-para e, below);

(3) logistics support; and/or

(4) technical standards, including inspections.

e. National centres may qualify for NATO funding for the purchase of equipment, or the provision of telecommunications circuits, which are needed to meet specific NATO requirements which cannot be met by use of existing, or planned, national or NATO funded facilities. Procedures to obtain such funding will be in accordance with current NATO budget, infrastructure and procurement regulations and should be initiated by the SMetO of the NATO command which raises the requirement.

f. National centres may be located:

(1) remote from any military headquarters,

(2) in a national headquarters with no NATO role,

(3) in a national headquarters which has collocated national and international/NATO staffs (see Para 402b), or

(4) in a national headquarters which has a national staff with a dual-hatted NATO role (see Para 402c).

305. NATO Meteorological Centres

a. These are meteorological centres which have been established by NATO funding, normally in an international NATO headquarters (see Para 402a) to provide meteorological support to the NATO Commander and his staff and, in some cases, to NATO operational units in the command area of responsibility where there is no national meteorological centre available to provide the support required. The only exception is the MSU at the Main Operating Base of the NATO Airborne Early Warning Force

(NAEWF) at Geilenkirchen, Germany, which is also NATO funded. A listing of NATO funded meteorological centres with their complement is at Annex A.

b. Personnel

(1) With the exception of the MSU at Geilenkirchen, which is manned by NATO civilians, NATO meteorological centres are manned by national personnel, with international status, on detachment from one or more nations for a fixed period of duty.

(2) Personnel remain under the administrative control of their own nation, but are subject to the functional control of their NATO superiors while on duty in the NATO meteorological centre.

(3) Preparation of the statement of requirement for personnel to man a NATO meteorological centre is the responsibility of the Command SMetO.

(4) Authorization of the posts on the headquarters Peace Establishment (PE) and/or Emergency Establishment (EE) is in accordance with current NATO manpower policy and procedures.

(5) Provision of personnel to fill these posts is subject to negotiation between the appropriate NATO and national manpower authorities.

(6) For all new, and changes to, manpower requirements (PE/EE), the MSC must work with their local personnel staff who will then send the requirement request through channels to the MNC for processing. The MNC will then work with the nation(s) involved to get the position(s) approved. Once approved and tasked to a particular nation, when the MSC wants the position filled for a particular exercise or contingency, the MSC must work directly with the nation involved.

c. Equipment

Equipment, telecommunications circuits and logistic support are normally provided by NATO funding in accordance with current NATO budget, procurement and infrastructure procedures.

d. Technical Practices and Procedures

Whenever possible, technical practices and procedures should follow the practices and procedures of the World Meteorological Organization (WMO), see References B - D. Internal office procedures are the responsibility of the officer-in-charge (OIC) and the nation responsible for technical supervision.

e. Technical Supervision

(1) All technical supervision is the responsibility of the nation which provides the OIC.

(2) Technical inspections should be carried out about every two years by representatives of the nation responsible for technical supervision, assisted by the SMetO of the next higher command.

(3) An Inspection Report, with appropriate recommendations, should be submitted by the nation responsible for technical supervision as soon as possible after the inspection, to the commander in whose headquarters the centre is located, with copies to:

(a) the next higher commander and

(b) the SMetO of the command.

(4) A Follow-up Report, giving details of actions taken as a result of recommendations in the inspection report, should be submitted by the commander to whom the report was submitted to the next higher commander not more than one year after the inspection, with a copy to the nation responsible for technical supervision.

f. National Support to NATO meteorological centres

All NATO meteorological centres rely upon national met centres for the routine provision of data collectives and computer products. Details of this support and the means by which it is provided should be established in accordance with Para 304c.

g. Products for dissemination

The products needed for dissemination will be determined by the SMetO of the command, in coordination with the OIC of the met centre, on the basis of:

(1) the mission, concept of operations, and functions of the commander and

(2) the headquarters, operations centres, and operational units to be supported.

Details are given in Chapters 4 through 7.

h. Support to national forces in peacetime

In order to improve liaison and practice procedures between NATO meteorological centres and national operational units, NATO met centres which are fully operational in peacetime should take every opportunity possible to provide support to national forces in peacetime by:

(1) making available to national units of any NATO nation, all the products which the met centre provides to NATO forces in peacetime.

(2) meeting, whenever possible, requests from national forces for non-routine products. However, the provision of such support should not be at the expense of the normal work of the met centre, nor should it require additional manpower or equipment. National units requiring such support should liaise directly with the centre.

306. NATO requirements of both national and NATO meteorological centres. National and NATO meteorological centres should:

a. Be familiar with:

(1) the command and control structure, mission, concept of operations, and functions of the NATO commander to whose headquarters and operational units they provide direct support.

(2) the OPLANS for NATO operations for which they will be required to provide direct support, as established by the procedures in Figure 2-IV.

b. Meet the NATO military requirements appropriate to their functions as defined in Paras 310c, 311c or 312c and in Chapters 4 through 7.

c. Maintain a document to promulgate:

(1) the centre's NATO area of responsibility.

(2) specific NATO forces to which support would be provided on a routine basis in times of peace, crisis and war, for example:

(a) NATO units or formations,

(b) OPLANS,

(c) NATO headquarters,

(d) NATO operations centres,

(e) NATO meteorological centres, and/or

(f) airfields.

(3) procedures to be used for the provision of support to NATO forces, if these are different from national or WMO procedures.

(4) details of additional products which it will exchange with other national and NATO met centres in times of crisis and war which are not exchanged routinely in peacetime.

(5) details of telecommunications facilities required specifically to support NATO operations.

d. Practice NATO plans and procedures whenever possible during NATO exercises.

e. Ensure that details of support available from the met centre to NATO forces are promulgated and kept up-to-date in appropriate NATO publications.

f. Take care to ensure that support provided in accordance with national plans by a national met centre to operational units of their own nation, but allocated to NATO operations, does not conflict with support provided to the same units by a NATO met centre, or a national met centre of another nation, in accordance with NATO plans. Coordination between the relevant centres may be required.

307. Development of the meteorological support required by military forces involves three basic processes in sequence:

a. Data collection,

b. Data processing and production of numerical products, and

c. Tailoring of numerical products to produce military-oriented products for use by military forces.

308. The organization of national and NATO meteorological centres which carry out these three functions is shown in Figure 3-I, and is comprised of three types of meteorological centres, each with a different mission.

a. Weather Analysis Centres (WAC),

b. Military Forecast Centres (MFC), and

c. Meteorological Support Units (MSU).

309. Most meteorological centres in the organization carry out the functions of only one type of centre, although some centres combine the functions of more than one. The actual title of each individual centre, e.g. Command Meteorological Centre (CMC), Allied Meteorological Office (AMO), Fleet Weather Centre (FWC), Atlantic or European METOC Center, etc, reflects its specific national or NATO responsibilities.

310. Weather Analysis Centres (WACs)

a. Mission of a WAC

(1) to collect surface and upper-air data from the sources described in Chapter 9.

(2) to develop the products, like those listed in Figure 3-II, using numerical prediction models.

b. NATO requirements of a WAC

WACs should carry out the mission above and one or more of the following actions, as appropriate:

(1) fulfil appropriate requirements listed in Para 306.

(2) provide some, or all, of the products listed in Figure 3-II on a routine basis to one or more of:

(a) their own national MFCs and MSUs, in accordance with national plans,

(b) specific NATO MFCs and MSUs, in accordance with Para 304c, and/or

(c) all NATO forces with the reception capability via radio teletype (RATT) or radio facsimile (FAX) broadcasts, in accordance with WMO plans.

(3) provide climatological information, which is not readily available in publications, to MFCs and MSUs listed in Chapter 4, to be used for planning purposes.

(4) exchange data and products with other WACs in order to improve their capability to meet NATO requirements throughout the NATO operational area.

(5) carry out research and development of equipment and techniques which will improve their capability to support NATO forces. Exchange relevant information with other NATO nations.

c. General information about WACs

(1) All WACs are national meteorological centres.

(2) Most WACs, in peacetime, are principal national met centres within the WMO organization, and thereby:

(a) act as the national communications centre for the collection and dissemination of data on a world-wide basis via the WMO telecommunications network,

(b) maintain an extensive climatological data base, and/or

(c) carry out research and development.

(3) Most WACs are civilian, but some nations have, in addition, military centres which carry out the main functions of a WAC and these are included, therefore, as WACs in this Manual.

(4) Some WACs provide support directly to NATO organizations as described in Paras 310b(2)(b) and (c). Other WACs do not provide support in either of these ways, but do provide support indirectly to NATO forces by providing it to national MFCs, as described in Para 310b(2)(a), which then use the information as a basis to provide support to the NATO forces.

(5) Some WACs also carry out the functions of an MFC.

(6) Figure 3-III lists the centres which carry out the functions of a WAC.

(7) National capabilities for providing meteorological support to NATO, particularly the capability of the various WACs, are detailed in Annex B.

311. Military Forecast Centres (MFCs)

a. Mission of an MFC

Using, as a basis, the data and products provided by a WAC, as listed in Figure 3-II, they:

(1) maintain the status of the current and predicted weather situations over an area appropriate to the provision of meteorological support to national/NATO forces within the centre's area of responsibility (AOR), and

(2) provide tailored products to national/NATO forces, as defined in Para 105, throughout the centre's AOR, taking into account:

(a) commanders' missions, concepts of operations, and functions,

(b) operational units' capabilities and tasks,

(c) current operations in their AOR,

(d) future operations in their AOR, and

(e) whether or not the recipients of the products have an MSU.

b. NATO requirements of an MFC. MFCs should carry out the mission above and one or more of the following actions, as appropriate:

(1) fulfil appropriate requirements listed in Para 306,

(2) provide guidance products to lower echelon meteorological centres within their AOR,

(3) coordinate and exchange products with MFCs in adjacent areas,

(4) assist in collection and dissemination of data and products among national and NATO met centres,

(5) maintain a climatological library containing recent data for their AOR, and mission-oriented data, as available, and/or

(6) provide climatological reports and statistical studies for planning staffs, consulting WAC climatological data bases, as necessary.

c. General information about MFCs

(1) MFCs may be national or NATO met centres.

(2) MFCs may be military or civilian manned.

(3) MFCs may provide support specifically for one or more of maritime, air or land operations. Further details are given in Chapters 5 through 7.

(4) some WACs also carry out the functions of an MFC.

(5) some MFCs also carry out the functions of an MSU for a collocated NATO headquarters.

(6) MFCs have individual titles which reflect their national or NATO responsibilities.

(7) some national MFCs support national and NATO forces; others support only their own national forces allocated to NATO.

(8) Figure 3-IV lists the centres which carry out the functions of an MFC. Further details are given in Chapters 4 through 7.

312. Meteorological Support Units (MSUs)

a. Mission of an MSU. Using the data and products provided by WACs and/or MFCs as a basis, they prepare and deliver tailored briefings or written forecasts to all elements that require meteorological support in the headquarters, operations centre or operational unit in which the MSU is located, taking into account:

(1) the commanders' mission, concept of operations and functions, or

(2) the operational unit's current tasks and capabilities, and

(3) the meteorological elements which affect the operational unit's weapons and/or sensor systems.

b. NATO requirements of an MSU. MSUs should carry out the function above and one or more of the following actions, as appropriate:

(1) fulfil appropriate requirements listed in Para 306.

(2) provide support to units of other nations under the following circumstances:

(a) on airfields, to crews of visiting aircraft,

(b) in ships, to ships in the same Task Force or Task Group, and/or

(c) with land forces, in combined operations.

(3) if there are MSUs in more than one unit of the same operational group, the MSU which supports the Group Commander should assume responsibility for coordinating support within the group in order to:

(a) avoid duplication of effort,

(b) ensure that all units in the group are receiving the support they require, and

(c) minimise the amount of meteorological information on communications links, particularly common-user links, to and from the group.

c. General Information about MSUs

(1) MSUs may be established in a command headquarters, in an air operations centre, on a military airfield, in a ship, and/or with a mobile land or maritime unit.

(2) Meteorological centres may be established in a command headquarters:

(a) specifically as an MSU to support the headquarters, or

(b) primarily as an MFC to provide support to operational units in the command area, with support to the headquarters as an MSU as a secondary task.

(3) MSUs at NATO international headquarters, not collocated with a national headquarters, are NATO MSUs. MSUs at collocated NATO and national headquarters are national MSUs.

(4) With the exception of the MSU at the NAEWF MOB at Geilenkirchen, which is NATO funded, all MSUs, other than those at NATO headquarters, are national.

(5) Specific tasks and requirements of MSUs will depend upon the role of the organization they support. More detailed information is given in Chapters 4 through 7.

(6) MSUs at NATO headquarters, NATO establishments and NATO operations centres are listed in Figure 3-V. This does not include MFCs which also act as MSUs at NATO headquarters.

313. Meteorological Organization and Capabilities of Partnership for Peace (PfP) Nations.

a. NATO combined operations and exercises with PfP nations also require the requisite level of meteorological support for success, and thus require various levels meteorological standardization and interoperability, to include climatology exchange, observation exchange, forecast exchange, common data formats, and eventually, generation of Unified Weather Forecasts.

b. Non-NATO nations who are participating in the PfP Program have provided the information in Annex C, which outlines the capabilities of their national meteorological organizations. Their potential contribution to PfP operations should not be overlooked.

IMPLEMENTATION

314. Practices and Procedures

a. Peacetime practices and procedures used by national meteorological centres and the international exchange of meteorological data and products between them are normally in accordance with agreed procedures of the WMO and the International Civil Aviation Organization (ICAO). National and NATO met centres should continue to use WMO and ICAO practices and procedures whenever possible when providing support to NATO forces in times of peace, crisis and war.

b. Procedures for Unified Weather Forecasts:

(1) To ensure that consistent meteorological advice is given to all subordinate tasking commanders within each MSC region, agencies listed below are designated under normal circumstances to produce the UWF. However, for specific operations or exercises, the MNC Chief Met Officer may designate a different agency than the one listed as the situation dictates.

MSC Region	Center Responsible For Issuing UWF	Alternate
Northwest	AFNORTHWEST	WAC Oslo
Central	GMGO Traben-Trarbach	RNLAF Met Group
Southern	CMFWC Naples	AMO 5ATAF/6ATAF
WESTLANT[1]	NAVLANTMETOCCEN	METOC Center Halifax
EASTLANT[1]	CINCFLEETWOC	NAVLANTMETOCCEN

(2) Designated Agencies should prepare and issue the UWF for the whole of the MSC region for which they are responsible, covering a period 12 to 96 hours ahead. Prearranged schedules for SHAPE regions are listed in Reference H.

(3) For periods up to 12 hours ahead, coordination is effected by exchange of forecasts and, if necessary, direct discussion between the appropriate centres.

(4) The precise form of UWFs varies according to regional requirements.

c. Procedures for the provision of meteorological support for the warning of hazards of nuclear, biological and chemical warfare are given in Reference I.

315. Crisis Management

a. Meteorological facilities which would be required to support NATO forces in the earliest phases of an emergency should be in existence in peacetime. They should be capable of providing all meteorological support required by NATO forces at the outset of an emergency, without essential change in organization or mobilisation of reserve forces.

b. In peacetime, there should be at least one national or NATO meteorological center which is operational 24 hours a day, 365 days a year, available in each MSC area to provide support to the Command at short notice in a developing crisis situation.

c. Support of full operations may require additional manpower, equipment and telecommunications circuits. These should be regularly activated and exercised in peacetime.

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[1] Also see paragraphs 515-517

NATO METEOROLOGICAL SUPPORT ORGANIZATION AND INFORMATION FLOW

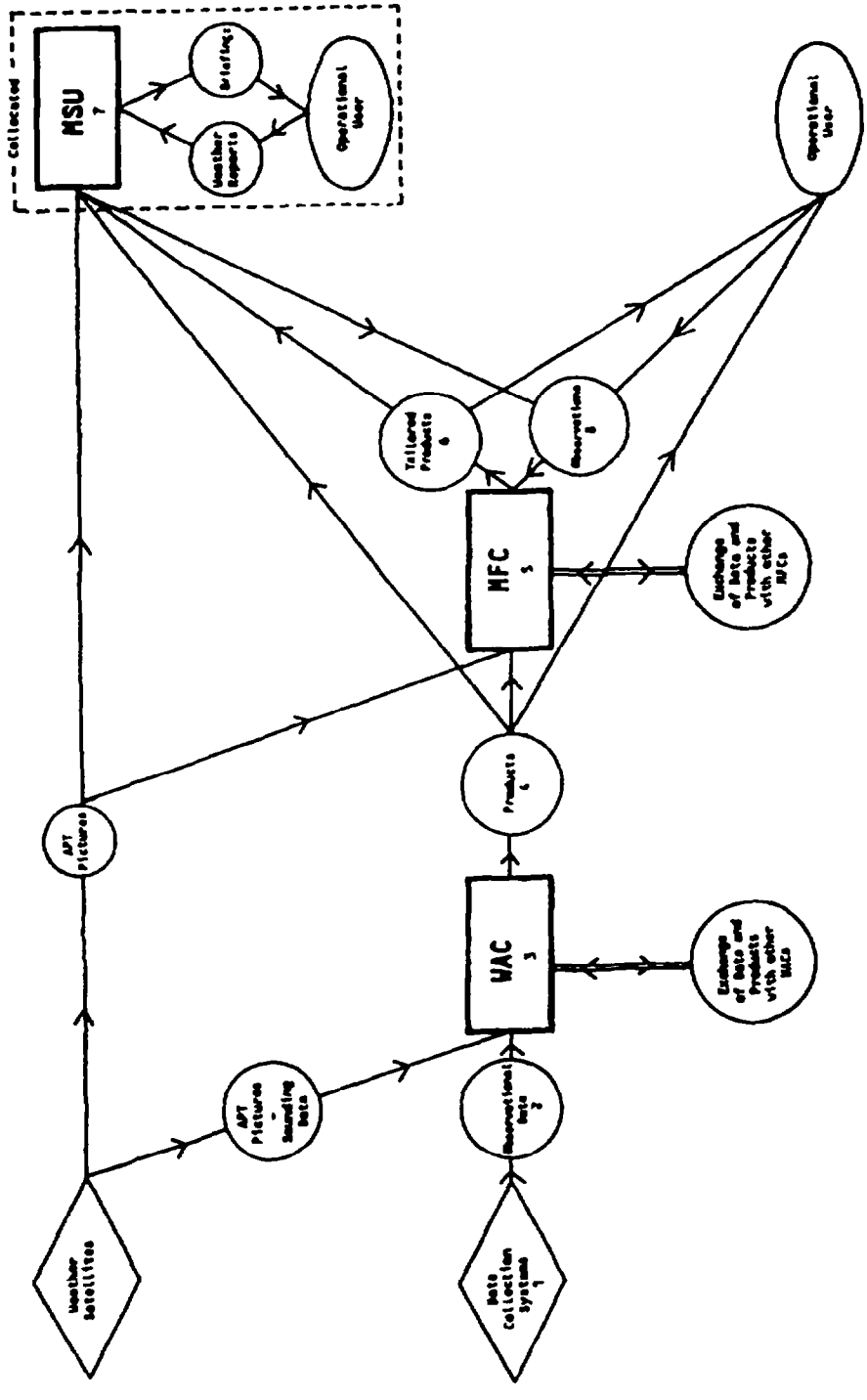


Figure 3-I

WAC METEOROLOGICAL PRODUCTS REQUIRED BY MFCs

Meteorological Products	Area of Coverage Required	Frequency Required (per 24 hrs)	Products Required by MFCs		
			Mari-time	Air	Land
1. Alpha-numeric Products					
Surface Synoptic Data Collectives	Limited	4	Yes	Yes	Yes
	Local	24		Yes	
Upper-air Synoptic Data Collectives	Limited	2	Yes	Yes	Yes
Synoptic Review	Limited	2	Yes	Yes	Yes
5-day Outlook	Limited	1	Yes	Yes	Yes
Climatological Data	As Req	-	Yes	Yes	Yes
Effective Downwind Messages	Limited	2	Yes	Yes	Yes
2. Graphic and Gridded Field Products					
Surface Analysis	Limited	4	Yes	Yes	Yes
	Hemisphere	2	Yes	Yes	Yes
Surface Prognosis +24 hrs	Limited	4	Yes	Yes	Yes
	Hemisphere	2	Yes	Yes	Yes
Surface Prognosis, +48, 72, 96, 120 hrs	Limited	1	Yes	Yes	Yes
Upper-air Analysis, Std lvls to 100 hPa 500 hPa	Limited	2	Yes	Yes	Yes
	Hemisphere	2	Yes	Yes	Yes
Upper-air Progs, Std lvls to 100 hPa, +24 500 hPa, +24	Limited	2	Yes	Yes	Yes
	Hemisphere	2	Yes	Yes	Yes
Plotted Synoptic Charts	Limited	8	Yes	Yes	Yes
Sea/Swell Analysis	Limited	1	Yes		
Sea/Swell Prognosis + 24 hrs	Limited	1	Yes		
Sea Surface Temperature Analysis	Limited	1	Yes		
Soil State Analysis	Limited	1			Yes
Soil State Prognosis +24 hrs	Limited	1			Yes
Satellite Composite Pictures	As Avail	-	Yes	Yes	Yes

Figure 3-II

WEATHER ANALYSIS CENTRES

Nation	Weather Analysis Center (WACs) (See Para 310)	Civil or Mil	Also Acts as MFC (See Para 311)	Dedicated Met Radio Broadcast		Products Available on NATO CCIS	Weather Centres Supported		Other WACs with which Data and Products are Exchanged
				RATT	FAX		National MFCs	NATO MFCs & MSUs	
Belgium			No	No	No	No	Beauvechain	None	Bracknell, Toulouse
Canada	Montreal	Civ	No	No	No	No	METOC Halifax	None	Washington
Denmark	Copenhagen	Civ	No	No	No	No	Karup	None	Bracknell, Oslo
France	Toulouse	Civ	Yes	No	No	No	Taverny	None	Bracknell, Rome, Offenbach
Germany	Offenbach (DWD)	Civ	No	Yes	Yes	No	None	None	GMGO, Toulouse, Bracknell
	GMGO(Traben-Trarbach)	Mil	Yes	Yes	Yes	No	FWC Glucksburg	CINCENT, Geilenkirchen	Offenbach, Oslo, Bracknell
Greece	Athens	Mil	Yes	No	No	No	FWC Athens HTAF/WC	*	Rome
Italy	Rome	Mil	Yes	Yes	Yes	No	None	CMFWC Naples AMO Vicenza	Athens, Ankara, Toulouse, Offenbach
Nether-lands	De Bilt #	Civ	No	No	No	No	RNLAF Met Group Woensdrecht	AFCENT	Bracknell
Norway	Oslo (Blindern)	Civ	Yes	No	No	No	Stavanger, Bodoe	HQ NORTH	Bracknell
Portugal	Lisbon	Civ	Yes	No	No	No	None	IBERLANT CMOC	Toulouse, Madrid
Spain	Madrid	Civ	Yes	No	No	No	CPVD (Madrid)	None	Toulouse, Lisbon
Turkey	Ankara	Civ	Yes	Yes	Yes	No	FWC Bandirma	AMO Izmir	Rome
UK	Bracknell	Civ	No	Yes	Yes	No	CINCFLEETWOC Northwood,CINCUK-AIR High Wycombe	AFNORTHWEST High Wycombe	Washington, Copenhagen, Oslo, Toulouse, Brussels, De Bilt, Offenbach
US	Washington	Civ	No	No	No	No	NLMOC Norfolk	None	Bracknell, Montreal, AFGWC, FNMOC
	AFGWC Offutt	Mil	No	No	No	No	EMC Traben-Trarbach	None	Washington, FNMOC
	FNMOC Monterey	Mil	No	No	No	No	NLMOC Norfolk NEMOC Rota	None	Washington, AFGWC

* AMO Larissa when 7ATAF is activated
\# LAM only

Figure 3-III

MILITARY FORECAST CENTRES

Country in Which Centre is Located	MILITARY FORECAST CENTRES (MFCs)						
	National Centres (See Para 304)			NATO Centres (See Para 305)			
	Centre	Nation Pro-viding	Ops Supported (Air, Land, Maritime)	Centre	Supervision (Para 305e)		Ops Sup-ported
					Command	Nation	
BE	Beauvechain	BE	A, L				
CA	METOC Halifax	CA	A, M				
DA	Karup	DA	A,L,M				
	Copenhagen	DA	M				
FR	MFC Toulouse	FR	M				
	WAC Toulouse	FR	A,L,M				
	MFC Taverny	FR	A,L				
GE	GMGO	GE	A,L				
	FWC Glucksburg	GE	M, A				
	EMC	US	A, L				
GR	WAC Athens	GR	A, L				
	FWC Athens	GR	M				
	HTAF/WC	GR	A, L	*			
IT	WAC Rome	IT	A, L, M	CMFWC Naples	CINCSOUTH	IT	A,L,M
	CMR Milano	IT	A,L, M	AMO Vicenza	5 ATAF	IT	A,L
	CMR Brindisi	IT	A,L,M				
NL	RNLAF Met Gp Woensdrecht	NL	A,L,M	AFCENT	AFCENT		A,L
NO	WAC Oslo	NO	A,L,M	HQ NORTH	COMNORTH	NO	A,L,M
	MFC Bodoe	NO	A,L,M				
	MFC Stavanger	NO	A,L,M				
PO	WAC Lisbon	PO	A,L,M	CMOC IBERLANT	CINCIBERLANT	UK	M
SP	WAC Madrid CPVD Madrid NEMOC Rota	SP SP US	A,L,M A,L,M M,A,L				
TU	WAC Ankara	TU	A,L	AMO Izmir	6 ATAF	TU	A,L
	FWC Bandirma	TU	M				
UK	CINCUKAIR	UK	A,L,M	AFNORTHWEST	CINCNORTH-WEST	UK	A,L
	CINCFLEET-WOC	UK	M				
US	NLMOC Norfolk	US	M,A,L				
	AFGWC Offutt	US	A,L				

AMO Larissa when 7ATAF is activated

Figure 3-IV

MSUs AT NATO HEADQUARTERS AND NATO ESTABLISHMENTS

Meteorological Support Unit (MSU)	National or NATO	Organization which It Supports	Supporting WAC(s)	Supporting MFC(s)
SHAPE	NATO	SHAPE	Bracknell GMGO	GMGO, AFCENT MSU
Geilenkirchen	NATO	NAEWF MOB	GMGO	GMGO
Messtetten GMGS RBZ	GE	CAOC	GMGO	GMGO
Kalkar GMGS RBZ	GE	CAOC	GMGO	GMGO
617 WS Heidelberg	US	AIRCENT, LANDCENT	AFGWC GMGO	EMC Traben-Trabach

Figure 3-V

COMPLEMENT OF NATO FUNDED METEOROLOGICAL CENTRES

Weather Centre	NATO Commander	Role of Centre (Paras 311 & 312)	SMetO		Complement				
			Nation	Grade	OIC		Nation	Officers	Other Grades
					Nation	Grade			
SHAPE Mons, BE	SACEUR	MSU	Any	OF5	SMO		Any	1	
HQ NORTH Stavanger, NO	COMNORTH	MSU	NO	OF4 *	NO	OF3 *	DE GE		1 1
HQ AFCENT Brunssum, NL	CINCENT	MSU	GE	OF5 *	GE	OF5 *	GE NL BE	1 1 1	1 1
CMFWC Naples IT	CINCSOUTH COMAIRSOUTH COMNAVSOUTH	MFC, MSU	IT	OF5	IT	OF5	IT US GR	7 1	6 1
AMO Vicenza, IT	COMFIVEATAF COMLANDSOUTH	MFC, MSU	IT	OF4	IT	OF4	IT	2	9
AMO Izmir, TU	COMSIXATAF COMLANDSOUTHEAST	MFC, MSU	TU	OF4	TU	OF3 *	TU	2 *	8 *
CMOC CINCIBERLANT Oeiras, PO	CINCIBERLANT	MFC, MSU	UK	OF4	UK	OF4	UK PO	1 1	1

* Civilian Equivalent

METEOROLOGICAL ORGANIZATION AND CAPABILITIES OF NATO NATIONS

1. Introduction This Annex outlines national meteorological organization, including the capabilities of WACs. This ihformation is provided by the respective nations and updated as required.

2. Contents

Appendix 1
Annex B
Chapter 3

BELGIUM'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. **Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.**

Belgium has 3 meteorological services:

A. Civil scientific service named "Institut Royal Meteorologique" (IRM) or "Koninklijk Meteorologisch Instituut" (KMI), created in 1913 and reports to the Ministry of Scientific Policy (diagram attached as Figure 3B-1-I). The IRM staff is located at Uccle, just south of Brussels, and the organization operates 6 regular synoptic observing stations. Employing about 186 people, its main responsibilities are:

(1) activities in the field of scientific research.
(2) public service in the field of atmospheric and geophysics sciences (meteorology, climatology, hydrology, geomagnetism, magnetohydrodynamics)
(3) Provides Belgian representative to WMO, ECMWF, EUMETSAT, ECOMET

B. Service for civil aviation named "Sv MET Regie des Voies Aeriennes" (SV MET RVA) or "Sv MET Regie der Luchtwegen" (Sv MET RLW), created in 1946 and reports to the Ministry of Communications and Infrastructure (diagram attached as Figure 3B-1-II). Sv MET RVA staff is located at Brussels Airport, and the organization operates 6 regular synoptic observing stations, corresponding to national and regional airports. Employing about 115 people, its main responsibilities are:

(1) flight information and safety for civil aviation
(2) aeronautical climatology
(3) meteorological telecommunications
(4) Provides Belgian representative at ICAO and at WMO Commission for Aeronautical Meteorology

C. The organization for meteorological support to the military is the Meteo W, created in 1947 and reports to the Ministry of Defence (diagram attached as Figure 3B-1-III). With headquarters at Beauvechain Airbase, Meteo W operates 12 regular synoptic observing stations. Employing about 260 people, its main responsibilities are:

(1) meteorological support to the Armed Forces.
(2) military climatology
(3) public service (roads meteorological protection during winter)
(4) Provides Belgian representative to MCMG and related NATO meetings.

2. **If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.**

Establishment or consolidation into a single common forecasting service to meet all national requirements was not considered feasible. A "Coordination Commission" is composed of representatives of each of the ministries, the directors of the meteorological services, and representatives of other departments having interest in meteorology. This commission has the responsibility to:

(1) advise the authorities about the area of responsibility of national meteorological services
(2) control the execution of respective responsibilities
(3) organize the free exchange of all meteorological data between the national meteorological services
(4) organise a permanent co-operation between the services, including the areas of instruments and observing methods, telecommunications, training, mutual assistance for meteorological studies and applications, and implementation of international meteorological resolutions.

3. **Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.**

A. Non-commissioned officers and civilian personnel attend a 15 week Initial Forecasting Course (IFC) conducted at the Meteo W school, followed by 6 month probation period on an airbase. After several years of experience, these people attend an 8 week Advanced Forecasting Course (AFC) at the Meteo W school. Selected forecasters attend the "Numerical Weather Prediction Appreciation Course" at the Meteorological Office College (Reading UK).

B. Officers graduating from the Royal Military Academy attend a 20 week IFC at the Meteorological Office College (Reading UK), followed by 6 months probation at an airbase or at the Military Forecast Centre. Dependent upon follow-on assignments, officers may also attend an 8 week AFC at the Meteorological Office College, and may also attend the "Numerical Weather Prediction Appreciation Course."

4 **Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.**

A. The Military Forecasting Centre is responsible for meteorological support to the Air Force, Army, and Navy, and is located together with the Meteo W staff at the Beauvechain Airbase. Its manpower is 1 officer supervisor, 13 forecasters and 12 assistants operating on a shift system to ensure 24 hour per day coverage. Shift manning is one synoptic forecaster, one operational forecaster, one medium ranger forecaster, and 3 assistants.

B. Equipment used by the Centre include two interactive workstations (Interactive Meteorological Data Processing System) (IMDP), four terminal stations (Terminal System of Meteorological Data Distribution Network) (TMSDDN), and one terminal controlling satellite and radar pictures.

C. The models used are mainly Bracknell (GRID), DWD (Fax), and ECMWF (GRIB).

D. The Centre is responsible for the daily issue of the following products: general forecast surface (twice a day), general forecast upper-air (twice a day), nowcast bulletin (4 times a day), synoptic bulletin, medium range forecast, significant weather charts (valid 6 hours), meteorological warnings, basic wind message and other dedicated forecasts (roads, AFN, SAR...)

5 **Briefly describe your meteorological support units which provide direct support to air forces.**

A. Meteorological support units are located on the airbases in direct support of flight operations. A standard unit is composed of 1 supervisor (officer or warrant officer), 3 forecasters, 7 observers and 1 assistant. The work is also organised in shifts. Each Unit has one interactive workstation (IMDP), one terminal station (TMSDDN) and one semi-automatic observing station.

B. The model used is the guidance issued from the Military Forecasting Centre.

C. The Unit is responsible for the daily morning briefing to air crews, for special briefings on request, for the local general forecast (surface and upper-air), for the support to operations (target area, route-forecast, night flying), for the permanent weather watch, for determining the colour state forecast of the airfield, for producing the TAF every 6 hours, a local cross-section, significant weather charts (every 3 hours), for the local applicable warnings, and for NBC data.

D. A project for automation of on-base distribution of these products to the operational users is planned for 1997. There is no intention to develop full self-briefing terminals.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

Similar support is provided to HQ 1 Mechanised Division, to 3 battalions of Light Aviation units, to artillery units, to the Light Aviation School, and to the Training Centre for Paratroops. Additional support can be provided to these units upon deployment using mobile equipment.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Naval units receive forecast products via their own operational links and Naval officers are trained for interpretation of those products.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Military Forecast Centre has access to the GTS circuit for selected data via NMC Brussels (X.25 protocol), and is the gateway to the GTS for Belgian military airfield observations and TAFs. Supplementary communication links exist between the Belgian MFC and allied MFC (Woensdrecht) and WAC (Traben-Trarbach) for military support exclusively (9600 bps, X.25 protocol).

The availability of data to external non-military users may need to be reevaluated upon the introduction of ECOMET.

9. Any additional information you desire to include.

The Meteo W maintains 2 Mobile Meteorological Units for support of units deploying out of Belgium. Equipment is contained in special transit cases and include the following capabilities: one mobile Meteosat reception, one MDD receiver/display terminal, one mobile observing station, one TSMDDN with dial-up capability (military or civilian lines), one SATCOM terminal (INMARSAT), one aerological station (MARWIN) and two shelters mounted on trailers. Each unit would normally deploy with 2 forecasters, 2 observers and 1 assistant to allow 24 hour per day operations.

STRUCTURE IRM - KMI

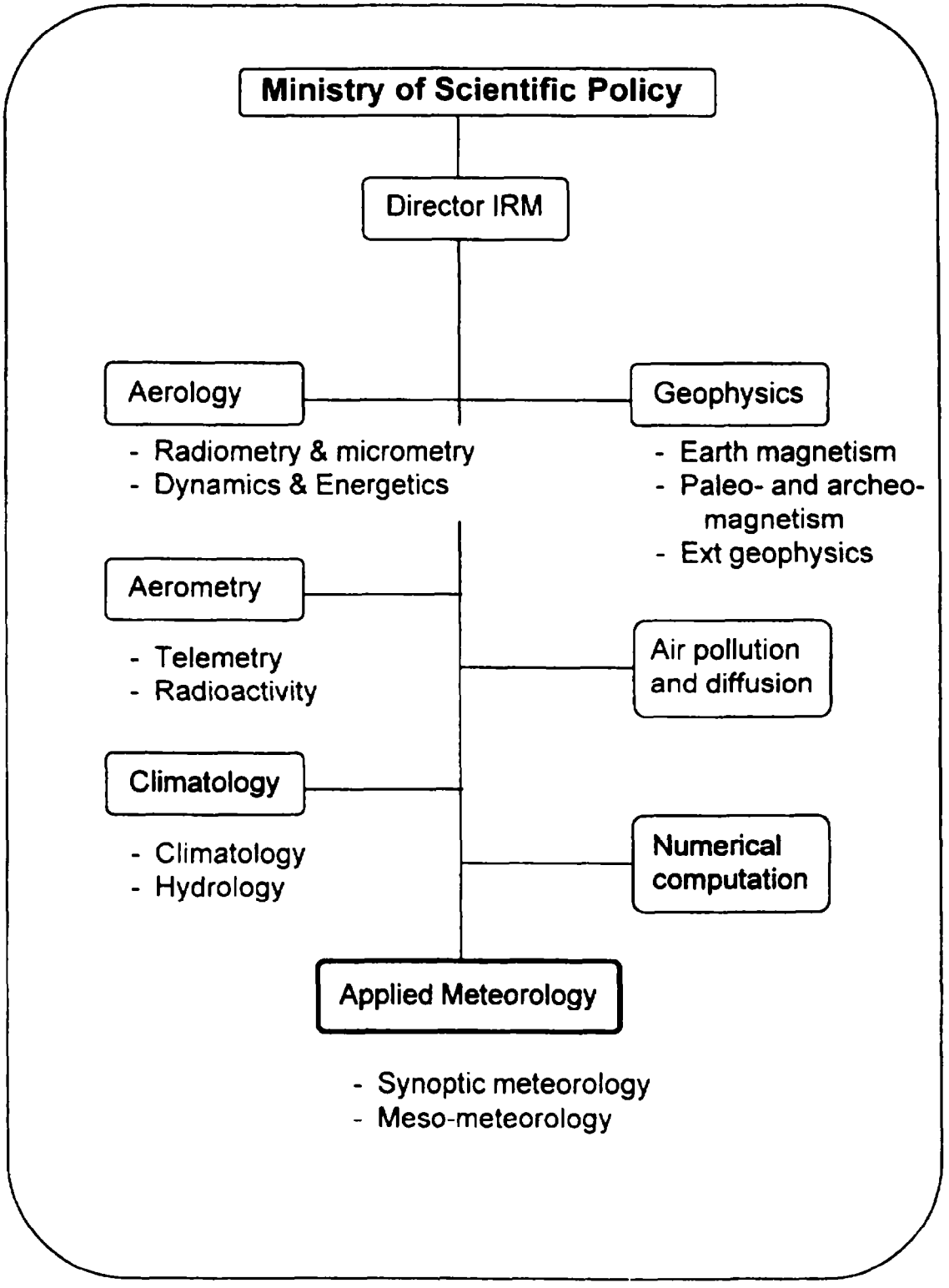


Figure 3B-1-I

STRUCTURE RVA - RLW

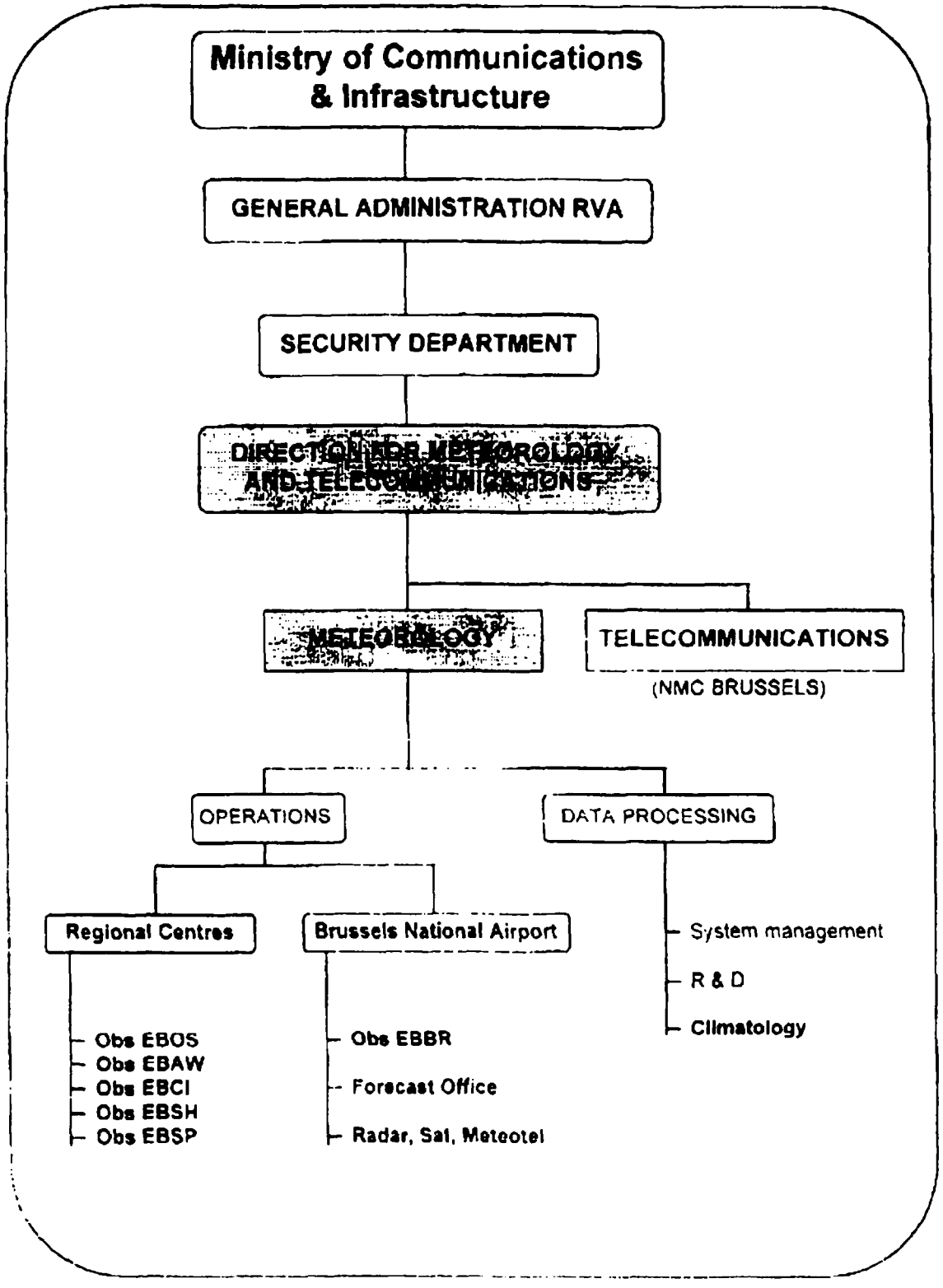


Figure 3B-1-II

STRUCTURE METEO WING

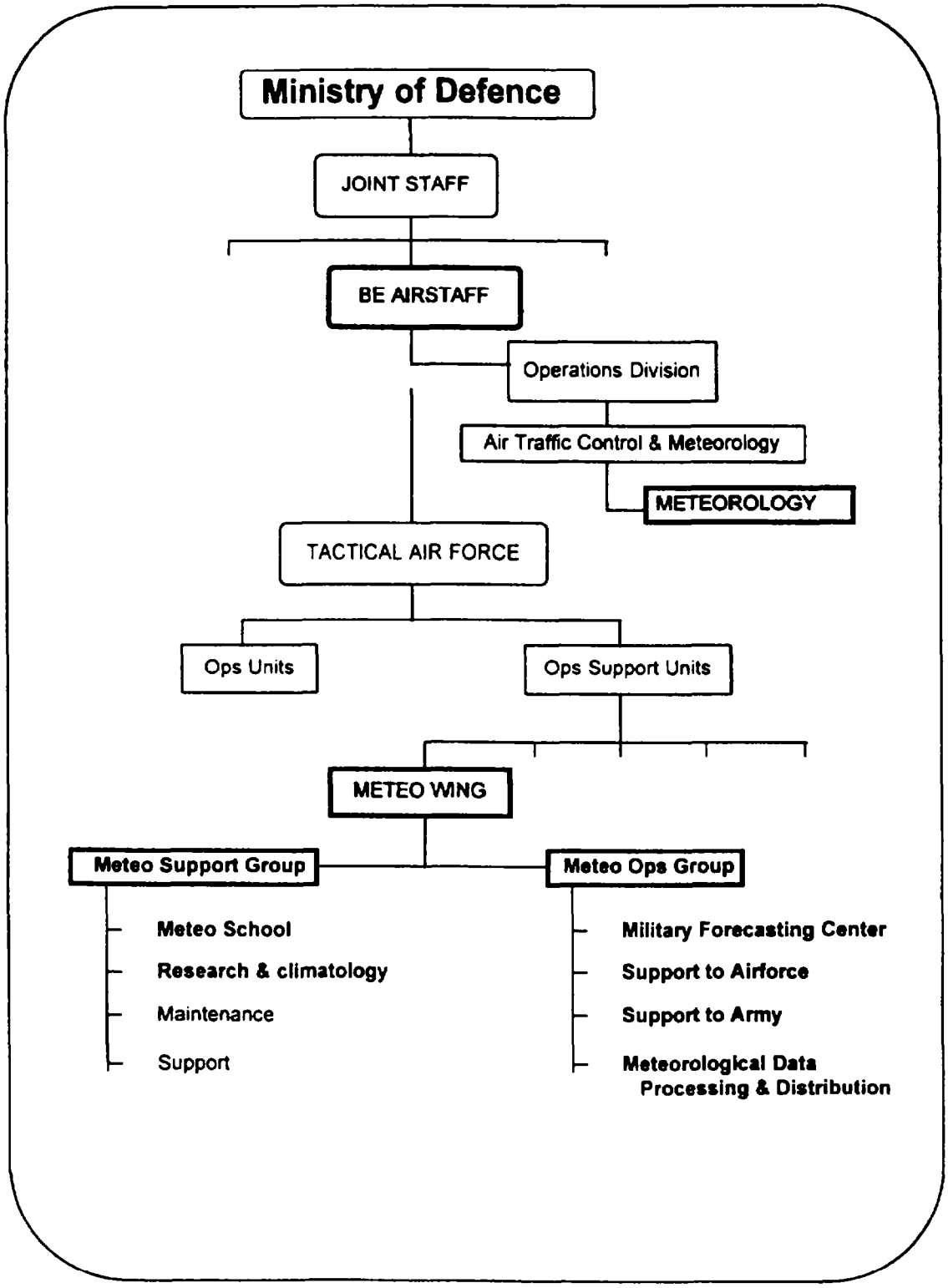


Figure 3B-1-III

CANADA'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Montreal (Dorval) Updated: February 1996

1. Capability

a. The Canadian Meteorological Centre has two sets of objective analyses. They both use optimum interpolation methods coupled with 6 hour trial fields. The global analyses use trial fields provided by the Global model while the regional analyses utilize the Regional model trial fields. The assimilation cycles can accommodate a temporary reduction of a few hours in data flow without major impacts. Analyses based on the Regional model cover the North American continent and the adjacent waters while the analyses based on the Global model are available over the whole globe. The regional and global analyses are available at all standard pressure levels from the surface up to 10 hPa.

b. The CMC runs a hemispheric, 28-level, variable resolution, short-range model (EFR-Canadian Regional Model). Maximum resolution is 35 km over North America. Forecasts out to 48 hours are produced twice a day. These forecasts are transmitted approximately 2 to 3 hours after data collection times (00 UTC and 12 UTC), depending upon the forecast length.

c. The CMC also runs a Global, medium-range, spectral model, 21 levels, using triangular truncation at wave number T119 (SEF Canadian Global Spectral Model). Forecasts are produced twice a day and are available out to day-10 for the 00 UTC cycle and to day-3 for the 12 UTC cycle. 48-hour forecasts are transmitted approximately 5 hours after data collection times (00 UTC and 12 UTC). The model is run to 15 days, once a week, early Sunday morning. Twice a month, it is run to 30 days, and once each three months, to 90 days.

d. Users receive forecasts in graphics form in broadcast mode via the Atmospheric Environment Service (AES) Meteorological Satellite Information System, or in bulletin form via the AES National Communications Computers Systems. Subsets of the overall production of graphics and bulletins are also disseminated in broadcast mode to an ANIK communication satellite. Through the ECONET, a wide area network for external users, grid point data from analyses and forecasts produced by both forecast models are available as GRIB encoded messages. Even though the standard transmitted products cover North America and adjacent oceans, analyzed and forecast weather charts and data can be produced on request for any other sector in the northern or southern hemispheres.

e. Independent software can directly extract from analyses, or from one or the other of the forecast models, meteorological variables such as: cloud cover, winds, heights, temperatures, humidity, precipitation, etc. These forecasts are available in various forms, and for numerous areas throughout North America. They could also be produced for any area around the globe.

f. The CMC is able to provide in real-time air concentrations and surface deposition estimates of airborne pollutants. These fields are obtained from a 3-D long-range atmospheric transport/dispersion/deposition model, named the "Canadian Emergency Response Model" or "CANERM". The main applications for this model have been for estimating concentrations of radionuclides and volcanic ash. Based on this operational capability, the CMC has been designated by the WMO as a Regional Specialized

Meteorological Centre (RSMC) with specialization in Atmospheric Transport Modelling Products for Environmental Emergency Response.Fields of wind, moisture, temperature and geopotential heights must be provided to CANERM. These are obtained either from the Global or the Regional forecast and objective analysis systems.

Latitude, longitude and time of the release are required input parameters for CANERM. Estimates of the intensity and duration of the release are also required. Standard default source parameters for initial response are defined as follows:

- Uniform vertical distribution up to 500 m above ground;
- uniform emission rate during the first 6 hours;
- total pollutant release of 1 arbitrary unit; and
- type of radionuclide is Caesium 137

CANERM can be executed in forecast mode up to day-10, using the operational Global forecast model and up to 2 days, using the operational Regional forecast model. CANERM can also be executed in hindcast mode using Global or Regional objective analyses. Presently three horizontal resolutions are operationally available: a resolution of 150 km on a quasi-hemispheric domain, a movable continental domain with a resolution of 50 km and a mesoscale domain with a resolution of 25 km.

During environmental emergencies, CMC can provide charts of air concentration estimates for the surface, 850, 700, 500, 300 and 250 hPa levels as well as total surface deposition estimates.

g. To summarize, the CMC can produce estimates of present and future atmospheric condition (values of meteorological parameters up to day-10) for any location in the world, at the surface and at standard pressure levels from the surface up to 10 hPa.

Appendix 3
Annex B
Chapter 3

DENMARK'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

Denmark has one meteorological service, the Denmark Meteorological Institute (DMI). DMI is organized under the Ministry of Transport, and was formed in 1990 when the three meteorological services (the aeronautical weather service, the defence weather service, and weather service of the Meteorological Institute) merged. DMI employs approximately 350 people, all civilians.

DMI has its headquarters in the northern part of Copenhagen, housing its four departments as shown in figure 3B-3-I: Observation, Research and Development, Weather Forecasting, and Data Processing and Computing. The forecasting department supplies services to the general public as well as to the military and to civilian aviation. The department of Research and Development is involved in numerous research projects ranging from solar and terrestrial physics to implementing and improving the HIRLAM (High Resolution Limited Area Model).

DMI also provides the Danish representatives to ECMWF, EUMETSAT, ESA, ICAO, WMO and ECOMET, while it is the Staff Meteorological Officer at the Danish Defence Command (under the Ministry of Defence) which provides the representative to the NATO meteorological committees and working groups. The Staff Meteorological Officer and DMI therefore work in very close cooperation.

There are two "regional Centres" supplementing the headquarters DMI. Weather Centre North (DMI Nord) is located in Soendre Stroemfjord and provides services to the customers in Greenland, although quite a lot of background material, and even worked forecasts come from Copenhagen.

Weather Centre West (DMI Vest, which is equivalent to Met Centre Karup) remains located in the TACDEN bunker. Met Center Karup remains the primary source for all meteorological support to the defence comprising all three services. In addition to the military, Met Centre Karup also provides meteorological services to an increasing number of civilian customers.

The Met Center is manned by one leader, his deputy, 12 forecasters and 18 assistants. The center uses three interactive workstations, all connected to DMI in Copenhagen. The workstations also control radar and satellite imagery. The main models used fore preparing the forecasts are the HIRLAM model and the ECMWF models, as well as the output from Bracknell. Met Center Karup also provides support to the land forces and can deploy with mobile units and equipment. The Navy is also supported both by Met Center Karup and from DMI directly.

In addition to Met Center Karup, the military still retains meteorological offices (during office hours manned by DMI meteorologists) at the following air stations: Aalborg, Karup, Vandel, Skrydstrup, and Vaerloese. The meteorological offices on the air bases also have interactive workstations connect to DMI, and a semi-automatic observing station.

The majority of the operational forecasters receive a bachelors degree from the University of Copenhagen in meteorology or geophysics. This is followed by an intensive course in operational and synoptic meteorology at DMI, after which they are ready for duty.

Structure DMI

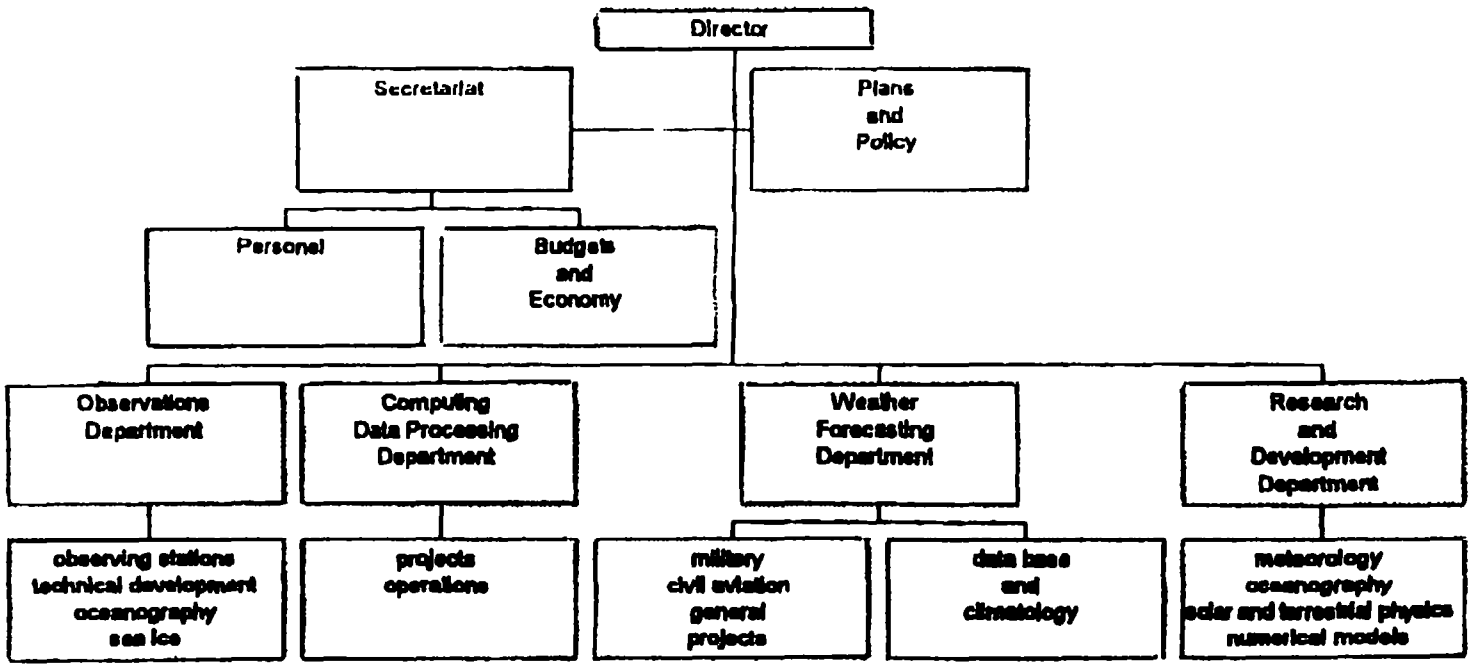


Figure 3B-3-I

Appendix 4
Annex B
Chapter 3

FRANCE'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.

There is in France one meteorological service called, since 1995, Meteo-France. This service has an official mission consisting in the support to the military, in the contribution to the security of the people, in the support of the civil aeronautical activity and in all sectors related to the economic development and the quality of life. It has also a marketing activity.

The Meteo-France headquarters is located in Paris. There are 5 technical centers, 2 in Paris or near it (marketing and instrumentation), and 3 at Toulouse (operational service, research and training). The organization is shown in figure 3B-4-I.

Meteo-France operates more than one hundred stations in the country, and is also present in its overseas territories and in the Antarctic.

Attached to the ministry in charge of transportation, Meteo-France employs 3500 people.

2. If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.

Not applicable.

3. Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.

More than 60 civil engineers are assigned in military met centers and stations with management responsibilities and as forecasters. These personnel receive a 3 year training course in the national met school (ENM).

The non-commissioned officers from the air and land forces attend first a 6 month course to become observers and some years later, another 6 month course for forecasting.

The navy NCOs are also acquainted with oceanography. Thus, they attend 2 courses with a duration of 10 months each.

All of these courses are organized by the national met school.

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, work station processing and computing capability, numerical models used or run on site, and output products.

The operational service, SCEM, is the forecasting center supporting the military. It is connected to the GTS and to ECMWF. It receives observations from civil and military met stations.

A global numerical weather model called Arpege is run twice a day on a Fujitsu J916 computer. This model has a continuously varying horizontal resolution of 15 km over France and of 180 km at

the antipode. The analysis uses a 3D multi-variate optimal interpolation method. A regional model called ALADIN is derived from the global model, giving a better resolution over Europe. Specific NWP output products are described in Figure 3B-4-II

The NWP are sent to 2 military centers: one at Taverny for the air forces, the other at Toulouse for the navy, in order to adapt them to the specific needs of the forces and distribution.

5 Briefly describe your meteorological support units which provide direct support to air forces.

The specific support to air bases is organized with a national center located at Taverny, 5 main stations and 25 ordinary stations. Taverny is connected to Toulouse by a high speed link and to the GMGO. It has also a direct Meteosat and NOAA satellite reception capability. Att the stations receive general products from the SCEM using a satellite broadcasting system (RETIM) and exchange data such as TAFs, airfield colour charts,... for air operations.

A department, dedicated to development of specific products for the air forces has been recently set up at Toulouse.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

The land forces are supported by Meteo-France through two met stations and some small units. A technical cell located at Satory, near Paris, brings them support for the equipment and in developing specific products. The stations and units also receive general products from Meteo-France using the satellite system.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

The support of the navy is similar to what is done for the air forces. A national center called CELENV adapts the meteorological products received from Meteo-France, adds oceanographic and acoustic information and transmits this information to the navy headquarters, the maritime commanders, to the 5 fleet air arm bases, and to ships and submarines by dedicated broadcasting systems.

The CELENV also has a role in developing new products for the navy.

Moreover, about 60 semaphores carry out daily observations.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The two military main centers are linked to the operational service of Meteo-France by high speed lines. Each of them exchanges information with their own stations through military networks. The satellite broadcasting system of Meteo-France is available for both civil and military stations. But specific dissemination is possible using dedicated channels. Thus, forces in operation outside the country, but in the area of coverage of the telecom satellite are able to receive met information.

The only access to an international network in the military center is found at Taverny which is connected to the GMGO by telegraphic lines.

9. Any additional information you desire to include.

The two military centers operate the French workstation Synergie which allows them an easier analysis of the situation and a faster adaptation of the products to their specific needs. Some units for mobile met support are available among the land and air forces for exercises and operations in foreign countries.

METEO FRANCE

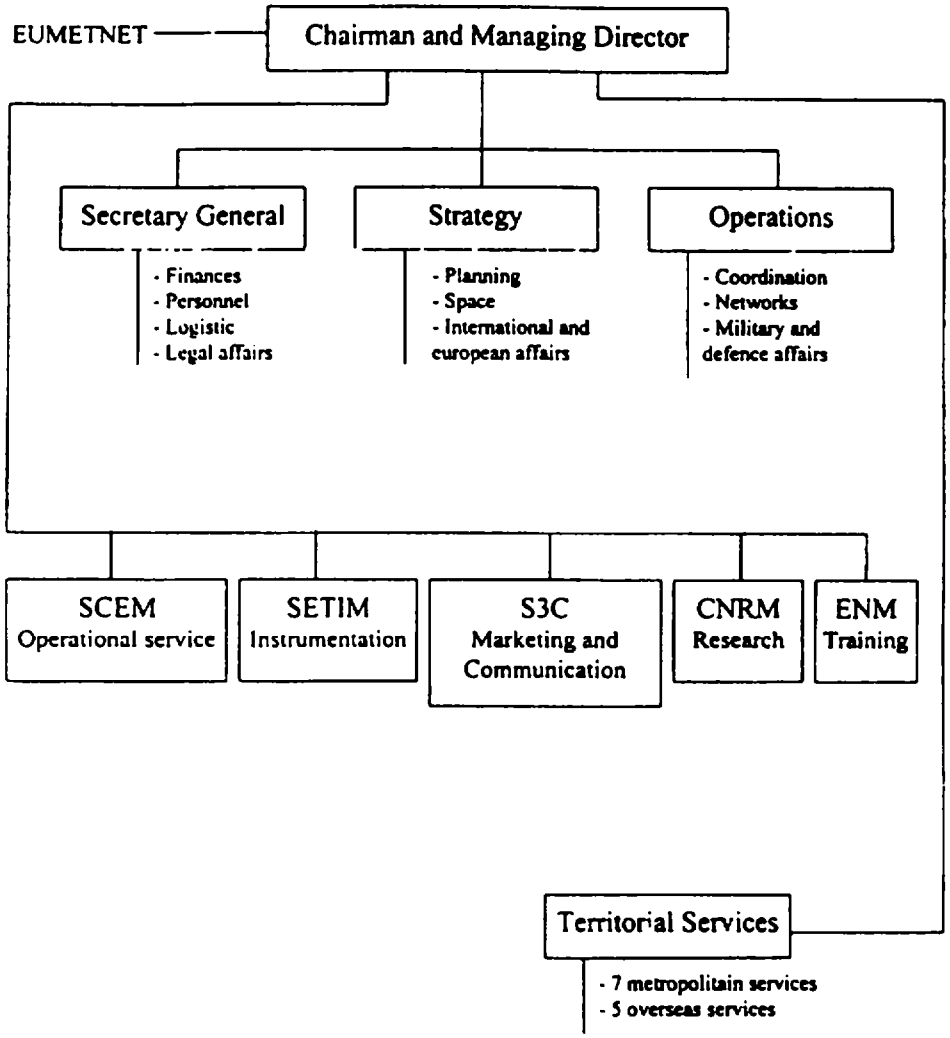


Figure 3B-4-I

Additional NWP products available from METEO-FRANCE

	ARPEGE fields in GRIB code (1°5 mesh)
Heading format	HT2 HA 2ii LFPW
Code (T1)	GRIB (T1=H)
data times	00 UTC and 12 UTC
Available about	04.15 UTC and 16.15 UTC
Average length of bulletins	6000 bytes
Elements (T2) and levels (ii)	Mean sea level and surface pressure (T2=P, ii=89/99) ; 2m temperature and relative humidity (T2=T/R, ii=98) ; 10 m wind components (T2=U/V, ii=98) ; Geopotential (T2=H), temperature (T2=T), wind components (T2=U/V), relative humidity (T2=R) at levels 950, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100 hPA (ii=95/92/85/70/50/40/30/25/20/15/10) ; Divergence (T2=G) at 925 and 200 hPa (ii=92/20) ; Vertical velocity (T2=O) at 500 hPa (ii=50) ; Accumulated precipitations, large-scale and convective (T2=E/F, ii=98).
Grid area (A1)	Latitude - longitude, 30°W-60°E (eastward), 45°N-45°S (southward), adjacent points on a paralell are consecutive, resolution 1°5x1°5, 61x61 points (A1=H)
Forecast ranges (A2)	From T+0h to T+72h by 12h step (A2=A/C/E/G/I/J/K)
Notes	Wind components are eastward and northward. For T+0h, all available parameters are uninitialised analysed ones, except divergence and vertical velocity which are initialised, and there are no precipitations. Originating center number is 85 (RSMC Toulouse)

	ARPEGE fields in GRIB code (2°5 mesh)
Heading format	GT2A1A2ii LFPW
Code (T1)	GRIB (T1=G)
data times	00 UTC and 12 UTC
Available about	04.15 UTC and 16.15 UTC
Average length of bulletins	2000 bytes
Elements (T2) and levels (ii)	Mean sea level pressure (T2=P, ii=98) ; 2m temperature (T2=T, ii=98) ; 10 m wind components (T2=U/V, ii=98) ; Height (T2=H), temperature (T2=T), wind components (T2=U/V), relative humidity (T2=R) at levels 1000, 850, 700, 500, 400, 300, 200 hPA (ii=99/85/70/50/40/30/20) ; Vertical velocity (T2=O) at levels 1000, 850, 700, 500 hPa (ii=99/85/70/50).
Grid area (A1)	Latitude - longitude, 75°N-25°N, 50°W-0°E and 00E-50°E, resolution 2°5x2°5, 21x21 points,NNN=010 and 011 (A1=O/M)
Forecast ranges (A2)	T+0h, 6h, 12h, 18h, 24h, 36h, 48h (A2=A to E/G/I)
Notes	For T+0h, all available parameters are uninitialised analysed ones, except vertical velocity which are initialised. F1F2 = 85 (RSMC Toulouse)

Version March 1996

Figure 3B-4-II

GERMANY'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Offenbach Updated: April 1996

1. Capability

a. Forecast products available from WAC Offenbach are derived from a 19-level global spectral model (GM), a limited area 20-level grid point regional model (EM), and a high resolution 20-level DM for Germany and surroundings. All three models are using a hybrid vertical coordinate.

b. The global model (GM) has the spectral resolution T 106 corresponding to a Gaussian latitude-longitude grid having a resolution of 1.125°. The GM provides forecasts out to 7 days ahead twice daily. The products are available within about 6 hours of datum time.

c. The model EM covers the area Europe-Atlantic with a grid having a resolution of about 55 km. The lateral boundary values are derived from GM forecasts. The EM provides forecasts out to 78 hours ahead twice daily.

d. The model DM covers the area of Germany and neighboring countries with a resolution of about 14 km. The lateral boundary values are derived from EM forecasts. DM provides forecasts up to 48 hours ahead twice daily.

e. Forecast fields of the models are transmitted to users using the WMO GRID and GRIB code as well as the facsimile facilities. Since summer 1993, two charts of forecasts of the DM are disseminated by facsimile broadcasting (DCF54). Contained parameters are: cloudiness in low levels, 2m-temperatures, 10m-winds, precipitation, convection and kind of precipitation.

f. The forecast fields of geopotential height, wind, temperature and relative humidity are interpolated to standard pressure levels for both models.

g. The accumulated precipitation amount, some interesting surface parameters as well as derived cloud coverage at different tropospheric layers are available.

h. NWP products in GRID code for regional area, extracted from global model GM, available at T + 0645.

(1) The following parameters are available or can be made available by request: temperature, sea surface temperature, 10 m wind; height, wind, temperature at levels 850, 700, 500, 300, 250, 200, 100, 50 hPa; relative humidity at levels 850, 700, 500 hPa; and vertical velocity at levels 700, 500 hPa.

(2) The product resolution is as follows: 2.5 x 2.5 deg over 90°N to 90°S, 180°W to 180°E.

(3) The following forecast times are available or can be made available by request: T+00, 06, 12, 18, 24, 30, 36, 42, 48, 60, 72, 84, 96, 108, 120, 132, 144, 156, and 168.

i. NWP products in GRIB code from global model GM, available at T + 0645

(1) The following parameters are available or can be made available by request: sea surface pressure, surface precipitation, 2 m temperature, sea surface temperature, 10 m wind, height, wind, temperature at levels 850, 700, 500, 300, 250, 200, 100, 50 hpa; relative humidity at levels 850, 700, 500 hPa; vertical velocity at levels 700, 500 hPa.

(2) The product resolution is as follows: 1.5 x 1.5°, 90 S to 90 N, 180 W to 180 E.

(3) The following times are available or can be made available by request: T + 00, 06, 12, 18, 24, 30, 36, 42, 48, 60, 72, 84, 96, 108, 120, 132, 144, 156, 168.

j. NWP products in GRIB code from the regional model EM, available at T + 0540

(1) The following parameters are available: sea surface pressure, surface precipitation, 2 m temperature, sea surface temperature, 10 m wind; height, wind, temperature at levels 850, 700, 500, 300, 250, 200, 100, 50 hPa; relative humidity at levels 850, 700, 500 hPa; vertical velocity at levels 700, 500 hPa.

(2) The product resolution is as follows: 50 km at 60°N; grid covers 35°N to 90°N and 60°W to 40°E.

(3) The following forecast times will be made available: T + 00, 06, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, and 72.

k. Planning for 1996:

(1) For technical and operational reasons, the present two longwave radio broadcasts DCF37 and DCF54 of the DWD will be replaced by a new data distribution system via satellite by spring of 1996. This satellite broadcast will transmit data and products of the DWD to the user groups within the footprint of transmission with a data throughput rate considerably exceeding that of the current analogue system.

(2) The new satellite system has been developed to achieve an areal coverage for distribution of all DWD data, not only nationally but also in Europe to comply with the international commitments of Offenbach centre as a RSMC and RTH to provide NHMS with meteorological data and products as required. The new system is called FAX-E (for FAX Europe). It will be selected and user oriented and provide a much higher capability in terms of reliability and throughput. It needs a special low cost technical receiving system including the application software for automatic reception and decryption of data and for presentation.

l. Numerical wave forecasts are available up to 168 h in GRIB-Code. Parameters includewind (10 m), direction and speed, sea (significant height, direction, and period), swell (significant height, direction, and period).

(1)	Shelf model:	North Sea, Baltic Sea, Western European waters, Norwegian Sea
(2)	Deep Water Model:	North Atlantic, North Sea

Dissemination by radiofax (short wave) via Pinneberg will be continued, confined to navigational users.

2. Capability

a. Forecast products available from GMGO Traben-Trarbach are derived from a 9-level hemispheric grid point model (BKFG) and a limited area 17-level grid point model for the boundary layer (BLM); BKFG is using the pressure coordinate system, BLM a terrain-following vertical coordinate.

b. The hemispheric model (BKFG) has a horizontal resolution of 180 km (effective) on the stereographic plane at 60°N. The BKFG provides forecasts up to 3 days ahead twice daily. The products are available within about 3 hours after observation time.

c. The BLM has a resolution of about 60 km and is relocatable globally. Up to four different model domains may be chosen.

The lateral boundary values are derived from forecast fields of the global model GM of the WAC Offenbach, transmitted twice daily to Traben-Trarbach, or, alternatively, from BKFG forecasts. The BLM provides forecasts up to 36 hours twice daily. The products are available within about 4 hours after observation time.

d. Forecast fields of both models are transmitted to users in form of facsimile charts and in bulletin form.

e. The BLM forecast fields are interpolated to standard pressure levels and constant height levels above MSL and AGL.

f. The accumulated precipitation amount is available from both models, low tropospheric parameters and cloud coverage only from BLM.

g. NWP products are available from both models in GRIB/GRID-code.

h. For facsimile chart production, the following parameters are available from BKFG in the model grid resolution: sea surface pressure, precipitation, snow cover depth, wind, geopotential height, temperature, relative humidity and vertical velocity at pressure levels from 1000 to 50 hPa.

The following forecast time are available: T + 00, 03, ..., 45, 48, 60, 72.

i. For facsimile chart production, the following parameters are available from BLM in the model grid resolution:

- wind, pressure, temperature, relative humidity and vertical velocity at height levels from surface to 10 km.

- geopotential height, temperature, relative humidity at pressure levels from 1000 to 250 hPa.

- precipitation, cloud cover (high, medium, low), ceiling, stability of constant flux layer, convection.

The following forecast times are available: T + 00, 03, ..., 36.

j. A semi-manual analysis procedure (SMA) has been developed, which enables the meteorologists to add or cancel data in the synoptic scale analysis cycle. It is tailored to the requirements of silent area conditions. Applying a special interactive mode, the meteorologist can revise the last routine numerical analysis by making use of non-routine information (e.g., satellite images or data produced by military measuring systems). A succeeding model run completes the semi-manual intervention.

GREECE'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Athens

Updated: October 1991

1. The WAC provides a full range of meteorological analyses and forecast products for the Central-Eastern Mediterranean Sea and Balkan Areas, defined by: 50°N to 25°N and 10°E to 40°E. The main products are surface and upper-level analyses and weather prediction prognoses and forecast for H+24 and H+48 hours, based on the daily numerical products of the ECMWF and Bracknell. Products are delivered to customers via radiofacsimile and teletype broadcasts.

ITALY'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Rome Updated: October 1991

1. Capability

a. Base data: surface observations and soundings.

b. Analyzed fields: sea-level pressure, height, temperature, wind components at standard levels, tropopause (pressure and temperature), freezing level, direction and speed of maximum wind. Short-range forecast valid 12 and/or 24 hours and previous analysis are used as early approach. The sea-level pressure field is analyzed by using a two-dimensional, univariate, successive correction scheme through a recursive, Gaussian filter; the upper-air analysis is performed in a multivariate, statistical way.

c. A dry adiabatic, primitive equation, fine-mesh model is used for data processing. Main features:

- 6 sigma levels with top at 100 hPa;
- horizontal staggered E-grid with a resolution of 150 km;
- semi-explicit, semi-Lagrangian, time integration scheme;
- topography with same grid resolution is included;
- the area of interest covered includes North Atlantic, whole Europe and the Mediterranean basin.

The daily production schedule includes numerical analysis and forecast for 6 standard levels, valid 0000Z and 1200Z. Forecasts valid at 18, 24, 36 and 48 hours are issued in grid-form or in form of automatically traced maps.

d. A numerical forecast product, named ARGO, that is obtained through a perfect-prog, post-processing, provides a variety of weather information for 62 Italian localities. Post-processing is applied to grid-point forecasts from the ECMWF, Bracknell or NMC Washington, whichever arrives first.

e. The following special alpha-numeric and graphic products can be obtained from the data bank of Rome WAC by means of appropriate personal computer:

(1) refractive index profile - for any sounding station issuing TEMP message,

(2) graphic diagram for radar coverage (shadow zone) - against the combined conditions of antenna position/refractive index stratification,

(3) evaporation duct forecast - thickness forecast valid 12, 24, 36, 48 hours, for the Mediterranean basin, and

(4) stability indexes (Simila, Bajley, Whitning and Sweat) for TS activity and strong wind prediction.

2. Climatological Information. The following climatological information is available from the Italian Air Force Meteorological Service (WAC Rome):

a. Climatic Archives - only for Italian meteorological stations and stored on magnetic tapes, continuously refreshing:

180 met stations - 'SYNOP', last 30-40 years
70 met stations - 'METAR', since 1973
6 upper-air stations - 'TEMP', since 1973
35 met stations - for solar radiation (intensity and duration)

b. Historical Archives - on magnetic tapes, continuously refreshing, containing worldwide GTS messages arriving at CNMCA (WAC/Regional Telecommunications Hub (RTH) Rome) during the last 18 months.

c. Current Archives - stored on disk on CNMCA mainframe, containing worldwide messages of GTS reaching WAC Rome during last 24 hours and available by means of an "inquiry" PC procedure for CNMCA users convenience.

d. Climatological elaborations and publications:

(1) general climatic tables, for Italian sites (synoptic stations) with frequency, mean values and extremes of various meteorological parameters.

(2) aeronautical climatic tables, for Italian met stations based on airports (both military and civilian), containing models A, B, B', C, C', D, K of WMO Tech Reg, Vol II, chapter 12.

Appendix 8
Annex B
Chapter 3

THE NETHERLAND'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. **Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.**

The Netherlands have 3 government-funded meteorological services (i.e., a civilian, air force, and navy met service) and one commercial meteorological service.

A. The Civilian Meteorological Service is the "Royal Dutch Meteorological Institute (Koninklijk Nederlands Meteorologisch Instituut/KNMI)" comprising the National Civil Met Centre (NMC) in De Bilt, 4 airfield met officers, 2 hydro-meteorological offices, and 10 manned observing sites. KNMI is an agency within the Ministry of Transport, Public Works and Water Management. Government funding amounts to 85% of the yearly income, the remaining 15% is commercial income. The KNMI's mission is to supply information, consultation and services concerning weather, climatology and seismology to government, general public, trade and industry. Its activities are both scientific and operational. Total manning is around 500 personnel. The organizational scheme of the NMC is shown in figure 3B-8-I.

B. The Airforce Meteorological Service comprises the Airforce Met Group (LMG) in Woensdrecht (consisting of the Airforce Met Centre, the Airforce Met School and the Airforce Meteorological automation department), 7 air base met offices, and 9 (partly) manned observing sites. The met services' mission is to enhance the safety, efficiency and effectiveness of airforce and army operations by providing meteorological and climatological data and information to airforce and army units. Apart from soundings and wind data for ballistic purposes, the army will receive all meteorological data form the Airforce Met Service. Total manning is around 170 personnel. The organizational scheme is shown in figure 3B-8-II.

C. The Navy METOC Service comprises 2 naval base met offices and 1 manned observing site. Its mission is to enhance the safety, efficiency and effectiveness of navy operations by providing meteorological, oceanographic, and climatological data and information. Total manning is around 40 personnel.

D. The commercial meteorological service is Meteo Consult with 1 met office, with a staff of around 40 personnel. Its activities are in the field of providing information to the media and trade and industry.

2. **If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.**

Coordination is agreed upon through a ministerial agreement between the Ministry of Defense and the Ministry of Transport, Public Works and Water Management. Procedures are laid down in special directions. The executive body is the Committee for Meteorological Co-ordination (CCM), with 4 standing working groups and several project groups. In the CCM the KNMI, Airforce, Navy and Army are represented. Co-ordination is resulting in intensive co-operation between the government-funded services in the fields of schooling, communications, joint procurement and maintenance, and operations (by product-support and by providing mutual back-up and product co-ordination in times of crises).

3. Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.

A. Non-commissioned officers of the Airforce attend initial schooling at the Met Group's Met School during 5 months, followed by on-the-job training for another 5 months on an air base. After this training, they qualify as meteorological assistant and observer. After some years of experience, NCOs can apply for the job of squadron meteorological assistant, for which they have to pass a 3 week course and 1 month on-the-job training. After that, they may qualify as a meteorological assistant in the Met-Centre, for which they need another 2 months of schooling and training.

B. Officers of the airforce attend 6 months of initial schooling at the Met Group's Met School, followed by on-the-job training for another 6 months, after which they qualify as WMO class III forecasters. After some years of experience, they can apply for (1 month of) additional schooling at the Airforce Met Group. After several years of experience, forecasters can apply for advanced schooling, which will take 2 years on a part time basis and which will bring them to the level of WMO Class II forecasters.

C. Initial and advanced training/schooling of navy personnel is identical to that of airforce personnel. In addition to meteorological school and training, naval officers also follow a 2 week introduction course to oceanography and after some years of experience oceanographical school for 3 months at the Royal Naval School in Culdrose (UK). In exceptional cases, naval officers can apply for a course in oceanography at the Naval Postgraduate School in Monterey (USA).

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, work station processing and computing capability, numerical models used or run on site, and output products.

A. The Airforce Met Centre (a division of the Air Force Met Group) is situated at Woensdrecht Air Base. The centre's responsibilities are:

- Providing meteorological support to all army units.
- Providing meteorological support to all airforce units without Met Support Unit.
- Monitoring meteorological data flow to, from and within the military meteorological organization.
- Providing guidance and back-up for the Airforce Met Offices.
- Providing support to AFCENT, including UWF back-up production.

B. Equipment used by the centre includes 4 interactive meteorological workstations (METIS), the METDAT-system for handling, switching, monitoring and control of meteorological data flow, and terminal equipment for the reception and handling of satellite, radar and lightning detection systems data.

C. The models used are UK Met Office's coarse and fine mesh, ECMWF, the German military boundary layer model, and KNMI's HIRLAM (High Resolution Limited Area Model) and NEDWAM (a limited area version for the North Sea of the international wave model WAM). Both GRID- and GRIB-data are handled. The KNMI is providing MOS-data.

D. The Military Met Centre is responsible for daily output of nowcast bulletins for the Netherlands, short term aviation forecasts for the Netherlands, synoptic review and planning forecast for the Netherlands, upper air forecasts for the Netherlands, RAFORs for Vlieland Range, sea state forecasts for the North Sea, forecasts for QRA-forces, road conditions forecasts for the Netherlands, and met warnings as appropriate.

The Military Met Centre will provide the following products on request:

- Aviation route forecasts for areas outside of Western Europe.
- TAFs for military airfields during closing hours.
- NVG forecasts.
- NBC forecasts for the Netherlands
- Climatological data

5 Briefly describe your meteorological support units which provide direct support to air forces.

A. All RNLAF air bases have their own meteorological support unit (MSU). The MSU's primary function is to support flight operations. A typical Dutch MSU has an observers-section, manned full time and a forecasting section manned during (and some hours prior to) air base operating hours. During flying hours, dedicated meteorological assistants are assigned to jet and helo squadrons in order to provide detailed nowcasting and short range forecasts. Each MSU has an interactive meteorological workstation and a semi-automatic observing station.

B. Forecasts are based on model output from Bracknell, the Dutch HIRLAM, and guidance from the Met Centre.

C. The MSUs are responsible for daily productions of weather watch and observations, trend forecasts, TAFs, local forecasts (surface and upper air), significant weather charts, briefings (air base-oriented and mission oriented), and local met warnings as appropriate. The MSU will provide the following on request: (local) CDMs, ballistic wind data for local SHORAD, and limited area (Western Europe) route forecasts.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

All met support to land forces in the Netherlands (with the exception of artillery met data) is provided by the Airforce Met Centre. Support to units of the 1 GE/NL Corps is provided through the Corps Staff Geophysical Branch in Muenster (GE), in co-operation with GMGO. An artillery sounding unit is providing ballistic wind and temperature data.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

A. Both Naval Air Stations (Valkenburg and De Kooy) have their own MSU which compare to the MSUs at an Airforce base. The Met Office at Valkenburg is the Operational Support Unit and main METOC Centre in the Netherlands Navy. Apart from supporting flight operations, it also provides oceanographic information to independent units (frigates, mine-countermeasure ships, and submarines).

B. The BNLTG (Belgium/Netherlands Task Group), when at sea, has its own METOC team (1 officer, 2 NCOs).

C. The oceanographic survey vessel HNLMS Tydeman has a METOC team of 3 NCOs.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Met Centre, all MSUs (navy included), CRC, and the ATC-centre are connected to the RNLAF METDAT system, which has access to the GTS with 9.6 kbps links to HQSTC High Wycombe, GMGO Traben-Trarbach, and NMC De Bilt.

9. **Any additional information you desire to include.**

A. Within the near future, a reduction of the Airforce Met Service will be implemented, reducing the number of manned observations made.

B. Starting in early 1997, a new meteorological workstation (METIS^{2000}) will be implemented within the military met organization.

C. As of 1997, internal meteo data communications will be run on a high speed defence network (2 Mbps).

ORGANIZATION OF ROYAL DUTCH METEOROLOGICAL INSTITUTE (KNMI)

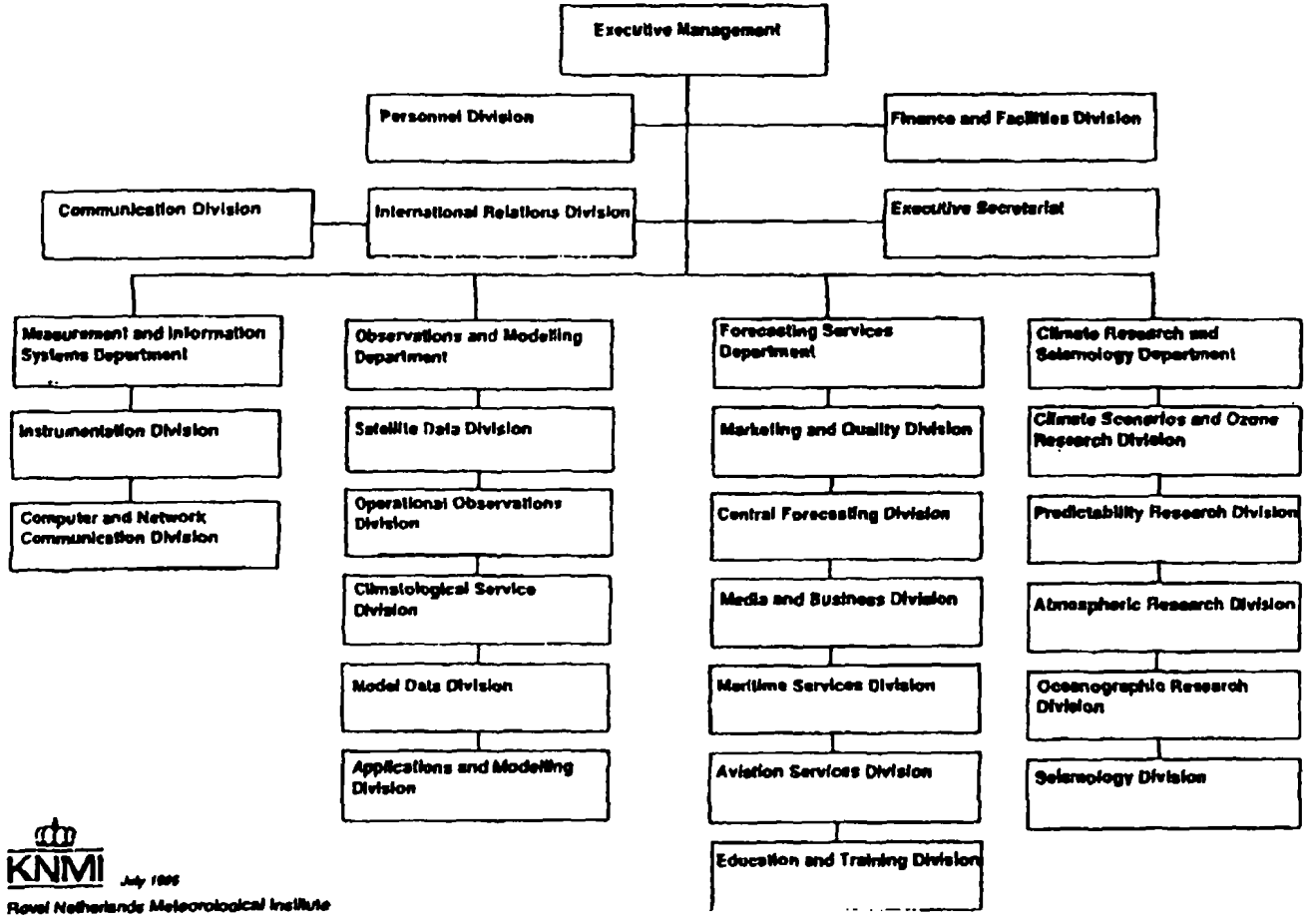


Figure 3B-8-I

NETHERLANDS AIRFORCE METSERVICE ORGANIZATION

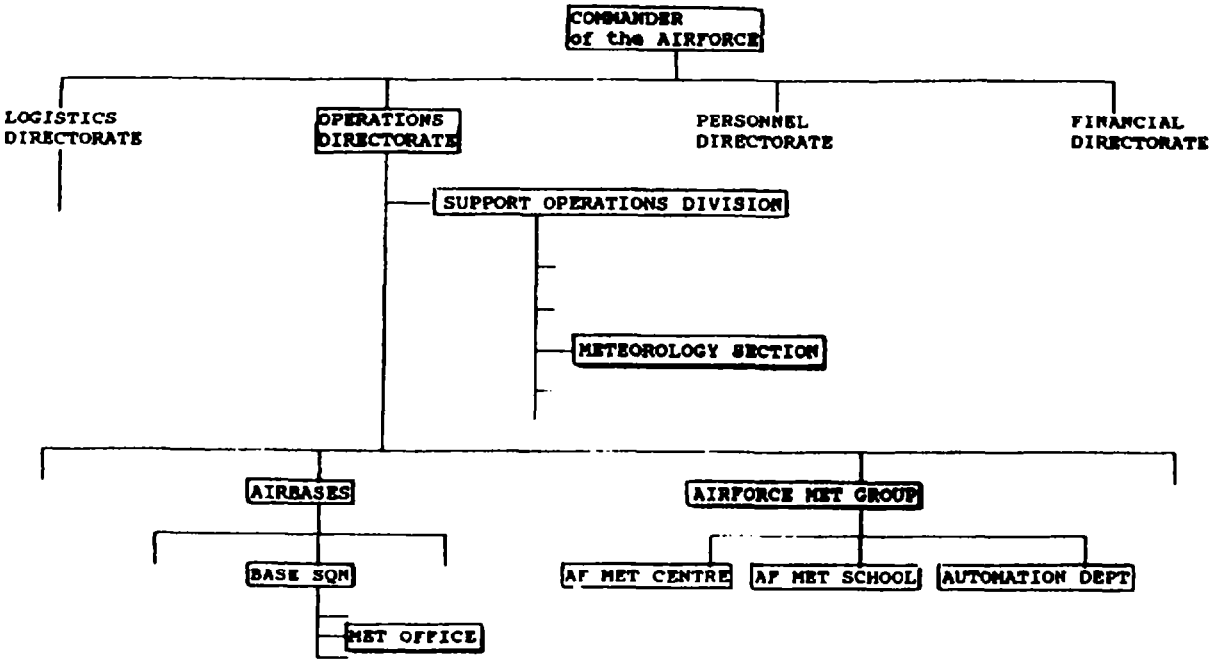


Figure 3B-8-II

NORWAY'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Oslo Updated: Nov 1991

1. Capability

a. Analyses, prognoses and all standard forecasts for the area of responsibility defined by: 80°N 30°W, 50°N 30°W, 50° 25°E, 65°N 55°E, 80°N 55°E.

b. General: The Norwegian Meteorological Institute are running two limited-area, numerical weather prediction models. The output from these models is used as a guidance for the forecasters, but direct model output is also transferred daily to various users within Norway by standard telecommunication lines. In addition, gridded output from the global models at the UK Met Office, Bracknell, ECMWF and NCEP Washington are received. UK Bracknell also provides gridded output from their limited-area model; wind forecasts from the atmospheric models, which are also used to force ocean models (currents, temperature and salinity); a wave model; and an ice-edge model. Modern numerical weather prediction models compute weather directly. This means that wind, air and ground temperature, cloud cover, rain, etc. can be taken directly from the models. They require, however, a considerable amount of computer power. The quality of the forecasts are sensitive to the amount of initial data and, for the limited-area models, the quality of the information that is used on lateral boundaries of the computation area, operationally, lateral boundary values are taken from global models, e.g. from UK, Bracknell.

c. Specific Model Products: The Norwegian models are:

LAM50S, mesh size 50 km at 60°N, 19 levels, covers the area (stereographic map) with corner points: 35°N 33°W, 35°N 25°E, 60°N 75°E, 62°N 85°W. The model is run up to 42 hours, twice a day from 00Z and from 12Z.

LAM25S, mesh size 25 km at 60°N, 30 levels, covers the area (stereographic map) with corner points: 48°N 05°E. 64°N 45°E, 84°N 05°W, 56°N 27°W. The model is run up to 30 hours once a day from 00Z.

These models provide wind, temperature, humidity, geopotential heights, clouds and precipitation every 6 hours (every 3 hours for some components) in every model layer, as well as standard pressure surfaces (100, 150, 200, 250, 300, 400, 500, 700, 850, 925 & 1000 hPa) for every grid point. Several byproducts can be derived from the main products, e.g. stability indexes and ducting indexes.

The wave model WINCH provides directional wave spectrum, significant wave height, wave speed and direction of the same area as the atmospheric model LAM50S. The ocean model ECOM3D is a 3-dimensional, baroclinic model. A full baroclinic version of the model (temperature and salinity vary) is not implemented. The model provides current at various depths and sea elevation for the Norwegian Sea. The Norwegian Meteorological Institute can also run an ice edge model where

sea-surface temperatures and ice coverage are analyzed and gridded every week. The models are run on the Cray X-MP/216 at SINTEF in Trondheim. Data are transferred via a 2mb telecommunication line. In case of disconnection with Trondheim, coarser resolution versions of the models can be run on local work stations.

d. Additional meteorological systems: LLP automatic location of lightning discharges (pos and neg) to ground within the area 53°N to 70°N and 0°E to 25°E. Weather radar coverage area: SE Norway, SW Sweden and part of Skagerrac.

2. Climatological Information. Standard climatological information for Norway, Norwegian polar regions and continental shelf. Special surveys can be made upon request.

PORTUGAL'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Lisbon

Updated: October 1985

1. Numerical forecast products available from WAC Lisbon are those received once a day from ECMWF and complemented twice a day from Bracknell and Washington. Seven standard pressure levels from 1,000 to 200 hPa, horizontal resolution of 150/300 km, forecasts up to 10 days for the region: 15 - 90N, 90W - 45E and tropical belt 30N - 30S. The numerical products (grid) received from those centers are used to construct height, wind and temperature charts for several purposes, including aeronautical and maritime.

SPAIN'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

WAC Madrid

Updated: March 1995

1. The Forecasting Center is located just outside Madrid near the University Campus.

2. Capability

   a. The Center runs, four times a day, two versions of the HIRLAM code, based on 00, 06, 12 and 18Z data, with outputs every 3 hours up to H + 48. The computer system, a CRAY YMP-C94A, has 4 CPUs of 1 Gflops each. The model has started operational on March 1995.

   b. The area for the coarser version is 65.0°N, 66.5°W, 15.5°N, to 30.0°E, with 31 hybrid levels and resolution 0.5 degrees in both latitude and longitude. The forecast integration is a Leapfrog, semi-implicit, 3 minute time step. The area for the finer version is 50.0°N, 23.6°W, 30.2°N to 15.0°E, with resolution of 0.2 degrees.

   c. The orography is the mean orography over each grid square of the model taken from the navy tape having 10" resolution.

   d. The physics include a Sundqvist scheme for condensation, a Savijari-Sass radiation, and a lineal 4th order horizontal diffusion.

   e. The boundary conditions are taken from the ECMWF model using the relaxation scheme after Davies (1974).

   f. The first guess is the forecast H+6 from the same HIRLAM.

   g. The data assimilation is intermittent, every 6 hours, with observation window -3/+2 hours.

   h. The telecommunications computer handles three medium-speed lines connected to Bracknell, Toulouse, and ECMWF. It is also linked to the host computer and to the regional and Defence meteorological offices.

   i. The 0.5 degrees version has an elapsed time for the forecasting part of 23 minutes, using 4600 seconds of CPU time with a concurrent CPUs average of 3.56. The total wallclock time for the whole suite is 26 minutes. The total wallclock for the finer resolution is 35.5 minutes.

Appendix 12
Annex B
Chapter 3

TURKEY'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. **Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.**

Turkey has only one meteorological service which is named "Turkish State Meteorological Service." It was established in 1937 and is a civilian organization. It is responsible for carrying out meteorological services for both civil and military sectors. Its headquarters is located in Ankara. Organizational structure is attached as figure 3B-12-I.

The Turkish State Meteorological Service has about 1200 different meteorological stations and employs about 4000 personnel within the organization. The Met centres and the network of met stations are as follows:

- WAC/NMC Ankara
- FWC Bandirma
- NAEWF FOB, Konya
- Allied Met Office/6ATAF, Izmir
- Aeronautical Met Officers (25)
- Aeronautical Met Stations (23)
- Upper air sounding stations (7)
- Synoptic stations (96)
- Marine met and/or VHF broadcasting stations (30)
- Climatological stations
- Rain gauge stations

The main responsibilities of the Turkish State Meteorological Service are:

- Meteorological support to the armed forces (army, navy, and air).
- Meteorological support for military and civil aviation.
- Activities in the field of scientific research.
- To provide meteorological support to the civil organizations
- Public weather service.
- Climatological data.
- To provide Turkey's representation in WMO, ICAO, ECMWF, EUMETSAT, MCMG, and related NATO meetings.

2. **If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.**

Not applicable.

3. **Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.**

The need for forecasters is met from 3 different sources. These are:

Meteorological high school is under the sponsorship at Turkish State Met Service: 3 years of education including one year of English language preparatory class.

Graduates of meteorological engineering.

Various branches of university graduates (physics, mathematics, computer sciences, geography, statistics, agricultural and other related disciples) are trained in a 6-8 month analysis and forecasting course.

After several years of experience, these people attend an 8-12 week advance forecasting course.

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, work station processing and computing capability, numerical models used or run on site, and output products.

A. WAC Ankara is responsible for providing meteorological support to the armed forces and civil sectors as military and civil weather analysis/forecasting centre. It is named the Weather Forecasting Department and has four divisions: the weather analysis and forecasting division, the aeronautical and military meteorology division, the synoptic and marine meteorology division, and the meteorological telecommunications division.

B. Equipment used by the WAC Ankara include 2 VAX 11/750, 2 VAX 8350, one VAX 3100, one VAX 2000, PCs, MDD, PDUS, and peripherals which include plotters, printers, terminals, and modems.

C. Sources of data include GTS, ECMWF products and data, Wien OPMET Centre, ACEWEX, satellite pictures, MDD products and data.

D. PCs are used for data processing and data exchange.

E. The numerical models used are mainly ECMWF and TURLAM.

F. Output products:

- General weather forecast up to 10 days and forecasts for other purposed are produced, based on the products of the ECMWF.
- General forecast (3 times a day).
- Prognoses up to 36 hours are prepared for surface and 700, 500, and 300 hPa levels.
- Medium range forecast.
- Meteorological warnings.
- Daily met bulletin.
- Dedicated forecasts.
- Significant weather charts (valid for 12 hours).
- Marine forecast and warning.

5 Briefly describe your meteorological support units which provide direct support to air forces.

A. Aeronautical Meteorological Offices or stations are located at the air bases/aerodromes in direct support of flight operations. A standard aeronautical met office is composed of a director, an assistant, 4 chief of tem (forecaster), 8 forecasters, and 8 observers. The work is done 24 hours a day in shifts.

B. Each office has:

- One PC (used for telecom and data processing).
- Radio facsimile receiver.
- Facsimile.
- Semi-automatic observing stations (at the 10 air bases and 4 international airports) and other observing equipment.

- APT (10 air bases).
- 4800/9600 bps data circuit.
- Teletype circuit (50/100 baud).

C. The Aeronautical Meteorological Offices at the aerodromes commonly provide the following information to air crews:

- Aviation routing weather report with trend forecast (METAR, hourly or half-hourly).
- Aviation selected special weather report (SPECI).
- TAF:
  - Valid 9 hours, issued every 3 hours,
  - Valid 18 hours, issued every 6 hours (only at international airports),
  - Valid 24 hours, issued every 6 hours.
- Daily morning briefings.
- Special briefings on request.
- Local general forecasts.
- The support to operations (target area, route forecast, night flying).
- Aerodrome warnings.
- Significant Weather Charts.
- Satellite pictures (APT).

6 Briefly describe your meteorological support units which provide direct support to your land forces.

Meteorological support is ensured by WAC Ankara and/or aeronautical met offices on request. Aeronautical met stations are located on the land aviation units and provide weather observations and weather reports.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

FWC Bandirma is the national centre routinely providing meteorological support to national and NATO naval forces. It is supported by WAC Ankara. FWC Bandirma has PC, RATT, and CW broadcast devices, and uses a 9600 bps circuit connected to WAC Ankara. Services provided:

- Surface and upper air analysis.
- Surface and upper air prognoses
- Shipping forecast, gale and storm warnings, general synoptic situation, and a brief outlook.
- Selected surface and upper air synoptic observations.

Naval units receive forecast products via their own operational links. Forecasters are employed to the ships on request.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

All products and data are exchanged by WAC Ankara communication centre. Communication links:

- GTS (Ankara-Sofia at 100 baud, Ankara-Rome at 2400 bps).
- Ankara-Reading (ECMWF) at 64 kbps.
- Ankara-Wien at 2400 bps (OPMET).
- Ankara-ACEWEX.

STRUCTURE OF TURKISH STATE METEOROLOGICAL SERVICE

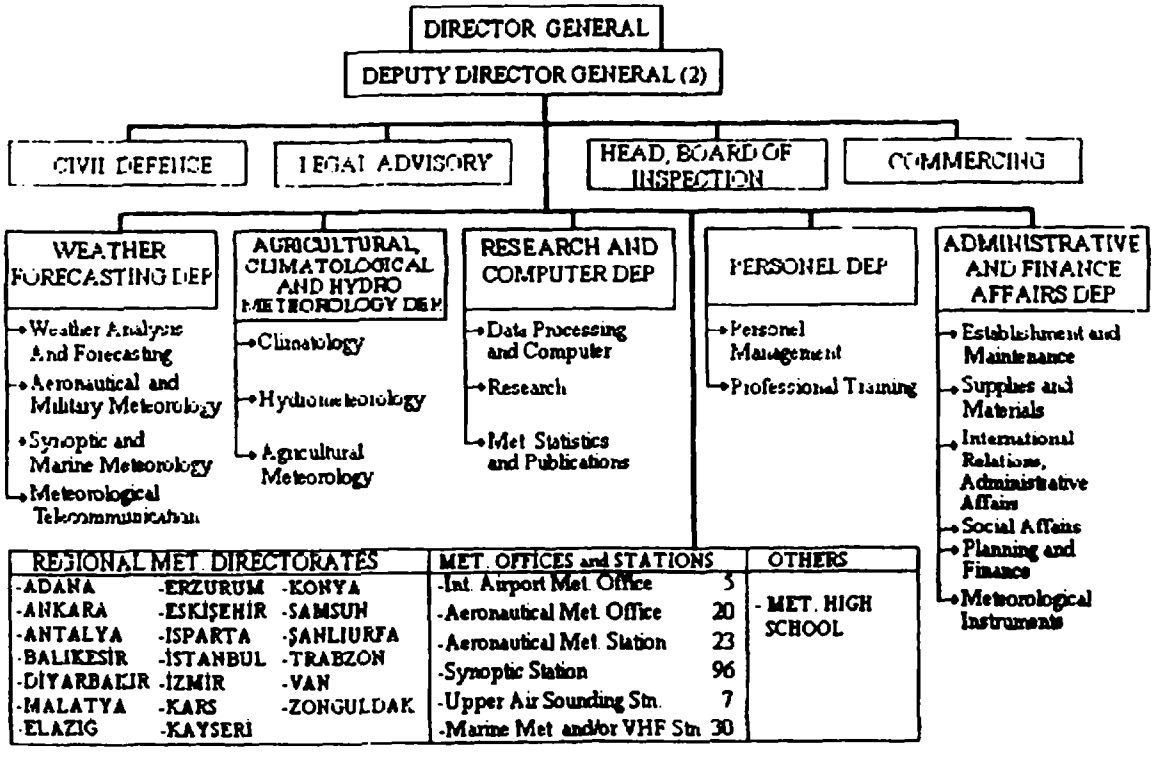


Figure 3B-12-I

UNITED KINGDOM'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: June 1996

1. Briefly describe the organisational structure of the meteorological service of your nation. Please include a diagram depicting the organisational structure for each service and outline responsibilities and major facilities of each organisation

The United Kingdom (UK) has a single integrated National Meteorological Service providing meteorological services to UK Armed Forces (air and land), civil aviation, other government departments and a range of service to commercial customers. The only exception being the provision of meteorological and oceanographic support to the Royal Navy (RN), which is undertaken by uniformed RN personnel. About 400 staff of a total Met. Office manpower of 2250 are directly involved in the provision of support to UK air and land forces at 40 locations in the UK and overseas.

The organisational structure of the UK Met. Office is shown at figure 3B-13-I.

The UK Met. Office is an Executive Agency wholly owned by the Ministry of Defence and operating as a Trading Fund. All Government Departments are obliged to meet their meteorological requirements through the Met Office, but the cost of the service is met from the customer's budget, rather than through central government funding. This establishes a customer/supplier relationship and brings commercial-type pressures to the costs of meteorological services.

2. If your nation has more than one meteorological organisation, briefly describe the level of co-ordination among these organisations and how it is achieved.

The UK RN has a Military Forecast Centre - the Fleet Weather and Oceanographic Centre (FWOC) - at Northwood which receives basic meteorological data and Numerical Weather Prediction from Weather Analysis Centre Bracknell. Close co-ordination is maintained between the Met. Office and FWOC concerning equipment programmes, training and operationally between the MFC at High Wycombe and the FWOC.

3. Briefly describe the educational background or training pipeline for forecasters in you national meteorological organisation supporting the military.

Forecasters in the UK Met. Office have a range of academic qualifications from 'Advanced Level' examinations taken at the end of normal schooling through to university degrees and doctorates . Most forecasters will attend the Initial Forecasting Course (18 weeks) held at the Met. Office College, and after a period of operational forecasting experience this is followed by the Advanced Forecasting Course (6 weeks) also held at the Met. Office College.

The Met. Office College additionally provides a number of forecasting related courses, e.g. Numerical Weather Prediction (NWP), Remote Sensing, Tropical Meteorology, South Atlantic Meteorology. Some are residential, others available as a self-teaching packages. A number of Computer Assisted Learning packages are also available.

The RN trains its own METOC personnel at the Royal Naval School of Meteorology and Oceanography (RNSOMO).

4. Briefly describe your primary forecasting centre supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.

Weather Analysis Centre (WAC) Bracknell is the UK's primary forecast centre - it occupies the Richardson Wing of the Met. Office headquarters. WAC Bracknell provides a comprehensive range of data, products and guidance to subsidiary forecast offices supporting UK Armed Forces.

All NWP models are run on the supercomputing facility at Bracknell. The NWP Unified Model system comprises a Global Model (GM) with 90 km horizontal resolution, a Limited Area Model (LAM) (45 km) and a Mesoscale Model (MM) with 17 km resolution. The GM and LAM models have 19 levels in the vertical, the MM has 31. The GM runs to T+120 hours twice a day, the LAM and MM are run four times a day, the LAM to T+36 (T+48 is available as a back-up) and the MM to T+24. The MM can be relocated to any area of the globe to provide forecasts in support of a military activity. MMs for the Gulf and the Former Yugoslavia are run as routine once a day.

NWP products are also available at WAC Bracknell in a variety of formats from ECMWF, USA, DWD and MeteoFrance.

The Military Forecasting Centre located in the Primary War Headquarters at RAF High Wycombe provides a range of data and products in support of UK air and land forces. It also provides meteorological services to NATO's Allied Forces Northwest Europe and subsidiary commands. The MFC has 3 forecaster positions and 3 support staff and operates 24 hours a day.

The MFC has interactive HORACE workstations for the receipt, processing and dissemination of data and products. As full HORACE functionality is not yet available the MFC also uses Outstation Display Systems, and analogue facsimile broadcast systems for the display and dissemination of data and products. Data and products are also disseminated by military Information Technology (IT) systems.

The RN Fleet Weather and Oceanographic Centre (FWOC) is the RN's primary forecast centre. Linked to the Met Office at Bracknell and HQSTC. The FWOC has access to all Bracknell data and products and its own HORACE software for data display, manipulation and analysis purposes. The RN does not run and meteorological computer models but does run oceanographic models. The FWOC is manned continuously and its standard manning is one Met and one Oc forecaster supported by 3 ratings.

5. Briefly describe your meteorological support units which provide direct support to air forces.

A typical Military Forecast Unit at a Royal Air Force Station has a complement of 8 staff - a Senior Met. Officer, 3 Forecasters 1 senior support officer and 3 observers. This MFU will provide continuous support typically from late Sunday evening to the end of flying on Friday afternoon.

The MFU is equipped with an Outstation Display System (ODS) and facsimile equipment which receive basic data and products from WAC Bracknell and MFC High Wycombe.

The MFUs provide all forecast services to the RAF at a base via mass and personal briefings (face-to-face or by telephone) and military IT systems.

The RN has its own airstations which are manned continuously by RN METOC personnel who provide forecasts using the same ODS system as used by the Met Office and MMUs.

6. Briefly describe your meteorological support units which provide direct support to your land forces.

Similar MFUs provided to support Army aviation units, and these MFUs as well as the MFC provide support to UK Land Forces.

7. Briefly describe your meteorological support units which provide direct support to your maritime forces.

The RN Fleet, which includes submarines, is supported by RN METOC personnel. Support is on a tiered basis depending on task. This ranges between:

- Support from the FWOC only (no METOC personnel onboard).
- Small METOC team (one officer and rating) usually in frigates engaged in passive ASW. Data issupplied by FWOC.
- Major METOC team (2-3 officers and 24 hour rating support) routinely in CVSG. Data is supplied by FWOC.

8. Briefly describe the extent and type of data communications within the organisation supporting the military and its access to international networks.

WAC Bracknell is an integral part of the GTS and receives basic data and NWP products from other National Met. Services (NMS). The MFC at RAF High Wycombe is connected to WAC Bracknell by a multi-path megastream link to provide basic data, including radar and satellite imagery, and NWP products from Bracknell and other NMSs. Other communications links including analogue and digital facsimile are also available.

All MFUs receive basic data and products from WAC Bracknell via a 9.6 Kbps telecommunications link which is being replaced by a 64 Kbps resilient network known as the Weather Information Network (WIN). All MFUs also have access to analogue or digital facsimile receivers.

The RN has one-way communication links from Bracknell down which data and products are supplied. The RN transmits data and products to ships and submarines at sea using a combination of HF FAX transmissions and satellite communications.

9. Any additional information you desire to include (mobile meteorological support capability, etc.)

The UK Met. Office has a Mobile Meteorological Unit (MMU) which comprises about 45 members who hold reserve Commissions in the Royal Air Force. The MMU will normally deploy with 2 forecasters and 2 observers to operate 24 hours a day. At least 2 such deployments plus a number of smaller teams can be deployed at any one time.

The MMU has mobile versions of the ODS available at MFUs. Mobile ODS can receive data via military or civil satellites, or military or civilian telecommunications lines. To provide back-up, a dial-up Personal Computer based system is available with a capability to receive data and products from WAC Bracknell and other NMSs

RN ships have a range of MET and OC equipment. These include FAX machines, NOAA satellite receivers, RATT receivers and computer-based MET and OC forecasting tools.

UK MET OFFICE ORGANIZATIONAL STRUCTURE

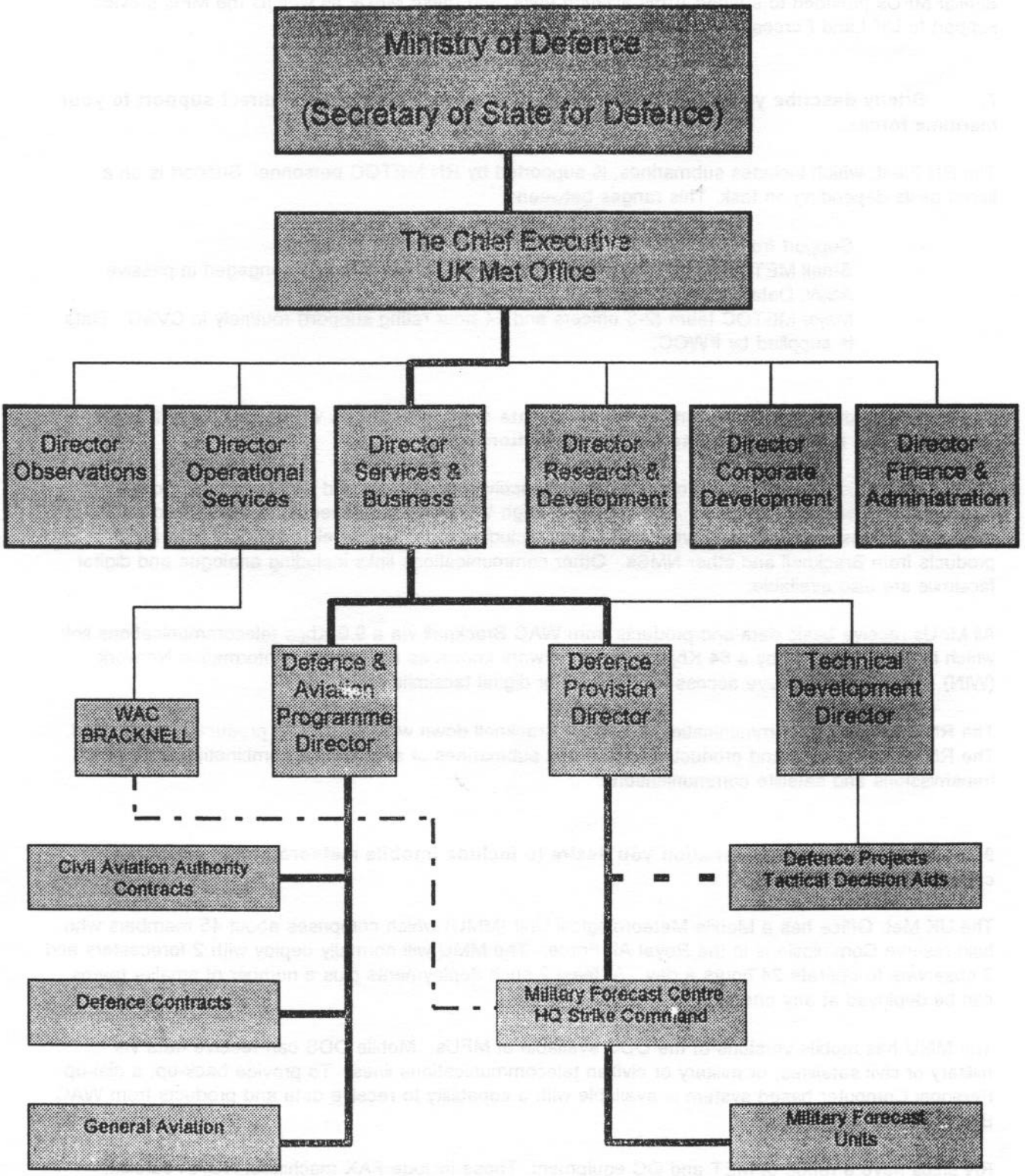


Figure 3B-13-I

Data and products

UNITED STATES' METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.

A. In the United States, the National Weather Service (NWS) is responsible for providing weather support to the civilian sector. It is a branch of the National Oceanic and Atmospheric Agency, a part of the Department of Commerce.

B. Support to military forces is provided by each Service. The Naval Meteorology and Oceanography Command supports naval forces (U.S. Navy and U.S. Marine Corps). The U.S. Air Force Air Weather Service provides meteorological support to U.S. Army and U.S. Air Forces. When operating jointly, meteorological support is provided from a combination of sources, both military and civilian. In those cases, the senior METOC officer in that theater coordinates support for the joint forces. The Air Force and Navy meteorological organizations are outlined in figures 3B-14-I and 3B-14-II.

2. If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.

A. Coordination is initially achieved at the production center level. The three primary meteorological production centers, NWS National Center for Environmental Prediction (NCEP); Navy Fleet Numerical METOC Center (FNMOC); and Air Force Global Weather Central (AFGWC), share observational data, numerical model output, and other products through established communications systems. In order to reduce redundancy, the two military production centers share responsibilities, i.e., FNMOC has responsibility for global models and AFGWC has responsibility for processing weather satellite data. This information is made available to military forces directly, and also indirectly through tactical support products.

B. Coordination is also achieved at other levels of command. Through various communication paths, forces of all services have access to products and data produced by the three primary production centers as well as forecasts and tactical support products of in-theater METOC forces supporting operations, no matter which service they are in.

3. Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.

A. METOC officers receive master-level degrees in meteorology and/or oceanography early in their careers, either through the Naval Postgraduate School in Monterey, California, or through civilian universities. They also attend service schools periodically which provide training in applied meteorology or oceanography, with emphasis on tactical support to operators.

B. Navy/Marine Corps enlisted personnel initially attend approximately 12 weeks of basic level METOC training which prepares them to be observers and analysts/briefers. Their next formal training, approximately 30 weeks, prepares them to be forecasters, and they achieve site-specific qualifications at their next duty station.

C. Air Force enlisted personnel initially attend 18 weeks of basic meteorological training (observations, analysis, equipment and field skills). After several years, they would typically attend the forecaster course, 27 weeks of advanced weather training.

D. Navy and Air Force personnel periodically return for training in applied meteorology/oceanography and tactical support.

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.

A. The Fleet Numerical Meteorology and Oceanography Center (FNMOC) in Monterey, California, issues global METOC guidance products in Naval (Navy and Marine Corps) forces. Regional METOC centers in Rota Spain, Norfolk Virginia, Pearl Harbor Hawaii and Guam use these guidance products, modify guidance based on locally available data, and tailor support to operational forces. METOC personnel at headquarters staffs, air bases, on Battle Group and Amphibious Ready Group staffs, and in support of selected smaller units apply these products to provide support to the warfighters.

B. FNMOC employs approximately 400 civilian and military personnel. FNMOC has a Cray Supercomputer and many workstations which are linked together to process many different forecast and tactical support products. FNMOC runs the Navy Operational Global Atmospheric Prediction System (NOGAPS) and NORAPS (Regional) models twice daily. The Coupled Ocean Atmospheric Model Prediction System (COAMPS) triple-nested relocatable mesoscale model was added in the summer of 1996. The Global Wave Model (WAM) produces sea state forecasts.

C. The Air Force Global Weather Central in Offutt Air Force Base, Nebraska, employs approximately 700 personnel. AFGWC runs regional models initialized by NOGAPS and produces centralized weather products for Air Force and Army major commands and operational forces. Similar to the way naval forces use FNMOC-generated guidance, Air Force weather personnel used AFGWC guidance and tailor it to support local commanders using Air Force tactical forecast systems. AFGWC uses an IBM PS2 computer to process weather satellite data, regional numerical models, and tailored products, and operates the Automated Weather Network (AWN) to transfer data.

5. Briefly describe your meteorological support units which provide direct support to air forces.

A. Weather flights are located on the air bases in support of flight operations and report directly to the operational commander. A typical unit consists of 2-3 officers, 6 observers and 6 forecasters working in shifts.

B. Weather flights have connectivity to AFGWC and other weather facilities through the AWN, modem connections, and via classified and unclassified networks, and receive satellite and radar data.

C. Products which they use and provide depend upon the mission of the commander they support, but typically include local/aerodrome forecasts, local warnings, and tactical support products tailored to forces. Briefings to flight crews are provided in person or via local networks.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

Army land forces are supported directly by Air Force weather personnel. Weather teams support Army units at the corps (24 personnel), division (18), regiment (13) and battalion (6) levels depending on the types of forces involved. They take observations and produce tactical aviation products, local weather forecasts, trafficability products, and other tactical support products. Weather teams report through echelon intelligence officers, except for artillery weather teams which report through the operations officer. Artillery units are supported by Army personnel trained in meteorological support. They receive guidance from higher echelon weather teams.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

A. Meteorological support to navy forces starts at FNMOC, which provides guidance to regional METOC centers. The regional centers customize support for fleet units and transmit products via satellite or landline communications. METOC facilities and detachments further tailor products for local customers. Naval air bases are supported by a detachment of approximately 1 officer and 10 enlisted personnel. Aircraft carriers and large amphibious ships are each supported by a METOC division of approximately the sam size. Ashore and afloat, METOC support consists of the full spectrum of meteorological and tactical support as well as antisubmarine warfare tactical support, amphibious forecasts, and other specialized products.

B. Marine Expeditionary Units are supported in the field by a Marine Corps METOC detachment normally collocated with the Aviation Combat Element. The detachment typically consists of one officer and 7 enlisted personnel. They take observations, receive forecast guidance from FNMOC and other production centers and regional METOC centers, and tailor METOC support to combat and combat support forces.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The main production centers are tied to the Global Telecommunications System (GTS) via the AWN. Existing METOC-unique communication networks will soon be discontinued in favor of the same systems and networks which are used by the rest of the Defense Department. They include T-1 and T-3 lines, SHF satellite links, dial-in modems, and INTERNET-like network connections.

9. Any additional information you desire to include.

Each service has mobile meteorological support capabilities. Mobile Environmental Teams of 1-3 personnel can deploy on all types of navy ships with full connectivity to METOC centers and satellite reception; Air Force personnel with full METOC capabilities can deploy in small units as required to support Air Force and Army combat forces where space is limited; Marine Corps personnel similarly can tailor mobile support teams to suit any particular requirement; and Special Operations Forces deploy with organic METOC support, including man-portable computers and satellite connectivity.

AIR FORCE / ARMY METEOROLOGY ORGANIZATION

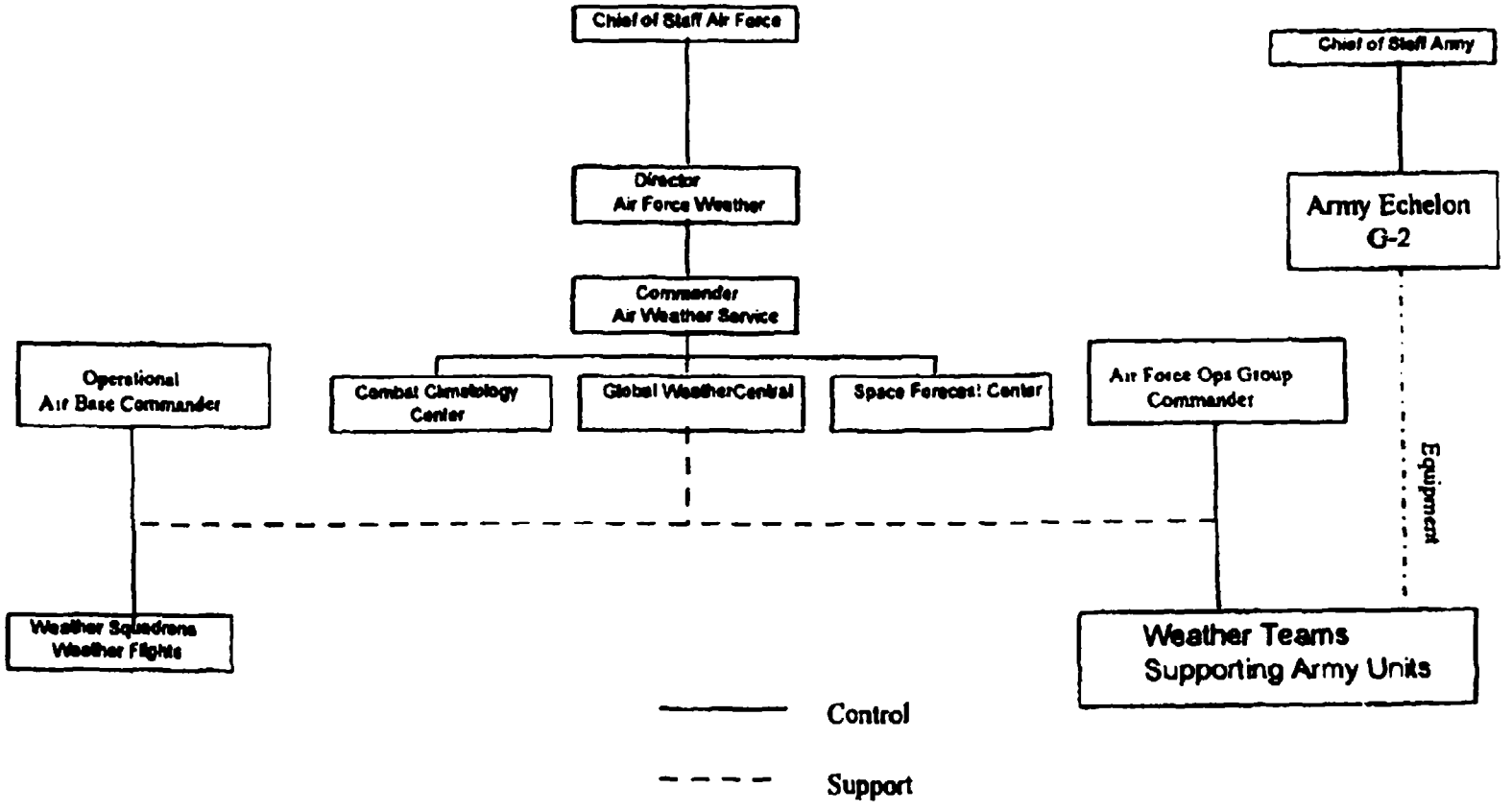


Figure 3B-14-1

NAVY / MARINE CORPS METOC ORGANIZATION

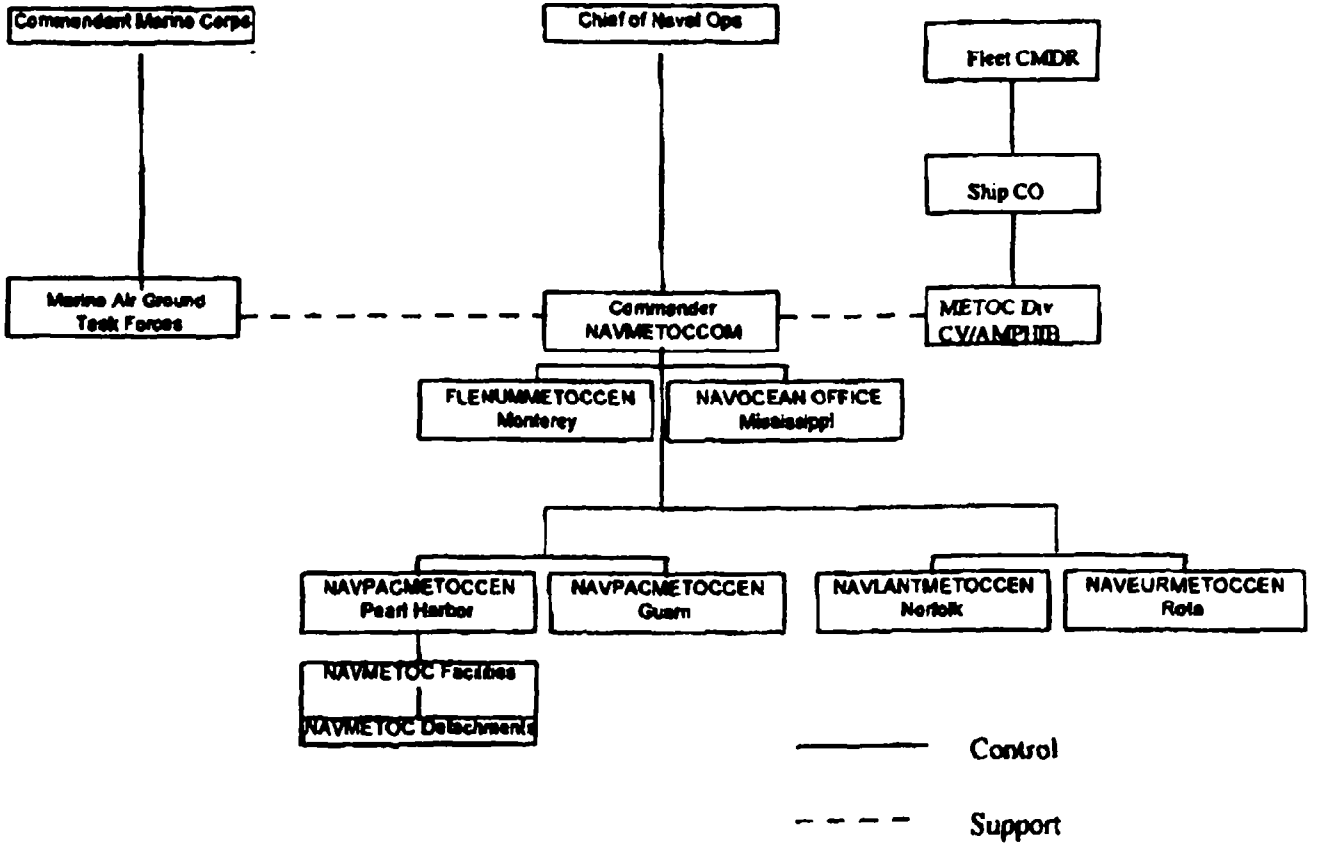


Figure 3B-14-II

Annex C
Chapter 3

METEOROLOGICAL ORGANIZATION AND CAPABILITIES OF PfP NATIONS

1. Introduction. This Annex outlines national meteorological organization, including the capabilities of WACs, of Partnership for Peace nations. This information is provided by the respective nations through period meetings of the Military Committee Meteorological Group with Cooperating Partners (MCMG + CP).

2. Contents

Appendix 1
Annex C
Chapter 3

AUSTRIA'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.

Austria has 3 meteorological services:

A. Civil scientific and operational service named "ZENTRALANSTALT FUR METEOROLOGIE UND GEODYNAMIK" (ZAMG) reporting to the Ministry of Science, Traffic and Culture (BMWVK) (Line diagram attached as Figure 3C-1-I). The main office is located in Vienna. The ZAMG operates the mass of the observing stations, except those on airports and airfields. Employing 215 people, its main responsibilities are:

- Austrian representative to WMO, ECMWF, EUMETSAT, ECOMET;
- Activities in the field of scientific research (with a very close connection to the University of Vienna, Dept of Meteorology and Geodynamics);
- Public service in the field of meteorology and geophysics;
- Operation of the network of some 80 automatic weather stations, the climatological network and 1 radiosonde station in Vienna.

B. Civil aviation service as a part of the "AUSTRO CONTROL COMPANY" (ACG) (Line diagram attached as Figure 3C-1-II). Although this is a private company, it is under control of the Ministry of Science, Traffic and Culture. The headquarters are in Vienna and the civil aviation service has 163 people and in addition some 30 technicians. This service runs 6 main observation and briefing offices on the 6 international airports in Austria, the main operational office is located on Vienna International Airport (LOWW). The main responsibilities are:

- Austrian representative at ICAO and WMO Commission for Aeronautical Meteorology;
- Meteorological telecommunication (ca. 90%);
- Flight information and safety for the civil aviation;
- Aeronautical climatology;
- Austrian weather radar network (3 stations);
- 3 radiosonde stations (LOWG, LOWS, LOWI);
- Flight information and safety for military aviation and army units at the airfields Linz/Horsching (LOWI) and Graz/Thalerhof (LOWG).

The ACG was formed in 1994 and has been the "Civil Aviation Office" before. It still holds the position of the Civil Aviation Authority.

C. Military Weather Service reports to the MOD (Line diagram attached as Figure 3C-1-III) and has at the moment 64 people. The commanding HQs are in Vienna, the operational center is in St. Johann/Pongau (some 60 km south of Salzburg). After a restructuring and reduction in 1993, the MWS has 5 observing stations, 4 briefing offices and some 30 observing posts in military camps and training facilities. The main responsibilities are:

- Meteorological support to the Armed Forces (in peacetime this is 85% or more for the Air Force);
- Military climatology;
- Meteorological support for different departments of the MOD;
- Providing Austrian representative to the MCMG + CP.

2. If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.

A "Coordination Commission" composed of the directors of the three weather services has a regulatory effect; however, the three services are independent! This commission meets on a regular basis at least 4 times per year and has responsibility to:

- Organize the cooperation between the three services to keep the over-all costs low;
- Coordinate the representation to the different international organizations (WMO, ICAO, etc);
- Coordinate the common operational needs (data exchange, communication, etc).

There is a full and unlimited exchange of all the data and products among the three services.

3. Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.

A. Officers and civilian personnel attend a 6 week (Basic) and a 12 week "Observer Course" and have to serve at least 2 years as observers/forecast-volunteers. 30 additional weeks spread over a full year of theoretical education and training follow those 2 years. After another 4-6 weeks of "on the job training" as forecaster there is a final examination to become "Forecast & Briefing Officer".

B. Meteorologists graduating from the University have to serve a full year on a "rotation base" going through all airfields and the military center. There is a final examination to become "Chief Forecaster & Briefing Officer."

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.

A. The Military Forecast Center is located in St. Johann/Pongau south of Salzburg and is a part of the Air Defence Center. Its manpower is 7 forecasters (6 with university degree) and 14 assistants/weather technicians operating in a shift h + 24 for communication and data transfer, and in a shift daily 0500 UTC to 2000 UTC for forecasting and briefing. On "operational days" (Monday-Friday) there are 1 synoptic forecast, 1 operational/briefing forecaster, and 2-3 assistants on duty. On weekends and holidays there are 1 forecast and 2 assistants on duty. For training and other military reasons, the Military Weather Center can be upgraded to h+25 duty within 3 hours.

B. Equipment used by the center is part of the "Flight Information System" (meteorological models) and has 4 working positions/terminals (upgrading to workstations will happen within 1997). Two independent workstations are for satellite (EUMETSAT) and weather radar pictures.

C. The models used are ECMWF (GRIB) and DWD (FAX E).

D. The Center is responsible for the daily issue of the following products (outgoing products; internal products are not listed):

- General forecast for Austria (twice a day);
- Military aviation forecast (twice a day) including significant weather charts;
- MIL MET WARNING(s) (Special meteorological warnings for military aviation including SIGMET and AIRMET);
- Weather warnings (severe weather) for the territorial military commands;
- Special weather information for army units on training (upward brigade level).

E. In addition, the Center has to support the offices on the military airfields in general for night-flight operation

5 Briefly describe your meteorological support units which provide direct support to air forces.

A. Meteorological support units are located on the airbases in direct support of flight operations. These weather offices are a mixture between observation stations (h+24) and forecast/briefing station (0600 UTC to 1700 UTC). Their main duties are:

- Permanent weather watch organized in shifts;
- Local forecast (TREND, TAF) for the airfield and training areas;
- Local warnings for air operations, ATC and ground crew chiefs;
- Forecast and information for army units within a defined "briefing Zone".

A standard unit is composed of a meteorologist, 2 forecasters/briefing officers and 8 weather technicians. The unit has 2 terminals within the "Flight Information System" and in addition 1-2 independent workstations for satellite (EUMETSAT) and weather radar pictures. Since 4 weeks there is also FAX-E with workstation available at each office.

B. The model used is the guidance issued from the Military Weather Center.

C. The unit is responsible for the daily morning briefing to air crews and commanding officers and the individual briefings before each flight out of MTCA.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

The Meteorological support units described in paragraph 5 also have to support the land forces within the "briefing zones" ("Militarkommando-Bereich"). In addition, the HQs has to support the training facilities schools and special courses. Support for artillery is only on technical bases.

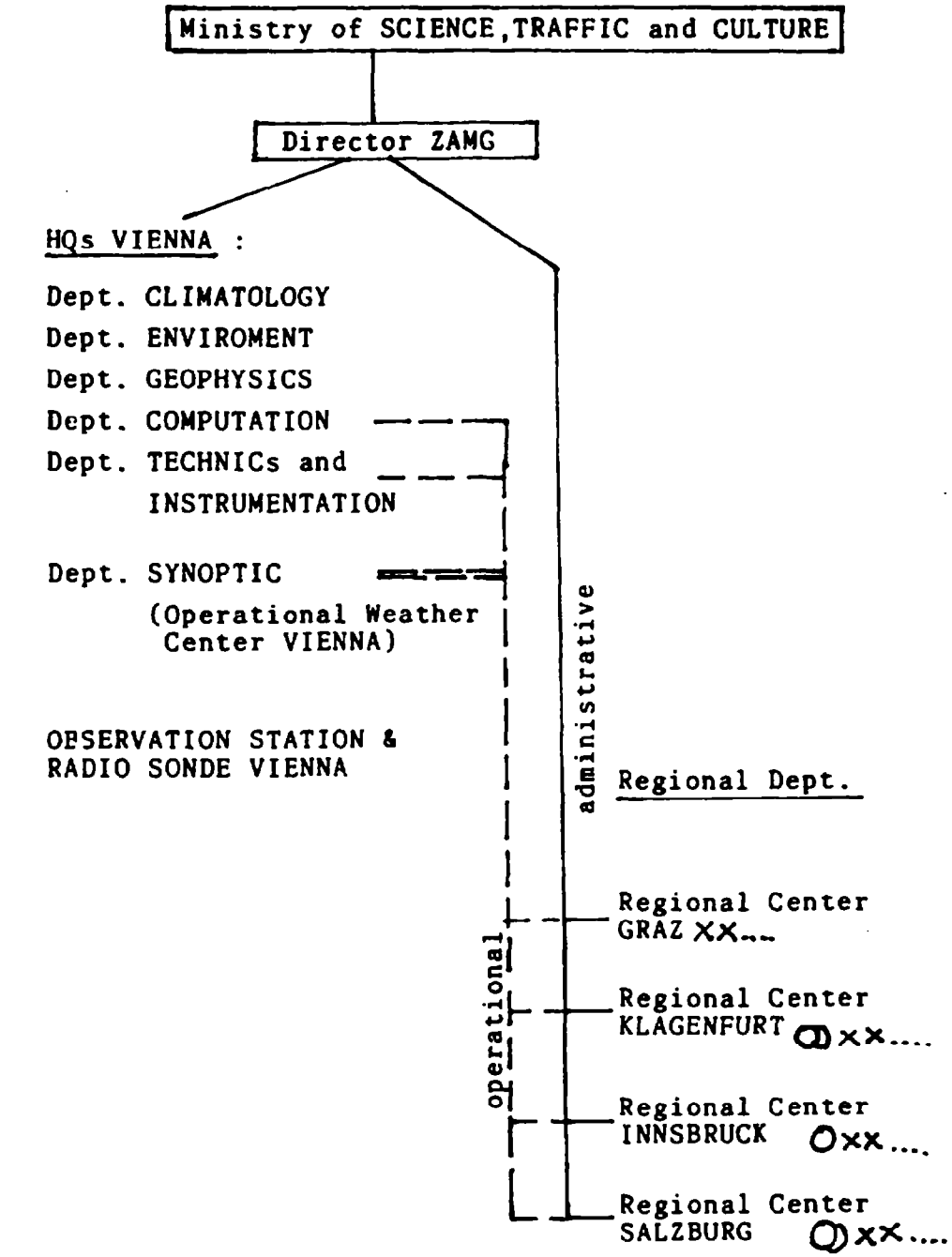
7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Not applicable. The two patrol-boats at the River Danube do not need special support.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Military Weather Center has access to the GTS circuit via ACG and is the gateway to the GTS for Austrian military airfield observations and TAFs. There are no additional direct links to foreign military or civil weather services. Since 1995, the Military Weather Service has the permission to exchange data and information for operational needs with the neighbouring countries and member countries of PfP by phone and telefax.

STRUCTURE of "ZENTRALANSTALT FÜR METEOROLOGIE UND GEODYNAMIK" (ZAMG)

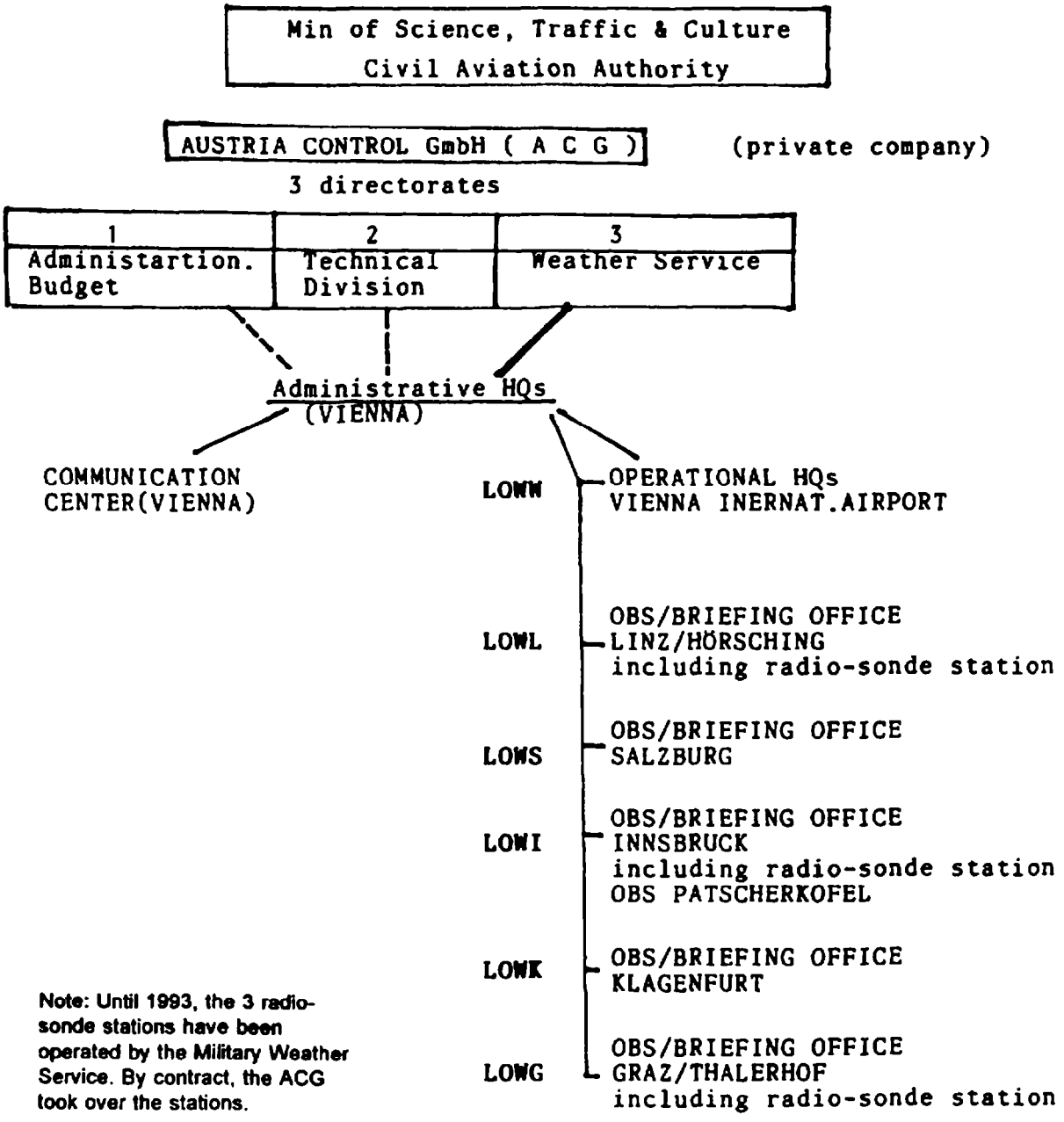


O manned observation stations

X unmanned/automatic observation stations

Figure 3C-1-1

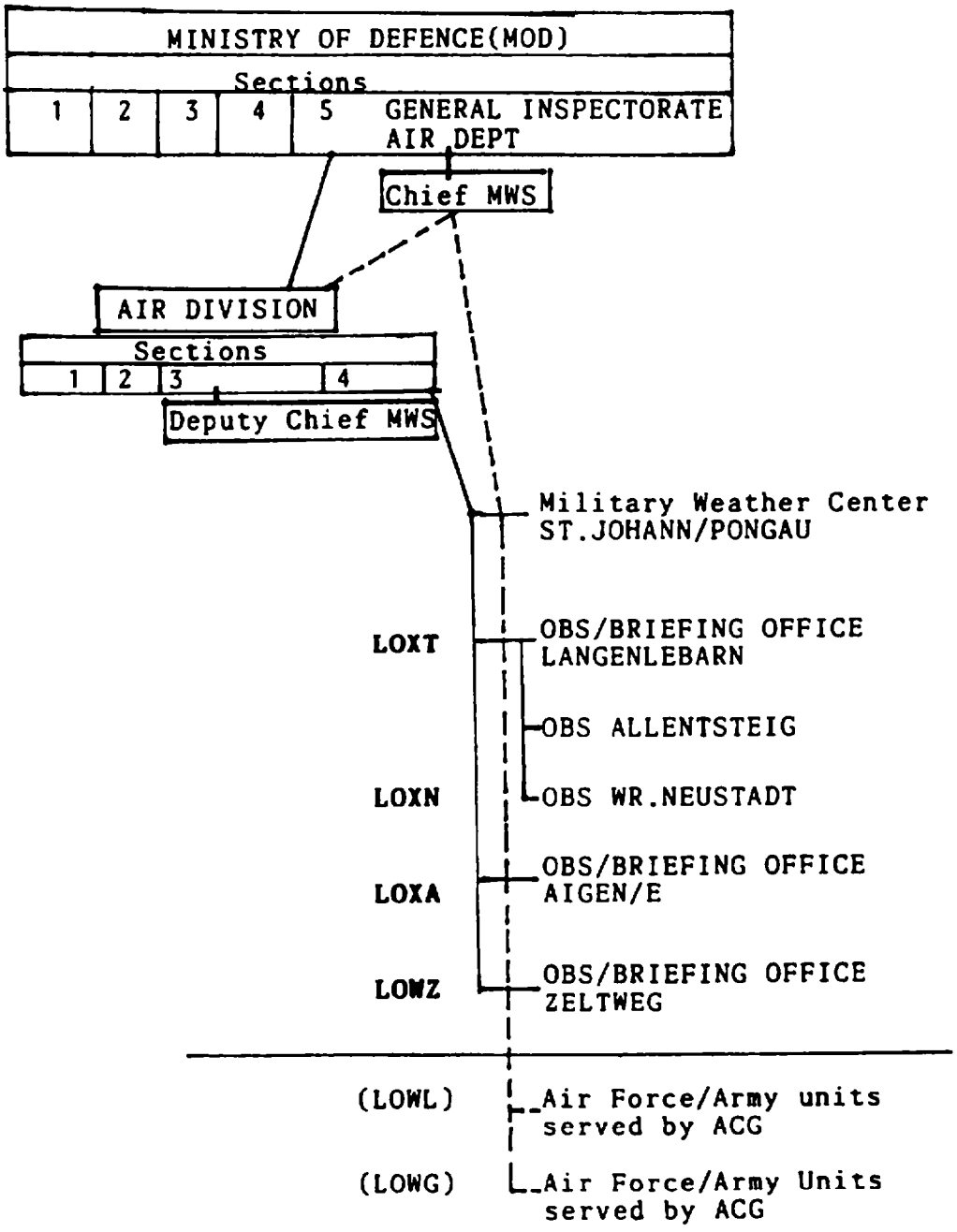
STRUCTURE of the "CIVIL AVIATION WEATHER SERVICE"



Note: Until 1993, the 3 radio-sonde stations have been operated by the Military Weather Service. By contract, the ACG took over the stations.

Figure 3C-1-II

STRUCTURE of the "MILITARY WEATHER SERVICE " (MWS)



——— military command; administration

– – – – – operational command

Figure 3C-1-III

ORIGINAL
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Appendix 2
Annex C
Chapter 3

CZECH REPUBLIC'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. **Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.**

The Czech Republic has two meteorological services:

A. The Civil hydrometeorological service named "Czech Hydrometeorological Institute-Cesky hydrometeorologicky ustav - CHMU", created in 1969. The history of the service dates back to the State Institute of Meteorology, which was founded after the disintegration of the Austrian-Hungarian Monarchy in 1918, and the Czechoslovak Meteorological Institute, created in 1953. Nevertheless, the measurement of meteorological phenomena and elements has a tradition of more than 200 years and dates back to the meteorological observatory in the Prague Clementinum in 1775. The CHMU reports to the Ministry of Environment of the Czech Republic (line diagram depicted in figure 3C-2-I). The CHMU staff is located in Prague and the institute operates 23 regular meteorological stations, out of which 7 meteorological units on civil airports. The CHMU operates 2 automated meteorological radars (one in unmanned and one in manned mode) and one upper-air radiosonde station. The professional measurement and observation network is supplemented by a scope of volunteer-operated climatological and limnigraphic stations. Hydrology operates a dense network of surface water and ground water sites for measurement of water level, river discharges and ground water sources. In the field of emission and immersion measurement there are four networks of Automated Imission Monitoring System (AIM). The staff of the CHMU has about 850 employees and the main responsibilities are as follows:

- Scientific research;
- Public service in the field of meteorology, climatology, hydrology and air pollution;
- Flight information and safety for civil aviation, aeronautical climatology;
- Hydrological information and warning reports on flood situations;
- Information on dispersion situation and status of air pollution;
- Provides the nation representatives to the WMO and ICAO.

B. The military meteorological service was called before the separation of the Czechoslovakia The Weather Service of the Air Force. After 1993 it has been called the Hydrometeorological Service of the Armed Forces of the Czech Republic - (Hydrometeorologicka shuzba Armady Ceske republiky - HMS-ACR) and reports to the Air Force and Air Defence Staff of the Armed Forces of the Czech Republic. As depicted in figure 3C-2-II, the military weather service operates 8 aviation weather stations (LMSt) on airbases with regular synoptic observations, two of them with a daytime synoptic observations only. There are 2 Weather Radar Centres and one Radiosonde Radar Centre in operation. The Military Weather Centre (MFC) is called Povetrnostni ustredi Praha - PUP, and is located in Prague. The centre is responsible for meteorological and technical support of the Hydrometeorological Service. The service has 225 employees and the main tasks are as follows:

- Hydrometeorological support to the Air Force and Air Defence;
- Provides meteorological information to ground forces and other branches of the Armed Forces of the Czech Republic (ACR);

- Technical support and development of automatization in the service;
- Management of the Meteorological Information System (METIS);
- Creation of concepts and regulations;
- Training and education of specialists of the service;
- Provides representatives of the ACR to the MCMG + CP and related NATO meetings.

2. If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.

The co-ordination of both services (CHMU and HMS ACR) is based on a bilateral ministry agreement. In accord with the agreement representatives of both services hold regular meetings on appropriate levels to coordinate procedures. The coordinations concern the following fields:

- Exchange of meteorological data (ground and upper-air observations);
- Implementation of WMO and ICAO information, recommendations and resolutions to the HMS ACR;
- Supplementation of civil observation network by synoptic and climatological observations;
- Briefing to air crews on airports with common air operation;
- Provision of necessary actual and forecasting data from international data exchange for the HMS ACR;
- Co-ordination and acquisition of technology aimed at unified technical equipment of the service;
- Mutual assistance in the field of research and development.

3. Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.

The HMS ACR prepares their undergraduate and graduate specialists.

A. Undergraduate level. Meteorologist-observers, operators and personnel serving meteorological equipment are warrant officers and civil servants with high school degree (A-level). They are trained in short-term courses organized by the Weather centre or instructed directly at their workplace. In the future, training of the personnel is planned at the Air Force School at Brno or in common short-term courses organised with the CHMU.

B. Graduate level. Junior and senior graduate officers are assigned to the functions of meteorologists, aerologists and in other specialised fields. Officers are graduating from the Military Academy - the Air Force and Air Defence Faculty, at Brno, branch of study is Air Force Management and Support. The study takes 5 years and graduates hold a degree of Engineering (Dipl.-Ing.) During the study there are practical lessons and probation at an airbase station, at the Weather Centre and the Forecasting Department of the CHMU. University graduates following a probation can be assigned to a position at the Weather Centre.

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.

The Weather Centre Prague (Provetrnostni ustredi Praha) is responsible for hydrometeorological support of the Air Force and Air Defence and provides other branches of the armed forces with information. The centre is located together with other inter-ministerial organisations of the Air Traffic Control Centre in Prague. It is headed by a supervisor, who reports to the Chief of the Hydrometeorological Service of the Armed Forces of the Czech Republic, who is member of the Air Force and Air Defence Staff, ACR. The structure is composed of the administration and special departments (Figure 3C-2-III):

- Department of weather forecasts (OPZ) is responsible for collection, processing and dissemination of actual and forecast information.

- Department of automatization is responsible for provision of hardware and software for use at the Weather Centre and at other levels of the HMS ACR.

- Technical department is responsible for management and implementation of modern instruments and technique at all sites, for their continuous operation, and is in charge of metrological service and partly of technical maintenance also.

B. Equipment used by the weather Centre includes two telecommunication servers, one satellite communication workstation (VSAT), two PC for meteorological data processing with a graphic plotter (SUN), one terminal station controlling combined radar information (4 weather radars), one terminal controlling satellite pictures. Telecommunications with the CHMU and with weather stations at airbases are provided by Meteorological Data Distribution Network "TELEX".

C. The models used for short-term and middle-range forecasts are mainly DWD (GRID) and Washington (GRID) and a CHMU model for short-term forecasts.

D. The Weather Centre manages the Meteorological Information System (METIS) and the following products are issued daily:

Forecast surface chart + 24 hours (twice a day), forecast surface charts 48 hours to 168 hours (once a day), regional weather forecast (4 times a day, validity up to 9 hours), general hydrometeorological forecast (once a day), middle-range forecast, flight-route forecasts on request of home and foreign aircrews, general weather warnings, synoptic and METAR bulletins (every hour, 24 hours a day), TAF bulletins (every 3 hours from 06 to 21 UTC), local warning reports SPECI, upper-air measurement reports TEMP and PILOT (4 times a day), weather information for Regional Flight Control Centre and other supplementing products (radar information, SAR, NBC data...)

5 Briefly describe your meteorological support units which provide direct support to air forces.

A. A meteorological unit forms a meteorological station (LMSt) which is located directly on an airbase and is a part of an air force wing. The unit directly supports flight operations. A standard unit is composed of a supervisor (officer), five forecasters (officers) and six observers (warrant officers, sergeants or civil servants). The weather support is permanent and is organised in shifts. Every unit is equipped with one VSAT communication workstation with a user terminal station, one observing station WINOBSERVER for automatic measurement and processing of ground weather elements with semiautomatic operation modus, one stationary observing meteorological station and one portable observing meteorological station.

B. The model used is in accord with the guidance "Meteorological Support to the Air Force" (Let-10-1) from 1996 and "Flight regulation", from 1996.

C. The unit is responsible for permanent weather watch, for measurement, processing and providing weather data in form of reports (data exchange) and messages (for direct support of Flight Control sites), for daily morning briefing to the commander of the airbase, for pre-flight and flight briefings to air crews for the flight region and for flight operations, for producing the TAF (valid for 9 hours) and for local warning service. The synoptic and climatological reports of a station are used in

the frame of co-operation with the CHMU in accord with national procedures to supplement the national observation network.

D. A project for automation of on-airbase distribution of meteorological data and information to all operational users is planned for 1996.

E. The Air Force and Air Defence airbases are included in the structures of the Air Force Corps. An Air Force Corps HQ has one meteorological section (one supervisor, one vice-supervisor, 4 forecasters and 5 operators-warrant officers or sergeants). The section provides meteorological support to the commander and operation centre for planning and decision-making purposes. It is responsible for management of weather stations and weather radar centres.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

In accord with requests of the Army staff, meteorological support is being provided to Army units by regular or irregular distribution of data. Artillery units are provided with upper-air reports. In 1996 the radiosonde equipment has been updated by radiotheodolites. For measurement of principal meteorological elements, portable meteorological stations are used which are maintained by the Technical Department at the Weather Centre Prague.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Not Applicable.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Weather Centre Prague has access to the GTS for selected international data via RTC of the CHMU (X.25 protocol, 9600 bps) and is gateway to the RTC Prague for airbase weather reports SYNOP, METAR, SPECI and TAF to be available to civil users. Satellite communication with the WAC Traben-Trarbach is in operation since July 1996. (See Figures 3C-2-IV and 3C-2-V for communications and data exchange structure).

9. Any additional information you desire to include.

Meteorological support of units deployed in field conditions is provided by portable meteorological stations. Meteorological data are distributed by the Command Communication Information System. Mobile meteorological units are planned to be operational after 1998.

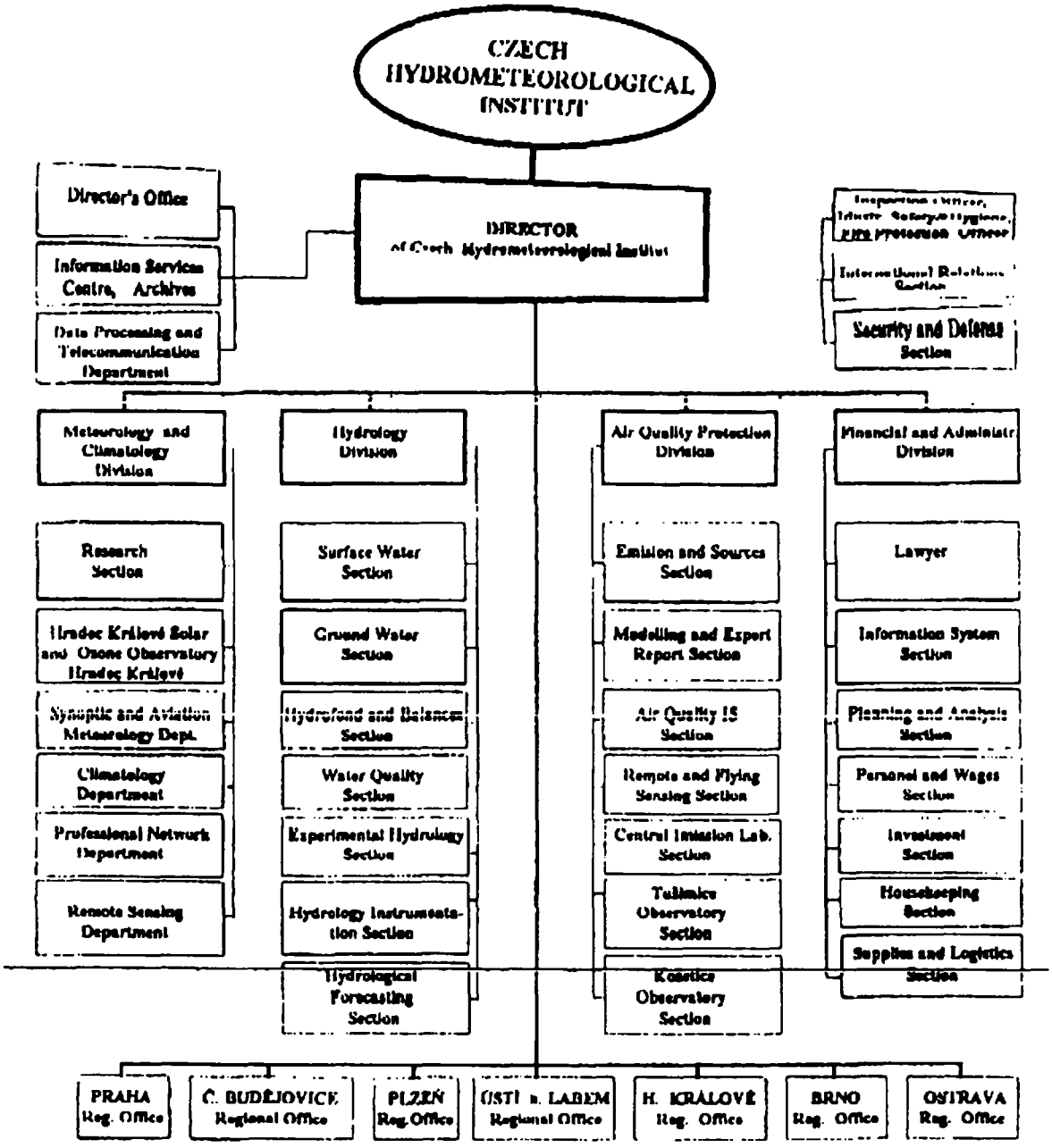

CZECH HYDROMETEOROLOGICAL INSTITUTE
DIRECTOR
Director's Office
Information Services Centre, Archives
Data Processing and Telecommunication Department
Security and Defense Section
Meteorology and Climatology Division
Hydrology Division
Air Quality Protection Division
Financial and Administr. Division
Research Section
Hradec Králové Solar and Ozone Observatory Hradec Králové
Synoptic and Aviation Meteorology Dept.
Climatology Department
Professional Network Department
Remote Sensing Department
Surface Water Section
Ground Water Section
Water Quality Section
Experimental Hydrology Section
Hydrology Instrumentation Section
Hydrological Forecasting Section
Emission and Sources Section
Modelling and Expert Report Section
Remote and Flying Sensing Section
Central Emission Lab. Section
Tušimice Observatory Section
Kosetice Observatory Section
Lawyer
Information System Section
Personal and Wages Section
Investment Section
Housekeeping Section
Supplies and Logistics Section
PRAHA Reg. Office
Č. BUDĚJOVICE Regional Office
PLZEŇ Reg. Office
ÚSTÍ n. LABEM Regional Office
H. KRÁLOVÉ Reg. Office
BRNO Reg. Office
OSTRAVA Reg. Office

Figure 3C-2-I

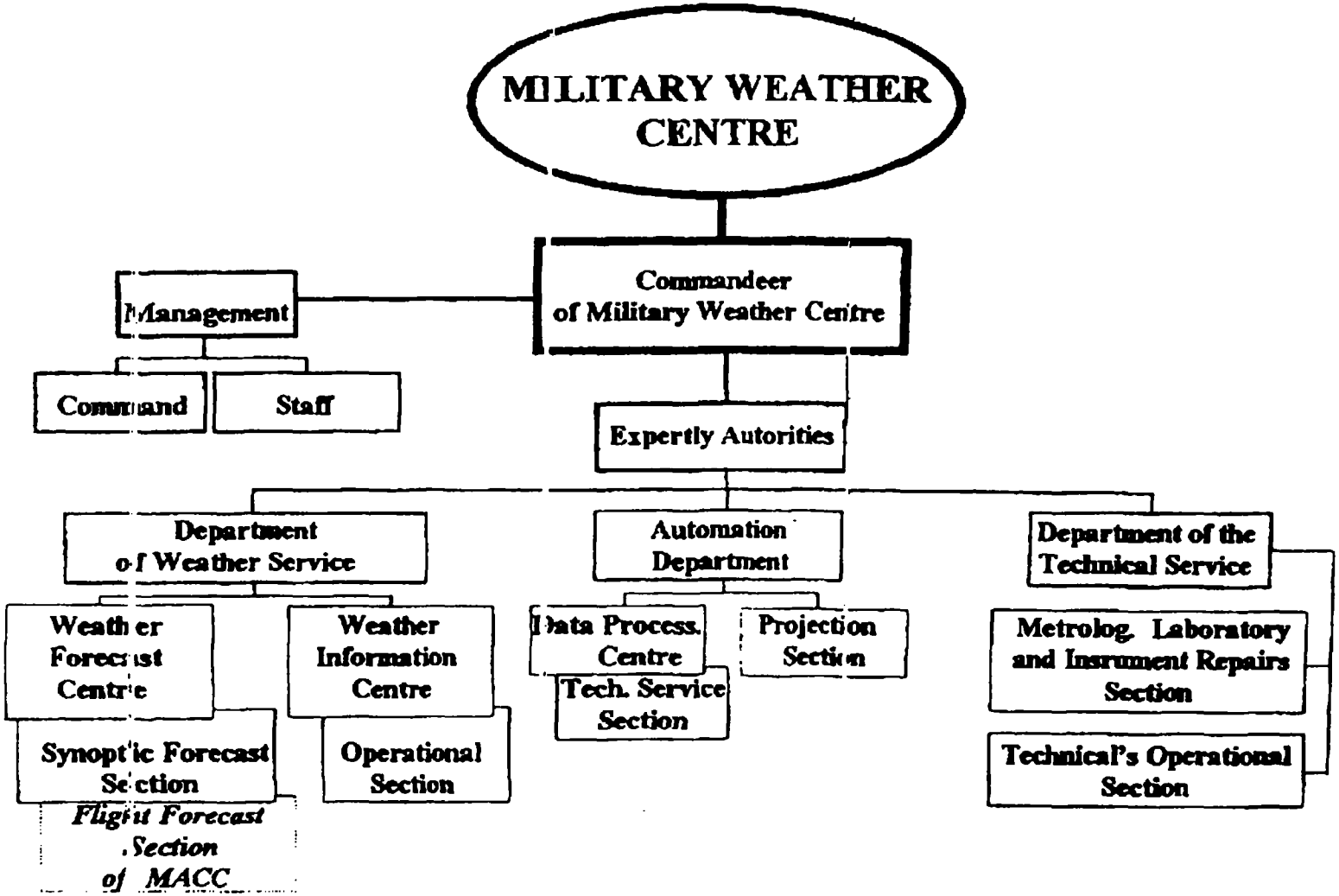
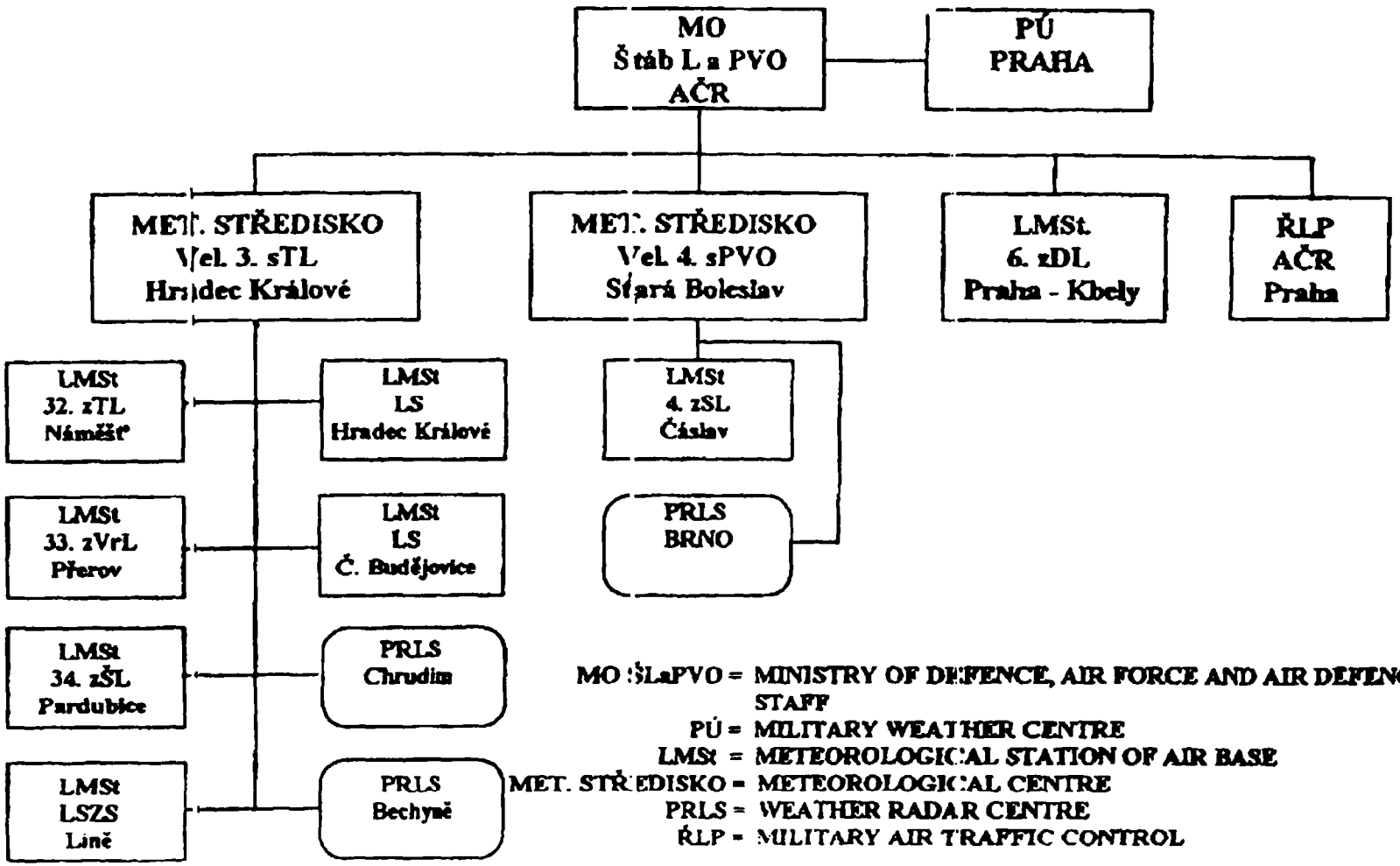


Figure 3C-2-II

THE ORGANIZATION OF MILITARY HYDROMETEOROLOGICAL SERVICE OF THE AČR



MO ŠLaPVO = MINISTRY OF DEFENCE, AIR FORCE AND AIR DEFENCE STAFF
PÚ = MILITARY WEATHER CENTRE
LMSt = METEOROLOGICAL STATION OF AIR BASE
MET. STŘEDISKO = METEOROLOGICAL CENTRE
PRLS = WEATHER RADAR CENTRE
ŘLP = MILITARY AIR TRAFFIC CONTROL

Figure 3C-2-III

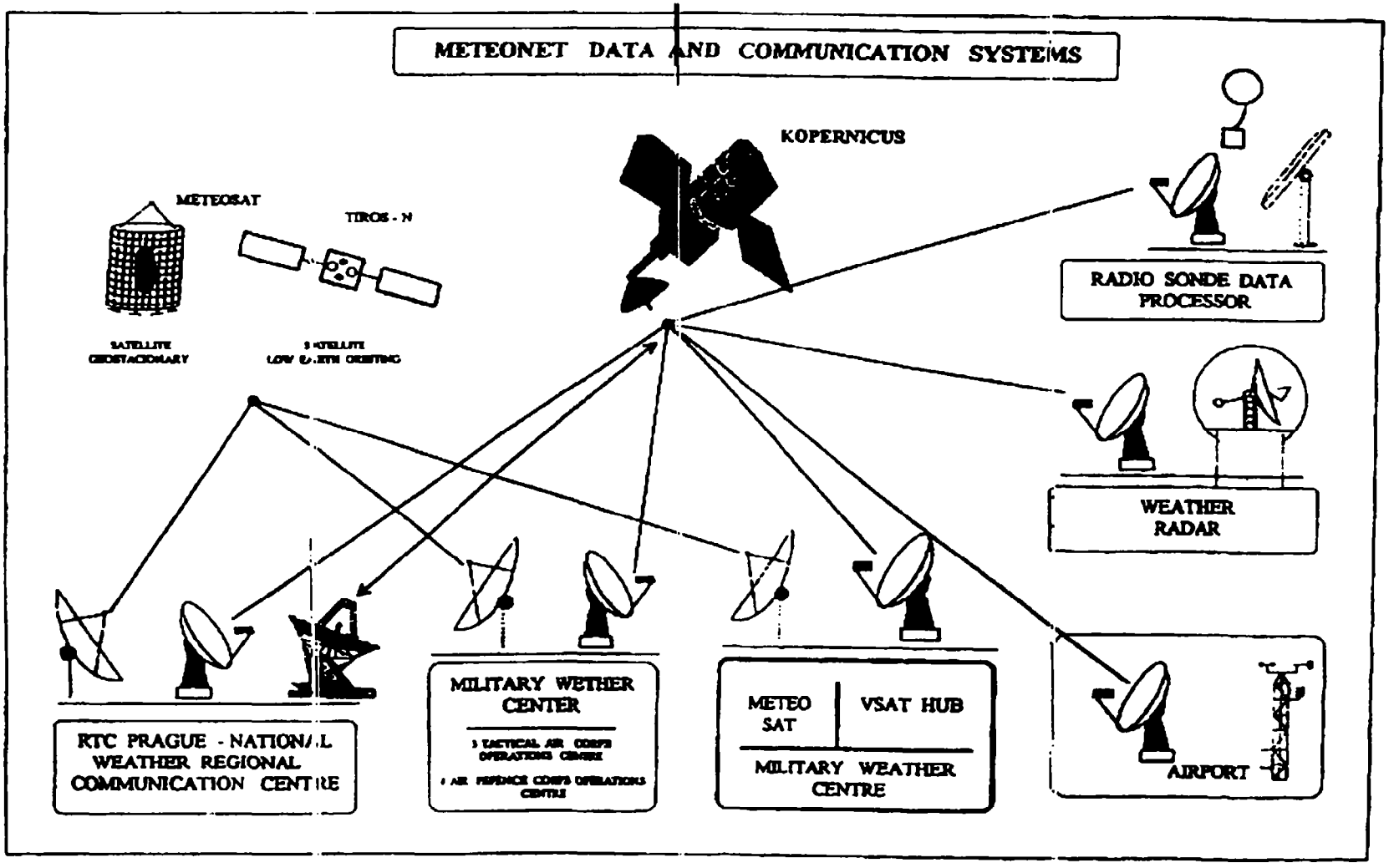


Figure 3C-2-IV

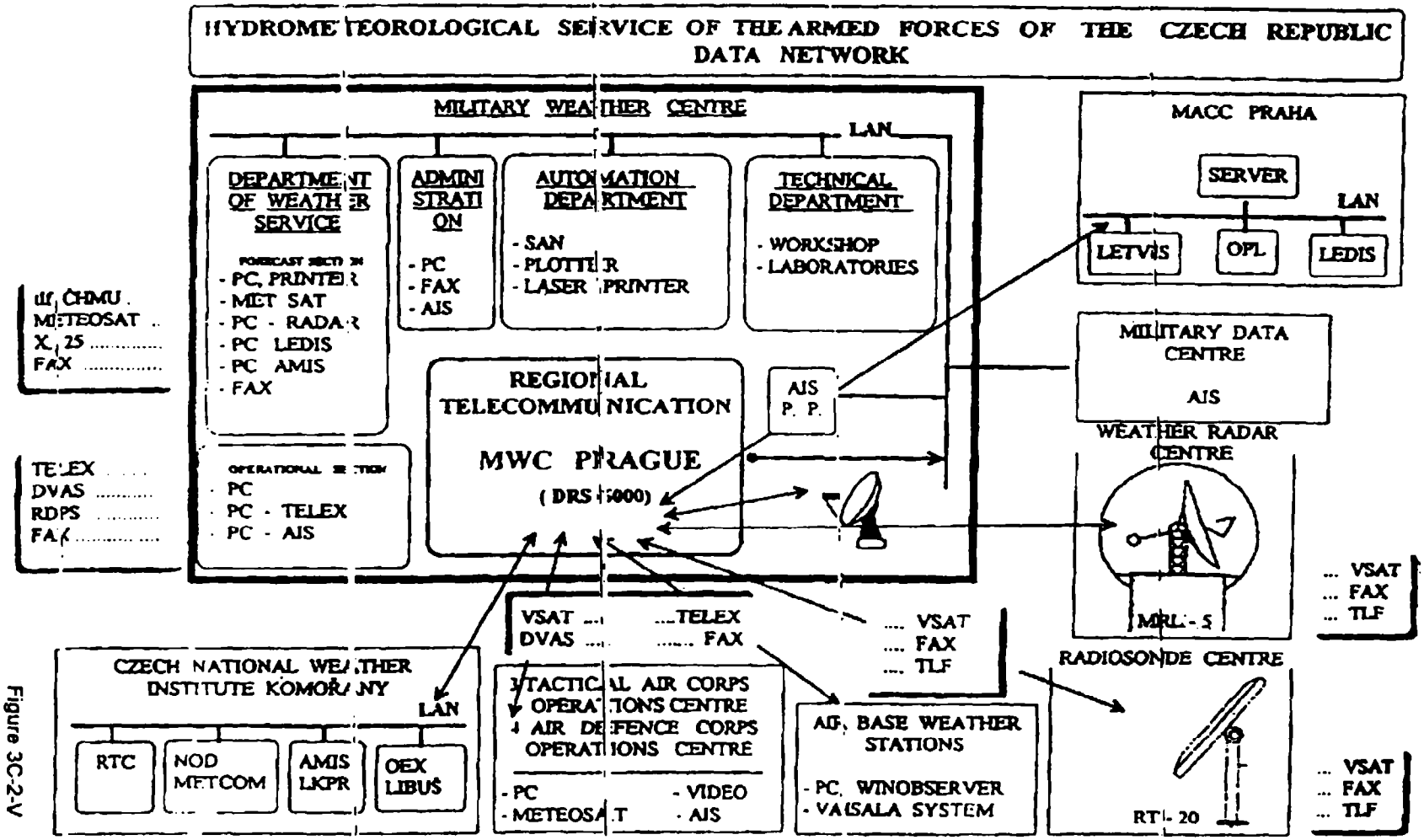

HYDROMETEOROLOGICAL SERVICE OF THE ARMED FORCES OF THE CZECH REPUBLIC
DATA NETWORK
MILITARY WEATHER CENTRE
LAN
DEPARTMENT OF WEATHER SERVICE
- PC, PRINTER
- MET SAT
- PC - RADAR
- PC LEDIS
- PC AMIS
- FAX
ADMINISTRATION
- PC
- FAX
- AIS
AUTOMATION DEPARTMENT
- SAN
- PLOTTER
- LASER PRINTER
TECHNICAL DEPARTMENT
- WORKSHOP
- LABORATORIES
REGIONAL TELECOMMUNICATION
MWC PRAGUE
(DRS 6000)
AIS P. P.
- PC
- PC - TELEX
- PC - AIS
CHMU
METEOSAT
X.25
FAX
TELEX
DVAS
RDPS
FAX
MACC PRAHA
SERVER
LAN
LETVIS
OPL
LEDIS
MILITARY DATA CENTRE
AIS
WEATHER RADAR CENTRE
MRL - 5
... VSAT
... FAX
... TLF
VSAT
DVAS
TELEX
FAX
.... VSAT
.... FAX
.... TLF
CZECH NATIONAL WEATHER INSTITUTE KOMORANY
LAN
RTC
NOD METCOM
AMIS LKPR
OEX LIBUS
TACTICAL AIR CORPS OPERATIONS CENTRE
AIR DEFENCE CORPS OPERATIONS CENTRE
- PC
- METEOSAT
- VIDEO
- AIS
AIR BASE WEATHER STATIONS
- PC, WINOBSERVER
- VAISALA SYSTEM
RADIOSONDE CENTRE
RT - 20
... VSAT
... FAX
... TLF

Figure 3C-2-V

HUNGARY'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.

There are two meteorological services in Hungary: The first one is the Hungarian Meteorological Service (HMS) responsible for non-military meteorological tasks. The second one is the Military Meteorological Service

A. Civil Meteorological Service whose name in Hungarian is "Orszagos Meteorologiai Szolgalat" (OMSZ) and in English is "Hungarian Meteorological Service" (HMS). It was established in 1870 and belongs under the control of the Ministry for Environmental Protection and Area Development (Figure 3C-3-1). The Central Office, the Forecasting and Data Centre of the HMS is located in Budapest. It operates 2 radio sounding stations, 3 weather radar stations, 25 synoptic main stations, 100 climatic and almost 650 rain-gauge stations in the observer system. It employs about 300 personnel. Its major fields of responsibility are as follows:

- The operation of air environmental observer (including the measuring of radioactivity as well), telecommunications, and data processing systems.
- General and special service on the past, present, and the prospective condition of the air environment for the governmental organizations.
- Public information on the basic pieces of the information of air environment.
- Aviation meteorological service for the civil air traffic and the supervision of the meteorological activity for aviation safety.
- Research and development activity.
- HMS sends a representative to WMO, RCLACE, and ICAO.

B. The organization of the military meteorological support is the Meteorological Service of HDF, and its leading organ is the Service Branch that is subordinated to the Operations Directorate of the General Staff. Its centre is located in Budapest in the building of the civil meteorological service. It operations 7 synoptic main stations and 3 radar stations, employs about 140 personnel, and has the following main areas of responsibility:

- Meteorological support for the HDF.
- Organizing and maintaining the national and international cooperation.
- Representation in the Aviation Meteorological Committee of WMO and in MCMG + CP.

2. If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.

The OMSZ| and the Meteorological Service of HDF are two completely independent organizations considering their organizational structure, supervision system and the financial issues. However, as the meteorological infrastructure is jointly operated, there has been a close professional relation

between the two institutions. The cooperation between the services is coordinated by a "Joint Committee" consisting of the leaders of the two services. The main tasks of the Committee are as follows:

- The standardization of the operation and the means of the joint meteorological infrastructure.
- To organize the exchange of the international and national information.
- The standardization of the forecasting methods.
- To organize cooperation in case of natural, industrial and nuclear catastrophes.

3. **Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.**

There is no meteorologist training in the armed forces. Our experts are trained - on civil basis - by the Budapest University Meteorology Department. The so-called "meteorologist I" full five-year training, the students are on a Hungarian Defence Forces scholarship. The so-called "Meteorologist II" level experts are training on a two-year course. After graduation there is a three month probation at one of our airports.

4 **Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.**

A. The Hungarian Defence Forces Military Meteorological Centre in Budapest is responsible for the meteorological support of the military staff, the air force and the land troops. Effective strength is 22 persons: 9 officers and 13 technician civil employees. In details: 1 commanding officer, 4 synoptic officers, 12 technicians and 1 administrator. Work time is permanent 24 hours, composition of shifts: 2 forecasting officers and 3 technicians.

B. The availability of international and national meteorological data are provided by the joint military-civil telecommunication computer. Source of data: GTS (Vienna, Prague), MOTNE (Vienna), ECMWF.

C. In forecasting we use one of an interactive workstation of a local network and one terminal connected to the telecommunication computer, an ECMWF workstation, and a terminal for representation of a meteorological satellite and digitalized image on a radar screen.

D. Used models: SMHI, Sweden, operated locally once a day (GRID, GRIB), ALADIN (GRID), NCEP Washington (GRID), DWD Offenbach (GRID, FAX), UKMO Bracknell (GRID), ECMWF (GRIB).

E. The Centre is responsible for the production of the following products: flight meteorological forecasts (12 hours, twice a day), flight meteorological forecast (24 hours, once a day), general orographic forecasts (72 hours, twice a week), mean wind data (twice a day), synoptic information (once a day), warnings for danger, data for extension model of contamination for chemical protection service (twice a day) and other forecasts (in extraordinary weather situation, exercises, IFOR, etc.)

5 **Briefly describe your meteorological support units which provide direct support to air forces.**

The airport based meteorological subunits' tasks are to support air operations and training flights. In general, the airport services consist of 5 officers (1 commanding officer, 4 synoptic officers) and 8 (or rather for one location 10) observing NCOs. Their work time is permanent 24 hours, in shifts. The development of computer workstations and automated observing system is in progress, planned for accomplishment by the end of 1997.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

There is no meteorological subunit at the land troops. They are indirectly supported by the Hungarian Defence Forces Military Meteorological Centre.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Not applicable.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Military Meteorological Centre, through NMC Budapest, has an access to the whole amount of data coming out on GTS. The meteorological services of military airports get selected data through our communication network. The Centre collects and transmits the observation data and TAFs of military airports through NMC Budapest.

structural organisation of the

HUNGARIAN METEOROLOGICAL SERVICE 1996

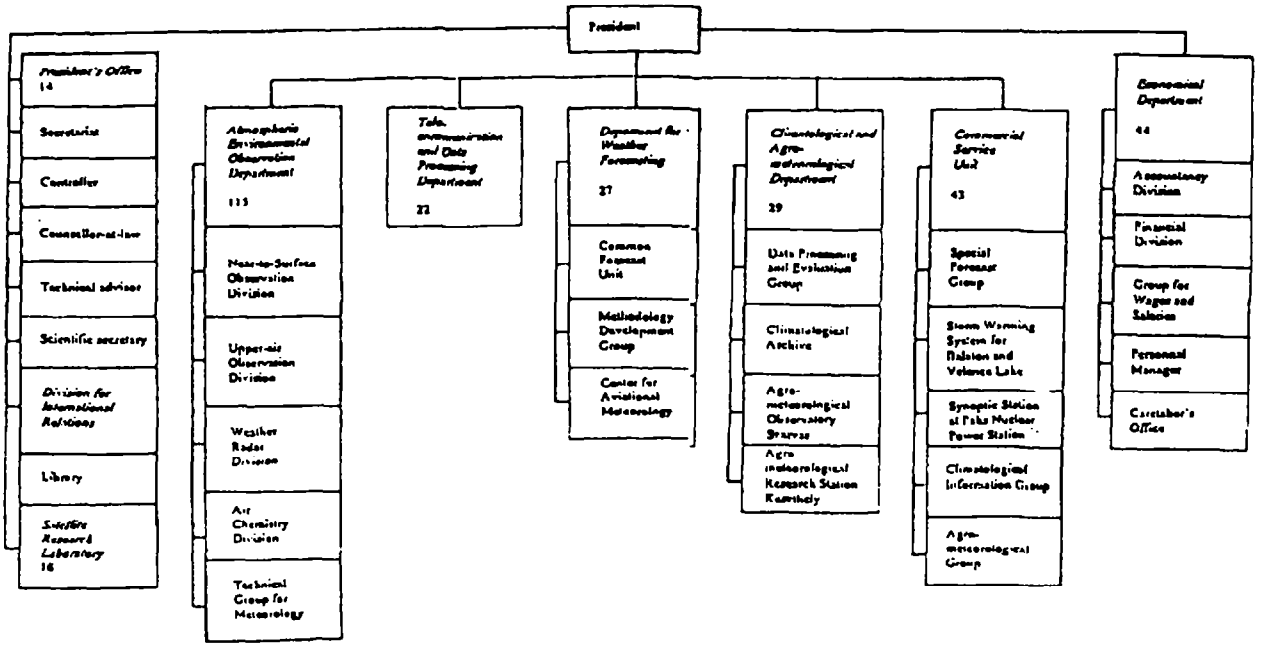


Figure 3C-3-I

ORIGINAL

Appendix 4
Annex C
Chapter 3

ROMANIA'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.

In Romania there are three institutions involved in meteorological activities:

A. The National Meteorological Service, called the National Institute of Meteorology and Hydrology (NIMH), founded in 1884 and organized as indicated in figure 3C-4-I. The central headquarters of NIMH is located in Bucharest. For meteorological purposes, NIMH operates with:

- 210 meteorological stations, out of which 176 have an hourly observation programme, the others carrying out climatic observations.
- 3 aerological observatories
- 7 radar observatories.
- 1412 pluviometric stations.

NIMH has 850 employees (meteorologists and hydrologists) in the central unit and the regional meteorological centres. The national meteorological network has 1250 employees. The NIMH has as main attributions:

- Elaboration of specialized scientific studies and researches.
- Elaboration of diagnoses and forecasts in operative regime.
- Elaboration and administration of the national data fund.
- Representation in the relationships with WMO, as the national authority in this field.

B. Meteorological service for civil aviation within ROMATSA (Romanian Air Traffic Services Administration) was created in 1991 by taking over the tasks for the aeronautical met assistance from the Department for Civil Aviation. Through ROMATSA, the meteorological service for civil aviation is reporting to the Ministry of Transports and is organized as depicted in figure 3C-4-II. From the meteorological point of view, ROMATSA is responsible for:

- The organization of aeronautical meteorological assistance in Romania for civil aviation.
- Supplying operators, flight crew members, air traffic services units, safety and rescue services units, airport managements and others with the necessary meteorological information.

The operational units are:

- Observing stations at each of the 17 civilian airports (four of them, Bucharest/Otopeni, Bucharest/Baneasa, Constanta and Timisoara are provided with new AWOS installed in 1996).

- 3 local area forecast centres on the airports Bucharest/Otopeni, Bucharest Bancasa and Constanta/M.Kogalniccanu.

- The meteorological watch office for Bucharest FIR, located on the Bucharest/Otopeni Airport.

Employing about 175 people, the main responsibilities of the above mentioned units are:

- Meteorological assistance for civil aviation.

- Aeronautical climatology

- Aeronautical meteorological telecommunications.

- Provides representatives and experts at ICAO and Eurocontrol in the field of aeronautical meteorology.

C. The organization for meteorological support to the military is the Air Force and Air Defence Meteorological Service, created in 1945 by separating from NIMH. It reports to the Ministry of National Defence, General Staff, Air Force and Air Defence Staff, and on request to Land Forces Staff, as indicated in figure 3C-4-III. The Headquarters are at Air Force and Air Defence HQ, Bucharest. It operates 3 METEO Wing, 19 Airbase Weather Stations (AWS), 15 Met cells for paratroops, 3 Met radars and 1 aerological observatory. Employing 430 people, its main responsibilities are:

- Meteorological support to the Armed Forces

- Military climatology

- Provides Romanian representative to MCMG+CP.

2. **If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.**

Establishment or consolidation into a single common forecasting service to meet all national requirements was not considered feasible. The coordination between the organizations presented at item 1 above is done through conventions agreed as legal regulations. These conventions:

- Determine the competence of each organization.

- Regulate the mutual exchanges of data and information.

- Establish the standard and methodological procedures and the basic systems (observing, telecommunications, and data processing), according to the WMO and ICAO standards, as well as the specific national requirements.

The creation of an inter-ministerial commission for the coordination and control of the meteorological activities at the national level is in view.

3. **Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.**

A. The MET officers attend a 4 year course conducted at the Air Force and Air Defense Academy (Brasov). After graduation, these officers attend a 9 month advanced forecasting course at the Air Force Training School - Meteorological Branch (Boboe) and after this they are certified as forecasting officers, and assigned to AFAD Staff Units.

B. Non-commissioned officers graduating from the Communications Military School (Sibiu) attend a 12 week specialization course conducted at the Air Force Training School, followed by 6 months probation period on the airbase level. Afterward, they are certified as MET assistants.

C. The conscripts attend a 6 week initial course conducted at the Air Force Training School, followed by a 3 month probation period. Afterwards, they are appointed as MET observers.

D. The civilian personnel graduating the Meteorological High-school (Arad) follow a 3 (6) month probation period on the airbase level. Upon completion, they are appointed as MET observers (assistants, respectively).

E. The civilian personnel graduating from universities (mathematics, atmosphere science, geography) are specialized on (sub)domains at NIMH and Air Force Training School for 9-12 months. After this, they are appointed as forecasters.

Dependent upon follow-on assignments, the forecasting personnel may attend a 12 week advanced forecasting course conducted at the Air Force Training School or the NIMH. We are going to develop a better cooperation with NATO members and Cooperation Partners for specializing military forecasting personnel at the Regional Area Forecasting Centres (military or civilians).

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.

A. The Military Forecasting Centre is responsible for meteorological support to Air Force, Air Defence, Paratroops and at request to Army Forces. It is located within the HQ Air Force and Air Defence in Bucharest. The MFC organizational structure consists of: 1 officer supervisor, 8 forecasters and 12 assistants on a shift system to ensure 24 hour per day coverage. Shift manning is 2 forecasters and 3 assistants.

B. The equipment used by the Centre include one interactive workstation (IMDP), two terminal stations (TMSDDN), one display for satellite (METEOSAT) and radar pictures and two semi-automatic sets for synoptic analyses.

C. The models used are mainly Bracknell (GRID), DWD (fax), and the National Institute of Meteorology and Hydrology (NIMH).

D. The centre is responsible for the daily issue of the following products: general forecast surface (twice a day), nowcasts (4 times a day), hourly informative bulletin, warnings, wind data for Air Defence Artillery (4 times a day) and many other specific forecasts (precipitation, snow cover, road status etc.)

5 Briefly describe your meteorological support units which provide direct support to air forces.

A. Airbase Weather Stations in direct support of flight operations are located on airbases. A standard AWS is composed of 1 supervisor (officer), 4 forecasters and 3 observers. The work is organised in shifts. Each unit has 2 radio-teletype sets, 2 radio-facsimile sets and one semi-automatic observing station.

B. The models used (mentioned in the previous paragraph) are received by radio-facsimile from the originators or by fax from the Military Forecasting Centre. A semi-automatic synoptic analysis is also used.

C. The unit is responsible for the daily morning briefing to air crews, for special briefings on request, for the local general forecast, for the support to operations (target area, route forecast, night flying), for the permanent weather watch, hourly MET bulletins, forecast on request for land forces, for the local applicable warnings, and for TAF messages elaboration (every 6 hours).

D. A project for the automation of primary and processed MET data dissemination is planned for 197-1998, after the installation of a MET Messages Switching System at NIMH and connection to GTS (9600 bps, protocol X.25).

6 Briefly describe your meteorological support units which provide direct support to your land forces.

Similar support is provided to paratroops and, on request, to land forces. Additional support can be provided to these units upon deployment, using mobile equipment.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Naval units receive forecast products via their own operational links and naval officers are trained for interpretation of those products. Hydrometeorological section in Maritime Hydrographic Directorate coordinates this activity.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Military Forecast Centre has access to the GTS circuit for selected data via NCTc (line NIMH/Bucharest - Moskow, protocol X-25, level 2) and is the gateway from the GTS for Romanian military airfields. Supplementary communication links exist between MFC and National Aeronautical Meteorological Centre/ROMATSA as well as between the aerodrome observing stations and the appropriate Regional Forecasting Centres/NIMH (protocol X-25, level 2). For 1997 a project is envisaged to automate the MET data dissemination for all the Romanian military air bases, after the MMSS has been installed and X-25 protocol has been implemented in the telecommunication military network.

9. Any additional information you desire to include.

Each AWS maintains a Mobile Meteorological Unit (MMU) for support of units deployed on the unknown terrains or alternate airfields. MMU equipment consist on special cases mounted on a van and include the following capabilities: one RTT set, one RFT set, one set for semi-automatic synoptic analysis and one mobile observing station. In the period 1997-2000, this equipment, having a Russian origin, is to be replaced with MMU, type Vaisala, from Finland, provided with: one MDD receiver/display terminal, one TSMDDN with dial-up capability (military or civilian lines) and one mobile observing station.

STRUCTURE NIMH

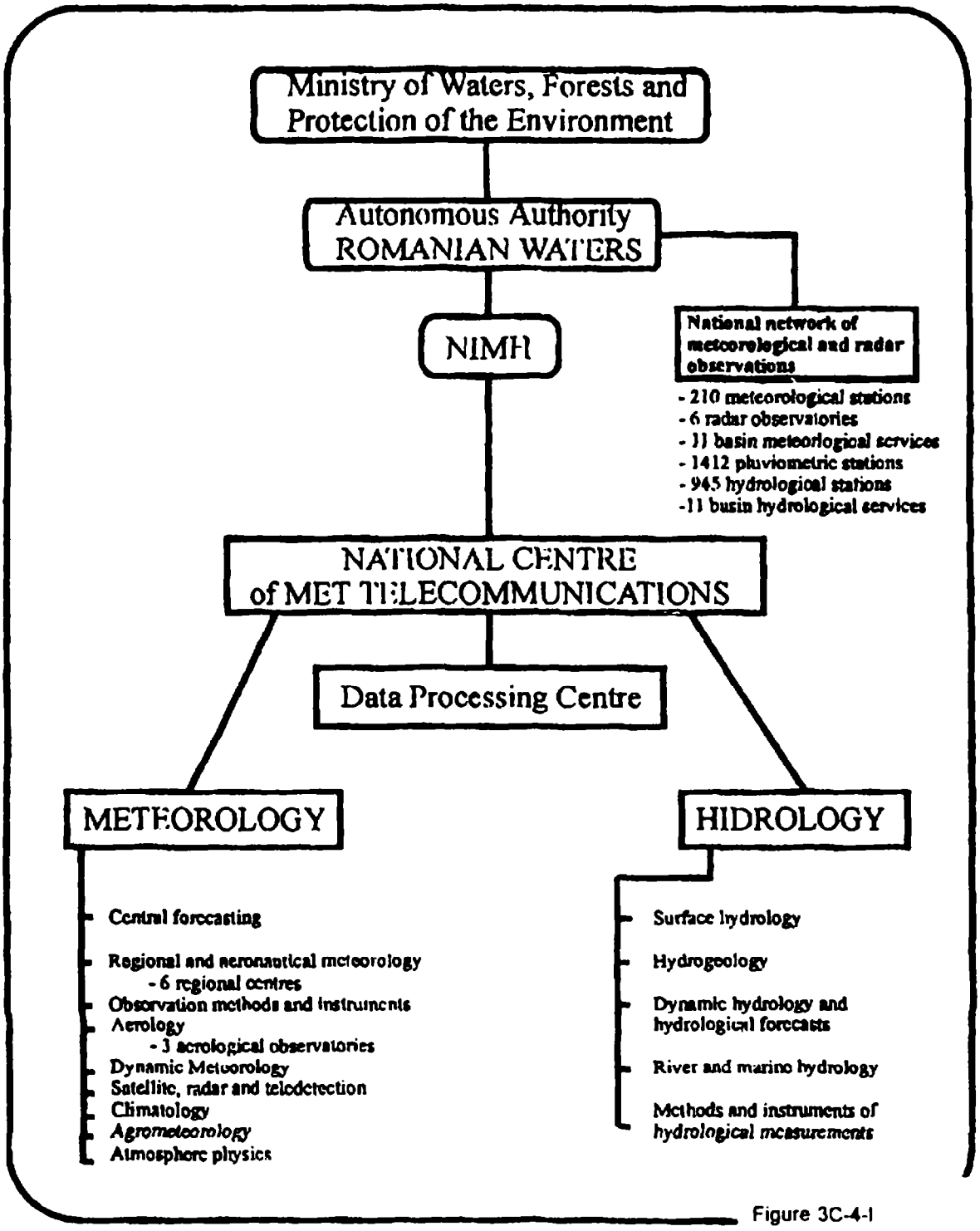


Figure 3C-4-I

STRUCTURI MET ROMATSA

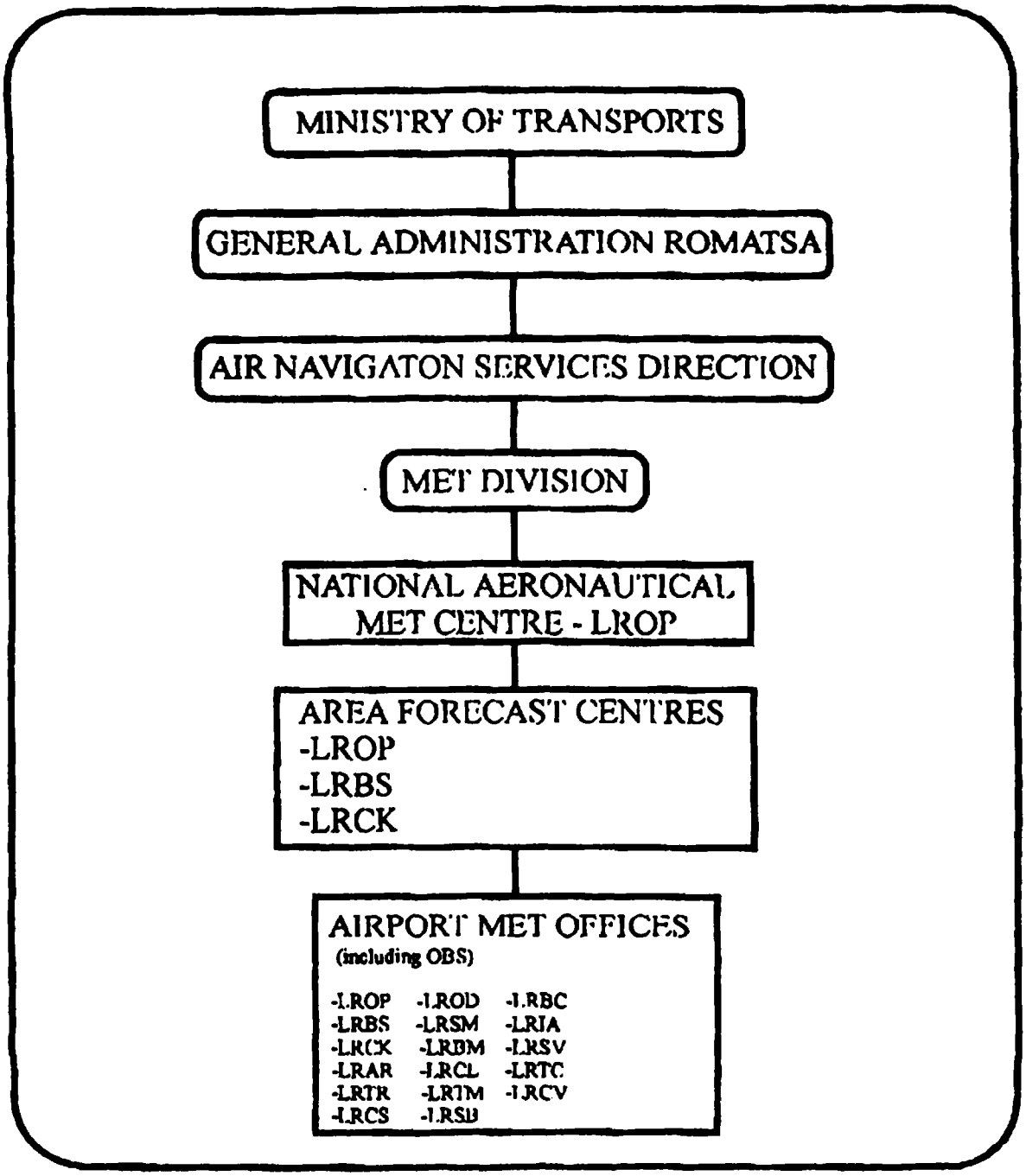


Figure 3C-4-II

MILITARY MET SERVICE STRUCTURE

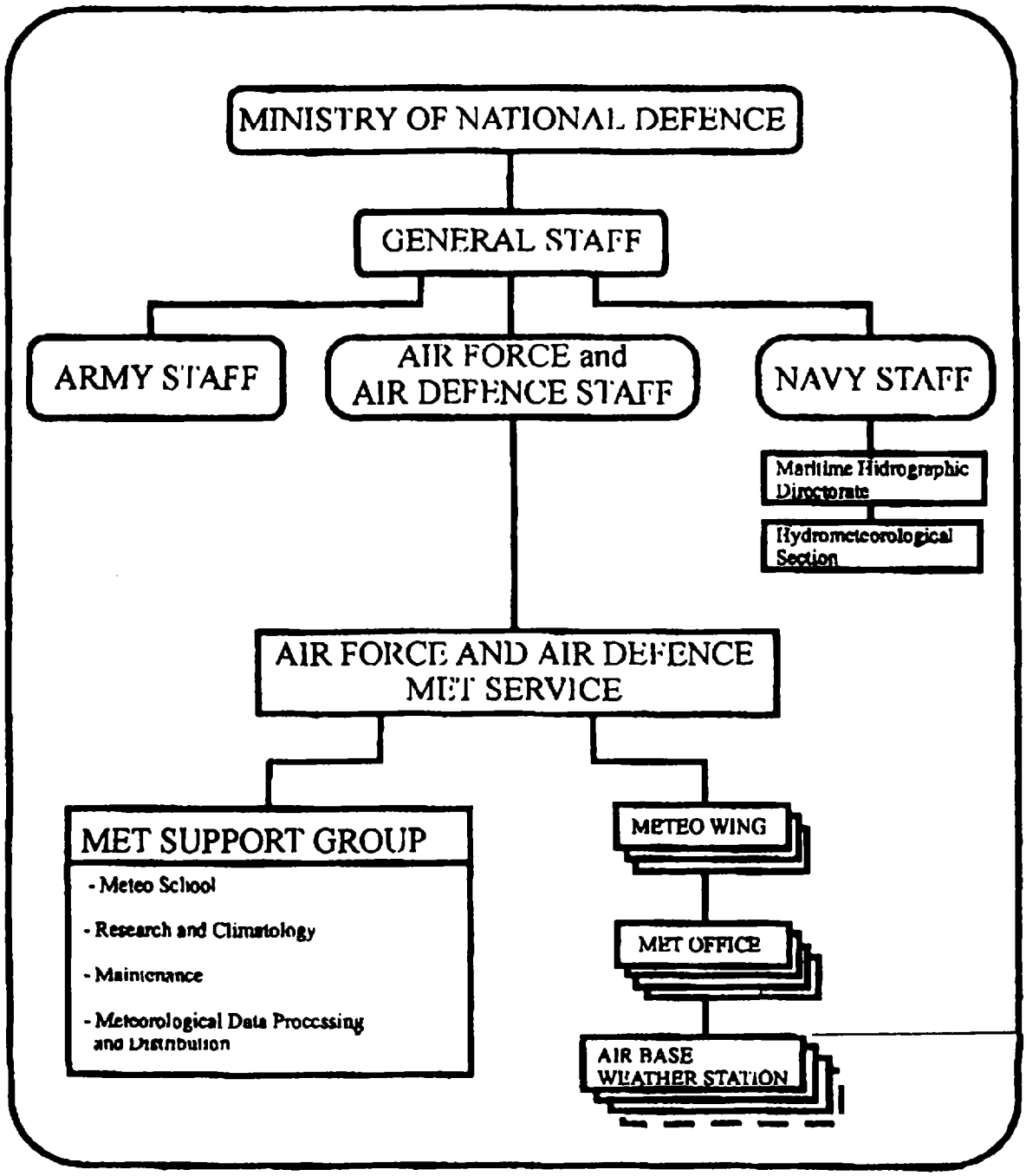


Figure 3C-4-III

ORIGINAL
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Appendix 5
Annex C
Chapter 3

SLOVENIA'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. **Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.**

Hydrometeorological Institute of Slovenia covers all the needs for meteorological support in Slovenia. It reports to the Ministry of environment and physical planning. Organizational structure is shown in figure 3C-5-I.

2. **If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.**

There is only one meteorological organization in Slovenia.

3. **Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.**

There is no special training organized for forecasters supporting the military in Slovenia. All the civil forecasters, who also provide necessary support to the military, have finished a 4 year study of meteorology at Faculty of Physics in Ljubljana. Additionally, they have attended several courses at ECMWF, DWD, and Meteo-France.

4 **Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.**

A. There is no special forecasting center supporting the military. The weather forecasting section of Hydromet Institute is divided into two sub-sections.

- Weather forecasts sub-section deals with forecasts for media and development of new methods and techniques as well as numerical models. It is located in Ljubljana city. It employs 10 forecasters and 7 assistants. The operational forecaster is present from 0230 UTC to 1830 UTC every day, the assistant 24 hours a day.

- Meteorological air traffic protection sub-section deals with forecasts for civil aviation and is located at Ljubljana-airport. It employs 4 forecasters and 8 assistants. The forecaster is present from 0600 local time to 2000 local time every day, the assistant 24 hours a day. There are plans to begin a 24 hour job in one of the two sub-sections in 1997.

B. Hydromet is connected to GTS and MOTNE via RTH-Wien. Numerical models used are DWD (fax), ECMWF (GRIB), LACE (GRIB) and Meteo-France (GRIB). The computer and communication center is based on micro-VAX technology, but weather forecasts sub-section also operates 3 workstations and several PCs used as X-terminals. The Institute operates a PDUS Meteosat receiving station and a 5 cm weather radar. The Institute operates 22 synoptic stations and about 40 automatic meteorological stations. Recently, the Institute started to run a workstation version of the mesoscale model Aladin with a horizontal resolution of 10 km. The Institute output products are textual and graphic weather forecasts and meteorological warnings.

5 Briefly describe your meteorological support units which provide direct support to air forces.

The Institute's meteorological air traffic protection sub-section located at Ljubljana airport provides meteorological support to air bases. This unit is connected to the central computer in Ljubljana city, so an identical set of data is available to them. The work of the unit is oriented more towards short range forecasting (partly nowcasting). The sub-section is responsible for producing the TAF (every 3 hours) and for briefings and warnings.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

The weather forecasts sub-section provides such forecasts on request.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Both sub-sections of the Institute's forecasting service are able to provide some information on request.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

The Institute is connect to GTS and MOTNE (using MSS software for exchanging bulletins) via RTH-Wien using dedicated line (9600 bps, X.25 protocol).

9. Any additional information you desire to include.

Hydrometeorological Institute (together with military-civil protection authorities) maintains one mobile meteorological/hydrological unit. Its equipment consists of: automatic meteorological station (temperature, humidity, 10m wind, air pressure), radiation dose rate sensor, some hydrological equipment, mobile tel/modem and mobile radio station. There are plans to upgrade the equipment with PC computer, mobile SDUS Meteosat receiver, and GPS satellite navigation unit.

HYDROMETEOROLOGICAL INSTITUTE OF SLOVENIA

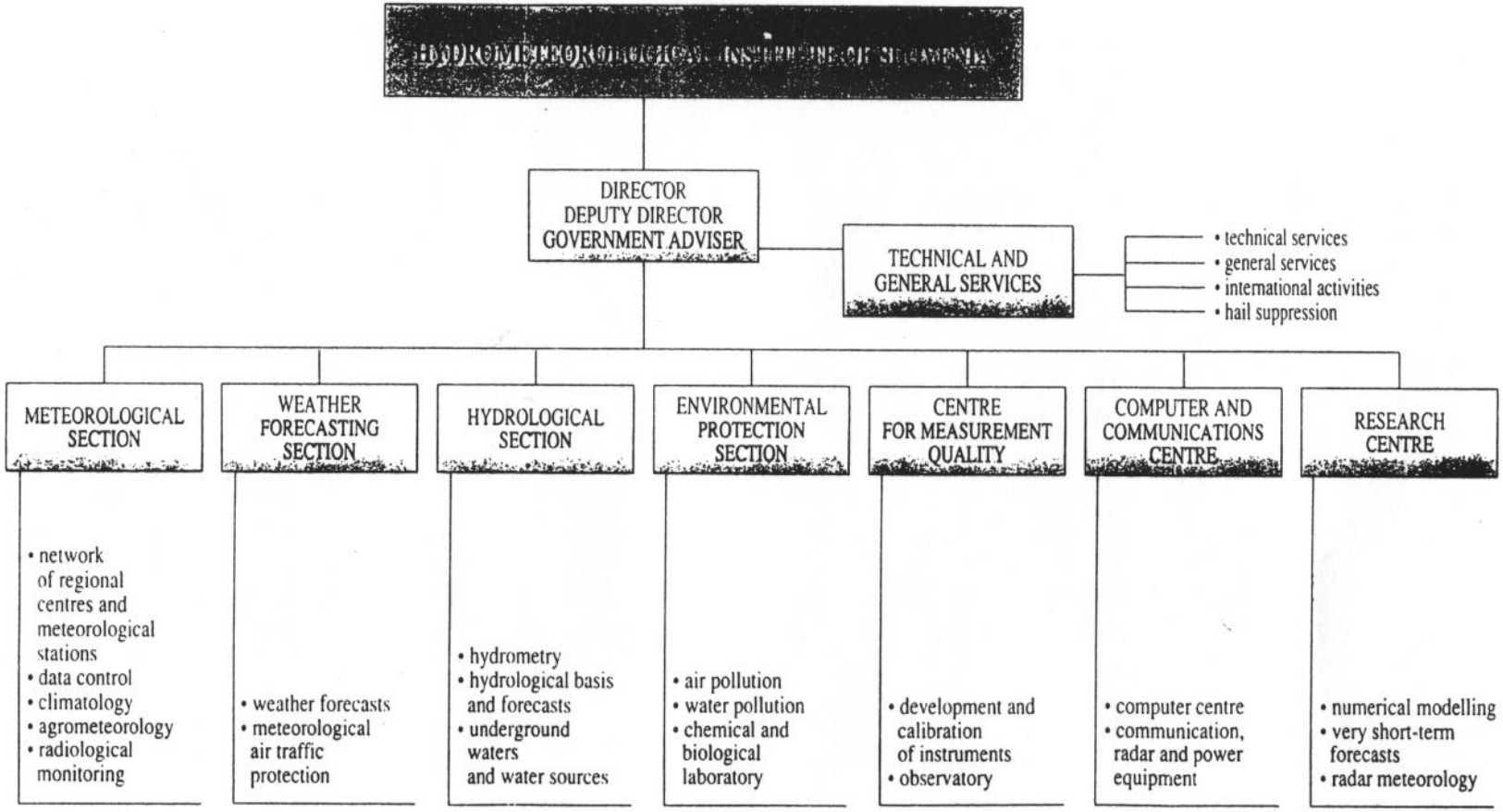


Figure 3C-5-I

Appendix 6
Annex C
Chapter 3

SWEDEN'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.

The Swedish Meteorological and Hydrological Institute, SMHI, is the national authority for meteorology in Sweden. The agency reports to the Ministry of Communications. SMHI forecasting center and central administration is located in Norrkoping. Regional forecasting centers, FCs, are run at Sundsvall/Harnosand, Stockholm/Arlanda, Gothenburg/Landvetter and Malmo/Sturup airports. These regional FCs are run partly on behalf of the Swedish Civil Aviation Administration that has the formal responsibility for providing met service to civil aviation.

SMHI provides weather forecasting and climatological service to the public and to national authorities. It also provides forecasting service to customers on the commercial market. SMHI also runs the national network of meteorological observation stations and the national network of weather radar stations. SMHI is the authority representing Sweden in international meteorological agencies such as WMO, EUMETSAT, ECOMET, etc. For organization structure of SMHI, see figure 3C-6-I.

The National Board of Roads, reporting also to Ministry of Communications, runs an additional network of weather observation stations along main roads. That network is designed for road maintenance purposes. For forecasting the National Board of Roads is depending on SMHI. Therefore, data from the road observation stations is made available at SMHI.

The Swedish Armed Forces, FM provides its own weather forecasting service at military air bases and military forecasting centers. Weather service staff belongs to the armed forces, met officer being military officers attending military schools as well as met institutions at a recognised university during their education. Civilian staff members work as assistant met officers. Conscripts are trained to take observations and provide the observations at military air fields as a part of their training under varying degrees of supervision due to growth of competence. The main tasks for met officers at air base weather service sites is to provide tailor made forecasts for different military activities and weather surveillance, especially for flight operations. Guidance on use of meteorological information at decision making is an important issue for the trained met officers.

2. If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.

FM is closely cooperating with SMHI:
In the field of met observations:

- FM is running some of the observation stations in the national network at the Air Force bases.
- FM owns and is running 6 of the weather radar stations in the national network.
- Lightning detection information and weather satellite data is collected and processed by SMHI and is provided to FM.

In the field of forecasting:

- FM depend on SMHI for NWP using data from the high resolution limited area model, HIRLAM, run by SMHI, and from the ECMWF, provided via SMHI.

- Man-made analyses and forecasting analyses from SMHI are disseminated to military forecasting units as background material.

In the field of R&D, the two organisations are sending personnel to work together in joint development projects and sharing costs for these projects.

In the field of education, training courses of mature interest are being planned in cooperation and carried through using instructors from both organizations.

The above related means that FM and SMHI very much depend on one another. The cooperation is based on mutual interest in economising weather service. FM pays 25% of the costs for infrastructure in the field of meteorology. This infrastructure is defined as:

- The agreed basic SYNOP observation network, comprising ... stations, of which many are automated.
- The weather radar network, comprised of 11 stations.
- Satellite receiving and processing facilities.
- The lightning detection system.
- The resources for production and distribution of NWP and man-made analysis.

Cooperation between FM and SMHI is regulated in an agreement that states mutual exchange of information on plans of operation and for future procurement of material. Twice a year directors meet for exchange of information and ideas. Working groups in the different fields of cooperation are also meeting regularly or when needed.

Through the years many investigations have examined ideas of joining weather service under one single administration based on the impression that weather is the same disregarding who wants to know about it. These investigations have brought about the insight that in the field of weather service, the service part is as much essential as the weather part of the expression. By putting economic strains on both parties, the government has secured that possibilities of avoiding duplicative work will be taken care of.

The relations between Sweden's two main weather service producers today are excellent and under question from none of the involved parties.

3. **Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.**

Forecasting officers in FM are commissioned officers or officers in the reserve, the latter category mainly being a resource in the organization for war. Education in meteorology is about the same for both categories comprising of 3-4 years university studies. Commissioned officers also attend military schools like other categories of Air Force officers.

Practical training as forecasters under supervision of trained colleagues follows graduation from university. Normal length of training is about 4 months after which met officers are licensed to take full responsibility as forecaster at air bases. 6 weeks of completing training is given to forecasters before entering service in forecasting centers which requires some 3-4 years of air base service in advance.

Flying training as a navigator is part of forecasters eduction, flying weather reconnaissance flights being one of the duties for FM met officers.

Selected met officers are being sent for two years of post graduate studies at university. Meteorology topics of special interest to military are studies within the frame of higher university

courses, enhanced knowledge of scientific methodology being the main educational goal. Met officers with higher university training may stay in positions in which forecasting duties still is part of the job. This gives them opportunity to transfer their knowledge to younger and less experienced colleagues.

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, work station processing and computing capability, numerical models used or run on site, and output products.

Three forecasting centers are organized. All three centers are manned during daytime. During nights, weekends, and holidays, normally one center is responsible for all military weather service. Their main duties are to provide:

- basic forecasting support to local forecasting units.
- Distant weather support to military units lacking or for the time being not running weather service resources of their own.
- weather forecasting and consulting to co-located military units and commands.

Weather centers also provide weather surveillance regarding single military flying activities when local weather forecasting units are not in operation at the airports involved.

Forecasting centers also are hubs in MILMET, a data distribution and handling system linking together all forecasting units in FM. (Links from MILMET to military information systems are to be established shortly.)

MILMET uses work stations (SUN Spark 10 and others). Work stations are available not only in the centers but at every forecasting unit. A central administration unit is organized in one of the centers.

The SMHI data unit for producing HIRLAM is co-located with one of the military forecasting centers. Total number of forecasters in the three centers all together is about 30.

Data available in the centers includes:

- observation station reports (SYNOP, METAR from Europe. Information from the rest of the world may be made available on request.
- weather radar information covering most of Sweden and Finland and parts of Denmark and Norway.
- Weather satellite pictures from METEOSAT and NOAA polar satellites. (Data is coming via SMHI in original and processed in the form of RGB and cloud classification pictures.)
- HIRLAM products every 6 hours.
- Medium range forecasts every day (ECMWF).
- A selected amount of TAF coming in daily (can be completed on request via SMHI to the extent messages are available in communication hubs in Europe).
- Lightning location data.

A fairly great proportion of the above mentioned data is sent out to local units forming a distributed data base to be used by met officers to tailor forecasts for every single need.

Via fax manually produced flight weather analyses and forecasts are distributed from the centers.

Forecasts are also sent out by fax to military commands without forecasting staff of their own.

5 Briefly describe your meteorological support units which provide direct support to air forces.

Forecasting units are established at the Air Force stations and at Army and Navy helicopter units. Weather service staff is integrated in the main unit that they are serving. Every unit comprises of 3-4- met officers (ranks from LT to LTCOL) and normally one civilian met assistant. 8-12 conscripts serving for about one year are being trained at the units. Observation sites and forecasting sites are co-located to make it possible for forecasters to supervise observation service/training during flying time. After some months of training observers are allowed to work on their own during non-flying hours and later on may be approved to take observations on their own responsibility also during flying hours.

Forecasting service to flying squadrons comprises daily morning and afternoon briefings followed by weather surveillance, meaning that information on any weather event influencing the flying activities announced at the briefings is given to flying squadrons should it divert from given forecast or should more precise information on it become available after briefing. At briefings mostly carried out via CCTV, flying personnel are in position to discuss on given information and relation to planned activities and to request additional information if needed. Briefings normally are carried out by fully qualified forecasters who take responsibility for the information provided no matter who prepared the different kinds of forecasts that make up the information. ATS personnel attend briefings via their CCTV sets and get the same information and service as the squadrons.

As mentioned above, local units have access to a distributed database of great magnitude.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

Support to land units is given mainly by weather centers. Units closely located to air bases, temporarily or permanent, may turn to air base weather unit for support. Information asked for mostly consists of upper wind forecasts for artillery or AAA general forecasts for outdoors activities including information on snowfall and conditions for driving on roads and in the terrain.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Support to maritime forces is given by weather centers and by forecasting units at Navy helicopter bases. Daily routine forecasts are transmitted by fax. Special forecasts can be asked for when weather sensitive activities are being planned or carried out.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

FM gets access to meteorological data available on the GTS as well as other information from SMHI via data communication networks. General telephone lines serve as back up for exclusive connections (x.25 protocol, 64 kbps). Between weather centers, data is transferred by 64 kbps connections. For local units, 9 kbps lines are available. General telephone network is back up.

9. Any additional information you desire to include.

A unit providing climatological material and consulting for military planning purpose is available, located to one of the forecasting centers.

SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE

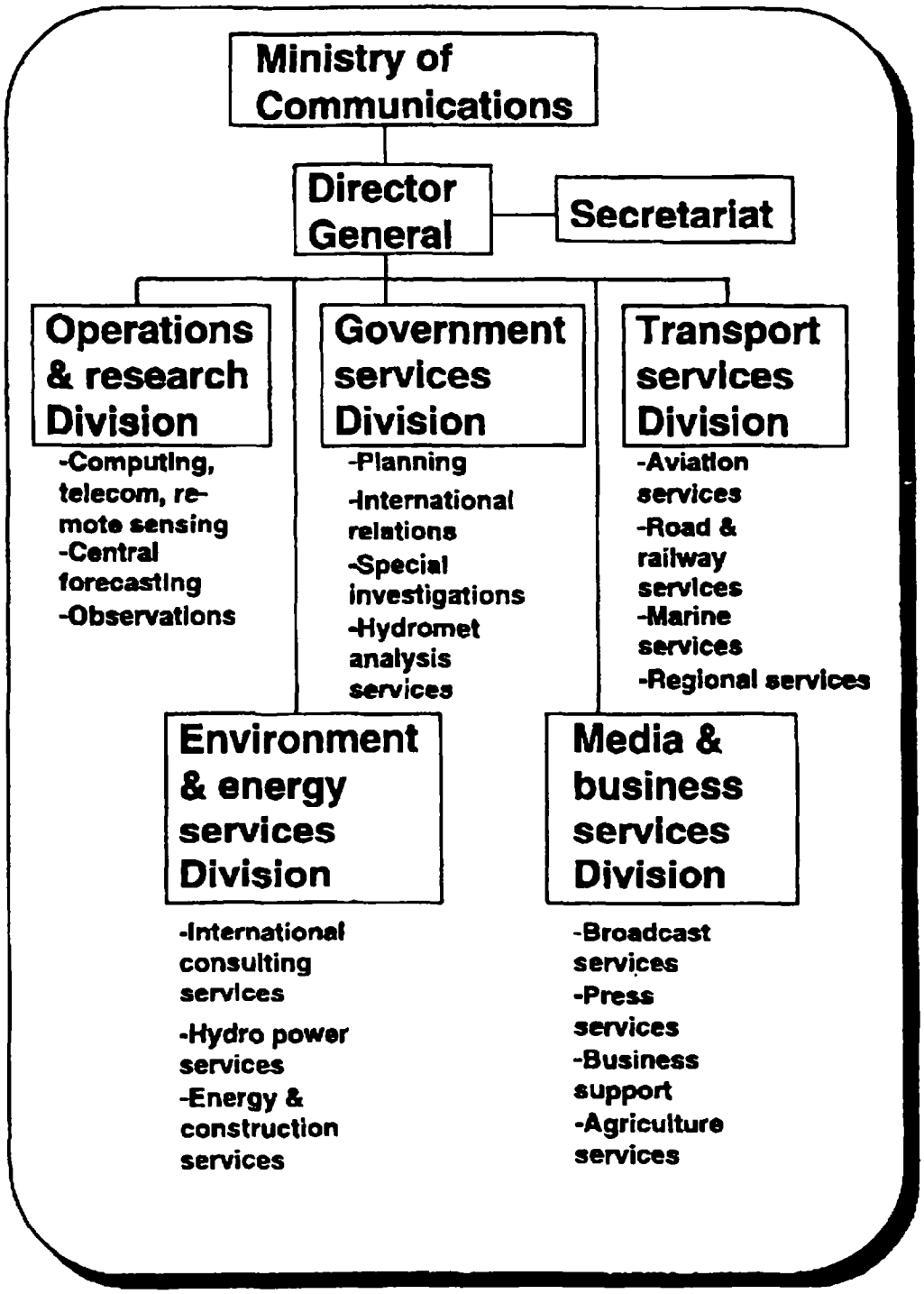


Figure 3C-6-I

Appendix 7
Annex C
Chapter 3

UKRAINE'S METEOROLOGICAL ORGANIZATION AND CAPABILITIES

Updated: Aug 96

1. **Briefly describe the organizational structure of the meteorological services of your nation. Please include a diagram depicting the organizational structure for each service and outline responsibilities and major facilities of each organization.**

Ukraine has two main meteorological organizations:

A. Civil service named "State Committee of Ukraine for Hydro meteorology" (SCUH) was created in 1921 and reports to the Cabinet of Ministers of Ukraine (see organizational diagram at figure 3C-7-I). The headquarters of SCUH are located in Kyiv. The committee includes 209 meteorological stations (75) of which are the correspondents of an international information exchange, 35 aviation meteorological stations). It employs about 5000 persons. 371 hydrological points are located on 6 largest river basins and 60 hydrological points - on lakes and reservoirs. Sea hydrological observations are conducted in 18 stations and 18 sea points along the Black and Azov sea coasts.

SCUH provides:

- Activity and development of the state observation system;
- Collection, processing, distribution and storage of hydrometeorlogical information about environmental pollution;
- Implementation of the state policy in the field of hydrometeorology and radioactive observations;
- Provision of hydrometeorlogical forecasts and warnings to consumers;
- Development of hydrometeorlogical science and methodology in the field of hydrometeorlogical observations;
- Participation in international cooperation according to the World Meteorological Organization (WMO) and other international organization plans.

B. Hydrometeorlogical service of the Armed Forces of Ukraine (HSAFU) is responsible for the hydrometeorlogical data supply to the Armed Forces (organization diagram at figure 3C-7-II). It was created in 1991 and reports to the Head of the General Staff. It includes hydrometeorlogical services relevant to the Armed Forces, its units and formations and is responsible for:

- Meteorological data supply for the troops;
- Application of climatology in military related issues;
- Interaction with SCUH.

2. **If your nation has more than one meteorological organization, briefly describe the level of coordination among these organizations and how it is achieved.**

SCUH realizes its cooperation with HSAFU within the framework of "Regulations on hydrometeorlogical provision of the Armed Forces by SCUH". Concrete types, amounts and terms of information exchange are determined in "the Plan for hydrometeorlogical provision of the Armed Forces of Ukraine" which has been structured and approved taking into account the main hydrometeorlogical center needs and capabilities of the State Committee of Ukraine for Hydrometeorology.

Hydrometeorlogical service of the Armed Forces interacts with SCUH in hydrometeorlogical exchange of information according to the special regulations.

3. Briefly describe the educational background or training pipeline for forecasters in your national meteorological organization supporting the military.

The Russian Hydrometeorology Skills Improvement College regularly conducts extension courses for SCUH specialists. The training is also carried out by the WMO.

Engineers' training for the hydrometeorlogical service of the Armed Forces is conducted in the military department of the State hydrometeorlogical institute. Meteo observers, technicians and other junior specialists are trained in educational subsections.

4 Briefly describe your primary forecasting center supporting the military, including size, sources of data, workstation processing and computing capability, numerical models used or run on site, and output products.

A. Ukraine hydrometeorlogical center in Kiev is the data processing and operational organization and also the main operating and methodological center of SCUH. The center is divided into the following departments:

- Meteorological forecasts department;
- Agricultural forecasts department;
- Hydrological forecasts department;
- Numeric methods of weather forecast and environmental pollution forecasts department;
- Hydrometeorlogical data supply department.

Ukraine hydrometeorlogical center conducts processing, analysis and distribution of operative data for hydrometeorlogical observations:

- Works out various forecasts, storm warnings about dangerous hydrometeorlogical phenomena, large-scale air pollution;
- Provides consumers with forecasts, warnings, inquiries (references) about hydrometeorlogical conditions and other information;
- Directs working process of the SCUH industrial process organizations on providing the information about actual and upcoming hydrometeorlogical conditions and other information to the bodies of State power, fields of economy, defence organizations, mass-media and population.

Besides there is the Black and Azov seas Hydrometeorlogical center in Odessa, 23 regional centers on hydrometeorology and 23 aviation meteorological stations.

When working out meteorological forecasts, computer calculation and also materials in graphic forms and as facsimile charts received from the World Data Center (Russia), specialized meteorological centers in Offenbach (GE) and Bracknell (UK), European Center of the medium range weather forecasts (for the 5 day period) and also meteorological satellite materials are used.

Ukrainian hydrometeorlogical centers use the data supplied by the orbit satellites NOAA-II (USA).

B. The leading forecasting, informative and coordinative body of the hydrometeorlogical service of the Armed Forces of Ukraine is the Main hydrometeorlogical center. It provides all kinds of meteorological information to the General Staff of the Armed Forces, staffs, hydrometeorlogical units and formations of the Armed Forces.

The Main hydrometeorlogical center is the subscriber of the WMO network, conducts coordinative functions with SCUH and has computing center at its disposal.

5 Briefly describe your meteorological support units which provide direct support to air forces.

Meteorological support units are located on the air bases in direct support of flight operation. They are responsible for the issue of 24, 12, and 6 hour forecasts, conduct meteorological observations, meteorological information to flight workstation and flight guidance group.

6 Briefly describe your meteorological support units which provide direct support to your land forces.

Land forces are provided with general weather forecasts and storm warnings about dangerous and elemental phenomena by the SCUH departments according to their location.

7 Briefly describe your meteorological support units which provide direct support to your maritime forces.

Hydrometeorlogical service provides Maritime forces with hydrometeorlogical information. It operates hydrometeorlogical units and provides hydrometeorlogical information to ships.

8. Briefly describe the extent and type of data communications within the organization supporting the military, and its access to international networks.

There is a communications channel between Telecommunication System Main Center and Main Control Hydrometeorlogical Center of the Armed Forces through which information and production exchange is conducted. SCUH represents Ukraine in the WMO (the IV Regional association) and is also the member of Interstate Council on CIS states meteorology.

Hydrometeorlogical service of the Armed Forces uses general military communication means. Main Hydrometeorlogical Center of the Armed Forces has the access to international networks through SCUH.

Hydrometeorological service of Ukraine

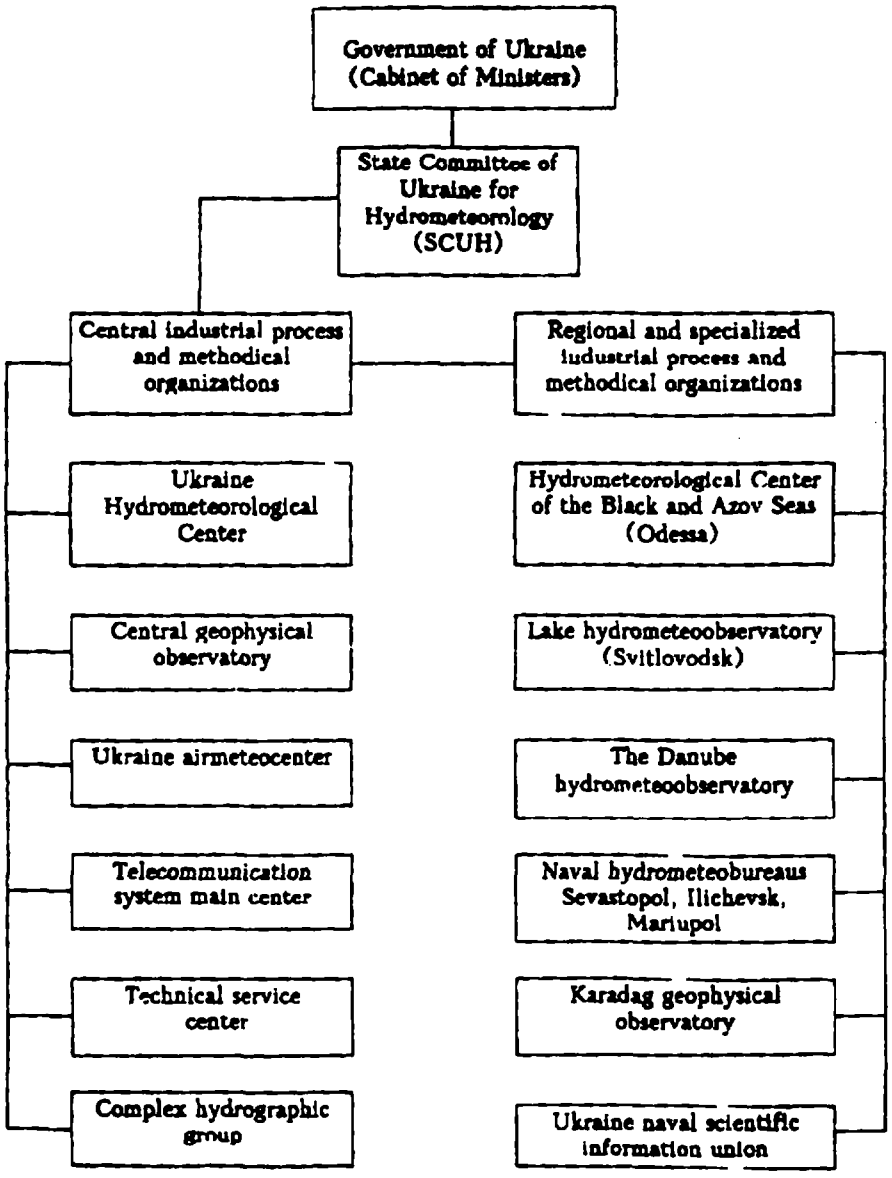


Figure 3C-7-1

Hydrological service of the Armed Forces (structure)

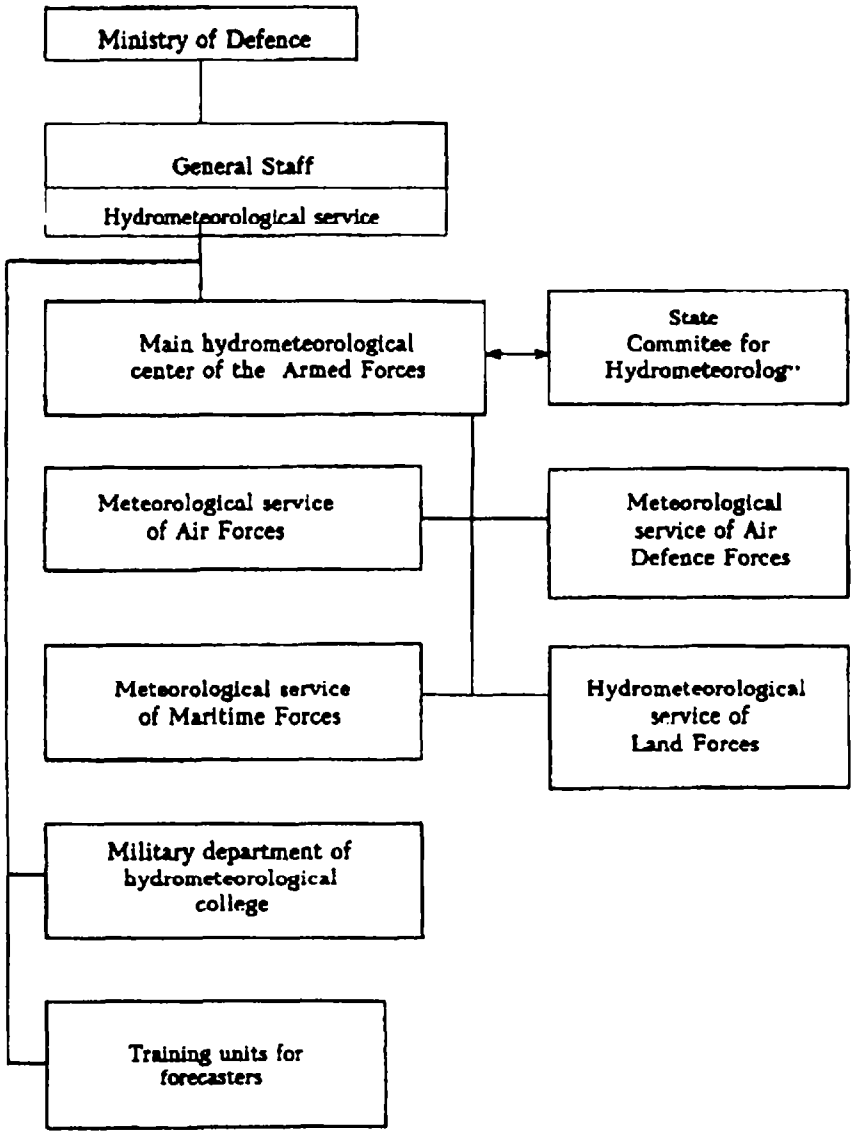


Figure 3C-7-II

CHAPTER 4

METEOROLOGICAL SUPPORT TO NATO COMMAND HEADQUARTERS

Reference: A. Guidelines for Meteorological Support to NATO and PfP Forces (Draft MCMG + CP document)

INTRODUCTION

401. Figure 2-II and Annexes A and B of this chapter give details of the NATO Military Command structure. NATO military commanders may be:

a. Full-time NATO appointments,

b. Dual-hatted NATO and national appointments with separate NATO and national staffs which may be collocated or in different locations, or

c. National appointments which become NATO in wartime. The staff is normally national, but carries out NATO tasks in peacetime, when required.

402. A NATO commander may be located in:

a. An international headquarters which has only an international NATO staff (I),

b. A national headquarters with an international NATO staff collocated with the national staff (C), or

c. A national headquarters with a national staff that has a dual-hatted NATO role (N).

The letters (I), (C) and (N) relate to Column 2 of the Appendices to Annexes A and B.

403. In addition to peacetime headquarters (PHQ), each commander may have a separte wartime headquarters (WHQ). Some maritime and land force commanders will be located with mobile operational units in wartime.

404. At the higher levels of the NATO command structure, NATO commanders have broad responsibilities covering all types of maritime, air and land operations. At the lower levels, the commanders' responsibilities are much more specialised and usually involve only one of the three types of operations. Most commanders have a designated area of responsibility (AOR). The AOR of a subordinate commander may be:

a. A subdivision of his superior commander's AOR, or

b. The same AOR as his superior commander, but with responsibility for a specific operational role in that area.

REQUIREMENT

405. Meteorological support, tailored to the specific requirements of the particular mission of each individual commander, will be required by the commander and his staff in any of his headquarters or when located with a mobile operational unit.

406. The requirement is divided into two separate functions:

a. Planning and coordination of meteorological support to operational units in the command area, which is the staff function described in Chapter 2.

b. Provision of real-time meteorological support to headquarters staff exercising command and control of NATO operational forces in times of peace, crisis and war, which will be covered in this Chapter.

407. Although weather effects may influence many military decisions, the most weather sensitive, routine decisions in the command chain will be at PSC level and below, by commanders with control of operational forces. As the level of command rises, the requirement is for longer range, but less detailed information about a larger area.

408. The support required at each headquarters of each commander will depend upon the mission of the commander while he is located in the headquarters, and the physical constraints of space and communications capability.

409. Because NATO commanders rarely have OPCON of operational forces in peacetime, many PHQs do not have an operational requirement for real-time meteorological support on a routine basis. However, most commanders will require a much higher level of support during developing crises which could mean that additional facilities, equipment and manpower will have to be provided.

410. Meteorological support to ACE Reaction Forces, including HQ ARRC and future CJTF(s), are summarized in Annex A to Chapter 6.

ORGANIZATION

411. Meteorological support to a NATO headquarters may be provided in one of the following ways:

a. By a collocated MSU (which may also be an MFC).

b. By the staff meteorological officer using products provided by an MFC located elsewhere.

c. When there are no meteorologists at the headquarters, by an MFC which is located elsewhere or the MSU at another headquarters using tailored products delivered to the headquarters by one of the following methods:

(1) a mobile briefing officer from the MFC travelling to the headquarters for each briefing,

(2) closed circuit television (CCTV),

(3) automated command, control, and information system (ACCIS), or

(4) facsimile and/or teletype via land line, satellite, or radio.

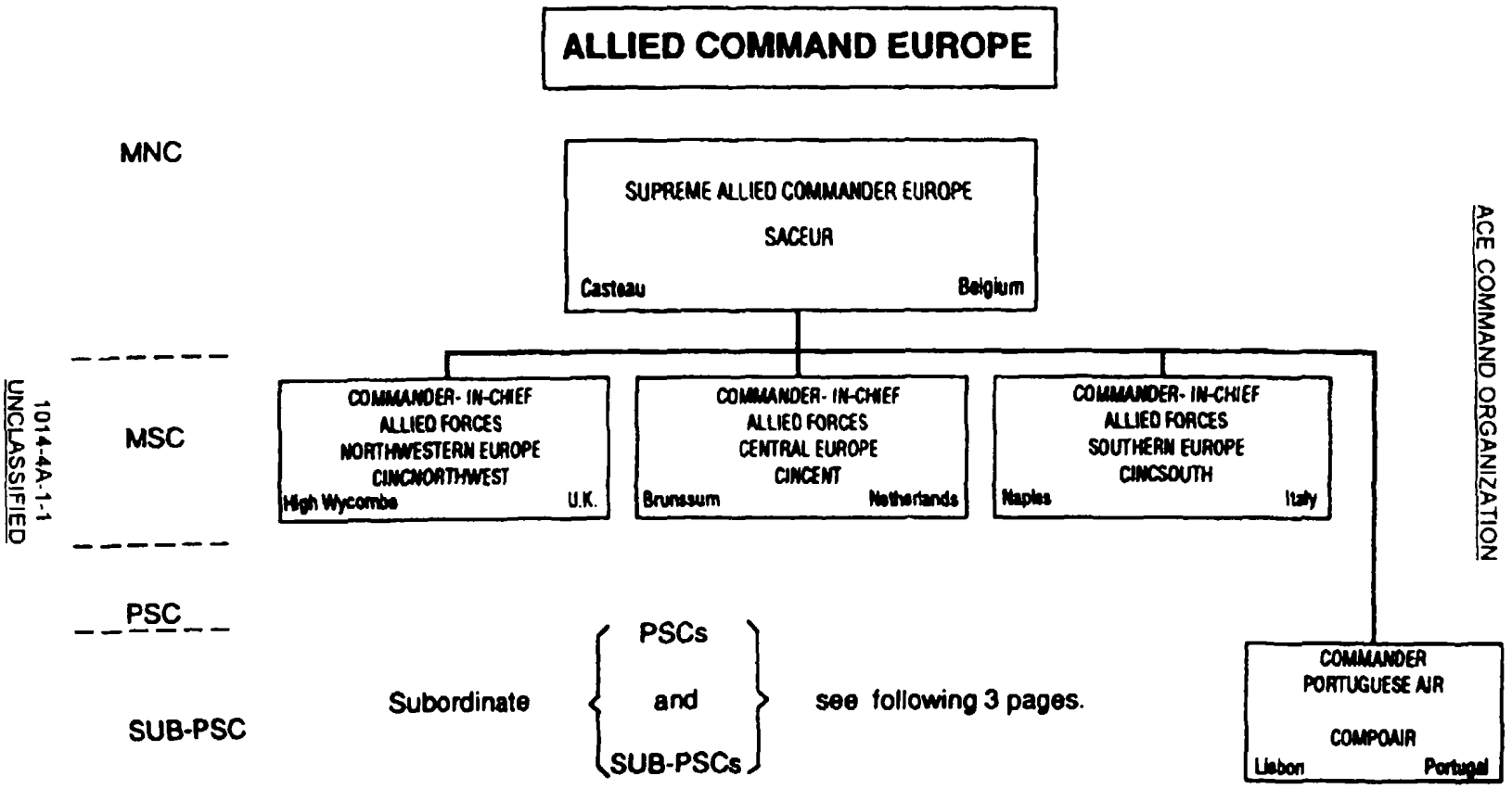
IMPLEMENTATION

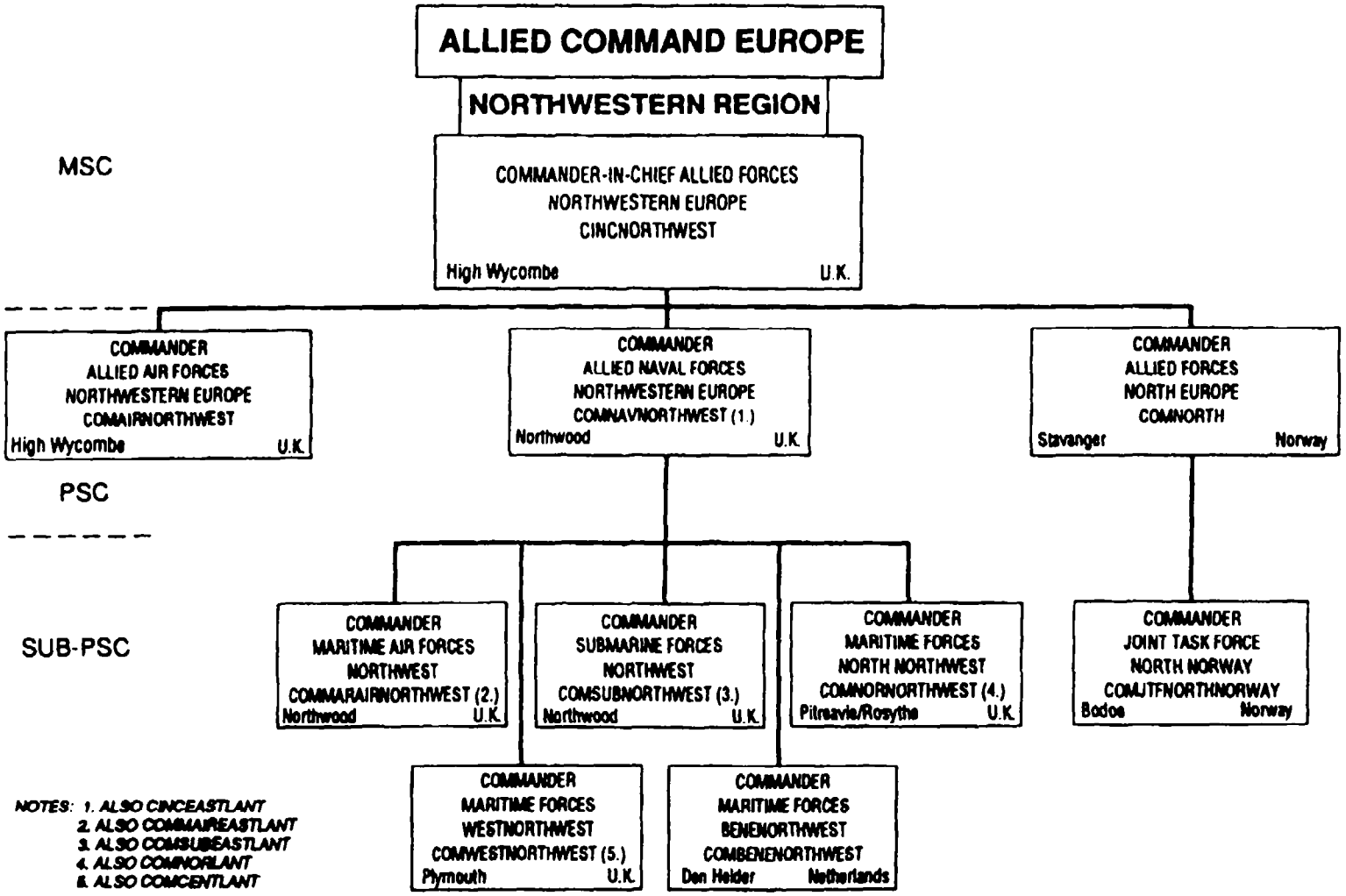
412. The NATO command structure and meteorological support organization for NATO headquarters are shown in Annexes A and B.

LIST OF ANNEXES AND APPENDICES

METEOROLOGICAL SUPPORT TO A NATO HEADQUARTERS IN ALLIED COMMAND EUROPE

ACE COMMAND ORGANIZATION




ALLIED COMMAND EUROPE
NORTHWESTERN REGION
MSC
COMMANDER-IN-CHIEF ALLIED FORCES
NORTHWESTERN EUROPE
CINCNORTHWEST
High Wycombe U.K.
COMMANDER
ALLIED AIR FORCES
NORTHWESTERN EUROPE
COMAIRNORTHWEST
High Wycombe U.K.
COMMANDER
ALLIED NAVAL FORCES
NORTHWESTERN EUROPE
COMNAVNORTHWEST (1.)
Northwood U.K.
COMMANDER
ALLIED FORCES
NORTH EUROPE
COMNORTH
Stavanger Norway
PSC
SUB-PSC
COMMANDER
MARITIME AIR FORCES
NORTHWEST
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COMMANDER
SUBMARINE FORCES
NORTHWEST
COMSUBNORTHWEST (3.)
Northwood U.K.
COMMANDER
MARITIME FORCES
NORTH NORTHWEST
COMNORNORTHWEST (4.)
Pitreavie/Rosyth U.K.
COMMANDER
JOINT TASK FORCE
NORTH NORWAY
COMJTFNORTHNORWAY
Bodoe Norway
COMMANDER
MARITIME FORCES
WESTNORTHWEST
COMWESTNORTHWEST (5.)
Plymouth U.K.
COMMANDER
MARITIME FORCES
BENENORTHWEST
COMBENENORTHWEST
Den Helder Netherlands
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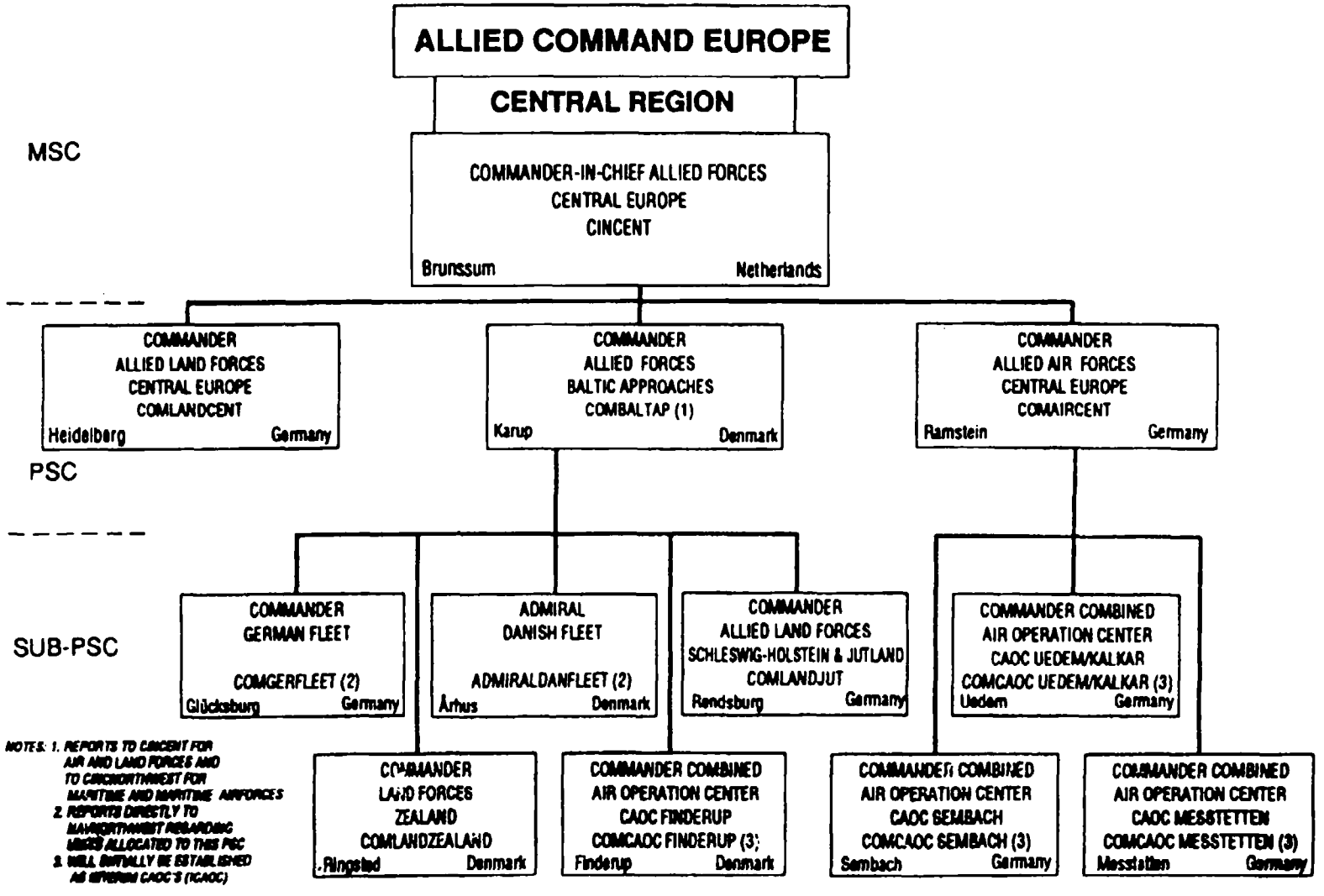
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Brunssum
Netherlands
COMMANDER
ALLIED LAND FORCES
CENTRAL EUROPE
COMLANDCENT
Heidelberg
Germany
COMMANDER
ALLIED FORCES
BALTIC APPROACHES
COMBALTAP (1)
Karup
Denmark
COMMANDER
ALLIED AIR FORCES
CENTRAL EUROPE
COMAIRCENT
Ramstein
Germany
PSC
SUB-PSC
COMMANDER
GERMAN FLEET
COMGERFLEET (2)
Glücksburg
Germany
ADMIRAL
DANISH FLEET
ADMIRALDANFLEET (2)
Århus
Denmark
COMMANDER
ALLIED LAND FORCES
SCHLESWIG-HOLSTEIN & JUTLAND
COMLANDJUT
Rendsburg
Germany
COMMANDER COMBINED
AIR OPERATION CENTER
CAOC UEDEM/KALKAR
COMCAOC UEDEM/KALKAR (3)
Uedem
Germany
NOTES: 1. REPORTS TO CINCENT FOR AIR AND LAND FORCES AND TO CINCNORTHWEST FOR MARITIME AND MARITIME AIRFORCES
2. REPORTS DIRECTLY TO MARNORTHWEST REGARDING UNITS ALLOCATED TO THIS PSC
3. WILL INITIALLY BE ESTABLISHED AS INTERIM CAOC'S (ICAOC)
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LAND FORCES
ZEALAND
COMLANDZEALAND
Ringsted
Denmark
COMMANDER COMBINED
AIR OPERATION CENTER
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COMCAOC FINDERUP (3)
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COMMANDER COMBINED
AIR OPERATION CENTER
CAOC SEMBACH
COMCAOC SEMBACH (3)
Sembach
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COMMANDER COMBINED
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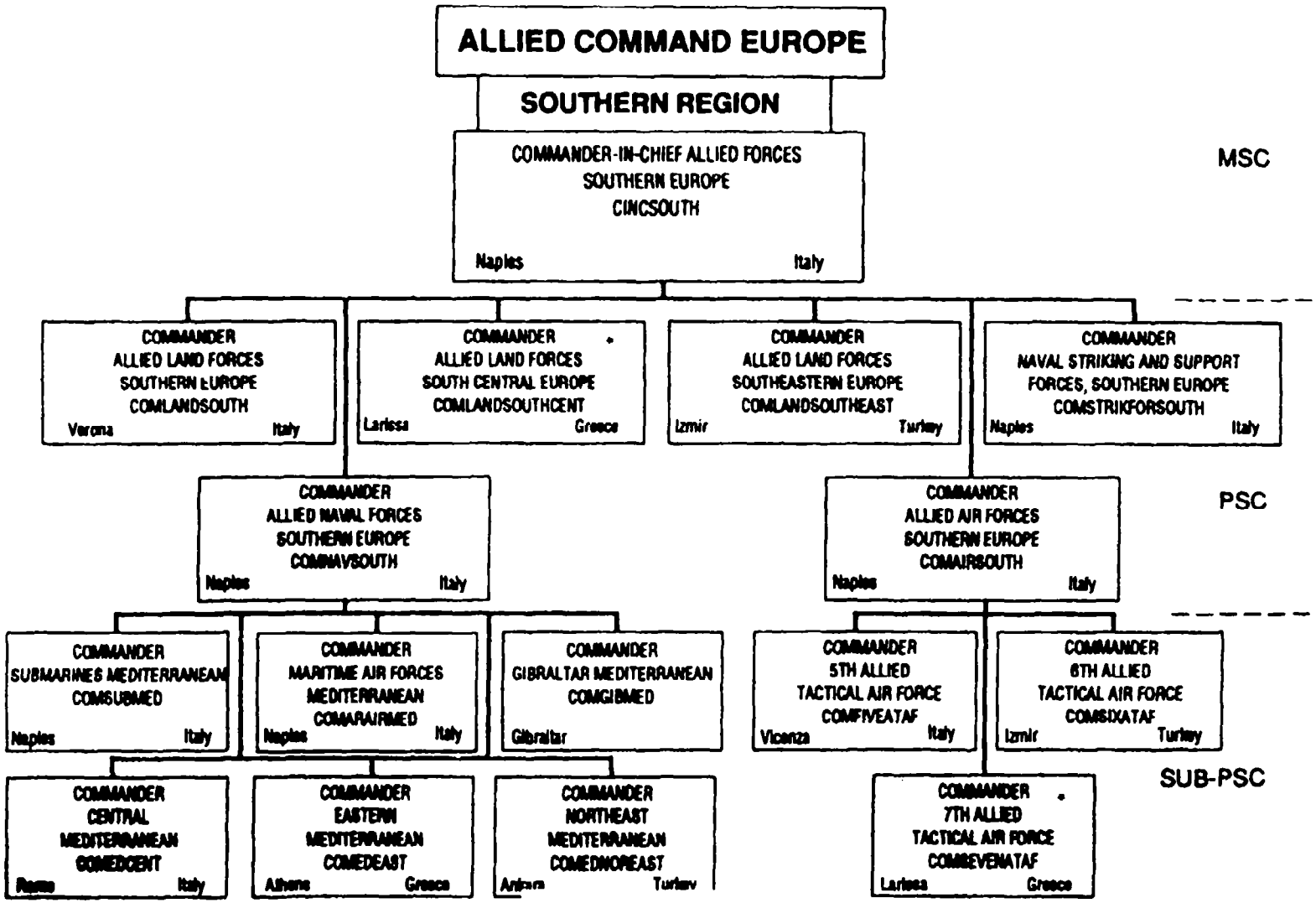
Messtetten
Germany



* When Activated

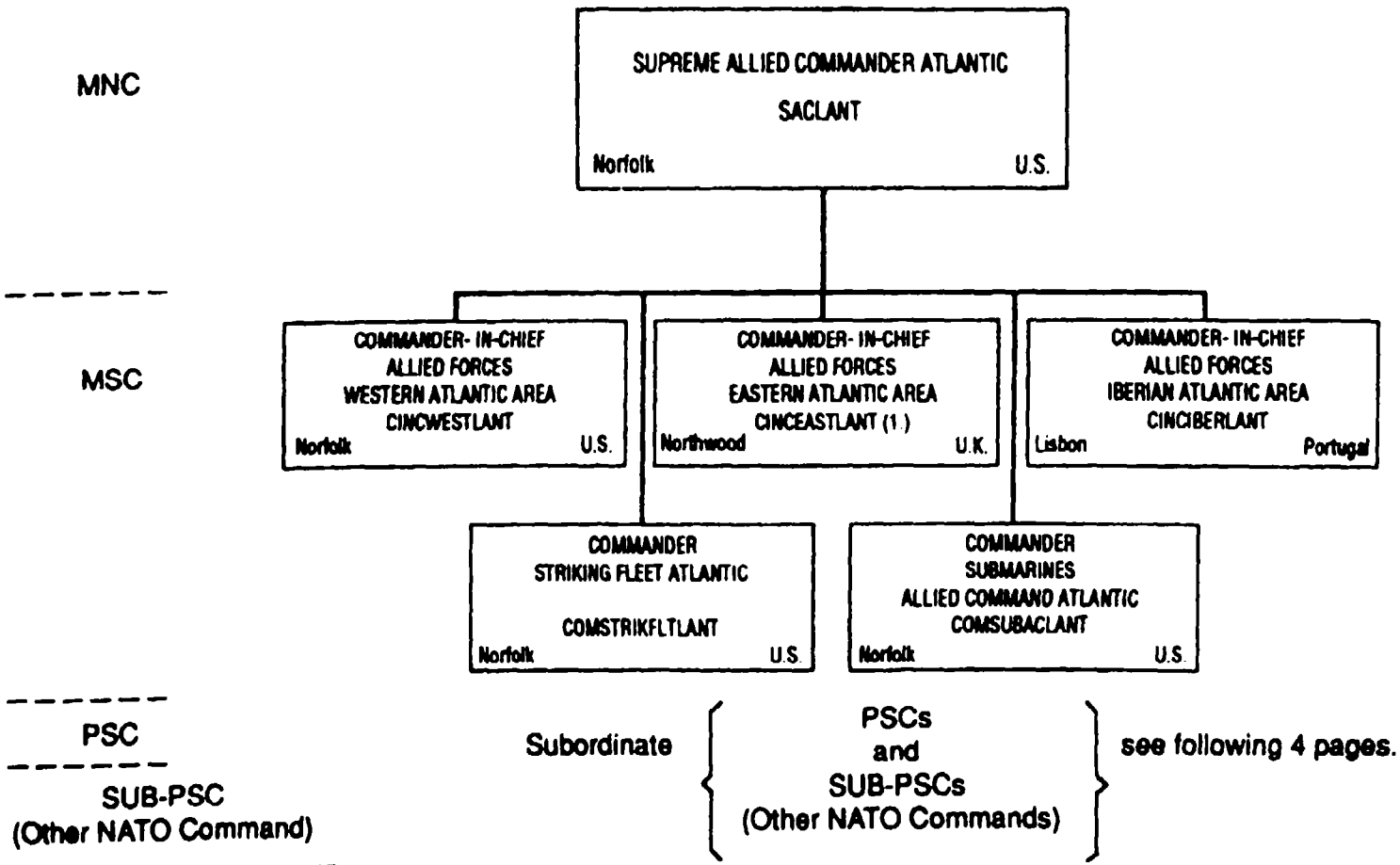
METEOROLOGICAL SUPPORT TO A NATO HEADQUARTERS IN ALLIED COMMAND EUROPE

NATO Commander	I,C, or N (Para 402)	Dual Hatted National Command	Headquarters		
			Location	Support Method (Para 413)	Supporting WACs or MFCs
SACEUR	I	CINCEUR	Casteau, BE	b	Bracknell
CINCNORTHWEST	C	RAF Strike Cmd	High Wycombe, UK	a(1)	Bracknell
COM ARRC *			Rheindahlem, GE		Bracknell
COMAMF(L)			Seckenheim, GE		
COMAIRNORTHWEST		CINCUKAIR	High Wycombe, UK		Bracknell
COMNAVNORTHWEST (CINCEASTLANT)		CINCFLEET	Northwood, UK		Bracknell
COMMARAIRNORTHWEST (COMMAIREASTLANT)			Northwood, UK		Bracknell
COMSUBNORTHWEST (COMSUBEASTLANT)			Northwood, UK		Bracknell
COMNORNORTHWEST (COMNORLANT)			Pitreavie, UK		CINCFLEETWOC Northwood
COMWESTNORTHWEST (COMCENTLANT)			Plymouth, UK		CINCFLEETWOC Northwood
COMBENENORTHWEST			Den Helder, NL		Woensdrecht, Glucksburg
COMNORTH	I		Stavanger, NO	a(1)	Oslo, CINCUKAIR
COMJTF NORTH NORWAY			Bodoe, NO		Oslo, CINCUKAIR
CINCENT	I		Brunssum, NL	b	GMGO, Woensdrecht
COMAIRCENT	C	USAFE (US)	Ramstein, GE	c(1)	EMC Traben-T
COMCAOC Kalkar			Uedem/Kalkar GE		GMGO
COMCAOC Sembach			Sembach, GE		GMGO
COMCAOC Messtetten			Messtetten, GE		GMGO
COMLANDCENT	C	USAREUR (US)	Heidelberg, GE	c(1)	EMC Traben-T
COMBALTAP	I		Karup, DA	a(1)	Oslo, Bracknell
COMGERFLEET			Glucksburg, GE		FWC Glucksburg
ADMIRALDANFLEET			Aarhus, DA		
COMLANDJUT	I		Rendsburg, GE	c(4)a	Oslo, GMGO
COMCAOC Finderup			Finderup, DA		Oslo, GMGO
COMLANDZEALAND	N		Ringsted, DA		Oslo, Bracknell
CINCSOUTH	I	CINCUSNAVEU	Bagnoli, IT	a(1)	Rome, CMFWC
COMAIRSOUTH	I		Bagnoli, IT	a(1)	Rome, CMFWC
COMFIVEATAF	I		Vicenza, IT	a(1)	Rome, CMFWC
COMSIXATAF	I		Izmir, TU	a(1)	Ankara, AMO Izmir
COMSEVENATAF *					
COMNAVSOUTH	I		Nisida, IT	b	CMFWC, NEMOC
COMSUBMED	C		Agnano, IT	b	NEMOC Rota
COMARAIRMED	C		Agnano, IT	b	NEMOC Rota
COMGIBMED	N	FO Gibraltar	Gibraltar		CINCFLEETWOC
COMEDCENT	N		Rome, IT	a(1)	Rome
COMEDEAST	N		Athens, GR	c(1)	Athens WAC/FWC
COMEDNOREAST	N		Ankara, TU		Ankara
COMSTRIKEFORSOUTH	I	COMSIXTHFLT	Naples, IT	a(1)	NEMOC Rota
COMLANDSOUTH	I		Verona, IT	c	Rome, CMFWC
COMLANDSOUTHEAST	I		Izmir, TU	c	Ankara, AMO Izmir
COMLANDSOUTHCENT *					

* When activated

ALLIED COMMAND ATLANTIC

ACLANT COMMAND ORGANIZATION

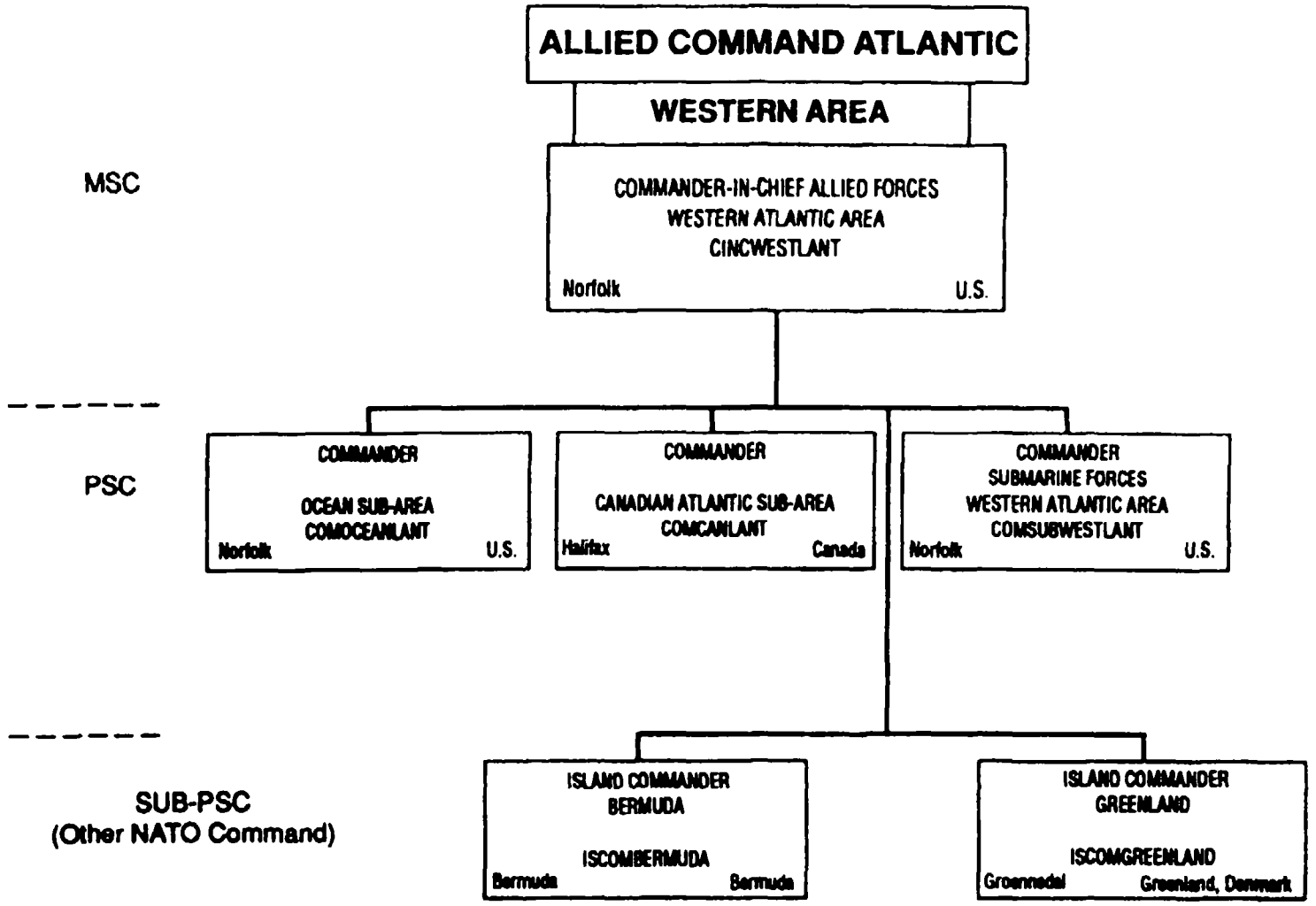


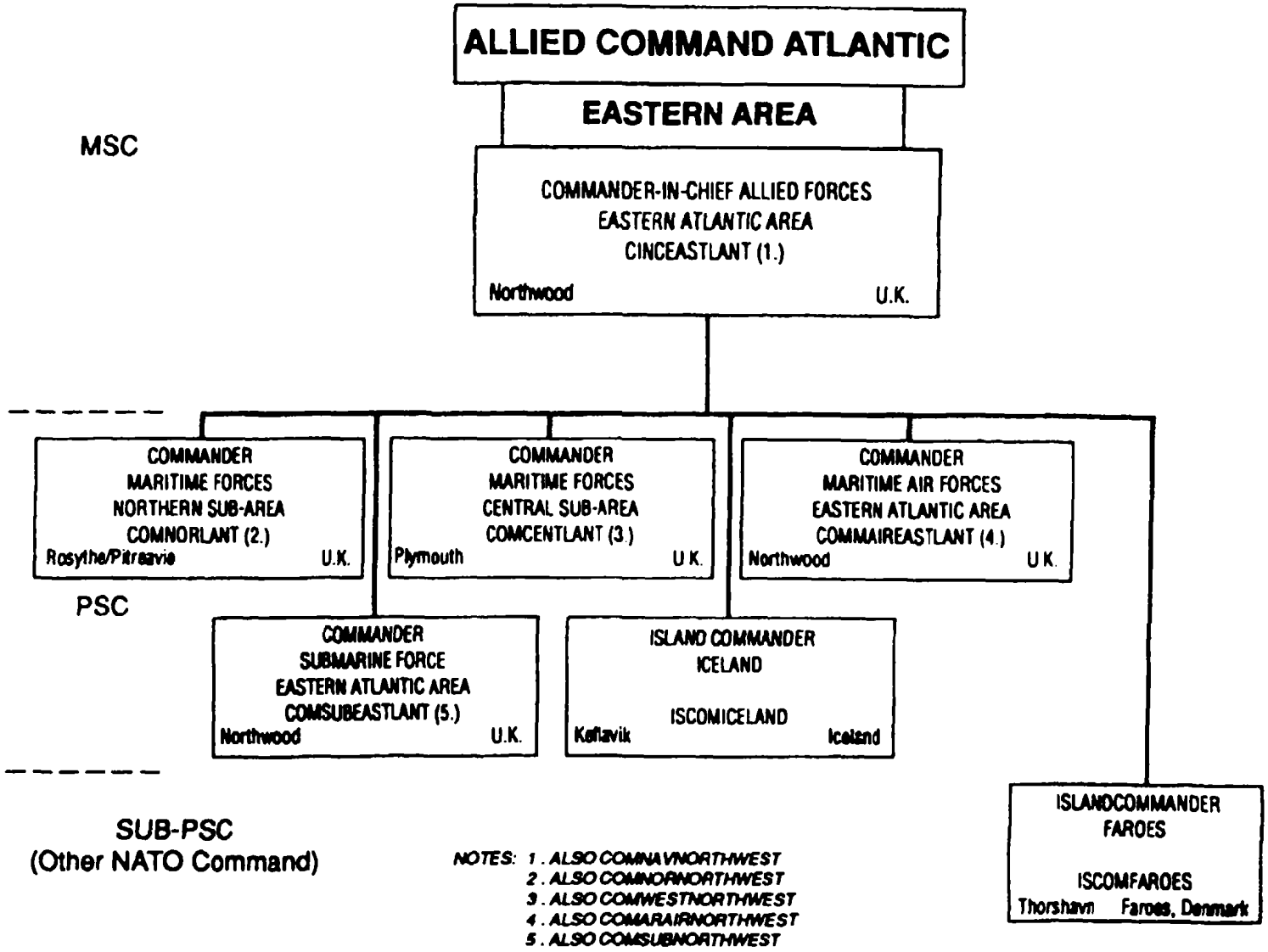
PSC

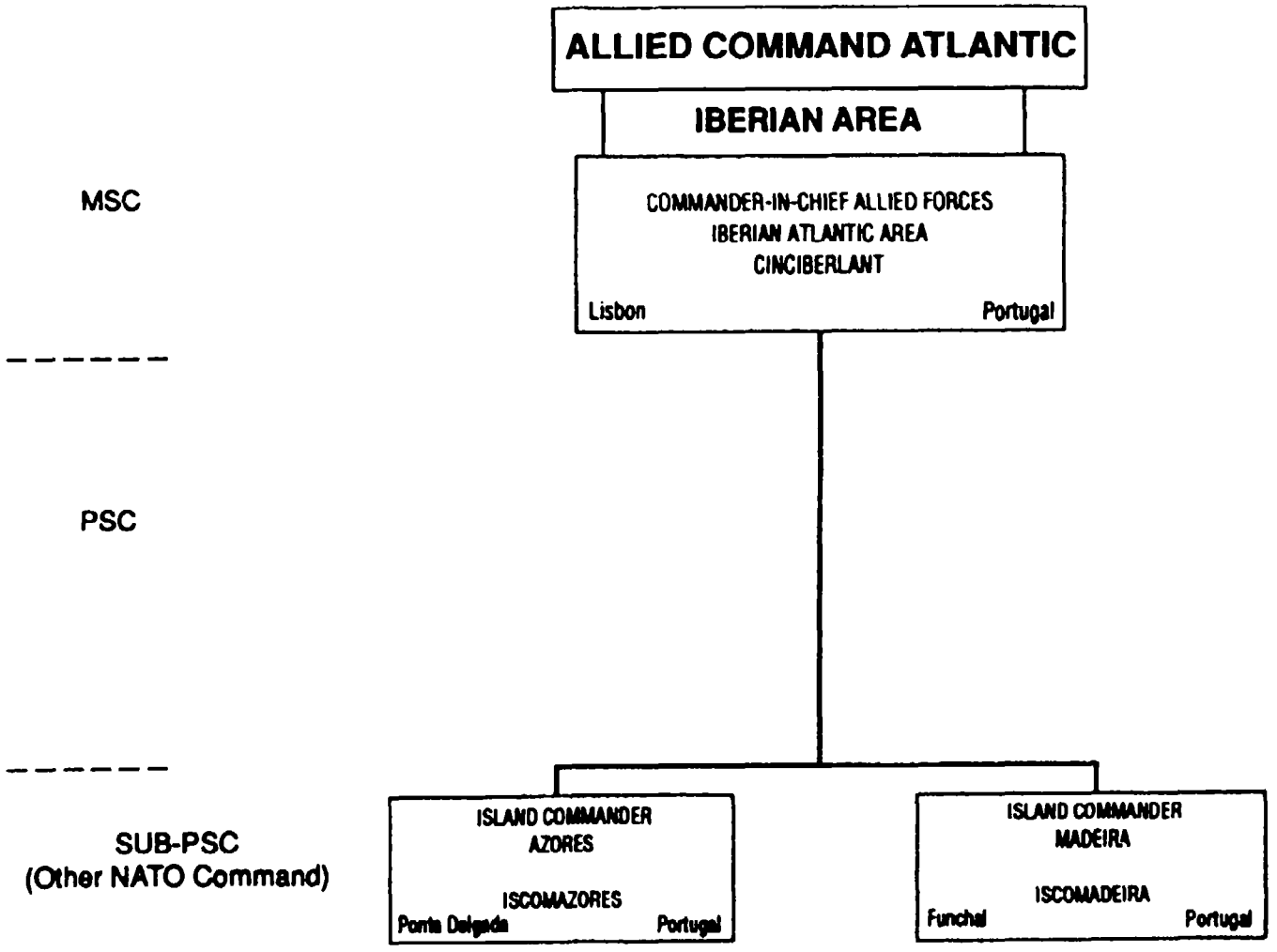
Subordinate { PSCs and SUB-PSCs (Other NATO Commands) } see following 4 pages.

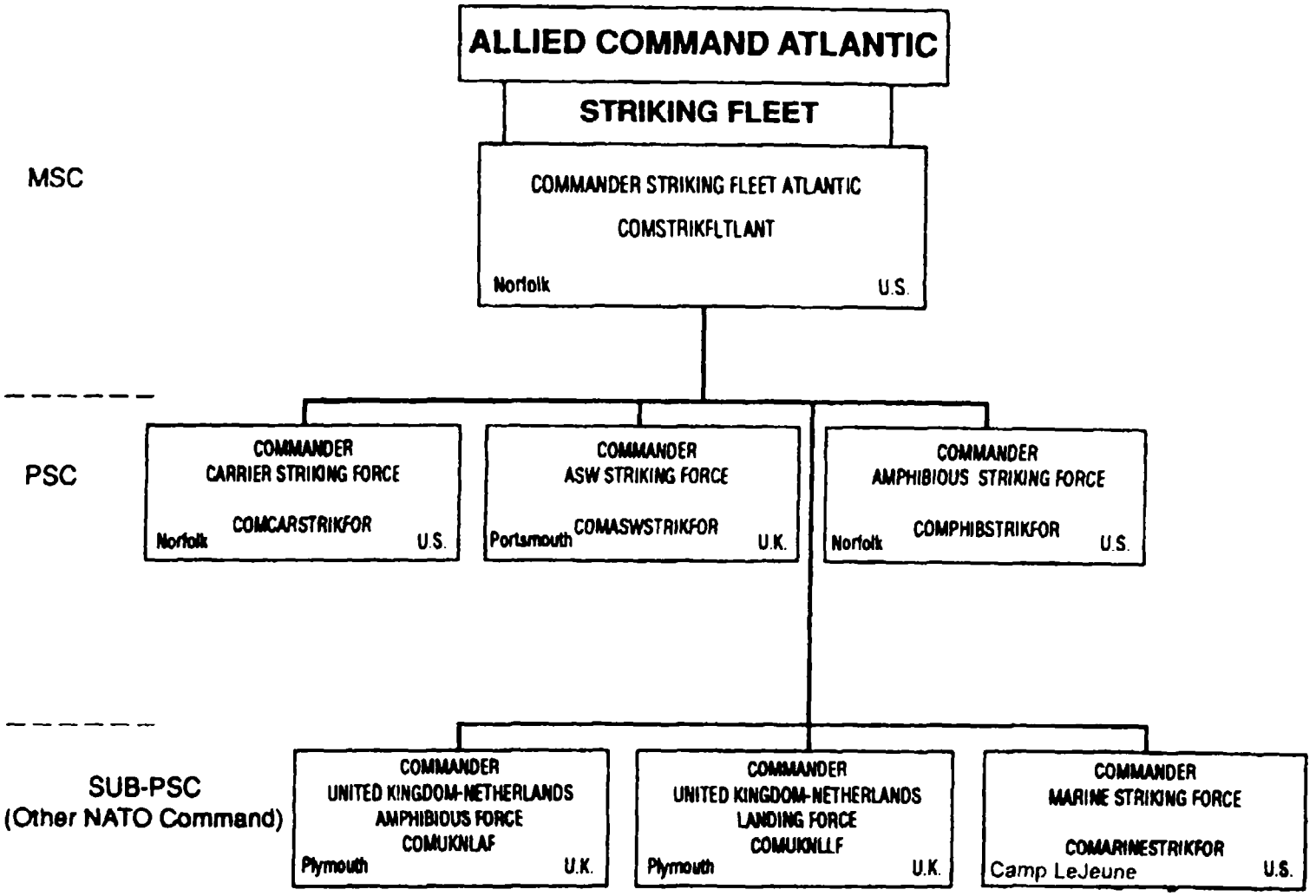
SUB-PSC
(Other NATO Command)

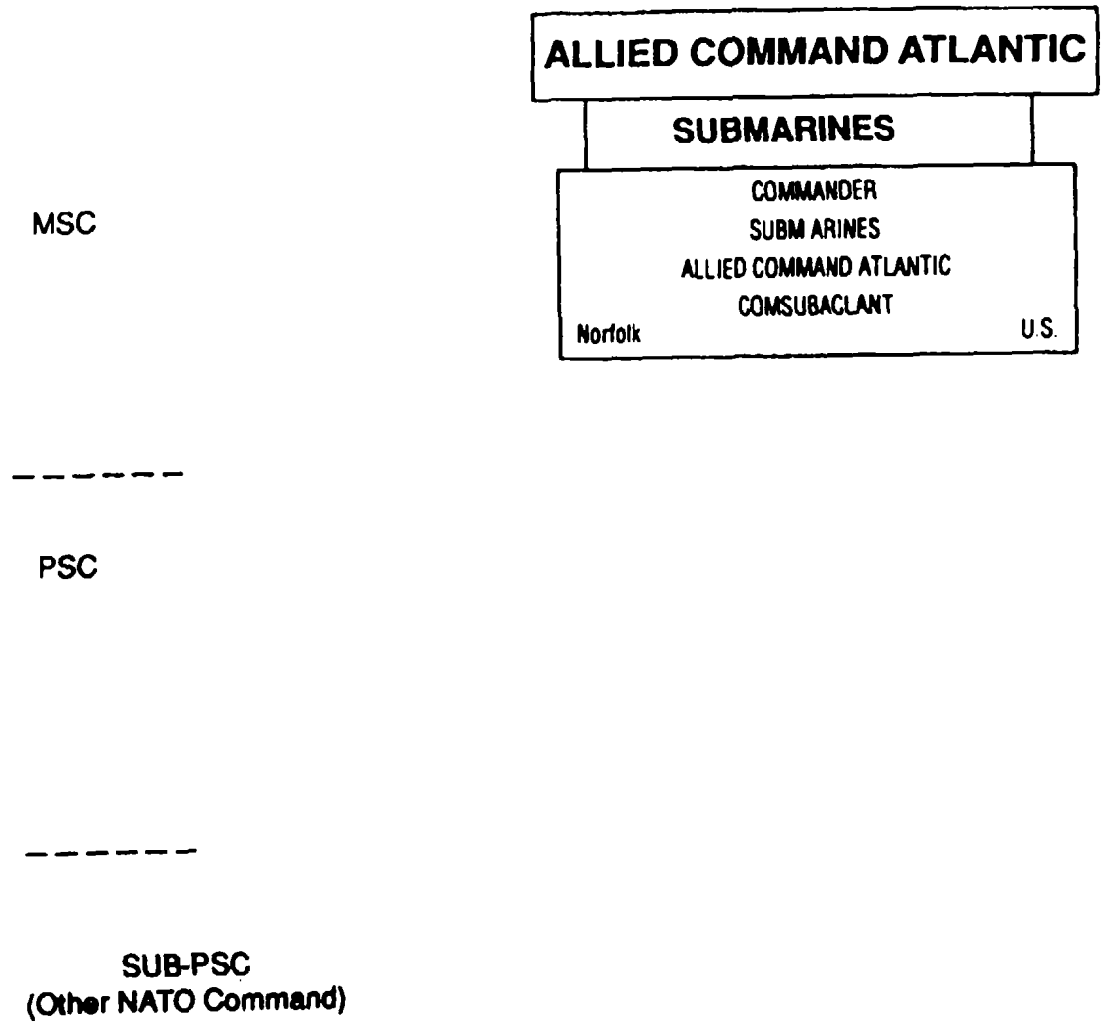
NOTE: 1. ALSO COMNAVNORTHWEST


ALLIED COMMAND ATLANTIC
WESTERN AREA
MSC
COMMANDER-IN-CHIEF ALLIED FORCES
WESTERN ATLANTIC AREA
CINCWESTLANT
Norfolk
U.S.
PSC
COMMANDER
OCEAN SUB-AREA
COMOCEANLANT
Norfolk
U.S.
COMMANDER
CANADIAN ATLANTIC SUB-AREA
COMCANLANT
Halifax
Canada
COMMANDER
SUBMARINE FORCES
WESTERN ATLANTIC AREA
COMSUBWESTLANT
Norfolk
U.S.
SUB-PSC
(Other NATO Command)
ISLAND COMMANDER
BERMUDA
ISCOMBERMUDA
Bermuda
Bermuda
ISLAND COMMANDER
GREENLAND
ISCOMGREENLAND
Groennedal
Greenland, Denmark


ALLIED COMMAND ATLANTIC
EASTERN AREA
MSC
COMMANDER-IN-CHIEF ALLIED FORCES
EASTERN ATLANTIC AREA
CINCEASTLANT (1.)
Northwood
U.K.
COMMANDER
MARITIME FORCES
NORTHERN SUB-AREA
COMNORLANT (2.)
Rosyth/Pitreavie
U.K.
COMMANDER
MARITIME FORCES
CENTRAL SUB-AREA
COMCENTLANT (3.)
Plymouth
U.K.
COMMANDER
MARITIME AIR FORCES
EASTERN ATLANTIC AREA
COMMAIREASTLANT (4.)
Northwood
U.K.
PSC
COMMANDER
SUBMARINE FORCE
EASTERN ATLANTIC AREA
COMSUBEASTLANT (5.)
Northwood
U.K.
ISLAND COMMANDER
ICELAND
ISCOMICELAND
Keflavik
Iceland
ISLANDCOMMANDER
FAROES
ISCOMFAROES
Thorshavn
Faroes, Denmark
SUB-PSC
(Other NATO Command)
NOTES: 1. ALSO COMNAVNORTHWEST
2. ALSO COMNORNORTHWEST
3. ALSO COMWESTNORTHWEST
4. ALSO COMAIRNORTHWEST
5. ALSO COMSUBNORTHWEST


ALLIED COMMAND ATLANTIC
IBERIAN AREA
MSC
COMMANDER-IN-CHIEF ALLIED FORCES
IBERIAN ATLANTIC AREA
CINCIBERLANT
Lisbon
Portugal
PSC
SUB-PSC
(Other NATO Command)
ISLAND COMMANDER
AZORES
ISCOMAZORES
Ponta Delgada
Portugal
ISLAND COMMANDER
MADEIRA
ISCOMADEIRA
Funchal
Portugal


ALLIED COMMAND ATLANTIC
STRIKING FLEET
MSC
COMMANDER STRIKING FLEET ATLANTIC
COMSTRIKFLTLANT
Norfolk
U.S.
PSC
COMMANDER
CARRIER STRIKING FORCE
COMCARSTRIKFOR
Norfolk
U.S.
COMMANDER
ASW STRIKING FORCE
COMASWSTRIKFOR
Portsmouth
U.K.
COMMANDER
AMPHIBIOUS STRIKING FORCE
COMPHIBSTRIKFOR
Norfolk
U.S.
SUB-PSC
(Other NATO Command)
COMMANDER
UNITED KINGDOM-NETHERLANDS
AMPHIBIOUS FORCE
COMUKNLAF
Plymouth
U.K.
COMMANDER
UNITED KINGDOM-NETHERLANDS
LANDING FORCE
COMUKNLLF
Plymouth
U.K.
COMMANDER
MARINE STRIKING FORCE
COMARINESTRIKFOR
Camp LeJeune
U.S.


ALLIED COMMAND ATLANTIC
SUBMARINES
COMMANDER
SUBM ARINES
ALLIED COMMAND ATLANTIC
COMSUBACLANT
Norfolk
U.S.
MSC
PSC
SUB-PSC
(Other NATO Command)

METEOROLOGICAL SUPPORT TO A NATO HEADQUARTERS IN ALLIED COMMAND ATLANTIC

NATO Commander	I,C, or N (Para 402)	Dual Hatted National Command	Headquarters		
			Location	Support Method (Para 413)	Supporting WACs or MFCs
SACLANT	I	CINCUSACOM	Norfolk, VA, US		NLMOC Norfolk
CINCWESTLANT	N	CINCLANTFLT	Norfolk, VA, US		NLMOC Norfolk
COMOCEANLANT	N		Norfolk, VA, US		NLMOC Norfolk
COMCANLANT	N		Halifax, NS, CA		METOC Halifax
ISCOMBERMUDA	N		(Dormant)(Norfolk)		
ISCOMGREENLAND	N		Groennedal, GL	c(4)b	Copenhagen
COMSUBWESTLANT	N	COMSUBLANT	Norfolk, VA		NLMOC Norfolk
CINCEASTLANT (COMNAVNORTHWEST)	C	CINCFLEET	Northwood, UK	a(1)	Bracknell
COMMAIREASTLANT (COMARAIRNORTHWEST)	C	HQ 18 GP	Northwood, UK	a(1)	Bracknell
COMNORLANT (COMNORNORTHWEST)	N	FOSNI	Rosyth, UK	a(2)c	Northwood, Bracknell
COMCENTLANT (COMWESTNORTHWEST)	N	FO Plymouth	Plymouth, UK	a(2)C	Northwood, Bracknell
COMSUBEASTLANT			Northwood, UK	a(1)	Bracknell
ISCOMICELAND	N		Keflavik, IC		NLMOC Norfolk
ISCOMFAROES	N		Thorshavn, Faroes	c(4)a	Copenhagen
CINCIBERLANT	I		Oeiras, PO		Lisbon CMOC IBERLANT
ISCOMAZORES			Ponta Delgada, AZ		CMOC IBERLANT
ISCOMMADEIRA			Funchal, Madeira		CMOC IBERLANT
COMSUBACLANT		COMSUBLANT	Norfolk, VA		NLMOC Norfolk
COMSTRIKEFLTLANT		COM2NDFLT	Norfolk, VA		NLMOC Norfolk
COM UKNLAF			Plymouth, UK		Northwood
COM UKNLLF			Plymouth, UK		Northwood
COMARINESTRIKFOR			Camp LeJeune, US		NLMOC Norfolk
COMCARSTRIKFOR			Norfolk, VA, US		NLMOC Norfolk
COMASWSTRIKFOR			Portsmouth, UK		Northwood
COMPHIBSTRIKFOR			Norfolk, VA, US		NLMOC Norfolk

CHAPTER 5

METEOROLOGICAL SUPPORT TO NATO MARITIME OPERATIONS.

References:
- A. ACP 176 NATO SUPP1. (current edition) NATO Naval and Maritime Air Communications Instructions and Organization
- B. ACP 127, Communications Instructions, Tape Relay Procedures
- C. AAP-3, Procedures for the Development, Preparation, Production and the Updating of NATO Standardization Agreements (STANAGS) and Allied Publications (APs)

INTRODUCTION

501. With the exception of R/V ALLIANCE, the NATO funded research vessel of the SACLANT Undersea Warfare Research Centre, SACLANTCEN, all ships which will require support are national.

502. In peacetime, other than during NATO exercises, the only national ships allocated to NATO operational control are those in the multinational NATO forces:

Standing Naval Force Atlantic (STANAVFORLANT),

Standing Naval Force Channel (STANAVFORCHAN), and

Standing Naval Force Mediterranean (STANAVFORMED).

Details of the NATO Command and Control Organization, and areas of responsibility of the NATO Maritime Commanders are given in Annexes A and B to Chapter 4.

REQUIREMENTS

503. Support tailored to the specific requirements of NATO maritime operations will be required by:

a. Maritime commanders and their staffs:

(1) in shore-based headquarters at MNC level and below and

(2) embarked in ships at MSC level and below.

b. Ships and submarines with a wide variety of operational roles including merchant ships on reinforcement/resupply (RE/RE) operations.

c. Aircraft involved in maritime operations, including

(1) ship-borne aircraft:

(a) fixed-wing and

(b) helicopters.

(2) land-based aircraft:

(a) maritime patrol aircraft (MPA),

(b) tactical air support of maritime operations (TASMO), and

(c) mine laying operations by aircraft.

504. The geographical coverage, period of interest and general nature of the meteorological support required at the various levels of command and control and by operational users in maritime operations are summarised in Figure 5-I.

505. More detailed requirements will relate to:

a. Warnings of severe weather which could reduce the capability of operational units to carry out their mission or create a significant hazard to the safety of personnel and ships. These are:

(1) for all ships:

(a) strong surface winds,

(b) high sea state,

(c) poor visibility,

(d) sea ice,

(e) freezing precipitation, and/or

(f) thunderstorms.

(2) for ships with embarked aircraft, applicable aviation hazards are listed in Chapter 6, Figure 6-V.

b. Meteorological data and products, both surface and upper-air, which are used to:

(1) improve mission effectiveness and safety precautions of ships and shipborne aircraft.

(2) determine the best mode of operation of weapon and sensor systems in ships and shipborne aircraft.

(3) develop correction factors for use with the guidance system of weapon systems to compensate for atmospheric conditions. This information may be needed in the form of a tactical index or decision aid for electro-optical systems.

(4) predict NBC fall-out patterns.

506. Requirements at headquarters. Details are given in Chapter 4.

507. Requirements in Ships

a. Most warships are equipped to carry out a specific specialist role. The armament or sensor systems used to carry out these roles may require some form of meteorological support which is unique to each particular role. However, the main part of the support required is common to all ships.

b. The support required will comprise:

(1) actual information of current conditions, which is needed to support weapon and sensor systems. Most ships are equipped with suitable instrumentation to make accurate current weather observations.

(2) forecast information for the area of operations which is provided either from:

(a) an MSU in the ship, or in another ship in the same task group or

(b) a weather centre ashore.

c. MSUs in ships will need to receive, on a routine basis, up-to-date synoptic data and products for an area large enough to enable them to provide the necessary support for the ship's area of operations.

d. All ships will, therefore, need to receive some form of meteorological support on a routine basis from a weather centre ashore. The support required will depend on:

(1) whether or not the ship has an embarked MSU and

(2) the principal operational role of the ship.

f. Details of support required by different types of ships are given in Figure 5-II-1, 5-II-2, and 5-II-3.

508. Requirements for land-based aircraft in support of maritime operations . These requirements are covered in Chapter 6.

ORGANIZATION

509. The organization to meet the requirements for support to NATO maritime operations is provided, as described in Chapter 3, by a combination of WACs, MFCs and MSUs.

510. MFCs

a. MFCs which provide support to maritime operations are known collectively as Fleet Weather Centres (FWCs), although individual centres may have different titles relating to the specific national or NATO responsibilities.

b. Since oceanographic and acoustic support products for ASW operations are often dependent on meteorological conditions, FWCs are frequently collocated with Military Oceanographic Information Centres (MOICs) to facilitate the exchange of data and sharing of manpower, equipment and communications.

c. The organization of MFCs which provide support to NATO maritime operations comprises seven national FWCs and three NATO FWCs, details of which are given in Figure 5-III-1 and 5-III-2.

d. The detailed capabilities of the FWCs for providing meteorological support to maritime operations are given in Annex A.

511. MSUs

a. MSUs are located in:

(1) some maritime headquarters,

(2) some ships, and

(3) some airbases which provide support to maritime operations.

b. Centres which act as MSUs in maritime headquarters are all FWCs whose primary responsibility is to provide support to maritime units in the command area.

c. All MSUs in ships and airbases are national.

IMPLEMENTATION

512. Support to maritime commanders

a. In shore-based headquarters. See Chapter 4.

b. In ships. Commanders at sea will normally be in ships which have an MSU to provide the necessary support. Commanders who do not have direct access to an MSU should request additional support, if required, from the most appropriate FWC.

513. Support to ships and submarines

a. In peacetime, meteorological support, in both alpha-numeric and graphic format, is readily available to ships anywhere in the world on a variety of radio broadcasts, as shown in Figure 5-IV.

b. Support from FWCs via dedicated METOC broadcasts

(1) The broadcasts are listed in Figure 5-IV.

(2) They are controlled by the FWCs and normally transmit standard products according to a fixed schedule.

(3) Details of products and schedules are listed in various national documents.

(4) The standard products are designed to meet the national requirements for which the broadcasts were established.

(5) There are no NATO-funded dedicated broadcasts. They are all national.

c. Support from MSUs in other ships in the same Task Group

(1) If a ship in any Task Group, particularly fixed-wing carriers, has an MSU, it is normal practice for the MSU to issue routine forecasts to the other ships in company via the ship/ship broadcasts.

(2) If more than one ship in the Group has an MSU, the Task Group Commander should delegate the responsibility for providing such forecasts to the most appropriate ship.

d. Support to fixed-wing aircraft carriers. As Figure 5-II-3 shows, these ships require considerably more meteorological support from shore-based centres than any other ships. Only a few NATO nations operate carriers and in most situations it is possible to provide support via dedicated national broadcasts.

e. Support to submarines. Because of the limited capacity of submarine broadcasts, meteorological support is transmitted only at the discretion of the appropriate submarine operating authority.

f. En Route Forecasts

(1) Track Weather Forecast/En route Weather Forecast (TRAX/WEAX) services for transatlantic crossings are available to naval ships of NATO nations, on request, from CINCFLEETWOC Northwood and NAVLANTMETOCCEN Norfolk.

(2) TRAX/WEAX services are available to merchant ships from commercial meteorological organizations by TELEX messages via shore radio broadcasts or satellite broadcasts.

514. Support to aircraft involved in maritime operations

a. Support to carrier-borne, fixed-wing aircraft. Because of the nature of the support required, all fixed-wing carriers have an MSU with a similar capability to that of an airbase weather office, as described in Chapter 6, Para 615e, to provide the support described in Para 608.

b. Support to ship-borne helicopters. A few ships, other than fixed-wing carriers, have an MSU with limited personnel and equipment which can provide the necessary support. Most ships of destroyer/frigate size with embarked helicopters have no such capability and can receive support only by the means described in Para 513. Some FWCs provide products which are specifically designed for use by such ships.

c. Support to land-based aircraft. See Chapter 6.

RESPONSIBILITIES

515. All national FWCs have a national area of responsibility for which each centre is required to provide support to its national ships in accordance with national plans and procedures. Areas of responsibility for the three NATO FWCs correspond to the maritime part of the MSC area in which the centre is located. There is considerable overlap of these areas of responsibility between all the FWCs listed in Figures 5-III-1 and 5-III-2. It would be impractical to divide the NATO maritime area into unique NATO areas of responsibility for each of the FWCs, with no overlap between them. However, there is a requirement to establish NATO responsibilities for the national FWCs in order to:

a. Ensure that every ship receives the support it needs;

b. Ensure that each FWC knows:

(1) what services it is required to provide,

(2) to which NATO forces it is required to provide support, and

(3) for what area it is required to provide support; and

c. Avoid duplication of effort by different FWCs and cause unnecessary loading of broadcasts by:

(1) having more than one FWC providing similar products to the same ships and

(2) having different national FWCs providing support to their individual national ships in a multinational Task Force via the same NATO broadcasts.

516. The geographic area of NATO responsibility for the national FWCs will be dictated by the area of coverage of the NATO broadcasts for which they have responsibility for providing routine support. For example, although the national area of responsibility for NAVLANTMETOCCEN NORFOLK is the whole of the North Atlantic, the area for which it is required to provide forecasts on NATO broadcasts is limited to the WESTLANT command area. However, FWCs should extend their forecast areas beyond the command boundaries to ensure that ships transitting from one command area to another, chopping operational control (OPCON) from one NATO commander to another at the command boundary, receive the forecasts they require during the transit period. In general, the forecast area should extend for a distance approximately equivalent to 24 hours steaming beyond the command boundary.

517. Responsibilities of FWCs. General responsibilities of National centres are given in Para 304 and of NATO centres in Para 305. General NATO requirements for all MFCs are given in Paras 306 and 311. In amplification of these responsibilities and requirements, the following information relates specifically to FWCs:

a. National FWCs should provide meteorological support to:

(1) their own national forces in accordance with national instructions, but only if this can be done via national broadcasts which have not become NATO broadcasts, or by NATO broadcasts for which they have responsibility.

(2) NATO and national forces via dedicated meteorological RATT and facsimile broadcasts, if applicable, using established schedules.

b. National FWCs should tailor meteorological support products, whenever possible, to the requirements shown in Figure 5-II, for ships being supported.

c. National FWCs should promulgate in appropriate NATO publications details of:

(a) schedules to be used on dedicated meteorological broadcasts from the centre;

(b) forecast areas to be used, as shown in Annex B; and

(c) code formats to be used, if different from standard WMO codes.

d. National FWCs should liaise with other FWCs which are providing support to ships in the same areas via other broadcasts to ensure, as far as possible, that conflicting advice is not given to different NATO units in the same areas.

SUMMARY OF REQUIREMENTS FOR METEOROLOGICAL SUPORT TO MARITIME OPERATIONS

Level	Primary Area of Interest	Primary Period of Interest	Meteorological Support Required
MNC, MSCs and PSCs Shore Based	Command area and part of forward area relevant to mission	0-120 hours	General forecast, Major weather systems affecting operations, particularly problem areas of bad weather which could significantly affect current and planned operations in the near future. Longer range forecasts and climatological information for planning. Nuclear fallout and biological and chemical contamination
Commanders at sea (MSC and below)	Operational area and part of forward area relevant to mission	0 - 120 hours	Specific forecasts for current and planned operations. Nuclear fallout and biological and chemical contamination.
Ship and submarine captains	Operational area	0 - 72 hours	Specific forecasts for ship safety and current planned operations. Nuclear fallout and biological and chemical contamination.
Shipborne aircrews	Operational area. Target area, if applicable	Period of mission	Highly specific, mission-oriented forecast to include target forecast and diversion TAFs, if applicable
Weapon and sensor operators	Area of interest	Period of mission	Specific meteorological data required by weapon or sensor system
Amphibious landing craft crews	Beach-head area	Period of mission	Specific forecast for mission with particular reference to state of sea and surf conditions.

Figure 5-I

METEOROLOGICAL PARAMETERS REQUIRED BY SHIPS TO SUPPORT MARITIME OPERATIONS

Meteorological Parameters	Requirements by Ships without an MSU										
	All Ships	Additional Requirements for Specific Maritime Operations									
		Anti-Submarine Warfare	Anti-Air Warfare (Note 1)	Surface Warfare	Mine Warfare	Command, Control, and Comms	Logistics Ops (RAS)	Sub-marines	Carrier Air Ops (Note 2)	Heli-copter Ops (Note 2)	Amphib Ops
Synoptic Situation & Developments	F										
Severe Weather Warnings	F										
Air Temperature	C						F				
Surface Wind - Direction, Speed, Gusts	C/F										
Sea Surface Temperature		C/F						C/F			
Humidity			C	C							
Sea State	C/F										
Swell (Period,Height,Direction)	F				C		C				
Precipitation	C/F										
Sea Ice	C/F										
Visibility	C/F										
Cloud Cover	C/F										
Radio Propagation Conditions		C/F	C/F	C/F		C/F					C/F
Nuclear Fallout and Biological/Chemical Contamination	P										
Balmets			F	F							
Surf											C/F
Tactical Indices (See Para 505b(2)			F	F							

C = Current Information, which is observational data collected by each ship to meet its own requirements
F = Forecast Information, which is provided by an MSU embarked in the ship, or a ship in the same Task Group, or from a shore-based weather centre.
Note 1: Also see Para 608 and Figure 6-IV
Note 2: See Chapter 6 for detailed requirements

Figure 5-II-1

METEOROLOGICAL PARAMETERS REQUIRED BY SHIPS TO SUPPORT MARITIME OPERATIONS

Meteorological Parameters	Frequency per Day Required by Ships without an MSU								
	All Surface Ships	Additional Requirements for Specific Types of Ships							
		All Ships With Helicopters	ASW Ships	Anti-Air Warfare Ships	Surface Warfare Ships	Command Ships	Sub-Marines	Amphib Ships	Merchant Ships
1 Alpha-Numeric Products									
Area or Route Forecast	2						2		
Sea Surface Temperature			2-0				2-0		
Radiopropagation Conditions		2	2	2	2	2		2	
BALMETS				R	R				
Surf Forecast								R	
Helicopter Forecast		2							
OTSR	R								2
Nuclear Fallout predictions + biological/chem contamination	2								
Tactical Indices (See Para 505b(2))				R	R				
2 Graphic Products									
Surface Analyses	2								
Surface Prognoses (+24 hrs)	2								
Surface Prognoses (+48, 72, 120 hrs)						1			
Surface Weather Depiction	2								
Sea Surface Temperature			1						
Helicopter Forecasts		2							
NBC forecasts	2								

NOTES:

1 These are the forecast products listed in Figure 5-II-1 which ships without an MSU will need to supplement the current observational data which they collect themselves. The products may be provided by either a short-based weather centre or a ship with an MSU in the same Task Group.

2. Area or Route forecasts include severe weather warnings, surface winds, visibility, precipitation, and sea state

3 R = on request only
O = information provided by an oceanographic centre

4 Gale warnings are required as soon as possible.

Figure 5-II-2

METEOROLOGICAL SUPPORT PRODUCTS REQUIRED BY SHIPS WITH AN EMBARKED MSU AND BY OCEANOGRAPHIC CENTRES

Meteorological Data and Products	Frequency per Day Required by Ships with an MSU and by Oceanographic Centres		
	Fixed Wing & Aircraft Carriers	All Other Ships with an MSU	Oceano-graphic Centres
1. Alpha-Numeric Products			
Severe Weather Warnings	A	A	
Surface Synoptic Data	4	2	2
Upper-air Synoptic Data	2	R	
TAFs	R		
Target Data	R		
Nuclear Fallout Predictions	2	2	
Synoptic Situation and Developments	2	2	
2. Graphic and Gridded Field Products			
Surface Analyses	4	2	2
Surface Prognoses (+24 hrs)	4	2	2
Surface Prognoses (+48, 72, 120 hrs)	1	1	1
Upper-air Analyses (850 hPa, 700 hPa, 1000-500 thickness,	2	2	
Upper-air Analyses (300, 200, 100 hPa)	2		
Upper-air Prognoses (+24 hrs - 850, 700, 1000-500 thickness)	2	2	
Upper-air Prognoses (+24 hrs - 300, 200, 100 hPa)	2		
Sea Surface Temperature & Ice Edge	1	1	1
Nuclear Fallout Prediction	2	2	
Nephanalyses	2		
3. Satellite Pictures			
Via Own Receiver	A	S	A

A = As soon as possible, when available
R = On request only
S = Selected ships only

Note: These are the data and products which a ship's MSU will need to receive from a shore-base weather centre in order to produce the tailored products required by their own ship or other ships in the same Task Group.

Figure 5-II-3

FLEET WEATHER CENTRES - GENERAL

Fleet Weather Centre (FWC)	National or NATO	National Area of Responsibility (AOR)	Supporting WACs		Other MFCs With Which Data and Products areExchanged	NATO Headquarters Supported	Military Oceanographic Info Centres Supported (MOICs)
			Primary	Others			
NAVLANTMETOCCEN Norfolk, US	US	North and South Atlantic from pole to pole, east to 100E, west to 95W polar areas northern hemisphere; east to 17E, west to 92W southern hemisphere; except east to 8E Baltic approaches and east to 9W in approaches to Strait of Gibraltar	FNMOC Monterey	Washington Bracknell	CINCFLEETWOC	SACLANT	MOIC Norfolk (Collocated)
METOC Halifax, CA	CA	CANLANT area enclosed by 45N 67W; 40N 66W; 40N 46W; 52N 32W; 60N 42W; East Coast of Canada; West Coast of Greenland	Montreal			COMCANLANT	MOIC Halifax (Collocated)
CINCFLEETWOC Northwood, UK	UK	Atlantic Ocean, Norwegian Sea and Barents Sea between 50W and 50E and between 42N and 80N	Bracknell		AFNORTHWEST CMOC COMNORTH NAVLANTMETOCCEN CINCIBERLANT	CINCEASTLANT	MOIC Northwood (Collocated)
CMOC IBERLANT Oeiras, PO	NATO	Not Applicable	Lisbon		CINCFLEETWOC	CINCIBERLANT	MOIC IBERLANT (Collocated)
CMOC COMNORTH Stavanger, NO	NATO	Not Applicable	Oslo		CINCFLEETWOC	COMNORTH	MOIC COMNORTH
NAVEURMETOCCEN Rota, SP	US	Atlantic waters between 33N and 37N east of 9W; Mediterranean,Baltic, and Black Seas	FNMOC Monterey	Washington Bracknell	CMFWC Naples		MOIC Rota (Collocated)
FWC Gluecksburg, GE	GE	North Sea, Baltic Sea, Baltic approaches	GMGO				MOIC Gluecksburg (Collocated)
CMFWC Naples, IT	NATO	Not Applicable	Rome	Ankara Athens	NAVEURMETOCCEN	CINCSOUTH COMAIRSOUTH COMNAVSOUTH	MOIC COMNAVSOUTH
FWC Athens, GR	GR	Mediterranean Sea, Black Sea and other waters enclosed by 50N to 25N and 10E to 40E	Athens		CMFWC Naples	COMEDEAST COMNAVSOUTH	MOIC Athens (Collocated)
FWC Bandirma, TU	TU	Mediterranean Sea, Black Sea and other waters enclosed by 50N to 25N and 15E to 50E	Ankara		CMFWC Naples	COMEDNOREAST COMNAVSOUTH	

Figure 5-III-1

FLEET WEATHER CENTRES - SUPPORT PROVIDED

Fleet Weather Centre (FWC)	Dedicated Meteorological Broadcast Capability		Fixed Wing Carrier Support (Para 513d)	Area of Coverage Required for Support on NATO Broadcasts (Para 516)
	Unencrypted RATT	Unencrypted Facsimile		
NAVLANTMETOC-CEN, Norfolk, US	H52N	H14N	Yes	North Atlantic Ocean west of line 22N 15W to 42N 15W to 68N 40 W (WESTLANT)
METOC Halifax, CA	C14L (Combined)	C14L (RATT/Fax)	No	Same as National AOR
CINCFLEETWOC, Northwood, UK	Nil	B14A	Yes	North Atlantic Ocean east of line 22N 15W to 42N 15W to 58N 40W; Norwegian Sea, Barents Sea, North Sea, English Channel
CMOC IBERLANT Oeiras, PO	Nil	Nil	Limited	Area bounded by 42N 5W; 42N 20W; 22N 28W; 22N 17W; Coast of NW Africa and Portugal
CMOC COMNORTH Stavanger, NO	Nil	Nil	Limited	Waters of Norwegian littoral; Baltic approaches east of 7E; Baltic Sea
NAVEURMETOCCEN Rota SP	Nil	H14K	Yes	Same as National AOR
FWC Gluecksburg, GE	Nil	Nil	No	Same as National AOR
CMFWC Naples IT	Nil	Nil	Yes	Mediterranean and Black Seas
FWC Athens GR	Nil	Nil	No	Same as National AOR
FWC Bandirma, TU	Yes	Nil	No	Same as National AOR

* UK - RATT Broadcast X11C is via Pitraevie and X11E via Plymouth

Figure 5-III-2

AVAILABILITY OF METEOROLOGICAL SUPPORT TO SHIPS

Types of Product	Types of Broadcasts	Availability to NATO Maritime Forces	
		Broadcasts Available	Reference Publications
Synoptic Data in Alpha-Numeric Format	Unencrypted Dedicated METOC RATT Broadcasts	C14L from METOC Halifax	
		Numerous WMO Broadcasts	WMO Pubs
Severe Weather Warnings, Area Forecasts in Alpha-Numeric Format	Broadcasts listed above for synoptic data also transmit these products	As above	As above
	Unencrypted voice broadcasts from coastal radio stations	Numerous	National pubs
	Unencrypted media broadcasts	Numerous	National pubs
Analyses and Prognoses in Graphic Format	Unencrypted national HF radio dedicated facsimile broadcasts from FWCs in NATO countries	H14K from NEMOC Rota	
		H14N from NLMOC Norfolk	
		B14A from Northwood	
		C14L from METOC Halifax	
	Unencrypted national WMO radio dedicated meteorological broadcasts from national WACs in NATO and other countries	Athens, Rome, Bracknell, Offenbach, Moscow	WMO Pubs

Figure 5-IV

Annex A
Chapter 5

CAPABILITY OF PROVIDING METEOROLOGICAL SUPPORT FROM FWCs

1. Introduction This Annex depicts the capability of FWCs based on reports by the responsible nations and commands. This information is provided by the respective nations or MNCs and updated as required.

2. Contents

METOC Centre Halifax Operated by: Canada Updated: Feb 1996

1. Capability

a. The METOC Centre provides a full range of meteorological and oceanographic products for the northwest Atlantic. Principle products include isobaric prognoses for H + 24 and H + 36 hours, weather depiction prognoses for H + 12, and sea state analyses and prognostics to H + 36 hours. Sea surface temperature and ocean features analyses are also produced on a twice weekly basis. Specialized route or area forecasts are available on request to support ship or aircraft activities.

b. General aerial coverage is bounded by the following: 60N 80W, 60N 25W, 40N 25W, 30N 65W and 40N 80W.

c. Products to the Fleet are delivered via a radiofacsimile and radioteletype broadcast operating on four HF frequencies: 4.271, 6.4964, 10.536 and 13.510 MHz and one LF frequency: 122.5 kHz. Both broadcasts share the same frequencies, thus, the transmission time is divided about equally between the two types of service. Plain language forecasts can also be supplied on request by utilizing the military message system.

d. The METOC Centre uses the Canadian Regional Finite Element Model and the Canadian Global Spectral Model as primary guidance in the production of forecast products.

FWC Gluecksburg Operated by: Germany Date: March 1996

1. Capability

a. Gluecksburg Centre routinely analyses an area which encompasses the North Sea and the Baltic Sea.

b. Meteorological/oceanographic reports (METOCREP) are transmitted three times a day.

c. Ice reports and forecasts are disseminated once a day for the Eastern North Sea and the Baltic Sea.

d. Non-routine products, e.g. forecasts for on-board helicopters, for aircraft and route forecasts, as well as non-routine oceanographic/hydroacoustic forecasts are available on request to national as well as to NATO Naval Forces.

FWC Athens Operated by: Greece Date: March 1996

1. Capability. FWC Athens (Athens Marine Meteorological Centre) provides plain language shipping forecasts for sea areas in the Mediterranean and Black Sea.

a. Daily Forecasts. Weather and sea bulletins for shipping (weather, winds, state-of-sea, visibility) four times per day for the Central - Eastern Mediterranean and Black Sea from Greek coast radio stations plus from weather channel through VHF at any time by tape. Also two times per day for the whole Mediterranean and the Black Sea via satellite INMARSAT.

b. Gale and Storm Warnings. Gale and storm warnings will normally be included in the daily forecasts, but additional warnings will be issued as necessary.

c. Radiofacsimile Broadcasts. Sea/swell forecast charts for 30, 36, 42, and 48 hours daily for the Central and Eastern Mediterranean Sea, plus surface analyses for 0600 UTC and 24-hour surface prognosis charts covering the Mediterranean Sea and South Europe.

2. Additional Services: Additional services on request include Terminal Airfield Forecasts and local forecasts.

FWC Bandirmà Operated by: Turkey Date: March 1996

1. Capability.

a. FWC Bandirma provides weather data and shipping forecasts for Sea of Marmara, Central-Eastern Mediterranean and Black Sea.

b. FWC Bandirma transmits surface and standard upper-level charts in the FM 45-IV IAC code form, and the surface and upper-air data by RATT.

c. Daily forecasts (sea state, weather, winds and visibility), Gale and Storm Warnings for responsible areas are transmitted by RATT and CW broadcast. Forecasts also contain the general synoptic situation and a brief outlook.

d. Also, weather forecasts and sea bulletins for shipping are transmitted from Turkish coastal radio station by VHF six times a day.

CINCFLEETWOC Northwood Operated by: United Kingdom Date: December 1990

1. Capability

a. CINCFLEETWOC is capable of providing weather data and forecast services as required to support maritime air, surface and sub-surface forces operating in the EASTLANT area.

b. As the primary receiving Centre for surface and upper-air weather reports from maritime forces in the EASTLANT area, CINCFLEETWOC can relay these data to adjacent and subordinate NATO and National Commands as signals with originator's classification. Relay of these data is necessarily subject to need-to-know for force dispositions.

c. Through access to the NATO Maritime CCIS, OPCON, meteorological data and forecasts are made available in support of NATO command decision-making at the Allied Headquarters Northwood and connected subordinate headquarters.

NAVLANTMETOCCEN Norfolk Operated by: United States Date: March 1996

1. Capability

a. The Naval Atlantic Meteorology and Oceanography Center (NAVLANTMETOCCEN) uses Fleet Numerical Meteorology and Oceanography Center (FLENUMMETOC-CEN) Monterey products as primary meteorological guidance for its area of responsibility. Products from the National Centers for Environmental Prediction (NCEP) (formerly titled NMC), Washington, D. C., are used as backup or secondary guidance, as required. FLENUMMETOCCEN guidance products are produced by two numerical meteorological models, Navy Operational Regional Atmospheric Prediction System (NORAPS) and Navy Operational Global Atmospheric Prediction System (NOGAPS). NOGAPS is an 18-level global spectral model with "T159" horizontal resolution (about .75 degrees on the Gaussian grid or degreeslat/long). Global Optimum Interpolation (OI) analyses are prepared on a .75 degree Gaussian grid on a 6-hour cycle and forecasts are made to 96 hours at 12Z and to 120 hours at 00Z. These analyses use conventional surface and upper-air data. In addition, the following satellite data are used:

- Temperature profiles (TOVS retrievals) from NOAA and DMSP
- SSM/I scalar winds
- MCSST for surface temperature
- SSM/I integrated precipitable water in the moisture analysis
- Ice/snow information as boundary conditions
- Tropical cyclone circulations based on official warnings are automatically entered

NOGAPS also produces forecast tropical cyclone tracks for guidance. NORAPS is a 36-layer, variable horizontal grid regional forecast model with executes twice daily for specific operational areas. Boundary conditions are supplied by NOGAPS. The horizontal resolution is usually 45 km to provide the best guidance for cyclogenesis and air-sea-land interaction. A FAST NORAPS response model can respond within 24 hours to changing tactical requirements. The Wave Model (WAM) produces sea state forecasts to 120 hours twice daily.

b. In addition to military circuits, environmental support is also routed to fleet units over the NFAX radio-facsimile HF broadcast. Selected FLENUMMETOCCEN Monterey charts provide users with oceanographic and atmospheric analyses and prognoses out to 120 hours. The facsimile broadcast includes twice-daily, hand-drawn surface pressure analyses, sea height analyses, and 48 and 84-hour surface prognoses for the entire North Atlantic as well as numerous other surface and upper-air analyses and prognostic displays which are man-made or computer generated. Satellite imagery of the Western Atlantic is also provided.

c. Environmental support in the form of North Atlantic high wind/sea warnings, area forecasts, site weather forecasts/warnings and tropical warnings/discussions are routinely disseminated.

d. Optimum Track Ship Routing (OTSR) and tailored enroute weather forecasts (WEAX) are also available to NATO units upon request. The tailored forecasts can include additional aviation parameter (AVWX) for seagoing airborne detachments.

NAVEURMETOCCEN Rota Operated by: United States Date: June 1996

1. Capability

a. ATP 32 (A) and AWP-1 provide the details of environmental support available from NAVEURMETOCCEN Rota. NAVEURMETOCCEN Rota transmits a 24-hour facsimile broadcast comprised primarily of numerical products created by Fleet Numerical Meteorology and Oceanography Center (FLENUMMETOCCEN) Monterey. Two manually produced products included on the broadcast are blends of numerical products and forecaster skill. A 36-hour surface prognosis (FSME) is issued four times daily over C-8 and covers the Mediterranean Sea, Black Sea, and Baltic Sea. Included on the prognosis chart are frontal systems, surface winds and projected movement of major features. A 36-hour significant wave height prognosis (OSME) is issued four times daily for the Mediterranean Sea, Black Sea, and Gulf of Cadiz.

b. NAVEURMETOCCEN Rota prepares four bulletins. The Prognostic Discussion Mediterranean (PDME1 LERT) and the Prognostic Discussion Baltic (PDBQ1 LERT) discuss the 36-hour surface and upper-air forecast with an extended 120-hour outlook. The PDME1 and PDBQ1 are issued at 0030Z and 1230Z. The High Wind and Sea Warnings (WWMM30 LERT and WWMM31 LERT) cover a 24-hour period and outline areas in the Mediterranean, Black and Baltic Seas forecast to experience winds greater or equal to 34 knots and/or significant wave heights greater or equal to 12 feet. The WWMM30 bulletin is issued for 0000Z and the WWMM31 bulletin is issued for 1200Z.

c. Tailored Enroute Weather Forecasts (WEAX) and Aviation Enroute Weather Forecasts (AVWX) are available to NATO units upon special request. Optimum Track Ship Routing (OTSR) is not available for the Mediterranean, Black or Baltic Seas.

d. Environmental support in the form of the Mediterranean, Black and Baltic Seas High Wind and Seas Warning, Prognostic Discussion Mediterranean and Prognostic Discussion Baltic are routinely disseminated to fleet units Enroute Weather Forecasts (WEAX/AVWX) are disseminated by request.

AFSOUTH CMFWC Operated by: CINCSOUTH Date: October 1986

1. Capability

a. The Command Meteorological and Fleet Weather Centre (CMFWC) produces four surface analysis charts every day and receives from Rome WAC and NAVEURMETOCCEN Rota (US Navy) upper analysis and prediction charts up to 120 hours in advance. The CMFWC also receives through AFSOUTH Loops A and B, Rota and Paris, selected SYNOP, METAR, AIREP, TAF, and TEMP lists. On the basis of these raw products, the CMFWC produces, in addition to the analysis charts, Fleet Forecasts twice a day (at 0510Z and 1710Z), Southern Region Forecast twice a day (at 0415Z and 1615Z), and Coded Surface Analysis twice a day (0415Z and 1615Z). The CMFWC produces, on request, special areas detailed forecasts and provides, on request, SYNOP and TEMP list. Gale Warnings are issued when necessary.

CINCIBERLANT CMOC Operated by: CINCIBERLANT Date: March 1996

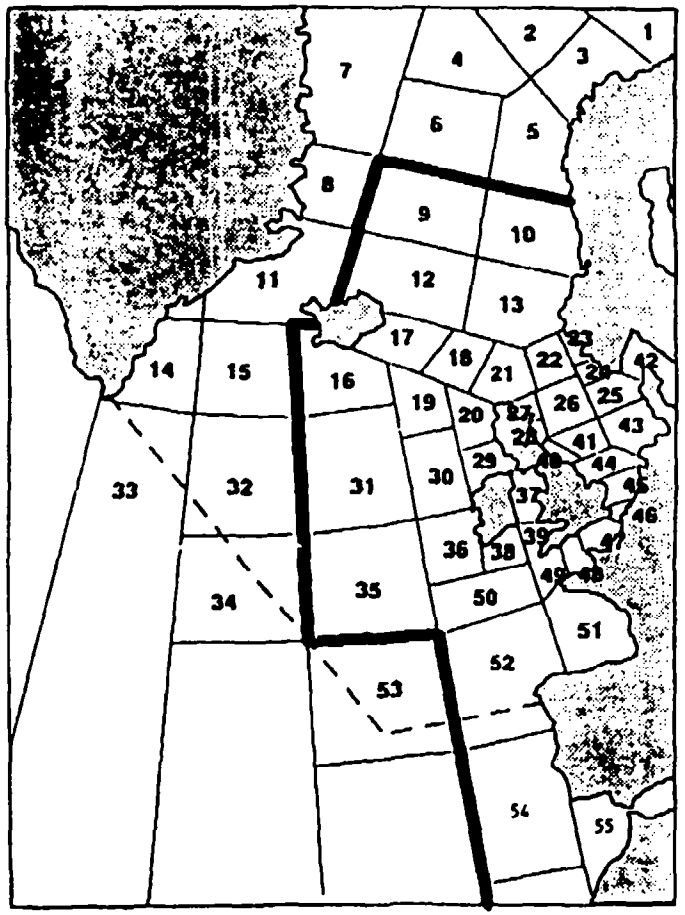
1. Capability

a. CINCIBERLANT CMOC receives coded data on dedicated lines from the Lisbon WAC and the Portuguese Air Force National Weather Centre. It also has a local weather satellite receiving capability. ECMWF and Bracknell products are received by commercial fax from the Lisbon WAC. There are also radio fax reception facilities.

b. A 24 hour forecast for the area of responsibility is signalled each working day. Tailored forecasts including radio and radar propagation, sea, swell and surf where applicable can be provided on request.

MARITIME FORECAST AREAS

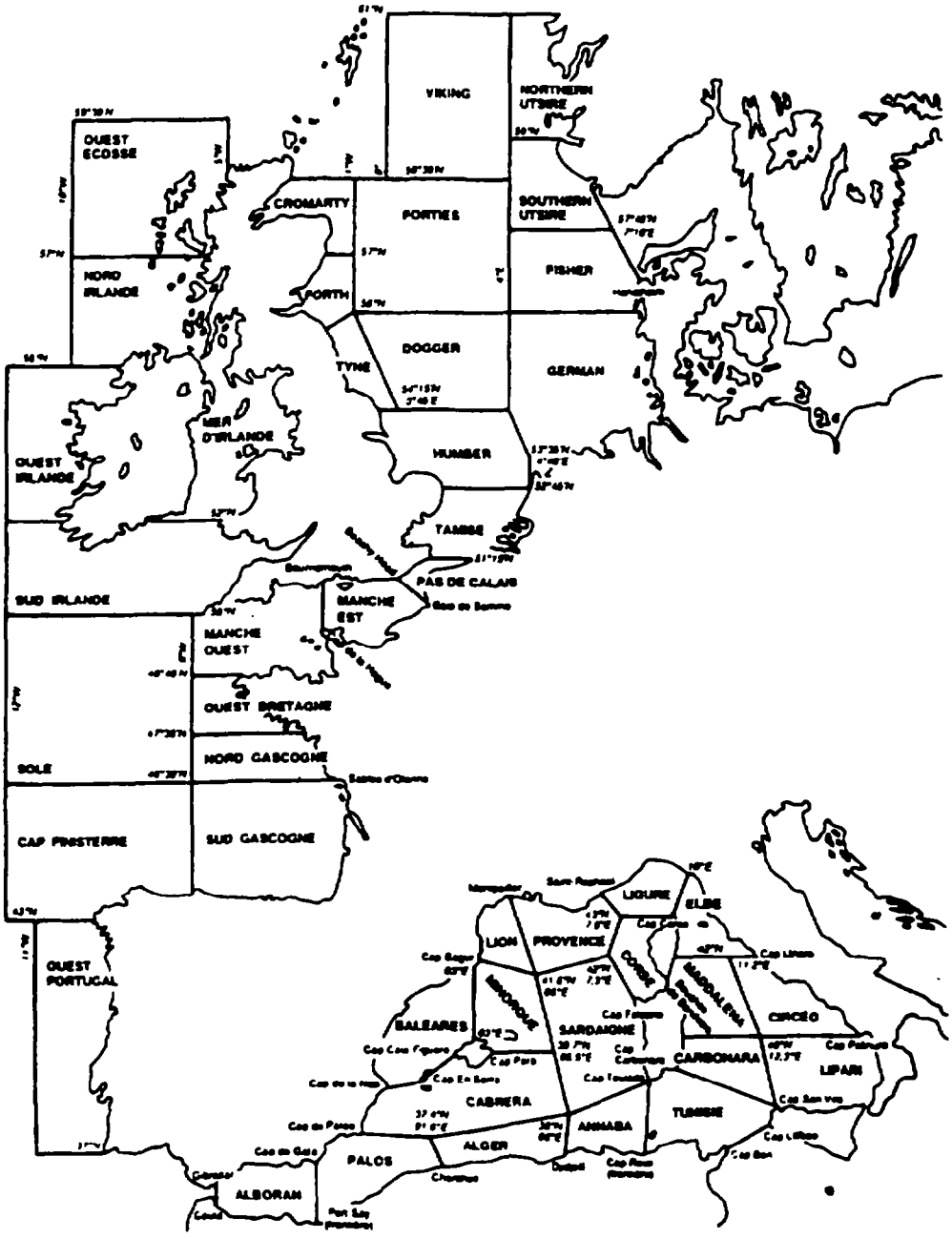
CINCFLEETWOC NORTHWOOD MARITIME FORECAST AREAS

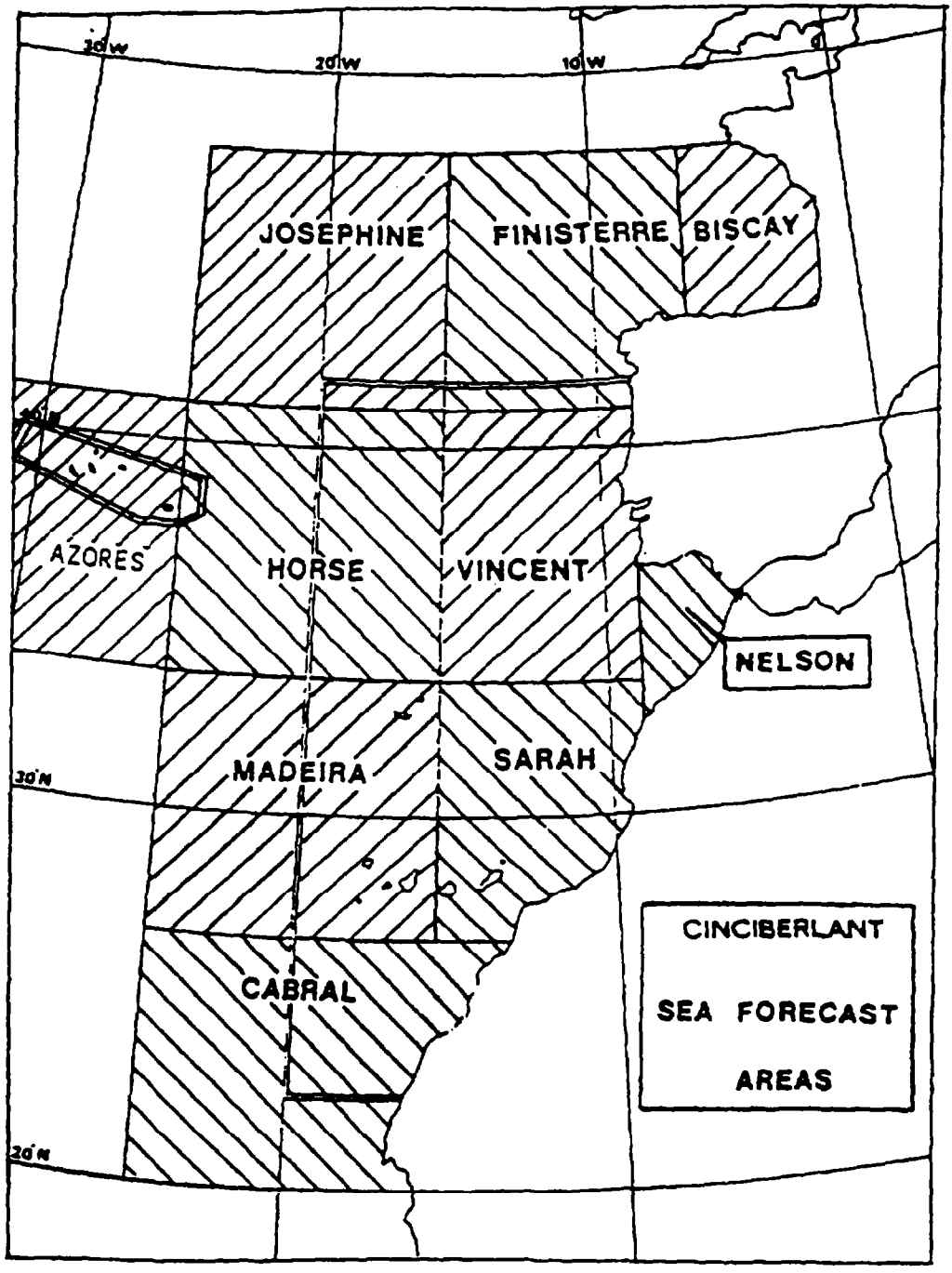


1 KOLA
2 HOPE
3 VARDO
4 SPITZBERGEN
5 LOFOTEN
6 GREENLAND
7 WILLIAM
8 DAVY
9 MAYEN*
10 TRAEN*
11 STRAITS
12 REYDAR*
13 STOR*
14 DAN
15 ABLE
16 HEKLA*
17 ICELAND*
18 FAEROES*
19 BAILEY*
20 HEBRIDES*
21 FAIR ISLE*
22 VIKING*
23 NORTH UTSIRE*
24 SOUTH UTSIRE*
25 FISHER*
26 FORTIES*
27 CROMARTY*
28 FORTH*
29 MALIN*
30 ROCKALL*
31 VIDAL
32 DEEP
33 NE FAREWELL
34 NE RIDGE
35 ATLANTIS*
36 SHANNON*
37 IRISH SEA*
38 FASTNET*
39 LUNDY*
40 TYNE*
41 DOGGER*
42 SKAGER*
43 GERMAN BIGHT*
44 HUMBER*
45 THAMES*
46 DOVER*
47 WIGHT*
48 PORTLAND*
49 PLYMOUTH*
50 SOLE*
51 BISCAY*
52 FINISTERRE*
53 JOSEPHINE
54 VINCENT*
55 NELSON*

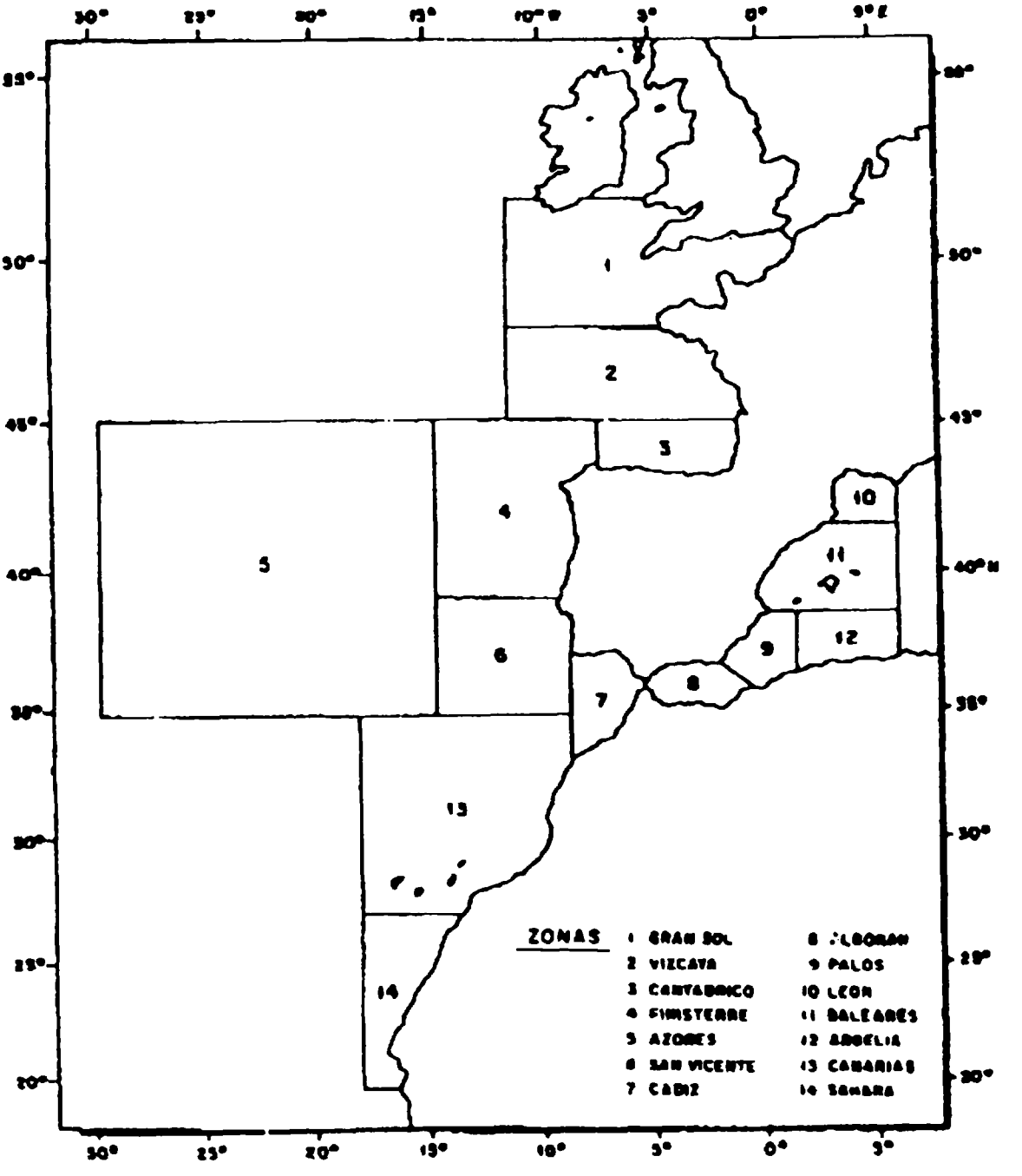
* AREAS TRANSMITTED IN ROUTINE PEACETIME CINCFLEETWOC FLEET FORECAST MESSAGES

METEO FRANCE MARITIME FORECAST AREAS

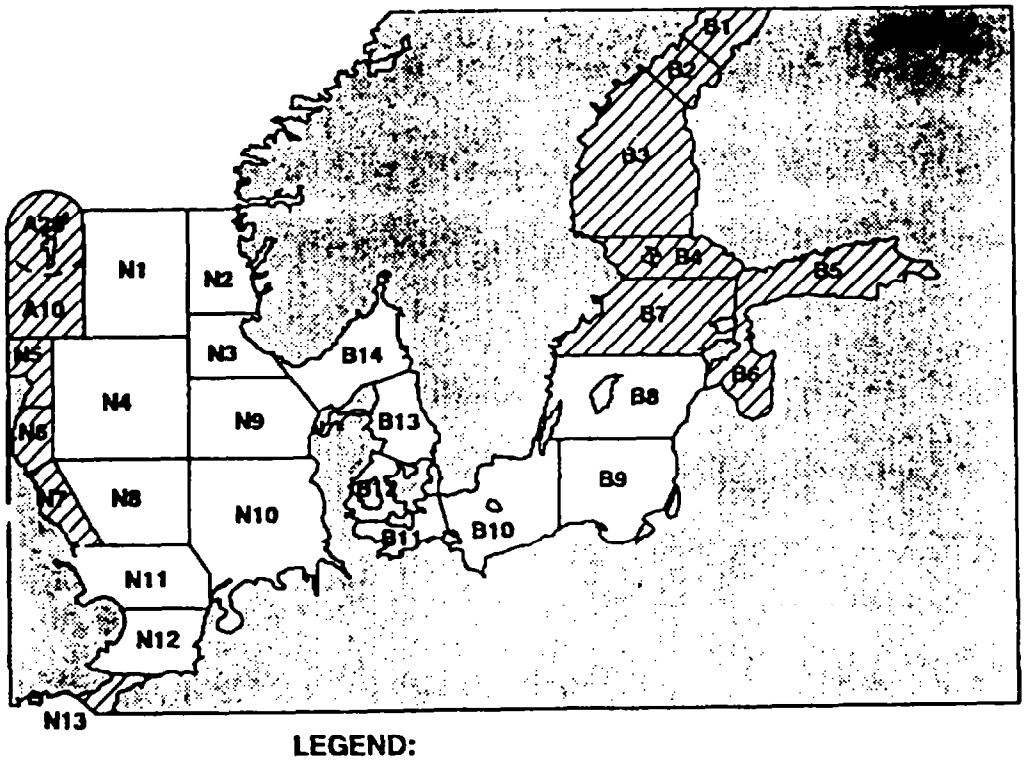



30°W
20°W
10°W
JOSEPHINE
FINISTERRE
BISCAY
AZORES
HORSE
VINCENT
NELSON
MADEIRA
SARAH
30°N
CABRAL
CINCIBERLANT
SEA FORECAST
AREAS
20°N

SPAIN MARITIME FORECAST AREAS



FWC GLUECKSBURG MARITIME FORECAST AREAS



LEGEND:

NORTH SEA

N1 VIKING
N2 UTSIRA NORTH
N3 UTSIRA SOUTH
N4 FORTIES
N8 DOGGER
N9 FISHER
N10 GERMAN BIGHT
N11 HUMBER
N12 THAMES

BALTIC

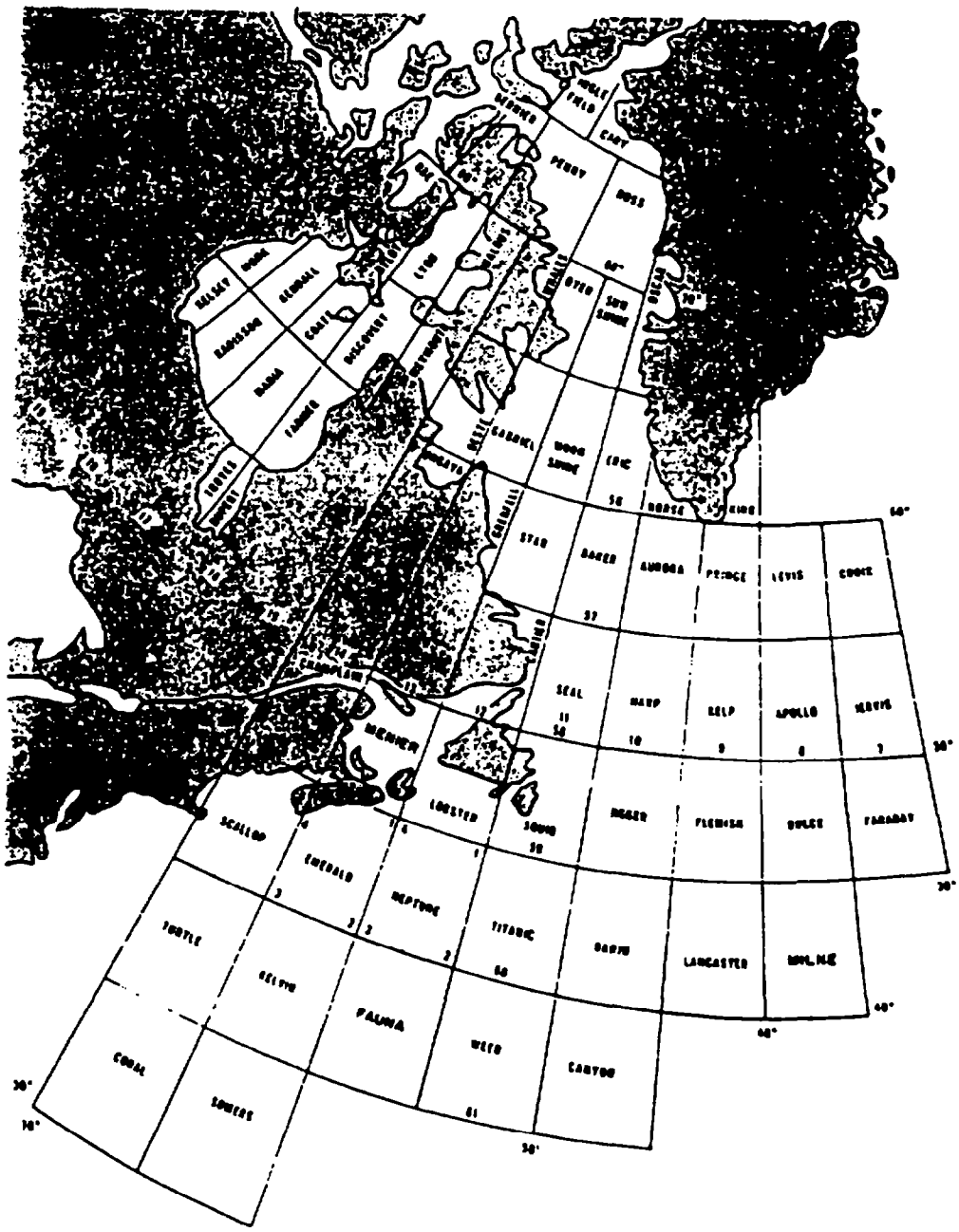
B8 CENTRAL BALTIC
B9 SOUTHEASTERN BALTIC
B10 SOUTHERN BALTIC
B11 WESTERN BALTIC
B12 THE SOUND AND BELTS
B13 KATTEGAT
B14 SKAGERRAK

ON REQUEST ONLY

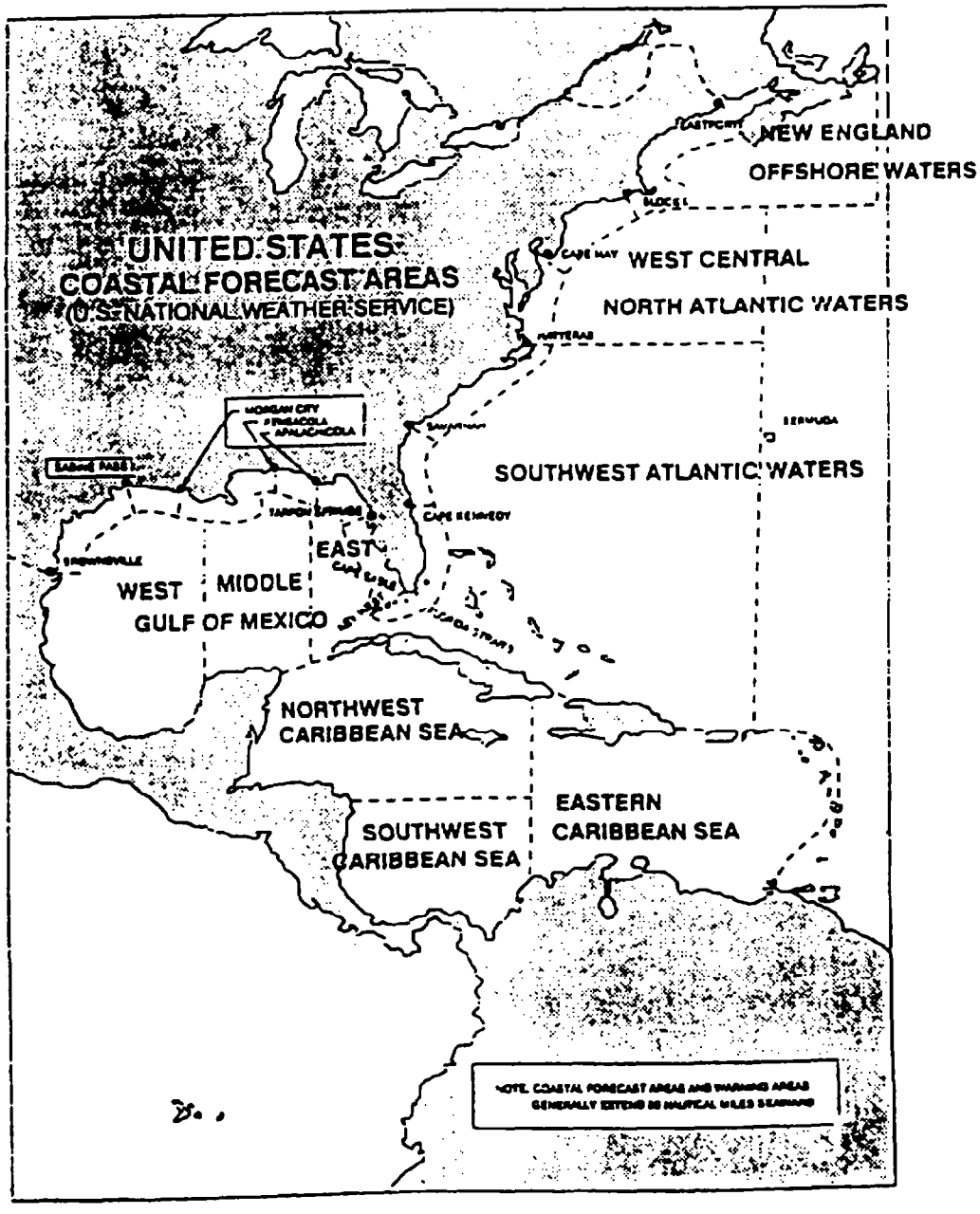
A10 PENTLANDS
A20 SHETLANDS
N5 CROMARTY
N6 FORTH
N7 TYNE
N13 DOVER

B1 BAY OF BOTHNIA
B2 THE QUARK
B3 SEA OF BOTHNIA
B4 SEA OF ALAND AND ARCHIPELAGO
B5 GULF OF FINLAND
B6 GULF OF RIGA
B7 NORTHERN BALTIC

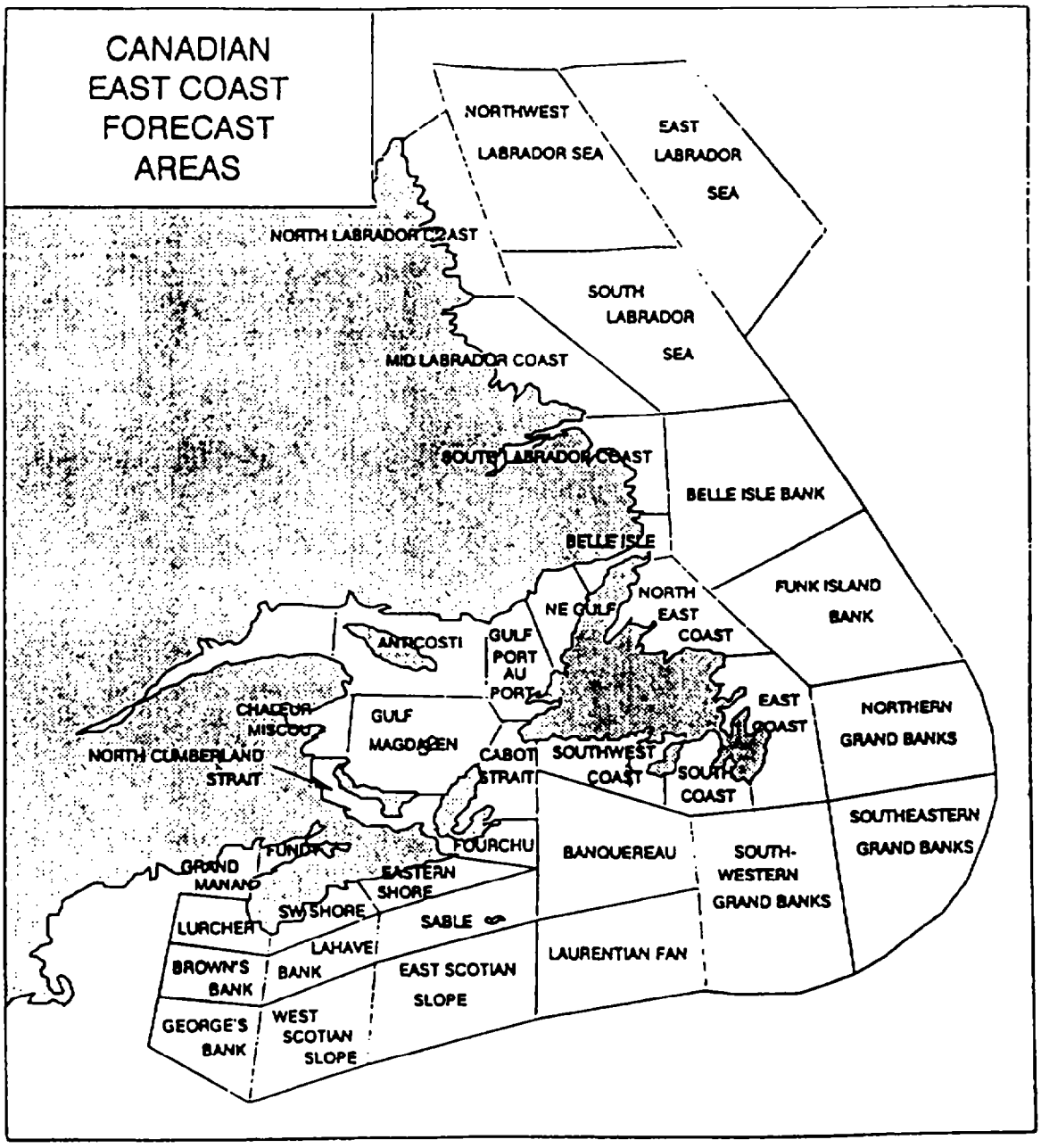
METOC CENTRE HALIFAX MARITIME FORECAST AREAS



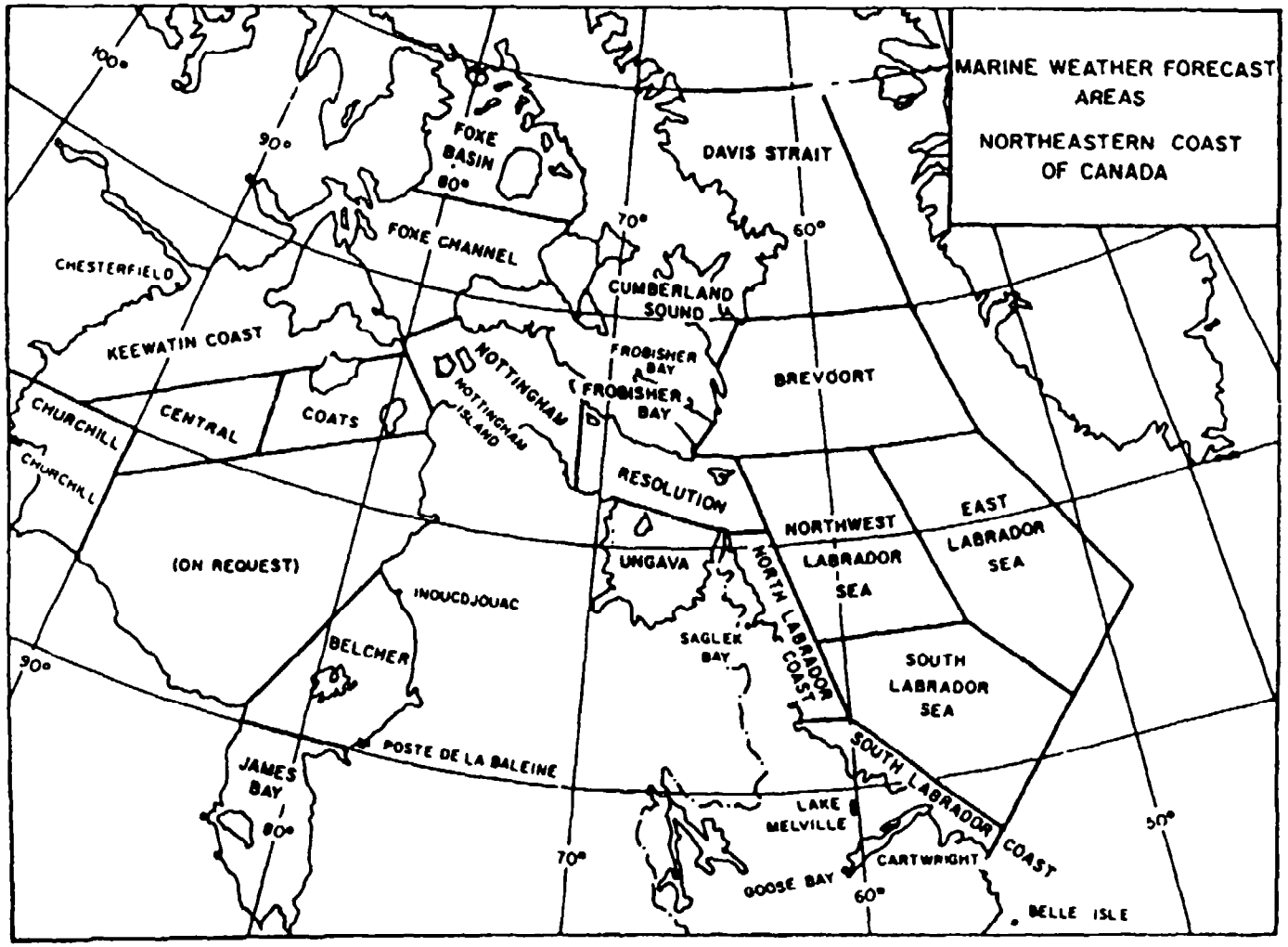
US COASTAL MARITIME FORECAST AREAS
(National Weather Service)



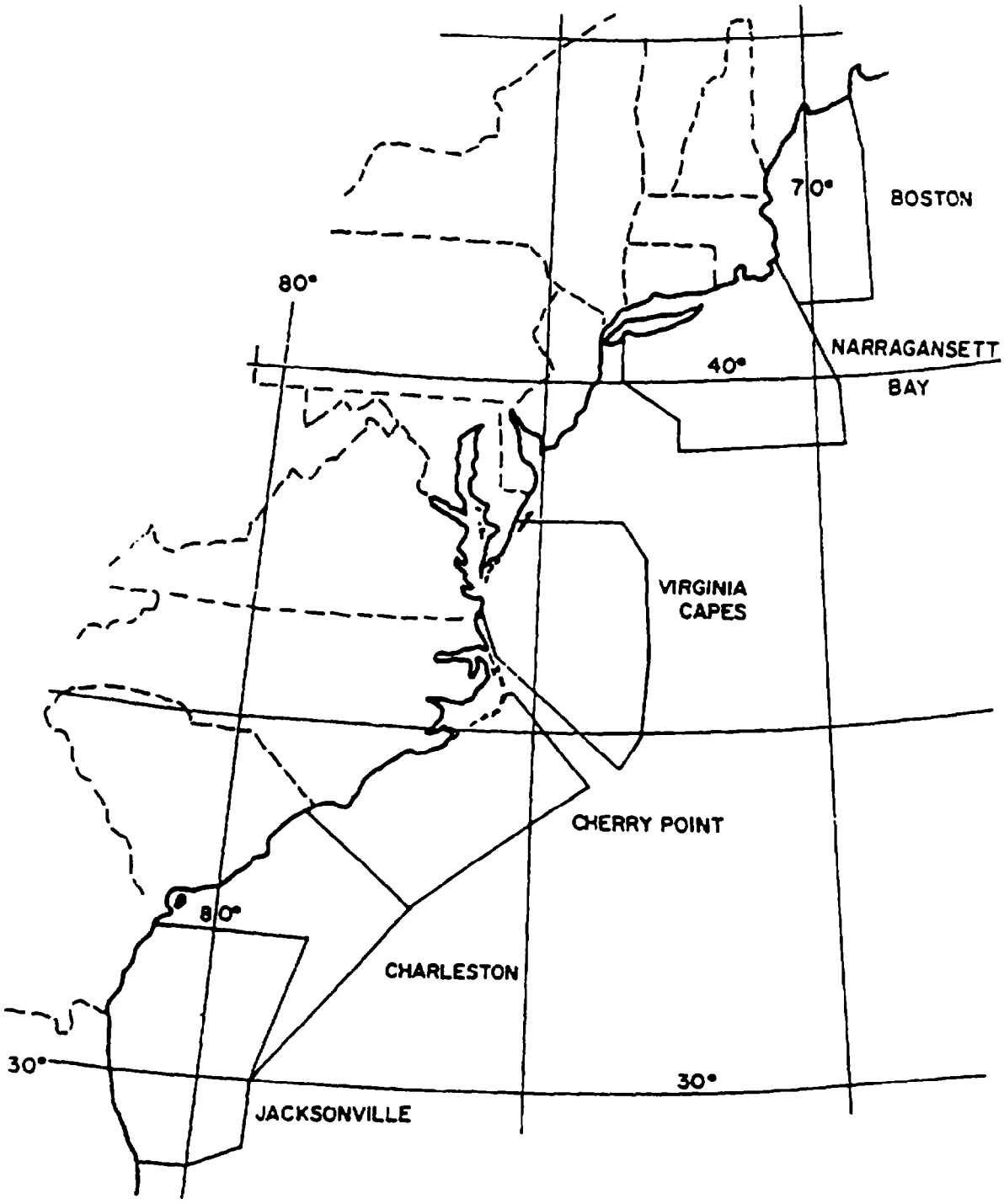
CANADIAN EAST COAST MARITIME FORECAST AREAS



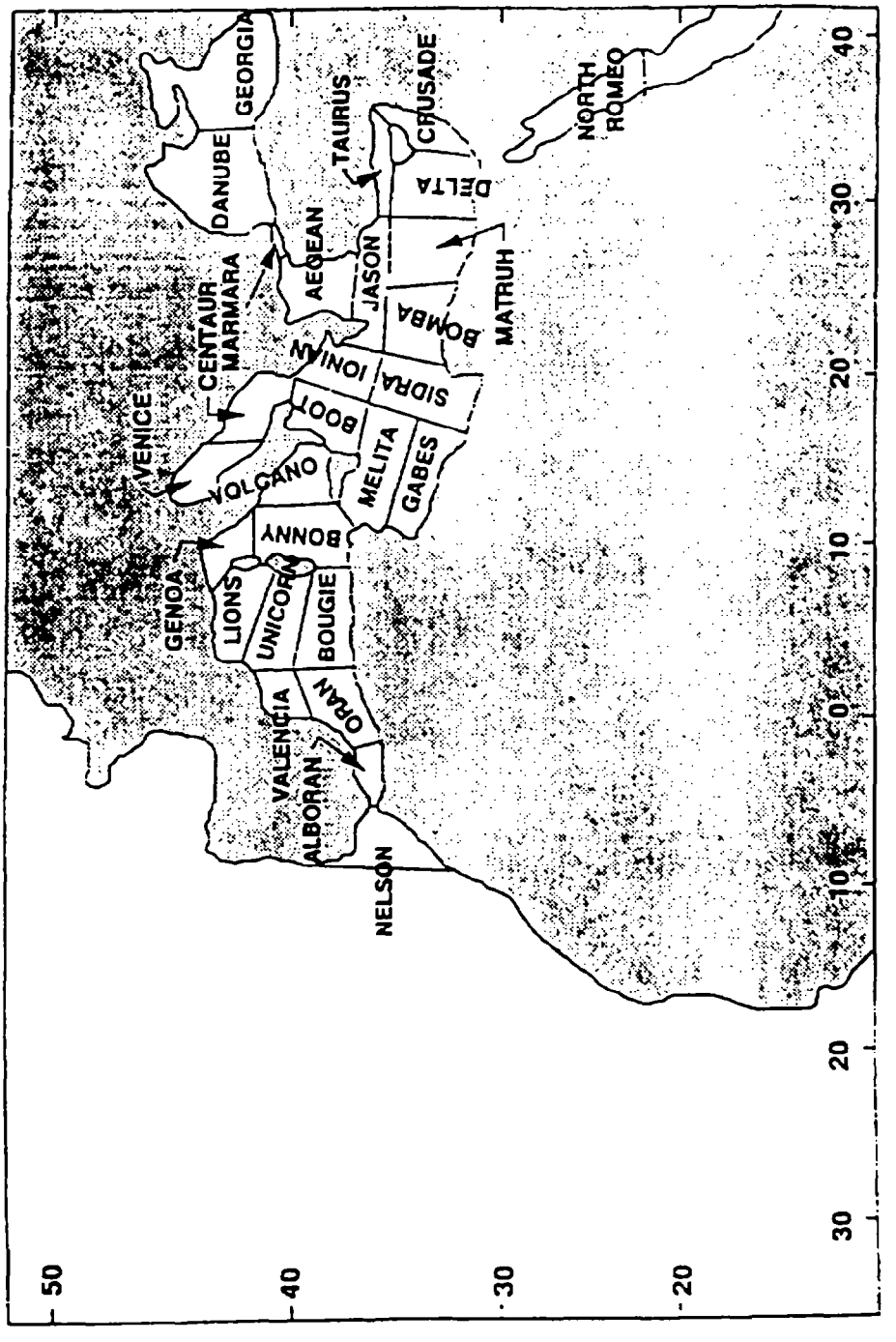
CANADIAN NORTHEASTERN COAST MARITIME FORECAST AREAS



NAVLANTMETOCCEN NORFOLK MARITIME FORECAST AREAS



CMFWC NAVSOUTH/FWC BANDIRMA MARITIME FORECAST AREAS

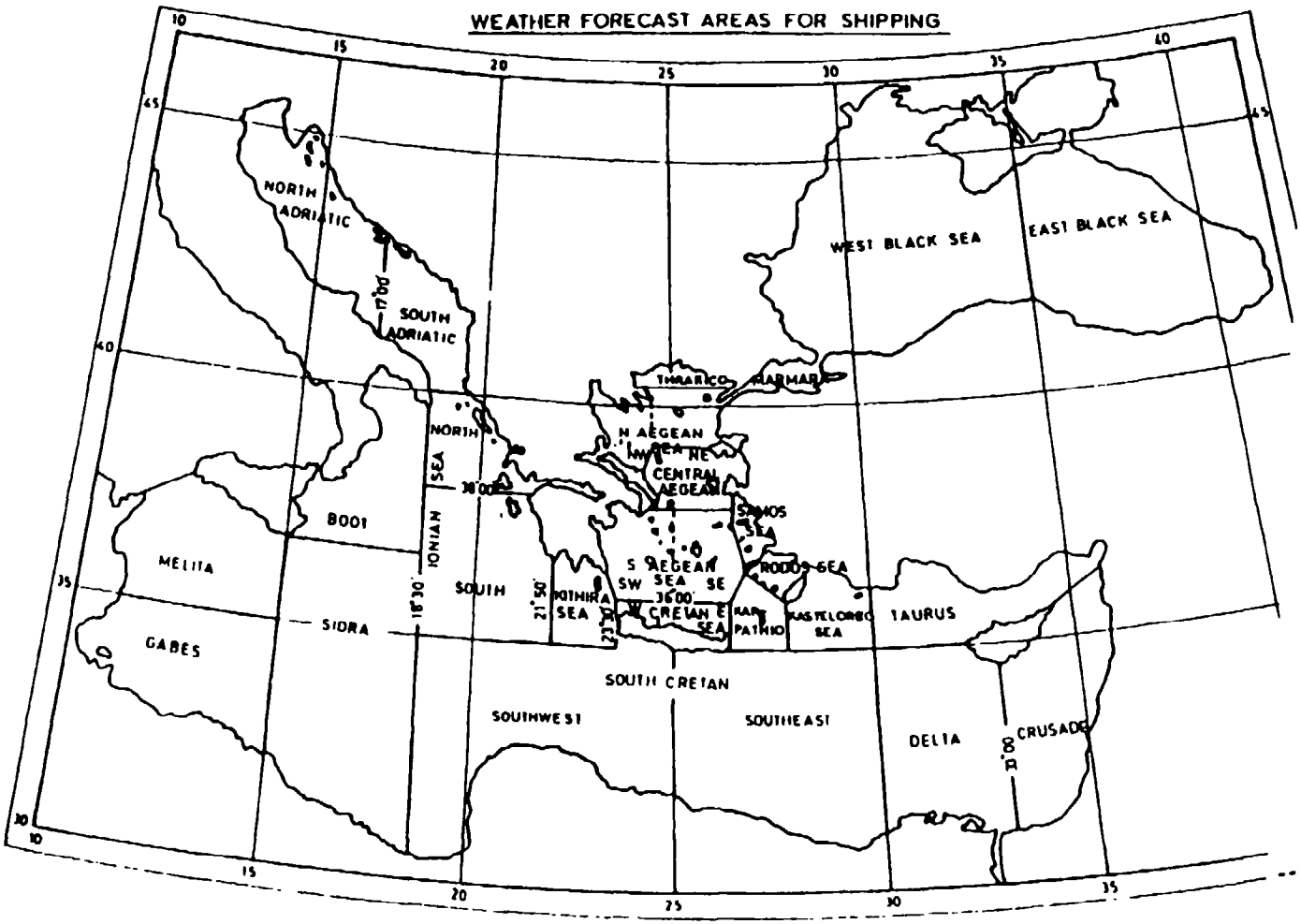


FWC ATHENS MARITIME FORECAST AREAS

GENERAL AIR STAFF
HELLENIC NATIONAL METEOROLOGICAL SERVICE
ATHENS MARINE METEOROLOGICAL CENTRE

REVISED 1st July 1992

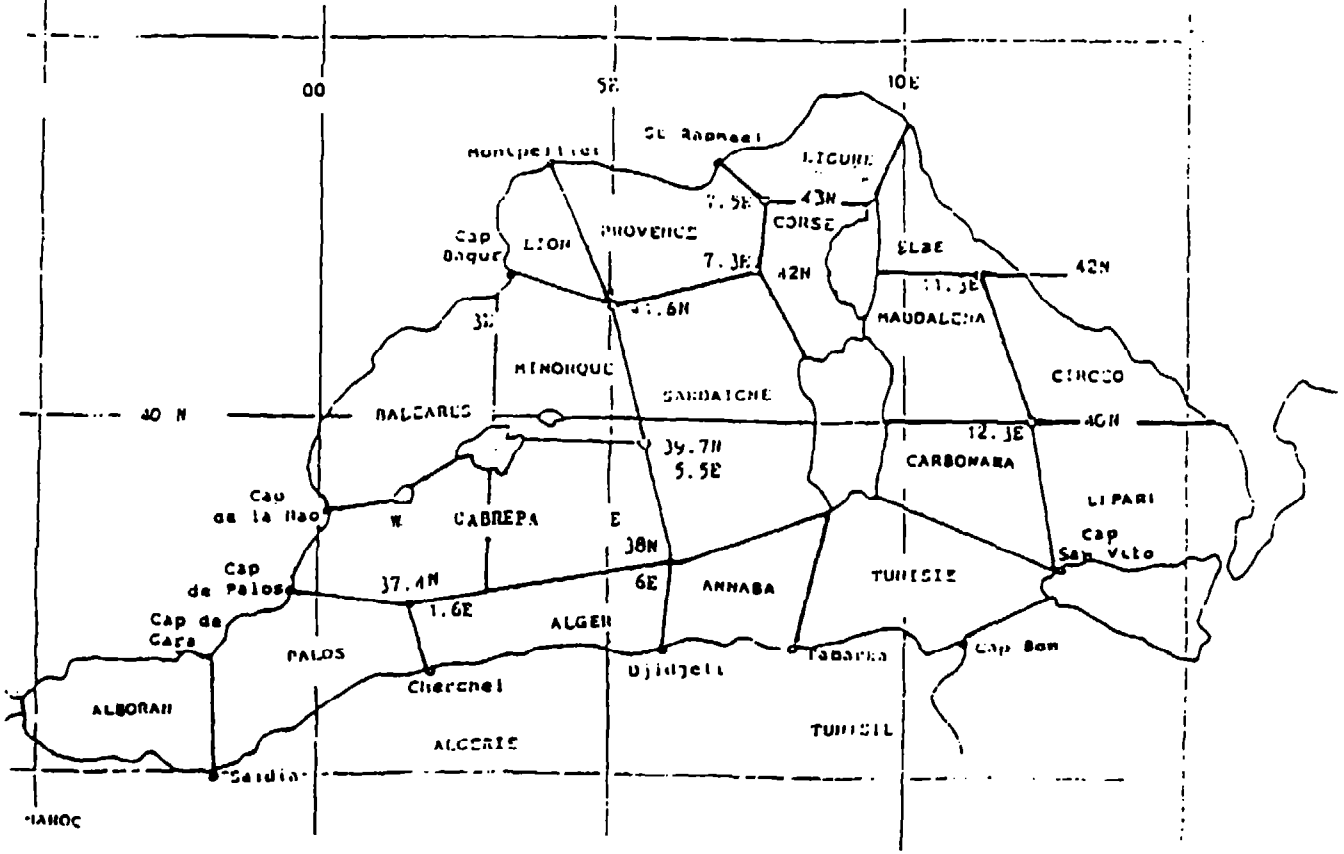
WEATHER FORECAST AREAS FOR SHIPPING



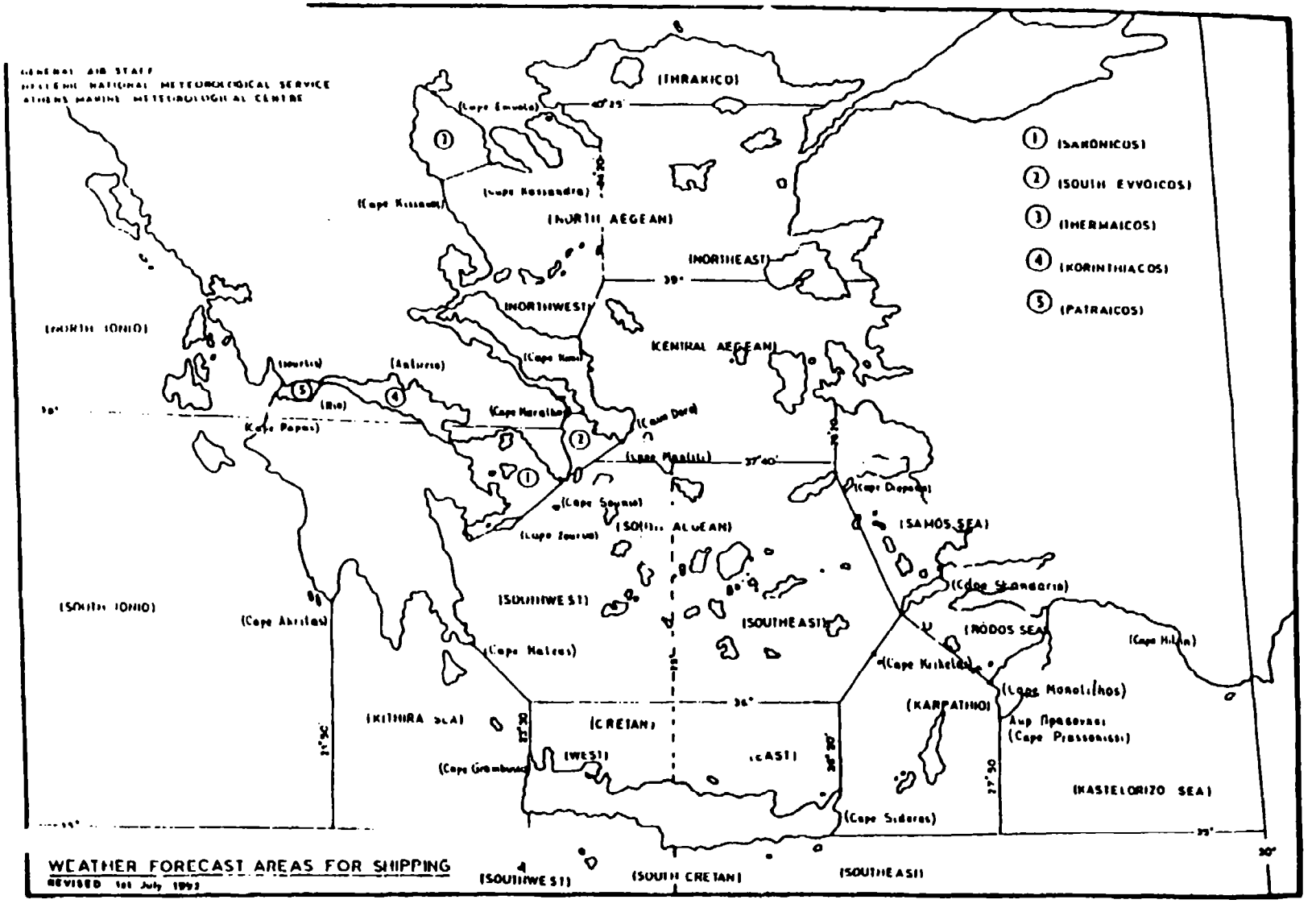
FWC ATHENS MARITIME FORECAST AREAS

HELLENIC NATIONAL METEOROLOGICAL SERVICE - METEO FRANCE
INMARSAT (SATELITE) METEOROLOGICAL COVERAGE VIA THERMO-
PYLAE COAST EARTH STATION (GREECE)

WEST MEDITERRANEAN SEA
WEATHER FORECAST AREAS FOR SHIPPING



FWC ATHENS MARITIME FORECAST AREAS - DETAIL



CHAPTER 6

METEOROLOGICAL SUPPORT TO NATO AIR OPERATIONS

References: A. AWP-4 NATO Meteorological Codes Manual

INTRODUCTION

601. The division of NATO's forces into Reaction Forces, Main Defence Forces, and Augmentation Forces in 1991, lead to a core of rapidly deployable, highly capable air units to enable regional commanders to respond quickly and create a balanced force structure. This reorganization allows for a leaner, sharper structure than hitherto with far fewer forces held at high readiness. In the case of the ACE Reaction Forces Air, NATO nations have allocated to SACEUR over 550 aircraft, 24 SAM/SHORAD units and 2 Air Control Squadrons. Most nations now contribute to the primarily defensive Immediate Reaction Force, and to the more offensively capable Rapid Reaction Force. The meteorological support for ACE Reaction Forces is outlined in Annex A.

602. In general, NATO air operations require meteorological support services which are similar to those for supporting any nation's air operations. The main additional requirements for NATO operations are for standardisation of procedures as much as possible, wider coordination of weather forecasts, additional dissemination of weather information and an operational weather briefing capability at each of the NATO Command HQs. In ACE each of the three MSCs have a Staff Meteorological Officer and comprehensive meteorological support facilities, either national as at HQ AFNORTHWEST, NATO as at HQ AFSOUTH, or a small NATO Met Cell as at HQ AFCENT with support from the national military weather services of Germany and the Netherlands. In the last case, the German Military Geophysical Office at Traben-Trarbach, with the RNLAF Met Centre at Woensdrecht as back-up, act as the NATO Weather Analysis Centre for the ACE Central Region.

603. Some nations have airbases located in other NATO countries in Europe. At some level of crisis, aircraft of some nations will deploy and operate from airbases of other NATO nations in Europe together with aircraft of the host nation. The deployed units usually include their own meteorological briefing cell which may rely heavily on host nation services such as airfield weather observations and TAFs.

604. There are many types of air operations and each has its own unique requirements for meteorological support. The main types of operations are;

a. Transport - Airlift of personnel, weapon systems and equipment
Tactical low level operations including para-drops
Air to Air Refuelling
Maritime Patrol Aircraft

b. Fast Jet - Reconnaissance
Air Defence
Strike Attack
Electronic Warfare

c. Helicopters - Transport
Reconnaissance
Attack
Search and Rescue

d. Airborne Early Warning

REQUIREMENTS

605. Meteorological support, tailored to the specific requirements of air operations, as described in References A through C, will be provided at:

a. NATO MNC, MSC and PSC headquarters for commanders and their staffs

b. Air Operations Centres of different types.

c. Airbases for:

(1) commanders at wing level,

(2) aircrews employed in a wide variety of operational roles, and

(3) Airbase Support Services (Air Traffic Control, Fire Services, etc.)

d. SAM sites.

e. Army Aviation Brigade Command Post and Landing Zones.

f. Rescue Coordination Centres (RCC) for SAR.

606. Requirements at MNCs, MSCs, and PSCs. At the MNCs, MSCs, and PSCs, there is a requirement for an overall analysis of the main weather features and an assessment of their impact on the relevant operations. The Staff Met Officer must be included in the Directing Officer's planning and coordination meetings, This ensures the weather brief at the daily Commanders Decision briefings, particularly the impact statement, is relevant to the current phase of the operation. During the build-up of forces, the weather forecast must give special consideration to the weather impact on land, sea and air movements into the theatre of operations, including airfield fog, flooding affecting land routes, and high seas. Snow cover, and or frozen ground, severely affects laying and clearing of land mines. In general, the Commanders at the strategic level need to be informed about those weather aspects which may delay the operation, or help to explain a delay already occurring .

607. Requirements at Air Operations Centre. The NATO Air Operations Centres require the following meteorological products :

a. Products required for Area of Operational Responsibility (AOR):

Severe Weather warnings
General Forecasts (0-72 hrs)
Aviation Weather Forecasts (0-18 hrs)
NATO Airfield Weather Actuals
NATO Airfield TAFs
NATO Airfield Colour States
Specific Target Forecasts
Advisary Airfield Forecasts
NBC Predictions

b. Content of Aviation Forecasts required by Air Operation Centres:

Upper Winds and Temperatures
Icing
Turbulence
Contrails
Height and Temperature of Tropopause
D Values
Pressure Altitude

Sea State
Sea Ice
Sea Surface Temperature

608. Requirements at Airbases:

a. Airfield weather reports and forecasts are an essential requirement for the Commander and his staffs to efficiently and effectively manage the many different airfield operations from air traffic control to authorization of flights. Most wing/squadron flying missions are to carry out a specific specialist task. The meteorological support which is provided to the aircrews for each mission needs to be tailored to the requirements of the specific role, the area of operations, and the period of the mission.

b. The support required will comprise:

(1) actual weather information for the airbases should be continuously monitored and routinely measured by qualified meteorological observers at the airbase, in accordance with ICAO/WMO standards.

(2) severe weather warnings for the home airbase must be provided to avoid significant hazards to air operations, safety of aircraft, aircrews, ground staff and equipment.

(3) forecast information for the home airbase, designated diversion airbases, the area of operations, and route should be provided to the aircrews, whenever possible, by personal briefing to individual aircrews, or group of aircrews on the same mission, by a trained forecaster as short a time as possible before the start of the mission to ensure that the most up-to-date information is used.

(4) mission specific forecast information is required for route planning, for tactical planning, and to help determine the best mode of operation of weapon and the sensor systems. Mission specific requirements include forecasts of electro-optic range and Infra-red range, night illumination levels for night vision goggles, radar ducting, sound propagation and NBC dispersion/fallout patterns.

c. Details of support need to be described in Local Operation Procedures / Local Staff Instructions. It is normal for these procedures to be established by direct liaison between the Staff Met Officer, the squadron commanders and the aircrew.

609. Requirements at SAM sites

a. Surface and upper air forecasts are required for the location of the unit and likely areas of deployment.

b. Severe Weather Warnings are required for conditions which may affect:

(1) the mobility of the unit,

(2) serviceability of ground equipment, or

(3) safety of personnel.

610. Requirements at Army Aviation Bases. When helicopter attack and lift missions originate from an airfield the requirements are similar to those for fixed wing aircraft but with greater emphasis on low level weather to support nap-of-the-earth flying. Often helicopters operate from landing zones or tactical locations without permanent observation equipment and the mission may cover several hours. In this case the weather brief must include information on landing zones.

611. More detailed requirements will relate to:

a. Warnings of severe weather which could create a significant hazard to air operations and safety of aircraft and ground personnel. Details are given in Figure 6-I.

b. Meteorological data and products, both surface and upper-air, which are used for:

(1) flight planning.

(2) determination of the best mode of operation of weapon and sensor systems.

(3) development of correction factors for use in guidance systems of weapons to compensate for atmospheric conditions. This information may be required in the form of a tactical index for electro-optical systems.

(4) deciding particular aircraft weapon systems to be used for a specific mission.

(5) making a choice of specific targets for missions.

(6) assessment of aircraft performance by air defence controllers.

(7) prediction of NBC fall-out patterns.

ORGANIZATION

612. The organization to meet the requirements for support to NATO Air Operations is provided, by a combination of WACs, MFCs and MSUs, as described in Chapter 3, and outlined below.

613. Military Forecast Centres (MFCs)

a. MFCs which support air operations do not have a collective name, but they include:

(1) Command Meteorological Centres (CMCs) which are NATO centres (as described in Para 305) that have been established at the headquarters of each MSC in ACE. The AFSOUTH CMC provides support for both air and maritime operations and is known as a Command Meteorological and Fleet Weather Centre (CMFWC).

(2) Allied Meteorological Offices (AMOs) which are NATO centres that have been established at the headquarters of PSCs and ATAFs.

b. The organization of MFCs which provides support to NATO air operations in ACE includes centres which are co-located with NATO HQs, as well as national centres, details of which are given in Figure 6-II.

c. Details of support required by air MFCs from WACs are given in Figure 3-II.

614. Meteorological Support Units (MSUs)

a. Because of the importance and nature of the meteorological support required by air operations, MSUs are located at:

(1) most air headquarters at ATAF level and below,

(2) some air operations centres, and

(3) most airbases.

b. With the exception of the MSU at the NAEW MOB Geilenkirchen, all MSUs at airbases and air operations centres are national.

c. Details of support required by air MSUs from WACs and/or air MFCs are given in Figure 6-III

IMPLEMENTATION

615. Support to Air Headquarters

a. MNC, MSC, PSC and ATAF level. See Chapter 4.

b. Below ATAF level These Commanders will normally be located on an airbase, where support can be provided by the airbase MSU.

616. Support at airbases

a. Support to the NAEW base at Geilenkirchen is covered in Para 618.

b. Support to national airbases in their own country is provided by a national meteorological organization of that country.

c. Support to national airbases located in another NATO country is normally provided by the nation which operates the base, not the host nation. Support to the MSU on such airbases may be provided by a WAC and/or MFC either from:

(1) the host nation by bilateral agreement, or

(2) their own country, or

(3) another NATO country by bilateral agreement.

d. Support to aircrews operating from an airbase in another NATO country, belonging to that country, is normally provided by the host nation's meteorological organization.

e. The MSU at an airbase may be either:

(1) A Forecast Office which is normally manned by qualified forecasters and observers on a 24 hours-per-day, 365 days-per-year basis. Because the support to be provided to the aircrews needs to be based on the very latest information possible, most forecast offices receive data and products directly from a WAC rather than use more tailored products from a MFC.

(2) A Briefing Office is not normally manned on a 24 hours-per-day basis. Qualifications of the staff depend on the individual requirements of the airbase. They interpret tailored products from a MFC to provide briefings to aircrews and ground support staff. The MFC which provides support should itself operate on a 24 hours-per-day, 365 days-per-year basis.

f. Although a significant number of operational aircraft of different NATO nations may be deployed during periods of crisis, the airbases to which they deploy will normally all be operational in peacetime, together with their supporting services, including the MSU.

g. Aircraft weather reports All airbase MSU's should have procedures for debriefing, evaluating and processing aircrew weather observations (TARWI, plain language pilot reports, etc). These observations should be transmitted as soon as possible for use by air operations centres and other airbases by means of the communications circuits used for the transmission of routine airbase observations.

h. Support at temporary "airbases" in the battlefield area for helicopters and VSTOL aircraft should be defined in appropriate OPLANs covering those operations. Usually the support is provided via communications with the closest appropriate weather unit.

617. Support to Air Operations Centres

a. Support is provided by either:

(1) an MSU, or

(2) a collocated MFC, or

(3) an MFC at another location, or

(4) an airbase MSU at another location.

b. Support from an MFC or airbase MSUs at other locations is provided by either:

(1) a direct dedicated meteorological circuit or

(2) an operations circuit.

c. Most air operations centres are supported by host nation meteorological centres.

618. Support to the NATO Airborne Early Warning Force (NAEWF)

a. The NAEWF is the only NATO air operations force which exists permanently in peacetime. The force comprises two elements, an NE-3A component and a UK component.

b. The NE-3A component is funded by 12 nations and is operated by mixed-nation crews.

c. The NAEWF is a Bi-MNC organization. The Force Commander (NAEWFC) and his staff are based as a lodger unit in SACEUR's headquarters at SHAPE. The Chief Meteorological Officer, SHAPE, acts as the Staff Meteorological Officer to the NAEWFC.

d. The aircraft of the NAEWF operate from the following bases:

(1) Main Operating Bases (MOBs):

(a) NE-3A component at Geilenkirchen, Germany and

(b) UK E-3D component at Waddington, UK.

(2) Forward Operating Bases (FOBs):

(a) Aktion, Greece;

(b) Trapani, Italy; and

(c) Konya, Turkey.

(3) Forward Operating Location (FOL): Oerland, Norway.

(4) Other Operating Bases.

e. The MOB of the E-3A component at Geilenkirchen is a NATO base, funded by 12 nations. The MSU at the base is also funded by the 12 nations and manned by NATO

civilian personnel. All the other NAEW operating bases are national and meteorological support is provided by national MSUs in accordance with host nation standards. Any exceptions will be specified by the NAEWFC and the nations concerned.

f. Environmental/meteorological support required by the NAEW aircrews from the MSUs at the MOB, FOBs and FOL consists of the following:

(1) information required by the flight crews for the safe operation of the aircraft;

(2) information required by the mission crews involved in battlefield surveillance operations which will normally be the general weather situation for the operating area of the force being supported;

(3) weather warnings;

(4) information on in-flight refuelling;

(5) bird TAMs and observations;

(6) radar propagation forecasts; and

(7) climatological data for planning.

g. The NAEWF aircraft usually operate under a specific tactical control (TACON) authority, which is responsible for providing required weather information to the aircraft being controlled by the NAEWF aircraft, e.g. for recovery. When NAEWF aircraft assume TACON authority, they become responsible to provide controlled aircraft with weather data. This information is available fromthe MOB via HF transmission or from an appropriate ground source in the operations area when available.

h. The biennial inspection of the MSU will be carried out by the CMetO SHAPE and representatives from Germany, in accordance with Para 305e.

i. A regular and reliable exchange of weather information is required between the MOB, FOBs and FOL. TAFs, METARs, and SYNOPs are required for aircraft in transit between these various locations.

j. Preflight documentation and briefings should be as standardized as possible at all the NAEWF operating bases/locations.

619. Support to SAM sites:

a. All SAM units are nationally supported, usually by the nation which has operational responsibility for the unit. However, if a unit is located in a remote area away from its primary meteorological support facilities, it may receive support from another nation, by bilateral agreement.

b. Support may be received from either:

(1) the airbase MSU, when the unit is situated on, or near, an airbase or

(2) via the appropriate CRC and/or Air Defence Operations Liaison Team (ADOLT) at the Army Corps, by means arranged by the nation with operational responsibility.

c. Each unit should have easy access, by telephone or other means, to an agency which can provide meteorological advice on short notice.

620. Airfield weather colour codes (See Reference A for more details)

a. Airfield weather colour codes are used by many NATO nations as a simple method of transmitting and displaying actual and forecast weather which influences landing capability at an airbase as an easy reference for operational planners and controllers.

b. They do not automatically determine whether or not landings are permitted.

c. Actual and forecast airbase weather should be passed to aircraft in plain language, not colour code, in accordance with normal ATC procedures.

d. Colour codes which have been developed by NATO nations and commands have minor variations to meet specific requirements. Experience has shown that it is not practicable to develop a NATO standard colour code to be used by all NATO nations. The only significant difference, however, is in the number of oktas of cloud used to determine the colour. Some nations use 5 eights while others use 3 eights.

621. Tactical Evaluation (TACEVAL) of meteorological units.

a. Guidelines for the conduct of TACEVALs of operational wings are contained in Reference F. More detailed instructions are issued by appropriate subordinate commanders.

b. TACEVALs of met facilities and support procedures should be included and the results documented in the report of the evaluated wing.

c. TACEVALs of met facilities should be carried out by one or more meteorologically trained evaluators provided by the appropriate nation(s).

RESPONSIBILITIES

622. In times of crisis and war, most elements of the organizations providing met support to NATO air operations should continue to provide the same support, to the same organizations, in the same way that they did in peacetime.

SEVERE WEATHER WARNINGS FOR NATO AIR OPERATIONS

Meteorological Element	Home and Alternate Airbases	Route or Opera-tional Areas	Target Areas	SAM Sites	Remarks
Strong Surface Winds	Yes		Yes	Yes	Mean > 25 kts, gusts > mean plus 10 kts
Strong cross-winds over runway	Yes				Exact values will be related to aircraft type
Low-level wind shear	Yes	Yes	Yes		
Strong upper winds (jet streams)		Yes			> 80 kts
Severe Turbulence		Yes			
Severe Icing		Yes			
Thunderstorms	Yes	Yes	Yes	Yes	
Hail	Yes	Yes	Yes	Yes	
Freezing Precipitation	Yes	Yes	Yes	Yes	
Fog	Yes	Yes	Yes	Yes	
Low cloud bases	Yes	Yes	Yes		Include hill fog, if applicable
Snow cover on runway	Yes				Include depth
Icing on runway	Yes				
Excessive drop in temperature	Yes			Yes	> 10°C to values below 0° C
Heavy precipitation	Yes			Yes	Which may affect mobility of SAM units

Notes:

1. Warnings should be issued as quickly as possible after it has been decided that severe weather is probable at some time in the future. They should not wait until the issue of the next routine forecast or for the onset of the severe weather.

2. Whenever possible, the expected duration of the severe weather should be included in the warning.

3. It is equally important that cancellations of warnings are issued as soon as the severe weather has ceased and is not expected to recur.

Figure 6-I

MFCs WHICH PROVIDE SUPPORT TO NATO AIR OPERATIIONS

Military Forecast Center (MFC)	NATO or Nation	Supporting WACs	MFCs With Which Data and Products Are Exchanged
CINCUKAIR WC High Wycombe UK	UK	Bracknell	Northwook UK Woensdrecht NL Traben-Trarbach GE Karup DE
HQ NORTH Stavanger NO	NO	Oslo	High Wycombe UK Karup DE Traben-Trarbach GE
CINCENT Brunssum NL	NATO	Traben-Trarbach	Woensdrecht NL
BAFMC Beauvechain BE	BE	Offenbach Bracknell	Traben-Trarbach GE Woensdrecht NL
GMGO Traben-Trarbach GE	GE	Offenbach	Beauvechain, Karup, Oslo, Woensdrecht, Naples, Taverny FR, Vicenza IT EMC Traben-Trarbach GE
EMC Traben-Trarbach GE	US	Offutt Traben-Trarbach	GMGO Traben-Trarbach
BALTAP Karup DA	DA	Copenhagen	High Wycombe UK Traben-Trarbach GE
NAEW Geilenkirchen, NL	NATO	Traben-Trarbach	Woensdrecht NL
CMFWC CINCSOUTH Naples IT	NATO	Rome	Traben-Trarbach GE 5ATAF Vicenza 6ATAF Izmir HTAF/WC NEMOC Rota
AMO 5ATAF Vicenza IT	NATO	Rome	CMFWC Naples IT Traben-Trarbach GE
AMO 6ATAF Izmir, TU	NATO	Ankara	CMFWC Naples IT
HTAF/WC*	GR	Athens	CMFWC Naples IT
NAVEURMETOCCEN Rota SP	US	Monterey	CMFWC Naples IT

* AMO Larissa when 7ATAF activated

Figure 6-II

METEOROLOGICAL DATA AND PRODUCTS REQUIRED BY MSUs SUPPORTING AIR OPERATIONS

Meteorological Data and Products	Frequency per day Required by MSUs at HQs, Operations Centers and Airbases				
	MNC, MSC, & PSC HQs	ATAF HQ	CAOC ICAOC	Air-base	Sources of Data and Products
Alpha-Numeric Products					
Synoptic review/guidance forecast	2	2	8	4	WAC/MFC
Severe Weather warnings	A	A	A	A	MFC
Surface synoptic data	R	R	4	4/8	WAC
Upper-air synoptic data			4	4	WAC
TAFs, METARs, PIREPs			A	A	Airfields
Target data (TARWIs)			A	A	Airfields
Effective downwind messages (EDMs)	2	2	2	2	Selected WACs (See Chpt 11)
Forward area data	R	R	A	A	TARWI
Climatological information	R	R		R	In-house/WAC
Unified Weather Forecasts	2	2	2	2	WAC/MFC (see Para 314b)
Graphic/Gridded Products					
Surface analyses	4	4	4	4	WAC
Surface prognoses, +24 hrs	4	4	4	4	WAC
Surface prognoses, +48, 72, 120 hrs	1	1	1	1	WAC
Upper-air analyses, std levels 850-100 hPa			2	2	WAC
Upper-air prognoses, std levels, +24 hrs			2	2	WAC
Upper-air analyses, 700/500 hPa spotwinds/temps	2	2	2	2	WAC
Upper-air progs, as above, +24, 48, 72, 120 hrs	1	1	1	1	WAC
Satellite pictures	A	A	A	A	Own reception
Significant weather	2				MFC
Tactical weather		2	2		MFC
Synoptic plotted surface chart	4	4	4	4	WAC
Effective downwind forecast	2	2	2	2	Selected WACs

A = Whenever available, as soon as possible
R = On request

Figure 6-III

Annex A
Chapter 6

METEOROLOGICAL SUPPORT FOR ACE REACTION FORCES

INTRODUCTION

1. The purpose of this paper is to describe the main elements of meteorological support for the ACE Reaction Forces (ARF) and where possible to identify the nations or agencies providing equipment or manpower. It is considered that only the broader aspects can be defined since details will be strongly exercise or operation specific. It will be important to exercise the agreed procedures regularly to ensure their effectiveness. All deployed personnel should be military, or civilian with a military designation, and in uniform.

2. This paper considers only RF deployments within the NATO area. The circumstances for any Out of Area basing are likely to be exceptional, and the requirements specific, therefore no special provisions are included at this stage of the planning. The basic requirements will remain the same, however, but the manning will be location specific.

3. As support procedures for maritime forces are well established, this paper only addresses the provision of meteorological support to land and air elements of the ARF. Close coordination will however be required to ensure consistency between forecasts provided to the various maritime, land and air elements of the ARF.

SUPPORT FOR REACTION FORCES (LAND)

4. In exercises, crises and peacekeeping duties, on-scene meteorological support is required at HQ ARRC as a minimum and, where possible, at Divisions and Army Aviation Units.

5. A Mobile Forecast Unit (MFU) is required to support the Corps HQ. Its purpose will be to generate and co-ordinate the distribution of theatre-wide forecast products to forces; to coordinate the collection and dissemination of observations; and to provide a strategic level interpretation of the impact of the weather on operations to the Corps commander and HQ Units. When deployed the MFU may be geographically separated from the ARRC HQ; therefore the manning requirements are considered independent of those required to maintain a 24-hour cover at the HQ.

6. HQ ARRC

a. The Staff Meteorological Officer (Staff Met O) ARRC is required for the development of infrastructure, procedures, exercise planning and to ensure a smooth transition to wartime status. The Staff Met O will be the meteorological adviser to the Corps Commander. The post needs to be permanently established but may be a national post, "dual-hatted" with a NATO role. The post should be filled by the nation supplying the Corps commander, in this case the UK, and the national post which best fits this role is the Deputy Chief Meteorological Officer, British Forces Germany. When the ARRC is deployed a forecaster is required to assist the Staff Met O on shifts. This post will be multinational and rotational for periods of 2 or 3 years.

(1) Staff Met O (OF-3/4) (PE post) UK

(2) 1 forecaster (EE post) to cover 24-hours with the Staff Met O, 1 per shift.

b. Equipment for the MFU will be supplied by the UK. To ensure familiarity with this, the recommended manning for the MFU is:

(1) 2 forecasters - (EE posts, 1 per shift) 1 UK and one multinational depending on the make-up of the Corps troops, Divisions and Force Packages being assembled. Since the MFU may be geographically separated from HQ and the Staff Met O ARRC for survivability reasons, one of these forecasters should be designated Deputy Staff Met O ARRC.

(2) 2 met assistants - (EE posts, 1 per shift) both UK, to facilitate operation of equipment.

7. Divisions

a. The support required at Division HQ is advice to the Division commander and his staff on the impact of weather on specific operations at a tactical level. It will require the input of meteorological data to Tactical Decision Aids. A meteorological unit supporting the Division will also provide high quality meteorological observations for Corps HQ. Whenever a Divisional Met Unit is deployed the following manning is recommended:

(1) 2 forecasters (OF-3) - (EE posts, one per shift) to facilitate operation of equipment and generate high quality meteorological observations. The nationality should be the same as that of the Division Commander.

(2) 2 met assistants - (EE posts, one per shift)

b. For the Multi-National Divisions, MND(C) and MND(S), it is recommended that a Staff Met O is permanently established. This may be a national post, dual hatted with a NATO role. The following manning level is recommended:

(1) Staff Met O (OF-3/4) - (PE post) designated by the nations making up the MND, otherwise of the same nationality as the MND Commander.

(2) 1 forecaster - (EE post) to cover 24-hours with the Staff Met O, 1 per shift.

(3) 2 met assistants - (EE posts, 1 per shift)

NOTE: The MNDs may require additional meteorological assistants to manage a radio-sonde unit.

8. Lower Level Formations. Nations or element commanders may wish to deploy or request additional meteorological personnel in support of lower level formations (e.g. Brigades).

9. Army Aviation Units. The requirement for support to Army Aviation Units is to be coordinated between the nations and services involved.

SUPPORT FOR REACTION FORCES (AIR)

10. Meteorological support to the Mobile Combined Air Operational Centre M/CAOC, and to the Airfield (MOB or FOB), are considered separately below. Except for a permanently established dual-hatted GE/NATO Staff Meteorological Officer RF (Air), all other meteorological support posts are planned to be EE only.

11. Mobile Combined Air Operations Centre.

a. The M/CAOC requires detailed military aviation forecasts for strategic and tactical planning as specified in this publication. A capability to run Tactical Decision Aids is required for predictions of Night Illumination, Radar Ducting and Electro-Optic designator range.

b. The recommended minimum manning for the M/CAOC Met Cell is:

(1) 1 - Staff Met Officer (OF-3/4), GE

(2) 2 - forecasters, 1 per shift (OF-2/3), 1 GE, 1 US

(3) 2 - met assistants, 1 per shift, 1 GE, 1 US

NOTE: In para b above the US personnel will be deployed only if the US is providing combat air forces to support the operation. Otherwise C MET O SHAPE will request appropriate manning from other nations involved.

12. Airfield MOB or FOB.

a. The requirements for meteorological services will be similar to those already detailed in section 11a above, except that the outputs will be more mission specific. The airfield, or airfields, chosen for deploying RF (Air) assets will require different levels of augmentation depending on the Host Nation Support (HNS) that exists, or is planned for, in a crisis or peacekeeping situation.

b. (1) If the airfield has a fully manned weather observing and forecasting capability then the senior Met Officer will act as the Staff Met Officer, coordinate the weather services and liaise between the appropriate cells in the different levels of Command. Exceptionally an OF (3/4) augmentee will be necessary to carry out these duties.

(2) Whenever possible the host nation should provide augmentees to the level requested by SACEUR, however, individual squadrons may deploy their own briefing officers.

c. If the airfield (FOB) has no weather observing or forecasting offices, the host nation should include provision to deploy staff for 24-hour weather observing and forecasting operations. If HNS is not possible, for whatever reason, the following personnel are required to be deployed:

(1) 2 - met officers, 1 per shift, nationality to be determined, forecasters also acting as coordinators and liaison officers.

(2) 3 - met assistants/observers, 1 per shift, to assist in general airfield met support.

(3) In addition individual squadrons may deploy their own briefing officers.

PRODUCT SUPPORT

13. All agencies are to use a standardised UWF, centred on the theatre of operations, for all planning forecasts (24-96 hours). Depending on the area of operations, C Met O SHAPE will task the military forecast centre at HQ AFNORTHWEST, GMGO Traben-Trarbach, or HQ AFSOUTH with production of a standardised UWF, centred on the theatre of operations. For coordination reasons, it

will be necessary to send UWFs produced to the appropriate NATO Regional Meteorological Centre and to other agencies. When the Combined Joint Task Force (CJTF) which contains a small meteorological cell is deployed, the relevant MSC or MNC is to ensure that it is provided with the necessary meteorological information including the Unified Weather Forecast.

14. All short-range (0 to 24 hour) wide area products, including significant weather charts and other required information as defined in Allied Weather Publication 2, will be provided by the appropriate, usually national, forecast offices supporting weather units in the field.

LOGISTICS/COMMUNICATIONS

15. Whenever possible HNS should be used. Deployed Met cells must be capable of receiving a NATO standardized UWF, covering the theatre of operations, and other essential data/products.

16. Met equipment for the deployed ARRC HQ and M/CAOC is the responsibility of the UK and GE respectively. For the national Divisions of the ARRC the responsibility lies with the respective nation. For the MNDs the responsibility has yet to be determined. The greatest degree possible of interoperability is necessary.

17. In the case of support to the RF (Air), the provision of meteorological equipment is again the responsibility of the nations as appropriate.

CHAPTER 7

METEOROLOGICAL SUPPORT TO NATO LAND OPERATIONS

Reference: A. ATP 35 Land Force Doctrine

INTRODUCTION

701. There are presently no NATO operational army units permanently mobilised during peacetime. However, there is a small, rapid reaction, mobile, multinational task force called the ACE Mobile Force - Land (AMF-L) available at short notice.

702. NATO land forces for cxercises and during times of crisis will most likely be composed of single nation units up to brigade level which will combine to form multinational army corps and groups.

703. Most national army units are based in their own country in peacetime. Exceptions are US, UK, Canada, Belgium, France and Netherlands units based in Germany and US units in Italy.

704. As with NATO maritime and air operations, most NATO army commanders have dual-hatted national and NATO responsibilities in peacetime, becoming NATO commanders in wartime. Details of th NATO Land Operations Command and Control organization are given in Annex A to Chapter 4. Meteorological support to ACE Reaction Forces (Land), including the ARRC, are summarized in Annex A to Chapter 6.

REQUIREMENT

705. Meteorological support, tailored to specific requirements of land operations, as described in Reference A, will be required by:

a. NATO headquarters for commanders and their staffs at MNC, MSC, PSC and Army Group level,

b. Mobile Command Centres at Corps level and below,

c. Operational army units involved in a variety of roles, and

d. Army air units.

706. The geographic coverage, period of interest and general nature of the support required at the various levels of command and control and by operational users are summarised in Figure 7-I.

707. More detailed requirements will relate to:

a. Warnings of severe weather which could reduce the capability of operational units to carry out their mission or create a significant hazard to the safety of personnel and equipment. Details are given:

(1) in Figure 7-II for land units, and

(2) in Chapter 6, applicable elements of Figure 6-I, for army air units.

b. Meteorological data and products, both surface and upper-air, are used for:

(1) assessment of trafficability:

(a) state of the ground, and

(b) condition of river crossings;

(2) assessment of conditions for:

(a) parachute drops, and

(b) amphibious landings;

(3) development of correction factors for artillery and surface-to-surface missiles to compensate for atmospheric effects;

(4) assessment of transport and diffusion of smoke;

(5) prediction of NBC fallout patterns;

(6) tank operations for thermal tank sights;

(7) light infantry for support to TOW systems;

(8) air defense artillery; and

(9) intelligence collection systems.

708. Meteorological information will be required by units for the following areas:

a. Friendly territory occupied by the unit.

b. The battle area of specific interest to the unit.

c. Forward area extending to targets for artillery.

709. Requirements at NATO headquarters. Details are given in Chapter 4.

710. Requirements at Mobile Command Centres. The support required will comprise:

a. actual information from the areas occupied by own units and by opposing enemy units in forward area of responsibility, for assessment of effect of the weather on capabilities, and

b. forecast weather for the same areas for planning future operations.

711. Requirements of operational army units

a. Most army units carry out a specialist role which may require specific meteorological support which is unique to that role. The support required will comprise:

(1) Actual information:

(a) for the area of current operations for artillery units for calculation of ballistic corrections, and target area weather for deep fires,

(b) for areas of current operations to support close combat heavy and light forces,

(c) for areas of current operations to provide information to support NBC defense, smoke employment, terrain analysis, mobility, and counter-mobility estimates, and forecasting future conditions.

(2) Forecast information for the area of current operations for planning current operations.

b. Detailed requirements of the different land operational missions are given in Figure 7-III.

c. Requirements for army air units are given in Chapter 6.

ORGANIZATION

712. The organization to meet the requirements for support to NATO land operations is provided, as described in Chapter 3, by a combination of WACs, MFCs and MSUs. In addition, some nations provide detailed meteorological products below corps level directly to division headquarters and to some brigade headquarters.

713. MFCs

a. There are no MFCs which are dedicated to the support only of land operations. MFCs which support land operations also support air operations or air and maritime operations.

b. The organization of MFCs which provides support to NATO land operations in Europe comprises both NATO centres and national centres. Details are given in Figure 7-IV.

714. MSUs

a. MSUs are located at:

(1) NATO headquarters at MNC and MSC level,

(2) NATO headquarters at PSC/Army Group level, mobile and/or static,

(3) Mobile army corps headquarters,

(4) Army airbases,

(5) Mobile air units, and

(6) Some mobile artillery units.

b. With the exception of MSUs at some NATO headquarters, all other MSUs supporting land operations are national.

c. Details of support required by land MSUs from WACs and/or MFCs are given in Figure 7-V.

IMPLEMENTATION

715. Support to land headquarters.

a. At MNC, MSC, PSC and Army Group level, see Chapter 4.

b. Below Army group level. These commanders will normally be supported in garrison by a staff meteorological officer and the Post's MSU. During crisis or war, the SMO may operate from a mobile command centre, if it is activated; or may deploy with the supported unit, if and when they deploy.

716. Support to mobile command centres at corps level. Support falls into two categories:

a. Attached to existing peacetime garrisons, support is normally provided to national corps by their own national met organizations via a predetermined communications pick-up point and thence by tactical communications networks.

b. In response to particular threats, support is normally provided by the most convenient NATO or national centre. Details of how the support will be provided should be determined by the appropriate command SMetO for each individual OPLAN, as described in Chapter 2.

717. Support to operational army units.

a. Units with an MSU.

b. Units without an MSU.

718. Support to army air units and airbases for parachute operations. Details are given in Chapter 6.

719. Support to the ACE Mobile Force - Land (AMF-L).

a. The AMF-L is composed of forces from Belgium, Canada, Germany, Greece, Italy, Luxembourg, Netherlands, Turkey, UK and US. Until mobilised at the request of SACEUR, most units assigned to the AMF-L are stationed in their own countries. US units are provided by US forces already stationed in Europe.

b. The AMF-L is a rapid reaction force which is available for deployment at short notice to any part of NATO in response to first acts of aggression, to restore peace and deter further aggression, particularly in areas which are protected in normal peacetime situations only by the forces of the NATO nation in which they are located.

c. The headquarters of the AMF Land component (AMF-L) has a small, permanent multinational staff based in Heidelberg, Germany. The Air component (AMF-A) has no permanent headquarters. The squadrons assigned to it are under the operational control of the NATO Air Commander in the area to which the force is sent.

SUMMARY OF REQUIREMENTS FOR METEOROLOGICAL SUPPORT TO LAND OPERATIONS

Level	Primary Area of Interest	Primary Period of Interest	Meteorological Support Required
MNC/MSC/ PSC/Army group	Command area and entire forward area	0 - 120 hrs	General situation and developments. Problem areas of bad weather which could significantly affect land operations. NBC prediction.
Army Corps	Area of operations including forward area of responsibility	0 - 48 hrs	General situation and developments. Problem areas of bad weather which could significantly affect land operations, including state of land, NBC prediction.
Operational Army units	Area of operations	0 - 12 hrs	Mission oriented forecasts. NBC predictions.
Army Air Units	Area of mission	Period of mission	Mission oriented forecasts. NBC predictions.

Figure 7-I

SEVERE WEATHER WARNINGS FOR NATO LAND OPERATIONS

Meteorological Elements	All	Infantry	Artillery	Tank Units	Amphib-ious Units	Para-chute Units	Remarks
Strong surface winds	Yes						
Strong upper winds						Yes	Below 10,000 ft
Low-level wind shear			Yes			Yes	
Poor visibility	Yes						
Snow	Yes						
Hail	Yes						
Freezing Precipitation	Yes						
Thunderstorms	Yes						
Frost	Yes						
Excessive drop in temperature		Yes	Yes	Yes			> 10°C to values below 0° C
Heavy precipitation	Yes						
High sea state and surf conditions					Yes		

Figure 7-II

METEOROLOGICAL INFORMATION REQUIRED IN SUPORT OF NATO LAND OPERATIONS

Meteorological Information Required	Operational Users						Remarks
	Corps HQs	Infantry Units	Artillery Units	Tank Units	Amphib-ious Units	Para-chute Units	
Severe weather warning	Yes	Yes	Yes	Yes	Yes	Yes	See Figure 7-II
Synoptic situation and development	F/C	F/C	F/C	F/C	F/C	F/C	
Surface wind direction & speed	F	F	F/A	F/A	F	F	Gusts > 10 kts over mean
Visibility	F	F	F	F	F	F	
Weather	F	F	F	F	F	F	
Cloud Amount, Base, Tops	F	F	F/A F/A	F	F	F/C F/C F/C	
Surface Temp	F	F	F/A	F/A	F	F	
Atmospheric Pressure				A			
Upper Winds			F/A			F/C	0 - 10,000 ft
Upper air temp			F/A			F/C	0 - 10,000 ft
Inversion height	F	F	F	F	F	F	For smoke diffusion
Humidity	F	F	F	F	F	F	For smoke diffusion
State of land	F/A	F/A	F/A	F/A	F/A	F/A	
Sea/swell height & direction					F/C		
Surf					F/C		
BALMETs			F				
Battlefield observations	A						MOBOBs
Forward area data	F/C		F			F/C	
NBC fallout predictions	F	F	F	F	F	F	

C = Current information from latest synoptic report or assessment byu trained forecaster
A = Actual information measured by qualified personnel in area of operations
F = Forecast information for the area of operations

Figure 7-III

ORGANIZATION OF MFCsPROVIDING SUPPORT TO NATO LAND OPERATIONS

Military Forecast Centers (MFCs) Supporting Land Operations	National or NATO	Supporting WACs		Other MFCs With Which Data and Products Are Exchanged	Connections	
		Primary	Others		Center	To, From or Both Ways
CINCUKAIR High Wycombe	UK	Bracknell	Nil	GMGO	Woensdrecht GMGO	Both To
EMC Traben-Trarbach	US	AFGWC	Bracknell FNMOC	GMGO	Croughton	Both
GMGO Traben-Trarbach	GE	Offenbach	Nil	EMC Beauvechain Karup Oslo Woensdrecht Naples Taverny Vicenza	Beauvechain Karup Woensdrecht Taverny Vicenza	Both Both Both Both Both

Figure 7-IV-I

Military Forecast Centers (MFCs) Supporting Land Operations	Operational Users Supported						
	NATO Headquarters (Land)		Land Operations Centers			Customers	
	Co-located	Others	Type	Place	With MSU or not	Place	Nation
EMC Traben-Trarbach	Nil	COMLANDCENT				All US Army in Europe	

Figure 7-IV-2

METEOROLOGICAL DATA AND PRODUCTS
REQUIRED BY MSUs SUPPORTING NATO LAND OPERATIONS

Meteorological Data and Products	Frequency per day Required by MSUs Supporting NATO Land Operations					
	HQ at MNC & MSC Level	Mobile Army Corps	Artillery Corps	Army Air & Para-troop (Chpt 6)	Mobile Air Units (Chpt 6)	Source of Data and Products
1. Alpha-numeric products						
Synoptic review & guidance forecasts	2	2	2			WAC/MFC
Severe weather warnings (Fig. 7-II)	A	A	A			MFC
Surface synoptic data	4	4	4			WAC
Upper-air synoptic data			2			WAC
Forward area data	A	A	A			SIGINT, Spec Ops Forces
Climatological information	R					WAC/MFC/in house
Effective downwind messages	2	2	2			WAC/MFC
Observations from battlefield area (MOBOBs)	A	A	A			WAC
2. Graphic & Gridded Field Products						
Surface Analyses	4	4	4			WAC
Surface Prognoses (+24 hrs)	4	4	4			WAC
Surface Prognoses (+48, 72, 96 hrs)	1	1	1			WAC
Satellite pictures	A	A	A			WAC/MFC/on site
Significant weather	2	2	2			MFC
Effective downwind forecast	2	2	2			Selected WACs (See Chpt 11)
Upper-air analyses, 850hPa, 700 hPA			2			WAC

A = Whenever available, as soon as possible
R = On request

Figure 7-V

CHAPTER 8

TELECOMMUNICATIONS FOR METEOROLOGICAL SUPPORT OF NATO FORCES

References: A. Guidelines for Meteorological Support to NATO and PfP Nation Forces (MCMG + CP Draft Document)

INTRODUCTION

801. Figure 3-I shows the basic meteorological support organization and information flow to support NATO operations, as outlined by reference A. For the support to be effective, there is a requirement for a telecommunications network capable of handling the flow of data and products among all the elements of the network in a timely fashion in peace, crisis and war:

a. From data collection sites to weather centres,

b. Between weather centres, and

c. Between weather centres and operational forces.

REQUIREMENTS

802. Chapters 4 through 7 contain detailed information on:

a. Data and products required by each element in the different stages of the support organization, including:

(1) WACs;

(2) MFCs supporting maritime, air and land operations;

(3) MSUs supporting NATO headquarters and operational units involved in maritime, air and land operations; and

(4) headquarters, operations centres, and operational units involved in all types of NATO maritime, air and land operations.

b. The WACs, MFCs and MSUs which comprise the overall NATO support organization showing for each centre or unit:

(1) What other centres and units provide it with the data and products it needs,

(2) What other centres and units it provides with the data and products they need, and

(3) What NATO headquarters and operational units it provides with the data and products they need.

803. The telecommunications network required to disseminate the data and products among the locations, as summarised above, within the required timescale and frequency, constitutes the NATO requirement. This network comprises a number of links, as shown conceptually in Figure 8-I-1 and described in Figure 8-I-2. Each link represents a point to point connection between two different

elements in the overall network between which meteorological information has to be transmitted, either in one direction only, or in both directions. It can be made up of a single method of communication, or any number of different methods, depending on the amount and type of meteorological information to be transmitted between the two points and the communications facilities available. A definitive statement of requirement for NATO meteorological telecommunications is contained in various formal documents of the MNCs' evolving Command and Control Information Systems (CCIS).

804. Dedicated Circuits. Because of the large quantity of information which needs to be exchanged and the highly perishable nature of that information, links in the telecommunications network should be, ideally, dedicated to the transmission of meteorological, or combination of meteorological and oceanographic information.

805. Command and Control Information System (CCIS) Circuits. NATO commanders and staff personnel at all levels frequently need rapid, on-call access to various types of meteorological data and products to facilitate knowledgable decision-making. Selected weather data and products are essential information required on CCIS circuits to plan and conduct any type of operation or exercise. Use of CCIS circuits also facilitates forecast consistency between staffs.

806. Common-user Circuits (Broadcasts). Meteorological information to be transmitted on a common-user broadcast must be allocated a suitable precedence to ensure that it is received by its operational users within its period of usefulness.

807. Circuit Schedules. Information transmitted over dedicated meteorological telecommunications links should, whenever possible, be sent according to a fixed schedule. Schedules should be published in appropriate national and NATO command publications, and any changes to these schedules should be forwarded as quickly as possible to all interested users.

ORGANIZATION

808. Most meteorological data and products are disseminated by nationally funded WMO or ICAO telecommunications networks, supplemented by nationally funded networks which support national military organizations.

809. Where these national networks do not fully meet the NATO requirements, they are supplemented by NATO funded or shared NATO/nationally funded circuits. The overall network will comprise, therefore:

a. Nationally funded WMO/ICAO circuits,

b. Nationally funded military circuits,

c. Shared NATO/nationally funded circuits, and

d. NATO funded circuits.

Circuits in categories a and c will normally be dedicated meteorological or METOC circuits. Those in categories b and d may be either dedicated circuits or common-user circuits.

810. Links in the network may be:

a. Medium and high speed data links,

b. Long-line teletype circuits,

c. Long-line facsimile circuits,

d. Radio teletype broadcasts,

e. CW broadcasts,

f. Radio facsimile broadcasts, and/or

g. CCIS circuits containing METOC data.

h. Satellite communications

IMPLEMENTATION

811. The overall network to meet the NATO requirement is constantly changing as new developments in technology are brought into use by nations and NATO commands. Occasionally deficiencies exist in these networks such as when they do not:

a. Fully meet the NATO requirements, as established in Chapters 4 through 7, in that not all the headquarters and operational users are able to receive all the products that they ideally require, in the format that they ideally want them, because of constraints imposed by the telecommunications network.

b. Use the most up-to-date technology currently available.

812. There is, therefore, a constant requirement to improve and update the existing network to the fullest extent possible within the constraints of national and NATO funding.

TELECOMMUNICATIONS NETWORK RQUIRED
TO PROVIDE METEOROLOGICAL SUPPORT TO NATO FORCES

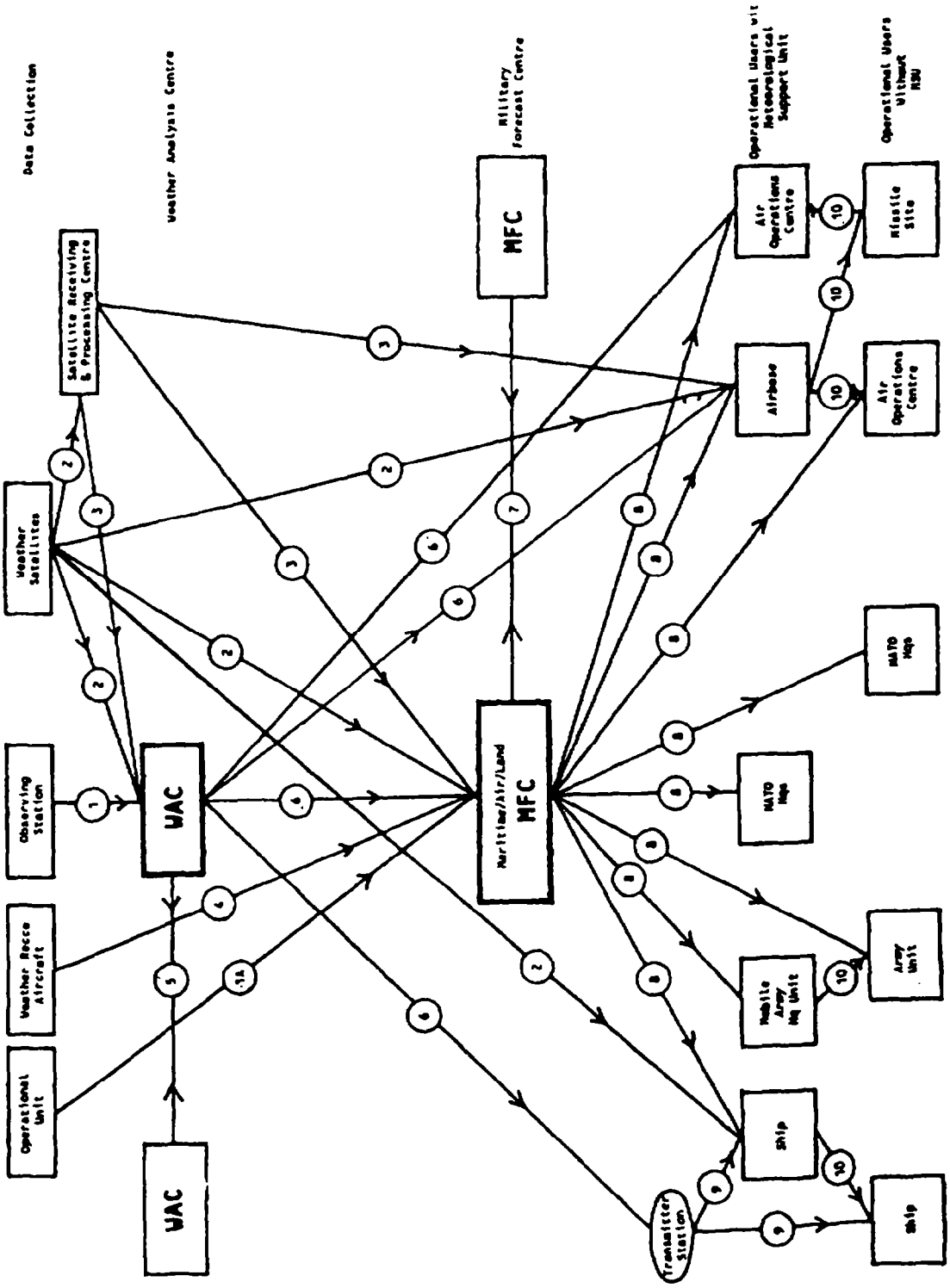


Figure 8-I-1

TELECOMMUNICATIONS NETWORK REQUIRED TO PROVIDE METEOROLOGICAL SUPPORT TO NATO FORCES

Link	Terminals	Alpha-Numeric (A), Graphic (G), or Digital (D) Data	Content	Remarks
1	Observing Site to WAC/MFC	A	Observations	
1A	Observations from Operational Units	A	Observations	Normally operational units' circuits
2	Weather Satellite to Processing Centre, WAC, MFC, or MSU	G,D	APT pictures, digital data	
3	Satellite Processing Centre to WAC, MFC, or MSU	G	Satellite imagery	Dedicated broadcast for centre from satellite pictures
4	Weather Reconnais-sance Aircraft to FWC	A, D	Observations	
5	WAC to WAC	All	Collectives; products	
6	WAC to MFC or MSU	All	Collectives; products	
7	MFC to MFC	A, D, or G	Data; products	Exchange of info
8	MFC to MSU or Operational Unit without MSU	A, D, or G	Data; products	Tailored info may be via dedicated met circuit, common user circuit, and/or CIS
9	WAC or FWC to ships via transmitter station	A, D, or G	Data; products	Shore-Ship broadcasts may be dedicated METOC broadcast, common user broadcast, and/or CCIS
10	MSU to Operational Units	A, D, or G	Products	Usually common user circuit or CCIS

Figure 8-I-2

CHAPTER 9

METEOROLOGICAL DATA

Reference: A. AWP-4, NATO Meteorological Codes Manual

INTRODUCTION

901. In the context of this document, meteorological data are defined as quantitative values of meteorological parameters. Data can be:

a. Actual, when the data have been measured or assessed at a specific time in the recent past. They may also be referred to as real-time data.

b. Forecast, when the data have been predicted for some time in the future.

c. Historic, when actual data are no longer valid. Because of the rapid changes which occur in the atmosphere, actual data normally remains valid for only a few hours.

d. Climatological, long-term, statistical data including mean values, range of variability of various measurable quantities and frequencies of various events.

902. As shown in Figure 3-I, the starting point of the meteorological support organization is the collection of actual data, to be used as the basis for the development of all meteorological products.

903. In peacetime, meteorological data are collected from a world-wide network of observing stations and freely exchanged between all nations of the world under the coordination of the World Meteorological Organization (WMO). In times of tension, crisis and war, it must be expected that the collection and free exchange of data will be severely disrupted, as a result of which, there will be significant areas from which actual data will no longer be available to NATO nations by normal peacetime methods. These areas are known as Silent Areas.

REQUIREMENTS

904. The requirements for meteorological data for the support of NATO forces are divided, as described in Para 213, into:

a. Military requirements, which are the specific data required by each individual type of military user in order to support his mission.

b. Meteorological requirements, which are the data required by the individual meteorological centres in the support organization in order to achieve their mission.

905. Military Requirements. The detailed requirements of different military users are defined in various figures in Chapters 4 through 7.

a. Actual data. There is a limited requirement for actual data to support weapon and sensor systems or safety of ships, aircraft and personnel. These data will normally be collected by the operational unit using its own resources or received from a WAC.

b. Forecast data. This is the primary requirement of most military forces to support current operations and those planned for the near future.

c. Historic data. Most units have little or no requirement for these data.

d. Climatological data. Required by planning staffs involved in long term planning.

906. Meteorological Requirements

a. Weather Analysis Centres (WACs) are the primary users of data:

(1) Actual Data are required in sufficient spatial and temporal distribution to satisfy the numerical analysis models in order to produce the analysis and forecast products required by Military Forecast Centres (MFCs) and Meteorological Support Units (MSUs).

(2) Forecast Data are produced by the WACs.

(3) Historic Data are required by the WACs for the development and maintenance of climatological data bases.

(4) Climatological data are normally produced by the WACs.

b. Military Forecast Centres (MFCs)

(1) Actual data are required from their area of responsibility for use in detailed analysis. These are usually provided by the WACs as data collectives.

(2) Forecast data The output from the numerical analyses of the WACs, usually received as a product in alpha-numeric or graphic format, required for the development of military oriented products.

(3) Historic data Little requirement.

(4) Climatological data required for development of climatological appreciations for use by military planners.

c. Meteorological Support Units (MSUs). MSUs have very similar requirements for data as MFCs, however, they may be required to provide actual data to operational units, e.g. airfield data to aircrews about to launch or recover. In this case, the actual data are normally measured by the MSU.

DATA COLLECTION

907. Meteorological data are collected in peacetime primarily by a network of observing sites and platforms as part of the WMO and ICAO networks. Limited amounts of data are also collected by military and academic research organizations. The following methods of data collection are used:

a. Fixed, manned observing stations (surface and upper-air),

b. Automatic weather stations,

c. Weather satellites,

d. Merchant ships,

e. Data collection buoys (moored or drifting),

f. Weather radars,

g. Commercial aircraft,

h. Warships,

i. Military aircraft,

j. Mobile observing stations (surface and upper-air),

k. Tropical storm search aircraft,

l. Meteorological research aircraft,

m. Constant-level balloons, and

n. Rocketsondes.

Figure 9-1 shows the distribution of observing stations in NATO and near-by non-NATO nations (including Partnership for Peace nations). Annex A contains details of NATO meteorological upper-air observing stations.

DATA DISSEMINATION

908. The provision of meteorological support to military forces is dependent on the rapid flow of data:

a. Among weather centres and

b. From weather centres to operational forces.

909. Data are disseminated as:

a. Raw data and

b. Products which have translated data into a user-friendly format.

Raw data are normally disseminated in a code format. This permits the transmission of large amounts of data in a relatively short period of time. Whenever possible, the NATO meteorological support organization should use WMO code formats. However, WMO formats do not meet all NATO requirements for data dissemination and it has been necessary to establish the code formats shown in Figure 10-II. Details of these formats are given in Reference A.

910. Products are normally designed by the originating weather centre to meet the specific needs of their customers. Ideally, each customer would be provided with a product which contains only the information he needs, supplied to him in a format from which he can most easily assimilate the information which he needs. However, such a level of support is normally available to military forces only from an MSU. All other customers receive products which combine the information required by a number of customers from which each one has to extract the information which he requires.

911. Detailed requirements of NATO operational users are defined in Chapters 4 through 7. Weather centres providing support to NATO forces should tailor their products to meet these requirements as closely as possible.

CLIMATOLOGY

912. Annex B describes climatology sources from each nation available to NATO forces.

WMO OBSERVING STATIONS

NATO			Non-NATO		
Country	Surface Ob Stations	Upper Air Stations	Country	Surface Ob Stations	Upper Air Station
Belgium	24	2	Albania	9	0
Canada	263	33	Armenia		
Denmark	70	2	Austria	91	4
France	182/38 *	28/17 *	Azerbaijan		
Germany	215	13	Belarus		
Greece	54	3	Bosnia		
Greenland	44	6	Bulgaria	34	2
Iceland	44	1	Croatia		
Italy	118	7	Cyprus	4	1
Luxembourg	4	0	Czech Republic	31	2
Netherlands	14/52 #	2	Estonia		
Norway	178	6	Finland	55	3
Portugal	32	2	FYROM		
Spain	104	5	Georgia		
Turkey	96	7	Hungary	25	2
United Kingdom	231	8	Ireland	15	1
United States	447	92	Kazakhstan		
			Kyrgyzstan		
			Latvia		
			Lithuania		
			Malta		
			Moldavia		
			Poland	73	4
			Romania	212	4
			Russian Federation		
			Slovakia		
			Slovenia	22/40#	
			Sweden	218	6
			Switzerland	60	1
			Tajikstan		
			Turkmenistan		
			Ukraine		
			Uzbekistan		
			Yugoslavia (Serbia & Montenegro)		
TOTAL	2388	234			

* Second number is overseas stations
\# Professionally manned stations / automated and/or non-professionally manned stations
\+ Number of fixed buoys

Figure 9-I

STANDARD NATO METEOROLOGICAL CODES

1. MAVOC — Military Aircraft Voice Weather Code

   This code is designed for voice transmission of meteorological reports from aircraft.

2. MAWEC — Maritime Aircraft Weather Code

   This code is intended primarily for the transmission of meteorological reports from maritime patrol aircraft.

3. MOBOB — Mobile Meteorological Observing Units Code

   This code is intended for use by mobile land units primarily within continental Europe, but is of equal application in any part of the NATO area.

4. TARWI — Target Weather Information Code

   This code is intended for use by aircrews for providing in-flight reports of target weather information.

5. RECCO — Meteorological Reconnaissance Aircraft Report Code

   This code will be used for reports from NATO Weather Reconnaissance Aircraft flights. Details of the code are contained in WMO Publication No. 306 - Manual on Codes, Vol II, under National Codes (United States of America).

6. SUPREP — Supplementary Surface Weather Reports Code

   This code is for reporting weather observations obtained by non-professional observers having limited or no meteorological instrumental facilities.

7. RAFOR — Range Forecast Code

   RAFOR is a standard forecast code for selected military ranges in Denmark, France, Germany, the United Kingdom and the Netherlands.

Figure 9-II

STATUS OF NATO METEOROLOGICAL UPPER-AIR STATIONS

Station Name	WMO Index No.	Soundings 00 GMT	06 GMT	12 GMT	18 GMT	30 KM?	Remarks
Belgium							
Uccle	06447	RW*	-	RW*	-	Yes	
Saint Hubert	06476	-	RW*	-	RW*	Yes	
Elsenborn	06496	-	RW	-	-	No	Wednesdays only. RW observations will be made according to ballistic requirements.
Mobile		-	-	-	-	Yes	3 mobile stations in support of artillery. RW observations will be made according to the ballistic requirements.
Canada							
Alert, NWT	71082	RW*	-	RW*	-	Yes	
Baker Lake, NWT	71926	RW*	-	RW*	-	Yes	
Broadview, SK	71861	RW*	-	RW*	-	Yes	
Cambridge Bay, NW	71925	RW*	-	RW*	-	Yes	
Churchill, Man	71913	RW*	-	RW*	-	Yes	
Coral Harbour, NWT	71915	RW*	-	RW*	-	Yes	
Edmonton, Albta	71119	RW*	-	RW*	-	Yes	
Eureka, NWT	71917	RW*	-	RW*	-	Yes	
Fort Nelson, BC	71945	RW*	-	RW*	-	Yes	
Fort Smith, NWT	71934	RW*	-	RW*	-	Yes	
Frobisher, NWT	71909	RW*	-	RW*	-	Yes	
Goose Bay, Nfld	71816	RW*	-	RW*	-	Yes	
Hall Beach, NWT	71081	RW*	-	RW*	-	Yes	
Inukjuak, Que	71907	RW*	-	RW*	-	Yes	All aerological stations are
Inuvik, NWT	71957	RW*	-	RW*	-	Yes	
Kelowna, BC	71203	RW*	-	RW*	-	Yes	partially automated
Key Lake, SK	71488	RW*	-	RW*	-	Yes	
Kuujjuaq, Que	71906	RW*	-	RW*	-	Yes	
Le Grande IV, QU	71823	RW*	-	RW*	-	Yes	
Lynn Lake, MB	71078	RW*	-	RW*	-	Yes	
Maniwaki, Que	71722	RW*	-	RW*	-	Yes	
Moosonce, Ont	71836	RW*	-	RW*	-	Yes	
Mould Bay, NWT	71072	RW*	-	RW*	-	Yes	
Nitchequon, Que	71826	RW*	-	RW*	-	Yes	
Norman Wells, NWT	71043	RW*	-	RW*	-	Yes	
Petawawa, ON	71625	RW*	-	RW*	-	Yes	
Pickle Lake, ON	71845	RW*	-	RW*	-	Yes	

Port Aux Basques	71197	RW*	-	RW*	-	Yes	
Port Hardy, BC	71109	RW*	-	RW*	-	Yes	
Primrose Lake, AB	71124	RW*	-	RW*	-	Yes	
Prince Albert, SK	71146	RW*	-	RW*	-	Yes	
Prince George, BC	71896	RW*	-	RW*	-	Yes	
Resoulte, NWT	71924	RW*	-	RW*	-	Yes	
Sable Island, NS	71600	RW*	-	RW*	-	Yes	
Sachs Harbour, NW	71051	RW*	-	RW*	-	Yes	
Saskatoon, SK	71866	RW*	-	RW*	-	Yes	
Sept Iles, Que	71811	RW*	-	RW*	-	Yes	
Shilo, MB	71853	RW*	-	RW*	-	Yes	
St John's, Nfld	71801	RW*	-	RW*	-	Yes	
Stephenville, Nfld	71815	RW*	-	RW*	-	Yes	
The Pas, Man	71867	RW*	-	RW*	-	Yes	
Thompson, MB	71079	RW*	-	RW*	-	Yes	
Toronto, ON	71638	RW*	-	RW*	-	Yes	
Valcartier, QU	71716	RW*	-	RW*	-	Yes	
Vernon, BC	71115	RW*	-	RW*	-	Yes	
Whitehorse, Yt	71964	RW*	-	RW*	-	Yes	
Yarmouth, NS	71603	RW*	-	RW*	-	Yes	
CFB Gagetown	71701	-	-	RW*	-	Yes	Mon-Fri only, for ballistic purposes.
Mobile	N/A	-	-	-	-	Yes	Unscheduled. 4 units for ballistic

Denmark

Egedesminde	04220	RW*	-	RW*	-	Yes	
Narssarssuaq	04270	RW*	-	RW*	-	Yes	
Danmarkshavn	04330	RW	-	RW	-	Yes	Except for 4 winter months, more than 80% reach 30km
Scoresbysund	04339	RW*	-	RW*	-	Yes	
Angmagssalik	04360	RW*	-	RW*	-	Yes	
Thorshavn	06011	RW*	-	RW*	-	Yes	
Karup	06060	-	RW	-	-	Yes	
Jaegersborg	06181	RW*	W	RW*	W	Yes	
Mobile	N/A	-	-	-	-	Yes	2 RW stations available
Mobile	N/A	-	-	-	-	No	8 B stations available

France

Ajaccio	07761	RW		RW			
Bordeaux	07510	RW		RW		Yes	
Brest	07110	RW		RW			
Lyon	07481	RW		RW			
Nancy	07180	RW		RW			
Nimes	07645	RW		RW			
Trappes	07145	RW		RW		Yes	

French Antilles

Le Raizet (Guadeloupe)	78897	RW	-	RW	-		
Rochambeau (Guiana)	81405	RW	-	RW	-		

Indian Ocean

Tromelin	61976			W			
Kerguelen	61998			RW			
Amsterdam	61619			RW			

New Caledonia

Noumea	91592	RW	W	RW	W		06 and 18 on request only

French Polynesia

Atuona	91925	RW	-	W	-		
Bora-Bora	91930	W	-	W	-		00 during cyclonic season
Tahiti FAAA	91938	RW	-	RW	-		
Hao	91944	RW		W			
Hereheretue	91945	W					
Mururoa	91952	RW		W			
Rapa	91958	RW		RW			
Rikitea	91948			W			
Takaroa	91943			W			
Tubuai	91954			W			

Antarctic

Terre-Adelie	89642	RW	-	-	-		

Atlantic Ocean

SARE	FNPH	RW	-	RW	-		
	FNOU	RW		RW			
	FNOR	RW		RW			
	FNRS	RW		RW			

Germany

German Military Geophysical Service

Bergen	10238	-	RW	RW	RW		(a), also W at 09, 15, and 21Z
Fritzlar	10437						(a), RW at 03, 09, and 15Z
Sigmaringen	10828						(a), RW at 03, 09, and 15Z
Emden	10200	RW	RW	RW	W	Yes	(b)
Wittstock	10272	RW	RW	RW	W	Yes	(b)
Idar-Oberstein	10618	RW	RW	RW	W	Yes	(b)
Kummersbruck	10771	RW	RW	RW	W	Yes	(b)

(a) Mobile unit, additional soundings by commander's request
(b) Stationary unit, additional soundings by commander's request

German Weatherservice

Schleswig	10035	RW*	W	RW*	W	Yes
Greifswald	10184	RW*	RW*	RW*	RW*	Yes
Hannover	10338	RW*	W	RW*	W	Yes
Lindenberg	10393	RW*	RW*	RW*	RW*	Yes

Essen	10410	RW*	W	RW*	W	Yes	
Dresden	10486	RW*	W	RW*	W	Yes	
Meiningen	10548	RW*	W	RW*	W	Yes	
Stuttgart	10739	RW*	W	RW*	W	Yes	
Munchen	10868	RW*	W	RW*	W	Yes	

Greece

Hellikon	16716	RW	-	RW	-	Yes	
Thessaloniki	16622	-	-	RW	-	No	
Iraklio	16754	RW	-	RW	-	No	

Italy

Brindisi	16320	RW*	RW*	RW*	RW*	Yes	
Cagliari/Elmas	16560	RW*	RW*	RW*	RW*	Yes	
Milano/Linate	16080	RW*	RW*	RW*	RW*	Yes	
Roma (Practica Di Mare)	16245	RW*	RW*	RW*	RW*	Yes	
Udine (Campoformido)	16044	RW*	RW*	RW*	RW*	Yes	
Trapani/Birgi	16429	RW*	RW*	RW*	RW*	Yes	
Mobile	N/A	-	-	-	-	Yes	1/RW capability, activated on request

The Netherlands

De Bilt	06260	RW	RW	RW	RW	No	
Mobile (4X)		RW	RW	RW	RW	No	(a)
RNAS Valkenburg	06210	RW	-	RW	-	No	

(a) 4 stations dedicated to 1(NL) Division will make observations as required.

Norway

Jan Mayen	01001	RW	-	RW	-	No	Vaisala Micro-Cora, Navaid (Omega)
Bjornoya	01028	RW	-	RW	-	No	Vaisala Micro-Cora, Navaid (Omega)
Bodo	01152	RW	-	RW	-	No	Lo-Cate, WL2DF, Navaid (Loran C)
Orland	01241	RW	-	RW	-	No	Lo-Cate, WL2DF, Navaid (Loran C)
Gardermoen	01384	RW	-	RW	-	No	Lo-Cate, WL2DF, Navaid (Omega)
Sola	01415	RW	-	RW	-	No	Lo-Cate, WF2DF, Navaid (Loran C)
OWS Mike	C7M	RW	RW	RW	RW	No	

Two coastguard ships are equipped with upper-air soundings capability (not including wind measurement). Observations on request.

Portugal

Funchal	08522	RW	-	RW	-	Yes
Lisboa	08579	RW	W	RW	W	Yes

Spain

La Coruna	08001	RW	-	RW	-	60%
Santander	08023	RW	-	RW	-	15%
Madrid	08221	RW	-	RW	-	79%
Palma de Mallorca	08302	RW	-	RW	-	86%
Murcia	08430	RW	-	RW	-	68%
Santa Cruz de Tenerife	60020	RW	-	RW	-	71%

Turkey

Ankara	17130	RW	-	RW	-	Yes
Istanbul	17062	RW	-	RW	-	Yes
Izmir	17220	RW	-	RW	-	Yes
Samsun	17030	RW	-	RW	-	Yes
Isparta	17240	RW	-	RW	-	Yes
Diyarbakir	17280	RW	-	RW	-	Yes
Adana	17352	RW	-	RW	-	Yes

There are no mobile upper-air stations at present.

United Kingdom

Boulmer	03240	RW	W	RW	W	No	27 km; RW or W for 06/18Z
Hillsborough	03920	RW	W	RW	W	Yes	RW or W for 06/18Z
Herstmonceux	03882	RW	W	RW	W	No	27 km; RW or W for 06/18Z
Camborne	03808	RW	W	RW	W	Yes	RW or W for 06/18Z
Hemsby	03496	RW	W	RW	W	Yes	RW or W for 06/18Z
Lerwick	03005	RW	W	RW	W	Yes	RW or W for 06/18Z
Stornoway	03026	RW	W	RW	W	Yes	RW or W for 06/18Z
Eskmeals	03213						(a)
Aberporth	03502	RW	RW	RW	RW		Replacement for Aughton
Shoeburyness	03693						(a)
Larkhill	03743						(a)
South Uist	03018						(a)
West Freugh	03130						(a)
Gibraltar	08495	RW		RW		Yes	High level once a day
Kinloss							(b)
Aberdeen							(b)
Leeming							(b)
Waddington							(b)
Brize Norton							(b)
Leuchars							(b)
Cardiff							(b)
Bruggen							(b)
Akrotiri							(b)
Civil ships	(1 mobile unit)						RW capable; obs at sea
Army (TTW only)	3 mobile units in UK(2xB, 1xRW) 1 in Bosnia (RW)						RW capable; obs as rqrd for ballistic purposes
Navy	12 units (RW) with Fleet						RW capable; obs as rqrd

(a) RW capability; station operates an irregular program of soundings
(b) R capability with minisonde; launched at discretion of forecaster

United States

Aberdeen, SD	78355	RW	-	RW	-	Yes
Albany, NY	72518	RW	-	RW	-	Yes
Albuquerque, NM	72365	RW	-	RW	-	Yes
Amarillo, TX	72363	RW	-	RW	-	Yes
Atlantic City, NJ	72407	RW	-	RW	-	Yes
Bicycle Lake, CA	74611	RW	-	RW	-	Yes
Bismarck, ND	72764	RW	-	RW	-	Yes
Boise, ID	72681	RW	-	RW	-	Yes
Brookhaven, NY	72501	RW	-	RW	-	Yes
Brownsville, TX	72250	RW	-	RW	-	Yes
Buffalo, NY	72528	RW	-	RW	-	Yes
Caribou, ME	72712	RW	-	RW	-	Yes
Centreville, AL	72229	RW	-	RW	-	Yes
Charleston, SC	72208	RW	-	RW	-	Yes
Chatham, MA	74494	RW	-	RW	-	Yes
Corpus Christi, TX	72251	RW	-	RW	-	Yes
Dayton, OH	72429	RW	-	RW	-	Yes
Davenport, IA	74455	RW	-	RW	-	Yes
Del Rio, TX	72261	RW	-	RW	-	Yes
Denver, CO	72469	RW	-	RW	-	Yes
Desert Rock, NV	72387	RW	-	RW	-	Yes
Detroit/Pontiac MI	72632	RW	-	RW	-	Yes
Dodge City, KS	72451	RW	-	RW	-	Yes
El Paso, TX	72270	RW	-	RW	-	Yes
Ely, NV	72486	RW	-	RW	-	Yes
Flint, MI	72637	RW	-	RW	-	Yes
Fort Worth, TX	72249	RW	-	RW	-	Yes
Glasgow, MT	72768	RW	-	RW	-	Yes
Grand Junction, CO	72476	RW	-	RW	-	Yes
Gray, ME	74389	RW	-	RW	-	Yes
Great Falls, MT	72776	RW	-	RW	-	Yes
Green Bay, WI	72645	RW	-	RW	-	Yes
Greensboro, NC	72317	RW	-	RW	-	Yes
Huntington, WV	72425	RW	-	RW	-	Yes
Huron, SD	72654	RW	-	RW	-	Yes
Internat'l Falls, MN	72747	RW	-	RW	-	Yes
Jackson, MS	72235	RW	-	RW	-	Yes
Jacksonville, FL	72206	RW	-	RW	-	Yes
Key West, FL	72201	RW	-	RW	-	Yes
Lake Charles, LA	72240	RW	-	RW	-	Yes
Lander, WY	72576	RW	-	RW	-	Yes
Lincoln, IL	74560	RW	-	RW	-	Yes
Little Rock, AR	72340	RW	-	RW	-	Yes
Longview, TX	72247	RW	-	RW	-	Yes
Medford, OR	72597	RW	-	RW	-	Yes
Midland, TX	72265	RW	-	RW	-	Yes
Monett, MOD	72349	RW	-	RW	-	Yes
Morehead City, NC	72305	RW	-	RW	-	Yes
Nashville, TN	72327	RW	-	RW	-	Yes
North Platte, NE	72562	RW	-	RW	-	Yes
Oakland, CA	72493	RW	-	RW	-	Yes
Omaha, NE	72553	RW	-	RW	-	Yes
Omaha Vly, NE	72558	RW	-	RW	-	Yes
Paducah, KY	72435	RW	-	RW	-	Yes

Peachtree, GA	72215	RW	-	RW	-	Yes	
Peoria, IL	72532	RW	-	RW	-	Yes	
Pittsburgh, PA	72520	RW	-	RW	-	Yes	
Portland, ME	72606	RW	-	RW	-	Yes	
Quillayute, WA	72797	RW	-	RW	-	Yes	
Rapid City, SD	72662	RW	-	RW	-	Yes	
Reno, NV	72489	RW	-	RW	-	Yes	
St Cloud, MN	72655	RW	-	RW	-	Yes	
Salem, OR	72694	RW	-	RW	-	Yes	
Salt Lake City, UT	72572	RW	-	RW	-	Yes	
San Diego, CA	72290	RW	-	RW	-	Yes	To be moved to Miramar NAS, CA
San Juan, PR	78526	RW	-	RW	-	Yes	
Sault Ste Marie, MI	72734	RW	-	RW	-	Yes	
Shreveport, LA	72248	RW	-	RW	-	Yes	
Slidell, LA	72232	RW	-	RW	-	Yes	
Spokane, WA	72785	RW	-	RW	-	Yes	
Stephenville, TX	72260	RW	-	RW	-	Yes	
Sterling, VA (WashDC)	72403	RW	-	RW	-	Yes	
Tampa, FL	72210	RW	-	RW	-	Yes	
Tallahassee, FL	72214	RW	-	RW	-	Yes	
Tonopah, NV	72485	RW	-	RW	-	Yes	
Topeka, KS	72456	RW	-	RW	-	Yes	
Tucson, AZ	72274	RW	-	RW	-	Yes	
Wallops Island, VA	72402	RW	-	RW	-	Yes	
Waycross, GA	72213	RW	-	RW	-	Yes	
West Palm Beach, FL	72203	RW	-	RW	-	Yes	
Winnemucca, NV	72583	RW	-	RW	-	Yes	
Winslow, AZ	72385	RW	-	RW	-	Yes	
Alaska							
Anchorage	70273	RW	-	RW	-	Yes	
Annette	70398	RW	-	RW	-	Yes	
Barrow	70026	RW	-	RW	-	Yes	
Bethel	70219	RW	-	RW	-	Yes	
Big Delta	70267	RW	-	RW	-	Yes	
Cold Bay	70316	RW	-	RW	-	Yes	
Fairbanks	70261	RW	-	RW	-	Yes	
King Salmon	70326	RW	-	RW	-	Yes	
Kodiak	70350	RW	-	RW	-	Yes	
Kotzebue	70133	RW	-	RW	-	Yes	
McGrath	70231	RW	-	RW	-	Yes	
Nome	70200	RW	-	RW	-	Yes	
St Paul Island	70308	RW	-	RW	-	Yes	
Yakutat	70361	RW	-	RW	-	Yes	
Hawaii and Pacific							
Guam, MI	91217	RW	-	RW	-	Yes	
Hilo, HI	91285	RW	-	RW	-	Yes	
Lihue, HI	91165	RW	-	RW	-	Yes	
Pago Pago	91765	RW	-	RW	-	Yes	
Wake Island	91245	RW	-	RW	-	Yes	
Yap, WCI	91413	RW	-	RW	-	Yes	

Operated by US Navy

Adak	70454	RW	-	RW	-	Yes	
Barking Sands, HI	91162	-	-	-	RW	Yes	Mon-Fri only. Sounding not encoded or transmitted at this time.
China Lake, CA	74612	-	-	RW	-	Yes	Mon - Fri
Diego Garcia	61967	RW	-	RW	-	Yes	
Guantanamo, Cuba	78467	-	-	RW	-	Yes	
Keflavik, Iceland	04018	RW	-	RW	-	Yes	
LeMoore NAS, CA	74702	RW	-	RW	-	Yes	
Midway Island	91066	RW	-	RW	-	Yes	
Point Magu, CA	72391	-	-	-	-	Yes	RW as requested
San Nicolas, CA	72291	-	-	-	-	Yes	RW as requested
Roosevelt Roads PR	78535	-	-	R	-	Yes	
McMurdo Station	89664	RW		RW		Yes	Funded by US National Science Foundation.
Mobile	N/A	R	-	R	-	No	36 US Navy ships and 5 deployable teams are U/A capable at sea

Operated by US Marine Corps

Cherry Point, NC	72309	RW	-	RW	-	Yes	
Mobile	N/A	R	-	R	-	Yes	6 teams (2 assigned to each US Marine Air Wing

Operated by US Air Force

Thule AB, Greenland	04202	RW	-	RW	-	Yes	Soundings by Danish contract personnel
Lajes AB, Azores	08509	RW	-	RW	-	Yes	Shared responsibility between the US and Portugal
Howard AFB, CZ	78806	-	-	RW	-	Yes	Mon-Fri
Shemya AFB, AK	70414	RW	-	RW	-	Yes	
Antigua Island	78861	RW	-	RW	-	Yes	Soundings by contract personnel with USAF and/or NWS technical supervision. Other soundings, as required.
Ascension Island	61902	-	-	-	-	Yes	Sounding once daily during weekdays by contract personnel with USAF technical supervision. Other soundings, as required.
Eglin AFB, FL	72221	-	-	-	-	Yes	Soundings twice daily, taken between 0900-1500L and 2100-0300L, depending on local requirements.
Edwards AFB, CA	72381	-	-	-	-	Yes	Soundings once daily, 0300L, during weekdays, others as required.
Vandenberg AFB, CA	72393	RW	-	RW	-	Yes	
South Vandenberg	74606	-	-	-	-	Yes	Soundings as required.
Utah Test Range		-	-	-	-	Yes	Soundings by contract personnel, as required, with USAF technical supervision. Soundings are not normally transmitted.
Pillar Point, CA	74504	-	-	-	-	Yes	Soundings as required
Cape Canaveral, FL	74794	RW	-	RW	-	Yes	Soundings by contract personnel with USAF technical supervision, other soundings as required.

Mobile	N/A	-	-	-	-	Yes	Six teams can provide RW soundings
Operated by US Army							
In the US							
Aberdeen PG, MD		-	-	RW	RW	Yes	
Dugway PG, UT·		-	-	-	-	Yes	As required
Ft Benning, GA	72225	-	-	15Z	-	Yes	Mon-Fri
Fort Bragg, NC	74693	RW	-	RW	-	Yes	
Fort Campbell, KY	74671	RW	-	RW	-	Yes	
Ft Carson, CO	72468			14Z	17Z	Yes	Mon-Fri
Ft Drum, NY	74370	-	-	-	17Z	Yes	Mon-Fri
Ft Greeley, AK	70267	-	-	RW	RW	Yes	As required
Ft Huachuca, AZ	72273	RW	-	RW	-	Yes	
Ft Lewis, WA	74207	-	-	-	-	Yes	As required
Ft Sill, OK	72355	-	-	RW	RW	Yes	As required
Ft Stewart, GA	74780	-	-	RW	-	Yes	Mon-Fri
Holloman AFB, NM	74732	-	-	RW	-	Yes	
Jefferson PG, IN		-	-	RW	-	Yes	
Northrup Strip, White Sands MR, NM		-	-	-	-	Yes	As required
Stallion Range, White Sands MR, NM		-	-	-	-	Yes	As required
Yuma PG, AZ		-	-	RW	RW	Yes	
Mobile	N/A	-	-	-	-	Yes	27 teams dedicated to US Army artillery support.
In Germany							
Babenhausen	10643	-	-	-	-	Yes	(a)
Feucht	10764	-	-	-	-	Yes	(a)
Giebelstadt	10653	-	-	-	-	Yes	(a)
Giessen	10533	-	-	-	-	Yes	(a)
Goeppingen		-	-	-	-	Yes	(a)
Grafenwoehr	10687	-	-	-	-	Yes	(a)
Hanau	10642	-	-	-	-	Yes	(a)
Katterbach	10755	-	-	-	-	Yes	(a)
Wertheim	10657	-	-	-	-	Yes	(a)
Wurzburg	10655	-	-	-	-	Yes	(a)

(a) Soundings are made Mon-Fri at 06 and 09L.

NATO SOURCES OF CLIMATOLOGY

1. For NATO operations and exercises, it is essential that planning staffs and participating forces are provided with a briefing document which summarises the meteorological conditions most likely to be encountered and warns of any meteorological effects which are peculiar to the area.

2. This Annex summarises:

a. NATO sources of climatological data (Figures 9B-I through IV),

b. addresses, telephone numbers, etc., for climatological facilities (Figure 9B-V), and

c. the procedure by which climatological data should be requested.

3. It is assumed that nations will make their climatological data available to support NATO operations. However, it is appreciated that the processing of data into a format suitable, for instance, for inclusion in a climatological briefing document may be manpower intensive or costly. Automatic acceptance of such tasks is not mandatory and each case should be addressed individually.

Procedures

4. The production of briefing documents or climatological reviews for NATO operations and exercises should be coordinated by SACLANT or SACEUR, as appropriate. Requests for support from nations should be made by C-MET-Os through MCMG representatives. When data is required for national purposes, provision should be arranged between the respective MCMG representatives. The data given in Figure 9B-V is intended to facilitate liaison rather than to encourage direct approaches to data centres other than in an emergency.

WORLDWIDE DATA

Nation (Facility)	Climatological Data			
	CD-ROM	Electronic Data Files	Tables	Atlases
Canada (1)	Yes	No	Yes	Yes
Germany (4)	No	Yes	Yes	Yes
(5)	No	Yes	No	No
UK (11)	No	Yes	Yes	Yes
US (12)	Yes	Yes	Yes	Yes

Figure 9B-I

EUROPEAN DATA

Nation (Facility)	Climatological Data			
	CD-ROM	Electronic Data Files	Tables	Atlases
Canada (1)	No	No	Yes	Yes
Germany (4)	No	Yes	Yes	Yes
(5)	No	Yes	No	No
Italy (6)	No	Yes [1]	No	No
Spain (9)	No	Yes [2]	No	No
UK (11)	No	Yes	Yes	Yes
US (12)	Yes	Yes	Yes	Yes

Note:

[1] Data for Malta
[2] Raw data

Figure 9B-II

MARITIME DATA

Nation (Facility)	Climatological Data			
	CD-ROM	Electronic Data Files	Tables	Atlases
Canada (1)	No	Yes	Yes	Yes
France (3)	No	Yes	No	No
Germany (4) (5)	No No	Yes Yes[1]	Yes Yes[1]	Yes Yes
Italy (6)	No	Yes[2]	No	No
Netherlands (7)	No	Yes[3]	Yes	Limited
Spain (9)	No	Yes[4]	No	No
UK (11)	No	Yes	Yes	Yes
US (12)	Yes	Yes	Yes	Yes

Notes:

[1] Mean monthly temperature of 5° x 5° areas for North Atlantic Ocean from equator to 70°N and 90°W to 10°E for period 1957-1974

[2] Raw data for Central Mediterranean

[3] For North Sea

[4] Raw data

Figure 9B-III

NATIONAL DATA

Nation (Facility)	Climatological Data			
	CD-ROM	Electronic Data Files	Tables	Atlases
Canada (1)	Yes	Yes	Yes	Yes
Denmark (including Faeroes and Greenland) (2)	No	Yes	Yes	Yes
France (3)	No	Yes	Yes	Yes
Germany (4) (5)	No No	Yes Yes	Yes Yes	Yes No
Italy (6)	No	Yes	Yes	Yes
Netherlands (7)	No	Yes	Yes	Yes
Norway (including continental shelf Arctic stations) (8)	No	Yes	Yes	Yes
Spain (9)	No	Yes	Yes	Yes
Turkey (10)	No	Yes	Yes	Yes
UK (11)	No	Yes	Yes	Yes
US (12)	Yes	Yes	Yes	Yes

Figure 9B-IV

CLIMATOLOGICAL DATA CENTRES

Nation (Facility)	Data Centre Information	
Canada (1)	Canadian Information Branch Atmospheric Environment Service 4905 Dufferin Street, Downsview Ontario M3H 5T4, Canada	Tel: (416) 739-4328 Telex: Nil Fax: (416) 739-4446
Denmark (2)	Danish Meteorological Institute Data Base Department Lyngbyvej 100 DK-2100 Copenhagen OE Denmark (Requests should be copied to Chief of Defence Denmark, Attn: Staff Meteorological Officer)	Tel:(45) 39 15 75 80 Telex: (055) 47138 (Att DATABASE METIN DK) Fax:(45) 39 15 75 98
France (3)	METEO-FRANCE 1, Quai Branly F-75340 PARIS cedex 07	Tel: (33) 1 40 62 67 61 Telex: METFRAN 202876 Fax: (33) 1 40 62 67 69
Germany (4)	Deutscher Wetterdienst Frankfurter Strasse 135 D-6050 Offenbach a.M. GE	Tel: 49 / 069 80620 Telex: Fax: 49 / 069 - 8062 - 2483
(5)	German Military Geophysical Office Mont Royal D-5580 Traben-Trarbach, Germany	Tel: 49 / 06541 - 181 Telex: Fax: 49 / 06541 - 18 - 296
Italy (6)		
Netherlands (7)	RNLAF Meteorological Group Postbox 94 4630 AB Hoogerheide The Netherlands	Tel:(31) 1646-93101 Telex: Fax:(31) 1646-93109
Norway (8)	Det norske meteorologiske institut PO Box 43, Blindern 0313 Oslo, Norway	Tel: Telex: Fax:
Spain (9)		
Turkey (10)	State Meteorological Service PO Box 401 Ankara, Turkey	Tel: (90 4) 3597545 Telex: 42671 ANKM TR Fax: (90 4) 3593430
UK (11)	Defence & Aviation Climatology Service UK Meteorological Office London Road Bracknell Berkshire RG12 2SZ, UK	Tel: (44) 1344 856975 Telex: 849801 Fax: (44) 1344 854906
US (12)	USAFETAC Scott Air Force Base Illinois, 62225 , USA FLENUMMETOCDET Asheville Federal Building (Room 563) 151 Patton Avenue Asheville, NC 28801-2696, USA	Tel: Telex: Fax: Tel: (704) 271-4852 Telex: Fax: (704) 271-4672

Figure 9B-V

CHAPTER 10

METEOROLOGICAL SUPPORT TO NBC OPERATIONS

Reference: A. STANAG 2103 Reporting Nuclear Detonations, Biological and Chemical Attacks, and Predicting and Warning of Associated Hazards and Hazard Areas

INTRODUCTION

1001. NBC attacks and the resulting contamination are expected to have a decisive influence on any battle situation, be it on land or at sea. In order to enable commanders at all levels to assess the impact of NBC attacks on plans and decisions, they must be provided with timely, accurate and evaluated information on these attacks. Collection, evaluation and exchange of information on NBC attacks form an extremely important part of the NBC defence system. To ensure timely provision of the most accurate data on enemy NBC attacks and the resulting hazard areas, a NATO-wide NBC reporting and warning organization has been established.

1002. There is a NATO requirement for nations to produce Effective Downwind Messages (EDMs) and Chemical Downwind Messages (CDMs) so that the movement of nuclear and chemical fallout can be forecast and advice given to the appropriate authorities. The method of producing the EDMs and CDMs is laid out in Reference A.

NBC PREDICTIONS

1003. Current meteorological data are a vital prerequisite for radiological fallout and chemical downwind predictions. The meteorological service agencies will collect data and distribute the messages described below to support the NBC warning system:

a. Basic Wind Data Message. A message containing basic meteorological data to be used for fallout prediction. This message contains information on the wind conditions, i.e. wind direction (from which the wind comes) and wind speeds in a number of layers from the surface of the earth to 30,000 m altitude. Additionally, the zone of validity and time of measurement are stated.

b. Effective Downwind Message (EDM). A message containing information on downwind speed and downwind direction (towards which the wind is blowing) for each of seven preselected weapon yields. (When submitted to naval ships, this message will be labelled NAV EDM and the downwind speed will be in the units of knots).

c. Chemical Downwind Message (CDM). A message containing basic meteorological information for predicting chemical vapour hazard areas.

NUCLEAR FALLOUT PREDICTIONS

1004. There are two procedures used to compute nuclear fallout predictions: a detailed procedure and a simplified procedure.

a. Detailed Procedure. This procedure requires nuclear burst or target analysis information and meteorological data. A fallout wind vector plot is prepared each time new meteorological data are received. Effective downwind speed, downwind direction and width of predicted zone are determined from the wind vector plot. The Basic Wind Data Message is the source of meteorological data for use in this procedure.

b. Simplified Procedure. This procedure requires nuclear burst information, a current Effective Downwind Message (EDM) and a simple template (radiological fallout predictor). This procedure affords the subordinate commands direct and immediately useable means to estimate the fallout hazard with the least possible delay. Effective downwind speed and downwind direction for each of seven selected weapon yields are transmitted periodically to subordinate units by higher headquarters, in the form of the EDMs, to enable subordinate commands to use this procedure. EDMs can be produced at NBC centres and meteorological centres from the Basic Wind Data Message or by use of standard pressure level winds.

c. Naval Procedures. Fallout prediction at sea is based on the principles described above, but due to the sea acting as an absorbent of and shield against radioactive products, some of the procedures are different. In order to avoid confusion and misunderstanding, NBC messages to and from ships must be given the prefix NAV in front of the normal heading of the message, e.g. NAV EDM.

d. Standard Pressure Level Winds. There may be cases where units, in particular naval ships, cannot obtain the meteorological information which is normally used for fallout prediction, i.e. the "Basic Wind Data Message" and the "NAV EDM". It may however be possible for the unit to obtain basic wind data which are generally available from meteorological sources (airbases, Met-ships or mobile weather stations) and make use of these data for the computation of effective downwind direction and effective downwind speed. This method of computation involves the use of "Standard Pressure Level Winds". The method assumes that the standard pressure level winds used are representative mean vector winds for contiguous layers or air, and that for any Standard Level.

CHEMICAL PREDICTIONS

1005. Meteorological conditions can have a major influence on the effectiveness of chemical agents in addition to forecasting the distribution and spread of the agents after their release.

a. Temperature. The rate of evaporation of liquid chemical agents increases as the temperature rises. High temperatures increase the effectiveness of persistent and non-persistent nerve agents. High temperatures also tend to decrease the concentration of liquid contamination by increasing the rate of evaporation. At very low temperatures, the evaporation rate of respiratory route agents may be so low as to reduce casualty potential very significantly.

b. Temperature Gradient. The temperature gradient is an expression of the difference in air temperature at two levels. For calculation and prediction of a chemical hazard area following an attack, temperature gradient information is necessary for stable, unstable, and neutral conditions. The more stable the air layer in the target area, the more effective the chemical attack will be.

c. Wind. High wind speeds increase the evaporation rate of liquid chemical agents and dissipate chemical clouds more rapidly than low wind speeds. The effects of wind speed on persistent attacks are variable. Large area non-persistent chemical attacks

are most effective in winds not exceeding 8 m/s (15 knots, 28 km/hr). Small area non-persistent attacks with rockets or shells are most effective in winds not exceeding 2.5 m/s (5 knots, 9.5 km/hr). High wind speed, in general, increases the effectiveness of non-persistent surprise attacks with massive chemical bombs. The wind speed as well as the wind direction will affect the spread of chemical clouds.

d. Humidity and Precipitation. High humidity and precipitation alter the effects of chemical agents differently. For example, high humidity increases the effectiveness of blister agents but does not influence the effectiveness of non-persistent nerve agents. Heavy or lasting rains wash away liquid chemical contamination. Light rainfall occurring after a liquid contamination can cause recurrence of a contact hazard. Also rain on top of persistent nerve or blister agent contamination temporarily increases the evaporation rate and, consequently, the vapour hazard. Snow cover reduces the evaporation rate of liquid chemical contamination, thereby lowering the vapour concentration above the contaminated area.

EFFECTIVE DOWNWIND MESSAGES (EDMs)

1006. Production Certain nations have agreed to produce EDMs for specific regions. Currently, the producing nations are GE, IT, NO and UK. Their areas of responsibility are shown on the map at Annex A. These nations should produce EDMs for their area of responsibility. Nations need only broadcast, routinely, EDMs to satisfy their own national requirements.

1007. Exchange The nations have also agreed to exchange EDMs when, for operational or exercise purposes, this is deemed necessary. Nations may exchange data on a routine bilateral basis or on receipt of a request for assistance. Both GE and UK have the capability of producing EDMs for the entire area.

1008. Area The area covered by the EDMs is bounded by:

25°N 80°W to 80°N 80°W to 80°N 50°E to 25°N 50°E

This area is subdivided into a number of rectangles. The size of each rectangle will be 10° of latitude and 10° of longitude. Each rectangle will have a unique identifying four-letter-code. A map showing the locations of the rectangles and their identifying four-letter-codes is at Annex A.

a. The producing nations may sub-divide each rectangle into four equal area sub-rectangles and produce EDMs for those sub-rectangles. These sub-rectangles will be identified by a number from 1 to 4. The upper-right sub-rectangle will be 1 and the numbering will continue, clock-wise and in sequence. Thus, the upper-right sub-rectangle of rectangle NEWB will be NEWB1.

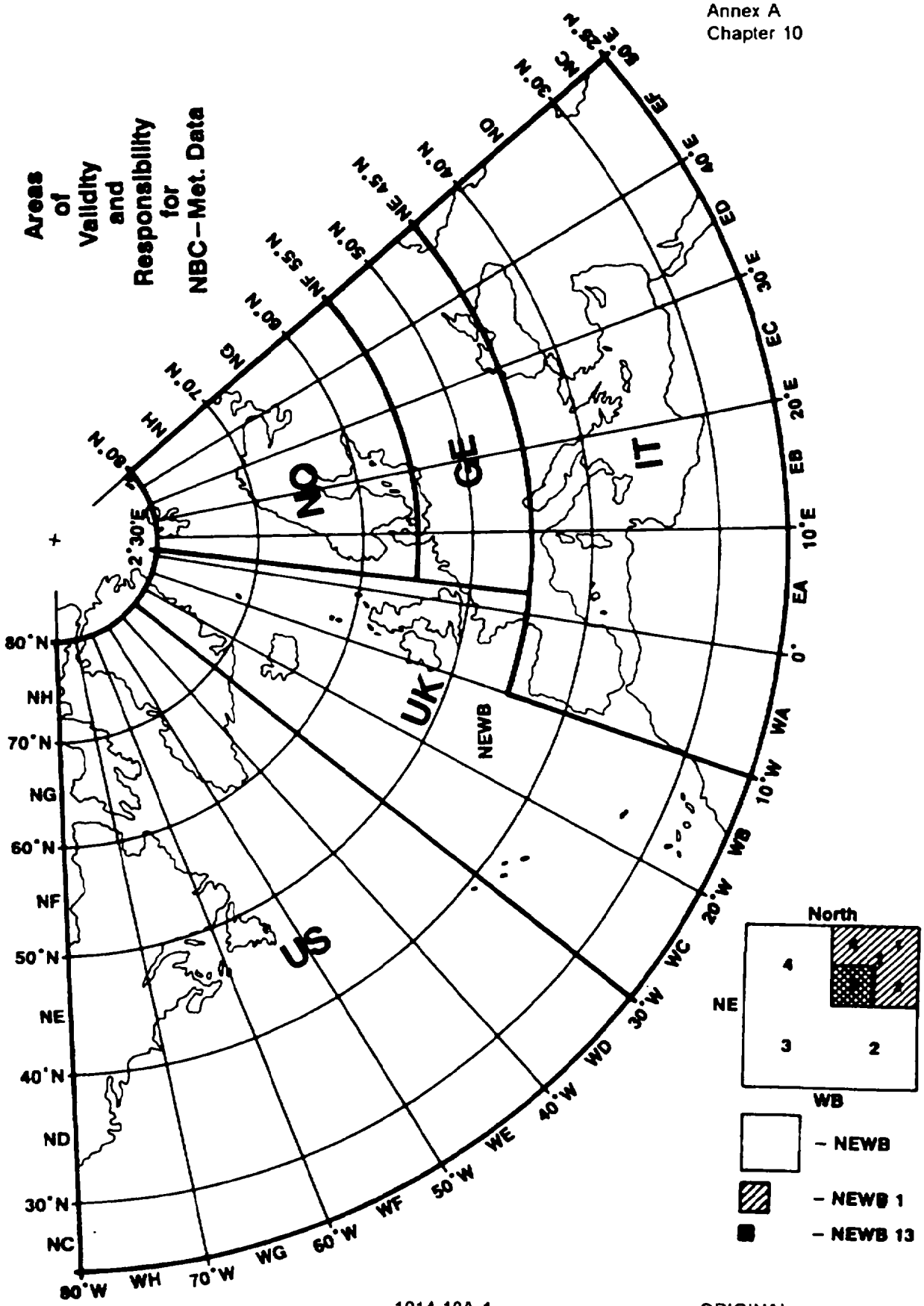
b. The producing nations may again sub-divide each sub-rectangle into four equal area sub-sub-rectangles and produce EDMs for each of these. These sub-sub-rectangles will be identified by a number from 1 to 4. Again, the upper-right sub-sub-rectangle will be 1 and the numbering will continue clock-wise, in sequence. Thus, the lower-left sub-sub-rectangle of sub-rectangle NEWB1 will be NEWB13.

1009. The EDM always covers a period of validity of only 6 hours, whereas the EDF might cover a period of 48 hours ahead. The output is programmed for several selected periods of 6 hours or 12 hours of validity.

CHEMICAL DOWNWIND MESSAGES (CDMs)

1010. Production To assist authorities in the determination of the most likely hazard area in the event of the release of chemical agents, meteorological information is to be provided in the form of a Chemical Downwind Message (CDM). A CDM can be prepared by an on-site forecaster for either a specific location or an area as required by the appropriate authority. If no local forecaster is available the CDM can be prepared by the host nation or nation responsible for that area, see Para 1006.

1011. Message The CDM is disseminated by the appropriate agencies every 6 hours and contains a forecast of the meteorological data needed for the chemical hazard area prediction procedure for three consecutive 2-hour periods.


Areas of Validity and Responsibility for NBC–Met. Data
80°N
NH
70°N
NG
60°N
NF
50°N
NE
40°N
ND
30°N
NC
80°W
WH
70°W
WG
60°W
WF
50°W
WE
40°W
WD
30°W
WC
20°W
WB
10°W
WA
0°
EA
10°E
EB
20°E
EC
30°E
ED
40°E
EF
50°E
NO
CE
IT
UK
NEWB
US
North
4
1
NE
3
2
WB
– NEWB
– NEWB 1
– NEWB 13

GLOSSARY

ACCIS	Automated Command and Control Information System
ACCSA	Allied Communications and Computer Security Agency
ACE	Allied Command Europe
ACEWEX	Allied Command Europe Weather Exchange Network
ACLANT	Allied Command Atlantic
ADMIRALDANFLEET	Admiral Danish Fleet
AFCENT	Allied Forces Central Europe
AFGWC	Air Force Global Weather Central
AFNORTHWEST	Allied Forces Northwestern Europe
AFSOUTH	Allied Forces Southern Europe
AMF	ACE Mobile Force
AMF-L	ACE Mobile Force - Land
AMO	Allied Meteorological Office
ANCA	Allied Naval Communications Agency
AOR	Area of Responsibility
APT	Automatic Picture Transmission
ARRC	ACE Rapid Reaction Corps
ASW	Anti-Submarine Warfare
ATAF	Allied Tactical Air Force
ATC	Air Traffic Control
ATP	Allied Technical Publication
AWN	Automated Weather Network
AWP	Allied Weather Publication
BALMET	Ballistic Meteorological Message
C2	Command and Control
CAPC	Civil Aviation Planning Committee
CCIS	Command, Control and Information System
CCTV	Closed Circuit Television
CDF	Chemical Downwind Forecast
CDM	Chemical Downwind Message
CECLANT	French Commander in Chief, Atlantic Area
CECMED	French Commander in Chief, Mediterranean Area
CINCEASTLANT	Commander in Chief Eastern Atlantic Area
CINCENT	Commander in Chief Allied Forces Central Europe
CINCFLEETWOC	Commander in Chief Fleet Weather & Oceanographic Centre
CINCIBERLANT	Commander in Chief Iberian Atlantic Area
CINCLANT	Commander in Chief Atlantic
CINCLANTFLT	Commander in Chief Atlantic Fleet
CINCNORTHWEST	Commander in Chief Allied Forces Northwestern Europe
CINCSOUTH	Commander in Chief Allied Forces Southern Europe
CINCUKAIR	Commander in Chief United Kingdom Air Forces
CINCWESTLANT	Commander in Chief Western Atlantic Area
CMETO	Chief Meteorological Officer
CMC	Command Meteorological Centre/Canadian Meteorological Centre
CMFWC	Command Meteorological and Fleet Weather Centre
CMOC	Command Meteorological and Oceanographic Centre
CMR	Centro Meteorologico Regionale (Regional Met Centre)
CNAD	Conference of National Armaments Directors
COB	Collocated Operating Base
COLOC	Change of Location
COMAIRCENT	Commander Allied Air Forces Central Europe
COMAIRNORTHWEST	Commander Allied Air Forces Northwestern Europe

COMAIRSOUTH	Commander Allied Air Forces Southern Europe
COMAMPHIBTASKFOR	Commander Amphibious Task Force
COMARAIRMED	Commander Maritime Air Forces Mediterranean
COMARINESTRIKFOR	Commander Marine Strike Force
COMASWSTRIKFOR	Commander ASW Strike Force
COMBALTAP	Commander Allied Forces Baltic Approaches
COMBENENORTHWEST	Commander Maritime Forces BENENORTHWEST
COMCANLANT	Commander Canadian Sub-area Atlantic
COMCAOC FINDERUP	Commander Combined Air Operation Center CAOC Finderup
COMCAOC MESSTETTEN	Commander Combined Air Operation Center CAOC Messtetten
COMCAOC SEMBACH	Commander Combined Air Operation Center CAOC Sembach
COMCAOC UEDEM/KALKAR	Commander Combined Air Operation Center CAOC Ueden/Kalkar
COMCARSTRIKFOR	Commander Carrier Striking Force
COMCENTLANT	Commander Maritime Forces Central Sub-area Atlantic
COMEASTLANT	Commander Eastern Atlantic Area
COMEDCENT	Commander Central Mediterranean Area
COMEDEAST	Commander Eastern Mediterranean Area
COMEDNOREAST	Commander Northeastern Mediterranean Area
COMFIVEATAF	Commander 5th Allied Tactical Air Force
COMGERFLEET	Commander German Fleet
COMGIBMED	Commander Gibraltar Mediterranean
COMINT	Communications Intelligence
COMJTFNORTHNORWAY	Commander Joint Task Force North Norway
COMLANDCENT	Commander Allied Land Forces Central Europe
COMLANDJUT	Commander Allied Land Forces Schleswig-Holstein & Jutland
COMLANDSOUTH	Commander Allied Land Forces Southern Europe
COMLANDSOUTHCENT	Commander Allied Land Forces South Central Europe [1]
COMLANDSOUTHEAST	Commander Allied Land Forces Southeastern Europe
COMLANDZEALAND	Commander Land Forces Zealand
COMMAIRCENTLANT	Commander Maritime Air Forces Central Sub-area Atlantic
COMMAIREASTLANT	Commander Maritime Air Eastern Atlantic Area
COMMAIRNORLANT	Commander Maritime Air Northern Sub-area Atlantic
COMMARAIRNORTHWEST	Commander Maritime Air Forces Northwest
COMNAVBALTAP	Commander Allied Naval Forces Baltic Approaches
COMNAVSOUTH	Commander Allied Naval Forces Southern Europe
COMNAVNORTHWEST	Commander Allied Naval Forces Northwestern Europe
COMNORLANT	Commander Maritime Forces Northern Sub-area Atlantic
COMNORNORTHWEST	Commander Maritime Forces North Northwest
COMNORTH	Commander Allied Forces North Europe
COMOCEANLANT	Commander Ocean Sub-area
COMPHIBSTRIKFOR	Commander Amphibious Striking Force
COMPOAIR	Commander Portuguese Air
COMSEVENATAF	Commander 7th Allied Tactical Air Force
COMSIXATAF	Commander 6th Allied Tactical Air Force
COMSTANAVFORLANT	Commander Standing Naval Forces Atlantic
COMSTANAVFORMED	Commander Standing Naval Force Mediterranean
COMSTRIKFLTLANT	Commander Striking Fleet Atlantic
COMSTRIKFORSOUTH	Commander Naval Striking & Support Forces Southern Europe
COMSUBACLANT	Commander Submarines Allied Command Atlantic
COMSUBEASTLANT	Commander Submarine Force Eastern Atlantic Area
COMSUBMED	Commander Submarines Mediterranean
COMSUBNORTHWEST	Commander Submarine Forces Northwest
COMSUBWESTLANT	Commander Submarine Force Western Atlantic Area

[1] When activated

COMUKNLAF	Commander United Kingdom-Netherlands Amphibious Force
COMUKNLLF	Commander United Kingdom-Netherlands Landing Force
COMWESTNORTHWEST	Commander Maritime Forces Westnorthwest
CONOPS	Concept of Operations
COP	Contingency Operation Plan
CRC	Control Reporting Centre
CRP	Control Reporting Post
CUSRPG	Canada United States Regional Planning Group
CW	Continuous Wave
DMSP	Defense Meteorological Satellite Program
DPC	Defense Planning Committee
DPQ	Defense Planning Quota
DWD	Deutsches Wetherdienst (German Meteorological Service, Civil)
ECMWF	European Centre for Medium-range Weather Forecasts
EDF	Effective Downwind Forecast
EDM	Effective Downwind Message
EE	Emergency Establishment
EMC	European METOC Center (formerly European Forecast Unit)
EM	Electro-magnetic
EMP	Electro-magnetic Pulse
EMPP	EMP Protection
EO	Electo-optical
FAX	Facsimile
FEBA	Forward Edge of the Battle Area
FG	Force Goal
FLENUMMETOCCEN	Fleet Numerical Meteorology and Oceanography Center
FNMOC	Fleet Numerical Meteorology and Oceanography Center
FOB	Forward Operating Base
FOL	Forward Operating Location
FWC	Fleet Weather Centre
GCA	Ground Control Approach
GMT	Greenwich Mean Time
GSOWM	Global Spectral Ocean Wave Model
HF	High Frequency
HTAF	Hellenic Tactical Air Force
IAU	International Accounting Unit
ICAO	International Civil Aviation Organization
IMS	International Military Staff
ISCOMAZORES	Island Commander Azores
ISCOMBERMUDA	Island Commander Bermuda
ISCOMFAROES	Island Commander Faroes
ISCOMGREENLAND	Island Commander Greenland
ISCOMICELAND	Island Commander Iceland
ISCOMADEIRA	Island Commander Madeira
LAM	Limited Area Model
LFM	Limited-area Fine-mesh Model
LLP	Lightning Locator Program
MAS	Military Agency for Standardization
MAVOC	Military Aircraft Voice Weather Code
MAWEC	Maritime Aircraft Weather Code
MC	Military Committee
MCMG	Military Committee Meteorological Group
METAR	Meteorological Airfield Report
METGUARD	Lead Meteorological Ship
METOC	Meteorological & Oceanographic
MFC	Military Forecast Centre

MMR	Minimum Military Requirement
MNC	Major NATO Commander
MND	Mission Need Document
MOB	Main Operating Base
MOBOB	Mobile Observations
MOC	Meteorological and Oceanographic Centre
MOIC	Military Oceanographic Information Centre
MOS	Model Output Statistic
MOU	Memorandum of Understanding
MPA	Maritime Patrol Area
MSC	Major Subordinate Commander
MSE	Mobile Staff Element
MSU	Meteorological Support Unit
NAEWF	NATO Airborne Early Warning Force
NAEWFC	NAEWF Commander
NATO	North Atlantic Treaty Organization
NAVEURMETOCCEN	Naval European Meteorology and Oceanography Center
NAVLANTMETOCCEN	Naval Atlantic Meteorology and Oceanography Center
NBC	Nuclear, Biological and Chemical
NCS	Naval Control of Shipping
NEMOC	Naval European Meteorology and Oceanography Center
NFAX	North Atlantic Facsimile Broadcast
NLMOC	Naval Atlantic Meteorology and Oceanography Centre
NMC	NATO Meteorological Centre/National Meteorological Centre
NOGAPS	Navy Operational Global Atmospheric Prediction System
NOIC	Naval Oceanographic Information Centre
NORAPS	Navy Operational Regional Atmospheric Prediction System
NWP	Numerical Weather Prediction
OCE	Officer Controlling Exercise
OIC	Officer in Charge
OPCON	Operational Control
OPLAN	Operations Plan
OPORD	Operations Order
OSE	Officer Scheduling Exercise
OTSR	Optimum Track Ship Routing
PE	Peace Establishment
PHQ	Peace Headquarters
PIREP	Pilot Report
PSC	Principle Subordinate Commander
RATT	Radio Teletype
RECCO	Meteorological Reconnaissance Aircraft Report Code
RE/RE	Reinforcement/resupply
RNLAF	Royal Netherlands Air Force
RNLAFMC	RNLAF Meteorological Centre
ROC	Regional Operations Centre
RoRo	Roll on/Roll off
RPV	Remotely Piloted Vehicle
RRP	Rapid Reinforcement Plan
RTT	RATT/Radio Teletype
SACEUR	Supreme Allied Commander Europe
SACLANT	Supreme Allied Commander Atlantic
SAM	Surface-to-Air Missile
SHAPE	Supreme Headquarters Allied Powers Europe
SIGINT	Signals Intelligence
SMETO	Staff Meteorological Officer/Staff Meteorological Officer
SMO	SMETO

STANAG	Standardization Agreement
STANAVFORLANT	Standing Naval Force Atlantic
STANAVFORMED	Standing Naval Force Mediterranean
STC	SHAPE Technical Centre
SYNOP	Synoptic observations
TACEVAL	Tactical Evaluation
TACON	Tactical Control
TAF	Terminal Aerodrome Forecast
TARWI	Target Weather Information
TASMO	Tactical Air Support of Maritime Operations
TOR	Terms of Reference
TSC	Tactical Support Center
UTC	Universal Time Coordinated/Coordinated Universal Time
UWF	Unified Weather Forecast
VSTOL	Vertical/Short Takeoff or Landing
WAC	Weather Analysis Centre
WG	Working Group
WHQ	War Headquarters
WMO	World Meteorological Organization
WRA	Weather Reconnaissance

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EXTAC 1014