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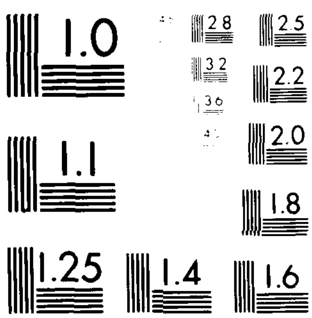

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TASK 3 REPORT

ASSESSMENT OF WWMCCS INTERFACES

WORLDWIDE CRISIS ALERTING NETWORK, PHASE II

June 1980

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Prepared for
DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D.C. 20305
under Contract DCA100-80-C-0010

ARINC RESEARCH CORPORATION

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ARINC Research Corporation is developing a system architecture for the Phase II Worldwide Crisis Alerting Network (WCANII). The objective of the program is to provide communication connectivity between specified U.S. and allied military and civilian subscriber groups.

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Worldwide Crisis Alerting Network, Phase II.

TASK 3 ~~REPORT~~

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by

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EXECUTIVE SUMMARY

This third task report assesses the subscriber communications systems identified in the Task 2 report in terms of their ability to interface with the WWMCCS and meet the WWMCCS requirements documented herein on the basis of an assessment methodology agreed upon by CCTC and WSEO. The report continues with a discussion of the information paths over which a Crisis Alert Message (CAM) would be transmitted to an AUTODIN Message Center (AMC) together with suggested locations of the subscriber communications system/AMC interface. The report concludes with the development of preliminary subscriber communications system/AMC interface procedures which would provide for the positive receipt of the CAM as well as follow-on acknowledgements, queries and responses.

The WWMCCS requirements were developed from a review of the Management Engineering Plan (MEP) for the worldwide Crisis Alert Network (WCAN), Phase I, and the WWMCCS Preliminary Transition Plan, Volume II, Annex G (Plan for Worldwide Crisis Alerting Network). The two documents were analyzed to determine those requirements most applicable to assessment of the subscriber communications systems in meeting the WWMCCS requirements. This analysis resulted in the development of the six assessment requirements as follows:

- Institutional/Political/Regulatory
- Availability
- AUTODIN Message Center AMC accessibility
- Geographical coverage
- Timeliness
- Transmission Quality

In the assessment of the subscriber communications systems, the six requirements were assigned weights as an indication of their relative importance in meeting the WWMCCS requirements i.e. institutional/political/regulatory (0.35), availability (0.25), AMC accessibility (0.15), geographical coverage (0.10), timeliness (0.08) and transmission quality (0.07).

Each of the six weighted requirements factors were, in turn, assigned assessment indices in order to reflect the degree to which a particular subscriber system meets the WWMCCS requirements. For example the assessment indices assigned to the AMC accessibility requirement factor are as follows:

Assessment	Index
AMC on Premise	10
AMC access via CONUS communications systems link - Hardcopy	6
AMC access via CONUS communications systems link - Voice	5
AMC access with multiple switching-CONUS link	3
AMC access with multiple switching -Foreign link	1

Each subscriber communications system defined earlier in Task 2 was assessed utilizing the methodology described above. The results of this assessment for the nine subscriber systems under study are as follows:

. Airline Systems

System	Score
FAA	8.96
ARINC	8.46
AFTN	6.38
SITA	4.75

. Maritime Systems

MARISAT	10.00
USCG	9.20
Offshore Oil Rigs	8.50
Commercial MF/HF/VHF	5.66

. NATO 5.30

Information paths, describing the information flow along the subscriber communications system to the AMC, were then developed in order to trace the CAM from the originator to the AMC and messages from the AMC back to the CAM originator. Information paths were described for each subscriber communications system with the resulting identification of one to two communications links to the AMC when the originator communicates through U.S. facilities (government or private) and up to three communications links when the originator communicates through foreign controlled facilities.

Following the description of information paths the development of subscriber communications systems/WWMCCS interface procedures was undertaken. This effort was based on the portrayal of a typical crisis alert scenario and traces the communications from transmission of the CAM from the originator to the AMC, CAM receipt acknowledgement, and continuing acknowledgement/query communications. The procedures development is supported by a detailed transaction and a functional flow diagram showing the step-by-step communications flow.

The basic conclusions reached in this Task 3 effort are that SITA should be dropped from consideration as a communications element of WCAN II at this time because of the expected problems overcoming the political/institutional considerations. The remaining subscriber communications systems under study should be continued to be considered as viable WCAN II communications element candidates since they reasonably meet the WCAN II requirements and a number of the noted deficiencies can be addressed in order to better meet these requirements.

CONTENTS

CONTENTS (Continued)

CHAPTER ONE

INTRODUCTION

ARINC Research Corporation is developing a system architecture for the Phase II Worldwide Crisis Alerting Network (WCAN II) under contract DCA100-80-C-0010 for the Defense Communications Agency. The objective of the program is to identify alternative procedures and means to provide communication connectivity between specified U.S. and allied military and civilian subscriber groups. The effort encompasses the simplification and standardization of the means associated with the submission of crisis alerting messages so that they can be handled more reliably and expeditiously than is currently possible. The project will examine the telecommunications systems currently serving each subscriber group and for each such telecommunication system, postulate interface means and procedures. The resulting modification of interface means and procedures will permit incidents, that are first recognized outside the military, to be reported quickly and efficiently to the proper authorities.

Two previous interim reports, have been prepared which covered Task 1 (REVIEW OF RELATED WORK WORLDWIDE CRISIS ALERTING NETWORK, PHASE II) and Task 2 (IDENTIFICATION OF EXISTING COMMUNICATIONS SYSTEMS WORLDWIDE CRISIS ALERTING NETWORK, PHASE II) activities of the project. This report addresses the results of our effort on Task 3 - ASSESSMENT OF WWMCCS INTERFACES.

1.1 OBJECTIVES OF TASK 3

The primary purpose of this third task of the project, "Assessment of WWMCCS Interfaces" is to evaluate the subscriber communications systems identified in Task 2 in terms of their WCAN applicability. The results of this task will serve as inputs to later tasks which will determine the resources required to develop and maintain WWMCCS/subscriber communications system interface procedures, the selection of the most advantageous subscriber communications systems to be interfaced with WWMCCS and the development of the resultant required WWMCCS interface implementation concept.

1.2 CONDUCT OF TASK 3

The conduct of Task 3 encompassed the performance of the following seven subtasks:

. Document WWMCCS Requirements

This subtask required a review of the WWMCCS operational and performance objectives as related to WCAN I. The WCAN I focuses on providing the crisis alerting capabilities service to the U.S. Military primarily through software changes at the AUTODIN switches.

. Develop Subscriber Communications Assessment Methodology

The development of a subscriber communications system assessment methodology is required to serve as a vehicle for evaluating each system in terms of its ability to satisfy the WWMCCS requirements.

. Perform Communications System Coverage and Routing Analysis

The characteristics of the majority of the subscriber communications systems of interest indicate that the aircraft and vessels served by these systems are mobile and move along relatively standard routes. It is therefore necessary to determine the number of aircraft, and vessels, which would predictably be within the communications coverage of a given subscriber communications system. This analysis serves to determine those systems covering the largest number of units in any given time period.

. <u>Assess Subscriber Communications Systems in Terms of WWMCCS Requirements</u>

The assessment of the subscriber communications is made on the basis of the WWMCCS requirements developed in the first subtask using the assessment methodology developed earlier in the second subtask.

. <u>Develop Communications System Information Paths and Identify Alternative Interface Locations</u>

Each subscriber communications system is analyzed to determine the information paths from the end users (e.g. aircraft and vessels), through their communications centers (e.g. TWA operations office) to an AUTODIN message center.

. <u>Develop Interface Procedures</u>

Procedures are developed for each subscriber communications system/ AUTODIN interface alternative including: method(s) for subscriber access, crisis interpretation, WCAN acknowledgment and query to the reporter, and interface testing procedures.

. <u>Prepare Task 3 Report</u>

This report is the result of the completion of this subtask.

The basic information used in the preparation of this task was developed in Task 2. The Task 2 information was supplemented by additional subscriber interviews and review of WWMCCS and WCAN I performance and operational requirements. Each subscriber system was analyzed in terms of its ability to provide communication between aircraft, vessels and fixed oil producing platforms and an AUTODIN interface. Such analysis considered the international movement of commercial aircraft and vessels registered in NATO countries, the location of fixed oil producing platforms in international waters and the communications paths of the subscriber communications systems.

1.3 ORGANIZATION OF THE REPORT

Chapter one of this report has served as an introduction to the Task 3 effort, Assessment of WWMCCS Interfaces. Chapter Two discusses the WWMCCS requirements to be met in the evaluation of the subscriber communications systems and Chapter Three describes the methodology developed for use in the evaluation of the various subscriber communications systems. Chapter Four applies the evaluation methodology to the subscriber communications identified earlier in Task 2 and identifies those systems most suited for analysis in later tasks. Chapter Five describes the information paths along which the crisis alerting transmissions acknowledgment and queries could flow to and from the AUTODIN and alternative interface locations for the most describe subscriber systems. Finally, Chapter Six contains a preliminary discussion of the interface procedures necessary for each interface alternative.

CHAPTER TWO

DOCUMENTATION OF WWMCCS REQUIREMENTS

2.0 INTRODUCTION

This chapter documents the WWMCCS requirements developed from a review of the Management Engineering Plan (MEP) for the Worldwide Crisis Alert Network (WCAN), Phase I and the WWMCCS Preliminary Transition Plan, Volume II, ANNEX G (Plan for Worldwide Crisis Alerting Network). Where necessary, requirements are generated from stated WWMCCCS operational objectives. In light of these requirements, six WCAN II requirements are established considering the operational characteristics of the existing subscriber communications systems under study.

2.1 WWMCCS CRISIS ALERT NETWORK CAPABILITY REQUIREMENTS

The two documents, referenced in 2.0 preceeding, describe nine applicable WCAN capability requirements summarized as follows:

- Global coverage including fixed and mobile (remote) access
- Capable of simple entry from aircraft, vessels and offshore oil platforms
- Accessible by elements from military, intelligence, diplomatic and civilian-commercial activities
- Continuously available
- Rapid dissemination to appropriate national and theater command centers
- Continuous monitoring by command centers

- Unambiguous message recognition and prescribed procedural reaction
- Support query (two-way) and continued reporting of situations, with positive acknowledgement back to alerting units
- Supporting multiple reports of a single event to the extent possible, consistent with other needs.

In addition to these nine requirements, Paragraph 5.4 (performance Goals) of the MEP states: "(U) The major performance characteristic for the Worldwide Crisis Alerting Network is the message delivery time. The message delivery time consists of the time from report incidence" ... "into the communication system until message delivery at command center. The performance goal for the AUTODIN portion of the system (the message delivery function) is a transmission time equal to that of an Immediate precedence message (see 6 below) as defined in ACP 121, US SUPP 1(E)." Six additional performance goals for the WCAN that are deemed necessary for the capability are listed in the MEP (Para. 5.4.2) as follows:

(1) Availability ≥ 0.999

(2) Misdelivery Rate $\leq 10^{-5}$

(3) Accountability - Required

(4) Character Error Rate $\leq 10^{-5}$

(5) Lost Message Rate $\leq 10^{-5}$

(6) Message Delivery Time $\leq$ 15 minutes

Section 4.2 of the MEP summarizes five functional areas which comprise the WCAN. The five functional areas, with a general statement of purpose, are as follows:

- Report Collection - This function enables a person without direct AUTODIN access to enter a crisis alert message to theater/area command centers.

- Report Entry - This function allows a person with a direct AUTODIN access to enter a crisis alert message. It also accepts entries from the report collecting system. Entries are translated into a media and abbreviated format acceptable to AUTODIN.
- Message Routing - This function, residing in the ASC, accepts crisis alert messages in abbreviated format and automatically routes them to predetermined addressees via AUTODIN.
- Message Delivery - This function receives crisis alert messages from AUTODIN and delivers them to the required addressees.
- Acknowledge & Query Response - This function confirms receipt of a crisis alert message by the action addressee to the originator by sending an acknowledgement back to the person who originated the message and originates requests for additional information.

It should be noted that there are no special security requirements for the WCAN since it is stated in the MEP (Para. 5.3.3) "No additional cryptographic equipments are required to support this requirement. No changes in the COMSEC measures incorporated within the AUTODIN system will be made." This indication of no need for special security requirements would appear to be consistent with the subscriber communications systems operational characteristics described earlier in Task 2.

2.2 WCAN II REQUIREMENTS GENERATED FROM THE WWMCCS REQUIREMENTS

In as much as the WCAN II performance will be conditioned to a high degree by the subscriber communications systems operating as WCAN II elements, WCAN II performance requirements must consider the operational characteristics of the existing subscriber communications systems. After careful consideration of the WWMCCS requirements, analysis of the operational characteristics of the subscriber communications systems, and discussions with CCTC personnel, six WCAN II requirements have been generated. As noted previously, the major performance characteristic for the WCAN I, and by extension for WCAN II, is message delivery time. This performance characteristic has been a major consideration of the six WCAN II requirements following:

. Institutional/Political/Regulatory - This is a requirement which indicates that there will be no prohibition against the use of the subscriber communications system for the transmission of crisis alert messages by owner/operators, foreign governments or foreign communications common carriers. This requirement must be considered since aircraft and vessels transmitting over great distances may, at some time, be in contact through foreign radio stations, some of which may be under the control of unfriendly governments while others may be under the control of friendly governments with whom bilateral agreements might be reached.

. Availability - A requirement that the subscriber communications system operate continuously, to the fullest extent practicable. This requirement also has a direct relationship to message delivery time.

. AUTODIN Message Center (AMC) Accessibility - The subscriber communications systems must have access to an AMC and the more direct linkage to the AMC, the faster the message delivery time.

. Geographical Coverage - This parallels the earlier cited coverage requirement of the WCAN I.

. Timeliness - As stated previously, message delivery time is the major performance characteristic of the WCAN I and as described above, availability and AMC accessability have a direct relationship to message delivery time. This requirement is a specific consideration of the message transmission time characteristics of the existing subscriber communications systems.

. Transmission quality - The crisis alert message (CAM) delivered to AMC must be understandable. The actual delivery and quality of the CAM is affected by the misdelivery rate, accountability, character error rate and lost message rate of the subscriber communications system.

CHAPTER THREE

SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT METHODOLOGY

3.0 INTRODUCTION

The purpose of assessing the subscriber communications systems is to evaluate each system in terms of its ability to satisfy the WWMCCS requirements. This assessment methodology description includes a discussion of the WCAN II system requirements defined in Section 2.2 which serves as the framework for assessing the WCAN II applicability of various subscriber communications systems. Also considered is the relative importance (weight) of the requirement factors in relation to each other, and the degree to which each of the requirement factors are met by each of the subscriber communications systems under consideration.

The assessment methodology encompasses, (1) the application of a level of desirability or weight to each requirement factor, and (2) an indication of the degree to which each of the requirement factors are met by the subscriber communications system - shown as a numerical index. The assessment methodology provides for the multiplication of each requirement factor weight by the assessment index to determine the factor score, and for the summation of the factor scores to develop a total score for each subscriber communications system.

3.1 REQUIREMENT FACTORS

In Chapter Two, Assessment of WWMCCS Requirements, six requirement factors were developed that can serve to describe the ability of a subscriber communications system to meet the WWMCCS interface requirements. Both the six requirement factors together with their respective weights, were reviewed with CCTC and WSEO representatives. The agreed-upon factors, and associated weights are as follows:

Requirement Factor	Weight
. Institutional/Political/Regulatory	0.35
. Availability	0.25
. AUTODIN Message Center Accessibility	0.15
. Geographical Coverage	0.10
. Timeliness	0.08
. Transmission Quality	0.07

A description of each of the six requirement factors follows:

. Institutional/Political/Regulatory

The subscriber communications systems included in this project are, for the most part, systems used and paid for by private commercial businesses. In addition, overseas portions of these systems are subject to rules of foreign governments and the regulations of the foreign communications common carriers many of which are government operated and controlled. Thus a subscriber communications system could be precluded from transmitting crisis alerting messages by the operating owners, government prohibition or communications common carrier regulations. Since the purpose of WCAN II is to transmit crisis alerting messages and a prohibition against such transmission would negate the use of the system, this factor was given the greatest weight.

. Availability

Availability relates to the hours of the day and days of the week the subscriber communications system is manned and operating and has a direct relationship to the key WWMCCS requirement, message delivery time.

. AUTODIN Message Center (AMC) Accessibility

AMC accessibility considers the facility of interfacing the subscriber communications system to an AUTODIN message center.

This encompasses the switching or transfer arrangements which must be activated to access an AUTODIN Terminal. This accessibility requirement factor also has a direct bearing on the message delivery time (a key WWMCCS requirement) since the more accessible the AMC, the less time will elapse between receipt of the message from the subscriber communications system and entry into AUTODIN.

. Geographical Coverage

Geographical coverage considers both the areas of the world served by the subscriber communications system and the number of aircraft, vessels, etc., that communicate from those areas via the system.

. Timeliness

This requirement factor considers the time it would take to transmit a given message over the subscriber communication system to an AMC. The total transmission time includes:

- Message preparation
- Transmission time by voice or hard copy
- Message receipt at the subscriber system terminal
- Switching or transfer to the AMC
- Message receipt at the AMC

. Transmission Quality

Transmission quality considers those technical and human factors which tend to reduce the clarity and accuracy of a transmitted message. Elements considered in this factor include:

- Error Rate
- Lost Message Rate
- Communications Path Reliability

3.2 FACTOR INDICES

A factor index is an indication of the degree to which a subscriber communications system meets the factor requirement. The six requirement factors together with their assessment elements and associated indices are as follows:

- Institutional/Political/Regulatory

  The assessment of this requirement factor is a matter of judgment based on preliminary discussions with owner operators, review of user regulations, and experience with operating systems.

Assessment	Index
No Identified Problem	10
Identified Problem with Near-Term Solution	5
Identified Problem with no Near-Term Solution	0

- Availability

  The assessment of this requirement factor is based upon published information relating to each subscriber communications system.

Assessment	Index
24 hours/day, 7 days/week	10
16 hours/day, 7 days/week	7
8 hours/day, 7 days/week	5
Less than 8 hours/day, 7 days/week	2

- AUTODIN Message Center Accessibility

  The assessment of this requirement is based upon subscriber communication terminal and AMC terminal location information developed in Task 2.

Assessment	Index
AMC on Premise	10
AMC access via CONUS communications systems link - Hardcopy	6
AMC access via CONUS communications systems link - Voice	5
AMC access with multiple switching-CONUS LINK	3
AMC access with multiple switching - Foreign Link	1

- Geographic Coverage

The assessment of this requirement factor is based on the analysis of the number of aircraft or vessels which are covered by a subscriber communications system in any given area or worldwide.

Assessment	Index
Over 90% of Area/Routes/Units	10
75% to 90% of Area/Routes/Units	8
50% to 74% of Area/Routes/Units	5
Less than 50% of Area/Routes/Units	1

- Timeliness

The assessment of this requirement factor is a considered judgment based on the preparation and transmission of an arbitrary average message length of 180 words, taking into account experience with MF, HF and VHF radio, and satellite communications as well as both voice and teletypewriter operating experience.

Assessment	Index
10 Minutes or Less	10
11 to 15 Minutes	8
16 to 30 Minutes	5
Over 30 Minutes	1

. Transmission Quality

The assessment of this requirement factor is a matter of judgment considering published information relating to the quality of radio transmission at various times of the year, under varying sunspot conditions from different areas of the world as well as discussions with subscriber system owner operators. The degree to which the message content is understandable at the AMC is assessed as follows:

Assessment	Index
Over 95%	10
80% to 94%	8
60% to 79%	6
50% to 59%	4
Less than 50%	1

3.3 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

The assessment methodology presented in this chapter will be applied to each of the subscriber communications systems in Chapter Four in order to assess the WCAN II interface potential of the various subscriber systems under study.

CHAPTER FOUR

ASSESSMENT OF SUBSCRIBER COMMUNICATIONS SYSTEMS IN TERMS OF WWMCCS REQUIREMENTS

4.0 INTRODUCTION

Each subscriber communications system, described in Task 2, is assessed in this chapter in terms of its ability to meet the WCAN II requirements which were generated from the WWMCCS requirements in Chapter Two of this report. There are two general classes of subscriber communications systems to be considered in this assessment - systems serving mobile units (i.e. aircraft and vessels) and systems serving fixed locations (i.e. NATO dedicated communications network). The systems serving fixed locations can be assessed without difficulty on the basis of the WCAN II requirements. However, systems serving mobile units must be considered in terms of the considerable mobility and diversity of locations in which the aircraft or vessels might be at any given time. Thus, as a first step in assessing the subscriber communications systems serving mobile units, it is necessary to perform an analysis of the geographical coverage of the routes of the NATO aircraft and vessels in comparison with the coverage provided by the serving subscriber communications system.

4.1 ANALYSIS OF SUBSCRIBER COMMUNICATIONS SYSTEM COVERAGE VERSUS ROUTES OF AIRCRAFT AND VESSELS

The purpose of this analysis is to determine the probable number of aircraft and vessels which will be covered by the various subscriber communications systems as they transit geographic routes. The analysis is performed in a three step process. The first step is to establish the routes and number of units in transit by area. The second step involves an overlay of the subscriber communications system coverage and third, a count of the number of units served within the area of coverage.

4.1.1 Analysis of Commercial Aircraft Subscriber Communications System Coverage

As described in the Task 2 Report (para. 2.1 and Table 2-1), there are approximately 4,000 commercial aircraft registered in NATO countries representing 68.1% of the world's commercial aircraft. Of this number over 2,700 of the world's commercial aircraft are U.S. registered. Analysis of the "Worldwide Edition of the Official Airline Guide" shows approximately 38,700 international flights per week. By assuming an average level of activity for the world's aircraft, the number of NATO international flights per week is estimated at the percentage of the world's commercial aircraft registered in NATO countries multiplied by the number of international flights per week (0.681 x 38,700) or approximately 26,400 flights per week.

Table 4-1 presents a listing of the world's international airport cities with 100 or more international flight take offs and landings per week. The total activity shown represents over 93% of the world's weekly international flights.

Figure 4-1 shows the international commercial aircraft routes between the airport cities listed on Table 4-1. Also shown in Figure 4-1 is an outline of the HF coverage area (dashed lines) served by FAA and ARINC from transceiver radio stations located in Guam, Cold Bay, Point Barrow and Anchorage in Alaska (FAA stations), Honolulu, San Francisco, New York and San Juan (ARINC stations).

ARINC serves approximately 20,700 flights per week which transit the North Atlantic, Central America, and northern South America.

TABLE 4-1

WEEKLY INTERNATIONAL FLIGHT ACTIVITY (TAKE OFFS AND LANDINGS) BY INTERNATIONAL AIRPORT CITIES

CITY	FLIGHTS/WEEK	CITY	FLIGHTS/WEEK
London	5,000	Johannesburg	300
Paris	4,000	St. Croix	300
Frankfort	3,250	Las Palma	300
Amsterdam	2,800	Manilla	300
Tokyo	2,600	Riyadh	300
New York	2,400	Anchorage	250
Kobenhavn	2.200	Washington	200
Zurich	2,000	Philadelphia	200
Roma	2,000	San Salvador	200
Berlin	2,000	Santiago	200
Bruxells	1,700	Rio De Janeiro	200
Beirut	1,500	Santo Domingo	200
Muchen	1,500	Delphi	200
Athinai	1,500	Aukland	200
Hong Kong	1,300	Bombay	200
San Juan	1,200	Saigon	200
Milano	1,100	Freeport	200
Stockholm	1,100	San Francisco	200
Madrid	1,100	Guam	200
Miami	1,000	Blantyre	200
Dublin	1,000	Casablanca	200
Singapore	1,000	Entebbe	200
Tel Aviv	850	Jakarta	200
Bangkok	850	Jeddah	200
Buenos Aires	800	Karachi	200
Lisbon	750	Lagos	175
Hamburg	750	Accra	175
Budapest	750	Abidjam	175
Montreal	750	Nassau	150
Mexico City	600	Tenerife	140
Osaka	600	Tripolis	140
Segul	600	Alger	140
Toronto	550	Dakar	140
Chicago	550	Salisbury	125
Los Angeles	550	Newark	100
Hannover	500	Baltimore	100
Helsinki	500	Detroit	100
Moskva	500	Guadalajara	100
Cairo	500	Acapulco	100
Sydney	500	San Jose	100
Taipei	500	Guayaquil	100
Boston	500	Monrovia	100
Caracas	500	Melbourne	100
Istanbul	500	Peking	100
Guatemala	400	Aden	100
Lima	400	Vancouver	100
Montevideo	400	Seattle	100
Nandi	400	Apia	100
Honolulu	400	Pago Pago	100
Nairobi	400	Dallas	100
Bermuda	350	Mauritius	100
KualaLum"ur	350	Tannarive	100
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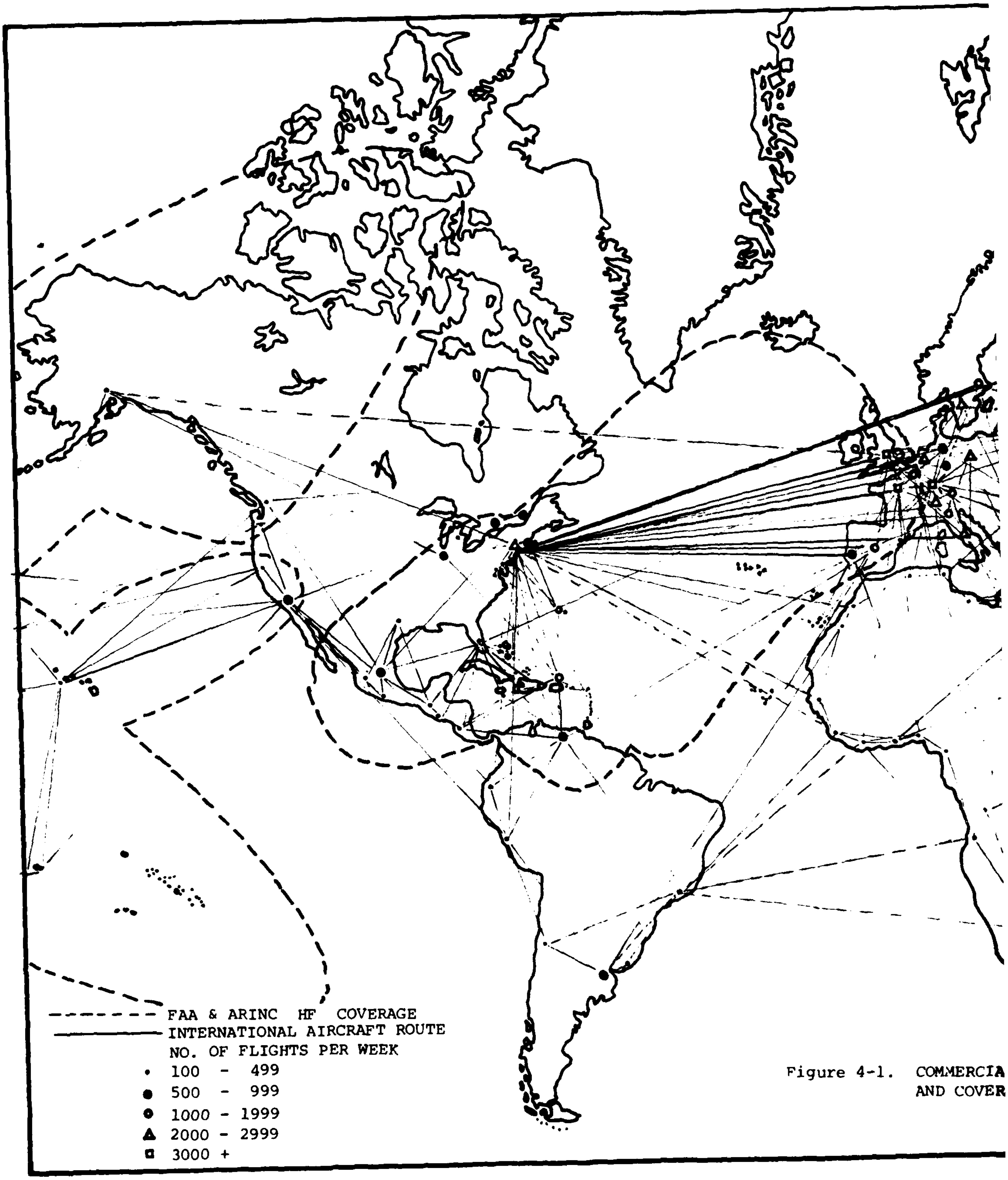
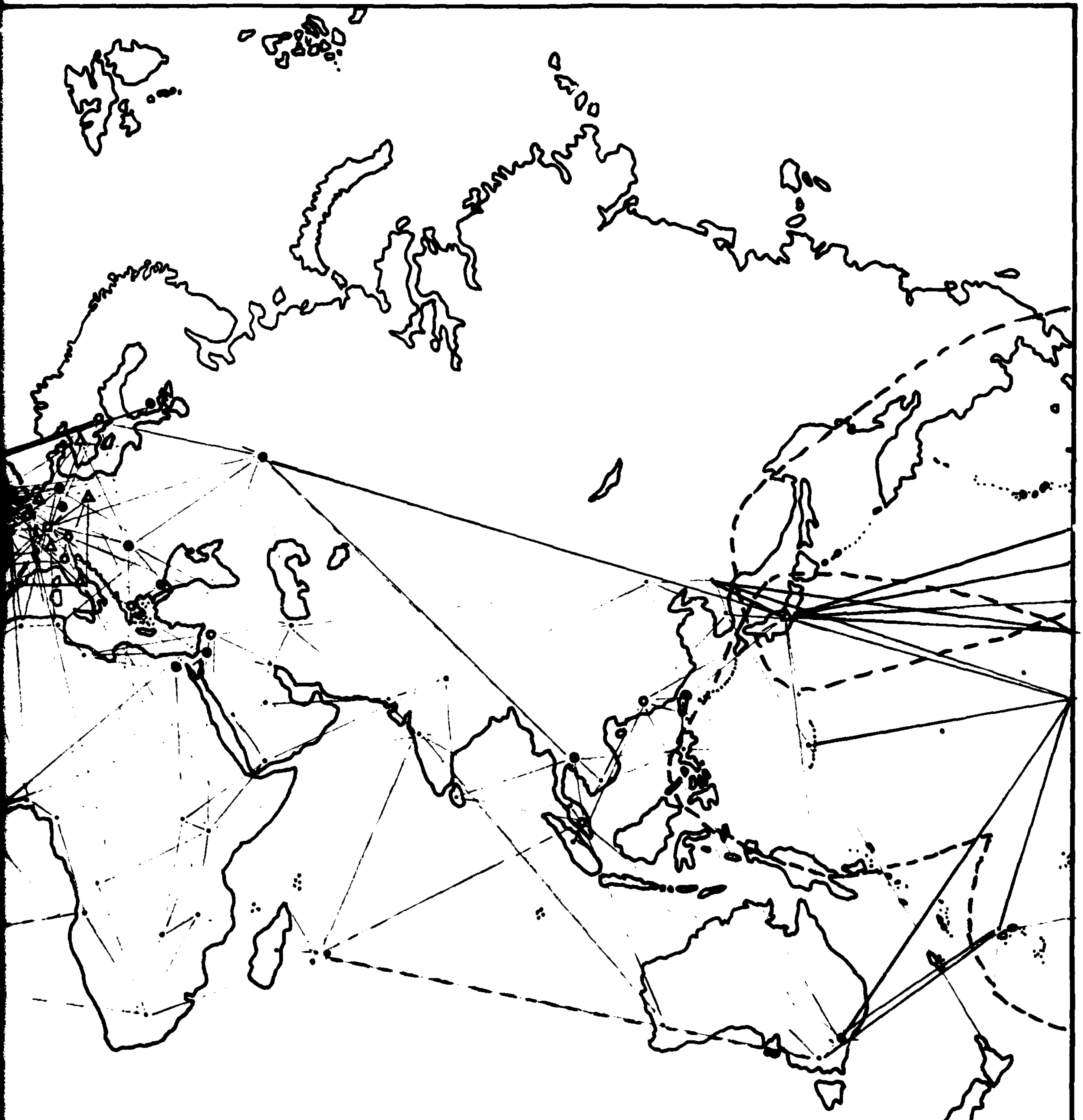


Figure 4-1. COMMERCIA
AND COVER



COMMERCIAL AIRCRAFT ROUTING
AND COVERAGE CHART

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The FAA and ARINC together serve some 3,900 flights per week transiting areas of the Pacific Ocean. Thus the FAA and ARINC, as part of the Airline Fixed Telecommunications Network (AFTN) (reference - Task 2 Report, Section 2.1.1), serve some 24,600 flights per week (63%) at some time during the flight. It must be emphasized that when a flight passes a point beyond which the FAA and ARINC can provide service (maintain radio contact), the aircraft will be served by another AFTN station. For example, an aircraft in transit from New York to Rio De Janerio will be served by ARINC New York and San Juan and by other AFTN stations such as,Caracas, Belem, Recife and Rio De Janerio in South America and possibly Dakar, Africa depending on atmospheric conditions affecting radio transmissions. In addition, the U.S. NATO allies in Canada and Europe serve, through their AFTN operations, over 26,000 international flights per week.

In light of the international flight paths, number of flights per week transiting different areas of the world, and the large number of NATO registered aircraft, the commercial subscriber communications systems that will be assessed later in this chapter include FAA, ARINC, and AFTN. (Note that the SITA communications system can only serve aircraft "at the gate", reference Task 2 Report Section 2.1.3, and hence is not included in this routing analysis.)

The primary mode of long-range air-to-ground communication for international flights is HF. The reliability of HF radio transmissions is adversly affected primarily by radiation from the sun called sun spots. As a result, the radio energy received at the HF receiver, includes both the transmitted signal and ambient noise. The noise is a function of the time of day, time of year and the level of solar activity which varies on an eleven year cycle. Thus a radio transmission between two points in the northern hemisphere, during the night time in winter at a given frequency could be loud and clear while radio transmission between the same two points at noon during the summer might be impossible. For example, there are occasions when a flight from New York to London will be served by ARINC New York from take off to its approach for landing. On other occasions, the radio signal can degrade so rapidly that contact with ARINC will be lost when the aircraft is still within ARINC's assigned area. (Further discussion of the vagaries of radio transmission are included in 4.1.2.1)

The varying reliability of HF radio transmissions reinforce the need to consider the entire AFTN if WCAN II global aircraft coverage is to be achieved.

4.1.2 Analysis of Commercial Vessel Subscriber Communications System Coverage

Of the approximate 24,100 registered commercial vessels world wide, 8,400 are registered in NATO countries; 840 of these are *U.S. Flag Vessels*. Included in the number of registered commercial vessels are drill ships, seismic ships, submersible and semi-submersible platforms serving the offshore petroleum industry.

Figures 4-2, 4-3, 4-4, and 4-5 show a plot of vessel reporting positions for an average week in the winter, spring, summer and fall in 5 degree segments on the high seas. The number shown in each segment indicates the estimated number of NATO Flag vessels which, on the average, could be expected in that segment. Also shown in each figure is the MARISAT coverage areas, MARISAT shore stations, and commercial ship-shore radio stations. In addition, but not shown, the U.S. Coast Guard also serves commercial vessels via HF ship-shore radio stations located at Guam, Honolulu, Kodiak, San Francisco, New Orleans, Miami, Portsmouth (VA), Boston and San Juan.

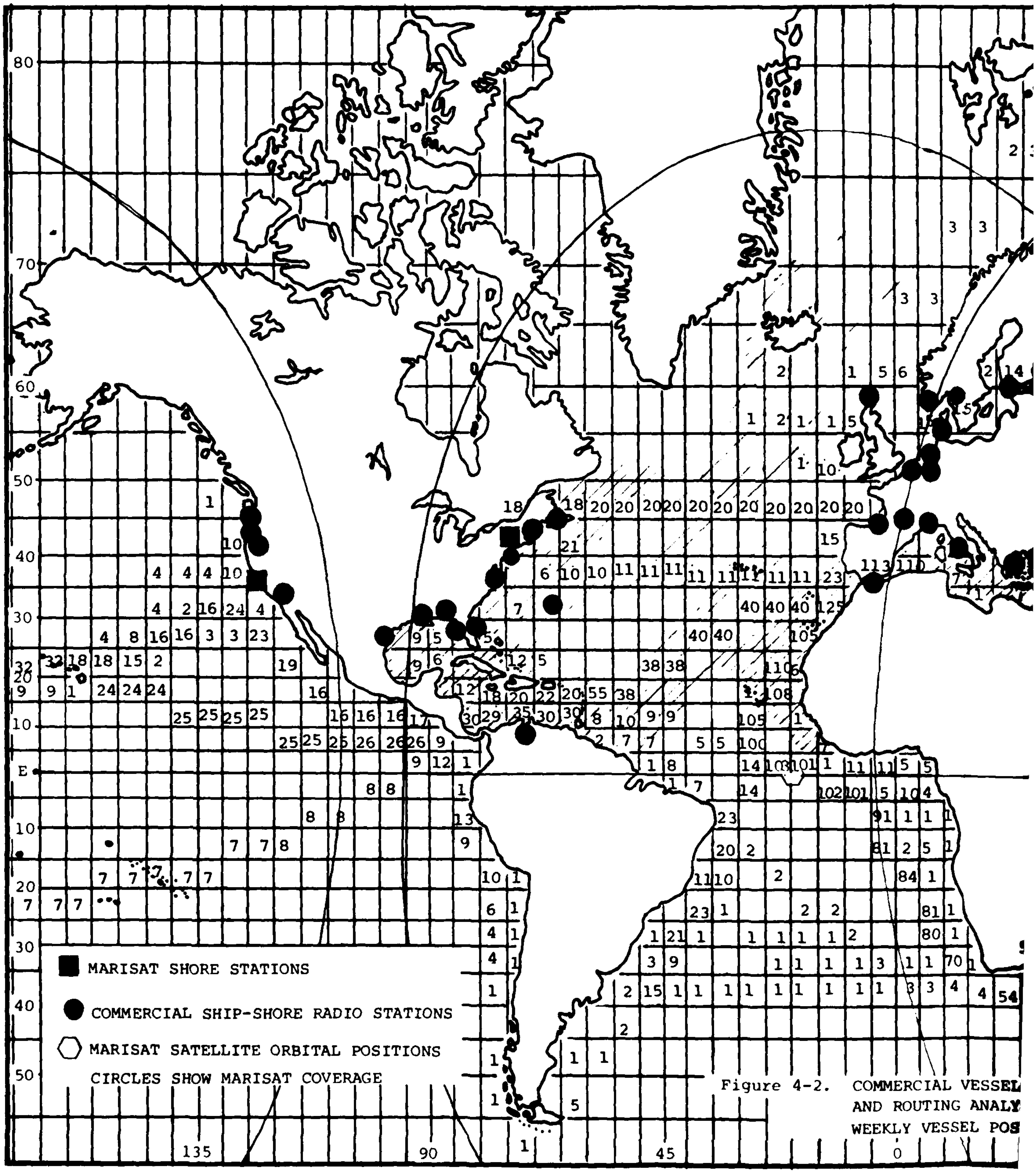
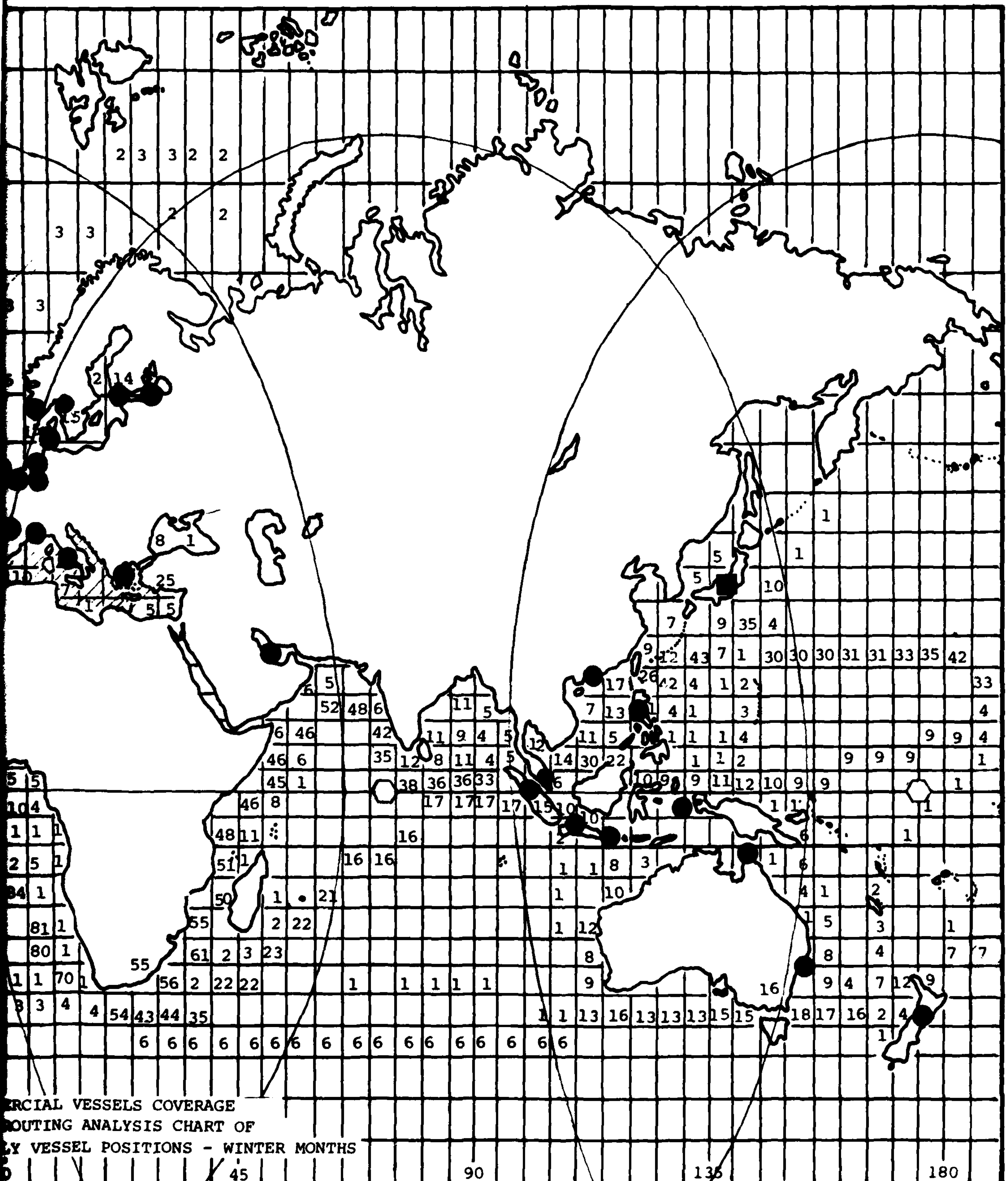


Figure 4-2. COMMERCIAL VESSEL
AND ROUTING ANALY
WEEKLY VESSEL POS



RCIAL VESSELS COVERAGE
OUTING ANALYSIS CHART OF
LY VESSEL POSITIONS - WINTER MONTHS

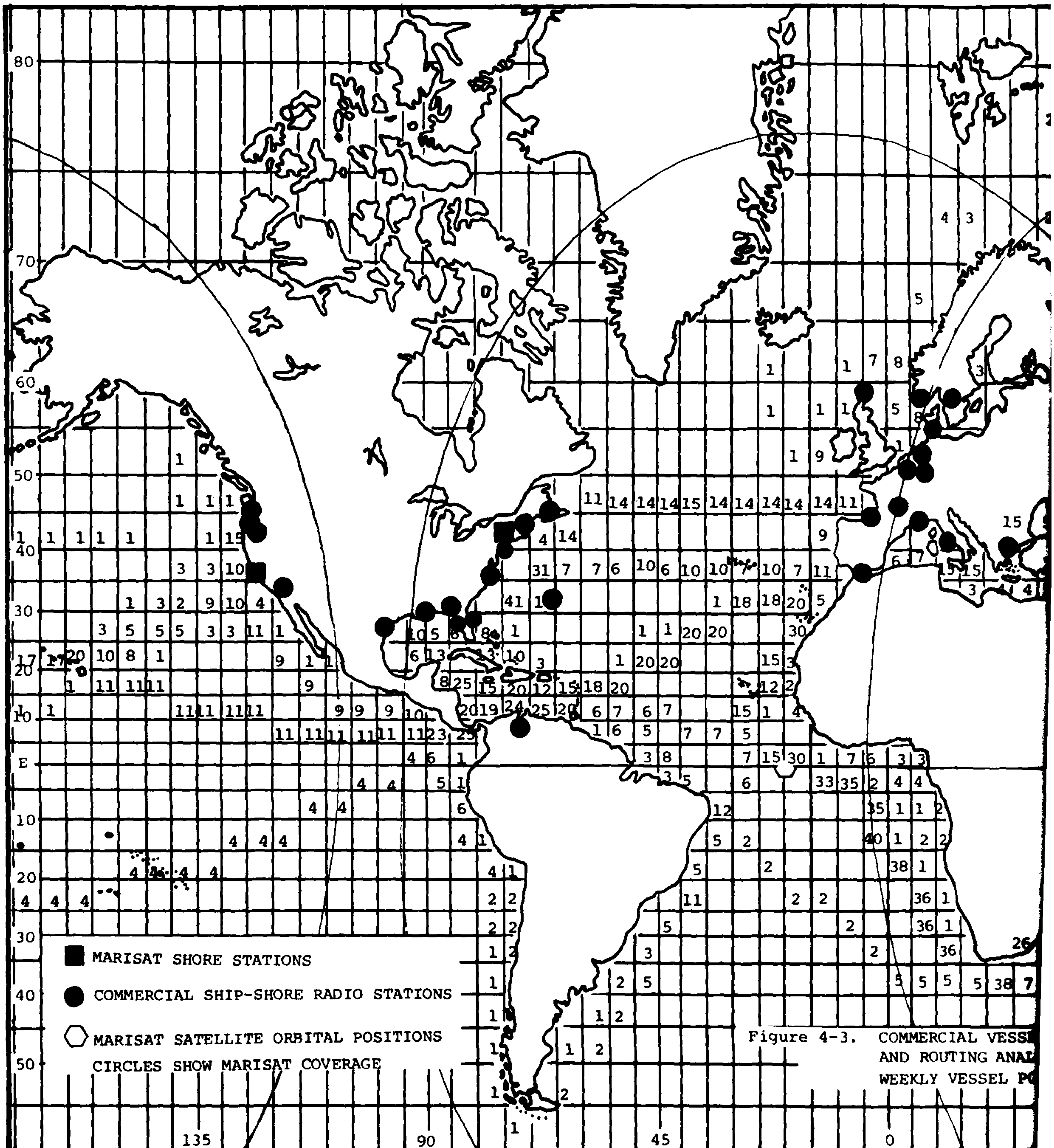
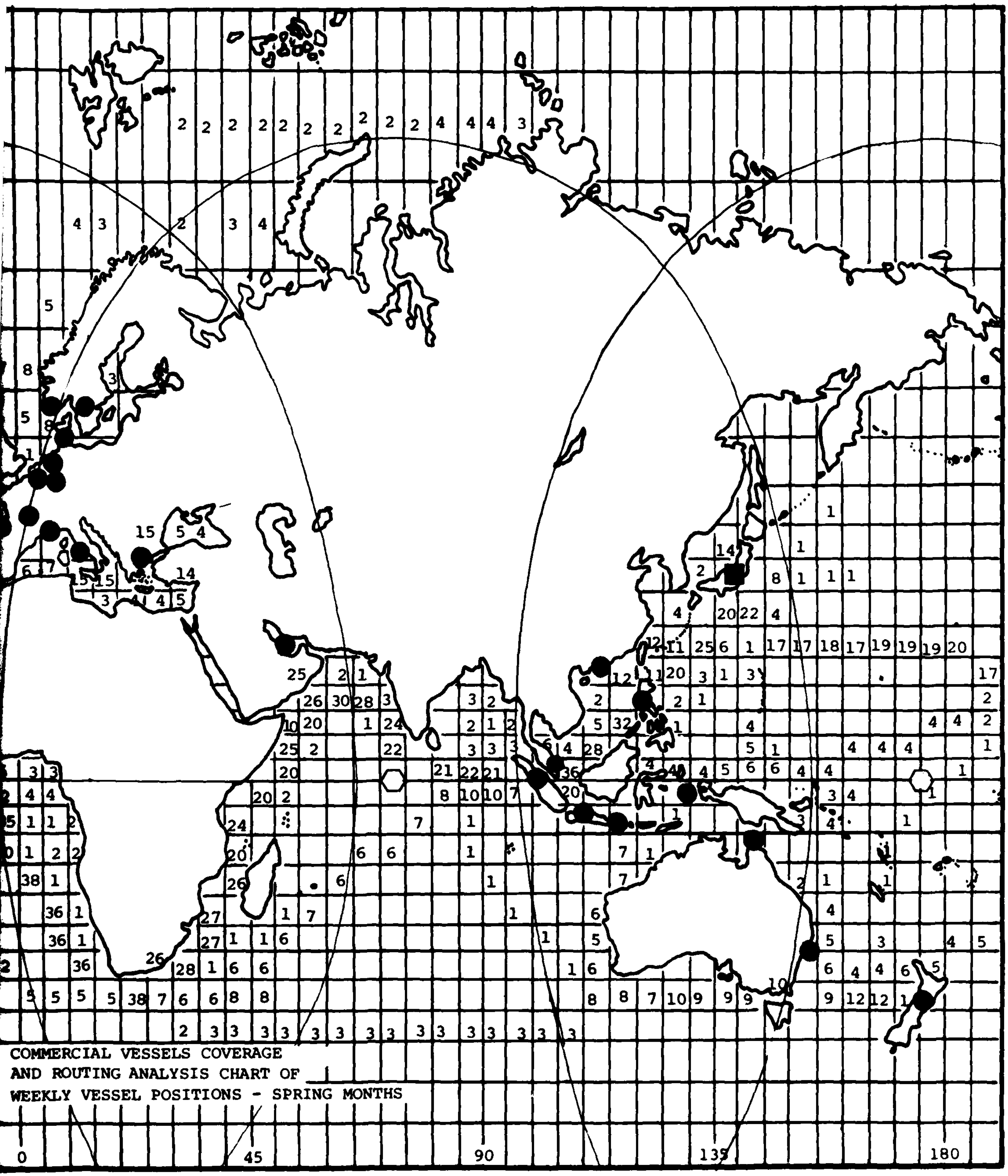


Figure 4-3. COMMERCIAL VESS[illegible] AND ROUTING ANA[illegible] WEEKLY VESSEL P[illegible]



COMMERCIAL VESSELS COVERAGE AND ROUTING ANALYSIS CHART OF WEEKLY VESSEL POSITIONS - SPRING MONTHS

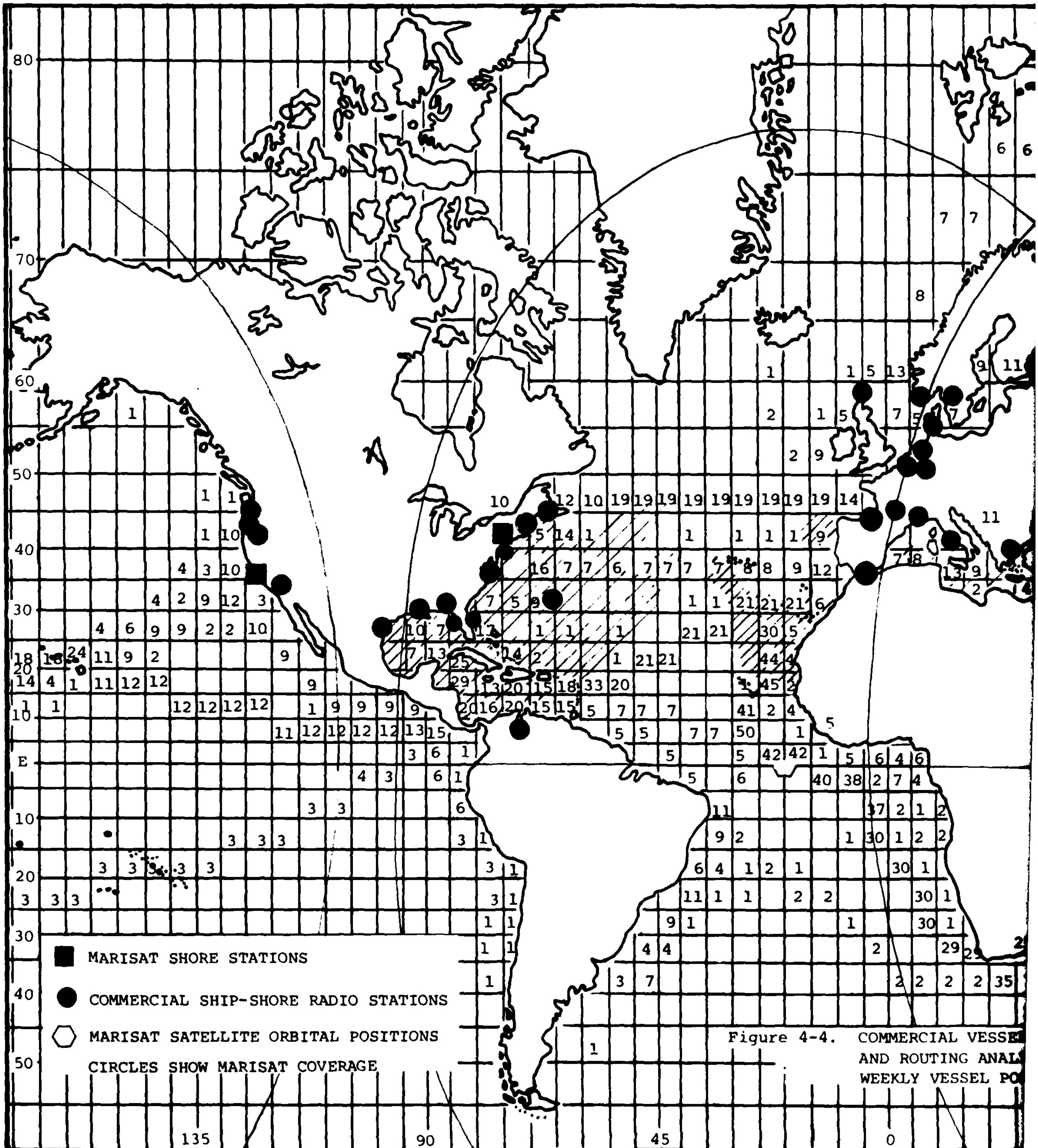
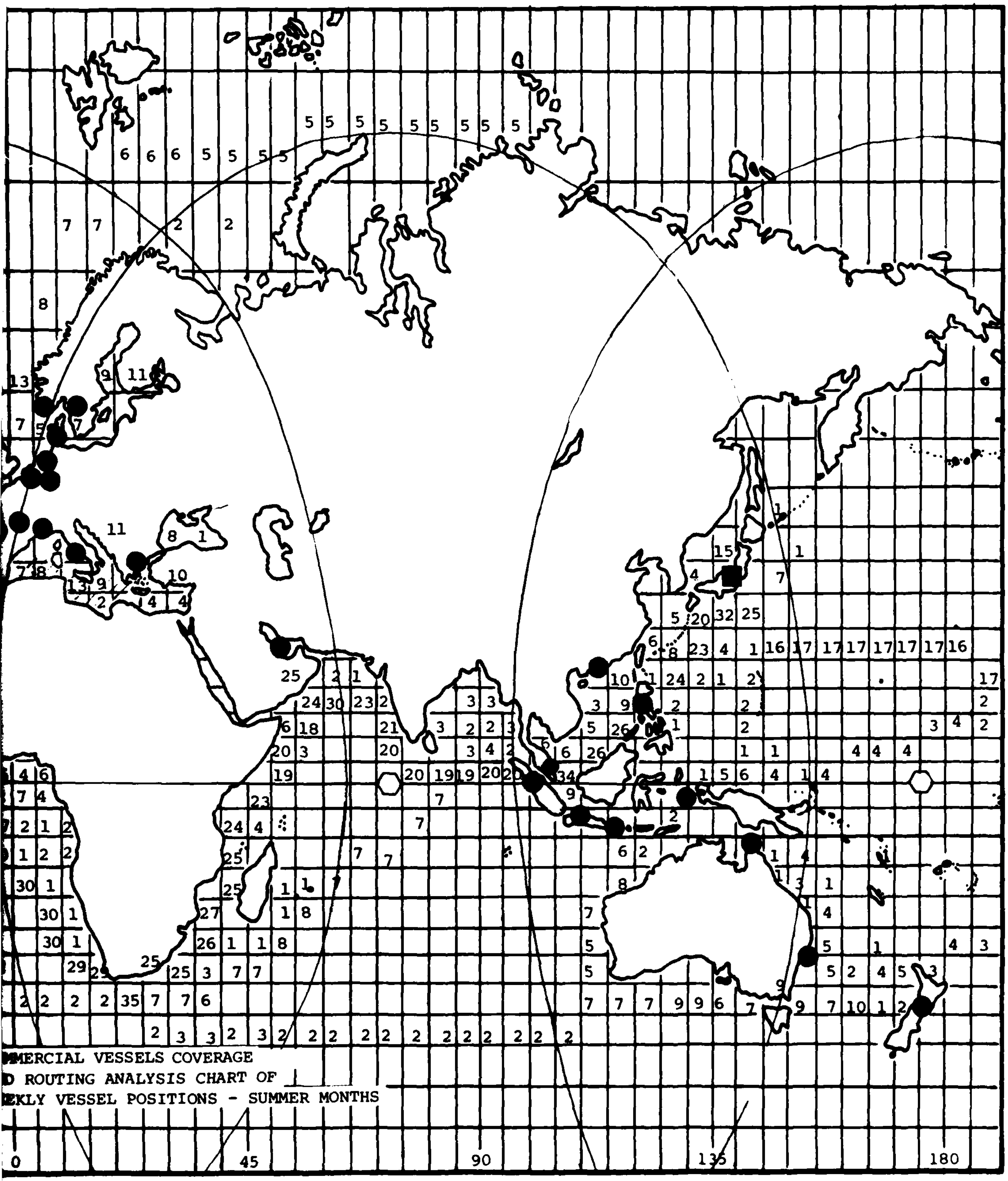


Figure 4-4. COMMERCIAL VESSE
AND ROUTING ANAL
WEEKLY VESSEL PO



MERCIAL VESSELS COVERAGE
D ROUTING ANALYSIS CHART OF
EKLY VESSEL POSITIONS - SUMMER MONTHS
0
45
90
135
180

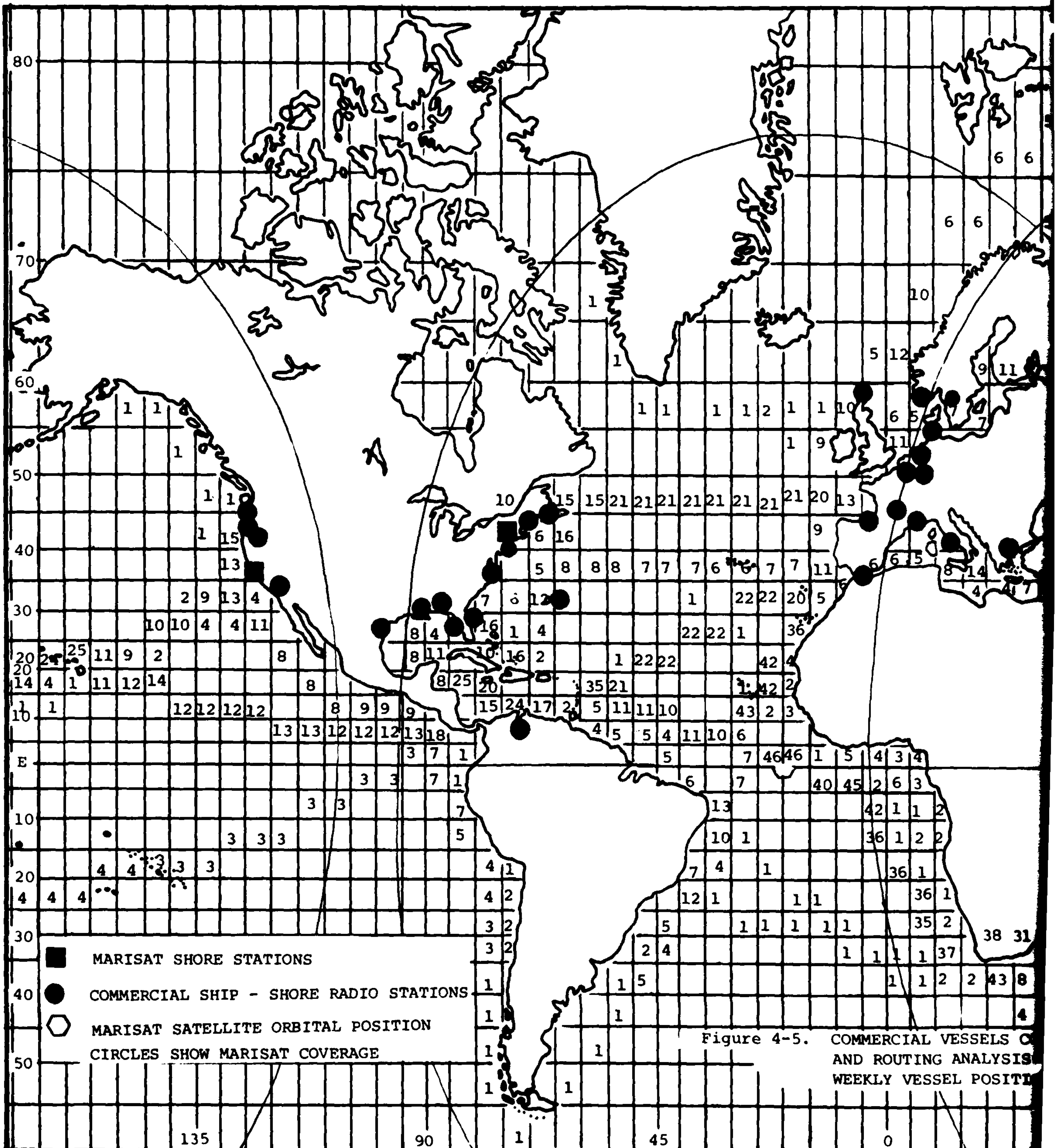
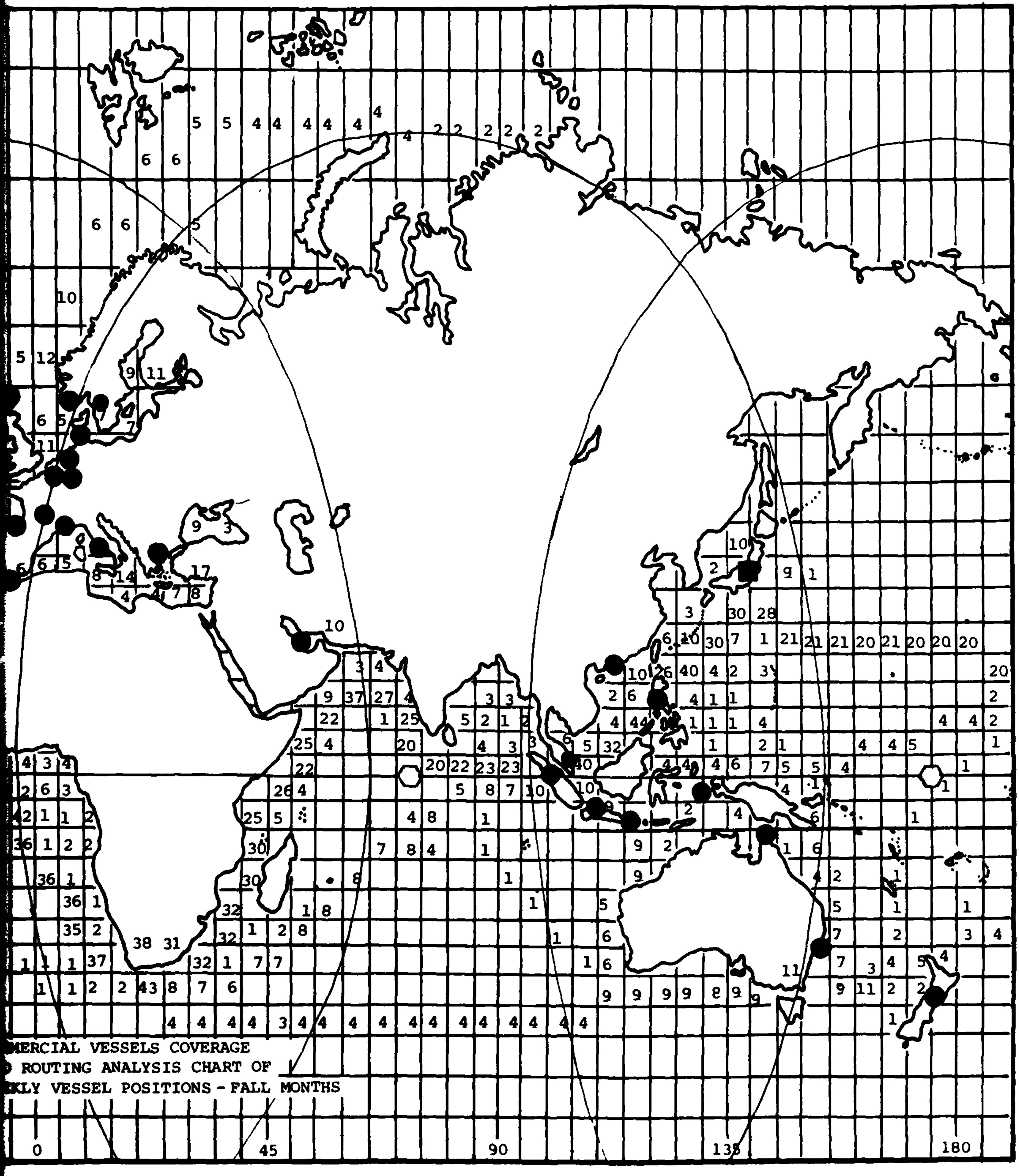


Figure 4-5. COMMERCIAL VESSELS C
AND ROUTING ANALYSIS
WEEKLY VESSEL POSIT



MERCIAL VESSELS COVERAGE
D ROUTING ANALYSIS CHART OF
KLY VESSEL POSITIONS - FALL MONTHS

During 1977, an analysis of the maritime high-frequency single-sideband voice communication system for the North Atlantic and the South Pacific was conducted by the U.S. Department of Commerce, Office of Telecommunications for the U.S. Coast Guard. The analysis was made for January (winter) and July (summer) covering voice transmissions using HF frequencies ranging from 4 to 22 MHZ. As mentioned earlier, HF radio transmission (the primary ship-shore mode of communication) is affected by energy flux from the sun, hence, time of year, time of day and solar activity are important factors in estimating the reliability of these radio transmissions.

Since reliability of HF radio transmission is a major concern, especially in cases of emergency, Figures 4-2 and 4-4 have areas shaded in the North Atlantic that indicate a predicted voice communications reliability of at least 85% from vessels in the shaded areas to East Coast ship-shore stations. During the winter months (Figure 4-2) there is a predicted radio transmission reliability in excess of 85% for approximately 75% of the North Atlantic and most of the Mediterranean. During the summer months (Figure 4-4) there is a predicted radio transmission reliability in excess of 85% for approximately 33% of the North Atlantic and western Mediterranean. Similar variations are applicable to the southern hemisphere except that the seasonal changes are reversed as compared to the North.

4.2 APPROACH USED IN ASSESSING THE SUBSCRIBER COMMUNICATIONS SYSTEMS

The subscriber communications system assessment methodology described in Chapter 3 is applied in this section as the means of determining the relative capability of each subscriber system in meeting the WCAN II (WWMCCS) requirements. Recall that the requirement factors under consideration are:

- Institutional/Political/Regulatory
- Availability
- AUTODIN Message Center Accessibility

- Geographical Coverage
- Timeliness
- Transmission Quality

Each subscriber system assessment considers the subscriber communications systems as they now exist so that deficient areas associated with each system will be fully identified.

The assessment of the subscriber communications systems was made by a team of members of the ARINC Research staff where skills cover a broad range of experience in aviation, maritime, international and NATO telecommunications. The team assessed each of the above listed requirement factors for each subscriber communications system on the basis of the factor indices described earlier in Section 3.2. Upon completion of this assessment, the requirement, the requirement factor weights described in Section 3.1 were multiplied by the associated factor indeces to determine the factor score. The six individual factor scores were then summed to determine the total score for each subscriber communications system.

4.2.1 Assessment of Airline Communications Systems

The airline related subscriber communications systems which were assessed are:

- Federal Aviation Administration (FAA) - See Table 4-2
- Aeronautical Radio Inc. (ARINC) - See Table 4-3
- Airline Fixed Telecommunications Network - See Table 4-4
- Societe Internationale de Telecommunications Aeornautiques (SITA) - See Table 4-5

4.2.2 Assessment of Maritime Communications Systems

The maritime related subscriber communications systems assedded were:

- MARSTAT Maritime Satellite System - See Table 4-6
- Commercial Private Maritime Radio Systems (MF/HF/VHF) - See Table 4-7
- Offshore Oil Rigs - See Table 4-9

TABLE 4-2

SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

FAA

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	10	No problem identified.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	10	AMCs located on FAA premises.
GEOGRAPHICAL COVERAGE	1	Coverage primarily in the North Pacific serving less than 50% of international flights.
TIMELINESS	10	Transmission time from originator to AMC 10 minutes or less.
TRANSMISSION QUALITY	8	Limited HF service range but subject to signal degradation requiring oral text verification resulting in 80% to 94% quality.

TABLE 4-3

SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

ARINC

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	10	No problem identified.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	6	AMC access via CONUS link for message delivery.
GEOGRAPHICAL COVERAGE	5	Coverage includes North Atlantic and North Pacific serving over 50% of international flights.
TIMELINESS	8	Limitation of AMC access increases transmission time to 11 to 15 minutes
TRANSMISSION QUALITY	6	Extended HF service range is subject to signal degradation requiring oral verification of message text resulting in 60% to 79% message quality.

TABLE 4-4 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

AFTN

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	5	Problems anticipated at some foreign government operated AFTN stations in transmitting messages to AUTODIN.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	3	Air/Ground transmissions must be switched from AFTN to FAA to AMC.
GEOGRAPHICAL COVERAGE	10	Global coverage.
TIMELINESS	5	General high speed service worldwide with time increase to about 30 minutes with handling between AFTN/FAA and FAA/AMC.
TRANSMISSION QUALITY	4	Signal degradation on HF and some foreign land line circuits indicate a 50% to 59% message quality for worldwide service.

TABLE 4-5 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

SITA

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	0	Problems have been expressed by SITA management in New York re the transmission of messages to non-airline locations.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	1	AMC access requires multiple switching from SITA to AFTN or or ARINC to FAA to AMC.
GEOGRAPHICAL COVERAGE	10	All airports and airline offices worldwide.
TIMELINESS	5	High speed transmission but multiple switching to AMC indicates 16 to 30 minutes transmission time.
TRANSMISSION QUALITY	10	Leased private line network with message accounting and error correction exceeds 95% quality.

TABLE 4-6 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

MARISAT

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	10	No identified problem.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	10	AMC access available via USCG.
GEOGRAPHICAL COVERAGE	10	Virtual global coverage for all MARISAT equipped vessels.
TIMELINESS	10	Rapid transmission and quick access to AMC estimated at 10 minutes or less.
TRANSMISSION QUALITY	10	High quality satellite communications links are providing over 95% transmission quality.

TABLE 4-7 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

COMMERCIAL MF/HF/VHF

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	5	Problems are anticipated at foreign shore stations particularly when a vessel is in port and required to communicate via the local communication carrier.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	1	AMC access requires multiple switching of messages and voice connections handled via foreign shore stations.
GEOGRAPHICAL COVERAGE	10	Global coverage.
TIMELINESS	1	Experience with radio transmission from the various global shipping lanes indicates that the average transmission time will exceed 1 hour.
TRANSMISSION QUALITY	4	MF/HF radio experience frequent degradation indicating message quality between 50% and 59%.

TABLE 4-8

SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

USCG

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	10	No problem identified.
AVAILABILITY	10	Continuous operation.
AUTODIN MESSAGE CENTER ACCESSIBILITY	10	Direct access to on premise AMC.
GEOGRAPHICAL COVERAGE	5	Global via MARISAT and operational areas via MF/HF/VHF estimated average coverage of about 50%.
TIMELINESS	8	Rapid transmission via MARISAT and moderate MF/HF/VHF capability from assigned operational areas indicate an average message transmission time of about 15 minutes.
TRANSMISSION QUALITY	8	Radio transmission quality for the assigned operational areas are estimated to be over 80%.

TABLE 4-9 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

U.S. OFFSHORE OIL RIGS

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	10	No problem identified.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	6	AMC access via CONUS link using MARISAT with alternate access via HF/VHF to CONUS from their fixed positions.
GEOGRAPHICAL COVERAGE	10	Coverage limited to that visible from the fixed oil rig hence defined as total coverage for those specific locations.
TIMELINESS	8	Generally high speed service to U.S. corporate offices estimated at 15 minutes service to AMC.
TRANSMISSION QUALITY	8	Generally good quality of transmission from most operating areas estimated at about 90%.

4.2.3 Assessment of North Atlantic Treaty Organization Communications Systems

The assessment of the North Atlantic Treaty Organization (NATO) Communications Systems is shown in Table 4-10.

4.3 SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

The subscriber communications system assessment is based on scores which are an indication of the ability of each system in meeting earlier defined WCAN II requirements. A maximum score of ten is indicative of a match between the system ability and the WCAN requirements. However, as discussed later in Sections 4.4 and 4.5, a system with a score below ten is not precluded automatically since deficiencies may be overcome and that system may be the only communications means available to fulfill the WCAN II mission. The detailed scoring of the subscriber communications systems are shown in Tables 4-11, 4-12 and 4-13 and summarized below.

. Airline Systems (See Table 4-11)

System	Score
FAA	8.96
ARINC	8.46
AFTN	6.38
SITA	4.75

. Maritime Systems (See Table 4-12)

System	Score
MARISAT	10.00
USCG	9.20
OFFSHORE OIL RIGS	8.50
Commercial MF/HF/VHF	5.66

. NATO System (See Table 4-13)

System	Score
NATO	5.30

TABLE 4-10

SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT

NATO

REQUIREMENT FACTOR	INDEX OF ASSESSMENT	COMMENT
INSTITUTIONAL/ POLITICAL/ REGULATORY	0	All NATO members would have to authorize the use of the system for CAM transmission to AUTODIN.
AVAILABILITY	10	Operates continuously.
AUTODIN MESSAGE CENTER ACCESSIBILITY	10	Both direct and indirect access to AMCs available.
GEOGRAPHICAL COVERAGE	8	Europe is assumed to be the geographic coverage area with NATO servicing about 75% of the area.
TIMELINESS	1	NATO's present communications system is frequently overloaded with transmission delays in excess of 1 hour.
TRANSMISSION QUALITY	6	Obsolete equipment, low grade circuits and mannual operations contribute to frequent transmission delays exceeding 1 hour.

TABLE 4-11

SUBSCRIBER COMMUNICATION SYSTEM ASSESSMENT SCORE

AIRLINES

REQUIREMENT FACTORS	(1) FACTOR WEIGHT	(2) FACTOR INDICES	SUBSCRIBER SYSTEM/SCORE (1) X (2)			
			FAA	ARINC	AFTN	SITA
INSTITUTIONAL/ POLITICAL/ REGULATORY	.35	10 5 0	3.5	3.5	1.75	0
AVAILABILITY	.25	10 7 5 2	2.5	2.5	2.5	2.5
AUTODIN MESSAGE CENTER ACCESSIBILITY	.15	10 6 5 3 1	1.5	.9	.45	.15
GEOGRAPHICAL COVERAGE	.10	10 8 5 1	0.1	.5	1	1
TIMELINESS	.08	10 8 5 1	.8	.64	.4	.4
TRANSMISSION QUALITY	.07	10 8 6 4 1	.56	.42	.28	.7
TOTAL SCORE			8.96	8.46	6.38	4.75

TABLE 4-12

SUBSCRIBER COMMUNICATION SYSTEM ASSESSMENT SCORE

MARITIME

REQUIREMENT FACTORS	(1) FACTOR WEIGHT	(2) FACTOR INDICES	SUBSCRIBER SYSTEM/SCORE (1) X (2)			
			MARISAT	COMMERCIAL MF/HF/VHF	USCG	OFFSHORE OIL RIGS
INSTITUTIONAL/ POLITICAL/ REGULATORY	.35	10 5 0	10 3.5	5 1.75	10 3.5	10 3.5
AVAILABILITY	.25	10 7 5 2	10 2.5	10 2.5	10 2.5	10 2.5
AUTODIN MESSAGE CENTER ACCESSIBILITY	.15	10 6 5 3 1	1.5	.15	1.5	.3
GEOGRAPHICAL COVERAGE	.10	10 8 5 1	10 1	10 1	5 .5	10 1
TIMELINESS	.08	10 8 5 1	10 .8	1 .08	8 .64	.64
TRANSMISSION QUALITY	.07	10 8 6 4 1	10 .7	4 .28	8 .56	8 .56
TOTAL SCORE			10.00	5.66	9.20	8.50

TABLE 4-13

SUBSCRIBER COMMUNICATION SYSTEM ASSESSMENT SCORE

NATO

REQUIREMENT FACTORS	(1) FACTOR WEIGHT	(2) FACTOR INDICES	SUBSCRIBER SYSTEM/SCORE (1) X (2)			
			NATO			
INSTITUTIONAL/ POLITICAL/ REGULATORY	.35	10 5 0	0 0			
AVAILABILITY	.25	10 7 5 2	10 2.5			
AUTODIN MESSAGE CENTER ACCESSIBILITY	.15	10 6 5 3 1	10 1.5			
GEOGRAPHICAL COVERAGE	.10	10 8 5 1	8 .8			
TIMELINESS	.08	10 8 5 1	1 .08			
TRANSMISSION QUALITY	.07	10 8 6 4 1	6 .42			
TOTAL SCORE			5.3			

The preceeding assessment scores show a fairly wide variation in the capabilities of the subscriber communications systems in meeting the WCAN II requirements. In considering the airline to AMC interface, both the FAA (8.96) and ARINC (8.46) are clearly potential elements of the WCAN II in airline communications service. However, the FAA and ARINC combined do not provide global coverage. As a result, the foreign operated AFTN (6.38) must be considered. SITA (4.75), the lowest airline system score) should be dropped from consideration as a WCAN II communications element at this time. SITA is solely a ground/ground communications service and would require the aircrewman to telephone or go the the SITA terminal to transmit a CAM. If the aircrewman could telephone the SITA office he could also call another office with direct or more direct access to an AMC.

The assessment of the Maritime to AMC interface shows MARISAT with the maximum score of 10. Unfortunately there are a small number of NATO vessels that are MARISAT equipped even though the number is growing each year. Since all vessels are equipped with MF/HF/VHF radio, commercial MF/HF/VHF (5.66) must be considered as a WCAN II element. The USCG (9.20) is an important element in the Maritime communications both as an observer (CAM originator) and as a link between commercial vessels and offshore oil rigs and the AMC. No amplification of the importance of petroleum is necessary in showing the value of including offshore oil rig communications systems (MARISAT and MF/HF/VHF) as a WCAN II communications element.

NATO communications systems (5.30) are an important element in the WCAN II since these systems could serve as an expedient means of alerting the United States of impending crises.

All scores in which a requirement factor assessment index was below 10 indicates a deficiency. Some of the deficiencies of these systems can be enhanced as discussed in the following section.

4.4 ENHANCEMENT OF SUBSCRIBER SYSTEM DEFICIENCIES

Some of the existing deficiencies of several subscriber communications systems can most likely be enhanced in order to improve their WCAN II applicability ratings. Those factors most akin to enhancement are Institutional/Political/Regulatory, AMC accessibility, and timeliness. The subscriber systems whose WCAN II applicability ratings could be increased are ARINC, AFTN, SITA, Commercial Marine, Offshore Oil Rigs and NATO. A summary of deficiencies which could be enhanced for these subscriber systems is as follows:

- ARINC - AMC accessibility could be enhanced with an ARINC terminal at an AMC or an AMC terminal installed at ARINC
  - Timeliness could be improved with greater AMC accessibility
- AFTN - Institutional/Political/Regulatory considerations may be enhanced through meetings with foreign AFTN operators or by incorporation of procedures which pass anticipated government restrictions.
  - AMC accessibility may be enhanced by extending the AFTN network to an AMC location.
  - Timeliness may be improved by a reduction in handling of messages through extension to an AMC
- SITA - Institutional/Political/Regulatory considerations may be improved through meetings with foreign SITA owner/operators

- MF/HF/VHF - Institutional/Political/Regulatory considerations may be improved through meetings with foreign governments or the development of procedures which bypass any government restrictions
- Offshore Oil Rigs - AMC accessibility may be improved by direct connection from some of the major international oil company subscriber communications systems to an AMC (after a detailed study)
- NATO - Institutional/Political/Regulatory considerations may be improved through government agreements

The deficiencies described above will be addressed in more detail during our performance of Task 4 (Estimation of Interface Development Resources).

CHAPTER FIVE

IDENTIFICATION OF INFORMATION PATHS AND ALTERNATIVE INTERFACE LOCATIONS

5.0 INTRODUCTION

For those subscriber systems under consideration, this chapter identifies the probable information paths along which crisis information will flow between the Crisis Action Message (CAM) originator and an AUTOVON Message Center (AMC. The information paths and AUTODIN interface locations described in the following sections are related to the subscriber communications systems as they now exist. Notations are made in each case where a more accessible AUTODIN interface would improve the message flow.

5.1 AIRCRAFT TO AMC INFORMATION PATHS

5.1.1 FAA Information Paths

In addition to its domestic CONUS operation which is not relevant to the WCAN II mission, the FAA serves commercial airline routes over the North Pacific via HF radio. As mentioned earlier, HF radio transceivers are located in Guam and Alaska (Cold Bay, Point Barrow, and Anchorage). AUTODIN terminals are located at the FAA's facilities in Guam and Anchorage and these sites are interconnected to the FAA network. Therefore, the FAA/WCAN II information path consists of two links as follows:

- Aircraft to FAA AMC site (Guam or Anchorage) via HF radio
- Direct AMC access at these sites

5.1.2 ARINC Information Paths

As discussed earlier, ARINC serves commercial airline routes over the Pacific Ocean, Gulf of Mexico, Caribbean Sea, and North Atlantic Ocean via HF radio. Radio transceivers and operators serving these areas are located at Honolulu, San Francisco, New York, and San Juan. Direct telecommunications facilities interconnect all four of these ARINC centers to an ARINC switching facility in Chicago. For voice communication, the four ARINC centers can patch the pilot directly into the FAA network for AMC access. For message traffic, there is a direct connection between the ARINC switch in Chicago and the FAA/AFTN switch in Kansas City where an FAA AUTODIN terminal is located. Therefore, for voice traffic, the ARINC/WCAN II information path consists of two links as follows:

- Aircraft to ARINC Center via HF radio
- ARINC Center to FAA AMC access

The particular information paths for each ARINC center location to FAA AMC access location is as follows:

ARINC Center Location	Connection	FAA AMC Location
Honolulu	Telephone Patch	Honolulu
San Francisco	Telephone Patch	Oakland
New York	Telephone Patch	New York
San Juan	Telephone Patch	San Juan

For message traffic, the ARINC/WCAN II information path consists of two links as follows:

- Aircraft to ARINC Center via HF radio
- ARINC Center to FAA Kansas City AMC via ARINC switching facility

As mentioned earlier in Section 4.4, ARINC AMC accessibility could be improved by the addition of an AUTODIN terminal at each of the four ARINC sites.

5.1.3 Non-FAA AFTN Information Paths

As discussed earlier, AFTN serves commercial airline international routes via HF radio. AFTN radio transceiver and operator locations were shown in Appendix A of the Task 2 report. All locations on the AFTN network can access the FAA/AFTN switch in Kansas City where an FAA AMC is located.

If the aircraft in a crisis situation cannot reach an FAA or ARINC operator via Long Distance Operational Control (LDOC), it will have to make contact with an AFTN foreign (non-FAA) operator. In this case the non-FAA AFTN/WCAN II information path consists of two links as follows:

- Aircraft to foreign AFTN operator via HF voice
- Foreign AFTN operator to the FAA Kansas City AMC via AFTN TTY network

It should be noted that the foreign AFTN operator must prepare and transmit the TTY message. The above-described information path appears relatively straightforward, but there are potential political problems associated with the transcription and transmission of messages at the foreign AFTN stations. The level of this problem is highly dependent upon that government's relationship with the United States. Another problem, particularly in South America, Africa, and Malaysia, is the difficulty in getting the operator to transcribe and transmit the message even without government interference.

5.2 MARITIME TO AMC INFORMATION PATHS

5.2.1 MARISAT Information Paths

As discussed earlier, MARISAT serves commercial vessels and oil platforms worldwide including drill ships, seismic vessels, submersible and semi-submersible oil platforms as well as fixed oil platforms. MARISAT earth stations are located in Yamaguchi, Japan; Santa Paula, CA, and Southbury, CT, and provide direct access to the U.S. domestic telephone, TWX and TELEX systems.

For voice communications, the vessel in contact with the Atlantic or Pacific Ocean satellite, will establish direct contact with the U.S. Coast Guard via the MARISAT distress priority feature. The USCG operator will transcribe the CAM and enter it directly into the Coast Guard's AMC. The vessel in contact with the Indian Ocean satellite will place a normal ship-to-shore telephone call to the USCG in Guam or Honolulu. Upon connection, the USCG operator will transcribe the CAM directly into the AMC. Therefore, for voice, the MARISAT/WCAN II information path consists of a single link as follows:

- Vessel or offshore petroleum rig to USCG AMC via satellite voice

For TELEX communications, the vessel radio operator will prepare the message in punched paper tape or magnetic tape format prior to transmission. The vessel in contact with the Atlantic or Pacific Ocean satellite will establish direct contact with the U.S. Coast Guard via the distress priority feature. Upon receiving the USCG TELEX answer-back code, the vessel radio operator will transmit the CAM. Upon receipt at the USCG, the USCG operator will address the CAM properly and enter the CAM directly into the AMC. The vessel in contact with the Indian Ocean satellite will place a normal ship-to-shore TELEX call to the USCG in Guam or Honolulu. Upon connection, the vessel operator will verify communication with the USCG through its answer-back code, transmit the CAM and verify transmission upon completion by the USCG answer-back code. Upon receipt of the CAM, the USCG operator will address the CAM properly and enter it into the AMC. Therefore, for TELEX, the MARISAT/WCAN II information path consists of a single link as follows:

- Vessel or offshore petroleum rig to USCG AMC via satellite TELEX

5.2.2 Commercial MF/HF/VHF and U.S. Coast Guard Information Paths

MF/HF/VHF radio serves commercial vessels worldwide including drill ships, seismic vessels, submersible and semi-submersible oil platforms as well as fixed oil platforms in international waters. Ship-to-shore radio stations are located virtually worldwide (see Task 2 report, Table 2-3) and have direct wire, cable or satellite connections to the U.S. domestic telephone, TWX and TELEX systems. In addition to commercial marine radio, the U.S. Coast Guard operates several ship-to-shore stations and depending on ship location could serve as a direct input to WCAN II.

All NATO vessels with a CAM should try to establish contact with the USCG. If unsuccessful, a U.S. commercial or NATO commercial ship-to-shore radio station will be contacted. Upon connection with one of these commercial radio stations, a connection will be requested to the USCG. After connection to the USCG, the CAM will be transmitted to the USCG operator who will enter the CAM into the Coast Guard's AMC.

For voice messages, the U.S. or NATO ally commercial radio/WCAN II information path consists of two links as follows:

- Vessel or petroleum rig to U.S./NATO ally commercial radio via HF voice
- Commercial radio to USCG via dial telephone for AMC entry

If the vessel cannot make contact with the USCG, U.S. commercial or NATO commercial ship-to-shore radio station, contact will have to be made by way of a ship-to-shore radio station operated by a non-NATO government. Dependent upon that foreign government's restrictions and the availability and quality of overseas telephone circuits, connection to the USCG and AMC entry will proceed as above.

In the case of hardcopy or Morse code messages, all NATO vessels should try to establish TELEX, TTY or Morse contact with a USCG, U.S. commercial or NATO commercial ship-to-shore radio station. Upon connection with one of these radio stations, a TELEX connection will be requested to the USCG or a TTY or Morse message will be addressed to the USCG for AMC entry. Upon receipt of the CAM at the USCG, the CAM will be addressed properly and entered into the USCG AMC (TELEX), transcribed, addressed and entered into the USCG AMC (TTY or Morse). In these cases, the U.S. or NATO ally commercial radio/WCAN II information path consists of two links as follows:

- Vessel or petroleum rig to U.S./NATO ally commercial radio via TELEX, TTY or Morse code
- Commercial radio to USCG via TELEX or TTY for AMC entry

As in the earlier-discussed voice case, if the vessel cannot make contact with a USCG, U.S. commercial or NATO commercial ship-to-shore station, contact will have to be made by way of a non-NATO government operated ship-to-shore radio station. Dependent upon that foreign government's restrictions and the availability and quality of the overseas teletypewriter circuits, connection to the USCG and AMC entry will proceed as above.

5.2.3 NATO Communications Systems Information Path

NATO communications systems (see Task 2 report, Section 2.5) interface with U.S. AUTODIN switches directly at Croughton, UK; and Coltano, IT. In addition, there are nine manual (torn tape) interfaces with AUTODIN, located as follows:

AUTODIN-NATO Link

Pirmasens - Erwin, GE

Pirmasens - Kindsbach, GE

Pirmasens - Rupertsweiler, GE

Croughton - Maastricht, NL

Croughton - Casteau (SHAPE), BE

Croughton - Kolsaas, NO

Coltano - Bagnoli, IT

Coltano - Izmir, TU

Coltano - Verona, IT

In all probability CAMs in this area, will be of most concern to CINCEUR. The information path to CINCEUR would be relatively direct from all NATO communications systems terminals to CINCEUR in Vaihingen, GE. However, it will probably be necessary to readdress the CAM after receipt of CINCEUR since only the two automatic interfaces at Croughton and Coltano could be expected to recognize the CAM DD ALERT header.

CHAPTER SIX

DESCRIPTION OF SUBSCRIBER COMMUNICATIONS SYSTEM/WWMCCS INTERFACE PROCEDURES

6.0 INTRODUCTION

This chapter contains a brief description of the proposed interface procedures for the WCAN II subscriber communications system interface to the AUTODIN network. The described procedures are based on the WCAN communications requirements for the exchange of transmissions of an initial crisis alert message (CAM) from the originator to the AMC, acknowledgment of the CAM receipt from the AMC and following query/acknowledgment/response communications between the AMC and the originator. The communications may be transmitted by voice or hard copy using a teletypewriter (TTY). For clarity, a sample ALERT communications exchange is used in order to track the communications flow and the proposed interface procedures.

6.1 SAMPLE ALERT COMMUNICATIONS EXCHANGE

In developing a detailed transaction analysis chart, the sample ALERT communications exchange illustrated in Figure 6-1 is selected as the typical scenario. This is a series of message exchanges between the CAM originator, a tanker named "Oil King" and a WWMCCS node, in this case the CINCEUR. The exchanges are either in TTY or voice conversational mode. Message A is an initial ALERT message originated by the tanker reporting the ship's name, the

ORIGINATOR (TANKER OIL KING)

WWMCCS NODE (CINCEUR)

A

DD ALERT.
FROM TANKER OIL KING 20° N LAT
60° E LONG, BELOW GULF OF OMAN IN
INTERNATIONAL WATERS. SUBMARINE SURFACED
ALONGSIDE 1400Z THIS DATE. THE FOLLOWING
INSTRUCTIONS RECEIVED: FOLLOW ME TO PORT.
NO FURTHER RESPONSE TO OUR COMMUNICATIONS.
EOM

B

DD ALERT
ACKNOWLEDGE SUBMARINE ALONGSIDE.
TRANSMIT YOUR POINT OF DEPARTURE AND
DESTINATION. IS NATIONALITY OF
SUBMARINE KNOWN? WHAT ARE YOUR INTENTIONS?
EOM

C

DD ALERT.
SUBMARINE NATIONALITY UNKNOWN. WILL
FOLLOW IN VIEW OF TORPEDO THREAT.
SUBMARINE REFUSES FURTHER COMMUNICATION
AND IS PROCEEDING ON COURSE 015 AT 6 KNOTS.
EX-NAVY CREW MEMBER STATES SUBMARINE
RESEMBLES SKIPJACK SSN 585. OIL KING
DEPARTED ABADAN ENROUTE YOKOHAMA. EOM

D

DD ALERT.
SUBMARINE MAY BE PAKISTAN *HANGOR CLASS* OR
USSR VICTOR CLASS ATTACK SUBMARINE.
DESTROYER SPRUANCE DD 963 ENROUTE TO INTERCEPT
YOUR PREDICTED COURSE. EXPECT INTERCEPT
2402007 JUL ______ IF PRESENT COURSE/SPEED
MAINTAINED. CONTACT SPRUANCE ON 5.815 MHZ.
MAINTAIN DD ALERT COMMUNICATION UNTIL FURTHER
NOTICE. EOM

Figure 6-1. SAMPLE ALERT COMMUNICATIONS EXCHANGE, TTY OR VOICE CONVERSATIONAL MODE location, the nature of the crisis and the time. Next in the scenario is Message B, which is sent from a WWMCCS node to the tanker. This message first acknowledges the receipt of the ALERT message and then asks a series of questions. In answering the questions contained in Message B, the tanker Oil King would send the response and amplification in Message C as shown in Figure 6-1. Next, Message D is sent to the tanker to provide further instructions in a command/control format. Message A, the CAM, is flagged DD ALERT in accordance with our understanding that the WCAN I AUTODIN software modifications will provide for its automatic addressing of the DD ALERT to theater/area command centers and other facilities which constitute the lateral and vertical elements in the chain of command.

By observing the type of information exchanged between the ALERT message originator and a WWMCCS node in the ALERT message exchange in Figure 6-1, one can generalize the ALERT messages into several categories. The first is an initial ALERT message which reports that an incident occurred at or near an observer with access to a subscriber communication system. The second is an ALERT (command/control) acknowledgment message from the WWMCCS node to the originator[1]. This message may include a query message from the WWMCCS node to the originator. The third is the response message to the aforementioned query message. The last category is a command/control message from the WWMCCS node to the originator.

---

1 - As for ALERT acknowledgment messages, there are two different acknowledgment messages in the WCAN II. The first is the acknowledgment message of a DD ALERT message by the WWMCCS node, and the second is the acknowledgment message by two operators between communication nodes. The first is designated in this report as the ALERT Command/Control acknowledgment message and the second as the ALERT service acknowledgment message.

In the following section, a transaction analysis of the sample ALERT communication exchange just described will be presented in terms of the communications node, the media, the protocol, and the format.

6.2 TRANSACTION ANALYSIS OF A SAMPLE ALERT COMMUNICATION EXCHANGE

In the sample scenario presented in Figure 6-2, it is assumed that an initial ALERT Message A is transmitted by the "Oil King" and received by a tributary AUTODIN message center (AMC); e.g., the NAVCOMSTA Diego Garcia. The communications media is HF/Voice in this sample case. The format used is a narrative voice message preceded by the sentinel "DD ALERT". When the message is received by the AMC, the operator manually enters the contents of Message A to the DCS/AUTODIN TTY circuit in the format of a narrative text message, again preceded by the sentinel "DD ALERT". At the AUTODIN Switching Center (ASC); e.g., Naples/Lago Di Patria, the content of the Message A is automatically translated into the JANAP 128 format and is distributed to WWMCCS nodes in accordance with the prescribed routing indicator in the ALERT message routing indicator list. In this particular scenario, it is assumed that Message A is sent to CINCEUR, as the primary WWMCCS node of that theater, and is distributed to CINCUSNAVEUR, CINCLANT, the CINCPAC and others. This initial ALERT message is handled at the IMMEDIATE precedence level in AUTODIN.

In this example, it is assumed that the tanker Oil King contacted U.S. installations with AUTODIN accessibility in the theaters such as the CONUS or LANT because as discussed earlier, the behavior of HF communications is not always predictable in terms of geographical coverage. In such cases, follow-on ALERT messages to perform the command/control functions are handed over to the primary WWMCCS node as much as is practicable depending on communication continuity.

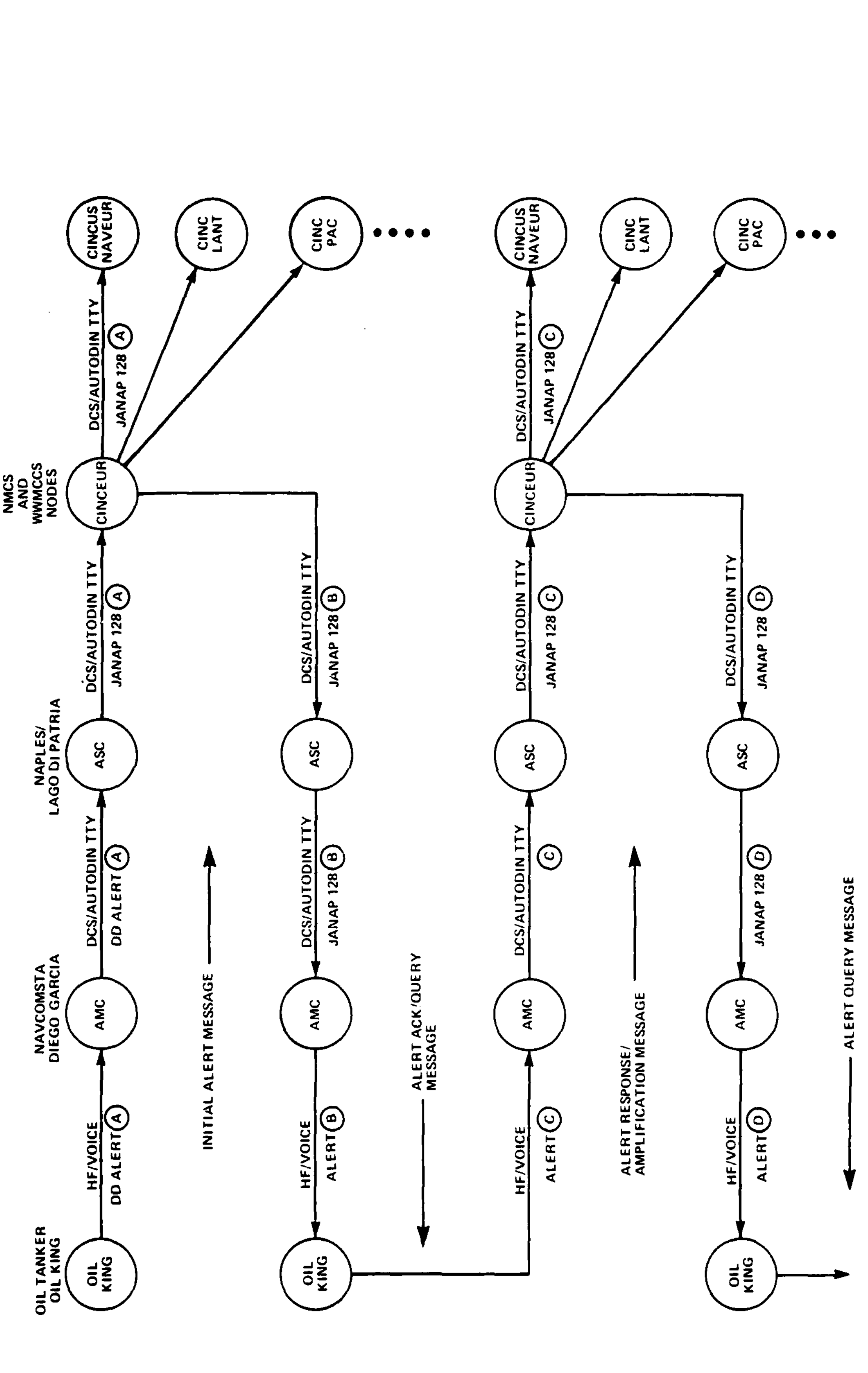


Figure 6-2. ALERT TRANSACTION ANALYSIS

Referring to Figure 6-2, in response to the initial DD ALERT message, an ALERT command/control acknowledgment and query message (B) would be generated and sent from the WWMCCS node (CINCEUR) to the originator. As shown in Figure 6-2, Message B is sent from the WWMCCS node to the ASC and then on to the AMC via the DCS/AUTODIN TTY circuit in the JANAP 128 format. From the AMC to the originator, Message B in this scenario is sent over HF/VOICE. The ALERT command/control acknowledgment and query message is as handled at the IMMEDIATE precedence level in the AUTODIN.

The transmission media in the AUTODIN network are mostly TTY circuits and the mode is narrative text messages in the JANAP 128 format. But as discussed previously, the transmission media for subscriber communications may be either voice, TELEX, TTY, or Morse code and the transmission mode is in free text messages.

Upon receipt of the AMC Message B, an ALERT response/amplification message (C) is sent from the originator to the WWMCCS node in the same manner as explained in the initial ALERT message. Another query message (D) is handled in the same manner as that of the ALERT acknowledgment and query message (B).

6.3 WCAN II SUBSCRIBER COMMUNICATIONS SYSTEM OPERATING AND INTERFACE PROCEDURES

In this section, a brief functional description of the WCAN II communications flow is presented. Although the WCAN II is exclusively concerned with civilian, commercial, diplomatic, and allied communities, the AUTODIN message center and the AUTODIN switching center are included in the operating/interface procedures because various ALERT messages are interactive with the

DCS and the WWMCCS nodes, which are parts of the WCAN I and an integral treatment of both elements is necessary. Prior to presenting the WCAN II functional flow, the major elements of the WCAN II operation are described.

6.3.1 WCAN II Station Descriptions

Report Origination Station (ROS) - A person or platform from which an initial ALERT message is originated; e.g., a commercial aircraft, a commercial vessel, an off-shore petroleum platform, etc.

Relay/Switching Station (R/SS) - A station which relays the subscriber communications or which performs the circuit/message switching function for the subscriber communication system.

AUTODIN Message Center (AMC) - The AUTODIN message center is collectively designated as those military communication centers or automated message processing centers connected to the AUTODIN switching center directly or indirectly by electronic means[1]. The AMC is the location at which ALERT messages from subscriber communication systems enter the AUTODIN network.

AUTODIN Switching Center - The switch node in AUTODIN that performs the store and forward message switch functions (and circuit switching in the leased ASCs) and includes the patch and test facility, power generation and distribution, timing source and equipment, and other peripheral or support functions.

6.3.2 End Instrument Modes

Two end instrument modes are to be used in the WCAN II subscriber communication system: the first is the voice mode, which is primarily unencrypted,

1 - More precise descriptions of the WCAN II message entry points are proposed in the "Operations/Requirements" section (Section 4) of the MEP by DCA Code 500, dated 27 May 1980.

commercial cable telephone or radio telephone systems which are available to the message originator; and the second is the record mode, which includes teletypewriter message systems, also available to the originator[1].

6.3.3 WCAN II Functional Flow Diagram

Figure 6-3 is a functional flow diagram of the WCAN II and is a generalized version of the transaction analysis chart depicted earlier in Figure 6-2. The communication media and the protocol/format used between any two nodes/stations are described. In this subsection, specific operating and interface functions of each of the four WCAN II node/stations (e.g., report originating station, AUTODIN message center) and associated message formats are delineated. Eight different message formats are described in support of the functional flow diagram presented in Figure 6-3. Figures 6-4 through 6-11 serve to describe those eight messages.

6.3.3.1 Report Originating Station (ROS)

Functions of a report origination station are:

a. To send an initial DD ALERT message via a voice circuit in format No. 1, or via a teletypewriter circuit in Format No. 7 to a relay/switching station.

b. To send an initial DD ALERT message via a voice circuit in Format No. 1 or via a teletypewriter circuit in Format No. 7, to an AMC directly.

c. To respond to a follow-on query message and to send additional ALERT amplification messages in Format No. 1 (via a voice circuit)

1 - In a certain commercial subscriber communication system, there is another end instrument mode, called the data mode, which includes coded message transmission from its IF/F equipment to a ground control center. This data mode is not considered in the WCAN II as a means of CAM transmission.

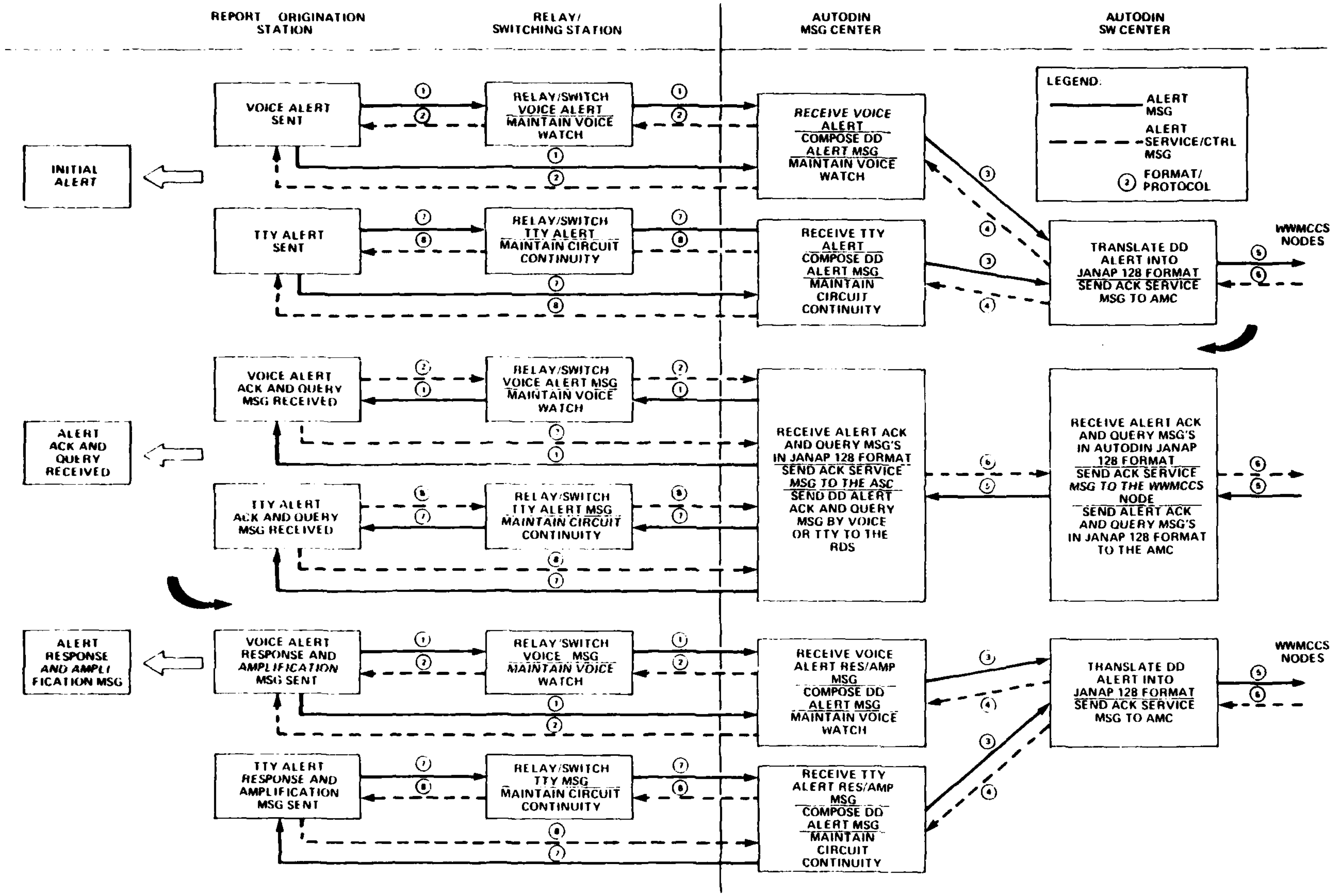


Figure 6-3. WCAN II FUNCTIONAL FLOW DIAGRAM

#	MESSAGE TYPE
1	VOICE INITIAL DD ALERT, ALERT QUERY, & ALERT RESPONSE/ AMPLIFICATION MESSAGES EXCHANGED BETWEEN A ROS AND AN *AMC OR A SUBSCRIBER COMM SYSTEM* R/SS.

THIS IS A "DD ALERT" FROM __________ TO __________	TEXT
FLAGWORDS	NARRATIVE MESSAGE

Figure 6-4. MESSAGE FORMAT NO. 1

#	MESSAGE TYPE
2	VOICE ALERT ACKNOWLEDGE SERVICE MESSAGE EXCHANGED BETWEEN OPERATORS OF A ROS AND AN AMC OR A SUBSCRIBER COMM R/SS ACKNOWLEDGING THE RECEIPT OF A DD ALERT MESSAGE. (NOTE 1)

THIS IS AN ALERT/ ACKNOWLEDGEMENT FROM ________TO____________	TEXT
FLAGWORDS	o DISPOSITION OF THE RECEIVED ALERT MESSAGE o INFORMATION REGARDING FREQ AND TIME TO MEET

(NOTE 1) THE ACKNOWLEDGEMENT SERVICE MESSAGE IS USED TO COORDINATE COMMUNICATION LINKS BETWEEN OPERATORS AND IS DIFFERENT TO ACKNOWLEDGE/ QUERY MESSAGES USED FOR COMMAND AND CONTROL.

Figure 6-5. MESSAGE FORMAT NO. 2

#	MESSAGE TYPE
3	DD ALERT MESSAGE SENT FROM AN AMC TO AN ASC IN TELETYPEWRITER MODE

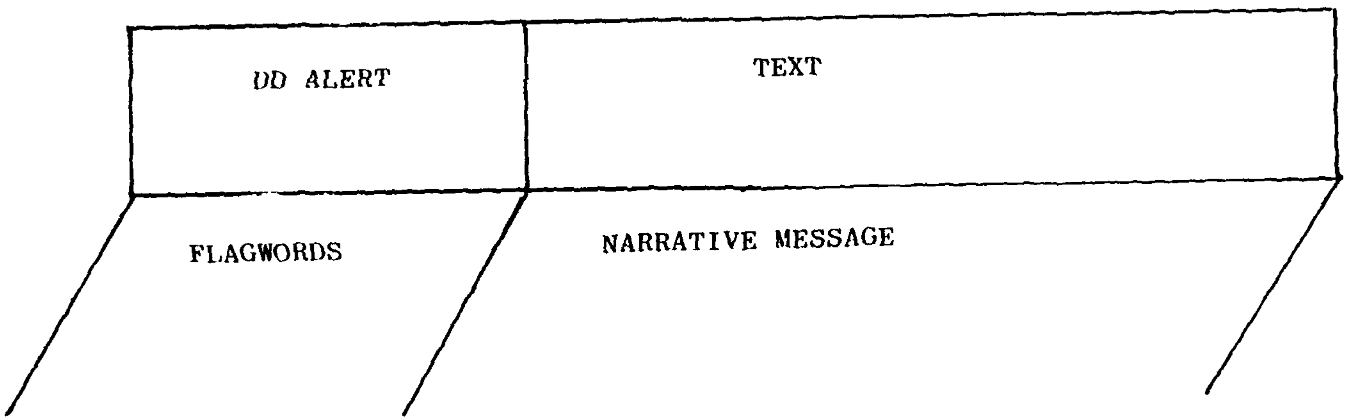


Figure 6-6. MESSAGE FORMAT NO. 3

#	MESSAGE TYPE
4	TELETYPEWRITER ACKNOWLEDGEMENT SERVICE MESSAGE BETWEEN OPERATORS OF TWO AUTODIN CENTERS ACKNOWLEDGING THE RECEIPT OF AN ALERT MESSAGE

ALERT/ACKNOWLEDGEMENT	TEXT
FLAGWORDS	o DISPOSTION OF THE RECEIVED ALERT MESSAGE o INFORMATION REGARDING THE CHANNEL AND TIME TO MEET

Figure 6-7. MESSAGE FORMAT NO. 4

#	MESSAGE TYPE
5	AUTODIN MESSAGE SENT FROM AN ASC TO VARIOUS WWMCCS NODES AND OTHER AUTODIN SUBSCRIBER STATIONS AS PREDETERMINED IN AMRIL OF THE SENDING ASC IN A SPECIFIC JANAP 128 FORMAT

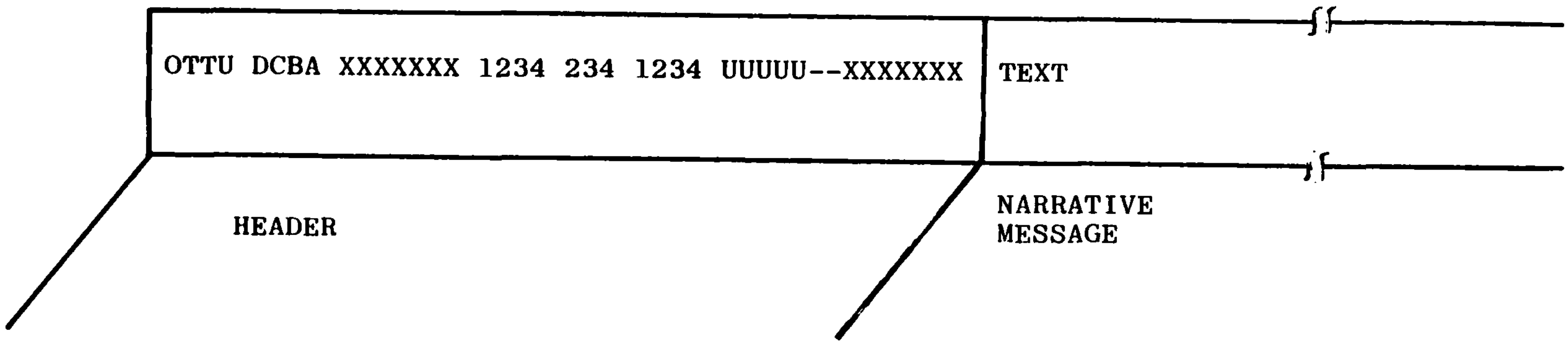


Figure 6-8. MESSAGE FORMAT NO. 5

#	MESSAGE TYPE
6	AUTODIN ACKNOWLEDGE SERVICE MESSAGE AS DEFINED IN JANAP 128

VZCACBAA233	OTTU DCBA XXXXXXX 1234 234 1234 UUUUU--XXXXXXX	ZNRUUU	TEXT
TRANSMISSION INDICATOR	HEADER	CLASSI-FICATION	

Figure 6-9. MESSAGE FORMAT NO. 6

#	MESSAGE TYPE
7	TELETYPEWRITER INITIAL ALERT OR ALERT QUERY MESSAGES EXCHANGED BETWEEN A ROS AND AN AMC OR A SUBSCRIBER COMM R/SS

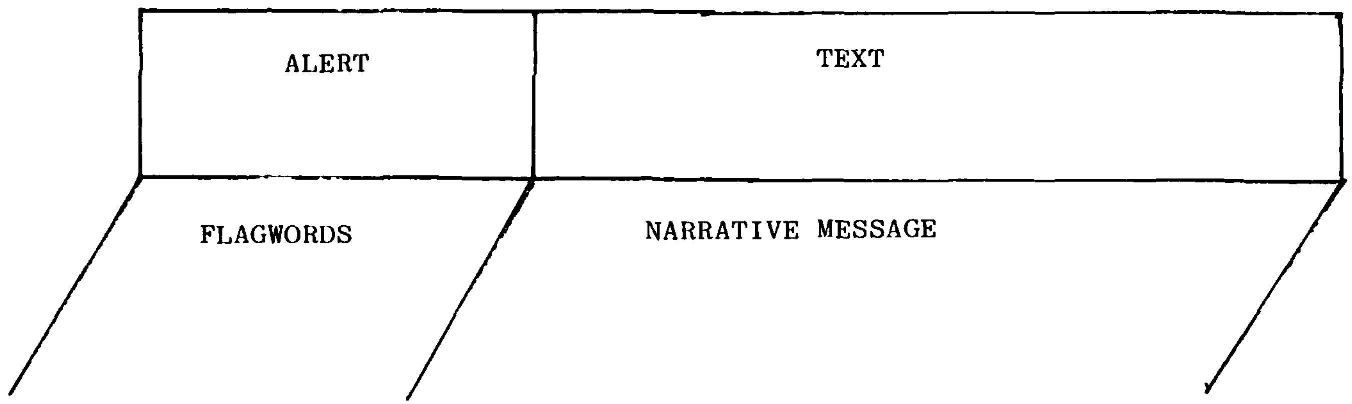


Figure 6-10. MESSAGE FORMAT NO. 7

#	MESSAGE TYPE
8	TELETYPEWRITER ACKNOWLEDGEMENT SERVICE MESSAGE BETWEEN OPERATORS OF A ROS AND AN AMC OR A SUBSCRIBER COMM R/SS, ACKNOWLEDGING THE RECEIPT OF AN ALERT MESSAGE

ALERT/ACKNOWLEDGE-MENT	TEXT
FLAGWORDS	(1) DISPOSITION OF THE RECEIVED DD ALERT MESSAGE (2) INFORMATION REGARDING THE TRANSMISSION MEDIA/THE CHANNEL NUMBER

Figure 6-11. MESSAGE FORMAT NO. 8

or in Format No. 7 (via a teletypewriter circuit) either to a relay/switching station or to an AMC.

d. To maintain voice or teletypewriter circuit watch for communication continuity (formats No. 2 and No. 8) by means of an acknowledgment service message between the two operators for the purpose of acknowledging positively the message receipt. If no acknowledgment service message is received within a prescribed time; e.g., seven (7) minutes from the sending time, either the initial DD ALERT or ALERT response/amplification message is to be retransmitted. (As discussed in Section 6.1, there is another acknowledgment message called ALERT command/control acknowledgment message which must be distinguished from the acknowledgment service message.)

6.3.3.2 Relay/Switching Station (R/SS)

Functions of a relay/switching station are:

a. To copy an initial ALERT message whenever received from a subscriber communications system and to relay it to the AMC without delay; the voice mode is to use Format No. 1 and the teletypewriter mode is to use Format No. 7.

b. To maintain voice or teletypewriter circuit watch for communication continuity; an acknowledgment service message is used between two operators in Formats No. 2 and No. 8 for the purpose of acknowledging positively the receipt of a query message.

c. To copy follow-on acknowledgment and query messages sent by the AMC and relay them to the originator.

6.3.3.3 AUTODIN Message Center

Functions of an AUTODIN message center are:

a. To copy initial DD ALERT or ALERT response/amplification messages whenever received from a subscriber communication system and to enter them into the AUTODIN in Format No. 3 without delay.

b. To send an acknowledgment service message to the operator of the ROS or R/SS, acknowledging positively the receipt of an ALERT message as described in Format No. 2 or No. 8.

c. To copy acknowledgment and query messages from the ASC and to enter these into the previously established subscriber communication system in Format No. 1 or No. 7; the subscriber communication system is either in the voice or teletypewriter mode.

d. To send an acknowledgment service message to the ASC operator acknowledging the receipt of an ALERT query message as described in (c) in Format No. 6.

6.3.3.4 AUTODIN Switching Center

Functions of an AUTODIN switching center are:

a. To receive initial DD ALERT or ALERT response/amplification messages (in Format No. 3) from the AMC and to automatically re-format these in Format No. 5; to distribute these to the addressees in accordance with the pre-determined ALERT message routing indicator list.

b. To send an acknowledgment service message message in Format No. 4 to the operator of the AMC acknowledging positively the receipt of an ALERT message as described in (a).

c. To copy acknowledgment and query messages from WWMCCS nodes and to send these in Format No. 5 to the AMC.

6.4 ADDITIONAL PROCEDURE FACTORS TO BE CONSIDERED FOR ACKNOWLEDGMENTS AND QUERY COMMUNICATIONS

The CAM from the originator is to be flagged with the message sentinel DD ALERT. In the voice mode, the originator will be in direct contact with the receiving operator and receive an acknowledgment Format No. 2 of the CAM upon completion of the communication. The acknowledgment service message probably containing a query (Format No. 5) from the ASC will be transmitted to the originator after some time has elapsed. Neglecting the nature of the crisis (e.g., observer in immediate danger) the elapsed time period between the CAM and acknowledgment/query may not be crucial for vessels and offshore fixed oil rigs, however, aircraft could present several problems. Aircraft in international service are, by international agreement, required to fly at Mach 0.82 (about 700 mph dependent upon atmospheric conditions). At that speed, the aircraft could:

- Fly beyond the range of the frequency used in the original contact
- Fly into an area in which the original frequency used has faded requiring a shift to another frequency
- Have landed at its destination where government restrictions prohibit the use of inflight frequencies
- Have landed at its destination and the flight crew left the aircraft

Consideration of these and other similar factors, especially as they relate to aircraft, will be required. Since factors of this type are related directly to the time that has elapsed between the receipt of the CAM at the AMC and the receipt of the acknowledgment/query back to the AMC for transmission to the originator, it is under the control of the AUTODIN. Additional procedures beyond those developed herein may be required.

CHAPTER SEVEN

SUBSCRIBER COMMUNICATIONS SYSTEM ASSESSMENT CONCLUSIONS

With the exception of the SITA system, all of the subscriber communications systems assessed in this report appear to satisfactorily meet the WCAN II requirements and therefore require continued consideration as WCAN II communications elements. It should be recognized that the major WCAN performance goal of rapid message delivery time will be met in varying degrees by these subscriber systems. Some of the systems, such as MARISAT, will afford rapid communications, while some systems, such as commercial marine radio, will (due to transmission vagaries and/or political considerations) not be as timely.

Of key importance is that the subscriber systems have the potential to provide crisis alerting coverage over major portions of the world and in reality, are the only practical means of interfacing commercial airlines, shipping, and oil platforms to the WWMCCS.

As illustrated in Chapter Five, the information paths of the crisis message to an AMC appear reasonable. Given a set of procedures as outlined in Chapter Six, it appears practical to interface the non-DoD elements under consideration to the WWMCCS. Therefore, the various subscriber systems examined in the Task 3 report (with the exception of SITA) will be analyzed fully in the context of Task 4 - Estimation of Interface Development Resources, Task 5 - Recommendation of Preferred Interface Procedures and Task 6 - Development of WWMCCS Implementation Concept.

APPENDIX A

LIST OF ABBREVIATIONS AND ACRONYMS

AIG	Address indicator group
AFTN	Airline Fixed Telecommunications Network
ALERT	The Prosign for the AUTODIN, used for crisis alerting
ANC	AUTODIN message center
AMRIL	AUTODIN message routing indicator list
ASC	AUTODIN switching center
ASCII	American Standard Code for Information Interchange
ARINC	Aeronautical Radio Inc.
AUTODIN	Automatic Digital Network
BT	A "Break" in the AUTODIN line format to separate a line from the next line
CAM	Crisis Alert Message
CCTC	Command and Control Technical Center
CIC	Communication Indicator Code
COMSEC	Communication Security
CONUS	Continental US
CR	Carriage return
CRITIC	A sentinel of the AUTODIN message; Critical intelligence communications
DCS	Defense Communication System
DD ALERT	A sentinel of the AUTODIN message
DTGZ	Date-time group ZULU

EOM	End-of-Message
FAA	Federal Aviation Administration
FIGS	FIGURES: Upshift in TTY code
FL	AUTODIN format line
GCT	Greenwich Civil Time
GMT	Greenwich Mean Time
GENSER	General Service in the AUTODIN
HF	High frequency 3 - 30 MHz
IF/F	Identify friend or foe
JANAP 128	JCS document on AUTODIN operating procedures
LF	Line feed
LTRS	LETTERS: Downshift in TTY code
MARISAT	Maritime Satellite Organization
MEP	Management Engineering Plan
MF	Medium Frequency *300kHz-3 MHz*
NATO	North Atlantic Treaty Organization
NAVCOMSTA	Naval Communication Station
OSRI	Orgination Station Routing Indicator
OSSN	Origination Station Serial Number
Q/R	Query/Response
RI	Routing Indicator
ROS	Report orininating station
R/SS	Relay/ switching station
SITA	Societe Internationale de Telecommunications Aeronautiques
SSN	Station serial number
SSN	Sun Spot Number
TI	Transmission Indicator

TTY	Teletypewriter
USCG	United States Coast Guard
VHF	Very high frequency 30-300 MHz
WCAN	WWMCCS Crisis Alerting Network
WSEO	WWMCCS Systems Engineering Organization
ZNR	A Security Warning Operating Signal; Unclassified
ZNY	A Security Warning Operating Signal; Classified
ZULU	Time Zone "Z", the same as GMT

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