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NORTH ATLANTIC MILITARY COMMITTEE

COMITE MILITAIRE DE L'ATLANTIQUE NORD

Standing Group Groupe Permanent

SGM-229-62

16 April 1962

MEMORANDUM FOR: Ministry of Defense, Brussels, Belgium
Ministry of Defense, Ottawa, Canada
Ministry of Defense, Copenhagen, Denmark
Ministry of Defense, Paris, France
Ministry of Defense, Bonn, Germany
Ministry of Defense, Athens, Greece
Ministry of Defense, Rome, Italy
Ministry of Defense, Luxembourg, Luxembourg
Ministry of Defense, The Hague, Netherlands
Ministry of Defense, Oslo, Norway
Ministry of Defense, Lisbon, Portugal
Ministry of Defense, Ankara, Turkey
Ministry of Defense, London, England
Secretary of Defense, Washington, D. C.
Supreme Allied Commander Europe
Supreme Allied Commander Atlantic
Channel Committee
Military Agency for Standardization
European Military Communications Coordinating Committee
European Long Lines Agency
Standing Group Representative

SUBJECT: Standards for NATO Data Links: Link 4

References: a. SGM-195-61 of 17 Apr 61
b. SGM-378-61 of 20 Jul 61

1. Reference a states a policy for simplifying and accelerating the procedure for the preparation of NATO Data Link Standards.

2. All nations have now approved the NATO data link standards for Link 4 (reference b). National comments received are reproduced at Enclosure 2.

3. A few minor changes proposed by ELDATRAWP have been included in reference b, and Enclosure 1 hereto is the final draft of standards for NATO Data Link 4.

2 ENCLOSURES
1. Standards for NATO Data Links: Link 4
2. Comments on Link 4

DISTRIBUTION: A B1,4,8 D E1-3, 5 F G H1-4,7-11 L

4. These standards are now forwarded to the Military Agency for Standardization for further promulgation as a STANAG. However, in accordance with reference a, these standards should be used by Nations and Commands as the basis for planning without awaiting the STANAG itself.

5. SGM-378-61 (reference b) is hereby superseded.

FOR THE STANDING GROUP:

JHE/md

J. H. EAMAN
Colonel, Canadian Army
Deputy Secretary

ENCLOSURE 1

LINK 4

GROUND/AIR DATA LINK

I. GENERAL INFORMATION

Objective

1. General. The objective of Link 4 is to provide a reliable, high capacity, automatic, line-of-sight data link for aircraft and airborne weapons ("aircraft" as used throughout this agreement encompasses both manned or unmanned aircraft and their ancillary systems, such as weapons). No provision is made in these Standards for the introduction of cryptography.

2. Subdivision In some cases, the complete link may consist of a ground/air part (Link 4A) and a ground/ground part (Link 4B). This paper is primarily concerned with the ground/air part (Link 4A). A description of the ground-to ground part (Link 4B) is contained in Appendix E.

3. Specific. It is to provide a link two ways if desired, as follows:

a. Between surface, or airborne, control stations and aircraft for:

(1) Vectoring a number of aircraft and/or weapons by one control station.

(2) Traffic control, wave off and transition control (WOTC), and landing, including automatic landing, of a number of aircraft by one control station.

(3) Status reporting and passing of other air derived information from a number of aircraft.

5 APPENDICES
A- The Message Structure
B- Assignment of Message Numbers to Operational Functions
C- Message Specifications
D- Link 4 Control Message Type 3
E- Link 4B

b. Between surface control stations and airborne control stations, or between airborne control stations for:

(1) Target data exchange.

(2) Status reporting.

Proposed Service Employment

4. The airborne equipment will be installed in military aircraft, weapon delivery systems and airborne early warning and control aircraft (AEW&C), as required. The surface equipment will be installed where needed to carry out the objectives stated above.

5. The airborne terminal equipment will be capable, by means of suitable conversion devices, of coupling to any of the following as required:

a. Automatic Pilot.

b. Fire Control System.

c. Airborne Computing Devices.

d. Navigational Instruments.

e. Other aircraft equipment where desired.

6. The surface terminal equipment will be capable, by means of suitable conversion devices, of coupling to surface computing and data processing devices.

II OPERATIONAL CHARACTERISTICS

General

7. It is required that the data link will in every case be backed up by at least one voice channel which is available either simultaneously or alternatively with the data link. In the latter case, change-over from data to voice will be announced to the pilot via a special code within a data link message. Handover from one control area to another area, including

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instruction to the pilot to change data link channel frequency will be performed by voice until such time as automatic handover procedure is agreed. During return to base, handover to a terminal area for traffic control and landing may also be performed by voice. Other voice traffic such as change of address (see. Para. 11) kill and damage reporting, etc., will also occupy the voice channel.

Address Assignment

8. In an area using a common frequency, specific data may be sent to a particular aircraft by assigning discrete addresses to individual aircraft. Two addresses are reserved for the universal test message and the dummy message leaving 8,190 possible discrete addresses which are available by use of the thirteen address bits (14-26).

9. Though the duplication of address assignments may be practicable with sufficient geographical separation, duplication of addresses with reliance on frequency separation should be avoided in the same operational area in order not to restrict flexibility from the point of view of operational and traffic control.

10. Block assignment of addresses will be dependent on the size, nature and disposition of forces. It is not necessary to establish assignment plans immediately in order to let equipment development and procurement proceed and, therefore, such planning should be postponed until theater commanders have had the opportunity to study the matter in detail and make their recommendations.

11. It is mandatory that all control environments be able to transmit messages having any one of the 8,192 available addresses. It is mandatory that all manned aircraft be able to select any one of the 8,192 while on the ground or ship.

12. It is essential that all future message number, message code and message standard assignments be the subject of NATO agreement.

III. TRANSMISSION CHARACTERISTICS

Frequency Coverage

13. This data link shall be capable of operating in the 225.0 to 399.9 MC/S band. When used with suitable R.F. components the system will be capable of operating on any higher or lower available military frequency where technically feasible. Channel assignment in the 225.0 to 399.9 MC/S frequency band shall be on the basis of 100 KC increments starting at 225.0 MC/S. Not less than 99% of radiated power shall be confined to the band of ± 50 KC of the frequency of the assigned channel. Control and associated reply messages shall be transmitted on the same channel.

Emission Designation.

14. Type of Modulation. Frequency Shift Keying (FSK) with a nominal frequency shift of plus or minus 20 KC/S shall be used. In the binary notation minus 20 KC/S is to represent '0' (space) and plus 20 KC/S to represent '1' (mark).

15. Continuity of Transmission. Contiguous marks or spaces will form continuous transmissions; the center frequency will not be radiated.

16. Type of Transmission. Transmission will be of the time division multiplex, discrete address type. Individual messages will be transmitted on a sequential time division basis and will be directed to designated aircraft by discrete addresses. Messages originated and sent by a control station will be known as "control messages", while messages, replying to control messages will be known as "reply messages", The use of the "reply message" is optional.

Specific Technical Characteristics.

17. Synchronisation. The system will be operated on a start-stop non synchronous basis.

18. Digit Length. The duration of each binary digit (time slot) will be 200 microseconds plus or minus 0.1%. The transfer from mark to space and vice versa will be accomplished in not more than 80 microseconds.

19. Message Length. The control message frame length will be 70 time slots long, i.e. 14 milliseconds plus or minus 0.1%. The reply message frame length will be 56 time slots long, i.e. 11.2 milliseconds plus or minus 0.1%.

20. Transmission Sequence.

a. Two-way transmission systems. Each control message frame (14 milliseconds plus or minus 0.1%) is to be followed by a control transmitter off and reply interval of 18 milliseconds plus or minus 0.1%. These times are measured at the originating control computer. There will be an interval of 34 milliseconds plus or minus 0.1% between the end of the control message as received by the airborne terminal and the start of the reply message. This time is measured at the airborne antenna, and provides 2 milliseconds between the start of the reply message and the end of the preceding control message to allow for the differential transmission delays which can occur in multi-site systems.

b. One-way transmission system. Each control message (14 milliseconds plus or minus 0.1%) may be followed by another control message, test message, an anti-spoof signal, or an interval necessary for switching directional antennas. It is recommended that message starts be spaced by multiples of 16 milliseconds ± 0.1% to provide at least 2 milliseconds tolerance for differential transmission delays in multi-site

systems.

c. In all cases, control messages addressed to the same aircraft will not be originated more frequently than once every 96 milliseconds, Times are measured at the originating control computer.

21. Stability

a. The mark and space frequencies of the transmitting equipment are :

$f_m = f_{center} + 20 \pm 1$ KC/S

$f_s = f_{center} - 20 \pm 1$ KC/S

where f_{center} = frequency of assigned channel ± 5 KC/S. in the case of ground transmitters, ± 7.5 KC/S in the case of airborne transmitters. It is desirable to reduce both these tolerances to ± 2.5 KC/S.

b. Phase continuity on shifting frequency will be maintained.

Special Features

22. Two-way control station equipment shall be capable of operating with aircraft equipped to operate on a one-way basis as well as aircraft equipped to operate on a two-way basis. One-way control station equipment shall be capable of operating one-way with aircraft equipped to operate on a two-way basis. This will be accomplished by a "cancel reply" bit in the appropriate control messages being transmitted to the aircraft with the two-way capability, or by a pilot-operated switch making the airborne transmitter inoperative.

23. The data link transmission and display system shall be as automatic as possible. The latest accepted control information shall be continuously displayed or stored in the aircraft until revised or cancelled. Each airborne receiver shall be addressed at least once every 30 seconds, to give the pilot an indication whether he is under control. A simple timing device

can warn the pilot when more than 30 sec. has elapsed since the last message was received.

24. The ground equipment must be capable of generating either fixed or dynamic test massages for inflight or ground checks. The Universal Test Address will be 000000001111l and is not available for assignment to an individual aircraft. The use of test messages must be explicit in the operational doctrine.

25. It is highly desirable in any mode of operation (two-way or one-way) that there be no unoccupied message frames in order to minimize the possibility of spoofing by low level signals. A dummy message CO may be used to fill in gaps in transmission.

IV. MESSAGE STANDARDS

Message Structure

26. Control Message. A control message consists of 70 time slots to cover synchronizing pattern, discrete address, message origin, label with parity, information with two parities and guard space as follows:

a. Synchronization. Utilizes thirteen time slots. The first eight time slots (1-8) will each comprise first a 100 microsecond space and then a 100 microsecond mark with o.1% tolerances. The next four time slots (9-12) will be standard 200 microsecond spaces. The last time-slot (13) of the group is the "start bit" and will be a standard 200 microsecond mark.

b. Address. Utilizes thirteen time slots (14-26) for discrete addresses 0-8191. A receiver will only process messages containing its assigned address, or the universal test address, depending upon the setting of a pilot-operated selector switch. To simplify the address for voice and written communication a five-figure semi-octal shall be used as follows:

DIGITS	14	15,16,17	18,19,20	21,22,23	24,25,26
	2 values	8 values			
	0	000 = 0			
	1	001 = 1			
		010 = 2	as in	as in	as in
		011 = 3	second	second	second
		100 = 4	column	column	column
		101 = 5			
		110 = 6			
		111 = 7			

c. Message Origin. Utilizes one time slot (27) to indicate origin of message. A space (o) is transmitted to indicate the control station is the originator.

d. Control Message Number and Label. The group of digits occupying the five time slots (28-32) which define control message numbers from 0 to 31 is called the label. The label code will correspond to the decimal message number. The label will be used to define the type and coding of information, e.g. close control, modified close control, and traffic control, to be transmitted in that message.

e. First Parity. Utilizes one time slot (33). The first parity bit shall be a mark or space so that the sum of marks contained in time slots 28 through 33 is odd; if correct parity is not received the entire message is rejected.

f. Information. Utilizes thirty-four time slots (34-49, 51-66 and 68-69) to transmit the information assigned to each control message number.

g. Second Parity. Utilizes one time slot (50). The second parity bit shall be a mark or space so that the sum of marks contained in time slots 34 through 50 is even. If correct parity is not received, the whole message is rejected.

h. Third Parity. Utilizes one time slot (67). The third parity bit shall be a mark or space so that the sum of marks contained in time slot 51 through 67 is

even. If correct parity is not received, the whole message is rejected.

i. Guard Space. The final time slot in every message will be used to provide a guard space. This interval may be used to switch the transmitter off.

27. Reply Message. A reply message consists of 56 time slots used for synchronization, reply message number, information, message origin, program and guard space as follows:

a. Synchronization. Same as in paragraph 26a.

b. Reply Message Number and Label. The group of digits occupying the three time slots (14-16) which define reply message numbers R0 through R7 is called the label. The label will be used to define the type and coding of information to be transmitted to the originator of the associated control message.

c. Information. Utilizes thirty-seven time slots (17-26 , 28-40 and 42-55) to transmit the information assigned to each reply message number.

d. Message Origin. Utilizes one time slot (27) to indicate origin of message. A mark is transmitted to indicate the replying aircraft is the originator.

e. Program. Utilizes one time slot (41) which is always a mark. It may be used to simplify programming of the reply message.

f. Guard Space. Same as in paragraph 26i.

28. The message structure details are tabulated in Appendix "A".

Message Number Assignments.

29. Control and reply message numbers assigned to the various operational functions and the environments in which they will be used are detailed in Appendix "B".

30. The meanings to be attached to the information bits of

the control messages Nos. C.2, C.3, C.4, C.5, C.6, C.9, C.10, C.11, C.18, C.19, C.20, C21 and C.22 and reply messages R.0 and R.1 are given in Appendix "C".

31. Other control and reply message standards to which numbers are assigned at Appendix "B" to this enclosure will be promulgated later.

Units, Conventions and Definitions.

32. Coding

a. For conveying quantitative information, straight binary coding will be used. The least significant digit will be transmitted latest in time. The table showing the contents of each message will also define the coding and order of transmission for non-numerical data.

b. Negative numbers will be transmitted as a modified two's complement, and are indicated by "0" in the first digit to be transmitted. The quantity "zero" is considered to be positive.

Example: Consider a system with position quoted in units of one data mile to four binary places, the fifth indicating sign. A point 9 data miles West and 5 data miles North will be treated as follows:

Plus 9 data miles (i.e. 9 data miles East) would be 11001
Minus 9 data miles (i.e. 9 data miles West) would be 00111
Plus 5 data miles (i.e. 5 data miles North) would be 10101

Thus, the final encoded coordinates are

00111 10101

In such a system 0 data miles are encoded as 10000.

c. Continuous quantities will be encoded to the nearest discrete value provided by the code, a received code must be interpreted to represent a value within ± 1/2 quantum of the value presented to the transmitting encoder.

d. Unless otherwise specified, increments (size of quanta) will be binary fractions or multiples of the basic unit defined for each quantity, unless otherwise specified for individual messages. All angular quanta will be binary fractions of a circle.

e. Where applicable, the extreme limits of the code (positive limit is all ones, negative limit is zeros) will indicate that the encoded value is at or beyond the limits defined for the quantity.

f. When message components have been specified, the effective value of each digit is defined for numerical data. Thus, if the digital number to be transmitted carries fewer bits than the specified message component, "zeros" or "ones" must be inserted appropriately at the beginning and/or end to make it correspond to the standard form.

33. Azimuth. All azimuthal quantities are positive, increasing clockwise and are referenced to true north at the coordinate origin. Unless otherwise stated in detailed message specifications, the origin of coordinates is chosen for each message to coincide with the location of the addressed interceptor. Specifically, the quantities requiring azimuth references are:

a. Distance and Velocity. The X and Y components of distance and velocity expressed in a Cartesian coordinate system in which the positive Y axis and the positive X axis correspond respectively to true north and the true east at the coordinate origin.

b. Command Heading. The present heading to fly at the aircraft's position.

c. Attack Heading. Heading to fly after time to go to offset point equals zero.

d. Target Bearing. Bearing of target position from aircraft position.

Note 1. The convention of paragraph 32e does not apply to 33 b, c and d.

Note 2. Any deviation from these conventions must be included as part of the interceptor parameters.

34. Distance. Unless otherwise specified, distance, or range, is measured along the straight line through the two points. This is commonly called "slant range" when an altitude difference exists. The 6,000 foot mile (1,829 m.) is the standard unit of distance for NATO Link 4 and will be known as the "data mile".

35. Time. The standard unit of time is the second.

a. Time to go. Time to fly from the vehicle's present position to the offset point at which the command heading becomes attack heading.

36. Velocity and Speed. The standard units are the data mile per second and Mach number, where the basic unit of the latter is 0.1M. Target velocity is normally expressed in data miles per second as x and y components, positive eastward and northward, negative westward and southward. Command speed may be expressed as desired indicated air speed in data miles per second or Mach number, or as a command for a discrete setting of power in the aircraft propulsion system. Meanings and codings for discrete power commands must be specified in the individual messages in which they appear.

37. Altitude. Altitude is measured radially outward from the earth as a positive quantity above mean sea level (MSL). The basic units are 100 feet and 1000 feet.

a. Command Altitude. Altitude which must be assumed and/or maintained by the interceptor.

b. Target Altitude. Present altitude of assigned target.

c. Relative Target Altitude. Target altitude minus present interceptor altitude.

38. Target Elevation Angle is the angle between the plane

through the interceptor normal to the local * gravity vector and the line through the interceptor and its assigned target. If the target is above the plane, the sign of the elevation angle is positive.

39. Pitch is the angle between the longitudinal axis of the aircraft and the plane through the aircraft normal to the local * gravity vector. If the forward extension of the longitudinal axis lies above the plane, the sign of the pitch is positive.

a. Command Pitch is the pitch which the interceptor should assume and/or maintain.

b. Pitch Correction is the change required from present pitch. If the pitch correction, when executed, will result in a more positive (or less negative) pitch, the sign of the pitch correction is positive.

40. Bank Angle is the angle between the lateral axis of the aircraft and the plane through the aircraft normal to the local * gravity vector. If the port (leftward) extension of the lateral axis lies above the plane, the sign of the bank angle is positive.

a. Bank Angle Correction is the change required from present bank angle. If the bank angle correction, when executed, will result in a more positive (or less negative) bank angle, the sign of the bank angle correction is positive.

41. Discretes: Binary Codes which are assigned discrete meanings. They are normally specific commands, intentions, or situations. They are not necessarily required to be repeated. They are defined in Appendix "C".

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* Note: "Local" means "at the location of the interceptor"

APPENDIX A TO ENCLOSURE 1

THE MESSAGE STRUCTURE

Time Slot Number	Binary Digit Value 'one' or 'zero'	Function	Remarks
a. Control Messages			
1 - 8	See Remarks	Synchronization	In each of time-slots 1 to 8 the first 100 micro-seconds is a space and the second 100 micro-seconds is a mark
9 - 12	0	Synchronization	
13	1	Start bit	
14 - 26	According to Address number	Discrete Addresses from 0 to 8191	
27	0	Control station is originator	
28 - 32	Label according to control message number	Control Message No. C.0. to C.31	See Appendix "B"
33	'1' or '0'	1st parity	The 1st parity is to be counted over the label digits, and including the parity digit is to be odd.
34 - 49	According to information	Information	
50	'1' or '0'	2nd parity	The 2nd parity is to be counted over the previous 16 information digits and including the parity digit is to be even.
51 - 66	According to Information	Information	
67	'1' or '0'	3rd parity	The 3rd parity is to be counted over the previous 16 information digits and including the parity digit is to be even.

Time Slot Number	Binary Digit Value 'one' or 'zero'	Function	Remarks
68 - 69	According to Information	Information	
70	'1' or '0' according to computer program	Guard space	
b. Reply Message			
1 - 13	Same as a. above	Synchronization	
14 - 16	Label according to reply message number (see Appendix "B")	Reply message numbers (R.0 - R.7)	
17 - 26	According to Information	Information	
27	'1'	Replying station is originator	
28 - 40	According to Information	Information	
41	'1'	Program bit	
42 - 55	According to Information	Information	
56	'1' or '0'	Program bit/Guard space	

APPENDIX B TO ENCLOSURE 1

ASSIGNMENT OF MESSAGE NUMBERS TO OPERATIONAL FUNCTIONS

Message Number	Label	Message Type	Category (Note 1)
a. Control Messages			
C.0	00000	Dummy Mess. No. for idling transmissions when no intelligence is to be convyed	II
C.1	00001	Tentative Allocation to AEW&C Ship Link	III
C.2	00010	Vectoring A	I
C.3	00011	Vectoring B & Close Control 1	I
C.4	00100	Traffic Control	III
C.5	00101	Traffic Control B/Wave Off Transition Control	III
C.6	00110	Automatic Landing	IV
C.7	00111	Unassigned	
C.8	01000	Unassigned	
C.9	01001	Close Control 2	I
C.10	01010	Modified Close Control 1 (Note 2)	III
C.11	01011	Modified Close Control 2 (Note 2)	III
C.12	01100	Missile Control 3	IV

Message Number	Label	Message Type	Category (Note 1)
C.13	01101	Missile Control 4	IV
C.14	01110	Missile Control 5	IV
C.15	01111	Missile Control 6	IV
C.16	10000	Unassigned	
C.17	10001	Unassigned	
C.18	10010	Precision Direction A	IV
C.19	10011	Precision Direction B	IV
C.20	10100	Close Control 3	I, II (Note 3)
C.21	10101	Consolidated (Note 4) Command Message	III
C.22	10110	Consolidated (Note 4) target information	III
C.23 - C.31 Unassigned			

Note 1: Category I. All control stations must be capable of transmitting these messages.

Category II. Any control station with additional capability should implement these desirable messages.

Category III. Subject to further study, these messages may be recommended for Category I or II.

Category IV. Messages for special application, not NATO standard.

Note 2: Messages C.10 and C.11 are "broadcast" control messages. The possible use of these in NATO is under study.

Note 3: Message C.20 is in Category I for all ground based stations Category II for ship and airborne stations.

Note 4: Messages C.21 and C.22 are suggested as future NATO minimum standard.

Note 5: Test messages appropriate to the above control messages are to be defined later.

Message Number	Label	Message Type	Category (Note 1)
b. Reply Messages			
R.0	000	Reply A	III
R.1	001	Reply B (TACAN Position)	III
R.2	010	Airborne Early Warning & Control	III
R.3	011	Airborne Early Warning & Control	III
R.4	100	Reply Integrated Control 1	III
R.5	101	Reply Integrated Control 2	III
R.6	110	Unassigned	
R.7	111	Unassigned	

Note 1:

Category I. All control stations must be able to receive and interpret these messages.

Category II. Any control station with additional capability should be implemented to receive and interpret these desirable messages.

Category III. Subject to further study, these messages may be recommended for Category I or II.

Category IV. Messages for special applications, not NATO standard.

APPENDIX C TO ENCLOSURE 1

MESSAGE SPECIFICATIONS

Control Message No. C.0. Label: 00000. All digits after the start pattern are zeros except digit No. 33.

Control Message No. C.2 (Vectoring A)
Label: 00010

Digit time slot position	Function	Limits	Quanta Size	Total No. of Digits
34 - 42	Delta Y	Minus 256 to plus 255 data miles	1.0 data mi.	9
43 - 49	Y Vel	Minus 3600 to plus 3544 data knots	1/64 data mi. per sec. (56.25 data knots)	7
51 - 59	Delta X	Minus 256 to plus 255 data miles	1.0 data mi.	9
60 - 66	X Vel	Minus 3600 to plus 3544 data knots	1/64 data mi. per sec. (56.25 data knots)	7
68	M/AP	---	---	1
69	AR/CR	---	---	1
				34

Abbreviations:

Delta Y	North-South component of interceptor to target range.
Delta X	East-West component of interceptor to target range.
Y Velocity	North-South component of target velocity referenced to the air mass.
X Velocity	East-West component of target velocity referenced to the air mass.
M/AP	Manual Control (0) or Auto Pilot Control (1).
AR/CR	Automatic reply (0) or cancel reply (1). It is desirable that the pilot be able to force a reply in a two-way environment to allow for emergency conditions which may arise in the aircraft. This will be accomplished by a pilot operated switch which can be called "cancel reply override" and which causes the aircraft to ignore the cancel reply bit.

Control Message No. C.3 (Vectoring B/Close Control 1)
Label: 00011

Digit time slot position	Function	Limits	Quanta Size	Total No. of Digits
34 - 41	CH	0-358.6°	360°/256	8
42 - 48	CA	(Low 0 - 12,700 ft. 100ft.) (High 0-127,000 ft. 1000ft.)		7
49	CA/SC	High - 0 Low 1	--	1
51 - 56	CS	0.38 - 3.53 Mach	0.05 M	6
57 - 63	TA	0-127,000 ft.	1000ft.	7
64 - 66	Discretes	(Details shown below)		3
68 - 69	Discretes	(Details shown below)		2
				34

Abbreviations:

CH	Command Heading
CA	Command Altitude
CA/SC	Command Altitude scale change
CS	Command speed
TA	Target Altitude
Discretes	See Table below

Discretes for Message No. C.3 only.

Group Number	Serial Number	Digit time slot and binary Code	Operational Meaning
(Note 2)		64 65 66 68 69 (Note 1)	
1	0	0 0 0 0 0	
1	1	0 0 0 1 1	
1	2	0 0 1 0 0	
1	3	0 0 1 1 1	
1	4	0 1 0 0 0	
1	5	0 1 0 1 1	
1	6	0 1 1 0 0	
1	7	0 1 1 1 1	
1	8	1 0 0 0 0	
1	9	1 0 0 1 1	
1	10	1 0 1 0 0	
2	11	1 0 1 1 1	
2	12	1 1 0 0 0	
2	13	1 1 0 1 1	
3	14	1 1 1 0 0	
3	15	1 1 1 1 1	

Note 1:

The purpose of having digits 68 and 69 the same when conveying a discrete instruction is to provide a form of parity check for these digits which are not covered by the normal parity checks; if these digits are unlike, there will be no changes in the discrete message displayed, but the remainder of the message will be accepted subject to the normal parity checks. If, in successive messages, there is no change in the discrete message, that discrete message will be repeated and messages with digits 68 and 69 unlike will not be intentionally transmitted.

Note 2:

Group 1 - Only one message in Group 1 may be displayed at any one time. Only transmission of a new Group 1 message will cancel the previous Group 1 message.

Group 2 - Any or all three messages of Group 2 may be simultaneously displayed. They shall be individually self-cancelling on a time basis, determined within airborne equipment.

Group 3 - One and only one of the two messages in Group 3 will be displayed at any one time. Transmission of either message shall cancel the other.

Message No. C.4 Traffic Control A
Label: 00100

Digit time slot position	Function	Limits	Quanta Size	Total No. of Digits
34 - 42	Y	Minus 256 to plus 255 data mi.	1.0 data mi.	9
43 - 49	Unallocated			7
51 - 59	X	Minus 256 to plus 255 data mi.	1.0 data mi.	9
60 - 66	Unallocated			7
68	M/AP			1
69	AR/CR			1
				34

Abbreviations:

Y	North-South component of aircraft to base distance
X	East-West component of aircraft to base distance
M/AP, AR/CR	As in message No. C.2

Message No. C.5 Traffic Control B/WOTC (Wave off and Transition Control)
Label: 00101

Digit time slot position	Function	Limits	Quanta Size	Total No. of Digits
34 - 41	Cmd. heading	0-358.6°	360°/256	8
42 - 48	Comd. Altitude	(Low 0-12,700 ft. (High 0-127,000 ft.	100 ft. 1000 ft.)	7
49	Cmd. Altitude Scale change	High - 0 Low - 1		1
51 - 56	Cmd.Air Speed (Indicated)	0 - 886 data knots	1/256 d.m./sec (14.06 data knots)	6
57 - 63	Rate of descent	0-12,700 ft./min.	100 ft./min.	7
64 - 66	Discretes	16 meanings	(coded same as for No. C3)	5
68 - 69	Discretes	Meaning to be promulgated later		
				34

Message No. C.6 Automatic Carrier Landing
Label: 00110

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
34 - 42	Pitch Correction	Minus 13.50 to plus 13.45°	27.00°/512	9
43	Unallocated	--	--	1
44 - 49	Range to touch down on Carrier	0 to 8001 yds.	127 yds.	6
51 - 59	Bank Angle Correction	Minus 30° to plus 29.88	60°/512	9
60 - 66	Unallocated	--	--	7
68	M/AP	As in message C.2		1
69	AR/CR			1
				34

Control Message No. C.9 (Close Control 2)
Label: 01001

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
34 - 41	AH	o-358.6°	360°/256	8
42 - 48	TTG	(High 0-4064 sec. (Low 0-127 sec.	32 sec.) 1 sec.)	7
49	TTG/SG	High - 0 Low - 1	--	1
51 - 58	TR	0 - 127.5 data mi.	0.5 data mi.	8
59 - 66	TB	0 - 358.6°	360°/256	8
68	Unassigned			1
69	AR/CR	As in message C.2		1
				34

Abbreviations:

AH	Attack Heading
TTG	Time to go
TTG/SC	Time to go scale change
TR	Target Range from Interceptor
TB	Target Bearing

Control Message No. C.10 (Modified Close Control 1)
Label: 01010

Digit time slot position	Function	Limits	Quanta Size	Total No. of Digits
34 - 47	X	-4096 to +4095.5 d.m.	o.5 d.m.	14
48	Voice/data link	1=Revert to voice 0=Continue data link		1
49	Assignment	1=take best target 0=		1
51 - 64	Y	-4096 to +4095.5	0.5 d.m.	14
65	Engagement	1=disengage 0=continue engagement		1
66	Coordinate origin	1=Data reference to interceptor 0=Data reference to a grid point		1
68	Tactics	1=single target 0=area target(Centroid X and Y)		1
69	Return to base	1= 0=		1
				34

Control Message No. C.11 (Modified Close Control 2)
Label: 01011

Digit time slot position	Function	Limits	Quanta size	Total no. of Digits
34 - 41	X Velocity	-3600 to +3571.9 Knots	1/128d.m. per sec. (28.125 data knots)	8
42 - 49	Y Velocity	-3600 to 3571.9 Knots	1/128d.m. per sec. (28.125 data knots)	8
51 - 57	TA	0-95,250 ft.	750 ft.	7
58 - 65	Grid Identification Code	--	--	8
66	MCC/CC	--	--	1
68 - 69	Tactics	--	--	2
				34

Abbreviations:

X Velocity - East component of target velocity, referenced to the grid system designated by digits 58-65.

Y Velocity - North component of target velocity, referenced to the grid system designated by digits 58-65.

TA - Target Altitude

MCC/CC - Modified Close Control ( ) or Close Control ( )

Control Message No. C.18 (Precision Direction A)
Label: 10010

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
34 - 42	Pitch Correction	-13.5 to +13.45 degrees	27.0°/512	9
43 - 49	Unassigned			7
51 - 59	Bank Angle Correction	-30 to +29.88 degrees	60°/512	9
60 - 66	Unassigned	---	--	7
68	M/AP	Same as No. C.2		1
69	AR/CR	Same as No. C.2		1
				34

Control Message No. C.19 (Precision Direction B)
Label: 10011

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
34 - 41	Command hdg.	0-358.6°	360°/256	8
42 - 48	CA	{Low 0-12,700 ft. / High 0-127,000ft.}	{100 ft. / 1000 ft.}	7
49	CA/SC	High - 0 Low - 1		1
51 - 56	Command Air Speed	0.38-3.53 Mach	0.05M	6
57 - 63	Time to go	0-127 sec	1 sec	7
64 - 66	Discretes	(coded same as No. C.3; meaning to be promulgated later)		3
68 - 69	Discretes			2
				34

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Control Message No. C.20 (Close Control 3)
Label: 10100

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
34 - 41	Command Heading	0-358.6°	360°/256	8
42 - 48	Target Azimuth	o-357.2°	360°/128	7
49	Warning of possible change in order	0=No Warning 1=Warning		1
51 - 54	Command Pitch	-11 1/4° to +30 15/16°	360°/128	4
55 - 59	Target Elevation Angle	-30 15/16 to +56 1/4°	360°/128	5
60 - 65	Target Range	0 to 31.5 d.m.	0.5 d.m.	6
66	Pilot Warning	Warning to pilot (Digit 66) means, in principle, that the interception should be stopped)		1
68 - 69	Command Speed	See table below		2
				34

Notes on Coding in message C.20

51 - 54 Command Pitch is coded assymmetrically, as indicated by the following examples:

51	52	53	54	
0	0	0	0	-11 1/4°
0	1	0	0	0°
1	0	0	0	+11 1/4°
1	1	0	0	+22 1/2°
1	1	1	1	+30 15/16°

55 - 59 Target Elevation angle is coded assymmetrically as indicated by the following examples:

55	56	57	58	59		
0	0	0	0	0	-30 15/16°	or less
0	0	1	1	1	-11 1/4°	
0	1	0	1	1	0°	
0	1	1	1	1	+11 1/4°	
1	0	0	1	1	+22 1/2°	
1	1	0	1	1	+45°	
1	1	1	1	1	+56 1/4°	or more

68 - 69 Command Speed is encoded in discrete power settings as follows:

68	69	
0	0	Liner (Fly at apeed for maximum cruising range).
0	1	Buster (Fly at maximum speed).
1	0	After burner
1	1	Booster

49 Warning of possible change in order. Transmission of warning to change an order (Digit No. 49) starts about 5 seconds before the change, and continues until the order is given. Order changes are: change of command heading, change of pitch angle, control and change of speed orders.

Control Message No. C.21 (Consolidated Command Message)
Label: 10101

Digit time slot position	Function	Limits	Quanta size	Total No of Digits
34 - 41	Command heading or Attack heading	0-358.6°	360°/256	8
42	CH/AH	CH=0 AH=1	--	1
43 - 48	Time to go	High 0-4032 sec. Low - 126 sec.	64 sec. 2 sec.	6
49	TTG/SC	High=0 Low= 1		1
51 - 57	Command Altitude	Low 0-12,700 ft. High 0-127,000 ft.		7
58	CA/SC	High=0 Low =1		1
59 - 61	Command Speed	See table below		3
62 - 65	Discretes	16 discrete possibilities as coded in message C2		4
66	M/AP	As in message C2		1
68	AR/CR	As in message C2		1
69	Parity on AR/CR	Repetition of digit 68		1
				34

59 - 61 Command Speed is encoded in discrete power settings as given in the following table:

59	60	61	
0	0	0	No Command
0	0	1	SAUNTER (Fly at speed for maximum endurance)
0	1	0	LINER (Fly at speed for maximum cruising range)
0	1	1	BUSTER (Fly at maximum continuous speed)
1	0	0	GATE (Fly at maximum possible speed)
1	0	1	Use after burner
1	1	0	Use booster jets or rockets
1	1	1	Spare combination

Note: Depending on local doctrine, GATE may include the use of after burners or rockets.

Control Message No. C.22 (Consolidated Target Information)
Label: 10110

Digit time slot position	Function	Limits	Quanta size	Total No of Digits
34 - 39	Target Bearing	0-354.4°	360°/64	6
40 - 44	Target Range	Coarse 0-248 d.m. Fine 0-31 d.m.	8 d.m. 1 d.m.	5
45	TR/SC	Coarse = 0 Fine = 1		1
46 - 49 and 51 - 52	* Target Speed	0-3544 d.m./hr.	1/64 dm/sec (56.25 dm/hr)	6
53 - 58	* Target Heading	0-354.4°	360°/64	6
59 - 64	Relative Target Altitude	-32,000 ft. to 31,000 ft.	1000 ft.	6
65 - 66	Spares	---	--	2
68 - 69	Spares	---	--	2
				34

* Referenced to the air mass.

Reply Message R.0

Label: 000

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
17 - 24	Aircraft True Heading	0-358.6°	360°/256	8
25 - 26	Weapon Status	--	--	2
27	Directional Digit	(always "1")		1
28 - 34	Altitude	High 0-127,000ft. Low 0-12,700 ft.	1000 ft. 100 ft.	7
35	Alt. scale change	0= high 1= low	--	1
36 - 38	Aircraft type	--	--	3
39 - 40	Weapon Status	--	--	2
41	Program Digit	(always "1")		1
42 - 48	Fuel Status	0-25,400 lbs.	200 lbs.	7
49 - 55	TACAN Station Identity (126 channels)	--	--	7

Reply Message R.1
Label: 001

Digit time slot position	Function	Limits	Quanta size	Total No. of Digits
17 - 24	Aircraft true Air speed	0-3586 Knots	1/256 d.m./ sec.(14.06 Knots)	8
25 - 26	Weapon Status	--	--	2
27	Directional Digit	(always "1")		1
28 - 36	TACAN Bearing	0-359.3°	360°/512	9
37 - 38	Weapon Status	--	--	2
39	Pilot Ready	0= not ready 1= ready		1
40	Auto-Pilot	0= No auto-pilot 1= Auto-pilot engaged		1
41	Program Digit	(always "1")		1
42 - 50	TACAN Range	0-306.6 n.m.	0.6 n.m.	9
51 - 55	Discretes	--	--	5

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APPENDIX D TO ENCLOSURE 1

Link 4 Control Message Type 3

The 16 Discrete Messages of Link 4 Control Message Type 3 have the following expanded definitions:

Discrete Message Number	Brief Definition	Expanded Definition
0	Disengage	Take immediate action in accordance with SOP or briefing. Do not fire.
1	Not under control	Ignore all data link commands and information except his discrete message read-out(s) of mission.
2	Vector to Waypoint (Orientation Point)	Vector is to a point in space
3	Vector to Handover	Vector is to a point at which your control will be transferred to another control centre. Expect further instructions on new frequencies for voice and data link channels and standby for a shift frequency command.
4	Orbit	Remain in the immediate vicinity of your present position using the pattern established by SOP or briefing.
5	Return to base	You are being vectored to a point at which your control will be transferred to your final destination control centre. Expect a shift frequency command. This is a special case of handover which permits the pilot to make preparation for letdown and landing. It may also be used as an emergency return to base advisory as for example, indication that fuel state has been determined by the control centre to have reached the minimum which would allow normal return with required landing reserve.
6	Challenge	Vector is to intercept an unknown for the purpose of visual identification. Action subsequent to identification will be contingent on briefing or SOP.

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7	Destroy with Arm No. 1	You are being vectored to attack a target with the weapon indicated. It has been determined at the computer that the indicated weapon is the preferred weapon for this attack accordingly your approach will be optimized for maximum kill probability with that weapon. This command does not preclude the use of other weapons during this attack as may be deemed appropriate by the pilot.
8	Destroy with Arm No. 2	Same as Code 7 above
9	Destroy with Arm No. 3	Same as Code 7 above
*10	Pilot Target Selection	Ignore target designation and attack most suitable target
*11	Altitude Change Warning	A change in altitude command is imminent or has already been transmitted. Observe the appropriate command read-out and respond promptly to the ensuing or existing change.
*12	Command Speed Change Warning	A change in speed (power setting) command is imminent or has already been transmitted. Observe the appropriate command read-out and respond promptly to the ensuing or existing change.
13	Revert to Voice	Take action as necessary to receive a voice message. If you have simultaneous voice and data reception capabilities the next message you hear on your voice channel will be intended for you.
*14	Maximum Rate Turn	All turns executed in response to command heading changes shall be executed in the indicated manner.
*15	Normal Rate Turn	Same as Code 14 above

* OPTIONAL: Implement if desired but do not use for any other purpose.

APPENDIX D TO ENCLOSURE 1

Proposal for

LINK 4B

Land-Line Connection between Air Defense Computers and Remote Ground-to-Air Data Link Transmitters

D.1 GENERAL

Where the operation of interceptors over a large geographical area is to be controlled from a single location, it becomes necessary to connect the control centre to several ground-to-air transmitting stations which must be geographically displaced, in order to overcome the line-of-sight limitation of UHF transmission. This requirement generates some technical problems, since, in general, the transmission media and bandwidths available for communications on the ground are dissimilar to those of UHF ground-to-air radio links. Unless there is available a ground communication channel with capacity at least equal to that of the ground-to-air link, a converter (or "buffer") is required at the remote UHF transmitting station. It is the intent of this Appendix to establish standards for transmitting to such a converter from a control centre capable of generating digital control messages.

TRANSMISSION STANDARDS

D.2 COMPATIBILITY WITH LINK 1

In general, the transmissions standards for Link 4B are those specified in Standards for NATO Data Link 1. Specifically the following paragraphs of Standards for Link 1 apply to Link 4B:

3 ANNEXES
I - Fig. 1: Relationship of Message Structures on Links 4A and 4B
II - Fig. 2: Link 4B Message
III - Link 4 Control Message Type 3

Link 1 Standards (cf. SGM-377-61)

	Paragraph No.	Title
(a)	5	Frequency Response
(b)	6	Peak Impulse Noise
(c)	7	Noise and Cross-Talk
(d)	9	Circuit Layout
(e)	13	Transmission Speed
(f)	14	Transmission Speed Tolerances
(g)	15	Modulation
(h)	16	Translation of Information
(i)	17	Standby Signal
(j)	18	Receiver Synchronization
(k)	19	Multiple Transmission Operation
(l)	20	Impedance
(m)	21	Transmitter Output Level
(n)	22	Receiver Input Level
(o)	23	Output Attenuator
(p)	24	Output/Input Filters
(q)	25b	Test Messages

D.3 MESSAGE FRAME

This is the unit of information for transmission. A message frame will contain 70 message digits, divided into 10 message groups of 7 digits each.

D.4 TRANSMISSION FRAME

A transmission frame will consist of 96 transmission digits, divided into 12 transmission groups of 8 digits each. The transmission groups will be of 3 different types as follows:

(a) Start Group. One start group begins a transmission frame. It consists of 8 start digits: these are chosen to give a unique train of digits (eight "zeros") to identify the start of a new frame.

APPENDIX E TO ENCLOSURE 1

LINK 4B

Land-Line Connection between Air Defense Computers and Remote Ground-to-Air Data Link Transmitters

D.1 GENERAL

Where the operation of interceptors over a large geographical area is to be controlled from a single location, it becomes necessary to connect the control centre to several ground-to-air transmitting stations which must be geographically displaced, in order to overcome the line-of-sight limitation of UHF transmission. This requirement generates some technical problems, since, in general, the transmission media and bandwidths available for communications on the ground are dissimilar to those of UHF ground-to-air radio links. Unless there is available a ground communication channel with capacity at least equal to that of the ground-to-air link, a converter (or "buffer") is required at the remote UHF transmitting station. It is the intent of this Appendix to establish standards for transmitting to such a converter from a control centre capable of generating digital control messages.

TRANSMISSION STANDARDS

D.2 COMPATIBILITY WITH LINK 1

In general, the transmissions standards for Link 4B are those specified in Standards for NATO Data Link 1. Specifically the following paragraphs of Standards for Link 1 apply to Link 4B:

2 ANNEXES
I - Fig. 1: Relationship of Message Structures on Links 4A and 4B
II - Fig. 2: Link 4B message

Link 1 Standards. (cf. SGM-377-61)

	Paragraph No.	Title
(a)	5	Frequency Response
(b)	6	Peak Impulse Noise
(c)	7	Noise and Cross-Talk
(d)	9	Circuit Layout
(e)	13	Transmission Speed
(f)	14	Transmission Speed Tolerances
(g)	15	Modulation
(h)	16	Translation of Information
(i)	17	Standby Signal
(j)	18	Receiver Synchronization
(k)	19	Multiple Transmission Operation
(l)	20	Impedance
(m)	21	Transmitter Output Level
(n)	22	Receiver Input Level
(o)	23.	Output Attenuator
(p)	24	Output/Input Filters
(q)	25b	Test Messages

D.3 MESSAGE FRAME

This is the unit of information for transmission. A message frame will contain 70 message digits, divided into 10 message groups of 7 digits each.

D.4 TRANSMISSION FRAME

A transmission frame will consist of 96 transmission digits, divided into 12 transmission groups of 8 digits each. The transmission groups will be of 3 different types as follows:

(a) Start Group. One start group begins a transmission frame. It consists of 8 start digits: these are chosen to give a unique train of digits (eight "zeros") to identify the start of a new frame.

(b) Data Group. Each transmission frame contains 10 data groups: each comprises a single fixed digit ("one") followed by a message group.

(c) Check Group. One check group completes the transmission frame. It contains a single fixed digit ("one") followed by 6 check digits, followed by a final digit ("one") which completes the transmission frame. The checking technique described in Paragraph 12 of the Link 1 Standards applies to Link 4B.

D.5 TIMING.

Control messages for Link 4 will be initiated by the control computer at intervals which are multiples of 16 milliseconds. (Para. 20). The message length for Link 4A is also a multiple of 16 milliseconds. Thus, for example, if control messages are initiated at the rate of one every 32 milliseconds, four parallel telephone lines operating at 750 bits per second (or two, at 1500 bits/sec.) would be required to convey these messages to a remote Link 4A radio transmitter. Transmission frames on the parallel telephone lines must be synchronized and staggered, as indicated in Paragraph 19 of the Link 1 standards. The equipment at the ground-to-air transmitting site will operate as a slave, generating and transmitting a Link 4A message corresponding to each message received on Link 4B. It is recommended that the conversion delay (time between reception of Link 4B messages on individual lines and transmission of Link 4A messages) be made manually adjustable as an integral number of digits. This adjustable delay can be used to equalize the delays incurred in the different Link 4B transmission paths.

MESSAGE STANDARDS

D.6 CONTENT

All working digits, with the exception of directional digit and information parity digits, of a complete

Link 4A message, i.e. address, label, parity and information will be contained in a single Link 4B message. In addition, Link 4B may carry digital instructions for automatic operation of the Link 4A transmitting station. Link 4A synchronizing pattern and guard space will be generated automatically and inserted in each ground-to-air message by the Link 4A transmitter.

D.7 UNITS, CONVENTIONS, DEFINITIONS.

The units, conventions and definitions specified for Link 4A in Paragraphs 32 - 41 also apply to Link 4B messages, including numerical data, instructions, etc., which flow on Link 4B, but do not form part of any ground-to-air (Link 4A) message.

D.8 CONVERSION OF MESSAGES

The relationship between the message structures on Link 4A and Link 4B is illustrated in Figure 1. Coding of Site Address, Mode Selection, Antenna Selection and Site Control Bits is shown in Figure 2.

D.9 FUTURE MESSAGES

The necessary flexibility to accommodate future requirements of Link 4B is provided by the Site Control Bits, which are used to determine the content and interpretation of the rest of the message following these bits.

(b) Data Group. Each transmission frame contains 10 data groups: each comprises a single fixed digit ("one") followed by a message group.

(c) Check Group. One check group completes the transmission frame. It contains a single fixed digit ("one") followed by 6 check digits, followed by a final digit ("one") which completes the transmission frame. The checking technique described in Paragraph 12 of the Link 1 Standards applies to Link 4B.

D.5 TIMING.

Control messages for Link 4 will be initiated by the control computer at intervals which are multiples of 16 milliseconds. (Para. 20). The message length for Link 4A is also a multiple of 16 milliseconds. Thus, for example, if control messages are initiated at the rate of one every 32 milliseconds, four parallel telephone lines operating at 750 bits per second (or two, at 1500 bits/sec.) would be required to convey these messages to a remote Link 4A radio transmitter. Transmission frames on the parallel telephone lines must be synchronized and staggered, as indicated in Paragraph 19 of the Link 1 standards. The equipment at the ground-to-air transmitting site will operate as a slave, generating and transmitting a Link 4A message corresponding to each message received on Link 4B. It is recommended that the conversion delay (time between reception of Link 4B messages on individual lines and transmission of Link 4A messages) be made manually adjustable as an integral number of digits. This adjustable delay can be used to equalize the delays incurred in the different Link 4B transmission paths.

MESSAGE STANDARDS

D.6 CONTENT

All working digits, with the exception of directional digit and information parity digits, of a complete

Link 4A message, i.e. address, label, parity and information will be contained in a single Link 4B message. In addition, Link 4B may carry digital instructions for automatic operation of the Link 4A transmitting station. Link 4A synchronizing pattern and guard space will be generated automatically and inserted in each ground-to-air message by the Link 4A transmitter.

D.7 UNITS, CONVENTIONS, DEFINITIONS.

The units, conventions and definitions specified for Link 4A in Paragraphs 32 - 41 also apply to Link 4B messages, including numerical data, instructions, etc., which flow on Link 4B, but do not form part of any ground-to-air (Link 4A) message.

D.8 CONVERSION OF MESSAGES

The relationship between the message structures on Link 4A and Link 4B is illustrated in Figure 1. Coding of Site Address, Mode Selection, Antenna Selection and Site Control Bits is shown in Figure 2.

D.9 FUTURE MESSAGES

The necessary flexibility to accommodate future requirements of Link 4B is provided by the Site Control Bits, which are used to determine the content and interpretation of the rest of the message following these bits.

ANNEX I TO APPENDIX D

TO ENCLOSURE 1

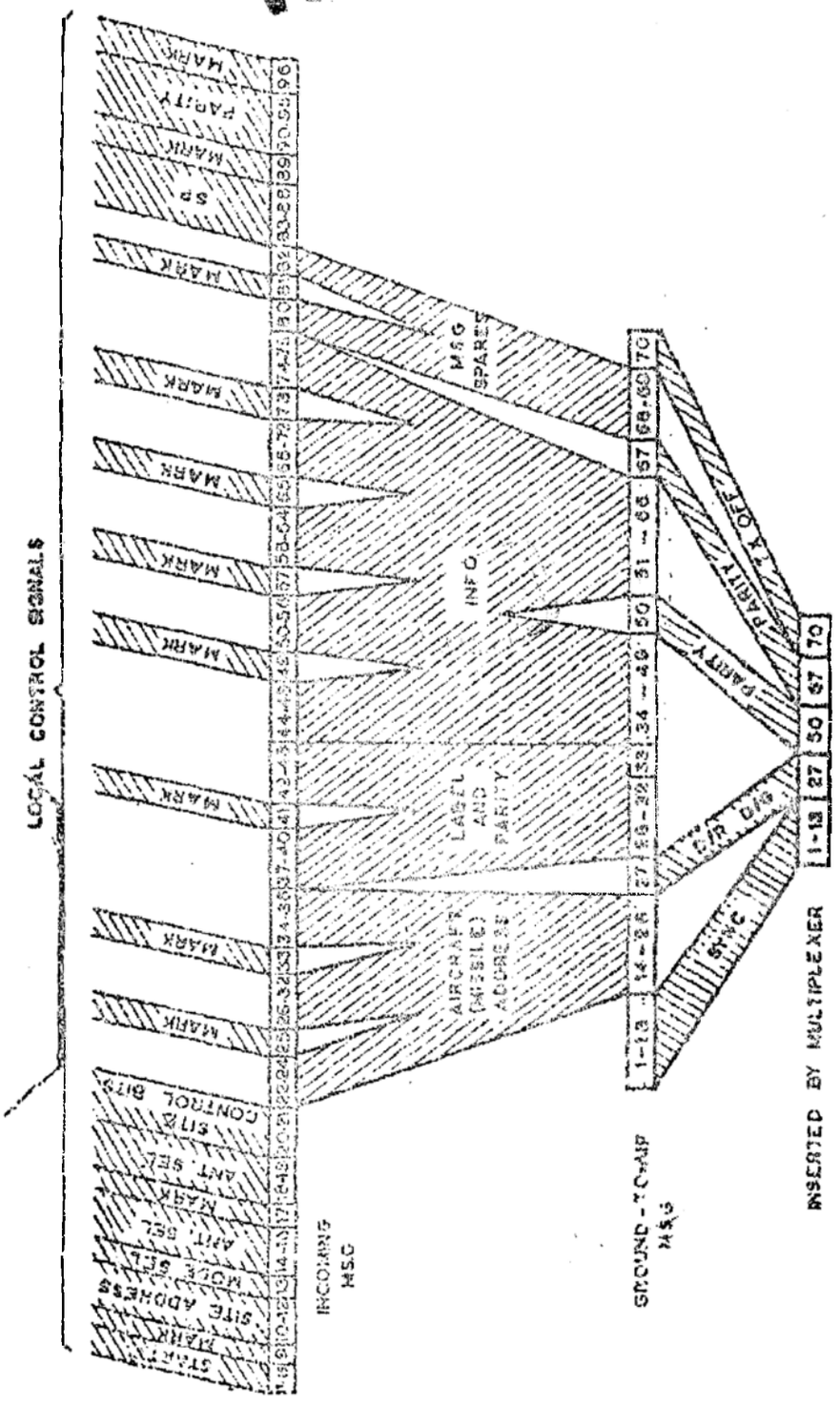

Fig: Relationship of message structures on Links 4A and 4B

ANNEX II TO APPENDIX D
TO ENCLOSURE 1
FIGURE 2
LINK 4B MESSAGE

Components	No. of Digits	Coding, etc.
a) Site Address	3	
b) Mode Selection	1	5
c) Antenna Selection	5	0 = omnidirectional 1 = directional 9 8 7 6 0 0 0 0 = 0 - 22.5° 1 0 0 0 = 22.5 - 45°
d) Site Control	2	11 10 0 0 = Normal A/C Message 1 0 = } Unallocated 0 1 = } 1 1 = Site Control Message
e) A/C Address	13	
f) Air Message Label	5	
g) Air Message Label Parity	1	
h) Air Message Information	34	Note: Information Parity Digits inserted at G/A Transmitter
i) Spares	6	
TOTAL	70	

ANNEX I TO APPENDIX E

TO ENCLOSURE 1

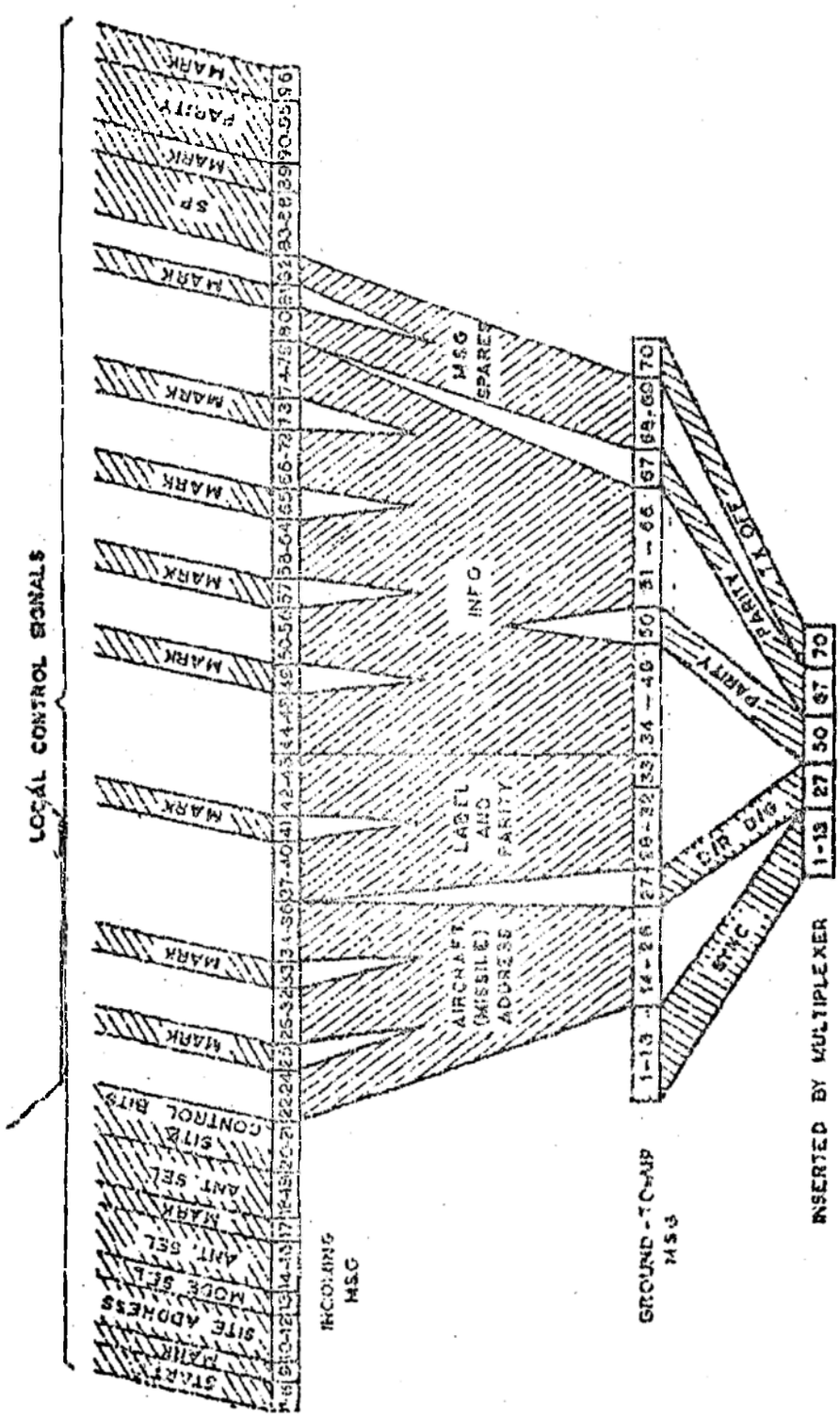

Fig.1: Relationship of message structures on Links 4A and 4B

ANNEX II TO APPENDIX E
TO ENCLOSURE 1
FIGURE 2
LINK 4B MESSAGE

Components	No. of Digits	Coding, etc.
a) Site Address	3	
b) Mode Selection	1	5
c) Antenna Selection	5	0 = omnidirectional 1 = directional 9 8 7 6 0 0 0 0 = 0 - 22.5° 1 0 0 0 = 22.5 - 45°
d) Site Control	2	11 10 0 0 = Normal A/C Message 1 0 = } Unallocated 0 1 = } 1 1 = Site Control Message
e) A/C Address	13	
f) Air Message Label	5	
g) Air Message Label Parity	1	
h) Air Message Information	34	Note: Information Parity Digits inserted at G/A Transmitter
i) Spares	6	
TOTAL	70	

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ANNEX III to APPENDIX D
to ENCLOSURE 1

Link 4 Control Message Type 3

The 16 Discrete Messages of Link 4 Control Message Type 3 have the following expanded definitions:

Discrete Message Number	Brief Definition	Expanded Definition
0	Disengage	Take immediate action in accordance with SOP or briefing. Do not fire.
1	Not under control	Ignore all data link commands and information except his discrete message read-out(s) of mission.
2	Vector to Waypoint (Orientation Point)	Vector is to a point in space
3	Vector to Handover	Vector is to a point at which your control will be transferred to another control centre. Expect further instructions on new frequencies for voice and data link channels and standby for a shift frequency command.
4	Orbit	Remain in the immediate vicinity of your present position using the pattern established by SOP or briefing.
5	Return to base	You are being vectored to a point at which your control will be transferred to your final destination control centre. Expect a shift frequency command. This is a special case of handover which permits the pilot to make preparation for letdown and landing. It may also be used as an emergency return to base advisory as for example, indication that fuel state has been determined by the control centre to have reached the minimum which would allow normal return with required landing reserve.
6	Challenge	Vector is to intercept an unknown for the purpose of visual identification. Action subsequent to identification will be contingent on briefing or SOP.

7	Destroy with Arm No. 1	You are being vectored to attack a target with the weapon indicated. It has been determined at the computer that the indicated weapon is the preferred weapon for this attack accordingly your approach will be optimized for maximum kill probability with that weapon. This command does not preclude the use of other weapons during this attack as may be deemed appropriate by the pilot.
8	Destroy with Arm No. 2	Same as Code 7 above
9	Destroy with Arm No. 3	Same as Code 7 above
*10	Pilot Target Selection	Ignore target designation and attack most suitable target
*11	Altitude Change Warning	A change in altitude command is imminent or has already been transmitted. Observe the appropriate command read-out and respond promptly to the ensuing or existing change.
*12	Command Speed Change Warning	A change in speed (power setting) command is imminent or has already been transmitted. Observe the appropriate command read-out and respond promptly to the ensuing or existing change.
13	Revert to Voice	Take action as necessary to receive a voice message. If you have simultaneous voice and data reception capabilities the next message you hear on your voice channel will be intended for you.
*14	Maximum Rate Turn	All turns executed in response to command heading changes shall be executed in the indicated manner.
*15	Normal Rate Turn	Same as Code 14 above

* OPTIONAL: Implement if desired but do not use for any other purpose.

ENCLOSURE 2

COMMENTS ON STANDARDS FOR NATO DATA LINKS: LINK 4

I. DENMARK

Denmark approves ... /SGM-378-61/ as a basis for standardization of the future ground/air data links. However, from the information which is, at present, available to Denmark, it appears that the proposed standards for NATO Data Link 4 are not compatible with the most of the existing communications equipment, notably AN/ARC-34 and AN/GRC-27. Therefore, Denmark cannot undertake to implement the resultant STANAG until a usable communication set, e.g. AN/ARC-62, has been procured.

Denmark wishes to stress the importance of ensuring compatibility of NATO Data Link 4 with the message standardization for data transmission system as suggested by ICAO in Doc. 7909, RAC/SAR Recommendation 25/2.

II. UNITED STATES

It should be recognized that many NATO nations may not be able to implement all aspects of these standards. This may dictate the need for a supplemental document delineating degree of implementation by participating nations. For example: the U.S. Air Force at present cannot, without considerable cost outlay and attendant redesign, implement the discretes in Message C-3; likewise, the U.S. Navy Airborne Technical Data System cannot implement the full range of speed commands in Message C-3.

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NORTH ATLANTIC MILITARY COMMITTEE

COMITE MILITAIRE DE L'ATLANTIQUE NORD

Standing Group Groupe Permanent

18 September 1962

CORRIGENDUM NO. 1

to SGM-229-62

Holders of SGM-229-62 (Standards for NATO Data Links: Link 4) are requested to replace pages 3, 4 and 36-43 with the attached revised pages, and to destroy the removed pages by burning or reducing to pulp.

FOR THE STANDING GROUP:

Ivan C. Henry, Jr.

IVAN C. HENRY, JR.
Lt Colonel, USAF
Assistant Secretary

ICH/md

1 ENCLOSURE (10 page changes)
Pages 3,4, 36-43 of
SGM-229-62

Regraded NATO Unclassified when separated from classified enclosure.

Corrected
AAP
21 Sept 62

DISTRIBUTION: as for basic paper

This document consists of 11 pages.