NASA Technical Memorandum

NASA TM-86562

SPACE FLIGHT OPERATIONS COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

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August 1986

National Aeronautics and Space Administration

George C. Marshall Space Flight Center

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LIST OF ABBREVIATIONS

CDT	Central Daylight Time
CST	Central Standard Time
C&D	Control and Display
EDT	Eastern Daylight Time
EST	Eastern Standard Time
GMT	Greenwich Mean Time
ICAO	International Civil Aviation Organization
JSC	Johnson Space Center
MCC	Mission Control Center
MDT	Mountain Daylight Time
MST	Mountain Standard Time
MET	Mission Elapsed Time
MSFC	Marshall Space Flight Center
PDT	Pacific Daylight Time
POCC	Payload Operations Control Center
PST	Pacific Standard Time
USA	United States of America
UTC	Universal Time Coordinated

TECHNICAL MEMORANDUM

SPACE FLIGHT OPERATIONS COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

I. INTRODUCTION

Communications are a critical link in space flight operations. The link can be a strong bond – or it can be broken with surprising speed and disastrous results. The discussion herein provides basic communications procedures of space flight operations personnel.

A. Purpose and Scope

The basics of space flight communications will be discussed. Space flight communications include verbal communications within and between control facilities such as Johnson Space Center's (JSC) Mission Control Center (MCC) and Marshall Space Flight Center's (MSFC) Payload Operations Control Center (POCC). It also includes communications between the control center and the manned orbiting spacecraft (e.g., the Shuttle Orbiter or Spacelab).

B. Background

In space flight operations people must communicate to achieve the mission objectives. The people communicate using special equipment that allows access to personnel that are locally and remotely located. The special equipment includes a headset with microphone and earpiece, and a communications panel or "comm panel" with as many as 48 voice circuits commonly called "loops." The operating procedures for comm panels will vary with their design and will not be addressed here. The communications techniques provided here generally apply to any comm panel used in space flight operations.

C. History

Since the beginning of manned space flight, specialized communications techniques have been needed to assure rapid and clear transfer of information. These needs are similar to those of aviation and it was natural for the space flight communications techniques to be similar to aviation communications. Also, it was natural for astronauts to use the aviation communications because of their aviation backgrounds. Thus, the techniques described here are often taken directly from those used in aviation.

II. COMMUNICATIONS BASICS

Effective communications are based upon clarity and brevity. This is achieved through the use of procedural words and phrases and careful communications techniques or procedures. This section addresses these basics.

A. Clarity and Brevity

The single most important thought in loop communications is understanding. Brevity is important, and contacts should be kept as brief as possible, but the position called must know exactly what you want to do before he or she can properly carry out his or her duties. And you must know exactly what other positions want you to do. Since concise phraseology may not always be adequate, use whatever words are necessary to get your message across.

B. Procedural Words and Phrases

Operations personnel will find the enclosed glossary helpful in learning what certain words or phrases mean. Good phraseology enhances communications effectiveness and is the mark of a professional space flight communicator. Chatter and "CB" slang are inappropriate in space flight communications. The enclosed glossary should be reviewed from time to time to sharpen your communications skills.

C. Loop Communications Technique

1. Listen before you transmit. Many times you can get the information you want by monitoring the loops. In this regard, monitoring of the air-to-ground loop is especially important. If you have just begun to monitor a loop on which you plan to talk, pause to listen and make sure the loop is clear.

2. Think before keying your microphone. Know what you want to say and if it is lengthy, jot it down.

3. The microphone should be close to your lips and after pressing the mike button, a slight pause may be necessary to be sure the first word is transmitted. Speak in a normal conversational tone.

4. When you release the button, wait a few seconds before calling again. The position called may be busy on another loop.

5. If you are called by another position while talking, attempt to take the time to answer with "standby" so the caller knows you are busy, but will call back later.

6. Be alert to sounds or lack of sounds in your headset. Check your volume, recheck your comm panel and make sure your microphone is not stuck in the transmit position.

III. COMMUNICATIONS PROTOCOLS

Specific space flight communications protocols and procedures have been established. This section describes these protocols and procedures.

A. Contact Procedures

1. Initial Contact. The term "initial contact" or "initial call-up" means the opening call you make to a given position. Use the following format:

- o The assigned call sign of the position being called.
- o Your call sign.
- o The loop you are talking on.
- o The type of message to follow or your request if it is short.

For example: OC, MUM, ON OPS CONTROL WITH AN OCR APPROVAL.

Use discretion and do not overload the position called with information he or she does not need. When you do not get a response from the called position, recheck your comm system and keep the next contact short.

2. Subsequent Contacts and Responses. Use the same format as used for initial contact except you should state your message or request with the call-up in one transmission. The call sign may be omitted if the message requires an obvious reply and there is no possibility for misunderstandings. You should acknowledge all call-ups or clearances unless the caller advises otherwise. There are some occasions when the position being called must issue time-critical instructions to other positions and he may be able to observe your response visually or on his display. If the situation demands your response, take appropriate action or immediately advise the position of any problem. Acknowledgment is made with one of the words "Wilco, Roger, Affirmative, Negative" or other appropriate remark. For example: CPE, WILCO.

3. Acknowledgment of Loop Changes. When advised by the caller to change loops, acknowledge the instruction before changing. If you select the new loop without an acknowledgment, the caller has no way of knowing whether you received the instruction.

4. Precautions in the Use of Call Signs. Improper use of call signs can result in operators executing an operation intended for another position. Only the assigned call signs should be used.

B. Time

1. Mission Elapsed Time (MET) is used most often for space flight operations. MET is the difference between the current time and the time of launch.

2. Greenwich Mean Time (GMT) may also be used. GMT is a time base that has the same value at all points on Earth. GMT may be determined in the USA from the following table:

TABLE 1. LOCAL TIME CONVERSION TO GMT

EST + 5 = GMT	EDT + 4 = GMT
CST + 6 = GMT	CDT + 5 = GMT
MST + 7 = GMT	MDT + 6 = GMT
PST + 8 = GMT	PDT + 7 = GMT

GMT is sometimes called "UTC" or "Universal Time Coordinated."

3. The 24-hour clock system is used for both MET and GMT. When a time value is to be voiced it should be spoken as given in the following examples: MET 3/02:19:00 should be read as "M-E-T THREE DAYS, ZERO TWO HOURS, ONE NINER MINUTES, ZERO ZERO SECONDS." GMT 219/23:11:30, should be read as "G-M-T TWO ONE NINER DAYS, TWO THREE HOURS, ONE ONE MINUTES, THREE ZERO SECONDS.

4. If no misunderstanding is likely to occur, MET may be stated as hours plus minutes as in the following example directing an operation to occur at MET 2/03:15:00:

PERFORM THAT OPERATION AT MET THREE PLUS ONE FIVE.

C. Figures

1. Figures indicating hundred and thousands in round numbers up to 9900 may be spoken in accordance with the following examples:

500 .....FIVE HUNDRED
4500 .....FOUR THOUSAND FIVE HUNDRED

2. Numbers above 9900 may be spoken by separating the digits preceding the word "thousand." Examples:

10000 .....ONE ZERO THOUSAND
13500 .....ONE THREE THOUSAND FIVE HUNDRED

3. All other numbers shall be transmitted by pronouncing each digit:

10 .....ONE ZERO
10184 .....ONE ZERO ONE EIGHT FOUR

4. When a number contains a decimal point the decimal point is spoken as "POINT" or "DECIMAL." For example:

122.1 .....ONE TWO TWO POINT ONE
or ONE TWO TWO DECIMAL ONE

D. Phonetic Alphabet

1. The International Civil Aviation Organization (ICAO) phonetic alphabet is used in space flight operations. It is given in Table 2.

2. Use the phonetic equivalents for single letters and to spell out groups of letters or difficult words.

E. Computer Entries

Because entries at a computer keyboard must be precise and may be lengthy, the following protocol shall be used when voicing such entries:

1. Voice the number of keyboard entries to be transmitted. For example: I HAVE THREE KEYBOARD ENTRIES WHEN YOU ARE READY TO COPY.

TABLE 2. PHONETIC ALPHABET

A	Alpha	(AL-FAH)
B	Bravo	(BRAH-VOH)
C	Charlie	(CHAR-LEE)
D	Delta	(DELL-TAH)
E	Echo	(ECK-OH)
F	Foxtrot	(FOKS-TROT)
G	Golf	(GOLF)
H	Hotel	(HOH-TEL)
I	India	(IN-DEE-AH)
J	Juliett	(JEW-LEE-ETT)
K	Kilo	(KEY-LOH)
L	Lima	(LEE-MAH)
M	Mike	(MIKE)
N	November	(NO-VEM-BER)
O	Oscar	(OSS-CAHR)
P	Papa	(PA-PA)
Q	Quebec	(KEH-BECK)
R	Romeo	(ROW-ME-OH)
S	Sierra	(SEE-AIR-RAH)
T	Tango	(TANG-GO)
U	Uniform	(YOU-NEE-FORM)
V	Victor	(VIK-TAHR)
W	Whiskey	(WISS-KEY)
X	Xray	(ECKS-RAY)
Y	Yankee	(YANG-KEY)
Z	Zulu	(ZOO-LOO)
	Space	(SPACE)
1	One	(WUN)
2	Two	(TOO)
3	Three	(THA-REE)
4	Four	(FOW-ER)
5	Five	(FI-YIV)
6	Six	(SIX)
7	Seven	(SEV-EN)
8	Eight	(ATE)
9	Niner	(NIN-ER)
0	Zero	(ZEE-RO)
-	Dash	(DASH)
/	Slant	(SLANT)
_	Underscore	(UN-DER-SCORE)

2. A display identifier should precede keyboard entries that need to be entered while viewing that display.

3. Read all alphanumeric keystrokes using the phonetic alphabet.

4. Read non-alphanumeric keystrokes as they are labeled on the keyboard. For example:

KB Label	Voice Word
CMD	COMMAND
ITEM	ITEM
DISP	DISPLAY
PFK1	PEE-EFF-KAY-WUN
ENTER	ENTER
RET	RETURN

EXAMPLE: The following keyboard entry shall be read as follows:

Keyboard: CMD TLC_SOPE02_999 ENTER

Voice: COMMAND TANGO LIMA CHARLIE SPACE SIERRA OSCAR PAPA ECHO ZERO TWO SPACE NINER NINER NINER ENTER.

EXAMPLE: The following command needs to be entered at a display called OFD:

Voice: AT THE OFD DISPLAY, ITEM 3 ENTER.

F. Procedure Information

All of the following information shall be included when voicing procedure information:

1. THE PROCEDURE BOOK TITLE.

2. THE BOOK PAGE NUMBER(S).

3. THE PROCEDURE NUMBER AND TITLE.

4. THE PROCEDURE STEP(S).

EXAMPLE: IN THE WIDE FIELD CAMERA BOOK ON PAGE MAL DASH ONE FIVE, FROM PROCEDURE CHARLIE ZERO TWO ZERO, TITLED "MANUAL OPS WITHOUT SOFTWARE," PERFORM STEPS SEVEN, EIGHT AND NINER.

G. Standard Voice Checks

When testing voice circuits, a standard short count (1, 2, 3, 4, 5, 5, 4, 3, 2, 1) should be spoken directly into the microphone at normal voice level. Voice checks provide the means to ensure that the circuit is operating, to check the intelligibility and quality of the speech on the circuit, and to verify that the speech is clearly understood tonal quality for the type of circuit under test. The degree signal strength and readability of the transmission are expressed in the following terms or combinations:

Signal Strength	Readability
Loud	Clear
Good	With distortion
Weak	With background noise
Barely audible	With fading but readable
Noise	Unreadable

IV. AIR-TO-GROUND COMMUNICATIONS

Communications between the flight crew in orbit and the ground are critical. Specific protocols associated with air-to-ground communications have been established to assure that operating priorities are adhered to.

A. Air-to-Ground Protocols

When using the air-to-ground loop to communicate with the payload crew, the following guidelines apply:

1. The payload crew shall have loop priority in air-to-ground communications.
2. The discussion should be limited to pertinent topics.
3. Hold communications if "BREAK BREAK" is heard on the loop.
4. All of the communications guidelines herein shall be closely followed.

B. Control and Display Panel References

All of the following information shall be included when voicing instructions to the flight crew involving control and display (C&D) panel operations:

1. THE PANEL DESCRIPTION.
2. THE PANEL DESIGNATOR IDENTIFIER.
3. THE CONTROL OR DISPLAY LABEL(S).

For example:

ON THE FLUID LOOP CONTROL PANEL AT ROMEO THREE PAPA, SET THE THREE PHASE AC TO OFF.

APPENDIX A

GLOSSARY OF COMMUNICATIONS TERMINOLOGY

The following words have specific meanings in space flight operations. Using these words as defined here will allow your communications to be concise and clear. Remember, though, that you should use whatever words are necessary to convey your message.

1. ACKNOWLEDGE – Let me know that you have received and understood my message.

2. ADVISE INTENTIONS – Tell me what you plan to do.

3. AFFIRMATIVE – Yes.

4. ALL AFTER – I refer to all the transmission following XXX. For example: "SPACELAB, HUNTSVILLE. SAY AGAIN ALL AFTER XXX."

5. BREAK – The current transmission is completed and new one will follow. For example, DMC, PROCEED AT THIS TIME. BREAK. OC, BEGIN ACTIVATION PROCEDURES.

6. BREAK BREAK – I wish to interrupt the transmission in progress. NOTE: These words shall be used only for urgent traffic.

7. COPY – I understand.

8. CORRECTION – An error has been made in the transmission and the correct version follows.

9. DISREGARD – Cancel my transmission or last transmission. For example: DISREGARD MY LAST TRANSMISSION.

10. EXPEDITE – Used when prompt compliance is required to avoid the development of an imminent situation.

11. GO AHEAD – Proceed with your transmission. Not to be used for any other purpose.

12. I SAY AGAIN – The message will be repeated.

13. IMMEDIATELY – Used when such action is required to avoid an imminent situation.

14. NEGATIVE – No or that is not correct.

15. ON MY MARK – An event is to take place. A countdown will be at 1-sec intervals. The countdown will start with 10, 5 or 2, and will end one second after "one" with the word "Mark" coincident with the event.

16. OUT – The conversation has ended and no response is expected.

17. OVER – My transmission has ended; I expect a response.

18. READ BACK – Repeat my message back to me.

19. REPORT – Advise when a specified event occurs.

20. ROGER – I have received and understand your transmission. NOTE: This is not to be used as an "affirmative" response.

21. SAY AGAIN – Used to request a repeat of the last transmission. E.g., "SAY AGAIN ALL AFTER 'LIGHT FAILED TO ILLUMINATE.' "

22. SPEAK SLOWER – Used in verbal communications as a request to reduce speech rate.

23. STAND BY – Means the position must pause for a few seconds, usually to attend to other duties of higher priority. Also means to "wait" as in "stand by for clearance." If a delay is lengthy, the caller should re-establish contact.

24. THAT IS CORRECT – The understanding that you have is right.

25. UNABLE – Indicates inability to comply with a specific instruction, request, or clearance.

26. VERIFY – Request confirmation of information; e.g., "VERIFY STEP 3 IS COMPLETE."

27. WHEN ABLE – When used in conjunction with instructions, this gives the latitude to delay compliance until a condition or event has been reconciled. "When Able" should not be used when expedient compliance is required.

28. WILCO – I will comply with your directive.

29. WORD AFTER – I refer to the word after XXX. For example: "SPACELAB, HUNTSVILLE. SAY AGAIN WORD AFTER XXX."

30. WORD BEFORE – I refer to the word before XXX. For example: "SPACELAB, HUNTSVILLE. SAY AGAIN WORD BEFORE XXX."

31. WORDS TWICE – As a request: "Communication is difficult. Please say every phrase twice." As information: "Since communications are difficult, every phrase in this message will be spoken twice."

REFERENCES

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2. Astro-1 Joint Operations Interface Procedures, Johnson Space Center, Texas, November 1985, JSC-20919.

3. FAR-AIM 1985, ASA Publications, Seattle, 1985.

APPROVAL

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AND TECHNIQUES

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The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

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Integration Laboratory

ACKNOWLEDGMENTS

Some of the information provided in this document has been paraphrased or copied from the references. Other portions document the professional approach to communications during simulations and the flights of Spacelab One, Spacelab Three, Spacelab Two, and Astro One. Thanks are due to the excellent communicators involved with those flights who developed their communications techniques and established the foundations upon which future missions will stand.

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
NASA TM-86562		

4. TITLE AND SUBTITLE	5. REPORT DATE
Space Flight Operations Communications Phraseology and Techniques	August 1986
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT #
Steven R. Noneman	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. WORK UNIT NO.
George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812	11. CONTRACT OR GRANT NO.
	13. TYPE OF REPORT & PERIOD COVERED
12. SPONSORING AGENCY NAME AND ADDRESS	Technical Memorandum
National Aeronautics and Space Administration Washington, D.C. 20546	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared by Systems Analysis and Integration Laboratory, Science and Engineering Directorate.

16. ABSTRACT

Communications are a critical link in space flight operations. Specific communications phraseology and techniques have been developed to allow rapid and clear transfer of information. Communications will be clear and brief through the use of procedural words and phrases. Communications protocols standardize the required information transferred. The voicing of letters and numbers is discussed. The protocols used in air-to-ground communications are given. A glossary of communications terminology is presented in the appendix.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
Space Flight Operations Voice Communications Procedures	Unclassified – Unlimited

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified	16	NTIS