Air-Ground Communications Briefing Note
5- Radio discipline

1. Introduction
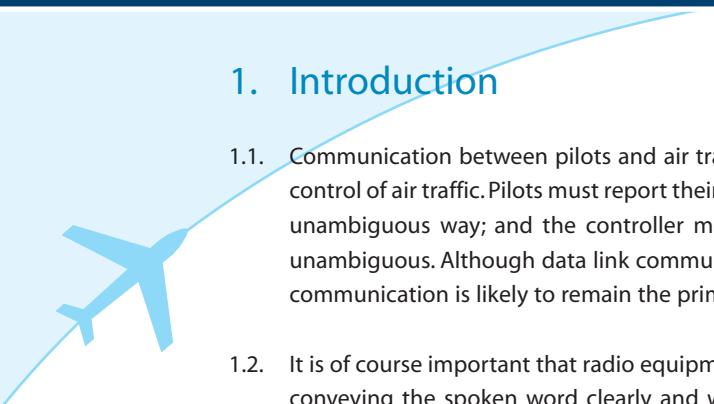
1.1. Communication between pilots and air traffic controllers is a process that is vital to the safe and efficient control of air traffic. Pilots must report their situation, intentions and requests to the controller in a clear and unambiguous way; and the controller must respond by issuing instructions that are equally clear and unambiguous. Although data link communication has reached an advanced stage of development, verbal communication is likely to remain the prime means of air-ground communication for many years.

1.2. It is of course important that radio equipment should be reliable and easy to use, and should be capable of conveying the spoken word clearly and without distortion over long distances. However, the process of communication is equally important and must be successful even in the most difficult conditions. Good radio discipline is essential to this process.

1.3. Of the many factors involved in the process of communication, phraseology is perhaps the most important, because it enables us to communicate quickly and effectively despite differences in language and reduces the opportunity for misunderstanding.

1.4. Standardised phraseology reduces the risk that a message will be misunderstood and aids the read-back/hear-back process so that any error is quickly detected. Ambiguous or non-standard phraseology is a frequent causal or contributory factor in aircraft accidents and incidents.

1.5. Other factors such as the format and content of the message, language and the speed and timeliness of transmissions also make important contributions to the communications process.

1.6. Finally, the read-back/hear-back process ensures that the transmitted message has been received and correctly understood.

1.7. A recent study[1] carried out for EUROCONTROL by the Dutch National Aerospace Laboratory (NLR) makes many recommendations based on an analysis of a large number of incidents reported in the European area.

2. Standard phraseology

2.1. International standards of phraseology are laid down by ICAO[2]. The most important of these are repeated in Section 3 below.

2.2. Many national authorities also publish radiotelephony manuals which amplify ICAO provisions, and in some cases modify them to suit local conditions (see paragraph 2.9).

2.3. This briefing note is not intended to replace ICAO or national documentation, but to supplement it.

2.4. Standard phraseology in pilot-controller communication is intended to be universally understood.

2.5.   Standard phraseology helps lessen the ambiguities of spoken language and thus facilitates a common understanding among speakers:
(a) of different native languages; or,
(b) of the same native language, but who use, pronounce or understand words differently.

2.6.   While the importance of standard phraseology is generally accepted, non-standard phraseology is a major obstacle to effective communications.

2.7.   Non-standard phraseology or the omission of key words may completely change the meaning of the intended message, resulting in potential traffic conflicts. For example, any message containing a number should indicate what the number refers to (e.g. a flight level, a heading or an airspeed). Inclusion of key words prevents erroneous interpretation and allows for effective read-back/hear-back.

2.8.   Particular care is necessary when certain levels are referred to because of the high incidence of confusion between, for example, FL100 and FL110.

2.9.   Non-standard phraseology is sometimes adopted unilaterally by national or local air traffic services, or is used by pilots or controllers in an attempt to alleviate problems; however, standard phraseology minimises the potential for misunderstanding. Sections 9&10 list examples of phraseology which have been adopted for use by certain countries, but which are contrary to ICAO phraseology.

3.   Message format and content

3.1.   The text of the message should be as short as practicable to contain the necessary information.

3.2.   The capacity of short-term memory is fairly limited: the maximum number of unrelated items that can be maintained is about seven. This has important implications for the amount of information that should be included in any single RTF message. Once this limit is exceeded, one or more items are likely to be lost or transposed.

4.   Language

4.1.   Language is potentially the greatest barrier to good communication. Because English has become a shared language in aviation, an effort has been initiated to improve the English-language skills of pilots and controllers worldwide. Nevertheless, even pilots and controllers for whom English is the native language may not understand all words spoken in English, because of regional accents or dialects.

4.2.   In many regions of the world language differences generate other communication difficulties. For example, controllers using both English (for communication with international flights) and the country's official language (for communication with domestic flights) hinder some flight crews from achieving the desired level of situational awareness (loss of "party-line communications")[3].

5. Speed of transmission

5.1.   ICAO recommends that the speech transmitting technique should be such that the highest possible intelligibility is incorporated in each transmission. Speech rate should be adjusted to allow clearances etc. to be written down if necessary.

6. Timeliness of communication

General

6.1.   Deviation from an ATC clearance may be required for operational reasons (e.g. a heading deviation or altitude deviation for weather avoidance, or an inability to meet a restriction).

6.2.   Both the pilot and the controller need time to accommodate this deviation; therefore ATC should be notified as early as possible.

Pilot workload

6.3.   Pilots have many tasks to perform; these are normally shared between the pilot flying (PF) and the pilot not flying (PNF) (pilot monitoring). At all times, one pilot is responsible for operation of the radios, although both pilots normally listen to calls directed to them when other duties permit.

6.4.   In addition to operational messages from air traffic control (ATC), the pilots have to make administrative calls to handling agents, airline operations, etc., and listen to voice weather broadcasts and the automated terminal information service (ATIS).

6.5.   Periods of very high workload include:
    (a) engine start, taxi, take-off and initial climb, standard instrument departure (SID);
    (b) descent, approach and landing;
    (c) abnormal situations such as equipment malfunction or extreme weather; and,
    (d) emergency situations.

6.6.   Multiple frequency changes are often given during high workload periods following take-off and during the SID. This can cause confusion and distraction from important monitoring tasks.

6.7.   Controllers may not be able to avoid passing or revising clearances during periods of high workload. However, by understanding when these occur, by passing on clearances as early as possible and by carefully monitoring readback, they can reduce the possibility of error. Further improvements may be possible by taking account of likely flight-deck workload when designing or revising ATC procedures.

7. Read-back/Hear-back

7.1.   ICAO Annex 11[4] requires that the safety-related part(s) of any clearance or instruction must be read back to the air traffic controller. Controllers must insist on an accurate read-back of clearances, both after initial issue and after any correction.

4 - Refer to ICAO Annex 11 Chapter 3 Section 3.7.3.

7.2. The action of reading back a clearance gives the controller an opportunity to confirm that the message has been correctly received, and if necessary, to correct any errors.

7.3. The pilot's read-back must be complete and clear to ensure a complete and correct understanding by the controller.

7.4. The absence of an acknowledgement or a correction following a clearance readback is perceived by most flight crews as an implicit confirmation of the read-back.

7.5. The absence of acknowledgement by the controller is usually the result of frequency congestion and the need for the controller to issue clearances to several aircraft in succession.

7.6. An uncorrected erroneous readback (known as a hear-back error) may lead to a deviation from the cleared altitude or non-compliance with an altitude restriction or with a radar vector.

7.7. A deviation from an intended clearance may not be detected until the controller observes the deviation on his/her radar display.

Short-term record

7.8. Some air traffic control centres provide controllers with a short-term recorder operated from the communications panel. Activation of the equipment plays back recorded messages in reverse chronological order, so that the last received message is played back first. When a controller is unsure of the correctness of a read-back, for example because the pilot has a heavy accent and is difficult to understand, use of this facility obviates the needed for repeated read-backs. In busy situations, this task can be delegated to the planner.

7.9. Short-term record is also a valuable tool for training, allowing the trainees to play back all their instructions, to correct their phraseology, intonation of the voice, etc. Additionally, it allows controllers to play back unusual situations which have occurred recently, providing an accurate picture of the event which can form the basis of informal discussion.

8.   Recommendations for operators

8.1. Insist on adherence to standard communications procedures by all flight crews.

8.2. Encourage communications best practice for flight crews.

8.3. Ensure that company standard operating procedures (SOPs) address all aspects of communications procedures, including:
   (a) adherence to ICAO standards and recommended practices (SARPs);
   (b) correct pronunciation;
   (c) procedures for monitoring communications (both pilots should listen to en-route clearances);
   (d) communication issues involved in the transfer of control between pilot flying (PF) and pilot not flying (PNF).

8.4. Provide resources for self-improvement in the use of the English language.

9. Recommendations for air navigation service providers

9.1. Insist on adherence to standard communications procedures by all controllers.

9.2. Encourage communications best practice for controllers.

9.3. Include in training packages communication procedures for emergency/unusual situations for which ICAO standard phraseology does not exist or is not sufficient.

9.4. Provide resources for self-improvement in the use of the English language.

9.5. Consider installing a short-term recorder to enable controllers to play back recent communications (see paragraphs 7.8 and 7.9 above).

10. Recommendations for pilots and controllers

10.1. Many recommendations apply equally to all transmissions. To avoid duplication, separate listings of recommendations for pilots and controllers are not given.

Phraseology

10.2. Communications should be concise and unambiguous. Use standard phraseology whenever available.

10.3. When it is necessary to spell out a word, use the standard ICAO spelling alphabet.

10.4. Convert ICAO abbreviations into the unabbreviated words or phrases (except for those which, in accordance with ICAO, should be transmitted as spoken words or as individual letters in non-phonetic form (e.g. CAVOK, ILS, QNH, RVR, etc.)).

10.5. Except as stated in the next paragraph, all numbers should be transmitted by pronouncing each digit separately. In the English language, pronunciation should follow the standard ICAO recommendations to avoid the confusion of digits (in particular, the spoken words "two" and "three" are often confused as are the spoken words "five" and "nine").

10.6. Numbers used in the transmission of altitude, cloud height, visibility and runway visual range (RVR) information, which contain whole hundreds and whole thousands, should be transmitted by pronouncing each digit in the number of hundreds or thousands followed by the word HUNDRED or THOUSAND as appropriate.

10.7. The word DECIMAL should be pronounced when appropriate, e.g. when passing an RTF frequency.

10.8. Table 1 overleaf gives examples of ICAO standard phraseology involving numbers, based on the provisions of ICAO Annex 10 Volume II. Note that Amendment List No 80 to ICAO Annex 10, dated 24 November 2005, provides a full explanation of the correct identification of VHF RTF frequencies depending on whether six digit (8.33kHz separation) or five digit (25kHz separation) is in use.

10.9. Messages should be transmitted in plain language or approved phrases. A complete listing of ICAO standard words and phrases is contained in ICAO Annex 10[5].

5 - ICAO Annex 10 Volume II Chapter 5 paragraph 5.2.1.5.8

10.10. Do not use the phrase "Go ahead" when it could be construed to mean that an aircraft is authorised to proceed.

10.11. Avoid the use of a word in an instruction which could be misinterpreted as a digit (e.g. the word "to" could be confused with the digit "2", or the word "for" with the digit "4").

10.12. Do not use the term "Roger" when a message requires a read-back or a positive or negative response. Message Format and Content.

10.13. Place the aircraft call sign at the beginning of a message. This allows pilots to identify messages intended for them quickly and reduces the chance of a message being acted on by the wrong pilot.

10.14. Use the full aircraft call sign when establishing communications. After satisfactory communication has been established, abbreviated call signs may be used provided that no confusion is likely to arise; however, an aircraft must use its full call sign until the abbreviated call sign has been used by the ground station.

10.15. Call signs may only be abbreviated in accordance with ICAO standard procedures, relevant portions of which are reproduced in Table 2. Note that most airline call signs belong to type (c) for which there is no abbreviation; therefore, abbreviations such as "RUSHAIR 34" are not permissible.

Message text

10.16. Limit the number of elements in a message to two to reduce the chance of an element being missed or misheard.

10.17. The elements of an RTF frequency are treated by a pilot as individual digits; therefore, do not combine a frequency change with another instruction.

10.18. Avoid combining numerical elements which may easily be confused in the same message, for example, flight level and heading.

10.19. Stress or repeat any non-standard elements in a message to ensure the pilot notes the differences from standard.

10.20. Avoid heavy accents or colloquialisms.

Read-back/Hear-back: Pilots

10.21. Always read back ATC clearances in full.

10.22. Do not switch immediately to the next sector frequency following read-back of controller's instruction. Ensure confirmation of your read-back is received.

10.23. If in doubt about an ATC instruction, ask the controller to re-confirm the clearance rather than saying what you thought you heard, (e.g. "London, confirm the cleared flight level for BIGJET 162" not "London, confirm the cleared flight level for BIGJET 162 is FL 190".) This procedure should also be followed if any doubt exists between flight crew members.

Table 1 – Examples of ICAO standard phraseology involving numbers	
Aircraft call sign OAL 242	*transmitted as* Olympic **two four two** [no abbreviation permitted]
flight levels Descend to FL 180 Maintain FL 100	*transmitted as* Descend to flight level **one eight zero** Maintain flight level **one zero zero**
altitudes 800 ft Climb to 3,400 ft 12,000 ft	*transmitted as* **eight hundred** feet climb to **three thousand four hundred** feet **one two thousand** feet
cloud height 2,500 ft	*transmitted as* **two thousand** five hundred feet
headings 100 degrees 080 degrees	*transmitted as* heading **one zero zero** heading **zero eight zero**
wind direction and speed 200 degrees 70 knots 160 degrees 18 knots gusting 30 knots	*transmitted as* wind **two zero zero** degrees **seven zero** knots wind **one six zero** degrees **one eight** knots gusting **three zero** knots
visibility 1,000 metres	*transmitted as* visibility **one thousand**
runway visual range (RVR) 600	*transmitted as* RVR **six hundred**
transponder codes 2400	*transmitted as* squawk **two four zero zero**
runway 27 30 R	*transmitted as* runway **two seven** runway **three zero right**
altimeter setting QNH 1010 QFE 990	*transmitted as* QNH **one zero one zero** QFE **nine nine zero**
RTF frequency 118.000 118.025 (25 kHz spacing) 118.025 (8.33 kHz spacing)	*transmitted as* **one one eight decimal zero** **one one eight decimal zero two** **one one eight decimal zero two five**
time 0920 1445	*pronounced as* **too ze-ro** or **ze-ro nin-er too ze-ro** **fow-er fife** or **wun fow-er fow-er fife**

Table 2 – Examples of full call signs and abbreviated call signs				
	Type (a)		Type (b)	Type (c)
Full call sign	ABCDE	AIRBUS ABCDE	RUSHAIR ABCDE	RUSHAIR 1234
Abbreviated call sign	ADE or ACDE	AIRBUS DE or AIRBUS CDE	RUSHAIR DE or RUSHAIR CDE	No abbreviated form.

10.24. Question unexpected instructions for any stage of flight.

10.25. Full read-back should never be replaced by the use of a term such as "Roger" or "Copied".

Read-back/Hear-back: Controllers

10.26. Always listen carefully to the read-back of a clearance.

10.27. Correct any error in the read-back and insist on further read-back until certain that the clearance has been correctly copied.

10.28. Do not use terms such as "Roger" to acknowledge messages requiring a definite answer (e.g. acknowledging a pilot's statement that an altitude or speed restriction cannot be met). Doing so decreases both the pilot's and the controller's situational awareness.

11. Non-standard phraseology in Europe

11.1. The UK CAA has adopted certain non-standard phraseology designed to reduce the chance of mishearing or misunderstanding RTF communications. This phraseology is not in accordance with ICAO but is based on careful study of the breakdown of pilot/controller communications. Some other European countries have also adopted similar non-standard phraseology.

11.2. The following paragraphs taken from the UK Manual of Radiotelephony[6] summarise the main differences.
(a) The word 'to' is to be omitted from messages relating to FLIGHT LEVELS.
(b) All messages relating to an aircraft's climb or descent to a HEIGHT or ALTITUDE employ the word 'to' followed immediately by the word HEIGHT or ALTITUDE. Furthermore, the initial message in any such RTF exchange will also include the appropriate QFE or QNH.
(c) When transmitting messages containing flight levels each digit shall be transmitted separately. However, in an endeavour to reduce 'level busts' caused by the confusion between some levels (100/110, 200/220 etc.), levels which are whole hundreds e.g. FL 100, 200, 300 shall be spoken as "Flight level (number) HUNDRED". The word hundred must not be used for headings.
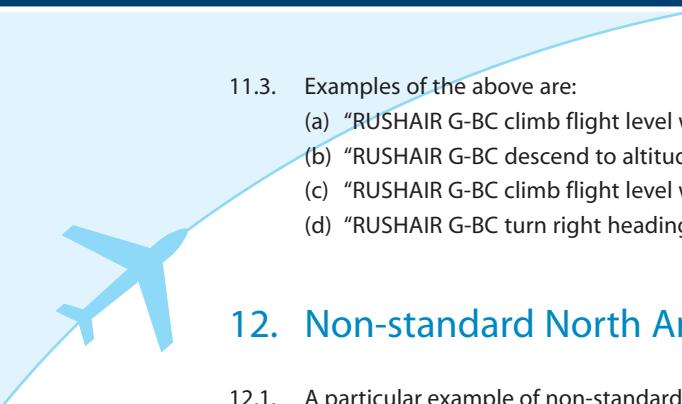
11.3.   Examples of the above are:

(a) "RUSHAIR G-BC climb flight level wun too zero."

(b) "RUSHAIR G-BC descend to altitude tree tousand feet QNH 1014."

(c) "RUSHAIR G-BC climb flight level wun hundred."

(d) "RUSHAIR G-BC turn right heading wun wun zero."

12. Non-standard North American phraseology

12.1.   A particular example of non-standard phraseology which is in regular use in North America is the instruction "taxi into position and hold", (which has the same meaning as the ICAO standard phrase "line up and wait"). This can be confused with the old ICAO phraseology "taxi to holding position" (which means taxi to, and hold at, a point clear of the runway).

12.2.   Use of this non-ICAO standard phraseology is fail-safe in North America, but in Europe can lead to an aircraft taxiing onto the runway when not cleared to do so.

12.3.   To overcome this problem ICAO has amended its phraseology to "taxi to holding POINT". [7]

13. Resources

13.1.   Other Air-Ground Communication (AGC) Briefing Notes

13.2.   There are five AGC Briefing Notes in this series, of equal applicability to flight operations and air traffic management:

■ No 1: General;

■ No 2: Call sign confusion;

■ No 3: Loss of communication;

■ No 4: Blocked transmissions; and,

■ No 5: Radio discipline.

Access to resources

13.3.   Most of the resources listed may be accessed free of charge from the Internet. Exceptions are:

■ ICAO documents, which may be purchased direct from ICAO;

■ Certain Flight Safety Foundation (FSF) Documents, which may be purchased direct from FSF;

■ Certain documents produced by the Joint Aviation Authorities, which may be purchased from JAA.

Regulatory resources

13.4.   Documents produced by regulatory authorities such as ICAO, JAA and national aviation authorities are subject to amendment. Reference should be made to the current version of the document to establish the effect of any subsequent amendment.

■ ICAO – Annex 10 – Aeronautical Telecommunications, Volume II – Communication Procedures including those with PANS status, Chapter 5 – Aeronautical Mobile Service Voice Communications, Section 5.2;

■ ICAO Doc 4444 – Procedures for Air Navigation Services (PANS-ATM)

■ ICAO Doc 9432 – Manual of Radiotelephony.

7 - See amendment 4 to the Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM, doc. 4444). Applicable 24 November 2005.

Other resources

- EUROCONTROL – Air-Ground Communication Safety Study: An Analysis of Pilot-Controller Communications;
- EUROCONTROL – Air-Ground Communication Safety Study: Causes and Recommendations;
- FAA Report – An Analysis of Ground Controller-Pilot Voice Communications;
- FSF Accident Prevention Volume 47 No 6 – My Own Mouth shall Condemn Me;
- UK CAA Safety Sense – RT Discipline (for Pilots & ATC).