

CHAPTER 19 — COMMUNICATIONS

DGCA RTR(A) / CPL / ATPL Study Notes — Air Regulations

Reference: ICAO Annex 10 · ICAO Doc 4444 · AIP India

Chapter Contents

- | | |
|--|--|
| 1. VFR Communications & Definitions | 17. RVR / Visibility |
| 2. Q-Codes (RTF Air-Ground) | 18. Air-Ground Communications |
| 3. Categories of Messages (Priority) | 19. ATIS & D-ATIS |
| 4. General Operating Procedures | 20. VOLMET |
| 5. Transmission of Numbers | 21. Distress & Urgency Procedures |
| 6. Transmission of Time | 22. IFR Communications |
| 7. Standard Phraseology (A–W) | 23. Wake Turbulence Phraseology |
| 8. Aeronautical Station Call Signs | 24. Level Reporting & Position Reports |
| 9. Read-Back & Acknowledgement | 25. Model AIREP SPECIAL |
| 10. Transfer of Communication | 26. VHF Propagation & Wave Theory |
| 11. Readability Scale & Test Calls | 27. Frequency Bands & Allocations |
| 12. Aircraft Call Signs (Full & Abbreviated) | 28. Satellite Communications |
| 13. Radar Procedural Phraseology | 29. Propagation of Radio Waves |
| 14. Traffic Information & Avoiding Action | 30. LOS, Tx Power & RCP |
| 15. Weather Information (VFR) | 31. CPDLC & ADS |
| 16. METAR / SPECI / TREND Format | |

1. VFR Communications & Definitions

WHAT THIS CHAPTER COVERS

Radiotelephony (RTF) procedures used for two-way air-ground voice communication between aircraft and Air Traffic Services (ATS) units, including standard phraseology, Q-codes, distress procedures, weather messages, and the underlying radio-wave theory.

Commonly Used Abbreviations Specific to R/T

Certain abbreviations have become so embedded in aviation terminology that they are **spoken using their constituent letters** rather than the phonetic spelling alphabet.

SPOKEN AS LETTERS (NOT PHONETICALLY)

Examples: **ILS**, **QNH**, **RVR**, **VOR**, **DME**, **ATIS**, **METAR**, etc.

i.e. say "I-L-S" — not "India Lima Sierra".

2. Q-Code Groups Used in RTF Air-Ground Communications

DEFINITION — Q-CODE

A Q-code is a three-letter group beginning with "**Q**", used as a shorthand to either **ask a question** or **give an answer/advice**. Same code carries both meanings depending on whether it's transmitted as a question or response.

Q-Code	Question	Answer / Advice
QDL	Do you intend to ask me for a series of bearings?	I intend to ask you for a series of bearings.
QDM	Will you indicate the MAGNETIC heading for me to steer towards you (no wind)?	The MAGNETIC heading for you to steer to reach me (no wind) was ... degrees (at ... hours).
QDR	What is my MAGNETIC bearing from you?	Your MAGNETIC bearing from me was ... degrees (at ... hours).
QFE	What should I set on the altimeter sub-scale so the instrument indicates height above the reference elevation ?	If you set the sub-scale to ... millibars, the altimeter will indicate height above aerodrome elevation (above threshold, runway no. ...).
QFU	What is the magnetic direction (or number) of the runway to be used?	The magnetic direction (or number) of the runway in use is ... Note: Runway number = two-figure group; magnetic direction = three-figure group.
QGH	May I land using ... (procedure or facility)?	You may land using ... (procedure or facility).
QNE	What indication will my altimeter give on landing at ... (place) at ... hrs, with sub-scale set to 1013.2 mb (29.92 in) ?	On landing at ... your altimeter will indicate ... (figures and units).
QNH	What should I set on the sub-scale so the altimeter indicates elevation if my aircraft were on the ground at your station?	Set sub-scale to ... millibars; altimeter will indicate elevation if on the ground at my station at ... hrs. Note: If setting is given in hundredths of an inch, abbreviation "INS" is used.
QTE	What is my TRUE bearing from you? / from (call sign)? / TRUE bearing of (call sign) from (call sign)?	Your TRUE bearing from me is ... degrees at ... hours.
QUJ	Will you indicate the TRUE track to reach you?	The TRUE track to reach me is ... degrees at ... hours.

MEMORY AID — BEARINGS & TRACKS

- **QDM** — "D for Direction to" — Magnetic HEADING **TO** the station (no wind).
- **QDR** — "R for Radial / from" — Magnetic BEARING **FROM** the station.
- **QTE** — "True" — TRUE bearing FROM the station.
- **QUJ** — "U-Track True" — TRUE TRACK TO the station.
- **QFE** — sub-scale for **HEIGHT** above aerodrome.
- **QNH** — sub-scale for **ELEVATION** (i.e. altitude AMSL).
- **QNE** — sub-scale set to **1013.2 mb** / **29.92 in** = Standard / Flight Level.

Visual Reference — QDM vs QDR vs QTE

flowchart LR

```
A((Aircraft)) -- "QDM: Mag HDG TO stn" --> S((Ground Station))
S -- "QDR: Mag BRG FROM stn" --> A
S -. "QTE: TRUE bearing FROM stn" .-> A
A -. "QUJ: TRUE track TO stn" .-> S
```

3. Categories of Messages (Priority Order)

PRIORITY ORDER — STRICT HIERARCHY

Messages in the Aeronautical Mobile Service follow this **strict priority order**. Higher-priority messages always take precedence over lower-priority traffic.

Priority	Category	Signal / Prefix
a)	Distress messages, distress calls, distress traffic	MAYDAY MAYDAY MAYDAY
b)	Urgency messages (incl. medical transports)	PAN PAN / PAN PAN MEDICAL / SECURITE
c)	Communications relating to direction finding	—
d)	Flight safety messages	—
e)	Meteorological messages	—
f)	Flight regularity messages	—

GHOST AVIATOR

flowchart TD

A[1. DISTRESS - MAYDAY] --> B[2. URGENCY - PAN PAN / SECURITE]

B --> C[3. Direction Finding]

C --> D[4. Flight Safety]

D --> E[5. Meteorological]

E --> F[6. Flight Regularity]

style A fill:#fecaca,stroke:#b91c1c,stroke-width:3px

style B fill:#fed7aa,stroke:#c2410c,stroke-width:2px

style C fill:#fef08a,stroke:#854d0e

style D fill:#bbf7d0,stroke:#15803d

style E fill:#bae6fd,stroke:#0369a1

style F fill:#e9d5ff,stroke:#6b21a8

4. General Operating Procedures — Pronunciation Standards

STANDARD ICAO PRONUNCIATION

Numbers are transmitted using **specific ICAO phonetic pronunciations** to avoid confusion over noisy or distorted radio links. Memorise these — they are heavily tested.

Number Pronunciation

Digit	Pronounced as	Digit	Pronounced as
0	ZE-RO	5	FIFE
1	WUN	6	SIX
2	TOO	7	SEV-en
3	TREE	8	AIT
4	FOW-er	9	NIN-er
Decimal	DAY-SEE-MAL	Hundred	HUN-dred
Thousand	TOU-SAND		

GHOST AVIATOR

Examples — Aircraft Callsigns, Levels, Headings, Wind

Application	Example	Transmitted as	Pronounced as
Aircraft callsign	AI 235	Air India 235	Air India TOO TREE FIFE
	6E 146	IFLY 146	IFLY WUN FOWEr SIX
Flight levels	FL 180	flight level one eight zero	flight level WUN AIT ZE-RO
	FL 200	flight level two zero zero	flight level TOO ZE-RO ZE-RO
	FL 70	flight level seven zero	flight level SEVen ZE-RO
Headings	150	heading one five zero	heading WUN FIFE ZE-RO
	080	heading zero eight zero	heading ZERO AIT ZE-RO
	300	heading three zero zero	heading TREE ZE-RO ZE-RO
Wind direction & speed	020° / 70 kt	wind zero two zero degrees seven zero knots	wind ZE-RO TOO ZE-RO degrees SEVen ZE-RO knots
	100° / 18 kt	wind one zero zero degrees one eight knots	wind WUN ZE-RO ZE-RO degrees WUN AIT knots
	210° / 18 G 30 kt	wind two one zero degrees one eight knots gusting three zero knots	wind TOO WUN ZE-RO degrees WUN AIT knots gusting TREE ZE-RO knots
Runway designator	19	runway one nine	runway WUN NINer
	06	runway zero six	runway ZE-RO SIX
	23L	runway two three left	runway TOO TREE left
Mach number	0.84	Mach decimal eight four	Mach DAY-SEE-MAL AIT FOWEr
Altimeter setting	984 hPa	QNH nine eight four	QNH NINer AIT FOWEr
	1027 hPa	QNH one zero two seven	QNH WUN ZE-RO TOO SEVen
Frequencies	128.3 MHz	one two eight decimal three	WUN TOO AIT DAY-SEE-MAL TREE

Join live classes for guided practice and doubt clearing.

Application	Example	Transmitted as	Pronounced as
	135.75 MHz	one three five decimal seven five	WUN TREE FIFE DAY-SEE-MAL SEVen FIFE
	5643 kHz	five six four three	FIFE SIX FOWer TREE

5. Transmission of Numbers — Hundreds & Thousands Rule

⚠️ STRICT DGCA / ICAO RULE

All numbers used in transmission of **altitude, height, cloud height, visibility, and runway visual range (RVR)** which contain **whole hundreds and whole thousands** shall be transmitted by:

1. Pronouncing **each digit** in the number of hundreds or thousands,
2. Followed by the word **HUNDRED** or **THOUSAND** as appropriate.

Combinations of thousands and whole hundreds: pronounce each digit of the thousands followed by "THOUSAND", then the hundreds digit followed by "HUNDRED".

Number	Correct Transmission
800	EIGHT HUNDRED
3 500	THREE THOUSAND FIVE HUNDRED
4 500	FOUR THOUSAND FIVE HUNDRED
11 000	ONE ONE THOUSAND
13 500	ONE THREE THOUSAND FIVE HUNDRED

🧠 WATCH-OUT — FLIGHT LEVELS USE A DIFFERENT RULE

Flight Levels are **NOT** spoken with "thousand/hundred". Each digit is pronounced separately.
Example: FL 180 → **flight level WUN AIT ZE-RO** (NOT "flight level one eighty").

6. Transmission of Time

✓ TIME TRANSMISSION SOP

- When transmitting time, normally **only the minutes of the hour** are required.
- However, the **hour shall be included** if any possibility of confusion exists.
- Time checks shall be given to the **nearest half minute**.
- **Coordinated Universal Time (UTC)** shall be used at all times, unless otherwise specified.
- **2400** hours designates midnight (end of day); **0000** hours = beginning of day.

Time	Transmitted as (minutes only)	Transmitted as (hour + minutes)
0920 (9:20 AM)	TOO ZE-RO	ZE-RO NINer TOO ZE-RO
1643 (4:43 PM)	FOWer TREE	WUN SIX FOWer TREE
175321 (5:53:21 PM)	FIFE TREE AND A HALF	WUN SEVEN FIFE TREE AND A HALF

7. Standard ICAO Phraseology (A–W)

▣ WHY STANDARD PHRASEOLOGY?

Standard phraseology eliminates ambiguity, reduces RTF time, and ensures every pilot and controller worldwide understands the same word the same way. **Deviation can be safety-critical.**

ACKNOWLEDGE

"Let me know that you have received and understood this message."

AFFIRM

"Yes."

Join live classes for guided practice and doubt clearing.

APPROVED

"Permission for proposed action granted."

BREAK

"I hereby indicate the separation between portions of the message." — **used where there is no clear distinction between the text and other portions of the message.**

BREAK BREAK

"I hereby indicate the separation between messages transmitted to different aircraft in a very busy environment."

CANCEL

"Annul the previously transmitted clearance."

CHANGING TO

When transferring to a pilot-to-controller channel — Aircraft: "CHANGING TO ..." (ATS unit concerned).

CHECK

"Examine a system or procedure." **Not to be used in any other context. No answer is normally expected.**

CLEARED

"Authorized to proceed under the conditions specified."

CLEARED FOR IMMEDIATE TAKE-OFF

"Taxi immediately to runway and commence take-off without stop."

CLIMB

"Climb to a FL, Altitude or Height."

CONFIRM

"I request verification of: **clearance, instruction, action, information.**"

CONTACT

"Establish communications with ..."

CORRECT

"True" or "Accurate".

CORRECTION

"An error has been made in this transmission (or message indicated). The correct version is ..."

CORRECTION, I SAY AGAIN

If a correction can best be made by repeating the entire message, the operator shall use the phrase "CORRECTION, I SAY AGAIN" before transmitting the message a second time.

DESCEND

"Descend to a FL, Altitude or Height."

DISREGARD

"Ignore."

HOLD SHORT

"Stop before reaching the specified location." **Only used in limited circumstances where no defined Point exists (e.g. where there is no suitably located holding point), or to reinforce a clearance limit.**

HOW DO YOU READ

"What is the readability of my transmission?"

I SAY AGAIN

"I repeat for clarity or emphasis."

LANDED

After landing — Aircraft: "LANDED ... (location) ... (time)".

MAINTAIN

"Continue in accordance with the condition(s) specified" or in its literal sense, e.g. "Maintain VFR".

MONITOR

"Listen out on (frequency)."

NEGATIVE

"No" or "Permission not granted" or "That is not correct" or "Not capable".

NEGATIVE, I SAY AGAIN

If, in checking the correctness of a read-back, an operator notices incorrect items, he shall transmit the words "NEGATIVE I SAY AGAIN" at the conclusion of the read-back followed by the correct version of the items concerned.

OPERATIONS NORMAL

When "operations normal" reports are transmitted by aircraft, they should consist of the prescribed call followed by the words "OPERATIONS NORMAL".

OVER

"My transmission is ended, and I expect a response from you." **Not normally used in VHF communications.**

OUT

"This exchange of transmissions is ended and no response is expected." **Not normally used in VHF communications.**

READ BACK

"Repeat all, or the specified part, of this message back to me exactly as received."

RECLEARED

"A change has been made to your last clearance and this new clearance supersedes your previous clearance or part thereof."

REPORT

"Pass me the following information ..."

REQUEST

"I should like to know ..." or "I wish to obtain ..."

ROGER

"I have received all of your last transmission." **Under no circumstances to be used in reply to a question requiring "READ BACK" or a direct answer in the affirmative (AFFIRM) or negative (NEGATIVE).**

SAY AGAIN / SAY AGAIN (item) / SAY AGAIN all after / SAY AGAIN all before / SAY AGAIN all between ... and ...

"Repeat all, or the following part, of your last transmission."

SPEAK SLOWER

"Reduce your rate of speech."

STANDBY

"Wait and I will call you." **The caller would normally re-establish contact if the delay is lengthy. STANDBY is not an approval or denial.**

UNABLE / IMPOSSIBLE

"I cannot comply with your request, instruction or clearance" (normally followed by a reason). / "To indicate that a request cannot be complied with, or that a requested manoeuvre cannot be executed."

VERIFY

"Confirm from originator."

WILCO (Abbreviation for "will comply")

"I understand your message and will comply with it."

WORDS TWICE

a) As a request: "Communication is difficult. Please send every word, or group of words, twice."

b) As information: "Since communication is difficult, every word, or group of words, in this message will be sent twice."

IMPORTANT DELETION — "GO AHEAD"

The phrase **"GO AHEAD"** has been **deleted**. In its place, the use of the **calling aeronautical station's call sign followed by the answering aeronautical station's call sign** shall be considered the invitation to proceed with transmission by the station calling.

8. Call Signs for Aeronautical Stations

SUFFIX SYSTEM

Every ATS unit has a defined RTF call-sign suffix that tells the pilot exactly what type of service is being provided. The aerodrome/area name precedes the suffix (e.g. "Delhi Tower", "Mumbai Approach").

Unit / Service Available	Call Sign Suffix
Area Control Centre	CONTROL
Upper / Lower Control Area	UPPER / LOWER CONTROL
Approach Control	APPROACH
Approach Control Radar / Area Control Radar	APPROACH RADAR / CONTROL RADAR
Aerodrome Control	TOWER
Surface Movement Control	GROUND
Radar (in general)	RADAR
Precision Approach Radar	PRECISION
Direction-finding Station	HOMER
Flight Information Service	INFORMATION
Clearance Delivery	DELIVERY
Apron Control	APRON
Company Dispatch	DISPATCH
Aeronautical Station	RADIO
Flow Control	FLOW

9. Read-Back & Acknowledgement Requirements

⚠ MANDATORY READ-BACK ITEMS

The flight crew **shall read back** to the air traffic controller the **safety-related parts** of clearances and instructions transmitted by voice. Items NOT listed below may be acknowledged by aircraft call sign or by an abbreviated read-back.

QNH IS ALWAYS READ BACK.

The following items shall **always be read back**:

- a. **ATC route clearance**;
- b. **Clearances and instructions to enter, land on, take off on, hold short of, cross, taxi and back-track on any runway**; and
- c. **Runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructions** and — whether issued by the controller or contained in ATIS broadcast — **transition levels**.

flowchart TD

```
Q[ATC Instruction Received] --> R{Is it a safety-critical item?}
R -- "Route clearance / Runway entry / TO / Land / Cross / Hold Short / Back-track" --> M[FULL READ-BACK Mandatory]
R -- "RWY in use / QNH / SSR / Level / Heading / Speed / Transition Level" --> M
R -- "Other info" --> A[Acknowledge by callsign or abbreviated read-back]
style M fill:#fecaca,stroke:#b91c1c,stroke-width:3px
style A fill:#bbf7d0,stroke:#15803d,stroke-width:2px
```

10. Transfer of Communication

✓ STANDARD PROCEDURE

- An aircraft will **normally be advised** by the appropriate aeronautical station to change from one radio frequency to another in accordance with agreed procedures.
- **In the absence of such advice**, the aircraft shall **notify** the aeronautical station before such a change takes place.
- Aircraft flying in **controlled airspace must obtain permission** from the controlling authority before changing frequency.
- An aircraft may be instructed to **standby** on a frequency when the ATSU will initiate communications, and to **monitor** a frequency on which information is being broadcast.

11. Readability Scale & Test Calls

⚠ TEST TRANSMISSION TIME LIMIT

All radio transmissions for test purposes shall be of the **minimum duration** necessary for the test and shall **NOT continue for more than 10 seconds**. The recurrence of such transmissions shall be kept to the minimum necessary for the test.

GHOST AVIATOR

Readability Scale (1–5)

Scale	Readability
1	Unreadable
2	Readable now and then
3	Readable but with difficulty
4	Readable
5	Perfectly readable

12. Aircraft Call Signs — Full & Abbreviated

Full Call Sign Types

Type	Description	Example
a)	Character corresponding to the registration marking of the aircraft.	VTEJP or CESSNA VTEJP
b)	Telephony designator of the aircraft operating agency, followed by the last four characters of the registration marking.	AIRINDIA TEJP
c)	Telephony designator of the aircraft operating agency, followed by the flight identification.	AIRINDIA 809

Abbreviated Call Signs

WHEN CAN YOU ABBREVIATE?

After **satisfactory communication has been established**, and provided **no confusion is likely to occur**, aircraft call signs may be abbreviated as follows:

Type	Description	Example
a)	The first character of the registration AND at least the last two characters of the call sign.	VJP or CESSNA VJP
b)	Telephony designator of the operating agency, followed by at least the last two characters of the call sign.	AIRINDIA JP
c)	Telephony designator of the operating agency, followed by the flight identification.	NO ABBREVIATED FORM

13. Radar Procedural Phraseology

Radar Identification of Aircraft

IDENTIFICATION ≠ RADAR SERVICE

An aircraft must be identified before it can be provided with a radar service. However, **the act of identifying an aircraft is not a service in itself** — pilots should not assume they are receiving a radar service, particularly when flying outside controlled airspace.

When a controller has identified an aircraft, he will inform the pilot, according to circumstances, of the following:

- That the aircraft is **identified**, and
- Of the **position** of the aircraft.

The pilot will be **warned if identification is lost**, or about to be lost, and appropriate instructions given.

Secondary Surveillance Radar (SSR) Phraseology

MANDATORY ACTION

The pilot **MUST respond to SSR instructions**, and **read back specific settings**.

Radar Service

Where it is not self-evident, pilots will normally be informed by the controller when they are under **radar control**, **radar advisory**, or **information service**.

Radar Vectoring

- Aircraft may be given specific vectors to fly in order to establish separation. Pilots may be informed of the reasons for radar vectoring.
- It may be necessary for a controller to know the heading of an aircraft as separation can often be established by instructing an aircraft to continue on its existing heading.
- A controller may not know the aircraft's heading but does require the aircraft to fly a particular heading.
- When vectoring is complete, pilots will be instructed to **resume their own navigation**, given position information and appropriate instructions as necessary.
- Occasionally an aircraft may be instructed to make a **complete turn** (known as an **ORBIT** or a **360-degree turn**) or given a heading, for delaying purposes or to achieve required spacing behind preceding traffic.

14. Traffic Information & Avoiding Action Phraseology

✓ STANDARD TRAFFIC INFORMATION FORMAT

Whenever practicable, information regarding traffic on a possible conflicting path should be given in the following form:

- a. **Relative bearing** of the conflicting traffic in terms of the **12-hour clock**; or, if the aircraft under service is established in a turn, the **relative position** of the conflicting traffic in relation to **cardinal points** (i.e. northwest, south etc.);
- b. **Distance** from the conflicting traffic;
- c. **Direction of flight** of the conflicting traffic; and
- d. **Relative speed** of the conflicting traffic or the **type of aircraft** and **level** if known.

RELATIVE MOVEMENT TERMS

Relative movement should be described using one of the following terms as applicable:

**closing · converging · parallel · same direction · opposite direction · diverging ·
overtaking · crossing left to right · crossing right to left**

If level is known: **1000 ft above/below** .

AVOIDING ACTION

Avoiding action is given by the controller when an **imminent risk of collision** will exist if action is not taken immediately. The controller will inform the pilot when the conflict **no longer exists**.

15. Relevant Weather Information Terms (VFR)

Aerodrome Weather Sources

A pilot may obtain weather through many sources such as: request from **ATC**, **Meteorological Offices**, **ATIS**, **VOLMET**, etc.

GHOST AVIATOR

Current Weather Messages & Forecasts

Term	Meaning
METAR	Aviation Routine Weather Report
SPECI	Aviation Selected Special Weather Report
TREND	Expected changes in the next 2 hours
TAF	Aerodrome Forecast
ROFOR	Route Forecast
SIGMET	Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.
AIRMET	Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of low-level aircraft operations and which was not already included in the forecast issued for low-level flights in the FIR concerned (or sub-area thereof).

Cloud Reporting

CLOUD AMOUNT IN OCTAS (EIGHTHS OF SKY)

Term	Octas (eighths)	Coverage
FEW	1 – 2 octas	Few clouds
SCATTERED (SCT)	3 – 4 octas	Less than half
BROKEN (BKN)	5 – 7 octas	More than half, not full
OVERCAST (OVC)	8 octas	Total / 100% cover

Example reading: "**Few at 2000, Scattered at 500, scattered cumulonimbus at 1000, broken at 2500.**"

✓ CAVOK — CEILING AND VISIBILITY OK

When the following **ALL** conditions are met, the term "**CAVOK**" is used:

- Visibility $\geq$ **10 km** ;
- NO cloud below **1500 m (5000 ft)** or below the highest minimum sector altitude, whichever is greater;
- NO cumulonimbus;
- NO precipitation, thunderstorm, shallow fog, or low drifting snow.

16. METAR / SPECI / TREND — Format & Decoding

Example 1: VIDP 070200Z 12003KT 2000 BR SKC 10/08 Q1013 NOSIG

Decoded: Delhi (VIDP) weather at 0200 UTC on the 07th — surface wind 120° / 03 kt, visibility 2000 m, mist, sky clear, temp 10 °C, dew point 08 °C, QNH 1013, trend = no significant change.

Example 2: VOBG 070030Z 12003KT 4000 HZ BKN004 18/16 Q1014 TEMPO 3000

Decoded: Bangalore (VOBG) at 0030 UTC on the 07th — surface wind 120° / 03 kt, visibility 4000 m in haze, clouds 5–7 octas at 400 ft, temp 18 °C, dew point 16 °C, QNH 1014. Trend: visibility expected to decrease temporarily to 3000 m.

17. Runway Visual Range (RVR) / Visibility

✓ RVR TRANSMISSION

- When transmitting RVR, the abbreviation "**RVR**" is used **without** spelling each letter phonetically.
Example: "**RVR runway 27, 800.**"
- The runway designator **may be omitted** if there is no possibility of confusion.
- Where **instrumented RVR (IRVR)** observations are available, **more than one reading** may be transmitted (e.g. touchdown, mid-point, stop-end).

⚠ CORRECT WAY OF EXPRESSING VISIBILITY

Visibility is expressed in **METRES** (or kilometres if large).

Example: "**Visibility 1200 metres**" — NOT "1.2 nautical miles" and NOT "1200 feet".

18. Air/Ground Communications

📺 CHANNELS PROVIDED TO INDIAN ATS UNITS

Air-Ground communications between aircraft and Indian ATS units are provided on the channels given below:

- Air/Ground (Voice) over **High Frequency (HF) Radio**.
- Air/Ground (Voice) over **Very High Frequency (VHF) Radio**.
- Air/Ground (Voice) over **Ultra High Frequency (UHF) Radio**.
- Remote Controlled Air-Ground (RCAG)** communication — for extended range of VHF/UHF Radio.
- ADS-CPDLC Service** is available at **Mumbai, Delhi, Kolkata, and Chennai**.

19. Automatic Terminal Information Service (ATIS)

✓ ATIS — ROUTINE AERODROME INFORMATION

- ATIS is available in **almost all airports in India**.
- This broadcast is related to the **terminal aerodrome** and is **continuous and repetitive**.
- Provides **routine information to arriving and departing aircraft** by means of continuous and repetitive broadcast.
- **Data Link ATIS (D-ATIS)** service is provided through **Pre-FANS Data Link**.

GHOST AVIATOR

20. Voice Weather Broadcast (VOLMET)

📘 WHAT IS VOLMET?

VOL (flight) + **MET** (meteorology). Meteorological aerodrome reports for certain aerodromes are **broadcast on specified HF frequencies**. The callsign, frequency, operating hours, aerodromes contained within the group, and contents are published in the **AIP**.

VOLMET is presently broadcast by **Mumbai and Kolkata** stations on HF frequencies.

Content of a VOLMET Broadcast

GHOST AVIATOR

- Aerodrome identification (e.g. Mumbai / Kolkata)
- Surface wind
- Visibility
- RVR (if applicable)
- Weather
- Cloud
- Temperature
- QNH

- Trend (if applicable)

D-VOLMET NOTE

Data Link VOLMET (**D-VOLMET**) service is provided through Pre-FANS Data Link. Non-essential words such as "surface wind", "visibility" etc. are **NOT spoken** in D-VOLMET.

21. Distress & Urgency Procedures

DISTRESS TRAFFIC FREQUENCY RULE

Distress traffic shall **normally be maintained on the frequency on which such traffic was initiated**, until it is considered that better assistance can be provided by transferring that traffic to another frequency. Any other frequency shall be used to establish contact with any land/mobile or direction-finding station.

International Distress Frequencies

Frequency	Description
121.5 MHz / 243 MHz	International VHF / UHF distress frequency
2182 kHz	International distress frequency (MF band)
500 kHz	International Maritime distress frequency

Special Purpose SSR Codes

SSR Code	Meaning
7700	Emergency / Distress
7600	Radio Communication Failure
7500	Hijack or Other Act of Violence

Join live classes for guided practice and doubt clearing.

ELT Transmission Frequencies

✓ EMERGENCY LOCATOR TRANSMITTER (ELT)

ELT transmissions are made on:

- 121.5 MHz
- 243 MHz
- 406 MHz

■ SIGNAL WORDS

- **MAYDAY MAYDAY MAYDAY** — Distress signal (spoken 3 times)
- **PAN PAN PAN PAN PAN PAN** — Urgency signal (spoken 3 times)
- **PAN PAN MEDICAL** — Protected medical transport prefix
- **SECURITE SECURITE SECURITE** — Safety signal

```
graph TD
    E[Emergency Situation] --> T{Type?}
    T -- "Threatened by grave / imminent danger - immediate assistance" --> D[DISTRESS  
MAYDAY x3  
Squawk 7700]
    T -- "Safety of aircraft/person concerned - no immediate assistance" --> U[URGENCY  
PAN PAN x3]
    T -- "Radio Comm Failure" --> R[Squawk 7600]
    T -- "Hijack / Unlawful interference" --> H[Squawk 7500]
```

style D fill:#fecaca,stroke:#b91c1c,stroke-width:3px
style U fill:#fed7aa,stroke:#c2410c,stroke-width:2px
style R fill:#fef08a,stroke:#854d0e,stroke-width:2px
style H fill:#fecaca,stroke:#7f1d1d,stroke-width:3px

22. IFR Communications

✅ IFR VS VFR PROCEDURES

The procedures specified above for **VFR flights** are equally applicable to **IFR flights**. IFR flights will maintain **two-way communications** with ground in **ALL classes of airspace**.

An IFR flight operating **outside controlled airspace** shall **maintain listening watch** and **establish two-way communications** with the ATS unit providing **Flight Information Service**.

23. Wake Turbulence Phraseology

⚠️ MANDATORY WAKE CATEGORY SUFFIX

Aircraft in the **heavy wake turbulence category** shall include the word **"HEAVY"** immediately after the aircraft call sign **in the initial call to each ATSU**.

For the **Airbus A380**, the word **"SUPER"** is to be included after the call sign on initial contact.

Purpose: confirm the aircraft type and/or wake turbulence category is the same as that stated on the flight progress strip.

Wake Category	Suffix on initial call	Example
Heavy (e.g. B777, B747)	HEAVY	"AIR INDIA 285 HEAVY"
Super (A380)	SUPER	"EMIRATES 504 SUPER"

24. Level Reporting & Voice Position Reports

Level Reporting

WHOLE NUMBERS & REFERENCE

- All messages relating to an aircraft's climb or descent to a **HEIGHT (QFE)** or **ALTITUDE (QNH)** are given in **whole numbers**.
- The **initial message** in any such RTF exchange will also include the **appropriate QFE or QNH**.
- When transmitting messages containing **flight levels (1013.2 hPa)** each digit shall be transmitted separately.
- Once given an instruction to climb or descend, a **further overriding instruction** may be given to a pilot.

Content of Voice Position Reports

STANDARD POSITION REPORT ELEMENTS

1. Aircraft identification
2. Position
3. Time
4. Flight level or altitude
5. Next position and time over
6. Ensuing significant point

Meteorological Information at MET Reporting Points

ONCE PER FIR

Pilots shall give the following meteorological information **once in each FIR** along with the position report at **designated MET reporting points** on international and national ATS routes:

- Air temperature
- Wind direction
- Wind speed
- Turbulence
- Aircraft icing
- Humidity (if available)

25. Model AIREP SPECIAL

SPECIAL AIR-REPORT

An **AIREP SPECIAL** is a special air-report transmitted by an aircraft when an unusual or hazardous meteorological phenomenon is encountered en-route.

Section	Item	Parameter	Transmit in Telephony
—	—	Message-type designator	(AIREP SPECIAL)
SECTION 1	1	Aircraft identification	(aircraft identification)
	2	Position	POSITION (lat/long) / OVER (sig pt) / ABEAM (sig pt) / (sig pt) (bearing) (distance)
	3	Time	(time)
	4	Level	FLIGHT LEVEL (no.) or (no.) METRES/FEET / CLIMBING TO FL (no.) / DESCENDING TO FL (no.)
	5	Next position and ETO	(position) (time)
	6	Ensuing significant point	(position) NEXT
SECTION 2	7	Estimated time of arrival	(aerodrome) (time)
	8	Endurance	ENDURANCE (hours and minutes)
SECTION 3	9	Moderate turbulence	TURBULENCE MODERATE
		Severe turbulence	TURBULENCE SEVERE
		Moderate icing	ICING MODERATE
		Severe icing	ICING SEVERE
		Severe mountain wave	MOUNTAIN WAVE SEVERE
		Thunderstorms without hail	THUNDERSTORMS
		Thunderstorms with hail	THUNDERSTORMS WITH HAIL
		Heavy dust / sand storm	DUST STORM or SAND STORM HEAVY
		Volcanic ash cloud	VOLCANIC ASH CLOUD
		Pre-eruption volcanic activity / volcanic eruption	PRE-ERUPTION VOLCANIC ACTIVITY or VOLCANIC ERUPTION
		Runway braking action	GOOD / GOOD TO MEDIUM / MEDIUM / MEDIUM TO POOR / POOR / LESS THAN POOR

Join live classes for guided practice and doubt clearing.

ADDITIONAL — TRANSONIC & SUPERSONIC FLIGHTS

For transonic and supersonic flights, **moderate turbulence** or **hail** or **cumulonimbus clouds** are included in AIREP SPECIAL reports.

Runway Braking Action — Specifications

Category	Specification
Good	Braking deceleration is normal for the wheel braking effort applied and directional control is normal .
Good to Medium	Braking deceleration or directional control is between Good and Medium.
Medium	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.
Medium to Poor	Braking deceleration or directional control is between Medium and Poor.
Poor	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.

Example — Spoken in Radiotelephony:

"Air Rep Special Air India 213, Position zero six seven radial of DPN VOR at seventy five DME, fix zero one three two, Flight Level two nine zero climbing to Flight Level three five zero, thunderstorm with hail."

26. General Principles of VHF Propagation & Wave Theory

WAVE ENERGY — BASICS

Wave energy is of a **continuous nature** in that it consists of many waves, one following the other at regular intervals, with the wave cycle repeating itself over and over again as the wave motion passes a given point. (A cork floating on water moves up and down as water waves pass — note that the water itself does not move out horizontally with the waves.)

Three Main Wave Parameters

Parameter	Symbol	Definition
Wavelength	λ (lambda)	The length of one single wave (one complete cycle); also the distance travelled by the wave during transmission of one cycle.
Frequency	F	The number of completed waves (or cycles) passing a point in one second .
Amplitude	—	The distance from one extremity of the oscillation to the other — "peak to peak".

Wave Equation & Conversions

✓ KEY FORMULA

$$F \propto 1/\lambda \quad F = C/\lambda$$

Where **C** = 3×10^8 m/s (speed of EM waves / light in vacuum).

Higher the wavelength → lower the frequency, and vice-versa.

Unit conversions:

- 1 cycle = 1 Hz
- 1000 Hz = 1 kHz = 10^3 Hz
- 1000 kHz = 1 MHz = 10^6 Hz
- 1000 MHz = 1 GHz = 10^9 Hz
- 1 km = 1000 m; 1 m = 100 cm; 1 cm = 10 mm

Polarisation

■ POLARISATION DEFINITION

In an **EM wave**, two components — **electrical** and **magnetic** — travel **perpendicular to each other** in a direction which is **mutually perpendicular to both**. The direction in which the **electrical component** lies is called the **direction of polarisation**.

Polar Diagram

A polar diagram gives the **aerial characteristics** of a transmitter or a receiver. For a transmitter it is drawn up to a distance where signal strength **reduces up to 50% of transmission**.

Modulation

WHAT IS MODULATION?

Modulation is the **process of superimposing audio frequency or information onto a carrier wave.**

FOUR TYPES OF MODULATION

1. **Amplitude Modulation (AM)**
2. **Frequency Modulation (FM)**
3. **Pulse Modulation**
4. **Phase Modulation**

Properties of Radio Waves

KEY PROPERTIES

- i. EM waves travel at the **speed of light** = $3 \times 10^8 \text{ m/s}$.
- ii. They get **refracted, reflected, diffracted, and attenuated** during propagation (attenuation = lessening of amplitude in time).
- iii. Their **direction and velocity both change** while passing from one medium to another.
- iv. While passing from a medium of **lower density to higher density** they **bend TOWARDS the normal**, and vice-versa. They **always bend towards the denser medium**.

27. Frequency Bands & Allocations

Band	Frequency Range	Wavelength Range	Wavelength Denomination
VLF — Very Low Frequency	3 – 30 kHz	100 km – 10 km	Myriametric
LF — Low Frequency	30 – 300 kHz	10 km – 1 km	Kilometric
MF — Medium Frequency	300 kHz – 3 MHz	1 km – 100 m	Hectometric
HF — High Frequency	3 – 30 MHz	100 m – 10 m	Decametric
VHF — Very High Frequency	30 – 300 MHz	10 m – 1 m	Metric
UHF — Ultra High Frequency	300 MHz – 3 GHz	1 m – 10 cm	Decimetric
SHF — Super High Frequency	3 – 30 GHz	10 cm – 1 cm	Centimetric (Microwave)
EHF — Extremely High Frequency	30 – 300 GHz	1 cm – 1 mm	Millimetric

Aviation Systems & Their Frequencies

System	Frequency Range	Band
Decca	70 – 130 kHz	LF
Loran C	100 kHz	LF
ADF	190 – 1750 kHz	LF / MF
HF Communications	2 – 25 MHz	HF
ILS Markers	75 MHz	VHF
ILS Localiser	108.1 – 111.95 MHz	VHF
VOR	108.0 – 117.95 MHz	VHF
VHF Communications	118 – 137 MHz	VHF
ILS Glidepath	329.15 – 335.0 MHz	UHF
DME	960 – 1213 MHz	UHF
SSR	1030 and 1090 MHz	UHF
GPS (L1)	1575.42 MHz	UHF
GPS (L2)	1227.6 MHz	UHF
Satcom (Inmarsat) — Aircraft to Sat	1500 – 1600 MHz	UHF
Satcom (Inmarsat) — Sat to Ground	4000 – 6000 MHz	SHF
Radio Altimeter	4200 – 4400 MHz	SHF
Weather Radar	9375 MHz	SHF
MLS	5031 – 5091 MHz	SHF
ATC Surveillance Radars	600 – 1300 MHz	UHF
ATC Ground Manoeuvre Radar	10 – 16 GHz	SHF

Join live classes for guided practice and doubt clearing.

Propagation by Band

HOW EACH BAND TRAVELS

- **VLF, LF** are **absorbed by layers** → More range as **Ground Wave**.
- Part of **MF and HF** are **reflected back** → Travel as **Sky Wave**.
- **VHF, UHF, SHF, EHF** pass through the layers → **Line of Sight (LOS)** only.

```
graph LR
    A["VLF / LF"] --> G["Ground Wave - long range"]
    B["MF / HF"] --> S["Sky Wave - ionospheric reflection"]
    C["VHF / UHF / SHF / EHF"] --> L["Line of Sight"]
    style A fill:#bae6fd
    style B fill:#fef08a
    style C fill:#bbf7d0
    style G fill:#bae6fd,stroke:#0369a1,stroke-width:2px
    style S fill:#fef08a,stroke:#854d0e,stroke-width:2px
    style L fill:#bbf7d0,stroke:#15803d,stroke-width:2px
```

28. Satellite Communications (SATCOM / SATVOICE)

SATCOM — DEFINITION

SATCOM refers to the **voice and data service** that allows an aircraft to communicate, **via satellite**, with air traffic control and its airline operations center when **outside the coverage of conventional ground radar and VHF stations**.

Three Types of Satellite Communication Services

1. **Telecommunications**
2. **Broadcasting**
3. **Data communications**

Satellite communication systems provide **real-time data to aircraft**, allowing for more precise monitoring and improved response times in the event of a maintenance or safety issue. This enhanced capability has led to improved safety and performance, as well as increased efficiency in aircraft maintenance operations.

✓ ICAO DOC 9869 — DEFINITIONS

- **SATCOM** is used only when referring to **BOTH voice AND data** satellite communication.
- **SATVOICE** is for **satellite voice communications only**.
- The SATVOICE system shall be capable of detecting **loss of service, equipment failures, and/or logon failures** and provide indication to the controller / radio operator or flight crew of system status.

⚠ SATVOICE STATUS AS LRCS

In addition to **HF**, ICAO recognises **SATVOICE** as a **valid Long-Range Communication System (LRCS)**. However, it will take some more maturing before SATVOICE replaces HF.

29. Propagation of Radio Waves

📘 TWO MODES OF PROPAGATION

EM waves travel from a transmitter to a receiver in **two ways**:

- Ground Waves**
- Sky Waves**

Wave Type	Definition
Ground Wave	A wave received either directly from transmitter or after reflection from ground is called a ground wave.
Sky Wave	A wave received at the receiver after getting refracted from atmosphere (ionosphere) .

30. Range, Tx Power, LOS & Required Communication Performance

1. Transmission Power

✓ TX POWER RULE

Higher the transmission power, more is the range. Hence, to **double the range**, power must be increased 4 times.

$$\text{Range} \propto \sqrt{(\text{Tx Power})}$$

2. Line of Sight (LOS) Range Formula

⚠ LOS FORMULA — MEMORISE

$$\text{LOS (range)} = 1.25 \times (\sqrt{H_t(\text{Tx})} + \sqrt{H_t(\text{Rx})})$$

Where:

- **Ht** = height in **FEET**
- **Range** = in **Nautical Miles (NM)**

Worked Example: Aircraft at FL80 (8000 ft), Ground VHF at 325 ft:

$$\text{LOS} = 1.25 \times (\sqrt{8000} + \sqrt{325}) = 1.25 \times (89.44 + 18.03) = 1.25 \times 107.47 \approx \mathbf{134 \text{ NM}}$$

3. Required Communication Performance (RCP)

RCP CONCEPT

The RCP concept characterises the **performance required for communication capabilities** that support ATM functions without reference to any specific technology, and is open to new technology. This approach is essential to evolving operational concepts using emerging technologies.

An **ATM function** is an individual operational component of air traffic services. Examples include the application of separation between aircraft, the re-routing of aircraft, and the provision of flight information.

The number attached to your RCP is the number of seconds it takes for an instruction to travel from the ground to you and your acknowledgement back to the ground.

31. CPDLC & Automatic Dependent Surveillance (ADS)

Controller Pilot Data Link Communications (CPDLC)

CPDLC — DEFINITION

CPDLC is a **two-way data-link system** by which controllers can transmit **non-urgent strategic messages** to an aircraft as an alternative to voice communications. The message is displayed on a flight-deck visual display.

✓ OPERATIONAL USE

- When communicating with an aircraft operating **within airspace beyond the range of DCPC VHF voice communication**, CPDLC is available, and (unless local ATC procedures state otherwise) controller and flight crew would normally **choose CPDLC** as the means of communication.
- Voice (VHF, HF, or SATVOICE direct or via radio operator) would be used as an **alternative means**. However, the controller and flight crew always determine the communication medium most appropriate at any given time.
- Messages from aircraft to ATC may follow a **standard format** or may be **free-text**.
- Messages from a controller normally follow a **standard format**.
- **Response is required to most messages.**
- Voice and data link shall **co-exist**.
- Implementation of CPDLC is intended as a **supplementary means** of communication to the use of voice communication.

⚠ CPDLC USAGE RESTRICTION

CPDLC shall only be used in the context of **NON-TIME-CRITICAL communications**.

Automatic Dependent Surveillance (ADS)

📘 ADS — DEFINITION

ADS supports **automatic reporting by the Aircraft Flight Management System (FMS)** of:

- Aircraft **position**;
- **Intent** information;
- **Meteorological information** (Spot wind and Temperature).

The FMS reports the required information in accordance with **parameters selected by the ground system**. Messages will be transferred by **VHF and satellite data links**.

✓ ADS-CPDLC IN INDIA

- ADS/CPDLC is integrated with the **Flight Data Processing System (FDPS)** at **Chennai, Mumbai, Delhi, and Kolkata**.
- ADS-CPDLC Service is available through **FANS-1A Data Link**.
- All aircraft fitted with this facility shall **login 10 minutes prior to entering the concerned FIR**.

```
graph TD
    A["A[Flight Deck FMS] -- 'Position / Intent / Met data' --> ADS[ADS via VHF + SATCOM Data Link]"]
    ADS --> FDPS["FDPS[FDPS - Chennai / Mumbai / Delhi / Kolkata]"]
    FDPS --> ATC["ATC[ATC Controller]"]
    ATC -- "Non-time-critical msgs" --> CPDLC["CPDLC[CPDLC Data Link]"]
    CPDLC --> A
```

style A fill:#bae6fd
style ADS fill:#fef08a
style FDPS fill:#bbf7d0
style ATC fill:#fecaca
style CPDLC fill:#e9d5ff

GHOST AVIATOR

32. Exam-Prep Quick Cards — Answer Key Highlights

HIGH-FREQUENCY EXAM POINTS (FROM END-OF-CHAPTER QUESTIONS)

- **QDR** = Magnetic bearing FROM the station.
- **Height** → set **QFE**; **Altitude** → set **QNH**; **FL** → set **QNE (1013.2)**.
- **ATIS** = Automatic **Terminal** Information Service (not "Traffic", not "Termination").
- **QDM** = Magnetic heading TO the station (no wind).
- **QTE** = TRUE bearing FROM the station.
- **QUJ** = TRUE track TO the station (D/F use for true heading no-wind).
- Priority order = **Distress** → **Urgency** → **D/F** → **Flight Safety** → **Met** → **Flight Regularity**.
- 3500 ft → "Three Thousand Five Hundred".
- 13500 → "One Three Thousand Five Hundred".
- "Decimal" may be omitted if no chance of misunderstanding (some operators); standard rule is the term must be transmitted.
- 9:20 AM (no confusion) → just "TOO ZE-RO" (minutes only).
- "CORRECTION QNH 1016" → standard phrase for error in transmission.
- "YES" → **AFFIRM** (NOT "Affirmative", NOT "Roger").
- "Listen out" → **MONITOR**.
- Surface movement = **GROUND**; Approach Radar departures = **APPROACH RADAR**.
- AIR INDIA 285 > 136 t initial call → **"AIR INDIA 285 HEAVY"**.
- Readability 3 = Readable but with difficulty.
- Test call ≤ **10 seconds**.
- Always read back: RWY in use, altimeter settings, SSR codes, level/heading/speed instructions.
- "Overcast" = 100% / 8 octas; "Broken" = 5–7 octas; "Scattered" = 3–4 octas; "Few" = 1–2 octas.
- Visibility expressed in **METRES**.
- CAVOK = ≥ 10 km vis, no cloud below 5000 ft/MSA, no CB, no precip/TS/fog/drifting snow.
- Comm failure → try alternative frequency.
- Blind transmission → make **twice on designated frequency**.

Join live classes for guided practice and doubt clearing.

- Distress: aircraft "threatened by serious / imminent danger" requiring immediate assistance.
- Squawk **7700** = distress.
- MAYDAY x 3 = distress; uses **frequency currently in use**.
- Urgency call: **PAN PAN PAN** on freq in use + station addressed + nature + intentions.
- ATIS = routine continuous repetitive broadcast to arrivals & departures.
- HDG 225 @ 3500 ft → "HEADING TOO TOO FIVE AT TREE THOUSAND FIVE HUNDRED".
- Area Control Centre (no radar) = **...CONTROL**.
- Approach Control Radar Arrivals = **...RADAR**.
- Blind transmission = caller believes called station can still receive though no acknowledgement.
- "Runway vacated" = no longer on active runway.
- IFR + IMC + comm failure → continue per flight plan to designated navaid serving destination.
- Commence descent over destination navaid: **at, or as close to, ETA from current flight plan**.
- Medical transport prefix = **PAN PAN MEDICAL**.
- Urgency > all other comms EXCEPT distress.
- VOLMET includes **METARs**.
- Air India 5345 abbreviated → **No abbreviated form** (telephony designator + flight number cannot be shortened).
- FL80 + 325 ft VHF station → ≈ **134 NM** LOS.
- 295 kHz → **LF** band.
- Frequency = number of complete waveforms passing a spot in **1 second**.
- HF wavelength = **Decametric** (100 m – 10 m).
- Weather radar (9375 MHz) wavelength = **Centimetric**.
- 19 cm → 1.579 GHz, **UHF**.
- Thunderstorms without hail → reported as **"THUNDERSTORMS"**.
- **SATVOICE** — recognised as a valid **LRCS** by ICAO.

GHOST AVIATOR

GHOST AVIATOR