COMMAND AND STAFF TRAINING INSTITUTE

BANGLADESH AIR FORCE

Individual Staff Studies Programe (ISSP)

PROFESSONAL-2 : AIR TRAFFIC CONTROL
PART-II, PHASE-16

ISS Course No:

PROFESSONAL-2 : AIR TRAFFIC CONTROL
PART-II, PHASE-16

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INTRODUCTION TO THE PHASE

Scope **of the Phase**

1. This is your professional subject. By this time, you know about your subject quite well. Only important topics have been included in this phase. The main aim of this phase is to review and recheck your knowledge on profession. In addition to this phase note**, y**ou should consult AFM 60-1, AFM 60-13 (MATS- under review)**,** AFM 61-1, AFM 55-3 and AFO 61-1, AFO 61-2, AFO 61-3 etc. You should also consult ICAO Annexes & Docs on ATS and AIP Bangladesh & other relevant CAAB publications (CAR 84, ANO etc). On ATS by CAAB. You may also go through relevant manuals/publications on Navigation and Meteorology. Also do not forget to visit different ATC related website on internet.

2. Duration of the phase is 8 weeks. Your study during this period is very vital and your exercise result will reflect how much benifit you have derived from it. Self assessed exercises of different tasks are given in the phase note. You should try and solve those problem meticulously.

PART-II, PHASE-16: PROFESSIONAL-2 (AIR TRAFFIC CONTROL)
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TASK : 1

ATS POLICY AND INSTRUCTION

BAF ATS Policy

1. The Air Traffic service policy in BAF is that it shall provide, in time of peace and war, aeronautical facilities and a ground organisation, which will:

a. Enable pilots of BAF aircraft to operate safely and efficiently with tactical freedom in, day and night, all weather conditions.

b. Meet the objectives of Air Traffic Services.

c. Meet the requirement of the air defence organisation for the notification of aircraft movements.

2. This will also to issue such orders and instructions as will enable the highest possible standard of ATS to be achieved.

Civil Aviation Policy

3. Bangladesh being a member state of International Civil Aviation Organisation (ICAO) is to adhere, where possible, to ICAO standard and recommended practices adopted for use in the Bangladesh area of responsibility for civil aviation.

4. The civil aviation policy is governed by the Civil Aviation Rules, 1984. These rules shall not apply to, or in relation to, military aircraft and military airfields of Bangladesh. However, the provisions of these rules relating to manoeuver of aircraft and air traffic control shall apply to, and in relation to, a flight by the military aircraft and State aircraft when they operate at exclusive military airfields.

Civil/Military Co-ordination

5. The practical application of civil/military co-ordination is based on the philosophy that the greatest degree of safety and efficiency in the utilization of airspace is achieved. It is essential to have joint operation procedures, for all foreseeable situations, described in a written form and agreed to by the appropriate authorities.

Joint Civil/Military Policy

6. To avoid duplication of efforts, military and civil aircraft must share the use of the ground organisation and aeronautical facilities. It is desirable that a pilot, whether military or civil, flying anywhere in Bangladesh should find a uniform ground organisation, governed by standard regulations and using standard procedures.

7. **Principles**. To implement this policy the following principles are to be observed:

a. BAF is to conform to the “Rules of the Air”.

b. BAF is to conform to the ICAOI “Standard and Recommended practices” provided they do not conflict with military requirements.

c. The air space over Bangladesh is to be a single Flight Information Region (FIR) and controlled air spaces are to be established by CAAB in consultation with Air Headquarters.

d. Flight Information Centre (FIC) is to be established, manned and equipped by CAAB.

e. Military aircraft unless exempted by special regulations, are to comply with the regulations and procedures for controlled airspaces when flying in those air spaces.

f. The regulations and procedures applicable to FIR are to be relaxed for aircraft engaged in exercise, whenever possible.

g. Joint user aerodromes are to be established at the discretion of Air Headquarters where aerodrome facilities are required for both military and civil aviation and where one aerodrome is to meet those requirements.

Joint Civil and Military Control System.

8. In peacetime, the system of air traffic control is based on a joint Civil/Military scheme in which the BAF observe such ICAO regulations as have been accepted by Bangladesh, provided these do not impair the operational procedure of military aircraft.

Area Control Service

9. The provision of area control service is the responsibilities of CAAB. However, BAF may maintain elements as required in area control centre to supervise the conduct of all military flights and to facilitate the co-ordination of military and civil air traffic movements.

Aerodrome and Approach Control Services at Joint-User Airfields.

10. The responsibility for provision of ATS at each joint user airfield is determined by mutual agreement between BAF and CAAB. The allocation of responsibility is clearly specified in the Air Traffic Services Instruction (ATSI) issued time to time by CAAB, such responsibilities being determined having regard to the following:

a. Responsibility is allocated in respect of each operating position established.

b. CAAB will be responsible for control at an airfield where civil movements normally predominate or are significant and the airfield is not normally used as a base for large scale military flying.

c. Responsibility will be shared between BAF and CAAB where the airfield is used as a base for large-scale BAF operations and extensive civil operations. However, at the discretion of BAF authority, BAF controllers may be provided on a temporary or continuous basis depending on the frequency, extent and duration of BAF operations.

d. BAF will be responsible for safe and efficient conduct of air traffic at an airfield where BAF movements normally predominate or are significant.

e. A controller required to exercise control over civil and military aircraft is to possess a civil air traffic controller's license or the equivalent BAF certificate of competency and current ratings appropriate to the functions to be performed.

Policy in National Emergency

11. In national emergency, BAF, when deem it necessary, may suspend or modify the standards and procedures contained in this publication to permit military aircraft to operate with a greater degree of operational freedom in the interest of national defence. BAF may take over the control of any ATC ground organisation including facilities, which is operated by CAAB.

BAF ATC Instruction

12. Instructions to the Captain of aircraft, originated by BAF controllers are usually advisory. Controllers cannot normally originate mandatory instructions, they may relay these on behalf of an appropriate authority when authorised. In such cases, if time and circumstances permit, controllers are to specify the authority when relaying the mandatory instructions.

13. **Exception to Rule**. BAF controllers in the following circumstances can originate mandatory instructions:

a. When aircraft are flying under Radar Control, irrespective of airspace.

b. When aircraft are flying on IFR/VFR within BAF control Zone, irrespective of airspace.

c. When aircraft are flying on IFR/VFR within class 'A', 'B' or 'C' airspace and IFR only within class 'D' and 'E' airspace.

Civil ATC Instruction

14. Civil ATC instructions are generally advisory but civil controllers can originate mandatory instructions to Captain of aircraft provided that the aircraft is flying on IFR/VFR within class 'A', 'B' or 'C' airspace and IFR only within class 'D' and 'E' airspace.

CONSOLIDATED EXERCISE-1

Q1. What are the ATS policies in BAF?

Q2. What are the principles to be observed while implementing joint civil/military ATS policy?

Q3. When BAF Controllers can originate mandatory instructions?

ANSWERS TO CONSOLIDATED EXERCISE-1

A1. Write para 01 to 02 from Task-1

A2. Write para 06 to 07 from Task—1

A3. Write para 12 to 13 from Task – 1

Reference Materials.

1. AFM 60-13 (under review).

2. Civil Aviation Rule 1984 (Bangladesh Gazette). Amended in 2009.

3. ICAO Doc 4444 (ATM).

4. ICAO Regional Seminar Paper on ATS Airspace Classifications and Civil/Military Co-ordination, Bangkok, Thailand 1-5 June 1992.

TASK: 2

ATS ADMINISTRATION - GENERAL

Responsibilities

1. BAF air traffic controllers and other operational staff are at all times bound by the Air Force orders and amendments thereto. Controllers shall not discuss special operations or any accident/Incident of which they may become aware of by reason of their employment unless authorized by the Air HQ.

2. It is the responsibility of controllers and other operational staff to familiarize themselves with MATS review of AFM 60-13 is in progress, this will be rename as AFM 61-2, Manual of ATS (MATS), ATS FLIP, ATS related other AFMs/AFOs/AFIs/AFLs, Sqn's Local Orders, Base/Sqn's FOBs, CAAB Rules, AIP, ANU the relevant ICAO Documents and other operational/administrative instructions that may be issued from time to time to enable them to discharge their responsibilities.

3. The general duties and responsibilities of the OIC/ ATC Sqn/SATCO and DATCOs are given in subsequent paragraphs. All concerned shall read these duties and responsibilities in conjunction with the other duties and responsibilities detailed in the MATS review of AFM 60-13 is in progress, this will be rename as AFM 61-2, Manual of ATS (MATS), and in the operational/administrative directives and instructions issued from time to time.

4. **Responsibilities of OIC ATC Sqn/SATCO.** The OIC ATC Sqn/Senior Air Traffic Control Officer (SATCO) is responsible to the OC Ops Wing for the efficient functioning of the Base ATS facilities/operations. He is also responsible for the following:

a. Maintaining an efficient ATS system and ensuring that procedures conform to the standard as laid down by Air HQ.

b. Formulation and implementation of ATS procedures for the airfield.

c. Ensuring that Navigational Aids, Approach Aids, Airfield Lighting, Aircraft Arresting Barriers and Runway Sweepers etc are properly maintained and function efficiently.

d. Supervising repairs, markings and maintenance of main airfield(s) and satellite airfield(s).

e. Reporting all flying violations to the OC Ops Wing.

f. Familiarizing himself with the station crash procedures and capabilities of the station crash facilities.

g. Ensuring that his staffs are fully conversant with the pre-accident plan and Base evacuation plan.

h. Ensuring that ATS staffs are fully conversant with all current ATS regulations and procedures and satisfy himself that Base flying orders are amended, when necessary, in conformity with new ATS regulations.

j. Liaise with military and civil agencies in connection with his duties, if necessary.

k. Supervising the GCA radar operation at the Base.

l. Ensure conducting of weekly/monthly quiz test for the ATCOs and ATS staffs.

Relief of Duty Controller

5. The following are the circumstances during which a Duty controller is to be relieved of his watch:

a. When the AOC/Base Commander considers it necessary to take over the responsibilities from the duty controller. This is only to be done in exceptional circumstances when the AOC/Base Commander is convinced that the situation requires his direct personal control.

b. When the OC Ops Wing considers it necessary.

c. When the OIC ATC Sqn/SATCO considers it necessary.

d. When the Duty Controller, for any good reason, feels in need of a relief controller or guidance.

6. The following persons are authorised to take over the responsibilities of air traffic control from a Duty Controller:

a. The AOC/Base Commander.

b. The OC Ops Wing.

c. The OIC ATC Sqn/SATCO.

d. Any qualified ATCO detailed to do so by the AOC/Base Commander or by OC Ops Wing or by OIC ATC Sqn/SATCO.

e. The Duty Controller of the next shift (for normal handing/taking over).

7. If a Duty Controller is relieved of his watch, whether at his own request or not, he is to remain in the control tower to act as assistant or adviser to the who has assumed the responsibility, unless he is permitted by the officer to absent himself.

8. When any entitled person relieves a Duty Controller of his watch and takes over responsibility for air traffic control, or through not relieving the controller gives orders or executive instructions to him regarding his control procedures in an emergency or

incident, the ATC watch keeping Log Book is to be suitably endorsed and signed by the person concerned and by the Duty Controller being relieved or ordered.

Normal Procedure for Handing/Taking Over Watch

9. Before handing over watch, the two controllers concerned are to confer to ensure that all relevant information concerning the current ATC situation is fully understood.

10. The incoming controller is to ensure that he is conversant with the latest promulgated orders and notices, and that he appreciates weather situation and the weather tendency forcast during his watch.

11. The controller handing over is to complete action (including reports) relating to any emergency or distress incident, or incident, which has occurred during his period of watch. He is not to transfer the responsibility to the controller taking over.

12. After appropriate actions mentioned above both controllers are to sign the ATC watch log, making the entries ‘HANDING OVER WATCH’ with full name and initials and TAKING OVER WATCH’ with full name and initials and signing to indicate the transfer of responsibility. This includes responsibilities for the safe custody of classified material, and valuable and attractive items of equipment.

Unit Cleanliness

13 The respective ATCO in charge shall ensure that his unit premises and equipment are maintained clean and neat at all times. If necessary he shall make appropriate arrangements with Base to maintain the cleanliness and tidiness. Other staff at the unit shall assist in maintaining the unit clean and tidy.

Local Order

14. The OIC ATC Sqn/SATCO is responsible for the preparation and issue of ATS Local Order for the efficient provision of air traffic services within the area of his jurisdiction. Local ordrs shall contain full details on all matters related to:

a. The provision of air traffic services.

b. Operational Procedure.

c. Handling of emergencies.

ATS Log

15. The ATS Log Book serves to record all significant occurrences and action relating to operations, facilities, equipment and staff at an ATS unit. It is an official document and unless otherwise authorised, its contents shall be restricted to those personnel requiring access to the information. All personnel should read those log entries of concern to them, which were made during the period since their last tour of duty before accepting responsibilities for an operating position.

16. Where there is more than one unit within a facility, a logbook shall be maintained for each unit.

17. The DATCO shall be responsible for opening, closing and maintaining the logbook as applicable. Any controller may make an entry but all entries shall be made in ink and no erasure is permitted. Incorrect information shall be struck out and the correct information inserted and initialed.

18. Information to be recorded in the ATS logbook should, as appropriate to the facility, include such matter as:

a. Incidents, accidents, non-compliance with regulations or ATC clearance etc;

b. Aerodrome inspection reports, details of work in progress, aerodrome closures, and other essential aerodrome information;

c. Changes in the status of facilities, services or procedures;

d. Any occurrence of a significant nature;

e. Time of receipt of Met warnings/reports;

f. Opening and closing of shift or watch.

19. Controllers should follow the following procedure for recording of entries in the ATS Log Book.

a. Each entry should be accompanied by the signature of the controller making the entry;

b. The time of entries shall be based on BST and events recorded in a chronological order;

c. Entries shall give sufficient details to give readers a full understanding of all actions taken;

d. The time an incident occurred and the times at which each action was initiated shall be stated;

e. An entry that needs to be brought to the attention of the SATCO shall be so annotated to enable him to take follow up action.

20. If during an emergency or busy periods, it is not possible to make detailed entries in the log book at the time of occurrence, controllers are permitted to keep rough notes with exact times. As soon as possible thereafter, a detailed entry shall be made in the log book.

21. The SATCO shall review the log entries at least once on each working day taking note of all significant entries. He shall deal with any entry of significance and which requires a response accordingly.

22. If a log book is impounded for the purpose of an inquiry, this shall be recorded in the log book and a replacement log book shall be used.

Release of Information

23. Release of information to the public and the media is strictly prohibited unless specifically authorized by the Air HQ.

Preservation of ATS Records

24. All records associated with the provision of air traffic services shall be retained for specific periods after which they may be disposed off provided any such records is not required for the purposes of investigations or complaints. The following guidelines are to be applied as the minimum for preservation of ATS records:

a. **Log Books**. Log Books are not to be destroyed before 01 year after the date of their closing.

b. **Flight Progress Strips, ATS/MET Messages, Flight Plans etc**. Copies of all such messages are to be kept in chronological sequence, and in a readily accessible place (pigeon-hole), for 01 month. They are then to be preserved elsewhere in monthly ‘block’ for further three months, after which they are to be destroyed provided that no query has arisen regarding any of them.

c. **Recording Media**. Recording media used for the recording of ATS communications (intercom, interphone and HF/VHF/UHF) and data (radar, flight plan and electronic flight strips) shall be re-used after a period of 7 days.

Secondary Duties – ATC Officers

25. ATC Officers employed on ATC duties are not to be detailed for any other secondary duties, however they may be detailed as members of BOO/Investigation etc concerning ATS.

Use of English

26. The English language shall be used in all communications, written or verbal, to prevent any misinterpretation and ensure uniformity in the safe application of ATS rules and procedures.

27. When there is a need to communicate with external agencies where the use of English may not be appropriate or suitable, then Bangla may be used if required.

CONSOLIDATED EXERCISE – 2

Q1. What are the circumstances when the DATCO is to be relived of his watch? Who all can relief a DATCO?

Q2. What are the information to be recorded in ATS Log Book?

Q3. What are the preservation procedures for following ATS records:

a. ATS Log Book?

b. Flight Progress Strips, ATS/MET Messages, Flight Plan Messages?

c. Recording Media?

ANSWERS TO CONSOLIDATED EXERCISE – 2

A1. Write para 05 to 06 from Task-2

A2. Write para 18 from Task-2.

A3. Write para 24 from Task-2

Reference Materials

1. AFM 60-13 (under review).

2. Manual of ATS (MATS), Malaysia.

3. ATC Local Order Books of different BAF Bases.

TASK : 3

STANDARD OPERATING PROCEDURES(RULES OF THE AIR)

Compliance of the Rules of the Air

1. The operation of an aircraft either in flight or on the manoeuvring area of an aerodrome shall be in compliance with the general rules and, in addition, when in flight, either with:

a. The visual flight rules (VFR), or

b. The instrument flight rules (IFR).

(***Note***: A pilot may elect to fly in accordance with IMC in visual meteorological conditions or he may be required to do so by the appropriate ATS authority.)

Responsibility for Compliance of the Rules of the Air

2. **Responsibilities of Pilot-in Command**. The pilot-in command of an aircraft shall, whether manipulating the controls or not, be responsible for the operation of the aircraft in accordance with the rules of the air, except that he may depart from these rules in circumstances that render such departure absolutely necessary in the interests of safety.

3. **Pre-flight Action**. Before beginning a flight, the pilot-in command of an aircraft shall familiarize himself with all available information appropriate to the intended operation. Pre-flight action for flights away from the vicinity of an aerodrome, and for all IFR flights, shall include a careful study of available current weather reports and forecasts, taking into consideration fuel requirements and an alterative course of action if the flight cannot be completed as planned.

ATC and Met Briefing

4. A general ATC and Met briefing is to be conducted centrally at all flying wings/units before flying commences on the first day of the week and every day before night flying.

5. In the case of individual flight the pilot of the aircraft is to familiarize himself with all available information appropriate to the mission.

Protection of Persons and Property

6. **Negligent or Reckless Operation of Aircraft**. An aircraft shall not be operated in a negligent or reckless manner so as to endanger life or property of others.

7. **Minimum Heights**. Except when necessary for take-off or landing, or permitted by the appropriate authority, aircraft shall not be flown over the congested areas of cities, towns or settlements or over an open-air assembly of persons, unless at such a

height as will permit, in the event of an emergency arising, a landing to be made without undue hazard to persons or property on the surface.

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8. **Dropping or Spraying**. Nothing shall be dropped or sprayed from an aircraft in flight except under conditions prescribed by the appropriate authority and as indicated by relevant information, advice and/or clearance from the appropriate air traffic services unit. The dropping of leafietsor or any other articles over land or sea are permitted under following conditions:

a. For the purpose of training.

b. When approved by Air Headquarters.

c. At the discretion of the captain when the safety of his aircraft will be seriously endangered by not doing so.

9. **Towing**. No aircraft or other object shall be towed by an aircraft, except in accordance with requirements prescribed by the appropriate authority and as indicated by relevant information, advice and/or clearance from the appropriate air traffic services unit.

10. **Parachute Descents.** Parachute descents, other than emergency descents, shall not be made except under conditions prescribed by the appropriate authority and as indicated by relevant information, advice and/or clearance from the appropriate air traffic services unit.

11. **Aerobatic Flights**. The following serve as guidance for the conduct of aerobatic flight within an aerodrome circuit/control zone (CTR) :

a. Such flights must not endanger other aircraft;

b. Such flight must not be carried out over town or populous area; and

c. Are subject to authorization by ATC.

12. **Air Displays**. An air display is organized flying event including aircraft races, contests, exhibitions of flying or local flights made for the purpose of carrying passengers for hire or reward, performed before a public gathering assembled for the purpose of witnessing the air display. Whenever an air display has been authorised by Air Headquarters and the CAAB, the SATCO shall ensure that:

a. All communications and visual signaling equipment (Aldis Lamps, Vary pistols, etc.) for the purpose of controlling aircraft are available and serviceable.

b. Aircraft without suitable radio communication equipment are not permitted to operate during the period of the air display, except for those participating aircraft so authorised in the flying programme.

c. A copy of the approved programme detailing all flying activities for the air display is available for controllers.

d. Pilots taking part in the flying activities are briefed with regard to flying manoeuvres, airfield layout, circuit direction, forecast weather, emergency procedures and any other pertinent ATC requirements.

e. Adequate arrangements are made with the airport authority (CAAB) and organisers to prevent spectators from encroaching on the manoeuvring area.

f. A weather forecast is obtained; and,

g. Appropriate NOTAM action is taken.

13. **Prohibited, Restricted and Danger Areas**. Aircraft shall not be flown in a prohibited area, or in a restricted or in a danger area, the particulars of which have been duly published, except in accordance with the conditions of the restrictions or by permission of the state over whose territory the areas are established.

Avoidance of Collisions

14. **Proximity**

a. An aircraft shall not be operated in such proximity to other aircraft as to create a collision hazard.

b. Aircraft shall not be flown in formation except by pre-arrangement.

c. When flying VMC it is the direct responsibility of the captain-in-command of an aircraft to avoid collision with other aircraft not withstanding that the flight is being conducted on an air traffic clearance.

15. **Operation in the Vicinity of an Aerodrome**. An aircraft operated on or in the vicinity of an aerodrome shall, whether or not within an aerodrome traffic zone:

a. Observe other aerodrome traffic for the purpose of avoiding collision.

b. Conform with or avoid the pattern of traffic formed by other aircraft in operation.

c. Make all turns to the left, when approaching for a landing and after taking off, unless otherwise instructed.

d. Land and take off into the wind unless safety, the runway configuration, or air traffic considerations determine that a different direction is preferable.

Border Flying

16. **Flying Limitation**. No aircraft is to fly within 15 NM of Bangladesh-India and Bangladesh-Myanmar borders unless authorised by Air Headquarters. The restriction does not apply to aircraft:

a. Engaged in take off and landing at airfields in the proximity of the border, when so authorised.

b. Engaged in commitments or operational missions.

c. Operating with the GCI station on an interrogation mission, in which case the controller is to take the aircraft under radar surveillance up to 5 NM from the border.

Flights Over Troubled Areas

17. Unless operationally necessary, all flights over the troubled areas, which would be notified from time to time, are to be flown at heights above 3,000 AGL to avoid small arms fire.

Safety Altitude Instruction (BAF)

18. The safety altitude calculation for a particular route or area should be made by taking elevation of the highest obstacle within 10 NM each side of the centre line of that route or area plus 1,000 ft rounded up to the next 100 ft. Application of the semi-circular system of cruising level where applicable will then give the minimum altitude to fly. To decide the highest ground over which an aircraft is to fly is considered on available navigational aids for determining position. However, where the angular divergence of the navigational aid signal in combination with the distance between the navigational aids could result in the aircraft being more than 5 NM on either side of the centre line, the 10 NM protection limit is increased by the extent to which the divergence is more than 5 NM from the centre line.

Example: If there is an obstacle mast of 376 ft AMSL en-route Dhaka-Jessore within 10 or 15 NM of the route (the calculation of width of the route will be considered on navigation aids available). Then the safety altitude shall be 376 ft + 1000 ft = 1,376 or 1400 ft.

Time

19. Co-ordinate Universal Time (UTC) shall be used and shall be expressed in hours and minutes of the 24 hour day beginning at midnight.

20. Air traffic services units shall be equipped with at least two clocks (for BST and UTC) indicating the time in hours, minutes and seconds, clearly visible from each operating position in the unit concerned.

21. Air traffic services unit clocks and other time recording devices shall be checked as necessary to ensure correct time to within plus or minus 30 seconds of BST/UTC at all times.

22. The correct time shall be obtained from a standard time station or, if not possible, from another unit which has obtained the correct time from such station.

23. Aerodrome control towers shall, prior to an aircraft taxiing for take-off, provide the pilot with the correct time, unless arrangements have been made for the pilot to obtain it from other sources. Air traffic services units shall, in addition, provide aircraft with the correct time on request. Time checks shall be given to the nearest half-minute.

24. BAF controllers shall use Bangladesh Standard Time (BST) in ground communication.

Diplomatic Clearance for BAF Aircraft Abroad

25. Diplomatic clearance regarding flight by BAF aircraft to or over foreign countries is to be obtained through the Air Headquarters Directorate of Air Intelligence Dhaka.

26. BAF aircraft, as far as possible and consistent with operational necessity, are to be flown in accordance with air traffic regulation issued by the countries over which they are flown.

President's/VVIP's Flight - Air Traffic Facilities

27. **Civil Airports/Airfields**. The following procedure shall be enforced at all airports/ airfields in Bangladesh when Presidential/VVIP flight is notified:

a. **Aerodrome Control**. No aircraft be allowed to land or depart from the aerodrome or operate in the circuit for the period indicated below:

(1) Five minutes before ETA of Presidential/VVIP flight till 'Door Open time'.

(2) 'Door Close time' till five minutes after take off.

(3) Air Traffic may be delayed on ground or in air to facilitate unrestricted climb and descent to Presidential/VVIP Flight.

b. **Controlled Airspace:**

(1) Standard separation shall be provided in controlled airspace. When vertical separation is applied the vertical separation minimum shall be 2,000 feet at all levels.

(2) No VFR operations shall be allowed during the period the President's/VVIP flight is expected to operate in controlled airspace.

c. **Uncontrolled Airspace (Enroute)**. When the President/VVIP is flying in Bangladesh no other aircraft shall be cleared to operate in the block of uncontrolled airspace defined as under:

(1) 2,000 feet below and above the cruising level and 25 NM either side of the intended route of the President's/VVIP flight in uncontrolled airspace.

(2) This restriction will not be applicable when it is known that horizontal separation based on the current flight plans will exist between the President's/VVIP flight and other aircraft.

28. **BAF Airfields**.

a. **Aerodrome Control**. If the President's/VVIP's aircraft is landing at, or departing from a BAF airfield, the Commanding Officer is to promulgate orders to:

(1) Prohibit all local flying within 10 NM of the airfield up to 5,000 feet, and ensure that the circuit is cleared from 15 minutes before the ETA of the President's/VVIP's aircraft until it has landed and cleared the runway.

(2) Prohibit all local flying within 10 NM of the airfield up to 5,000 feet, and ensure that the circuit is cleared from 15 minutes before the ETD of the President's/VVIP/s aircraft until it has taken-off and obtained airfield clearance.

b. **Controlled Airspace**. Same as in paragraphs 27,b (1) & (2)

c. **Uncontrolled Airspace (Enrote)**. Same as in paragraph 27. c. (1) & (2)

AVAILABILITY OF BAF AIRFIELDS TO CIVIL AIRCRAFT

Availability of BAF Airfields to Bangladesh Civil Aircraft

29. Bangladesh civil aircraft are permitted to use the following BAF airfields:

a. **Joint User Airfields (BAF Control).** Joint user airfields are to provide facilities for scheduled civil air services and/or charter, privately owned, and club aircraft. However, unless the joint-user aerodrome has permanent customs facilities it is to be used only for inland flights. The planned use of such aerodromes by civil airline operators is to be approved by the Air Headquarters. The facilities for chartered, privately-owned and club aircraft is normally to be restricted to the hours of watch promulgated in AIP/NOTAM.

b. **Other Airfields**.

(1) Civil aircraft flown on inland flights by members of the regular armed forces can use BAF airfields provided that the aircraft is not being flown for the carriage of passengers or goods for hire or reward. In addition, civil aircraft may use BAF airfields if authorized by Air Headquarters.

(2) In genuine emergency, any civil aircraft may make a forced landing at any BAF airfield.

(3) Civil aircraft can use BAF airfields if they are engaged on inland emergency flights (e.g. landing of medical supplies, ambulance services) or for reasons of national importance, in cases only where no convenient civil aerodrome exists. In all such cases prior approval is to be obtained from the Air Headquarters.

Availability of BAF Airfields to Foreign Civil Aircraft

30. Civil aircraft of foreign registration are permitted to use BAF airfields in cases of genuine emergency and for essential diversion when their destination aerodrome is closed owing to adverse conditions.

Prior Permission to Land Civil Aircraft at BAF Airfields

31. Civil aircraft operators are to obtain prior permission from Air Headquarters to land at a BAF airfield before beginning their flights. This procedure is to be strictly observed except in the following cases:

a. Forced landings in genuine emergency.

b. Approved scheduled services.

Air Traffic Control of Civil Aircraft at BAF Airfield

32. The captains of civil aircraft landing at or taking off from BAF airfields are to comply with the following instructions:

a. Before taking off they are to inform air traffic control giving particulars of their flight, and signing all relevant documents.

b. When taking off and landing they are to comply with local BAF standard take off and landing procedures.

Accommodation for Civil Aircraft

33. The dispersal area for civil aircraft is to be decided by the AOC/Base Commander. Hangar accommodation is to be provided, but only if it is available after all service requirements have been met. If provided, it is to be used entirely at the owners risk.

Refueling of Civil Aircraft.

34. Generally, the AOC/Base commander is to exercise his discretion about the issue to civil aircraft of petrol, oil or lubricant on payment from BAF stocks, subject to technical conditions.

35. Civil pilots are to make their own arrangements with commercial suppliers to refuel their aircraft at a BAF airfield, provided that:

a. Prior permission is obtained from Air Headquarters.

b. The civil aircraft owner accepts full responsibility for any damage, or loss arising from the presence of the supplier’s equipment.

c. The supplier’s equipment and representatives are subject to the standard air traffic control regulations for the control of vehicular traffic on the manoeuvring area of a BAF airfield.

36. BAF Units are not responsible for the accommodation or messing of civil aircrew or their passengers, or for providing telephone or transportation facilities. The Base Commander is, however, to provide any of these facilities at his discretion is case of emergency.

Recovery of Charges

37. Civil/Foreign aircraft are to pay the landing, housing and parking charges if they use BAF premises/areas for these purposes. For the purpose of assessing such charges, the air traffic control unit must make a most accurate recording of civil/foreign aircraft movement in the BAF Tarmac, Hangars etc. A register of “Aircraft other than BAF” may be maintained.

Landing and Housing Charges.

38. The charges for landing, housing and parking of civil/foreign aircraft in BAF areas will be in consonance with the charges promulgated by the Government of Bangladesh and followed by CAAB.

Collection of Charges.

39. The charges are to be collected by the concerned ATC Sqn and a receipt is to be given to the aircraft operator as per form approved for this purpose. The collected money is to be deposited to the Accounts Sqn for onward submission to the Government fund.

CONSOLIDATED EXERCISE-3

Q1. What procedures are followed when conducting aerobatic flights within CTR?

Q2. What are the actions of SATCO during the event of air display?

Q3. What are the boarder flying limitations for BAF aircraft?

Q4. How Safety Altitude is to be calculated in BAF?

Q5. When a foreign registered civil aircraft is allowed to land at BAF airfield?

ANSWERS TO CONSOLIDATED EXERCISE-3

A1. Write para 11 from Task 3.

A2. Write para 12 from Task-3.

A3. Write para 16 from Task-3.

A4. Write para 18 from Task-3.

A5. Write para 30 from Task-3.

Reference Materials

1. AFM 60-13 (under review).
2. AFM 60-1 and AFM 61-1.
3. Civil Aviation Rule 1984 (Bangladesh Gazette).
4. AIP Bangladesh.
5. ICAO Annex-2, Doc 4444 (ATM), Doc 7030.

TASK: 4
LAY – OUT OF BAF AIRFIELDS

General

1. The sitting, lay-out and physical characteristics of an airfield should facilitate safe, orderly and expeditions flow of air traffic.

Characteristics.

2. The basic areas associated with physical lay-out have been standardised for BAF airfields. The standardised physical characteristics have been worked out considering all the aircraft in BAF inventory. These conform, as far as possible, to the ICAO standards and the Civil Aviation Rules 84. However, the criteria for lay-out and associated areas in an airfield will depend upon the following factors:

a. The operational role assigned to the Base.

b. Type and amount of air traffic to be served, including air traffic control aspects.

c. Aeroplane performance considerations.

d. Topographical conditions of the airfield.

e. Weather and environmental considerations.

Movement Areas

3. Movement areas are that part of an airfield intended for the surface movement of the aircraft. These are paved areas and include runways, taxiways, dispersal areas, tarmacs and operational readiness platform (ORP)

Runways

4. **Number and Orientation**. Under normal conditions, only one runway will be provided, selection of runways orientation will depend on a number of facors including prevailing wind, approach paths, suitability for instrument landing, obstruction, availability of barriers etc.

5. **Runway Length.** The length of BAF runway should be 6000 ft to 9000 ft. The actual length of a runway to be provided should be adequate to meet the operational requirements of the aeroplanes for which the runway is intended and should not be less than the longest length determined by applying the corrections for local condition to the operation and performance

6. **Runway Width**. The width of the runway should be 45m (150ft). However, depending on the operational requirement of particular airfield, reduced width may be considered according to the appropriate dimension specified in ICAO Annex-14.

7. **Parallel Runways**. Where traffic density is such that a single runway is inadequate, a second runway parallel to the main runway may be provided.

8. **Separation of Parallel Runways.** Where parallel runways are provided for simultaneous use under visual meteorological conditions only, the minimum distance between their centre lines should be 210m (750 ft).

9. **Runway Strength**. A runway should be capable of withstanding the traffic of aeroplanes the runway is intended to serve.

10. **Runway Surface**. The surface of a runway should be constructed without irregularities that would result in loss in braking action or otherwise adversely affect the take off or landing of an aeroplane.

11. **Runway Clearance**. A side clearance of 75m (250 ft) on either side of the centre line of the runway shall be maintained free of all obstructions including ditches for the full length of the runway including stop way.

Shoulders

12. These are areas immediately adjacent to the edges of the runway, taxiways and tarmacs prepared for accidental or emergency use in the event of an aircraft running off the runway, taxiways or tarmacs. The areas are so prepared as to provide transition between the runway, taxiways or tarmacs and adjacent surface, so as to minimize the risk of damage to aircraft running off the runway, taxiways and tarmacs. This surface shall be paved, bituminized and graded to the extent necessary so as to minimize the risk of damage to aircraft. It should also be the capable of supporting the vehicles that may be operated on the shoulders. Width of runway shoulder shall be 7.5 (25 ft), for taxiway and tarmacs, it shall be 4.5m (15 ft).

Runway strips

13. **Dimension**. A rectangular area including the runway and stop way extended laterally to a distance of 75m (250 ft) on each side of the runway centre line, intended to reduce the risk of damage to aircraft running off of a runway and to protect aircraft flying over it during take-off and landing operation.

14. **Objects on Runway Strips**. The runway strips are to be cleared, graded and free of all natural or other obstructions, unless required for operational purposes. The surface is to be such as to keep dust to a minimum. No part of any open drain, or other such depression is permitted within the strip. If monsoon drains are provided to avoid water logging on the runway, taxiways and tarmacs those shall be covered with concrete slabs. No mobile object shall also be permitted on the runway strip during the use of runway for landing or take off. The fixed objects or visual aids required for operational purposes/air navigation purposes and satisfying the relevant frangibility shall be permitted on a runway strip.

Stop way

15. The length of the stop way shall be 61m (200 ft) and a width equal to that of the runway for the full length of stop way is to be constructed having bearing strength equal to one-third of that of the runway.

Stopway Extension

16. The length of the stop way may be extended to 274m (900ft) from the end of the runway with a width of 150m (500 ft) on either side of the extended centre line of the runway. This area will invariably be acquired. The areas are to be compacted and maintained free of all obstructions including canals and ditches.

Taxiways

17. **General.** To permit maximum runway utilization, sufficient entrance and exit taxiways will be provided to expedite the movement of aircraft to and from the runway. High-speed exit taxiways may be constructed where traffic volumes are high or benefits in operational flexibility will accrue. Where the end of a runway is not served by a taxiway, it may be necessary to provide additional pavement at the end of the runway (**dumbbell**) for the turning of aeroplanes. Such areas may also be useful along the runway to reduce taxing time and distance for some aeroplanes.

18. **Taxiway Surface**. The surface of a taxiway should not have irregularities that cause damage to aeroplane structures.

19. **Taxiway Strength**. The strength of a taxiway should be at least equal to that of the runway it serves, due consideration being given to the fact that a taxiway will be subjected to a greater density of traffic and as a result of slow moving and stationary aeroplanes, to higher stresses than the runway it serves.

20. **Design of Taxiways**. The design of a taxiway should be such that when the cockpit of the aeroplane for which the taxiway is intended remains over the taxiway centre line markings, the clearance distance between the outer main wheel of the aeroplane and the edge of the taxiway should be not less than 3m (10 ft).

21. **Taxiway Width**. A straight portion of a taxiway should have a width of not less than 15m (50 ft).

22. **Taxiway curves**. Changes in direction of taxiways should be as few and small as possible. The radious of the curves should be compatible with the manoeuvring capability and normal taxing speeds of the aeroplanes for which the taxiway is intended. The design of the curve should be such that, when the cockpit of the aeroplane remains over the taxiway centre line markings, the clearance distance between the outer main wheels of the aeroplane and the edge of the taxiway should not be less than 3 m (10 ft).

23. **Taxiway Clearance**:

a. There shall be no taxiway parallel to the runway within 75m (250 ft) from the centre line of the runway.

b. An area of 46m (150 ft) on either side from the centre line of the taxiway shall be cleared of all kinds of obstructions.

Operational Readiness Platforms (ORP).

24. ORPs are required at specific airfields. They are located at both ends of the runway, either alongside the runway or outside the runway strip. In the latter case, they are joined to the runway by a high-speed taxiway.

Dispersal Areas

25. These are paved areas provided for dispersal of aircraft and include tarmacs, aircraft servicing platforms, blast pens etc.

Tarmacs

26. **Characteristics**. Each part of a tarmac should be capable of withstanding the traffic of the aircraft it is intended to serve, due consideration being given to the fact that some portions of the tarmac will be subjected to a higher density of traffic and, as a result of slow moving or stationary aircraft, to higher stresses than a runway.

27. **Tarmac Clearance**. The horizontal clearance for tarmacs shall be minimum of 7.5m (25 ft) measuring from its edges. These areas are to be compacted and maintained free of all obstructions.

Strength of Pavements.

28. The bearing strength of all pavements shall be made available using the appropriate Aircraft Classification Number-Pavement Classification Number (AC/VPCN) method.

Declared Distances

29. The aeroplane performance operating limitations require a length, which is adequate to ensure that the aeroplane can, after starting take off, either be brought safely to a stop or complete take-off safely. For this purpose, following distances shall be calculated for a runway intended for use by aeroplanes:

a. **Take-off Run Available (TORA)**. The length of runway declared available and suitable for the ground run of an aeroplane taking off.

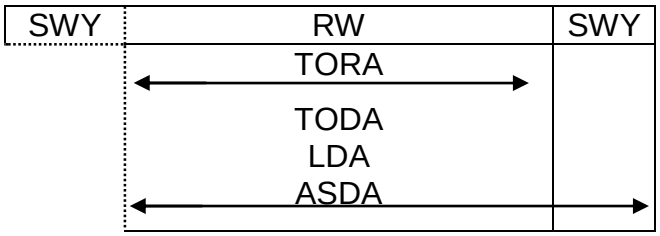
b. **Take-off Distance Available (TODA).** The length of the take-off run available plus the length of the clearway, if provided.

c. **Accelerate Stop Distance Available (ASDA)**. The length of the take-off run available plus the length of the stop way, if provided.

d. **Landing Distance Available (LDA**). The length of runway, which is declared available and suitable for, the ground runs of an aeroplane landing.

Calculation of Declared Distances

30. A standard BAF runway is provided with a stopway (SWY). The TORA, TODA and LDA should normally be equal to the length of the runway. The ASDA will include the length of runway and the length of stopway.



Note: *When the aircraft arresting barrier is installed within the stopway then ASDA will include only the length of stopway upto barrier.*

Standard Dimensions of Areas

31. Standard dimension of different areas associated with BAF airfields have been laid down as per the following Table-1. However, when authorised by appropriate authority, deviations from standard dimensions may be made at airfield depending upon operational, technical, physical necessities etc.

STANDARD DIMENSIONS OF AREAS ASSOCIATED WITH BAF AIRFIELDS

SER	AREAS	DIMENSIONS	REMARKS
1.	**Runways**		
	a. Length	1830M -2745M (6000 ft-9000 ft)	
	b. Width	45M (150 ft)	
	c. Shoulders Width	7.5M (25 ft)	
	d. Runway Strip	75 M (250 ft)	
2.	**Taxiways**		
	a. Width	15M (50 ft)	
	b. Width of Shoulders	4.5M (15 ft) on either side.	
	c. Taxiway Clearance	15M (150 ft)	
	d. Width of culverts on taxiways	33M (110 ft)	
	e. Distance between runway and nearest edge of parallel taxiway.	75M (250 ft)	Minimum
3.	**Stopway Areas**		
	a. Length of paved Stopway.	61M (200 ft) from end of the runway	
	b. Width of Paved Stopway.	Equal to runway width	
	c. Length of Stopway extension.	274M (900 ft) from end of the runway.	
	d. Width of prepared Stopway extension	300M (1000 ft)	
4.	Distance of security fencing from end of Stopway extension.	120M (1000 ft)	
5.	Distance of a road or a railway crossing from end of extension.	455M (1500 ft)	
6.	**ORP for Fighter Bases**		
	Size	180M to 230M X 45M (600 ft to 750 ft X 150 ft)	To accommodate 8 aircraft

CONSOLIDATED EXERCISE-4

Q1. Layout of a BAF airfield depends on what are the factors?

Q2. What are the characteristics of runway strips?

Q3. What are the taxiway clearance limitations?

Q4. How declared distances to be calculated for a standard BAF airfield?

ANSWERS TO CONSOLIDATED EXERCISE-4

A1. Write para 02 from Task-4.

A2. Write para 13 to 14 from Task-4

A3. Write para 24 from Task-4

A4. Write para 31 from Task-4

Reference Materials.

1. AFM 60-13 (under review).

2. AFM 61-1.

3. Civil Aviation Rule 1984 (Bangladesh Gazette).

4. ICAO Annex – 14.

5. Trg Notes of BATCO Course, ATCOTE, Air Force Academy, IAF, India.

TASK : 5
AIRFIELD OBSTRUCTION CLEARANCE POLICY (BAF)

Introduction

1. The objectives of the specifications mentioned herein are to define the airspace around aerodromes to be maintained free from obstacles, so as to permit the intended aeroplane operations at the aerodromes to be conducted safely and to prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace. The criteria laid down in the subsequent paragraphs are based on ICAO Annex-14, and CAR 84.

2. **The objectives are**:

   a. Facilitate inspection of these areas at regular intervals with a view to prevent unauthorised constructions.

   b. Lay down criteria for permitting new constructions in the vicinity of an aerodrome.

Note: Objects which penetrate the obstacle limitation surfaces contained herein may in certain circumstances cause an increase in the obstacle clearance altitude/height for an instrument approach procedure or any associated visual circling procedure. Criteria for evaluation obstacles are contained in “Procedures for Air Navigation Services-Aircraft Operations (PANS-OPS) Doc 8168”.

Objects Outside Obstacle Limitation Surface

3. In areas beyond the limits of the obstacle limitation surfaces, at least those objects, which extend to a height of 150 meters or more above ground elevation, should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes. This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

Restriction of Obstruction

4. It is desirable that those objects or portions thereof that extend above the obstacle limitation surfaces should be regarded as obstructions and should be removed. It is also desirable that the land beneath or the airspace above the aforementioned surfaces be either under the control of the competent authority or subject to suitable zoning restrictions to prevent the projection of obstructions into the surfaces.

Other objects

5. Objects which do not project through the approach surfaces but which would nevertheless adversely affect the optimum sitting or performance of the visual or non-visual aids, should as far as practicable, be removed.

6. Further, objects which might in the opinion of the appropriate authority, after aeronautical study, endanger aeroplanes even though these objects do not constitute an obstruction as such, should be removed so far as practicable.

7. The following constructions shall not be permitted:

a. Overhead HT/LT lines or telephone/telegraph lines shall not be permitted in the approach/take-off climb areas, within 3000m of the inner edge of these areas;

b. Construction of butcheries, tanneries and refuse dumps shall not be permitted within a radius of 10 Km from ARP;

***Note**: Incinerators could be permitted clear of approach/take-off areas.*

c. Factory chimneys proposed to be constructed within a radius of 8000m of ARP shall not be permitted unless owners give a written undertaking that oil, electrical furnaces or any other fuel, which will not cause smoke hazard, will be used.

Transitional surface

8. The limits of the transitional surface shall comprise:

a. A lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length to the strip parallel to the runway center line: and

b. An upper edge located in the plane of the inner horizontal surface.

9. The slope of 14.3% of the transitional surface shall be measured in a vertical plane at right angles to the centre line of the runway.

Inner Transitional Surface

10. A surface similar to the transitional surface but closer to the runway. The limits of an inner transitional surface shall comprise:

a. A lower edge beginning at the end of the inner approach surface and extending down the side of the inner approach surface to the inner edge of that surface, from there along the strip parallel to the runway centre line to the inner edge of the balked landing surface and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and

b. An upper edge located in the plane of the inner horizontal surface.

11. The elevation of a point on the lower edge shall be:

a. Along the side of the inner approach surface and balked landing surface equal to the elevation of the particular surface at that point; and

b. Along the strip equal to the elevation of the nearest point on the centre line of the runway or its extension.

***Note**: As a result of (b) the inner transitional surface along the strip will be curved if the runway profile is curved or a plane if the runway profile is a straight line. The intersection of the inner transitional surface with the inner horizontal surface will also be a curved or straight line depending on the runway profile.*

12. The slope of the inner transitional surface shall be measured in a vertical plane at right angles to the centre line of the runway.

***Note**: It is intended that the inner transitional surface be the controlling obstacle limitation surfaces for navigation aids, aircraft and other vehicles that must be near the runway and which is not to be penetrated except for frangible objects. The transitional surface described in Para 8 is intended to remain as the controlling obstacle limitation surface for buildings, etc.*

Inner Horizontal Surface

13. The inner horizontal surface is located in a horizontal plane above an aerodrome and its environs. The purpose of the inner horizontal surface is to protect airspace for visual circling prior to landing, possibly after a descent through cloud aligned with a runway other than that in-use for landing.

14. The radius or outer limits of the inner horizontal surface shall be measured from a reference point or points established for such purpose. The shape of the inner horizontal surface need not necessarily be circular. The height of the inner horizontal shall be measured above an elevation datum established for such purpose. Within the inner horizontal surface of an aerodrome, there shall not be any obstacle above 46.5m (150 ft) from the runway level.

The Conical Surface

15. The conical surface is a surface sloping upwards and outwards from the periphery of the inner horizontal surface. The limits of the conical surface shall comprise:

a. A lower edge coincident with the periphery of the inner horizontal surface.

b. An upper edge located at a specified height above the inner horizontal surface.

16. The slope of conical surface shall be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface.

Outer Horizontal Surface

17. The outer horizontal surface extends outward from the periphery of conical surface upto distance of 15km from ARP. It will be a flat surface with the maximum permissible height of 150m above the aerodrome elevation.

Approach Surface (Funnel)

18. The approach surface shall start from the end of 60m (200 ft) stopway area spreading out to a maximum width of 610m (2000 ft) on either side of runway extended centre line at a distance of 3060m (10,200 ft) from the end of the runway.

19. The elevation clearance of the approach area shall be 2% starting from the end of the stopway to maximum height of 55m (182 ft) which shall be maintained upto a distance of 4,000m (13,000 ft) from the end of the runway and from 4,000m (13,000 ft) the elevation clearance shall be 2.5% till it reaches a height 150m (500 ft) which shall be maintained till 15 km (50,000 ft) from the end of the runway.

Take-off Climb Surface

20. The take-off climb area shall be established for each runway direction intended to be used for take-off. It is an inclined plane or other specified surface beyond the end of a runways or clear way. It comprises of:

a. An inner edges of a specified length (180m) horizontal and perpendicular to the centre line of the runway and located at a specified distance (60m) beyond the end of the runway;

b. Two sides originating at the ends of the inner edge, diverging uniformly at a specified rate each side (12.5%) to a specified final width (1200/1800m) and continuing thereafter at that width for the remainder length of the take-off climb surface; and

c. An outer edge horizontal and perpendicular to the specified take-off track.

21. In the case of a straight take-off flight path, the slope of the take-off climb surface shall be measured in the vertical plane containing the centre line of the runway. If a take-off flight path involves a turn, take-off climb surface shall be a complex surface containing the horizontal normal to its centre line, and the slope of the centre line shall be the same as that for straight take-off flight path.

Balked landing surface

22. An inclined place located at a specified distance after the threshold extending between the inner transitional surfaces. The limits of the balked landing surface shall comprise:

a. An inner edge horizontal and perpendicular to the centre line of the runway and located at a specified distance after the threshold;

b. Two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centre line of the runway; and

c. An outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.

23. The elevation of the inner edge shall be equal to the elevation of the runway centre line at the location of the inner edge. The slope of the balked landing surface shall be measured in the vertical plane containing the centre line of the runway.

Inner Approach Surface

24. A rectangular portion of the approach surface immediately preceding the threshold. The limits of the inner approach surface shall comprise;

a. An inner edge coincident with the location of the inner edge of the approach surface but of its own specified length.

b. Two sides originating at the ends of the inner edge and extending parallel to the vertical plane containing the centre line of the runway; and

c. An outer edge parallel to the inner edge.

Authorisation of Unavoidable Constructions

25. Due to operational reasons certain installations like runway controllers' Caravan/ mobile hut and radio/visual aids may be required to be sited in areas where they might constitute an obstruction. Such equipment/installation should be of minimum practicable mass and height, frangible designed and mounted, and sited in such a manner as to reduce the hazard to aircraft operation in every case clearance must be obtained from the appropriate authorities.

Obstacle Limitation Surfaces

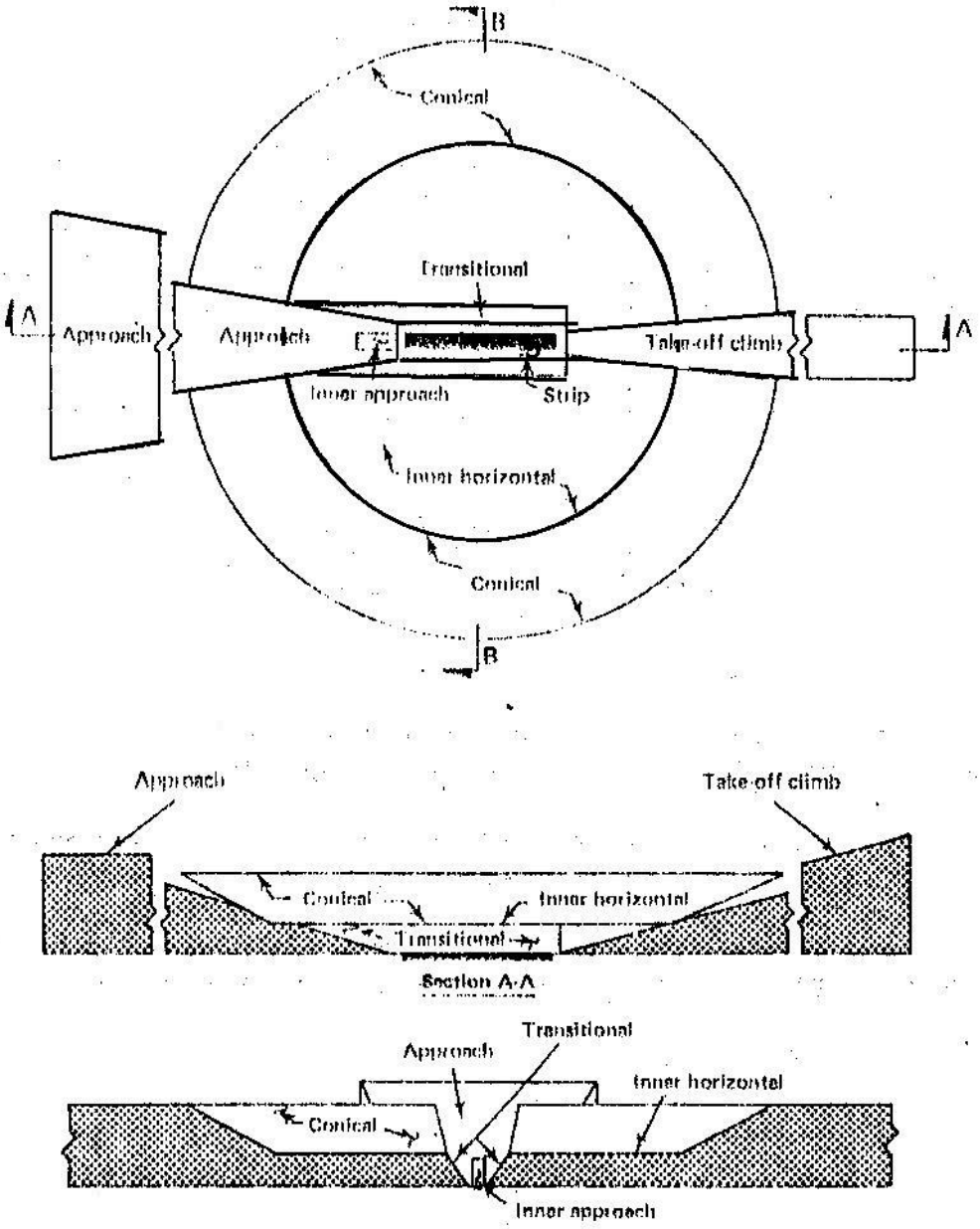


Figure-1

Inner Approach, Inner Transitional and Balked Landing Obstacle Limitation Surfaces

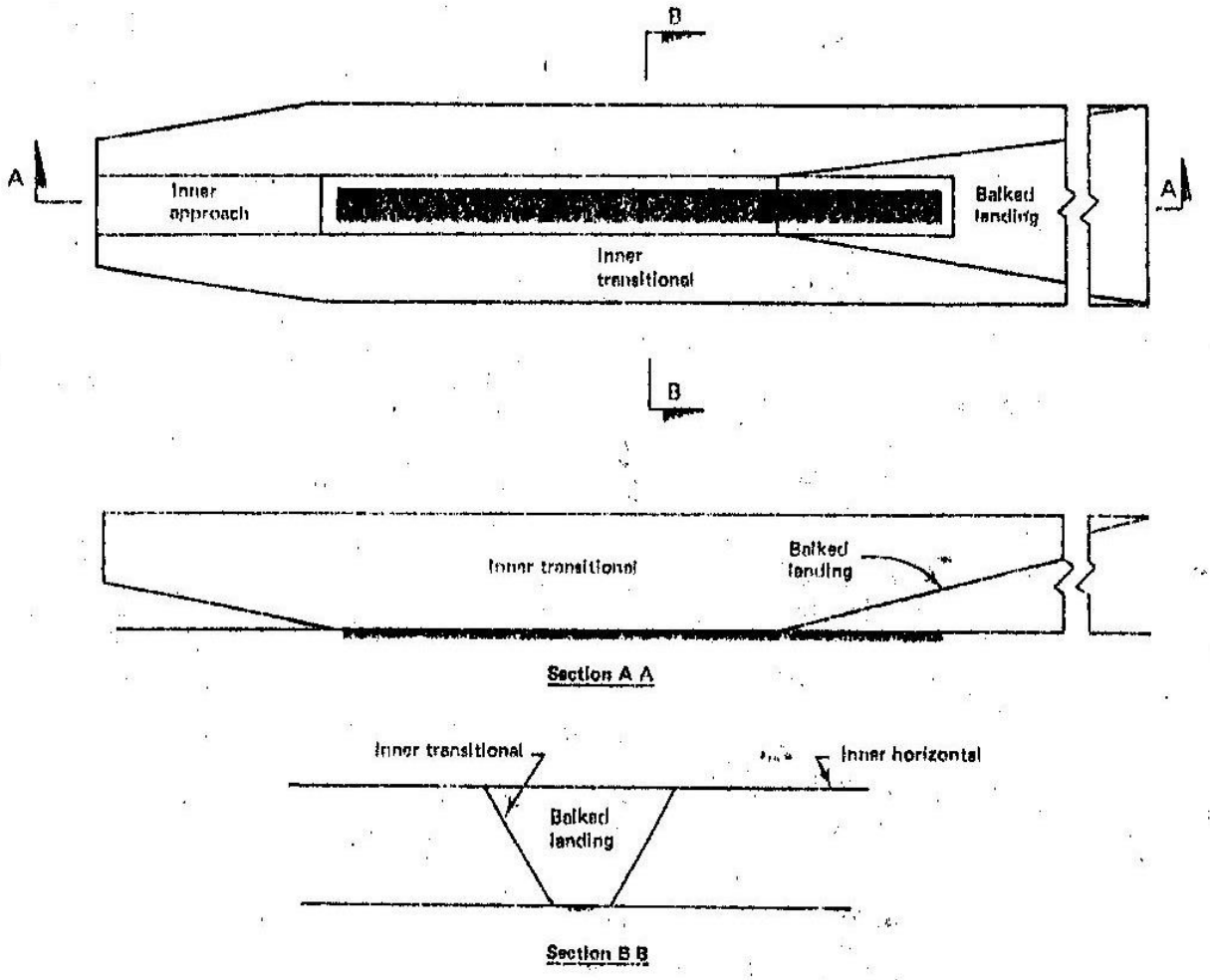


Figure-2

DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES: APPROACH RUNWAYS

Ser	Surface and Dimensions	Runway Classification	
		Non-Precision (Similar to ICAO Code 3 or 4)	Precision (Similar to ICAO Code 3 or 4)
1.	**INNER HORIZONTAL**		
	a. Height	45m	45m
	b. Radius	4000m	4000m
2.	**CONICAL**		
	a. Slope	5%	5%
	b. Height	100m	100m
3.	**OUTER HORIZONTAL**		
	a. Length	8900m	8900m
	b. Total Length	15000m	15000m
	c. Height	150m	150m
4.	**TRANSITIONAL**		
	a. Slope	14.3%	14.3%
5.	**APPROACH**		
	a. Length of inner edge	300m	300m
	b. Distance from threshold	60m	60m
	c. Divergence (each side)	15%	15%
	d. First Section (1) Length (2) Slope	 3000m 2%	 3000m 2%
	e. Second Section (1) Length (2) Slope	 3600m 2.5%	 3600m 2.5%
	f. Horizontal Section (1) Length g. Total Length (d+e+f)	 8400m 15000m	 8400m 15000m

Table – 1

DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION OF INNER SURFACES

Ser	Surface and Dimensions	Runway Classification	
		Non-Precision (Similar to ICAO Code 3 or 4)	Precision (Similar to ICAO Code 3 or 4)
1.	**INNER APPROACH**		
	a. Width	-----	120m
	b. Distance from threshold	-----	60m
	c. Length	-----	900m
	d. Slope	-----	2%
2.	**INNER TRANSITIONAL**		
	a. Slope	------	33.3%
3.	**BALKED LANDING SURFACE**		
	a. Length of inner edge	------	120m
	b. Distance from threshold	------	1800m
	c. Divergences (each side	-----	10%
	d. Slope	-----	3.33%

Table- 2

DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES: RUNWAYS MEANT FOR TAKE-OFF

Surfaces	Dimensions/slope
TAKE-OFF CLIMB	
a. Length of inner edge	180m
b. Distance from runway end	60m
c. Divergence (each side)	12.5%
d. Final width	1200 m (1800m)*
e. Length	15000m
f. Slope	2%

* When the intended track includes changes of heading greater than 15 deg for operations conducted in IMC, VMC by night.

Table – 3

CONSOLIDATED EXERCISE -5

Q1. What is the Inner Horizontal Surface? What is the maximum height of a obstacle is permitted within Inner Horizontal Surface??

Q2. How Approach Surfaces are established? What is the obstacle limitation within Approach Surfaces?

ANSWER TO CONSOLIDATED TXERCISE – 5

A1. Write para 13 to 14 from Task – 5.

A2. Write para 18 to 19 from Task – 5.

Reference Materials

1. AFM 60-13 (under review).

2. Civil Aviation Rule 1984 (Bangladesh Gazette).

3. ICAO Annex-14 and Doc 8168.

4. Training Notes of BATCO Course, ATCOITE, Air Force Academy, IAF, India.

TASK : 6

AERONAUTICAL GROUND LIGHTS PERMANENT LIGTING

Runway Threshold Lights

1. **Application**. Runway threshold lights shall be provided for a runway equipped with runway edge lights.

2. **Location.**

a. The threshold lights shall be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any case, not more than 3 m outside the extremity.

b. The lights should be either:

(1) Equally spaced between the rows of runway edge lights.

(2) Symmetrically disposed about the runway centre line in two groups, with the lights uniformly spaced in each group and with a gap between the groups equal to the gauge of the touchdown zone marking or lighting, where such is provided, or otherwise not more than half the distance between the rows of runway edge lights.

3. **Characteristics**

a. Threshold lighting shall consist of at least six lights.

b. Runway threshold lights shall be fixed unidirectional lights showing green in the direction of approach to the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

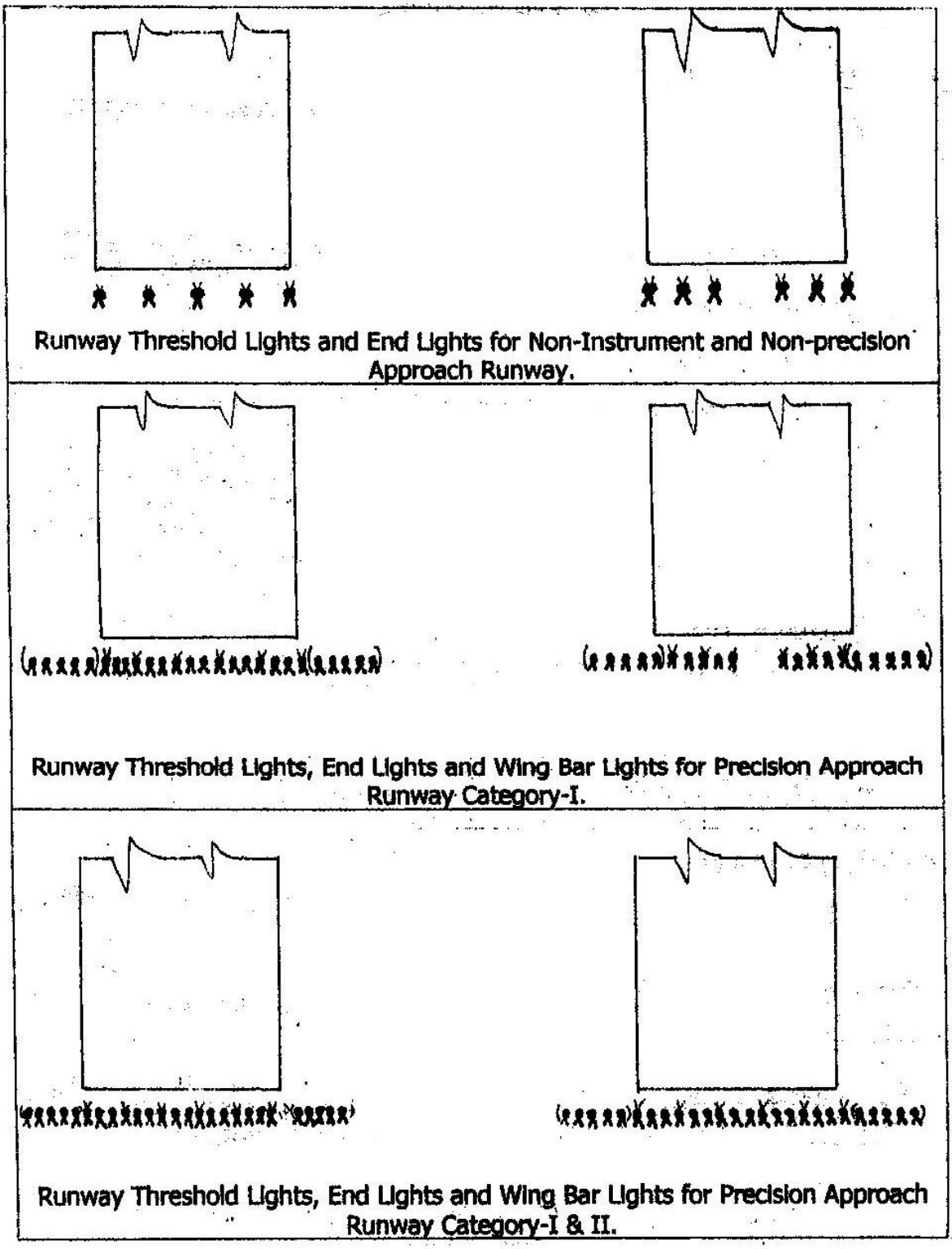
Runway End Lights

4. **Application**. Runway end lights shall be provided for runway equipped with runway edge lights.

5. **Location**. Runway end lights shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3 m outside the end.

6. **Characteristics**. Runway end lights shall be fixed unidirectional lights showing red in the direction of the runway. The intensity and beam spread of the lights shall be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

7. The arrangements of runway end lights are shown in the figure-1.



Runway Threshold Lights and End Lights for Non-Instrument and Non-precision Approach Runway.

Runway Threshold Lights, End Lights and Wing Bar Lights for Precision Approach Runway Category-I.

Runway Threshold Lights, End Lights and Wing Bar Lights for Precision Approach Runway Category-I & II.

Figure-1

Runway Edge Lights

8. **Application**

a. Runway edge lights shall be provided for a runway intended for use at night.

b. Runway edge lights should be provided on a runway intended for take-off with an operating minimum below an RVR of the order of 800 m by day.

9. **Location**.

a. Runway edge lights shall be placed along the full length of the runway and shall be in two parallel rows equidistant from the centre line.

b. Runway edge lights shall be placed along the edges of the area declared for use as the runway or outside the edges of the area at a distance of not more than 3 m.

c. The lights shall be uniformly spaced in rows at intervals of not more than 60m. The lights on opposite sides of the runway axis shall be on lines at right angles to that axis. At intersections of runways, lights may be spaced irregularly or omitted, provided that adequate guidance remains available to the pilot.

10. **Characteristics.**

a. Runway edge lights shall be fixed lights showing variable white, except that:

(1) In the case of a displaced threshold, the lights between the beginning of the runway and the displaced threshold shall show red in the approach direction.

(2) A section of the lights 600 m or one-third of the runway length, whichever is the less, at the remote end of the runway from the end at which the take-off run is started, may show yellow.

b. The runway edge lights shall show at all angles in azimuth necessary to provide guidance to a pilot landing or taking off in either direction.

11. The arrangements of runway edge lights are shown in the figure-2.

Runway Centre Line Lights

12. **Application.** Runway centre line light shall be provided on a precision approach runway category II or III (ICAO Standard) and on a runway intended to be used for take-off and with an operating minimum below an RVR of the order of 400m.

13, **Location.** Runway centre line lights shall be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of the runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line. The lights shall be located from the threshold to the end at a longitudinal spacing of approximately:

a. 7.5m or 15m on a precision approach runway category III.

b. 7.5m, 15m or 30m on a precision approach runway category II or other runway on which the lights are provided.

14. **Characteristics**. Runway centre line light shall be fixed lights showing variable white from the threshold to the point 900 m from the runway end; alternate red and variable white from 900 m to 300 m from the runway end; and red from 300m to the runway end, except that:

a. Where the runway centre line lights are spaced at 7.5 m intervals alternate pairs of red and variable white lights shall be used on the section from 900 m to 300 from the runway end; and

b. For runway less than 1800 m in length, the alternate red and variable white lights shall extend from the mid point of the runway usable for landing to 300 m from the runway end.

15. The arrangements of runway centre line lights are shown in Figure-2.

Runway Touch Down Zone Lights

16. **Application**. Touchdown zone lights shall be provided in the touchdown zone of a precision approach runway category II or III.

17. Touchdown zone lights shall extend from the threshold for a longitudinal distance of 900 m, except that, on runways less than 1800m in length, the system shall be shortened so that it does not extend beyond the midpoint of the runway. The pattern shall be formed by pairs of barrettes symmetrically located about the runway centre line. The lateral spacing between the innermost lights of a pairs of barrettes shall be equal to the lateral spacing selected for the touchdown zone marking. The longitudinal spacing between pairs of barrettes shall be either 30 m or 60 m.

18. **Characteristics**.

a. Touchdown zone lights shall be fixed unidirectional lights showing variable white.

b. A barrette shall be composed of at least three lights with a spacing between the lights of not more than 1.5m.

c. A barrette should be not less than 3 m nor more than 4.5m in length.

19. The runway touch down zone lights are shown in Figure-2.

Taxiway Edge Lights

20. **Application** Taxiway edge lights shall be provided on a holding bay, apron, etc. Intended for use at night and on a taxiway not provided with taxiway centre line lights and intended for use at night, except that taxiway edge lights need not be provided where, considering the nature of the operations adequate guidance can be achieved by surface illumination or other means.

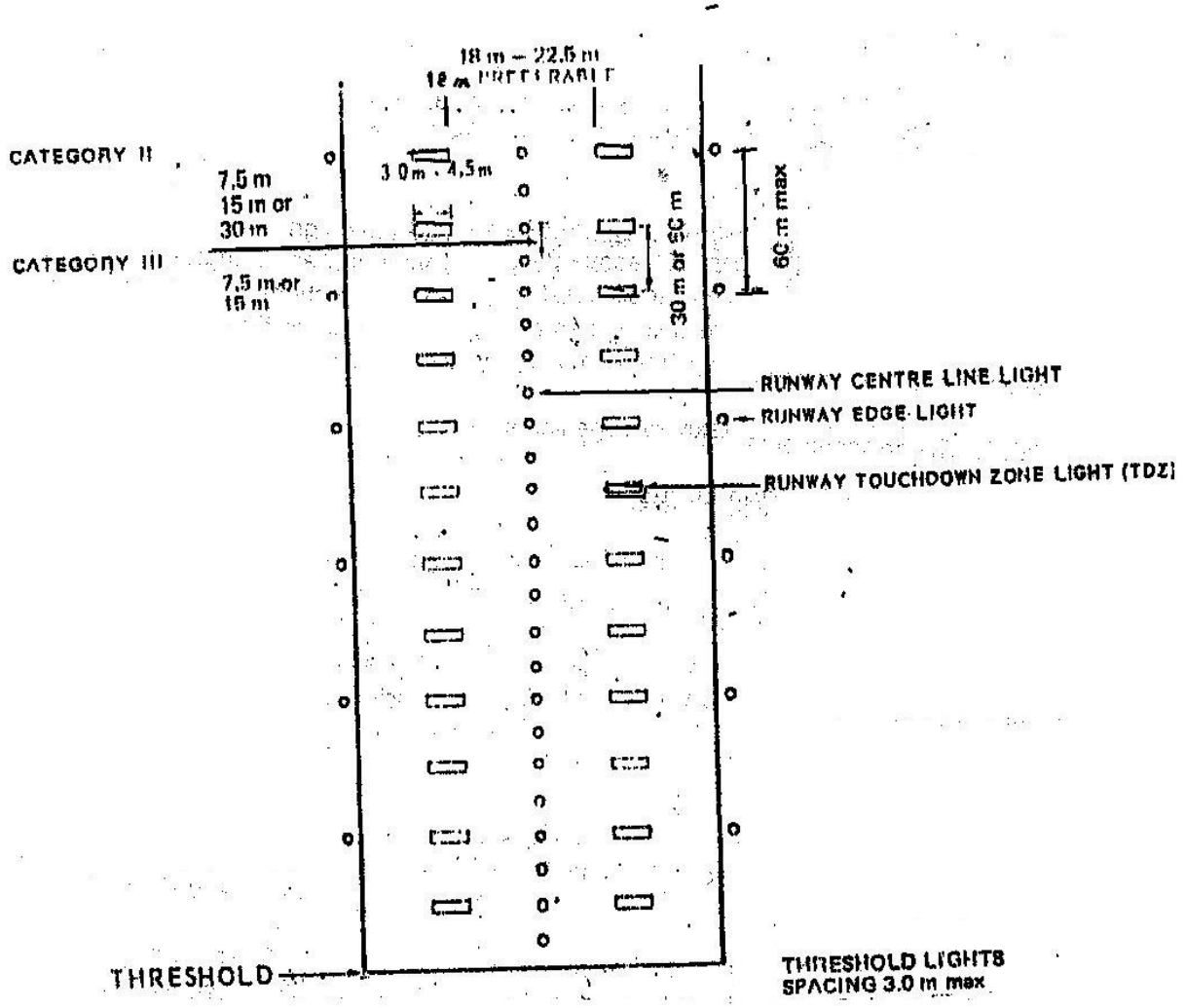

18 m – 22.5 m
CATEGORY II
7.5 m
15 m or
30 m
CATEGORY III
7.5 m or
15 m
3.0 m - 4.5 m
30 m or 60 m
60 m max
RUNWAY CENTRE LINE LIGHT
RUNWAY EDGE LIGHT
RUNWAY TOUCHDOWN ZONE LIGHT (TDZ)
THRESHOLD
THRESHOLD LIGHTS
SPACING 3.0 m max

Figure-2

21. **Location.**

a. Taxiway edge lights on a straight section of a taxiway should be spaced at uniform longitudinal intervals of not more than 60m. The lights on a curve should be spaced at intervals less than 60m so that a clear indication of the curve is provided.

b. The lights should be located as near as practicable to the edges of the taxiway, holding bay or apron, etc, or outside the edges at a distance of not more than 3 m.

22. **Characteristics**. Taxiway edge lights shall be fixed lights showing blue. The lights shall show up to at least 30^0 above the horizontal and at all angles in azimuth necessary to provide guidance to a pilot taxing in either direction. At an intersection, exit or curve the lights shall be shielded as far as practicable so that they cannot be seen in angles of azimuth in which they may be confused with other lights.

23. The arrangements of taxiway edge lights are shown in the figure-3.

Runway Holding Position Lights

24. **Application**. Runway-holding position lights should be provided at a precision approach category II or III runway-holding position.

25. **Location**. Where provided, runway-holding position lights shall be located at each side of a runway-holding position as close as possible to the taxiway edge.

26. **Characteristics.**

a. Runway holding position lights shall consist of two alternately illuminated yellow lights. The light beam shall be unidirectional and aligned so as to be visible to the pilot of an aeroplane taxing to the holding position.

b. The intensity of the light should be adequate for the conditions of visibility and ambient light in which the use of the holding position is intended but should not dazzle the pilot.

27. The arrangement of runway holding position is shown in the figure-3.

FORTABEL LIGHTING

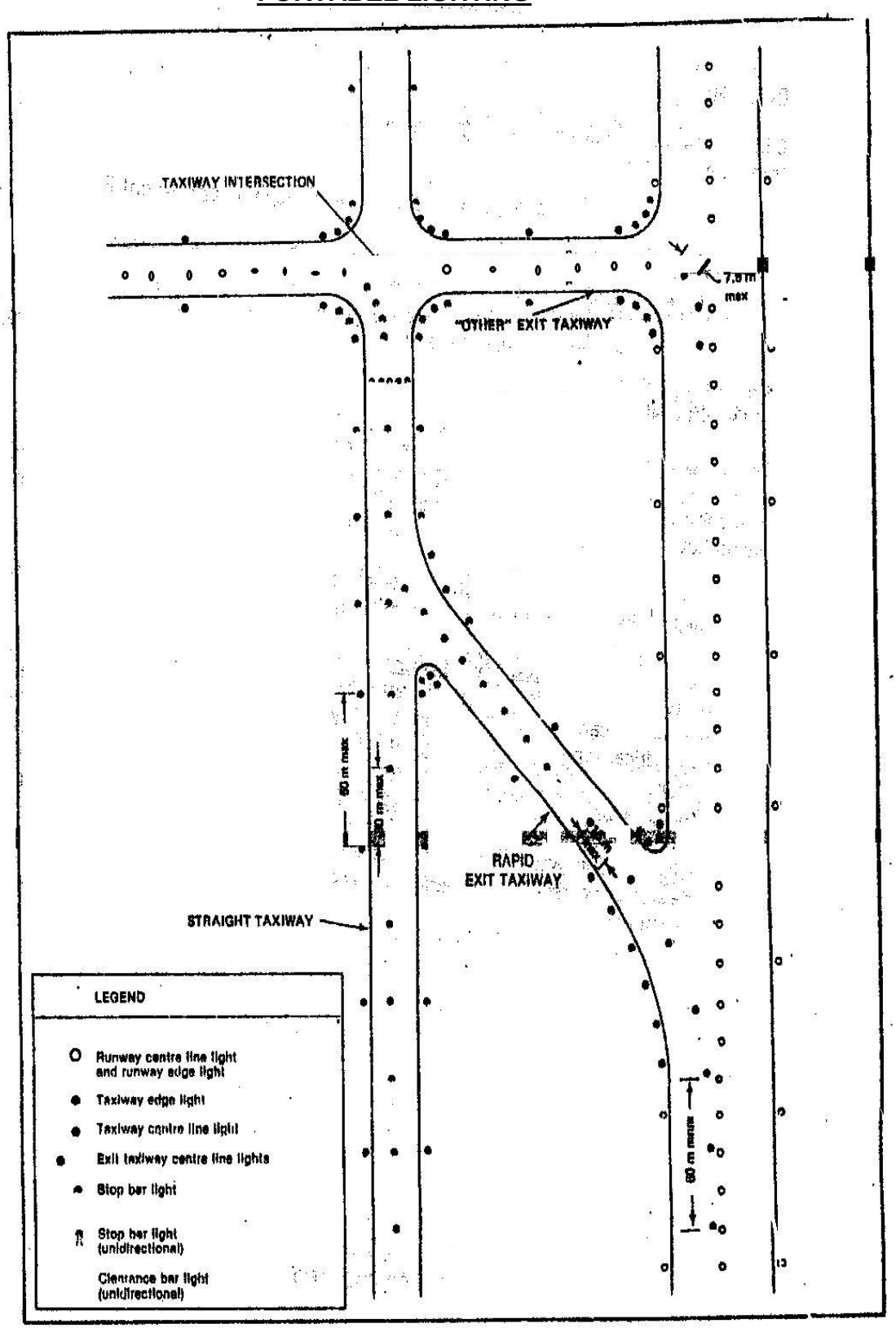


Figure –3, Taxiway Lightings

Purpose

28. Portable aerodrome lighting equipment and flare paths are designed for three main purposes:

a. To provide lighting at aerodromes which have no permanent lighting.

b. To cover sudden failure of permanent lighting and thus provide pilots with extra assistance during critical phase of take-offs and landings at night.

c. To augment partial failures/un-serviceability of main lighting elements.

Portable Lighting Equipment

29. All flying Bases shall have portable aerodrome lighting equipment ready to lay whenever night flying takes place. OIC ATC Sqn/SATCO is responsible for ensuring availability of portable lights and other night flying equipment in the Base Night Flying Equipment Store according to approved scale. The equipment consists of:

a. **Gooseneck Flares**. These are Kerosene/Paraffin-burning flares which shall remain alight at least for six hours.

b. **Retor-Reflective Markers**. Airfields that do not have permanent electric taxiway lights is authorised to use retro-reflective markers. These markers can be installed on taxiways by insertion into pre-embedded cylindrical pipes or by driving into ground with spikes fitted to the batons (Flgure-4). These can also be used for providing additional guidance on blind turns, bifurcation of taxiways, edges of aircraft parking areas/aprons and as additional obstruction markers. These markers are effective on taxiways upto width of 50ft when placed at a distance of maximum of 100ft. The spacing needs to be reduced on bends, curves and zones/areas requiring additional prominence.

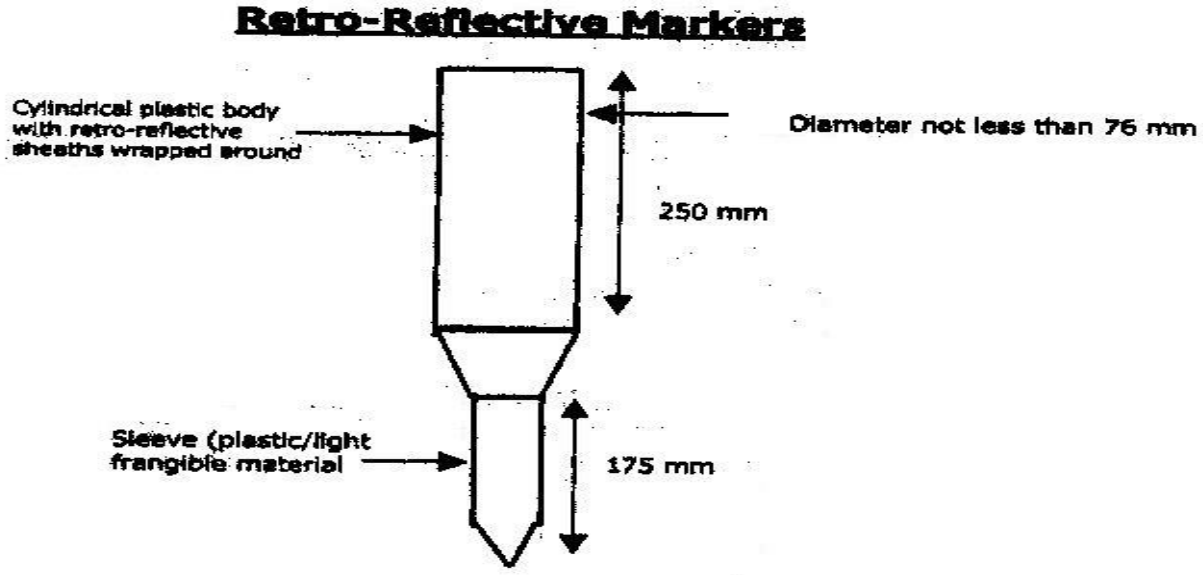


Figure - 4

Layout of Portable Lights at Airfield Having No/Fully Unserviceable Electrical Lights.

30. **Runway Lighting**. During night flying operations at airfields having no/unserviceable electric lights shall be served with portable lights. Standard Layout' (the arrangement is illustrated in the Figure-5) as described below is to be done:

a. **Runway Edge Flare Path**. The Kerosene flares (Goosenecks) shall be uniformly spaced in rows at intervals of 300 ft. The flares should be placed along the edge of the runway or where practicable outside the edges (on the shoulder) at a distance of not more than 10 ft.

b. **Indication of Remaining Distance on the Runway**. Considering the complex nature of modern aircraft i.e. its speed and runway length requirement etc, it is necessary to provide checkpoints information on aircraft performance and the action to be taken by the pilot. This necessitates to give an indication to the pilot of the remaining distances on the runway. This is provided as under:

(1) **First and Last 2000 ft Runway Wing Bar Lights**. 1st and last 2000 ft of runway is to be indicated by placing 3 goosenecks on both side of runway 5 ft away from the edge. The spacing between the flares is 5 ft.

(2) **Runway Middle Wing Bar**. Remaining half of the runway is to be indicated by 5 goosenecks on both sides of the runway 5 ft away from the edge. The spacing between the flares is 5 ft.

c. **Threshold Wing Bar Lights**. No flares shall be placed on the threshold of runway-in-use. The threshold of runway-in-use shall be indicated by placing 4 goosenecks on both sides of runway not more than 10 ft.away from the runway edge lights. The first runway edge lights are also form the innermost lights of the wing bars, thus the total number of flares including the runway edge flares in each bar shall be 5. The spacing between the flares is 5 ft.

d. **Runway End Wing Bar Lights**. No flares shall be placed on the runway end of runway-in-use. The runway end of runway-in-use shall be indicated by placing 4 goosenecks on both sides of runway not more than 10 ft. away from the runway edge lights. The last runway edge lights are also form the innermost lights of the wing bars, thus the total number of flares including the runway edge flares in each bar shall be 5. The spacing between the flares is 5 ft.

31. **Taxiway lighting**. The taxiways are to be lighted by Retro-Reflective (Stickers) Markers. The layout and spacing is to be the same as for permanent taxiway lights. The colour of these lights is to be aviation blue. These are placed on the edge of the taxiway on both sides opposite to each other. Under no circumstances goosenecks flares will be used for lighting taxiways.

Emergency Flares Layout at Runway Having Serviceable Electrical Lights

32. **Purpose**. The main purpose of emergency fares layout is to provide a landing reference to aircraft which is committed to land and is on final stage of landing when main power supply fails and the automatic generator has not yet taken over. Emergency flares are to be lighted before the commencement of night flying.

33. **Limitation**. Emergency flares layout is only done at BAF airfields and joint civil/military airfields serving as domestic airports having fully serviceable permanent electric lights. Gooseneck flares are not to be laid at the joint civil/military airfields serving as international airports, where wide-bodied aircraft are operating. International airports usually have permanent electric lights with very reliable main and standby power sources.

34. **Layout.** The emergency flares layout is normally done on the left hand edge of runway-in-use. The goosenecks are to be placed at every alternate electric light for the full length of runway. The Runway Middle Wing Bar shall be of only one bar on left hand side of the runway (e.i emergency flares layout side) consisting of 5 goosenecks. If the runway-in-use changes, emergency flares shall remain as laid and pilots are warned accordingly. The Threshold and Runway End Wing Bars are to be placed as of standard layout mentioned in para 30 c & d.

Placing of Flares at Runway with Partial Failure of Electrical Lights

35. Partial failure of electric lightings may occur due to faulty supply cable or unserviceable bulbs. More than 30% lights unserviceable in any one edge may make it difficult for pilot to get accurate runway reference. Effort should be taken to make all the lights serviceable before starting night flying. In case electric lights cannot be made serviceable and unserviceable lights are more than 30% of the total lights of any edge, then additional gooseneck flares are also to be placed at the position of all unserviceable electrical flights. This arrangement is in addition to emergency flares layout.

Fire Pre-caution

36. Gooseneck flares are carried in a deep-lipped metal tray and should be transported in metal-bodied vehicle. Under no circumstances are lighted flares to be loaded in to a vehicle; nor are they to be filled or lighted in the vehicle.

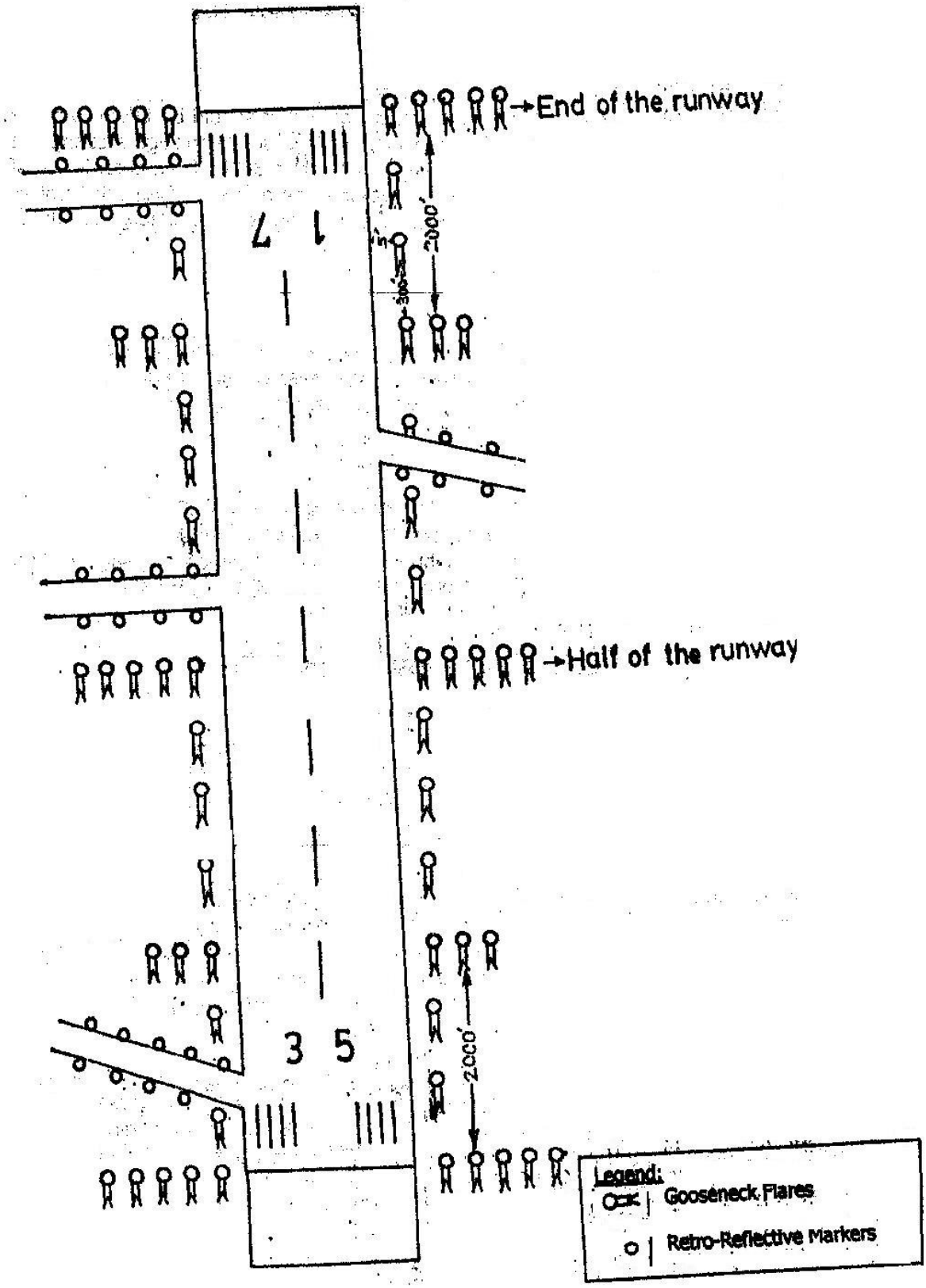


Figure - 5 : Flares Layout

Night Flying Equipment Store

37. Night Flying Equipment because of its inflammable nature should be stored in a safe building. This building should be away from other buildings. It should have no wooden structure inside. Proper fire fighting equipment, like as POL store area, should be provided. The store shall be properly marked and distinguished.

PORTABLE ELECTRICAL FLARE PATH

38. **Requirement**. The portable electrical flare paths are made available in the country to light those airfields which are located in combat zone during war or to be used as standby lighting source at Base. It is laid down or is held ready to be laid down when required. These flares are dome shaped. Its lay out is similar to the Gooseneck flares. These are placed on the edge of runway. The power supply to this flare path is 220 volts from the main supply sources. As these flares are of temporary nature they are supplied by overland (not conceal) power cables. These powers cables should be placed immediately outside the runway edge. These flares can be dismantled packed and ready to be dispatched to another Base within few hours. It is therefore very advantageous to have these flares because it can be used both at forward Bases and also on those airfields for which no plan exist for the lights installation but are required for operational reason.

39. **Maintenance**. MES (Air) is responsible for maintenance of electrical flares and generator. When these flares installed in an airfield, in case of un-serviceability of the lights/generator etc SATCO/DATCO is to report direct to GE (Air) for immediate replacement/repair. Any un-serviceability or failure of the lights/generator is subjected to immediate NOTAM action.

CONSOLIDATED EXERCISE-6

Q1. Explain the application, location and characteristics of runway edge lights.

Q2. Explain the application, location and characteristics of taxiway edge lights.

Q3. Describe the emergency flares layout procedure?

Q4. What pre-cautions to be observed for storing and carrying gooseneck flares?

ANSWERS TO CONSOLIDATED EXERVISE-6

A1. Write para 8 to 11 from Task-6.

A2. Write para 20 to 23 Task-6.

A3. Write para 32 to 34 Task-6.

A4. Write para 36 & 37 from Task-6.

Reference Materials

1. AFM 60-13 (under review).

2. ICAO Annex-14 & Doc 8168.

3. Training Notes of BATCO Course, ATCOTE, Air Force Academy, IAF, India.

TASK : 7

AIRSPACE MANAGEMENT – CLASSIFICATION OF AIRSPACE

ICAO Airspace Classifications

1. Whenever a control area is designated it shall be designated in accordance with following airspace classifications:

a. **Class A**. IFR flights only are permitted; all flights are subject to air traffic control service and separated from each other.

b. **Class B**. IFR and VFR lights are permitted; all flights are subject to air traffic control service and are separated from each other.

c. **Class C**. IFR and VFR flights are permitted, all flights are subject to air traffic control service and IFR fights are separated from other IFR flights and from VFR flights. VFR flights are separated from IFR flights and receive traffic information in respect of other VFR flights.

d. **Class D**. IFR and VFR flights are permitted and all flights are subject to air traffic control service, IFR flights are separated from other IFR flights and receive traffic information in respect of VFR flights. VFR flights receive traffic information in respect of all other flights.

e. **Class E**. IFR and VFR flights are permitted. IFR flights are subject to air traffic control service and are separated from other IFR flights. All flights receive traffic information as far as is practicable.

f. **Class F**. IFR and VFR flights are permitted; all participating IFR flights receive an air traffic advisory service and all flights receive flight information service if requested.

g. **Class G**. IFR and VFR flights are permitted and receive flight information service if requested.

2. Controllers shall note that where airspaces under different classification adjoin vertically, that is, one above the other, flights at a common level would comply with the requirements of, and be given services applicable to the less restrictive class of airspace. In applying these criteria, Class B airspace shall therefore be considered less restrictive than Class A airspace; Class C airspace less restrictive than Class B airspace etc.

3. The requirements for flights within each class of airspace shall be as shown in the table- to this Task.

ATS AIRSPACE CLASSES – SERVICES PROVIDED AND FLIGHT REQUIREMENTS.

Class	Type Of flight	Separation provided	Service provided	Speed limitation	Radio communication requirement	Subject to an ATC clearance
A	IFR only	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
B	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
C	IFR	IFR from IFR IFR from VFR	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	VFR from IFR	1) Air traffic control service for separation from IFR; 2) VFR/IFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3050 m (10000ft) AMSL	Continuous two-way	Yes
D	IFR	IFR from IFR	Air traffic control service, traffic information about VFR flights (and traffic avoidance advice on request)	250 kt IAS below 3050 m (10000 ft) AMSL	Continuous two-way	Yes
	VFR	Nil	IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3050 m (10000 ft)AMSL.	Continuous two-way	Yes
E	IFR	IFR from IFR	Air traffic control service and as far as practical, traffic information about VFR flights	250 kt IAS below 3050 m (10,000 ft) AMSL	Continuous two-way	Yes

	VFR	Nil	Traffic information as far as practical	250 kt IAS below 3050 m (10,000 ft) AMSL	No	No
F	IFR	IFR from IFR as far as practical	Air traffic advisory service; flight information service	250 kt IAS below 3,050 m (10,000 ft) AMSL	Continuous two-way	No
	VFR	Nil	Flight information service	250 kt IAS below 3050 m (10,000 ft) AMSL	No	No
G	IFR	Nil	Flight information service	250 kt IAS below 3,050 m (10,000 ft) AMSL	No	No
	VFR	Nil	Flight information service.	250 kt IAS below 3,050 m (10,000 ft) AMSL	No	No
When the height of the translation attitude is lower then 3050 m (10,000 ft AMSL, FL 100 should be used in lieu of 10,000 ft.						

Airspace Classification in Bangladesh

4. The airspace in the Dhaka FIR is classified in accordance with the ICAO classification of airspace. Following are the airspace classification in Bangladesh:

a. Class B : Airways

b. Class C : Control Zone and Terminal Control Area.

c. Class D : Controlled Aerodromes.

d. Class F : Advisory routes above FL 150 to lower limit of Airway of FL 460 or FL 255 where applicable.

e. Class G : Other ATS routes and airspace within FIR outside of controlled airspace/aerodromes and advisory routes.

AIRSPACE RESERVATION

General

5. Though the primary users of the airspace are civil aircraft operators and the military, no single party can claim exclusively to its use. In planning the organisation of the airspace the principle that shall be adhere to is that airspace organisation must provide for an equitable sharing of its use by all those having a legitimate interest in it. The objective should be to organize the airspace so that it can be used in the most flexible way through co-ordinated effort by the parties concern.

Airspace Reservation

6. Airspace reservation is normally associated with activities requiring advance planning, while the requirement for block clearances is more real and should preferably be planned prior to the commencement of each day's activity and throughout each day having regard to any unforeseen changes that may occur in programming or schedules.

7. In general, there exist two types of airspace reservations namely:

a. Fixed defined areas to cater for military air exercises, flying displays, etc; and

b. Mobile areas to cover activities such as enroute aerial refueling, enroute mass formation flights, etc.

8. Applications for airspace reservation by one controlling authority to the other should normally be in written form although verbal requests may be accepted under certain circumstances. Each application shall clearly state the reason for the application and other details of activity. Applications shall be made in ample time to enable the necessary co-ordination to be effected and required arrangements to be made.

9. The request shall be approved, whenever possible, if the nature of the operation involved justifies the granting of some degree of priority. In making a decision, the authority concerned shall consider very carefully the effect the approval or non-approval may have on the operational and economic aspects of all flights concerned.

10. Applications by the BAF for air exercises and other related activities shall be made to the Director ATS, Air Headquarters during the planning stages of the operations to ensure the proper co-ordination of all actions required especially in respect of BAF flights requiring controlled airspace. Application by the Army and Navy for such military activities shall be made to CAAB HQ (Director ATS). Large scale military exercise shall be planned to avoid traffic peaks including seasonal peaks.

11. Following the granting of approval, the authority requiring the reservation shall forward written confirmation of the arrangements to the other authority as soon as possible.

12. The controlling authority making the reservation shall have the exclusive use of the airspace reserved and shall be responsible for the provision of air traffic services to the aircraft using the airspace.

13. The controlling authority from which the airspace has been released shall keep its aircraft clear to the airspace reserved.

14. When airspace is reserved for a significant period of time for example in excess of one hour, and it transpires that activity in the reserved airspace is delayed or there is a significant time interval between activity, the authority reserving the airspace shall keep the releasing authority advised accordingly and permit the release of the reserved airspace where this can be accomplished without compromising safety.

15. The releasing authority shall be notified immediately after cessation of the operations for which airspace was reserved.

Block Clearance

16. Negotiations between civil and military ATS units concerning the release of airspace shall be concluded so that wherever possible, block clearances may be issued in time to allow for the preparation of flight plans, briefing of aircrew or other necessary arrangements. When issuing a block clearance the controlling authority shall clearly indicate:

a. The physical dimensions of the airspace to be temporarily released to the other authority;

b. The period of validity ; and

c. Any special control and/or co-ordination requirements.

17. When a block clearance has been issued, the releasing authority shall not be responsible for the separation of aircraft within the airspace so released. Nevertheless, the releasing authority shall ensure that aircraft under its control are kept clear of the released airspace during the period the block clearance is applicable.

18. Block clearances shall be issued where possible to facilitate maximum use of airspace under the following circumstances:

a. To accommodate military flights in controlled airspace during low density traffic conditions;

b. To accommodate civil flights in military airspace on cessation of military operations for significant periods, including periods outside the normal hours of operation of military Bases and where practicable, during low density military operations; and

c. To facilitate operation of random and Base-to-Base military flights operation in controlled airspace.

19. The ATC unit issuing a block clearance shall clearly define the terms and conditions of the clearance. Segregated operation by military and civil flights shall be achieved by confining each to different height bands and/or different well-defined geographical areas. Airspace within the upper control areas shall be released for military flights as soon as it is vacated by civil flights subject to adherence to the segregation principal.

Exchange of Information on Projected Activities

20. Subject only to security limitations, the controlling authorities shall exchange information on projected activities involving use of airspace, which must be considered in negotiating temporary releases of airspace. This is necessary in order that the parties concerned may determine in advance the requirements of each user and plan for the temporary release of airspace under the block clearance system or by airspace reservation, as appropriate to the circumstances. This information exchange shall be carried out on a routine basis to enable an accurate appreciation of the situation by each authority.

Prohibited, Restricted and Danger Areas

21. Restrictions of varying degrees of severity are necessary to accommodate the requirements of certain activities, which are not compatible with civil aviation, example ground to air firing. In addition, there are also aerial activities by specific users or user groups which may require the reservation of portions of airspace for their exclusive use for determined periods of time, example BAF air exercises.

22. However, as such restrictions and/or reservations invariably impose limitations to other users, it is the responsibility of the user requesting for such restrictions or reservations to consider and determine the following:

a. Whether the activities leading to the request for the establishment of an airspace restriction or reservation are in fact valid and justified; and

b. The minimum needs, in terms of space and time and conditions of use, required to confine the activities so that potential hazards and disruptions to other users of the airspace are minimized or avoided.

CO-ORDINATION

23. Co-ordination is essential in airspace and air traffic management particularly in relation to:

a. The resolution of often conflicting demands on the use of airspace.

b. The development of both national and international procedures and agreements to be used to facilitate air traffic operations; and

c. The efforts that are necessary to ensure services and facilities are to the best advantages of all users of airspace.

Civil/Military Co-ordination

24. As the BAF is a major user of the airspace it is particularly important that regular co-ordination between the CAAB and the BAF is established and maintained at the policy level, Headquarters and Base level and the individual ATS unit level, where appropriate, to ensure that activities potential hazardous to civil aircraft are co-ordinated and safety assured.

25. At the policy level such co-ordination should aim at ensuring that:

a. Procedures developed conform to the ICAO Rules of the Air, CAAB Rules and the AFM 60-13, (MATS 61-2 under review).

b. Aeronautical services and facilities required for civil or military use are provided on a joint basis to the extent possible.

c. Civil and military ATS personnel meet equal and common standards of training ; and

d. Neither the civil nor the military authority unilaterally established controlled, reserved or restricted airspace.

26. With respect to the organisation and use of airspace, both the civil and military authorities shall take into consideration the following factors:

a. National security requirements.

b. The requirements of civil aviation.

c. The requirement of safety, flexibility and economy of air traffic.

d. The desirability of joint use of airspace by the provision of suitable services including radar.

e. Compatibility of civil and military operations in the same area.

f. The need for keeping airspace reservations to minimum.

g. The need to periodically review and assess the continued requirement for airspace restrictions.

h. Considerations of the effects of incompatibility between civil and military navigation and communication equipment.

j. Inconvenience caused to each user where conflict of interest occurs between civil and military users.

k. The need for joint consulting prior to the establishment of new aerodromes, military installations, navigation aids and other facilities which, once completed, have an impact on the organisation and use of airspace.

27. At the base level, the OC Ops Wing of the respective Base shall be responsible for the establishment of appropriate co-ordination procedures between CAAB, other civil and military units.

Inter Unit Co-ordination

28. The SATCOs are responsible to establish inter-unit and intra-unit co-ordination procedures in the form of local orders. Such directive shall address, but are not limited to the following:

a. The purpose of the directives.

b. Areas of responsibilities.

c. Procedures and co-ordination requirements.

d. Applicable instructions.

e. Separation applicable including lateral separation points.

f. Transfer of control procedures.

g. Details of formal amendment procedures.

Co-ordination with Adjacent States

29. Co-ordination with adjacent states can be achieved by bilateral agreement or as the result of informal or formal regional meetings. Contracting states are grouped into ICAO regions and problems arising between States which cannot be settled between them directly should always be referred to the appropriate Regional Office rather than allowing a situation to remain unresolved.

30. Aircraft traveling to and from adjacent States should be able to do so with the least possible changes in ATS procedures. Flight crews should be able to plan their flight from point of departure to destination knowing that as they pass from one FIR to another, or as they traverse the frontier from one State to another, their cockpit workload will not complicated by the need to be familiar with different methods or procedures.

31. The Director ATS of CAAB HQ is responsible for the establishment of Operational Letters of Agreement defining the procedures, release of airspace if any for operational purposes and the communications requirements to ensure the safe and expeditious movement of flights operating between or transiting the FIRs.

Co-ordination of Non-Flying Activity

32. Agencies responsible for the conduct of non-flying activity in designated airspace are required to give adequate notification to aviation authorities of their intention to use the airspaces in order that NOTAM may be issued and appropriate action taken to safeguard military and civil flights.

33. Because of the effect of non-flying activities on aviation in the more congested airspaces, the CAAB and the BAF shall determine which non-flying activities should be subject to special co-ordination procedures.

Establishment of Temporary Control Areas

34. CAAB may, after co-ordination with the BAF, establish a temporary control area for a specific period to cover short-term increase in traffic if deemed necessary in the interests of safety and efficiency.

CONSOLIDATED EXERCISE-7

Q1. Describe the airspace classifications in Bangladesh.

Q2. Under what are the circumstances block clearance for an airspace shall be issued?

Q3. What are the factors to be considered for organizing and use of an airspace?

ANSWERS TO CONSOLIDATED EXERCISE-7

A1. Write para 03 from Task-7

A2. Write para 17 from Task-7

A3. Write para 25 from Task-7

Reference Materials

1. AFM 60-13 (under review).

2. ICAO Annexes-2, 11, 14 and Doc 4444.

3. Manual of ATS (MATS), Malaysia.

TASK – 8

AERODROME CONTROL

Responsibilities

1. Aerodrome Control units shall provide aerodrome control service, flight information service and alerting service to all air traffic under their control. Aerodrome control units provide services principally to aircraft:

a. Which are flying with visual reference to the surface and in the vicinity of the aerodrome traffic zone.

b. Operating in the maneuvering area.

Functions

2. Aerodrome control services shall be provided to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision between:

a. Aircraft flying in the aerodrome traffic circuits around an aerodrome.

b. Aircraft operating on the maneuvering area.

c. Aircraft landing and taking off.

d. Aircraft and vehicles operating on the maneuvering area.

e. Aircraft on the maneuvering area and obstructions on that area.

Alerting Service by Aerodrome Control Towers

3. Aerodrome control towers are responsible for the following alerting functions:

a. Alerting Rescue and Fire Fighting (RFF) services.

b. Reporting any failure or irregularity of operation of any apparatus, visual or non visual aids or other facilities provided for the purpose of aerodrome control.

c. Alerting appropriate organizations or authorities of aircraft known to be overdue or in need of search and rescue aid.

Approach Control Functions By Aerodrome Control Tower

4. The aerodrome control tower shall perform the functions of approach control at such aerodromes where the necessity or desirability of establishing a separate approach control unit has not been felt and where the aerodrome control towers, equipped with requisite facilities can safely combine the functions of approach control and aerodrome control services.

Surface Movement Control (SMC)

5. Additionally an aerodrome control unit may provide at certain location Surface Movement Control. Where established, the SMC will be responsible for providing these services mentioned in the para 2 b, d & e excepting the active runway and its entry/exit points.

Suspension of VFR Operations at Aerodromes Within Control Zones

6. Any or all VFR operations on and in the vicinity of an aerodrome may be suspended by any of the following units, persons or authorities whenever safety requires such action:

a. The area control centre within whose control area the aerodrome is located.

b. The aerodrome controller on duty.

c. The appropriate ATS authority.

7. All such suspensions of VFR operations shall be accomplished through or notified to the aerodrome control tower.

8. Aerodrome controllers shall suspend VFR flights at an aerodrome within a control zone or aerodrome traffic zone whenever:

a. Cloud ceiling (4/8) is less than 450 m (1500 ft) ; or

b. The ground visibility is less than 5 km.

9. Aerodrome controllers shall adopt the following procedures whenever meteorological reports indicate that VFR operations are not possible:

a. Hold all departures, apart from those aircraft which have filed IFR flight plans and obtain approval thereof from the area control centre.

b. Recall all flights operating under VFR or authorize special VFR operations, if appropriate, obtaining approval from Approach/Area Control.

c. Notify the area control centre of the action taken; and

d. If necessary or requested, notify the operators of the reason for taking such action.

Co-ordinations With Approach/Area Control

10. Aerodrome controllers shall keep approach control or area control, as appropriate, advised of the following with respect to controlled IFR/VFR flights and special VFR flights:

a. Arrival and departure times.

b. All available information relating to overdue or unreported aircraft.

c. Information concerning missed approaches.

d. Information concerning aircraft that constitute essential local traffic to aircraft under the control of approach control ; and

e. Information on airport closure, restriction to aerodrome or runway length availability.

11. Special VFR flights shall be co-ordinate with approach control where appropriate.

Use of Radar Data

12. At certain aerodrome control units, radar displays are installed to achieve maximum runway utilization and aerodrome capacity. The operation of the radar is not associated with a particular rating and controllers shall not use the radar information to provide approach control services unless Headquarters has specified authorisation and the conditions of use.

13. Controllers may use the displayed radar information to:

a. Determine the landing order, spacing and distance from touchdown of arriving aircraft.

b. Assist in applying longitudinal separation for departing aircraft

c. Confirm that the initial track of a departing aircraft conforms with the clearance issued.

d. Provide information to aircraft on the position of other aircraft in the circuit or carrying out a missed approach.

14. Subject to specific approval by Headquarters, and provided that the controller has been appropriately rated, he is providing only aerodrome control services and procedures have been clearly defined; the radar information may be used to:

a. Validate SSR codes of departing aircraft and verify associated Mode C readouts following identification.

b. Establish separation between departing aircraft

c. Pass traffic information

d. Establish separation in the event of missed approach.

e. Assist in taking initial corrective action when the separation between arriving aircraft becomes less than the prescribed minimum : and

f. Monitor the progress of over flying aircraft identified by approach control to ensure that they do not conflict with the tracks of arriving and departing aircraft.

Essential Aerodrome Information

15. Essential aerodrome information is that information concerning the state of the manoeuvring area and its associated facilities, which may constitute a hazard to aircraft.

16. Aerodrome controllers shall issue essential aerodrome information in sufficient time to all aircraft for the information to be made use of except when it is known that the aircraft have received all or part of the information from other sources such as NOTAM, ATIS broadcasts and the display of suitable signals. Such information shall be issued in such a manner that pilots are able to appreciate the situation described.

17. Essential aerodrome information includes the following:

a. Construction work or maintenance on or immediately adjacent to the manoeuvring area.

b. Rough or broken surfaces on the manoeuvring area, whether marked or not:

c. Failure or irregular functioning of any portion of the aerodrome lighting system.

d. Failure or irregular functioning of approach aids.

e. Aircraft parked close to the runways or taxiways and aircraft engaged in engine ground run.

f. Wet surface when any portion of the runway is known or appears to be wet to arriving aircraft only.

g. Water on runway, taxiway or apron.

h. Reports of estimated braking conditions determined by approved measuring equipment or from pilots of aircraft which have landed.

j. Bird formations or individual large birds reported or observed on or above the manoeuvring area or in the immediate vicinity of the aerodrome and the extent of any bird dispersal action being carried by the airport/airfield authority.

k. Any other pertinent information that is likely to be a hazard.

Water on the Runway

18. The presence of water on the runway may reduce the braking efficiency of aircraft or even cause aquaplaning. Aerodrome controllers shall therefore advise pilots of the extent of water on a runway. To enable such information to be passed controllers may get the report through runway inspection. Alternately, controllers may request the information from pilots of landing aircraft in order to inform other pilots.

19. Controllers shall transmit information on the presence of water to each aircraft using the following descriptive terms:

a. **DAMP** - the surface shows a change of colour due to moisture.

b. **WET** - the surface is soaked but there is no standing water.

c. **WATER PATCHES** - patches of standing water are visible.

d. **FLOODED** - extensive standing water is visible.

Braking Action

20. Information concerning braking efficiency may be obtained by suitable measuring equipment. Where no such equipment is available, controllers shall request from pilots the braking characteristics experienced following a landing on a water-affected runway.

21. The following terms shall be used to describe to braking characteristics experienced:

a. **GOOD** Pilots should not expect to find the conditions as good as when operating on a dry runway but should not experience any directional control or braking difficulties because of runway conditions.

b. **MEDIUM** Barking action may be such that the achievement of a satisfactory landing or accelerate stop performance, taking into account the prevailing circumstances, depends on precise handling techniques.

c. **POOR** There may be a significant deterioration both in barking performance and directional control.

22. Controllers shall log all reports concerning water on the runway and barking action in the Logbook.

Selection of Runway-in-Use

23. “Runway-in-use” is the term used to indicate the runway, which at particular time is considered by controllers to be the most suitable for use by aircraft expected to land or take off at the aerodrome.

24 Normally the runway most nearly aligned into wind is used for all take off and landings unless factors such as safety, the runway configuration, or air traffic conditions determine that a different direction is preferable. A runway however, is to be continued to be used in light and variable wind conditions not exceeding a down wind component of 6 knots. The maximum permissible cross wind components of each aircraft laid down in appropriate dash one are not to be exceeded.

25. In selecting the runway-in-use however, controllers shall take into consideration the following factors:

a. Aircraft type.

b. Effective length of runway.

c. Slope and braking condition of the runway.

d. Wind velocity.

e. Weather phenomena including wind shear, wake turbulence effects and position of sun.

f. Availability of radio or visual aids for approach and landing (e.g. GCA, PAPI, Strobe Lights and approach lights) on a certain runway particularly during marginal weather conditions.

g. Parked position of air defence alert (ADA) aircraft.

h. Availability of the runway barrier for fighter aircraft for a particular runway end.

j. Taxing distances.

k. Obstructions and type of terrain on approach path.

l. Close proximity of other aerodrome/airspace/international border.

m. Presence of birds or bad weather in the circuit area.

n. Temporary obstruction such as weather balloon etc.

26. Pilots may request permission to use another runway if the designated runway-in-use is not considered suitable for a particular operation. Controllers may defer authorisation until the traffic situation permits the use of another runway and the expected delay, if any, shall be passed to the pilot.

27. The selection of runway-in-use shall be co-ordinated between aerodrome and approach control.

Air Defence Alert Aircraft.

28. The parked position of Air Defence Alert (ADA) aircraft is a serious consideration for selection of the suitable runway. Hot scrambles are to have priority over all other traffic. These aircraft are to be allowed to take off on any runway direction provided the down wind and cross wind components are in consistency with safe aircraft operation. The Base Commander are to lay down the maximum permissible down wind component for each type of ac on a hot scramble keeping in view the local aircraft limitations and pass this information to Air Headquarters. They are also to lay down the procedure for repositioning the ADA aircraft should the down wind component exceed the laid down limit. The aircraft on practice scramble however are not to be permitted the above relaxation and are to take off on a suitable runway with down wind component not exceeding 6 knots as for normal traffic. After the completion of the mission the aircraft on hot scramble are to land on the runway into wind and not necessarily on the runway on which the take off are being accomplished. This might necessitate quick raising and lowering of the arresting barriers and the Bases are to evolve procedures to accomplish this.

Availability of Approach Aid & Arresting Barrier.

29. In marginal weather and poor visibility conditions a pilot might not be able to land without the use of available radio radar, or visual aids for approach and landing. If the needed aid is available on only one end and the aircraft is not in a position to proceed to a suitable diversion, a landing is to be permitted upto a maximum down wind component of 14 knots provided the runway is not wet and a barrier is available for this runway.

Poor Visibility on Approach.

30. Should a pilot request for a take off or a landing in direction other than the one in use due to poor visibility an approach or position of the sun, it is to be permitted if the traffic position permits and the limitation laid down above are not violated.

Landing on Wet Runway.

31. As a general rule the landing run is doubled on a wet and slippery runway. No landings are therefore to be permitted on a wet runway with a wind component unless the aircraft is in emergency.

Aircraft Unable to Transmit on R/T

32. An aircraft joining circuit without R/T joins on the dead side of the circuit, flies parallel with the runway and rocks its wings. Permission to land is to be given by signal from the mobile or the control tower.

Visiting Aircraft

33. a. When a visiting aircraft is flying under aerodrome control the controller is to employ standard air traffic control methods and procedures and is not to use locally authorised (non-standard) procedures.

b. The parking area for visiting aircraft is to be selected by the Base Commander or Officer Commanding Operation Wing. The Aircraft is to be advised on R/T.

Straight in Approach

34. A straight in approach is to be requested at the discretion of a pilot. Permission to fly directly to the point from which the final approach is to be started is only to be given by air traffic control when the approach to land will not in any way prejudice the safety of other aircraft in aerodrome traffic pattern.

Special Procedure for Jet Aircraft

35. a. Initials are to vary with different airfields but normally an initial is a straight run in two miles from and in line with the runway in use. Normally two 45 degrees turns are done into initials.

b. Sufficiently before turning initials, the leader or solo aircraft is to descend or climb to 1500 ft AGL.

c. When a formation is 90^0 to the initials, aircraft are to assume the appropriate echelon.

d. Aircraft is to turn on to initials as laid down for the runway in use at their airfield.

Night Flying

36. **Airfield Layout Diagram**. Before night flying starts. An airfield diagram is to be prepared showing the following details.

a. Layout of flare path including the emergency flare path arrangements.

b. Position of marshaling points.

c. Taxing routes to be followed.

d. Position of dispersed aircraft if they are likely to cause obstruction, including details of their obstruction lighting.

37. This diagram is to serve four main functions namely:

a. To serve as a specification of portable lighting requirements for use by flare path assistants.

b. To serve as a guide to lighting inspection.

c. To provide notes for reference during night flying briefing.

d. To provide a presentation of the lighting layout for use during the watch keeping period e.g. for briefing other controllers, MT drivers, visiting pilots.

38. **Night Flying Briefing**. All night flying excluding that relating to transport aircraft engaged in their outstation commitments is to be preceded by organized briefing. Briefing is to include layout of the airfield and alternates as well as emergencies.

39. **General Rules**. The following are the general rules for the information and guidance of the air traffic controllers.

a. Aircraft are not to be flown at night unless their R/T equipment when fitted is serviceable on local, approach/area and distress channels.

b. Aircraft is to display standard navigation lights at all times when aircraft engines are running.

c. Number of aircraft carrying out circuit and landing exercise is not to exceed four at a time.

d. Only aircraft with similar circuit speeds are to be deployed on circuits and landings in any one detail.

CONSOLIDATED EXERCISE-8

Q1. Write the functions of Aerodrome Control.

Q2. When and who all can suspend VFR operations? Write the actions of aerodrome controller when VFR operation is suspended.

Q3. What are the essential aerodrome informations to be issued to aircraft?

Q4. What are the terms to be used to describe the presence of water on the runway?

Q5. What are the factors to be considered while selecting RW-in-use?

Q6. What are the general rules for night flyings?

ANSWERS TO CONSOLIDATED EXERCISE-8

A1. Write para 02 from Task-8

A2. Write para 06 to 09 from Task-8

A3. Write para 17 from Task-8

A4. Write para 18 to 19 from Task-8

A5. Write para 25 from Task-8

A6. Write para 39 from Task-8

Reference Materials

1. AFM 60-13 (Under review).

2. ICAO Annexes-2, 11, 14.

3. AIP Bangladesh.

4. ATSI 4/1993, 2/2002.

TASK – 9
AREA/APPROACH CONTROL

GENERAL PROVISTION

1. Area and Approach controllers shall provide separation between:

   a. All flights in Class A and B airspace.

   b. IFR flights in Class C, D and E airspace.

   c. IFR and VFR flights in Class C airspace.

   d. IFR flights and special VFR flights.

   e. Special VFR flights.

Except, for the cases under ‘a’, ‘b’ and ‘c’ above, during the hours of daylight when flights have been cleared to climb or descend subject to maintaining own separation and remaining in visual meteorological conditions.

APPROACH CONTROL SERVICE

Responsibilities

2. An approach control unit may be combined with an approach radar unit or an aerodrome control tower. Alternatively, an approach control unit may share the functions of an area control centre.

3. An approach control unit is responsible for providing air traffic services to aircraft from the time, level or place at which.

   a. Arriving aircraft are released by area control until control is transferred to aerodrome control.

   b. Aircraft entering its area of responsibility from uncontrolled airspace come under its control until control is transferred to aerodrome control.

   c. Departing aircraft are taken over from aerodrome control until.

      (1) They are transferred to area control, or

      (2) They are clear of controlled airspace and separated from other IFR and special VFR flights.

   d. Over flying aircraft transit the unit’s airspace.

Provision of Services

4. An approach control unit shall provide:

   a. Approach control service.

   b. Flight information service.

   c. Alerting service.

Co-ordination

5. Between Approach Control and Aerodrome Control

a. Approach controllers shall retain control of arriving aircraft until such aircraft have been transferred to, are in communication with, aerodrome control . The transfer of responsibility between approach control and aerodrome control may take place with instructions for an aircraft to change frequency provided that the agreed transfer of control procedures have been effected between the units concerned.

b. After co-ordination with aerodrome control, approach controllers may:

(1) Clear arriving aircraft to visual holding points or to hold aircraft until further advised by aerodrome control.

(2) Authorize aerodrome control to release aircraft for take-off subject to the discretion of the Aerodrome controller with respect to other arriving aircraft.

c. Aerodrome control towers shall obtain approval from the unit providing approach control service prior to authorising operation of special VFR flights.

d. Approach control may specify to aerodrome control a time of take-off for an aircraft if necessary for separation purposes.

Exchange of Flight and Control Data

6. **With Aerodrome Control**. Approach control shall notify aerodrome control of all pertinent data on controlled IFR/VFR flights as follows:

a. ETA for the aerodrome, or for an associated aerodrome facility, and level if appropriate.

b. The transfer of control point.

c. The anticipated sequence in which control of aircraft will be transferred.

d. Anticipated delay to departing traffic and reason for the delay.

7. **With Area Control**. Approach control shall notify area control of the following data on IFR flights:

a. Lowest vacant level at the holding facility or facilities available for use by area control.

b. Expected type of instrument approach procedure.

c. The average time interval between successive approaches as determined by approach control.

d. Revision of EATs issued by area control when approach control calculations indicates a variation of 5 minutes or such other time as has been agreed by two ATS units concerned.

e. Arrival times over the holding point when these vary by 3 minutes or more.

f. Cancellation by aircraft of their IFR flight plan.

g. Departure times.

h. Missed approaches when rerouting is entailed in order that subsequent action may be co-ordinated.

j. All available information relating to overdue or unreported aircraft.

8. If over flying traffic may cause delay, approach control may request area control to release the aircraft to enable it to sort the traffic more efficiently.

Transfer of Control

9. Approach controllers may transfer control of arriving IFR flights to aerodrome control under the following conditions:

a. When an aircraft carrying out an instrument approach procedure has become No.1 to land and has reported passing the FAF inbound or other agreed position.

b. Subsequent following aircraft when they are established on final approach and are appropriately separated from preceding aircraft.

c. Aircraft operating in the traffic circuit.

d. Aircraft approaching visually below all cloud when the visibility is 5KM or more.

AREA CONTROL SERVICE

Provision of Services.

10. The area control centre provides the area control service to controlled flight outside the responsibility of approach and aerodrome control units. These controlled airspaces are known as control areas and include airways and Terminal Control Areas (TMA).

11. Like any other air traffic control service, the area control functions also include the provision of air traffic control service, flight information service and alerting service.

12. The area control centre shall be responsible for the issuance of ATC clearance for controlled flights under its jurisdiction. It shall also be responsible for the provision of air traffic advisory service, flight information service and alerting service to all known traffic in its area of responsibility.

Co-ordination Between Area Control and Approach Control

13. A unit providing approach control service may issue air traffic control clearances to any aircraft released to it by an area control centre without reference to the area control centre, except that when an approach has been missed, the area control centre shall be advised immediately and subsequent action co-ordinated between the area control centre and the unit providing approach control service.

14. Time of take-off shall be specified by the area control centre when it is necessary to:

a. Co-ordinate the departure with traffic not released to the unit providing approach control service; and

b. Provide en-route separation between departing aircraft following the same route.

15. If time of take-off is not specified, the unit providing approach control service shall determine the take-off time when necessary to co-ordinate the departure with traffic released to it.

16. A unit providing approach control service shall not give climb to the aircraft above the level released by the area control centre.

17. When weather conditions require an approach sequence, the area control centre shall clear arriving aircraft to the holding point, including holding instructions and expected approach time in such clearance.

18. An area control centre may, after co-ordination with approach control unit release aircraft directly to aerodrome control tower if, the entire approach will be made under visual meteorological conditions.

Exchange of Flight and Control Data with Approach Control

19. The area control centre shall forward information on arriving aircraft not less than fifteen minutes before estimated time of arrival and such information shall be revised as necessary. Area control centre shall promptly advice the unit providing approach control service of the following pertinent data on controlled traffic:-

a. Identification, type and point of departure of arriving aircraft;

b. Estimated time and proposed level of arriving aircraft over holding point or actual time if aircraft is released to the unit providing approach control service after arrival over the holding point;

c. Requested type of instrument approach procedure if different to that specified in para 7 b.

d. Expected approach time issued;

e. Statement that aircraft has been cleared to contact the unit providing approach control service;

f. Statement that an aircraft has been released to the unit providing approach control service including, if necessary, the time and conditions of release;

g. Anticipated delay to departing traffic due to congestion.

Transfer of Control

20. Controllers shall generally transfer aircraft at the transfer of control points agreed between the area control and approach/aerodrome control units.

CONSOLIDATED EXERISE-9

Q1. Describe the responsibilities of Approach Control Units.

Q2. What are the co-ordinations to be effected between Approach Control and Aerodrome Control Units?

Q3. What are the flight and Control data to be exchanged between Approach Control and Area Control Centre?

ANSWERS TO CONSOLIDATED EXERCISE-9

A1. Write para 02 to 03 from Task-9

A1. Write para 05 from Task-9

A1. Write para 07 from Task-9

Reference Materials

1. AFM 60-13 (under review).

2. ICAO Annexes-2 11 and Doc 4444.

3. Manual ATS (MATS), Malaysia.

4. AIP, Bangladesh.

TASK – 10

RADAR PROCEDURES

Introduction

1. Radar is an electronic device for detection and location of objects. It is used to extend the capability of man's senses for observing his environment especially the sense of vision. The value of the radar lies not in being a substitute for the eye but in doing what the eye cannot do. It is designed to see through those conditions impervious to normal human vision such as darkness, haze, fog, rain and snow. In addition, radar has the advantage of being able to measure the distance or range of the object. There is no other competitive technique, which can measure range as rapidly as can radar. This is probably its most important attribute.

Application of Radar

2. The development of radar was started primarily for military needs. However, radar has found many civilian applications, especially in the air, maritime navigation and space. The nature of the vehicle that carries the radar and the environment in which it operates, has significant influence on its design; be it ship borne, airborne or on ground. Large numbers of application of radar are common to both civil and military.

3. Radar is extensively used in the following fields:

a. Air Traffic Service.

b. Air/Naval Defence.

c. Meteorological Services.

d. Space Research.

e. Communication System.

f. Airborne Equipment.

USE OF RADAR IN AIR TRAFFIC CONTROL SERVICES

Air Traffic Services

4. The objective of the Air Traffic Services is to ensure smooth and safe flow of air traffic under all weather conditions. Tactical freedom of aircraft operations becomes an additional objective in the case of military operations. The installation of a radar system contributes significantly to the efficient operation of an Air Traffic Service (ATS) unit. Primary use of radar is in the provision of Air Traffic Control Services. However, its application has also been extended in the provision of flight information and advisory services. The Radar Used in the provision of ATC services are:

a. Air Route Surveillance Radar (ARSR).

b. Terminal Area Radar (TAR).

c. Aerodrome Surveillance Radar (ASR).

d. Precision Approach radar system comprising:

(1) Surveillance Radar Element

(2) Precision Approach Radar.

e. Aerodrome Surface Detection Equipment (ASDE) or Aerodrome Surface Movement indicator (ASMI).

General Functions.

5. The information presented on the radar display may be used to perform the following functions in the provision of ATC services:

a. Provide radar services as necessary for optimum airspace utilization, reducing delays, for direct routings and more optimum flight profiles, and to enhance safety.

b. Provide radar vectoring to departing aircraft for the purpose of facilitating an expeditious and efficient departure flow and expediting climb to cruising level.

c. Provide radar vectoring to aircraft for the purpose of resolving potential conflicts.

d. Provide radar vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence.

e. Provide radar vectoring to assist pilots in there navigation, eg to or from navigation aid, away from or around areas of adverse weather, etc.

f. Provide separation and maintain normal flow when aircraft experiences communication failure within the area of radar coverage.

g. Maintain radar monitoring of air traffic.

***Note**: Where tolerances regarding such matters as adherence to track, speed or time have been prescribed by the appropriate ATS authority, deviations are not considered significant until such tolerances are exceeded.*

h. When applicable, maintain a watch on the progress of air traffic in order to provide a non-radar controller with:

(1) Improved position information regarding the aircraft under control.

(2) Supplementary information regarding other traffic.

(3) Information regarding any significant deviations, by aircraft, from the terms of their respective ATC clearance, including their cleared routes as well as levels when applicable.

Note: See note under Para 5 g above.

Approach Control Service

6. The information presented on a radar display may be used to perform the following additional functions in the provision of approach control service:

a. Provide radar vectoring of arriving traffic on to pilot-interpreted final approach aids.

b. Provide radar monitoring of parallel ILS approaches and instruct aircraft to take appropriate action in the event of possible or actual penetrations of the no transgression zone (NTZ).

***Note**: See Doc 4444 part IV, section 13.*

c. Provide radar vectoring of arriving traffic to a point from which a visual approach can be completed.

d. Provide radar vectoring of arriving traffic to a point from which a precision radar approach or surveillance radar approach can be made.

e. Provide radar monitoring of other pilot-interpreted approaches.

f. In accordance with prescribed procedures, conduct:

(1) Surveillance radar approaches,

(2) Precision radar (PAR) approaches.

g. Provide radar separation between:

(1) Succeeding departing aircraft.

(2) Succeeding arriving aircraft.

(3) A departing and a succeeding arriving aircraft.

Aerodrome Control Service

7. When authorised by and subject to conditions prescribed by the appropriate ATS authority, surveillance radar may be used in the provision of aerodrome control service to perform the following functions:

a. Radar monitoring of aircraft on final approach.

b. Radar monitoring of other aircraft in the vicinity of the aerodrome.

c. Establishing radar separation between succeeding departing aircraft.

d. Providing navigation assistance to VFR flights.

8. Special VFR flights shall not be radar vectored unless special circumstances, such as emergencies, dictate otherwise.

9. Caution shall be exercise when radar vectoring VFR flights so as to ensure that the aircraft concerned does not inadvertently enter IMC.

10. In prescribing conditions and procedures for the use of radar in the provision of aerodrome control service, the appropriate ATS authority shall ensure that the availability and use of radar information will not be detrimental to visual observation of aerodrome traffic.

Note*: Control of aerodrome traffic is mainly based on visual observation of the manoeuvring area and the vicinity of the aerodrome by the aerodrome controller.*

Flight Information Service

11. The use of radar in the provision of Flight Information service (FIS) does not relieve the pilot-in-command of an aircraft of any responsibilities and he has to make the final decision regarding any suggested alternation of flight plan.

12. The information presented on the radar display may be used to provide identified aircraft with:

a. Information regarding any aircraft observed to be on a conflicting path with the radar identified aircraft and suggestions or advice regarding avoiding action.

b. Information on the position of significant weather and, if practicable, advice to the aircraft on how best to circumnavigate any such areas of adverse weather.

c. Information to assist the aircraft in its navigation.

Air Traffic Advisory Service.

13. When radar is used in the provision of air traffic advisory service, the procedure for the use of radar in the air traffic control service shall be applied subject to the conditions and limitations governing the provision air traffic advisory service.

Co-ordination Between Radar and Non-Radar Controller

14. The radar and non-radar controllers shall maintain close liaison to ensure that adequate separation exist at all times between the radar-controlled aircraft and all other controlled aircraft.

15. Radar and non-radar controllers shall comply with procedures specifying use of routes and levels by the respective controllers in order to reduce coordination.

16. The radar controller shall not make significant changes to a clearance issued by the non-radar controller without his prior approval except when special procedures are in effect or in circumstances requiring immediate action.

17. ATS Units shall establish coordination procedures defining the precise coordination to be effected at their locations for compliance by controllers.

Coordination Between Approach Control and Tower.

18. Approach radar controllers shall comply with the following general procedures for coordination with the aerodrome controller:

a. Provide the tower with information on the position of an arriving aircraft at least once before instructing the aircraft to change to tower frequency.

b. Adjust the approach interval to the extent practicable to assist in expediting the movement of other aerodrome traffic if requested by the tower.

c. Inform the tower if an IFR or a VFR aircraft that is on final approach and in communication with the tower is observed to deviate from the normal approach pattern.

19. Unless otherwise prescribed by the appropriate ATS authority, the radar controller should notify the aerodrome controller when an aircraft making a radar approach is approximately 15 Km (8NM) from touchdown. If landing clearance is not received at this time, a subsequent notification should be made at approximately 8 Km (4NM) from touchdown and landing clearance requested.

20. **Clearance to Land**.Clearance to land or any alternative clearance received from the aerodrome controller should normally be passed to the aircraft before it reaches a distance of 4Km (2NM) from touchdown.

GROUND CONTROLLED APPROACH

Introduction

21 Ground Controlled Approach (GCA) is a runway approach aid consisting of a ground radar which tracks aircraft in azimuth and elevation. A GCA controller observes the radar display and passes instruction to the aircraft pilot which enable him to approach the runway in conditions of bad weather and poor visibility.

Surveillance Radar Element

22. The surveillance radar element or search element is usually a ten-centimeter radar set, whose primary function is to locate and identify aircraft and vector them onto the final approach path, where they are detected by the precision radar system. Its function may also include the surveillance of aircraft in the holding stack. The radar range is a maximum of 30 mm for aircraft at 4,000 ft and the display is usually a 360^0 PPI. Aircraft on the display are identified by their reaction to maneuvering instructions or by means of their trace on the CRDF display.

Precision Approach Radar

23. The final approach path to the runway is scanned by the precision approach radar (PAR) which is a three-centimeter radar transmitting two narrow beams. The azimuth beam is shown on a range and azimuth display, whilst the elevation beam is shown on a range and height display. The controller notes the aircraft position on the displays, and instructs the pilot to take corrective action to remain on the designated approach path. The accuracy of GCA depends to a large extent on the proficiency of both pilot and controller. The equipment limitations, which take into account obstacle on the approach path, are published as an Obstacles Clearance Limit (OCL) in the En Route Documents and the Terminal Approach Procedure Charts for each airfield. The PAR equipment, like all centimeter radars can by badly affected by weather clutter.

Procedure

24. The GCA procedure is passed to the pilot as a series of verbal instructions. Provided that the aircraft is equipped with the appropriate R/T channels and the pilot is proficient at flying on instruments. The procedure is relatively straightforward. A standard GCA pattern is shown at Figue-1

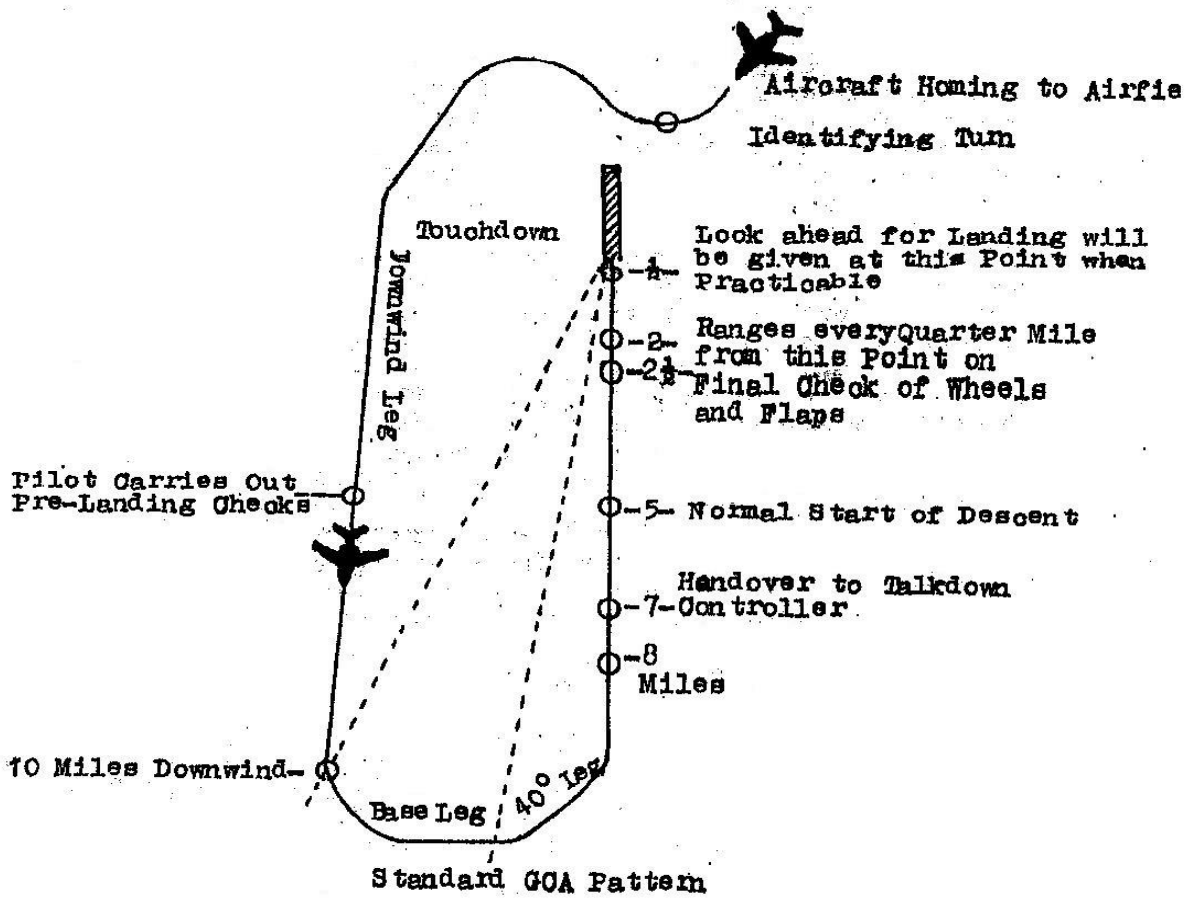

Aircraft Homing to Airfie
Identifying Turn
Touchdown
Look ahead for Landing will be given at this Point when Practicable
Downwind Leg
-1-
-2-
-2½-
Ranges every Quarter Mile from this Point on
Final Check of Wheels and Flaps
Pilot Carries Out Pre-Landing Checks
-5- Normal Start of Descent
Handover to Talkdown Controller
-7-
-8
Miles
10 Miles Downwind
Base Leg
400 feet
Standard GCA Pattern

Figure - 1

25. **Homing**. The aircraft is initially homed towards the airfield using a suitable navigation aid until it is identified on the search radar, which can normally control up to 4 aircraft at a time.

26. **Downwind Leg.** The aircraft is positively identified and then vector onto a downwind leg by passing headings and heights to fly to the pilot. All messages should be acknowledged and executive instructions read back. During the downwind leg pre-lending checks are carried out, and weather conditions, OCL and R/T failure instructions are communicated. At a range of ten miles downwind (dependent on aircraft type) the aircraft is directed on to a base leg followed by a 40^0 leg to feed into the PAR beams. The talk down is normally started from 1,500 ft above touchdown elevation. If because of terrain clearance or other air traffic considerations it is not possible to fly the whole circuit at 1,500 ft the pilot is normally ordered to reduce to 1,500 ft before the glide path is reached.

27. **Final Approach** About seven miles from touchdown the final controller takes over the GCA, usually on different R/T channel to the one used by the search radar controller. The glide patch is normally a standard 3^0, although a 2.5^0 glide path may sometimes be offered. When positive R/T contact has been established the controller will request the pilot to state his Break-off Height and will subsequently instruct him not to acknowledge further instructions. For a normal GCA the controller instruct the pilot to start a descent to maintain a 3^0 glide path at a range of five miles. From this point continuous instructions are passed to enable the pilot to guide the aircraft down the approach path. Whilst he is transmitting the controller is unable to hear transmissions from the aircraft, but at 2.5 miles when he instructs the pilot to check his wheels and flaps (or other checks according to the aircraft type) the controller momentarily ceases transmitting. This enables the pilot to confirm that he has three green lights (or whatever other reply is appropriate). The descent is continued until the controller advises the pilot he is approaching Break-off Height; from this point only advisory information is passed and the pilot must continue the descent visually or overshoot if conditions do not permit a landing.

28. **Straight-in-Approach**. Aircraft can be fed directly into the GCA pattern from an airfield approach aid such as a NDB or CRDF. The pattern is arranged so that the aircraft is fed into the extended centerline at a range of 15 to 20 nm. The search radar vectors the aircraft in to seven miles and the PAR controller takes over for the final approach.

Surveillance Radar Approach

29. A surveillance radar approach is carried out without glide path information since the display simply consists of a PPI. The pilot therefore has to equate his height above touchdown elevation with the correct height for his range to ensure that he is maintaining the correct rate of descent.

30. The approach pattern is similar to the GCA pattern, and at five miles the pilot is requested to start a descent. If a 3^0 glide path is used the approach height will be 1,500 ft, and the rate of descent 300 ft per mile. The controller passes headings to fly and ranges with advisory heights. The pilot checks his height on the pressure altimeter (set to QFE) to ensure that he is on the glide path.

31. On this type of approach the Aircraft Approach Limitation and hence the Break-off Height are greater than that for a PAR approach.

CONSOLIDATED EXERISE-10

Q1. In what are the fields of ATS the Radar are used?

Q2. Write the general functions of Radars in ATS.

Q3. What are the co-ordination to be effected between Approach Radar Controllers and Aerodrome Controllers?

ANSWERS TO CONSOLIDATED EXERCISE-10

A1. Write para 04 from Task-10

A1. Write para 04 from Task-10

A1. Write para 18 to 19 from Task-10

Reference Materials

1. AFM 60-1.

2. AP 3456C (Radar & Radar, Part-6, Section-1).

3. ICAO Annes-10.

4. AIP, Bangladesh.

5. Manual of ATS (MATS), Malaysia.

6. Trg Notes of BATCO Course, ATCOTE, Air Force Academy, IAF, India.

TASK – 11

SEARCH AND RESCUE

Purpose and Scope

1. The aim of air, land and sea search and rescue organisation, briefly stated, is to afford assistance to eliminate human suffering and save life and equipment. Utmost effort is to be made to locate, aid and rescue distressed personnel to safety. The search and rescue personnel are to ensure that no life is lost or jeopardized through waste of time or misdirected effort. Operational readiness and speedy action are mandatory requirements to achieve maximum effectiveness of a successful search and rescue mission.

2. Details on planning of SAR organizations, operational procedures, conduct of search and rescue etc are published in ICAO Annex-12, Doc-7333. The details on SAR operations in Bangladesh are published in CAAB pamphlet "Organization and Procedures for Search and Rescue of Aircraft in Distress"-2nd Edition, 1983. The SAR Operations in BAF are done in accordance with AFM 55-3. Some of these procedures and instructions are briefly mentioned in subsequent paragraphs.

SEARCH AND RESCUE ORGANISATION IN BANGLADESH

Coverage

3. The territory of Bangladesh along with its territorial waters shall be the area for search and rescue operation.

Rescue Co-ordination Centre (RCC)

4. The Rescue Co-ordination Centre is located in the Flight Information Centre (FIC) at Hazrat Shahjalal International Airport, Dhaka and is responsible for all search and rescue operations in the territory of Bangladesh along with its territorial water.

Rescue Units

5. All manned civil and military airports/aerodromes are established as Rescue Units. The name and location are-given below:

a. Hazrat Shahjalal International Airport (HSIA) Dhaka.

b. Shah Amanat (R) International Airport (SAIA) Chittagong.

c. Rajshahi Aerodrome.

d. Jessore Aerodrome.

e. Osmani International Airport Sylhet.

f. Saidpur Aerodrome.

g. Cox's Bazar Aerodrome.

h. Barisal Aerodrome.

j. Tejgaon Airfield.

Alerting Posts

6. An alerting post is an agency designated to serve as an intermediary between a person reporting aircraft in distress (or other emergencies) and rescue co-ordination centre. All alerting posts are, therefore, advised to report any occurrence of observed or information received to RCC at Hazrat Shahjalala International Airport (HSIA), Dhaka in most expeditions manner. If it is expedient the information may be routed through the nearest rescue units as indicated in para 5 above. The following shall act as Alerting Posts, they may also be of immense help incase of search and rescue:

a. All civil and military airports/aerodrome in Bangladesh.

b. All Police Stations in Bangladesh (they may route their information through Police Headquarters).

c. All Army, Naval and Air Force Units in Bangladesh.

d. All BGB units and Out Posts in Bangladesh (message may be routed through BGB Headquarters).

e. All Coast Guard units and Out Posts in Bangladesh (message may be routed through Coast Guard Headquarters).

f. All Railway stations in Bangladesh.

g. All Post and Telegraph Offices in Bangladesh.

h. All Forest Department Units located in different forest ranges in Bangladesh.

j. All IWTC offices in Bangladesh.

k. Mercantile Marine and Port Trust authorities.

l. All other establishments and offices, having communication and broadcasting facilities.

Responsibilities

7. The details of duties and responsibilities of Rescue Co-ordination Centre and Rescue Units have been laid down in the S A R plan published by the Chairman CAAB.

8. Search and rescue in Bangladesh is provided under the joint collaboration of Bangladesh Air Force, Bangladesh Army, Bangladesh Navy and Civil Aviation Organizations

9. Search and Rescue Organisation, is very closely linked with the air traffic control services because flight information centre, at all times possesses full information about the movement of aircraft and their flight conditions. It is, therefore, a principle that distress information, as far as possible, should be passed to the search and rescue agency through the FIC. Navy is primarily responsible to alert search and rescue agency, when

any surface vessel military or merchant, is in distress in the waters of Bangladesh's area of responsibility. Air Traffic controls are responsible to alert the search and rescue services directly during a local emergency or when the aircraft is under their positive control, without channeling through FIC, if situation warrant.

10. Bangladesh Air Force is responsible, as far as operational requirements permit, for undertaking the search, aid and rescue of occupants of civil as well as military aircraft and ships in distress. The responsibility of Bangladesh Navy is to assist Air Force search and rescue units in the water areas of responsibility.

Search and Rescue in Prohibited Areas

11. Defence Services shall primarily be responsible for the search and rescue in the prohibited areas. Civil agencies are to take prior clearance form appropriate Defence authorities before initiating search and rescue in prohibited areas.

12. Air Headquarters is to be informed for any search and rescue operation within the border areas of Bangladesh. Information to Army posts within the border area or prohibited areas is to be passed through Air Headquarters. In case, search and rescue operation has to be carried out within a danger area, it will be the duty of ROC (Rescue Operation Centre) to inform the appropriate authorities for the suspension of active firing.

SAR OPERATION IN BAF

13. BAF is responsible for initiating and conducting SAR operations in respect of military aircraft of Bangladesh besides being integral part of overall SAR operations for the country.

Officer Commanding BAF Bases

14. At flying Bases where search and rescue units are based, the Base Commander is to be responsible to Air Headquarters for all types of search and rescue as mentioned in the AFM 55-3, and :

a. Base Commander is to take decision, whether a search and rescue mission is to be continued or to be terminated, when the mission fails to achieve a favorable result. He is to inform all concerned of his decision.

b. Base Commander is to decide for the provision of more aircraft when the search and rescue aircraft engaged in the mission are not considered adequate for the purpose.

c. Base Commander may divert aircraft already in the air for search and rescue missions keeping in mind the prevailing weather, endurance and suitability of the aircraft to carry out such a mission.

d. Base Commander is to decide for such type of search, rescue and aid which are not mentioned in this manual but may be made available when requested by any civil organisation or individuals.

BAF SAR Units

15. BAF search and rescue units shall be organized at all BAF Bases to carry out independent or co-ordinated air, land sea rescue operations. These units are to be the basic operating units of the rescue system. Each unit is to be equipped with appropriate type of aircraft and specialized vehicles, and rescue equipment. Wherever, it is applicable Naval Headquarters is to be requested to detail a vessel best suited for the purpose of search and rescue duties.

16. BAF Bases not having flying facilities shall organise ground search and rescue only.

17. SAR units are to establish a Rescue Operation centre. The centre is to evaluate all incoming Information, brief search and rescue crew and co-ordinate with appropriate agencies.

Alert System

18. Communication is the most important factor for successful search and rescue operations. Therefore, it is essential to have rapid and reliable communication with all reporting agencies, to prompt receipt of distress information and to alert search and rescue units. All possible care is to be taken to eliminate delays and errors in relaying information. The entire rescue organisation is activated according to the following phases in sequences:

a. **Uncertainty Phase**. It is an incident when a ship/aircraft is overdue, position report is not received and possibility of impending emergency exists. In this phase, necessary personnel and equipment is to be made ready and communication search is to be carried cut.

b. **Alert Phase**. After receiving unsatisfactory result in the uncertainty phase communication search or when a reasonable apprehension exists regarding the safety of ship/aircraft, search and rescue units are immediately alerted. In case of aircraft, the rescue services are to be alerted when:

(1) Turbo-prop and piston engine aircraft are overdue by half an hour without any communication.

(2) Jet aircraft are overdue on ETA-with no communication.

c. **Distress Phase.** In this phase it is believed that ship/aircraft is in distress or a distress message is received from them. This phase demands immediate dispatch of search and rescue service to afford help to the distressed.

19. **Action on Alert**. A Rescue Operation Centre (ROC) is established within the BAF Rescue Unit itself, to receive incoming information, evaluate and brief the SAR crew throughout a search and rescue operation and co-ordinate with appropriate agencies. During the uncertainty phase, the ROC is to co-operate to the utmost with appropriate Air Traffic Service, or other agencies to evaluate the incoming information and to ascertain the requirements of the search and rescue services. The rescue services are to be kept informed. While in this phase, the ROC is to immediately alert appropriate search and

rescue services at the station and the following information is to be provided to the rescue services, as far a practicable:

a. Type Call signs (W/T, R/T) and nationality of ship/aircraft.

b. Position and time.

c. Heading and speed.

d. Nature of emergency.

e. Intention of captain.

f. Height.

g. Endurance.

h. Type of emergency radios and safety equipment carried (according to the ATC flight plan).

20. **Completion of Rescue Phase**. A mission is deemed to be complete when the rescue phase is successfully concluded. The SAR operation officer is to immediately intimate the following authorities of completion of the mission for taking necessary actions:

a. Appropriate BAF Station - If BAF aircraft is involved.

b. Rescue-Co-ordination Centre - If civil other aircraft is involved.

c. Bangladesh Navy - When surface vessel is involved.

21. **Cancellation of 'Alert.'** When communication search or other reliable information reveals that the overdue/missing aircraft is safe or the aircraft in distress has cancelled its distress call, all the interested agencies are to be immediately informed "Incident Closed" and de-alerted.

Air Traffic Control

22. ATC is to co-operate with search and rescue services in passing information on development of the mission to the RCC as follows:

a. To maintain contact with search and rescue services in passing information on the development of the mission to the rescue co-ordination centre.

b. Search and rescue unit operation centre.

c. ATC is responsible to inform the following on alert or distress phases:

(1) Search and rescue unit operation centre.

(2) Medical Officer.

(3) Station/Base Commander.

d. During a local airfield emergency, ATC is to take action according to the local accident plan.

e. It is also the responsibility of ATC to alert or call rescue services when a message received and aircraft flying under positive control has lost communication and is over due:

(1) By 30 minutes, incase of piston engine and turboprop aircraft.

(2) On ETA in case of jet aircraft.

f. ATC is to try its utmost to take all possible radio bearings of aircraft in emergency/distress. It should also to try to get from the pilot, his radio compass/VOR reading of any station to which it is tuned.

h. ATC is responsible to inform immediately the authority concerned, when an aircraft in emergency/distress.

SAR Operation Procedures

23. **Operation Phases**. There are four distinct phase in a search and rescue mission:-

a. **Notification Phase**. The notification phase is the initial incoming information from the Air Traffic Controls, F.I.C or any other agencies. In this phase, it is essential for the SAR unit to receive correct information for evaluation of the situation.

b. **Search Phase**. The physical search by SAR unit to locate scene of distress or incidence, may involve a single rescue aircraft or a ship or a maximum effort of aircraft or ships which will depend on the extent of search to be conducted on the available information. Every effort is to be made to make the search most effective.

c. **Aid Phase.** After the completion of the search phase, the survivors are to be provided with immediate and continuous aid, until the rescue phase is accomplished. This aid, may vary in kind, quantity and type depending on the need of survivors and circumstances.

d. **Rescue Phase**. This is the phase when survivors are recovered and delivered to the proper receiving authority.

24. **Search and Rescue Limiting Factors**. The SAR units are responsible to take all possible action to save a life at any time and at any place. The inherent risk in search and rescue mission is to be carefully weighted with mission success and gains. There is limit beyond which SAR assistance is not to be expected or may not be justified. This will depend on the capability of SAR personnel, availability of equipment. Operational requirements, economy of effort, weather and terrain etc.

25. **Co-ordinated SAR Between Different Unit's Aircraft**. If occasion arises when two or more units are engaged in the same mission, the controlling authority of SAR unit under whose responsibility area falls is to be the controlling authority for all participating search and rescue services. A continuous two-ways R/T communications are to be maintained between aircraft at all times.

26. **Co-ordinated SAR Between Aircraft and Surface Vessels**. Aircraft and the surface vessel when engaged in a search and rescue mission, the "On Scene" control is to be automatically transferred to the senior most officer in command. During the operation vessel and aircraft are to maintain contact with each other.

27. **On Scene Commander**. SAR unit commander is to detail an "On Scene Commander" when more than one aircraft are engaged in a SAR mission, "On Scene Commander" is to act as a leader throughout the flight and is to be responsible to see that:

a. Flight safety is not jeopardized.

b. Continuous communication with appropriate ground station is maintained.

c. The other aircraft are informed of any approaching weather.

d. Proper guidance and advice are given in case a search aircraft is in emergency.

28. **News Release**. News to press concerning Search and Rescue is only to be made available through the proper agencies with prior permission of Air Headquarters.

CONSOLIDATED EXERISE-11

Q1. Write the general responsibilities of different agencies in regards to SAR operation in Bangladesh.

Q2. Describe the actions of ROC on Alert Phase.

Q3. How ATC can co-operate with SAR services and RCC on development of the SAR mission?

ANSWERS TO CONSOLIDATED EXERCISE-10

A1. Write para 07 to 10 from Task-11

A1. Write para 094 from Task-11

A1. Write para 22 from Task-11

Reference Materials

1. CAAB pamphlet on SAR.

2. ICAO Annexes-12 and Doc 7333.

3. AFM 55-3.

4. Manual of ATS (MATS), Malaysia.

5. Trg Notes of BATCO Course, ATCOTE, Air Force Academy, IAF, India.

TASK – 12

METEOROLOGY

MET SERVICE GENERAL - OBJECTIVES

Objectives

1. The objective of the meteorological services is to contribute towards the safety, regularity and efficiency of aviation by providing to aircraft operators, flight crew, air traffic services units, search and rescue units, airport operators and others concerned with meteorological information necessary for their functions. In Bangladesh meteorological information necessary to ATS units are provided by civil meteorological (MET) offices/BAF MET Sqn established at various airports/airfields.

Routine Meteorological Reports

2. Routine Weather Reports (METAR**)**. The METAR(s) for an aerodrome are issued by the MET Sqn/Office hourly or half-hourly as required. These contain the information in the order tabulated below:

Item	Details
Identification of the type of report (and location)	METAR (VGTJ)
Time of Observation	UTC
Surface Wind	Direction in degree True and speed in knots
Visibility and runway visual range if applicable	In increments of 50 metres when visibility is less than 500 metres, in 100 metres when more than 500 metres but less than 5 Km, in whole kilometre if more than 5 Km but less than 10 Km and, when 10 Km or more given as 10 Km unless conditions for CAVOK apply.
Present Weather	At the time of observation, e.g. drizzle, fog, light rain etc.
Could amount and type	The layers of clouds with base in feet and amounts in oktas as FEW, SCT, BKN, OVC. Camubrimbus (cb) cloud in the vicinity of the aerodrome whatever the amount and height, is to be specified.
QNH	In Hectopascal (hPa), Milimeter (MM) and Inches
Surface Temperature and Dew Point	In degrees Celsius (Centigrade)
Supplementary information	e.g. SPECI.

3. **Special Reports (SPECI)**. Issued when improvements or deterioration to any of the information given in a routine report occur. These are issued between routine reports and contain only those items that are affected. The order and criteria for issuing special reports are tabulated below:

Surface Wind	Criteria to be agreed locally a. A change in mean direction of 60 deg or more from previous report, the mean speed before/after the change being 10 kts or more. b. Change in mean speed of 10 kts or more from last report.

	c. Variation has changed by 10kts or more from previous. d. Such changes as are operationally significant.
Surface Visibility	a. Increase and decrease to, or through: 800 metres, 1500 metres and 3000 metres or 5000 metres when VFR operations are concerned. b. In addition arrangements can be made at aerodromes where RVR is not available, either permanently or during a temporary unserviceability, to report increases and decreases to, or through. 150 m, 350 m 600m, 800 m.
Weather	At the onset, cessation and change in intensity of: Rain showers Hail Thunderstorm Squall Dust or sandstorm Tornado or waterspout
Cloud	**Base**: When the base of the lowest cloud covering more than half the sky increase or decreases to, or through: 1000 ft, 500 ft, 200 ft **Amount**: When the amount of cloud at or below 1000 ft changes from half or less to more than half and vice versa.
Pressure	When the QNH or QFE changes by 1.0 hPa.

Co-ordination Between ATC and MET

4. It is essential that close liaison is maintained between ATS units and the MET Sqn/Office in order that the best possible weather information can be made available to aircraft. Controllers should assist in this by:

a. Keeping a close watch on the weather and notifying the MET Sqn/Office of their observations.

b. Obtaining weather observations from aircraft when requested.

c. Reporting to the MET Sqn/Office without delay information obtained from pilots or any sudden and unexpected changes observed by the Controller.

5. When it is known that a flight may operate into an airfield/airport outside the normal hours of operation, Controllers shall make arrangements with the local MET Sqn/Office for routine weather information.

Meteorological Briefing

6. Controllers familiarize themselves with current and forecast weather and trends before taking responsibility for an operating position or before opening watch. The following expand the requirements with respect to briefing concerning MET.

7. Controllers shall study the weather conditions in the areas related to their areas of responsibility by either:

a. Briefing themselves by studying the information supplied by the MET Sqn/Office on a routine basis; or

b. Making a visit to local MET Sqn/Office for a personal briefing, and if this is impracticable, to obtain the briefing by telephone.

8. At aerodromes, Controllers will need an overall appreciation of the existing and forecast meteorological conditions for:

a. The local and adjacent areas.

b. Any routes with which the ATS unit is concerned.

c. Diversion aerodromes, if these are likely to be required.

9. At the area control, Controllers will need an overall appreciation of the existing and forecast meteorological conditions for:

a. Aerodromes within their area of jurisdiction.

b. Adjacent areas.

c. Routes with which the Area Control is concerned.

d. Diversion Aerodromes when conditions at the aerodromes in (a) are likely to be marginal.

10. Where message are passed verbally to ATC via telephone, Controllers/ATC assistants shall record the MET messages in the official recording form, read back the messages to verify their correctness and record their initials on the form.

Transmitting Meteorological Information

11. As early as practicable after an arriving aircraft has established contact with ATS Units the following elements of meteorological information in the order given below shall be transmitted to the aircraft:

a. Identification of the type of report

b. Location Indicator

c. Time of the observation

d. Surface wind direction and speed

e. Visibility

f. Runway visual range (RVR) when applicable

g. Present weather

h. Could amount, type (only for the cumulonimbus and towering cumulus clouds at or near the aerodrome) and height of the base.

j. Air Temperature and dew-point temperature

k. QNH and when applicable QFE.

l. Supplementary information.

12. As a general rule, Controllers shall only transmit to aircraft information that has been supplied by the MET Sqn/Office. Controllers may however pass their own observation (eg Tower observation etc) to aircraft as stated below:

a. Wind direction and speed information if equipment to sense and display such information are available at the control positions.

b. RVR reading obtained either by visual observation or supplied by automated RVR systems where installed.

c. Sudden or unexpected deterioration which, in the interests of safety, a Controller considers it advisable to warn aircraft immediately and consult with the MET Sqn/Office afterwards.

d. Information from an aircraft in flight which a Controller considers essential to be passed to other aircraft. (Controller shall inform the aircraft concerned, and as appropriate the MET Sqn/Office that the information originated from an aircraft in flight and the time, position and level at which the observation was made).

e. Weather as observed on radar.

13. Controllers should, as a practice, compare the current weather report received with the previous report and the prevailing conditions. If differences that are difficult to reconcile with the observed conditions, or if barometric pressures which are not consistent with the apparent tendency are evident then Controllers should confirm with the MET Sqn/Office before transmission to aircraft.

Release of Radiosonde (Baloons)

14. At specified locations, MET Sqn/offices will release weather balloons at notified times for the purpose of taking atmosphere readings. The MET Sqn/office will normally notify the ATS units concerned before release of the balloon.

TERMINOLOGY USED IN MET BRIEFING/FORECASTING

Introduction

15. ATS personnel may familiarize themselves with the terminology used in MET briefing/forecasting. This will help them in easy understanding of these terminologies during coordination with MET personnel.

Various Synoptic Situation

16. The conditions of pressure pattern, wind speed, state of sea and sea-swell for various synoptic situations are termed as follows:

Ser	Synoptic Situation	Pressure Pattern (closed Isobar)	Wind Speed (Kts)	Sea State	Sea Swell
a.	Low (L)	1	7-13	-	-
b.	Well Marked Low (WML)	2-3	14-23	Slight	-
c.	Depression (D)	4-6	24-27	Moderate	-
d.	Deep Depression (DD)	7-9	28-33	Rough	Moderate
e.	Cyclone Storm (CS)	12-15	34-47	Very Rough	Heavy
f.	Severe Cyclonic Storm (SCS)	12-15	48-63	High	-"-
g.	Severe Cyclonic Storm (SCS) with a core of Hurricane	16	64 of more	Very High	-"-

Time Variation (Local Forecast)

17. Specifications to denote time variation (local forecast) are shown below:

Ser	Specification	Time Variation
a.	Temporary (TEMPO)	1-2 times, duration less than 1 hr each time.
b.	Occasional (OCNL)	2-3 times, duration less than 1 hr each time.
c.	Intermittent (INTER)	3-4 times, duration less than 1 hr each time.
d.	Continuous (CONT)	4 times or ones for few hours.

Space Variation (Area Forecast)

18. Specifications to denote space variation (area forecast) are shown below):

Ser	Specification	Time Variation
a.	Isolated (ISO) (at one or two places)	01% -25% of the whole area.
b.	Scattered (SCTD) (at few places)	26%-50% of he whole area.
c.	Fairly Wide Spread (FWD) (at many places)	51%-75% of the whole area.
d.	Wide Spread (WD) (at most places)	76%-100% of the whole area.

Sky Condition

19. Specifications to denote sky conditions are shown below:

Ser	Specification	Time Variation
a.	Fine	Practically clear sky or cloud less than 1/8 with sunshine during day & moon/star light during night.
b.	Fair	1/8 or 2/8 of clouds.
c.	Partly Cloudy	3/8 or 4/8 of clouds.
d.	Cloudy	5/8 or 6/8 of clouds.
e.	Mainly Overcast	7/8 of clouds other than large Cu/Cb.
f.	Overcast (OVC)	Sky completely covered with 8 oktas of clouds other than large Cu/Cb.
g.	Obscured	Sky not discernible due to Fog, Dust.
h.	Thundery Sky	Clouds 3 to 8 oktas with large Cu/Cb.

Abbreviation to describe Cloud Amount

20. Cloud amount shall be given in terms of following:

Ser	Specification	Time Variation
a.	SKC	Sky Clear.
b.	FEW	1or 2 oktas of cloud.
c.	SCT (Scattered)	3 or 4 oktas of cloud.
d.	BKN (Broken)	5 or 7 oktas of cloud.
e.	OVC (ovaraast)	8 oktas of cloud.

Rainfall Intensity.

21. Specifications to denote rainfall intensity are shown below:

Ser	Specification	Time Variation
a.	Light Rain	004 to 009 mm per hour
b.	Moderate Rain	010 to 022 mm per hour
c.	Heavy Rain	023 to 044 mm per hour
d.	Very Heavy Rain	045 mm or more per hour.

Monsoon Intensity

22. Specifications to denote monsoon intensity are shown below:

Ser	No of Isobar	Over Land	Over Bay
a.	1-2	Less Active	Weak
b.	3-5	Fairly Active	Moderate
c.	6-8	Active	Strong
d.	More than 8	Very Active	Vigorous.

Civil Radar Observation

23. Definition of echoes received through civil radar observations are given below:

Ser	Specification	Time Variation
a.	Isolated Echo	Independent connective echo.
b.	Widely Scattered	Related or similar echoes covering <10% of the reported area.
c.	Scattered Area	Related or similar echoes covering >10% - <50% of the reported area.
d.	Broken Area	Related of similar echoes in pattern that cover >60% - <90% of the reported area but contains breaks or corridors.
e.	Solid Area	Continuous echoes covering, usually > 90% of the reported area
f.	Line of Scattered Echoes	Related echoes in an extended pattern covering 10% to 50% of the reported area.
g.	Broken Line of Echoes	Related echoes in an extended pattern that covering 60% to 90% of the reported area but contains breaks or corridors.
h.	Solid Line of Echoes	Continuous echoes in an extended pattern covering usually more than 90% of the reported area.

BAF Radar Observation

24. Definition of echoes received through BAF radar observations are given below:

Ser	Specification	Time Variation
a.	Isolated Echo	Individual solid mass echo either isolated or separated from other echoes by a distance greater than the diameter of the echo.
b.	Scattered Area	A group of echoes not forming a line, covering <50% of the area within a circumscribing circle.
c.	Broken Area	A group of echoes not forming a line, covering 50% to 90% of the area within a circumscribing circle.
d.	Solid Area	An area not forming a line, covering greater than 90% of the area within a circumscribing circle.
e.	Scattered Line of Echoes	A group of echoes covering less than 50% of the area within a circumscribing rectangle and forming a straight or slight curved line.
f.	Broken Line of Echoes	A group of echoes covering 50% to 90% of the area within a circumscribing rectangle and forming a straight or slight curved line.
g.	Solid Lines of Echoes	A group of echoes forming a solid straight or slight curving line, covering greater than 90% of the area within a circumscribing rectangle and forming a straight or slight curved line.

INTRODUCTION TO METEOROLOGY

Introduction

25. Weather influences aviation to such an extent that it becomes necessary for the Controller, to understand some of the basic weather factors. The basic weather factors are always in evidence. This part is designed for the Controller to know the basic theory behind the weather factors. While exercising the control of Air Traffic, one need not to be a meteorologist, yet he is to be well informed as to the weather conditions at all times and is to be familiar with the terminology.

Atmosphere

26. **Definition**. Atmosphere is the gaseous envelope covering the earth. It is impossible to give any definite value for the extent of the atmosphere since it has no well defined upper surface. However, it is believed that the atmosphere is extended up to 600-700 km above the earth surface.

27. **Layers of Atmosphere**. The atmosphere is classified into layers by characteristics exhibited in these layers. These layers are:

a. Troposphere

b. Stratosphere

c. Mesosphere

d. Thermosphere

28. **Inversion Layer**. It is the layer in which temperature increases with the height instead of decreasing as what is normal in the troposphere. The lapse rate is negative in an inversion layer.

29. **Isothermal Layer**. It is the layer in which temperature remains constant through the layer. The lapse rate is zero in such layer. Tropopause may be treated as isothermal layer.

30. **The ICAO Standard Atmosphere**. The ICAO standard atmosphere is defined on the basis of average conditions in the lower 65,000 ft at about 40^0 N. For convenience some of the values of particular significance to aviation are listed below:

a. The Mean Sea Level (MSL) Pressure is 1013.25 hPa or 29.90 inches or 760 mm.

b. MSL Temperature is $+15^0$C.

c. Up to 11 km (about 36,000 ft) temperature deceases by 6.5^0 C per km (about 1^0 per 500 ft).

d. Above 11 km to 20 km the temperature is constant at -56.5^0 C.

e. From 20 km to 32 km the rate of temperature rise per km is 1^0 C.

Atmospheric Temperature

31. **Definition**. The temperature of a body is the condition which determines its ability to transfer heat to other bodies or to receive heat from them. In this system two bodies, the one which losses heat to other is said to be at a higher temperature; this hotness and coolness of a substance is called temperature. The earth surface is heated by the heat received from the sun and the atmosphere is heated from below by terrestrial radiation from the earth surface.

32. **Freezing Level**. It is the level where the temperature environment curve (solid line) cuts the 0^0 centigrade isotherm line.

33. **Mintra Level**. The level at which the contrail (Condensation Trail) formation takes place is called Mintra Level. Condensation trail or sublimated water vapor forms in the wake of moving aircraft.

Winds

34. **Definition**. Wind is defined as air in horizontal motion. For describing wind we are to specify both speed and direction of the air motion.

35. **Katabatic and Anabatic Wind** At night the hill or mountain slope cools rapidly than the free air. Consequently air close to any point on the slope is colder and denser than free air at the corresponding level. The denser air than slides down the slope and the wind is known as 'Katabatic wind'. The opposite phenomena that cause during day when air moves up the slope of a valley or mountain due to warmer land is known as 'Anabatic wind'.

36. **Backing**. Backing is a term used to describe the changes of wind in an anticlockwise sense.

37. **Veering**. Veering is a term used to describe the changes of wind in a clockwise sense.

38. **Land Breeze**. During night land surface becomes cooler than the sea surface because of long wave radiation and its more heat capacity than water. As a result the sea is warmer, therefore, rise up and lifts the isobaric surface downwards on the land which causes offshore movement of the surface and a compensating on shore winds aloft. This constitutes the land breeze.

39. **Sea Breeze**. During the day time the land surface becomes hotter than the sea surface. As a result air over land becomes hot and rises upwards creating a vacuum over the land. To fill up the vacuum, air from the colder surface starts flowing towards the land constituting what is called "Sea breeze".

40. **Dust storm or Sand storm**. Phenomena in which enormous amount of dust or sand is lifted to great heights over a limited area by strong and turbulent wind.

41. **Gale**. A gale is defined as a surface wind of 34 kts or more averaged over a period of 10 minutes.

42. **Gust**. A rapid increase in the strength of the wind relative to the mean strength at the time of observation and lasts for few seconds.

43. **Squall**. A squall is a strong wind that rises suddenly and lasts for at least a minute and than dies away suddenly. As per WMO, squall is a sudden increase of wind speed by at least 16 kts, the speed raising to 22 kts or more and lasting for at least one minute.

Visibility

44. **Definition**. Visibility is defined as the ability, as determined by atmospheric conditions expressed in units of distance to see and identify prominent unlighted objects by day and prominent lighted objects by night

45. **Reporting Visibility.** When the visibility is less than 500 m it shall be expressed in steps of 50 m, i.e. VIS 350 M; when it is 500 m or more but less than 5 km in steps of 100 m i.e. 'VIS 500 m'; when it is 5 Km or more but less than 10 Km in steps of kilometer, i.e. 'VIS 6 KM'; and when it is 10 Km or more it shall be given as 'VIS 10 KM', except when the conditions for the use of CAVOK apply. When the visibility is not the same in different directions the lowest visibility shall be given. When there are significant directional variations in visibility, additional values shall be reported with indications of the direction of observation.

Fog

46. **Definition**. Very small, usually microscopic water droplets suspended in the air that reduces surface visibility at earth's surface to less than 1,000 meters, relative humidity is generally near 100%.

47. **Types of Fog**. Depending on the way of formation and place of occurrence, fog may be classified into the following different types:

a. **Radiation Fog**. Caused by cooling of the ground by loss of radiation at night.

b. **Advection Fog**. Caused by the transport of relatively warm air over a colder surface.

c. **Steam Fog or Sea Fog**. Caused by evaporation into cold air lying over warmer water.

d. **Upslope Fog**. Forms on the windward side of mountain slopes and observer can see that status clouds hangs at low elevations on the mountain side.

e. **Frontal Fog**. Caused by precipitation or very low cloud near frontal surface.

f. **Inversion Fog**. It occurs as the result of a downward extension of a layer of stratus cloud under the base of a temperature inversion.

Mist

48. **Definition**. A suspension in the air of microscopic water droplets or hygroscopic particles, reducing visibility at the earth's surface, relative humidity being more that 75%. The visibility in mist is more than 1,000 meters but less than 5 km.

49. **Difference Between Fog and Mist**. During Fog visibility reduce to less than 1000 meters while during Mist visibility reduce to 1000 metres or more but less than 5km.

Clouds

50. **Definition**. A cloud is a hydrometer consisting of minute particles of liquid water or ice or of both, suspended in the free air and usually not touching the ground.

51. **Formation of Cloud**. When air is saturated or super saturated one can no longer hold all of its water vapor, clouds are formed by the condensation of a part of water into visible droplets, snow or ice crystals. The following three conditions are essential for cloud formation:

a. Sufficient water vapour must be present.

b. There must be a cooling process.

c. There must be nuclei, or core particles, around which the droplets can form.

Moist Air And Humidity

52. **Moist Air**. Air consisting of dry air and water vapour is called moist air When more vapor is allowed to enter in already saturated (the air with its full capacity of water vapour) air, condensation takes place.

53. **Humidity**. The term humidity refers to the amount of water vapour present in the atmosphere at a particular temperature and pressure. The ratio of the amount of water vapour actually present in the air to the maximum amount of water vapour the air can hold at a given temperature is called Relative Humidity. It is expressed in percentage. When air contains all the water vapor possible at a given temperature, the RH is 100% i.e. the air is saturated.

Thunderstorm

54. **Definition.** Thunderstorm may be defined as the ultimate manifestation of growth of a large cumulus or cumulonimbus cloud. The sound produced by the sudden expansion of incandescent air trapped in an electrical flash is known as thunder. The other weather associated with them like hail, turbulence, shower, gust, squall etc, are known as storm and both thunder and storm are jointly known as thunderstorms.

55. **Weather Associated with Thunderstorm**. Thunderstorms are characterized by the following weather phenomena:

a. Moderate to strong up and downdraughts.

b. Turbulence of light, moderate and severe intensity.

c. Hail, icing, lightning and precipitation.

d. Squalls and surface gusty winds.

e. Heavy showers.

56. **Recognition and Detection of Thunderstorm**. We can identify, recognize and detect the presence of thunderstorm by the following system:

a. **Day**

(1) Clouds : Cb

(2) R/T, W/T, Interference by lightning, static discharge.

(3) Severe turbulence.

(4) Heavy showers of rain or hail.

(5) Radar echoes.

b. **Night**.

(1) Lighting Flashes

(2) R/T, W/T interference

(3) Severe turbulence

(4) Heavy shower of rain or hail

(5) Radar echoes.

Norwester

57. **Definition**. Every year, in the months of March to May, Bangladesh, particularly its southern and south eastern districts is frequently visited by thunderstorms, some of which reach tornado violence causing considerable damage to properties and lives. These pre-monsoon thunderstorms are called “Norwester” because they mostly approach from NW direction. In Bengali, they are popularly known as “Kalbalshakhi”

58. **Some Important Facts about Norwester**

a. The Norwesters generally begin about the mid-March and ceases in the beginning of June as soon as Monsoon is established.

b. Frequency of Norwester is higher over southeastern districts and majority of these thunderstorms occurs between 1700 hrs to 2100 hrs and 10% occur between mid-night and 0900 hrs.

c. The thunderstorms come from almost all directions but those coming from west/NW are the most frequent.

d. Majority of the Norwesters are associated with squalls. The most common wind speed is 25 knots to 50 knots. In few cases wind speed reach 100 knots or more.

e. The average rainfall associated with Norwester is 0.5 inch but in individual cases it may vary from nil to 2 inches or more.

f. Some of the Norwester are accompanied by hail which are sufficiently large to damage aircraft. At the time of Norwester horizontal visibility may reduce to zero due to raising dust.

g. The height of the base of the lowest clouds in some of the Norwester may be 500 ft or less.

h. Thickness of the Cb clouds may at times be as high as 40,000 ft.

Turbulence

59. **Definition**. The atmosphere is said to be turbulent when irregular whirls or eddies of air affect the aircraft so that a series of joints or bumps are felt. Turbulence is defined as irregular motion of the atmosphere produced when air flows over a comparatively uneven surface, such as the surface of earth, or when two currents of air flows past over each other in different direction or at different speed.

60. **Effect of Turbulence on Aircraft**. The following effects can be encountered by an aircraft while flying in turbulent air:

a. There may be loss of control during take off and landing.

b. It is capable of producing structural damage.

c. It can produce fatigue to pilot as well as to passenger.

d. The aircraft instruments may give inaccurate readings.

e. It can increase stalling speed. Encountering on upward vertical gust causes an abrupt change in relative wind. This result in an equally abrupt increase in angle of attack, which could result in a stall. So when making an approach under turbulent conditions, a higher than normal approach speed should be maintained.

Wind Shear

61. **General**. Wind shear is a sudden change in wind velocity along an aircraft's flight path. Which occurs significantly faster than the aircraft can accelerate or decelerate. Wind shear can occur at any level, but it is the 'low level wind shear' occurring from the surface to a height of approximately 1,500 feet, which causes problems of sufficient magnitude to affect the control of aircraft in the departure and approach phases of flight.

62. **Wind Shear Hazards at Airfields**. At aerodromes, Controllers shall be alert to the following conditions which are conductive to wind shear :

a. The presence of a front, squall or thunderstorm activity in the vicinity of the aerodrome.

b. The presence of low level inversion where the surface wind will be significantly different from that at only a few hundred feet above the ground.

c. Controllers shall also be aware that obstructions within an aerodrome such as local terrain or buildings considered in relation to wind speed and direction, can cause wind shear in addition to the usual generation of turbulence and gusts.

63. **ATC Action**. Because of the need to both maintain a safe margin above the stalling speed and a clearly defined flight profile, particularly during the climb-out and approach phases of flight, sudden changes in air speed must be countered immediately by pilots. In order to assist pilots encountering wind shear, controllers shall take following action:

a. When a departing or arriving aircraft reports windshear conditions to air traffic control, Controllers shall be alert to the possibility of an abnormal landing or crash and, shall pass the reported windshear to subsequent inbound out bound flights until confirmation is received that the condition no longer exists. Windshear reports from pilots should contain the following information:

(1) A warning of the presence of the windshear.

(2) The height or height band where the windshear was encountered.

(3) The time at which it was encountered.

(4) Details of the effect of the wind shear on the aircraft, e.g. speed gain or loss, vertical speed tendency and change in drift.

Note: Pilots may also use the words "slight", "moderate" or "severe" to describe the windshear effect.

b. Controller shall use the following phraseology to transmit a wind shear condition to aircraft.

"At (time) A DEPARTING B737 REPORTED WINDSHEAR AT 300FT. AIRSPEED LOSS 30KT, STRONG LEFT DRIFT."

c. Controllers shall include the windshear information in ATIS broadcasts.

d. Controller shall take note that pilots may delay their approach or take-off when wind shear conditions have been reported.

CONSOLIDATED EXERCISE-12

Q1. What is the responsibility of DATCO in regards to MET briefing?

Q2. Describe the clouds specifications in denoting Sky Conditions.

Q3. What are the reasons for formation of clouds and name Genera of different clouds?

Q4. How can you recognize and detect Thunderstorm?

Q5. What are the difficulties encountered by an aircraft while flying in turbulent air?

Q6. What are the ATC actions when wind shear is reported at an airfield?

ANSWERS TO CONJSOLIDATED EXERCISE-12

A1. Write para 06 to 10 from Task-12.

A2. Write para 19 from Task-12.

A3. Write para 51 and 53 from Task-12.

A4. Write para 59 from Task-12.

A5. Write para 63 from Task-12.

A6. Write para 66 from Task-12.

Reference Materials

1. AFM 60-13 (under review).

2. AFO 61-3.

3. Manual of ATS (MATS), Malalysia.

4. Meteorology 3rd and 4th Edition by W.L Down

5. Introduction to Meteorology by S. Petersen.

6. Précis on Meteorology, BAFA and Training Wing, BAF.

ENRICHMENT 1
(Student may know it)

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

Introduction

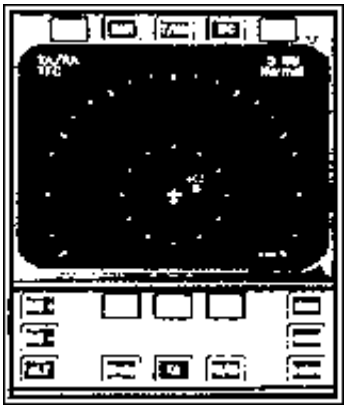
1. The Traffic Alert and Collision Avoidance System, or TCAS, is an instrument integrated into other systems in an aircraft cockpit. It consists of hardware and software that together provide a set of electronic eyes so the pilot can "see" the traffic situation in the vicinity of the aircraft. Part of the TCAS capability is a display showing the pilot the relative positions and velocities of aircraft up to 40 miles away. The instrument sounds an alarm when it determines that another aircraft will pass too closely to the subject aircraft. TCAS provides a backup to the air traffic control system's regular separation processes.

Background

2. Since the early 1960s, MITRE Corporation's Center for Advanced Aviation System Development (CAASD) has provided the FAA with Air Traffic Control (ATC) system engineering support. As part of this longstanding partnership, CAASD helped the FAA implement a collision avoidance system for aircraft. The resulting Traffic Alert and Collision Avoidance System, or TCAS, has become a standard for safety in the United States and abroad. Its value is clear: no airline mid-air collisions have occurred in the United States since 1990, when the airlines began equipping their planes with TCAS.

3. From its inception, TCAS has dramatically improved pilots' chances of successfully averting the threat of a mid-air collision. Pilots have come to rely on TCAS to give them the crucial data to avoid collisions. As their last line of defense, TCAS gives pilots the edge needed to ensure that their crew and passengers have the safest flight possible.

Historical Perspective



4. On June 30, 1956, two planes collided over the Grand Canyon. In the wake of this and other such airborne disasters, the industry realized they needed a system that could help prevent similar incidents. Companies soon began designing collision avoidance systems, but two problems hampered their efforts. First, adoption of the proposed systems would require the airlines to equip their fleets with expensive new hardware. Second, there was still a lot of development left to do before an adequate system would be ready.

5. In 1974, MITRE proposed an alternative. Using the transponders already installed in many aircraft for communication with the FAA's ground-based Air Traffic Control Radar Beacon System (ATCRBS), developers took advantage of existing technologies to significantly hasten the design and implementation process. The Beacon-Based Collision Avoidance System (BCAS) was the predecessor of today's TCAS. This system sent

interrogation signals to nearby aircraft similar to the FAA's radar system. The transponders then sent back response signals. The system interpreted these signals to determine the location, speed, and course of each plane and used the data to avoid a potential collision.

6. BCAS test results were promising. On the ground, MITRE equipped a trailer to receive transponder signals as if it were an aircraft. BCAS lived up to expectations, prompting the FAA Technical Center to test the system on one of its aircraft. On the basis of these two tests, the FAA moved forward with further development of BCAS.

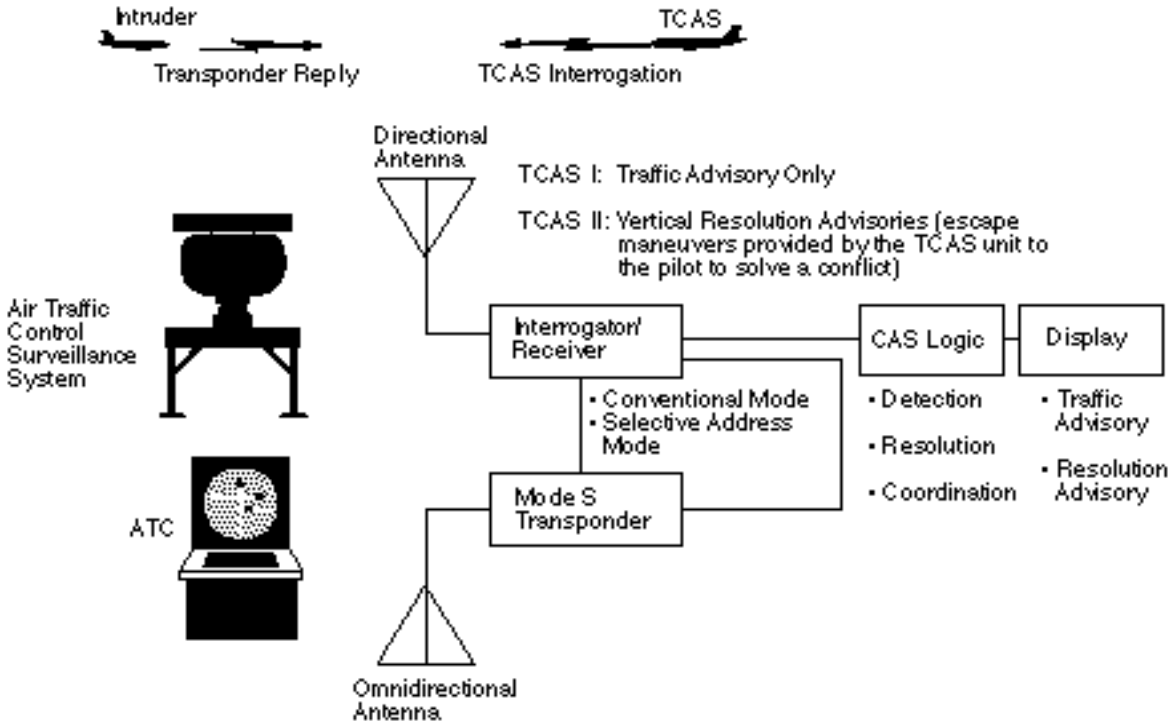
A Collision Avoidance System is Born

7. In 1981, the FAA chose to pursue the onboard design approach used in BCAS rather than a ground-based collision avoidance system, which was also under consideration. At that point, BCAS was renamed TCAS.

8. There are two different versions of TCAS, for use on different classes of aircraft. The first, TCAS I, indicates the bearing and relative altitude of all aircraft within a selected range (generally 10 to 20 miles). With color-coded symbols, the display indicates which aircraft pose potential threats. This constitutes the Traffic Advisory (TA) portion of the system. When pilots receive a TA, they must visually identify the intruding aircraft and may alter their plane's altitude by up to 300 feet. TCAS I does not offer solutions, but does supply pilots with important data so that they can determine the best course of action. An illustration of TCAS range and altitude criteria shows the horizontal and vertical distances to monitor traffic and issue advisories to maintain safe separation of aircraft.

9. In addition to a traffic display, the more comprehensive TCAS II also provides pilots with resolution advisories (RA’s) when needed. The system determines the course of each aircraft; climbing, descending, or flying straight and level. TCAS II then issues an RA advising the pilots to execute an evasive maneuver necessary to avoid the other aircraft, such as "Climb" or "Descend." If both planes are equipped with TCAS II, then the two computers offer deconflicting RA’s. In other words, the pilots do not receive advisories to make maneuvers that would effectively cancel each other out, resulting in a continued threat.

10. In TCAS II the collision avoidance logic software uses the collected data on the flight patterns of other aircraft and determines if there is a potential collision threat. The system doesn't just show the other planes on a display like a radar screen, but offers warnings and solutions in the form of traffic advisories (TA’s) and resolution advisories (RA’s).



TCAS Queries Other Aircraft, Receives Information, Displays Traffic, And Reacts By Warning Pilots When There Is A Potential Threat.

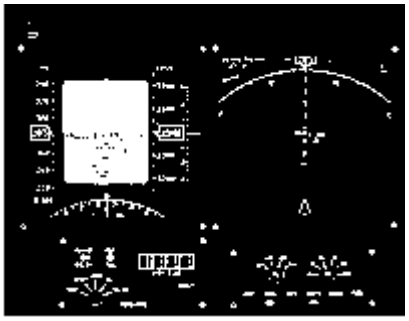
Audio Announcements

11. Complementing the TCAS visual advisories are audio announcement which are announced over the flight station speaker. For not to increase the pilot's normal workload by spending all of their time looking at the screen, the TCAS speaks up and advises them as they need to make a maneuver to avoid a collision.

Taking to the Sky: The Congressional Mandate

12. On August 31, 1986, while TCAS was still in development, a collision occurred over Cerritos, California, involving an Aero Mexico DC-9 and a small Piper aircraft carrying a family of three. The DC-9 was descending toward Los Angeles International Airport in clear skies, flying at 6,500 feet. The Piper hit the DC-9's tail, causing both aircraft to plummet from the sky.

13. The accident resulted in the deaths of all 67 people aboard the two planes, as well as 15 people on the ground. In the aftermath of this accident, Congress passed a law requiring the FAA to mandate the use of TCAS. By 1993, all carrier aircraft operating within U.S. airspace with more than 30 passenger seats were equipped with TCAS II. Aircraft with 10 to 30 seats were required to employ TCAS I.



The Final Generation

14. In 1997, CAASD finished work on one final major change to the TCAS logic, version 7. It was approved by the RTCA standards committee and the FAA, and is the version that will be installed on all new aircraft. It has also been adopted by the International Civil Aviation Organization (ICAO) as the international standard.

Parts of TCAS

15. The TCAS system is comprised of a TCAS processor (TPA-81A), Transponder/TCAS control unit (CTA-81B), two Traffic Advisory vertical speed Indicators (TA/VSI) (IVA-81A), and two TCAS antennas (ANT-81A).

TCAS Processor (TPA-81A)

16. The TCAS Processor controls all survillance, data acquisition, tracking, advisory and air-to-air maneuvering co-ordination functions of the TCAS system. It consists of a combined computerized control system and L-band receiver transmitter. The TCAS processor is also integrated with the aircraft intercommunication system and with a speaker in the flight station. When traffic warnings or advisories are detected, the appropriate warning is provided to the flight crew.

Transponder/TCAS Control Unit(CTA-81B)

17. The transponder/TCAS control unit, located on the flight control pedestal, is the master control for the TCAS processor, TRA-67A Mode S transponder and 621A-6A Mode C transponder. The control unit traverses control data and failure status data to and from the Mode S transponder or Mode C transponder.

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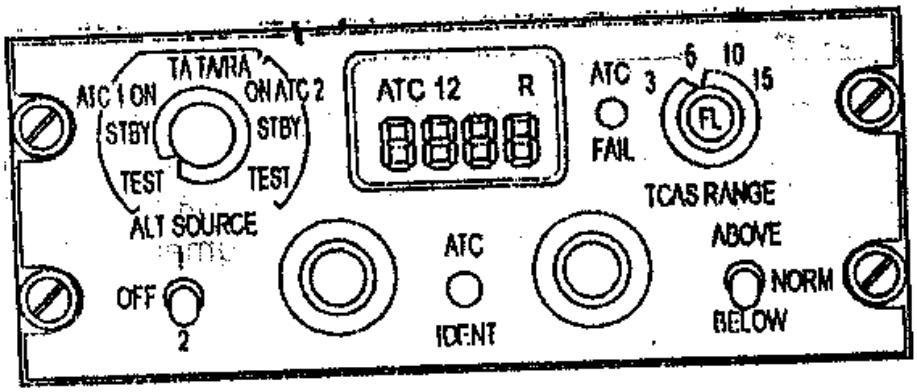


Transponder/TCAS Control Unit

Traffic Advisory Vertical Speed Indicator(IVA-81A).

20. The Traffic Advisory Vertical Speed Indicator (TA/VSI) display vertical speed of aircraft and position of surrounding aircraft traffic and resolution advisories. There are two TA/VSIs, one located in the pilot's instrument panel and the other in the co-pilots instrument panel.

TCAS Antenna(ANT-81A)

21. There are two TCAS directional antennas mounted on the top and bottom of the aircraft. Each antenna contains array of four passive, steerable, radiating elements.

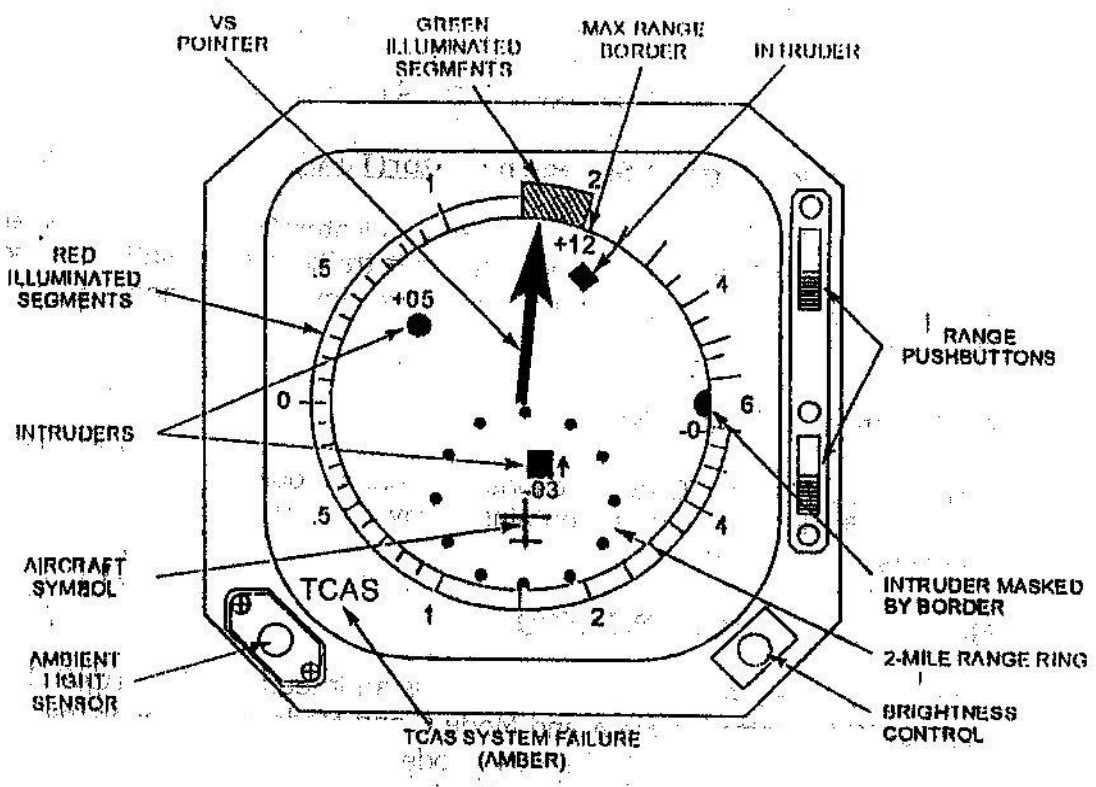
Mode S Transponder(TRA-67A)

22. The TRA-67A Mode S transponder is an integral part of TCAS. It can respond to ATCRBS formatted Mode A and Mode C and Mode S interrogations. It responds to Mode A interrogations with the 4096 codes and to Mode C interrogations with the host aircraft's barometric pressure altitude.

TA/VSI Display System

23. There are four types of traffic symbols displayed on the TA/VSI for intruder aircraft. The symbol, shape and color identifies whether the aircraft has been categorized as a non-threat, proximity, traffic advisory (TA), or resolution advisory (RA) threat. Non-threat advisory (open white diamond) indicates an intruder whose range is greater than 6 NM and/or has an altitude greater than ±1200 ft of own aircraft altitude. Proximity advisory (Solid white diamond) indicates an intruder is within 6 NM and ±1200 ft of own aircraft. A traffic advisory (Solid Yellow Circle) indicates a potential threat. A resolution advisory (Solid red circle) indicates that a maneuver is required to prevent a mid-air collision. These advisories are displayed as red and green illuminated segments which are located around the circumference of the vertical speed scale. Corrective or preventive RA guidance is

accomplished by keeping the vertical speed indicator within the green segments and out of the red segments.



TA/VSI Display

SYMBOL	INTRUDER COLOR	DESCRIPTION	RECOM ACTION
▬	Solid Red	Resulation Advisory	Take Corrective or Preventive Action
⬬	Solid Yellow	Traffic Advisory	Potential RA-Monitor
◆	Solid White	Proximity Intruder	Monitor for Future Development
◇	Open White	Non-Threat	Monitor for Future Development

TCAS Audio Announcements

ADVISORY COMMAND	AUDIO ADVISORIES	
	Corrective	Preventive
CLIMB	Climb Climb Climb	Monitor Vertical Speed Monitor Vertical Speed
DESCEND	Descend Descend Descend	Monitor Vertical Speed Monitor Vertical Speed
VERTICAL SPEED LIMIT (climbing)	Reduce Climb Reduce Climb	Monitor Vertical Speed Monitor Vertical Speed
VERTICAL SPEED LIMIT (descending)	Reduce Descent Reduce Descent	Monitor Vertical Speed Monitor Vertical Speed
CROSSOVER CLIMB	Climb, Crossing Climb Climb, Crossing Climb	Monitor Vertical Speed Monitor Vertical Speed
CROSSOVER DESCEND	Descend, Crossing Descend Descend, Crossing Descend	N/A
INCREASE CLIMB RATE	Increase Climb Increase Climb	N/A
INCREASE DESCENT RATE	Increase Descent Increase Descent	N/A
CHANGE FROM CLIMB TO DESCENT	Descend, Descend Now Descend, Descend Now	N/A
CHANGE FROM DESCENT TO CLIMB	Climb, Climb Now Climb, Climb Now	N/A
CLEAR OF CONFLICT	Clear of Conflict	Clear of Conflict
SOFTENED COMMAND	N/A	Monitor Vertical Speed
OTHER FUNCTIONS	**AUDIO ADVISORIES**	
TRAFFIC ADVISORY	Traffic Traffic	
SELF - TEST	TCAS System Test OK or TCAS System Test Fail	

ENRICHMENT – 2
(Student may know it)

SATELLITE NAVIGATION SYSTEMS

Introduction

1. Global navigation satellite system(s) (GNSS) will provide world-wide coverage and will be used for aircraft navigation and/or for approaches. This article gives a brief summary of the two satellite navigation systems currently available to international civil aviation, as well as some of the options for the future.

Global Positioning and Satellite System

2. The United States Global Positioning System (GPS) and the Russian Global Orbiting Navigation Satellite System (GLONASS) are networks of satellites that provide highly accurate positioning information from anywhere on Earth. Both systems use a group of satellites that orbit around the north and south poles at an altitude of 17,500 km (10,900 mi). These satellites constantly broadcast the time and their location above Earth. A GPS receiver picks up broadcasts from these satellites and determines its position through the process of triangulation. Using the time information from each satellite, the receiver calculates the time the signal takes to reach it. Factoring in this time with the speed at which radio signals travel, the receiver calculates its distance from the satellite. Finally, using the location of three satellites and its distance from each satellite, the receiver determines its position.

Introduction to GPS

3. Global Positioning System (GPS), space-based radio-navigation system consisting of 24 satellites and ground support. GPS provides users with accurate information about their position and velocity, as well as the time, anywhere in the world and in all weather conditions.

A Navstar global positioning system (GPS) satellite is launched into orbit by a Delta rocket. GPS satellites continuously transmit data about the satellite's position and the current time. Military and civilian navigators use the information gathered from several satellites to compute their own position.

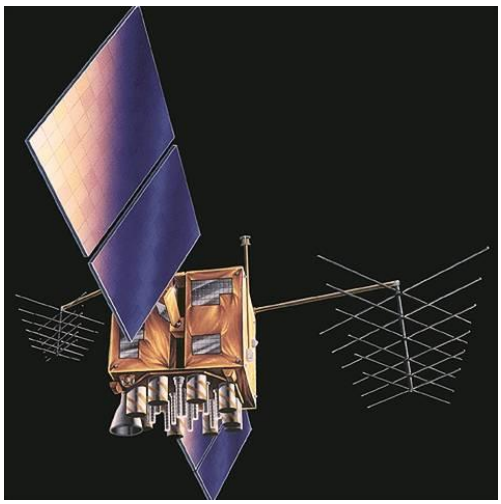
GPS Satellite Launching

4. GPS, formally known as the Navstar Global Positioning System, was initiated in 1973 to reduce the proliferation of navigation aids. GPS is operated and maintained by the United States Department of Defense. By creating a system that overcame the limitations of many existing navigation systems, GPS became attractive to a broad spectrum of users. GPS has been successful in classical navigation applications, and because its capabilities are accessible using small, inexpensive equipment, GPS has also been used in many new applications.

How GPS Works

5. GPS determines location by computing the difference between the time that a signal is sent and the time it is received. GPS satellites carry atomic clocks that provide extremely accurate time. The time information is placed in the codes broadcast by the satellite so that a receiver can continuously determine the time the signal was broadcast. The signal contains data that a receiver uses to compute the locations of the satellites and to make other adjustments needed for accurate positioning. The receiver uses the time difference between the time of signal reception and the broadcast time to compute the distance, or range, from the receiver to the satellite. The receiver must account for propagation delays, or decreases in the signal's speed caused by the ionosphere and the troposphere. With information about the ranges to three satellites and the location of the satellite when the signal was sent, the receiver can compute its own three-dimensional position.

GPS System



A total of 24 U.S. Global Positioning System (GPS) satellites orbit overhead and provide accurate positioning and navigation information for both military and civilian use. Solar cells power each satellite and its atomic clocks. Antennas on a satellite continuously transmit timing information from the clocks. The signals can be picked up and processed by a GPS receiver to determine exact location and altitude.

6. An atomic clock synchronized to GPS is required in order to compute ranges from these three signals. However, by taking a measurement from a fourth satellite, the receiver avoids the need for an atomic clock. Thus, the receiver uses four satellites to compute latitude, longitude, altitude, and time.

The Parts of GPS

7. GPS comprises three segments: the space, control, and user segments. The space segment includes the satellites and the Delta rockets that launch the satellites from Cape Canaveral, in Florida. GPS satellites fly in circular orbits at an altitude of 20,100 km (12,500 mi) and with a period of 12 hours. The orbits are tilted to the earth's equator by 55 degrees to ensure coverage of polar regions. Powered by solar cells, the satellites continuously orient themselves to point their solar panels toward the sun and their antennas toward the earth. Each satellite contains four atomic clocks.

8. The control segment includes the master control station at Falcon Air Force Base in Colorado Springs, Colorado, and monitor stations at Falcon Air Force Base and on Hawaii, Ascension Island in the Atlantic Ocean, Diego Garcia Atoll in the Indian Ocean, and Kwajalein Island in the South Pacific Ocean. These stations monitor the GPS satellites. The control segment uses measurements collected by the monitor stations to predict the behavior of each satellite's orbit and clock. The prediction data is *uplinked,* or transmitted, to the satellites for transmission to the users. The control segment also ensures that the GPS satellite orbits and clocks remain within acceptable limits.

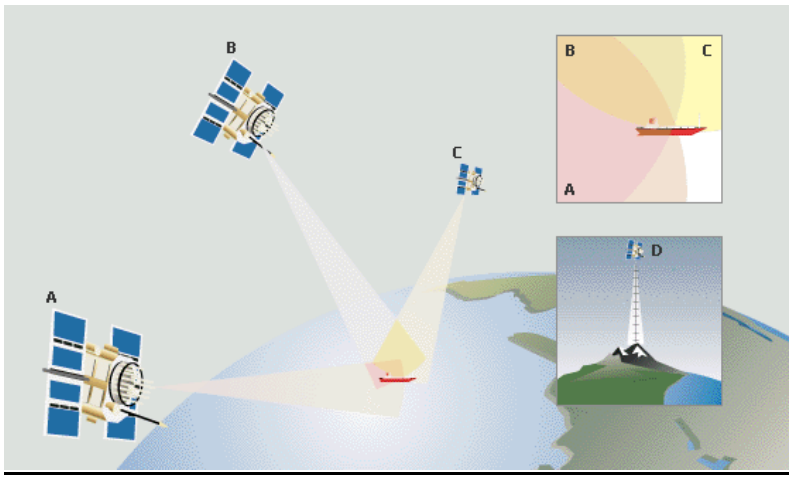
The Navstar Global Positioning System (GPS) is a network of 24 satellites in orbit around the earth that provides users with information about their position and movement. A GPS receiver computes position information by comparing the time taken by signals from three or four different GPS satellites to reach the receiver.

GPS Satellite

9. The user segment includes the equipment of the military personnel and civilians who receive GPS signals. Military GPS user equipment has been integrated into fighters, bombers, tankers, helicopters, ships, submarines, tanks, jeeps, and soldiers' equipment. In addition to basic navigation activities, military applications of GPS include target designation, close air support, “smart” weapons, and rendezvous.

10. With more than 500,000 GPS receivers, the civilian community has its own large and diverse user segment. Surveyors use GPS to save time over standard survey methods. GPS is used by aircraft and ships for en route navigation and for airport or harbor approaches. GPS tracking systems are used to route and monitor delivery vans and emergency vehicles. In a method called *precision farming,* GPS is used to monitor and control the application of agricultural fertilizer and pesticides. GPS is available as an in-car navigation aid and is used by hikers and hunters. GPS is also used on the Space Shuttle. Because the GPS user does not need to communicate with the satellite, GPS can serve an unlimited number of users.

Finding Location With GPS



Global Positioning System (GPS) satellites orbit high above the surface of Earth at precise locations. They allow a user with a GPS receiver to determine latitude, longitude, and altitude. The receiver measures the time it takes for signals sent from the different satellites (A, B, and C) to reach the receiver. From this data, the receiver triangulates an exact position. At any given time there are multiple satellites within the range of any location on Earth. Three satellites are needed to determine latitude and longitude, while a fourth satellite (D) is necessary to determine altitude.

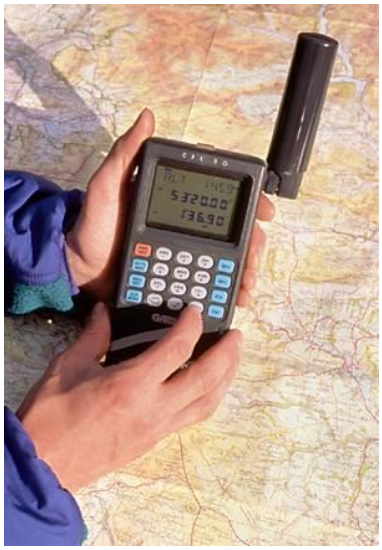
GPS Capabilities

11. GPS is available in two basic forms: the standard positioning service (SPS) and the precise positioning service (PPS). SPS provides a horizontal position that is accurate to about 100 m (about 330 ft); PPS is accurate to about 20 m (about 70 ft). For authorized users—normally the United States military and its allies—PPS also provides greater resistance to jamming and immunity to deceptive signals.

12. Enhanced techniques such as differential GPS (DGPS) and the use of a carrier frequency processing have been developed for GPS. DGPS employs fixed stations on the earth as well as satellites and provides a horizontal position accurate to about 3 m (about 10 ft). Surveyors pioneered the use of a carrier frequency processing to compute positions to within about 1 cm (about 0.4 in). SPS, DGPS, and carrier techniques are accessible to all users.

13. The availability of GPS is currently limited by the number and integrity of the satellites in orbit. Outages due to failed satellites still occur and affect many users simultaneously. Failures can be detected immediately and users can be notified within seconds or minutes depending on the user's specific situation. Most repairs are accomplished within one hour. As GPS becomes integrated into critical operations such as traffic control in the national airspace system, techniques for monitoring the integrity of GPS on-board and for rapid notification of failures are being developed and implemented.

Global Positioning System (GPS) receivers use the signals from orbiting GPS satellites to determine location. The liquid crystal display of a basic GPS receiver shows latitude, longitude, and altitude. Advanced receivers display maps showing the user's location.



GPS Receiver

The Future of GPS

14. As of 2003, 24 GPS satellites were in operation. Replenishment satellites are ready for launch. GPS applications continue to grow in land, sea, air, and space navigation. The ability to enhance safety and to decrease fuel consumption will make GPS an important component of travel in the international airspace system. Airplanes will use GPS for landing at fogbound airports. Automobiles will use GPS as part of intelligent transportation system. Emerging technologies will enable GPS to determine not only the position of a vehicle but also its altitude.

Introduction to GLONASS

15. The Global Orbiting Navigation Satellite System (GLONASS) is based on a constellation of active satellites which continuously transmit coded signals in two frequency bands, which can be received by users anywhere on the Earth's surface to identify their position and velocity in real time based on ranging measurements. The system is a counterpart to the United States Global Positioning System (GPS) and both systems share the same principles in the data transmission and positioning methods. GLONASS is managed for the Russian Federation Government by the Russian Space

Forces and the system is operated by the Coordination Scientific Information Center (KNITs) of the Ministry of Defense of the Russian Federation.

Operation of GLONASS

16. The operational space segment of GLONASS consists of 21 satellites in 3 orbital planes, with 3 on-orbit spares. The three orbital planes are separated 120 degrees, and the satellites within the same orbit plane by 45 degrees. Each satellite operates in circular 19,100 km orbits at an inclination angle of 64.8 degrees and each satellite completes an orbit in approximately 11 hours 15 minutes.

17. The ground control segment of GLONASS is entirely located within former Soviet Union territory. The Ground Control Center and Time Standards is located in Moscow and the telemetry and tracking stations are in St. Petersburg, Ternopol, Eniseisk, Komsomolsk-na-Amure.

Future of GLONASS

18. The constellation is currently operating in a degraded mode with only eight satellites fully operational. A program for the gradual enhancement of the GLONASS constellation is being developed. That plan calls for 12 functioning satellites in 2001.

19. Work is underway to modernize the system. The Russian Space Forces plan to start flight tests of a new GLONASS-M program which would be launched between now and 2004. The new GLONASS-M satellite will have better signal characteristics as well as a longer design life (7-8 years instead of the current 3 years). In the future, plans are being developed to transition to a low mass third generation GLONASS-K satellites with a guaranteed lifespan of 10 years.

Brief Description of ICAO CNS/ATM Concept

20. The main features of the global concept of the CNS system, to be implemented within a period of the order of twenty years, may be recapitulated as follows :

21. **Communications**.

a. Satellite data and voice communication capable of global coverage. Initially, high frequency (HF) may have to be maintained in the transition period and over polar regions until such time as satellite communication is available.

b. Very high frequency (VHF) data will be used along with VHF voice in many continental and terminal areas.

c. The secondary surveillance radar (SSR) Mode S data link will be used for air traffic service, (ATS) purposes in high-density airspace.

d. The aeronautical telecommunication network (ATN) will provide for the interchange of digital packet data between end-users over dissimilar air-ground and ground-ground communication links.

22. **Navigation**.

a. Progressive introduction of area navigation (RNAV) capability in compliance with the required navigation performance (RNP) criteria.

b. Global navigation satellite system(s) (GNSS) will provide world-wide coverage and will be used for aircraft navigation and or non-precision type

approaches. Precision approaches may become common as well. Additionally, GNSS will see use for providing surface movement guidance.

c. A combination of GNSS and microwave landing system (MLS) will phase out the current instrument landing system (ILS) for precision approach and landing.

d. Non-directional radio beacon (NDB) and VHF omni-directional radio range distance measuring equipment (VOR/DME) will be progressively withdrawn.

23. **Surveillance**.

a. SSR Mode A/C or SSR Mode S will be used in terminal areas and in high-density continental airspace.

b. Automatic dependent surveillance (ADS) will be used extensively. In continental and some terminal areas, it may eventually become a supplement to SSR.

c. The use of primary radar will diminish.

24. **Future ATM System**. The goals for the future ATM system include :

a. Maintain or increase the existing level of safety.

b. Increased system capacity and full utilization of capacity resources as required to meet traffic demand.

c. Dynamic accommodation of user-preferred three-dimensional and four-dimensional flight trajectories.

d. Accommodation of full range of aircraft types and airborne capabilities.

e. Improved provision of information to the users. Such as weather conditions, situation, availability of facilities.

f. Improved navigation and landing capabilities to support advanced approach and departure procedures.

g. Increased user involvement in ATM decision-making including air-ground computer dialogue for flight negotiation.

h. Creation, to the maximum extent possible, of a single continuum of airspace, where boundaries are transparent to users.

j. Organisation of airspace in accordance with ATM provision and procedures.

k. Minimisation of airborne delays and holding, coupled with adjustment of flight-track schedules to achieve efficient traffic flows as well as efficient airspace and airport usage ; and

l. Improved ATS strategic planning to minimize future aircraft conflict and tactical conflict-resolution manoeuvring by the ATS system.