Civil Aviation Authority

Safety Regulation Group

CAP 745

Aircraft Emergencies

Considerations for air traffic controllers

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Introduction

This booklet is aimed at promoting thought about emergencies, to outline some considerations and, perhaps, dispel some myths. There is rarely a single correct way to deal or assist with an aircraft emergency because each one is different, but the greater a controller's understanding of the potential difficulties, the more appropriate his or her response is likely to be. It is hoped that the information contained in the booklet will be of value to controllers undertaking TRUCE (Training for Unusual Circumstances and Emergencies) and may form the basis of discussion exercises.

Some simple to use 'rules of thumb' have been provided to assist controllers to calculate quickly track distances and time for descent from altitude during an emergency. There is also a description of the processes the pilot is going through. In addition a number of lists of points for consideration have been provided. It is hoped that these will stimulate thought and discussion on the subject.

Whilst this booklet is primarily aimed at circumstances involving commercial air transport (CAT), many of the principles described apply equally to general aviation (GA).

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Emergency overview

Emergency overview

Flight crew behaviour during an emergency

When flight crew are confronted with an abnormal situation, they will normally prioritise their immediate actions in the following order.

- **AVIATE**
- **NAVIGATE**
- **COMMUNICATE**

Aviate

Their immediate priority is to ensure the safe flight path and condition of the aircraft. This will not only include the flying of the aircraft but also the completion of checklist drills. The safe flight path may even include the initiation of a controlled rapid descent.

In order to maintain the correct balance of workload, the flight crew will normally distribute the responsibilities between the available crew. For a modern two crew flightdeck, one flight crew member will take responsibility for the flight path of the aircraft and all radio communications and the other flight crew member will conduct any checklist actions.

The workload during the first moments will be high and the flight crew may elect immediately to inform air traffic control of a problem by the most direct means. This will normally entail the use of an initial radio call incorporating the phrase 'standby'.

e.g. “London, c/s 123, we've got a problem - standby”

Once the flight crew have completed the checklist actions and the aircraft is in a safe flying condition, the flight crew will reassess the situation. This will generally follow this format.

D	Diagnose the problem
O	Options available
D	Decide what to do
A	Allocate tasks
R	Review

Navigate

The flight crew will decide on whether to continue the flight to destination or to initiate a diversion. The decision to divert may be immediate but normally it will require co-ordination with air traffic control and other parties.

Emergency overview

Communicate

The flight crew will endeavour to inform all related parties as to the type of emergency and their intentions. Related parties will include air traffic control, cabin crew, passengers and the company. The flight crew will normally use the following format to facilitate a quick and effective briefing.

N	Nature of the emergency
I	Intentions of the crew
T	Time available
S	Supplementary information

The flight crew may require extra information before a plan is agreed. They may ask air traffic control to assist them before they are ready to advise their intentions. This extra information may be requested from any number of sources, but the most important and accessible will be air traffic control.

Establish the *need to know* and ignore the nice to know!

Degree of emergency

Degree of emergency

There are two classes of emergency messages:

Distress A condition of being threatened by serious and/or imminent danger and of requiring immediate assistance.

Urgency A condition concerning the safety of an aircraft or other vehicle, or of some person on board or within sight, but which does not require immediate assistance.

The message will be prefixed:

MAYDAY MAYDAY MAYDAY (for distress messages)

or

PAN PAN, PAN PAN, PAN PAN (for urgency messages).

Flight crew may be reluctant to use the standard prefixes to inform air traffic control initially. It is likely that the declaration of an emergency will occur after a period of diagnosis.

If the flight crew has given certain items of information normally associated with an emergency message but has not prefixed the message with 'MAYDAY' or 'PAN', the controller is to ask the pilot if he wishes to declare an emergency. If the pilot declines to do so, the controller may, if he thinks it appropriate, carry out the necessary actions as if the pilot had declared an emergency.

The terms 'fuel emergency' and 'medical emergency' have no status in the UK and controllers are not required to give priority to aircraft with a reported shortage of fuel or medical problem unless an emergency is declared.

Indications of a potential emergency situation

- Crew not responding to your transmissions could indicate they are preoccupied.
- A request to 'standby' could be an indication of a problem or that a checklist is being completed.

  Note: Voice pitch/tone does not necessarily reflect the seriousness of the situation or the level of flightdeck activity.

Summary

- Emergencies usually start with a statement of a problem and a request to standby.
- A period of diagnosis by the flight crew will then follow.

Degree of emergency

- Once the situation and its implications are understood, a PAN/ MAYDAY may be declared.

  Note: Not all airlines use DODAR/NITS, however, they will have their own similar version.

Remember a PAN can deteriorate into a MAYDAY!

Considerations for the handling of emergencies by controllers

Initial actions

- Acknowledge the aircraft call - observe any request to standby.
- Inform the crew of their position and that of the nearest available airfield.

  Note: Crews have stressed that in an emergency situation they require ATC to pass accurate range checks.
- Reduce workload as much as possible:
  - ⇨ Call for help - alert supervisors and/or colleagues.
  - ⇨ Ask flight to squawk 7700 - this is particularly helpful in the en-route environment.
  - ⇨ Consider sterilising the runway or stopping further sector traffic.
  - ⇨ Consider using a discrete frequency or clearing the frequency of other traffic.
  - ⇨ Consider imposing RTF silence.
  - ⇨ Consider the option of providing a non-standard holding pattern - modern aircraft can easily set up holding patterns anywhere. This will reduce workload on both sides.
- Make use of any pause in communication with the pilot to consider options for the aircraft:
  - ⇨ What action can you take to minimise frequency changes.
  - ⇨ Landing options.
  - ⇨ Nearest 'available' airfield and weather.
  - ⇨ Nearest 'suitable' airfield and weather.
  - ⇨ Continue to destination or nominated alternate.
  - ⇨ Time may be required in order to resolve, contain or improve the situation.
- Whenever possible, avoid vectoring aircraft in emergency over built up areas.

Remember: The crew may not be aware of the full situation (for example, the extent of any damage or the full effect it will have on aircraft handling).

Do not hassle the crew - they need thinking time!

Considerations for controllers

Considerations for controllers

The following may be of interest to note:

- For flight crew, time will appear to 'compress' whereas for the controller it will seem to 'expand'.
- Try to jot down times of contact so as to rationalise 'TIME DISTORTION'.
- Try to avoid talking too much.
- Communication problems may be encountered:
  - ⇨ The crew may be wearing oxygen masks.
  - ⇨ Under stress language problems increase.
  - ⇨ Do not ask for too much information at one time.

  Remember: Use of standard phraseology may help to overcome many communication problems.

Subsequent actions

On receipt of further information from the crew (see NITS page 10), you should be able to establish the exact nature of the emergency (if known by the crew) and any effects on aircraft handling or performance.

'Time available' will depend upon the nature of the emergency but there are generally three immediate options.

Immediate landing In a critical situation or to contain a worsening situation.

Delayed landing Fuel jettison, Drills, Situation analysis and approach preparation.

Immediate descent Depressurisation or critically ill passenger.

Provide further assistance in the form of updated position information and consider providing vectors and other information such as ILS frequencies. Inform Distress & Diversion (D&D), adjacent sectors/units and other agencies as appropriate.

Assistance from other agencies

Wherever practical the controller should delegate tasks to other competent persons in order to be able to concentrate on communication and direct assistance to the crew. Numerous internal and external resources may be able to assist, including:

- Other aircraft in the vicinity.
- ATC support staff.
- Unit watch manager.
- Adjacent ATC units.

- ACC watch manager.
- D & D Cell.
- Airline operations departments.
- Airport fire services.
- Airport security.
- Airport switchboard.
- Local authority emergency services.
- HM coastguard.
- Aircraft operator ground staff (e.g. operations or engineering personnel).
- Locally based flying instructors and aircraft engineers with experience of the aircraft in difficulties.

Considerations for controllers

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Crew intentions/options

All of the following intentions/options will depend upon the time available versus the risk (for example, fuel dumping will not always be necessary).

Type of approach required

- Ask the crew what type of approach they require.
- Radar to ILS will normally minimise flightdeck workload.
- Radar vectoring for surveillance radar approach (SRA).
- Radar vectoring for a visual approach will assist an aircraft with limited or no radio navigation aids.
- The go-around may be difficult or impossible.
- A 'fly by' may be required before landing to establish the full extent or nature of any damage.

Considerations for nearest 'suitable' airfield

- Runway direction/runway length.
- Height vs. range to runway (see Rule of thumb).
- Wind direction and weather.
- Flight crew familiarity.
- Emergency facilities/ground facilities.

RULE OF THUMB: ***A rough guide to work out track miles to landing is to multiply the height in 1,000s of feet by 3, for example, 30,000 feet = 90 miles***

Fuel jettison (when requested)

Not all aircraft have the capability to dump fuel. Larger aircraft are more likely to have an ability to dump fuel, for example, B767.

- How much fuel to dump depends on time available.
- MATS Part 1 gives guidance on where fuel dumping should take place.
- Weather in the area may be unsuitable for fuel dumping (for example, thunderstorm activity).

  Note: A B747 could need to dump fuel for 1 hour.

RULE OF THUMB: ***As a rough guide, aircraft dump fuel at a rate of 2% of the AUW (all up weight) per minute.***

Crew intentions/options

Landing

- Implications of overweight landings:
  - Aircraft may be fast on approach.
  - Aircraft may require the full length of the runway.
  - The brakes may be hot. Brake fires and tyre deflation are possible.
  - The runway may be blocked after landing.
- The aircraft may not be able to comply with normal ATC procedures when executing a go-around.
- Steering may be compromised by hydraulic loss or wheel damage.
- Be ready to pass the fire service frequency to the flight crew.
- Depending on the nature of the emergency:
  - Braking may be reduced.
  - Emergency evacuation may take place.
  - Aircraft may be unable to vacate the runway.

Priorities - Time available - Priorities!

Factors affecting types of emergency

Remember: No two emergencies will ever be the same. The same situation can develop and be resolved in an entirely different way on a different occasion as there are so many variables that can affect the eventual outcome.

The following list attempts to highlight some of the factors that may affect the progress and outcome of different categories of emergency and identifies some typical actions that may be necessary.

Fire or smoke

- Time is critical - the flight crew will want to land the aircraft as quickly as possible.
- An emergency descent is highly likely.
- Initial diagnosis may be delayed, particularly on large aircraft, as the source is investigated.
- Use of oxygen masks can limit the ability of the flight crew to communicate.
- The visibility of instruments may be minimal.
- The fire may not be extinguishable.
- Frequency changes may hinder communication.
- The type of approach may be critical due to the time available.
- Flight crew incapacitation is possible.
- Crosswinds may cause complication on landing due to the location of fire.
- Aircraft evacuation is likely.
- Controllers should inform flight crew of the nearest suitable or available airfield and consider an initial vector.

Loss of pressurisation

- Descent may already be established before the controller can be contacted.
- Requesting a squawk of 7700 will assist other controllers.
- Emergency descent to approximately 10,000 ft (or Minimum Safe Altitude, if higher).
- Rate of descents up to 8,000 ft per minute may be observed. Hypoxia is a threat to air crew in this event; it is possible that crew with hypoxia will read back instructions incorrectly or will not follow ATC instructions.
- A spiral descent may be used to increase rate of descent.

Factors affecting emergencies

- If structural damage is suspected a slower descent may be carried out.
- If structural damage is suspected the crew may request a handling check before commencing approach.
- Communication can be difficult due to the high ambient noise and the use of oxygen masks.
- A diversion is likely, although if decompression is non-explosive the aircraft may continue to destination.
- An explosive decompression can lead to additional technical and medical problems.
- Additional medical problems can occur when descent starts above FL 250, such as bleeding noses and burst eardrums.

  Note: ATC at the intended destination should be alerted that medical attention may be required.

Failure of all engines

- Acknowledge MAYDAY and inform flight crew of nearest suitable or available airfield. Controllers should consider offering an initial vector.
- Consider imposing RTF silence for other aircraft.
- Orbiting above an airfield will assist the pilot to plan a glide approach.
- Accurate range and track distances can aid descent planning.
- Flight crew workload will be high due to engine relight techniques.
- A steeper than normal approach path can be expected.
- When giving turns the rate of descent may double.

Engine failure - take-off

- Very high workload initially - flight crew may make use of an initial 'Standby' call.
- Aircraft may not follow initial departure clearance - it may continue straight ahead or follow its own emergency turn procedure.
- A stepped climb may be required to retract high lift devices.
- A larger radius of turn can be expected due to reduced aircraft performance and manoeuvrability.
- The flight crew may experience other handling difficulties. For example, turns in one direction may be preferred.
- The flight crew may elect to dump fuel.
- A longer landing distance may be required.

- The flight crew may request an automatic landing.

  Remember: The ILS/runway may need to be protected.
- Degradation of other aircraft systems can result.

Engine failure - climb, cruise or descent

- The aircraft is likely to drift down - the flight crew will advise of the altitude that can be maintained.
- Further descent may be requested or an increased descent rate observed in order to assist engine restart capability.
- The aircraft may have an increased turn radius.
- A diversion is highly likely.

  Note: An engine failure for most modern multi-engine aircraft may have little apparent effect on the flight. Although it will remain an emergency, all significant systems will work almost as normal. ETOPs twin jets can be certificated to operate 180 minutes flying time from the nearest diversion airfield.

High speed rejected take-off

- The decision to abort at high speed will indicate a critical problem.
- Tyre and brake fires can result - tyre burst can damage the aircraft further
- Tyres may deflate due to hot brakes resulting in runway blockage.
- The aircraft may overrun the runway.
- Informing the flight crew of exterior conditions of the aircraft will assist them in assessing the situation. Location of smoke is a good example.

  Note: Experience shows that unless the controller is absolutely sure of the source of a problem, all advice should be general. For example, "Smoke appears to be coming from the rear of the aircraft" rather than "Your APU is on fire".

Low speed rejected take-off

- The aircraft will normally vacate runway.
- The aircraft may return to stand or even reattempt take-off.

Bomb threat - suspicious object

- A diversion to more suitably equipped or nominated airfield may be required.
- Try to vector clear of populated areas unless this will delay the aircraft in reaching a suitable airfield.

Factors affecting emergencies

- An evacuation is possible.
- The flight crew may make unexpected requests due to co-ordination with other agencies. Requests for step climbs and descents can be expected.

Landing gear

- Landing gear extension time may be prolonged.
- A go-around is likely if problem first occurs on final approach.
- A visual inspection may be required. A 'fly by' or sighting from another aircraft can be used.
- The aircraft may have reduced braking capability.
- Undercarriage collapse or loss of directional control is possible upon landing.
- Landing gear retraction may not be possible following extension and can restrict the go-around performance and endurance of the aircraft. Consider restricting the use of the runway by other aircraft.
- The flight crew may not retract undercarriage if a tyre fails on take-off.
- Damage to the aircraft can result from tyre bursts. Fuel or hydraulic fluid leaks may result.

Hydraulic failures

- An abnormal landing configuration is possible. This may result in increased approach speeds.
- Systems may be slow to operate. The flight crew may request extended routings and/or final approach.
- High flight crew workload can occur with multiple system failures.
- Increased landing distance may be required due to the loss of braking systems, reverse thrust and spoilers.
- The aircraft may have limited flight control. Wider circuit patterns may assist the flight crew.
- Nose wheel steering may be inoperative and the aircraft may not be capable of vacating the runway.
- A crosswind can reduce directional control on landing.
- Fire may result from leaking hydraulic fluid.

Total (or nearly total) electrics failure

- An immediate diversion is essential if only battery power available.

- On some aircraft types the RTF is a big drain on battery power. Controllers should consider transmitting blind or offering the flight crew a range of options which require only a short transmission to indicate the preferred choice.
- The flight crew may have a high workload due to limited instrumentation. Vectoring to an area of known VMC may assist.
- Navigation may be difficult. Controllers should consider the use of radar vectors.
- An abnormal approach configuration is possible.
- Controllers should monitor headings and levels as they may be different from those indicated on the flightdeck.

Birdstrike

- The flight crew may have difficulty in establishing the damage or effects.
- Incidents involving engines are usually the most serious.
- The flight crew may elect to continue with flight if no effects are apparent

Control problems

- Likely to be most serious with smaller, less sophisticated, aircraft.
- Increased circuit pattern speeds may be required due to minimum control speeds.
- Possible handling problems may lead to an increased turning radius.
- Following an engine failure, smaller twin engined aircraft may require turns in one direction only.
- A high-speed approach and landing may be required.
- The problem may disappear in warmer air if it was originally due to icing.
- Handling checks may be required before an approach is attempted.

Medical emergency

- The medical emergency may relate to flight crew or cabin crew as well as passengers.
- 'Medical Emergency' is not a term that is recognised in the UK as a class of emergency - the pilot should be asked if he/she wishes to declare an emergency (and, if not specified, the class of emergency).

Factors affecting emergencies

- In the event of flight crew incapacitation - on suitably equipped aircraft - this will normally necessitate an automatic landing.
- The phrase 'Life threatening' can be used to clarify the situation.
- The flight crew may have access to medical advice through HF/ VHF phone patch. The advice given may dictate the choice of diversion airfield.

Fuel shortage

- The flight crew can often be reluctant to declare an emergency
- 'Fuel Emergency' is not a term that is recognised in the UK as a category of emergency - the pilot should be asked if he/she wishes to declare an emergency (and, if not specified, the class of emergency).
- Low fuel quantity will limit the range of the aircraft.
- A fuel leak will result in a continually worsening situation.
- Weather or traffic delays may result in diversion before critical fuel levels are reached.

Icing

- Icing is a problem predominantly experienced by helicopters and turbo-prop and piston engined aircraft due to the low cruise altitudes used.
- A descent may be established before controller can be contacted.
- Flight controls can jam or engines can flame out.
- Fuel icing can occur at high altitude or low temperatures.
- The performance of propellers, rotors and engines can be severely reduced.
- A reduced climb performance and faster approach speed can be expected.
- A descent or turn to warmer air may resolve the situation.

Radio failure

- The flight crew may be unaware of the failure.
- The flight crew may be unfamiliar with the local radio failure procedures.
- The flight crew may be distracted or confused while finding procedure.
- Other methods such as company frequency, SELCAL or ACARS can be used to contact aircraft.

Additional considerations

- **Helicopters**
  - ⇨ Helicopters are inherently unstable. They may be difficult to fly with failures.
  - ⇨ Complex engineering with critical components, gearbox/ transmission, rotor vibration.
  - ⇨ A problem in a helicopter can result in a very high flight crew workload.
  - ⇨ Controllers should consider minimising frequency or SSR changes in order to reduce flight crew workload.
  - ⇨ Passengers can be disembarked in the hover following a landing gear problem.
- **Military**
  - ⇨ Many 'fast' jets have limited endurance.
  - ⇨ The aircraft may be carrying live weapons.
  - ⇨ Single seat aircraft will have a high crew workload.
  - ⇨ Aircraft may be at very low level and make rapid climb to enter radar cover or establish position.

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Emergencies on the ground

Although this document focuses on in-flight emergencies, aircraft emergencies can also occur on the ground. Many of the considerations shown on the previous pages can be applied to an emergency that occurs on the ground. There are, however, a number of additional considerations that may be relevant when an emergency occurs on the ground (or when an aircraft that has experienced an in-flight emergency has landed).

Many of the procedures to be followed will be laid down in the aerodrome Emergency Orders and in the Manual of Air Traffic Services Parts 1 and 2. It is important, though, to remain aware of the situation and to recognise the resources that you can call on to assist.

It is important to remember that aircraft may evacuate passengers onto operational areas of the aerodrome. In these circumstances, caution must be exercised to ensure that passengers remain safe after leaving the aircraft.

Similarly, emergency services vehicles and personnel that are not normally based at the aerodrome are likely to be less familiar with the aerodrome layout and may require assistance to remain in areas of the aerodrome that are not in operational use.

A few additional considerations when dealing with a ground emergency are shown below.

Aircraft emergencies on the ground

- Tell other aircraft in the area to stop in order to enable emergency vehicles to reach the aircraft in emergency more quickly.
- Stop other aircraft entering the area.
- If appropriate, co-ordinate with other agencies that operate in that part of the aerodrome to ensure that they can modify their procedures or provide assistance.
- Aircraft may return unexpectedly to a parking stand if it is necessary to disembark passengers.
- If necessary, 'sterilise' a portion of the aerodrome in order to protect passengers from hazards.
- If ATC is responsible for airside operations, consider the need to liaise with the Air Accidents Investigation Branch (AAIB).

  Remember: It may be necessary to obtain permission from AAIB before an aircraft is moved following the conclusion of the emergency.

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Human factors

Human factors

Aircraft emergencies are stressful for everyone involved. Our initial reaction to stress is the so-called 'fight or flight' response where our bodies physically prepare to stay and fight or to take flight and run away from danger with a rush of adrenaline. This reaction does not necessarily help us think or perform better.

The following summarises some human responses to emergency situations both on the flightdeck and in the ATC environment and makes some suggestions for managing them.

Impact on the flightdeck of in-flight emergencies

- There may be an extremely high workload, especially early on, whilst completing initial checklists and diagnosing the problem.
- The flight crew may experience very high stress levels. Personal danger is real and many crews are likely to be finding themselves in their first real emergency of that kind.
- Time distortion - crew perception of time is compressed as they feel they have an inordinate number of things to do in a very short period of time.
- Language and communication difficulties may be experienced. When under stress, any existing language difficulties will be exacerbated.
- Voices do not necessarily reveal seriousness. The flight crew can sound very cool, calm and collected when it is anything but that on the flightdeck.
- Communication with ATC is a low priority. The crew's last priority will be to communicate with ATC (aviate, navigate, then communicate).
- There may be a reluctance to acknowledge the extent of the problem. Sometimes there may be a reluctance to declare an emergency when it is appropriate to do so.

Impact on the controller of in-flight emergencies

- Time distortion - the controller's perception of time is expanded so that it appears more time has elapsed between communications than is actually the case. Jot down the times of communications to keep this in check.
- Resist the urge to 'throw information' at the flight crew. A common response of the need to 'do something' is to pass on as much information as possible. This can have the effect of overloading the flight crew at a time when they have other

Human factors

priorities. Anticipate this urge and take a few seconds to consider the amount, relevance and timing of the information to determine what is really useful before transmitting. Keep additional information on hand and ready in case of flight crew request or a change of circumstances.

- 'Tunnel vision' is a common response to stress and high workload. Anticipate it and force yourself to monitor all relevant sources of information.
- Minimise requests for information, especially early on, when the crew are likely still to be running through checklists and diagnosing the problem.
- Memory is degraded by stress. Jot down more notes than you would do normally as a reminder and keep scanning the notes and other sources of information to help back up your memory.
- There may be a high workload. Let colleagues know that you have an emergency as soon as possible so that support is at the ready when you need it.
- Post-event stress may occur. Involvement in emergencies can lead to post-event stress for controllers as well as flight crew. Seek help promptly if affected.

Summary

Summary

Although modern technology and design techniques have rendered serious emergencies a rare occurrence, it is inevitable that aircraft and their crews will experience emergencies from time to time. Whilst the reduction in serious emergencies is to be welcomed, it does mean that both the controller and aircraft crew may not have previously experienced such an event.

Controllers and aircraft crews undertake training to handle emergencies and practise the actions that may have to be taken in such an event. These training exercises will enable the basic and predictable steps necessary to handle such an event to be carried out consistently and will release 'spare thinking capacity' which can be devoted to coping with the unanticipated or unique aspects of the situation. An understanding of the environment in which the aircraft operates and of the tasks of the aircraft crew, many aspects of which are mentioned in this document, will also enable the unpredictable aspects of an emergency to be dealt with effectively.

The controller will often play a significant part in the safe and successful resolution of most aircraft emergencies and is able to call on a variety of resources in order to assist an aircraft.

This document highlights many of the factors that a controller may draw on when handling an aircraft emergency. Many will have been covered already during training, others may not have otherwise come to mind.

Flight crews look to the controller for direct assistance and to act as intermediaries with other ground based services. There is a fine balance to be drawn between providing timely and useful assistance to the flight crew and not interfering with the completion of vital checks and drills. Co-operation and co-ordination to minimise crew workload are the keys to success. Keeping ATC procedures and communications as close as possible to normal will usually assist greatly.

Flight crews will normally want to give ATC as much information as they can, and, indeed, ATC will need to have this information in order to offer the most appropriate assistance, but it can take time to ascertain the full extent of the problems they face. Although a single failure in a modern aircraft is rarely critical once cockpit drills have been completed, some drills can be complicated and lengthy. Controllers can use this time to carry out actions that may be helpful later.

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Remember!

Pilots will:

Aviate - Navigate - Communicate

They will try to evaluate the problem using a technique such as:

- **D** Diagnose - the problem
- **O** Options - assess
- **D** Decide - course of action
- **A** Assign - tasks
- **R** Review - actions taken

Then communicate to the aircraft crew and ATC:

- **N** Nature - of problem
- **I** Intentions - of crew
- **T** Time - available
- **S** Supplementary - information

Workload = time available - time required

Remember