The minimum fuel that a commercial flight must uplift is defined in the regulations, ICAO Annex-6. The fuel required is what is expected to be used from departure to destination, if unable to land then fly the missed approach procedure and then fly to the alternate. When the aircraft reaches the alternate airport, the aircraft needs fuel to hold over the alternate for at least 30 minutes before commencing the approach to land.

SID/STAR Fuel, ICAO Fuel planning recommendation

> Base flight plans and trip fuel on lengthy IFR departure and arrival routing procedures (longest RNAV SID to longest RNAV STAR). In the real world, these routings may rarely occur, thus introducing some conservatism into the trip fuel calculation. Conversely, those operators capable of assessing the probability of which SID/STAR combination will be used on a given city pair, including the likely track miles to be flown, may account for some or all of the fuel for such procedures as part of SCF, discretionary fuel or extra fuel. This would make the trip fuel calculation less conservative and more reflective of real-world performance based on statistical analysis.
>
> ICAO Doc 9976

While most airlines uplift minimum fuel as per regulatory requirements, there are a few airlines which depend on statistical analysis and have a pragmatic approach to the fuel requirement. Regulations do permit this approach as compared to the prescriptive fuel uplift provided a safety risk analysis is carried out.

As per ICAO, where a destination alternate aerodrome is required, the amount of fuel required to enable the aeroplane to:

i) **perform a missed approach at the destination aerodrome**;

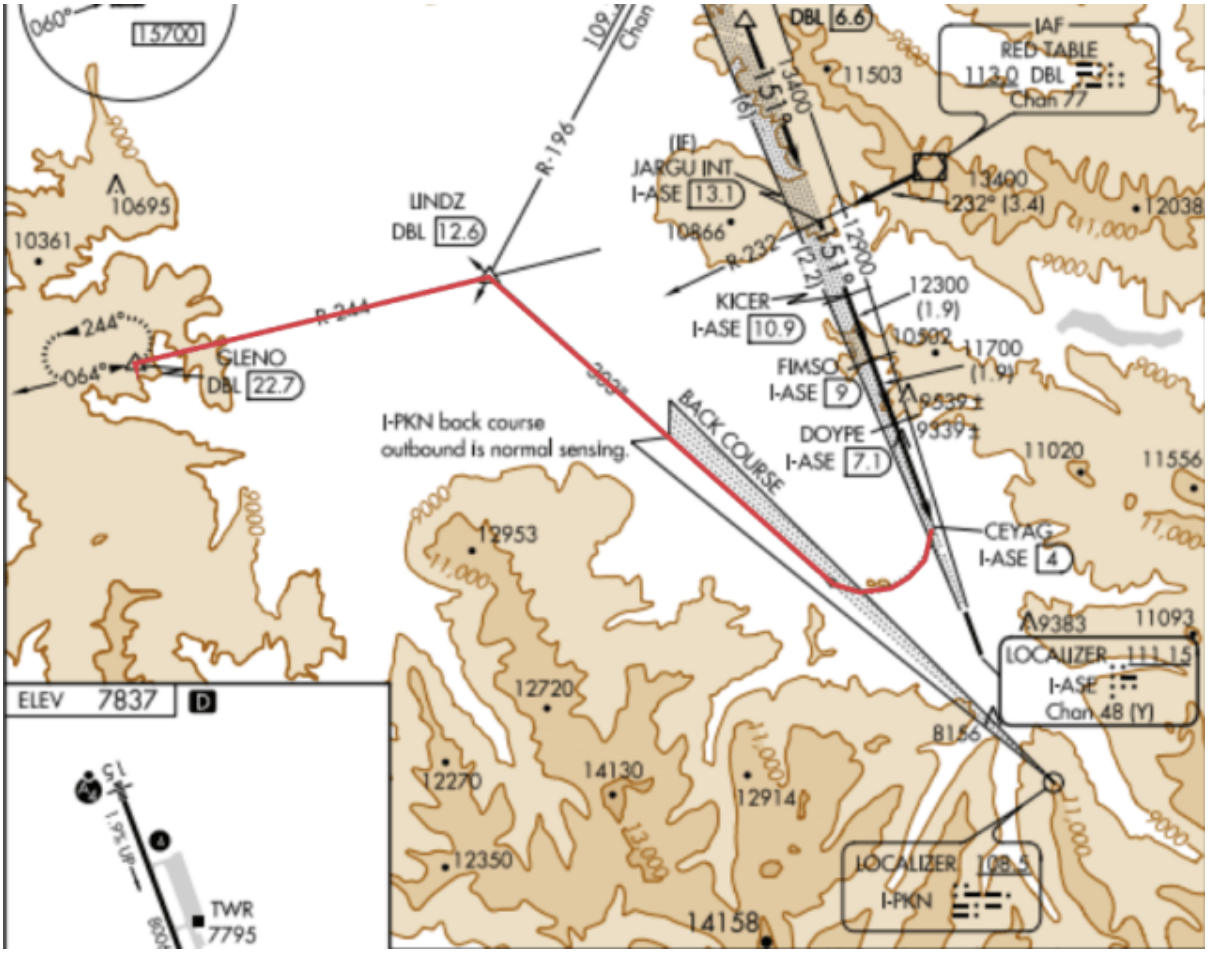
ii) climb to the expected cruising altitude;

iii) fly the expected routing;

iv) descend to the point where the expected approach is initiated; and

v) conduct the approach and landing at the destination alternate aerodrome

It all seems safe and logical. Have you ever wondered what this missed approach is? How much fuel is required for the missed approach segment? Do the airlines carry enough fuel for this segment, especially when it is long?

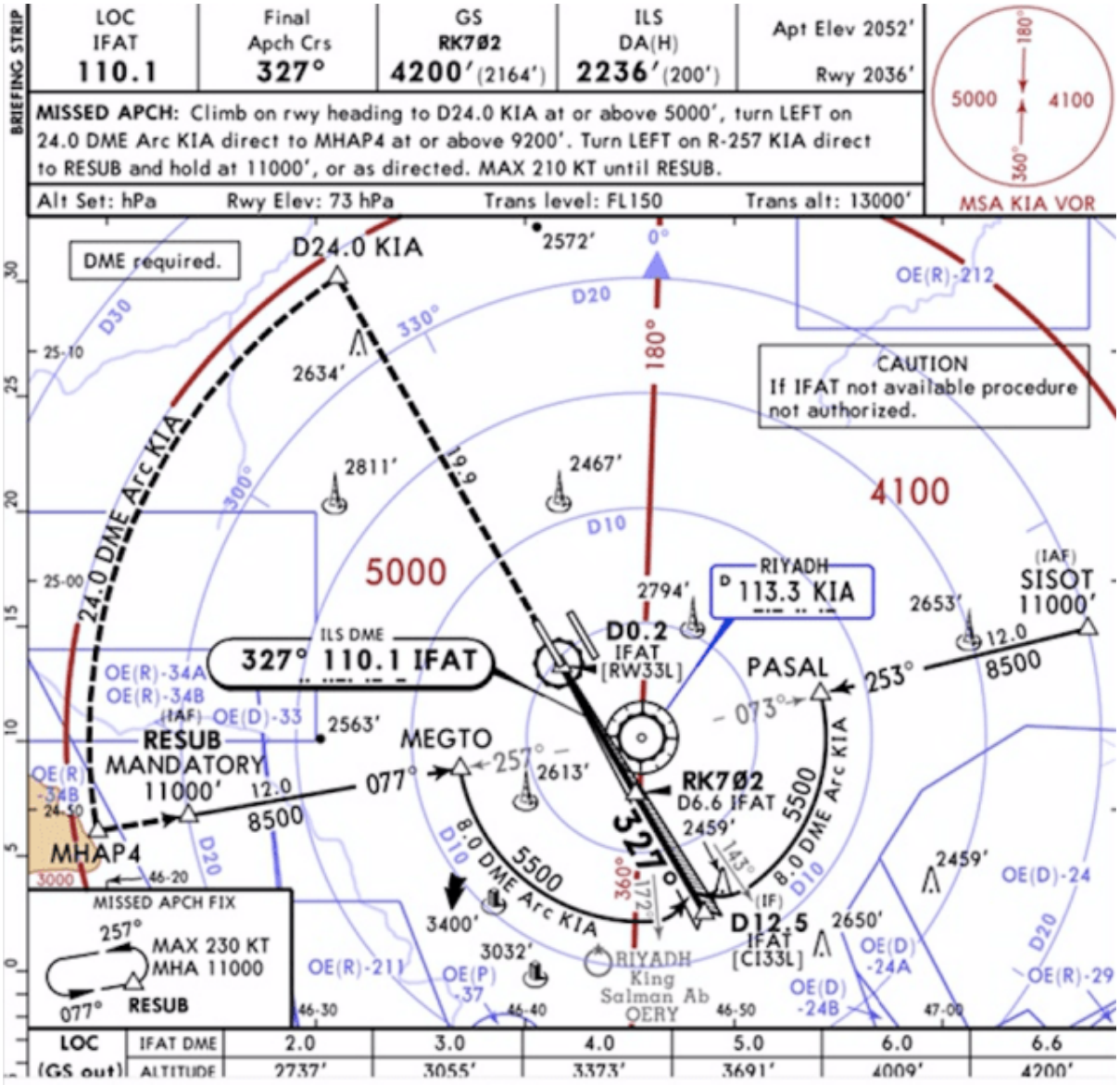


Missed approach procedure in Red

A missed approach procedure is the procedure to be followed if an approach cannot be continued. It specifies a point where the missed approach begins, and a point or an altitude/height where it ends. A missed approach procedure is specified for all airfield and runway Precision Approach and Non-Precision Approach procedures. The missed approach procedure takes into account de-confliction from ground obstacles and from other air

traffic flying instrument procedures in the airfield vicinity. Only one missed approach procedure is established for each instrument approach procedure.

If the flight planning software misses out on this important segment, then at some places on the globe, there will be a significant difference in the fuel required v/s actual uplift. The above missed approach procedure is an example of a long procedure which would required significant fuel to be uplifted as per regulations.



Long missed approach procedure

The above procedure is between 70-90 nautical miles long. A mid-size jet would require approximately 600-700kgs of fuel if required to fly the complete procedure before being able to set course for the alternate airport.

There is a need for the airlines to ensure that the fuel uplift for the flight includes the realistic missed approach procedure fuel and that the aircraft would fly if unable to land at the destination. With the growing complexity of the airspace,this becomes a safety issue for airports as the ones mentioned above where the missed approach procedure is longer than the usual segments.

Risk based contingency fuel, mostly ignored

c) ***In-flight contingency***. The designation of contingency fuel was established to compensate for unforeseen factors that could influence fuel burn to the destination aerodrome. Such factors included, for example, deviations of an individual aeroplane from expected fuel consumption data, or deviations from forecast meteorological conditions or planned routings and cruising altitudes/levels.

Contingency fuel has traditionally been computed as a percentage of trip fuel, a carry-over from a time when both consumption data and forecast wind components were less accurate than they are today. Contingency fuel requirements also typically specify a minimum cut-off value in terms of flight time, recognizing that some contingencies occur once per flight (e.g. take-off and landing delays) and are not proportional to flight time.

Amendment 36 to Annex 6, Part I, defines contingency fuel allowing the use of it, to compensate for unforeseen factors, from the moment that an aeroplane first moves for the purpose of taking off. Thus, under some circumstances, it may be used prior to take-off. It is important to note that the definition of trip fuel includes compensation for *foreseen* factors such as meteorological conditions, air traffic services procedures, restrictions, anticipated delays and NOTAMS.

4.2.2 It should be noted that hazards, other than the aforementioned deviations accounted for in contingency fuel calculations, may not typically be considered by an operator that is strictly complying with prescriptive alternate aerodrome selection and fuel planning regulations. Such hazards that typically cannot be planned for, anticipated or are beyond the control of the operator include, but are not limited to:

a) human error or distractions;

b) loss of situational awareness;

c) workload spikes;

d) inaccurate prognostics (meteorological);

e) equipment failures;

f) database failures;

g) ATM failures;

h) ATM saturation and tactical measures; and

i) incidents/accidents resulting in infrastructure closures.

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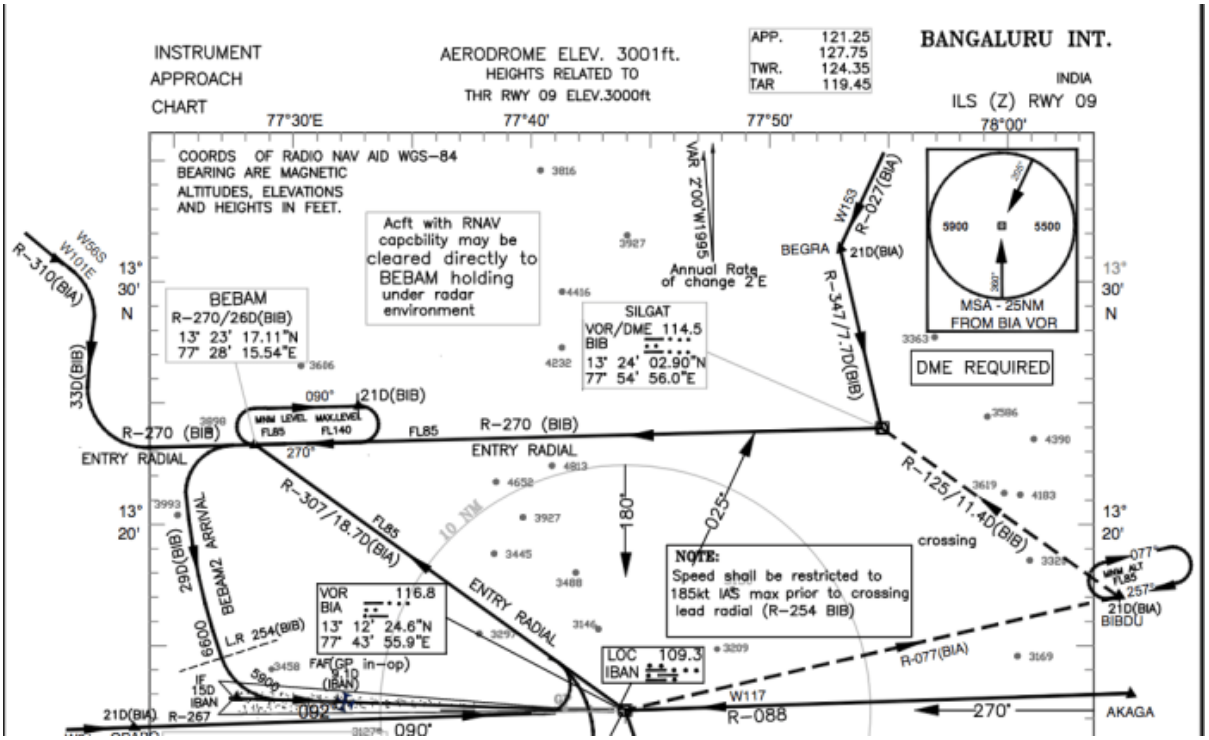
Final reserve fuel based on archaic data: Unsafe for future growth mindFly

Contingency fuel

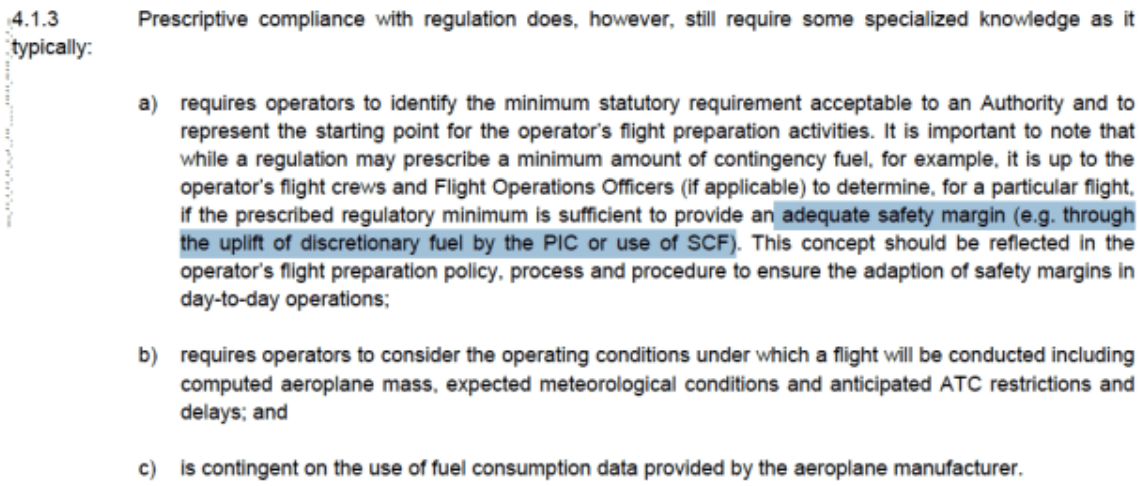


Long segment.

mindFly analysis

There are 2 distinctive methodologies for calculating the fuel uplift. First is the prescriptive method and the second is based on statistical analysis.

The prescriptive criteria contained in The ICAO Annexes & DOCS (SARPs) are representative of the most basic systemic defences of an aviation system in addition to others such as training and technology. Such criteria also provide the basis for a sensible and well-defined regulatory framework for use in complex operating environments as well as form the foundation for the development of sound SRM practices.



4.1.3 Prescriptive compliance with regulation does, however, still require some specialized knowledge as it typically:

a) requires operators to identify the minimum statutory requirement acceptable to an Authority and to represent the starting point for the operator's flight preparation activities. It is important to note that while a regulation may prescribe a minimum amount of contingency fuel, for example, it is up to the operator's flight crews and Flight Operations Officers (if applicable) to determine, for a particular flight, if the prescribed regulatory minimum is sufficient to provide an adequate safety margin (e.g. through the uplift of discretionary fuel by the PIC or use of SCF). This concept should be reflected in the operator's flight preparation policy, process and procedure to ensure the adaption of safety margins in day-to-day operations;

b) requires operators to consider the operating conditions under which a flight will be conducted including computed aeroplane mass, expected meteorological conditions and anticipated ATC restrictions and delays; and

c) is contingent on the use of fuel consumption data provided by the aeroplane manufacturer.

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If the airline is not catering for the SID/STAR requirement in the flight plan, they should have a statistical analysis based on which the fuel needs to be uplifted for extra fuel burn.
If the airline has not catered for a missed approach fuel especially the long missed approach, then they have to cater for the same. A few airlines do uplift a standard 150kgs for e.g. a A-320 aircraft but it is insufficient for a long missed approach procedure like Bengaluru.
If the airline/operator has not catered for either or both the above requirements, then they are uplifting less than the legal fuel required for the flight and increasing the risk to safety of operation.

Such glaring oversight if so only points towards an airline culture which puts cost saving over flight safety. The airlines culture is at a pathological or reactive level rather than a generative one.