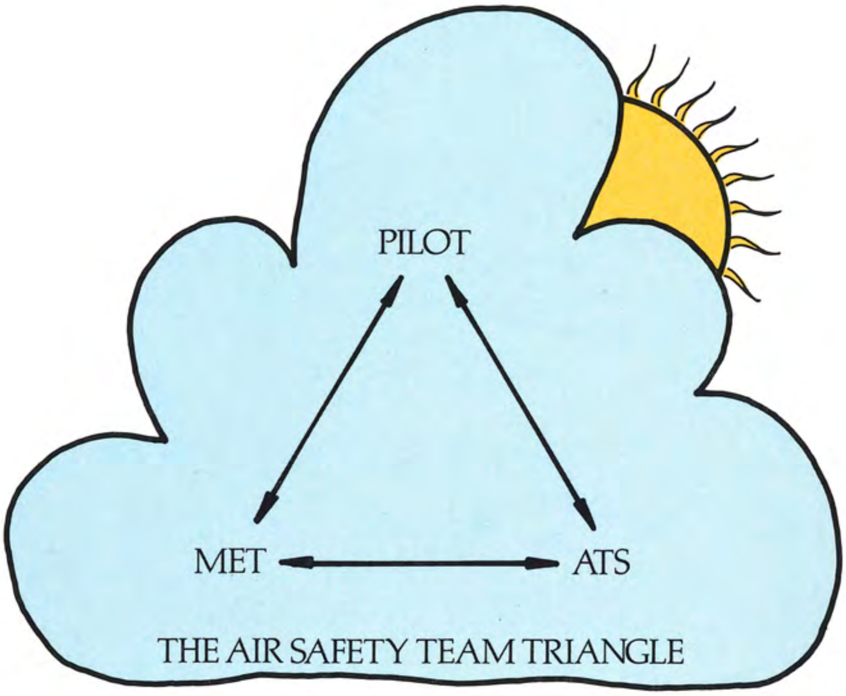
SMHI METEOROLOGI
Nr 70, 1987



WEATHER and FLYING BRIEFING ASPECTS

Ex 2.

SMHI METEOROLOGI

Nr 70, 1987

Rapport SMHI
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WEATHER and FLYING BRIEFING ASPECTS

Kjell Lindström

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SMHIs tryckeri, Norrköping 1987.

INTRODUCTION

This course deals with Met Service and aeronautical meteorology aimed at already operational and qualified meteorologists.

The objective is not only to give a comprehensive picture of *what* the pilot or ground service *need*, but also *why*. The last part will bring us to the border of and outside of the meteorological field.

The compendium contains a base for the above and a starting point for more detailed discussions, adopted to local conditions.

Actual and complementary material will be added during the lessons, especially examples where the weather was the major part in accidents/incidents.

Thus the main thread through all lessons will be *air safety*.

WEATHER AND AIR SAFETY

Long ago a high official in a Civil Aviation Authority said:

'In the future there will be no need for meteorological service. The aircraft will be independent of weather due to new instruments'.

This very year another one said:

'The weather is *not* a safety problem, only a regularity one'.

Aircraft accident statistics give a different picture.

The ideal situation is that the pilot has an unbroken weather service from planning stage until the flight is safely over, ending with a feed-back line to Met Service (Figure 2). This can be solved today with modern technique.

Why is it not done then?

Another thing to keep in mind is that we have a great variety of flying, for instance:

- VFR or IFR
- large and small aircrafts
- old and new ones
- man

THE AIR SAFETY TEAM TRIANGLE

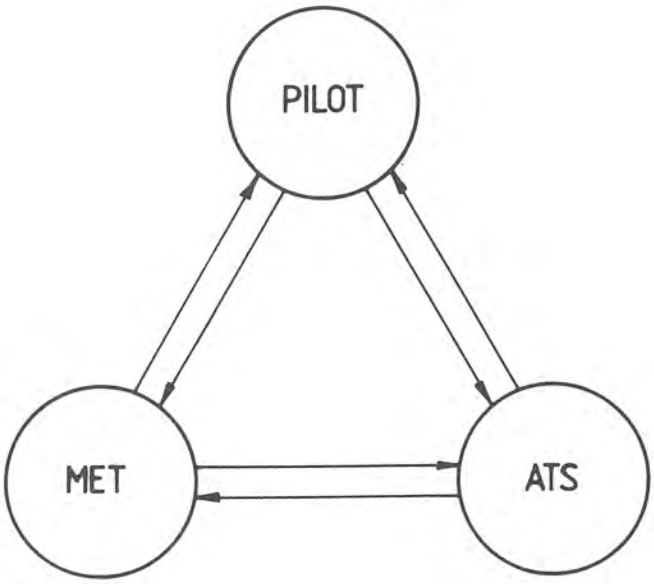


Figure 1

THE AERONAUTICAL WEATHER CYCLE

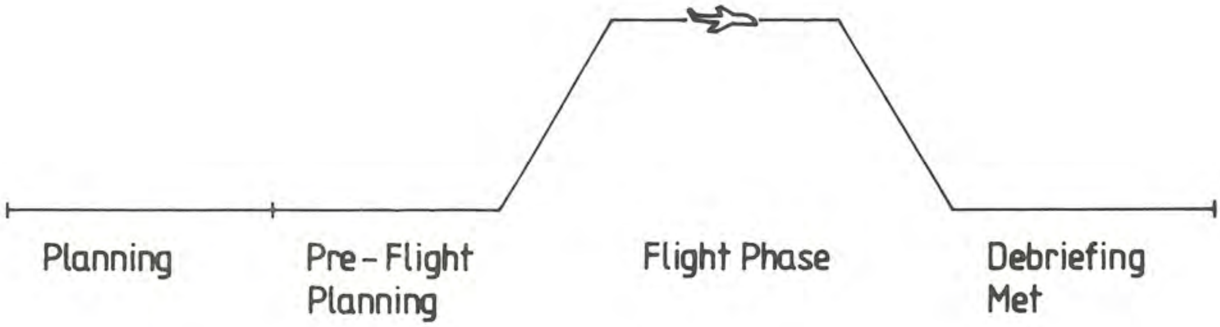


Figure 2

These two concepts are a basis for the course.

COURSE CONTENT

Answers on the question:

WHY?

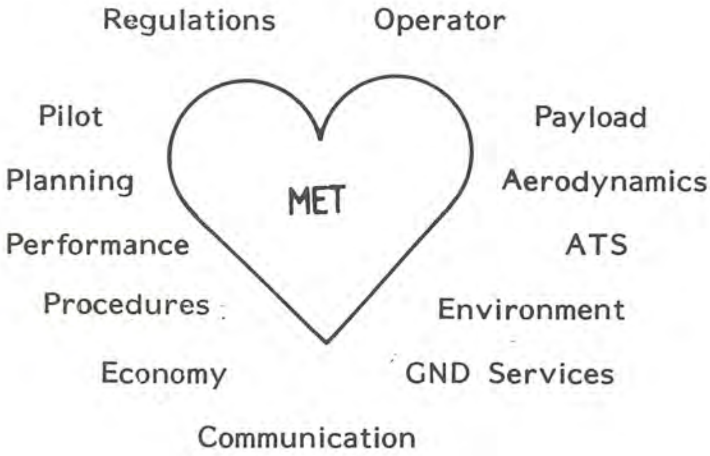


Figure 3

In every category above surrounding MET, the atmosphere and weather have quite an influence, in many cases it is a limiter.

If the heart is healthy, there is a good team spirit and a good communication throughout we have the ultimate *air safety* as concerns meteorological factors.

If something fails we may see this in an accident report, a 'heart attack'.

REGULATIONS

1. International background

1919 - The Paris CONVENTION
1928 - The Havanna CONVENTION
1944 - The Chicago CONVENTION
1945 - PICAO is formed
1947 - ICAO is formed
1947 - 6 months later ICAO joins the UN family

After this additional conventions and a few amendments have been taken, but the basis from 1947 is still valid word by word.

ICAO is independent, but uses the UN administrative body and rules.

2. The ICAO structure (Figure 4)

A. The Assembly

All members (156, 1986).
One vote each regardless of size of the country.
Meets every third year.

B. The Council

33 elected members from the Assembly.
The election is made in such a way that a good representativeness is achieved. The Nordic countries have been represented continuously from the beginning of 1949 by one of the countries.

The Council is the executing body during the time between Assembly meetings.

The Council approves and adopts:

- Annexes (SARPS)
- PANS
- Regional supplementary procedures
- ANP

C. The five Committees and one Commission

These are the working bodies, preparing the material for the Council.

Members are elected from the Council, but this time according to personal qualifications. In the Council these people represented their countries, here they represent *only* themselves as experts.

D. The Secretariat

Lead by the Secretary General.

Supports C above, the Regional Services and country projects.

Consists of five bureaus and in one of them there is a MET Division.

The staff is employed, as far as possible, in a representative way, the qualification come in second.

E. Regional offices

- Bangkok	Other regional organizations.
- Cairo	-ECAC (Europe Civial Aviation Conference)
- Dakar	-AFCAC (African Civil Aviation Commission)
- Lima	-LACAC (Latin American Civil Aviation
- Mexico City	Commission
- Nairobi	-ACAC (Arab Civil Aviation Council)
- Paris	-EF (The European Common Market
	Countries)

There are also nine ANPs (Air Navigation Plans)

F. National Civil Aviation Boards

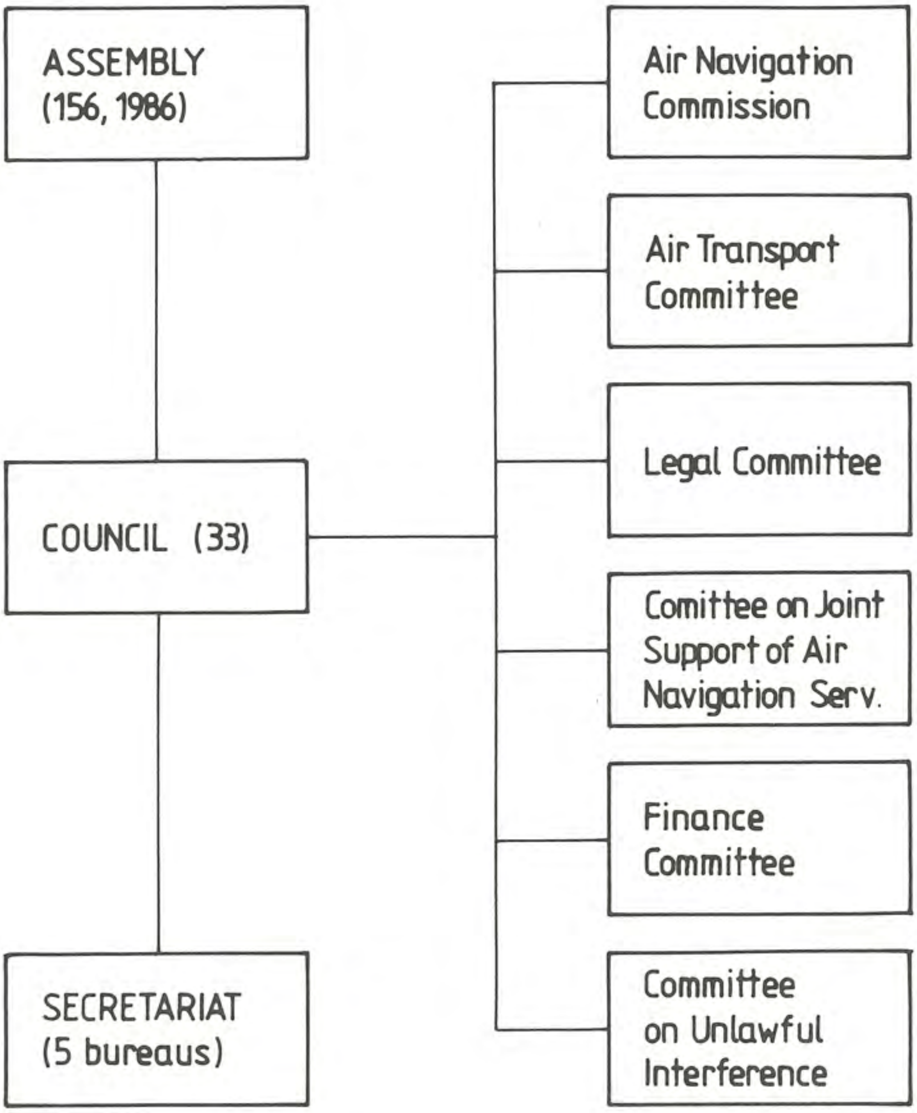

ASSEMBLY
(156, 1986)
COUNCIL (33)
SECRETARIAT
(5 bureaus)
Air Navigation
Commission
Air Transport
Committee
Legal Committee
Comittee on Joint
Support of Air
Navigation Serv.
Finance
Committee
Committee
on Unlawful
Interference

Figure 4

ANNEXES TO THE ICAO CONVENTION ON INTERNATIONAL CIVIL AVIATION

1.	Personnel Licensing	Licensing of flight crews, air traffic control officers and aircraft maintenance personnel
2.	Rules of the Air	Rules relating to the conduct of visual and instrument flights
3.	Meteorological Service for International Air Navigation	Provision of meteorological services for international air navigation and reporting of meteorological observations from aircraft
4.	Aeronautical Charts	Specification for aeronautical charts for use in international aviation
5.	Units of Measurement to be used in Air-Ground Communications	Dimensional systems to be used in air-ground communications
6.	Operation of Aircraft Part I - International Commercial Air Transport Part II - International General Aviation	Specifications which will ensure in similar operations throughout the world a level of safety above a prescribed minimum
7.	Aircraft Nationality and Registration Marks	Requirements for registration and idenfication of aircraft
8.	Airworthiness of Aircraft	Certification and inspection of aircraft according to uniform procedures
9.	Facilitation	
10.	Aeronautical Telecommunications	Standardization of communications equipment and systems (Vol I) and of communications procedures (Vol II)
11.	Air Traffic Services	Establishment and operation of air traffic control, flight information and alerting services
12.	Search and Rescue	Organization and operation of facilities and services necessary for search and rescue
13.	Aircraft Accident Investigation	Uniformity in the notification, investigation of and reporting on aircraft accidents
14.	Aerodromes	Specifications for the design and equipment of aerodromes
15.	Aeronautical Information Services	Methods for the collection and dissemination of aeronautical information required for flight operations
16.	Environmental Protection	Specifications for aircraft noise certification, noise monitoring and noise exposure units for land-use planning (Vol I) and aircraft engine emissions (Vol II)
17.	Security	Specifications for safeguarding international civil aviation against acts of unlawful interference
18.	Safe Transport of Dangerous Goods by Air	Specifications for the labelling, packing and shipping of dangerous cargo

3. STANDARDIZATION

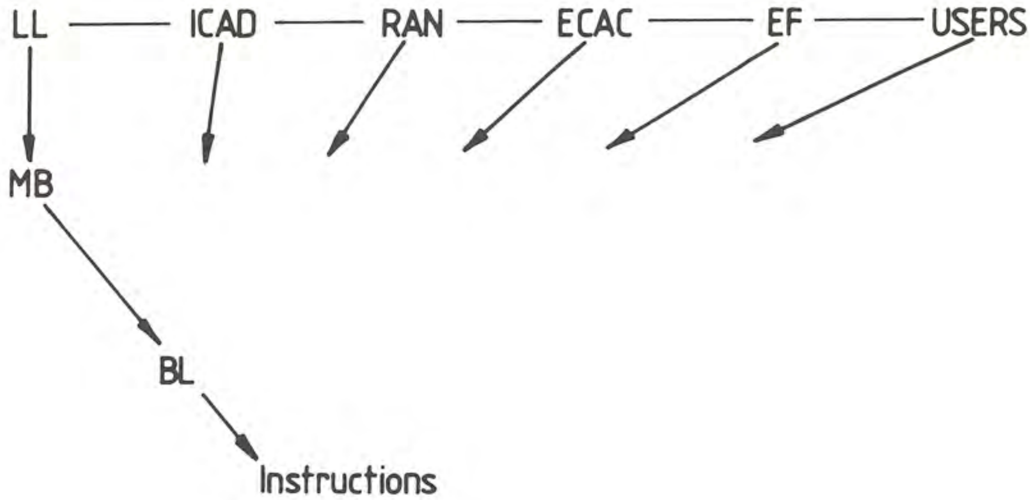
The ICAO main objective is the same standardization adopted all over the world.

The basis for this is:

* 'STANDARDS'	- Necessary, if a country does not comply with it, notification is compulsory and is added to the very same document in which the standard is written.
* 'RECOMMENDATIONS'	- Desirable, if a country does not comply with it, notification is recommended, and if received added to the document.
	- Deviation from the Standards and Recommendations may be noted on Supplement to the Annex, together with the date notice is made. There is also a list: 'Contracting States from which no information has been received'.
	- The Standards and Recommendations are the main body in the Annexes (18, see page 11) to the Conventions.
* 'PROCEDURES' (PANS)	- Procedures for Air Navigation Services. How things are done, on a more operational level.
* 'REGIONAL PROCEDURES'	- Regional adaption or supplementary procedures.
* 'GUIDANCE MATERIAL	- Manuals, syllabi etc.

4. COUNTRY ADAPTION

Example Denmark:



(Example: SLV Skrivelse 1 Oct 1986, J Nr 8-90101)

PLANNING OF FLIGHT OPERATIONS

This has a quite variable time scope, hours up to months or year.

The required MET data for long time planning is of the climate type. Unfortunately the climatologists as a rule are not Aeronautical Meteorologists, so the data stored and tabled does not include, e g RVR.

The question for the operator is what kind of MET parameters is important?

Probably some of these:

- RVR
- Low cloud base or vertical visibility
- The frequency of certain weathers
- Surface wind
- Surface temperatures
- Other local effects

All of which might influence the regularity of a planned operation.

This service is covered in the Annexes 3 and 14.

As an operational meteorologist, have you got any question about this type of data?

Do you know how to handle this in case you are consulted?

PRE-FLIGHT SERVICE

1. Operators
   - Do I put the passenger into a hotel awaiting better weather?
   - What shall I tell the passengers concerning expected time of departure?
   - Shall I ferry fly this evening or can I land tomorrow morning and pick-up the passengers then?

The operational meteorologist is quite often consulted in this way, meaning: Give me an answer which I can decide on, not a 'rubber forecast'.

The actual person which contacts MET may have a sound meteorological background or just be a 'messenger boy'. The answers given must then be formed in such a way that the operator's representative understands it.

REGULATIONS: Annex 3, chapter 9 which gives the operator the same right to information as the pilot.

2. Flight crew

- There are flight crews and pilots.
- Professionals and 'amateurs'.
- A great variety of operations.
- Flying crafts of different size and type.
- The crew may visit the MET Office, use telephone, CCTV or a self service data link.

  In many cases the operator's representative is the relay.

- Those with no time for MET briefing and those who may spend the day at MET awaiting better weather.
- Those who *must* fly and others who can wait.

To be efficient this requires a MET officer to:

a) have a complete actual 'weather picture'
b) experience of serving the above variety
c) preferably a natural human communication

If a) is missing, the MET man needs more time to extract the information from the material available at the MET Office and the quality of the oral comments will be lower and less useful to the pilot. In a queue situation this is very frustrating for all parts.

If b) is missing both longer time is needed for the briefing and the quality will be inferior. But far more important: Serious mistakes or misunderstandings may *and* do occur.

CONCLUSIONS:
- it is *important* that the pilot gets correct weather informations
- it is *more important* that he understands it correctly
- it is *most important* that he takes the right decisions

REGULATIONS: This is covered by the Annex 3, chapter 9 and is specified in Attachment A to Part IX.

Are the requirements in Annex 3 just met in your country or do you provide a higher standard of service in some parts?

POST-BRIEFING PRE-FLIGHT SERVICE

What is this?

- After MET briefing a SIGMET or TAF AMD is received at MET Office.
- One hour later the pilot calls the TWR for take-off or engine start-up.
- The TAF AMD happens to be the alternate for this flight.
- The SIGMET requires changes in flight planning.
- A VFR-pilot is briefed by you on telephone and a few minutes later you get information of weather which most certainly is a hazard to the planned VFR-flight.

When and how do the pilots above get this important information about adverse weather?

Discuss your *ROUTINES* in these cases.

FLIGHT PLANNING

IFR-planning

The rules and obligations a pilot has to follow fill many volumes of different kinds. In most of them meteorological considerations come in somewhere. Only a few rules and considerations will be taken up here.

- One destination alternative is always needed.
- When destination weather may be below minimum weather two alternatives are required.
- You have to have enough fuel for:
  . taxi at departure
  . the calculated consumption for the flight
  . route reserves
  . holding a specified minimum time over your destination
  . make a try and divert to your alternative
  . make a try at your first alternate (if applicable) and reach your second alternate after that
- Is there one or two alternatives within reach for the type of aircraft?
- If yes, is the sum of needed fuel + aircraft empty weight + payload less than the maximum take-off weight? Most aircraft *cannot* take maximum fuel + maximum load simultaneously!
- Are there other meteorological factors which will effect the planning? Is there a risk for TAF AMD to calculate for. NOTE: Values given in a TAF is the most *likely* to happen and there is a natural variation around these figures. En-route weather?
- *MINIMUM FUEL*, a modern not very popular (among pilots) concept directed by economy. Does not calculate for the unexpected, e g TAF AMD at the destination or the alternative.
- *ECONOMY FUEL*, take as mush as is economic at airports with the lowest fuel prices. Then you must consider the cost of carrying around the surplus fuel.

CONCLUSIONS: The pilot will appreciate if the meteorologist giving the briefing can come up with the alternative(s) without a tidious search. This implies that the briefer should have a good operational knowledge.

VFR-planning

The pure VFR-pilot bases his flying on visual references and must not loose them under any circumstances. If he does that the likely result is lost control and an accident.

The VFR-flyers are a very mixed group concerning flight experience and training. Examples:

- The 100 hr 'experienced' pilot, who has forgotten parts of his MET training and not accumulated new knowledge by practice. If a 'must return to my home base this afternoon'-situation occurs, then this combination may lead to a dangerous flight if the weather is marginal.
- The experienced pilot with more than 1000 flying hours who knows he can 'handle any situation' and tends to fly down to the lowest VFR-minima.
- The professional IFR-pilot who sometimes flies VFR by convenience and is able to change to IFR if the en-route weather becomes too bad.
- Helicopter operations. No formal weather limits, they may fly VFR in fog! A MET briefing should take this into account.
- The trainee on his first solo navigation. He must not run into any kind of weather trouble. Visibility 8 km is not enough.
- The flight school instructor. Has a lot of experience and responsibility, by necessity he has a good knowledge of aviation meteorology.
- Glider pilots are in most countries allowed to fly motorgliders and then become VFR-pilots. Some in this category also fly inside Cu/Cb-clouds. The problem here is that these pilots quite often know more about the special thermal meteorology than the briefing or forecasting meteorologist! There are very few meteorologists who practice soaring themselves.
- Balloon flyers, need a thorough briefing of winds in the lower layers and weak winds for safe landings.
- Ultra-Lights, need no formalities in many countries. *Rule*: Fly if you can! What about the meteorological knowledge?

The planning of the VFR-flight might then be everything from just a check of the aircraft and then fly, up to calculations, checks of weather, aeronautical charts etc.

REGULATIONS: Annex 2, Rules of the Air, Chapter 4.

The above rules may have supplementary regulations or are translated to the country's language in extensis.

But there is a problem with these rules. They are not formulated with reference to meteorological parameters. The question arizing is then:

'Does the weather figures today fulfil the requirements for VFR-flying'?

Then additional specifications in respective country will clarify and make reference to meteorological parameters as well.

The pilot in command (PIC) is always responsible for all decisions he makes and has to make to ensure a safe flight. The meteorologist may not say: 'You shall not fly today because the weather is below the values in the regulations'.

But what happens in practice?

The most common question a VFR-pilot may ask is:

'Can I fly VFR today from X to Y'?

What is your answer as a meteorologist?

'Not my table to decide on that, but the weather is like this .....'.

or

'I think it is possible because the weather is like this .....'

WEATHER AT DEPARTURE AERODROME

Start-minima
For take-off on instrument the normal RVR needed is about 300 m and with centerline lights 200.

Low-vis and taxi
Is there any problem involved here? Discuss local conditions.

Runway-conditions
Every aircraft has a calculated runway length needed taken in to account:

wind
temperature
pressure
runway condition
runway slope
de-icing on or off
aircraft weight

A pilot has to check all these parameters before take-off.

A take-off shall be possible to abort or continue. In case of an aborted take-off the aircraft shall be brought to a stand still before the end of the runway.

Thus a runway with poor breaking action will result in a lower take-off weight for the aircraft, with the consequences that may imply.

If the runway is covered by slush, the take-off distance will increase dramatically:

1.5 cm - about 20%
2.5 cm - about 40%
5.0 cm - the aircraft will normally not reach lift-off speed

Temperature and pressure

The maximum take-off weight is corrected for due to current QFE by SAS for DC-8 for every airport and runway. Every 5 hPa results in approximately 1% increase in runway length needed.

Temperature corrections are done for most aircrafts. Every degree will result in several hundred kilos or more than 1.5 tons for the biggest aircraft.

Temperature and humidity

In case the humidity is high (above 85%) and the temperature around zero there is a great risk for ice in jet engines. Therefore the pilot selects engine de-icing on to prevent this. But the de-icing is done by engine bleed air, taken from the compressor. This reduces the take-off power, resulting in a lower maximum take-off weight.

Wind shear

This is a pronounced problem with modern aircraft and has caused many accidents. It will be dealt with in a separate section.

Temperature inversion

This is important when other circumstances make the take-off marginal. If the pilot knows in advance what he has to expect, he can compensate for it by adjusting the engine settings.

Structural icing condition

An aircraft may not take-off with ice on the wings, not even the slightest rime.

Therefore it is de-iced on ground with alcohol.

But if the weather is likely to produce new ice during taxiing, what to do?

The de-icing liquid has a lasting protective effect from 6 min to 45 min depending on the weather. The protection will disappear totally at rotation speed. So the pilot must have his built-in aircraft de-icing on during take-off, reducing engine thrust.

EN-ROUTE

When the flight safely is in the air, all the tidious planning problems are history.

Well, some people act as if the above was true!

A considerate pilot knows that the weather is not static and many things may happen on short notice. Therefore he follows the rule: Check-up the weather during the flight.

'Replanning with alternate

As the flight progresses, the weather trend and the trend of other factors affecting the safety of the flight are to be frequently and carefully checked and adequate action taken as required'. (From Route Instructions 7.2.3 LIN).

What kind of service is available for the pilot?

- VOLMET transmissions
- ATIS
- ATS compulsory service (SIGMET, TAF AMD and AIREP SPECIAL)
- ATS service on request
- In some countries direct contact with MET is possible.

A VFR pilot flying underneath a low stratus layer has a more limited choice because his radio does not reach very far. At the same time he may have difficulties to navigate and still worse, when he is alone, he has not the time to try all frequencies.

REGULATIONS: Annex 3, Attachment A to part IX. Gives the details of weather information the pilot may request and should be available on the ground (ground exchange).

VFR-en-route

The VFR pilot has not the same options to avoid bad weather as the IFR pilot has.

- He is not allowed or has not the ability to fly in IMC.
- The aircraft has normally no de-icing equipment and
- the vertical space is normally limited to the interval between ground and cloud base.
- The possibilities to get aid when in air are less than for IFR because the low flying altitude makes his radio less effective.

The VFR-pilot mainly has to rely upon a

- *GOOD PRE-FLIGHT BRIEFING*
- *ABILITY TO JUDGE THE WEATHER* when en-route

The first point is the responsibility of the weather service. But the second one partly depends on the first!

CONCLUSION: The briefing by the meteorologist is IMPORTANT!

Are you as an experienced meteorologist always sure that the pilot has understood your briefing correctly?

Do you have any kind of 'technique' to check this up?

IFR-low levels

(FL040-100)

- The aircraft concerned is mostly 1 or 2 engine small or medium sized. They are normally equipped with de-icing but the single engine ones mostly not.
- They are unpressurized and may not fly above FL 100 without extra oxygen.
- Lowest FL available as a rule FL050 or FL040.

Because of these limits vertically the possibility to avoid icing levels is restricted.

Do you have a level without icing today within this vertical layer?

IFR-medium levels

(FL100-250)

- The aircraft concerned is mostly 2 engine, small or medium sized. They are equipped with de-icing and pressurized.

- Both piston-, turboprop- and jet-engines are represented here.

What problems may they have?

There is one predominant problem:

- Cb -clouds are difficult, if engines are set on idle they may flame out due to water! Naturally the passengers do not appreciate the turbulence either.

But this category may be the one with the least weather problem of all.

IFR-high levels

(FL250-510)

- The aircrafts concerned are mostly jets but some turboprops cruise up to FL350.

- There are the big jumbos and the small Lear jets.

Do these aircrafts have anything to fear *en-route*?

Yes: - A Cb is a hazard when on descend from high level. The engine may flame out due to water ingestion.

- The bigger an aircraft is the weaker is also the construction. In the worst cases g-forces will tear any commercial liner apart inside a Cb if normal cruise speed is maintained.

- The CAT or any kind of turbulence is a hazard, really dangerous if the aircraft flies near its ceiling. This may lead to overspeed or deep stall situations.

Fatal accidents have happened on several occasions due to reasons above.

Economic considerations: For medium or long range flight it is of interest to minimize the reserve fuel by two reasons:

- You may need to increase your payload.

- The extra, not needed fuel costs in itself some fuel to carry around. Remaining at landing will be only 60-80%.

This in turn points on three meteorological factors:

- Upper temperature and pressure for most fuel economic FL.

- Upper winds as accurate as possible.

- Alternatives as near to the destination as possible.

APPROACH AND LANDING

Together with the take-off the landing is the most risky parts of the flight. The majority of accidents happens there.

All kinds of weather phenomena will effect the safety during the landing phase.

- Surface winds, gusty, cross.
- Wind shear of all kinds.
- Precipitation, wing efficiency, drag.
- Icing conditions.
- Visibility.
- Runway condition, breaking action, aquaplanning.
- Cloud base.
- TS involves all of the above and the lightning may effect instruments.

To pass weather information to the pilot during approach and landing is today technically possible. Unfortunately at this moment the crew work load is high why the important meteorological message may be a grave disturbance instead of absorbed and taken into account.

Another problem is that every airport and runway have their own meteorological pecularities which the pilot must learn, one way or another.

Do you know any significant local meteorological features at the airports within your area of responsibility?

ATS and MET

December 1986: 'Because of the air traffic controller shortage we must speed up the basic training by cutting out parts, for instance the MET section'.

Suggestion by a Civil Aviation Authority planner.

REGULATIONS:

- In ICAO training manuals there are syllabi for the MET training of ATS personnel.
- Annex 3 prescribes the coooperation MET-ATS.
- Regional plans specify this further.
- National regulations have this built-in with most detailed specifications.

How are your contacts with the ATS?

How are the ATC contacts eith MET?

Is the 15 second demand met?

Any warnings for below VFR-minima?

Emergency routines?

What do you know about the ATS in general?

Do the ATSs have weather echoes on their radars?

BRIEFING TECHNIQUE

In the aeronautical business there are basically people and technique.

The technique may be perfect but bad human relationships may spoil all of it.

This brings us to the conclusion that human communication is a prerequisite for a good weather briefing.

Some hints:

- The first impression, mostly gained by the opening words will normally give the atmosphere for the rest of the briefing.
- You, the weather briefer, are the professional meteorologist. Although you may be very uncertain about the weather development there is no pilot who at the briefing occasion is able to make a better estimate.
- The weather is to a part unpredictable. That is a fact and keep this in mind if you deal with a pilot trying to extract more information than is possible to give. Read for instance H Tennekes: Spredte byger, Vejret. November 1986.
- But when dealing with actual weather there is a risk. The pilot may just have been in the air and has seen the weather 'from above'. Be sure what you say is correct!

To transfer the weather picture

As said earlier:

1. It is *important* that the pilot gets the correct information.

2. It is *more important* that he understands it.

3. It is *most important* that he makes the right decisions.

The first sentence does not imply that 2 will be fulfilled and consequently not 3 either.

1 and 2 fulfilled results normally also in the correct decisions.

As the briefer you are responsible for 1 but also for 2 jointly with the pilot.

To fly or not to fly (3), that is the pilot's responsibility.

So the question is: Why do some pilots act as if they do not understand the weather situation?

We will try to find some answers to the last question.

The pilot in the other end of the telephone, who is he?

- Professional.
- VFR.
- IFR.
- Type of aircraft

etc. The list of characteristics may be quite long.

As a briefer you should:
- find this out at the beginning
- try to adjust your briefing in accordance

If you do not do these two things there is a risk that the pilot misunderstands parts of the briefing.

When a pilot misunderstands you can be quite sure that it is in a favourable way for him, but potentially dangerous.

The 'human function'

Human behaviour includes a tendency to listen to what one wants to hear and excluding the rest. A sort of mental blocking. Ask your neighbours at home: What did they say in the weather forecast today? You will then get quite astonishing answers.

Human capacity to store oral piecemeal information is surprisingly small.

A study in Sweden (C Kempe) with average people in a decision situation indicates that the maximum number of parameters that could be remembered and understood was about seven. E g Drogden, wind northerly 5 kts, rain, temperature $7^{o}C$.

For a professional in the weather service this number could be increased to about fourteen parameters or weather words. This is probably due to the fact that the meteorologist puts the values and words into a ghost weather picture and that is easier to remember. Compare when you read a book!

Man is a good analogue machine but a poor digital one!

So, if the pilot calling on telephone should have a chance what so ever to make the right decision he must either:

- write down all figures/weathers given (speak in a writing speed!) and study figures afterwards.

or

- get the *weather picture* orally transferred from the briefer.

Preferably both and in reverse order.

In the end of the briefing, you may ask yourself something like this: Is the pilot going to fly or not and is this adviceable according to my belief? Then you have a last chance to clarify critical points.

Stress

Stress will influence the quality of the briefing and to have a chance for corrective measures we must first try to find the causes.

Stress may be caused by:

1. Too much to do, too many briefings at the same time.
2. A weather situation where you are not sure what to say, the unpredictable weather.
3. Technical aid malfunctions or just not-so-well planned technical environment.
4. Work organization.
5. Human relationships.
6. Employer-employee relations.

On the pilot's side you may have:

A. A pilot in hurry.

B. Important passengers - must get to the destination.

C. Marginal weather, difficult to decide what to do.

D. What shall I tell my passengers?

The lists may be extended further.

All problems above *are* possible to solve. Sometimes within present resources, sometimes additional means are needed.

Since all factors involved are individual for every work place they have to be discussed locally, but ideas may be added from outside. A study at the University of Lund (report coming 1987) takes up the human being in the weather service in combination with the technical environment.

Briefing adaptions

There are two completely different ways to brief a pilot:

1. The briefer describes the weather situation in a fixed order with the same words for every pilot in succession - general situation down to details and when finished lets the pilot ask questions.

   For the un-experienced meteorologist this might be the best way to do it.

2. The briefer goes more or less directly on to the special needs of the particular pilot and adapts the briefing as much as possible.

   This is the way an experienced meteorologist works when there is a queue situation and time is precious.

There are two important things to keep in mind:

The contact and relationship with the pilot. Here much knowledge emanates in both directions and the briefer has a good opportunity to improve his skill.

One simple rule to have in mind may be: Think like the pilot! That is, if you know about the pilot's situation.

To get a good end result the actual technique or mix of techniques a briefer uses should fit to his own personality.

Documentation:

In the Annex 3 the documents a pilot or an agency need and may request are listed in a flexible way. Therefore a certain adaption and selection must be done by the briefer and then, consequently, you must know something about the operations do be able to do this.

Today in the computerized age there is a tendency towards automation which at some places has lead to: 'Yards of paper inches of information' (a pilot's comment) How to avoid this?

FLIGHT SAFETY AND THE FUTURE

Today

What is the situation today?

The very rough accident causes today are: (airline companies)

PILOT - 62%
PERSONNEL - 47%
WEATHER - 42%

other causes much less.

This makes more than 100%, which is quite natural. When an aircraft accident happens there are *always* many causes simultaneously. The accident might have been prevented if just *one* of the causes had been eliminated.

How much does an accident cost?

A rough estimate should be, with the human life included:

5-10 million SEK per killed person regardless of aircraft size.

Could then some resources have been used in a better way to prevent an accident?

Compare the costs for weather related accidents with the weather service budget!

Tomorrow

Tomorrow we will still have the old aeroplane, they tend to become older and older. We will also have the same spectrum of pilots as today.

An additional element is the enormously rising costs and new types of aircraft.

The aircraft will develop towards fuel efficiency, new materials, improved aerodynamics and avionics.

Some effects with relation to the meteorology can be seen:

- New smooth wings with advanced profiles make aeroplanes more sensitive to water drops and mosquitoes. 20-30 micron smoothness is the goal! Icing more critical! Stalls more violent!
- Fuel efficiency requires more 'lean burn' increasing the risk of flame out in heavy rain.
- Total electrical aircraft. What about lightning?
- Total computerized avionics. What about lightning? What about soft-ware errors!
- Radio data link replacing human voice communication.
- Pollution regulations. What about the effect on the ozone layer?

A conclusion is, that the variety and expensiveness of aircraft operation, old and new will require a good MET service for not only safety reasons but also economic ones.

Will the modern aeroplane be of this type:

'This super new aircraft has no pilots because it is completely automatic and nothing can go wrong, go wrong, go wrong ......'.

ATTACHMENTS

1. Definitions.
2. Annex 3, Attachment A to Part IX,
   Ground exchange of operational meteorological data.
3. Annex 2, Chapter 4, Visual Flight Rules.
4. IAL-chart, EKCH ILS 22L.

DEFINITIONS

. ALTERNATIVE - In case the weather goes below your minima you must be able to land at another airport.

1.8 km/400 ft — VIS/cloud base requirement mostly 1.8 km/400 ft, in some cases slightly higher.

If the weather at your intended destination may go below the planning minima (look at the TAF or TREND) you need two alternatives, the first one with weather at or above the planning minima at the airport, the second with the 1.8/400 weather.

First alt.

Second alt.

. DEPARTURE ALTERNATIVE - If the weather at the departure airport is below your landing minima you must have an alternative airport within one hour at cruising speed (2-engine aircraft).

. CAT 1 - Normally correlated to the ILS-system with lowest minima RVR 550 and decision height 200 ft. At many airports these values are slightly higher 300 ft/800 m.

. CAT II - This instrument landing system permits minima as low as RVR 350 m and decision height 100 ft.

. CAT III - This is the so-called 0/0 landing system. The most advanced level takes the aircraft down, brakes, taxis into gate position without the pilot touching the controls. Today the pilot normally takes over somewhere on the runway. Very few airports are equipped for CAT III landings.

. DECISION ALTITUDE - The altitude (QNH) at which the pilot decides to make a pull up or continue the landing.

. DECISION HEIGHT - The same but with reference to QFE.

. IAL Chart - Instrument Landing Chart including procedures and weather minima.

. ILS - Instrument Landing System. The base for CAT I, II, III landings. Consists of many parts, the main three are Glide Path, Localizer and approach and runway lights.

. MINIMA - The lowest weather values you and the technical system are qualified for.

The lowest values given on the previous page are for fully equipped systems and at least two pilots.

An addition to higher minima has to be done in many cases:

- airport equipment is partly malfunctioning
- aircraft equipment is not complete or partly U/S
- aircraft type addition
- pilot status
- airport category requires a certain frequency of landings and if you have less than that number within the last period you have to increase your minimum weather.
- Cross wind component does not permit CAT II and III landings if the wind speed is above a certain figure. (CAT II only 10 kts!)

. MLS - Microwave Landing System, the future replacement for ILS. Permits variable glide path angle and a curved approach. Especially useful for STOL-ports.

. PLANNING MINIMA - A prescribed figure for every airport. Normally VIS 800 m and vertically 100 ft. To these figures you add the alternative add (see IAC Chart) which mostly is 1 km/300 ft and the resulting figure will be 1.8 km/400 ft. If the destination weather may go below PLANNING MIN then 2 alternatives are needed.

ATTACHMENT A TO PART IX

Ground exchange of operational meteorological information

(This material represents parts of the statement of basic operational requirements for regional planning developed by the Air Navigation Commission)

Oprational meteorological information should be exchanged to meet the needs of current flight operations as follows:

Type of information	Required coverage and/or period of validity of information to be available	
	At departure aerodrome	For aircraft in flight
Routine and selected special reports for final aerodrome and alternates (with landing forecasts, if applicable)	For flights not exceeding 2 hours * flying time	During last 2 hours * of flight
Routine reports for significant observation stations	Along and adjacent to route up to distance corresponding to 2 hours * flying time	Along and adjacent to route up to distance from aircraft corresponding to 2 hours * flying time
Aerodrome forecasts and amendments	As per Annex 3, paragraphs 9.1.4 and 9.7.1 for validity period appropriate to the flight	As at departure aerodrome, but forecasts are required to be available only as long as appropriate
SIGMET information	For route ahead up to distance corresponding to 2 hours * flying time	For route ahead up to distance from aircraft corresponding to 2 hours * flying time
Air-reports	For whole route	Appropriate special air reports for route ahead **

* With possible exceptions for certain routes

** Appropriate special air-reports will be those not used in the preparation of corresponding SIGMET information messages

CHAPTER 4. VISUAL FLIGHT RULES

4.1 Except as otherwise authorized by the appropriate air traffic control unit for VFR flights within control zones, VFR flights shall be conducted so that the aircraft is flown in conditions of visibility and distance from clouds equal to or greater than those specified in the following table.

4.2 Except when a clearance is obtained from an air traffic control unit, VFR flights shall not take off or land at an aerodrome within a control zone, or enter the aerodrome traffic zone or traffic pattern:

a) when the ceiling is less than 450 m (1 500 ft); or

b) when the ground visibility is less than 8 km, or 5 km if so prescribed by the appropriate ATS authority.

4.3 Unless authorized by the appropriate ATS authority, VFR flights shall not be operated:

a) between sunset and sunrise, or such other period between sunset and sunrise as may be prescribed by the appropriate ATS authority;

b) above FL 200;

c) at transonic and supersonic speeds.

4.4 Except when necessary for take-off or landing, or except by permission from the appropriate authority, a VFR flight shall not be flown:

a) over the congested areas of cities, towns or settlements or over an open-air assembly of persons at a height less than 300 m (1 000 ft) above the highest obstacle within a radius of 600 m from the aircraft;

b) elsewhere than as specified in 4.4 a), at a height less than 150 m (500 ft) above the ground or water.

Note.— See also 3.1.2.

4.5 Except as provided in 4.5.1, VFR flights in level cruising flight when operated above 900 m (3 000 ft) from the ground or water, or a higher datum as specified by the appropriate ATS authority, shall be conducted at a flight level appropriate to the track as specified in the Table of cruising levels in Appendix C.

4.5.1 VFR flights operated in controlled airspace (instrument/visual) shall select cruising levels from those to be used by IFR flights as specified in 5.2.2, except that the correlation of levels to track shall not apply whenever otherwise indicated in air traffic control clearances or specified by the appropriate ATS authority in Aeronautical Information Publications.

4.6 VFR flights shall comply with the provisions of 3.6:

a) when forming part of aerodrome traffic at controlled aerodromes; or

b) when operated as special VFR flights; or

c) when operated in controlled airspace (instrument/visual).

Table *(see 4.1)*

	Within Controlled Airspace		*Outside Controlled Airspace*	
	Above	*At or Below*	*Above*	*At or Below*
	*900 m (3 000 ft) above mean sea level or 300 m (1 000 ft) above terrain, whichever is higher**		*900 m (3 000 ft) above mean sea level or 300 m (1 000 ft) above terrain, whichever is higher**	
Flight visibility	8 km	8 km [5 km**]	8 km	1 500 m***
Distance from cloud:				
a) horizontal	1 500 m	1 500 m	1 500 m	Clear of clouds and in
b) vertical	300 m (1 000 ft)	300 m (1 000 ft)	300 m (1 000 ft)	sight of the ground or water

* *Unless a higher plane of division is prescribed on the basis of regional air navigation agreements or by the appropriate ATS authority.*

** *When so prescribed by the appropriate ATS authority.*

*** *Except that helicopters may operate with a flight visibility below 1 500 m if manoeuvred at a speed that will give adequate opportunity to observe other traffic or any obstructions in time to avoid collision.*

4.7 A VFR flight operating outside controlled airspace (instrument/visual) but within or into areas, or along routes, designated by the appropriate ATS authority in accordance with 3.3.1.1.2.1 c) or d), shall maintain continuous listening watch on the appropriate radio frequency of, and report its position as necessary to, the air traffic services unit providing flight information service.

Note. — See Note following 3.6.5.1.

4.8 An aircraft operated in accordance with the visual flight rules which wishes to change to compliance with the instrument flight rules shall:

a) if a flight plan was submitted, communicate the necessary changes to be effected to its current flight plan, or

b) when so required by 3.3.1.1.2, submit a flight plan to the appropriate air traffic services unit and obtain a clearance prior to proceeding IFR when in controlled airspace.

NEW PANS-OPS

CPH - EKCH 1 29 JUL 86

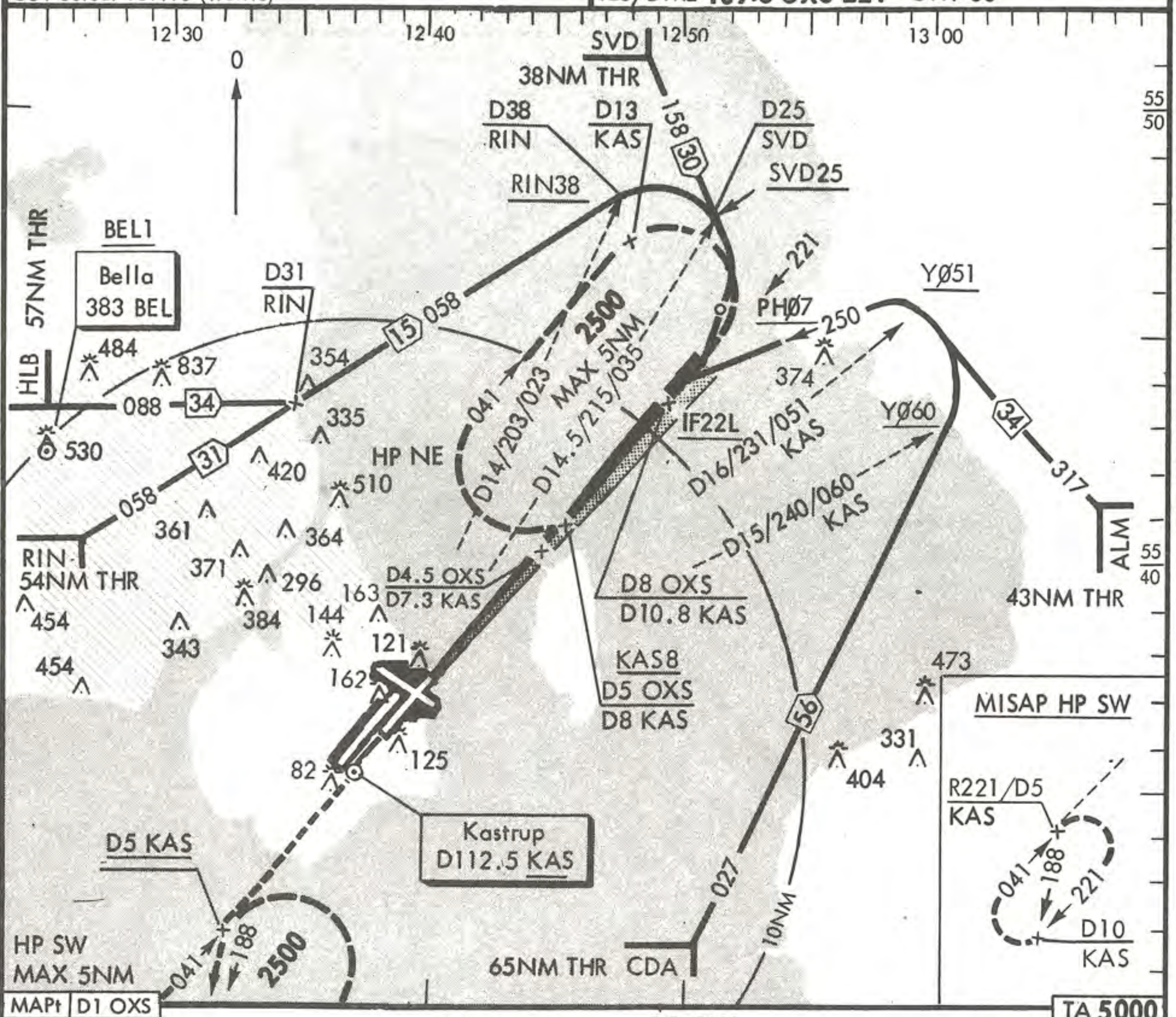
ILS-22L

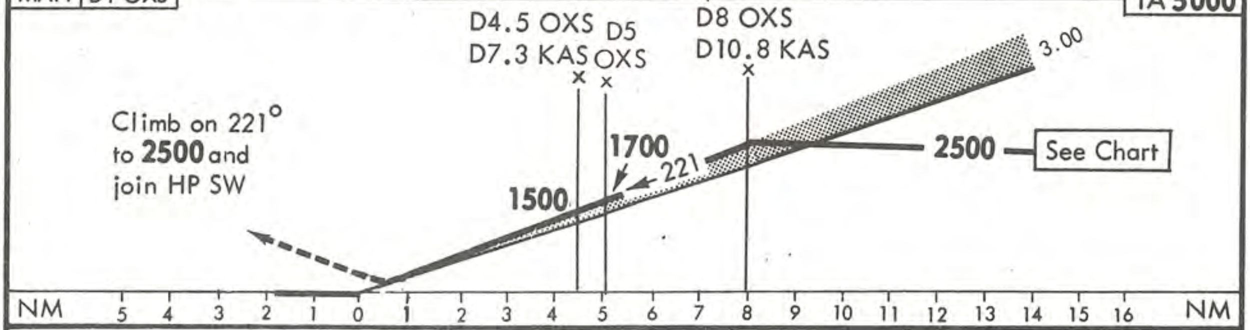
KØBENHAVN KASTRUP DENMARK

Kastrup (App: Copenhagen)
ATIS ARR 122.75 DEP 122.85 06-22 122.75 22-06
APP RAD 119.80
TWR 118.10 119.90
GND Parking 121.90 06-22 * 121.60 HO
DEP RAD 119.35 119.10 HO
CUT Selcal 131.95 (Traffic)

SRE Director 120.25 120.20 HO

ILS/DME **109.5 OXS 221°** GHT 53





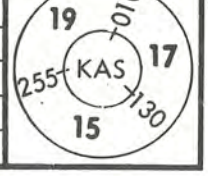
DP=D1.1 OXS	MDA	400	100KT -	120KT -	140KT -	160KT -	180KT -

APCH PROC	ILS x)	LLZ x)	SRE 22L	Circling z)		OCH 2.5%:
720 F28 C D	ALL	ALL	ALL	F28 C	720 D	ILS 173
Planning Min WX	100/0.8	200/1.2	300/1.6	600/2.8	700/3.0	LLZ 390
DA MA **QNH**/Min VIS	**210** *0.60* y)	**400/1.1**	**410/1.1**	**620/2.4**	**720/3.0**	SRE 22L 393

x) DME or 4.5NM Radar check required (ALT **1500**)
y) F28 VIS ***0.55***
z) SE of AD only

DH	RVR	CAT II
F28	100	*0.35*

ADD to DA, MA/Min VIS		
APL U/S	ILS/PAR	0/0.4
	LLZ	0/0.9
	Other	0/0.9
Plan Altern ADD 300/1.0		



THR ELEV **8** FT/AD ELEV **17** FT Change: ANS, DME, DIST

SWR - OFLR

© SAS - STOOV - HMXYZRKL - 1800 - Y

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