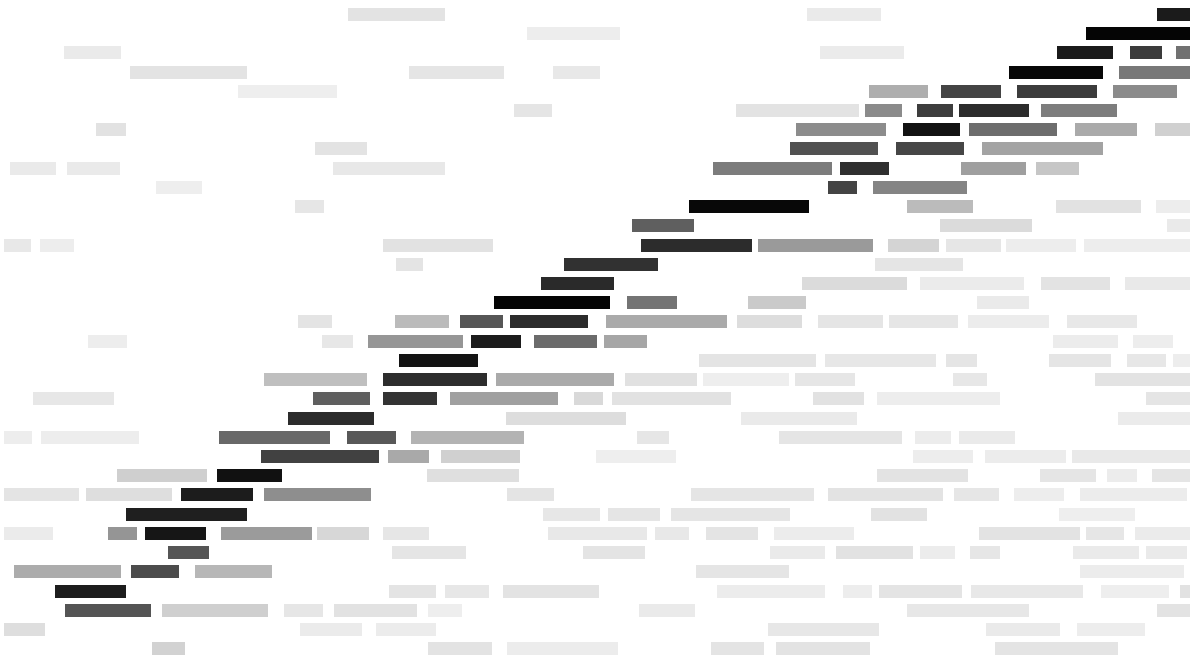
CAPITAL ALLOCATION
TECHNOLOGY SYSTEMS

CATS Training

Training for operations staff

For duty managers, operations controllers and dispatchers



CATS Training Materials

These materials are for training only. Nothing in them replaces your own company's operations manual or the instructions of your authority: where they differ, follow them. Information in them is subject to change without notice.

They are not certified for use in the operation of actual aircraft. Any resemblance to actual flights, weather or overdue reports is coincidental.

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About These Materials

These modules are for the people who run an airline's day: duty managers, operations controllers and dispatchers. Each takes one subject and sets out what you need to know to do the job, in the order you'll meet it on shift. They're about the work, whatever system you do it on.

- **Aircraft position reporting (page 7)**: How you know where your aircraft are, by radar and by the aircraft's own datalink, what each can and can't tell you, and what to do when a report is overdue.
- **Reading the SIGWX chart (page 13)**: The significant weather chart, symbol by symbol: cumulonimbus, jet streams, fronts, tropical cyclones and the weather at airports.

Using these modules

Read a module through once, then keep it to hand on shift. Nothing here replaces your own company's operations manual or the instructions of your authority: where they differ, follow them.

MODULE

1

Aircraft position reporting

How you know where your aircraft are, by radar and by the aircraft's own datalink, what each can and can't tell you, and what to do when a report is overdue.

An operations room is only as good as its picture of where the aircraft are. That picture is never the aircraft itself: it's the last thing something told you. This module covers the four things that tell you, what each is good for, and what to do when they go quiet.

What you see on a fleet display is the **last known position**: where the aircraft was when it was last seen or last reported. Always know how old that is, and where it came from.

The four sources at a glance

Source	Where it works	What it carries	Cost, delay, reliability
Radar	Over land and near the coast, in reach of a radar station	Position only	A subscription. Seconds old. Dependable inside cover.
VHF ACARS	In sight of a ground station: about 200 NM at cruise. On the ground, only at an airport that has one	Position, level, fuel and estimate of landing. Messages both ways	The cheapest link. Seconds. Dependable.
SATCOM ACARS	Almost everywhere but near the poles, on aircraft fitted with it	The same as VHF	The dearest: charged by the message. Seconds. Dependable.
HF datalink	Everywhere	The same as VHF	Its own rate. Minutes. Reports may be delayed or lost.

Radar

Air traffic control's radar positions, passed on to operations by a service provider. Positions refresh every few seconds as the radar sweeps, over land and near the coast only. An aircraft that flies out of cover simply stops moving on your display, at the last place the radar saw it.

- Radar gives a position and nothing else: no fuel, no estimate of landing.
- It is not a datalink. You can't send the aircraft a message over it, or ask it for a report.
- It sees aircraft in the air. On the ground, go by the movement messages.

VHF ACARS

ACARS is the aircraft's own datalink: short messages between its avionics and the ground, sent without the crew having to do anything. Over VHF ra-

dio it's quick, cheap and dependable, but VHF travels in a straight line, so the aircraft has to be within sight of a ground station: about 200 nautical miles at cruising level, and much less lower down. On the ground an aircraft can only use the station at its own airport, if there is one.

Use it freely. It is the link to expect over land in busy regions.

SATCOM ACARS

The same messages by satellite, for when the aircraft is out of reach of a ground station. It works over the oceans and over thinly served land, on aircraft that carry the equipment: many short-haul types don't. The satellites sit over the equator, so near the poles they are below the horizon and there is no service.

Each message is charged for, so SATCOM costs more than any other link. Position reports are set less often on it for that reason.

HF datalink

The same messages by high frequency radio, which reaches anywhere by way of the upper atmosphere. Every aircraft has it, and falls back to it when it has neither VHF nor SATCOM: across an ocean on a type without SATCOM, or over the poles on any type.

HF datalink: reports may be delayed or lost; do not rely on it alone to keep track of an aircraft. A message takes minutes rather than seconds, and some never arrive. The same goes for anything you send the aircraft. A gap in the reports from an aircraft on HF is more often the link than the aircraft, but you can't tell which from the ground.

Which link an aircraft is on

You don't choose. The avionics pick the best link they have, in this order: VHF, then SATCOM, then HF. The link changes during a flight without anyone being told: a transatlantic flight leaves on VHF, goes to SATCOM or HF a few hundred miles out, and comes back to VHF on the far side. Expect the pattern of its reports to change with it.

What the aircraft sends

Movement reports. The aircraft reports the four events of every flight itself, known as OOOI: **Out** of the gate, **Off** the ground, **On** the ground, and **In** at the gate. They arrive as movement messages (`MVA`), in the same form as a station's `MVT`. With Off the aircraft gives its own estimate of landing.

Position reports. In the air it reports its position at a set interval, which depends on the link. Each report gives where it was, when, its flight level, the fuel on board, and its estimate of landing. The layout is published by the Air-Ground Message Standards Committee (AGMSC), the body that agrees the formats airlines and datalink providers exchange:

```
POS
UE101/05.GUEAA
5132N00027W 0712 F350
EA1010 JFK FOB12400
```

`UE101/05.GUEAA`	The flight, the day of the month of its scheduled departure, and the aircraft's registration
`5132N00027W`	Its position in degrees and minutes: 51°32′ north, 000°27′ west
`0712`	The time it was there, UTC
`F350`	Its flight level
`EA1010 JFK`	Its estimate of landing, and where
`FOB12400`	Fuel on board, in kilograms

The aircraft's estimate of landing is the crew's and the avionics' best figure at that moment. It allows for how the flight has gone, not for a wait at the destination. Early in a flight it can be a few minutes out; close to landing it is good to about a minute. Add the taxi in to know when the aircraft will be on stand.

Requested reports. You can ask an aircraft for a position report at any time (`RQP`). The request goes up on whichever link the aircraft is using, so on HF it may take minutes to get there, or not get there at all, and the same for the answer.

Good practice

- **Track every aircraft at least every 15 minutes over oceanic and remote areas.** If the routine reports come less often than that, ask for one.
- Before a flight leaves radar cover, know which link it will fall back to. A type without SATCOM over an ocean is on HF, and needs watching more closely.
- Read the age of a position before you act on it. An aircraft at cruise covers about eight nautical miles a minute: a report a quarter of an hour old is a hundred and twenty miles behind the aircraft.
- Treat the radar picture and the datalink picture as two witnesses. Where you have both, they should agree.

When a report is overdue

A position report is overdue when nothing has given the aircraft's position for longer than its reporting interval and a few minutes' grace. Most overdue reports clear by themselves: the next one arrives. Don't wait for that.

1. **Request a report** from the aircraft.
2. Check what else you have: the last report's position and time, the link it was on, and whether the aircraft should by now be back in radar or VHF cover.
3. **If there is still no contact, follow your company's procedures and alert air traffic services (ATS).** Give them the flight, the last known position and its time.

Record what you did and when. An aircraft on HF that has missed one report is usually found by the next. One that has missed a report on VHF or SATCOM, or that should have come back into cover and hasn't, is not routine.

MODULE

Reading the SIGWX chart

2

The significant weather chart, symbol by symbol: cumulonimbus, jet streams, fronts, tropical cyclones and the weather at airports.

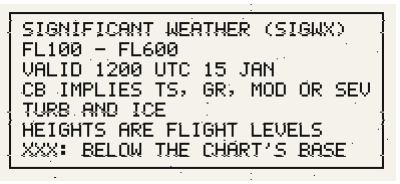
The significant weather chart, or SIGWX, shows the weather that matters to aircraft between FL100 and FL600: cumulonimbus, jet streams, fronts and tropical cyclones, and the weather at the larger airports. It comes from the meteorological provider by fax, so it's in black and white, with a speck or two from the telephone line. It follows the conventions of ICAO Annex 3 and the WMO.

This module goes through the chart from the top down, symbol by symbol. Have a chart in front of you as you read.

The top of the chart

The line across the very top is printed by the sending machine: the day and time it was sent, the provider's fax number and name, and the page.

The **title block** at the top left says what the chart is:



- `FL100 - FL600`: the levels it covers. Anything below FL100 isn't on it; for that, read the airports' reports and forecasts.
- `VALID 1200 UTC 15 JAN`: the time the chart is for. It shows the weather as it will be then, not over a period.

- `CB IMPLIES TS, GR, MOD OR SEV TURB AND ICE`: wherever cumulonimbus is marked, expect thunderstorms, hail, and moderate or severe turbulence and icing, though none of them is drawn.
- `HEIGHTS ARE FLIGHT LEVELS`: `340` means FL340.
- `XXX: BELOW THE CHART'S BASE`: a height of `XXX` is below FL100.

The dotted lines are every ten degrees of latitude and longitude, numbered at the edges. The thin solid lines are the coasts.

Cumulonimbus



A **scalloped line** encloses each area of cumulonimbus. Its label is inside it, or under it when the area is too small to hold it. The label reads from the top:

1. **How much there is**, then `CB`.
2. **The tops**, as a flight level: `450` is FL450.
3. A line, and under it **the base**: `XXX`, below FL100. Cumulonimbus reaches down to near the ground, so its base is always below the chart.

How much is said as ICAO has it, by how much of the area the cumulonimbus covers:

`ISOL`	Isolated: separate cells, covering less than half the area
`OCNL`	Occasional: well separated, covering half to three-quarters
`FRQ`	Frequent: little or no gap between them, covering more than three-quarters
`EMBD`	Embedded in layers of other cloud, so it can't be seen from the cockpit and has to be found on radar. It goes with one of the others, as `FRQ EMBD CB`.

So `FRQ CB` over `450` over `XXX` is frequent cumulonimbus with tops at FL450 and its base below FL100. Remember the title block: every one of them means thunderstorms, hail, turbulence and icing.

Tropical cyclones



A tropical cyclone (a hurricane or typhoon) is the **ring with a curved arm either side**, at its centre. Around it, the cumulonimbus of its rain bands is marked as any other, as frequent and embedded: `FRQ EMBD CB`, with tops well above FL500. Where it's heading, and the airports in its way, are in the provider's advisory, which comes by fax: see Faxes and briefs.

Jet streams



A **heavy line with an arrowhead** is the core of a jet stream, wherever the wind is 80 knots or more. The arrowhead is at the end the wind is blowing towards.

Where the jet is fastest, and every so often along a long one, its speed is marked on the line in **pennants and feathers**, as on a wind barb, with the flight level of the core on the other side of the line:

A pennant (a filled triangle)	50 knots
A feather (a stroke)	10 knots

Add them up. Above, two pennants and two feathers are 120 knots, at FL340. Below, one pennant and four feathers are 90 knots, at FL300.



As on a wind barb, the pennants are furthest upwind, with the feathers downwind of them, and both lean back into the wind. They stand on the

side of the line towards the pole, which is the side of lower pressure: above the line north of the equator, with the flight level beneath, and below it south of the equator, with the flight level above.



Speeds are to the nearest 10 knots. The wind shear at a jet's edges is where clear-air turbulence is likeliest.

Fronts

Fronts have the same symbols as on the surface chart, in black. The symbols are on the side the front is moving towards; in these, it's moving up the page.

	**Cold front**: triangles.
	**Warm front**: half-discs.
	**Occlusion**: triangles and half-discs in turn, on the same side.
	**Quasi-stationary front**: triangles on one side and half-discs on the other. It's hardly moving.

Weather at airports

At the larger airports with weather to report, the chart has the WMO symbol for it. The **small ring** marks the airport, with the symbol above it. Where an airport reports more than one kind of weather, a thunderstorm is shown first, then anything falling, then the rest. Where airports are close together, only one has its symbol, so that they don't run into each other. For the full picture at an airport, read its METAR and TAF.

The more dots, commas or stars, the heavier it is: two side by side for light, three in a triangle for moderate, four in a diamond for heavy. These are the WMO's symbols for continuous rain, drizzle and snow. A single mark, or marks one above the other, would mean it was coming and going, which a report doesn't say, so the chart never has them.

	Rain: light, moderate, heavy `-RA RA +RA`
	Drizzle: light, moderate, heavy `-DZ DZ +DZ`
	Snow: light, moderate, heavy. Snow grains have the star too. `-SN SN +SN SG`
	Ice pellets: an open triangle with a dot in it, however hard they're falling `PL`
	Showers: an open triangle, point down, under what's falling: a dot for rain, a star for snow, a filled triangle for hail, an open one for small hail `SHRA SHSN SHGR SHGS`
	Thunderstorm: alone, with rain, with hail. What's falling is at the top right. `TS TSRA TSGR`
	Freezing rain, freezing drizzle: a wave, for ice forming on whatever it lands on, over what's falling `FZRA FZDZ`
	Fog: three bars. Freezing fog has them too. `FG FZFG`
	Mist: two bars `BR`
	Haze: two rings side by side `HZ`

Know where your aircraft are, and what they're flying into.

Training from CATS for the people who run an airline's day, one subject at a time, in the order you'll meet it on shift.

- Aircraft position reporting
- Reading the SIGWX chart

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