

User Manual

En-route / area control ATC simulator

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1 General

Radar Contact Center is an air traffic control simulator that puts you in the position of a controller in an area control centre (ACC). Your job is to guide aircraft safely and efficiently from one boundary of your airspace (the entry point) to another (the exit point). To do that you can assign flight levels, headings and speeds, and you can clear aircraft direct to waypoints along their route.

Every aircraft enters your sector on a published route, called an airway, which is a sequence of waypoints. You may shortcut that route at any time if it is safe, and you can also use the airways themselves as a separation tool — for example by sending one aircraft direct while leaving another on the planned route.

For each aircraft you coordinate an entry level with the upstream sector and an exit level with the next one. Every aircraft also has a requested flight level (RFL), the level the crew would prefer, and part of your job is to get them there while they are with you. Some aircraft climb into your sector from below, and some begin their descent towards their destination while still inside it.

Your main task is to keep every aircraft separated at all times. Beyond that, you should aim for an efficient, orderly traffic flow.

Difficulty is set by the traffic rate — the number of aircraft entering in a ten-minute period. Four aircraft are always present when a session begins, and at least three of them will need a level change, so there is something to do from the first moment.

This is a simulation rather than an arcade game, and the radar picture follows real practice fairly closely. Without some air traffic control background it takes a while to handle it comfortably, so everything you need is explained in this manual and in the in-game help.

2 Main Menu

The main menu lets you choose the sector you want to work and the traffic rate, and start, load or quit a session.

- SECTOR — choose between Tuxford, Hemswell and Reydon. Not all sectors are available from the start; see the unlocks below.
- TRAFFIC RATE PER 10’ — how many aircraft enter the sector in a ten-minute period. At a rate of 0 the Start button is disabled, since nothing would ever arrive.
- WEATHER — OFF, LIGHT or MODERATE, giving no cells, two cells or four cells. See the Weather Simulation section.
- START NEW — begins a new session with the settings above.
- LOAD — continues the saved session, if one exists. All settings are taken from the saved game rather than from the menu.
- HELP — opens the in-game help pages, which cover the same ground as this manual in shorter form.
- QUIT — leaves the game.

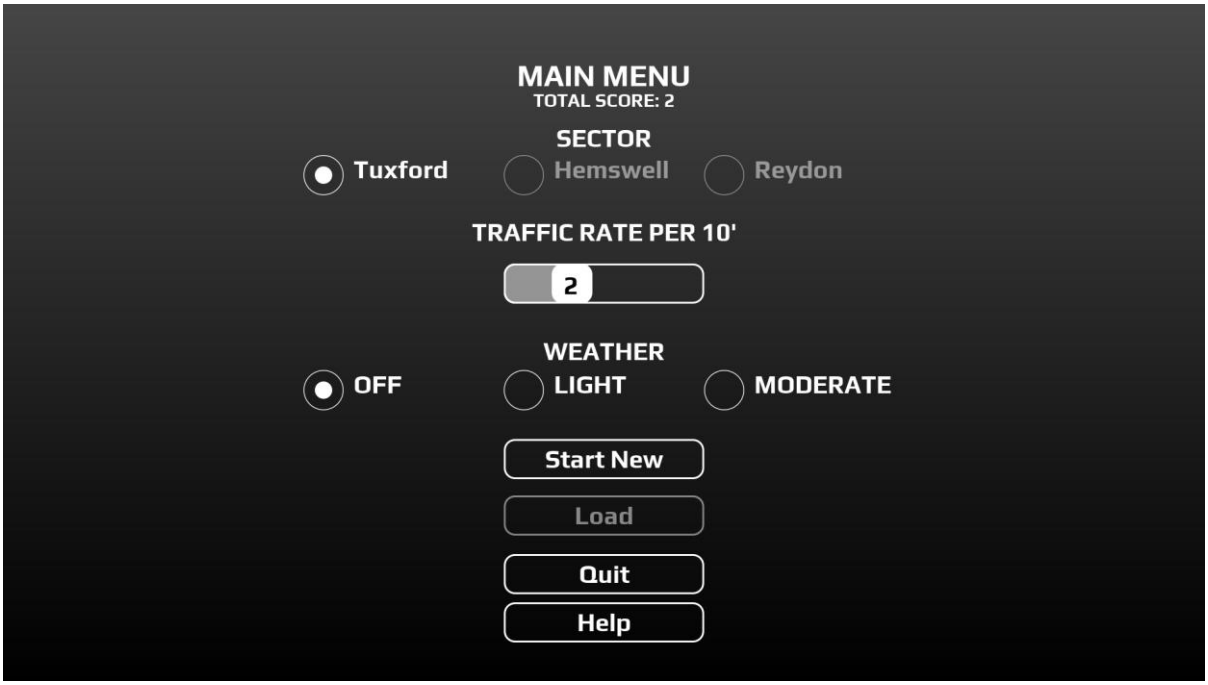


Figure 1 — The main menu. Sectors you have not unlocked yet are greyed out, and Load is dim when no saved session exists.

Your total score is shown in the menu. It is the sum of all session scores achieved so far, and it controls which sectors are available: Hemswell unlocks at a total score above 49, Reydon above 299. Tuxford is always available.

3 The Radar Screen

After starting a session you are presented with the radar picture. The screen width corresponds to 120 nautical miles and the height to about 67 nautical miles. The background is black and shows the airways of your sector, each labelled with its name — these begin with "U" for upper airspace followed by letters and numbers, for example UL603.

Waypoints are drawn as small symbols with their five-letter names beside them. Airways, waypoints and their labels are all drawn in the same muted grey so that aircraft stand out clearly against them.

The radar picture is updated every five seconds, because the antenna has to complete a rotation before new data is available. Aircraft therefore jump forward in steps rather than smoothly, exactly as on a real radar display.

Aircraft appear in the coordination list before they are visible on the screen, often several minutes before they arrive. That is deliberate: it gives you time to coordinate an entry level before the aircraft is anywhere near your airspace.

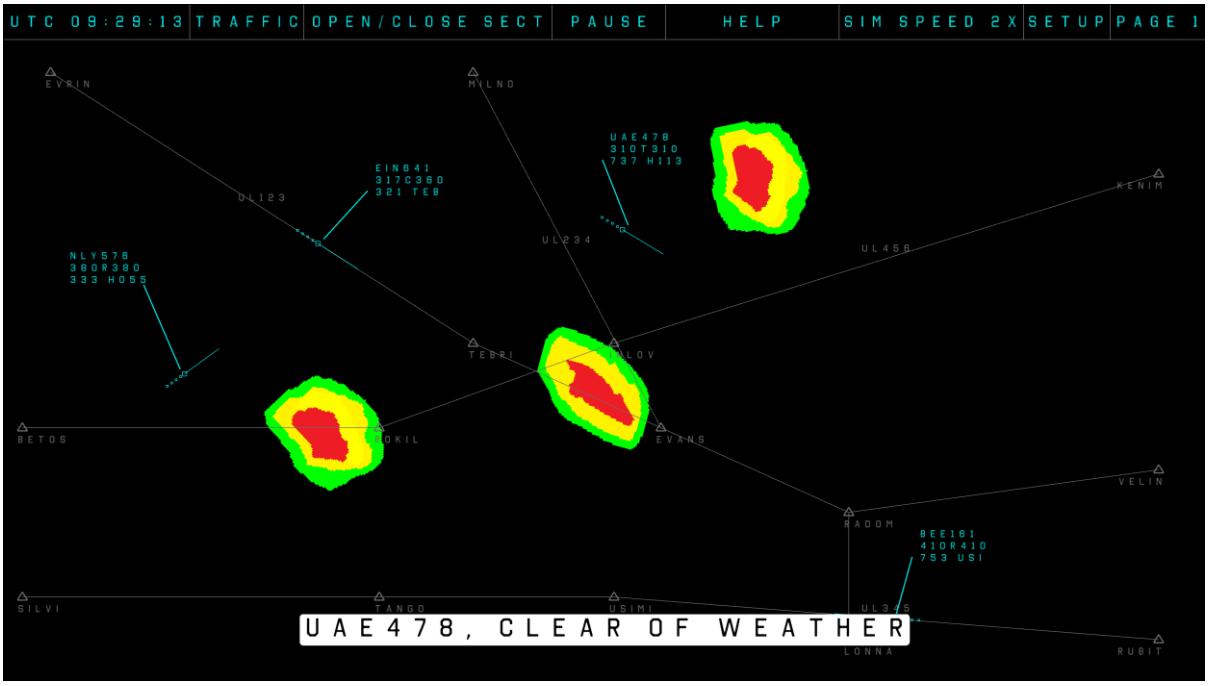


Figure 2 — The radar picture. Airways and waypoints in grey, aircraft with their datatags, and the top bar across the top of the screen.

3.1 Top bar, page 1

- UTC — the current time in Universal Time Coordinated.
- CRD IN — blinks yellow while an aircraft still has an uncoordinated entry level that you can do something about. Tap it to open the coordination list.
- TRK/DIST — the result of the last track and distance measurement. See Controlling Aircraft.
- CRD OUT — blinks yellow while an aircraft still has an uncoordinated exit level that can still be agreed. Tap it to open the coordination list.
- SCORE — the current session score.
- WIND — the upper wind for this session, as direction and speed in knots. It affects every aircraft's track over the ground.
- EXIT — ends the shift, with the option to save.
- PAGE 2 — switches to the second page of the bar.

Both coordination fields stop blinking once nothing can be done: an entry level cannot be changed after the aircraft has been accepted or once it is within 25 NM of its entry point, and an exit level cannot be changed within 51 NM of the exit point. A blinking field therefore always means there is still an action available to you.

3.2 Top bar, page 2

- TRAFFIC — opens a dialog where the traffic rate can be changed during the session.
- OPEN/CLOSE SECT — closes your sector to new arrivals, or opens it again. Useful when traffic has built up beyond what you can comfortably handle. See the note below on what closing does and does not do.
- PAUSE — freezes the simulation. Tap the screen to resume.
- HELP — opens the in-game help pages.

- SIM SPEED 1X / 2X — runs the simulation at double speed. Turns, climbs, descents and spawn intervals all scale together, so the geometry of the traffic picture is unchanged; only your thinking time is shorter.
- SETUP — display options. See below.
- PAGE 1 — switches back to the first page.

Closing the sector stops the next aircraft from being generated, and nothing more. Every aircraft already created keeps coming, including those still outside the radar picture — so everything that is already in the coordination list will enter your airspace and has to be accepted and worked as usual. An aircraft appears in the list about five minutes before it reaches the radar picture, so that is roughly how long it takes for a closure to have any effect; at a high traffic rate two or three aircraft may already be on their way. The upstream sector never takes an aircraft back once it has been offered to you.

Nothing accumulates while the sector is closed: the arrivals that would have been generated are simply lost, and when you open the sector again the next aircraft comes at the next normal interval rather than all at once. Closing is therefore a slow valve rather than a brake — it is worth using before the traffic picture becomes unmanageable rather than after.

3.3 Setup

The setup dialog has two display options:

- TRACKLINE — the short line extending ahead of each aircraft symbol, showing where it will be after about 40 seconds at its present track and groundspeed.
- HISTORY TRAIL — the five previous radar positions behind each aircraft, which make the direction and speed of a target easy to judge at a glance.

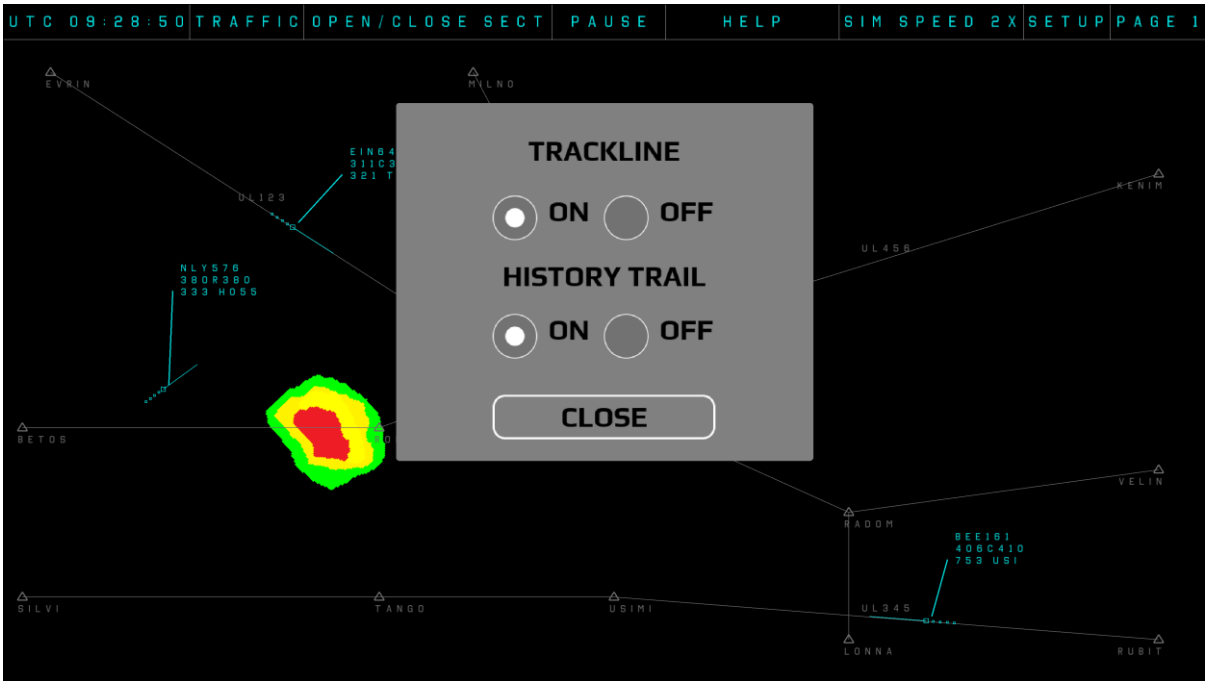


Figure 3 — The setup dialog, with the trackline and history trail options.

4 Target Symbols

An aircraft, or target, is drawn as a small square with a block of text beside it (the datatag) and a line connecting the two. The datatag has three lines:

```
Line 1:   Callsign
Line 2:   Current level | trend letter | cleared level
Line 3:   Aircraft type and alternating data
```

For example:

```
DLH123
350R350
320 460
```

This is a Lufthansa Airbus A320, level at FL350, cleared to FL350, with a groundspeed of 460 knots. The letter between the two levels tells you what the aircraft is doing vertically:

- C — climbing to the cleared level.
- D — descending to the cleared level.
- T — level, but not yet at its requested flight level. There is still a climb to give.
- R — level at its requested flight level. Nothing more is needed vertically.

The difference between T and R is worth learning, because it is the quickest way to see which aircraft still need attention. Both show the same two levels; only the letter tells you whether the crew have what they asked for.

The third line alternates every few seconds between the groundspeed, the assigned heading or direct-to waypoint, an assigned Mach number shown as for example M78, and H/O when the aircraft is ready to be handed over or has been transferred.

4.1 Colours

- Normal — an accepted aircraft under your control.
- Yellow — a new aircraft awaiting acceptance, or one that is ready to be transferred to the next sector, or one already transferred. Transferred aircraft can no longer be selected.
- Orange — an early conflict warning: this aircraft may lose separation with another if nothing changes.
- Red — an active separation conflict, or an aircraft with an emergency.

4.2 Moving the datatag

Datatags can be dragged to any convenient position: press and hold the tag, then drag. A tag cannot be dragged under the top bar. A short tap opens the aircraft control panel instead. New aircraft place their tag automatically on whichever side keeps it on the screen.

4.3 Airline codes

The datatag shows the three-letter ICAO code of the operator followed by a flight number. The radio callsign used in readbacks is given in the third column.

Code	Airline	Callsign
DLH	Lufthansa	Lufthansa
AUA	Austrian Airlines	Austrian
BAW	British Airways	Speedbird
AFR	Air France	Air France
IBE	Iberia	Iberia
BEL	Brussels Airlines	Beeline
KLM	KLM	KLM
UAE	Emirates	Emirates
RYR	Ryanair	Ryanair
TCX	Thomas Cook	Kestrel
AZA	Alitalia	Alitalia
SWR	Swiss	Swiss
AEE	Aegean	Aegean
BER	Air Berlin	Air Berlin
COA	Continental Airlines	Continental
AAL	American Airlines	American
FDX	FedEx	Fedex
NLY	FlyNiki	Niki
THY	Turkish Airlines	Turkish
QFA	Qantas	Qantas
SAS	Scandinavian Airlines	Scandinavian
JAI	Jet Airways	Jet Airways
FIN	Finnair	Finnair
BMA	British Midland	Midland
TOM	Thomson	Tomson
CLX	Cargolux	Cargolux
TRA	Transavia	Transavia
EZY	easyJet	Easy
EIN	Aer Lingus	Shamrock
ETD	Etihad Airways	Etihad
ADR	Adria Airways	Adria
MSR	Egyptair	Egyptair
CTN	Croatia Airlines	Croatia
MAH	Malev	Malev
BEE	Flybe	Jersey
LOT	LOT Polish Airlines	LOT
OAL	Olympic Air	Olympic
ANA	All Nippon Airways	All Nippon
JAL	Japan Airlines	Japan Air
ACA	Air Canada	Air Canada

4.4 Aircraft types

Wake turbulence category affects an aircraft's climb and acceleration performance. Max level and Max Mach are the highest flight level and Mach number the type can be given.

Code	Type	Category	Max level	Max Mach
736	Boeing 737-600	Medium	FL410	M.82
737	Boeing 737-700	Medium	FL410	M.82
738	Boeing 737-800	Medium	FL410	M.82
753	Boeing 757-300	Heavy	FL420	M.83
763	Boeing 767-300	Heavy	FL430	M.83
773	Boeing 777-300	Heavy	FL430	M.83
744	Boeing 747-400	Heavy	FL430	M.83
748	Boeing 747-8	Heavy	FL430	M.83
788	Boeing 787-8	Heavy	FL430	M.83
318	Airbus A318	Medium	FL390	M.82
319	Airbus A319	Medium	FL390	M.82
320	Airbus A320	Medium	FL390	M.82
321	Airbus A321	Medium	FL390	M.82
332	Airbus A330-200	Heavy	FL410	M.83
333	Airbus A330-300	Heavy	FL410	M.83
343	Airbus A340-300	Heavy	FL410	M.83
346	Airbus A340-600	Heavy	FL410	M.83
380	Airbus A380	Heavy	FL430	M.83
M82	McDonnell Douglas MD-82	Medium	FL370	M.80
E19	Embraer 190	Medium	FL410	M.82

5 Controlling Aircraft

Tapping a datatag opens the control panel for that aircraft. The title line shows the callsign and the airway it is following. Below it, the data line shows the requested level, the current track, the groundspeed and the current Mach number.

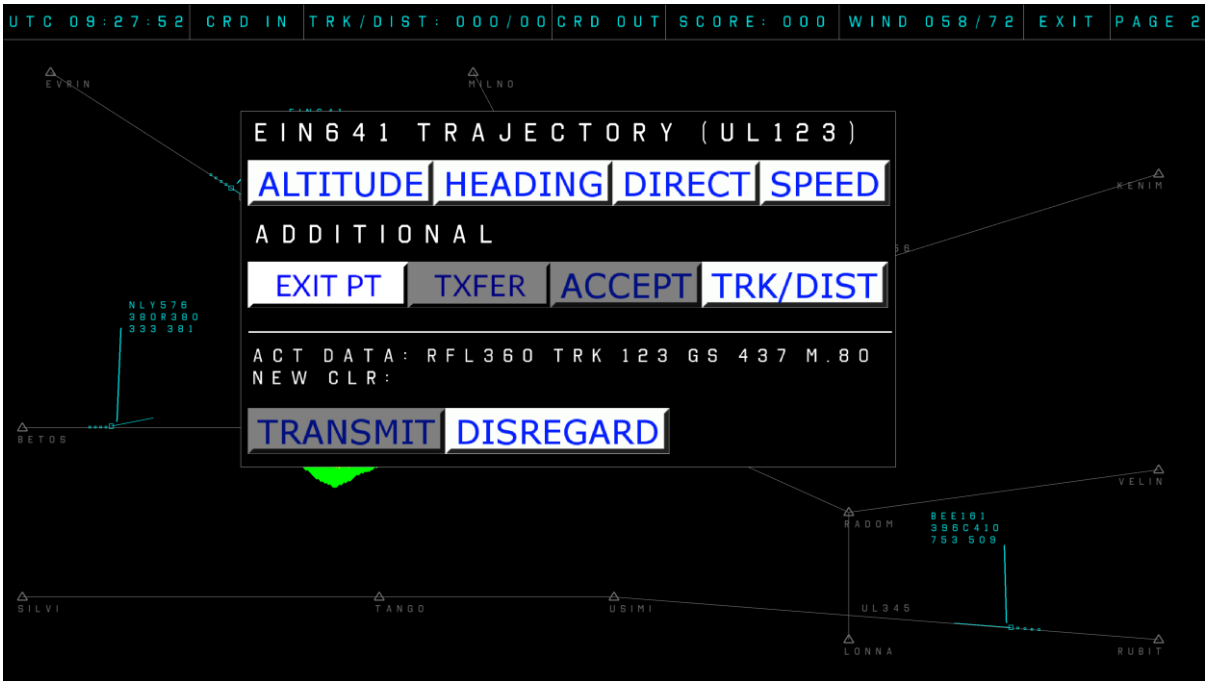


Figure 4 — The aircraft control panel. The title line gives the callsign and airway, and the three lines at the bottom show the present data and the clearance being built.

The first row of buttons sets the clearance:

- ALT — assign a flight level between FL290 and FL430. The aircraft's requested level is marked with a pale blue button face, so you can see at a glance what it would like. Levels above what the aircraft type can reach (see section 4.4) are greyed out and cannot be selected.
- HDG — enter a heading as three digits, including leading zeros: heading 005 is entered as 0, 0, 5. Assigning a heading takes the aircraft off its airway; it will then fly that heading until you give it something else.
- DCT — clear the aircraft direct to one of the next waypoints on its route. Up to five waypoints still ahead of it are offered. This is the normal way to shorten a route.
- SPD — assign a Mach number between .74 and .83. Numbers above what the aircraft type can fly (see section 4.4) are greyed out and cannot be selected. At these levels speed is controlled by Mach rather than knots. Note that the datatag shows groundspeed, not Mach, so two aircraft at the same Mach number can show quite different groundspeeds depending on their level and the wind.

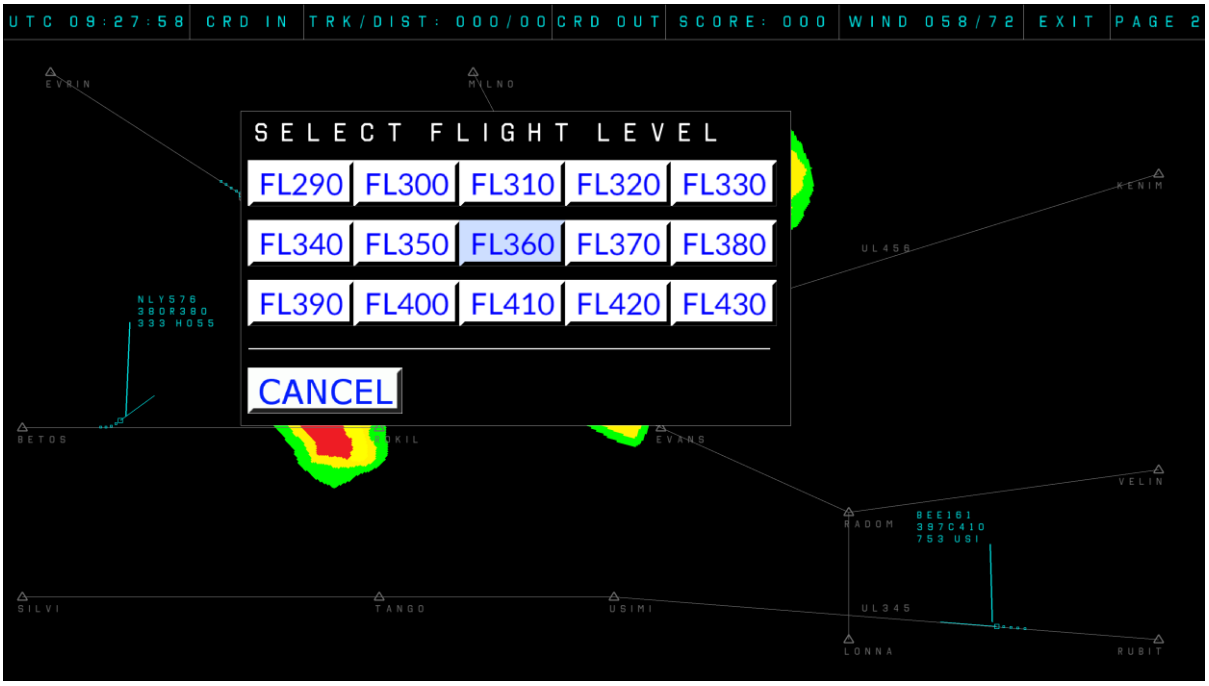


Figure 5 — The ALT panel. The pale blue button face marks the aircraft's requested flight level.

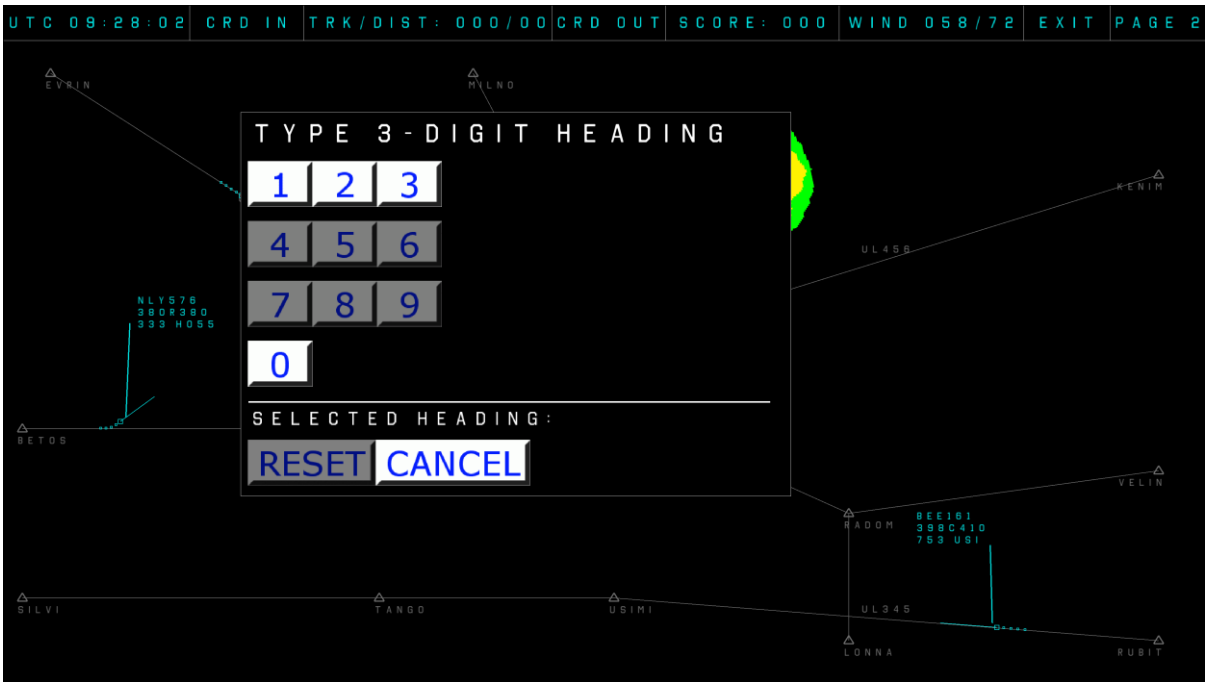


Figure 6 — The HDG panel. Headings are entered as three digits, including leading zeros.

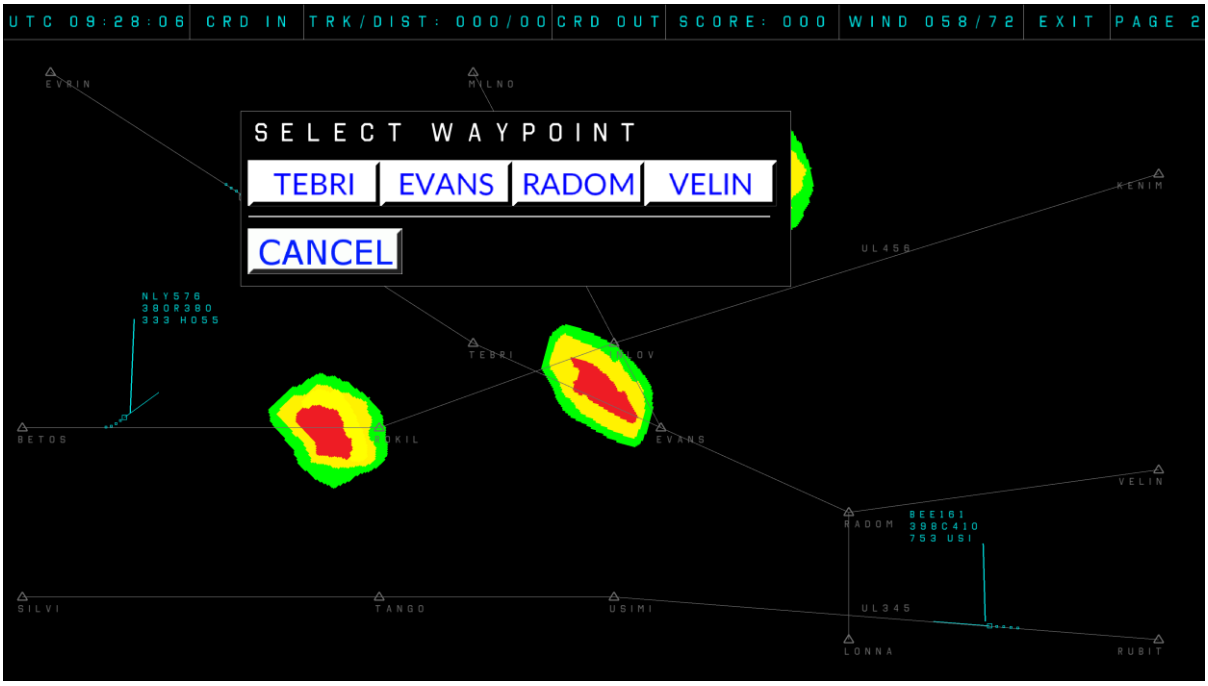


Figure 7 — The DCT panel, offering the next waypoints still ahead of the aircraft on its route.

The second row contains actions:

- EXIT PT — highlights the aircraft's exit point and the route still ahead of it on the radar picture, blinking four times. It does not change the clearance; it is there to show you where the aircraft is going.
- TXFER — transfers the aircraft to the next sector. It becomes unselectable afterwards. Transfer is only possible once the aircraft is nearly at the boundary, or for a descending aircraft once it is approaching the bottom of your airspace.
- ACCEPT — takes a new aircraft under your control. The crew answer with a greeting, and the aircraft's route and exit point are highlighted briefly so you can see where it is headed. Accepting is immediate and does not need TRANSMIT.
- TRK/DIST — after tapping this, tap anywhere on the radar picture and the track and distance from that aircraft to that point appear in the top bar.

Below the buttons, three lines show the aircraft's present data and the clearance you are building. Nothing is sent until you tap TRANSMIT; DISREGARD clears the pending clearance and leaves the aircraft on its current one. You can combine items — a level, a heading and a speed can all go in one transmission. VERTICAL, next to DISREGARD, opens the vertical view (section 6.3) for this aircraft.

After a transmission the crew read the clearance back, and the readback appears briefly near the bottom of the screen.

5.1 Headings, tracks and wind

A heading is the direction the aircraft's nose points. With wind, that is not the direction it travels over the ground, which is the track. A random upper wind is generated for each session and affects every aircraft; its direction and speed are shown on page 1 of the top bar. If an aircraft is pointing west with a strong southerly wind, its track over the ground will be roughly west-north-west. Aircraft always turn the shorter way round to a new heading.

6 Sector Coordination

As an area controller you accept aircraft from adjacent sectors, work them, and transfer them onwards. Both the entry and the exit have to be agreed with your neighbours, so that everyone knows at which level an aircraft will cross the boundary.

An upstream sector might offer you an aircraft at FL360, which you can see would conflict with traffic you already have. You can then coordinate a different entry level — FL350, say — and the aircraft will arrive at that level instead. For departures you offer a level to the next sector, which in this simulation always accepts it. Whatever is agreed, every aircraft should leave your sector at its coordinated level.

Vertical coordination is simulated too: aircraft can enter from the sector below, climbing, and others descend out of the bottom of your airspace towards their destination.

6.1 The coordination list

Tapping CRD IN or CRD OUT opens the coordination list, which shows every aircraft not yet transferred, including those still outside the radar picture, with the aircraft not yet accepted at the top, each group sorted by how soon it reaches its next waypoint. Each row reads:

```
CALLSIGN | WAYPOINT | ETA | IN | OUT | RFL | AIRWAY
```

The callsign is yellow while the aircraft has not been accepted. The entry and exit level columns are colour coded: red for uncoordinated, magenta for a request still pending with the other sector, and the normal colour once coordinated. A level also turns the normal colour once it is too late to change it, so red always means there is still something you can do.

A climbing aircraft shows CLMB in the entry column until its level is agreed; an aircraft descending out of the sector shows DESC in the exit column, since its exit is vertical rather than across a boundary.

ACCEPT ALL agrees every level that can still be coordinated: entry levels as offered, exit levels at the requested level. It is quick, but it accepts the upstream sector’s suggestions without checking them, so use it in light traffic or when you are confident there are no conflicts. CLOSE returns to the radar.

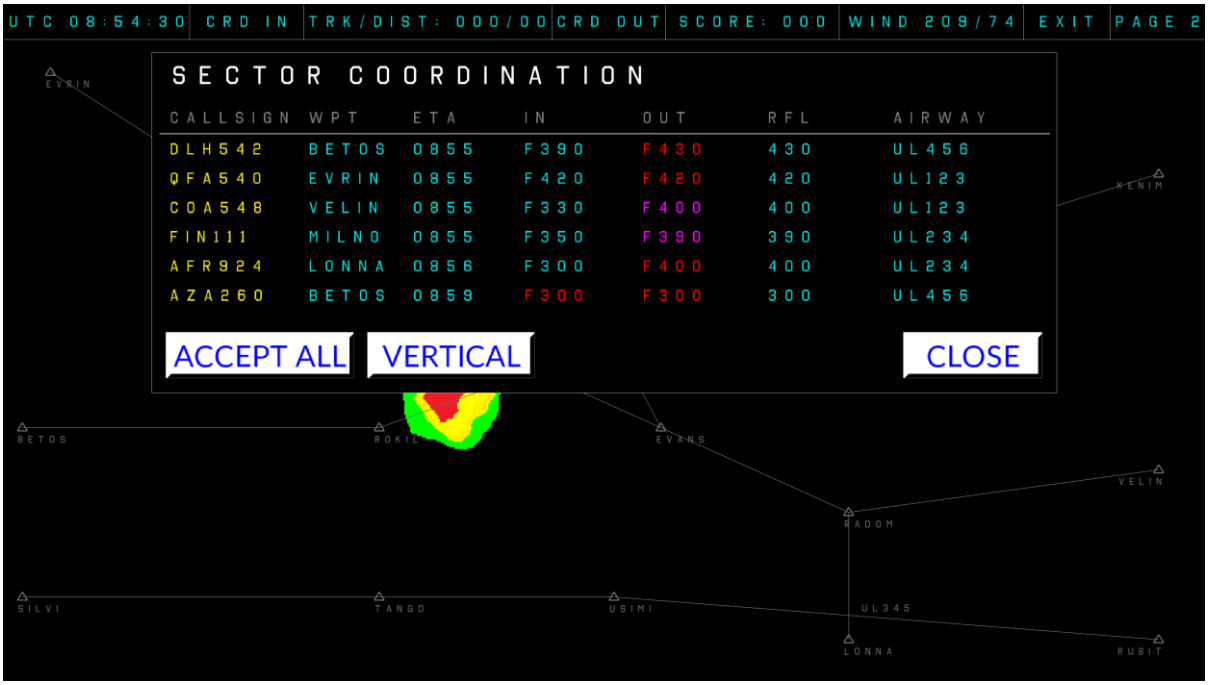


Figure 8 — The coordination list: aircraft not yet accepted first, then by time to the next waypoint. Red entry and exit levels still need to be agreed; VERTICAL opens the side-on view of the whole sector.

6.2 The coordination dialog

Tapping a row opens the dialog for that aircraft, with three columns: LEVEL IN, LEVEL OUT and LVL CONF. Choose the levels you want and tap OK; the request goes to the other sector and is confirmed a few seconds later. CANCEL closes without changing anything.

An entry level cannot be chosen once the aircraft has been accepted or once it is within 25 NM of its entry point — the column then reads N/A, because it is too late to re-coordinate. An exit level cannot be chosen within 51 NM of the exit point, or at all for an aircraft descending out of the sector, whose exit level is fixed. Exit levels above what the aircraft type can reach are greyed out, and entry levels above it are not offered.

LVL CONF lists the aircraft that your chosen levels could bring into conflict. The check flies both aircraft forward along their actual routes for ten minutes in half-minute legs, working out the closest they come on each leg and where each of them will be vertically at that moment — so a turn at a waypoint, or a climb that will be complete by the time the two meet, are both taken into account. An aircraft is listed if the two would come within 8 NM of each other with less than 1000 feet between them while both are inside the radar picture. Only aircraft you have already accepted are checked. It is a planning aid rather than a guarantee: you can still change a clearance afterwards and create a conflict that was not predicted.

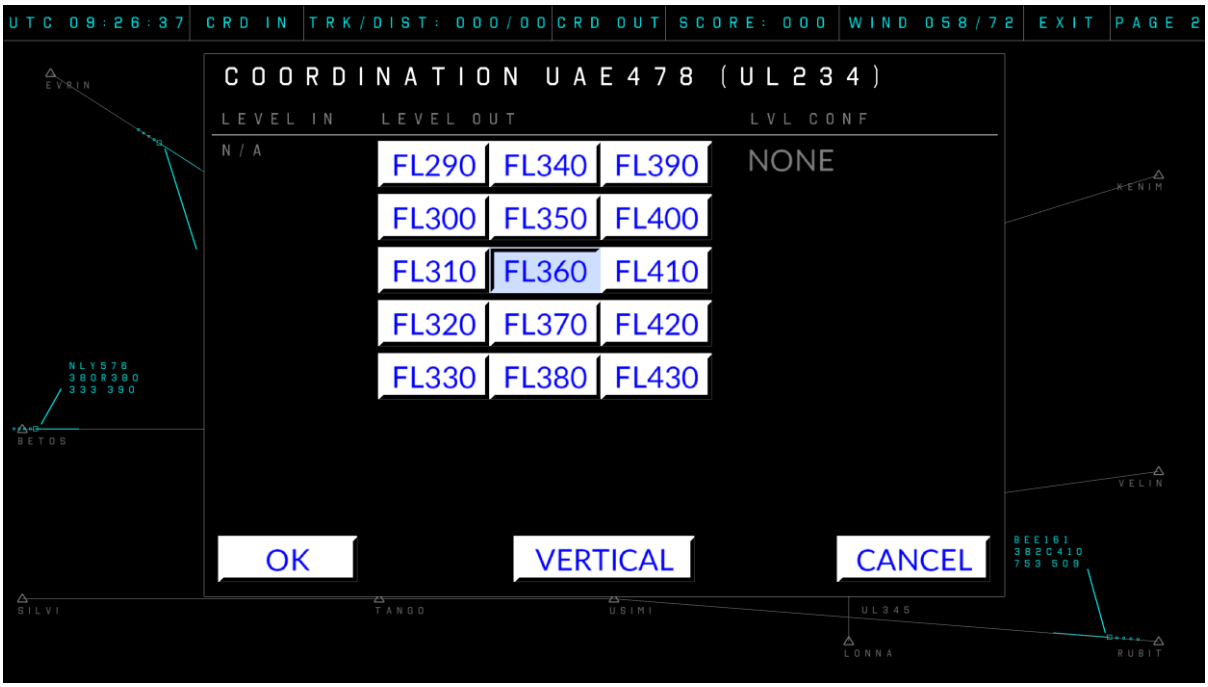


Figure 9 — The coordination dialog, with LEVEL IN, LEVEL OUT and the predicted level conflicts.

6.3 The vertical view

A VERTICAL button opens a side-on view of the whole sector, which makes the vertical traffic picture much easier to read than the radar display can. It is on the coordination list itself, where it shows the sector as it stands, and in the dialog for a single aircraft, where it also shows the levels you are trying for that one. VERTICAL in the clearance panel opens the same view for the selected aircraft.

- The horizontal axis is the west-to-east position on the radar picture; the vertical axis runs from FL290 at the bottom to FL430 at the top, with one grid line per level.
- Every aircraft in the coordination list is a small square at its present level — cyan once you have accepted it, yellow before that — with a line and arrow to the level it is cleared to. A thinner line then continues to a hollow square at the level the aircraft is to leave your sector at, so the climb or descent still outstanding on each one can be read off at a glance. Nothing is drawn for an aircraft that is already at its exit level.
- The aircraft you are coordinating is drawn in white and ringed, at the entry level you have selected (at its present level once the entry level can no longer be changed), with an arrow to the selected exit level, so you can see the effect of your choice before you confirm it. The ring stays white if a predicted conflict turns the aircraft red.
- Aircraft below FL290 sit on the bottom edge, and one still outside the radar picture sits on the side edge.
- Where a conflict is predicted, both aircraft are drawn in red and the conflicting callsigns are listed beneath. Only aircraft you have accepted are checked against each other, so one still awaiting acceptance is shown for information but never flagged.

CLOSE returns to whichever window you opened the view from, with any selection unchanged.



Figure 10 — The vertical view, opened from the list. West to east across, FL290 to FL430 up, every aircraft in the coordination list at its present level, with a line on to the level it is to leave the sector at.

7 Aircraft Separation

Aircraft must be separated from each other at all times. The minimum is 5 nautical miles horizontally or 1000 feet vertically — one or the other is enough, so two aircraft may be directly above one another provided the vertical gap is there.

The game warns you in two stages:

- Orange — an early warning. The aircraft is within about 10 NM of another ahead of it, or within 20 NM nearly head-on. Nothing has been lost yet, but it needs attention.
- Red — separation has been lost: less than 5 NM apart with less than 1000 feet between them. An alarm sounds and one point is deducted for every radar update the situation continues.

If two aircraft come within 3 NM of each other with less than 600 feet between them, the session ends and 20 points are deducted. A session that ends this way cannot be saved.

Separation only counts when at least one of the two aircraft is under your control. Two aircraft that are each either not yet accepted or already transferred are the business of the neighbouring sectors, and may pass close to each other without a warning or a penalty. A transferred aircraft does still count against an aircraft you control, except during the first minute after you accept that aircraft.

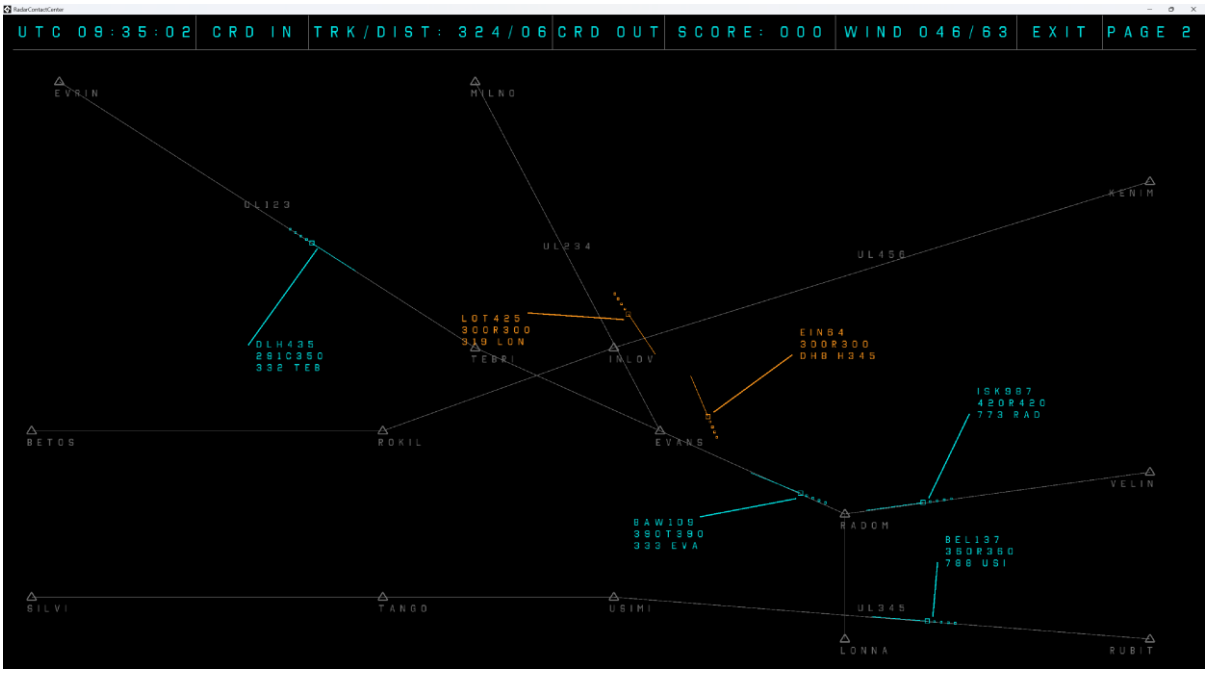


Figure 11 — An orange early warning: two aircraft converging, separation not yet lost.

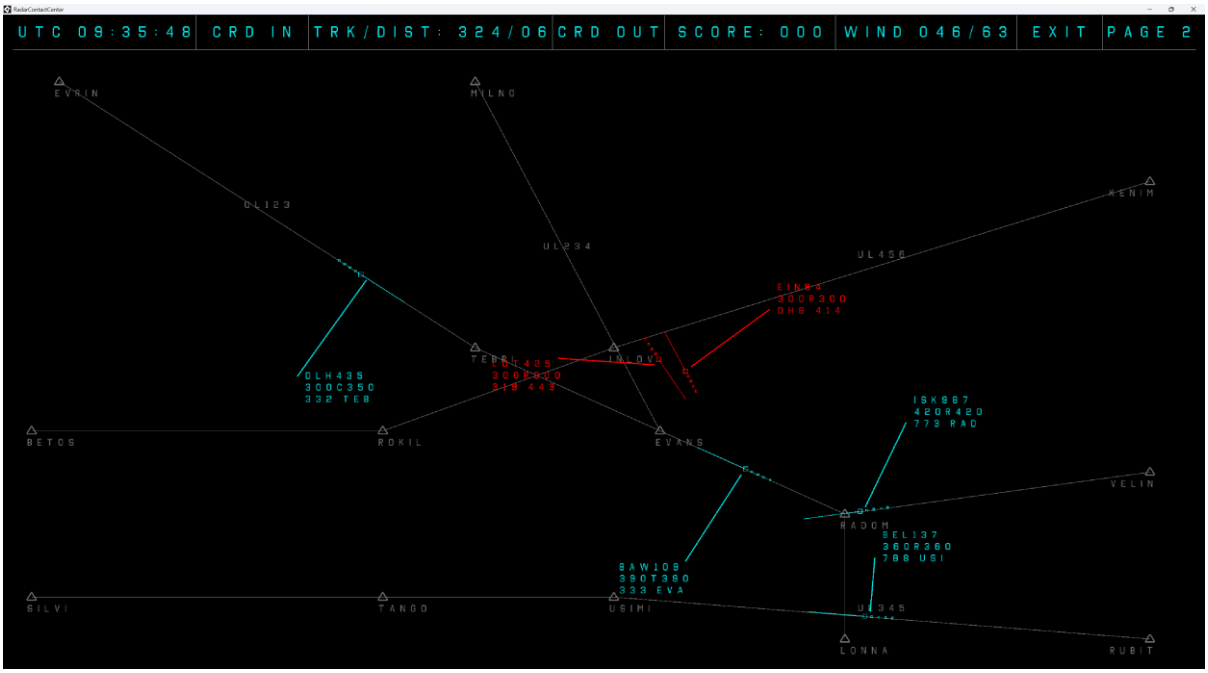


Figure 12 — A red conflict: less than 5 NM apart with less than 1000 feet between them.

8 Weather Simulation

Thunderstorm cells can be enabled in the main menu at a light or moderate level, giving two or four cells. Each cell is about 12 NM across and is drawn with its heaviest precipitation in the centre, shading out towards the edge.

Cells drift downwind at about a third of the upper wind speed. When one leaves the screen it is replaced by a new one entering from the upwind side, so the weather does not simply disappear over a long session. New cells are kept clear of the entry points, so that aircraft do not arrive already in weather — but a cell can drift over an entry point later, which is part of the challenge.

8.1 How crews react

Pilots will not fly into a thunderstorm. Two things follow from that:

- If you assign a heading or a direct that would take an aircraft through a cell within the next 20 NM, the crew refuse it: the readback says UNABLE HEADING DUE WEATHER or UNABLE DIRECT DUE WEATHER, and the turn is not flown. A level or speed sent in the same transmission still applies.
- If an aircraft is already heading for a cell and you do not turn it in time, the crew take their own avoiding action about 20 NM from the cell, turning 30 degrees towards the nearer side and tightening the turn further if needed. They tell you the heading they are taking, and you cannot assign a new heading until they report clear of weather.

An aircraft on its own avoiding heading has left its route, and its new heading may take it towards other traffic, so it is far better to vector around the weather yourself in good time.

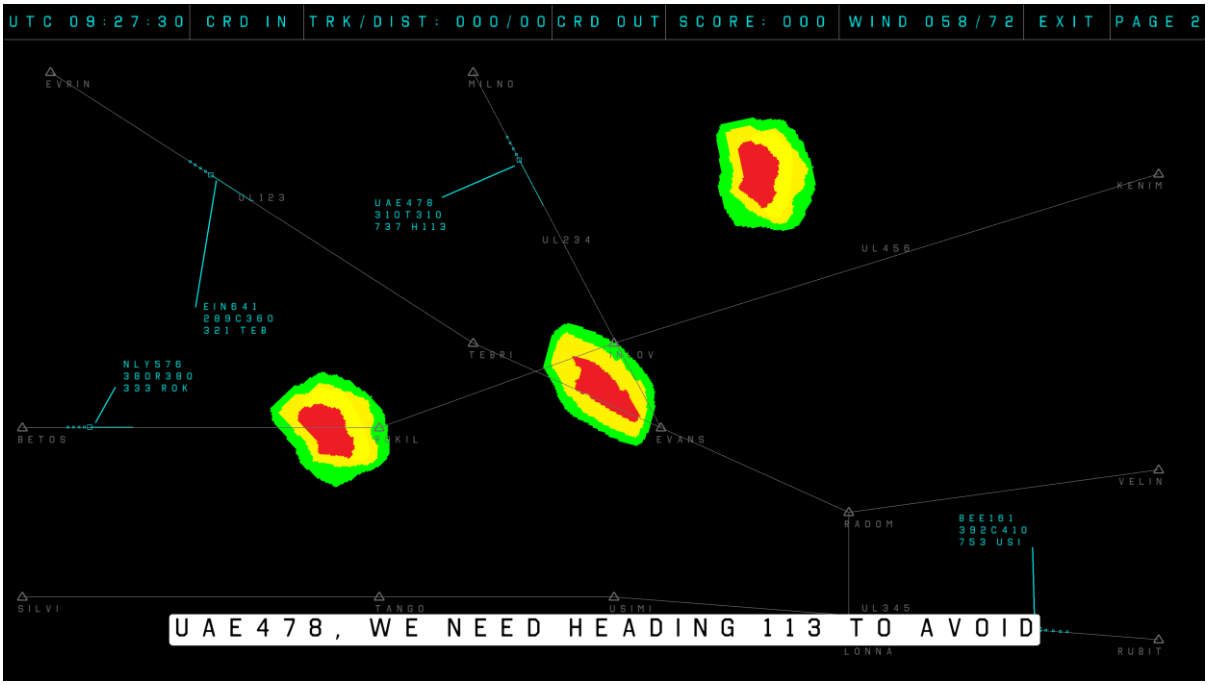


Figure 13 — A thunderstorm cell on an aircraft's route. The crew will turn away from it themselves if you do not vector around it first.

9 Emergencies

Occasionally a crew will declare an emergency — in this simulation always a pressurisation problem requiring an immediate descent. The aircraft turns red and announces a MAYDAY, then begins a rapid descent to FL100 at around 4000 feet per minute, accelerating as it goes.

An emergency aircraft will not accept a different level, so your job is to clear the airspace beneath and around it and let it go down. It cannot be transferred to another sector while the emergency is running, and it costs nothing for leaving without a transfer. There is no countdown and no time limit — handling it well is what counts.

Getting an emergency aircraft out through the bottom of your sector is worth 10 points.

10 Score System

Each session has a session score, and a total score accumulates across sessions. The total score is what unlocks sectors: Hemswell above 49 points, Reydon above 299.

Most of the score is earned when an aircraft leaves your sector, and only aircraft you accepted are scored at all. The individual bonuses for one exit are added together and only credited if the total is positive, so a badly handled aircraft costs you nothing rather than going negative. The penalty for failing to hand an aircraft over is the exception: it is always deducted, except for an emergency, which cannot be transferred.

Action	Points
Leaves the sector within 500 ft of its requested level (RFL)	+1
Leaves the sector within 500 ft of its coordinated exit level	+1
Leaves within 10 NM of its exit waypoint	+1
Leaves more than 20 NM from its exit waypoint	-1
Leaves more than 30 NM from its exit waypoint	-5
Entry level was coordinated	+1
Exit level was coordinated	+1

Action	Points
Descending aircraft leaves through the bottom of the sector	+1
Emergency aircraft leaves through the bottom of the sector	+10
Not handed over before leaving (always deducted; not for emergencies)	-3
Separation conflict, per radar update	-1
Loss of separation (ends the session)	-20

Your total score is only updated when you end a shift without saving. If you save, the game assumes you will continue later and the score is left alone until you finish the session properly. A saved game cannot be loaded again after it has been finished without saving, so the same session cannot be scored twice.

11 End of Shift

Ending a shift with EXIT offers to save the session. Either way you are shown the statistics for the shift:

- AIRCRAFT ACCEPTED — how many you took under control.
- HANDED OVER — how many you transferred properly to the next sector.
- REACHED RFL — how many you climbed or descended to their requested level. Aircraft that arrived already at their requested level are not counted, since they needed nothing from you.
- EXITED AS COORDINATED — how many left at the exit level you had agreed with the next sector.
- SEPARATION CONFLICTS — how many times separation was lost, counted once per occurrence rather than per radar update.
- WEATHER AVOIDANCES — how many times a crew had to take their own avoiding action around a cell.
- EMERGENCIES — how many were declared during the shift.

The same statistics are shown if a session ends through a loss of separation.

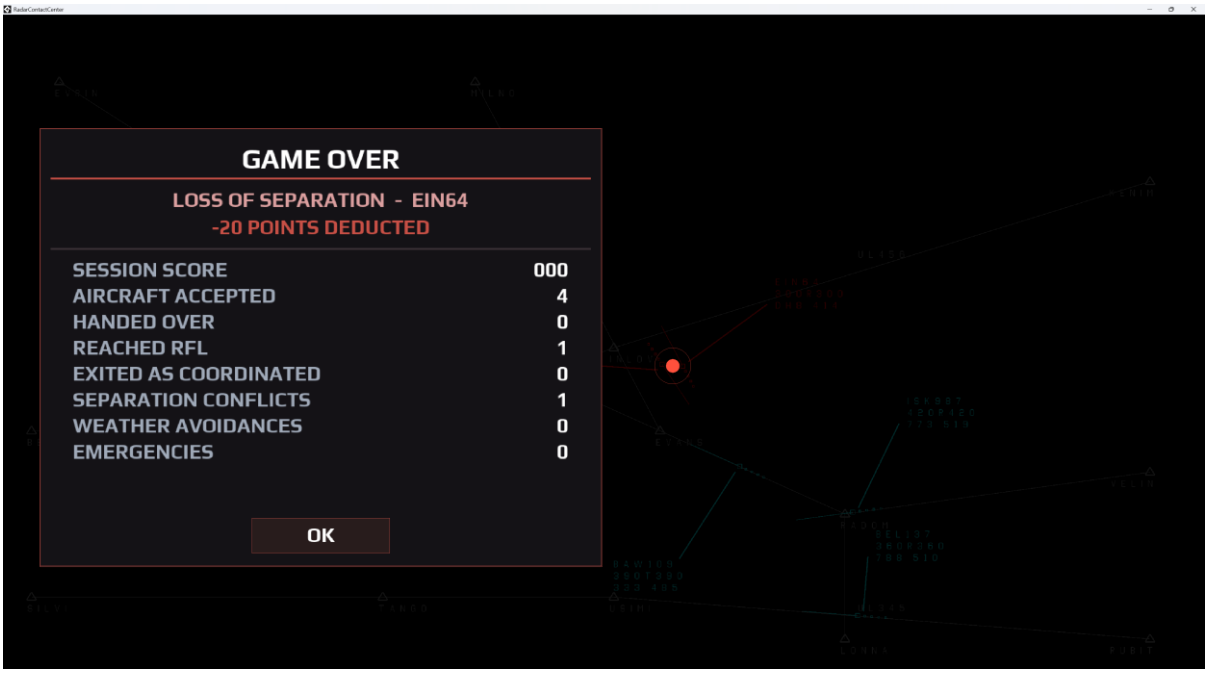


Figure 14 — The end of a shift. The statistics are shown over a frozen picture of the radar screen.

12 Save and Load

A session can be saved and continued later, even after closing the game. There is one save slot. Choosing EXIT and then YES stores the complete session: every aircraft with its route, level, clearance and coordination state, the weather, the wind, the traffic rate and the score so far.

Load in the main menu continues the saved session. All settings come from the saved game rather than from the menu. A session that ended through a loss of separation cannot be saved.

13 Sound

The game uses two sounds: a chime when a new aircraft is offered to you or coordination is required, and an alarm when separation is lost. Readbacks and system messages are shown as text near the bottom of the screen. There is no speech synthesis in this version.

14 About

Radar Contact Center is the sister game of Radar Contact, which simulates approach control at three airports. It is a remake of the Android game RadarContact Center.

All sectors, airways, waypoints and callsigns in this game are fictional. It is a game, not a training device, and nothing in it should be taken as representing real air traffic control procedures.

The version number is shown on the ABOUT page of the in-game help.

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