Course Manual

Product Version: 8.12

Document Version: 8.12

Contents

Preamble:

VV Enroute™ is a Windows-based Air Traffic Control trainer that teaches basic skills in surveillance-based Enroute/Area control. The training program is structured in incremental learning steps that will enable students to lean to manage intense and challenging traffic scenarios in a realistic environment. It is ideal for deployment at the commencement of a radar (or surveillance) ATC course, and will reduce training times and failure rates - and their associated costs. Skills taught include:

- Vectoring;
- Conflict recognition and resolution;
- Application of radar/surveillance separation;
- Sequencing;
- Interface usage;
- Task management;
- Prioritization;
- Communications and phraseology;
- Scanning.

VV Enroute™ provides many hours of challenging traffic scenarios on four platforms: *Basic MAZE*, *Complex MAZE*, *GRID* and *DIAMOND*. In the early scenarios the traffic complexity is selectable - aircraft may be added as the student becomes confident to handle them. Later scenarios present structured traffic flow but it can be dynamically changed to add variety and to provide exposure to a wide range of configurations. A random traffic generator provides an infinite variety of traffic flow for skills development.

The program includes a choice of regional airlines, to allow local preferences for aircraft callsigns to be selected in simulation. This enables familiarity with the telephony likely to be required for local traffic to be developed. Metric and imperial measures of distance, height and speed are available.

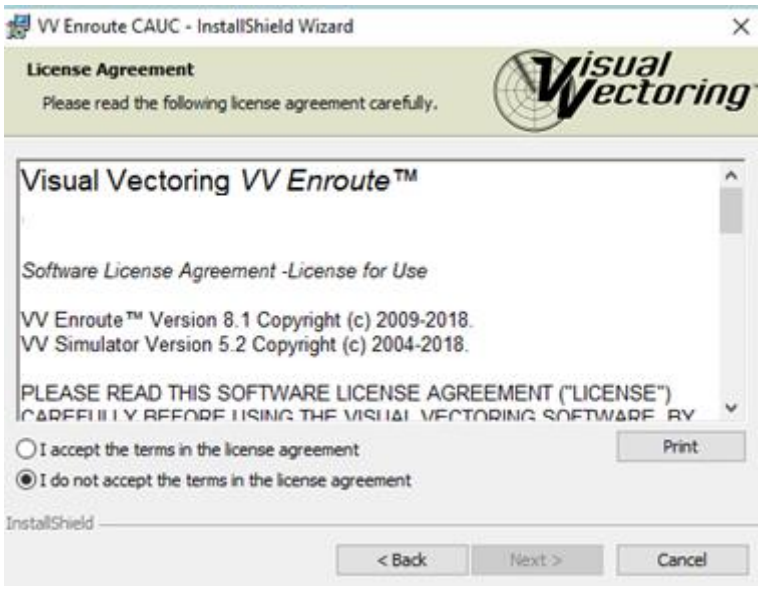
On all platforms traffic levels and complexity rise as progress is made through the simulator exercises. The portable and modular nature of the training package makes it suitable for delivery in a classroom or computer laboratory environment, or for learning in private. The training is student-paced.

Installation

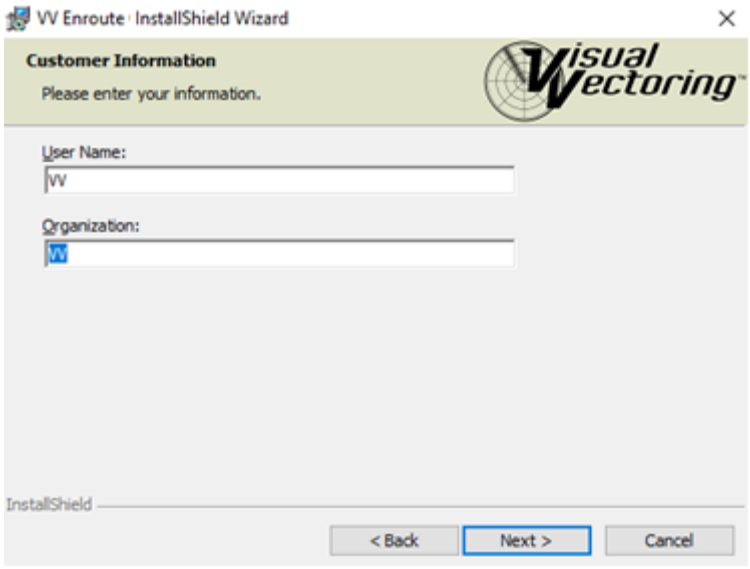
The program installation is supplied on a branded USB flash drive. The installer and executable have been digitally signed.

Once the installation is launched, the dialog below will be displayed. Click **Next**.:

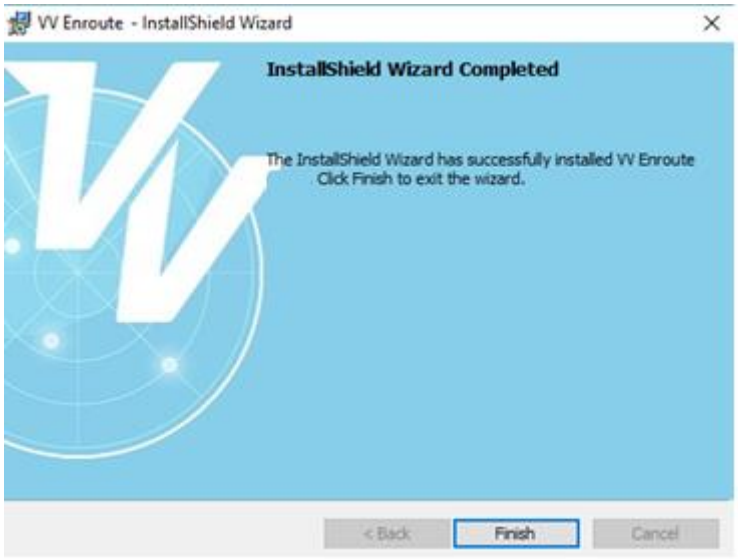
The licence agreement is presented. Click that you accept the terms in the agreement and then click **Next**.



If required, enter the user name and organisation. This information is not used by the program, so any information can be entered. Click **Next**.



The final panel below will appear. Click Finish to complete the installation.



Following this, a desktop shortcut will be created and there will also be a shortcut placed in the start menu under Visual Vectoring Pty Ltd.

Firewall

To run the networking function that communicates performance data with the *VV Management* program, it will be necessary to approve access of the program through the Windows firewall and/or any other firewall that may be installed.

The executable file to be allowed through the firewall is **vvenroute.exe**. See the *VV Management* Operating Manual for more information on this.

Features

The *VV Simulator* as implemented in *VV Enroute™* has been designed to support the acquisition of traffic management skills in a radar (or surveillance) environment. For this reason, a range of learning tools not normally present in operational systems is included. These include:

- Task-trainer functionality;
- Task completion prompts;
- Scoring functionality;
- On-screen feedback of sequencing and separation performance.

Full description on the operation of the simulator is available in the VV Simulator Operating Manual.

Learning Outcome

VV Enroute™ teaches a wide range of real, practical ATC skills and provides the facility to practise them to a high level of expertise. The student becomes competent at managing traffic arguably more complex than they are ever likely to encounter in real life.

Aside from skills acquisition, this has other significant benefits. Completion of the course serves to provide confidence to the student that he/she has the necessary cognitive capacity to cope with the unique mental demands of ATC work, and so promotes a vital factor in all learning - confidence. In many cases, traditional ATC does not foster confidence, because it is a high-pressure learning environment with very limited lesson time and even more limited opportunity for practice. The student 'sinks or swims'.

VV Enroute™ provides a training methodology that removes many of the impediments, principally rising skill requirements for busier traffic, and learning pressure that have, over time, caused traditional 'live' training to become less efficient and costlier. In *VV Enroute™* practical skills are passed from instructor to student via a computer-based interface. Training can thus be absorbed at an individual's own rate and then practiced without time limitation to high levels of proficiency. The basic skills acquired are then advanced to suit local rating requirements by traditional methods.

To summarise, the Learning Outcome of *VV Enroute™* is the practical ability to manage confidently a range of complex and realistic traffic scenarios in a Surveillance Enroute/Area Control environment. The outcome is achieved from a zero-skills base.

Training structure

All VV training follows a sequence widely-recognized as the optimum method of transferring practical skills from one person to another:

Training Lessons

Instruction presented as slideshows but run as MP4 movies. Full control of the *flow of information* is available by pausing and forward/reverse scanning the movie player.

Demonstrations

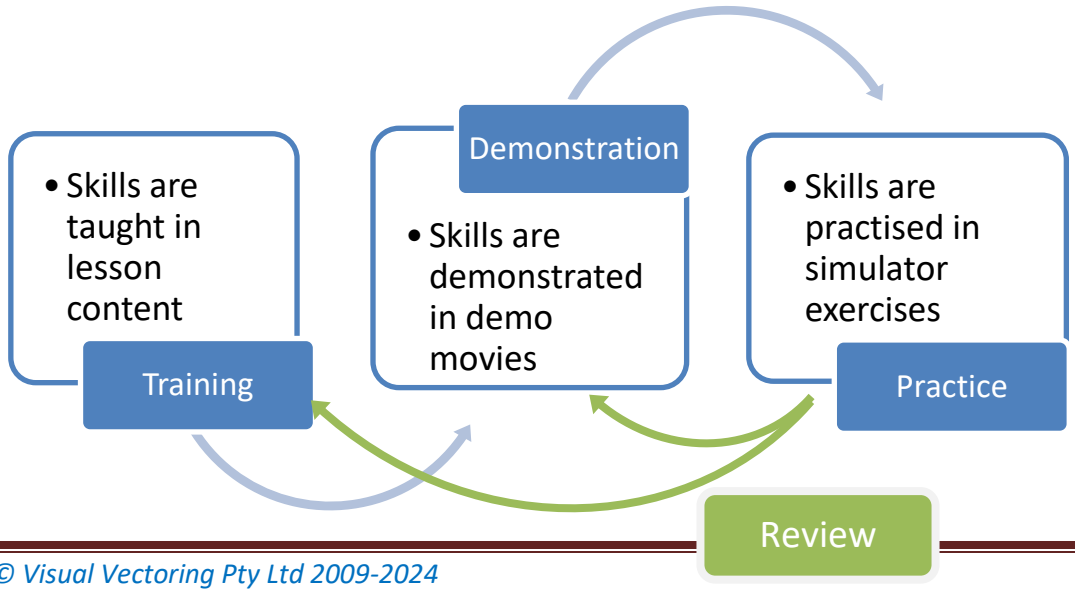
Screen-capture MP4 movie(s) of actual simulator performance of a selection of traffic scenarios from the upcoming exercise series, with audio. Graphic overlays of the radar relate the techniques being used to the lesson content. The movies can be paused and reviewed at will. The controller voice is replaced with a synthesised one. Aircraft responses are generated by the simulator.

Practice Simulation

A series of exercises to be performed on the incorporated simulator provides unlimited practice opportunity to establish control techniques to the level required to progress to the next Learning Step. A performance assessment (score) is provided at the end of each exercise to allow the student to self-assess his/her readiness to progress to the next.

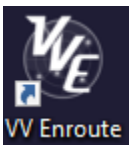
Review

Following self-assessment, the trainee is free to revisit the lesson and demonstration content to review and consolidate.

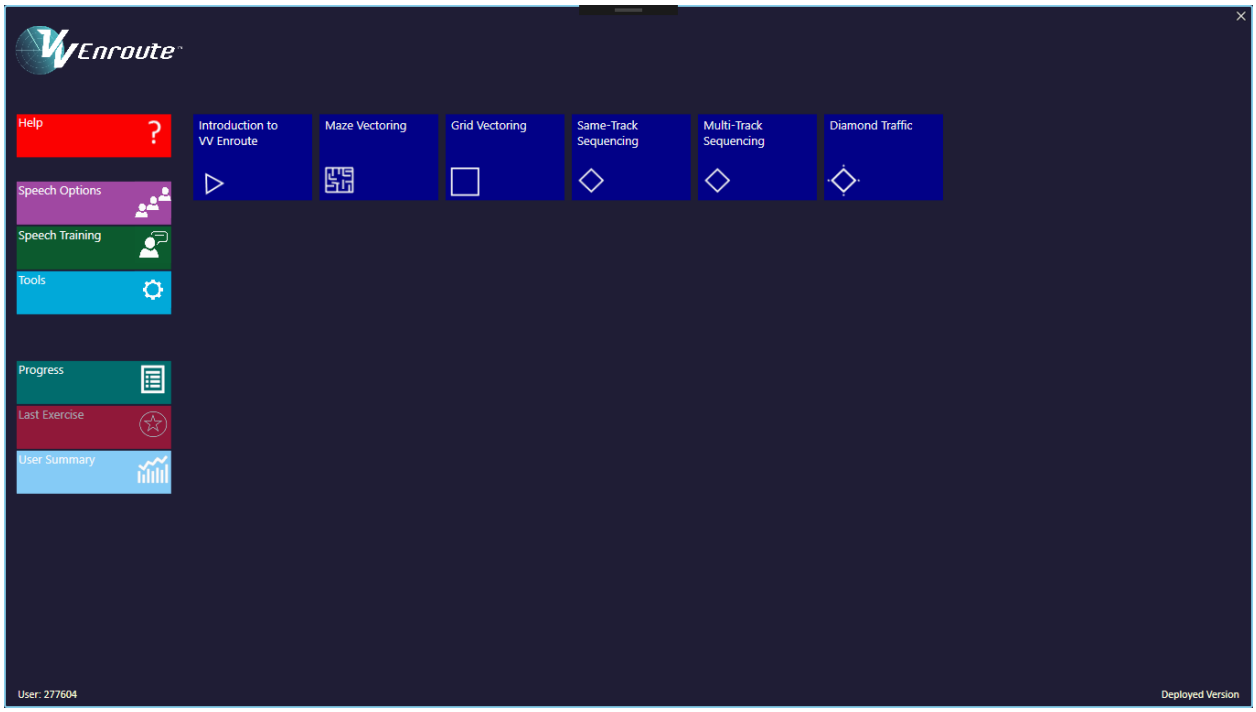


Main interface

The software installation will place a *VV Enroute™* icon on the computer desktop as below. Note that the caption may include a name of the licencing institution or company.



Double-clicking this will open the *VV Enroute™* Main Interface:



The Main Interface contains many tiles that allow course content to be displayed or executed, as well as other tiles that perform a utility function, such as setting up and training the speech recognition system.

Depending on the installation, the tiles present may vary slightly from the presentation above.

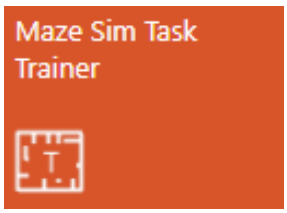
Course Tiles

Course Tiles fall into the following categories:

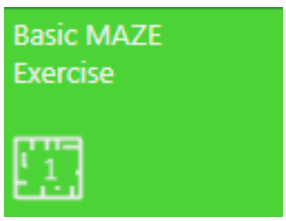
Module Tiles: Clicking on these tiles will display or hide the course tiles contained in this module.

Lesson Tiles: Clicking on this tile will run a lesson movie.

Demonstration Tiles: Clicking will run a demonstration movie.



Sim Task Trainer Tiles: Clicking will launch a Sim Task Trainer exercise.



Exercise Tile: Clicking will launch a simulator exercise.

Random Exercise Tile: Clicking will launch an exercise containing randomly generated traffic.

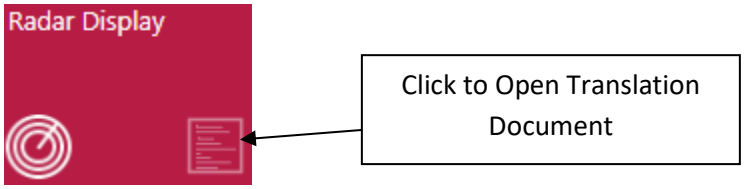
When a simulator exercise or lesson/demonstration movie has been completed, it is marked completed with a white triangle in the top right corner:

Provided the feature is enabled in the Tools Panel, an exercise or lesson/demonstration can be marked as completed by centre-clicking on the tile.

A module tile is shown as completed when all course elements beneath have been completed.

Translation Slides

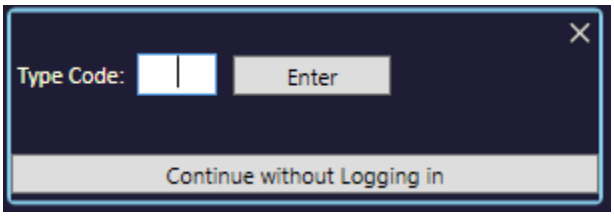
Depending on the installation, for some Course Tiles, a document is available in pdf format containing foreign language translation of the lesson or demonstration. This document may be opened by clicking the icon to the bottom right of the tile.



Student Credentials

Before running a simulator exercise or a lesson movie, opening the User Summary, the Last Exercise window or the Speech Trainer App, a user will be required to enter in a four-digit code to verify that they are the correct user.

The code is generated on the VV Management machine and will be provided by the Course Administrator.



Once the code is typed in, it will be remembered for the current session for the current Speech User.

Each student computer retains a recent copy of the passwords to that VVE can be used offline when the Management computer is not available.

For Exercises and Lessons, the user may proceed without logging in by clicking the **Continue Without Logging in** button. Performance records will be saved and transmitted to the Management machine, but this will need to be approved by the course administrator before inclusion in the Performance Database.

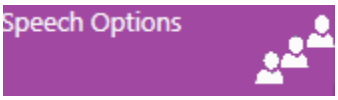
Utility Tiles

There are up to eight utility tiles that may be on display to the left of the main display.

Help Utility Tile

Clicking the red Help Utility Tile will open a folder containing electronic copies of this document and simulator and licencing information.

Speech Options Utility Tile

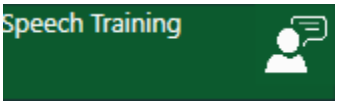


Clicking the Speech Options Utility Tile will open the Advanced Speech Options applet. This interface allows the following functions to be performed:

- Change of microphone input for speech recognition;
- Change of audio output for speech synthesis;
- Adjustment of microphone volume levels;
- Change of speech recognition engine in use;
- Selection of the active Speech User; and
- Training of the speech recognition engine using a generic script.

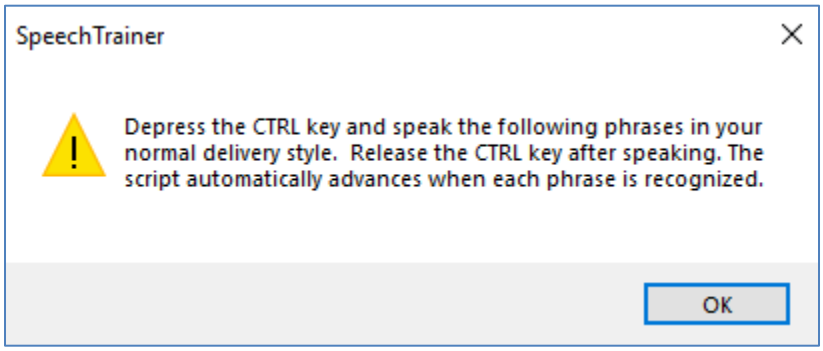
Full details on the use and applicability of the above functions are contained in the VV Simulator Operating Manual.

Speech Training Utility Tile

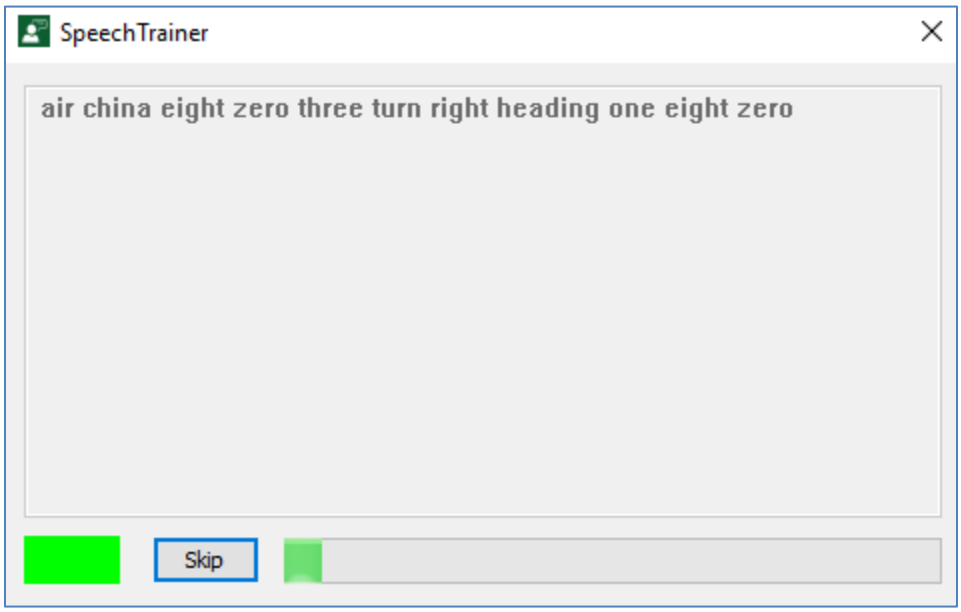


Clicking the green Speech Training tile will allow training of the speech recognition engine using a script that is targeted for *VV Enroute*.

Initially a set of instructions is displayed:

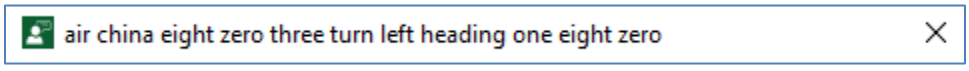


On clicking OK, the display below will appear:



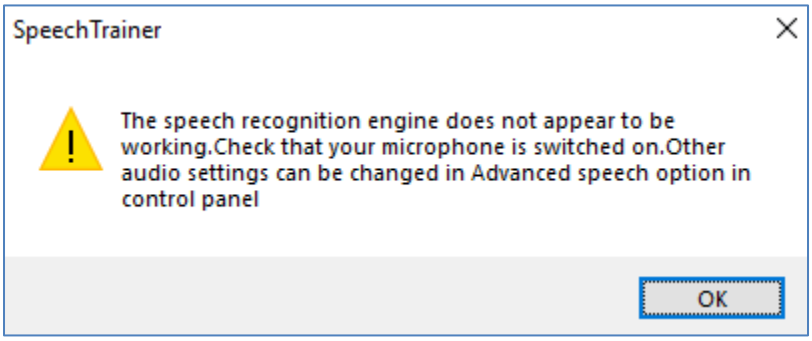
With the CTRL key depressed, the user should speak the displayed phrase. Once a spoken phrase is recognised, one of three events will occur:

1. The phrase recognised correctly matches the displayed phrase. The speech Recognition engine will be updated, and the next phrase will be displayed; or
2. A different phrase is recognised. This phrase will be displayed in the task bar as below. The correct phrase should be re-spoken until it is correctly recognised.



3. The speech is not recognised or there is insufficient acceptable audio. In this case, the task bar will show the (FALSERECO) indicator below. The correct phrase should be re-spoken until it is correctly recognised.

If the speech recognition engine is repeatedly receiving poor audio or unexpected phrasing the following dialog may appear. If so, consult the Appendices of the VV Simulator Operating Manual for advice on improving recognition performance.



Tools Utility Tile

Clicking the Tools Utility Tile will open the Tools Panel (see the section later in this document). This panel contains information and settings about the operation of the *VV Enroute*™ course. See the Tools section below for details.

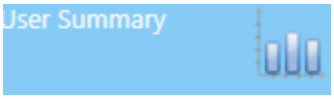
Progress Utility Tile

Clicking the Progress Utility Tile will open the Progress Report Window This provides the student with a graphic display of his/her progress through the VVE course.

Last Exercise Utility Tile

Clicking the Last Exercise Utility Tile will display a lengthy summary of the events and performance in the last simulator exercise that was run.

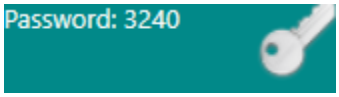
User Summary Utility Tile



Clicking the User Summary Tile will open the User Summary Window containing performance and completion data. This is intended as a reference only for the student. Primary data collection is performed by the *VV Management* tool.

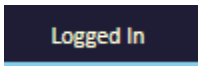
Password Utility Tile

The Password Utility Tile will appear when the Administrator has sent the password from the Management computer.



When the correct password has been entered, or a course module is commenced, the Password Utility tile will fade from view.

Once the correct password is entered, the text “Logged In” will appear at the bottom of the main course interface.



Speech User Name

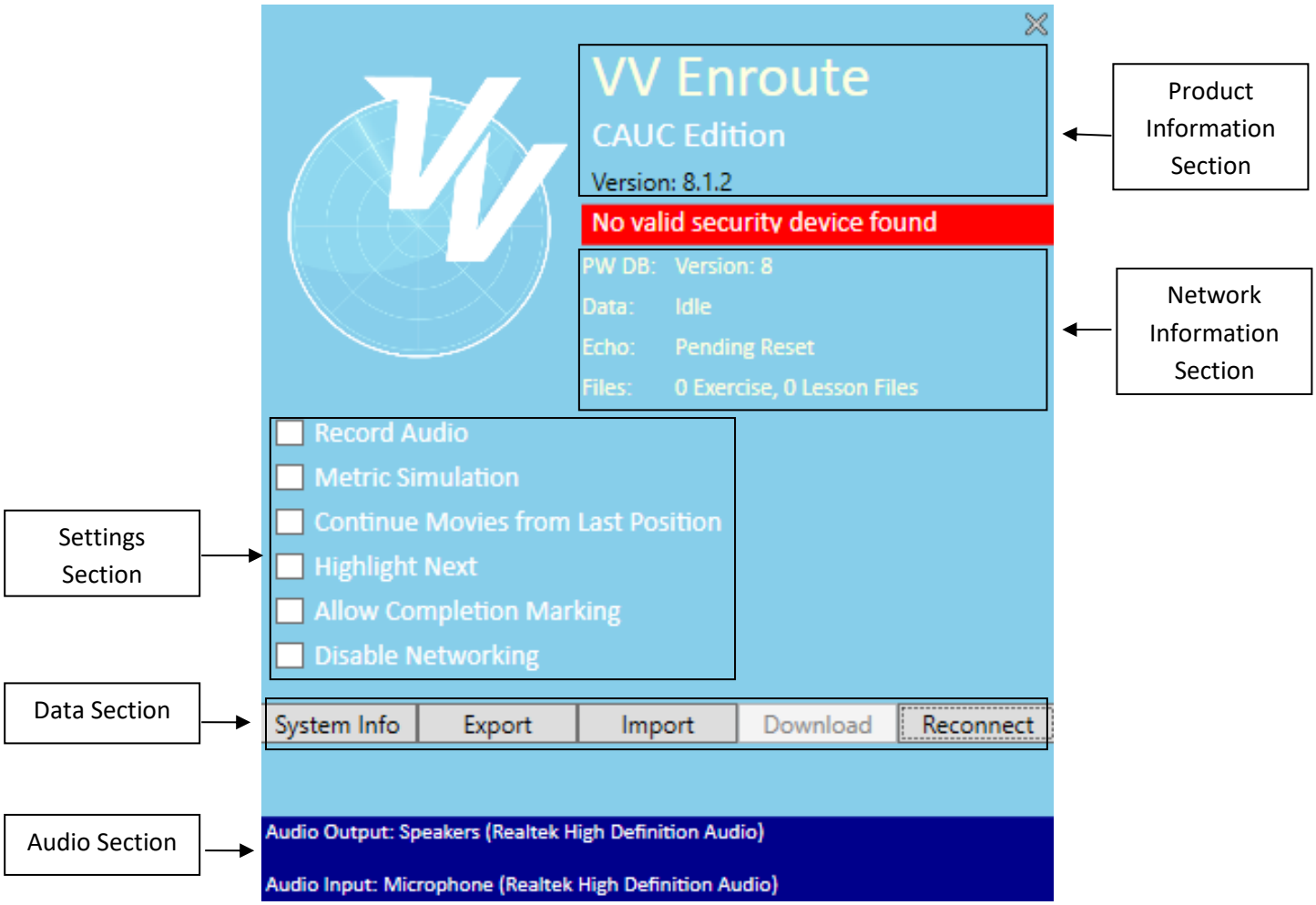
The Speech User Name is displayed at the bottom left of the Main Display. It is imperative that this text matches the students name or identifier as it is coded into performance records.

To change the Speech User Name, click the purple Speech Options Utility Tile. The Speech Properties panel will open. Click the Speech Recognition Tab and ensure that the correct name is selected from those available. Click New to make a new Speech user.

Full details on management and training of Speech Users is available in the VV Simulator Operating Manual.

Note that when the Speech User is changed the appropriate password will be required to be entered.

Tools Panel



Product Information Section

This section contains details about the product name, versioning and licensing information. Where used, the status of the security dongle is displayed in red. Clicking this item will show more information.

Network Information Section

This section contains information about the network communication with the VV Management application. Where the networking function has been disabled, or the functionality is not included in the installation, this section will show the networking as disabled.

PW DB

The password database allowing access to VV Enroute is regularly updated by the VV Management Computer. This label shows the current version of the database held on the local machine.

Data

The Data Network is used for sending performance data to the Management computer. The is the main network used to communicate information so that it may be stored and analysed. This field is coloured red when the network is disconnected.

Echo

The Echo Network is used to locate and verify the *VV Management* computer at load-up, and when the **Reconnect** button is pressed. When a connection has not been found, periodic attempts at reconnection are made.

Settings Section

This section contains settings for the general functioning of the *VV Enroute* program. Once set, a setting will be retained for the current user.

Record Audio

If set, audio transmissions from the controller will be recorded to file. These will be stored in the Personal Data Area.

Metric Simulation

All deployed versions of VV Enroute will be deliver in a standard system of measurement. The course and simulation use imperial (or non-metric) units for which distances are measured in nautical miles and altitudes are measured in feet, thousands of feet.

Some installations provide the options to simulate in an alternative metric system of measurement. Clicking this textbox will result in all simulator exercises using the metric system. Lessons and demonstration movies are delivered in the imperial system.

Continue Movies from Last Position

If selected, this setting will result in movies that have been previously watched to commence at the point at which they were closed.

Highlight Next

The Highlight Next setting will provide a flashing yellow frame around the module, lesson, demonstration or simulator exercise that is the first uncompleted course element.

Allow Completion Marking

Selecting this setting will allow course elements to be marked as completed. They will display the graphical indications of being completed. This feature may be disabled in some installations.

Disable Networking

If this setting is selected, the use of network connections to transfer performance and screen-capture information is disabled. This may be selected if the network option is not available with the installation, or network exceptions cause performance to be affected in simulation.

Data Section

System info

Clicking this button will result in the Windows System Information panel to be displayed. This application allows a detailed summary of the system attributes to be saved to a text file. This is normally used for debugging and troubleshooting purposes.

Export

The export function allows the performance data stored on the local machine to be saved to a flash drive or network disk for use by the *VV Management* app.

Import

The import function allows performance data from another machine to be saved on the local machine so that individual student metrics and performance graphs are available. This function would normally be used in lieu of a networked *VV Management* solution.

Download

This function allows all Performance Records to be downloaded from the *VV Management* computer to the local machine. This allows individual student metrics and performance graphs to be available for display. The latest version of the Password Database will also be downloaded. Use of this function should not usually be required because connected machines are updated with data on a regular basis.

Reconnect

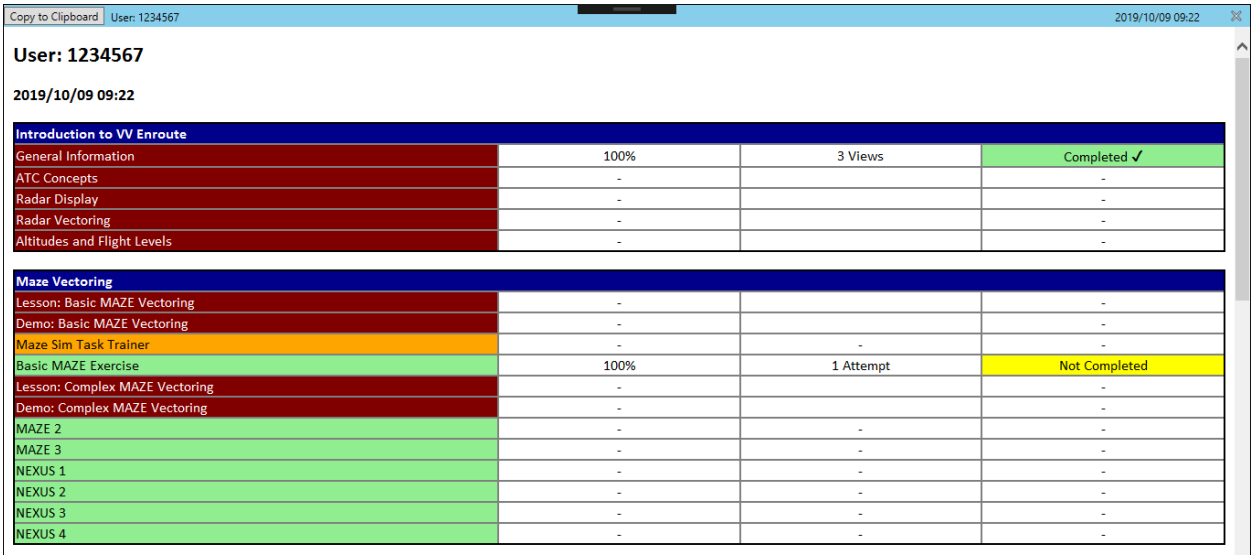
This button will become active when the Data network disconnects or fails to connect. When clicked, the Echo network is used to locate the server and make a reconnection. While disconnected from the network, all data is retained and will be sent to the Management computer the next time a connection is made.

Audio Section

This section displayed a read-only text description of the audio output used for the speech synthesis system and the audio input used for the speech synthesis system.

Progress Report Window

The Progress Report window is opened by clicking on the Progress Utility Tile on the main interface. It provides the user with a pictorial representation of progress through the course, with indications on how much content has been covered.



Introduction to VV Enroute			
General Information	100%	3 Views	Completed ✓
ATC Concepts	-		-
Radar Display	-		-
Radar Vectoring	-		-
Altitudes and Flight Levels	-		-

Maze Vectoring			
Lesson: Basic MAZE Vectoring	-		-
Demo: Basic MAZE Vectoring	-		-
Maze Sim Task Trainer	-	-	-
Basic MAZE Exercise	100%	1 Attempt	Not Completed
Lesson: Complex MAZE Vectoring	-		-
Demo: Complex MAZE Vectoring	-		-
MAZE 2	-	-	-
MAZE 3	-	-	-
NEXUS 1	-	-	-
NEXUS 2	-	-	-
NEXUS 3	-	-	-
NEXUS 4	-	-	-

Last Exercise Window

The Last Exercise Window is opened by clicking the Last Exercise Utility Tile on the main interface. It opens a summary, generated by the VV Simulator, of the last exercise that has been completed.

Summary:

Record Identifier	YOGKTZZM829DBDY
Name	Not Designated
Extra Name	Not Designated
Speech Name	1234567
Student ID	Not Designated
Windows Environment Name	micha
Validated User?	True
Group	Not Designated
Product	VVE
Sector	BMaze
Exercise Grouping	MAZE
Exercise Name	MBSTT
Start Date/Time	2019/10/09 09:26
Simulation Minutes (total)	0.6
Termination Reason	Manual
Completed?	False
Success?	False
Passed?	False

In the Detail section, information about how the final score was calculated as well as pointers for improved performance.

User Summary Window

The User Summary Window is opened by clicking on the User Summary Utility Tile on the main interface.

It provides graphical feedback for progress through the VVE course for the current Speech User.

Nine charts are provided:

- Total time in simulation, grouped by module;
- Completion of simulator exercises, grouped by modules;
- Overall score in simulation, weighted by time in exercise and grouped by module;
- Separation score in simulation, weighted by time in exercise and grouped by module;
- Sequencing score in simulation, weighted by time in exercise and grouped by module;
- Speech recognition outcomes;
- Lesson percentage completions;
- Lesson attempts;
- Lesson time watching.

The charts may be individually copied to the clipboard by clicking the Clip button to the left of the chart title. The entire page can be copied to the clipboard by clicking the Clip button to the top left of the window.

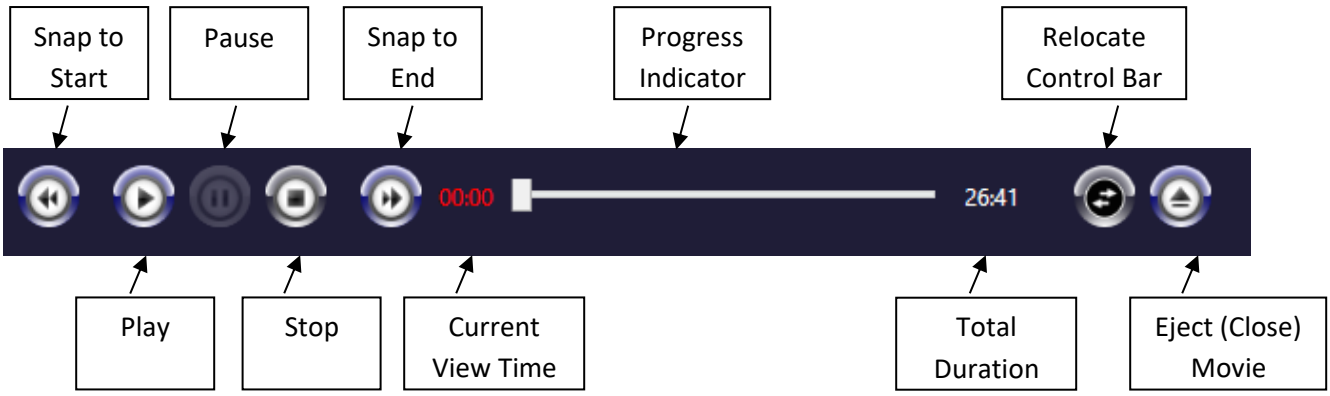
Movie Player

Lessons and Demonstrations are presented as slideshows that play as a movie. Depending on the installation, the movies may play in the embedded *VV* movie player, or on the default media player that has been installed.

When loaded, a lesson or demonstration will always revert to the beginning of the movie unless the Continue Movies from Last Position checkbox in the Tools Panel is selected. In this case, movies will be primed to the last part of the movie that was watched.

Control Bar

The *VV* Movie player contains a modal Control Bar (below) that is used to control the movie playback. The Control Bar will fade out of view when the exercise is started. It will fade into view when the exercise is paused or when the mouse is moved over its position.



Key Commands

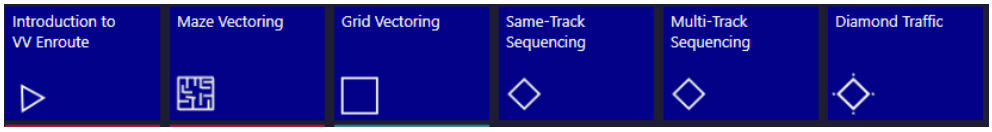
The *VV* Movie Player will respond to the following keyboard commands:

Key	Action
Space	Start/Pause
Page Up	Rewind by one second (when paused)
Page Down	Move forward by one second (when paused)
Esc	Eject (close) the movie
Right Arrow	Move forward by three seconds
Left Arrow	Reqinf by three seconds

Course Content

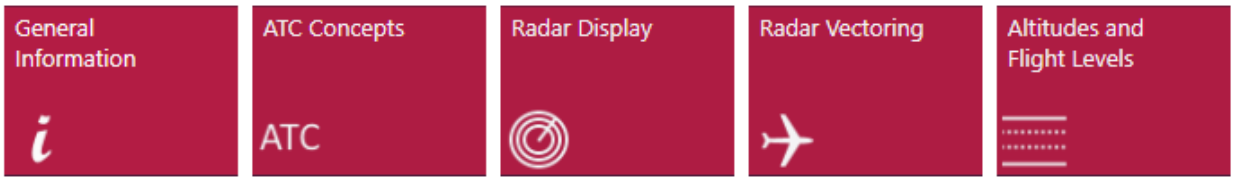
The following section details the content of the VV Enroute course. It is available in tabulated format in Appendix 3, which contains the full course summary, along with abbreviation used in reporting and expected durations.

There are six training modules in the *VV Enroute* course. These are accessed by clicking on a module tile at the top of the Main Interface:



Introduction to *VV Enroute*™:

The first module, Introduction to *VV Enroute,* contains five short lessons:



General information

Introduces the student to the training platform and course structure. Students should be encouraged to study the information in detail, to ensure correct progress through the *VV Enroute™* training.

ATC Concepts

This lesson introduces beginners in Air Traffic Control to fundamental insights about the ATC system's functioning in broad terms and relates this program to actual airspace configurations.\

Radar Display:

This lesson details the radar display used in *this course*. Items of information that comprise the display for aircraft are detailed.

Radar Vectoring:

In this lesson, the rationale behind the issuance of a turn instruction to an aircraft is explained. The practical considerations of direction and heading selection, timing and wording of the instruction are emphasized in the context of the required outcome. Integrated movies (with audio) relate the theory to its practical application.

Altitudes and Flight Levels:

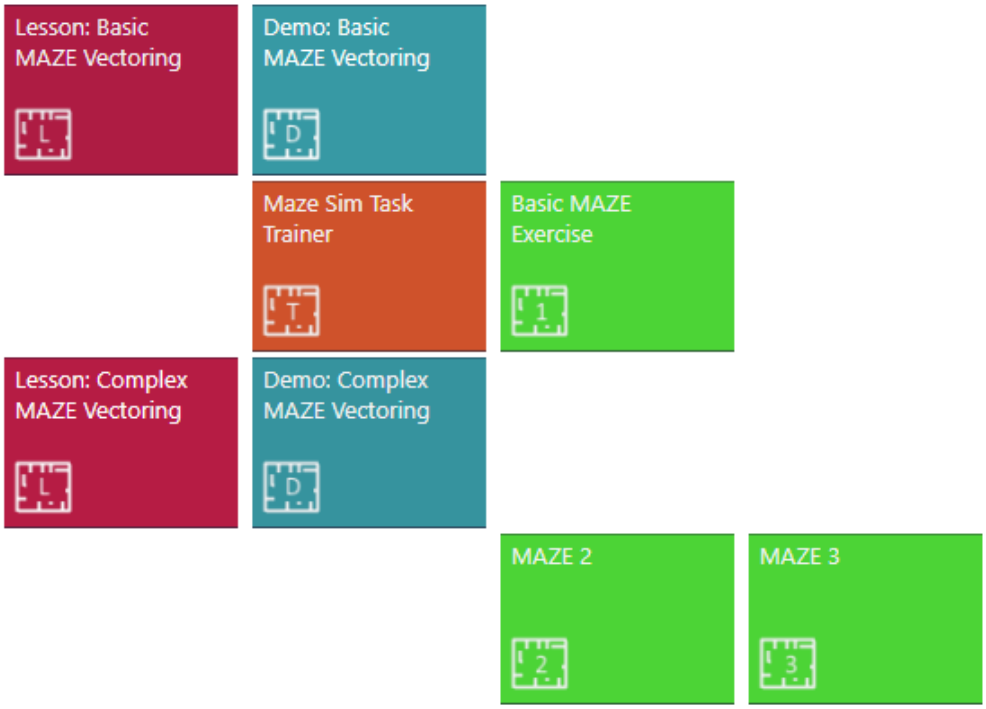
In this lesson, various aspect of level display and selection is detailed, including

- The distinction between and altitudes and Flight Levels
- Level displays in the aircraft label
- Technique for changing the Cleared Level label component.
- Radio phraseology for level change instructions
- Vertical Separation standards

Lesson running times indicated in Appendix 3 assume no pauses or rewinds, but most students require time to absorb the training content - even repeating lessons in full.

MAZE Vectoring:

The *MAZE Vectoring* module contains two lessons, two demonstrations, a Simulator Task Trainer and three simulator exercises:



Lesson: Basic MAZE Vectoring

Teaches the theory of vectoring aircraft around a simple track called a maze. Then follows detailed information on how to configure and train the Speech Recognition for an individual student's use in simulation. (22:40).

Demo: Basic MAZE Vectoring:

A screen capture movie of the first *MAZE* exercise, with audio.

MAZE Simulator Task Trainer (STT):

A simple one-aircraft MAZE exercise designed to teach the student the use of the simulator.

Basic MAZE Exercise:

The student's first experience with the simulator. Ten aircraft are available and are manually added as confidence rises. The exercise will self-terminate twenty minutes after the last aircraft is added and a score window will appear. Students should be encouraged to repeat the exercise at least once, but with the map rotated by 40-50 degrees.

Lesson: Complex MAZE Vectoring:

Teaches the theory of vectoring aircraft around a figure-8 path that produces crossing conflicts between aircraft that are to be resolved with level changes.

Demo: Complex MAZE Vectoring:

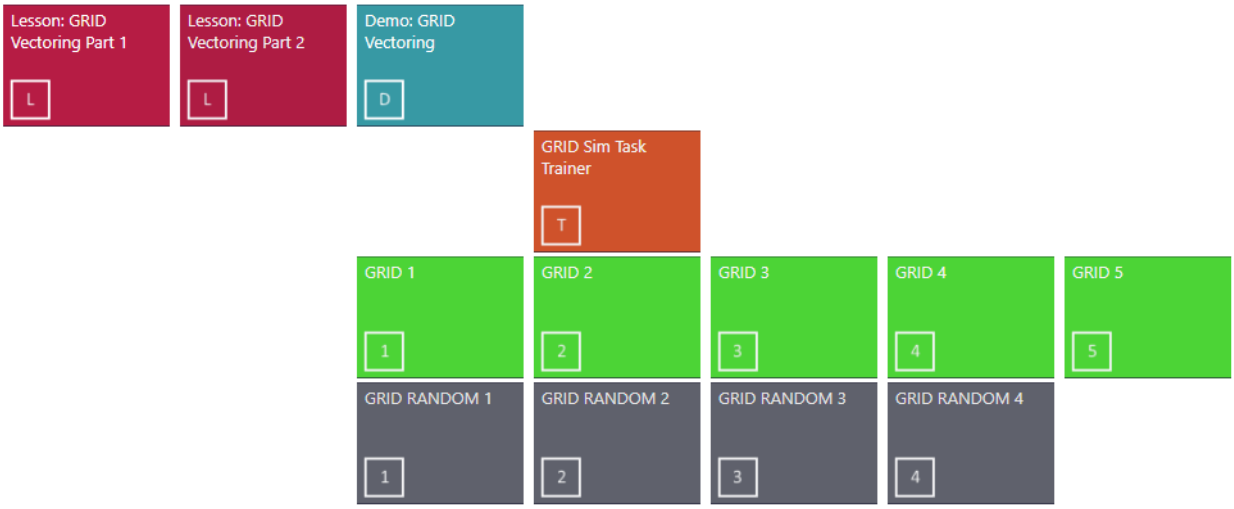
A screen capture movie of Exercise *MAZE* 3, with audio.

Exercises: MAZE 2 and 3:

Again, ten aircraft are available in each exercise. In (2) the aircraft are at low altitudes and speeds; in (3) they are higher - and therefore faster. After completing each exercise at least once they should be repeated with the map rotated 30 degrees – to alignment 210 or 150 for example. Larger angles than this tend to compress the long axis of the map excessively. A score is displayed at the completion of each run of an exercise. It should not be taken as a definitive evaluation of performance (that can only be done by observation of performance by an experienced instructor) but rather as a base for comparison between runs of an exercise, for the student's information.

GRID Vectoring:

In this module, the management of cruise-level traffic through a typical Enroute/Area sector of airspace is explained and implemented.



Training is presented in two lessons:

Lesson: GRID Vectoring Part 1: Conflict recognition.

Teaches the geometry of the crossing of the flight paths of two aircraft and how it can be determined that the crossover will not cause a loss of standard minimum separation.

Lesson: GRID Vectoring Part 2: Conflict resolution.

Having determined that two aircraft cannot remain on pilot navigation as they cross – separation will be lost at crossing – sound methods of resolving the conflict are required. This lesson describes vectoring routines for conflict resolution. Vertical solutions – changing the level of one or both aircraft – are not considered. Those methods are simple to implement and have been used in Complex *MAZE* exercises. Instruction in this lesson uses traffic from the first simulator exercise, *GRID* 1, at the teaching platform.

Demo: GRID vectoring:

A screen-capture movie of the running of Exercise *GRID* 1, with graphic overlays linking to the theory taught in the Lesson Part 2.

GRID Sim Task Trainer:

A second **Sim Task Trainer** is provided at this point, to teach the simulator controls not previously required.

Exercises: GRID 1 to 5:

Five simulator exercises of traffic on the GRID platform, gradually rising in complexity.

Exercises: GRID Random 1 to 4:

Four exercises containing traffic that is randomly generated, again rising in difficulty. In these exercises aircraft from selectable airlines can be used, for student familiarisation with local callsigns.

Same-track sequencing

The sequencing of aircraft, that is, the establishing a required distance spacing between them as they pass a geographical location, is covered in this module.

Training is presented in two stages, first with pairs of aircraft then with groups of four. A custom airspace structure called *DIAMOND* is used as the training platform. It has four Exit Gates, each with four tracks to it. Structured exercises present aircraft on all sixteen tracks for sequencing.

Lesson: 2 aircraft:

Teaches the fundamental act of sequencing, the setting of required distance spacing between two aircraft on the same track to an exit gate, using vectoring methods only. Aircraft from a forthcoming simulator exercise are used.

Demo: 2 aircraft:

Shows examples of the sequencing of a variety of pairs of aircraft to a variety of gates, with audio of controller/pilot communications.

DIAMOND Sim Task Trainer:

Teaches a range of simulator controls not previously required.

2-aircraft exercises 1 to 4:

Four simulator exercises for the development of basic sequencing skills. Each exercises features groups of two aircraft on each of four tracks to one of the four exit gates.

Lesson: Multiple aircraft:

Increases the number of aircraft to be sequenced to a gate to four. Techniques for vectoring groups of aircraft on the same track into an organised, correctly-spaced trail as they pass the gate.

Demo: Multiple aircraft:

Movie display of the sequencing of groups of four aircraft from the simulator exercises to be performed.

Multiple-aircraft exercises 1 to 4:

Four simulator exercises, rising in complexity, featuring groups of four aircraft on each of four tracks to each of the four gates.

Multi-track sequencing:

This module extends sequencing training to include aircraft In all combinations on multiple tracks to a common gate.

A similar format is employed: pairs of aircraft on different tracks followed by groups of four, on any configuration of four the tracks.

Lesson: 2 aircraft:

Teaches the fundamental act of sequencing, the setting of required distance spacing between two aircraft on the different tracks to an exit gate, using vectoring methods only. Aircraft from a forthcoming simulator exercise are used.

Demo: 2 aircraft:

Shows examples of the sequencing of a variety of pairs of aircraft on different tracks to a variety of gates, with audio of controller/pilot communications.

2-aircraft different track exercises 1 to 4:

Four simulator exercises for the extension of basic sequencing skills. Each exercises features groups of two aircraft on different tracks to the four exit gates.

Lesson: Multiple aircraft:

Increases the number of aircraft to be sequenced to a gate to four. Techniques for vectoring groups of aircraft on multiple tracks into an organised, correctly-spaced trail as they pass the gate.

Demo: Multiple aircraft:

Movie display of the sequencing of groups of four aircraft from the simulator exercises to be performed.

Multiple-aircraft, different tracks, exercises 1 to 4:

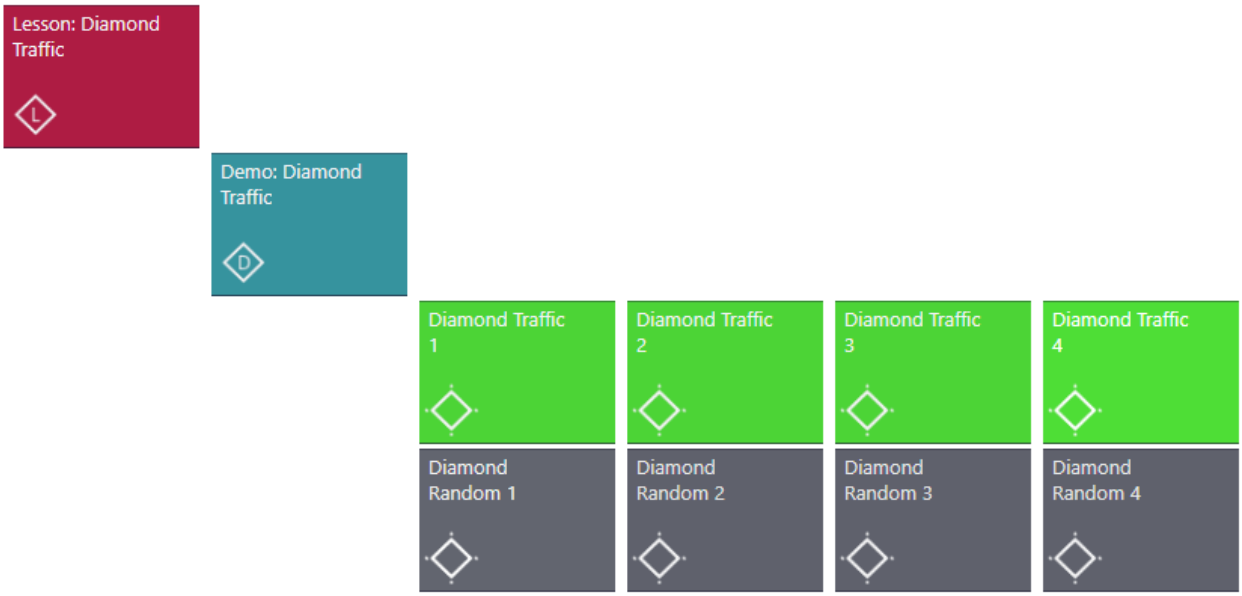
Sequencing sets of multiple aircraft inbound to the four gates on different tracks.

DIAMOND Traffic:

The final module combines all the skills learned in earlier modules and presents complex traffic simultaneously on all tracks to all gates in various configurations. It is a very realistic simulation of high-density Enroute traffic and is an ideal preparation for formal ATC training.

In *DIAMOND* Traffic the student is required to:

- Accept aircraft hand-offs from all four adjoining Sectors;
- Recognise all conflicting traffic along an aircraft's flight path to its exit gate;
- Resolve all conflictions, either by radar vectoring or vertical separation;
- Ensure all aircraft are *at* the specified level as they pass their exit gate;
- Sequence aircraft through multiple gates, with specified spacing;
- Maintain a correct display of every aircraft's current Cleared Level;
- Pass control of aircraft to the appropriate adjoining Sector prior to the exit gate;
- Control aircraft using standard radio transmission phrases;
- Manipulate the interface to display correct data associated with all of the above processing.



Lesson: *DIAMOND* Traffic:

A storyboard analysis of Exercise *DIAMOND* Traffic 4 showing the thought processes and control actions typically employed to manage busy traffic in the *DIAMOND* Sector.

Demo: *DIAMOND* Traffic:

Screen-capture movie of the running of Exercise DIAMOND 3 with graphic overlays to link the actions taken to the theory of vectoring and sequencing learned during the course.

DIAMOND Traffic Exercises 1-4:

Challenging exercises rising in complexity and requiring high levels of expertise in all aspects of the skills that have been covered in the course.

DIAMOND Random Exercises 1-4:

Randomly-generated traffic at four levels of complexity, presenting limitless scenarios for skills development and practice.

Performance Measurement

Note: The evaluation of performance of ATC Radar Control is a very complex process. Ultimately, it is the observance of a student's actions by a qualified instructor or professor that determines suitability for the job. The aim of the scoring system of the VV Simulator is to measure some of the definable aspects of performance for comparison and assessment of progress in learning, both *by* a student and *between* students. No claim is made by Visual Vectoring that the scoring system gives an absolute indication of the suitability or otherwise of a student for live Air Traffic Control without confirmation from a suitably-qualified training expert. It is recommended that end-users use a moderation system to confirm any scoring system matches with performance capability that has been assessed by a qualified instructor.

Performance Records

Each time a simulation exercise is run, or a lesson movie is watched, details about the event are stored in a Performance Dara Record file.

These files contain information about the student's performance during the activity. They may be transmitted or saved to the *VV Management* program for collation and analysis. See the *VV Management Operations Manual* for further details.

Termination Panel

After the simulator exercise has been completed the Termination Panel will display some feedback on performance, provided the exercise has been run for at least one minute. Most often, a score will be reported in up to five competencies. These are:

- ATC;
- Interface;
- Separation;
- Sequencing; and
- Vectoring.

Algorithms for calculating the score in each of these competencies are outlined below.

Where used, the score for each competency is weighted and combined to produce an overall score.

A summary of the student's performance is displayed. The specific details that are recorded are dependent on the exercise.

Algorithms for calculating the score in each of these competencies are outlined later in this document.

Where used, the score for each competency is weighted and combined to produce an overall score.

For exercises that have been run for a minimum period of time (normally one minute), a Detailed Feedback panel is available by clicking the top button in the Feedback Panel. This panel will provide a detailed summary of metrics captured during the exercise.

Completion

For an exercise to be completed, the following criteria must apply:

- For Maze exercises, the student must run the exercise for 20 minutes with all aircraft added to the Maze. The exercise length for Maze exercises is 30 minutes, so this effectively means all the aircraft must be added within the first ten minutes, or the exercise cannot be completed;
- For Task Trainer exercises, at least 80% of the tasks must be completed;
- For other exercises, the simulator must be run for 80% of the design length of the exercise. This does not include repeated time from backstepping the simulator.

Success

For an exercise to be marked as successful, the following criteria must apply:

- Score in each individual competency (ATC, Interface, Sequencing, Separation and Vectoring) must not be less than 70%; and
- Overall score must not be less than 80%.

Passing

For a student to be deemed as having passed the exercise, the following criteria must apply:

- The exercise must be Completed; and
- The exercise must be Successful.

Weights

Sim Task Trainers:

For Sim Task Trainers, there are no individual competencies scored only an overall score. The overall score is the percentage of tasks that have been completed. This score is used to determine Completion, Success and Passing.

Maze Exercise

For Maze and Nexus exercises, the ATC, Vectoring and Interface competencies are scored. The weighting is as below. Note that Separation is not scored in the Basic Maze exercise.

Competency	Scoring Weight
ATC	0.5
Interface	0.5
Separation	1.0
Vectoring	1.0

GRID Exercises

For the GRID exercises, the ATC, Interface, and Separation competencies are scored. The weighting is:

Competency	Scoring Weight
ATC	0.8
Interface	0.8
Separation	1.0

DIAMOND Exercises

For the DIAMOND exercises, the ATC, Interface, Separation and Sequencing competencies are scored. The weighting is:

Competency	Scoring Weight
ATC	0.8
Interface	0.8
Separation	1.0
Sequencing	1.0

ATC Competency:

Description

The ATC Competency is designed to capture the student's performance in performing general ATC tasks, other than separation and sequencing. This is generally related to the service provided to the aircraft, such as ensuring that the aircraft is assigned appropriate descent, kept in controlled airspace and

Applicability

The ATC Competency not scored in Task Trainer or Target exercises. It is scored in all other exercises.

Metrics

The following metrics are used in scoring the ATC competency:

Metric	Details
Pauses	The number of times the exercise was paused.
Aircraft 'Killed'	The number of aircraft removed from the exercise.
Requests	The number of aircraft requests made. This is normally when descent is needed because the aircraft is too high when close to the airport. This is unlikely to occur for VVE.
Bad Phrases	The number of bad phrases that were issued in the exercise. Examples: • An aircraft is cleared direct to a position that is not on its route; • An aircraft is cleared direct to a point it is already tracking to; • An aircraft is given descent to a level above; • An aircraft is given climb to a level below; • An aircraft is issued a level outside the Maze; • An aircraft is issued a right turn to a heading that is to the left; • An aircraft is issued a left turn to a heading that is to the right..
Frequency Changes Incorrect	The number of frequency changes (transfers) incorrectly issued in the exercise.
Exit Levels Incorrect	The number of outbound aircraft tracks that were transferred to the next sector assigned an incorrect level.
Handovers on Vector	The number of handovers with aircraft still on a vector.

Updates ALT	The number of individual radar/surveillance updates when an aircraft was outside controlled airspace. This is unlikely to occur for VVE.
Updates Outside Maze Vertically	The number of individual radar/surveillance updates outside the vertical confines of the Maze, and not assigned a level inside.
Updates Slow	The number of individual radar/surveillance updates for which the simulator clock speed has been slowed.

Algorithm

The following table describes how the ATC score is calculated:

Metric	Deduction	Note
Pauses	0.25% for each Pause during the exercise.	One Pause is allowed without penalty.
Aircraft 'Killed'	7.5% is deducted for each aircraft 'Killed' (removed from the exercise).	Maximum deduction: 40%. Note that version 8.8 corrected bug where this was not deducted.
Requests	1.5% is deducted for each request (such as a descent or intercept request).	Unlikely for VVE.
Bad Phrases	1.5% is deducted for each Bad Phrase detected.	
Frequency Changes Incorrect	1.5% is deducted for each incorrect frequency change.	
Handovers on Vector	2.5% is deducted for each time an aircraft was handed over while still being vectored.	
Exit Levels Incorrect	1.5% is deducted for each incorrect exit level.	
Updates ALT	0.1% is deducted for each individual aircraft surveillance update detected outside controlled airspace.	Not in Maze exercises, Maximum deduction: 15%; Unlikely for VVE.
Updates Outside Maze Vertically	0.1% is deducted for each individual aircraft surveillance update detected outside the Maze vertically (and not assigned a level within).	Maze exercises only; Maximum deduction: 25%. An allowance of five updates is provided to issue the level.
Updates Slow	15% is deducted if more that 25% of the exercise time was conducted at a reduced clock speed.	

Interface Competency:

The Interface Competency is designed to capture the correct interaction with the label interface, such as keeping label contents up to date, and handing off and accepting aircraft ion t timely fashion.

Applicability

The Interface Competency not scored in Task Trainer or Target exercises. It is scored in all other exercises.

Metrics

The following metrics are used in scoring the Interface Competency: This is a subset of the full range of metrics recorded by the VV Simulator. A list of these is available in the Operating Manuals for the VV Simulator and for VV Management.

Metric	Description
Handovers Incorrect	The number of outbound aircraft tracks that were handed over to the incorrect sector.
Updates CL Incorrect	The number of individual radar/surveillance updates for which Cleared level in the label did not match the assigned level.
Updates CL Highlight	The number of individual radar/surveillance updates for which Cleared level highlight in the label was on. This is an indication that level readbacks and initial calls are not being monitored.
Acceptances Late	The number of inbound aircraft tracks that were accepted too late (after crossing the airspace boundary).
Updates off Frequency Inside Sector	The number of individual radar/surveillance updates for which the aircraft was inside the sector but not on the user's frequency. This is an indication of a late acceptance or an early handover. Updates are ignored for exiting aircraft within three minutes of the boundary.
Assumptions	The number of aircraft tracks that were assumed (forced acceptances without a handover).
Updates on Frequency Outside Sector	Individual radar/surveillance updates for which the aircraft was outside the sector but on the user's frequency. This is an indication of a late handoff/transfer.

Algorithm

The following table describes how the Interface score is calculated:

Metric	Deduction	Note
Handovers Incorrect	1.5% is deducted for each incorrect handover.	
Updates CL Incorrect	0.1% is deducted for each individual aircraft surveillance update detected when the assigned level does not match the level in the label.	Two updates are allowed for each level change; Maximum deduction: 15%;
Updates CL Highlight	0.05% is deducted for each individual aircraft surveillance update detected when the CL is highlighted.	Allowance is applied of 2 updates per level change, and 5 updates per acceptance; Maximum deduction: 15%;
Acceptances Late	1% is deducted for each late acceptance.	Maximum deduction: 15%
Updates off Frequency Inside Sector	0.1% is deducted for each individual aircraft surveillance update detected inside sector and off frequency (and not within three minutes of exit).	Maximum deduction: 20%
Assumptions	1% is deducted for each Assumption.	Maximum deduction: 10%
Updates on Frequency Outside Sector	0.1% is deducted for each individual aircraft surveillance update detected outside sector and on frequency.	Maximum deduction: 15%

Separation Competency:

The Separation Competency is designed to measure the ability to detect conflicts and apply (or regain) separation.

Applicability

The Separation Competency not scored in Task Trainer or Target exercises. It is scored in all other exercises.

Metrics

The following metrics are used in scoring the Separation Competency:

Metric	Description
Updates Loss of Separation	The number of individual radar/surveillance updates for tracks subject to a CA (loss of separation).
Losses of Separation	The number of conflicts (losses of separation) during the exercise.

Algorithm

The following table describes how the Separation score is calculated:

Metric	Deduction	Note
Updates Loss of Separation	0.5% is deducted for each individual aircraft surveillance update subject to a CA (loss of separation).	
Losses of Separation	10% is deducted for each individual CA event (loss of separation).	

Sequencing Competency:

The Sequencing Competency is designed to measure the ability to correctly space arrivals through a gate.

Applicability

The Separation Competency not scored in Task Trainer, Circuit, Maze or Target exercises. It is scored in all other exercises.

Metrics

The following metrics are used in scoring the Sequencing Competency: In the table below, the reference distances make use of the default target sequencing trail distances. If the trail distance is changed from default, then the reference distances will change proportionally. These reference distances are saved in the performance record.

Metric	Description	Reference Distance (Km)	Reference Distance (NM)
Trails Very Low	The number of sequencing trails through a gate that were measured as 'Very Low'.	<36.1	<18.1
Trails Low	The number of sequencing trails through a gate that were measured as 'Low'.	36.1-40.0	18.1-20.0
Trails Ideal	The number of sequencing trails through a gate that were measured as 'Ideal'.	40.0-45.0	20.0-22.0
Trails High	The number of sequencing trails through a gate that were measured as 'High'.	45.0-55.0	22.0-25.0
Trails Very High	The number of sequencing trails through a gate that were measured as 'Very High'.	55.0-65.0	25.0-30.0
Trails Low and Vector	The number of sequencing trails through a gate that were below 'Ideal' and the following aircraft was under a vector.	<40.0	<20.0
Trails Ideal and Vector	The number of sequencing trails through a gate that were 'Ideal' and the following aircraft was under a vector.	40.1-45.0	20.1-22.0
Trails High and Vector	The number of sequencing trails through a gate that were above 'Ideal' and the following aircraft was under a vector.	>45.0	>22.0
Missed Gate	The number of aircraft that were directed to miss a sequencing gate.	-	-

Algorithm

The following table describes how the Sequencing score is calculated:

Metric	Deduction	Note
Trails Very Low	4% is deducted for each ‘Very Low’ trail	
Trails Low	2% is deducted for each ‘Low’ trail	
Trails Ideal	1% bonus is applied for each ‘Ideal’ trail	Maximum score limited to 100%
Trails High	1.5% is deducted for each ‘High’ trail	
Trails Very High	3% is deducted for each ‘Very High’ trail	
Trails Low and Vector	1% is deducted when the following aircraft is below 'Ideal' distance in trail and still under a vector.	
Trails Ideal and Vector	0.5% is deducted when the following aircraft is at an 'Ideal' distance and still under a vector.	
Trails High and Vector	4% is deducted when the following aircraft is above 'Ideal' trail distance and still under a vector.	
Missed Gate	4.5%is deducted for each time an aircraft is tracked to miss a sequence gate.	

Vectoring Competency:

The Vectoring Competency is designed to measure the ability to select and issue vector instructions.

Applicability

The Vectoring Competency scored in Maze exercises only.

Metrics

The following Metrics are used in scoring the Vectoring Competency for Maze exercises:

Metric	Description
Updates Outside Maze Laterally	The number of individual radar/surveillance updates outside the lateral confines of the Maze.

Algorithm

The following table describes how the Vectoring score is calculated:

Metric	Deduction
Updates Outside Maze Laterally	0.25% is deducted for each individual aircraft surveillance update laterally outside the Maze.

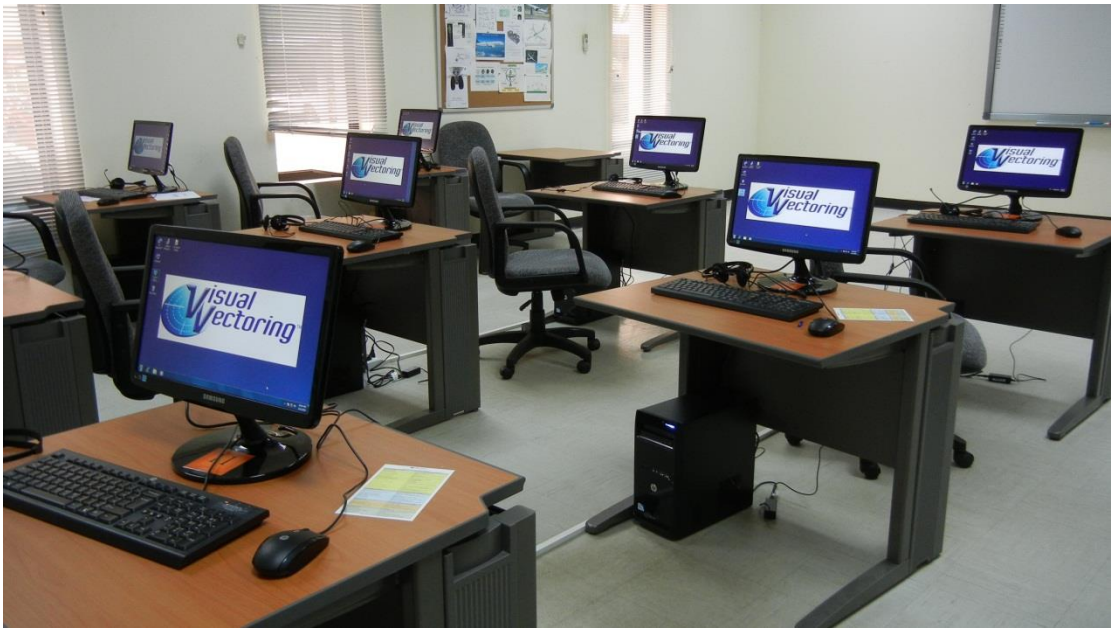
Appendix 1: Frequently Asked Questions:

Who will benefit from *VV Enroute™* training?	*VV Enroute™* is intended for delivery to *abinitio* and *cross-stream* conversion trainees with limited or no radar ATC experience.
How is the training delivered?	The program may be delivered in an instructor-led classroom environment or distributed on desktop or laptop computers for self-paced learning. It may even be deployed to prospective recruits as part of an aptitude-testing process.
What does it teach?	*VV Enroute™* teaches basic Area/Enroute Radar Control, including vectoring, vertical and lateral separation and sequencing.
What doesn't it teach?	Airspace specific services, including clearance requirements, aeronautical information services such as meteorological advice and Inflight Emergencies are not covered. Enroute holding is not currently included but is planned for future versions.
Can extra content be added?	Yes. With the collaboration with local training experts, extra theory content may be added by the construction of PowerPoint-style lessons (run as movies) which are added to the main interface.
Does the training content support regional variations in procedures and phraseology?	Yes. The instruction content in *VV Enroute™* is designed to be generic in nature but may be customised to local phrasings and procedures. Similarly, the *VV* Simulator can be programmed with specific speech and data parameters to support local requirements.

Appendix 2: Computer specifications

- Windows 7 (Ultimate), 8, 8.1 or 10 operating system (English version of Speech Recognition essential)
- Minimum (and recommended) screen resolution: 1366x768 pixels
- Minimum screen size: 15.6”
- PDF reader
- Headset: 2 earphones + microphone. Common types are usually suitable, but USB devices are recommended.

In Academy training it is highly recommended that computers dedicated to *VV* training be used, and that they be made accessible to students for practice during otherwise unutilized hours. Monitors with 22”-24” screen and 1366x768 pixel resolution are ideal.



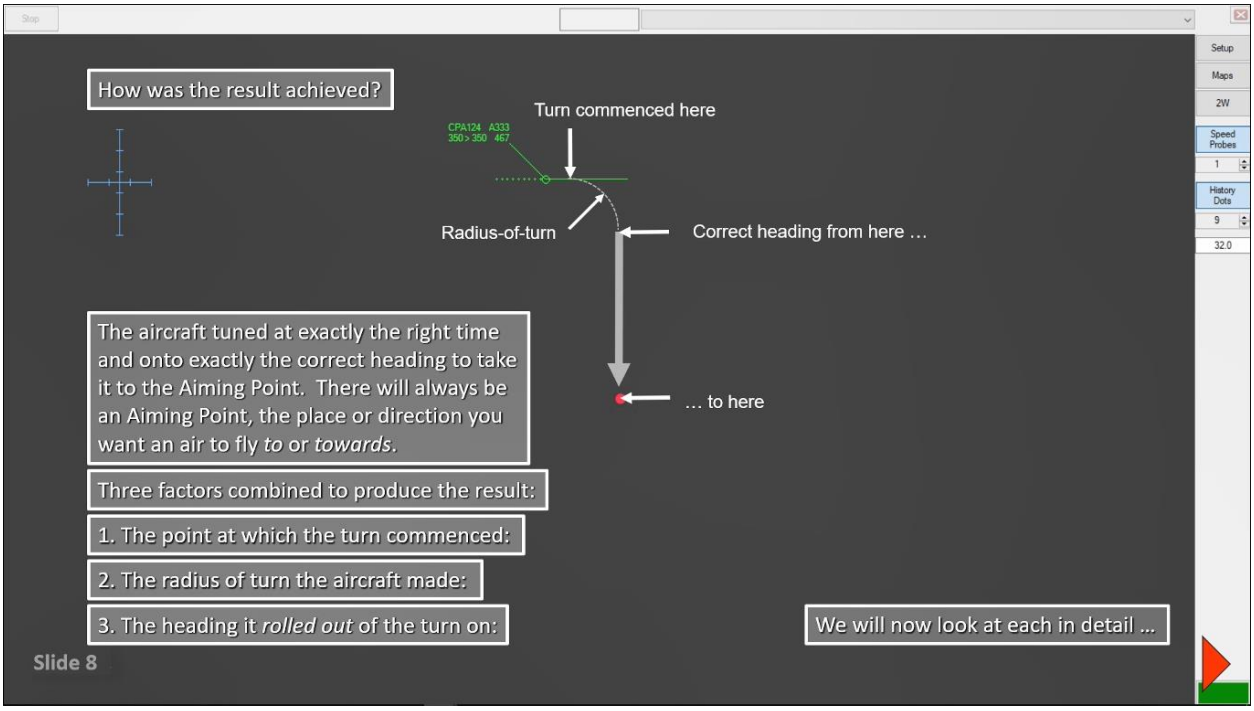
Appendix 3: Course Content Summary

Module	Element Name	Element Type	Abbreviation	Duration (mm:ss)
Introduction to VV Enroute	General Information	Lesson	GEN	05:57
	ATC Concepts	Lesson	ATC	06:05
	Radar Display	Lesson	DISP	05:56
	Radar Vectoring	Lesson	VEC	34:29
	Altitudes and Flight Levels	Lesson	ALT	04:08
MAZE Vectoring	Lesson: Basic MAZE Vectoring	Lesson	BML	22:49
	Demo: Basic MAZE Vectoring	Demonstration	BMD	13:00
	MAZE Simulator Task Trainer (STT):	Exercise (STT)	MBSTT	05:00+
	Basic MAZE Exercise	Exercise	MB	20:00+
	Lesson: Complex MAZE Vectoring	Lesson	CML	13:29
	Demo: Complex MAZE Vectoring	Demonstration	CMD	17:36
	MAZE 2	Exercise	M2	20:00+
	MAZE 3	Exercise	M3	20:00+
***GRID* Vectoring**	GRID Vectoring Part 1: Conflict recognition	Lesson	GL1	24:40
	GRID Vectoring Part 2: Conflict resolution	Lesson	GL2	34:04
	Demo: GRID vectoring	Demonstration	GD	18:29
	GRID Sim Task Trainer	Exercise (STT)	GSTT	5:00+
	GRID 1	Exercise	G1	25:00
	GRID 2	Exercise	G2	25:00
	GRID 3	Exercise	G3	25:00
	GRID 4	Exercise	G4	25:00
	GRID 5	Exercise	G5	25:00
	GRID Random 1	Exercise (Random)	GR1	30:00
	GRID Random 2	Exercise (Random)	GR2	30:00
	GRID Random 3	Exercise (Random)	GR3	40:00
	GRID Random 4	Exercise (Random)	GR4	40:00
Same-track sequencing	Lesson: 2 aircraft	Lesson	ST2L	26:41
	Demo: 2 aircraft	Demonstration	ST2D	12:56
	DIAMOND Sim Task Trainer	Exercise (STT)	DSTT	05:00+
	2-aircraft exercise 1	Exercise	DST1	00:50
	2-aircraft exercise 2	Exercise	DST2	00:50

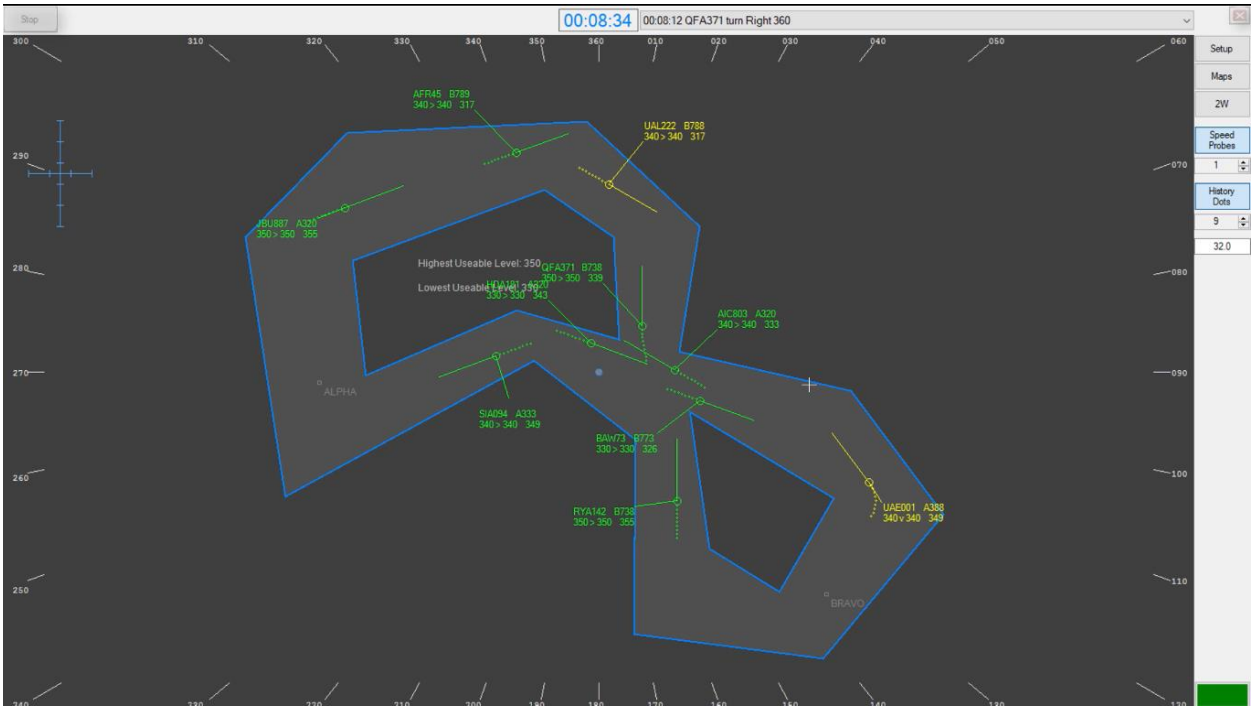
	2-aircraft exercise 3	Exercise	DST3	00:50
	2-aircraft exercise 4	Exercise	DST4	00:50
	Lesson: Multiple aircraft	Lesson	STML	12:50
	Demo: Multiple aircraft	Demonstration	STMD	14:09
	4-aircraft exercise 1	Exercise	DST5	00:50
	4-aircraft exercise 2	Exercise	DST6	00:50
	4-aircraft exercise 3	Exercise	DST7	00:50
	4-aircraft exercise 4	Exercise	DST8	00:50
Multi-track sequencing	Lesson: 2 aircraft	Lesson	MT2L	10:12
	Demo: 2 aircraft	Demonstration	MT2D	19:02
	2-aircraft different track exercise 1	Exercise	DMT1	00:55
	2-aircraft different track exercise 2	Exercise	DMT2	00:55
	2-aircraft different track exercise 3	Exercise	DMT3	00:55
	2-aircraft different track exercise 4	Exercise	DMT4	00:55
	Lesson: Multiple aircraft	Lesson	MTML	17:25
	Demo: Multiple aircraft	Demonstration	MTMD	19:47
	4-aircraft different track exercise 1	Exercise	DMT5	00:55
	4-aircraft different track exercise 2	Exercise	DMT6	00:55
	4-aircraft different track exercise 3	Exercise	DMT7	00:55
	4-aircraft different track exercise 4	Exercise	DMT8	00:55
***DIAMOND* Traffic**	Lesson: *DIAMOND* Traffic	Lesson	TFCL	22:30
	Demo: DIAMOND Traffic	Demonstration	TFCD	14:16
	DIAMOND Traffic Exercise 1	Exercise	DT1	00:30
	DIAMOND Traffic Exercise 2	Exercise	DT2	00:35
	DIAMOND Traffic Exercise 3	Exercise	DT3	00:30
	DIAMOND Traffic Exercise 4	Exercise	DT4	00:30
	DIAMOND Random Traffic Exercise 1	Exercise (Random)	DR1	00:30
	DIAMOND Random Traffic Exercise 2	Exercise (Random)	DR2	00:30
	DIAMOND Random Traffic Exercise 3	Exercise (Random)	DR3	00:40
	DIAMOND Random Traffic Exercise 4	Exercise (Random)	DR4	00:40

Appendix 4: Screen captures

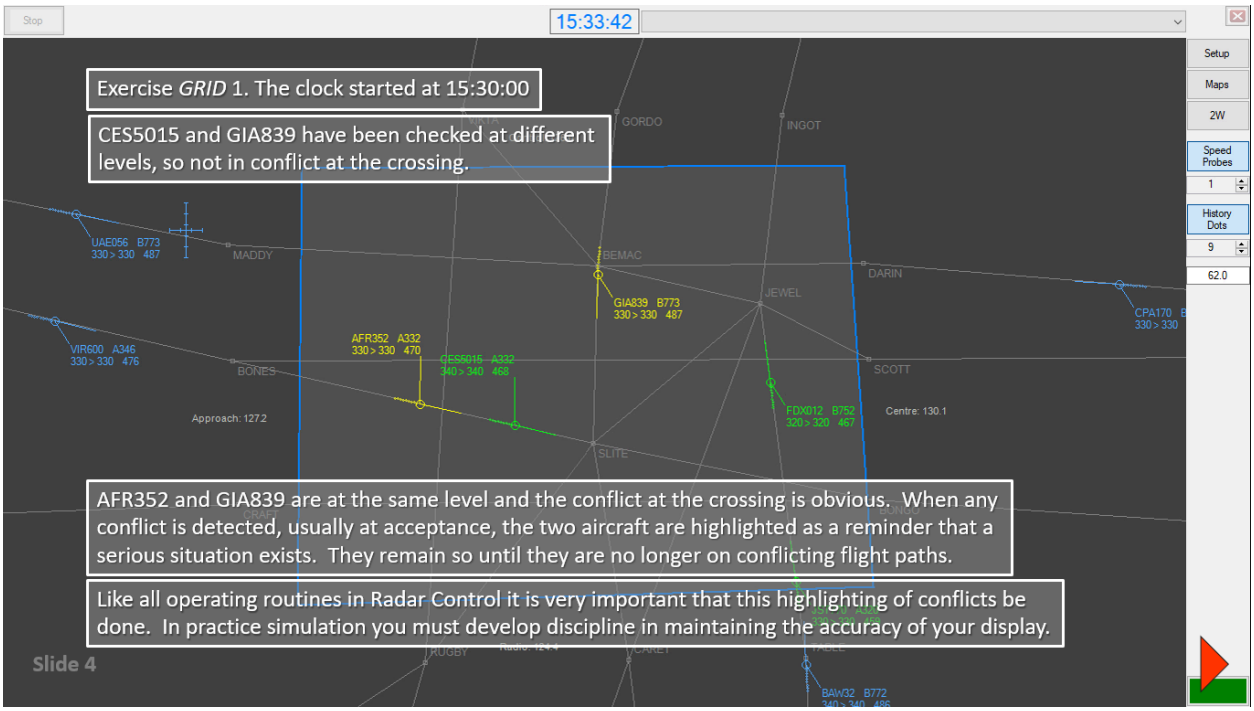
Radar vectoring lesson



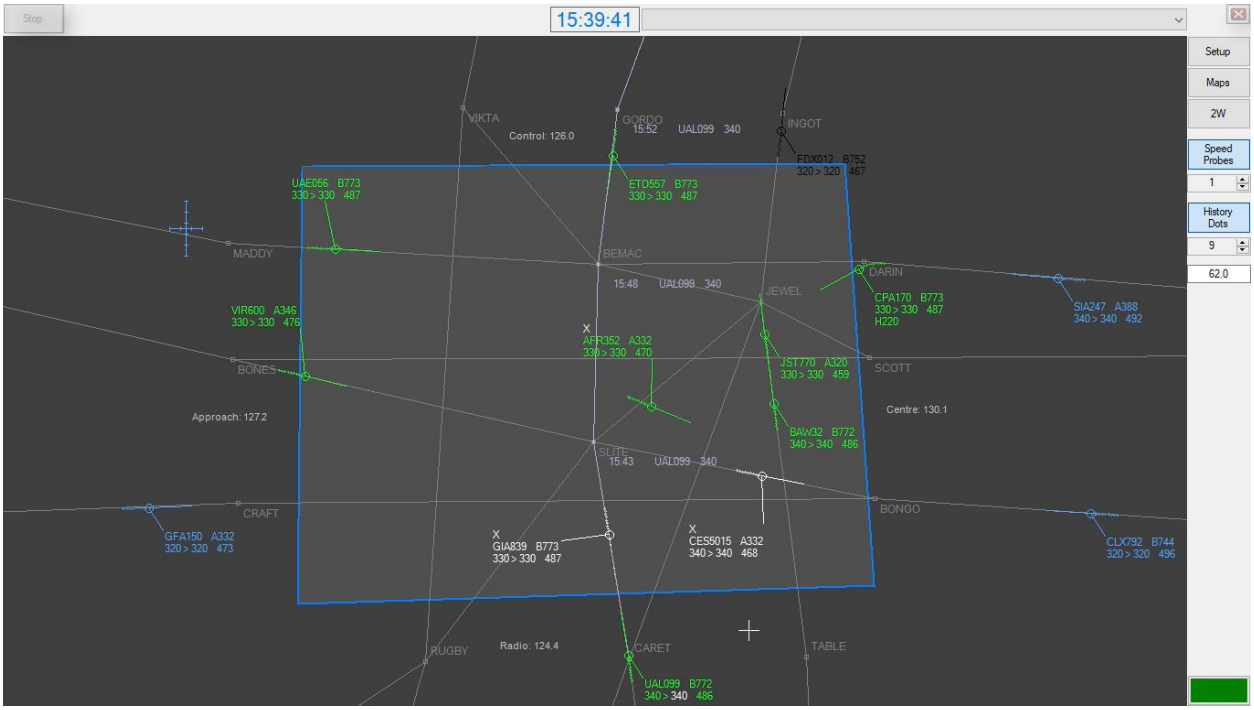
Complex MAZE exercise:



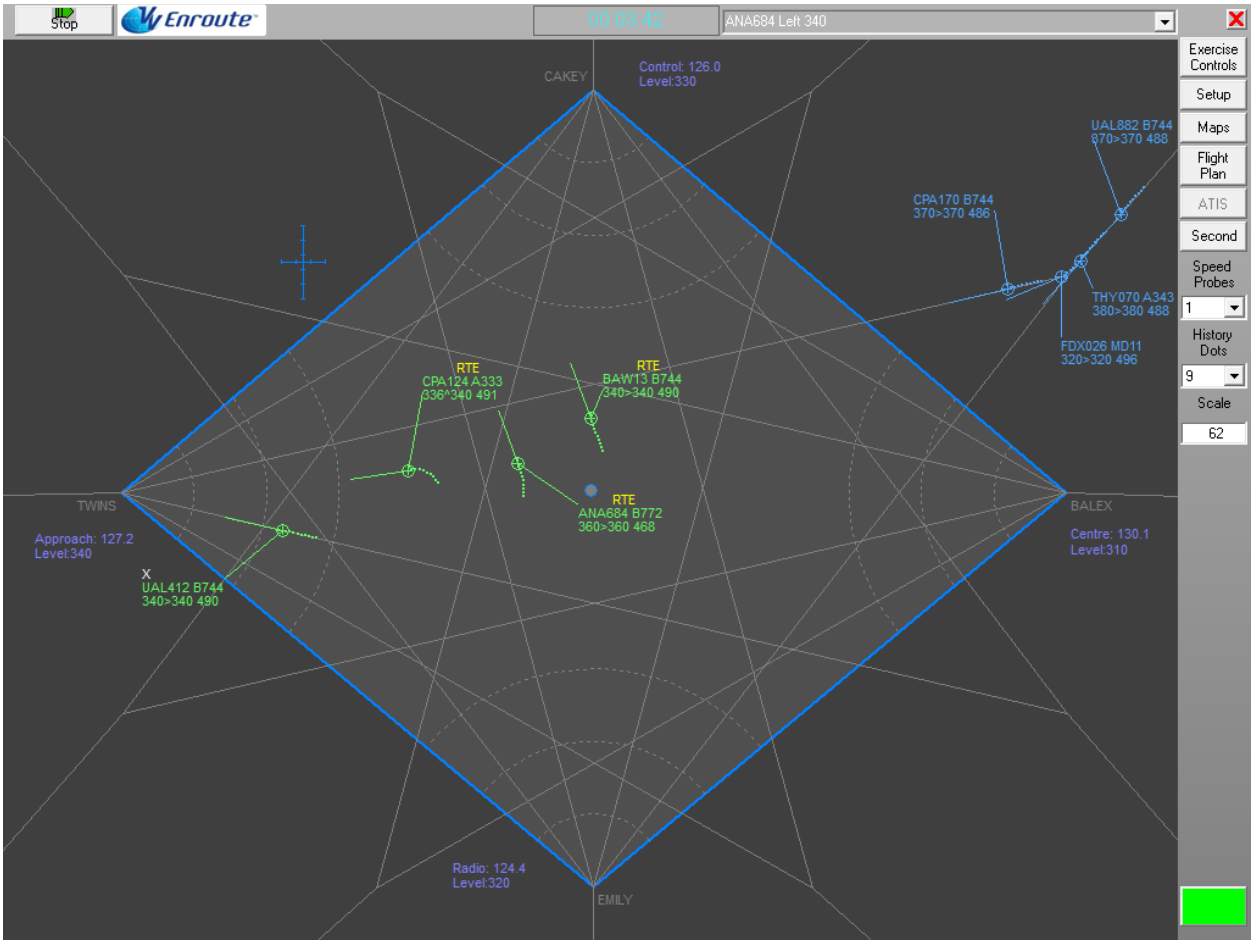
GRID vectoring lesson:



GRID exercise



Same-track sequencing exercise



Multi-track sequencing exercise