# Teaching how to use Moving Map Devices safely under Visual Flight Rules







A I R P I L O T S

#### Who should read this guide?

Moving map devices have become more prevalent in General Aviation (GA). There are many forms of devices, which are either temporarily or permanently installed in GA aircraft, and as an instructor, you are likely to encounter a pilot flying with one. This could be in a formal Nav teach, a biennial check or a request to mentor. This guide is written to provide a few points to consider when flying with a GA pilot using a moving map. If there is one major point to take away it is this: the moving map is a 'performance' instrument. It is not a primary instrument and, as such, the aircraft must be in a stable, trimmed attitude with a sensible power set before using the device.

As with all instruction topics, the instructor should have a degree of competence in operating the moving map application. Therefore, this guide does not give instruction with regards to operating the functions of the application; there are plenty other tutorials for that. However, it is worth reading the UK <u>CAA Safety</u> <u>Sense Leaflet 29 – VFR Moving Map Devices</u> to understand their use from a regulators point of view.

## **Opportunities for Teaching and Learning**

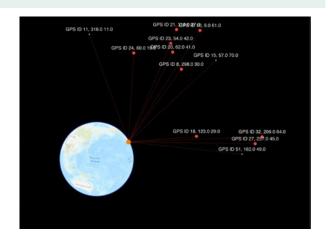
The prescribed programme of study for the Private Pilot's Licence (PPL) and related qualifications may mention the use of moving map devices relying on satellite navigation technology, but is thin on detail. Nevertheless, the structure of the taught programme presents opportunities enhancements that the instructor can orchestrate to better prepare pilots to use moving map technologies to their full advantage flying safely in visual meteorologic conditions. Additionally, modern moving map devices are often equipped with a simulator function that enables familiarity to be gained safely on the ground in advance of putting skills to into practise in the air.

- 1. Enhancements to Theoretical Knowledge (TK) especially with regard to Navigation and Human Performance.
- 2. Simulation
- 3. Pre-flight Briefing
- 4. Navigation Flying Exercises
- 5. Debrief

# 1. ENHANCEMENTS TO THEORETICAL KNOWLEDGE

# **NAVIGATION**

- Basic principles of satellite navigation-A. measurement of time taken for time-stamped signals to be received from each satellite
- В. GNSS satellite constellation vs GPS





VS

GPS is a single satellite system that utilizes 31 satellites



GNSS utilizes 89 satellites from all 4 satellite systems







Orange Accuracy within 250 feet



3,000

Yellow Accuracy within 150 feet 3,000

Red More than 250 feet of inaccuracy

**Indications of** device accuracy

- C. The importance of the antenna's view of sufficient satellites, spatially distributed.
- D. How to check that sufficient satellites are in view.



# 1. ENHANCEMENTS TO THEORETICAL KNOWLEDGE

## **NAVIGATION** (continued)

- E. The accuracy of vertical location versus horizontal location. Implications for airspace avoidance.
- F. 'Take2'.





When routing near controlled airspace (CAS), GASCo recommends that pilots plan to remain clear of the horizontal and vertical boundaries of the airspace by a suitable distance that's appropriate for them, their aircraft and the prevailing conditions. As a general rule of thumb 'Take Two' (i.e. 2 nautical miles horizontally and 200 feet vertically) would seem to be sound practical advice but in some cases it might be prudent to allow even more. After all, it only takes a small distraction, a moment's inattention or a bit of turbulence in the atmosphere to gain a hundred feet or more.

#### **HUMAN PERFORMANCE**

- E. Attention tunnelling and moving map displays.
- F. The importance of retaining a visual scan both when navigating and when alerted to traffic or airspace



Safety Sense 31

## 2. SIMULATION



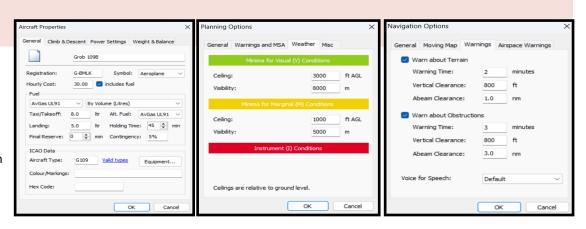
- A. Many moving map devices have a 'simulator mode' or an accompanying Training Application (app) which will run on a PC, laptop or tablet.
- B. These can be useful for ensuring the student can set up the device correctly.
- C. Work with the student to set up the device with the correct parameters for the aircraft to



be used for the flying exercises and with sensible parameters for airspace alerts, terrain clearance weather minima and the like.

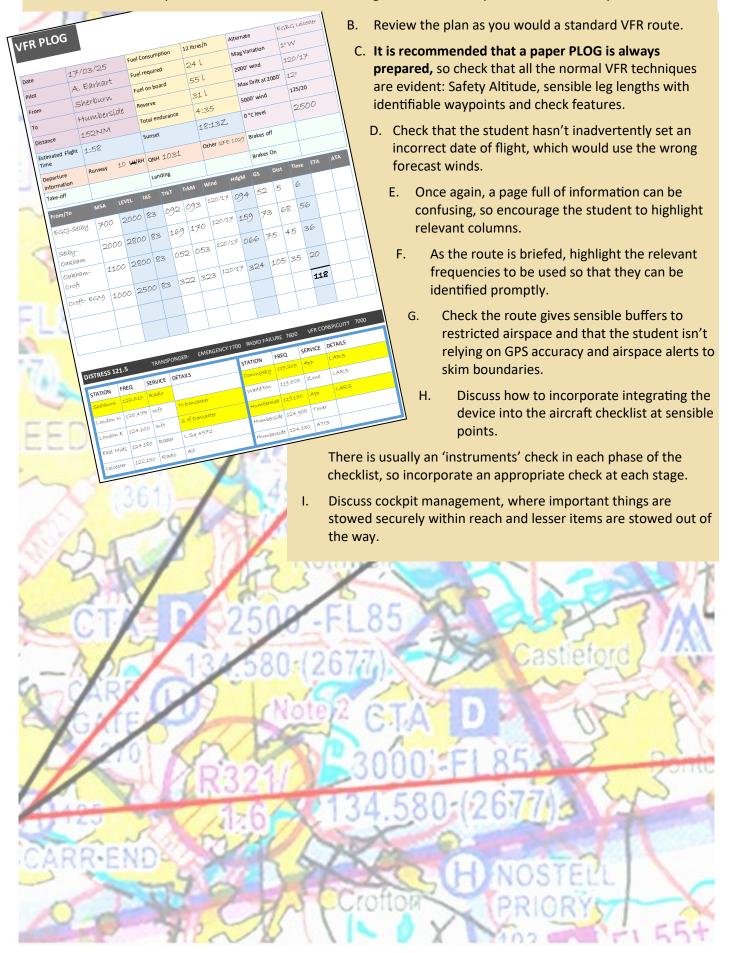
- D. Check the aircraft settings for sensible information; if the student uses the device for mass and balance, fuel calculations and timings in flight, these need to be correct.
- E. Discuss how the student has set up the device with regard to track timing marks, displayed data, map overlays, Safety altitude corridors and alerts (both airspace and traffic).
- F. Discuss the problems caused by the distraction of too much information, particularly if the student doesn't intend to use all of the information presented.

Examples of settings that will need the student to consider— from Skydemon in this instance.



#### 3. PRE-FLIGHT BRIEFING

A. Once both you (as the instructor) and the student are happy with the set-up of the device and the student can find their way around the buttons and menus, agree a route to be planned and flown by the student.



# 4. Navigation Flying Exercises

#### Pre-flight Checks:

- A. Check the device installed securely, clear of any controls and not obscuring any primary flight instruments.
- B. Get the student to confirm that the 'back-up' aid can be accessed safely.
- C. Make sure the student checks the device as you would any piece of equipment before flight. Ensure it is in good condition, sufficiently charged and updated.

#### **Before Start Checks:**

- D. Make sure that the student checks that the device is connected to any separate GPS receivers; that it is accessing sufficient satellites and is showing horizontal location correctly.
- E. If necessary, remind the student to check that audio alert levels are appropriate and that the display is configured for 'flight' mode.

#### **Before Take-off Checks:**

F. The student needs to check that the device is ready for flight and displaying useful information.

#### Take-Off:

G. Ensure that the student does not make selections on the device during the take-off roll. If it fails to respond as expected, continue the departure and get to a safe phase of flight before dealing with the device. Reinforce the message "DON'T get distracted!"





#### VFR Navigation:

- H. Reinforce the concept that the moving map is a 'PERFORMANCE' instrument and that it should be check only when the aircraft is in a stable, trimmed condition with a sensible power set, heading in a safe direction.
- I. As you approach a turning waypoint, take control and ask the student to focus on the moving map. Using the moving map indication, get the student to tell you when to turn and when to roll out to acquire the new track. This should demonstrate the lag in the system.
- J. Explain that the predicted flightpath, both lateral and vertical, is based on where the aircraft was a finite moment ago and can be used only when the aircraft is in steady flight.

# 4. Navigation Flying Exercises (continued)

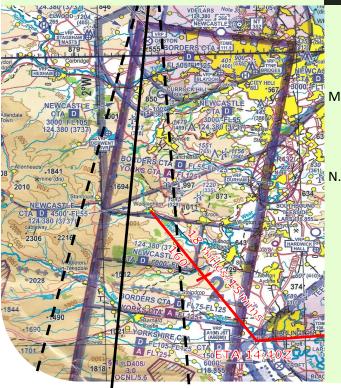


K. So, using the VFR navigation work-cycle, if the student checks the moving map and notices that he is off track, teach him to assess the error and estimate a new heading. Set this heading on the HSI and turn onto the new heading while looking at the attitude. Once stable and trimmed, recheck the track on the moving map device.

#### **En-route Diversion**

- L. The student's first unplanned diversion should be planned and executed using dead reckoning. You need to be sure that the student can successfully manage the diversion should the moving map fail.
- M. An en-route diversion shouldn't be rushed, but it is likely to have come about due to a change in circumstances, usually weather. Hence, it needs to be completed reasonably expeditiously.



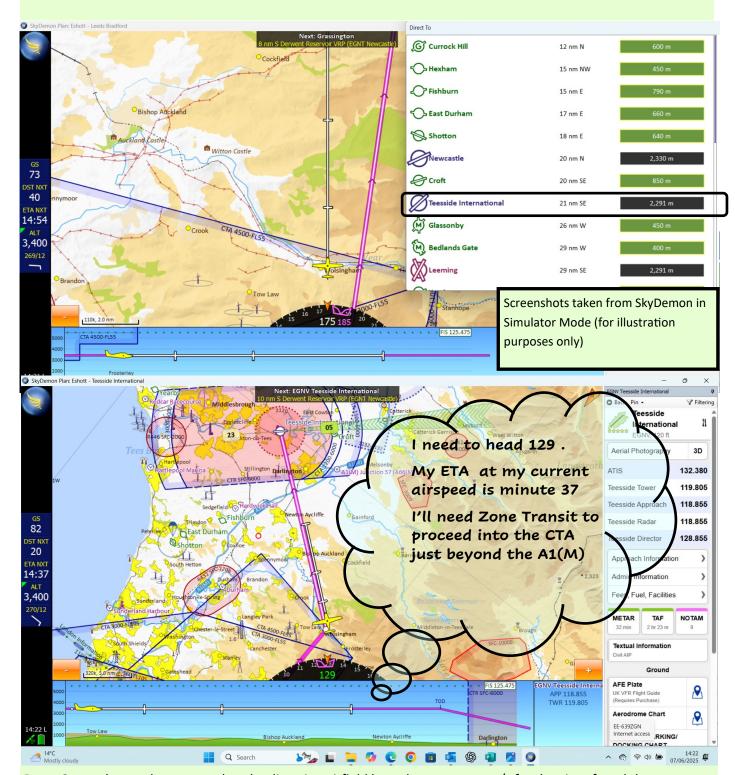


- Teach the student to estimate a new track and wind corrected heading from an identifiable ground feature.

  Note these down and then estimate distance, and hence time and fuel used.
  - Assess any threats along the new track such as weather, geographical avoids and restricted airspace, and replan accordingly (the student cannot not rely on airspace alerts without the moving map). Upon reaching the ground feature, turn onto the nominated track then use the navigation work-cycle to refine track and timing updates.

# 4. Navigation Flying Exercises (continued)

O. On a **SUBSEQUENT** navigation exercise, brief the use of the moving map's '**Direct To'** feature to plan and execute a diversion in the air but do not reveal when the diversion will requested. If possible, rehearse the diversion procedure on the ground using the 'Direct to' feature in Simulator mode or on the manufacturer's PC Trainer application.



- P. Stress the need to ensure that the diversion airfield has adequate runway/s for the aircraft and the conditions.
- Q. The student should note from the moving map, the ETA and required heading in case the moving map fails.

# 4. Navigation Flying Exercises (continued)

#### Moving Map Device Failure

- R. The student should have been keeping a track of the flight on the paper PLOG. With this updated, then a device failure shouldn't present a problem. The current leg can be completed, if not indeed, the remainder of the flight.
- S. A sensible plan will have identifiable ground features and normal VFR techniques should be applicable. At a sensible position, ask the student to cover the display and continue navigating, initially using the PLOG. At a sensible point, the student should change to the back-up aid, whether this is a paper chart or a replacement device. The essential point is that the student isn't over relying on the device and has the SA (Situational Awareness) to react to a failure safely without becoming disorientated or distracted.

#### **VFR PLOG**

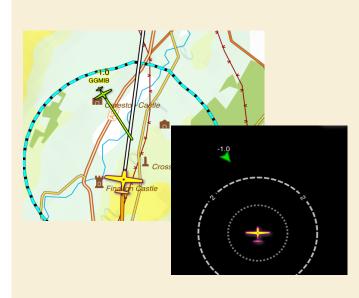
Date	17/0	3/25		Fuel Consi	umption		12 litre	s/h	Alterr	nate		EGBG LI	eicester
Pilot	A. Ea	arhart		Fuel requi	red		24 l		Mag \	/ariation	1	1°W	
From	Sherl	burn		Fuel on bo	oard		55 l		2000′	wind		120/17	<b>≠</b>
То	Ним	.bersíd	e	Reserve			31 l		Max (	Orift at 2	000′	120	
Distance	1521	1M		Total end	urance		4:35	5	5000′	wind		125/20	)
Estimated Flight Time	1:58			Sunset			18:1:	3Z,	0 °C le	evel		2500	
Departure Information	Runway	ا 10	<b>H</b> /RH	QNH 10	31		Other @	2FE 1029	Brake	s off		10:02	
Take-off	10:17			Landing					Brake	s On			
From/To	MSA	LEVEL	IAS	TrkT	TrkM	W	ind	HdgM	GS	Dist	Time	ETA	ATA
EGCJ-Selby	700	2000	83	092	093	12	20/17	094	52	5	6	:23	:23
Selby- Oakham	2000	2800	83	169	170	12	20/17	159	<del>7</del> 3	68	56	:19	:21
Oakham- Croft	1100	2800	83	052	053	12	20/17	066	<del>7</del> 5	45	36	:57	
Croft- EGNJ	1000	2500	83	322	323	12	20/17	324	105	35	20		

DISTRESS 121.5 TRANSPONDER- EMERGENCY 7700 RADIO FAILURE 7600 VFR CONSPICUITY 7000										
STATION	FREQ	SERVICE	DETAILS	STATION	FREQ	SERVICE	DETAILS			
Sherburn	122.610	Radio	RWIORH QNH 1031	Coningsby	119.205	Арр	LARS			
London N	125.475	Info	To Doncaster: <b>B 1177</b>	Wadditon	119.505	Zone	LARS			
London E	124.600	Info	S of Doncaster <b>B 1177</b>	Humberside	119.130	Арр	LARS			
East Míds	124.180	Radar	B 4 <i>5†</i> 3 1030	Humberside	124,905	Tower				
Leicester	122.130	Radio	Alt	Humberside	124.130	ATIS				

# **RESPONSE TO ALERTS**

#### **Airspace Alert**

T. Any pre-flight threat assessment should have highlighted any legs which may come close to restricted airspace. Hence, the student should have a reasonable SA of where the threats are and which direction to turn if alerts occur. Nevertheless, alerts can occur at any time, both laterally and vertically, so it is important that the student assimilates the alert promptly, decides an appropriate course of action, then flies that course of action visually. Once stable, the device can be used to assess present position and a safe course around the alert.



#### **Traffic Alert**

- U. Emphasise that good lookout is still essential, particularly as modern traffic warning systems still fail to detect a large number of threats. Traffic alerts are presented in a progressive level of threat. Teach the student to use the alert to enhance her/his SA and not to fixate on one reported threat. If a distant aircraft is reported, try to identify it within a normal lookout scan.
- V. If an imminent threat is alerted, the student must not fixate on the display, but should search outside the window using the alert to enhance SA. If avoiding action is required, this must be done visually; any manoeuvre conducted while looking at the device are likely to disorientate and induce an unusual position.

# 5. Debrief

- A. Use any exercise debrief to review how efficiently and safely the student used the moving map in flight.
- B. Pay particular attention to any occasions on which the student was distracted by the device, either because of alerts or because s/he struggled to get the device to do that which was intended.
- C. If appropriate, use the simulator or PC trainer to develop the student's skills in using the device safely and effortlessly.



- D. Build up the complexity of the tasks demanded of the student so that her/his capacity developed systematically over time.
- E. Check the notes made by the student on the paper PLOG to ensure that s/he is recording sufficient information to be able to continue to fly the route using dead reckoning should the moving map fail and any back-up device became unserviceable.



- It's a good idea for everyone to keep the log of their flight in digital format in case you are ever required to prove your route in relation to controlled or regulated airspace to the authorities, or for airprox investigations.
- **This applies to all pilots including instructors and students.**

#### **SUMMARY**

The GNSS moving map applications on a variety of devices are now extremely common in GA. Indeed, in any air-space incursion, the first question asked is generally regarding whether a moving map was used. It can be argued that the use of moving maps make pilots attempt to fly in tighter airspace than they would have before and that the standard of VFR navigation has reduced. They have their utility, but must be used sensibly and safely. It is easy to see how pilots can become over reliant on the information presented. It is also easy to see how pilots become distracted by these displays, possibly leading to disorientation. At the earlier stage in one's flying the better, it is important to treat these devices as a PERFORMANCE instrument, no different to an altimeter or a VOR display; both can present misleading information if set up incorrectly, and both can disorientate if used as primary instruments. Emphasis should always on placing the aeroplane in a steady flight phase, in a safe direction, trimmed, with a suitable power set before operating any other systems.

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