



- 1. The two aircraft were IFR aircraft and in IMC so should be relying on procedural separation**
 - a. Yes, procedural separation relies on the pilot being made aware of traffic, assessing whether this traffic is a hazard and, if required communicating to establish self-separation. The investigation found that the pilots did not communicate likely due to them not identifying the other as a hazard. Where the hazard has not been identified and the pilots do not subsequently communicate, they are relying on 'see and avoid' to ensure self-separation
 - b. The addition of the ADS-B IN technology provides an additional layer of defence in case the pilots do not recognize the hazard that the other aircraft poses and communicate effectively. An ADS-B system can both assist the pilot in locating the other aircraft and recognising the hazard it poses. Additionally, where ADS-B IN systems have an alerting capability they can alert the crew to the hazard if it breaches certain proximity thresholds.
 - c. The flight rules for IFR flight list 'see and avoid' (where possible) as the final layer of defence to prevent mid-air collisions in non-controlled airspace.
 - d. Further details on aircraft separation in relation to this accident can be found in the occurrence investigation report [AO-2020-012](#).
- 2. Are there other examples of where alerting systems have assisted pilots in avoiding a collision when the hazard of approaching traffic has not been recognized?**
 - a. Recent ATSB Investigation [AO-2021-023](#) shows the benefits of internal alerting in assisting effective conflict avoidance. The investigation found that the pilots of an AW139 medical helicopter and a Seminole training aircraft operating in the vicinity of Mangalore Airport did not effectively identify, for a number of reasons, the hazard that the other aircraft posed after receipt of traffic information from air traffic control. In this case the helicopter was fitted with a traffic collision avoidance system (TCAS) that provided the pilot with a display of the approaching traffic and advisories to assist in resolving the conflict. The pilot of the Seminole, which was not fitted with a TCAS or ADS-B IN, display was unaware of the presence of the helicopter until after they had landed at Shepparton Airport.
 - b. Note ADS-B IN and TCAS are not equivalent systems please refer to Q8 for more detail.
- 3. The flight was in IMC and it was found that the two aircraft couldn't see each other because of cloud. What was the point of the study?**
 - a. The study considered three different environmental conditions
 - i. Those that emulated the conditions recorded by the weather station at Mangalore airport at approximately the time of the accident.
 - ii. Conditions that were more conducive to visual acquisition but maintained approximate levels of contrast and background illumination
 - iii. Sky clear conditions.

The study found that in all three cases it was unlikely that the pilots of the aircraft would have been able to visually acquire one another in time to avoid collision.

- b. The study doesn't just apply to IFR pilots or aircraft, it is also important for those operating in VMC to be aware of the limitations of 'see and avoid' and to consider using the available technologies, such as ADS-B IN, to assist in self-separation.
- 4. As the pilots were operating IFR they were likely heads down and looking at the controls or instruments and not out the windscreen. How did the ATSB account for this?**
- a. The study presents the opportunities for visual acquisition if the pilot was looking out of the windscreen the whole time, essentially a best-case scenario. As determined, even in this best-case scenario, it was unlikely that there would have been sufficient time to detect the approaching aircraft and maneuver to avoid the collision. Where the pilot is heads down the opportunity for detection would obviously be further reduced. This emphasises the importance of radio communication, the ADS-B IN system and its alerting capability. The ADS-B IN system does not require a pilot to be looking out the windscreen to identify traffic and if fitted with an aural alerting capability does not require the pilot to be looking at the device to identify conflict.
- 5. The pilot's head and eye position will be constantly moving, how did the ATSB account for this?**
- a. Due to the large number of possible pilot head and eye positions, the ATSB was not able to account for each of them individually. The ATSB developed a matrix of eye positions and rotations that showed the effect that this movement has on the position and visibility of the target aircraft. The sensitivity analysis sections of the visibility study report look at examples of movement of the position and field of view and how these changes can affect the position of the target relative to the viewer aircraft's crew and the shielding by aircraft structure.
- 6. I have an aircraft how do I go about getting ADS-B IN.**
- a. There are two ways that you can have ADS-B IN, the first is to get a fully installed ADS-B IN system and display as demonstrated in the ATSB's animation. These are available from a range of manufacturers and can be installed by a relevantly licensed LAME. The second, is via the use an electronic flight bag (EFB) application and electronic conspicuity (EC) device combination to display ADS-B OUT equipped traffic. Note that if your aircraft is already ADS-B OUT equipped you will need to switch off any ADS-B OUT functionality on the EC device or purchase one that only has ADS-B IN capability. A list of approved EC's can be found on CASA's website, in the electronic conspicuity devices section, of the surveillance network and equipment page [here](#).
 - b. More detail about ADS-B fitment can be found on CASA's website and in Advisory Circular 91-23 [here](#)
- 7. I have ADS-B OUT and IN do I still need to make radio calls?**
- a. Yes, radio communications remain the primary method of establishing self-separation outside of controlled airspace. An ADS-B IN system is designed to assist pilots with situational awareness and allow radio communications to be more targeted and effective. Regardless of ADS-B equipage status all pilots should make radio calls required by relevant publications and to maintain self-separation.
 - b. It is also important to remember that not all aircraft will be ADS-B IN and/or OUT equipped, nor are they required to be, and so effective radio communications and 'see and avoid' remain their defenses against mid-air collision.

8. Is an ADS-B IN system equivalent to a TCAS system?

- a. No, ADS-B IN systems have some of the same functionality, including proximity alerting as TCAS systems but do not have the same avoidance programming. ADS-B IN systems are a lower cost alternative for those aircraft that do not require TCAS. They should be used to aid pilot situational awareness and to assist in locating and establishing communications with other aircraft to ensure separation earlier and before avoidance maneuvering becomes necessary.