Briefing Notes:
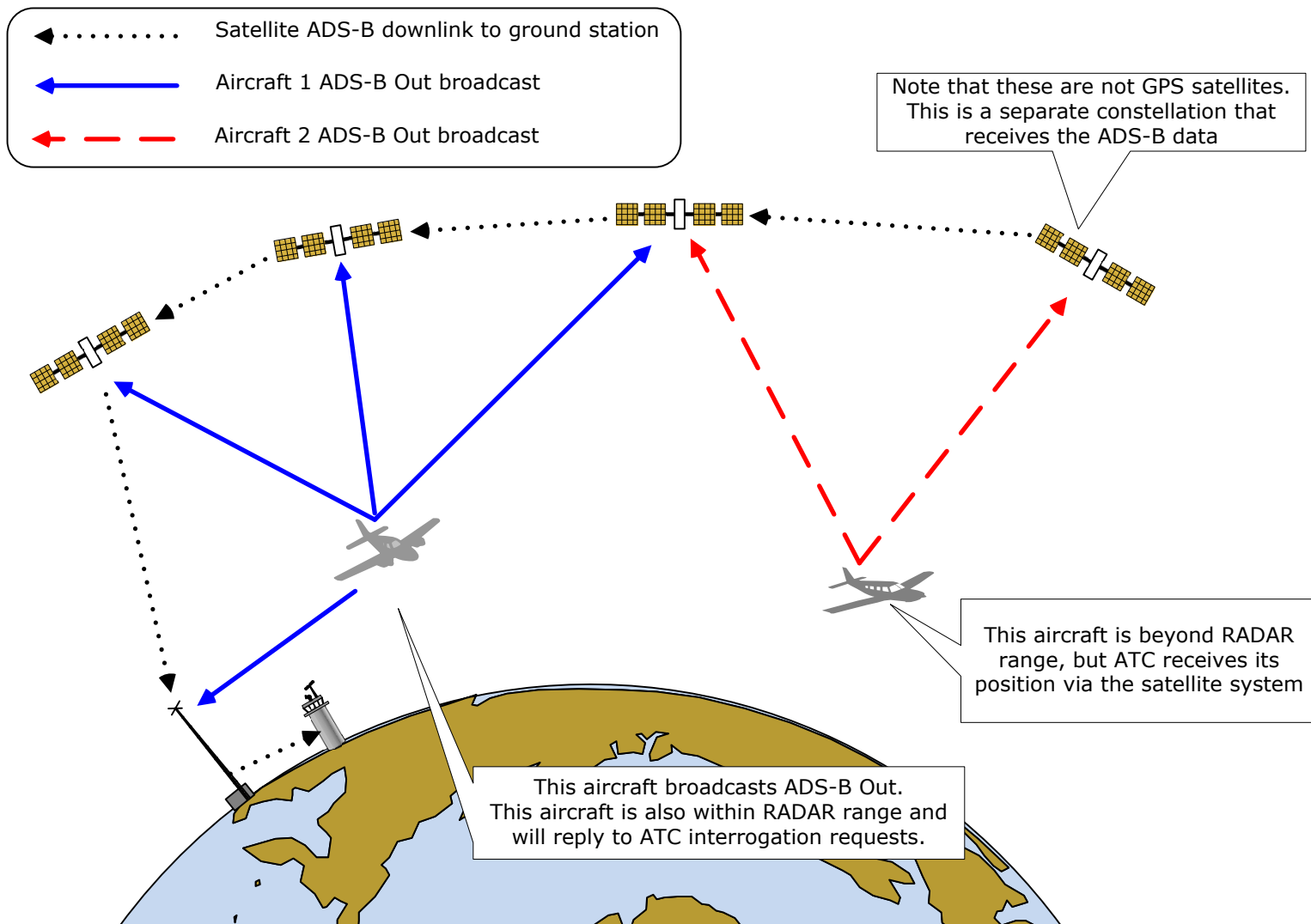## Surveillance Equipment and ADS-B (CAR 605.35, 551.103; AIM COM 7.3)

Another surveillance technology is available and becoming mandatory throughout the world. This technology is called **Automatic Dependent Surveillance – Broadcast Out (ADS-B Out)**.

Most of the world, including Canada, use space-based ADS-B, meaning that there is a group of satellites in low earth orbit which receive the signals from each aircraft and re-broadcast them to air traffic control and to other aircraft.

Legend:
- Satellite ADS-B downlink to ground station
- Aircraft 1 ADS-B Out broadcast
- Aircraft 2 ADS-B Out broadcast

Note that these are not GPS satellites. This is a separate constellation that receives the ADS-B data

This aircraft is beyond RADAR range, but ATC receives its position via the satellite system

This aircraft broadcasts ADS-B Out. This aircraft is also within RADAR range and will reply to ATC interrogation requests.

Once every second, ADS-B Out equipped aircraft will broadcast their identification, position, altitude, etc.

This goes to low earth orbit satellites, nearby aircraft and nearby ground stations.

The satellite system re-broadcasts to the ground station, so that ATC has a full picture of all aircraft, even when the aircraft are beyond line-of-sight from a RADAR station. If the aircraft responds to an interrogation by ATC RADAR then the ATC computer system will resolve the two responses and present one target on the display.

Ground stations re-broadcast so that all aircraft receive the traffic information, if they are ADS-B In equipped.

The names ADS-B Out and ADS-B In are derived from their function...

Automatic – It doesn't require input from the flight crew, and doesn't require an interrogation signal from the ground. It automatically transmits the data regularly.

Dependent – It depends on the aircraft's on-board GPS equipment as the source of position information.

Surveillance – It allows ATC know where everyone is in their airspace.

Broadcast – The system broadcasts, or sends, information via data link.

Out – This describes the aircraft broadcasting its own information outwards to other aircraft and to ATC via satellites and ground stations.

In – This describes the ability to receive and display ADS-B information that other aircraft, ATC or weather stations send out.

Nice to know!
There is not a legal requirement at this time to have ADS-B In

The ability of an ADS-B Out system to broadcast the aircraft's identification, position and altitude without needing a ground based radar system means that now other aircraft can easily be equipped to display traffic nearby, but more importantly, ATC can now provide traffic separation services outside of radar coverage.

Type of Surveillance System	Dependent on Aircraft Systems?	Cooperative (Works with other systems)?	
Primary Surveillance RADAR (PSR)	No. position information is derived by the RADAR, without interaction from aircraft systems	No. It doesn't depend on or integrate with aircraft equipment	These are the legacy RADAR systems
Secondary Surveillance RADAR (SSR)	Yes. Position information provided by aircraft transponder	Yes. Requires aircraft to have a transponder	
Automatic Dependent Surveillance (ADS-B)	Yes. Position information is provided from aircraft on board equipment	Yes. Requires aircraft to have ADS-B Out equipment	This is the new ADS-B system

What equipment is required, and how does it work?

The ADS-B system is built on top of the Mode S transponder capabilities. The data portion of a Mode S signal is transmitted on a frequency of 1090 MHz. An additional data message is added to the end of this signal.

In addition to the Mode S transponder requiring ADS-B capability, you must also have a GNSS receiver (e.g. GPS) to provide the aircraft's position information to the transponder, a pressure altitude encoding altimeter, and an appropriate ADS-B antenna. ADS-B systems need to be able to transmit both upwards to satellites and downwards to ground stations. This is known as antenna diversity.

Where is ADS-B Out required?

The regulations that require ADS-B Out capability are slowly coming into force. Eventually, all transponder airspace will require ADS-B Out. The deployment schedule is as follows:

Airspace	Date required to be equipped
Class A	Aug 10, 2023
Class B	May 16, 2024
Class C,D & E	Expected 2028

NEED TO KNOW!

The following information is broadcast by ADS-B Out equipment:

o GPS Position

o Pressure altitude

o Aircraft identity
   o This is a unique transponder identifier set during installation

o Flight identification
   o This flight ID can be modified by the flight crew. It is used for the aircraft registration (e.g. CGABC) or ICAO airline flight number (e.g. ACA0151)

o SPI
   o This is like the IDENT button on a legacy transponder, and positively identifies the aircraft for ATC.

o Emergency status
   o This sends an emergency code to ATC if an emergency transponder code is selected, (e.g. 7500, 7600, 7700)