AUTOMATIC DIRECTION FINDER (ADF)

➢ AUTOMATIC DIRECTION FINDER (ADF)

- ✓ An automatic direction finder (ADF) operates off of a ground signal transmitted from a NDB.
- ✓ Early radio direction finders (RDF) used the same principle.
- ✓ A vertically polarized antenna was used to transmit LF frequency radio waves in the 190kHz to 535kHz range.
- ✓ A receiver on the aircraft was tuned to the transmission frequency of the NDB.
- ✓ Using a loop antenna, the direction to (or from) the antenna could be determined by monitoring the strength of the signal received.
- ✓ This was possible because a radio wave striking a loop antenna broadside induces a null signal.

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- ✓ When striking it in the plane of the loop, a much stronger signal is induced.
- ✓ The NDB signals were modulated with unique Morse code pulses that enabled the pilot to identify the beacon to which he or she was navigating.
- ✓ With RDF systems, a large rigid loop antenna was installed inside the fuselage of the aircraft.
- ✓ The broadside of the antenna was perpendicular to the aircraft's longitudinal axis.
- ✓ The pilot listened for variations in signal strength of the LF broadcast and maneuvered the aircraft so a gradually increasing null signal was maintained.
- ✓ This took them to the transmitting antenna.

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- ✓ When over flown, the null signal gradually faded as the aircraft became farther from the station.
- ✓ The increasing or decreasing strength of the null signal was the only way to determine if the aircraft was flying to or from the NDB.
- ✓ A deviation left or right from the course caused the signal strength to sharply increase due to the loop antenna's receiving properties.
- ✓ The ADF improved on this concept.
- ✓ The broadcast frequency range was expanded to include MF up to about 1800 kHz.
- ✓ The heading of the aircraft no longer needed to be changed to locate the broadcast transmission antenna.

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- ✓ The antenna rotated to seek the position in which the signal was null.
- ✓ The direction to the broadcast antenna was shown on an azimuth scale of an ADF indicator in the flight deck.
- ✓ This type of instrument is still found in use today.
- ✓ It has a fixed card with 0° always at the top of a non-rotating dial.
- ✓ A pointer indicates the relative bearing to the station.
- ✓ When the indication is 0°, the aircraft is on course to (or from) the station.
- ✓ As ADF technology progressed, indicators with rotatable azimuth cards became the norm.
- ✓ When an ADF signal is received, the pilot rotates the

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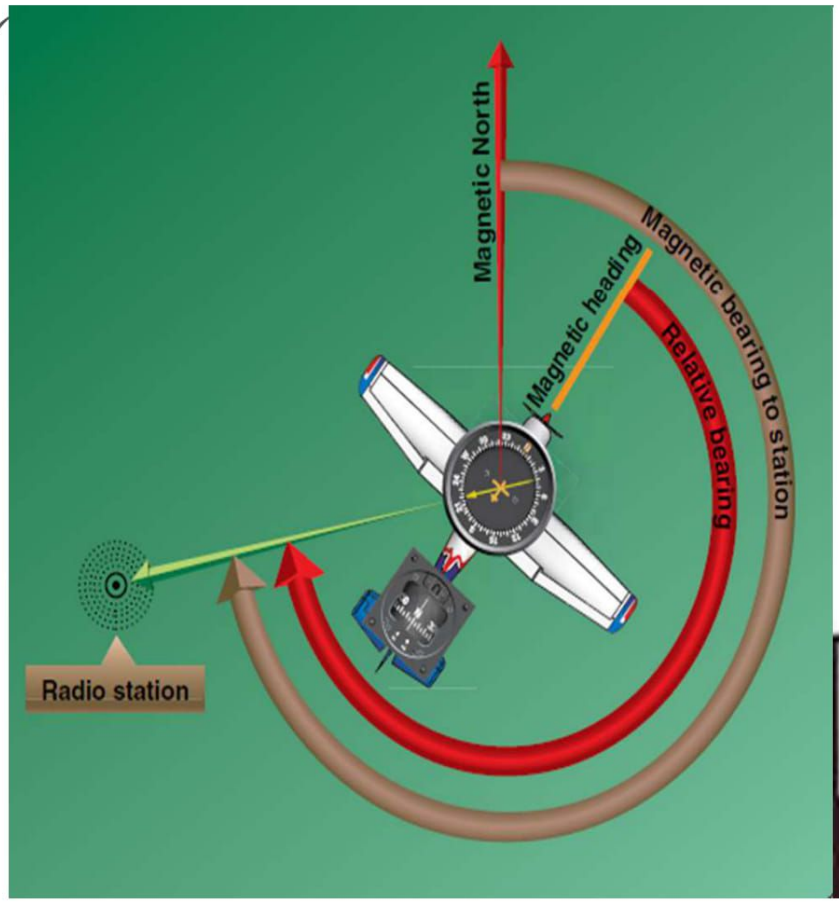
- ✓ This results in the pointer indicating the magnetic bearing to the ADF transmitter.
- ✓



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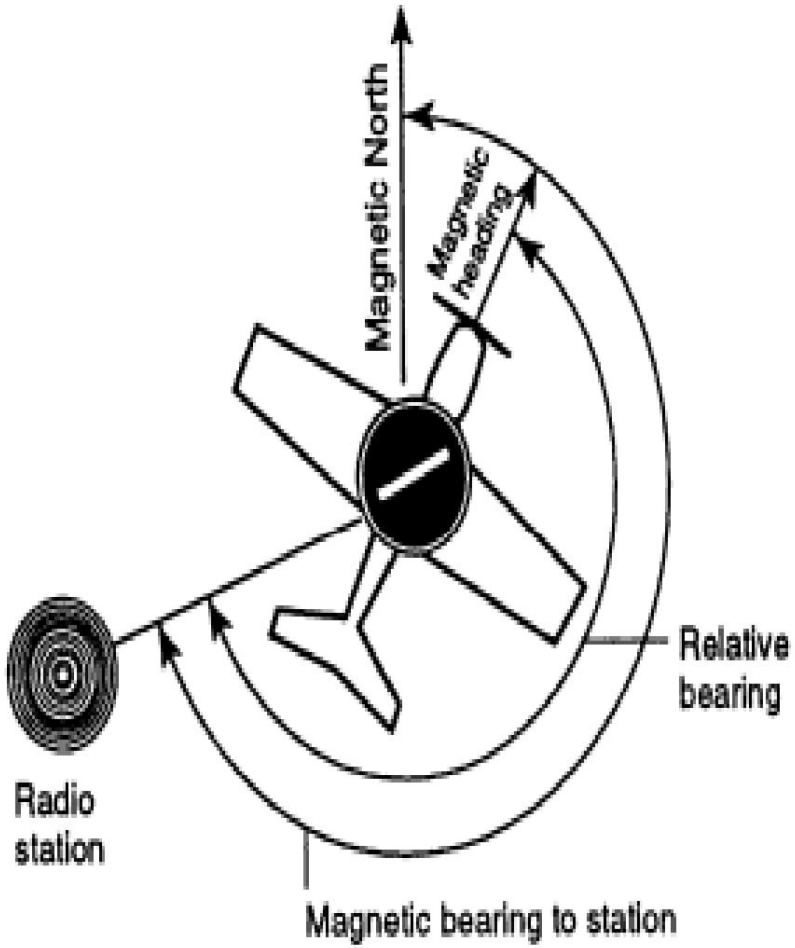

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- ✓ In modern ADF systems, an additional antenna is used to remove the ambiguity concerning whether the aircraft is heading to or from the transmitter.
- ✓ It is called a sense antenna.
- ✓ The reception field of the sense antenna is omni-directional.
- ✓ When combined with the fields of the loop antenna, it forms a field with a single significant null reception area on one side.
- ✓ This is used for tuning and produces an indication in the direction toward the ADF station at all times.
- ✓ The onboard ADF receiver needs only to be tuned to the correct frequency of the broadcast transmitter for the system to work.

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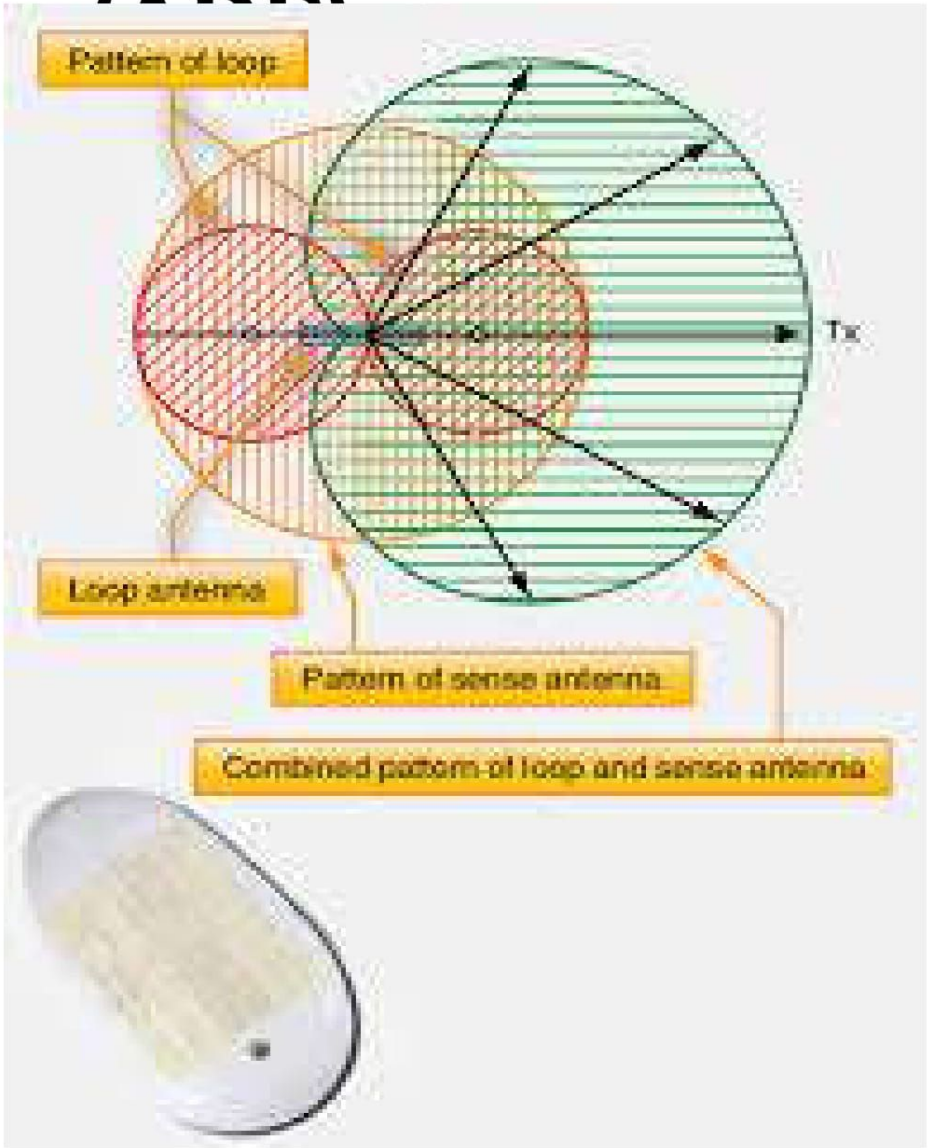

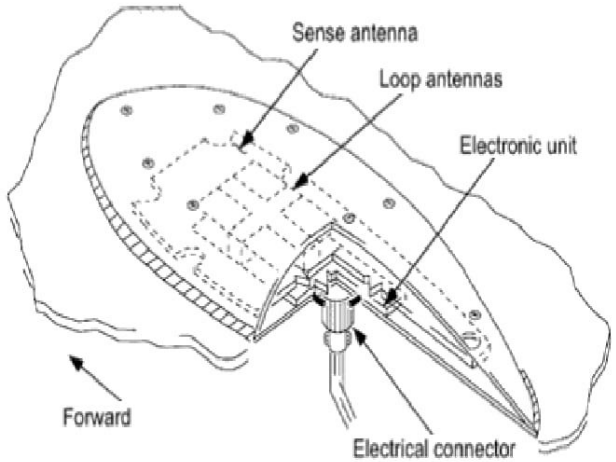

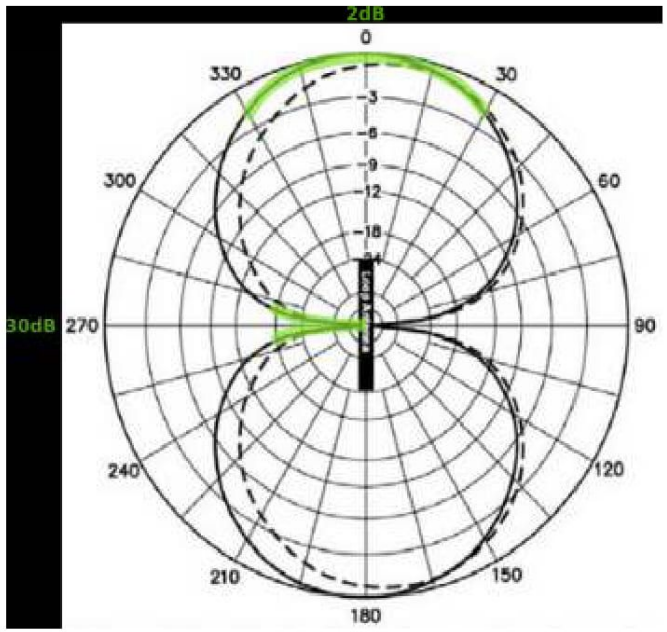

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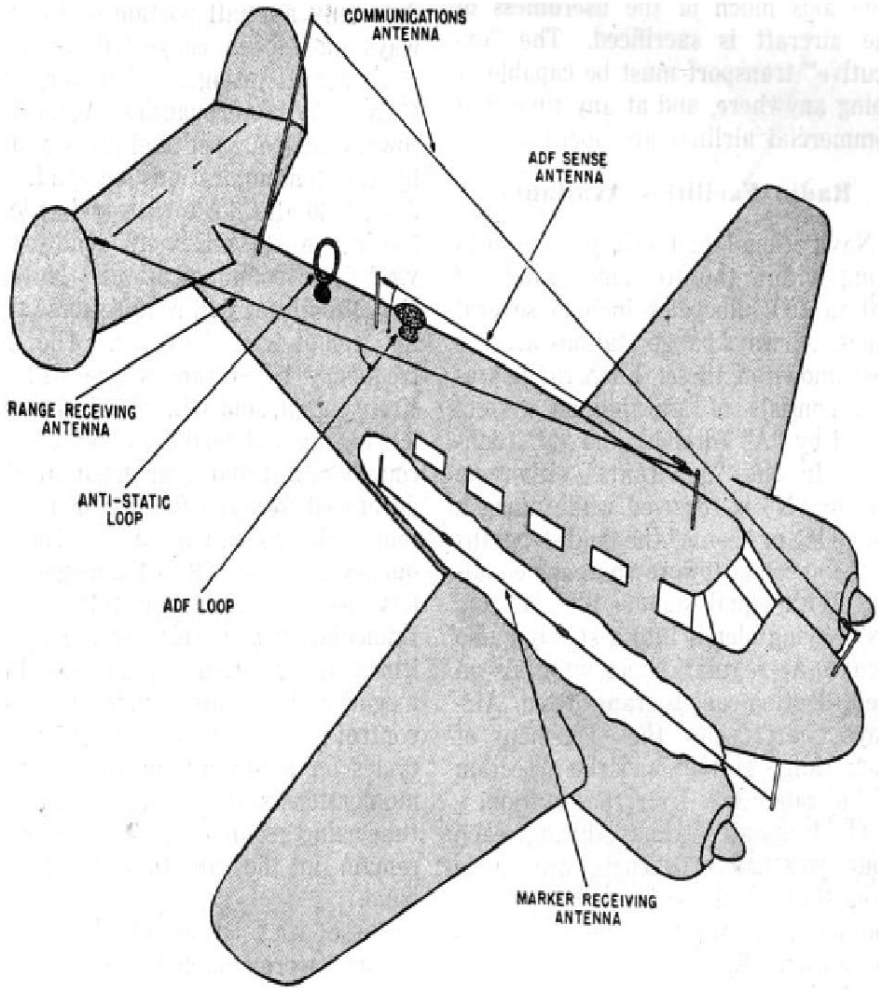

The ADF antenna is below the cockpit. (Click image for full size.)

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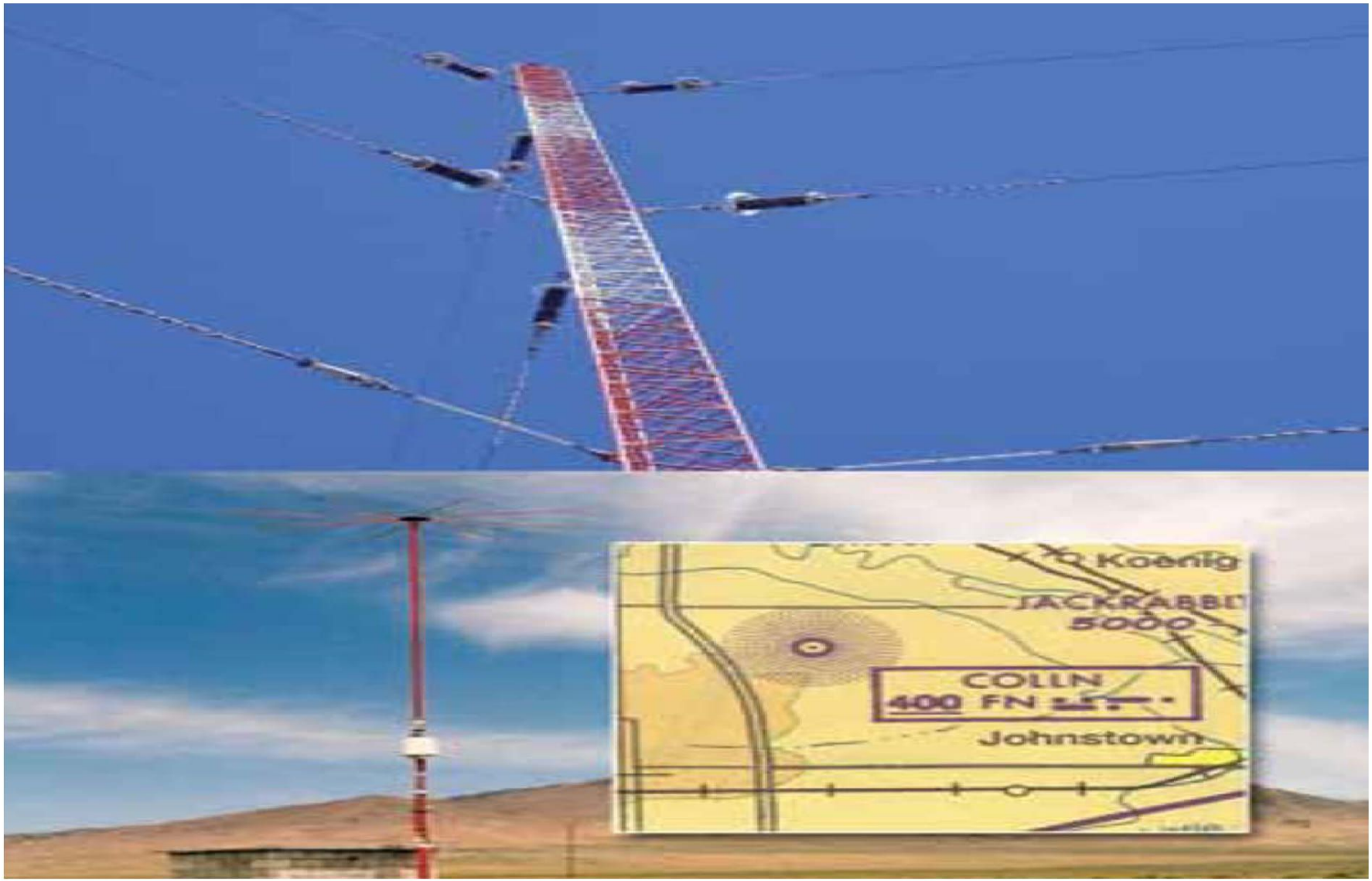

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- ✓ ADF receivers can be mounted in the flight deck with the controls accessible to the user.
- ✓ This is found on many general aviation aircraft.
- ✓ Alternately, the ADF receiver is mounted in a remote avionics bay with only the control head in the flight deck.
- ✓ Dual ADF receivers are common.
- ✓ ADF information can be displayed on the ADF indicators mentioned or it can be digital.
- ✓ Modern, flat, multipurpose electronic displays usually display the ADF digitally.
- ✓ When ANT is selected on an ADF receiver, the loop antenna is cut out and only the sense antenna is active.
- ✓ This provides better multi-directional reception of broadcasts in the ADF frequency range, such as weather or AWAS broadcasts.

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- ✓ The rotor is driven by a motor to seek the null. The same motor rotates the pointer in the flight deck indicator to show the relative or magnetic bearing to the station.
- ✓ ADF antenna is critical to a correct indication since it is a directional device.
- ✓ Calibration with the longitudinal axis of the fuselage or nose of the aircraft is important.
- ✓ A single null reception area must exist in the correct direction.
- ✓ The antenna must be oriented so the ADF indicates station location when the aircraft is flying toward it rather than away. Follow all manufacturer's instructions.

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