# MagArrow Heading Error Compensation Flight Instruction

- **Required Equipment:**
    1. MagArrow
    2. Base-station with GPS
- **Compensation Flight Steps:**
    1. Find a location with low magnetic field gradient:
        i. Choose a location far away from cars/equipment/roads/buildings/powerlines.
        ii. Turn on MagArrow or Base-station and record the reading B_0 (if 50/60 Hz signal > 20 nT, field readings need to be averaged).
        iii. Keep MagArrow/Base-station pointed in one direction and move it forward, backward, left and right by 10 feet and record four readings B_1, B_2, B_3, B_4, at four locations, respectively (make sure the person moving the instrument is magnetically clean).
        iv. Calculate $|B_1-B_0|$, $|B_2-B_0|$, $|B_3-B_0|$ and $|B_4-B_0|$. Make sure that they are all less than 100 nT. Otherwise, choose a new location and repeat from step ii.
        v. If such a location cannot be found, choose the location with the least gradient. However, a large gradient will affect the compensation result negatively.
    2. Set up the base-station:
        i. Make sure all equipment at least 20 m away from the low gradient area.
        ii. Turn on the Base-station and make sure that it works and has GPS time stamps.
        iii. Start data logging.
    3. Fly the MagArrow:
        i. Attach the MagArrow to the drone, start the MagArrow and make sure that it is working. Start data logging.
        ii. Fly the MagArrow to the low gradient area and elevate it as high as possible (check your local regulations about the maximum drone height as well). We recommend > 60 m elevation for 100 nT gradient on the ground. In general, if the gradient is a factor of 8 smaller, the flight height can be a factor of 2 lower.
        iii. Rotate the drone slowly so that one full rotation takes more than 10 seconds. Do at least one full rotation. Two full rotations are preferred.
        iv. Fly a clover-leaf pattern at the same height. Ideally, the pattern is contained within 10m x 10m centered on the low gradient area.

Clover-leaf Pattern
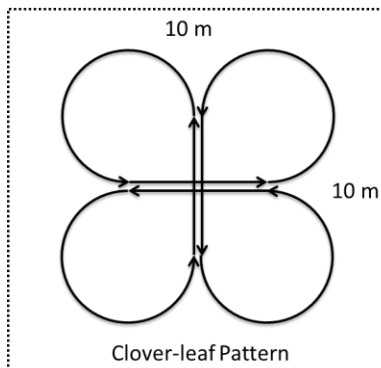
        v. If time permits, repeat step iii and iv a couple of more times.
        vi. Fly the drone back, stop the MagArrow data logging and download the compensation flight data.