1. **Phase 2**

The hardware installation in the BAS Twin Otter (VP‐FAZ) consisted of the following instruments:

* ESA Ku-band interferometric radar ASIRAS
* MetaSensing Ka-band radar altimeter KAREN
* BAS Airborne Laser Scanner (ALS) of the type Riegl LMS Q‐240i‐80
* 2 geodetic dual‐frequency GPS receivers of type Javad delta (AIR2-4)
* An Inertial navigation system (INS) of the type Honeywell H‐764G
* An inertial navigations system (INS) of the type iMAR
* An Inertial navigation system (INS) of the type OxTS xNav 550
* An integrated NovaTel GPS-INS system to support the Ka-band radar
* Slant looking DSLR camera (Canon 60D)
* Nadir looking DSLR Camera (Canon EOS 7D)

The ALS setup is similar to the setup in the same aircraft during EU ICE-ARC/ESA FinExp campaign in 2015 (Hvidegaard et al., 2017) and ESA campaign CryoVEx17. All instruments were mounted in the camera bay located below the floor in the cabin, except for the Honeywell and IMAR INS, which were mounted on the floor below the operator seat in the cabin.

Camera Bay Antenna:

* AIR2 Javad Delta (connected to antenna G)
* AIR4 Javad Delta (connected to antenna F)

The instruments were mounted in the aircraft and tested in Calgary before the departure for the phase 2 campaign. The lever arms from GPS antenna to ASIRAS and ALS reference points are given in Table 4, and the hardware installation can be seen in Figure 3 and 4.

**Table 4: The dx, dy and dz offsets for the lever arm form the GPS antennas to the origin of the laser scanner, and to the back centre of the ASIRAS antenna (see arrow Figure 8).**

|  |  |  |  |
| --- | --- | --- | --- |
| **To laser scanner**  | **dx (m)**  | **dy (m)**  | **dz (m)**  |
| from GPS antenna F  | + 0.27  | + 0.05  | + 1.55  |
| from GPS antenna G | - 0.28 | +0.413 | +1.52 |
| **To ASIRAS antenna**  | **dx (m)**  | **dy (m)**  | **dz (m)**  |
| From GPS antenna F  | - 0.82  | + 0.05  | + 1.92  |
| From GPS antenna G | - 0.27 | + 0.413 | + 1.89 |