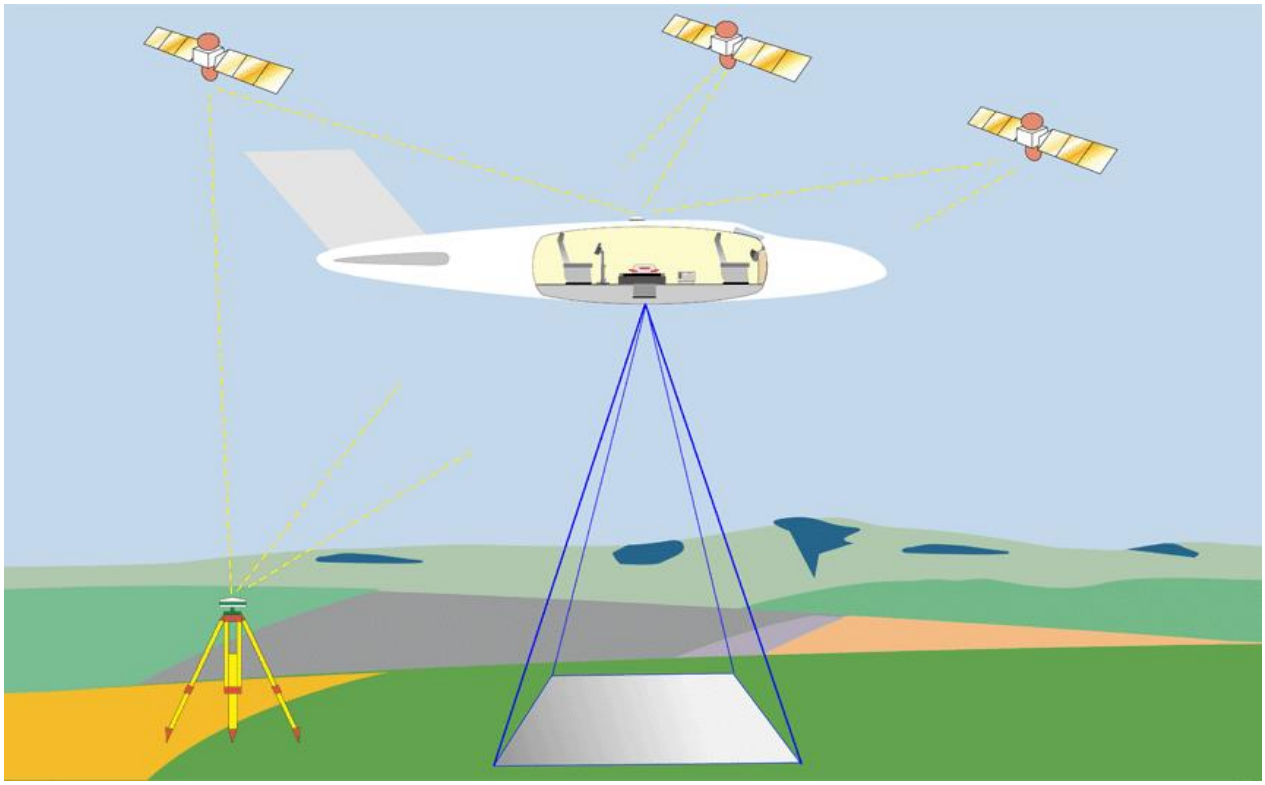
Leica RCD30
Calibration Certificate



	Camera Head	Serial Number	Lens	Serial Number
This certificate is valid for	***CH82***	***82553***	***NAG-D 4.0/50***	***50165***

Calibration certificate issued on ***25.02.2015***

Inspector

Riedl Bernhard

Certificate and calibration data ID

RCD30_Geometry_CameraHead-82553-D-798528_LensSystem-50165-A-785422_DateTime-20150225-095644

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Document code 791649

- when it has to be **right**

Leica Geosystems

Sensor layout of tested system

The RGB CCD carries a BGGR Bayer pattern with overlapping spectral bands.
The NIR sensor is a monochrome CCD. It is spectrally separated from RGB through a dichroitic beam splitter device. NIR pixels are 2x2 binned from 0.006 mm to 0.012 mm.

Sensor	Pixel size [mm]	Active rows	Active columns	Raw rows	Raw columns
RGB	**0.0052**	**7752**	**10320**	7788	10336
NIR	**0.0120**	**3654**	**4478**	3366	4500

Camera model of distortion free images

All factory calibration results contain fixed nominal focal lengths and zero principal point offsets.
Leica FramePro applies the grid to create distortion-free images of nominal focal length and pixel size. NIR is interpolated to the resolution of RGB during this process.

Parameter	Value of distortion free images
c: focal length	53 mm
xP, yP: principal point (PPA)	Zero The PPA is the origin of the image coordinate system. It is located in the image center (row 3893.5, column 5167.5).
k0, k1, k2: radial symmetric distortion	Zero
p1, p2 : decentering distortion	Zero
b1, b2: non-orthogonality	Zero
Pixel size (height and width)	0.0052 mm for RGB and 0.006 mm for NIR
Image rows	7788
Image columns	10336

Calibration process

Adjustment of optical systems in optical laboratory

		Passed	Date	Inspector
DSNU (Dark Signal Non-Uniformity)	*checked*	***ok***	***25.02.2015***	**Robin Weinbuch**
PRNU (Photo Response Non Uniformity)	*calibrated*	***ok***	***25.02.2015***	**Robin Weinbuch**
FMC origin	*calibrated*	***ok***	***25.02.2015***	**Robin Weinbuch**
CCD Saturation (VNS)	*calibrated*	***ok***	***25.02.2015***	**Robin Weinbuch**
CCD blemish list	*created*	***ok***	***25.02.2015***	**Robin Weinbuch**
Best image plane	*adjusted*	***ok***	***25.02.2015***	**Robin Weinbuch**
Goniometric calibration	*created*	***ok***	***25.02.2015***	**Robin Weinbuch**
Final image quality check	*checked*	***ok***	***25.02.2015***	**Christoph Reumiller**

Inspection

Inspectors

Name	**Bernhard Riedl**	***25.02.2015***	
Position	RCD30 Production Manager		

Results of the calibration in the optical laboratory

The resulting distortion grid file that contains all the geometric information of the camera is attached to this certificate. File name is on the first page and footer of each page.
All factory calibration results contain fixed nominal focal lengths and zero principal point offsets.
Leica FramePro applies the grid to create distortion-free images of nominal focal length and fixed pixel size of 0.0052 mm. NIR is interpolated to the resolution of RGB during this process.

Reference band (green)

Calibration method	Measurement of image distortion, using a bi-axial highest precision goniometer. The measurement is done on 117 points with the camera rotating in front of a collimator that projects a circular pinhole from infinity into the camera. The measurement is done in two faces to compensate for non-orthogonality of goniometer axes and internal camera effects.
Expected accuracy of distortion	Better than 0.003 mm for 90% of the image, and 0.006 mm at the image border
Principal point (PPA)	The PPA is determined with and accuracy of 0.0300 mm

Other spectral bands

Calibration method	Goniometric calibration, using the same set of images as for the reference band.
Expected accuracy of co-registration to the reference band	Red and Blue: Better than 0.002 mm Near Infrared: Better than 0.003 mm for 90% of the image, and 0.006 mm at the image border.

Remark

IMU misalignment can only be calculated based on flight data. Flight data also enables precise determination of the PPA. The procedures how a user can determine the IMU misalignment and the PPA are given in the Leica RCD30 Documentation, Volume2 ‘Technical Reference Manual’, Chapter ‘Advanced operation’.