

Star Tracker testing campaign – Sutherland December 2015

The SEAM satellite will use a star tracker system for attitude determinations and that star tracker is developed by KTH. The function of the star tracker is that a camera with a 5-megapixel sensor takes a picture and finds light blobs in the picture and store data about where the light blob is on the sensor, how many pixels that are involved in the blob and the intensity of it.

A Lost-In-Space algorithm is then used which calculates the angles between the stars and compare it to a star catalogue. Four stars is usually enough to achieve a unique pattern and reliable recognition. A reduced star catalogue is used to save memory and around 4000 stars is enough to have total coverage of the celestial sphere.

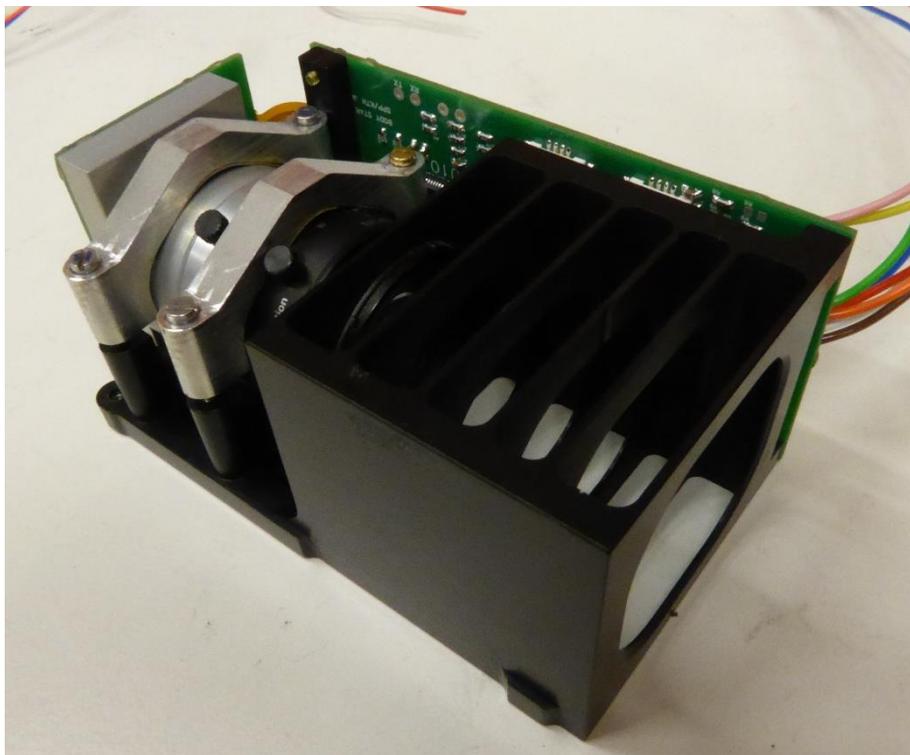


Figure 1. Star tracker.

During the development phase the star tracker has been tested extensively on the stars seen from Stockholm but also from other parts in Sweden and Europe. This has been done in order to not only test the function of the system but also to make sure that it works on the whole sky and can give reliable results independent of which directions it is pointed in. Not all stars of the celestial sphere can be seen from Swede. Therefore one also need to go to the southern hemisphere to achieve total coverage of the sky.

Sutherland Observatory in South Africa

Through the good relations between KTH and South African Astronomy Society (ASSA) an opportunity was found where a big part of the southern hemisphere could be covered with excellent conditions. Namely at Sutherland Observatory in the Karoo Desert.

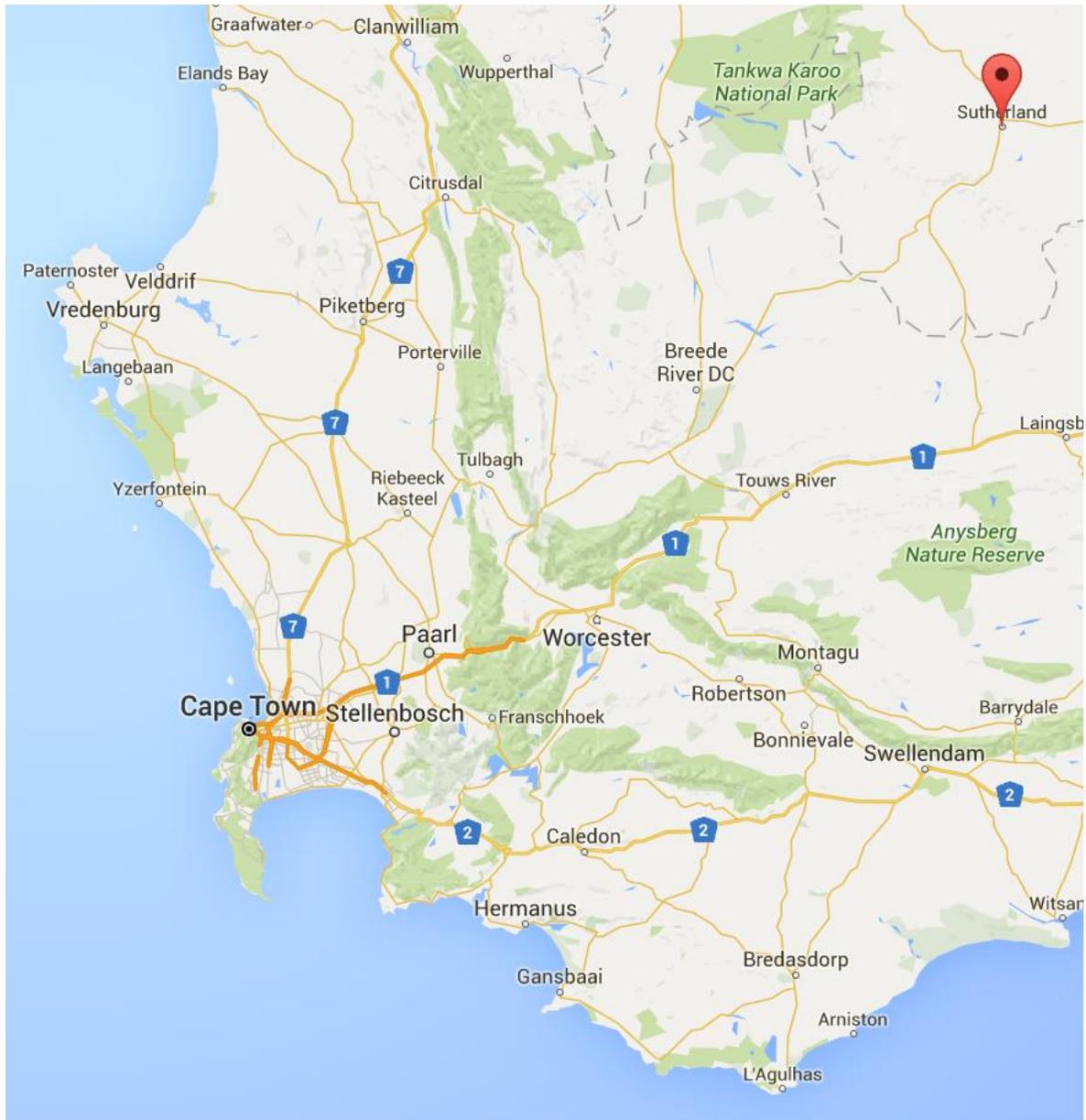


Figure 2. Sutherland, South Africa.

Simon Westerlund spent 8 nights observing between 5th-14th of December 2015. Around 100 000 pictures were taken each night. A motorized rig was used to aim the camera and to make sure to cover as much as possible of the sky. The rig could tilt the camera around an axis and as the sky moved during night it covered almost 50 % of the southern hemisphere each night.

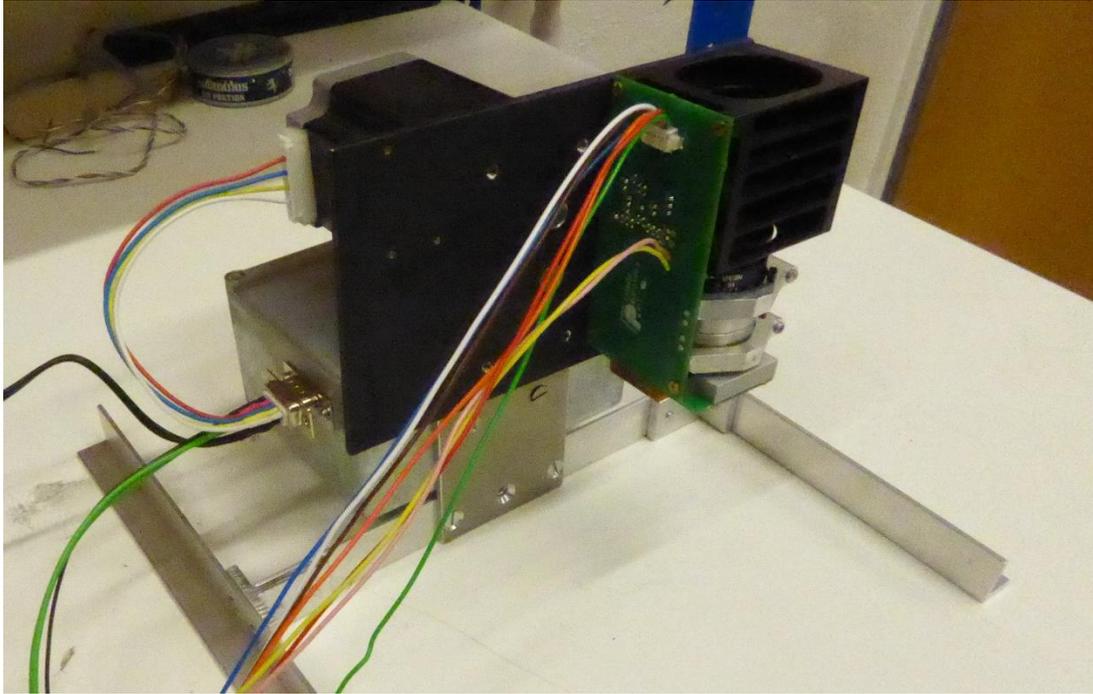


Figure 3. Star tracker of motorized rig.

At every time of the year some stars will be blocked by the sun and the challenge was to take photos of the stars closest to the sun. All the recognized stars can be seen in figure 4.

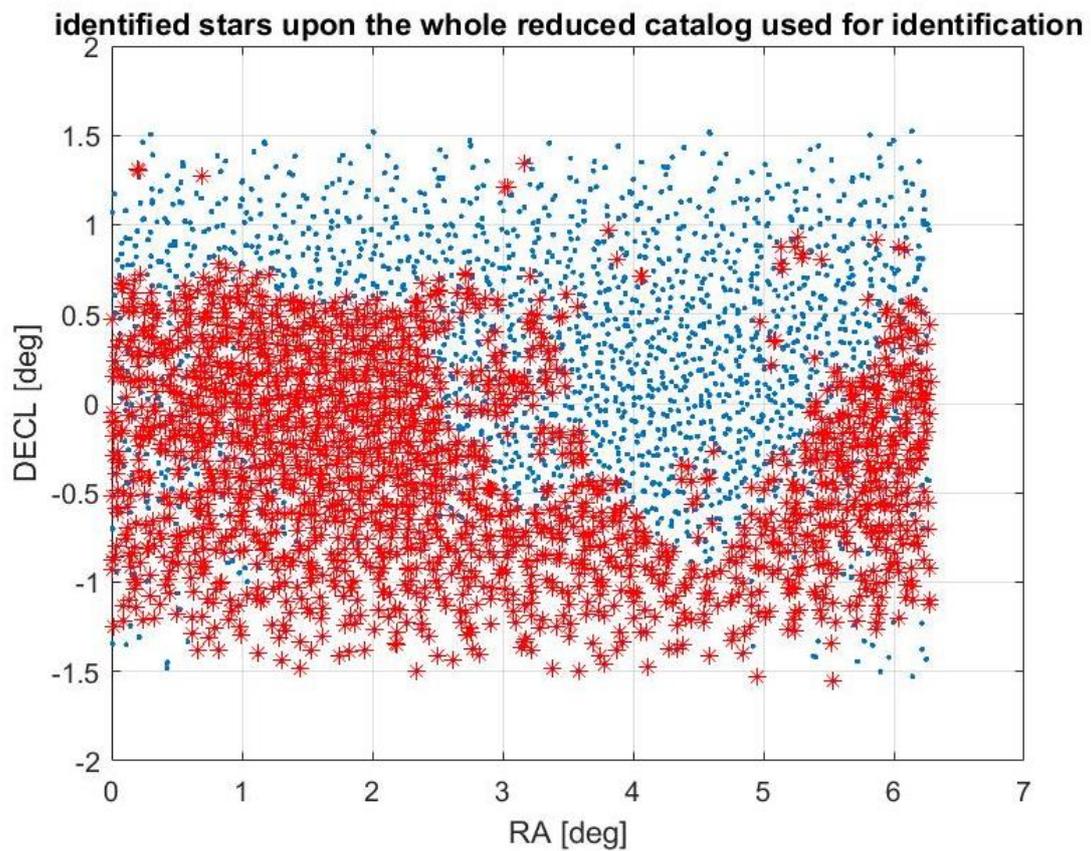


Figure 4. A map of the celestial sphere where the blue dots are the stars in the onboard star catalog and the red are identified stars. DECL 0 is the equator.

The results were good and a valuable part of the development of the star tracker system that SEAM will use to navigate in space. Some of the stars close to the equator which were not covered during the time in Sutherland might be possible to reach from south Europe during spring 2016.