



SAN FERNANDO BAKER-NUNN CAMERA

TRANSFORMATION

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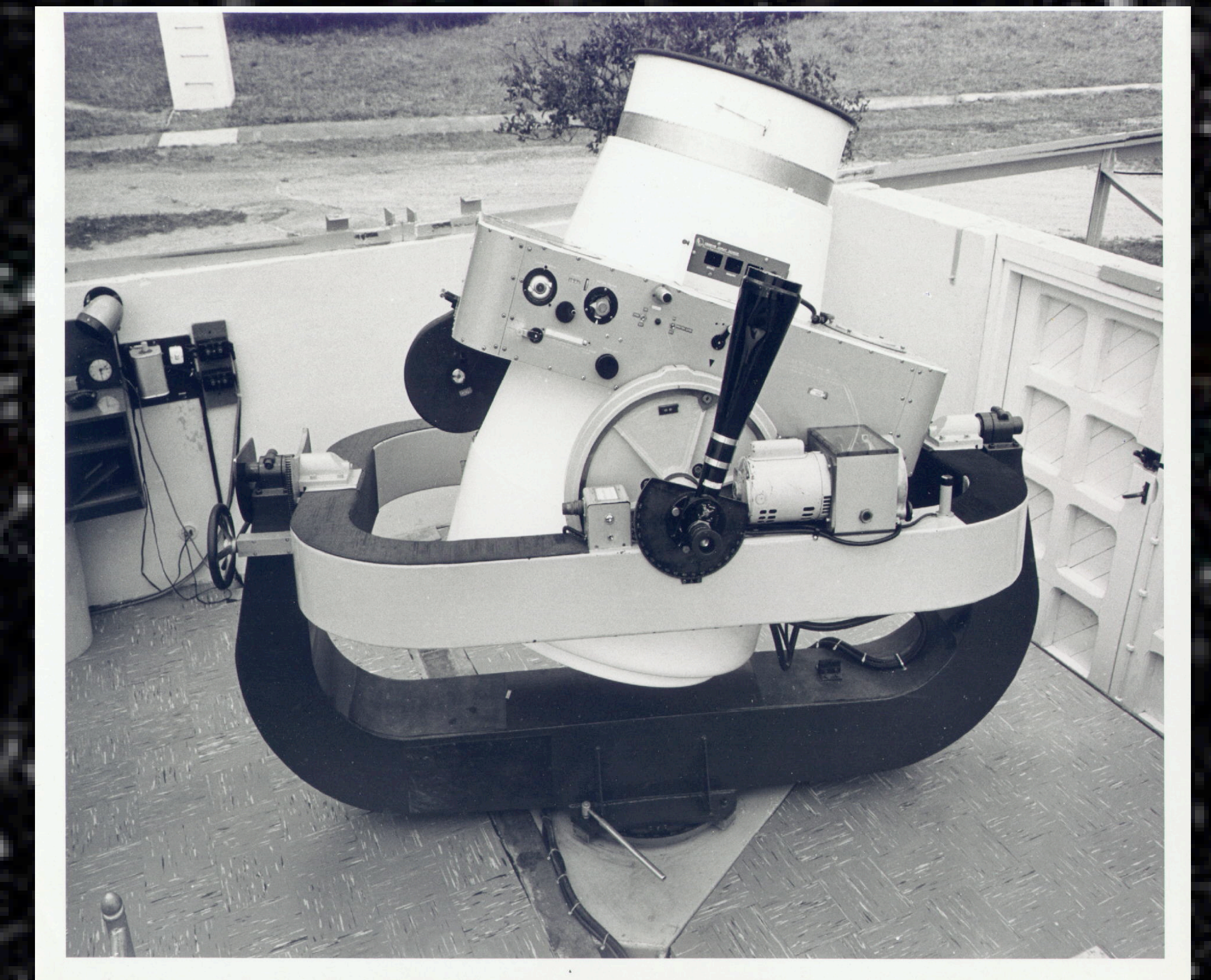
The Automatic Wide Field Telescope (AWFT) project is a San Fernando-Fabra collaboration to enable a Baker-Nunn camera for remote and robotic CCD use

Original Baker-Nunn Camera (BNC)

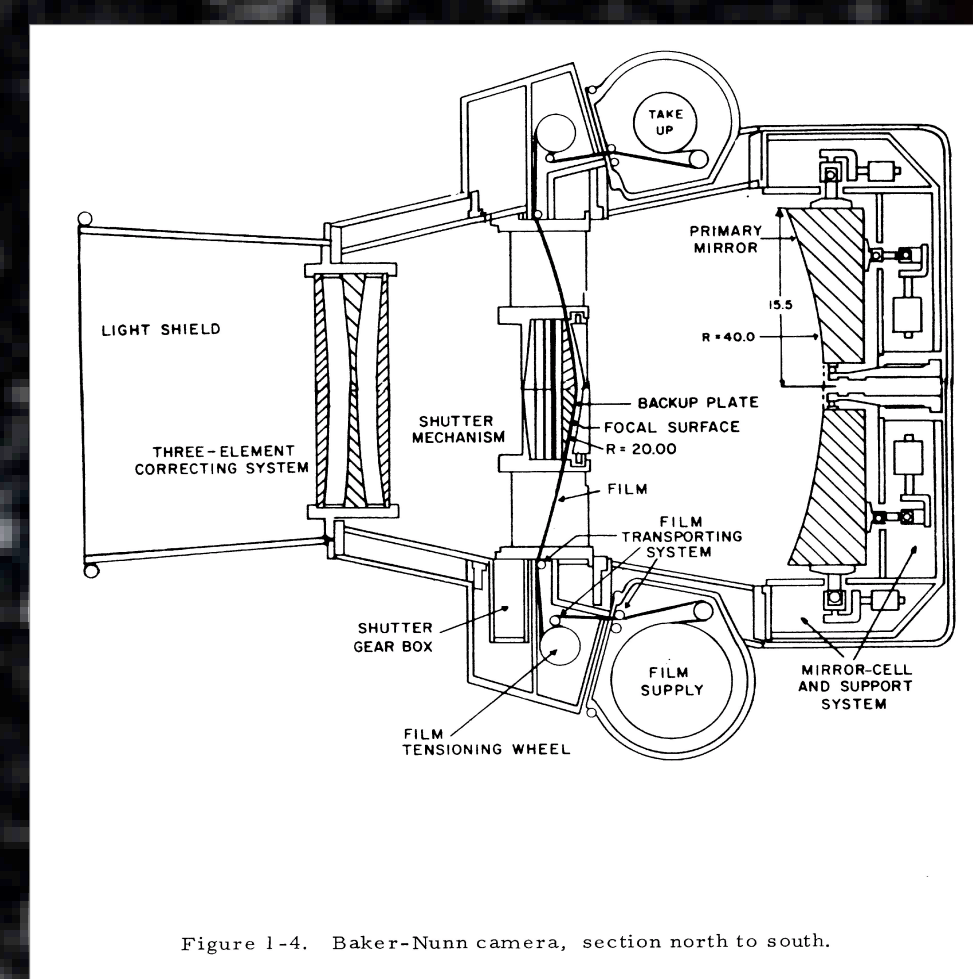
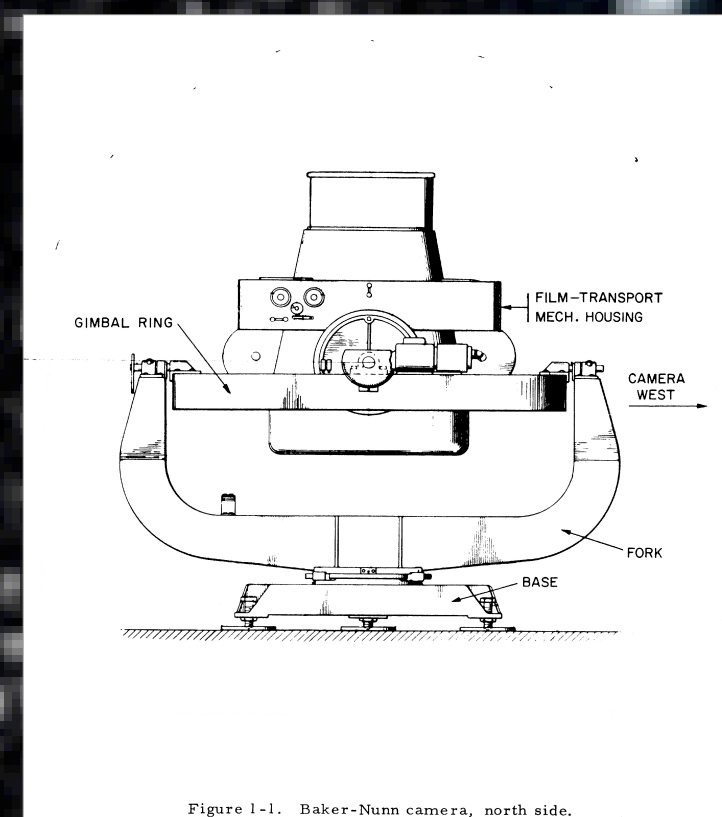
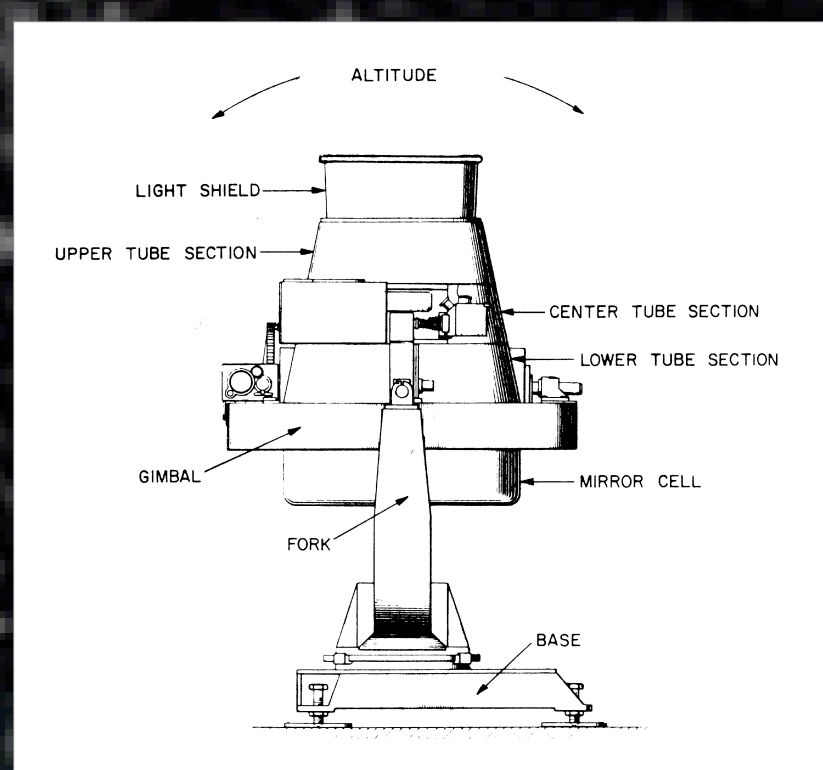
BNC brief history

- The BNC was commissioned during the spatial race in the 50th by Smithsonian Institution (USA) with the aim of detecting artificial satellites. It's a photographic telescope f/1 of wide field of view (fov 5°x30°) with a spot size smaller than 20 microns throughout the field.
- There was installed 12 identical cameras around the world. One of them at the ROA in San Fernando during the 60s. It was the first tracking satellite station in Spain.
- It performed an excellent job with more than 15000 photographs of all kind satellite passes.
- During the 80s BNC cameras were superseded by new technologies as laser, radar and digital CCD photography.
- Once the photographic observation of satellites was relegated, the camera was donated to ROA, where it has been maintained inactive but in excellent state of conservation.

Mechanics	
Type	Alt-azimutal system
Azimuth	Manual
Altitude	Manual
Optics	
Design	Original Baker-Nunn-Schmidt modified with spherical mirror and three corrector elements.
Aperture	50 cm.
Focal ratio	f/1
Scale	410 arcsec/mm
Mirror diameter	0.78 m
Field of view	5° x 30°
Spot size	<20 microns all field
Detector	
Detector	Cinemascope film
Format	55 mm



Baker-Nunn Camera at Real Observatorio de la Armada de San Fernando (ROA), its original site, when it was still in operation. Observations were performed by NASA and ROA teams.



Refurbishment project

AWFT is a project to modified the BNC applying new technologies to be used as wide field remote and robotic telescope, working with CCD digital technics. It will be controlled from ROA and Fabra Observatory in Barcelona.

Through a simple optical modification to adapt the camera for CCD use, we will get a useful FOV of 5°x5°. This will provide us with a unique instrument to perform precise systematic observations of large sky areas in a short period of time and with a relative high limiting magnitude.

The BNC and other devices included in the system will be modified to operate as a fully automatic, robotic and remote facility controlled via internet.



Mechanical modification in Carnaca Arsenal, San Fernando

Modification tasks in ejection:

Mechanical:

- Conversion of original mount to equatorial.
- Installation of new servo drive for RA and DEC axes.
- Installation of posicional absolute encoders and GPS card.

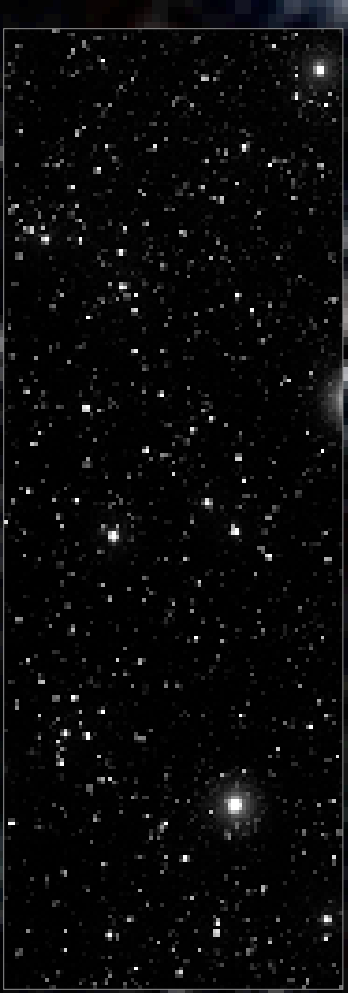
Optical:

- Addition of a field flattener 2-element corrector.
- Modification of optical parameters to maximize the useful FOV.
- Cover the first element corrector lens with a thin layer anti-humidity of MgF₂

CCD Adaptation:

- CCD Peltier effect refrigerated (3 stages).
- Pixel size: 9 μ → 3.7 arcsec/pixel
- Field of view with CCD 4096x4096 (9 μ): 4.2x4.2 deg²
- Optional filters 5 mm BVRI.

Scientific project



1. QDSS (Quick Daily Sky Survey)

Capability to cover all visible sky from site in only 4 nights (TDI mode).

2. Especific programs

The great FOV and fast response time (less than one minute) in remote-robotic observation mode, enables modify BNC to work in observational programs such as:

3. Education and divulgation activities

- Discovery and tracking of asteroids and comets.
- Extrasolar planets detection.
- Detection and tracking of transit optical phenomena like GRBs, supernovas (SNs) and novas.
- General CCD photometry and high temporal resolution in scan mode.
- Detection and tracking of Space Debris.



Working Site



In a natural park (Cadi-Moixeró) protected by law, 100 Km. north of Barcelona city, in Catalan Pirnyees.

Longitude: + 1° 53' 40.7"
 Latitude: + 42° 19' 14.7"
 Altitude: 2531 m

New site advantages

In order to take advantage of the BNC specifications, it should be moved to a site with very good astronomical conditions. We have chosen the Tossa d'Alp Peak in Catalan Pyrenees.

- Excellent sky conditions (darkness, moderate humidity and seeing, low extinction, good transparency...)
- Guaranteed round year access. Forestal track in summer and telecabin (sky station of La Molina) all the year.
- Electricity conventional net, water and phone.
- Meteorological data of the place for the last 5 years.
- Guarded building to harbour the observatory next to a mountain refuge with all year round guard living in.

