Upgrading the 30-inch Telescope at Linden Observatory

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The 30inch Telescope Comes to Linden

1997. Under the direction of famed supernova hunter and Linden trustee Bob Evans, the 30inch Starsplitter Telescope was shipped from the USA to provide a really large telescope for use at Linden and to be a focus for observational astronomy there. It was recognised that the Beames 24inch probably could not be used in its present configuration by the public - for safety reasons.
The Beames 24inch is a “bent cassegrain” design: 152mm secondary at top and a small optical flat in the bottom tube. Eyepieces were inserted to the side of the tube.
30inch telescope shed on left. Beames dome with 24inch telescope on right.
WSAAG Members Become Caretakers of the 30inch

The 30inch telescope became less used over time and was in need of some attention. Linden Trustee Bob Evans remarked: “the 30inch telescope needs somebody to love it and to use it”.

October 2012. WSAAG expressed interest in operating the telescope. As primarily Dob users, Bob made Gerry Flanagan and I new caretakers of the scope.
Old Optical Specs

Primary mirror diameter: 30inch (762mm).
Primary mirror focal length: 132.5inch (3362mm).
Primary mirror weight: 44kg.
Focal ratio: f/4.42.
Secondary mirror size: ~ 5inch (125mm).
Early Issues we noted with the Shed and Scope

• Manual winch to roll the shed off was slow and labour intensive.
• Base of shed was in need of rust treatment.
• Concrete slab was not wide enough for ladders. This was a major safety concern.
• EQ platform was a bit of a lemon so the scope was essentially manually operated.
• Not enough in-focus for several eyepieces e.g. Ethos 21mm.
• Straight through finderscope at the top of the scope was a fall risk.
• Scope needed frequent collimation. Sometimes more than once in a night’s viewing.
• Old 2-wheel wooden ladder was unusable. Metal 3-wheel step ladder was cumbersome, could roll-away and, at times, had to be jimmied over the rails.
• Scope could be pointed below horizontal → risk of primary mirror flopping forward.
• Primary mirror was now some 18 years old and well-overdue for a recoat.
Some Initial Solutions

A Right-angle finderscope was placed lower to front of scope (relocated again later). Original finderscope still attached in photo below.
Note: low-profile rack and pinion focuser with no fine focus.
Low-elevation stop added to rocker box.
New Ladders:

Gorilla 0.8m Step Ladder.

Gorilla 1.8m Platform Ladder. Spring-loaded wheels were added later.

Red lights were added to the bottom of both ladders.

A 12V boat winch was purchased to move the shed.
Early May 2013 - The concrete platform around the 30inch was extended. Laying the concrete was tricky as we wanted the smallest gap left next to the rails that would still allow the shed to roll off.

Trustee Ian Bridges inspects the area.
The 0.8m step ladder and 1.8m platform ladder can be left at any corner without interfering with the movement of the scope.
Finding Objects before the Argo Navis and ServoCAT Installations
The EVANS 30” Telescope (T-Rex) was upgraded by SDM Telescopes mid May - early June 2013
May 2013. The 30” telescope was stripped down and packed by a dedicated crew of WSAAG members under the competent supervision of Dave Gault. It was ferried to SDM Telescopes Bunbartha (Victoria) by Dave Gault and myself.

Tony Barry, Alan Plummer, Lachlan Davis, Dave Gault, Peter Nosworthy
Dave Gault, Peter Read, Rob Horvat at Peter Read’s residence (SDM Telescopes), Bunbartha.
Early June 2013. The scope was returned to Linden by Peter Read. Photos courtesy of Kim Read.
Telescope Upgrades – Peter Read

• New powered ground board (EQ platform discarded)
• Full ServoCAT GOTO with Argo Navis and 10K encoders
• New 27-point stainless steel mirror cell with cable sling
• 2.5inch Feathertouch focuser
The trusses were also shortened to provide a better range of focus for eyepieces and some video cameras.

At some time in the future, we will replace the 5inch secondary mirror with a 5.5inch mirror.

When upright, the scope is about one foot (30 cm) lower to top. The old EQ platform added about 20cm to the height.

This also improves safety on the tall ladders as we don’t have to stand as high.
In honour of Bob Evans, the scope was officially named **The EVANS 30” Telescope**. Previously, it had a more casual name of T-Rex. Decals by Peter Read.
Stalk with Argo Navis handpad (blue) and ServoCAT handpad (black).
The top end of the scope also has a wireless ServoCAT handpad. Peter moved the boards with Finderscope, Telrad & ServoCAT handpad closer to the focuser for better access.
2.5inch Feather Touch Focuser with a 10:1 reduction fine focus knob.
SkyFi wireless adapter in rocker box.
The scope is routinely controlled using SkySafari on an iPad.
A floatation cell should be designed so that all points support the mirror evenly. Old mirror cell (left photo) –
• Many of the triangular pieces were locked (they should swivel) and none were flat.
• Triangles of the same size were of different thicknesses.
• Some had the wrong proportions with the bolt hole in the wrong place.
Net result: not all the teflon pads were in proper contact with the mirror. Fabric sling supported mirror to only 140 degrees of circumference.

Peter made up a complete new cage and cell of stainless steel triangles (right photo). The stainless steel wire sling supports the mirror to 180 degrees of circumference.
Adapters were constructed by Tony Barry and Dave Gault to insert a Point Grey Flea 3 video camera down the 2” focuser and a Grasshopper Express video camera down the 2.5inch focuser when using a 0.5x focal reducer.

The scope was one of a large contingent used for the Pluto occultation of June 29th 2015 just prior to the New Horizons flyby.

The Grasshopper Express camera was run by Dave Gault at 7.5 frames per second.
Flea3 in the 2inch adapter

Grasshopper in 2.5inch drawtube
NGC 1566 - Taken by Tony Barry in Oct 2014 using the Evans 30” and Grasshopper Express.

Supernova ASASSN-14ha, mag 14.6, clearly seen at centre in the inset at bottom right.

Stack of 100 images at 2 secs each. No darks, flats or post processing.

The supernova could also be spied visually in the telescope.
TPAS

The Argo Navis can be used to improve telescope pointing using its inbuilt Telescope Pointing Analysis System (TPAS). The system can, for example, take into account the gravitational flexure of the scope.

The two most used eyepieces in the telescope are:
21mm Ethos → 160x and TFOV ~ 38’
13mm Ethos → 260x and TFOV ~ 23’

Without any defined model, a slew to an object will usually put it somewhere within the field of view of the 13mm Ethos (radius ~ 12’).

Many hours were spent by Gerry Flanagan and I developing a pointing model. If we need to, we can perform a 6-star acquire and pointing will usually be well within 6’ of the target.
An Unexpected Problem

In November 2013, we experienced some issues where the scope would seemingly stop when slewing to an object. A test with a set of scales showed it took 3.2kg of force to pull the scope round from the top end. The scope is heavy. Peter Read and Dave Gault surmised that the ground board may have dished. Dave had a shim assembly made-up to lift the centre of the ground board.

Result: the scope now only takes 1.5kg of force to pull around from the top. Recent tests indicate this has not changed.
Spare Secondary

Dave Gault and I replaced the degraded 5inch secondary (left) with the spare from the main shed at Linden in March 2015.
The EVANS 30” primary mirror was re-coated early July 2015.
Evans 30” Disassembled and Mirror Packed

Early July 2015. Peter Read arrived around 8:45am.

We stripped the scope down and removed the primary mirror. The velcro, which centered the sling around the mirror, wasn’t too hard to get off. Eucalyptus oil got the stickier bits of glue off.

We had the mirror packed into Peter’s crate by 9:40 or so. Less than an hour and it was on its way north.

WSAAG work crew: Peter Nosworthy, John Bellingham, Sel Yusuf, Alan Plummer, me.
The recoat was done by Wayne Sainty of Saintech Ion Beam Systems, Taree. Photos courtesy of Peter Read.

Evans 30” mirror going into chamber

30” mirror rotating face-down and coated with vapourised aluminium ions in vacuum chamber
Photos courtesy of Peter Read.

Coated 30” mirror being lifted out. Note clamp around mirror.

A proud Wayne Sainty photographs his work. Assistant David removing clamp.
Evans 30” Mirror Back and Scope Reassembled

Photos courtesy of Peter Nosworthy.

WSAAG work crew: Peter Read, Tony Barry, Lachlan Davis, Dave Gault, Peter Nosworthy, Sel Yusuf, me.
So what was the Improvement achieved by the Re-Coat?

Expert variable star observer Alan Plummer did a number of limiting star magnitude tests before and after the re-coating of the mirror.

14/3/15, old optics.
A chart for the variable star CG Canis Majoris was used.
A star of magnitude 15.3 could be seen. Mag 16.0 could not be confirmed.
19/3/15, old optics.
The same field as above, with the sky a little better than on the 14th.
A star of magnitude 16.0 was definitely seen, but not 16.2
23/5/15, old optics.
The field of R Scorpii was used, with M80 in the field.
A star of 15.8 mag could be seen.
12/9/15, new optics.
The field of VY Sculptoris was used.
A star of magnitude 17.1 could be seen.

3/10/2015, new optics.
The VY Scl field was used again.
Magnitude 16.6 was clear, the 17.1 was not confirmed.

“This is a very rough and ready test of a telescope’s optics. It would be better if there were many more observations both before and after the work on the mirrors. However, unlike many modern large telescopes, the point of this instrument is for people to look through.

So from that point of view this test is reasonable. **Before the work we have an average limiting visual magnitude of 15.73, and after we have 16.85.** And remember that a 1 magnitude difference is a difference in light intensity of 2.5 times.”

Alan Plummer
The Evans 30 inch Telescope Today

The great thing about this big Dob is that it sits at a reasonably dark site not too far from Sydney and that it is available for visual observing. It gets lots of use in this regard. I never tire of the fantastically resolved views of Saturn, 47 Tuc or the two lobes of the Homunculus. The Tarantula is just spectacular. And you can see detail in galaxies that my 12inch Dob just can’t grasp.

The scope points and tracks well and is often used for events like occultations where the targets are too faint for the smaller scopes.

Many thanks to the Linden Trust for the use of the scope and their continued support in this venture.
I think we have made this into one of the best telescopes around for use by amateur (or professional) astronomers.