Digital Large Format Camera

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2013

Location: Glebe Tram Sheds
Original Image Size: 4288 x 2848px
Date: 18/01/2011
Camera: Nikon D90
Lens: AF-S DX NIKKOR 16-85mm f/3.5-5.6G ED
Image Data: 16mm, f/4, 1/10sec, iso200

Front page photo:
Location: Victoria Park, Sydney
Image Size: 12328 x 4730px (58MP)
Date: 01/09/2013
Image Data: f/45, 1200dpi

MOTIVATION

I am a passionate photographer who enjoys photography as a hobby. One aspect of photography that I enjoy is going to places and documenting a series of photos that describes a sense of the place. Techniques include taking overall views to minute details.

During a recent review of photos that I have taken I realised that some of the places I have document no longer exists. One such place is Glebe Tram Sheds. The graffitied and dilapidated walls are being replaced with a market and apartments. Only photographs remain to show the character of the place.

While the camera I had at the time did a great job of capturing the photos, however it wouldn't be the best to use for capturing photos that could be archived.

I decided that for photos that would be useful for this purpose I would need a camera that could capture great image quality, as close to what the eye can see as possible. The lens would have precise technical optical performance and a capturing device that would capture light a accurately as possible.

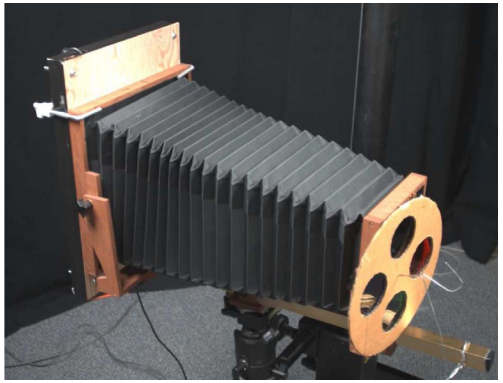
Upon some research I decided that the large format camera system would be the best possible technology I could have access to. The lens used in this system have been developed over the past 100 years to a stage that is highly matured. Currently the capturing medium is still film, while it does offer great image quality, it has a limited storage life and there are variances between the captured image to processing and final image. A digital capturing device would be a possible solution as what is captured can be directly archived with little need for processing.

However at the time of writing no such commercial digital capturing device exist for the camera. After more research I came across hobbyist and professional projects that use a scanner as capturing device for vintage camera system.

I decided to uses this approach to create the camera.

Source: http://mosesblah.wordpress.com/2010/03/03/the-scanner-camera/

Source: http://golembewski.awardspace.com/cameras/current/index.html



Source: http://www.cs.ubc.ca/~heidrich/Papers/EG.04.pdf

Source: http://dwarmstr.blogspot.com.au/2008/04/adventures-in-large-format-digital_09.html

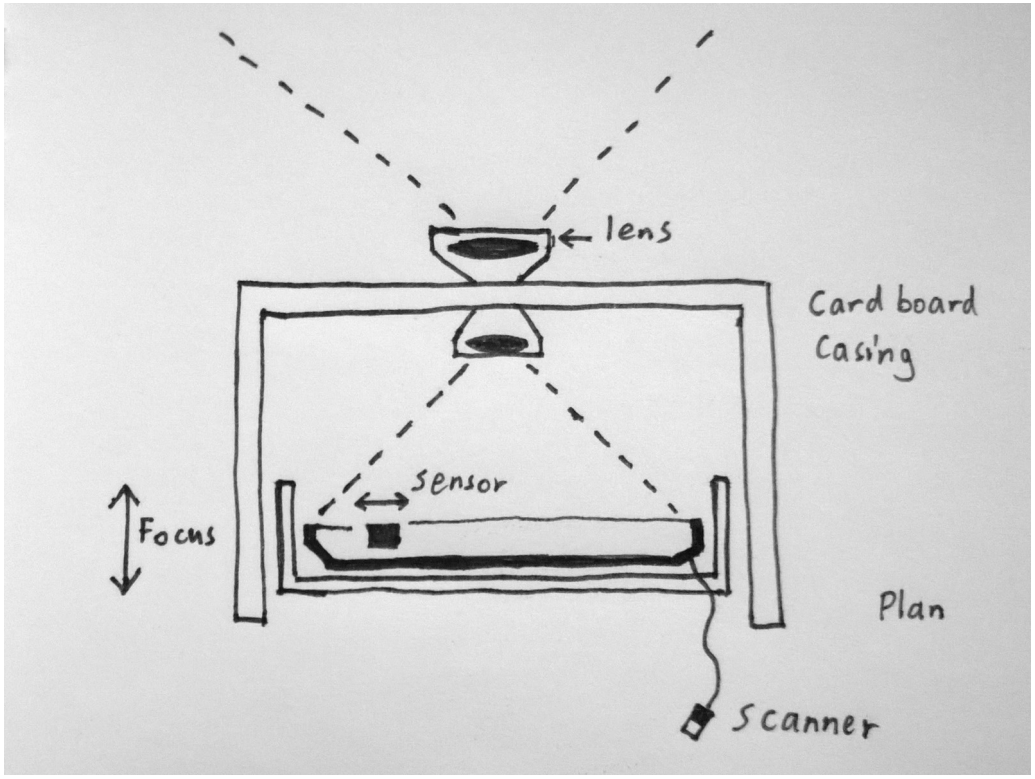
Source: http://golembewski.awardspace.com/photographyGallery/vehicles/index.html

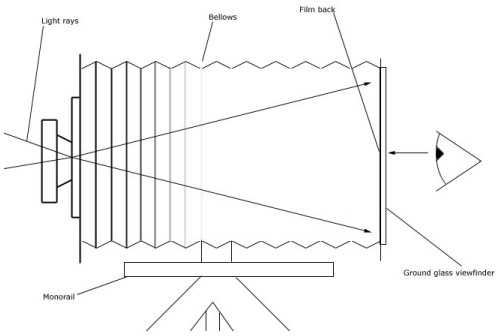
Source: http://dwarmstr.blogspot.com.au/2008/04/adventures-in-large-format-digital_09.html

RESOURCES

The scanner camera ideas has been widely developed and well documented on the internet. One of the most accomplished projects is a PHD document that describes there process to create a scanner camera that can capture high resolution colour photos. However scan lines that was captured during the scanning process have to edited thus reducing the amount of actual data captured.

Other projects have used this artefacts as a creative tool for capturing photos. The inherent process of ‘scanning’ a photo has also been used creatively by several scanner camera project to capture images with distorted objects moving in front of the sensor.





Source: http://library.thinkquest.org/25473/media/images/ph_images/ph_d_view_camera.gif

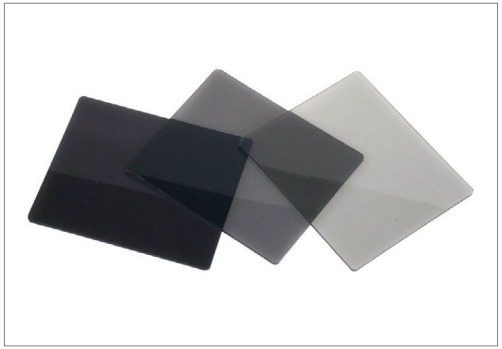
THE DESIGN

The design is based on the principle design of a view camera. It is simplified to a housing that holds a lens and sensor back. The housing has a slot for lens board so lenses can be changed. The sensor back is a separate movable part that can be moved back and forth for focusing.

Cardboard was chosen as the material for the camera to be built from as it is very easy to work with and cut into shape. It is also rigid enough to house the lens and scanner. Changes and adjustments can be easily made by cutting and gluing extra pieces of cardboard to the camera.

Large Format Lens

Infra-red Filter



Neutral Density Filter

Scanner

UHU Glue

Electrical Tape

PARTS LIST

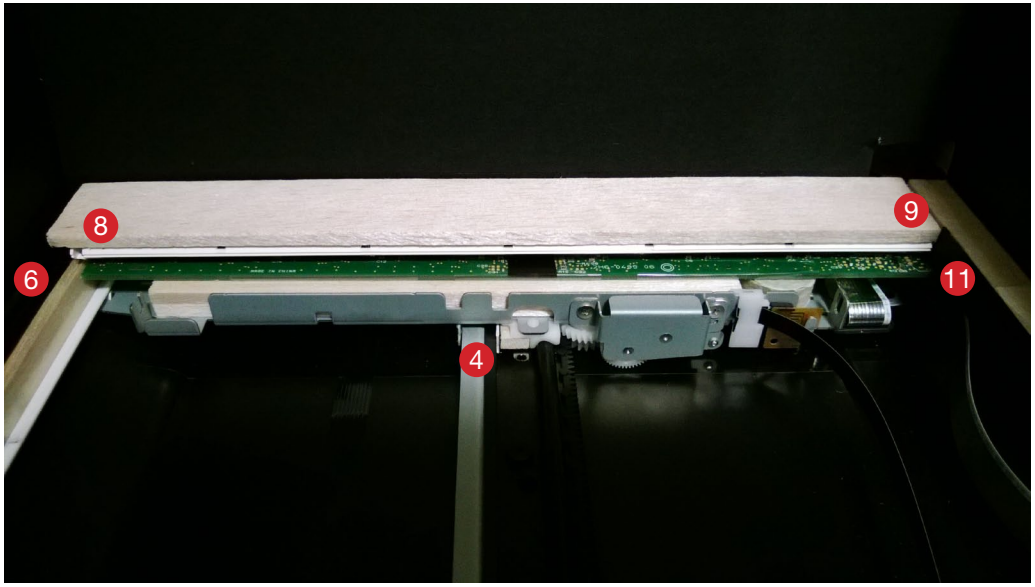
Lens: Schneider-Kreuznach Symmar S 210mm	Ebay
Infra Red Filter	Ebay
Neutral Density Filter	Ebay
Scanner: Canon LIDE 210	Computer Shop
Cardboard	Art shop
Black Card	Art Shop
Black Electrical Tape	Hardware Shop
Double Sided Tape	Art Shop
Masking Tape	Art shop
Clear Tape	Newsagent
4mm Balsa	Art Shop
4mm Nylon angle	Art Shop
UHU glue	Art Shop

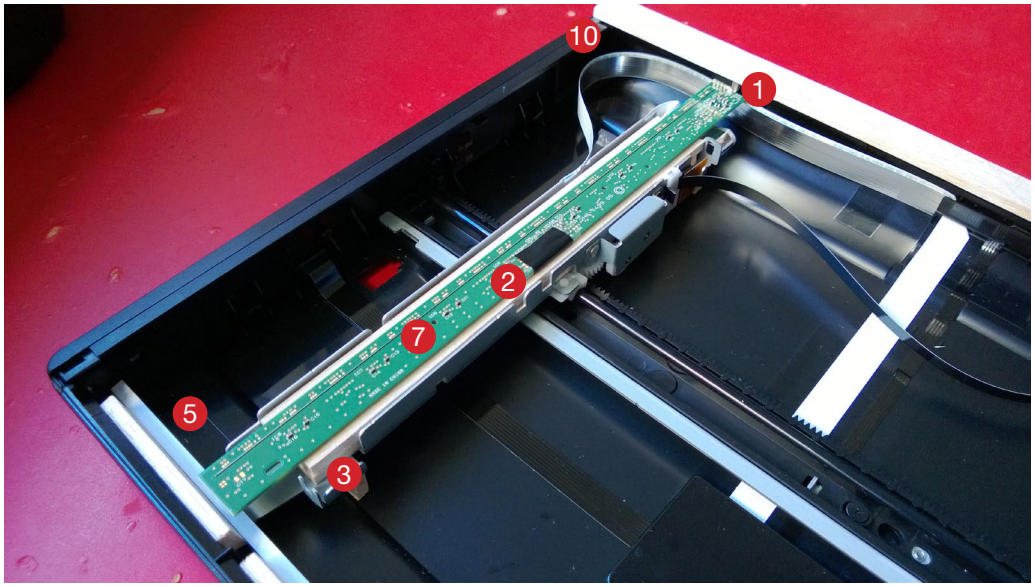
ACQUIRED FROM

CONSTRUCTION

1. DISMANTLE SCANNER

1. Remove cover.
2. Remove plastic strip that runs along glass. Use knife to prise open.
3. Slide glass out and lift up to remove glass plate.
4. Lift scanner head off transport mechanism and unplug flat wire
5. Remove plastic clips holding sensor by prising them off.
6. Remove clear plastic clips at ends of scanner head.
7. Lift sensor from lens holder.

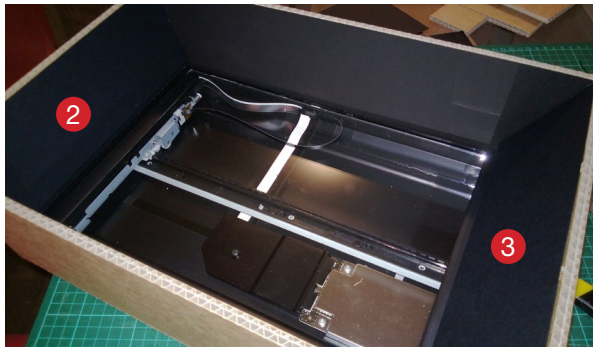




2. DIGITAL SENSOR BACK

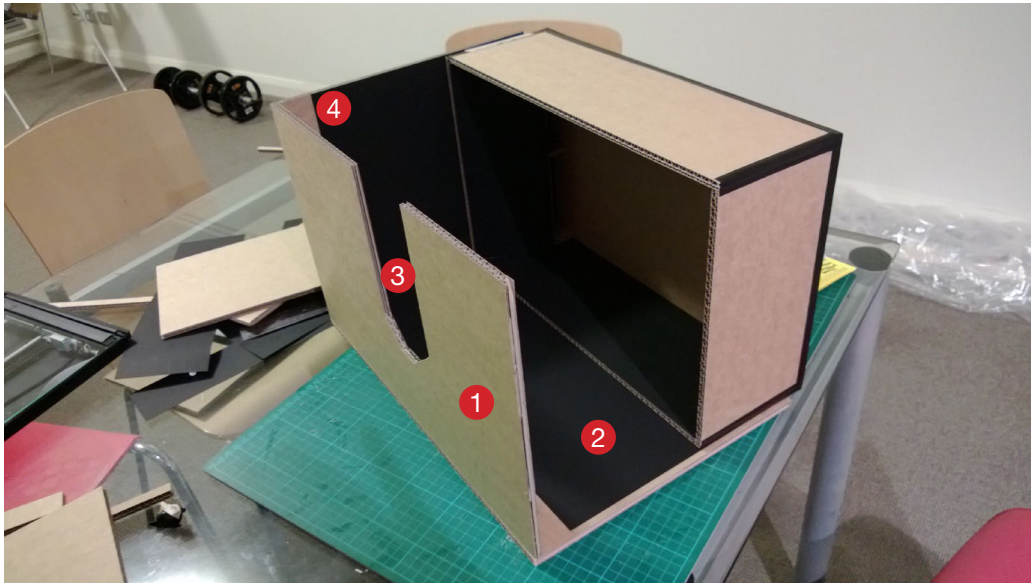
The scanner is used to capture the image. Streaking artefacts in the scan will appear if the LED light is covered during the scan. To overcome the line streaks that occur with scanner, the sensor must calibrate itself before it scans the photo. This means allowing the LED to operate before scan and turn it off when scanning.

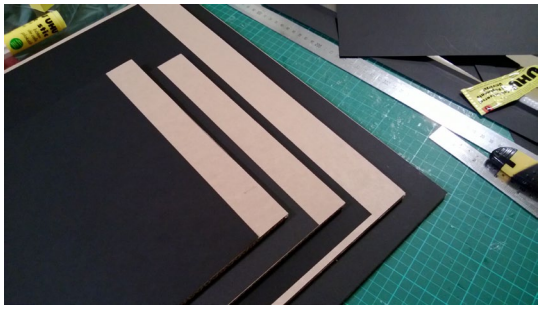
1. Tape around LED housing to reduce light leakage so only source of light is coming directly from LED chip.
2. Tape over scanner CPU to avoid contact.
3. Pack transport mechanism with balsa so sensor has surface to rest on.
4. Pack transport mechanism with balsa and plastic so transport mechanism travels smoothly when operating.
5. Build rail guide along edge of scanner case to guide transport mechanism.
6. Cut balsa into shape, wrap with clear tape and attach to case with double sided tape.
7. Connect wire back into sensor, stick back to transport mechanism with double sided tape.
8. Build prescan lens by sticking lens and white paper to balsa.
9. Stick lens to side of scanner and align with LED and directly over sensor.
10. Build rail guide along other side of scanner case so transport mechanism does not fall out when operating.
11. Stick black card to rail and align to LED light to reduce light leakage when operating.



2. DIGITAL BACK HOUSING

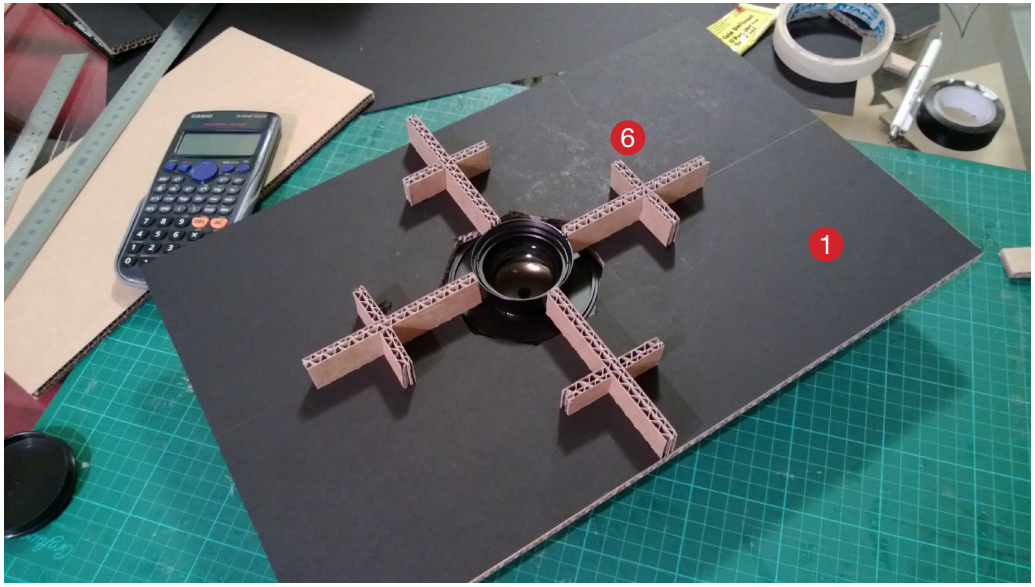
1. Build box around scanner so scanner can sit vertically when operating.
2. Build brace so scanner can slide under and not move when operating.
3. Leave one end of housing unglued so sanner can be removed.
4. Line inner box with black card to reduce light reflecting onto sensor.
5. Fold black card strip and stick to outside of box to act as light seal.

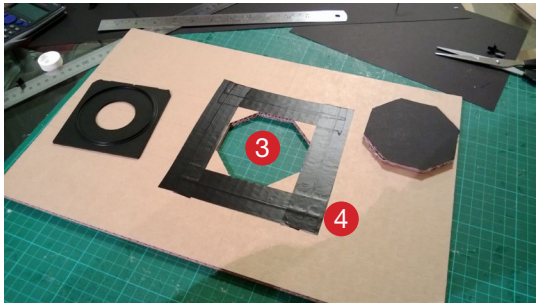


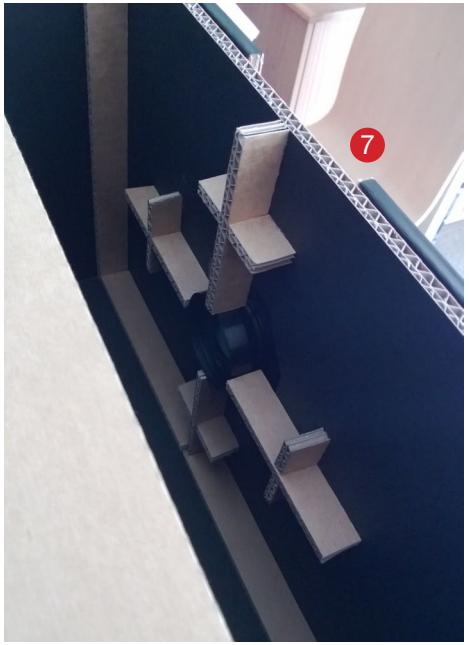


3. CAMERA HOUSING

1. Build box to same width and height of sensor back.
2. Line inside of housing with black card to reduce light reflection.
3. Cut opening at front of housing to allow lens to slide into.
4. Glue card strip to inside of housing to act as guide for lens board.
5. Add removable cover to camera housing.

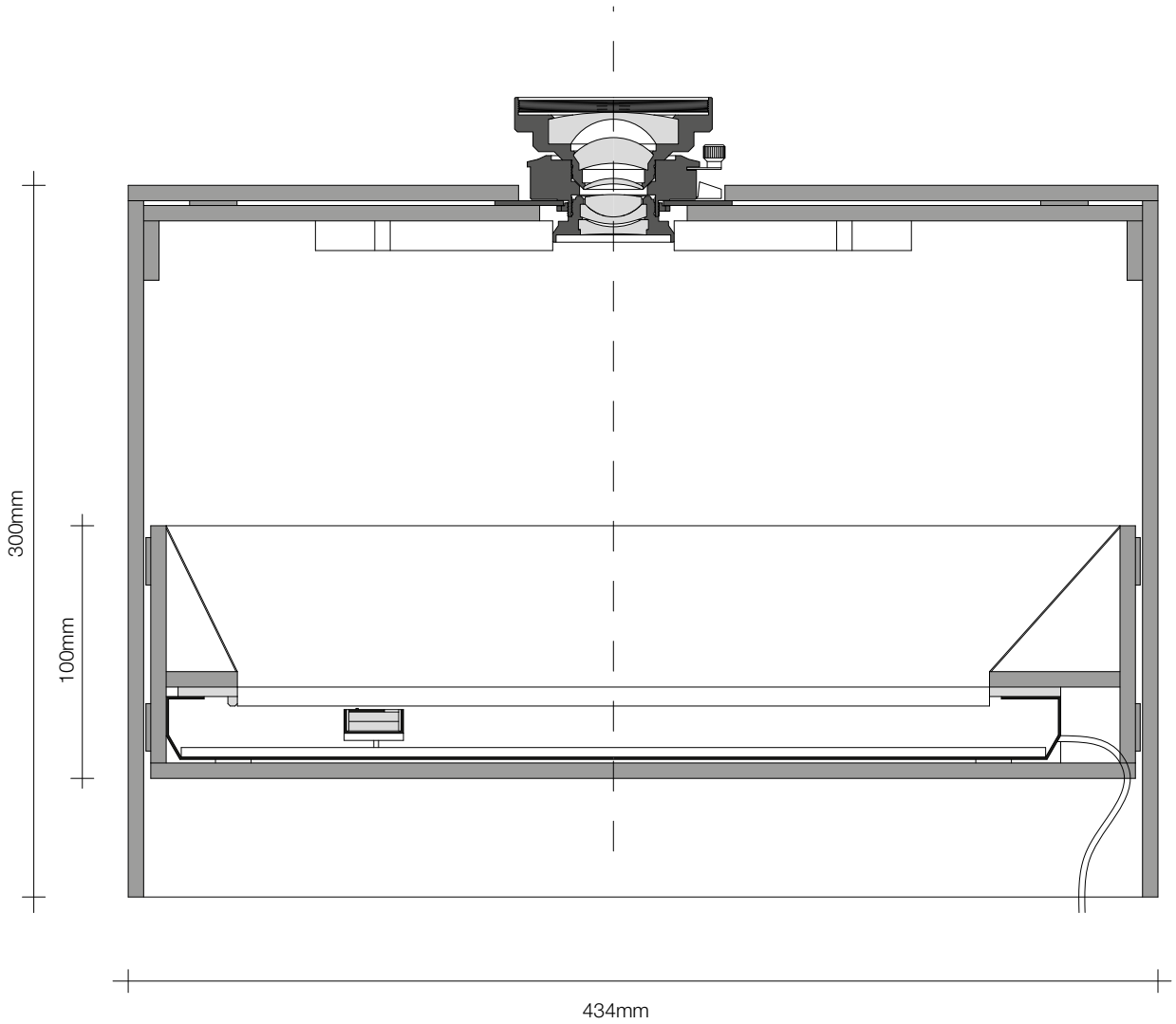






4. LENS BOARD

1. Cut cardboard to size of inside face of housing.
2. Glue one side of lens board with black card to minimise light reflectance.
3. Cut hole to fit steel lens board.
4. Tape surrounding hole with electrical tape.
5. Mount lens to lens board with masking tape.
6. Glue cardboard as lens supports to lens board.
7. Slide lens into camera housing



5. FINISHED CAMERA

Captured Image

Final Image

Captured Image:

Early test scan shows artefacts;
Top: Light leakage from uncovered LED.
Left: Vignetting from misaligned lens.
Bottom: Noise from broken part of scanner sensor.

6. SCANNING

1. Use scanning software to scan at highest resolution.
2. Open in photo editing software to crop, adjust contrast and levels.

Location: Living Room
Image Size: 28336 x 17884px (505MP)
Date: 02/12/2013
Image Data: f/11, 2400dpi

Shoes:
Dimple pattern in shoes captured clearly. Painting imperfection in window sill also captured. Even individual threads of carpet is able to be distinguished.

Location: Victoria Park, Sydney
Image Size: 26108 x 10248px (265MP)
Date: 31/08/2013
Image Data: f/22, 2400dpi

Duck:
Ducks eyes, beak and feathers captured with clarity. Individual leaves of plant is also legible. Scanning process also creates ‘interference’ pattern from water ripples.

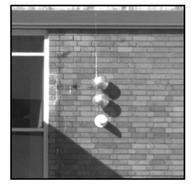
People:
Movement of people in front of scanning process captured with ‘cardboard cutout’ effect.

Scanner lens:
Early scan before scanner lens removal. Creative line effect from scanner lens.

Scanner testing and observations

People and Sign:
The writing on the sign is clearly legible and pedestrian able to be recognised on nearby street.

Antenna:
Wiring on cell phone antenna captured clearly. The dark line is artefact of alignment in scanners sensors hardware.



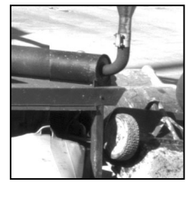
Bricks and Metal dome:
Individual bricks of nearby building captured clearly showing brick pattern and imperfection in laying. Vertical sun flare from steel dome artefact from scanner.

Centre Point Tower:
Located several kilometres away, windows and antennas is captured with clarity. The sky is captured with a smooth gradient and little to no grain.

Striation:
Striation pattern and artefact from some part of scanner capturing low contrast, low light areas.

Trees:
Some trees captured in low contrast. Can be corrected with infra-red filter.

Leaves:
Individual leaves captured with clarity. Blurring around the edges due diffraction from lens stopped down to f45. This can be corrected by using neutral density filter and lower aperture.



Truck:
Wheel barrow tire treads captured with clarity. The split in image is computer unable to write the large amount of data being captured.

Image Analysis:

Location: Ultimo, Sydney
Image Size: 12466 x 7642px (95MP)
Date: 01/09/2013
Image Data: f/45, 1200dpi