THROUGH A **TECHNICAL** LENS

CRAIG MARTIN

ABSAROKA OBSERVATORY AND VISITOR CENTER

Beartooth Pass, Wyoming

45° 58’ 15.18”N 109° 28’ 27.14” W

The Proposal.

Theoretical Ideas Research Case Studies Site Architecture Conclusions

The Presentation.

THESIS **PROBLEM STATEMENT**

How can architecture adapt to the changing needs of astronomy research?

THESIS **CLAIM**

As astronomy changes over time so do the techniques it uses. Architecture can adapt to these changes as astronomy develops by reconstructing itself for the future needs of users and the instruments it holds.

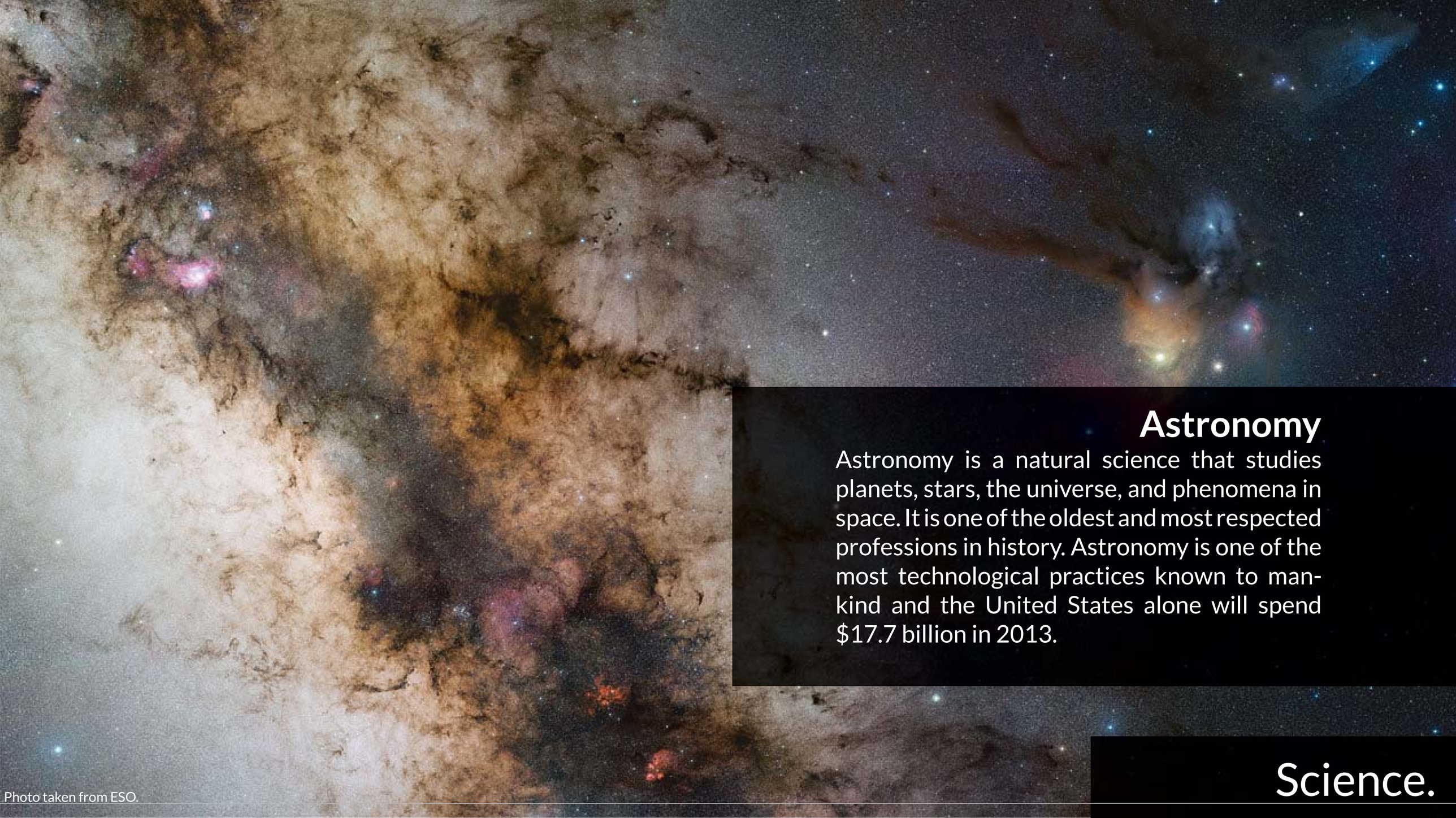
THESIS **PREMISES**

Astronomers need adequate and flexible space to conduct their research.
Observatories should be capable of evolving as quickly as the technology is houses.
Observatories and visitor centers must inspire and promote healthy work environments.
Observatories must achieve these ideas by becoming a building block for future technology and user interaction.

THE **THEORETICAL PREMISE - UNIFYING IDEA**

Observatories can use **regenerative design and deconstruction principles** to remain relevant to future techniques/technologies and the developing culture of astronomy research. Using these principles will allow architecture to be flexible and adaptable to future advancements in astronomy.

Design **Research**



Astronomy

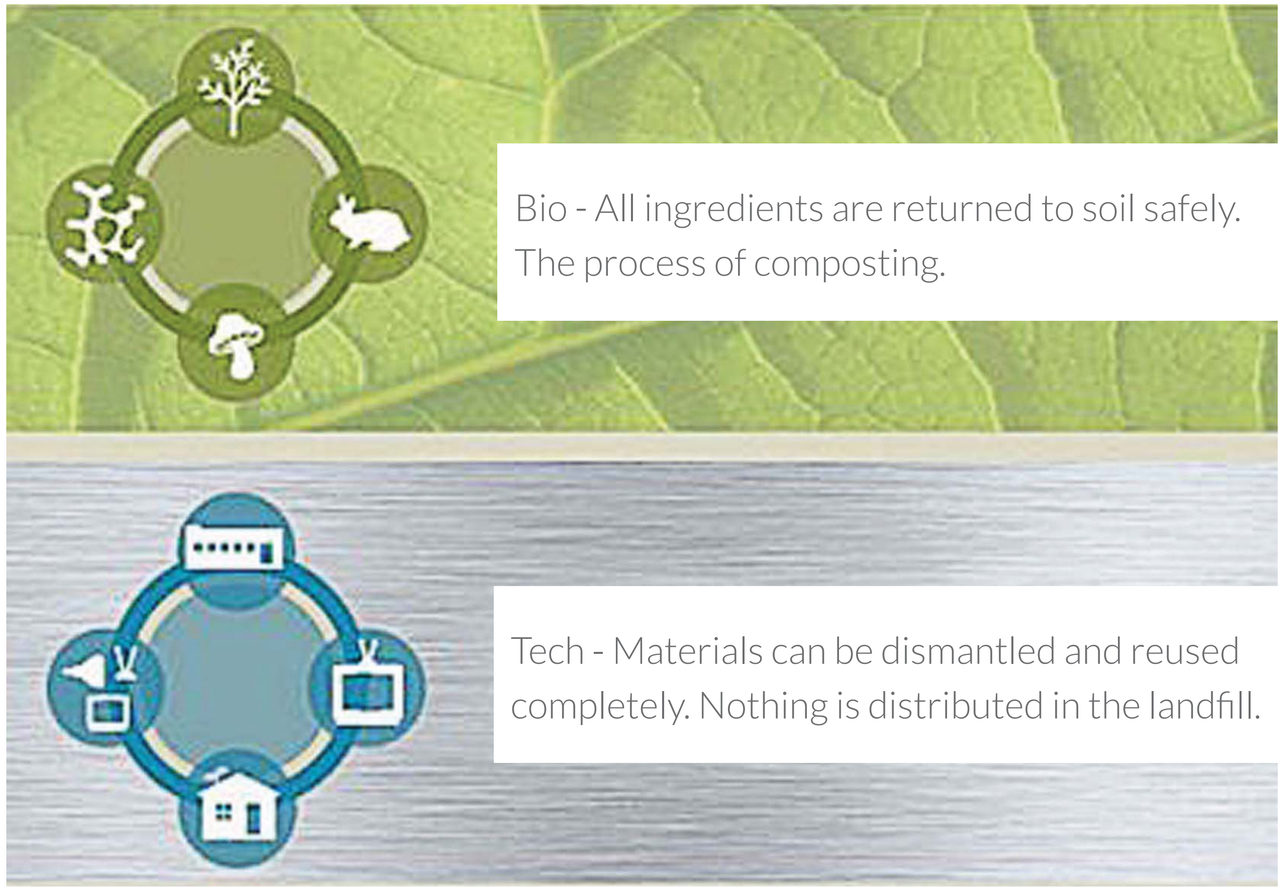
Astronomy is a natural science that studies planets, stars, the universe, and phenomena in space. It is one of the oldest and most respected professions in history. Astronomy is one of the most technological practices known to man-kind and the United States alone will spend $17.7 billion in 2013.

Photo taken from ESO.

Philosophy to Modern Science

Galileo “The father of modern observational astronomy” first used telescopes to observe the night sky. Those observations led to controversial new ideas of how the universe worked. His observational techniques developed rapidly into new telescope designs. Today billion dollar mega telescopes peer deep into space. New findings and ideas will continue to stimulate the human mind. We are a restless and curious people making astronomy a science that will never die away.

Photo taken from ESO.



Bio - All ingredients are returned to soil safely.
The process of composting.

Tech - Materials can be dismantled and reused completely. Nothing is distributed in the landfill.

Eliminating waste by using closed cycles to remanufacture parts for the observatory. Buildings can plan for change by using easy to assemble parts that take little energy to manufacture. Using products free of harmful chemicals not only reduces harm to the environment but it also eliminates harm done to the users of the facility.

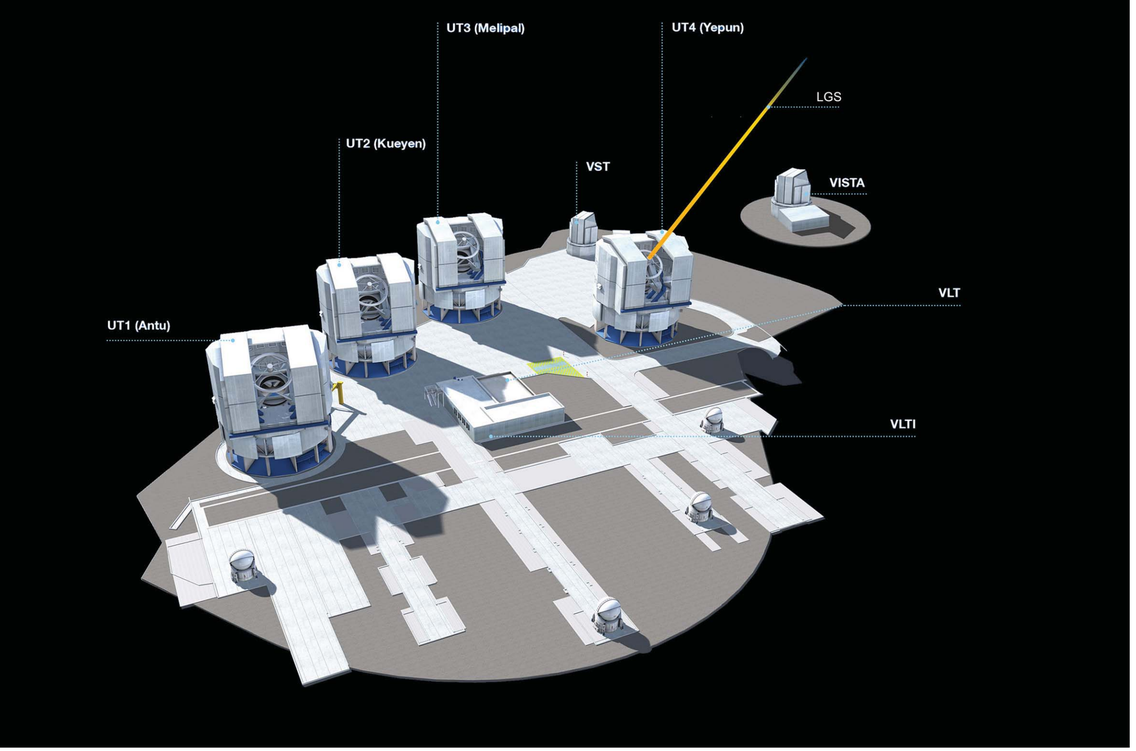
Image from Cradle to Cradle. William McDonough

Regenerative Design.

Buildings that can be disassembled and recycled. Each piece of the building becomes a valuable piece of material that can be reused in the next design. Structure should be recycled using minimal energy. Facades can be broken down into its separate elements and reused in the next facade. Pieces of the buildings are designed to be dismantled in the end.

Deconstruction.

Typological Case Studies



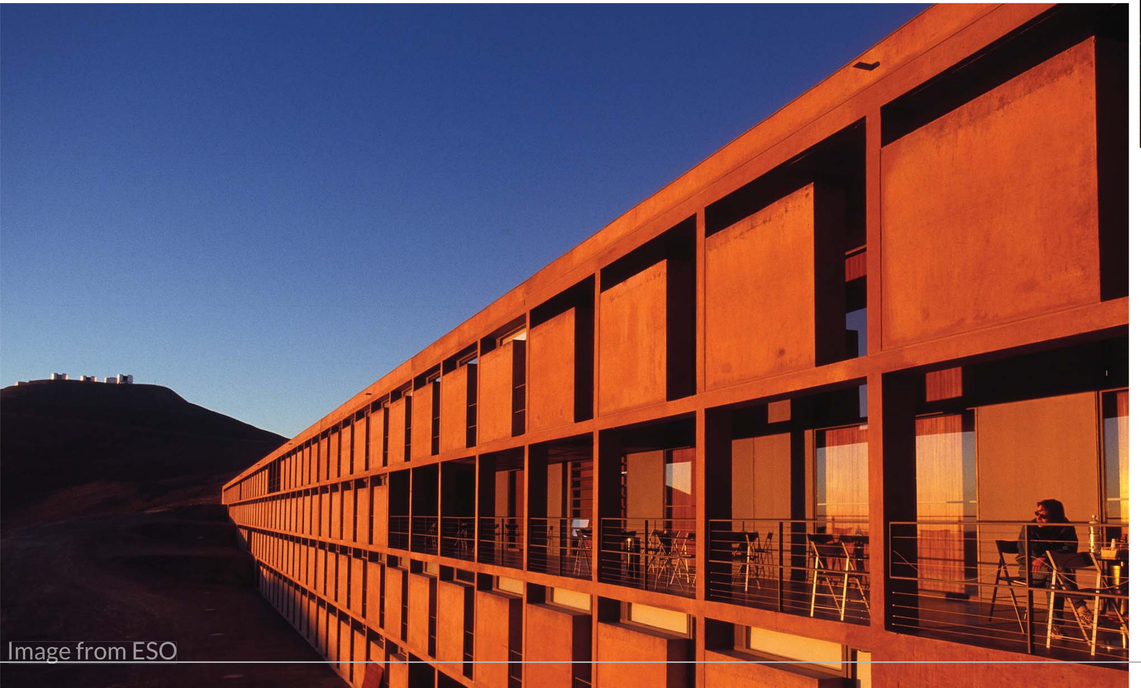
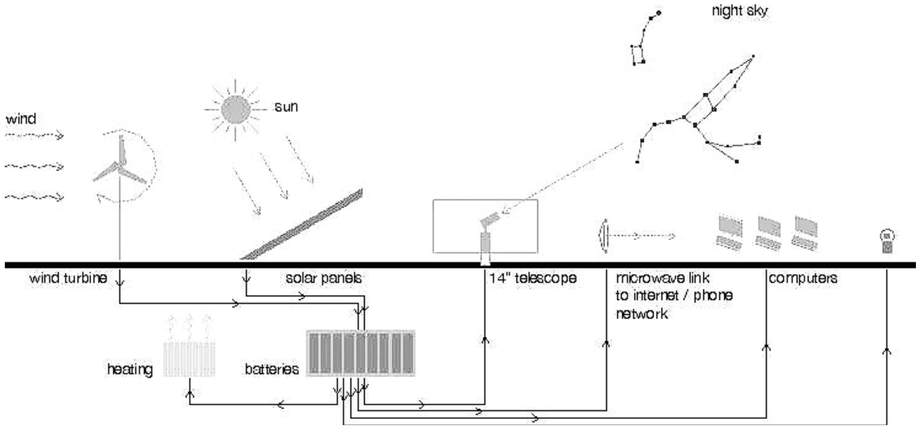


Image from ESO

ESO[European Southern Observatory], Chile **Cerro Paranal**

Interferometry
Interior gardens for humidification
Geared toward collaborative work environments

Image from Kielder Observatory

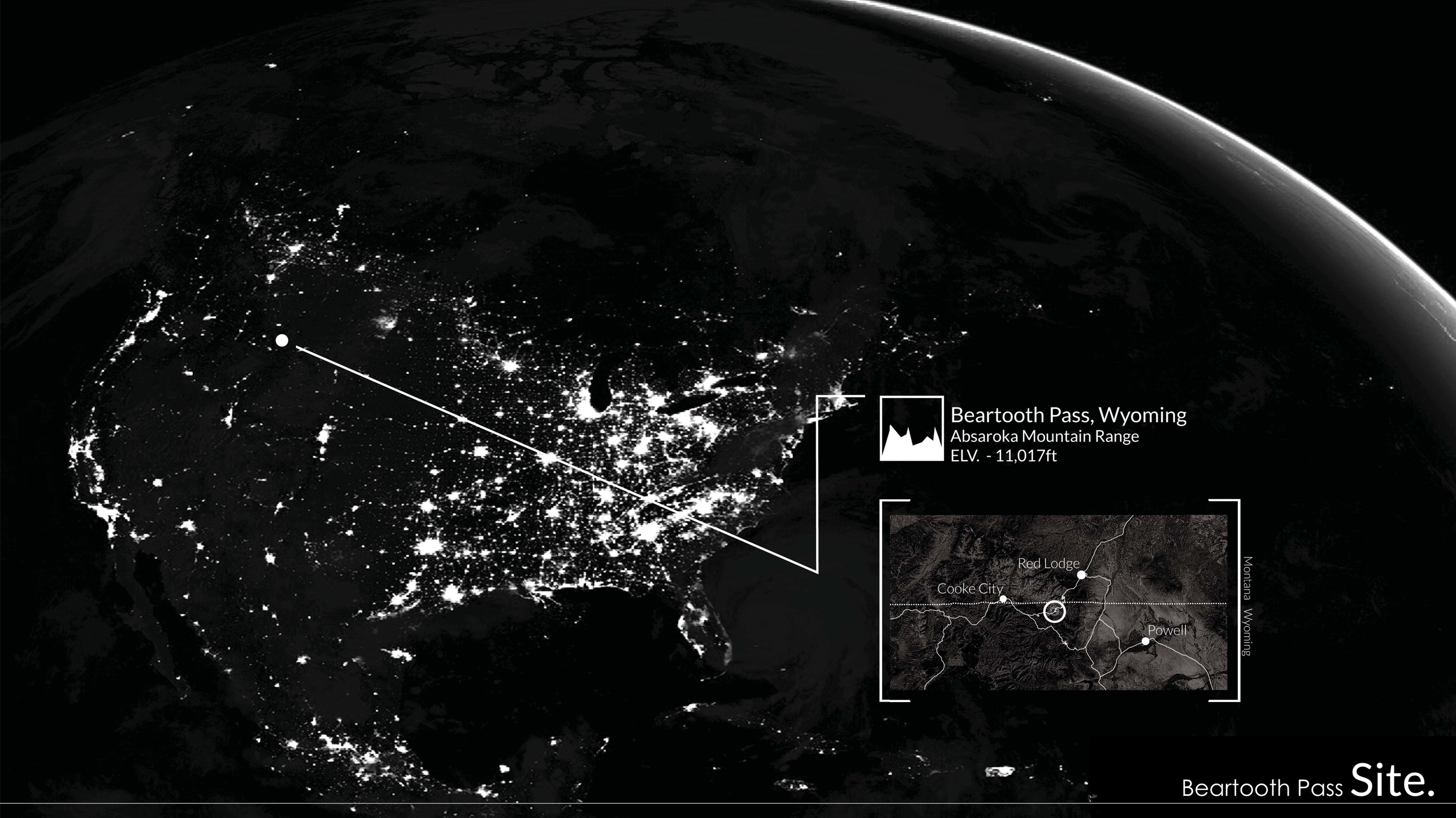


England **Kielder Observatory**

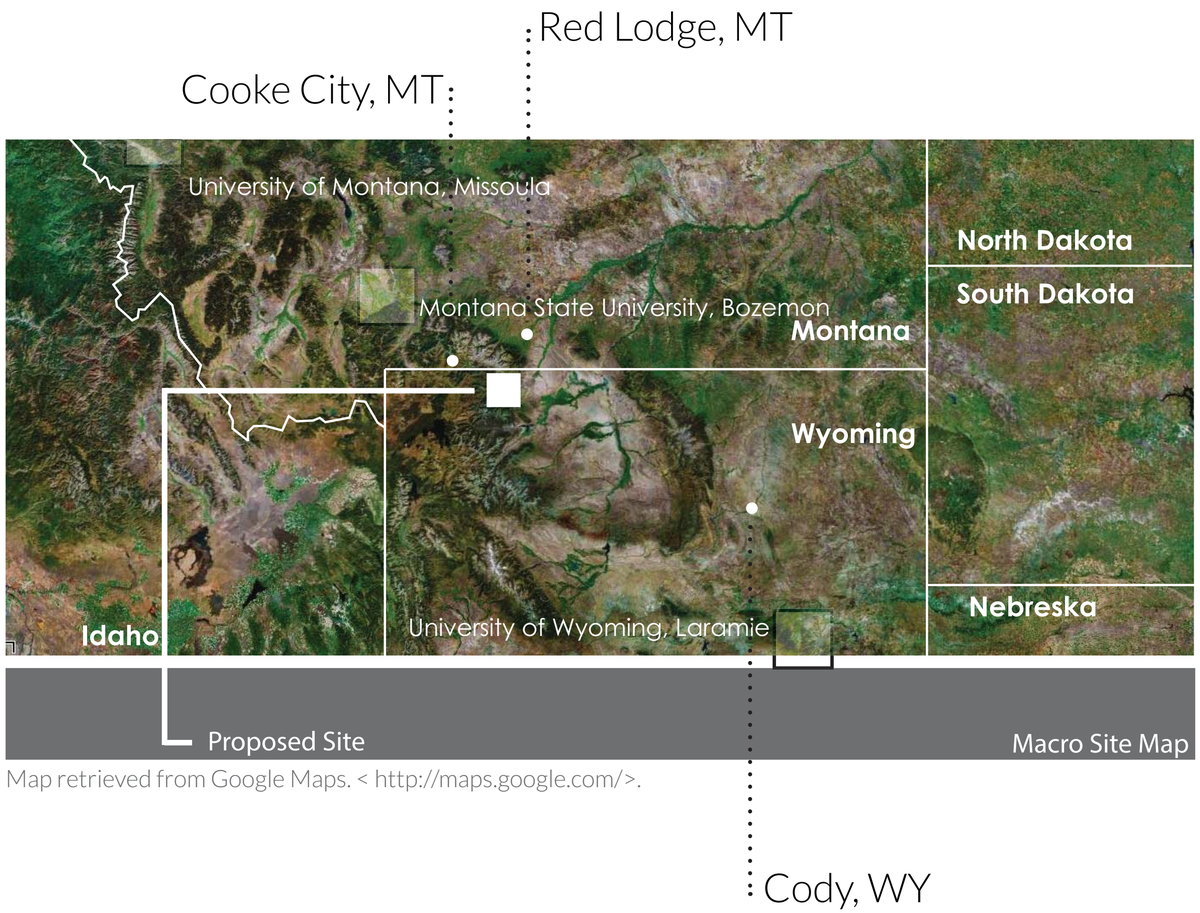
Use of recycled lumber
Outdoor space for amateur astronomy
Renewable energy resources

Case Studies.

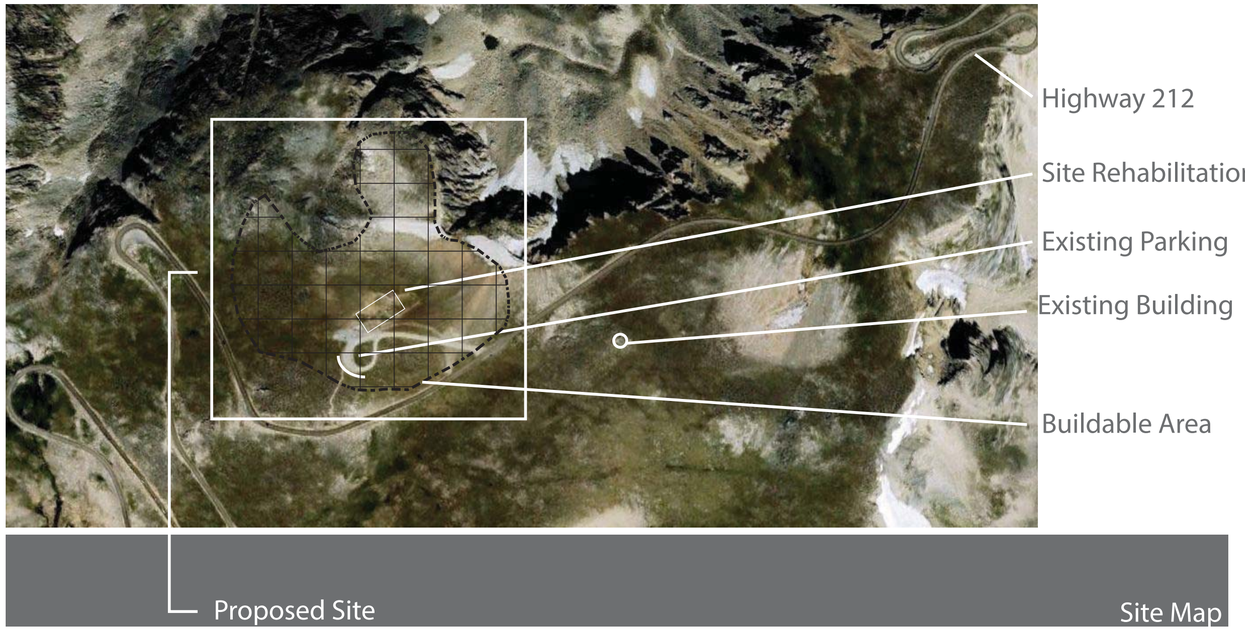
Observatory **Site**



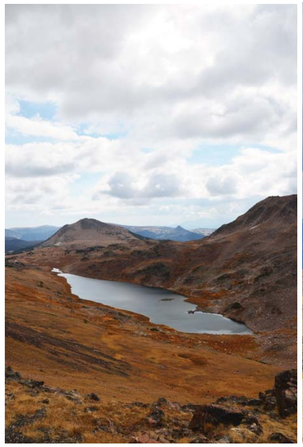
Beartooth Pass Site.



Map retrieved from Google Maps. < http://maps.google.com/>.



Beartooth Pass Site.

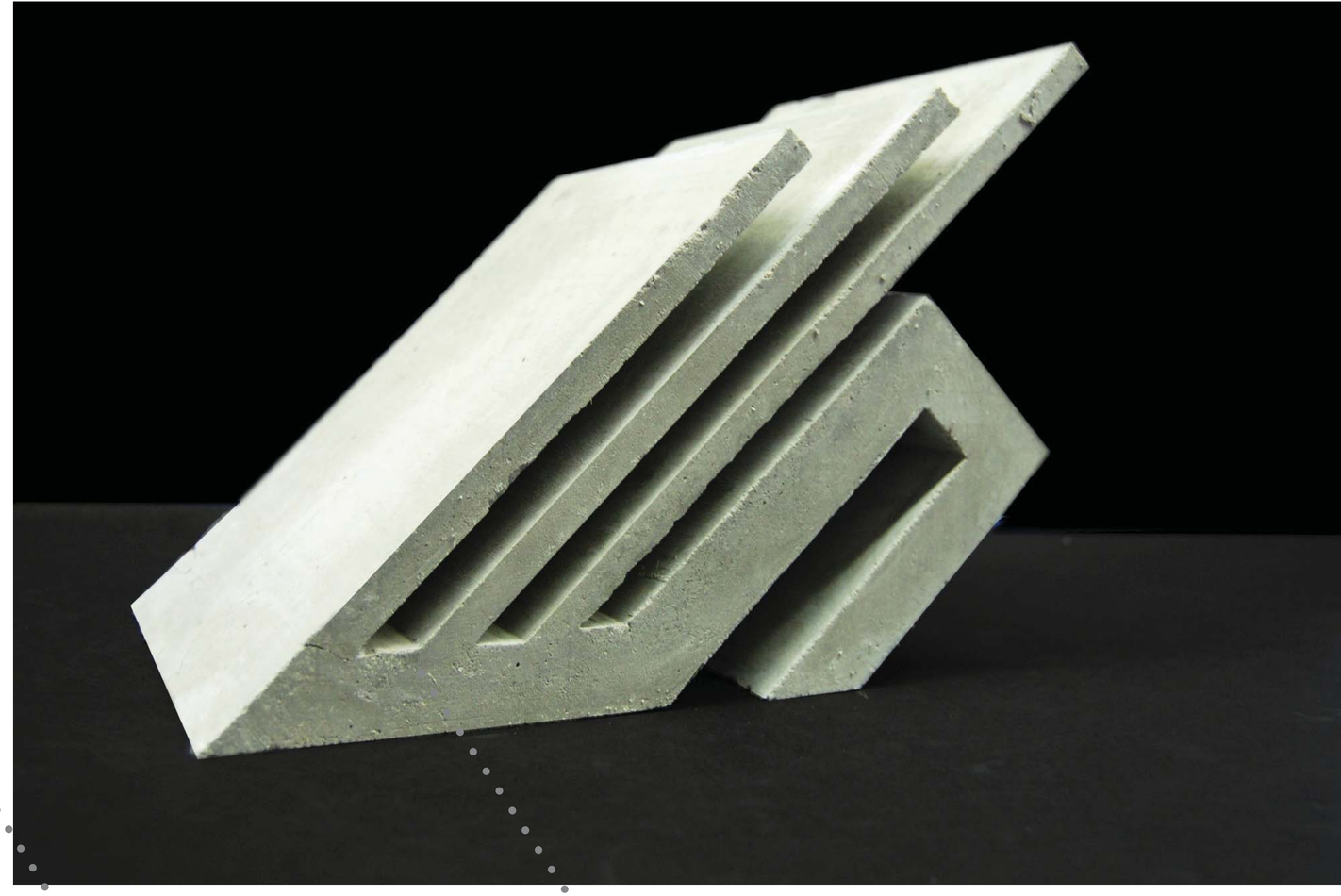





Beartooth Pass Site.

Opened in 1936, the Beartooth Pass was designed to be the North entrance to Yellowstone National Park. Over the years thousands of people have ventured to this magnificent road to drive along some of the highest terrain accessible by automobile in America.

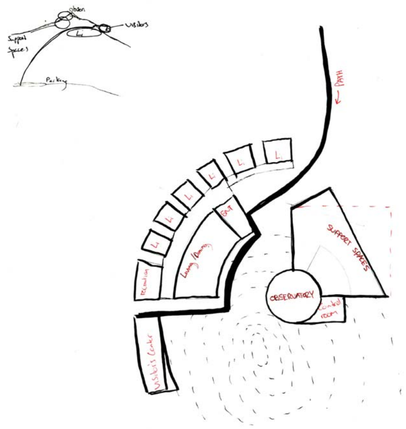
Site History.

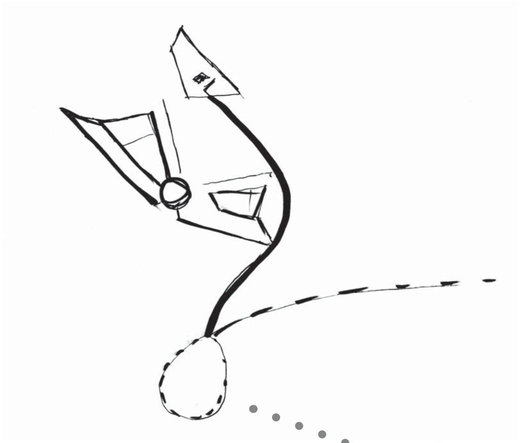


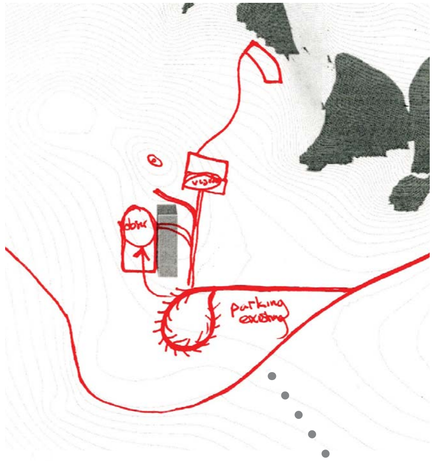
- Rough texture when turning.
- Smooth wood finish, similar to alpine meadows and refined technological approach to astronomy.
- Glacial movement.
- Mass and void similar to rock formations.

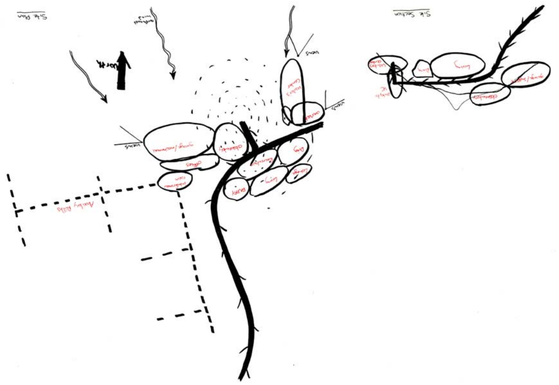
Site Inspiration.

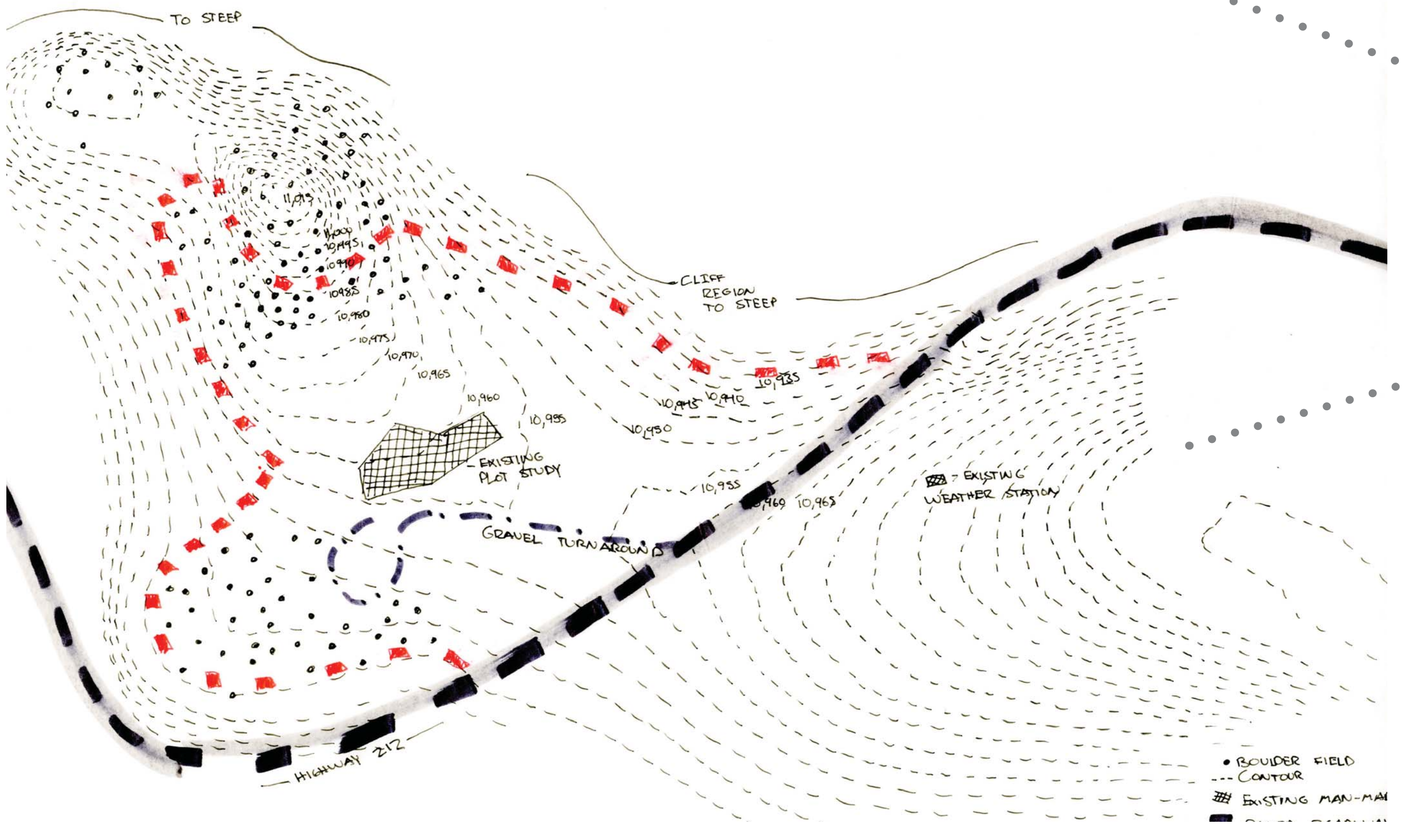
Design Architecture





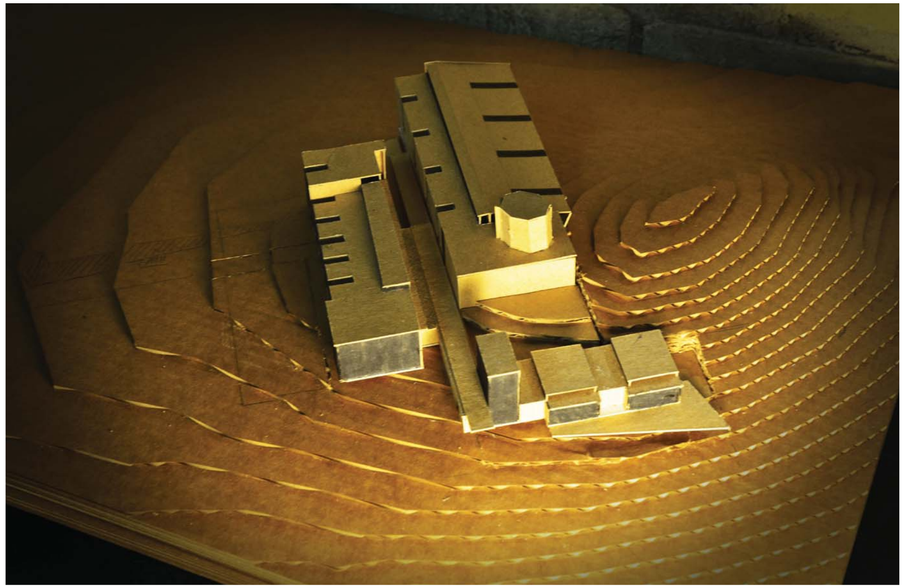


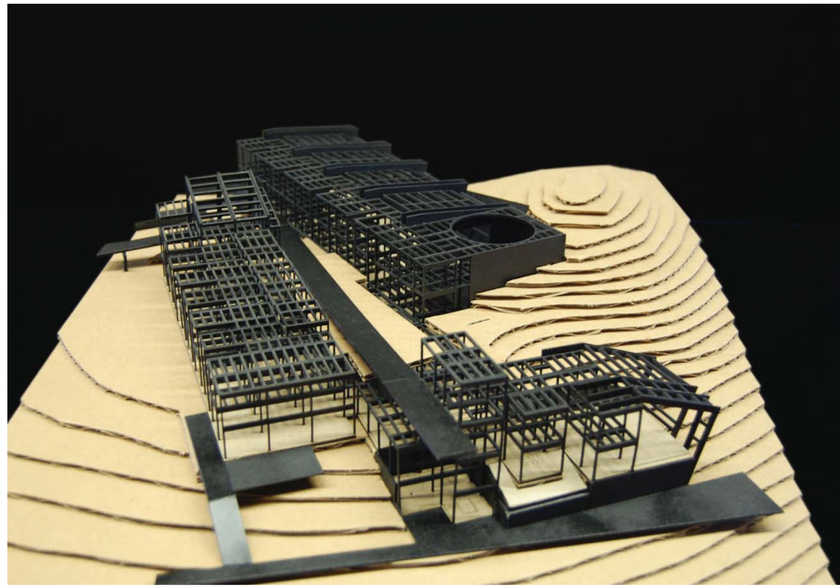


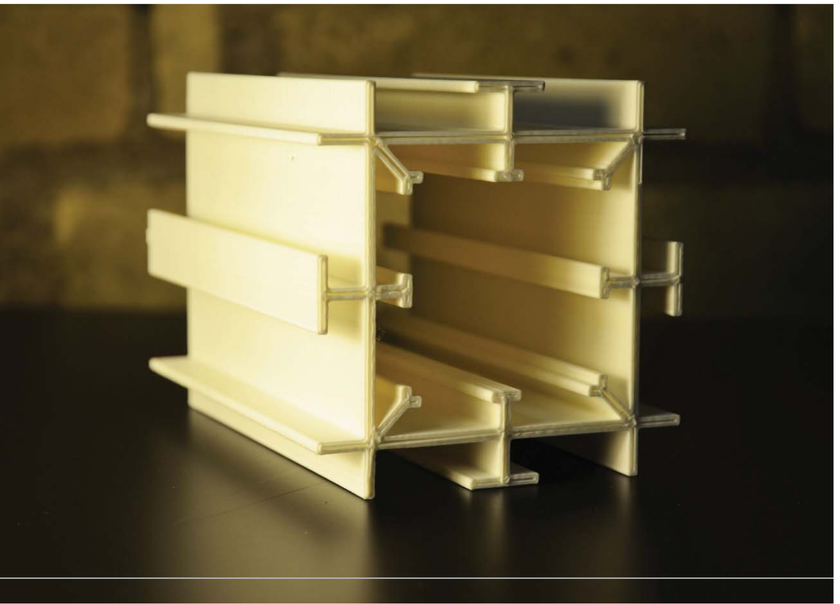


- Site movement sketches.
- Initial building sketches.
- Buildable locations sketch.

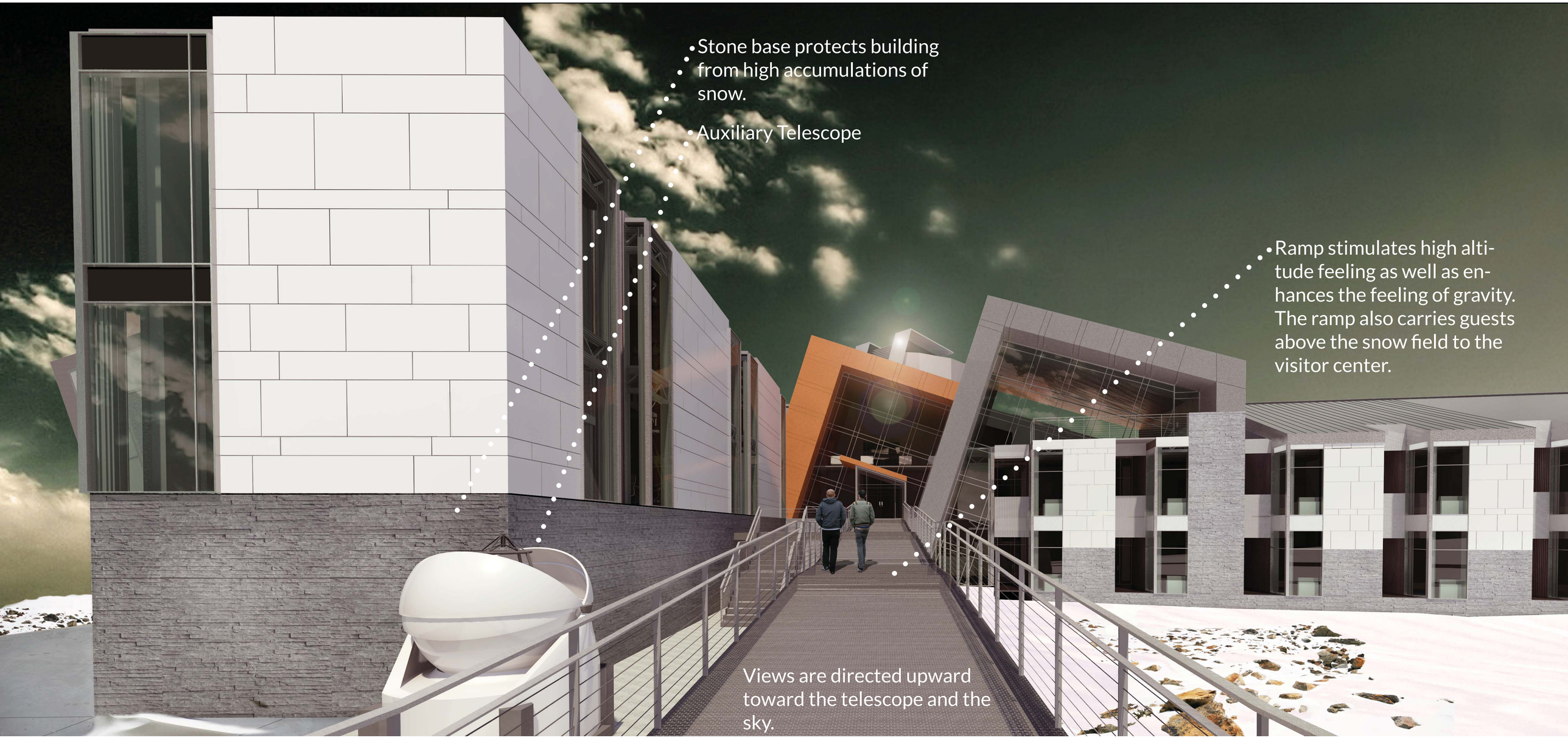
Process Sketches.







Process Models.



Pathway to Entrance.

Building Program.

UL - Upper Level
4,291

- Athletic Room
- Upper Lobby Seating
- Control Room
- Collaborative Work Space
- Office
- Director's Office

ML - Main Level
15,514

- Entrance
- Lobby
- Visitor Telescope Viewing
- Library
- Men's Toilets
- Women's Toilets
- Custodial
- Break Space
- Conference Room
- Upper Observatory Hotel
- Upper Viewing Deck

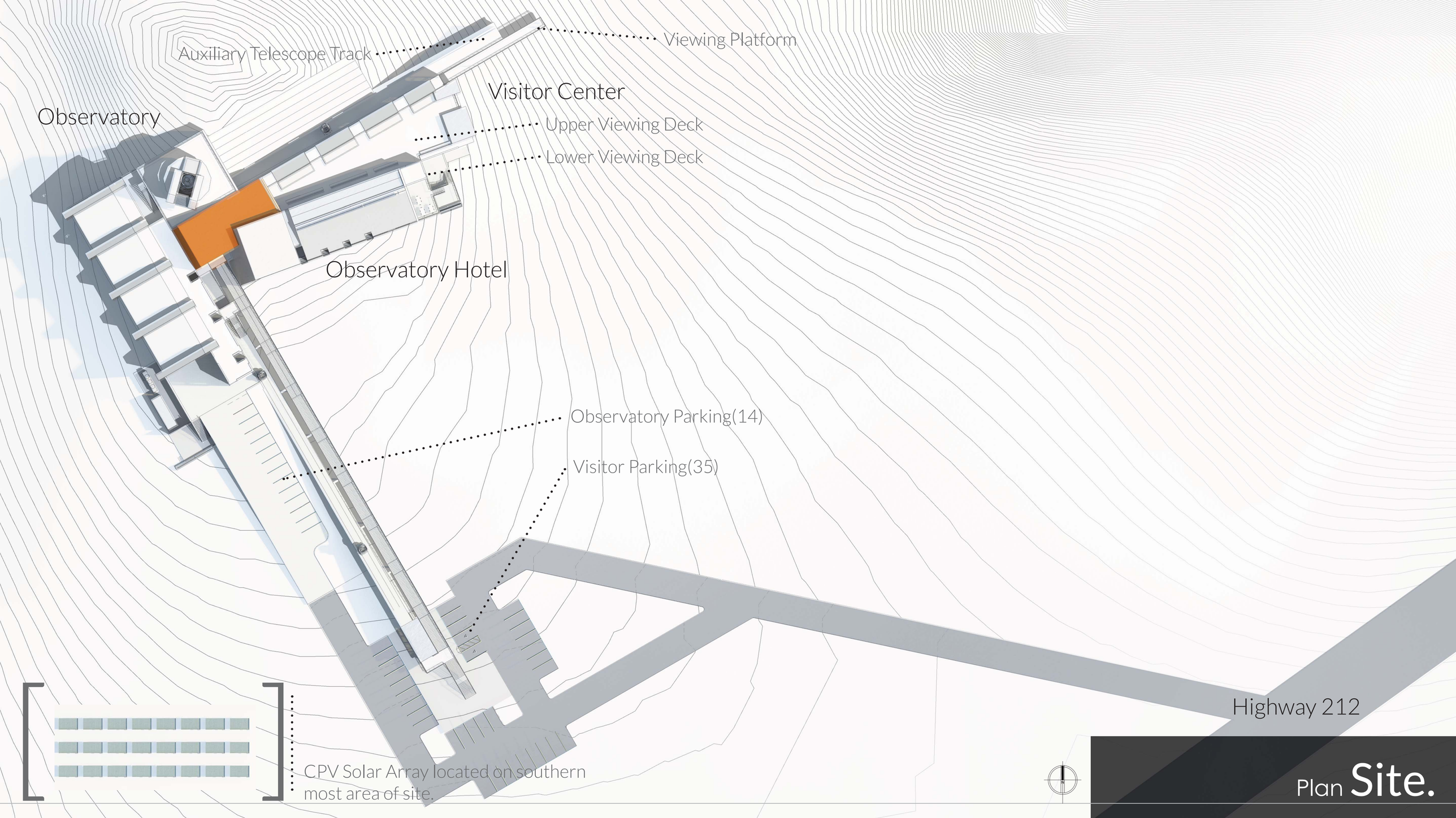
LL - Lower Level
28,347

- Garage
- Custodial
- Mirror Room
- Mechanic Shop
- Laboratory
- Lower Platform
- Mechanical
- Staff Recreation
- Laundry
- Freezer Storage
- Dry Goods
- Commercial Kitchen
- Visitor Center [VC] Gift Shop
- Gift Shop Storage
- Women's Toilets's
- Men's Toilet's
- VC Media Room
- VC Office
- VC Gallery
- Dining Center
- Staff Lounge
- Observatory Hotel
- Outdoor Dining
- Shipping/Receiving

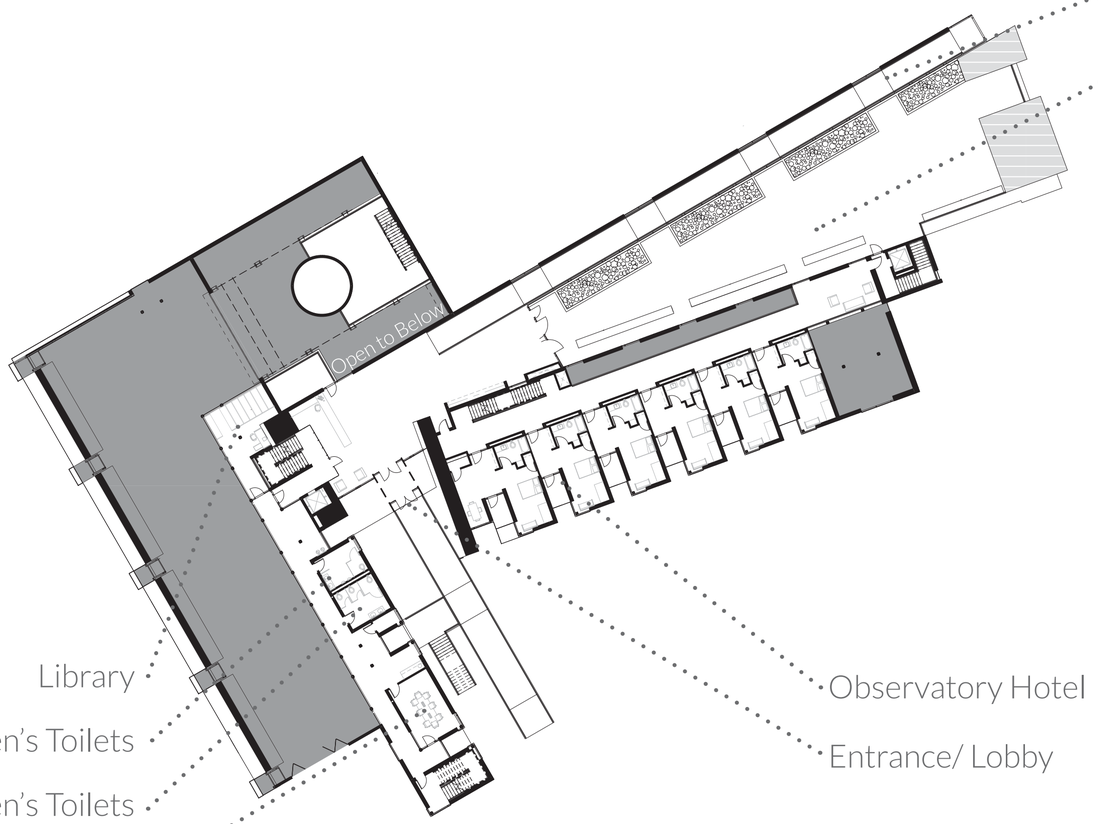
LL2 - Lower Level 2
10,111

- VC Classrooms
- Lower Viewing Deck
- Coudè Room
- Hydrogen Power Plant/ Cooling Tower and Storage Tanks

Building SF - 58,263


Auxiliary Telescope Track
Viewing Platform
Visitor Center
Observatory
Upper Viewing Deck
Lower Viewing Deck
Observatory Hotel
Observatory Parking(14)
Visitor Parking(35)
Highway 212
CPV Solar Array located on southern most area of site.

Plan Site.



Ramp to Visitor Center

Upper Viewing Deck

Observatory Hotel

Entrance/ Lobby

Library

Men's Toilets

Women's Toilets

Conference Room

Level Main.

Fabric ceiling clouds are easily dismantled and refurbished at the end of its life cycle.

Living Walls help humidify the living space. Natural plants help comfort people in harsh conditions.

Aluminum structure is celebrated in the main lounge areas

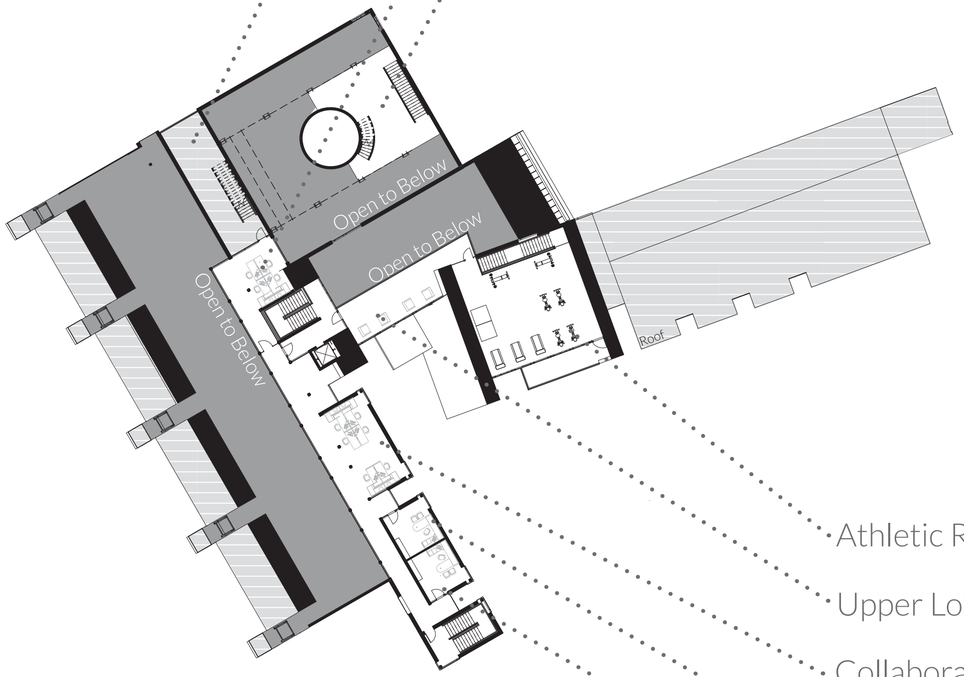
Upper Concourse **Observatory Hotel**

Light colored walls and dark flooring ties to earth and sky.

Control Room Exterior Access

Control Room

Upper Telescope Platform



Athletic Room

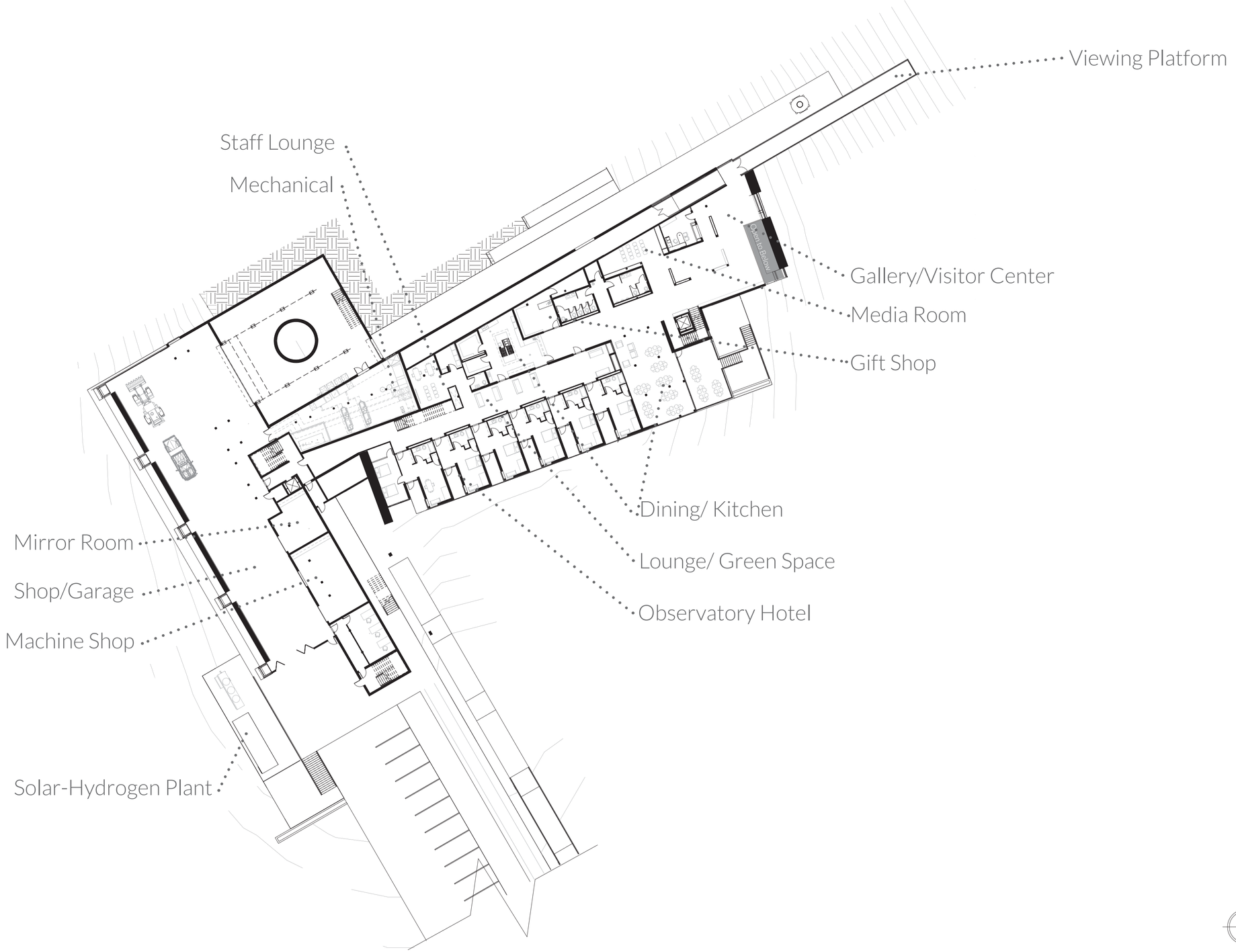
Upper Lobby Seating

Collaborative Work Space

Office

Director’s Office

Level Upper.


Viewing Platform
Staff Lounge
Mechanical
Open to Below
Gallery/Visitor Center
Media Room
Gift Shop
Dining/ Kitchen
Lounge/ Green Space
Observatory Hotel
Mirror Room
Shop/Garage
Machine Shop
Solar-Hydrogen Plant

Level Lower.

As one walks down the ramp they feel gravity pulling them towards the cliff edge at the end of the platform. The rough cut stone along the right wall provides a feeling of cutting into the earth.

Ramp to **Visitor Center**

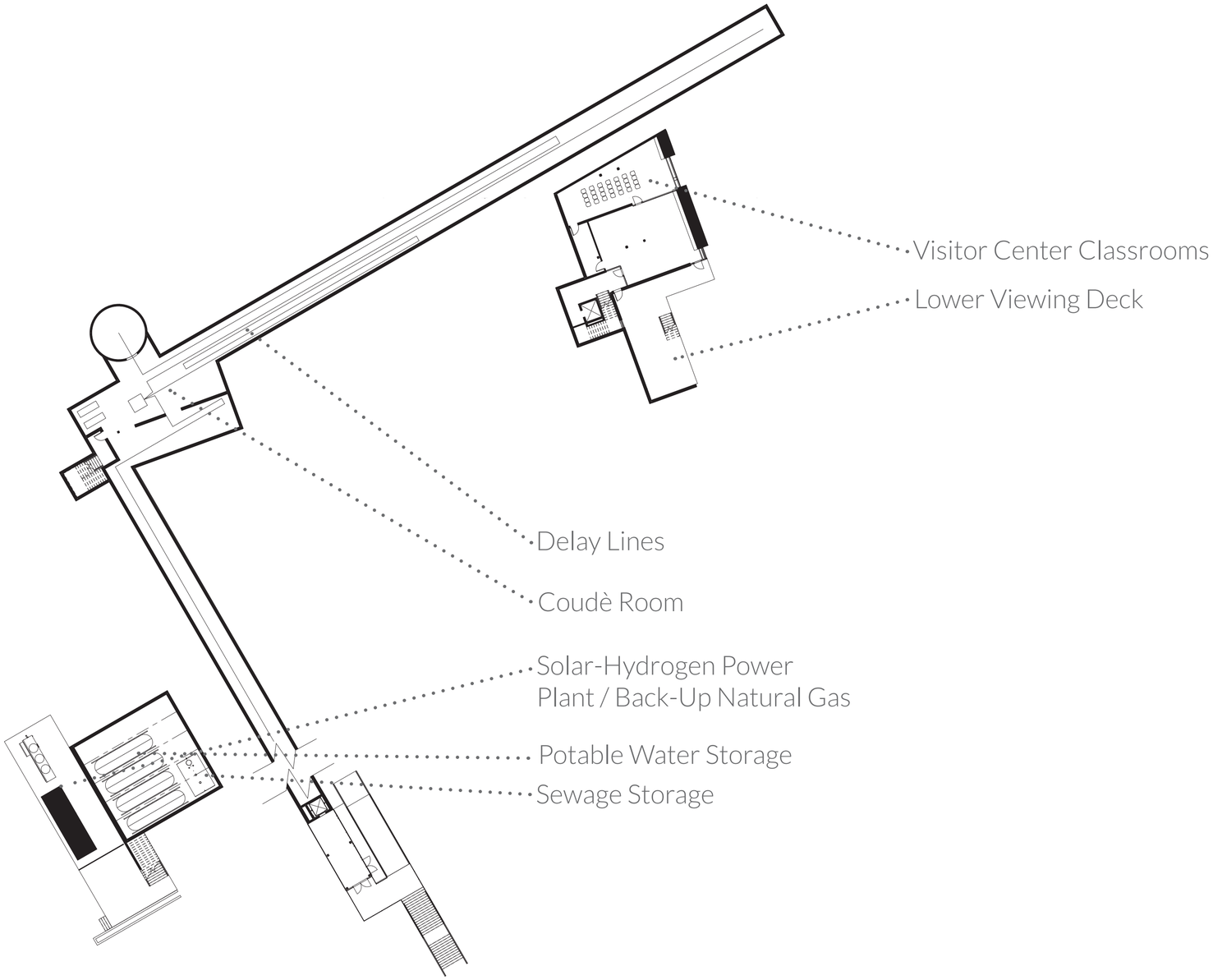
The bright sunlight gives a feeling of openness above.

Bench seating also acts as sky-light for spaces below.

Upper viewing deck allows amateur astronomers to view the night sky.

Upper **Viewing Deck**

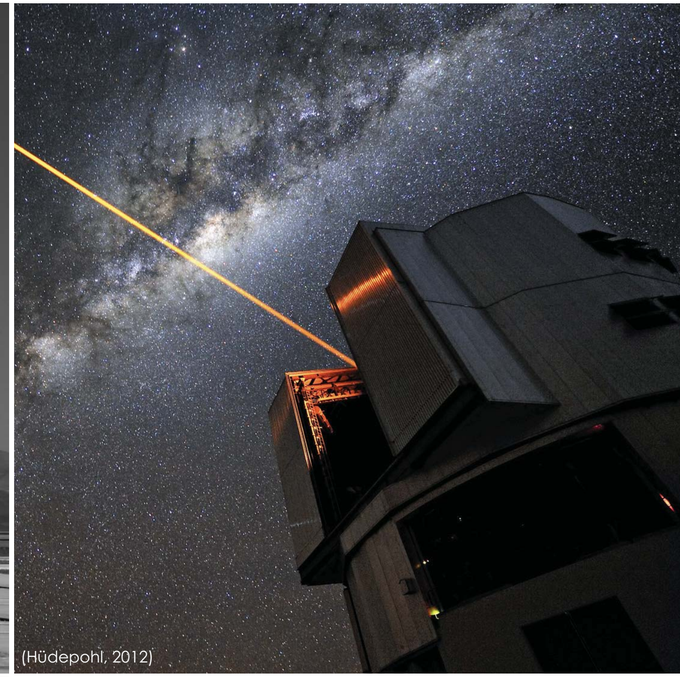
Low frequency red lights help lower light pollution for the main telescopes.



Level Lower 2.

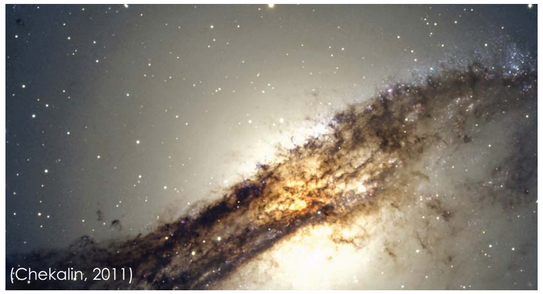
(Hüdepohl, 2012)

(Hüdepohl, 2012)


(Hüdepohl, 2012)

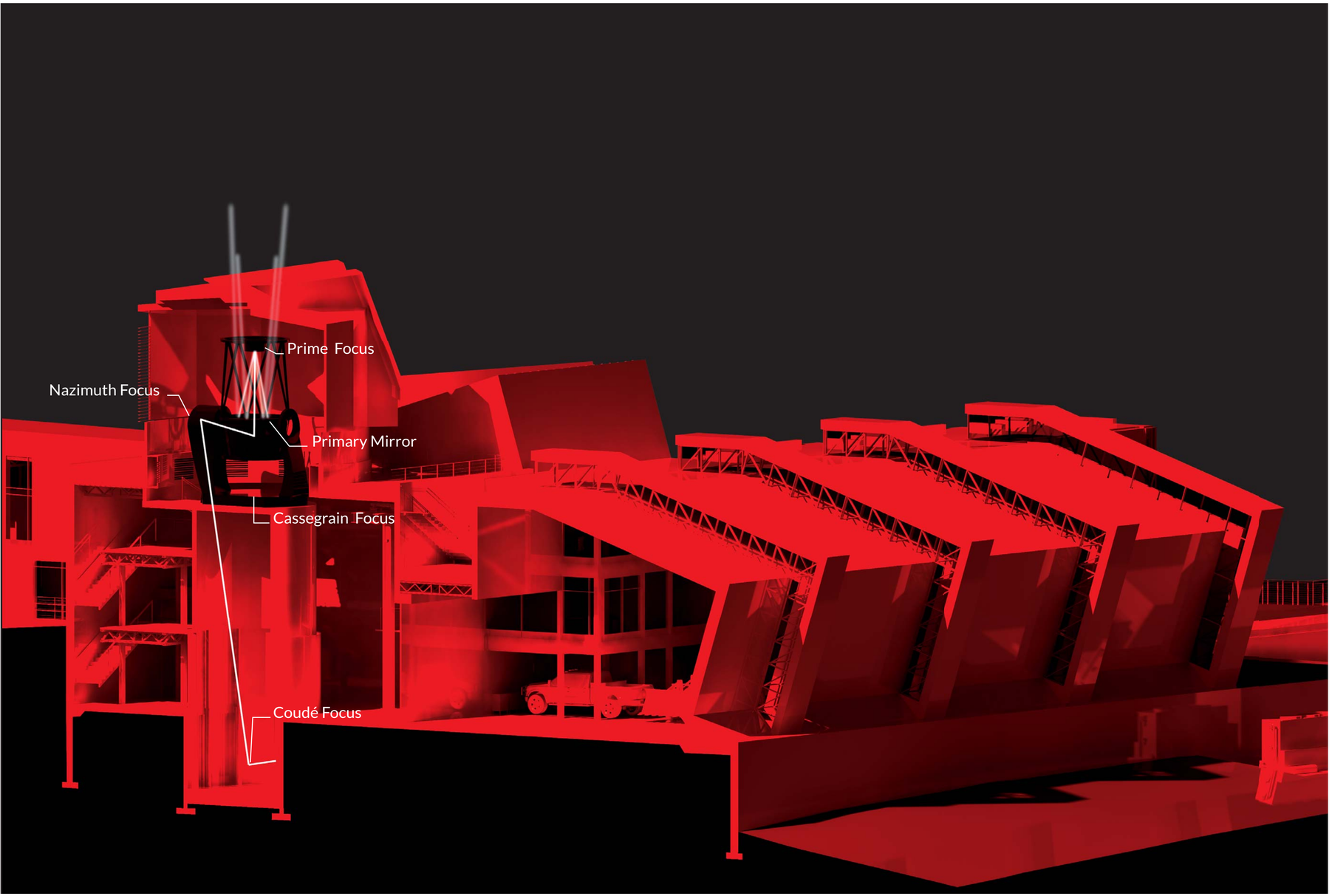

(Chekalin, 2011)

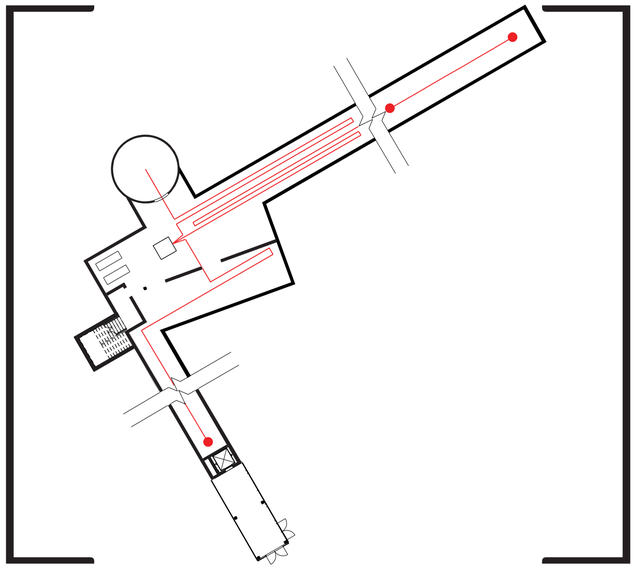

(Chekalin, 2011)


(Chekalin, 2011)

Auxiliary Telescopes work with a stationary 3m telescope to produce higher quality images. Stationary telescopes can be inserted into current plan but multiple auxiliary telescopes can be added with minimal costs involved.

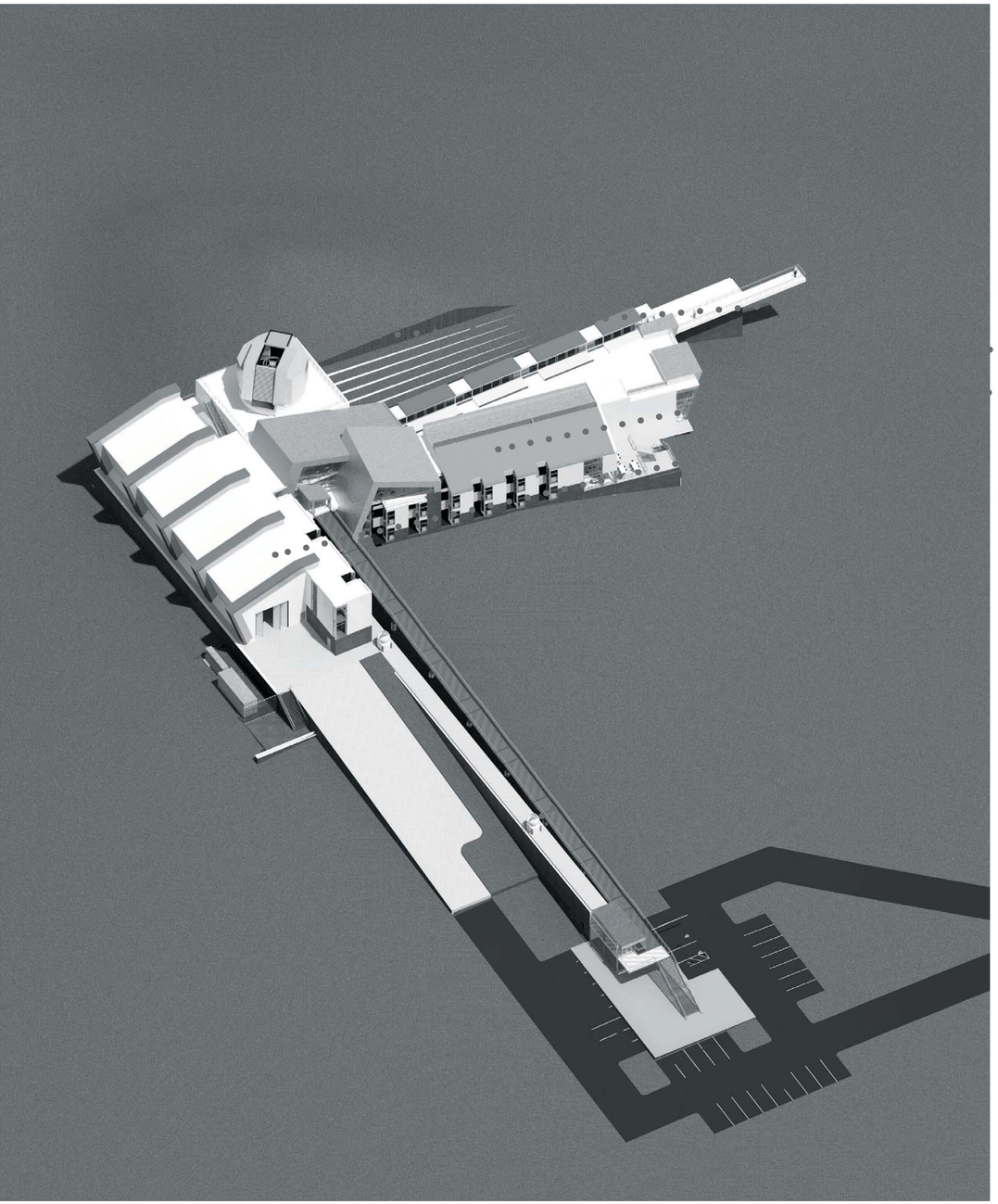
Flex Instruments.





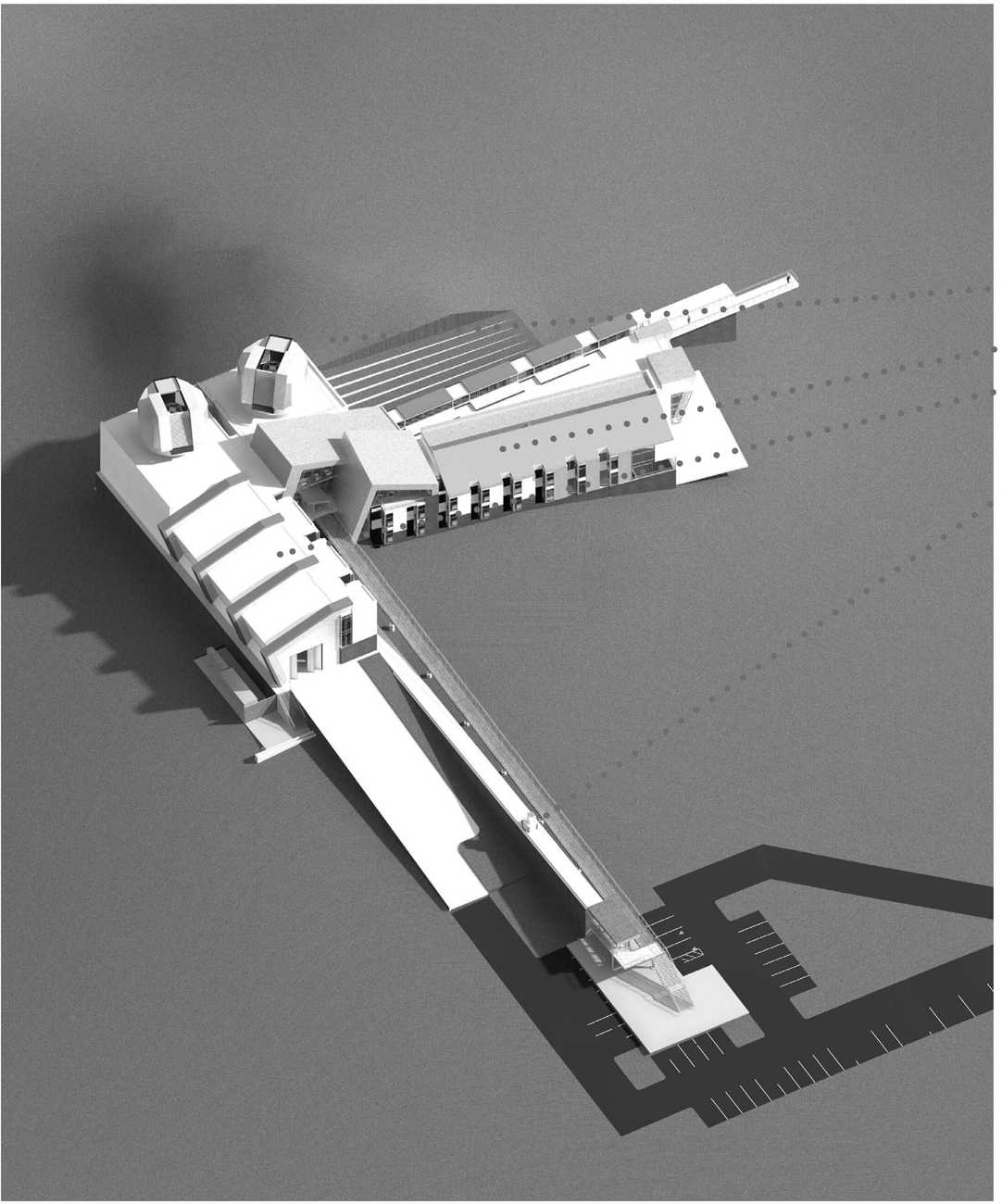
Interferometry is the combination of light using multiple telescopes. Light travels through the telescope reflecting off a series of mirrors as illustrated. The light from all three telescopes must travel the same distance to the main receptor within the coudè room. The image created from combing the light is higher quality making interferometry a powerful tool for smaller observatories such as this one.

Interferometry.



- Single 3m telescopes
- 12 Observatory hotel rooms
- 4 garage bays
- Two Auxiliary Telescopes

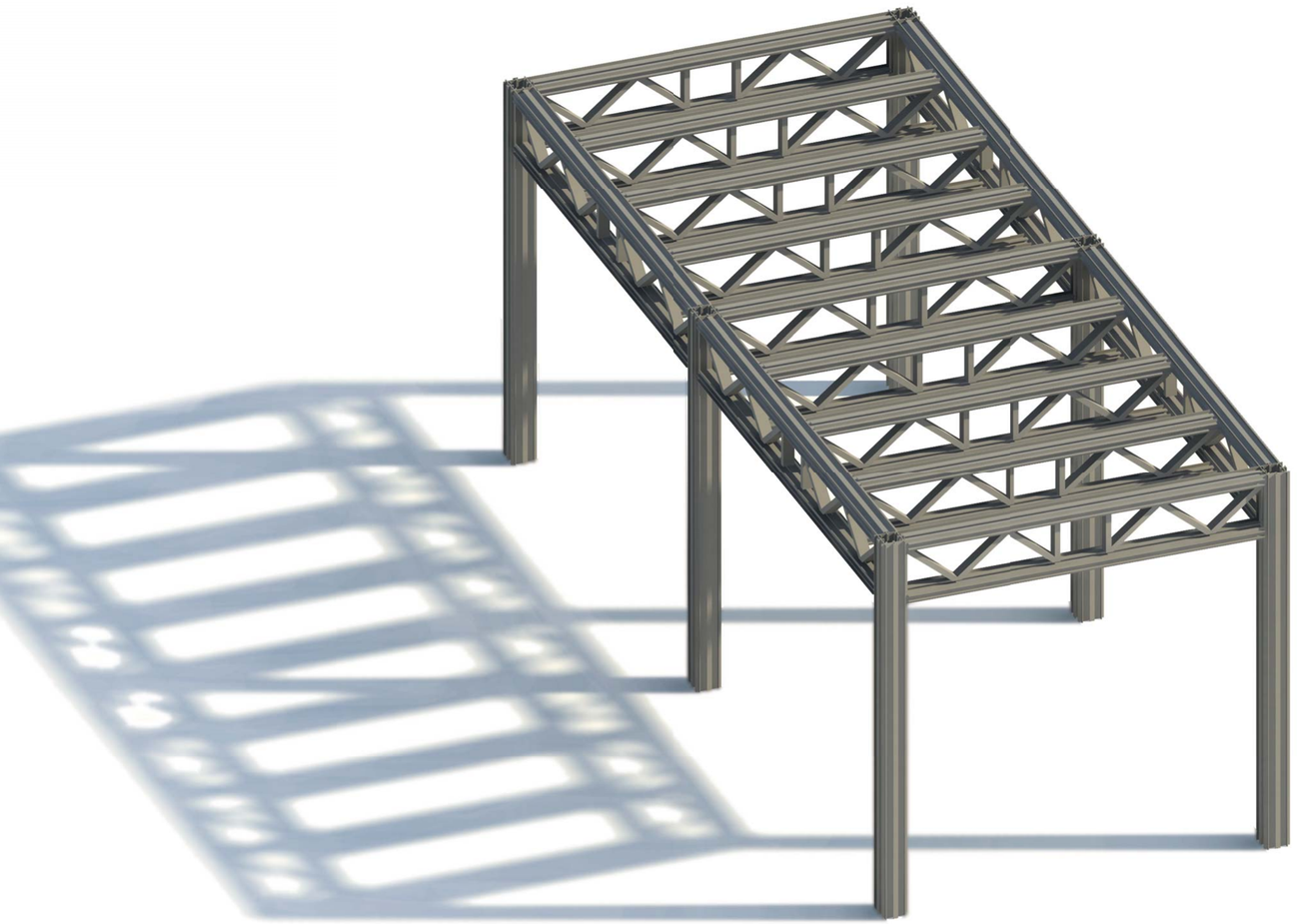
Proposed Design



- Two 3m telescopes
- 16 Observatory hotel rooms
- 4 garage bays
- 3 Auxiliary Telescopes

Phase 2 Design

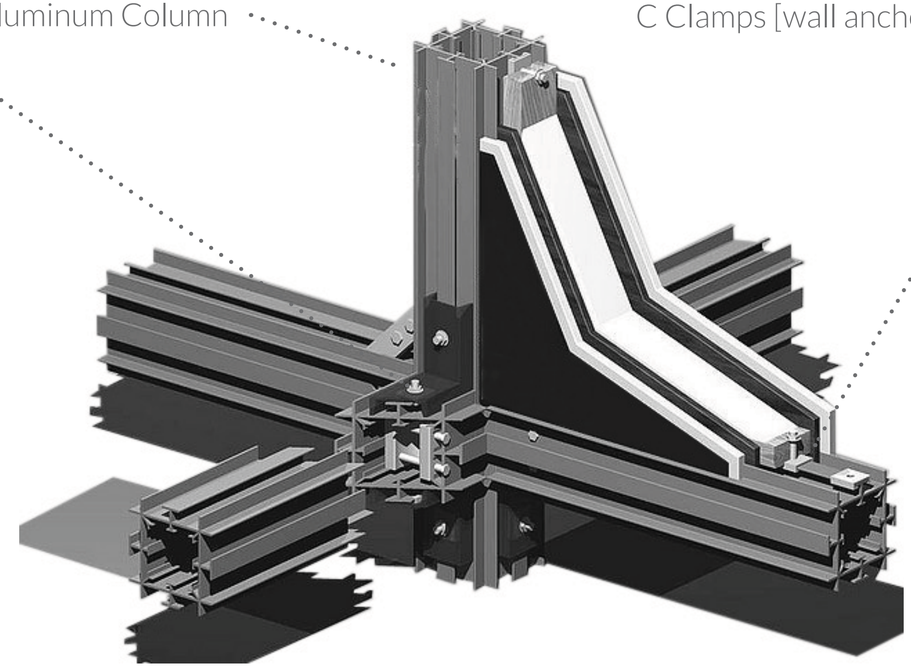
Flex Architecture.

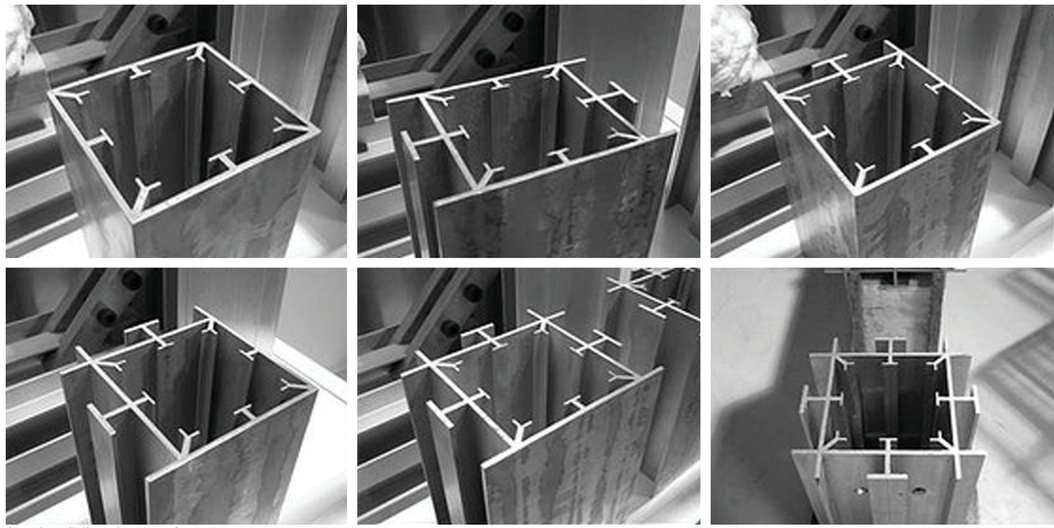


8” Extruded Aluminum Column

C Clamps [wall anchor points]

Beam Clamps



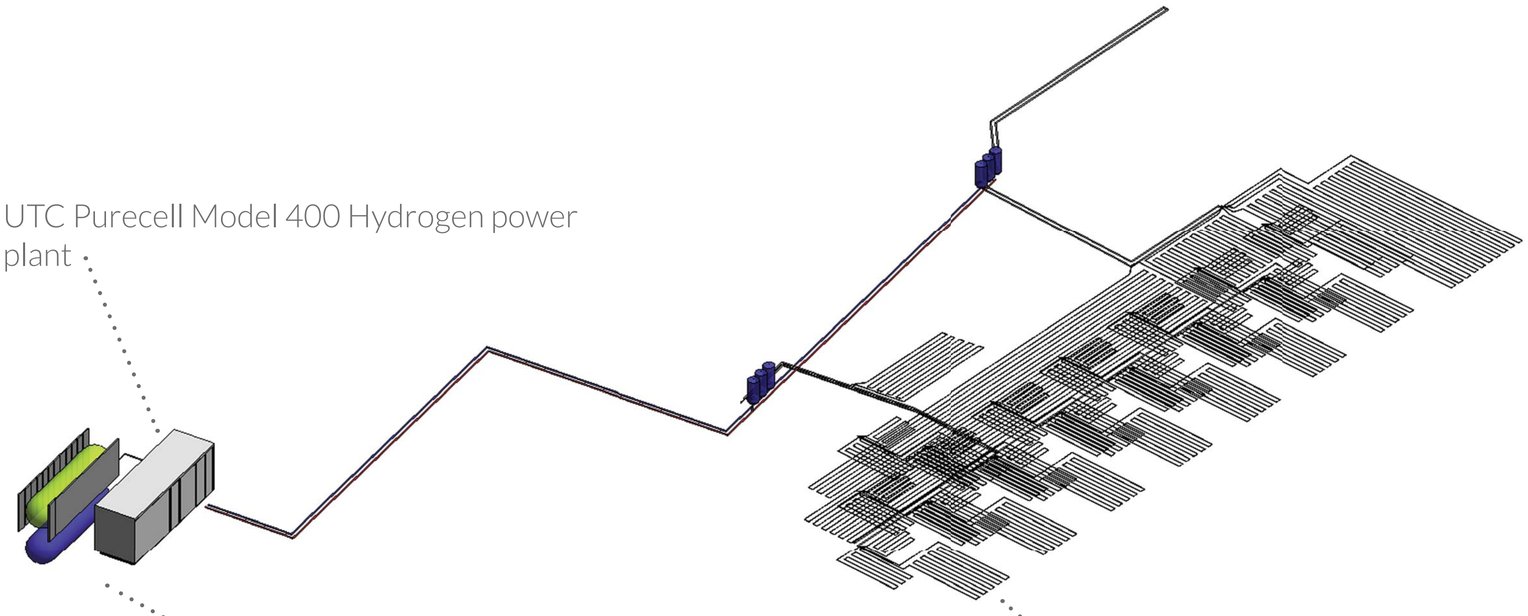


(MHS Building Systems)

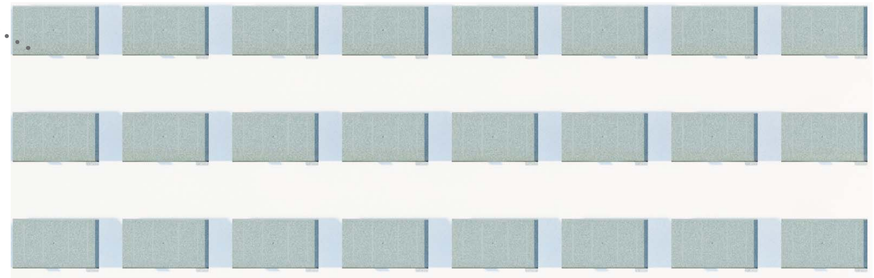
Aluminum Life Cycle: Construction...Deconstruction...Recycled...Remanufactured

Flex Structure.

UTC Purecell Model 400 Hydrogen power plant



Excess fuel cell heat becomes radiant floor heating for building

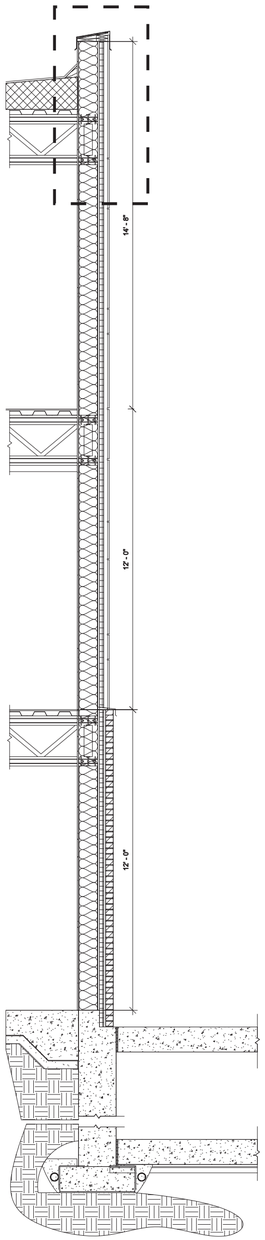


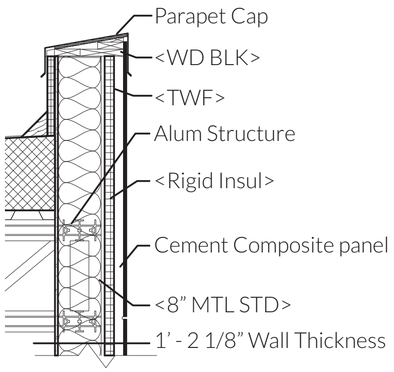
400 kw array

Discovery.com)

(SolFocus Industries)

Flex Energy.



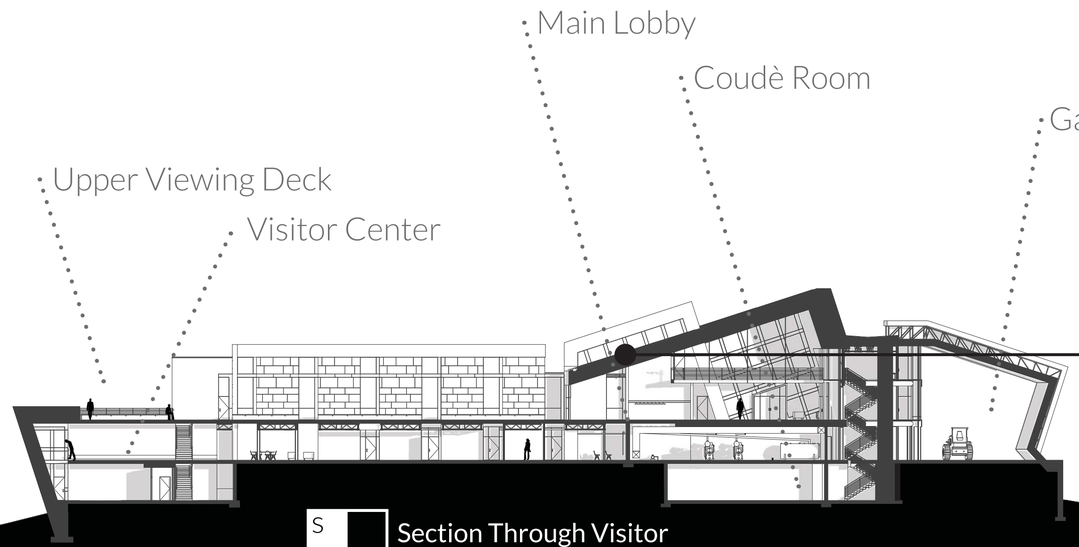


R55

Swiss Pearl

Cement composite w/MTL STD backup
-Low energy manufacturing
-100% recyclable
- Easy deconstruction

Building Sections



S

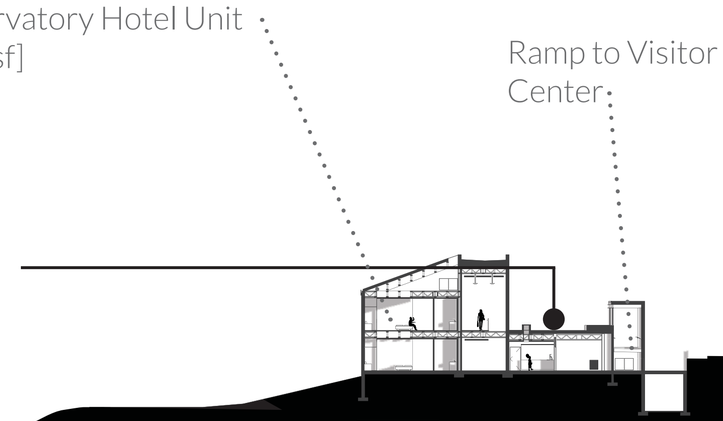
Section Through Visitor Center/Observatory

Rainwater Harvesting

-Minimizes transportation of water to observatory

-Collected from Lobby roof and Upper View Deck

-Used and recycled for cooling systems, toilets, green wall hydration, etc...



S

Section Through Obsrv Hotel

Building Sections

Conclusions

THESIS **PROBLEM STATEMENT**

How can architecture adapt to the changing needs of astronomy research?

By using regenerative design and deconstruction principles this observatory can be flexible for future users. The structure can easily be manipulated as well as the materials used. Promoting the use of closed loop life cycle materials is healthier for the user and the environment. Architecture can be adaptable and still poetic at the same time.

Comments or **Questions**