HOT+COLD : Physical and Atmospheric Phenomena in the Antarctic

by

Eric Randall Morris

Bachelor of Science in Architecture
Georgia Institute of Technology, 2011

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARCHITECTURE
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

FEBRUARY 2014

© 2014 Eric Randall Morris. All rights reserved.

The author hereby grants to MIT permission to reproduce and distribute publicly paper and electronic copies of this thesis document in whole or in part in any medium now known or hereafter created.

Signature of Author : ________________________________________________________________

Department of Architecture
January 15, 2014

Signature of Author : ________________________________________________________________

Sheila Kennedy
Professor of the Practice
Thesis Supervisor

Signature of Author : ________________________________________________________________

Takehiko Nagakura
Associate Professor of Design and Computation
Chair of the Department Committee on Graduate Studies
Thesis Committee

Thesis Supervisor:
Sheila Kennedy
Professor of the Practice

Thesis Readers:
Terry Knight
Professor

Athanassios Economou
Associate Professor, Georgia Institute of Technology
HOT+COLD: Physical and Atmospheric Phenomena in the Antarctic

by

Eric Randall Morris

Submitted to the Department of Architecture
on January 15, 2014 in Partial Fulfillment
of the Requirements for the
Degree of Master of Architecture

ABSTRACT

Utopias have historically been perceived as instruments of societal change, while prior manifestations have normally been attributed to emerging cultural conditions or evolving ethical views, however one of the most pertinent agendas relevant to our field would be the rapidly shifting state of our environment.

Human environmental impact is frequently looked at a local or regional scale, with large international protocol, remaining largely ineffective and mired through process. The summation of this altered climate includes effects like rising surface and atmospheric temperatures, rising sea levels, ozone depletion, and reduced cloud formation. And nowhere are these environmental consequences more seen than in Antarctica.

Claimed as a global commons, Antarctica is ungoverned, yet under the international protection and afforded the combined preservatory efforts of these bodies of power. Despite our concerted efforts, its current deterioration is due directly to an individual and universal, detrimental contribution.

This thesis aims to generate an awareness and visibility to the oscillating physical and atmospheric ephemera of this continent, while using the internal and external extrema of a research installation as a performative bridge between architecture and environment. Through granting a variety of sensorial experiences, this station will help instill strong desires to change decision making processes of individuals and other political bodies, while raising questions of personal and institutional responsibility.

Thesis Supervisor: Sheila Kennedy

Title: Professor of the Practice
Well, there are many people I’d like to thank.

First of which would be my sister. We’ve been through so many good and so many bad times, and there is no one I’d rather have spent those moments with.

Mom, you’ve always been there, and there are no words to express how appreciative I am of everything you’ve done.

Thank you friends. You all know who you are. You’ve all shaped the person I am today, and I can only hope I’ve done the same for all of you.

Thanos, thank you so much for your mentorship throughout the pursuit of my education. You’ve always been my ally.

Terry, you have been essential part in not only this thesis, but also in my studies here. Thank you for guiding me through this.

Sheila, you have always challenged me, and this thesis is a testament to the rigorous thought and experimentation that we’ve been through this past year. On that note, thanks for putting up with me.

And dad. I know that I’ve made you proud.
“Men wanted for hazardous journey. Small wages, bitter cold, long months of complete darkness, constant danger, safe return doubtful. Honor and recognition in case of success.”

— Ernest Shackleton (1874—1922), [probably fake] newspaper announcement before his Endurance Expedition.
HOT+COLD
PHYSICAL AND ATMOSPHERIC PHENOMENA IN THE ANTARCTIC
Table of Contents

Introduction 12
   Foreward
   Mapping across Scales

Precedents 25
   New Architectures in Antarctica

Climate 29
   Thermal Variations
   Ice Loss
   Weather Patterns

Strategies 43
   Passive Snow Collection
   Visual Phenomena
   Solar Orientations
   Energy + Infrastructures
   Excavation Techniques

Design 69

Appendices 95
   Initial Advertisements
   Archival Images
   Final Boards
   Presentation Photos
   Model Photos
   Image Citations
   Bibliography
‘...people grow powerfully attached to that kind of life, when they get the chance to live it. It allows you to concentrate your attention on the real work, which means everything that is done to stay alive, or make things, or satisfy one’s curiosity, or play. That is utopia... especially for primitives and scientists, which is to say everybody. So a scientific research station is actually a little model of prehistoric utopia, carved out of international money economy by clever primates who want to live well.’

- Kim Stanley Robinson’s “The Martians”
Utopias have historically been perceived as instruments of societal change, while prior manifestations have normally been attributed to emerging cultural conditions or evolving ethical views, however one of the most pertinent agendas relevant to our field would be the rapidly shifting state of our environment.

Human environmental impact is frequently looked at a local or regional scale, with large international protocol, remaining largely ineffective and mired through process. The summation of this altered climate includes effects like rising surface and atmospheric temperatures, rising sea levels, ozone depletion, and reduced cloud formation. And nowhere are these environmental consequences more seen than in Antarctica.

Claimed as a global commons, Antarctica is ungoverned, yet under the international protection and afforded the combined preservatory efforts of these bodies of power. Despite our concerted efforts, its current deterioration is due directly to an individual and universal, detrimental contribution.

This thesis aims to generate an awareness and visibility to the oscillating physical and atmospheric ephemera of this continent, while using the internal and external extrema of a research installation as a performative bridge between architecture and environment. Through granting a variety of sensorial experiences, this station will help instill strong desires to change decision making processes of individuals and other political bodies, while raising questions of personal and institutional responsibility.
"in reference to westward expansion" True sons of Archimedes, the Americans have gone one bet ter than the old grand daddy of mechanics. To move the earth he required a lever long enough and somewhere to rest it a gizmo and an infratstructure but the great American gizmo can get by without any infrastructure. Had it needed one, it would never have won the West or opened up the transcontinental trails. The quintessential gadgetry of the pioneering fronteirs man had to be carried across trackless country, set down in a wild place, and left to transform that hostile environment without skilled intention. "Design by Choice, Reyner Banham 108" When compared with other terms architects use to conjure ideas of the local and specific like place or position, or spot or station, or even frame or land, as well as site it becomes apparent that context is the only one that is not a verb. It links to matter and fixed form, but not to action. To site a building takes geometric account of existing conditions such as exposure to weather, relation to services, distribution of public and private spaces in relation to patterns of surrounding access, and so on. "Contested Contexts, Sandy Isenstadt 178" In this period, the future has become the object of new and different kinds of scrutiny, impelled not only by the promise and the reality of an encompassing technological change that could and should be conscientiously directed, but also by the awareness and the reality that civilization has recently escaped one awful future and that it now faced an unthinkable one. "Proximate Utopia, or the Semblance of the Future, Timothy Hyde 1" ... to throw the present into relief by revealing a future for which the present is an inadequate past, the function of a proximate future is to employ its nearness to shift the balance between the real and the utopian, to make the semblance more possible and more effectual than the real. "Proximate Utopia, or the Semblance of the Future, Timothy Hyde 5" Contextualism did not repeat context so much as register changes in the context. A contextualist project would become an index of accommodations to context, in contrast to modern insensitivity to circumstances such as orientation or entry, external vectors that were overwhelmed by the outward expansion of modern space. In short, overturning the coin of modernist planning meant having two sides, not one or the other. Contextualism proposed a process to mediate between inevitable change and existing conditions. "Contested Contexts, Sandy Isenstadt 164"
VARIOUS MAPPINGS OF ANTARCTICA
‘Antarctica is governed internationally by 28 Countries under the Antarctic Treaty System (ATS). Under the ATS, Antarctica is designated as a “natural reserve, devoted to peace and science”, where military activities, nuclear explosions, disposal of radioactive waste, as well as mining are prohibited. As a result of its geographical location, unique natural features and relatively undisturbed natural environment, Antarctica has been seen as an ideal laboratory for understanding natural processes, many of which have global implications. Biology, geology, astronomy, glaciology, global climate change and many other disciplines are studied in Antarctica.’ (ATS Handbook)
Overlapping Territorial Claims: Argentina, Chile, Great Britain

Chilean: 1.25 million km$^2$
British: 1.7 million km$^2$
Argentine: 966 thousand km$^2$
Norwegian: 2.5 million km$^2$
New Zealand: 450 thousand km$^2$
French: 432 thousand km$^2$
Australian: 5.9 million km$^2$

Approx 14 million square km in total, currently 84% 'claimed'.
CONTOURS AT 1000M
HIGHEST POINT: VINSON MASSIF 4,892M
TOPOGRAPHIC MAP OF THE ATARCTIC REGION
“[T]here is a kind of intellectual polarization taking place around the mid-twentieth century which separates the intellectual establishment into two - one, those who are still preoccupied with the world as conditioned by its pre-1900 parameters, and those who are attempting to recast and reorient their world view to one which is unprecedented in human experience.”

- The Future of the Future, John McHale
GLACIAL MOVEMENT

SHIPPING + FLIGHT PATHS

SEA CURRENTS
ANTARCTICA IS AT THE CENTER OF THE WORLD.
Small to large scale shipping and flight reroutes could bring necessary visibility to the decaying nature and melting landscape of the continent. Being no longer seen at the bottom of the world, or being cut off from existing world maps, Antarctica could be seen for what it is, a large continent with legitimate climatic issues.
Over the past decade and exciting new genre of extreme architecture has been developing in Antarctica. It was only until recently that the mainstay of Antarctic architecture was based purely on function; however, the region is a forum of design, technology, and engineering innovation, with emphasis on the lessening of environmental impact and improving living conditions, as well as visual integration into the landscape.
WHERE IS ANTARCTICA’S?

The emerging question here, is that even though this rising interest in the development of engaging design in the Antarctic, there are still the residues of the various nations, companies, and architects involved. The vernacular of the various nations is still felt through these designs, which should feel inappropriate. Some of these nations may have cold snaps, or high winds, or heavy snowfall, but the fact still remains that this climate is the most extreme in the world, and the station should reflect the surroundings entirely. For example, the Jang Bogo station being developed by South Korea, still pays homage to the pagodas and filigreed templed that dot it’s cities and
landsapes. Another still, Denmark’s proposal by MAP Architechts and David Garcia Studio, maintains a strong resemblance to the Nordic style of housing. With buried programs and thatched roofs, the Iceberg Living Station adopts these regional ideals.

While these proposals are perfectly fine, and fulfill all the necessary, and some unnecessary requirements of living and working below the 70th parallel, there is still little questioning about what IS the Antarctic vernacular.

What is it?

What is the Antarctic vernacular?

And.

How can it be informed for a long-term research station?
“When compared with other terms architects use to conjure ideas of the local and specific --- like place or position, or spot or station, or even frame or land, as well as site --- it becomes apparent that context is the only one that is not a verb. It links to matter and fixed form, but not to action. To site a building takes geometric account of existing conditions such as exposure to weather, relation to services, distribution of public and private spaces in relation to patterns of surrounding access, and so on.”

- Contested Contexts, Sandy Isenstadt
CLIMATE

THERMAL VARIATIONS
ICE LOSS
WEATHER PATTERNS
CONTINENTAL THERMAL VARIATION
CONTINENTAL THERMAL VARIATION
COMPOSITE IMAGE. ROSS ISLAND. 2002 - 2005.
IT'S EVIDENT THAT THE CLIMATE IS SHIFTING.

SO WHAT DOES IT LOOK LIKE NOW?
Covered by snow buildup and foggy from activity.

Projective renders of an Antarctic research station.
FOGGY EXTERIOR WHILE OBSERVING WEATHER PHENOMENA.
PROJECTIVE RENDERS OF AN ANTARCTIC RESEARCH STATION.
CLIMATE INFOGRAPHICS OF ROSS ISLAND FOR 2012.
CLIMATE INFOGRAPhICS OF ROSS ISLAND FOR 2012.
MCMURDO STATION, AQ
JAN 2012 - DEC 2012
SOLAR EXPOSURE [HR]

CLIMATE INFOGRAPHICS OF ROSS ISLAND FOR 2012.
CLIMATE INFOGRAPHICS OF ROSS ISLAND FOR 2012.
STRATEGIES

PASSIVE SNOW COLLECTION
VISUAL PHENOMENA
SOLAR ORIENTATIONS
ENERGY + INFRASTRUCTURES
EXCAVATION TECHNIQUES
VISUAL REPRESENTATION OF WHAT IT TAKES TO LIVE THERE. HOW MUCH FUEL? PROJECTIVE RENDERS OF AN ANTARCTIC RESEARCH STATION.
LOOKING THROUGH ICE TOWARDS OTHER PROGRAMS.
PROJECTIVE RENDERS OF AN ANTARCTIC RESEARCH STATION.
PASSIVE SNOW ACCUMULATION STUDIES.
PASSIVE SNOW ACCUMULATION STUDIES.
diagonal control ridge bump

passive snow accumulation studies.
Countries condemned to everlasting rigidity by Nature, never to yield to the warmth of the sun, for whose wild and desolate aspect I find no words; such are the countries we have discovered; what then may those resemble which lie still further to the south? To judge the bulk by the sample it would not be worth the discovery. Should anyone possess the resolution and fortitude to elucidate this point by pushing yet further south than I have done, I shall not envy him the fame of his discovery, but I make bold to declare that the world will derive no benefit from it.

Captain James Cook

For this far violet line could be nothing else than the terrible mountains of the forbidden land, the highest peaks of earth's peaks and focus of earth's evil; harbourers of nameless horrors and Archean secrets; shunned and prayed to by those who feared to carve their meaning; untrodden by any living thing of earth, but visited by the sinister lightnings and sending strange beams across the plains in the polar night; beyond doubt the unknown type archetype of that dreaded... cold waste. We were the first human beings to ever see them; and I hope to God we may be last.

The Mountains of Madness, H.P. Lovecraft
WITH THE CLIMATE BEING SO HOSTILE.

WHAT SORT OF ENVIRONMENTAL EFFECTS CAN BE INTRODUCED IN THE ARCHITECTURE?
LIGHT REFRACTION THROUGH ROD CRYSTALS, HEXAGONAL CRYSTALS, WATER DROPLETS. GEOMETRY IN OPTICAL PHENOMENA.
LIGHT PILLAR

HALO

HALO

LIGHT RAY ALIGNMENTS WHICH PRODUCE ATMOSPHERIC PHENOMENA.
PROJECTIVE RENDERS OF AN ANTARCTIC RESEARCH STATION.
As seen previously, ice crystals produce a much more finite amount of light reflections, which induce a lot of parallel light rays in the atmosphere. Coupled with the extremely low average of the solar azimuth, the Antarctic region, specifically around Ross Island, is prone to a lot of atmospheric interference and visual phenomena. These factors together, will help involve the extreme environment into the research station. Rather than sheltering researchers entirely from the outside, these effects can have an affectual influence on the formation of an Antarctic Architecture.
The average research station has an energy consumption of 160 kw/h. How do you produce that much energy?
Energy producing machines.
9 330 KW/H WINDMILLS

2,300 m²'S PV

483 BARRELS OF OIL ANNUALLY

ENERGY PRODUCTION CYCLE WITH AMOUNTS NEEDED.
STEAM ENGINE

SABATIER REACTOR

ELECTROLYSIS CHAMBER

GREYWATER FILTER + CISTERN

FERTILIZER EXCRATOR

HEAT PRODUCTION AND ELECTRICAL MACHINERY

WASTE DIGESTOR
Resource input and output cycles.
WHAT MATERIALS SHOULD BE USED, MORE SO, HOW DO WE GET THEM THERE?

THE MATERIALS ARE THERE, JUST DIG DOWN.
EXCAVATOR

EXCAVATED GEOMETRIES FROM CONSTRUCTION EQUIPMENT.
EXCAVATED GEOMETRIES FROM CONSTRUCTION EQUIPMENT.
HOW DO YOU GET THERE?

AMS
ATL
BOS
CPH
IST
JFK
LAX
LHR
SAN
SBP
SFO
STL

INTERNATIONAL AIRPORT RUNWAYS FROM AROUND THE WORLD.
I GUESS WE'RE FLYING IN.

INTernational Runways FROM AROUND THE WORLD.
DESIGN
Research station requirements:

Energy production

Wind velocity

Heat production

Fog release

Light refraction
ENVIRONMENTAL

METEOROLOGICAL

HABITABLE

ATMOSPHERIC

AFFECTUAL
WINTER - RUNWAY EXISTANT

SUMMER - RUNWAY NON-EXISTANT
SEASONAL SITE PLAN
EXCAVATED MATERIAL + SNOW ACCUMULATION.

SURFACE GROUND PLANE.

CONCAVE INTERIOR ROOF.

PROJECTED TOOLPATHING.

DESIRED INTERIOR SURFACE RELIEF.

FACILITY AXONOMETRIC STUDIES.
AMBIENT THERMAL MAPPING.

THERMAL MAPPING DETAIL.

FACILITY AXONOMETRIC STUDIES.
OUTSIDE HOSTILITY AND SHELTERED ENTRANCES WITH AIRPORT AND RESEARCH PROGRAMS. ENTRY PORTS INTO THE FACILITY
THE WASTE HEAT FROM THE MACHINES IS CHANNELED INTO THE VARIOUS OTHER AREAS. INFRASTRUCTURAL HALL WITH AMBIENT PERCIPITATIVE EFFECTS.
GROUND LEVEL PLAN.
GROUND LEVEL PLAN DETAIL.
GROUND LEVEL PLAN DETAIL.
LOWER LEVEL PLAN DETAIL WITH AMBIENT TEMPERATURE EXCHANGES.
LOWER LEVEL PLAN DETAIL WITH AMBIENT TEMPERATURE EXCHANGES.
LOOKING THROUGH THE THEATER WHILE STREAMING RESEARCH THROUGH THE INTERNET. STATION AND DIGITAL PROXIMITY
THE HEAT OF MACHINES AND INHABITANTS MIXES WITH AMBIENT COLD, FOG IS PRODUCED. ATMOSPHERE WITHIN THE RESEARCH HALL
LONGITUDINAL SECTION B-B WITH ZOOMED DETAIL.
LONGITUDINAL SECTION B-B WITH ZOOMED DETAIL.
SECTION A - A
1/16" - 1'0"

TRANSVERSE SECTION A-A WITH ZOOMED DETAIL.
TRANSVERSE SECTION C-C WITH ZOOMED DETAIL.
“Contextualism did not repeat context so much as register changes in the context. A contextualist project would become an index of accommodations to context, in contrast to modern insensitivity to circumstances such as orientation or entry, external vectors that were overwhelmed by the outward expansion of modern space. In short, overturning the coin of modernist planning meant having two sides, not one or the other. Contextualism proposed a process to mediate between inevitable change and existing conditions.”

- Contested Contexts, Sandy Isenstadt
FOGGY EXTERIORS WOULD FURTHER REFRACT THE LIGHTS PROJECTING THROUGH THE ICE ROOF
REVISED EXTERIOR RENDERING.
APPENDICES

INITIAL ADVERTISEMENTS
ARCHIVAL IMAGES
FINAL BOARDS
PRESENTATION PHOTOS
MODEL PHOTOS
BIBLIOGRAPHY
ARCHIVED IMAGES.
ARCHIVED IMAGES.
ARCHIVED IMAGES.
ARCHIVED IMAGES.
ANTARCTICA

DISCOVER
ANTARCTICA

EXPLORE

ANTARCTIC TOURISM POSTERS.
Designated as a global commons, Antarctica is an internationally shared and protected territory, yet in spite of our combined preservatory efforts, this warming area has become the product of vast, global oversight. This thesis aims to generate an awareness and greater visibility to the oscillating physical and atmospheric ephemera of this continent, through the engagement of internal and external extrema of a research station as a performative bridge between architecture and environment. Through granting a variety of sensorial experiences, this station will attempt to instill strong desire towards ethical decision making, individual responsibility towards our shifting climate, and the effects of our collective impacts.

HOT+COLD: Physical and Atmospheric Ephemera in the Antarctic

McMurdo Station, aq

January 2012 - December 2012

Temperature

<table>
<thead>
<tr>
<th>MONTH</th>
<th>TEMPERATURE (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>-20</td>
</tr>
<tr>
<td>Feb</td>
<td>-15</td>
</tr>
<tr>
<td>Mar</td>
<td>-10</td>
</tr>
<tr>
<td>Apr</td>
<td>-5</td>
</tr>
<tr>
<td>May</td>
<td>0</td>
</tr>
<tr>
<td>June</td>
<td>5</td>
</tr>
<tr>
<td>July</td>
<td>10</td>
</tr>
<tr>
<td>Aug</td>
<td>15</td>
</tr>
<tr>
<td>Sept</td>
<td>20</td>
</tr>
<tr>
<td>Oct</td>
<td>25</td>
</tr>
<tr>
<td>Nov</td>
<td>30</td>
</tr>
<tr>
<td>Dec</td>
<td>35</td>
</tr>
</tbody>
</table>

Wind Speed

<table>
<thead>
<tr>
<th>MONTH</th>
<th>WIND SPEED (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>5</td>
</tr>
<tr>
<td>Feb</td>
<td>10</td>
</tr>
<tr>
<td>Mar</td>
<td>15</td>
</tr>
<tr>
<td>Apr</td>
<td>20</td>
</tr>
<tr>
<td>May</td>
<td>25</td>
</tr>
<tr>
<td>June</td>
<td>30</td>
</tr>
<tr>
<td>July</td>
<td>35</td>
</tr>
<tr>
<td>Aug</td>
<td>40</td>
</tr>
<tr>
<td>Sept</td>
<td>45</td>
</tr>
<tr>
<td>Oct</td>
<td>50</td>
</tr>
<tr>
<td>Nov</td>
<td>55</td>
</tr>
<tr>
<td>Dec</td>
<td>60</td>
</tr>
</tbody>
</table>

Solar Exposure

<table>
<thead>
<tr>
<th>DATE</th>
<th>SOLAR EXPOSURE (HR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 1</td>
<td>12</td>
</tr>
<tr>
<td>Jan 2</td>
<td>11</td>
</tr>
<tr>
<td>Jan 3</td>
<td>10</td>
</tr>
<tr>
<td>Jan 4</td>
<td>9</td>
</tr>
<tr>
<td>Jan 5</td>
<td>8</td>
</tr>
<tr>
<td>Jan 6</td>
<td>7</td>
</tr>
<tr>
<td>Jan 7</td>
<td>6</td>
</tr>
<tr>
<td>Jan 8</td>
<td>5</td>
</tr>
<tr>
<td>Jan 9</td>
<td>4</td>
</tr>
<tr>
<td>Jan 10</td>
<td>3</td>
</tr>
<tr>
<td>Jan 11</td>
<td>2</td>
</tr>
<tr>
<td>Jan 12</td>
<td>1</td>
</tr>
</tbody>
</table>

Solar Azimuth

<table>
<thead>
<tr>
<th>DATE</th>
<th>SOLAR AZIMUTH (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 1</td>
<td>0</td>
</tr>
<tr>
<td>Jan 2</td>
<td>15</td>
</tr>
<tr>
<td>Jan 3</td>
<td>30</td>
</tr>
<tr>
<td>Jan 4</td>
<td>45</td>
</tr>
<tr>
<td>Jan 5</td>
<td>60</td>
</tr>
<tr>
<td>Jan 6</td>
<td>75</td>
</tr>
<tr>
<td>Jan 7</td>
<td>90</td>
</tr>
<tr>
<td>Jan 8</td>
<td>105</td>
</tr>
<tr>
<td>Jan 9</td>
<td>120</td>
</tr>
<tr>
<td>Jan 10</td>
<td>135</td>
</tr>
<tr>
<td>Jan 11</td>
<td>150</td>
</tr>
<tr>
<td>Jan 12</td>
<td>165</td>
</tr>
</tbody>
</table>

Climate + Atmospheric Data

Mapping + Precedent Stations

- Germany
- United States
- South Korea
- Belgium
- India
- Great Britain
- Denmark

Coastal Ice Shelf

Surveyed Landscapes

- Wind Currents
- Ocean Gyres
- Topography
- Glacial Movement

Energy + Resource Cycles and Consumption

- To produce 160 kW/h
- 330 kW/h Windmills
- 2,300 m^s
- PV 483 Barrels of oil annually
- Steam Engine
- Windmill
- PV Arrays
- Petrol Engine
- H2O
- Water Filtration
- Human
- O2
- Fertilizer Filter
- Plants
- Desalinated Water
- Waste Digester
- Sabatier Reactor
- Hydrolysis Machine

Passive + Active Material Alteration

- 11.53
- 11.67
- 11.46
- 11.67
- 11.67
- 7.26
- 3.43
- 4.3
- 3.77
- 4.23
- 5.73
- 7.77
- 11.86
- 8.38
- 8.17
- 3.82
- 2.36
- 3.1
- 3.84
- 3.35
- 1.72
- 3.71
- 2.56
- 3.85
- 2.55
- 3.38
- 1.18

Excavation Techniques + Dimensions

- Excavator
- Backhoe
- Bulldozer
- 5m 5m 10m 10m 15m 15m 20m 25m 35m

Thesis Presentation Boards
THESIS PRESENTATION PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
MODEL PHOTOGRAPHS.
**Image Descriptions**

Figure 96.01

Shackleton’s expedition to the Antarctic ice hole on Elephant Island where the lost party first attempted to live.

96.02

Shackleton’s expedition to the Antarctic faithful dogs being fed in the ice kennel, while Endurance was stuck fast.

96.03

Shackleton’s expedition to the Antarctic Endurance after ice pressure was released. Photograph shows the Endurance, partially submerged and mast heads broken, stuck in the ice; dog team hitched together sit in snow away from ship. 1916.

96.04

Dog team resting by an iceberg. Photograph shows two men resting with a dogsled team near an iceberg, during the British Antarctic Expedition. 1911.

96.05

Photograph shows two men resting with a dogsled team near an iceberg, during the British Antarctic Expedition.

96.06

Elbert J. Thawley, engineer of the “Eleanor Bolling,” standing beside the fuselage of the huge tri-motor Ford plane “Floyd Bennett,” before the ship was transported to Little America, the permanent base of the party.

96.07

Shackleton’s expedition to the Antarctic ocean camp. Photograph shows Sir Ernest Shackleton, seated on right, and Mr. Frank Wild, skinning a fish, sitting in front of tent next to camp stove. 1916.

96.08

The Gaumont Co. LTD. London presents the motion picture records of the undying story of Capt. Scott and animal life in the Antarctic.

96.09

Exterior of the Grotto iceberg.

97.10

Herbert G. Ponting and his camera.
Image Descriptions

Figure 97.11
The Castle berg, a weathered iceberg.

97.12
Capt. Scott’s winter quarters.

97.13
Midnight sun in the Antarctic 1913.

97.14
Amundsen’s favorite dogs, Fix and Lassesin 1912.

97.15
The Terra Nova in McMurdo Sound 1913.

97.16
Stranded and iced in research vessel.

97.17
A quartermaster taking inventory in one of the earlier outposts.

97.18
A stretch of land populated by penguins during mating season.

98.01
Whaling station and British base, Whalers Bay, Deception Island. The Whalers Bay station was used by a Norwegian-Chilean whaling company in the early 1900s as a ship base. When oil prices dropped during the Great Depression, the place was abandoned.

98.02
In 1944, the British Admiralty and the Colonial Office built a permanent base there as the part of Operation Tabarin to establish a year-round presence in the Antarctic. However, due to volcanic eruptions between 1967 and 1969, the spot was once again abandoned and has been for more than four decades.

98.03
Oasis Station [Soviet Union, 1956-1959] later renamed A.B. Dobrowlski [Poland, 1959-1979], Bunger Hills, Knox Coast
98.04 Pole of Inaccessibility, 1958

98.05 Shackleton’s Hut, 1909. The famous explorer simply left this fully stocked hut behind after the British Nimrod Expedition (1907-1909).

98.07 / 98.08 / 98.09
Scott’s Hut, Ross Island, 1913. Robert Falcon Scott and his Terra Nova Expedition attempted to become the first people to reach the South Pole, but the Norwegian Roald Amundsen beat them by only a month. On the return journey, Scott and the other expedition members died from extreme cold, starvation, and exhaustion, but their hut, filled with lots of food, oil, and other goods, remains.

99.01
Base W, Detaille Island, 1956-1959

99.05
Grytviken, South Georgia. The settle meant was established in 1904 by a Norwegian sea captain as a whaling station for his fishing company. It was closed in December 1966, but the church is still used occasionally for marriages.

99.08
Leith Harbour or Port Leith, 1909-1965. This was once the world’s largest whaling center, but has been totally abandoned since 1965. The station housed a library, a cinema, and a hospital. There was a gun mount on the hill behind the station, and another with the original 4.1” gun on the west side of the harbor.

100.01

101.01

102.01

103.01
**Image Descriptions**

**Figure 104.01-05**

Seen from the bottom up, boards 1 through 5 of the final thesis presentation on 19 December 2013. Measured individual board size, 36” x 72”.

**105.05-05**

Seen from the bottom up, boards 6 through 10 of the final thesis presentation on 19 December 2013. Measured individual board size, 36” x 72”.

**106.01-02**

Photographs taken during the final presentation on 19 December 2013.

- 106.01 Photo credit Erioseto Hendranata.
- 106.02 Photo credit Marsha Tessmer.

**107.01-02**

Photographs taken during the final presentation on 19 December 2013.

- 107.01 Photo credit Erioseto Hendranata.
- 107.02 Photo credit Marsha Tessmer.

**108.01-109.04**

Photographs taken of various models displayed during the final thesis presentation on 19 December 2013 as well as extra models around my studio workspace.

- 108.01-109.04 Photo credit Marsha and Jim Tessmer.

**110.01**

Model displaying different emergent snowdrifts through pre arranged obstacles, e.g. perforated snow fencing. Sugar / Spray Adhesive / Bristol Paper / 1/16” Chipboard.

- 110.01 Photo Credit Marsha Tessmer.

**110.02**

Foam model showing the proposed tool paths of the excavated architecture at the Ross Ice Shelf. CNC Milled / 2” Extruded Polyethylene.

- 111.01-02

Printed model showing the various slopes and interiors of the project. Makerbot / Glacial Blue PLA.
Image Descriptions

Figure 112.01-115.01

Various photographs of a clear sectional model of the excavated area. The model itself was made to show the transparency of the ice and the collection of spaces within the ice shelf. Laser cut / 3/32” acrylic sheeting.

116.01 - 117.02

A series of formal studies of an initial scheme. 3D printed / Zcorp.

110.01 - 117.02 Photo credit Andy Ryan.
Bibliography


