The South Pole Base

Model and web pages by G. Moody

I would be grateful and pleased to receive corrections and additions to these pages.

To view the entire background image with labels, click here (you may need to zoom in on the image in order to read the labels; use your browser's BACK button to return here). For a large PDF file (~40 MB) of these pages, click here. Background image (taken 23 January 2012) courtesy of the US Antarctic Program and the (US) National Science Foundation, who have provided the caption below:

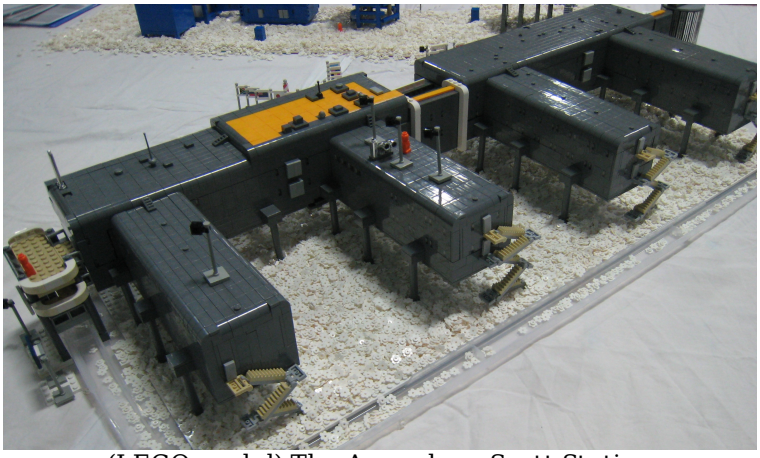
An aerial view of Amundsen-Scott South Pole Station. Sitting on the polar plateau at more than 9,000 feet above sea level, the South Pole is an excellent location for the study of astrophysics. Several telescopes are located in the area in the lower right of the photo, known as the Dark Sector, because it is devoid of radio and light waves during the austral winter. The area at the left is known as the Clean Air Sector as it is upwind from the station. Air monitoring is conducted daily by the National Oceanic and Atmospheric Administration (NOAA).

The Amundsen-Scott Station

It is home at the South Pole to nearly 200 people each summer. In the dark winters, up to 50 live there.

The large structure here is the third (and current) **Amundsen-Scott station**[A-Q], which is named after the leaders of the first two expeditions to reach the South Pole, Norwegian Roald Amundsen and Briton Robert Falcon Scott. Unlike any other building its size (about 120m/400ft long) in the world, all its components have been air-lifted to its construction site. More than 400 flights of the New York Air National Guard's ski-equipped LC-130 aircraft were needed for this task.

The Amundsen-Scott Station



(LEGO model) The Amundsen-Scott Station

The front of the station is shaped like an airplane wing, and it faces into a nearly constant 10-15 knot wind that sweeps away most of the snow that would otherwise accumulate beneath. Since all directions from the geographic South Pole are north, normal directions are not useful. The South Pole base uses a notional "grid direction" system aligned with the prime meridian, so Greenwich, England, is "north", and New York City is "west". To the "southwest" is a range of 3000m mountains responsible for the wind.

The first Amundsen-Scott Station was built for International Geophysical Year (1957), and it was abandoned after about 18 years because it had become a hazard, having been buried by drifting snow. The current station has been designed to last at least 25 years, and it was built between 2001 and 2008 for US $150 million, less than the cost of Newton North High School.

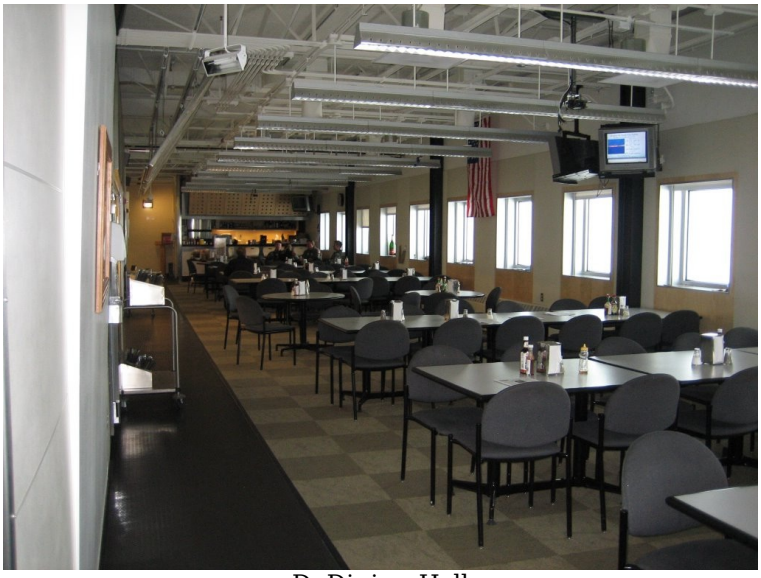
The station sits on 36 piers [A] which can be raised in 25cm (10in) increments to keep it above the snow. In all, it is designed to be raised by up to two full floors, and as of mid-2015, it had already been raised twice. It includes a conference room [B], gymnasium [C], dining hall and kitchen[D], single year-round rooms for 44 people [E], and single summer rooms for an additional 152 people. At one end is the "beer can" [F], which contains a spiral staircase leading down to the ice tunnels 15m (50 feet) below, and a cargo elevator. At the other end is an oval platform ("Destination Alpha", [G]) which is the main entrance to the station. There is a mezzanine above the science labs [H] for roof-mounted experiments that can be conducted inside the station, an emergency power plant[I], sick bay, a small library [J], a post office [K], a self-operated laundry [L], a sauna [M], arts and crafts [N] and music [O] rooms, a store [P] and a self-contained greenhouse [Q].

A: Piers

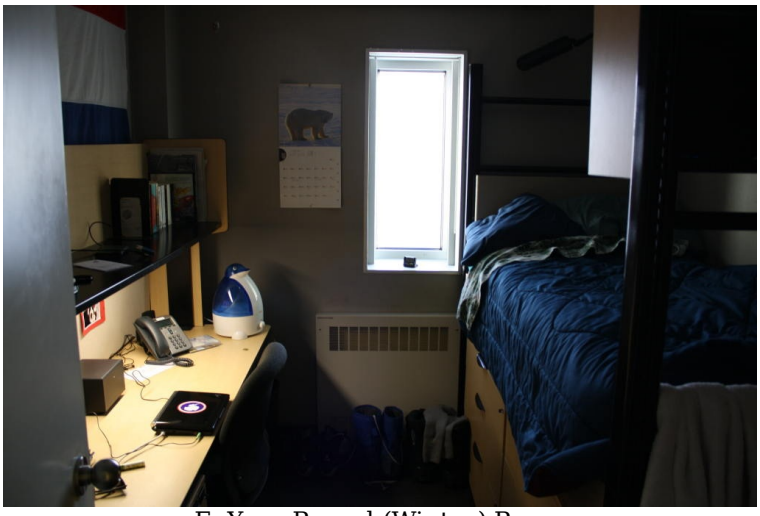
A': (LEGO model) Piers

B: Conference Room

C: Gymnasium

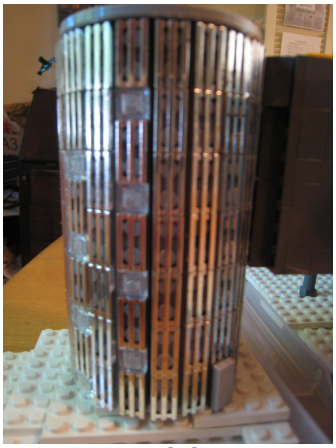


D: Dining Hall



E: Year-Round (Winter) Room

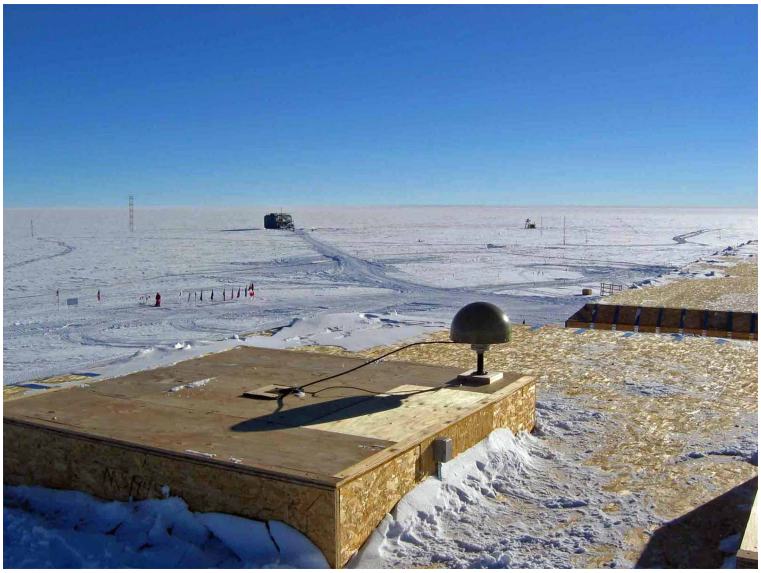
F: Beer Can



F': (LEGO model) Beer Can

G: Destination Alpha

G': (LEGO model) Destination Alpha



H: Mezzanine (ARO in background)

H': (LEGO model) Mezzanine

I: Emergency Power Plant

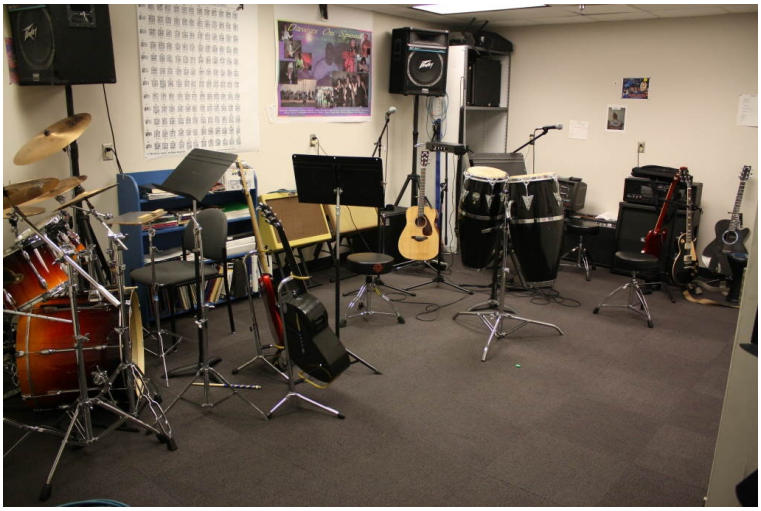
J: Library

K: Post Office

L: Laundry

M: Sauna

N:Arts and crafts room



O: Music room

P: Store

Q: Greenhouse

The Greenhouse was designed as a drop-in module at the University of Arizona (Tucson), about as far climatically as one can get from the South Pole. Residents of the station use it during the winter as their sole source of greens, melons, and flowers, and year-round as a quiet place for meditation.

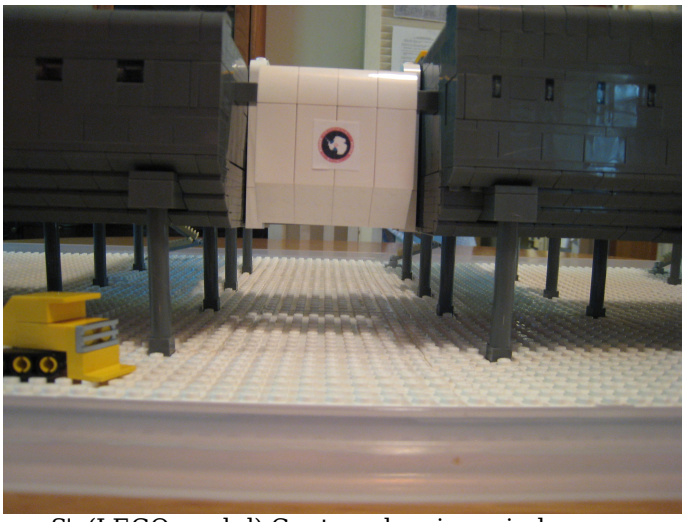
The South Poles

Near the station, there are two South Poles, one ceremonial and the other geographic. (There are at least two others: the South Magnetic Pole and the South Pole of Inaccessibility, defined as the spot on Antarctica and on the Earth's surface, and farthest from any ocean. Both are far from the base.) The **ceremonial Pole** [R] is fixed relative to the ice sheet (thus to the station) and is half-surrounded by the flags of the original signatories of the Antarctic Treaty (the USA, the UK, Norway, Belgium, France, the USSR, Japan, Argentina, Chile, South Africa, Australia, and New Zealand, with Russia taking the place of the USSR). The **geographic Pole** [S] (altitude 2837m/9308ft, varying slightly each year, although because of the Earth's spin it is barometrically and physiologically equivalent to 4000m) is re-measured annually on 1 January, moving about 10m (30 feet) "southwest" per year. (The model shows the station's closest New Year's Day approach to the Geographic Pole, on 1 January 2010, in the background of the photo, taken in 2011.)

R: Ceremonial Pole

S: Geographic Pole

R': (LEGO model) Poles



S': (LEGO model) Center, showing windscreen

Transit and Power

Temperatures at the Pole during winter (March through September) are often below -70 °C (-95 °F). The **LC-130 aircraft** [T], powered by AN-8 jet fuel that begins to gel at -56 °C (-70 °F), are used through the summers today to ferry supplies, scientific equipment, scientists, and other visitors from McMurdo Station on Ross Island near the Antarctic Peninsula and from Christchurch, New Zealand, headquarters of the US Antarctic Program. Usually, the engines remain on at the Pole, so the fuel doesn't freeze. The LEGO model of the LC-130 is Ralph Savelsberg's design.

T: LC-130

About 80% of the output of the **power plant** [U] is in the form of heat, which it distributes across the base via glycol heat pumps; the balance is electricity from conventional alternators. The plant burns about 2.3 million liters (600,000 gallons) of AN-8 jet fuel annually. This amount has been flown to the Pole at a cost of 3 units burned for each unit delivered, but using the Trans-Antarctic Traverse (an ice road to McMurdo Station) promises to cut this cost to less than half a unit burned per unit delivered. The plant is about 250m downwind ("north") of the "Beer Can."

U: Power Plant
(Amundsen-Scott Station visible in background)

The Blue (Science) Buildings, Spoolhenge, and the SPT

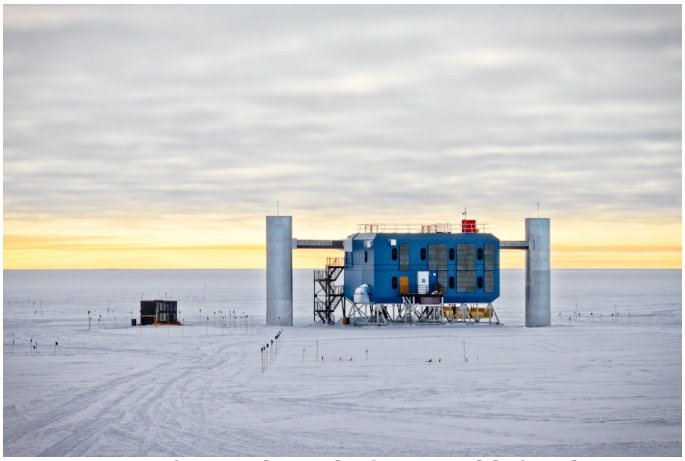
The four "blue buildings" (the IceCube Lab, the DSL with its attached SPT and Keck Array Telescopes, the MAPO with its attached BICEP and decomissioned VIPER telescopes, and the ARO) are repurposed prototypes for the Amundsen-Scott Station. The front of the ARO faces the station; the fronts of the others face away from the station. They were shipped to Antarctica as pre-fabs and substantially remodeled on-site. The laboratory area of the base is divided into the Dark Sector (the DSL, the IceCube, and MAPO), from which stray light and radio waves are excluded, the Quiet Sector (currently unoccupied, but reserved for seismologic and related experiments), from which sound is excluded, and the Clean Sector (ARO), from which pollution is excluded. Overflights are banned from all three sectors.

The **IceCube** [Vf,Vr,Vl], operated jointly by the University of Wisconsin (Madison) and the National Science Foundation (NSF), is the world's largest (and most sensitive) neutrino observatory, containing one cubic kilometer of water (as optically clear ice). Although conventional matter can't exceed the speed of light in a vacuum, this is possible in a medium such as water. When charged particles do this, they create conical shock waves called Čerenkov light. Neutrinos are nearly massless and travel at almost the speed of light, but they have no charge, so they don't generate Čerenkov light directly. Rarely they knock an electron loose, or a water nucleus, which are charged and do generate Čerenkov light that sometimes permits calculation of the neutrino's energy and trajectory. The IceCube has been used to map neutrinos that originated near the center of our galaxy. The IceCube is the successor to AMANDA (the Antarctic Muon And Neutrino Detector Array), which was used to test the technology at a smaller scale. The IceCube Lab (ICL) is about 1 km "east" of the station, and about 500m "north" of the DSL and MAPO. The cables that connect the Čerenkov light detectors of the IceCube were originally delivered to the South Pole on large spools. Rather than returning them as waste, they have been assembled into **Spoolhenge** [W], the only outdoor art installation on Antarctica.

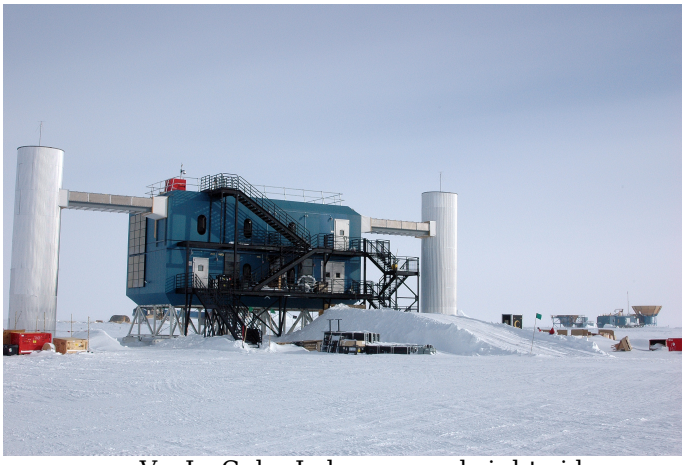
The **Dark Sector Laboratory** (DSL, [Xf,Xr,Xt,Xl]) is so named because of the absence of light and electromagnetic pollution that would otherwise interfere with ongoing experiments. Two large telescopes are mounted on the DSL: the South Pole Telescope (SPT), on an extension, and the Keck Array, on the roof. The SPT, the Keck Array (up to 5 identical refractors similar to BICEP2 with a total output roughly half that of BICEP3 [see MAPO below], operated by the Harvard-Smithsonian Center for Astronomy [CfA] with assistance from the Keck Foundation and the NSF), and BICEP (operated by Caltech, with funding from the NSF), though associated with different institutions, share data. The DSL is near MAPO. The **South Pole Telescope** (SPT, [Xt]) is a 10m reflector radio telescope finished to within 0.001in (0.04mm) of its designed shape. Its field of view is about a square degree, and its resolution is limited (so far) by its camera (currently SPTpol, SPT polarimeter, with a resolution of 1.2 minutes of arc at its typical observing frequency of 150 GHz). The extension to the DSL, on which the SPT is mounted, is designed so that its roof can be rolled away to make room for the SPT's receiver cabin, which can be worked on in relative comfort. (The model does not show this.) The SPT is operated by a consortium headed by Berkeley, funded by the NSF.

The **Martin A. Pomerantz Observatory** (MAPO, [Yf,Yr,Yl), now operated by the University of Delaware, was named in 1995 after the first true Antarctic astronomer, Pomerantz (1916-2008), who began work at the South Pole in 1964. The telescopes incorporate shields to reduce the noise of radio waves reflected by the surrounding snow. The DASI (Degree Scale Angular Interferometer) radio shield, visible in the photos, is mounted on the roof of an extension to MAPO. It surrounds the BICEP (Background Imaging of Cosmic Extragalactic Polarization) radio telescope (currently BICEP3, a 550mm f/1.6 refractor operating at 95 GHz). The 2.1m reflector ACBAR/VIPER telescope (ACBAR: Arcminute Cosmology Bolometer Array Receiver; "VIPER", the last in a series of snake-named telescopes at the South Pole, is not an acronym), shown in the photo on the far end of MAPO, was decomissioned in November 2005 and reinstalled in 2014 at Siena College (Loudonville, NY, USA), but was formerly operated by a consortium headed by Berkeley. MAPO is about 1 km "east" of the station.

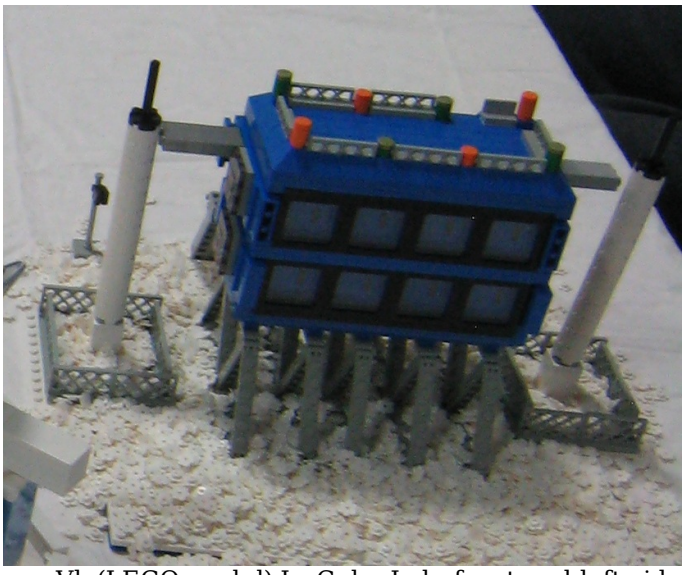
The **Atmospheric Research Observatory** (ARO, [Zf,Zr,Zl]), about 500m upwind ("south") of the Amundsen-Scott Station and operated jointly by the NSF and the National Oceanic and Atmospheric Administration (NOAA), measures the cleanest air in the world over long periods. The ARO recently published a 50-year time series of its carbon dioxide measurements, for example. Note the extra "layer" that separates the two floors of the ARO; in the model, this is used to support the second level of the cargo dock, except on MAPO, which has no dock. (Similar layers exist in the other three "blue buildings," but they are clearest in the ARO.)



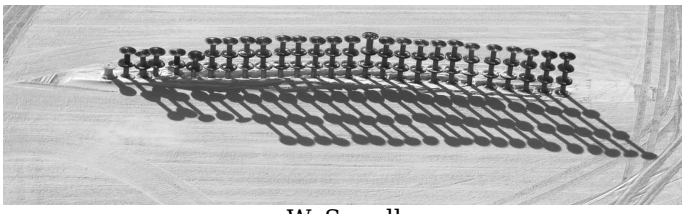
Vf: IceCube Lab, front and left sides



Vr: IceCube Lab, rear and right sides
(MAPO visible in background)

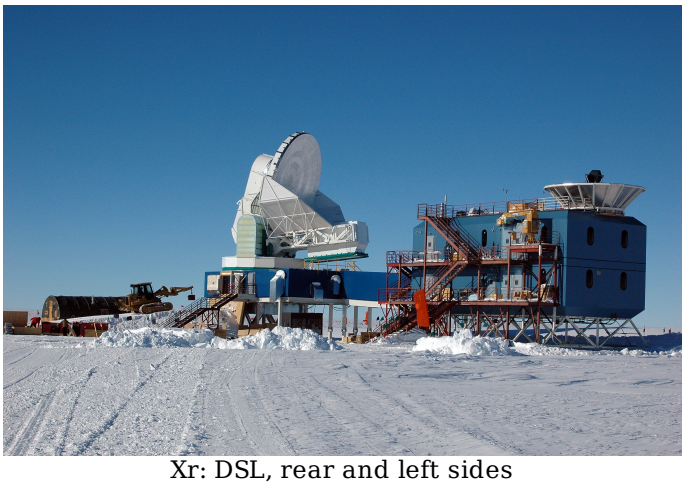


Vl: (LEGO model) IceCube Lab, front and left sides
(model of SPT visible in foreground)

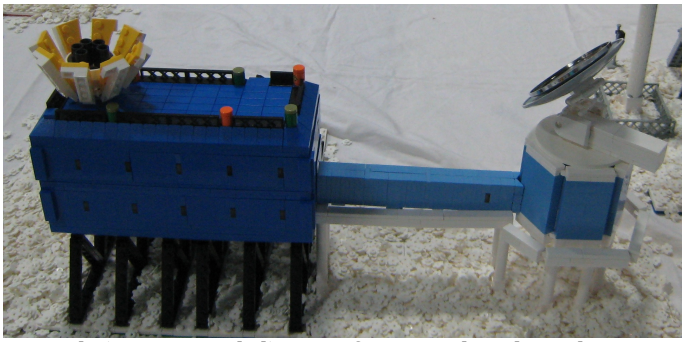


W: Spoolhenge

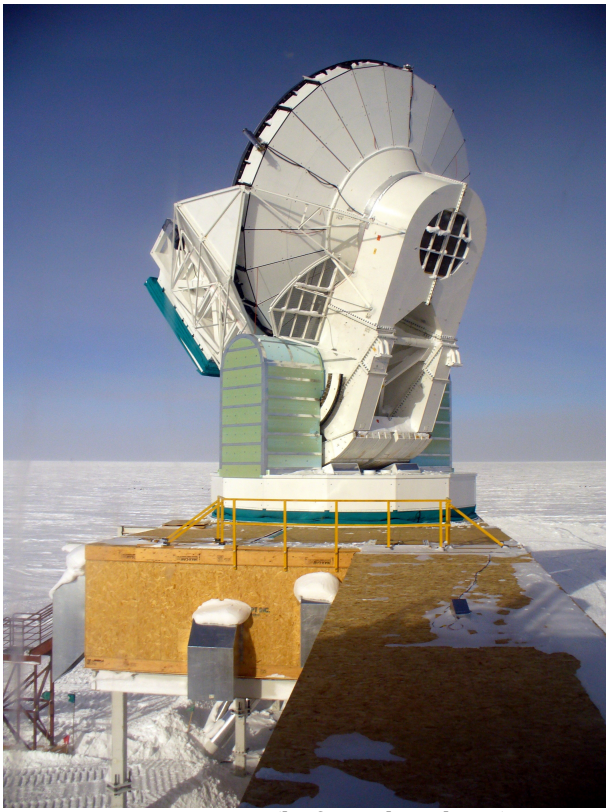
Xf: DSL, front and left sides, ICL in background
(right, SPT; left, on roof, Keck Array)



Xr: DSL, rear and left sides



Xl: (LEGO model) DSL, front and right sides
(models of Keck Array on roof, SPT at right;
model of ICL visible in background)

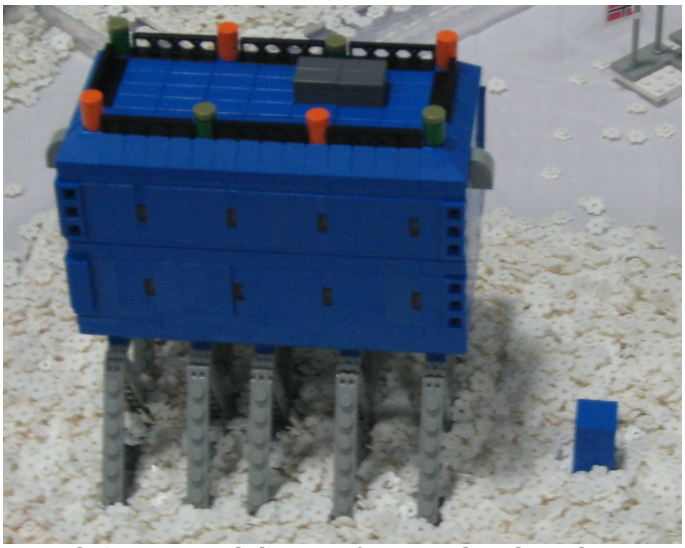


Xt: SPT (before sheathing)

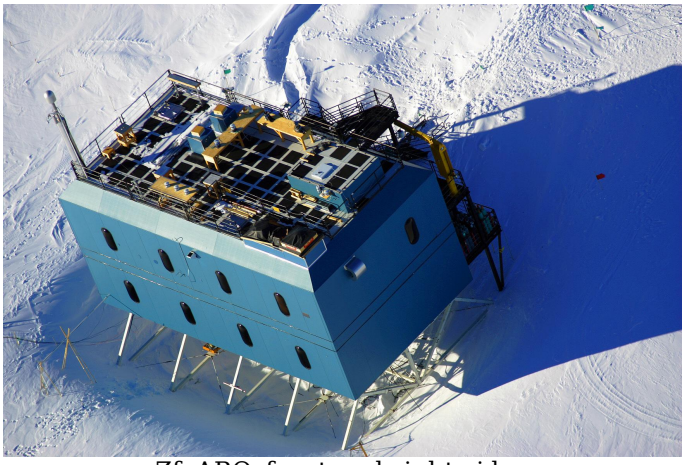
Yf: MAPO, front and left sides

Yr: MAPO, rear and left sides
(DSL visible in background)

Yl: (LEGO model) Viper, MAPO (rear and right sides),
and BICEP (model of ARO visible in background)



Zl: (LEGO model) ARO, front and right sides
(model of geographic pole visible in background)



Zf: ARO, front and right sides

Zr: ARO, rear and right sides
(Amundsen-Scott Station visible in background)

FAQs about this model (and a few about the South Pole)

Why build this?

I chose this subject because it is the closest thing on earth to a space habitat. I can also tell my friends that I am building a scale model of the Earth, starting at the bottom!

Why use Lego?

Because I like Lego, that's why!

Seriously, though, I was able to find the shapes and colors I needed, and the precision of Lego made it possible to build large structures from tiny pieces.

What do the letter flags mean?

They are keyed to the photos in these pages. For example, flag A is at (about) the same position on the model as photos A and A' (of the piers), and flag V marks the ICL, shown in photos Vf and Vr.

Why the *South* Pole? Don't you live closer to the North one?

I do, but the North Pole is ~~under water~~ occupied by Santa.

My friend only makes what's on the box.

I think he or she is missing something, don't you?

What date does the model represent?

About 2012, sort of. I imagined that the VIPER and BICEPS 3 scopes were simultaneously on the ends of the MAPO; in fact, VIPER in the partially disassembled state I show in the model was contemporary with BICEP 2, which (at Lego scale, anyway) looks identical to BICEP 3.

How long did it take to build?

I spent about 3 months on the main building, working on it about two hours a day. Quite a few people, including my wife (Edna), both our sons (Benjamin and Jeremy), and friends they recruited, and our daughter (Melissa), helped to make the "snow." Benjamin built Destination Alpha and the stairs on the back of the station. The model, in this state, was shown at several BrickWorld and Brickfair exhibitions. After some medical problems, I returned to make these pages, the stickers, and the "blue buildings" in about another year, again working about two hours a day. Edna built the BICEP and VIPER telescopes using my designs for them and suggested improvements in the "blue buildings." In 2016 and 2017, I showed the model at BrickFair New England. Using Ralph Savelsberg's elegant design, I assembled the LC-130 model in several weeks after BrickFair 2017 with help from Edna and Melissa.

I haven't built the power plant (not enough photos of the outside yet). After my brother-in-law Ed took me to see a ski-equipped LC-130 in Arizona (hint: they don't need them there), I built a model of one, but it still needs a hangar (like the power plant, I need more pictures). I hope to build the power plant and hangar eventually.

What is the "snow"?

At the real South Pole, it's a glacier about 3 km/2 mi thick. In this model, it's represented by white Lego flowers, which come four on a sprue and were separated manually. I need more, if anyone has extra.

What about the penguins?

One of the best-loved features of the model is the pair of slightly oversized penguins, made and given to me by Edna. She used minifig hands for the beaks. Penguins live in Antarctica, but not near the Pole (about 1300 km/800 mi from the nearest open sea) because they can't find food there and it's too cold. See the film, March of the Penguins (La marche de l'empereur), for the story of their remarkable migration.

Is the scale correct?

The scale of the buildings is consistent (1/125; one stud represents about one meter). There is a lot of room at the south pole, however, and the possibility of interference among experiments means that the buildings are more spread out there than in this model.

How many pieces are in it?

Not counting the "snow," about 3700 in the main building. There are about 12600 "snowflakes." Each of the four "blue buildings" is about 800 pieces. The Poles, flags, signs, and outhouses are about 150 more pieces. The LC-130 is about 600 pieces, so in all, that's roughly 20250 pieces if you're counting.

Did you use glue?

No.

Did you get paid for this?

No.

Did you make the insides of the buildings?

No, because you don't get to see them anyway.

Can I buy this kit somewhere?

This isn't a "kit," so no. (There is an exception; see below.) The individual pieces came from my collection, from the "Pick-a-Brick" wall at the local Lego store, and from parts vendors on BrickLink (www.bricklink.com).

The LC-130 *is* a kit, though, available from BrickMania. Ralph Savelsberg (aka Mad Physicist) made an excellent design that is ever so much nicer than anything I could have made, so I used it despite the slight discrepancy in scale (1/100, vs. 1/125 for the buildings).

Have you ever been to the South Pole Base?

No, I wish I had, though! I looked at a lot of photographs to get the dimensions right.

Has Buzz Aldrin ever been to the South Pole Base?

Yes, and so has the King of Norway (to celebrate the centennial of Roald Amundsen's visit to the Pole; needless to say, the Base wasn't there in 1911). You can go there, too, if you've been hired or if you have a lot of money you don't really need.

Is it really all Lego?

Yes, except for the lights inside, which are made by LifeLites (www.lifelites.com), and the stickers, which I designed using images from Wikipedia (www.wikipedia.org) and which were cut and attached to Lego pieces by Edna. The eighth sticker (the flag of the USAP) is a spare; the rest of the top 13 flags are arranged in a semicircle next to the ceremonial Pole, the next two flank the geographic Pole, and the last two fly above Destination Alpha. The top sticker on the left is centered on the windscreen that separates the two halves of the station, the second is a sign at the geographic Pole, and last is a sign at the base of Destination Alpha. Edna made the ceremonial South Pole 'barber pole' by wrapping two white strips of sticker paper (0.25x0.75in/6.25x16.8mm), offset by 180 degrees, around a red Technic pin joiner. The dish of the SPT was chromed on an original Lego part by bricks4all.

The signs I display were made by Victor at EclipseGrafx (www.eclipsebricks.com) on Lego tiles, and were given to me by Jeremy. The insignia on the LC-130 model is a set of vinyl stickers packed with the kit.

Aren't the stripes on the Ceremonial Pole backwards?

Shhhhh. (I goofed.)

When I was a kid, Lego didn't make all these weird pieces.

That's not a question!

The Lego logos aren't all pointing the same way.

That's not a question, either. Who invited this guy?

What are the little blue buildings next to the big ones?

Hint: they aren't mailboxes. They're what you think they are -- and they're unheated, too, so you can freeze your __ off if you stay in one too long.

The station itself has indoor plumbing, and bathrooms. The "blue buildings" have neither.

Are the metric measurements correct?

Not really. The contractor used by the NSF uses US customary units (in most cases, equivalent to English imperial units), like some of the rest of the US but unlike the rest of the world or almost all of the other people (scientists) to whom the NSF gives money, who use the metric system. Go figure. Anyway, the result is that the US customary measurements given in the text are definitive, and the metric equivalents are approximate.

It would be nice if these pages were posted publicly.

Yes, it would be. Try pointing your web browser to ecg.mit.edu/george/lego/sp/.

What time/date is it at the South Pole?

This is an arbitrary choice, made for the convenience of operating the station in concert with USAP Headquarters in Christchurch, New Zealand. The base keeps New Zealand time (UTC+12 hours).

I thought the station was a dome.

The second version of the station was a geodesic dome, like the one you might have seen on TV. Unfortunately, wind-blown drifting snow is unkind to most types of structures at the South Pole, and like other such structures the dome eventually became buried. It was hazardous to use and had to be replaced. (The first version was built of wood in 1956-7 and was designed to be partially buried by the snow. It is now more than 10 meters [30 feet] deep, having been abandoned c. 1975.)

Why are there so many telescopes? Is the South Pole a good place for astronomy?

Yes, because it's 3km/2mi high so there is little atmosphere to interfere, what little air is there is exceptionally clean, there are no street lights or other sources of light pollution (the windows of the station are covered during the annual five-month night for this reason), there's a patch of sky (the south circumpolar region) that's continuously visible for long exposures or observations of infrequent phenomena, and it is dry (the area around the Pole is the driest desert on Earth; the massive amount of ice and snow there is because it doesn't melt or sublimate). Nevertheless, optical astronomy hasn't been pursued seriously at the South Pole for years because much of the sky is *not* visible. Current large scopes at the Pole are all radio telescopes, since none of the sky has been surveyed comprehensively at other sites owing to near-ubiquitous *radio* pollution, which the snow reflects and is kept away from the scopes by prominent radio shields.

Operators of the radio telescopes now at the Pole are cooperating on a hunt for evidence of the Cosmic Gravitational Wave Background (GWB) by looking at the polarization (curl component) of the Cosmic Microwave Background (CMB). They are aided by most of the advantages listed above, and by the relatively low lead time of less than one year achievable using Earth-based locations.

Why only a *five*-month night? Isn't night at the Poles six months?

Twilight lasts about two weeks at each end.

Why are the telescopes in cages? Do they think the scopes will run away?

Second question first. The operators of the scopes are smart people. I don't think they think the scopes will run away.

As for the first question, I don't know. I'd guess they don't want the scopes to get hit by accident in whiteout conditions. What do you think?

Why are there so many trash barrels and recycling bins?

It's the South Pole, and the NSF wants to keep it clean. (Actually they are obligated by treaty to do so.) The contents of those receptacles goes back to McMurdo, and from there back to the US for disposal or re-use. That makes it some of the world's most expensive refuse. The NSF is (justly) proud that 70% of it gets recycled -- that's far more than most US communities -- but it implies that 30% *doesn't* get recycled. At the temperatures at the Pole, it doesn't decompose, either, so it would become a big problem if left to accumulate.

Members of the community sort their recycling finely. Around 1 April, bins labeled "dreams", "zombie parts", and the like often appear, but these aren't usually recycled.

Why doesn't the fuel for the power plant gel or freeze?

The plant runs constantly, keeping the fuel liquid. Heat is always needed at the base, so the fuel isn't wasted.

What wildlife lives at the South Pole?

Only humans (and the lifeforms they carry) live at the Pole. Arctic terns (*sterna paradisaea*) and antarctic skuas (*catharacta macormicki*) have been seen flying over the Pole occasionally, but they find no food there, so they don't live there. Brown skuas, also (confusingly) known as antarctic skuas and recently in the news because they seem to recognize individual humans, are a distinct species (*stercorarii antarctici*) and have *not* been spotted near the Pole. There is also a seabird called the south polar skua (*stercorarius maccormicki*), which oddly enough is sometimes seen in New Zealand (near the ocean, where it feeds) and not near the Pole (far from the ocean). Wikipedia disagrees (about the bird, not about the ocean).

How cold does it ever get at the South Pole?

Pretty cold. It often drops below -100° F (-73 1/3° C, but it sounds more impressive in Fahrenheit). The lowest recorded temperature at the Pole was -117° F (-82.8° C). [The all-time high is a balmy 9.9° F (-12.3° C)].

That's not as cold as the ISS. Why don't they fly year-round?

It's much more expensive to fly to the International Space Station. And they don't have to land on the ISS in the dark.

There are KOALA (Kind Of A Lotta Acronyms) here. What gives?

Haha, I see what you did there. Blame the NSF (there goes another one!) for them. If you find an acronym that isn't defined in the text, please let me know about it.

Why is the SPT on an altazimuth rather than an equatorial mount?

Because it's at (well, close enough to) the pole, so an altazimuth mount *is* an equatorial mount, at Lego scales anyway.

Has solar power been considered? Powering the base with jet fuel doesn't sound environmentally friendly.

(Thanks to Dave G. for this question.) The little blue buildings get solar power in the summers. (They aren't used during the winters.) The problem with solar power at the Poles is that the sun never gets very high, and is not in the sky at all for six months each year. Geothermal power would require drilling a long way, given the thickness of the ice.

Attempts to use solar power to heat the ICL are visible on the model.

Windmills look more promising, and are being tried at the South Pole.

What type of doctors work at the Lego hospital?

Plastic surgeons, and their patients are mostly minifigs with bumps on their heads.

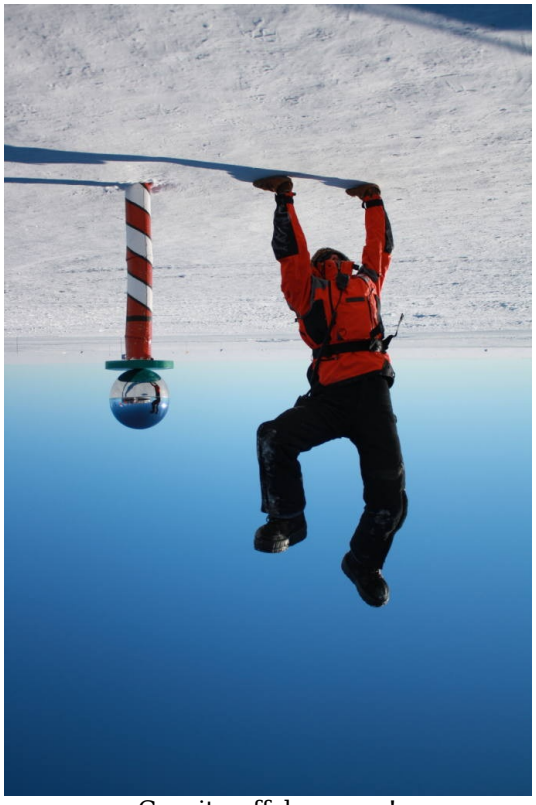
OK, this isn't actually a frequently asked question, but it should be.

Where is the bathroom?

Finally, a sensible question! Ask me, and I'll point.

It's upside-down! Why don't all the Polies fall off?

There's a South Pole Gravity Generator. Here's what happens when it's switched off for maintenance:



Gravity off, hang on!

Photo Credits

Click on any photo to open it in another browser tab or window, where you will be able to view it at higher resolution.

[aerial view of station]: www.southpolestation.com
A: antarcticarctic.wordpress.com
B: mananath.livejournal.com
C: Erik Verhagen
D: spadventure.blogspot.com
E: Erik Verhagen
F: antarcticarctic.wordpress.com
G: Elaine Hood/Antarctic Photo Library (APL)/National Science Foundation (NSF)
H: www.southpolestation.com
I: Jeffrey Donenfeld
J: antarcticdispatches.blogspot.com
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R: www.wikipedia.com/US Antarctic Program/NSF
S: www.southpolestation.com
T: Jordan Goodman
U: Devon Pike
Vf: David Renfroe (www.lifeofsaturdays.com)
Vr: antarcticsun.usap.gov
W: Robert Schwarz
Xf: Steffen Richter/Harvard University
Xr: Peter Rejcek/APL/NSF
Xt: www.wikipedia.com
Yf: Peter Rejcek/APL/NSF (cropped by George Moody)
Yr: Peter Rejcek/APL/NSF (cropped by George Moody)
Zf: Forest Banks/APL/NSF
Zr: University of Chicago
[in FAQ]: Erik Verhagen

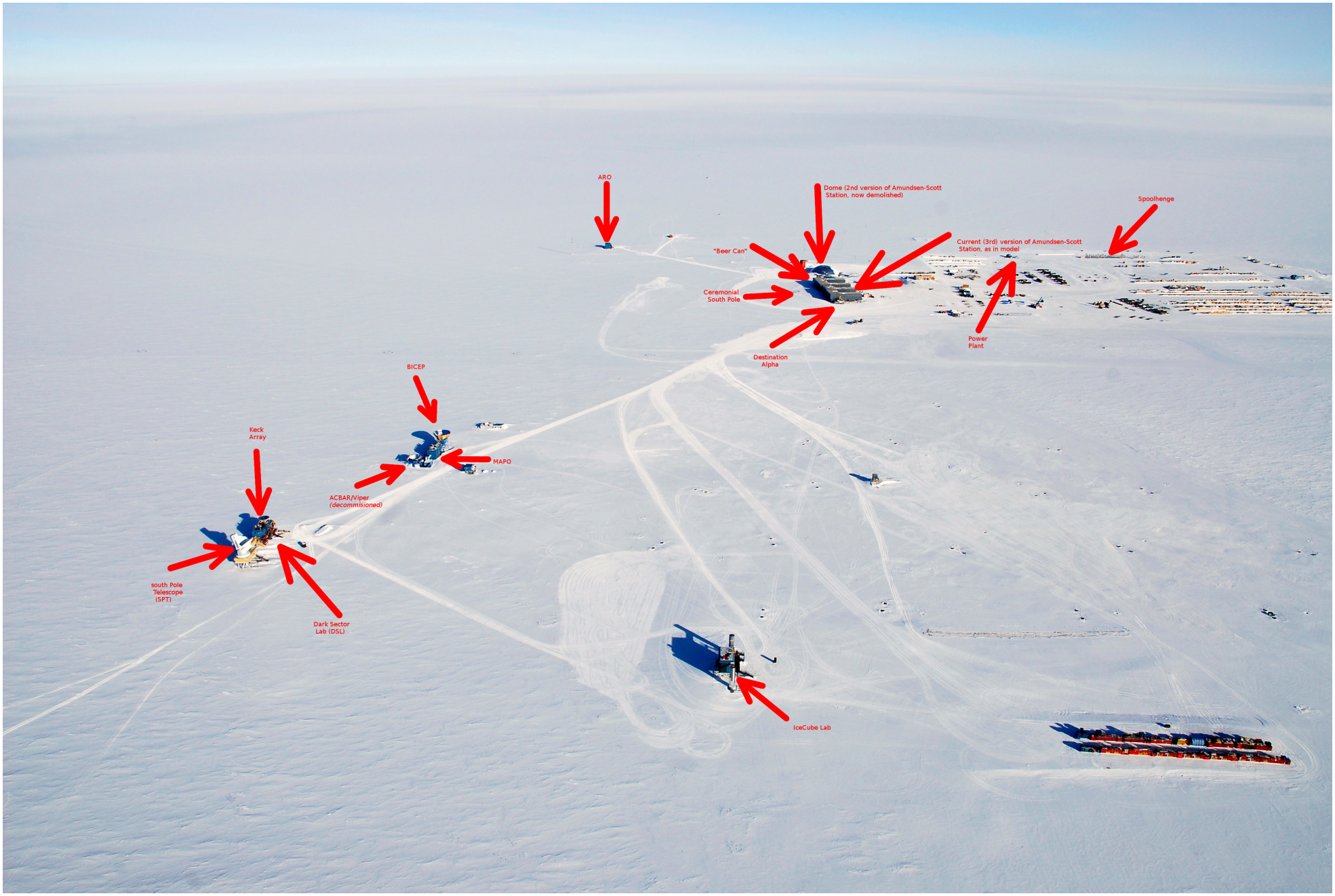
Photos of the LEGO model by Edna and George Moody

Further reading

The Lonely Planet guide, *Antarctica*, is cheap even though going there isn't.

Kim Stanley Robinson's novel, *Antarctica*, though it's centered on fictional elements, evokes a fine sense of place.

See Jeffrey Donenfeld's video tours of the Amundsen-Scott Station on Youtube, and read back issues of the *Antarctic Sun* and anything written by Bill Spindler. Use Google or another search engine to find them.


ARO
Dome (2nd version of Amundsen-Scott Station, now demolished)
Spoolhenge
"Beer Can"
Current (3rd) version of Amundsen-Scott Station, as in model
Ceremonial South Pole
Power Plant
Destination Alpha
BICEP
Keck Array
MAPO
ACBAR/Viper (decommisioned)
south Pole Telescope (SPT)
Dark Sector Lab (DSL)
IceCube Lab