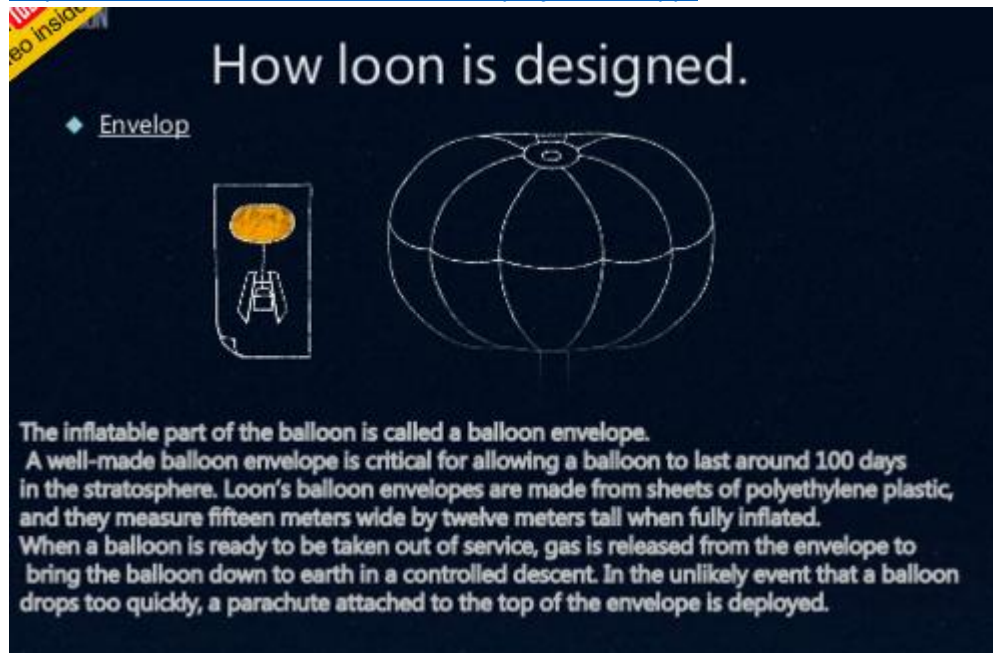
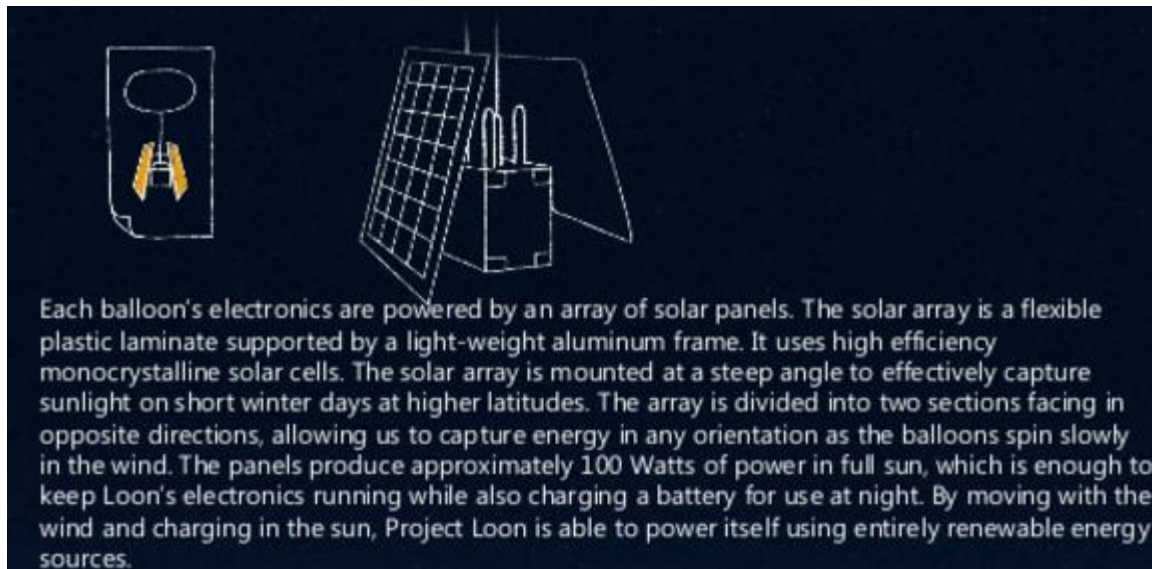


- a) Question to be answered: Are there benefits of our reflective concentrator method for high altitude balloons especially, Google's Loon Project?
- i) <https://www.google.com/loon/how/>
 - ii) <https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=google%20loon%20balloon%20technology>
 - iii) Google employees who look tiny as they tend to a pair of balloons, 15 meters across, that resemble giant white pumpkins. Google has launched hundreds of these balloons into the sky, lofted by helium. At this moment, a couple of dozen float over the Southern Hemisphere at an altitude of around 20 kilometers, in the rarely visited stratosphere—nearly twice the height of commercial airplanes. Each balloon supports a boxy gondola stuffed with solar-powered electronics. They make a radio link to a telecommunications network on the ground and beam down high-speed cellular Internet coverage to smartphones and other devices. It's known as Project Loon, a name chosen for its association with both flight and insanity.
 - iv) https://www.google.com/search?q=project-loon+solar+power&espv=2&biw=1745&bih=1014&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjnaz2t9jKAhUL5mMKHez_CbkQsAQILQ
 - v) <http://www.slideshare.net/snehatatode/project-loon-ppt>



- vi)
- vii) Question: Since they have these slices – and thus, didn't angles - why couldn't we place PV cells strategically opposing them, either inside of the skin or outside, to get their maximum focal points?
- viii) Benefit Assumption is that if greater power, they can increase coverage and/or bandwidth; and thus perhaps they can strengthen the balloons to have longer life as well beyond their current 100 days? If so, they are based across the highway – Moffet Field. Perhaps, they will collaborate with us and fund us too. In any case – it maybe appropriate to make contact with them.
- (1) Perhaps, they maybe interested in a “high power” cubesats?



ix)

x) <https://www.youtube.com/watch?v=YVhS1axhzRs>

xi) Sokol: Says if the focal point is too strong – it will burn a hole thru the skin...but we are diffused – being that the Google Loon balloon is using slice panels, and we will have multiple light weight PV cells.

xii) (Playing devil's advocate: Why don't we/they just put light weight PV thinfilms on the outer skin/slices of the balloon – to capture more solar?)



Manufacturing For The Stratosphere

xiii)

Project Loon



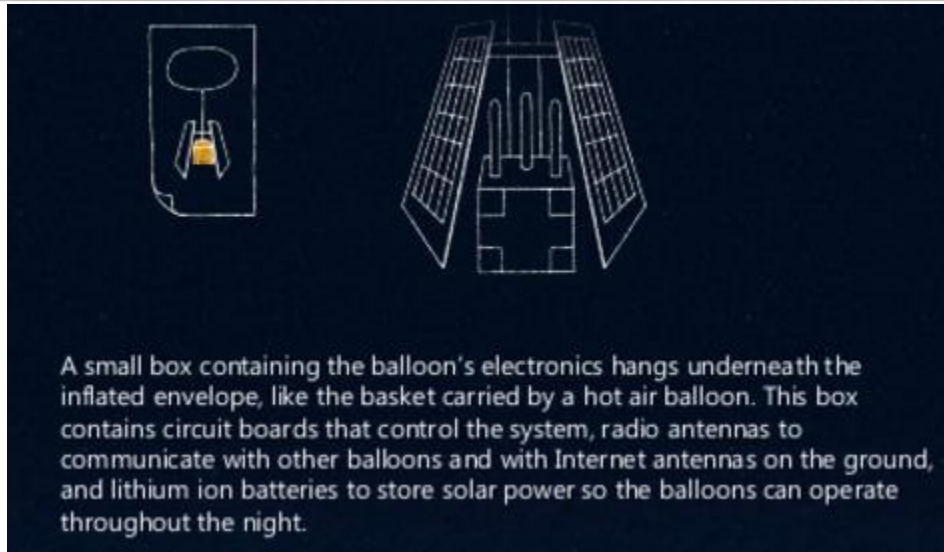
xiv)



xv)



xvi)



xvii)

xviii)

<https://www.youtube.com/watch?v=mcw6j-QWGMo&feature=youtu.be>



about 20 kilometers up, and through this network
we can give the Internet to the entire world.

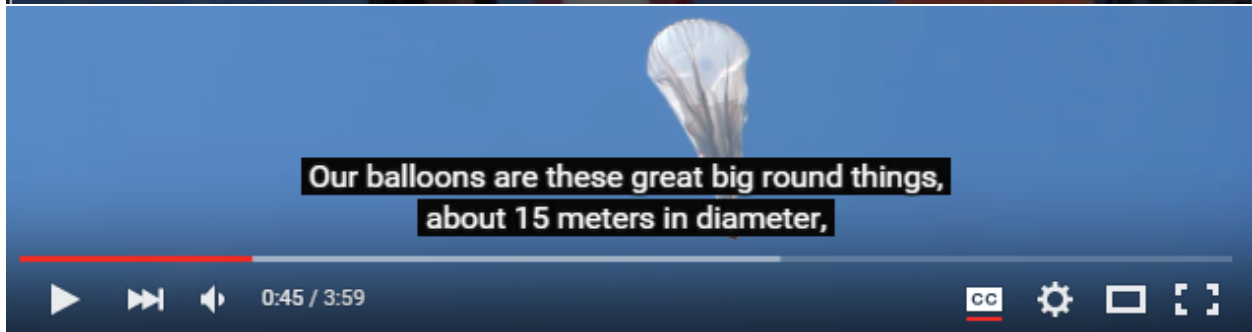
xix)



about 20 kilometers up, and through this network
we can give the Internet to the entire world.

xx)

xxi)



xxii)  Project Loon: The Technology



xxiii)



xxiv)



xxv)



xxvi)



xxvii)

Why Stratosphere ?


- ◇ The stratosphere ranges between 10 km and 60 km altitude
 - on the edge of space.
- ◇ The extreme altitude of the stratosphere presents unique engineering challenges:
 - Air pressure is 1 % of that at sea level
 - Temperatures hover around -50°C
 - A thinner atmosphere
 - Less protection from the UV radiation
- ◇ Suitable because this sphere is having steady stratospheric winds.

xxviii)



xxix)



SOLAR PANELS




- Each unit's electronics are powered by an array of solar panels that sits between the envelope and the hardware.
- In full sun, these panels produce 100 Watts of power - enough to keep the unit running while also charging a battery for use at night.
- By moving with the wind and charging in the sun, Project Loon is able to power itself using only renewable energy sources.

xxx)

EQUIPMENT

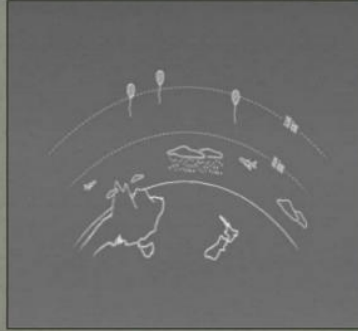
A small box is used that contains the balloon's electronic equipment :-

- Circuit boards that control the system .
- Radio antennas to communicate with other balloons and with Internet antennas on the ground .
- And batteries to store solar power so the balloons can operate during the night .

xxxi)

How loon moves?

- Winds in the stratosphere (10 to 60 km of altitude) are steady and slow-moving between 5 and 20 mph, and each layer of wind varies in direction.
- Project Loon uses software algorithms to determine where its balloons need to go.



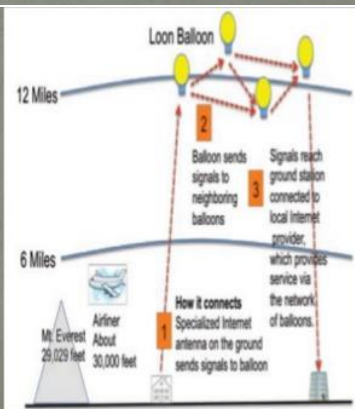
xxxii)

how loon connects?

- Each balloon can provide connectivity to a ground area about 40 km in diameter at speeds comparable to 3G.
- Each balloon is equipped with a GPS for tracking its location.
- The balloons use antennas equipped with specialized radio frequency technology.
- Project Loon currently uses ISM bands that are available for anyone to use.

xxxiii)

- Three radio transceivers.
 - a) balloon-to-balloon communications.
 - b) balloon-to-ground communications.
 - c) third for backup.



xxxiv)

Pilot test in New Zealand.



xxxv)

ENGINEERING challenges:



Moving of balloons in the stratosphere possess many challenges:

- air pressure is 1% of that at sea level
- temperatures hover around -50°C , and
- a thinner atmosphere offers less protection from the UV radiation and temperature swings caused by the sun's rays.



xxxvi)



Stratosphere

- Situated between 10 km and 60 km altitude on the edge of space.
- Air pressure is 1% of that at sea level.
- Thinner atmosphere offers less protection from the UV radiation and temperature caused by the sun's rays.

Raval Sneh

xxxvii)



xxxviii)

You Tube
video inside.

Google

History of Project Loon

◇ In 2008, Google considered contracting Space Data Corp, but didn't do so

◇ 2011, the unofficial development of the project began under Google X Labs

◇ 14 June 2013, Google announced this as an official project

◇ 16 June 2013, A pilot experiment happened in New Zealand and about 30 balloons were launched

Google's Project loon

xxxix)

Project loon

Baloon-powered internet for all

Connect people who have no
Internet access at all

Connect people after disaster



xl)



xli)




xlii)

You Tube
video inside.

Technology

The first person to connect to the "Google Balloon Internet" after the initial test balloons were launched into the stratosphere was a farmer in the town of **Leeston**, New Zealand, who was one of 50 people in the area around Christchurch who agreed to be a pilot tester for Project Loon.




The New Zealand farmer lived in a rural location that couldn't get broadband access to the Internet, and had used a satellite Internet service in 2009, but found that he sometimes had to pay over \$1000 per month for the service. The locals knew nothing about the secret project other than its ability to deliver Internet connectivity; but allowed project workers to attach a basketball-sized receiver resembling a giant bright-red party balloon to an outside wall of their property in order to connect to the network.

xliii)

You Tube
video inside.

Where Loon is going?

Project Loon began with a pilot test in June 2013, when thirty balloons were launched from New Zealand's South Island and beamed Internet to a small group of pilot testers. The pilot test has since expanded to include a greater number of people over a wider area.



Project Loon will continue to expand the pilot through 2014, with the goal of establishing a ring of uninterrupted connectivity around the 40th southern parallel, so that pilot testers at this latitude can receive continuous service via balloon-powered Internet.

◀ 13 of 21 ▶

xliv)

You Tube
video inside.

Google's Project Loon balloon goes around the world in just 22 days

Google



xlvi)