# GOOGLE LOON TECHNOLOGY

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**ABSTRACT**

**Project Loon is a research and development project being developed by Google with the mission of providing Internet access to rural and remote areas. The project uses high-altitude balloons placed in the stratosphere at an altitude of about 20 mi (32 km) to create an aerial wireless network with up to 3G-like speeds. Because of the project's seemingly outlandish mission goals, Google dubbed it "Project Loon". The balloons are maneuvered by adjusting their altitude to float to a wind layer after identifying the wind layer with the desired speed and direction using wind data from the National Oceanic and Atmospheric Administration (NOAA). Users of the service connect to the balloon network using a special Internet antenna attached to their building. The signal travels through the balloon network from balloon to balloon, then to a ground-based station connected to an Internet service provider (ISP), then onto the global Internet. The system aims to bring Internet access to** remote and rural areas poorly served by existing provisions, and to improve communication during natural disasters to affected regions. Key people involved in the project include Rich DeVaul, chief technical architect, who is also an expert on wearable technology; Mike Cassidy, a project leader; and Cyrus Behroozi, a networking and telecommunication lead.

## I. INTRODUCTION

Google's experimental department, Google X, has recently sought to address the issue of internet connectivity in geographically remote or isolated areas. The Loon project is entering the pilot phase of testing now, but has already gained international attention for its ambition. The program seeks to use balloons to provide internet coverage to areas that would otherwise never have that capability (Flatow, 2013).

Halfway across the world, Google has started a new project in New Zealand. In June 2013, thirty balloons were launched from New Zealand's South Island. These balloons were the first tests of Google's new golden egg "Project Loon". Project Loon proposes launching high altitude communication balloons at an elevation of 20 kilometers. For reference, most commercial aircraft fly at around 30,000 feet or just over 9 kilometers. Google plans to use software and algorithms to navigate its fleet of high flying communication balloons to form a slow moving communication network. This would essentially create a global network of aerial cell towers that each could provide internet access.

*PICTORIAL VIEW*

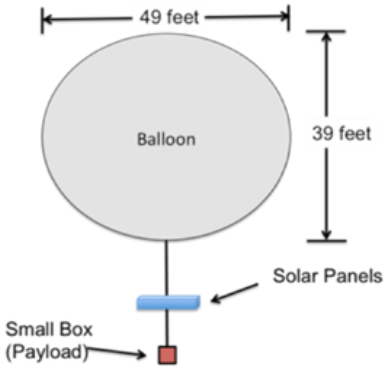
How Loon is designed

- Envelope
- Solar panels
- Equipments

## **II.** HISTORY

In 2008, Google had considered contracting with or acquiring Space Data Corp., a company that sends balloons carrying small base stations about 20 miles (32 km) up in the air for providing connectivity to truckers and oil companies in the southern United States, but didn't do so. Unofficial development on the project began in 2011 under incubation in Google X with a series of trial runs in California's Central Valley. The project was officially announced as a Google project on 14 June 2013. On 16 June 2013, Google began a pilot experiment in New Zealand where about 30 balloons were launched in coordination with the Civil Aviation Authority from the Tekapo area in the South Island. About 50 local users in and around Christchurch and the Canterbury Region tested connections to the aerial network using special antennas. After this initial trial, Google plans on sending up 300 balloons around the world at the 40th parallel south that would provide coverage to New Zealand, Australia, Chile, and Argentina. Google hopes to eventually have thousands of balloons flying in the stratosphere.

## **III.** TECHNICAL BACKGROUND




Google's goal with the Loon project is to fill the gap of internet connectivity. Only about 39% of the world's population has access to the internet (Kalavalpalli, 2013). Reaching that remaining 61% will require innovative new ideas that can conquer challenges such as geographic isolation of potential users. Loon is one way to provide wireless internet connectivity to users in these areas at a small expense comparable to other technologies, such as satellite connectivity.

The Loon consists of a simple polyethylene balloon carrying a payload which provides the wireless internet services. The payload uses ISM band, which are the 2.4 and 5.8 GHz wireless bands, to provide connectivity comparable to 3G internet speeds. Special antennas can be mounted on buildings to connect to the Loon network (Loon for all, 2013) The balloon will hover at about 20 kilometers above Earth, with Google using a special software to control the balloon and keep it in one place. Each balloon should be able to provide service to an area of about 40 kilometers in diameter.

The balloon itself is what is called a super pressure balloon. This means that the balloon can withstand more pressure than a typical weather balloon and should last longer (Loon for all, 2013). Google X's goal is for the balloons to stay operational for 100 days at a time. At that point the Loon Project team should be able to steer the balloon so

that it can be retrieved and retrofitted with the newest hardware, while simultaneously launching a new balloon to ensure continuity of operations (Flatow, 2013)

Steering the balloons is a complicated task. The air currents differ at the various altitudes surrounding the 20 kilometer range, and the balloons raise or lower their altitude to take advantage of these changing air currents to try and maintain a stationary position. Google has developed software to track these air currents and complex algorithms to steer the balloons using the currents (Loon for all, 2013).

The balloons are able to operate while using only about 10% of the power consumption of a typical laptop computer. When in the air, the balloons are powered by solar panels that should generate about 130 watts of power at 20 kilometers altitude. The solar panels are more effective at higher altitudes and provide more power. This is actually more power than the Loon needs to function, and surplus power is used to create heat to keep the equipment from being damaged by the extreme cold found at high altitudes (Lombardo, 2013 Jun 16).

## IV. POTENTIAL BENEFITS

The Loon project has numerous benefits over traditional methods of internet connectivity. The connection is wireless, which decreases the cost greatly by avoiding the logistics problems of moving infrastructure to remote areas (Loon for all, 2013). The decreased cost also stems from the technology used. Because of the need to replace balloons every 100 days, refitting the balloons with new ethnologies becomes trivial.

## V. FUTURE DEVELOPMENTS

The program is still in the pilot phase right now and, although there is a lot of excitement in the public about the program, Google has only deployed a few devices in one location. There are currently plans to expand the pilot to encircle the globe at the 40 degrees south latitude. Google has estimated that it should take about 300 balloons to provide full coverage along the 40$^{th}$ parallel, and by the end of the pilot Google expects to be operating the Loons in Australia, New Zealand, Chile, and Argentina (Flatow, 2013). Right now Google isn't releasing any plans they may have beyond that, but it is certain that if the technology is successful the pilot there will be a larger deployment

## VI. CONCLUSION

Google's Loon project showcases the company's trademark innovative spirit and truly thinks outside of the box to accomplish a worthwhile goal. Mike Crane of Google said in an interview with National Public Radio (2013) that there is no one solution to the problem when the interviewer confronted him with the fact that the high price of computer equipment would remain a barrier to connectivity for many of these remote areas. Loon may not be the idea that brings connectivity to the world, but it is a step in the right direction.

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