



Blue-Sky

Thinking

Cyrus Behroozi (BS '97)

Cyrus Behroozi wants to connect the whole world to the Internet. “Two-thirds of the world’s population still doesn’t have access,” says Behroozi, an engineer with Google[x], the Internet giant’s experimental division. “It’s easy to think of the Internet as a luxury, but it’s now so deeply tied to economic development.”

Considering that Google[x] is most widely known for engineering the driverless car, its solution to global connectivity might seem charmingly low-tech: balloons.

But these aren’t everyday balloons. Behroozi leads the network engineering for Project Loon, an ambitious experiment by Google[x] to create a global wireless network of transmitter-laden balloons floating around the world in the stratosphere, 12.5 miles above ground, which is twice the elevation flown by commercial airlines. “At that altitude, we gain the coverage advantages of satellites, but at a fraction of the cost to launch and maintain,” he says.

The project carries enormous engineering challenges. To be a viable alternative to satellites, the balloons must first be able to stay aloft for an extended period (Google[x] currently targets 100 days, enough for three trips around the globe). To meet that goal, engineers have developed balloon materials to withstand extremely wide variations in pressure and temperature.

Next, there is the issue of navigation—how exactly do you direct an unmanned balloon? In the stratosphere, winds tend to flow in a single direction, depending on elevation. Google[x]’s balloons loosely navigate by changing altitude to catch a ride with a current headed in a desired direction.

Having conquered these challenges, the team needs the balloons to deliver the Internet, which is where Behroozi comes in. His team has developed an array of lightweight transmitters and receivers powerful enough to connect the balloons to provider stations, one another, and end users—customers in rural, remote locations.

“One of our challenges is that the balloons constantly rotate,” Behroozi explains. “We’ve designed special antennas so that no matter which way the balloon is oriented, you can get a signal.”

Behroozi believes that his training at Caltech prepared him for the scope and diversity of Project Loon. “A lot of us at Google[x] tend to be what we call ‘T-shaped’ people,” he says. “We have exposure to a wide variety of disciplines (the top of the T), with a deep expertise in one particular field (the stem). That’s very much how Caltech trains us, and this makes it possible for us to combine our disciplines to tackle enormous challenges.”