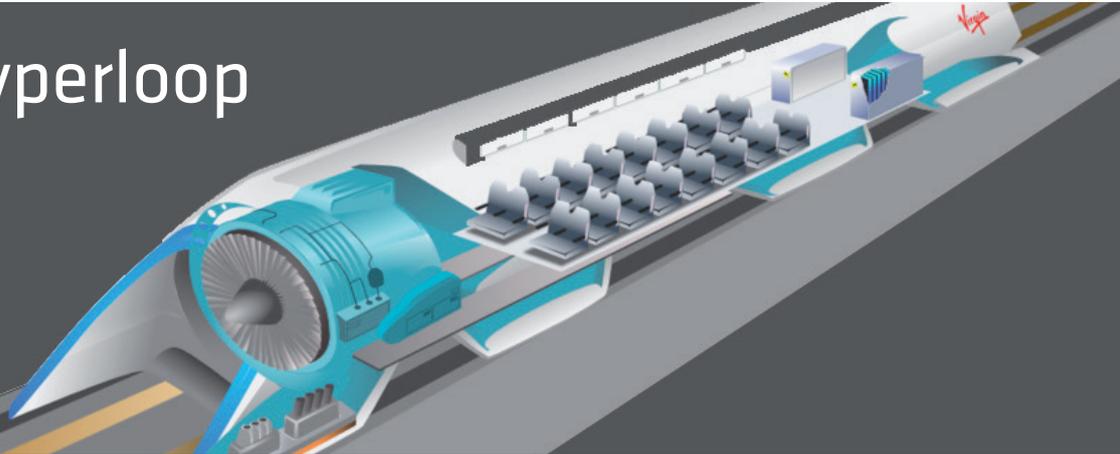# SUCCESS STORY

Hyperloop

Ellipse-N miniature INS used in the Hyperloop Competition

HyperXite, the team from the UCI university, participated to the second Hyperloop competition and ranked #1 of All-American Hyperloop team, and #2 in the world for Air-Based Levitation.
They used the Ellipse-N miniature INS to measure their pod position, velocity, and acceleration.

CLIENT
University of California, Irvine (UCI)

APPLICATION
Hyperloop Pod Subscale Design

PRODUCT
Ellipse-N Miniature Inertial Navigation System

PROJECT
Pod Position, Velocity, and Accelerations Measurement

The Hyperloop is an amazing concept that aim to increase transport efficiency. The Hyperloop is made of a sealed tube through which a pod can travel free of air resistance or friction conveying people or objects at high speed while being very efficient.

In 2015, SpaceX sponsored the first Hyperloop Pod Competition where teams built a subscale prototype to demonstrate technical feasibility of various aspects of the Hyperloop concept.

HyperXite, the team from the University of California, Irvine (UCI) took part in the second Hyperloop competition with the Ellipse-N from SBG Systems. Competition II is now over and HyperXite is ranked #1 of All-American Hyperloop team, and #2 in the world for Air-Based Levitation. The successful team is one

of the only six teams around the world to make it all the way through the Hyperloop tube to the open air.

THE UCI TEAM « HYPERXITE », AT THE HYPERLOOP COMPETITION

UCI Students worked on a tubular vehicle designed to travel through the near-vacuum tube at high speeds with great efficiency. The pod is made of strong yet lightweight carbon fiber and hosts advanced systems to help it levitate, carry passengers and cargo, and come to a safe stop. The competition takes place on a 1-mile long (1.6 km), 1.8-meter diameter (6 ft) test track being built in southern California. Each pod accelerates to achieve a top measured speed that is reported in real-time, and then decelerates by braking before the

> « *We were more than satisfied with the results the Ellipse-N gave us. Our pod's state machine behavior heavily relied on its estimated trajectory profile and time.* »

Andrew Tec, Captain of the HyperXite team

end of the test track. Pods are evaluated for speed, stability, braking, and smoothness.

AN INERTIAL SENSOR TO MEASURE THE POD BEHAVIOR

"Our prototype pod needed a reliable way to measure its position, velocity, and acceleration when the pod is in the SpaceX's Hyperloop vacuum tube" explains Andrew Tec, Captain of the HyperXite team. If the team initially had the concept of implementing sensor fusion with multiple accelerometers and rotary encoders to estimate the pod's behavior, the Ellipse-N provided all these features at industrial-grade accuracy (0.1° roll/pitch) and in a small package. The inertial sensor offered additional valuable features such as GNSS positioning and CAN bus protocol.

THE ELLIPSE-N FAST AND EASY INTEGRATION

"We needed a component that performs well under near vacuum conditions, one that was easy to integrate with precise sensors; the Ellipse-N satisfied all of the criteria", adds Andrew. The team was developing using a National Instrument's Compact RIO controller, and found the SBG public LabVIEW plugin very convenient; it made testing and development tremendously easy and fast.

"We were more than satisfied with the results the Ellipse-N gave us. It was the most reliable source of data we obtained. Our pod's state machine behavior heavily relied on its estimated trajectory profile and time" concludes the team Captain.

SpaceX has announced the third competition to be held in 2018, and HyperXite will compete with an all new redesigned pod to meet the new Hyperloop Competition rules.

■ AUTHOR
Hélène LEPLOMB from SBG Systems

"Our prototype pod needed a reliable way to measure its position, velocity, and acceleration when the pod is in SpaceX's Hyperloop vacuum tube"
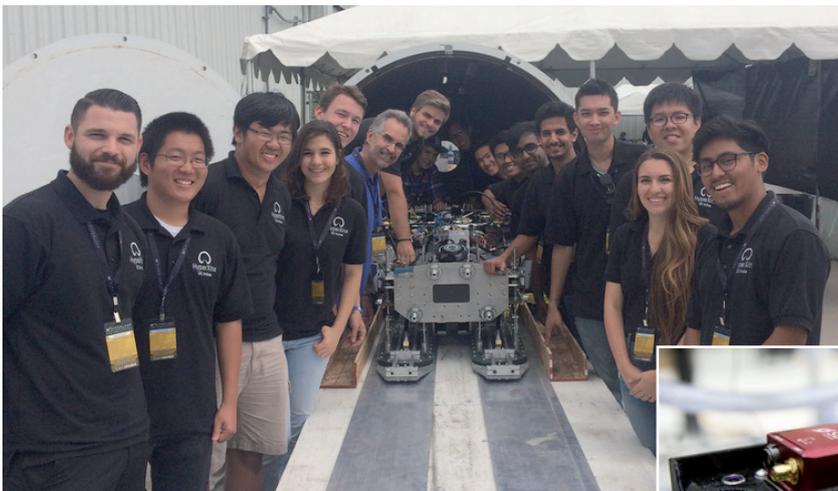
ELLIPSE-N KEY FEATURES

» Very Low Noise Gyroscopes
» 1 m Position (RTK GNSS)
» 0.1° Roll and Pitch
» 0.5° Heading (GNSS-based)
» RS232, RS422, & CAN Protocol

MORE INFORMATION

» More information on the Ellipse-N:
  www.sbg-systems.com

More information on the project:
» UCI HyperXite team: http://www.hyperxite.com
» Hyperloop Competition :
  http://www.spacex.com/hyperloop/

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