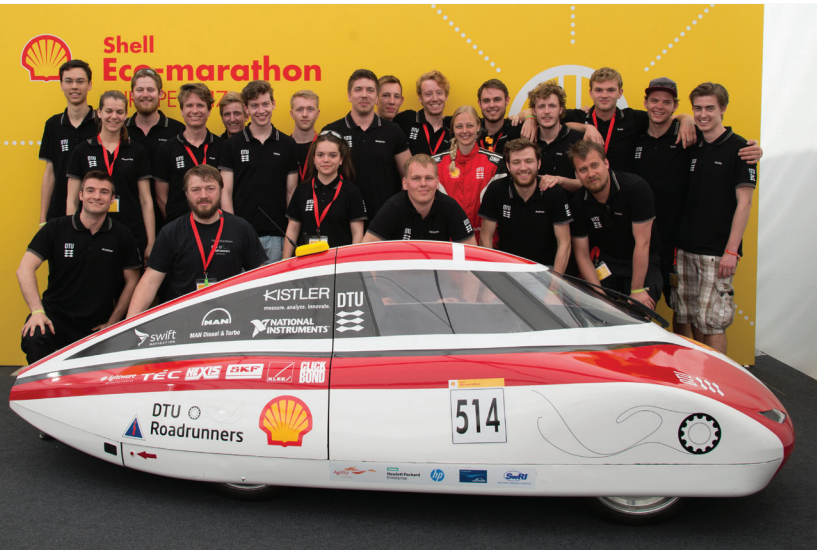# CASE STUDY | DTU ROADRUNNERS

> *Accuracy and robustness are two key metrics when implementing a sensor for autonomous driving. The Swift Navigation Piksi Multi navigation solution achieves both.*
>
> **Henning Si Høj**, DTU Roadrunners

CUSTOMER
DTU Roadrunners

PRODUCT
Piksi Multi

USE CASE
Autonomous Vehicles

EVENT
Shell Eco-Marathon

DTU Roadrunners is a student-driven project at the Technical University of Denmark (DTU) tasked with creating modern cars, considerably more fuel efficient than cars currently in production, to compete in the annual Shell Eco-marathon. The project is run by a team of enthusiastic students who are responsible for planning the project, designing the cars, producing technical drawings, buying or producing the necessary equipment and components as well as preparing and testing the cars prior to the event.

Challenge

While creating the fuel-efficient DTU Dynamo car—designed to drive as far as possible on a single liter of fuel—the DTU Roadrunners are also preparing their car to compete in the 2018 Shell Eco-marathon for fuel-efficient Autonomous UrbanConcept vehicles. This new, autonomous focus requires the integration of a hardware and software platform into the DTU Dynamo.

Solution

To augment the car with autonomous capabilities, sensors and actuators have been designed, implemented and tested by the DTU Roadrunners. LIDAR, GNSS, IMU and wheel sensors form the basis for the car's ability to sense its surroundings. Several products were considered by the DTU team for the GNSS sensor of which the Swift Navigation Piksi® Multi was chosen. They felt Piksi Multi's centimeter-level accuracy and fast convergence times were the best of the products reviewed.

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Piksi Multi was also the only RTK receiver option capable of multi-band and multi-constellation operation. The DTU Dynamo setup has the GPS antenna mounted externally to the vehicle to ensure an unobstructed sky views. For its RTK base station, a Piksi Multi module has been installed on a tripod with an antenna and a 12V battery. The team also produced a 3D printed enclosure to shield the Piksi Multi and its evaluation board.

Results

The Shell Eco-marathon Europe 2017 provided the DTU team the opportunity to test, and gather performance data on, the varying autonomous sensors in advance of the upcoming Autonomous UrbanConcept event. The DTU team reported that Piksi Multi, running Firmware version 1.0.11, lived up to its specifications. When an RTK fix was achieved, its best accuracy was measured slightly better than the specified 2 centimeters horizontal and 6 centimeters vertical. The RTK fixed mode was maintained throughout the test lap with 9 satellites in view.

Accuracy and robustness are two key metrics when implementing a sensor for autonomous driving. As seen in the data presented in the full report from the DTU Roadrunners, they found that the Swift Navigation Piksi Multi navigation solution achieved both. Their team shared that unless the antenna's view to the sky is obstructed, the system provides reliable and extremely precise position and heading data. This can be used to accurately determine the location and bearing of the autonomous vehicle in a global frame. "In the autonomous systems of the future, a high quality GNSS solution such as the Piksi Multi will be essential for its accurate navigation," shared Henning Si Høj with the DTU Roadrunners.

Contact Swift Navigation to see what Piksi Multi can do for your next project.