

LAND SPEED RECORD FOR AUTONOMOUS VEHICLES

On April 27th 2022 at the Kennedy Space Center , the PoliMOVE Autonomous Racing team, with its Indy Autonomous Challenge (IAC) Dallara AV-21, set the new land speed record for autonomous vehicles. The record results are summarized in three metrics:

- absolute top speed;
- top average speed over 100 m; two-ways average;
- top average speed over 1 km; two-ways average.

The average speed over 1 km is the metric used by the F.I.A. to assess land speed records [see for reference the F.I.A. International Sporting Code – Appendix D].

This document provides a brief overview of the test setup, the methodology to compute the aforementioned quantities, and the final world record results.

Test setup

The speed record attempt took place on the 5km-long runway of the Space Florida’s Launch & Landing Facility at Kennedy Space Center in Cape Canaveral, FL, USA (Figure 1).

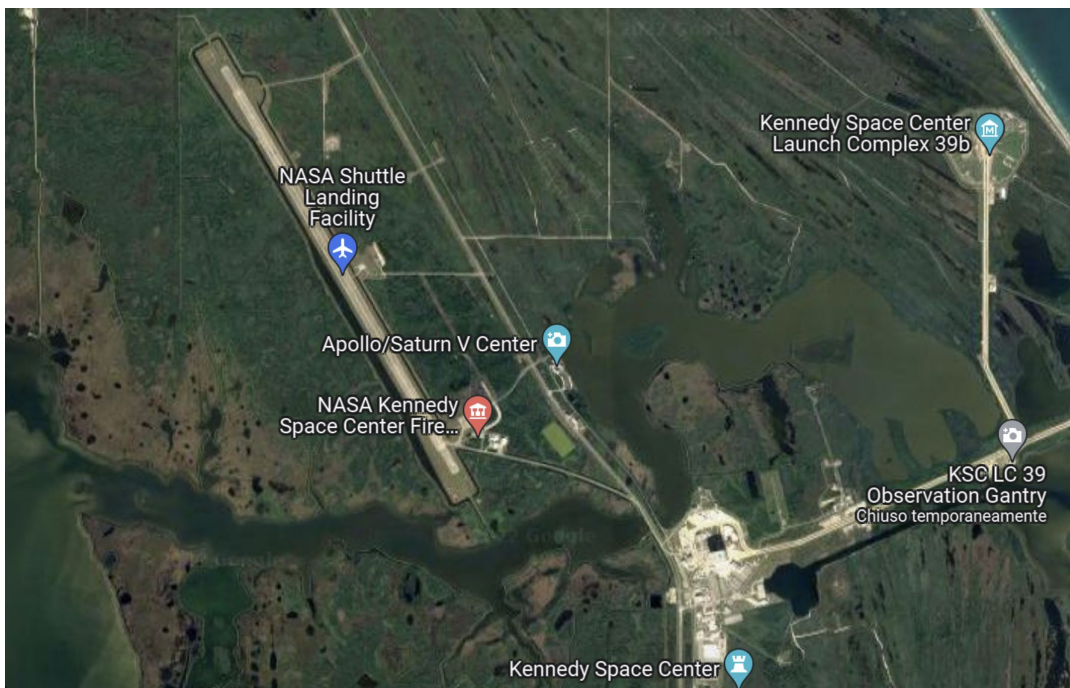


FIGURE 1: SATELLITE VIEW OF SHUTTLE LANDING FACILITY

The test consisted of two consecutive runs, in opposite directions (approximately South-North and North-South), executed within a 1-hour time window. The test started at 15:08:22 UTC time (11:08:22 Cape Canaveral local time). Temperature: approximately 27°C (80°F); almost no wind.

The new record-holding vehicle is a IAC Dallara AV-21 equipped with two independent GPS units, which can provide high-accuracy absolute position and velocity measures. We have used such measures to determine the top and average speed of the vehicle. Note that we have assessed the consistency of the two sensors by analyzing the standard deviation between the two velocity measures: such quantity is approximately 0.05 m/s over the whole test.

Figure 2 reports the speed profiles of the two consecutive runs, together with the trajectory along the runway. The figure also highlights two 1-km sectors, along which we have computed the *average speed* metric.

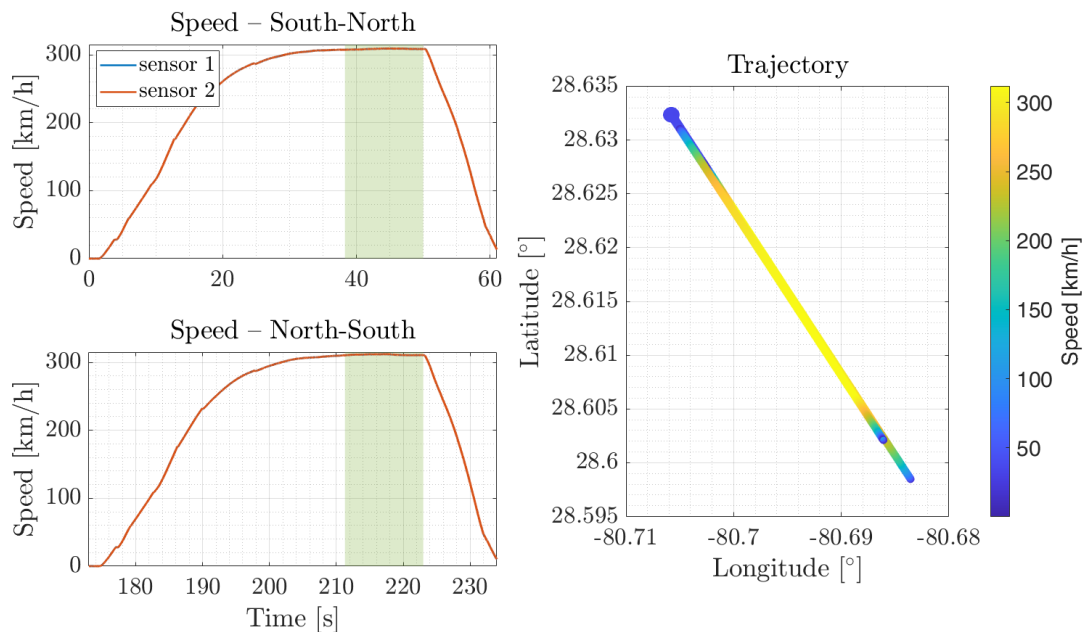


FIGURE 2: CONSECUTIVE RUNS: SPEED AND TRAJECTORY. IN GREEN: 1-KM SECTORS

Computing methodology

- The maximum speed is computed using the average of the speed recorded by the two sensors during both runs.
- The maximum average speed over 100 m is computed using a time window that covers 100 m along the runway centerline. The speed recorded by the two sensors over each window was averaged. The final result is the mean of the average values for each run.
- The maximum average speed over 1 km, uses the same procedure but the time window covers 1 km.

Figure 3 reports the absolute maximum speed, which was reached during the North-South run, while Figure 4 reports the selected 100-m and 1-km time windows both for South-North and North-South runs.

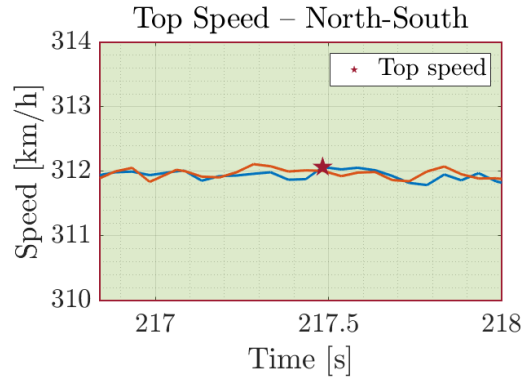


FIGURE 3: ABSOLUTE MAXIMUM SPEED

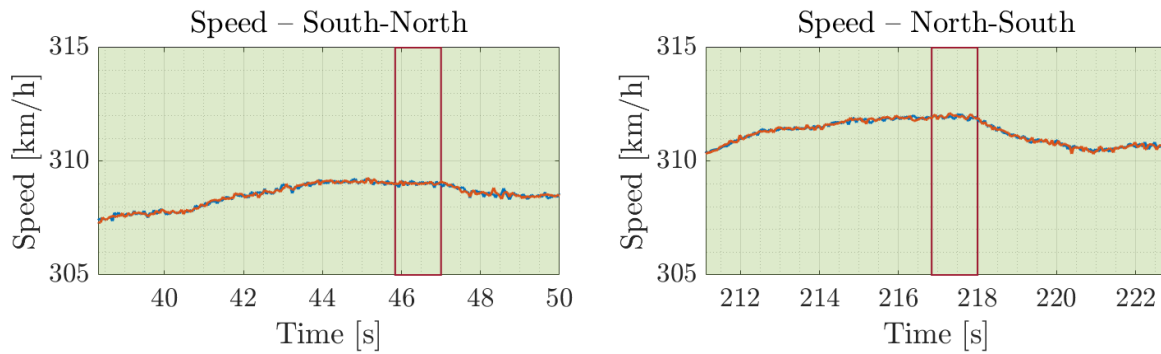


FIGURE 4: AVERAGE SPEED COMPUTATION. RED BOX: 100-M SECTORS, GREEN BACKGROUND: 1-KM SECTORS

Results

Based on the *Test setup* and the *Computing methodology* described earlier, we report the achieved results:

- Absolute top speed: **311.9 km/h – 193.8 mi/h – 86.3 m/s.**
- Maximum average speed over 100 m, two-ways average: **310.4 km/h – 192.8 mi/h – 86.2 m/s.**
- Maximum average speed over 1 km, two-ways average: **309.3 km/h – 192.2 mi/h – 85.9 m/s.**

These results let us claim the **Land Speed Record for Autonomous Vehicles.**

The GPS raw dataset is attached to this document and is openly available.

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