NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C.

SURVIVAL FACTORS and VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

CORAL GABLES, FLORIDA – HWY21FH011

CRASH INFORMATION AND SUMMARY

Refer to the *Crash Information and Crash Summary Report* in the docket for this investigation.

A. SURVIVAL FACTORS AND VEHICLE GROUP

Group Chairman	Thomas Barth NTSB 490 L'Enfant Plaza East, S.W., Washington, DC 20594
Group Member	Daniel Smith, Investigator Coral Gables Police Department 2151 Salzedo Street, Coral Gables, FL 33134

B. FACTUAL INFORMATION

1.0 Emergency Response

1.1 Coral Gables Police Department

The Coral Gables Police Department (CGPD) emergency communications event report for event ID 2021-122111 was obtained for an automobile accident with injury.[1] The E911 call was noted as received and finished at 8:56 p.m., while the radio communications log indicated that the first units were dispatched and enroute at 8:55 p.m.[2] The first CGPD unit arrived on scene at 8:57 p.m. and 4 units were on scene by 9:00 p.m. The involved vehicle, identified as a Tesla Model 3, was on fire and had impacted a tree. The vehicle was fully engulfed at 8:56 p.m.

The fire report included notations that were forwarded to the CGPD as described in section 1.2 below. The CGPD noted the location at 9:57 p.m. and that a passerby called in and had a dashcam video at 8:58 p.m. The notes indicated that the vehicle was fully engulfed in fire, units were working on traffic control at 9:00 p.m., and there were possible trapped occupants at 9:01 p.m. Air rescue was noted as being available if needed at 9:04 p.m. The eastbound traffic

[1] Attachment: CGPD Communications Event Report 2021-122111.
[2] The first notification of the event occurred from the Coral Gables Fire Department, and was sent to the CGPD at 8:55 p.m.

lanes were closed at 21:06 pm. The fire department updated the status and informed that there were 2 deceased victims at 9:08 p.m. The CGPD public information officer was notified at 9:46 p.m. and the fire department was requested to be available to assist the medical examiner (ME) at 11:20 p.m. The fire department was informed that the vehicle started smoking again at 11:33 p.m. The ME arrived at 12:11 a.m. Alhambra circle was opened at 1:27 a.m.

The CGPD Traffic Homicide Report, Case Number 21-005156 was obtained.[3] The report provided a summary of the investigation; provided information about the fire rescue (which is documented in section 1.2 below); provided dispatch, en-route, and arrival times for the CGPD units; noted the NTSB investigation; provided information about the vehicle and occupants; provided witness statements; and provided various other investigative information.

1.2 Coral Gables Fire Department

The Coral Gables Fire Department (CGFD) Communications Event Reports for Event ID 2021-122109 and 2021-122110 were obtained.[4] The E911 call was received at 8:54 p.m. and notification was forwarded to CGPD at 8:55 p.m. Fire units were dispatched at 8:55 p.m., the first were en-route at 8:56 p.m. The CGFD was informed that a Tesla was on fire after hitting a tree at high speed at 8:56 p.m. Engine 1 arrived at 9:01 p.m. It was noted that the vehicle was fully involved in fire at 9:01 p.m. and a request was made to confirm availability of air rescue at 9:02 p.m. The battalion chief arrived at 9:03 p.m. and assumed incident command. Engine 1 was connecting to a fire hydrant at 21:01 p.m. and was ready with water at 9:05 p.m. Engine 4 was accessing a hydrant at 9:03 p.m. and had water ready at 9:05 p.m. It was noted that the fire appeared to be out at 9:09 p.m.[5] Fire units except for engines 1 and 4 were allowed to clear the scene at 9:16 p.m. Engine 1 was then cleared at 9:16 p.m., and engine 4 were instructed to remain at 9:18 p.m. At 9:33 p.m. it was noted that the vehicle started to emit smoke and there was concern of a fire reignition. The interview with fire fighters noted that a small amount of water was applied as a preventative measure and a visible fire did not occur. The battalion chief was cleared at 9:46 p.m., and Engine 4 was cleared at 9:52 p.m. As described in the law enforcement response summary, smoke was noted again at 11:33 p.m., but dissipated and a fire response was not necessary.

The CGFD National Fire Incident Reporting System NFIRS Basic report for Incident #21006233 was obtained.[6] The NFIRS report provided basic information about the fire response and a very brief narrative summary. The summary noted that the CGFD arrived to a Tesla fully involved in fire situated next to a tree. It noted that Engine 1 was able to extinguish the vehicle quickly, and Engine 4 provided additional water in case the vehicle reignited. An interview with the CGFD was conducted and provides further details about the fire response.[7]

[3] Attachment: CGPD Traffic Homicide Report Case Number 21-005156.
[4] Attachment: CGFD Communications Combined Event Reports.
[5] The interview with fire fighters noted that they used water from the fire trucks to extinguish the fire.
[6] Attachment: CGFD NFIRS Basic Incident #21006233.
[7] Attachment: Interview of first responders at the Coral Gables Fire Department on September 22, 2021.

2.0 Witness Recorded Evidence

The crash was witnessed by another driver and residents near the scene, and a home security camera captured a portion of the post crash fire. Evidence was collected and interviews were conducted with the other vehicle driver and a resident.

2.1 Witness Ian Sheldon

The witness was travelling north in the single north travel lane of Alhambra Circle approaching when the Tesla passed him on the left (in the southbound lane). The driver's dashboard mounted camera captured the event from when the Tesla comes into view while passing on the left, the Tesla traversing the intersection at Coral Way, the loss of control, crash sequence and post crash fire. The witness driver followed north and parked a distance south of the Tesla final rest. Information obtained from the video recording has been documented in the Reconstruction Group Chairman's Factual Report and the Video Study Factual report, both available in the docket for this investigation. The CGPD interviewed Ian Sheldon for his account of the crash.[8]

2.2 Witness Jorge Perez

A bystander provided photograph of the fire event approximately 30 seconds after the crash and an NTSB investigator conducted a phone interview for his account.[9]

2.3 Other Witness Photographs

Two other witness provided photographs of the fire event. Two were taken at an undetermined time after the crash, and one was take at approximately 8:56 p.m.[10]

3.0 2021 Tesla Model 3 Vehicle Inspection

The Tesla was impounded at Downtown Towing, located at 1101 SW 69th Ave Miami, FL. The NTSB investigators inspected the vehicle on September 20 through 23, 2021. The Tesla had VIN: 5YJ3E1EB2MF037962.

3.1 Vehicle Damage

The vehicle sustained an extremely severe tree impact to the middle right (passenger) side in-between the A and B pillars with severe intrusion that is described below. The vehicle also sustained severe thermal damage to the interior, roof, and both right and left sides of the vehicle. Figure 1 shows a left front view of the Tesla.

[8] Attachment: Vehicle Witness Interview.
[9] The photograph is included in the photographs attachment for this report, the interview is in the Attachment: Bystander Witness Interview.
[10] The photographs are included in the photographs attachment for this report.

Figure 1: Left front view of the Tesla

The left front suspension components had cast aluminum mounting components that were fractured in several places; tree bark was found on some surfaces. The left front wheel and tire showed indications of a severe impact with a ruptured tire and a fractured wheel. Tree bark was found on the damaged portions of the tire and wheel. The tire, other than the portion ruptured by impact, appeared nearly new, and did not exhibit significant scuffing or abrasions.

The second tree impacted the right side of the vehicle just forward of the B-pillar. The high voltage (HV) battery caught fire and the middle of the vehicle was fire damaged. The vehicle structure was compromised, separating the vehicle along a diagonal pattern, from the rear/left to the front/right. This separation occurred just aft of the C-Pillar on the left side of the vehicle and extended forward near the front of the A-pillar on the right side. The right side A-pillar separated from the dashboard and right front the wheel well, and was displaced several inches inward and aft.

The front-left side of the vehicle remained intact back to the C-pillar, but the rear seats separated and remained with the rear of the vehicle. The driver seat and front seat floor pans, including the floor under the front passenger seat, remained with the front portion of the vehicle. Figure 2 provides a right-front view, and Figure 3 a left-rear view. The approximate lines of structural separation are shown with red lines.

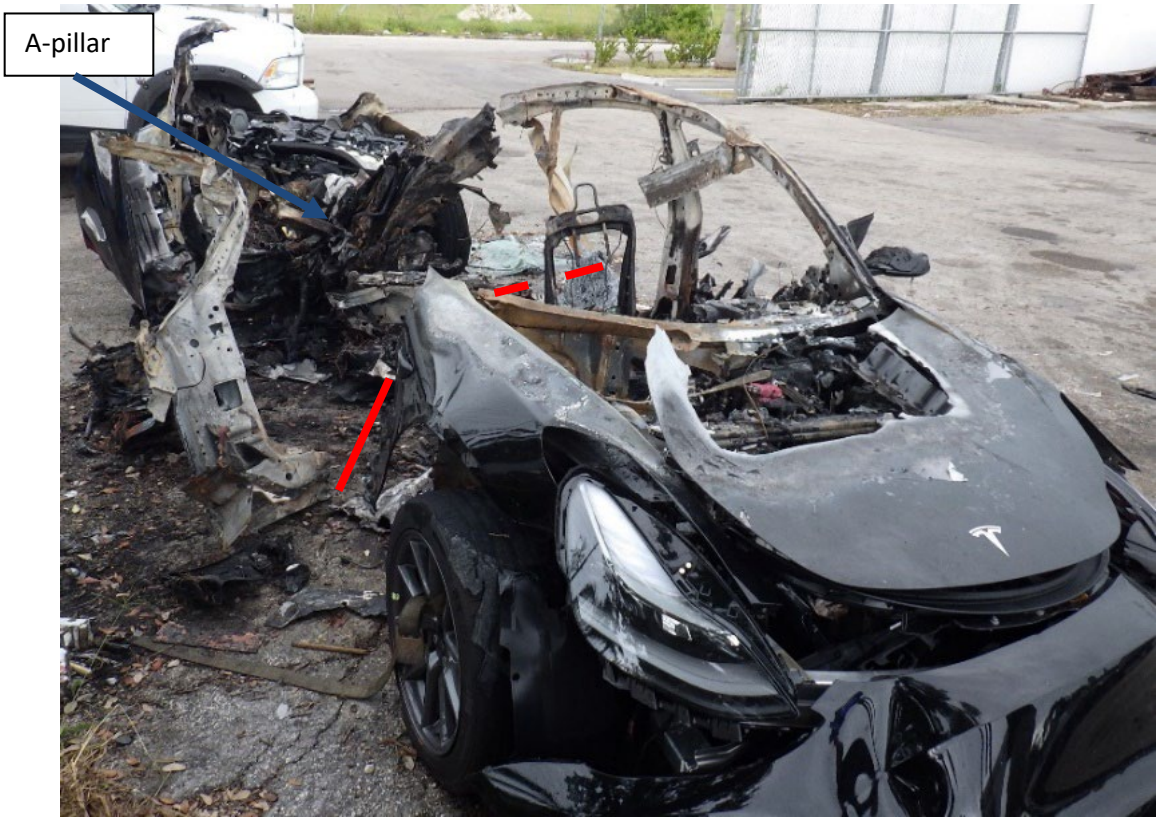

Figure 2: Right-front view of the Tesla

Figure 3: Left rear view of the Tesla

The tree impacted the right side of the Tesla at a location just forward of the B-pillar, and intruded the floor approximately 17 inches, as shown in figure 4.

Figure 4: Right side of the Tesla at the tree impact location

The right-side A-pillar was displaced aft, and found near the aft surface of the driver seat during inspection.[11] The C-pillar was displaced aft and inward, and the right side roof structure was folded inward above the rear seats. The right-side rocker panel remained with the rear of the vehicle, while the floor and battery case remained with the front of the vehicle. The fire damaged airbag control module (ACM) was found in the center console area and delivered to the NTSB for forensic evaluation.[12] The ACM as located under fire debris in the Tesla is shown in figure 5.

Figure 5: Tesla interior with airbag control module circled

[11] Recovery of the wreckage from the scene and unloading the Tesla at the tow yard resulted in movement of the wreckage and altered the position of wreckage.

[12] Refer to the Technical Reconstruction/Highway Group Chairman's Factual Report.

1.2 Seats and Restraints

The driver area containing airbags were consumed by fire. The driver seat remained attached to the floor. The backrest was twisted clockwise approximately 15 degrees, and the upper portion displaced outboard about 3 inches. Portions of the seat, including the backrest and right side of the seat pan, had non-metal components which were consumed by fire. The upholstery on the center and left side of the seat pan remained intact. The driver seat belt was consumed by fire; the latch plate was found connected to the buckle.[13]

The passenger frontal and side curtain airbag areas were also consumed by fire. The passenger seat was displaced aft, inward and upward. It had become separated from the floor and was found in the wreckage with the rear section of the vehicle. The upper portion of the backrest and portions of both sides of the seat sustained fire damage. Upholstery remained in the center of the seat. The partially burned and deployed side-seat airbag was visibly attached to the right side of the seatback. The right side of the seat was crushed inward to about half its original width. The seatbelt in the vicinity of the passenger seat was burned away, and the latch plate was found in the wreckage near the center of the vehicle. The inertia reel was found at the B-pillar with a significant portion of the webbing unspooled.[14] Figures 6 and 7 provide frontal views of the passenger and driver seat respectively.

Figure 6: Front passenger seat

Figure 7: Driver seat

[13] During movement of debris during inspection, the latch plate disengaged from the fire damaged buckle.
[14] Perhaps a footnote explaining that this was an indication that it was worn when the crash occurred?

2.0 Tesla Occupants

The driver of the Tesla was a 20-year-old male, who was fatally injured. The autopsy was performed by the Miami-Dade Medical Examiner Department, case number 2021-03331. The report indicated that the cause of death was vehicular crash injuries. The autopsy finding noted extensive thermal injuries, blunt injuries to the head and neck with fracture of the right front temporal bone, right middle cranial fossa and sub arachnoid hemorrhage, and cerebral edema. There were also blunt injuries to the torso with sternum and multiple rib fractures and hemorrhage of the perivehicledial sac and right lung. Vehiclebon monoxide was not detected in the blood. Toxicological tests were performed; refer to the Toxicological tests were performed; refer to the Human Performance Factual Report for these results.

The passenger of the Tesla was a 19-year-old female, who was fatally injured. The autopsy was performed by the Miami-Dade Medical Examiner Department, case number 2021-03332. The report indicated that the cause of death was multiple blunt injuries. The autopsy finding noted extensive thermal injuries, blunt injuries to the head and neck, blunt injuries to the torso, and blunt injuries to the extremities. The head and neck injuries included fractures of the maxilla, mandible, calvarium and base of the skull with transection of the brainstem. Injuries to the torso included fracture of the first thoracic vertebra, sternum, multiple ribs, and lacerations to the lung, heart, and liver, and fracture of the pubic symphysis. Injuries to the extremities included fractures of the left elbow, left tibia, and dislocation of the right knee. Vehiclebon monoxide was not detected in the blood.

3.0 High Voltage Battery Inspection

3.1 Preliminary Vehicle Inspection and Risk Assessment

The initial inspection of the battery assessed the risks associated with HV exposure or fire reignition due to stranded energy. Safety protocols were established using a written safety plan developed by the NTSB. Tesla provided a technician to provide technical support. Safety measures included items such as: defined work tasks, fire extinguishing lines, thermal camera monitoring, and fire suppression support from the Miami-Dade Fire Department.

The Tesla Model 3 HV battery pack consists of 4 modules, each containing approximately 1,000 cells, as shown in Figure 1.[15]

[15] The battery configuration and figure 1 was obtained from Electrek Tesla Model 3: Exclusive first look at Tesla's new battery pack architecture - Electrek

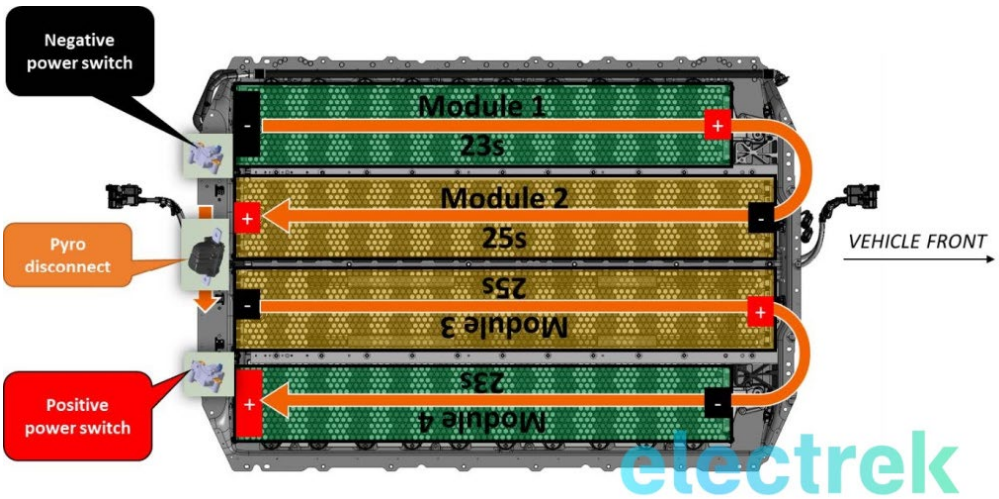

Figure 8: Diagram of a Tesla Model 3 battery pack. Source: electrek

The battery pack sustained severe damage to the entire right side of the battery, which breached the case and exposed cells. A large number (hundreds) of individual cells were displaced and scattered in the wreckage and on the ground. Module 4 exhibited the most damage and displacement of cells.

To obtain an estimate of the state of charge, a selection of individually displaced but intact cells were measured. They were found to have about 3.8 volts. To assess potential for stranded energy, multiple voltage measurements were taken across the large portions of the displaced module. The maximum voltage measured was 19 volts. At full state of charge, a complete module has a maximum voltage of about 100 volts across. Similarly, the maximum voltage across 2 modules is 200 volts, and so on. The total maximum pack voltage is about 400 volts. The battery pack contains a pyrotechnic fuse that are triggered under certain conditions such as airbag deployment or faults detected in the battery. These fuses isolate high voltage components to within the pack (cuts off high voltage lines going the motors outside the pack), and divides modules 1 and 2 from 3 and 4, resulting in a maximum of 200 volts on each side of the vehicle. Figure 9 shows measurement of voltage across the large section of the displaced battery module.

Figure 9: Voltage measurement of the displaced battery module section

Multiple voltage measurements were taken around the vehicle to identify electrical potential between battery case and chassis, exposed HV cables, or bus connections (from the power converter system). No electrical potential was identified (all voltages were in the millivolt range).

3.2 Battery Pack Inspection

The vehicle was vehicleefully lifted off the ground while being monitored with a thermal camera. No hot spots were identified during or after movement. Severe impact damage to the battery case was evident, extending laterally completely through the width of module 4 and most of module 3, near the center of the vehicle. Module 2 had a large, approximately 10 inch diameter, hole through the bottom of the case, located just left of the centerline of the vehicle, and roughly in line with the tree impact. The materials in the vicinity of the hole exhibited severe thermal damage. The battery case in the vicinity of module 1 did not exhibit ruptures or burns. The battery case exhibited thermal damage and heat warping throughout the intact sections beneath the vehicle. Figures 10 shows the hole in the middle of the battery case in the vicinity of module 3.

Figure 10: Underside of Tesla showing burn hole in the battery case

The battery case was not removed from the vehicle. However, when the rear section was elevated, the separation of the vehicle floor exposed the damaged aft portion of the battery case. The entire aft portion of the battery pack had cells in disarray, as shown in figure 11.

Figure 11: Tesla with back half elevated and exposed battery pack

The elevated rear section of the vehicle also showed that the HV electrical connections from the battery pack to the rear motor were damaged and disconnected, as shown in figure 12. Other high voltage lines at the rear of the battery pack were also damaged and displaced.

Figure 12: Underside of the back of the Tesla showing disconnected HV lines to rear motor

The elevated front section of the vehicle showed that the HV electrical connections from the battery pack to the front motor were intact, as shown in figure 13.

Figure 13: Underside of the front of the Tesla showing intact HV lines to the front motor

4.0 Tesla Vehicle Telematics and Crash Notification

The NTSB contacted Tesla to determine if a crash notification had occurred and if information regarding the crash was available as a result of a telemetric data upload from the vehicle. Tesla reported that there was no crash notification and no telemetry data for this vehicle resulting from the crash. Tesla provided information about crash notifications and telemetry data, indicating that an interruption of the 12-volt power system can result in lost ability to transmit a crash notification and process telemetry data.

DOCKET MATERIAL

The following attachments and photographs are included in the docket for this investigation:

LIST OF ATTACHMENTS

Attachment: CGPD Communications Event Report 2021-122111

Attachment: CGPD Traffic Homicide Report Case Number 21-005156

Attachment: CGFD Communications Combined Event Reports

Attachment: CGFD NFIRS Basic Incident #21006233.

Attachment: Interview of first responders at the Coral Gables Fire Department on September 22, 2021

Attachment: Vehicle Witness Interview

Attachment: Bystander Witness Interview

LIST OF PHOTOGRAPHS (CONTAINED IN THE PHOTOGRAPHS ATTACHMENT)

Attachment: Witness Photographs

1. Photo from Jorge Perez
2. Photo A from Celina Olmos
3. Photo B from Celina Olmos
4. Photo from Gus Rodrigo, taken at 8:56 p.m.

END OF REPORT

Thomas Barth, Investigator