

# THE HST



A vision for future European long-distance road haulage...

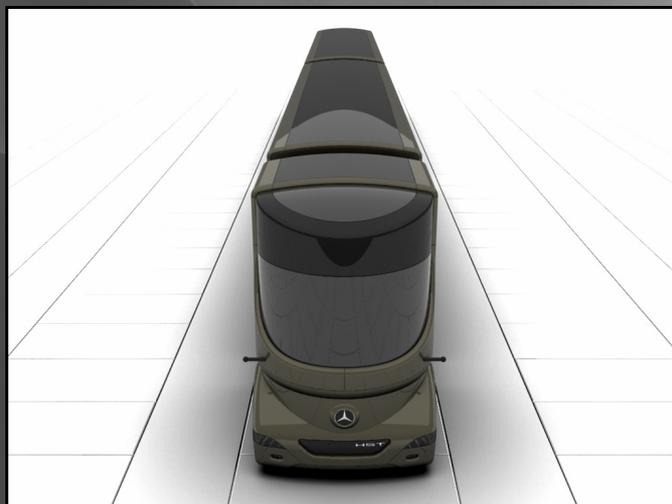
# THE HST

## Summary

The HST is a vision for future European long-distance road haulage. Designed to transport a high volume of widely accepted palletized and containerized cargo units, the concept features a proposed overall length of 29 metres with a proposed maximum gross combination weight (GCW) of 65 tonnes. Although the HST is considerably larger than contemporary articulated trucks, the concept would be no more difficult to manoeuvre.

By means of a comprehensive yet straightforward computer, the HST would be as simple to operate as a modern passenger car. With a 2.90 metres long cab, the concept would provide a working and living environment that would be far more comfortable than contemporary “cab over engine” trucks.

With reference to contemporary trucks, the HST would feature extraordinary fuel efficiency, a significantly improved driving experience, a higher level of active and passive safety, and enhanced environmental and infrastructural considerations.



*(The HST)*

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# THE HST

## **Flexible High Capacity**

In essence, the HST is designed to transport a high volume of widely accepted palletized and containerized cargo units.

### Flexibility

The HST would consist of tandem 12.20 metres long semi-trailers. Although the 12.20 metres length is uncommon, it is comparatively flexible. With an internal length of 12 metres (minus 0.20 metres for the front and rear end walls), the semi-trailers would efficiently accommodate both CEN (1.20m x 0.80m) and ISO (1.20m x 1.00m) pallets. In addition, the semi-trailers (in skeletal form) would efficiently accommodate one ISO 40' (12.20m) or two ISO 20' (6.10m) containers (should weight restrictions permit).

### Cargo Capacity

The following table illustrates the cargo capacity of the HST, with reference to contemporary articulated trucks with an overall length of 16.50 metres and a maximum GCW of 44 tonnes:

	<b>The HST</b>	<i>Typical Artic</i>
CEN Pallets	<b>60</b>	<i>34</i>
ISO Pallets	<b>48</b>	<i>26</i>
ISO 20' Containers	<b>4</b>	<i>2</i>
ISO 40' Containers	<b>2</b>	<i>1</i>
Payload (in tonnes)	<b>45</b>	<i>30</i>

### Loading & Unloading

In order to simplify loading and unloading procedures (via a loading dock), the HST's semi-trailers would merge. Roller shutter doors would be located at the rear end of the lead semi-trailer and at the front end of the secondary semi-trailer. With the doors opened, the link that would attach the semi-trailers would compress in order to bridge the ensuing gap.

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## **Effortless Manoeuvrability**

The HST would feature a unique vehicle layout with innovative steering characteristics. As a result, the concept would be no more difficult to manoeuvre than a contemporary articulated truck with an overall length of 16.50 metres.

## Vehicle Layout

In effect, the HST would consist of two 12.20 metres long semi-trailers connected to a tractor unit with a 2.90 metres long cab. The semi-trailers would link via a Jacobs bogie (found on articulated railcars) with the lead semi-trailer connecting to the tractor unit via a conventional fifth-wheel. The rear bogie of the secondary semi-trailer would steer (in a manner similar to the [BladeRunner](#) concept). Semi-permanent turntables would attach the Jacobs bogie and the steered rear bogie to the semi-trailer frames.

## Steering Characteristics

In order to “turn within a swept circle having an outer radius of 12.5m and an inner radius of 5.3m” as specified by EU Regulation 96/53/EC, the HST would feature the following:

- Four points of articulation (one fifth-wheel and three turntables).
- Electronically controlled steering on all nine axles (“tire scrub” is eliminated).
- Jacobs bogie semi-trailer link with a steered rear bogie on the secondary semi-trailer (in line with the second point, ensures full control of the vehicle’s tracking).

Effortlessly, the HST would comply with the regulation. *See Appendix I...*

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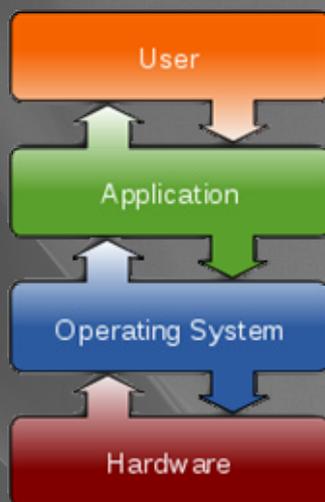
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## Simplified Complexity

The HST would feature an Advanced Universal Computer (AUC), which would manage and interface all of the vehicle's hardware. Designed to be comprehensive yet straightforward, the AUC would result in the concept being as simple to operate as a modern passenger car.

## Structure

Since the HST would be completely devoid of purely mechanical hardware, the AUC would electronically manage each hardware component. Each component of the concept's hardware would be managed by a specialized application. The AUC's operating system would interface hardware and application.



*(Wikimedia Commons)*

In addition to managing hardware, the AUC would also act as the primary interface between hardware and user (via the Controller).

## The Controller

Located directly in front of the driver's seat, the Controller is the primary interface between the HST and the driver.

In effect, the Controller would consist of five stacked modules:

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- The Base: where the touch-sensitive ‘Accelerator’ and ‘Brake’ pads would be located.
- The Stand: would support the other modules and would be vertically adjustable.
- The Block: where the ‘Engine’ and ‘Battery Power’ on and off buttons and a slot for inserting a memory card would be located.
- The Steering: would be the steering mechanism and would include a control for drive selection (i.e. PRND) and parking brake manipulation and wheels for interacting with applications while driving (right) and manipulating indication, horn, headlight flash, and windscreen cleaning functions (left).
- The Communication and Command Interface (CCi): would include a touch-sensitive display unit (for interacting with applications) and a projector (which would project a virtual instrument cluster on the windscreen). *See Appendix 2...*



*(The Controller)*

## Management & Support

In order to simplify the complicated task of operating a contemporary truck, the AUC would be designed to either manage or support the tasks executed by driver input (both physical and mental). For instance, tasks such as daily inspection and route planning would be managed by the AUC. However, more complicated tasks such as trailer coupling and driving (i.e. steering, accelerating, and braking) would be supported by the AUC, but managed by the driver.

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## Comfortable Environment

The HST would feature a 2.90 metres long cab. As a result, the concept's working and living environment would be far more comfortable than contemporary "cab over engine" trucks.

### The Cab

In effect, the HST's cab would consist of a working (i.e. driving) area and a living area. Entry into the cab would be facilitated by a wide, electronically operated, pantographic door, which would be located curbside. As opposed to typical vertical steps, the concept would feature an elevator for easier and safer ingress.



*(The Cab)*

### Working Area

The driver's seat would be centrally positioned within the HST's conical cockpit, creating a broad uniform view. With only the Controller occupying the space surrounding the driver's seat, the working area would be extremely spacious.

Above the driver's seat would be a multifunction console. The centre section would house the AUC's primary hardware. On either side of the centre section would be a two-piece storage compartment. Multiple display units, which would display images received from strategically placed cameras, would be located below the console. *See Appendix 3...*

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## Living Area

In order to maximize the living area, the HST would feature an overhead bunk. When not in use, the bunk would ascend to increase headroom. Underneath the bunk, the concept would feature an LCD television, a desk, and an activity seat, which would recline.

Additionally, the concept would feature an upright multipurpose console on either side of the cab. One console would house a kitchen (i.e. refrigerator, microwave, coffeemaker, sink, and pantry) while the other would house various storage compartments for clothing, bedding, and miscellaneous items.

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# THE HST

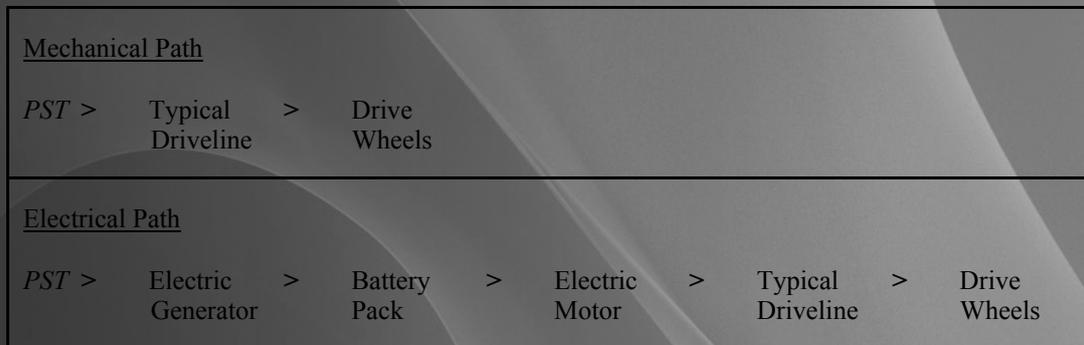
## Extraordinary Efficiency

The HST would feature a unique powertrain and an aerodynamically optimized design. As a result, the concept would be far more fuel efficient than contemporary trucks.

### Powertrain

At the core of the HST's powertrain would be a hydrogen-fuelled internal combustion engine (HICE). The HICE would feature a maximum power output of 550 kW (740 hp). This power would be transmitted through a power-split transmission (PST). The PST would transmit the power mechanically through a typical driveline (i.e. driveshafts, differentials, and halfshafts) or electrically through an integrated electric generator, which would charge a high capacity lithium-ion battery pack. An electric motor, which would draw power from the battery pack, would be integrated into the driveline.

The following diagram illustrates the mechanical and electrical power paths via the PST:



Given that a mechanical path is more efficient at consistent speeds while an electrical path is more efficient at inconsistent speeds, the AUC would determine which power path to employ to suit the driving situation. Regardless of whether a mechanical path or an electrical path is employed, the AUC would vary the number of active cylinders (up to ten) to meet prevailing power requirements efficiently.

Through the conversion of the vehicle's kinetic energy into electrical power, the PST would act as a regenerative brake. Additionally, solar cells would be integrated into the roof of the cab and the semi-trailers. The energy captured through both measures would be stored in ...

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... the battery pack. As a result, when power requirements are at their highest (e.g. when the vehicle is accelerating) or at their lowest (e.g. when the vehicle is at rest), the required power would be drawn from the battery pack, rather than from the HICE.

## Aerodynamics

For minimal air resistance, the HST would feature a sleek profile. This would be achieved by a conical windscreen, low-profile “nose”, “slippery” body panels, flush body (i.e. completely devoid of protrusions such as mirrors, wipers, handles, etc), rounded corners, low ride height (which would drop further at high speeds), and comprehensive panelling of the entire vehicle (i.e. undercarriage, side fairings, etc).

In order to reduce the drag between the tractor unit and the lead semi-trailer, between the lead semi-trailer and the secondary semi-trailer, and behind the secondary semi-trailer, the concept would incorporate [Airtabs](#) (i.e. vortex generators).

## Engine Access

The HST would feature a compact nanofluid radiator and a low-slung horizontally-opposed engine. Both the radiator and the engine would be fixed to a subassembly that would slide out from the front of the cab. This would eliminate the need for a tilting cab. *See Appendix 4...*

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# THE HST

## **Driving Experience**

The HST would feature an efficient driving interface and unique handling characteristics. As a result, the concept would provide a significantly improved driving experience compared to contemporary trucks.

## Driving Interface

As the primary interface between the HST and the driver, the Controller would be efficient to use. The integrated touch-sensitive foot pads would require minimal effort to manipulate and the steering mechanism's firmness would be speed-sensitive (i.e. light at low speeds, but tight at high speeds). Additionally, the horizontally rotating, direct ratio (1:1), steering mechanism would manipulate the front steering angle in a natural fashion.

When in motion, the driver would interact with applications (via the CCI display) through a "click wheel" (found on some iPod models) mounted on the right handgrip. This would allow the driver to efficiently interact with applications while driving.

## Handling

Due to the aerodynamically optimized design, the HST would be exceptionally stable at high speeds. Additionally, the concept's stability would be further enhanced by AUC-managed air suspension and disc brakes, low-profile tyres, and broad single-mounted wheels (for both the drive and trailer axles). The AUC-supported driving interface (the Controller) would provide responsive acceleration, braking, and steering.

## Autopilot

Via Acceleration Control (i.e. automatic acceleration), Brake Control (i.e. automatic braking), Steering Control (i.e. automatic steering supported by advanced lane sensing), and advanced GPS, the AUC could drive the vehicle. Consequently, the driver could (via the CCI display) watch TV, browse the Internet, chat face-to-face with family and friends, or just relax.

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# THE HST

## **Active & Passive Safety**

The HST would feature comprehensive active and passive safety. Consequently, the concept would be safer than contemporary trucks.

### Active Safety

Via radars and sensors placed throughout the proximity of the entire vehicle, the AUC would be fully conscious of the vehicle's immediate environment. Through this consciousness, the AUC would automatically initiate appropriate countermeasures. For instance, the AUC would automatically apply the brake force required to avoid an imminent collision, or prevent a lane change manoeuvre if a collision would occur as a result, or activate the infrared vision system when visibility through the windscreen becomes poor.

### Passive Safety

Should a collision occur, however, the HST would incorporate measures to protect the driver and other road users. These measures would include a low-profile energy absorbing "nose", a high-strength windscreen, multiple airbags, and full underrun protection.

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## **Enhanced Considerations**

With reference to contemporary trucks, the HST would feature enhanced environmental and infrastructural considerations.

### Environment

Fuelled by hydrogen through internal combustion (HICE), the HST would only emit nitrogen oxides (NO<sub>x</sub>). Furthermore, the quantities produced would be negligible due to the high cargo capacity and extraordinary fuel efficiency of the concept.

### Infrastructure

The HST would feature nine axles. Seven axles (i.e. the steer axle and six trailer axles) would bear just 7-tonnes while two axles (i.e. the drive axles) would bear 8-tonnes. The resultant 65 tonnes would be distributed lightly and evenly throughout the entire combination. As a result, the concept would cause no additional damage to roads and bridges.

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# THE HST

## A Paradigm Shift

The HST presents a radical departure from contemporary and even proposed truck designs.

### Contemporary Articulated Truck

With an overall length of 16.50 metres and a maximum GCW of 44 tonnes:



*(DAF Trucks NV, Image Bank)*

### Proposed LHV (Type A)

With an overall length of 25.25 metres and a maximum GCW of 60 tonnes:



*(AB Volvo, Image Gallery)*

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## Proposed LHV (Type B)

With an overall length of 25.25 metres and a maximum GCW of 60 tonnes:



*(Scania AB, Press Photos)*

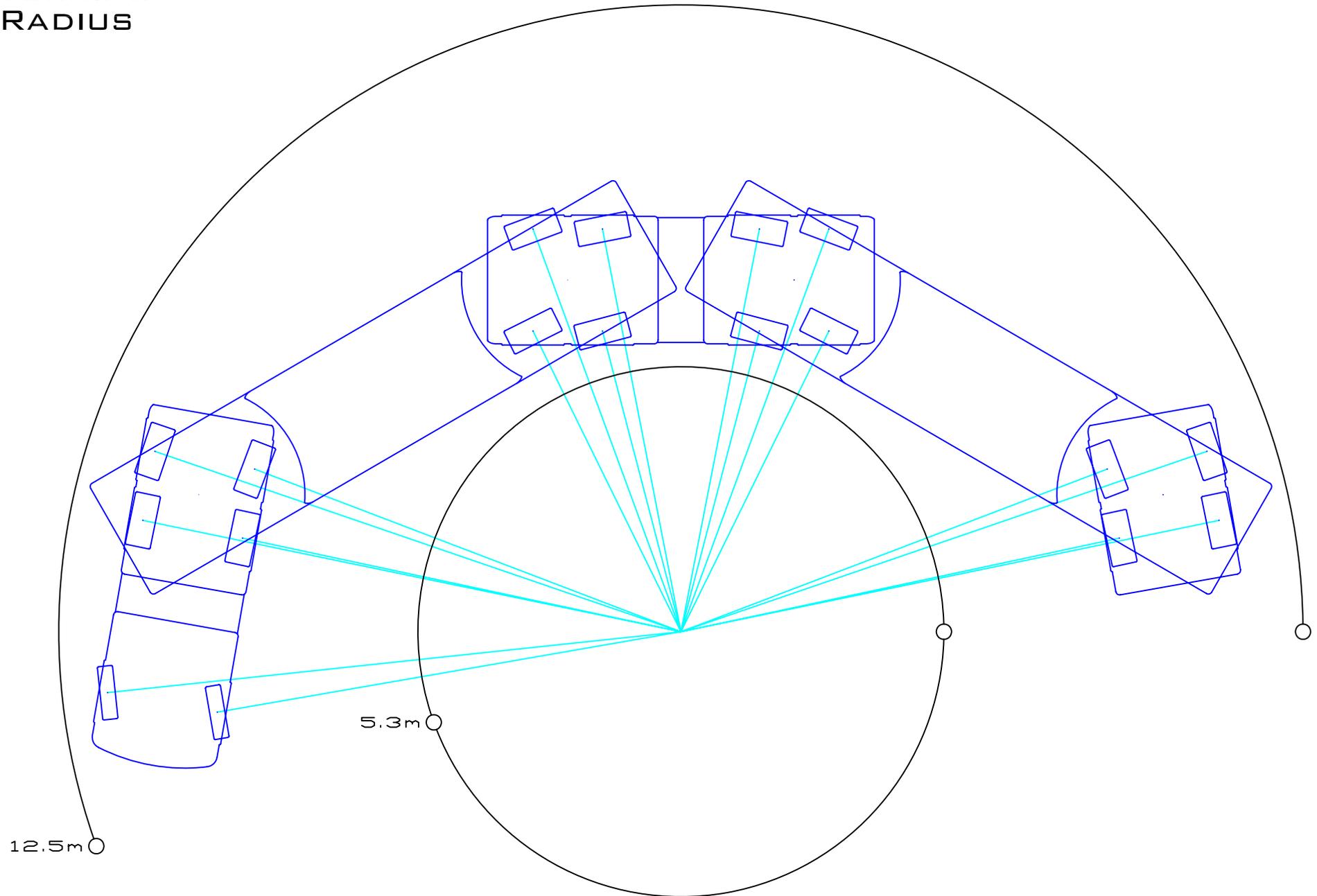
## The HST

With an overall length of 29 metres and a maximum GCW of 65 tonnes:

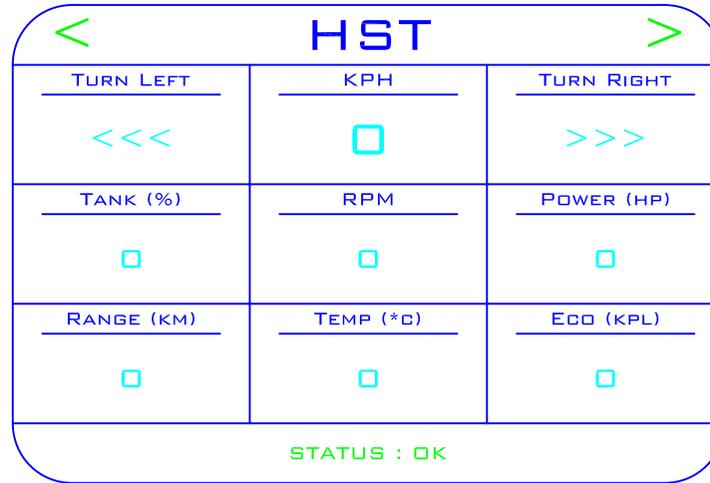


Highly Sophisticated Transport

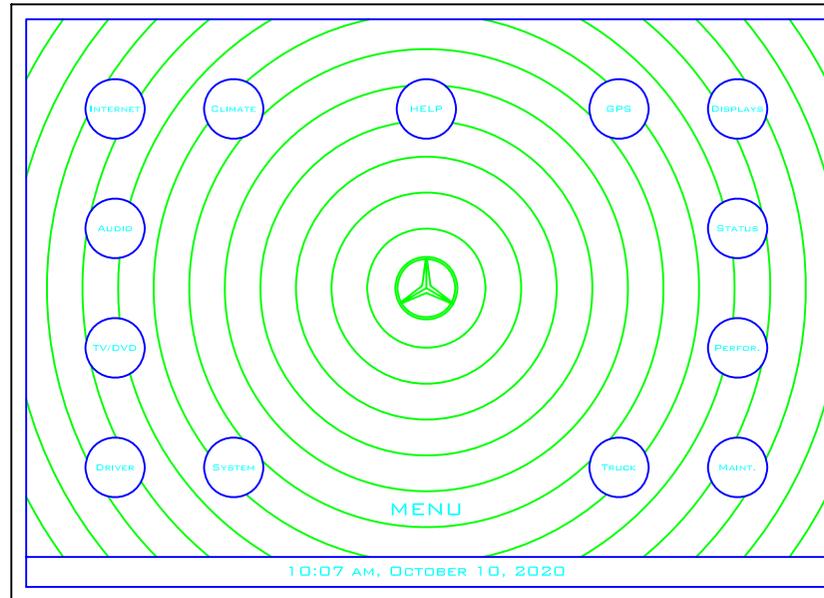
# TURNING RADIUS



# VIRTUAL INSTRUMENT CLUSTER

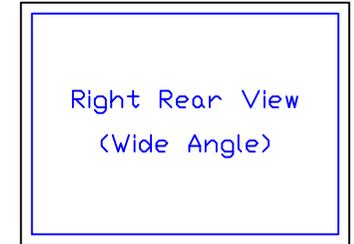
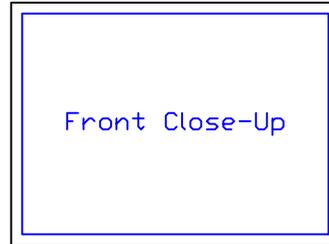
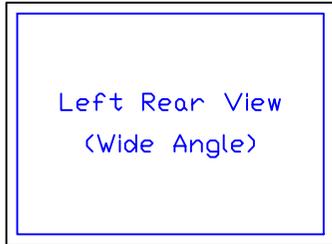


# TOUCH-SENSITIVE DISPLAY UNIT

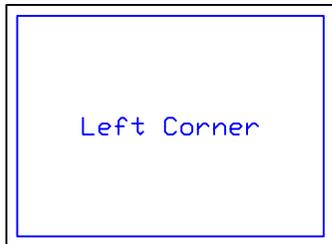


# MULTIPLE DISPLAY UNITS

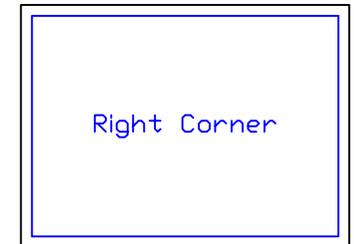
<Centre Displays>



<Left Display>



<Right Display>



<CCi Display>



# POWERTRAIN LAYOUT

