



Pit To Podium

The Smart Logistics Behind Audi F1

Team 4

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Overview | Steering Audi F1 to the Pole Position Through Logistics Excellence



In 2026, Audi will enter the grid as a full-fledged **Formula 1 constructor**, joining a sport where milliseconds separate legends and logistics is often the hidden driver of success.



24 races



Across 5 Continent

“F1 isn’t just about fast cars; it’s about fast, flawless, and flexible logistics” – Red Bull

Audi’s challenge is not only building a competitive car, but ensuring that every nut, bolt, technician, and sensor arrives on time, every time.

Why Logistics Matters in Formula 1 ?

The Pace of the Sport Vs The Pressure of Logistics

- Every team transports over **1,400 tonnes of equipment per season** – including race cars, servers, tyres, fuel rigs, pit walls... even espresso machines.
- Teams often go **continent-to-continent in under 4 days**, racing against the clock just to be ready on Friday
- Formula 1 is all about speed, but before a car hits the track, it’s logistics that runs the first lap

A Single Delay Can Take You Off the Grid

- One missed flight. One customs holdup. One misplaced crate disrupts months of planning and millions in engineering.
- Even Tier 1 teams build **redundancy buffers**: duplicate kits, advance shipments, backup freight providers.
- Equipment is tracked in real time with **RFID**, scanned at every stop, and routed through **multimodal transport chains** (air, sea, road)

Audi’s Mission: Match Precision with Sustainability

- As Audi joins the grid, it must compete logistically with the best — Red Bull, Mercedes, Ferrari — while staying true to its “No Fossil Fuels” promise
- This means building:
 - Smart first- and last-mile logistics
 - Circular economy-friendly freight
 - Mobile warehousing for rapid deployments



F1 Challenges

F1 Challenges | Identify the Most Important Logistics Challenges for Audi Team



Global Freight Movements:

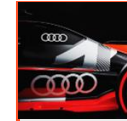
- To dismantle, transport, reassemble about 40 tons of equipments for ten teams across 24 races in 5 continents in a season of about ten months.
- To combine and coordinate different shipping modes and to address customs issues of freights.
- To face extreme challenges due to back-to-back races on different continents.



Eco-Friendly Logistics:

- To race **"WITH NO FOSSIL FUELS"** and use 100% sustainable fuels.
- To adopt greener transport methods
- To have a net-zero carbon footprint by 2030.

Ten Teams in Formular 1, 2025



Other Logistics Challenges:

- To allocate the limited space of Paddock area for garages, motorhomes, and support vehicles.
- To coordinate travels and accommodations for a large team across various global locations.
- To prepare and allocate all necessary supports and resources for all personnel.
- To face air shipping delays and other vulnerability due to heavy reliance on air transport such as cargo planes like DHL 747s.



Logistics Roles



Logistics Roles | Key Aspects for Sports Event Management and Roles of Sports Event Logistics



F1

2025 CALENDAR

*RACE ON SATURDAY

R1	14-16 MAR AUSTRALIA MELBOURNE	R13	25-27 JUL BELGIUM SPA
R2	21-23 MAR CHINA SHANGHAI	R14	01-03 AUG HUNGARY BUDAPEST
R3	04-06 APR JAPAN SUZUKA	R15	29-31 AUG NETHERLANDS ZANDVOORT
R4	11-13 APR BAHRAIN SAKHIR	R16	05-07 SEP ITALY MONZA
R5	18-20 APR SAUDI ARABIA JEDDAH	R17	19-21 SEP AZERBAIJAN BAKU
R6	02-04 MAY USA MIAMI	R18	03-05 OCT SINGAPORE SINGAPORE
R7	16-18 MAY ITALY IMOLA	R19	17-19 OCT USA AUSTIN
R8	23-25 MAY MONACO MONACO	R20	24-26 OCT MEXICO MEXICO CITY
R9	30 MAY-01 JUN SPAIN BARCELONA	R21	07-09 NOV BRAZIL SÃO PAULO
R10	13-15 JUN CANADA MONTREAL	R22	20-22 NOV USA LAS VEGAS
R11	27-29 JUN AUSTRIA SPIELBERG	R23	28-30 NOV QATAR LUSAIL
R12	04-06 JUL UNITED KINGDOM SILVERSTONE	R24	05-07 DEC ABU DHABI YAS MARINA

*SAT RACE

Key Aspects Entailed in Sports Event Management:

- Complex coordination of operations for various teams, schedules and venues.
- Transportations of athletes, equipment and other personnels between venues.
- Crowd management and spectator experience improvement.
- Resources management such as space and electricity.
- Technology applications to enhance logistical efficiency.
- Emphasis on sustainability by reducing environmental impacts of sports events.

Roles of Sports Event Logistics:

- To align all concerning elements of the sports event.
- To coordinate travel schedules, arrange accommodations and manage delivery and setup of necessary equipment at various venues.
- To design crowd flow patterns, implement security measures, and establish emergency response plans.
- To monitor status of shipments and coordinate schedules with real-time tracking systems, data analytics and different communication platforms.
- To implement green practices, including optimizing transportation routes, utilizing sustainable materials, minimizing waste and reducing greenhouse gas emissions.
- To coordinate internal functions and external stakeholders.

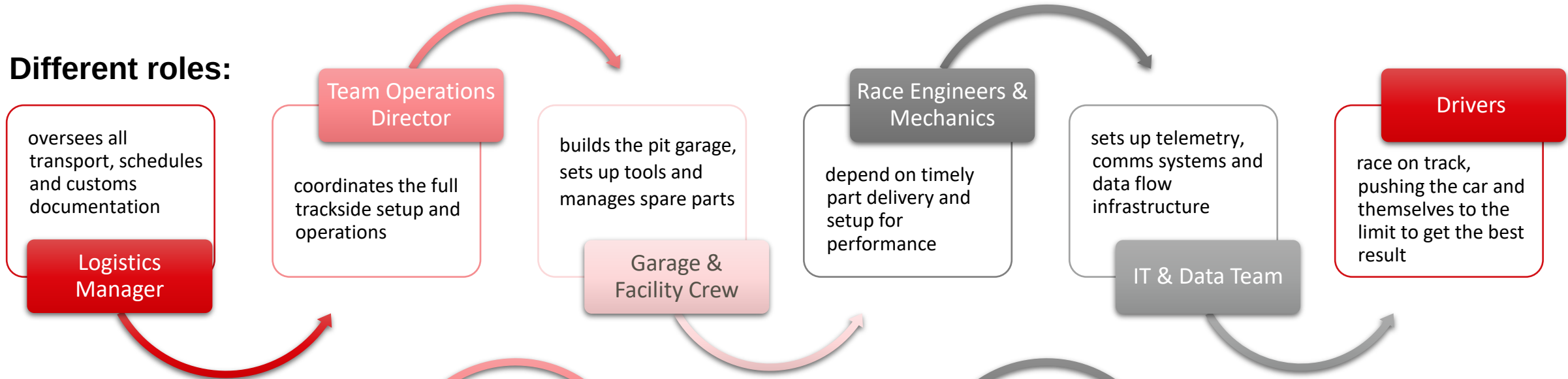


Key Stakeholders

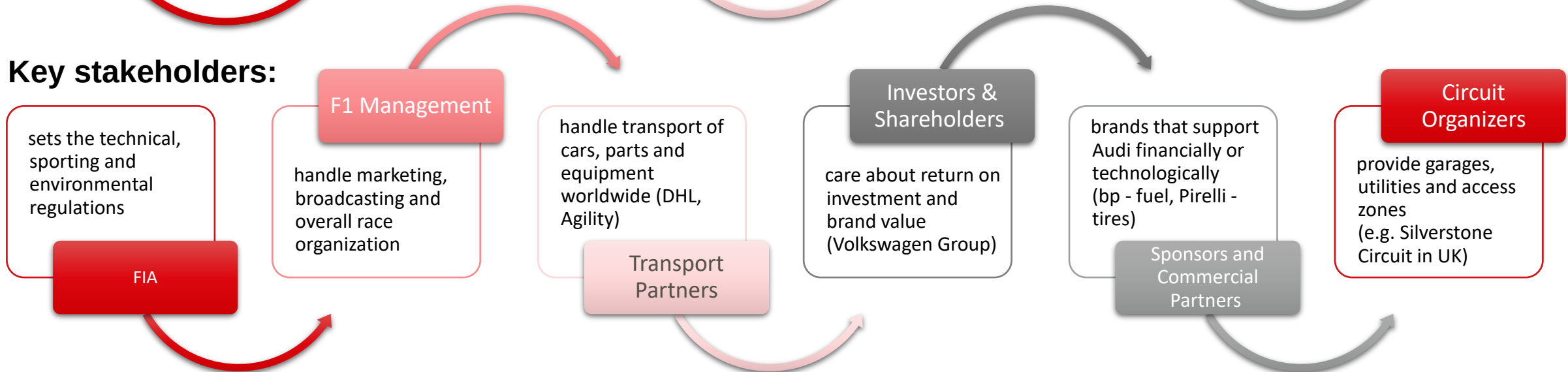
Key Stakeholders | Main internal roles and external stakeholders in participating in successful sports event logistics



Different roles:

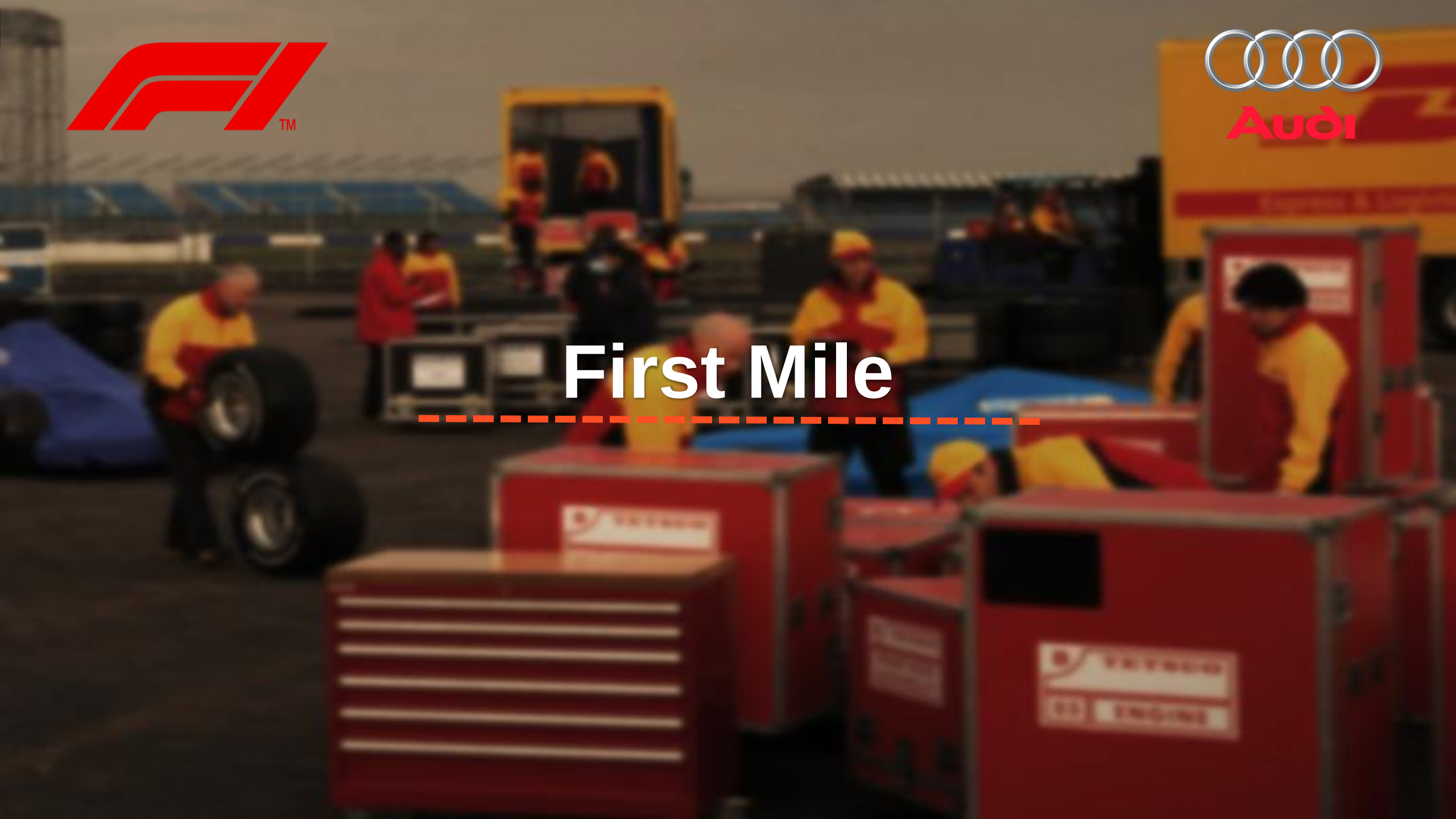


Key stakeholders:





First Mile



First mile | Set up is critical to ensure seamless movement of all equipment between key regions of F1 championship



01

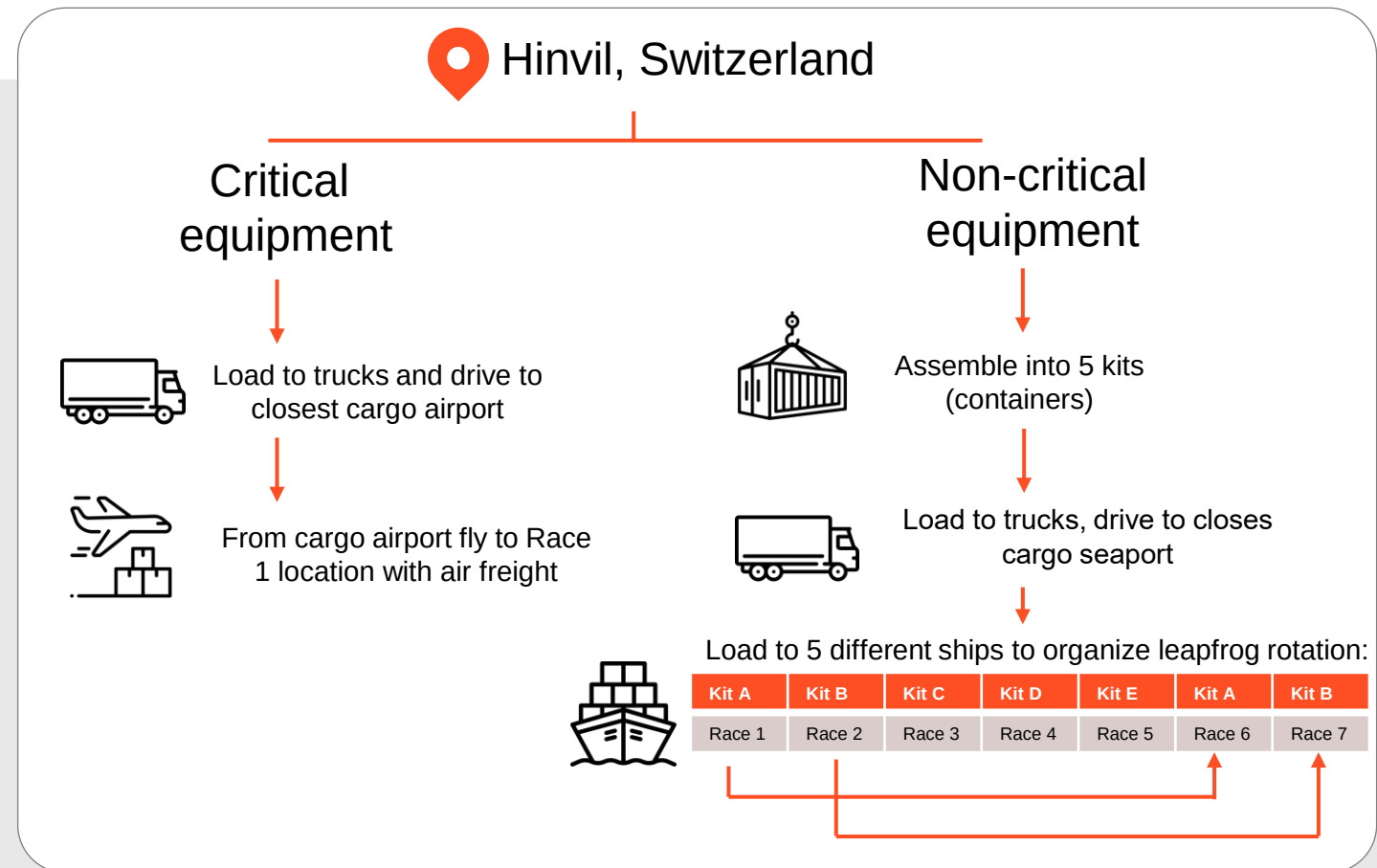
First mile includes moving all necessary items from team base in Hinvil to:

- European race venues (for initial setup)
- Airports (for onward international transport)
- Sea ports (for sending noncritical parts to distant regions in advance)

02

All the equipment should be divided into critical and non-critical:

- Critical will include important parts for making the race. Also, these are parts that could be upgraded or changed from race to race (e.g. cars, engines)
- Non-critical include things that will stay the same throughout all races (e.g. hospitality houses)



The first mile would involve:



Choice of the right distribution channel

The choice of the right distribution channel is a corporate strategic task

- Predominantly road transport via trucks within Europe, given the proximity of team bases and European race locations
- For urgent or critical components, express road freight is used for quick delivery to central hubs, while air freight may be employed for rapid movement between macro regions, similar to how teams expedite replacement part deliveries.
- Non-urgent components are shipped in advance via sea freight using a leapfrog scheme, allowing equipment to arrive ahead of time at future race locations

Choice of the right distribution location

Audi team, though new, will not start from scratch as they are buying Sauber F1 team

- Sauber HQ is in Hinwil, and Audi will inherit this location as a primary base
- Central logistics hub in Europe could be beneficial for consolidation and sorting before dispatch to race venues or airports, aligning with the concept of hubs in transportation networks
- An additional location in the UK could be beneficial due to the country's direct access to sea routes and its status as a hub for many F1 team headquarters, making it easier to hire skilled personnel and maintain efficient operations.

High delivery Service degree

Crucial even in the first mile

- Lead time needs to be minimised to ensure timely arrival at the next stage of logistics
- Delivery reliability and delivery consistency are essential to avoid delays that could impact race preparations
- Delivery flexibility would be needed to accommodate any changes in production schedules or urgent transport requirement

Handling Warehousing Issues

Distribution Centers and warehouses located near Audi F1's factory are crucial

- Housing spare parts, servicing tools, and equipment that are not immediately needed at the race venues
- Dedicated areas within the warehouses would facilitate the servicing, repair, and refurbishment of F1 car components and garage equipment
- A form of internal cross-docking could be used. For instance, newly manufactured or serviced components might be quickly moved from the production or repair area to the dispatch area for immediate transport if a tight schedule demands it

Freight selection evaluation criteria



	CRITERION	DESCRIPTION	IMPORTANCE IN F1 LOGISTICS
	Speed/Lead Time	Time taken to move goods from factory to initial logistics point.	Very High
	Cost	Expense associated with the transportation method.	High
	Reliability	Consistency and predictability of delivery schedules and condition of goods.	Very High
	Capacity	Volume and weight of goods that can be transported.	Medium
	Flexibility	Ability to adapt to changing schedules and urgent requests.	Medium
	Security	Measures to prevent damage, loss, or theft of high-value items.	High
	Sustainability	Environmental impact of the transportation method.	Increasing



Dedicated Road Freight (Trucks):

Use Case: Routine transport of race car components, garage equipment, and paddock infrastructure between the factory and a central logistics hub or directly to European race venues

Express Road Freight (Vans/Smaller Trucks)

- **Use Case:** Urgent transport of smaller, critical components or equipment needed quickly at a hub or race venue.

Air Freight (Chartered or Commercial Cargo):

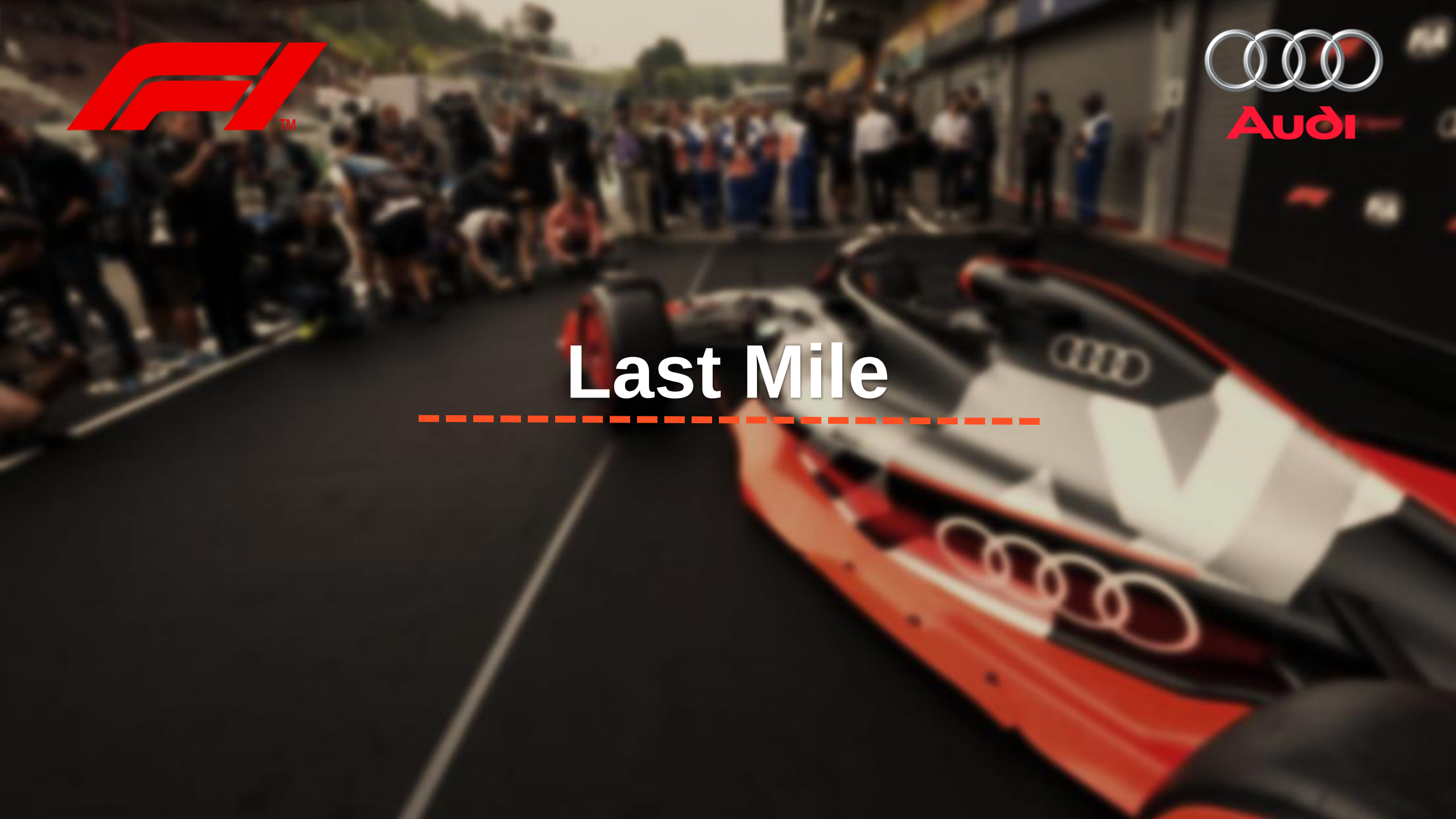
- **Use Case:** Primarily for extremely urgent situations within Europe where speed is paramount, or potentially for initial movement of highly sensitive or critical components if the factory is geographically distant from the main European logistics network. Less likely for routine first mile within a concentrated European base

Sea Freight (Containers shipping)

- **Use Case:** Transportation of non-critical equipment (paddock; hospitality buildings parts) made in advance. Several containers moving across locations in "leapfrog" manner will optimize installation and reduce costs



Last Mile

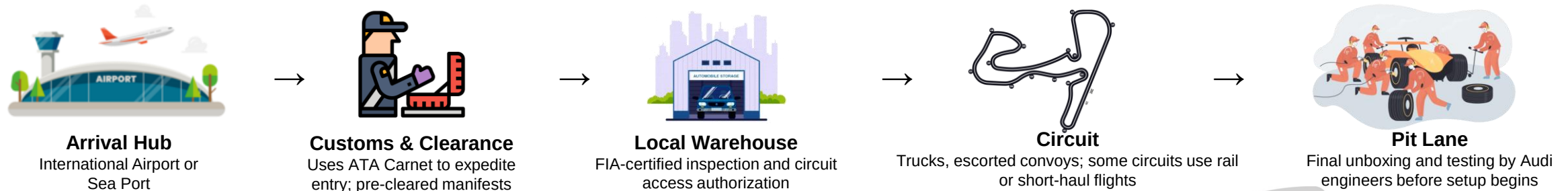


Last Mile Logistics for Audi F1 | Critical Path to the Starting Line



Definition in F1: Transport of critical parts, cars, and equipment from the arrival hub (airport/seaport) to the circuit before setup.

Key Locations:



Timeframe: Typically occurs within 24–48 hours before team setup begins. In some cases, night delivery windows are used for track-side access.

Why F1 Last-Mile Logistics Is Critical & Unique:

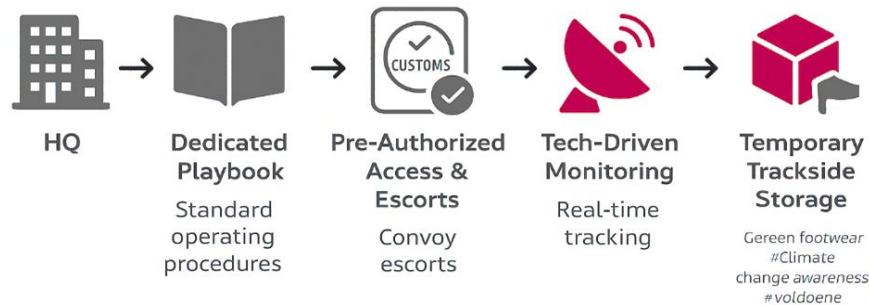
- **No Buffer for Delay:** Setup windows are fixed; delays = missed practice/qualification
- **High-Value, Custom Cargo:** Components worth millions, often irreplaceable
- **Global, Rotating Destinations:** 20+ circuits worldwide, each with different rules and access conditions
- **Complex Permissions:** Access passes, security credentials, event-specific regulation compliance
- **Specialized Handling Needs:** Items like sensitive telemetry, hydraulic units, and aero parts must be delivered intact

In F1, the last mile isn't the end of logistics — it's the start of performance.

Delivering Performance| Audi F1 Last Mile Logistics Plan



Strategy for managing last mile logistics for Audi F1 across the race calendar.



Region	Key Logistics Focus	Strategy & Solution	Logistical Challenges
European Union	Shorter transit times (1-2 days to most European venues)	Utilize centralized warehouse in Germany, with regional hubs in key countries (e.g., UK, Italy).	High traffic congestion during major events (Monaco, Silverstone).
	Proximity to F1 circuits – much of the calendar is Europe-based.	Local storage hubs for redundant parts (tires, wings, etc.), minimizing time lost in last-mile delivery.	Specific customs regulations for different EU countries.
America	Long-distance transport.	Airfreight to major US hubs (Miami, New York) followed by local trucking to the circuit.	High costs and time-sensitive nature of long-distance deliveries.
	Remote circuits: Brazil, Canada.	Pre-positioning containers at key venues like Circuit of the Americas .	Potential delays due to weather conditions (snow in Canada, hurricanes in the Caribbean).
Asia	Circuit locations in remote or difficult-to-reach places (e.g., Suzuka, Yas Marina).	Dedicated transport fleets with drivers familiar with circuits in Japan, Singapore, and the UAE.	Complicated customs clearance processes in some regions (UAE, Japan).
	Challenges with the distance from the F1 team’s European headquarters.	Pre-scheduled customs clearances with specific documentation for every region (e.g., Dubai, Singapore).	Geopolitical tensions and potential logistical delays (e.g., in Middle Eastern countries).

📖 Dedicated Last Mile Playbook

- Standard operating procedures per country/circuit.
- Partner with F1-experienced local logistics providers.

📄 Pre-Authorized Access & Escorts

- Use pre-cleared customs documents (ATA Carnet).
- Convoy escorts and night delivery to urban race circuits.

📡 Tech-Driven Monitoring

- Real-time GPS and sensor monitoring (temperature, shocks).
- Integrated control tower system at Audi HQ (visibility across regions).

🏠 Temporary Trackside Storage

- Setup of temporary micro-warehouses/pit garages at circuit.
- Backup parts for critical failure (wings, telemetry units, tires).

✳️ Modular Container Rotation

- Duplicate containers travel in rotation across continents (1 per region).

F1 vs. E-Commerce Last Mile | Key Differences for Audi F1



Q2: Any differences compared to e.g. the last mile in e-commerce?

Differences in complexity, goals, and risks in last mile logistics between F1 and typical e-commerce.

Aspect	F1 (Audi)	E-Commerce
 Urgency	High (delays = DNF or grid penalties)	Moderate (delivery SLA of 1–3 days)
 Value Per Shipment	Extremely high (engines, control units)	Low-medium (consumer items)
 Cargo Type	Bulky, fragile, customized	Packaged, standardized
 Delivery Site	Temporary/moving (race circuits worldwide)	Permanent addresses
 Handling	Trained F1 engineers/pit crew	Warehouse/3PL staff
 Infrastructure	Temporary lanes, VIP access, security control	Urban/local networks, drop-off points
 Failure Impact	Race performance lost, brand/sponsor damage	Refunds, complaints, minor dissatisfaction

mission-critical



customer experience





Warehousing



Warehousing Strategy for Race Locations | Building a Responsive & Resilient Trackside Model



Formula 1 logistics is mission-critical, and warehousing at race venues is not just about storage it's about ensuring **immediate availability** of performance sensitive parts and tools **under unpredictable conditions** (e.g., customs delay, weather, accidents, or last-minute part upgrades)



Trackside Warehousing Type



Modular

- Flexible, scalable structures (e.g. pre-fab containers)
- Easy to install/remove as per race size, location needs



- Mercedes-AMG Petronas F1** uses modular pit garages & containers,
- deployed and set up within 12–24 hours for each Grand Prix



Agile

- Supports last-minute part swaps, tool requests, or logistics disruptions
- Optimised for pit crew readiness and trackside servicing



- Red Bull Racing** pre-positions flexible storage hubs in Europe/Asia to avoid customs delays
- To ensure delivery during triple-header race weekends



Hybrid

- Combines physical warehousing with digital tech (RFID, IoT, WMS)
- Blends LSP execution with Audi F1's real-time inventory control
- Increases visibility, data access



- Ferrari F1 & CEVA Logistics** use hybrid logistics
- CEVA manages customs & warehousing,
- Ferrari controls inventory via IoT and cloud WMS from HQ

Strategic Trackside Warehousing Model for Audi F1

Dimension

Strategy

Rationale

Type



Structure

Temporary modular units (pre-fab containers)

Ensures fast deployment, dismantling, and transport across ~24 global race locations; aligns with Audi's sustainability and lean logistics philosophy



Modular



Location

On-track logistics zone or paddock-adjacent area, pre-approved by FIA/local hosts

Minimizes travel time for pit crews, supports JIS delivery to garages, complies with venue access rules and reduces last-mile delays



Agile



Operational Scope

High-turnover spare parts, race tools, fluid & tire stations

Enables just-in-time readiness for qualifying/race sessions; supports technical operations and emergency servicing



Agile



Technology

WMS + IoT integration (RFID tags, sensors, real-time dashboards)

Enhances transparency, remote monitoring, predictive replenishment; Audi F1 HQ can virtually track inventory & trigger orders



Hybrid



Logistics Partner

LSP-led execution (e.g. DHL, CEVA) with Audi retaining inventory governance

Leverages LSPs' F1 expertise for customs, transport, warehousing; ensures SLA compliance, while Audi controls asset visibility and access



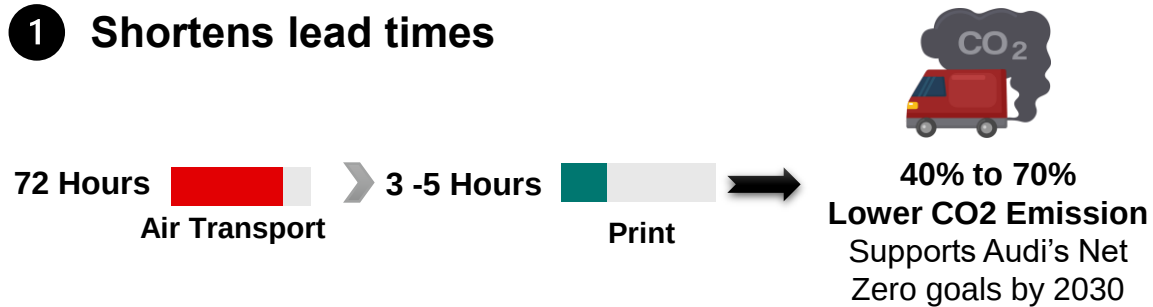
Hybrid

Integrating On-site 3D Printing | The Smart Spare Solution for F1



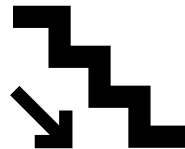
Why 3D Printing (Additive Manufacturing)?

1 Shortens lead times



2 Cost Savings

Freight costs: up to
€30,000 per shipment



Printing on-site
Reduce inventory holding
cost by **up to 60%**

3 Mitigate Supply Chain Risk

In 2023, F1 faced over 15 freight-related disruptions, especially in Asian double/triple headers. On-site 3D printing provides a buffer against global volatility.



**Risk in a Precision
Driven Sport**

Audi F1's logistics planning may be world-class, global freight volatility, customs delays, or mechanical failures during practice sessions can still jeopardize availability of components

Traditionally, such cases are managed through

Emergency air freight **€30,000–€50,000 per shipment**
(depending on weight/distance)

Inventory buffers Increased carbon footprint & capital tie-up

These reactive methods are **costly, carbon-intensive, and don't align with Audi's commitment** to sustainability and operational excellence

Realistic Scope of 3D Printing in F1



Flaps



non-structural,
high precision



Cable Brackets &
Mount



plastic or
polymer-based



Driver cockpit
accessories



custom or
comfort-related



Engine/internal parts



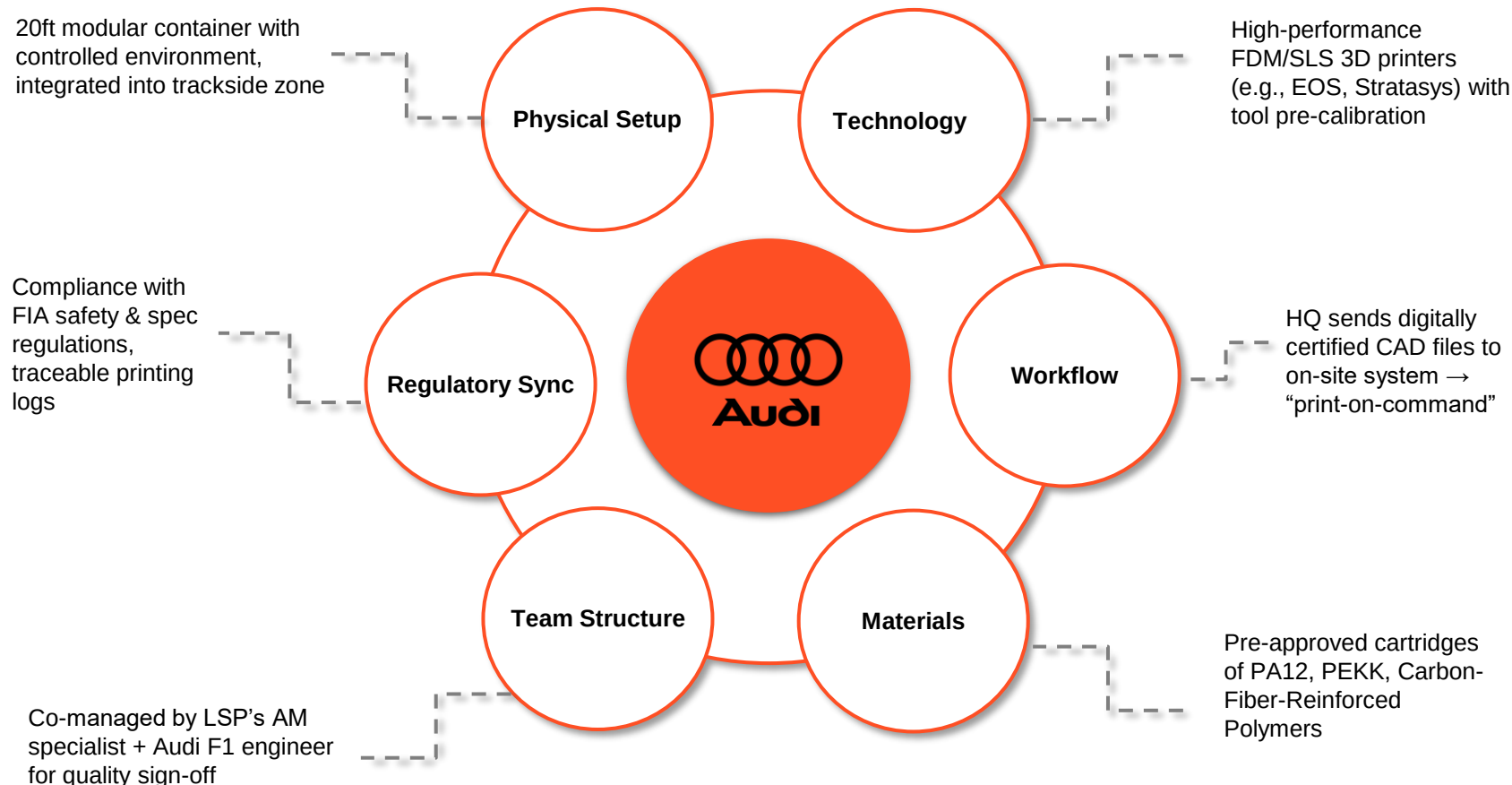
requires high-
temp alloys &
testing

F1 teams like **Red Bull, McLaren, and Ferrari** already print spares trackside for minor parts during race weekends

Implementation Blueprint



How Audi F1 Should Organize It On-Site



Strategic Impact

- Audi F1 must implement a hybrid, modular, and agile warehousing model at each race location to ensure uninterrupted, high-performance operations across the 2026 calendar.
- Trackside 3D printing is not optional—it is a strategic enabler, offering up to 70% CO₂ savings and cutting spare part lead times from days to hours, strengthening Audi's net-zero and innovation ambitions.
- Minimises air freight reliance, lowers inventory costs, and mitigates race-day disruptions – all while boosting real-time responsiveness and environmental sustainability.
- By integrating smart warehousing with on-site additive manufacturing, Audi creates a responsive, resilient logistics ecosystem, custom-fit to the dynamic F1 environment.
- Ultimately, this logistics design becomes a competitive differentiator, helping Audi not only meet the grid—but own the podium



Thank You !

