PBV and Its Unique Features

Purpose built vehicle (PBV) refers to special purpose vehicles based on small/medium-sized van or multi-box van. PBV suppliers adopt the approach of independent development of upper and lower vehicle bodies, and derive various vehicle types on the same chassis platform, meeting customization needs. Compared with conventional integrated vehicle development, such a development method has unique features below:

- Short development cycle and low cost
- Diversified PBV product forms
- Diversified PBV profit models

Examples:

- Source: Hyundai Motor Group
- KIA bodystyles enabled by Canoo's modular skateboard platform

Source: PIX Moving
PBVs built on the same chassis don’t need repeated development, which shortens the start-of-production and time-to-market of new models. The standardized chassis components can also be reused, reducing manufacturing costs.

For example, the use of "UP Super Board" developed by Shanghai U Power Technology Co., Ltd. cuts down the original 2 or 3 years of vehicle R&D cycle to 12 months, and the R&D costs by up to 60%.
Diversified PBV Product Forms

The flexible and changeable upper space of PBV allows a variety of product forms. For example, a PBV can be a logistics vehicle, a retail vehicle, a car, a bus, a sanitation vehicle, and so forth.

From the product layout of PBV suppliers, it can be seen that the product forms of PBV are led by three vehicle types: van, pickup and sedan. Wherein, PIX Moving enjoys the broadest range of product forms, involving four fields: passenger car, commercial vehicle, freight vehicle and special vehicle; U Power boasts the most abundant PBV product lineups and deploys five vehicle types, covering three fields: passenger car, commercial vehicle, and freight vehicle; with single PBV product form, Didi has only one product, D1, a customized car for the online ride-hailing mobility scenario. Didi plans to iterate a version every 18 months, to D3 in 2025 when 1 million units will be launched; and to remove the cockpit and realize autonomous driving in 2030.

<table>
<thead>
<tr>
<th>Passenger Cars</th>
<th>Commercial Vehicles</th>
<th>Freight Vehicles</th>
<th>Special Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
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</tr>
<tr>
<td>PIX Moving</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Didi</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Arrival</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Rivian</td>
<td>✓</td>
<td></td>
<td>✓</td>
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<tr>
<td>Canoo</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>U Power</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: ResearchInChina
Diversified PBV Profit Models

Through the lens of business models, PBV suppliers often apply the To B model. Among them, PIX Moving, Arrival and Rivian employ both To B and To C models. For instance, PIX Moving starts with Robobus at the business end in a bid for quick commercialization, and will build a complete marketing system after launching consumer products.

As for manufacturing, all suppliers except for Didi have their own production bases. Didi partners with BYD to produce D1 at BYD’s base in Changsha city. In June 2021, Canoo started building a production line in Oklahoma, the US, and ceased the outsourcing contract with VDL Nedcar, opting to build cars by itself.

There are mainly three profit models: vehicle sales, rental, and software subscription & other value-added services. Didi and Arrival apply the rental model, but their rental schemes are different. Didi offers two rental schemes that target Didi drivers: half-year rental, with a monthly rent of RMB4,399; one-year rental, RMB4,299 per month. Arrival, however, aims at third-party lessors such as LeasePlan (in 2021, Arrival and LeasePlan signed a sales cooperation agreement for 3,000 vans). For profits, the supplier Canoo has begun to take into account both the subscription and vehicle sales models.
The new idea of building brick cars gives birth to diversified vehicle forms, including Robocal, a robot that looks like a vehicle, can move freely and is capable of L4 autonomous driving. The product forms of Robocars are led by Robotaxi and Robobus. At present, Robotaxies built by Baidu, Pony.ai, QCRAFT and the like have begun to run. In the future, Robocars will also be upgraded to L5 autonomy, competent enough to self-learn, make decisions independently, and adapt to a variety of complex scenarios and inclement weather like rain and fog, and they will completely replace humans by then.

### Operation of Robotaxi

<table>
<thead>
<tr>
<th>Company</th>
<th>Start Time of Operation</th>
<th>Operating Area</th>
<th>Number of Launched Vehicles</th>
<th>Ride-hailing Mode</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baidu</td>
<td>Apr. 2020</td>
<td>Changsha Xiangjiang Area</td>
<td>45 units</td>
<td>Baidu Map APP, Apollo GoAPP</td>
<td>As of June 2021, Baidu Apollo self-driving mobility service has served more than 400,000 passengers, with over 14 million km test mileage and more than 2,900 autonomous driving patents.</td>
</tr>
<tr>
<td></td>
<td>Aug. 2020</td>
<td>Guangzhou</td>
<td>30 units</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sept. 2020</td>
<td>Beijing</td>
<td>40 units</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jul. 2021</td>
<td>Guangzhou</td>
<td>&gt;200 units</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aug. 2021</td>
<td>Shanghai</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pony.ai</td>
<td>Dec. 2018</td>
<td>Nansha District, Guangzhou</td>
<td>-</td>
<td>PonyPilot+APP</td>
<td>As of 2021, Pony.ai’s mobility as a service has provided about 600,000 rides for users.</td>
</tr>
<tr>
<td></td>
<td>Oct. 2019</td>
<td>Irvine, California</td>
<td>10 units</td>
<td>BotRideAPP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feb. 2020</td>
<td>Fremont, California</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>May 2021</td>
<td>Yizhuang, Beijing</td>
<td>30 units</td>
<td>PonyPilot+APP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jul. 2021</td>
<td>Jiading, Shanghai District</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WeRide</td>
<td>Nov. 2019</td>
<td>Within the designated areas in Huangpu District, Guangzhou Economic and Technological Development District</td>
<td>40 units (2020)</td>
<td>WeRide APP</td>
<td>As of January 2022, the company has operated safely for more than 2 years, fulfilled 307,363 orders with total mileage of 1.5 million kilometers, providing autonomous mobility services for more than 180,000 passengers.</td>
</tr>
<tr>
<td>UISEE</td>
<td>Feb. 2021</td>
<td>Wuhan Economic &amp; Technological Development Zone</td>
<td>42 units (An increase to 50 units as planned)</td>
<td>DF-GO APP</td>
<td>In February 2022, UISEE provided services for the Beijing Winter Olympics.</td>
</tr>
<tr>
<td>Idriverplus</td>
<td>2019</td>
<td>-</td>
<td>&gt;100 units (2021)</td>
<td>--</td>
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