



Global and China HD Map Industry Report, 2021

Apr.2021

STUDY GOAL AND OBJECTIVES

This report provides the industry executives with strategically significant competitor information, analysis, insight and projection on the competitive pattern and key companies in the industry, crucial to the development and implementation of effective business, marketing and R&D programs.

REPORT OBJECTIVES

- ◆ To establish a comprehensive, factual, annually updated and cost-effective information base on market size, competition patterns, market segments, goals and strategies of the leading players in the market, reviews and forecasts.
- ◆ To assist potential market entrants in evaluating prospective acquisition and joint venture candidates.
- ◆ To complement the organizations' internal competitor information gathering efforts with strategic analysis, data interpretation and insight.
- ◆ To suggest for concerned investors in line with the current development of this industry as well as the development tendency.
- ◆ To help company to succeed in a competitive market, and

METHODOLOGY

Both primary and secondary research methodologies were used in preparing this study. Initially, a comprehensive and exhaustive search of the literature on this industry was conducted. These sources included related books and journals, trade literature, marketing literature, other product/promotional literature, annual reports, security analyst reports, and other publications.

Subsequently, telephone interviews or email correspondence was conducted with marketing executives etc. Other sources included related magazines, academics, and consulting companies.

INFORMATION SOURCES

The primary information sources include Company Reports, and National Bureau of Statistics of China etc.

Abstract

HD Map Industry Report: the Curtain on Industrial Integration is Lifted, and Four Survival Models May be Staged.

In current stage, the challenge of HD map lies in follow-up maintenance and updates rather than initial mapping. Industry insiders still disagree over the frequency of HD map update, but it is clear that HD map does not need real-time update of all data, and elements of different attributes vary in update frequency, among which dynamic map layer needs the most frequent updates on traffic conditions including vehicles, non-motor vehicles and pedestrians.

Yet there may be constraints placed by related confidentiality regulations on the update process of HD map, a kind of electronic navigation map, for example, mapping needs qualification, what and how the map presents must be subject to policies and regulations, and requirements on data confidentiality and release should be met.

To solve the compliance issue raised during producing and updating HD map, the Ministry of Industry and Information Technology of China leads the Internet of Vehicles (Intelligent Connected Vehicles) Basic Data Service and Basic Map Service Platform Construction Project, introducing a new role, Tier1.5 (HD dynamic map basic platform) that bridges the gap between OEM, Tier1 (map provider) and government. Tier1.5 with four core capabilities of dynamic data aggregation, data push, service supervision support, and data compliance processing is an effective solution to the compliance issue in the process of crowdsourcing-based update.

In addition, the improving policies and regulations also provide practical solutions for HD map update. For example, the National Regulations on the Administration and Scope of Confidential Surveying and Mapping Geographic Information released in June 2020 defines the levels of confidentiality required for measured data of electronic navigation map, 3D model and point cloud data.

BAT (Baidu, Alibaba and Tencent), Service Providers and Automakers are Vying for HD Map Market, Which is to Raise the Curtain on Industrial Integration.

In recent years, L3/L4 automated driving has been in pilot operation in various scenarios like Robotaxi, port logistics and automated parking. Also, L3 autonomous passenger cars went into series production in China in 2020. Our findings show that in 2020, virtually 25,000 sets of HD maps from typical providers like Amap, Baidu, NavInfo and eMapgo were installed in mass-produced passenger cars in China. In future, HD map will be a standard configuration of L3 autonomous vehicles and become optional for some L2+ autonomous vehicles. It is predicted that over 500,000 sets of HD maps will be mounted on passenger cars mass-produced in China in 2025. HD map industry is booming.

Application Cases of HD Map

Application Scenario	Pilot Application Project	HD Map/Technology Provider
Mobility Service	In Sept. 2019, Baidu Robotaxi service was first introduced to Changsha. The first fleet of 45 Hongqi electric robotaxis co-developed by Apollo and FAW Hongqi carried out pilot run on some public road sections of the city; In Dec. 2020, Baidu launched its Robotaxi project in Shanghai.	Baidu Map
	In Dec. 2018, Waymo provided WaymoOne Robotaxi service in Arizona; In Sept. 2019, its Pacifica service was rolled out in California.	Google Map
Relatively Closed Areas (Park, Port, etc.)	In Nov. 2019, SAIC Group, Shanghai International Port (Group) Co., Ltd. (SIPG) and China Mobile kicked off the "5G + L4 Intelligent Heavy-duty Truck" pilot project in Yangshan Port of Shanghai.	DeepMotion
Parking	In May 2018, Baidu together with Pand-Auto built the "Autonomous Shared Car Demonstration Park" in an industrial park in Liangjiang New Area of Chongqing. 6 self-driving shared cars bearing Valet Parking, Apollo's open platform, made their trial run to finish given tasks.	Baidu Map
	The HD map-based indoor parking navigation service of EVCARD, a car-sharing brand under Global Car Sharing and Rental Co., Ltd. underwent a close beta at the front end of EVCARD APP.	BrightMap
	In Mar. 2021, Weltmeister W6 began to be pre-sold. The car can drive itself in designated scenarios (automatic parking).	Baidu Map
Highway	Autonomous vehicles like Xpeng P7, GAC AION V/LX and NIO EC6/ES6/ES8, mass-produced from 2020, can realize automated driving in some highway scenarios using HD map.	Amap, Baidu Map, etc.

Source: ResearchInChina

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The charge mode of HD map involves development, license and update service fees, delivering far higher value per vehicle than conventional navigation maps. Such is the optimism about HD map that players including BAT, Huawei, Didi, JD.com and Meituan in addition to traditional map providers flood into the market.

Baidu: list both autonomous driving and HD map in its strategy, providing HD map solutions for mass-production projects of OEMs as they require;

Alibaba: acquired 100% shares of AutoNavi (now known as Amap), bought in eMapgo (which was wholly acquired by Luokung Technology Corp. in 2021), and lavish on HD map;

Tencent: built its own HD map team (the wholly-owned subsidiary Tencent Tongtu Data acquired the class-A qualification for electronic navigation map early in 2007); bought a stake in NavInfo (trimmed its holdings in 2020);

Huawei: the subsidiary Beijing Huawei Digital Technologies Co., Ltd. was qualified for surveying and mapping in 2019; has forged partnerships with NavInfo and Lessor Spatial Information Technology since 2020, hoping to make it easier to collect, produce and update HD map data.

Moreover, OEMs have made a gradual foray into the HD map field. Foreign OEMs have made early deployments by way of acquisition and investment. In recent two years, Chinese OEMs like SAIC and Geely took up the activity as well.

SAIC: the wholly-owned subsidiary Heading Data Intelligence Co., Ltd. was qualified for surveying and mapping in 2018; BrightMap co-funded by SAIC, Dongfeng Motor and Jiangling Motors acquired the qualification in 2019; SAIC also invested in foreign HD map start-ups such as Civil Maps and DeepMap, and cooperated with Mobileye on REM map.

Geely: in 2019, Geely Technology Group invested in Luokung Technology Corp. and helped the big data tech firm buy 51% equities of eMapgo. In March 2021, Luokung Technology bought eMapgo out. In October 2020, Geely's arm, ECARX Co., Ltd., obtained the qualification for surveying and mapping. Geely deployments in HD map are a preparation for CoPilot solution to be released by Lynk & Co. for planned high automation on structural roads in 2021 and on public roads before 2023.

In a fiercely contested market, most HD map start-ups gain competitive edges by developing differentiated products. Examples include Wayz.ai, Kuandeng Beijing Technology and Momenta which use AI-based visual solutions to slash the cost of collection and update.

As for HD map update, Mobileye leads the world with its REM technology. The General Manager of Mobileye Greater China, Tong Lifeng says that by 2025, the global MaaS market will be worth more than USD160 billion, including the over USD70 billion potential data-related segment. And without a doubt, HD map data is one of the biggest data gold mines. Yet in China regulations will pose a barrier to the adoption of Mobileye REM technology.

OEMs place a high premium on the map data collected in real time. OEMs in possession of enormous amounts of HD map data, become data and technology companies, not traditional enterprises any more.

We argue that the curtain on industrial integration is to be lifted and four survival models may be staged:

(1) The first is conventional map providers, like Baidu, Amap and NavInfo. Baidu and NavInfo are trying to create complete autonomous driving solutions including HD map. Although typical map providers and OEMs have struck cooperation agreements of series production, it is hard for their HD maps to find broad application due to high cost.

(2) The second is map providers with close partnerships with OEMs, such as Heading Data Intelligence, BrightMap and eMapgo. The in-depth cooperation with OEMs helps these map providers remove some difficulties of improving the efficiency of automated driving projects. Their big gap with top three conventional HD map providers in strength calls forth their close ties with OEMs.

(3) The third is vendors with full stack solutions for autonomous driving, such as Momenta, Huawei and Mobileye. Momenta has enabled fully data-driven environmental perception, HD map, prediction and other links, and also has achieved continuous iteration and upgrade by closed loop automation. In March 2021, Momenta raised USD500 million in a Series C funding round led by SAIC, Toyota and Bosch. Momenta's HD map mode, very similar to REM mode and with class-A qualification for surveying and mapping, is favored by capital.

Cooperation Deployments of Foreign and Chinese OEMs in HD Map Field

Foreign OEM	Cooperation	Investment
Mercedes-Benz	DeepMap, TomTom, Momenta	Here
BMW	NavInfo, Mapbox	Here
GM	Ushr, Amap, Mobileye	-
Ford	DeepMap, TomTom, eMapgo	CivilMaps, Argo AI
Toyota	TomTom, Carmera, Momenta, Here	DMP, Ushr
VW	Baidu, Mobileye, Here, Amap	Argo AI
Mitsubishi	Zenrin, Google-Waymo	-
Nissan	Mobileye, Zenrin, Google-Waymo	DMP, Ushr
Hyundai	Here, Netradyne, Kuandeng Beijing Technology, Baidu	-
Fiat Chrysler Automotive	Google-Waymo	-
Renault	Google-Waymo	-
Honda	-	DMP, Ushr
Peugeot	Baidu	-
Jaguar Land Rover	Amap	-
Mazda		DMP, Ushr

Source: ResearchInChina

(4) The fourth is players which depend on some specific ecosystem, such as Didi, JD.com, Meituan and SF Express. They work hard on their own segments, and produce HD maps applicable to their own operations (e.g., autonomous delivery). Differing from OEMs, they need such road elements as bikeways, sidewalks, blind sidewalks and isolation piles.

Chinese OEM	Cooperation	Investment
GAC	Baidu, Kuandeng Beijing Technology	-
FAW	Baidu, eMapgo, Tencent Map	-
Geely	Amap, Tencent Map	ECARX, eMapgo
BAIC	eMapgo, Baidu	-
Changan Automobile	Baidu, Mobileye	-
SAIC	CivilMaps, DeepMap, Mobileye, NavInfo, Momena	Heading Data Intelligence, BrightMap, CivilMaps
Great Wall Motor	Mobileye, Baidu	-
NIO	Mobileye	-
Dongfeng Motor	Amap	BrightMap
Xiaopeng Motors	Amap	-
Chery	Baidu	-
Yutong Bus	BrightMap	-
BYD	Baidu, eMapgo	-

Source: ResearchInChina

Application of HD Map in the Favorable Wind Blowing from New Infrastructure

As well as perceptual redundancy for autonomous vehicles, the boom of new infrastructure, vehicle-infrastructure cooperation (CVIS) and smart highway gives HD map greater scope for growth.

In the case of application in vehicle-infrastructure cooperation in highway scenarios, HD map enables highways to be capable of warning. HD map, geo-fence technology and multi-sensor fusion constitute the solution.

Furthermore, the collaboration between HD map providers and highway operators allows for the backhaul of a mass of data from roadside infrastructure to enable rapid update of HD map.

The combination of HD map and CVIS not only favors real-time update of HD map data through V2X roadside equipment but helps to distribute data from the cloud to vehicles for lane-level warning and decision for autonomous driving and driving assistance.

Also, the HD and CVIS integration serves as a foundation for future layout of intelligent transportation. Nationwide HD map data as well as abundant data elements, lane-level positioning and quickly updated features provide basic data support for traffic control and real-time monitoring.

Map providers backed by ICT companies, such as Amap, Baidu, Huawei and NavInfo stand more chances of partaking in new infrastructure. An example is NavInfo's V2X-DMP (Dynamic Map Platform) that applies HD map and CVIS.

Global and China HD Map Industry Report, 2021 highlights the following:

1. HD map (basic technologies, industrial policies, regulations and standards);
2. HD map market (size, competitive landscape, and business and charge models);
3. HD map industry (main technical challenges and development trends, e.g., crowdsourcing update scheme and compliance, data fusion/correction, and HD map and V2X integrated application);
4. OEMs' demand for HD map, cooperative models and outlook of OEMs and HD map providers;
5. Main Chinese and foreign HD map providers, start-ups and technology providers.

01 HD Map Basic Technologies

1.1 Overview of HD Map

1.1.1 Classification of HD Map for Autonomous Driving

1.1.2 Composition of HD Map

1.1.3 Roles of HD Map

1.1.4 Integration of HD Map and Positioning Extends to More Application Scenarios

1.2 Main Elements of HD Map

1.2.1 Road Elements Needed by HD Maps for Different Levels of Automated Driving

1.2.2 HD Map Elements Required by NOA Function

1.2.3 HD Map Elements Required by Hands Free Function

1.2.4 HD Map Required by L3 Automated Driving

1.2.5 HD Map Required by L4 Automated Driving

1.2.6 HD Map Elements Collected by Main Map Providers in China

1.2.7 HD Map Elements Collected by Main Foreign Map Providers

1.3 Production Technology of HD Map

1.3.1 HD Map Production Methods

1.3.2 HD Map Produced with SLAM Technology

1.3.3 Vision-based SLAM

1.3.4 LiDAR-based SLAM

1.3.5 Comparison of HD Map Production Methods between Main Map Providers/Technology Providers

1.3.6 HD Map Production Process of Main Map Providers

1.4 Data Updates of HD Map

1.4.1 Update Frequency

1.4.2 HD Map Data Update Schemes of Main Map Providers

1.4.3 HD Map Update Schemes

02 HD Map Policies, Standards and Market Status

2.1 HD Map Policies

2.1.1 Favorable Policies for HD Map Industry

2.2 HD Map Regulations

2.2.1 Regulations Concerning HD Map

2.2.2 Regulations on HD Map Surveying and Mapping

2.2.3 Regulations on HD Map Presentations

2.2.4 Regulations on HD Map Review

2.2.5 Dynamics of China's HD Map Laws and Regulations

2.2.6 Development Trends of HD Map Laws and Regulations

2.3 HD Map Standards

2.3.1 HD Map Data Standard Bodies

2.3.2 Formulation of HD Map Standards in China

2.3.3 Work Plan of the Autonomous Driving Maps and Localization Working Group

2.3.4 Future Application and Update of HD Map for Autonomous Driving: Standard Demand System

2.4 HD Map Market Size

2.4.1 Estimated Installation of HD Map in Autonomous Vehicles in China, 2020

2.4.2 HD Map Market Size

2.5 Competitive Landscape of HD Map Companies

2.5.1 Distribution of HD Map Industry Chain

2.5.2 Status Quo of HD Map Market Competition

2.5.3 Traditional Map Providers Facing Challenges are Actively Seeking to Transform

2.5.4 Win-win Cooperation between Map Providers, and between Map Providers and Technology Providers

03 Main Challenges Posed by HD Map and Technology Trends

3.1 Crowdsourcing Update Technologies for HD Map

3.1.1 Low-cost Collection + SLAM Algorithm

3.1.2 Pure Vision + Deep Learning + SLAM Algorithm

3.1.3 Cloud + Terminal Forms a Closed Update Loop

3.1.4 HD Map Technology Trends: Crowdsourcing Update to Maintain Map “Freshness”

3.2 How HD Map Realizes Multi-source Data Fusion

3.2.1 Build a Service Platform for Multi-source Crowdsourced Data Fusion

3.2.2 Crowdsourced Data Fusion over Cloud

3.2.3 Set a Cross-correlation Layer that Fuses with ADAS Data

3.2.4 Problems in HD Map Data Fusion

3.3 How HD Map Validates Data Integrity

3.3.1 Validation of Data Integrity by Crowdsourcing Update

3.4 Compliance of HD Map

3.4.1 Regulatory Barriers to HD Map

3.4.2 Data Services for HD Map Compliance

3.4.3 Explore Compliance of Crowdsourcing Update

3.4.4 Explore Territorial Distribution and Crowdsourcing mode of Surveying and Mapping

3.4.5 Build a Dynamic HD Map Basic Platform

3.5 HD Map Commercial Models

3.5.1 Services Provided by Main Map Providers

3.5.2 The Integration of HD Map and High-Precision Positioning Technology Provides Technical Support for ADAS

3.5.3 Use HD Map Data to Provide Cloud Services for Autonomous Driving Simulation

3.5.4 Business Models

3.5.5 Commercialization Scenarios

3.5.6 HD Map Commercialization

3.6 How HD Map Integrates with V2X

3.6.1 Application of HD Map in V2X

- 3.6.2 Data Storage on V2X-DMP
- 3.6.3 HD Map will Become an Infrastructure for V2X Development
- 3.6.4 V2X will Support Millisecond Response of HD Map
- 3.6.5 HD Map and V2X Integrated Application Completes Multi-scenario Services
- 3.6.6 HD Map and V2X Cooperation

04 Cooperation Models of OEMs and Map Providers

- 4.1 HD Map Parameters Valued by OEMs
 - 4.1.1 Demand for HD Map from Autonomous Driving
 - 4.1.2 HD Map Parameters Valued by OEMs
- 4.2 Cooperation Models
 - 4.2.1 Map Providers Offer Basic Kernels and Build In-depth Cooperation with OEMs
 - 4.2.2 Map Providers Rely on Ecological Partners to Provide the Integration of HD Map and Autonomous Driving
 - 4.2.3 OEMs' Independent Layout of HD Map
 - 4.2.4 Map Providers Provide Proprietary Data Processing Platforms for OEMs
 - 4.2.5 Map Providers Provide Autonomous Driving Map Engines for OEMs
- 4.3 HD Map Solutions Installed by Main OEMs
 - 4.3.1 Cooperation/Investment Layout of Chinese and Foreign OEMs in HD Map Field

- 4.3.2 HD Map Solution Mounted on GAC's Mass-produced Autonomous Vehicles
- 4.3.3 HD Map Solution Mounted on Xiaopeng Motors' Mass-produced Autonomous Vehicles
- 4.3.4 HD Map Solution Installed by General Motors

05 Chinese and Foreign Map Providers

Chinese Map Providers

- 5.1 Amap
 - 5.1.1 Profile
 - 5.1.2 Data Acquisition of HD Map
 - 5.1.3 Positioning Solution
 - 5.1.4 Integrated Solutions Based on HD Map and High-precision Positioning
 - 5.1.5 HD Map Technology Roadmap
 - 5.1.6 HD Map Collaborations/Applications
- 5.2 Baidu Map
 - 5.2.1 HD Map Business
 - 5.2.2 Apollo HD Map File Structure
 - 5.2.3 Data Acquisition
 - 5.2.4 AI-driven Automated HD Map Production Line
 - 5.2.5 Professional Surveying and Mapping + Crowdsourcing-based Data Update Modes
 - 5.2.6 HD Map Business Plan
 - 5.2.7 Baidu Creates Differentiated HD Map Service Capabilities
 - 5.2.8 Baidu HD Map Ecosystem and Partners

5.3 NavInfo

5.3.1 Development History of HD Map

5.3.2 HD Map Products

5.3.3 HD Ultimate

5.3.4 HD Pro

5.3.5 HD Lite

5.3.6 HD Map Integrated Solutions

5.3.7 Data-driven Open Platform for L5 Automated Driving

5.3.8 HD Map Data Collection and Update Schemes

5.3.9 Benefits of HD Map Products

5.3.10 HD Map Collaborations

5.3.11 HD Map Coverage

5.4 Tencent Map

5.4.1 Profile

5.4.2 HD Map Business

5.4.3 HD Map Solution

5.4.4 HD Map Production

5.4.5 HD Map Development Strategy

5.5 Ledor

5.5.1 Profile

5.5.2 Provide Customized ADAS Map Data Collection Services

5.5.3 Big Data Production Platform

5.5.4 HD Map Data Update

5.5.5 HD Map Service Platform

5.6 eMapgo (EMG)

5.6.1 Profile

5.6.2 HD Map Products

5.6.3 HD Map Production

5.6.4 HD Map Application

5.6.5 HD Map Cloud Platform

5.6.6 Collaboration/Application

5.7 Momenta

5.7.1 Profile

5.7.2 HD Map Technical Route

5.7.3 HD Map Commercial Strategy

5.7.4 Role of HD Map in Mpiot Parking

5.7.5 HD Map Partners

5.8 Heading Data Intelligence

5.8.1 Profile

5.8.2 HD Map Business

5.8.3 HD Map Product Service

5.8.4 HD Map Update

5.9 JD Logistics

5.9.1 Profile

5.9.2 HD Map Business

5.9.3 Production Process of HD Map

5.9.4 Application Scenario of HD Map

5.10 Others

5.10.1 HD Map Business of Jiangsu Zhitu Technology

5.10.2 HD Map Business of Fengtu Technology

5.10.3 Huawei Map

5.10.4 DiTu (Beijing) Technology

5.10.5 Beijing Meida Zhida Technology

5.10.6 ECARX's Layout of HD Map

Foreign Map Providers

5.11 Here

5.11.1 Profile

5.11.2 HD Map Business

5.11.3 HD Live Map

5.11.4 ADAS Map

5.11.5 HD Map Production

5.11.6 HD Map Data Update

5.11.7 Strategic Layout of HD Map

5.11.8 Layout of HD Map in China

5.11.9 Collaboration

5.12 TomTom

5.12.1 Profile

5.12.2 Map Business

5.12.3 HD Map Data Collection

5.12.4 HD Map Production

5.12.5 AutoStream Map Service

5.12.6 Collaboration

5.13 Zenrin

5.13.1 HD Map Business

5.13.2 Partners and Development Plan

5.14 Others

5.14.1 Waymo

5.14.2 Increment P

06 HD Map-related Technology Companies

6.1 Mobileye

6.1.1 HD Map Business

6.1.2 REM Technical Process

6.1.3 REM to Reduce Cost of Map Production and Maintenance

6.1.4 Progress of REM Worldwide

6.2 Dynamic Map Planning

6.2.1 Profile

6.2.2 Dynamic Map

6.3 GEO

6.3.1 Profile

6.3.2 Core Advantages

6.3.3 HD Map Business

6.3.4 Application of HD Map in Logistics

6.4 Horizon

6.4.1 HD Map Business

6.4.2 NavNet Solution and Business Model

6.4.3 Collaboration	6.9.2 Business Layout
6.5 KuanDeng Technology	6.9.3 Three Kinds of Service
6.5.1 Profile	6.9.4 HD Map Business
6.5.2 HD Map Solution	6.10 Ushr
6.5.3 HD Map Solution Feature	6.10.1 Profile
6.6 DeepMap	6.10.2 HD Map Business Progress
6.6.1 Profile	6.11 DeepMotion
6.6.2 Financing and Major Products	6.11.1 Profile
6.6.3 3D HD Map Solution	6.11.2 HD Map Technical Solution
6.6.4 Crowdsourcing Data Fusion Solution	6.11.3 HD Map Feature and Advantages
6.6.5 Commercialization Path of HD Map	6.11.4 L2+ Supported HD Map
6.6.6 Collaboration	6.11.5 Vision HD Positioning Technology Application in Heavy Truck
6.7 Civil Maps	6.12 Mapbox
6.7.1 Profile	6.12.1 Profile
6.7.2 3D Map Solution	6.12.2 HD Map Business
6.7.3 HD Map Production	6.12.3 Cooperation
6.7.4 Major Products	6.13 BrightMap
6.7.5 Collaboration	6.14 Netradyne
6.8 Carmera	6.15 Others
6.8.1 Profile	6.15.1 Mapper.ai
6.8.2 Autonomous Driving 3D Map Solution	6.15.2 Atlatec
6.8.3 Map Data Acquisition	6.15.3 Bosch HD Map System
6.8.4 Collaboration	6.15.4 Dilu Technology
6.9 Wayz.ai	
6.9.1 Profile	

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