

# Terranet

Mangold Insight - Commissioned Research 16 Oct. 2020

**MANGOLD**

## Winning technology on the radar

Mangold has initiated coverage of the technology company Terranet with a buy recommendation and a 12-month forward target price of SEK 2.50. Mangold's view is that Terranet is well positioned to break into the market for lidar technology – optical sensor technology that scans a vehicle's surroundings and measures distances, which can be used in self-driving vehicles. Terranet's Voxelflow technology for advanced driver-assisted systems, is highly competitive and can complement the currently available technologies, radar and lidar.

## A growing market

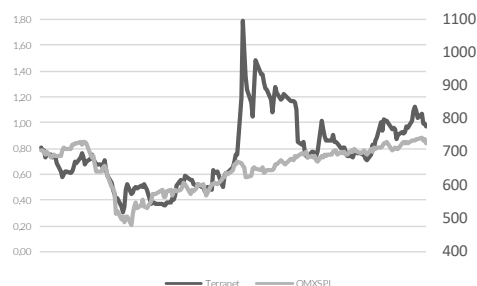
Leading players in the autonomous vehicle market, organisations and the automotive industry are all pushing for the development of advanced driver-assistance systems. Terranet is expected to compete in the market dominated by lidar, the technology used in self-driving vehicles. The market for lidar technology is expected to grow by almost 30 percent on average in the years ahead. Mangold has assumed that Terranet will be able to take a smaller share of this market: 5 percent in a base-case scenario.

## The company's technology can break through – big upside potential

Investment in Terranet entails high risk as there is no guarantee that the automotive industry will adopt Voxelflow technology. At the same time, no other currently available technology reaches the same high level of performance as Voxelflow. Mangold suggest that there is a high probability that a deal will be concluded with a Tier-1 company or semiconductor company, which features prominently in our report. In conducting a sensitivity analysis with both increased and decreased discount rates and adjusted market shares, the upside potential is appealing. In our base-case scenario, we see an upside of beyond 150 percent.

## Information

Target price (SEK)	Buy 2.50
Risk	High
Price (SEK)	0.97
Market cap. (MSEK)	165
Number of shares (M)	169.5
Free float	84.8%
Ticker	TERRNTB
Next report	13 Nov. 2020
Web address	<a href="http://terrannet.se">terrannet.se</a>
Analyst	Jan Glevén



## Share price performance

	1m	3m	12m
TERRNTB	-2,7	-16,4	-20,5
OMXSPI	2,0	7,5	16,5

## Key ratios

	2018	2019	2020E	2021E	2022E
Sales (SEK thous.)	8 635	4 510	10 000	20 000	30 000
EBIT (SEK thous.)	-61717	-42194	-28751	-45026	-47063
Profit before tax (SEK thous.)	-61566	-19619	-18604	-16543	-21370
EPS, adjusted (SEK)	-0,36	-0,12	-0,11	-0,10	-0,13
EV/Sales	20	36	16	12	6
EV/EBITDA	neg	neg	neg	neg	neg
EV/EBIT	neg	neg	neg	neg	neg
P/E	neg	neg	neg	neg	neg

## Ownership structure

	Shares	Capital
Maida Vale Capital	25 159 723	14.8%
Avanza Pension	12 096 002	7.1%
Nordnet Pension	6 177 967	3.6%
Knutsson Holdings	5 949 996	3.5%
Fredrik Olsson	4 374 072	2.6%
Other shareholders	115 745 117	68.3%
<b>Total</b>	<b>169 502 877</b>	<b>100%</b>

# Investment Case

## Winning technology on the radar

Mangold initiates coverage of Terranet with a buy recommendation and a 12-month forward target price of SEK xxx. Terranet's own new technology, Voxelflow, is intended for use in advanced driver-assistance systems in vehicles as a complement to radar and lidar. The company has more projects lined up as well as 5G technology, which may bear fruit over the long term. Mangold's assessment is that it is the Voxelflow technology that represents the greatest value in the company. It is also this technology that the company has invested its resources in developing.

*Target value of SEK xxx - upside of xxx percent*

*Voxelflow technology will be further developed*

## Attractive market

In this report, Mangold has mapped out the market that the company is expected to encounter and examined how different players have chosen to position themselves. Mangold's assessment of the market Terranet is expected to compete in is that it is a growing and highly lucrative market. The company's goal is for Voxelflow to serve as a complement to both radar and lidar, something we believe will generate a lot of interest and provide opportunities for both agreements and collaborations with players in the automotive industry.

*A growing market for Voxelflow*

## Competitive technology

Voxelflow technology offers several advantages over existing technologies such as radar and lidar. It is both cheaper and easier to integrate into a vehicle. Voxelflow's image quality is sharper, and its ability to operate in poor weather conditions is significantly better. The technology is intended to be standard in vehicles that can then be complemented with both lidar and radar.

*The technology complements both radar and lidar*

## Deals and collaboration a likely path forward

It is no secret that major players in the autonomous vehicle market are on the hunt for better technology than lidar has been able to deliver thus far. Several subcontractors that we cover in this report are choosing to develop their own new lidar technology or to buy start-ups as a means to acquire the latest technology. This creates opportunities for new players on the scene, such as Terranet, as there is still a lot of room for improvement in the current lidar and radar technologies. Mangold assesses that it is possible that Terranet will enter into one of these deals and lists potential partners in this report. Any potential deal is likely to raise the company's value significantly, which is not reflected in this report.

*Active player in the sector with a number of deals already concluded...*

*...high probability of a potential deal with Tier-1 company or semiconductor company*

## Heavyweight project partners already attracted to Terranet

Terranet is still in the early stages of its development but has already managed to attract heavyweights, such as the German vehicle manufacturer Daimler, the American entertainment group Disney and the Swedish vehicle subcontractor Haldex. Mangold assesses that Terranet is well positioned to attract more partners.

*Collaboration with Daimler a significant selling point*

## DCF - best valuation tool

In order to arrive at a fair valuation of the company, we have chosen to base our estimates on players in the lidar market, primarily the American lidar company Luminar Tech. Mangold believes that revenue generated by Voxelflow can start coming in 2023 and onwards. Until then, the company has good opportunities to implement additional projects that can bring in revenue until the Voxelflow technology breaks through.

*Revenue from Voxelflow starting in 2023 - several other projects can bear fruit*

# Terranet - Company and management

## About the company:

Terranet develops software for advanced driver-assisted systems (ADAS) and autonomous vehicles. The company's business plan consists of platform development of anti-collision systems within image analysis and signal processing. The company's registered office is in Lund, Sweden and was founded in 2004. The company also has operations in California, Stuttgart and Kiev. The company's operations were previously focused on telecommunications, an area where the company has built the expertise needed to be able to develop software for radio-based positioning systems for the automotive industry. In 2018, the company decided to focus its operations on ADAS (advanced driver-assistance systems), a collective term for electronic systems that assist drivers in driving functions. The company's key customers include Daimler, Haldex and Walt Disney. The company also has a strategic collaboration with AFRY (formerly ÅF).

*Terranet develops technology for advanced driver-assistance systems*

*Customers include Daimler and Disney*

*Collaborates with AFRY*

## Organisation

Pär-Olof Johannesson has been the CEO of the company since 2009. He has a background as an entrepreneur, with 20 years of experience in the telecommunications industry and a number of start-ups. He has previously held senior positions in larger groups such as Flextronics (now Flex), Ericsson and ABB. He has an extensive international contact network in Asia and China. He has also previously been active as a member of Terranet's board.

*CEO with extensive experience and vast international network*

The Chief Technology Officer is entrepreneur Dirk Smits, who is also the inventor of Voxelflow. He was previously at Samsung Electronics and has founded or acted as an advisor to a number of different start-ups. Terranet has signed a licensing agreement with Dirk Smits regarding patents and sales.

*Dirk Smits is the founder of Voxelflow technology*

Christian Larsson is the SVP Product Management for the company. He has experience on the international level in vehicle safety, advanced driver assistance and self-driving cars. He is also responsible for active vehicle safety at Afry (formerly ÅF Pöyry).

*Product manager with international experience*

Andrew Jue is responsible for Strategic Licensing and Sourcing and is based in Silicon Valley in the US. He has previously spent time at the semiconductor company Broadcom, Metta Technology and National Semiconductor.

The CFO of the company is Mattias Larsson, who brings extensive experience from the telecommunications industry. He has previously been at Orbital Systems, Sony and Accenture.

The chairman of the board is Göran Jansson. He is a serial entrepreneur and has extensive experience in electronics and software. He has held a variety of positions within product management, marketing and sales as well as a number of management roles.

*New chairman of the board*

## Other members of the board:

Karolina Bjurehed, IR manager at Volvo Cars Tech Fund with an extensive background in the automotive industry on the international level and in start-ups.

Lars Novak, MSc Computer Science and Technology and development manager at Sinch.

Michel Roig, Senior Vice President and Business Area Manager at Fingerprint Cards. Arne Hansson, BSc Strategic Management & Economics and CEO for Ideon Open.

Christian Rasmusson, lawyer with experience in a number of business transactions.

*Karolina Bjurehed has an extensive international contact network in the automotive industry*

# Terranet - Background

## Background

The automotive industry is on the precipice of a major transformation with the advent of increased automation to prevent accidents. According to figures from the WHO, 1.35 million people die each year as a result of road traffic crashes. Improvements in active safety systems in vehicles are needed to reduce the number of fatalities in road traffic. Terranet is currently developing technology that is expected to play a major role in shaping a future with fewer road traffic crashes in heavily trafficked urban environments. Terranet also has plans to develop a new positioning and collision warning system that will reduce reaction times compared to the capabilities of the currently available systems, which rely primarily on lidar technology. Lidar (Light detection and ranging) relies on differences in laser return times and wavelengths to create 3-D representations. However, in low-light conditions, the differences detected become low and it is difficult to distinguish between objects. Voxelflow outperforms lidar technology and can better determine position, detect and classify objects in low-light conditions.

*Major transformation in the automotive industry to reduce road traffic crashes*

*High performance in Voxelflow*

*See Appendix for more information about the automotive industry*

There are a number of challenges involved in establishing a company as a subcontractor to vehicle manufacturers. The sector has comparatively long sales cycles, and there are very high demands placed on active safety products incorporated in cars. Therefore, Terranet is largely dependent on establishing collaborations and entering into agreements with vehicle manufacturers and subcontractors (see Appendix).

## Agreements and collaborations

The company's business model assumes the company will enter into collaborations and sign contracts and will receive licensing and royalty revenue from vehicle manufacturers and suppliers. Terranet plans to build up a network of automotive manufacturers (OEMs) and suppliers (Tier 1) as well as industry organisations working within active safety. The ultimate goal is for Voxelflow to become standard in vehicles and to be able to bring in licensing revenue. In March of 2020, Terranet was approved as a supplier for Daimler. The company has entered into a collaboration with Daimler in order to further develop its Voxelflow technology. A supply agreement is also in place with the American company Disney Imagineering Research and Development for self-driving technology for their amusement parks. Terranet will work in collaboration with technology consultant Afry (formerly ÅF) to design a new active safety system for the park's attractions and rides. Terranet has completed a feasibility study that was handed over in February of 2020. The company is now waiting for word from Disney regarding the next step in the process, though Disney has been severely impacted by the coronavirus pandemic, which has led to delays.

*Licensing as a revenue model*

*Approved by Daimler*

*Disney looking to collaborate*

Terranet also has an ongoing project with the vehicle subcontractor Haldex. A prototype has been developed that allows the status of braking systems to be monitored through a wireless system. This is a task that is typically done by physically examining the brake system in a repair shop, which is both time consuming and resource intensive. This prototype has been delivered to Haldex for evaluation. The company has another project in motion with AB Volvo and Volvo Cars and LTH in Lund, Sweden that is looking at improving 5G positioning through the use of radio signals. The project is funded by Vinnova. This project is expected to be presented in 2022.

*Haldex evaluates Terranet's technology*

*5G project can bear fruit*

# Terranet - Business Operations

## Business operations

Terranet develops systems for vehicles that assist drivers and prevent road traffic crashes. The company is in the early stages of development with a number of active projects within advanced image processing and anti-collision and positioning technology for the identification of moving objects in hazardous road traffic conditions using 5G technology. The company's core business is software for laser scanning triangulation with efficient sensor technology that can be integrated into vehicles. Terranet's advanced driver-assistance technology can be used for a wide range of vehicles or intelligent transport systems in mines, warehouses and amusement parks. ADAS (advanced driver-assistance systems) is a collective term for electronic systems that assist drivers in driving and parking functions. Positioning is an important part of ADAS systems, where satellite-based positioning technology GNSS (Global Navigation Satellite System) is used. GNSS technology has limitations, as it is unable to perform optimally when satellite signals are blocked. Signals can be blocked in tunnels, parking garages and by tall buildings. Terranet's positioning technology is based on DSRC (Dedicated Short Range Communication), which utilises wireless radio technology that enables high-speed direct communication between vehicles and the surrounding infrastructure to assess distances. This technology can be used to complement GNSS to create a better system.

*Terranet is developing new technology that can lead to a breakthrough in the autonomous vehicle market*

*ADAS - a collective term*

*DSRC - new technology and a better system*

## Voxelflow - competitive new technology

Terranet has focused its efforts on the development of Voxelflow, a positioning technology with three-dimensional image analysis, which can quickly detect and identify objects in the surrounding environment. This technology is intended to be the first serious alternative to lidar that has been adopted by a number of players in the autonomous vehicle market (i.e. self-driving cars). The first prototype of Voxelflow was ready in 2019. Voxelflow then made its debut in 2020 at the CES (Consumer Electronic Show) in the US. A new prototype is in the works and is expected to be shown at Daimler's Startup Autobahn Expo in February of 2021, a forum for showcasing new innovations for vehicle manufacturers. Between the present day and the rollout of the new prototype, the test equipment must first be integrated into a commercial vehicle. Voxelflow is expected to be commercially available by 2023. A new camera sensor is expected to be developed within the next two years with a significant increase in 3D points measured per second and substantially improved resolution, which makes it very attractive in comparison with competing technology.

*Voxelflow prototype now ready - expected to be a finished product in 2023*

*New camera and better resolution make Voxelflow highly competitive*

## TERRANET - VOXELFLOW DEVELOPMENT

	Stage 1	Stage 2	Stage 3	Stage 4
	>	2020	2022	2023
Product stage	Proof of Concept	Early prototype	Prototype	Product
Hardware	Camera system	Event Camera	New Camera sensor 3D	Additions for long range
Scanning		200K points/s	>10M points/s	

Source: Terranet

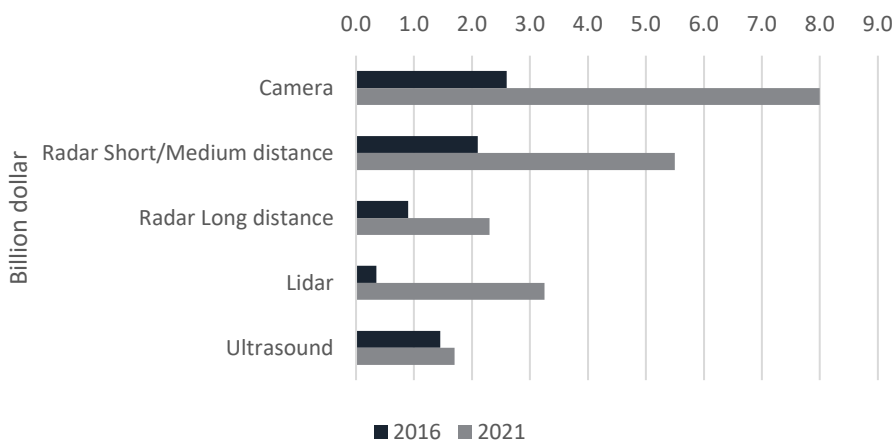
# Terranet - Sensor technology

## Multiple types of sensor technology

Laser sensors are the eyes of the vehicle. Sensors scan the vehicle's surroundings to alert the driver. There are many different types of sensor technologies available on the market. Through the use of cameras, a vehicle monitors traffic and its surroundings by measuring distances. Sensors detect obstacles and send a signal to the steering system so that the vehicle can either manoeuvre or brake. Current technologies used for vehicles include cameras as well as lidar and radar:

*Lidar and radar technology complement each other in the vehicle*

## Global ADAS sensor market



Source: Statista

## Robust and reliable radar

Radar, which stands for radio detection and ranging, relies on radio waves. Radar technology has been around since the 19th century but only became widespread in the 1930s when it was used by the British military to detect enemy aircraft. Radar has recently been used in self-driving cars for automatic emergency braking in heavy traffic and when reversing vehicles. Unlike lidar, technology that relies on radio waves is reliable in inhospitable weather conditions. Radar technology is also significantly less expensive than lidar and easier for vehicle manufacturers to design into vehicles. The disadvantages are poorer accuracy and lower resolution than lidar. Lidar sensors also have limited range, and the signal is blocked by walls or other vehicles. Radar has several proponents in the automotive industry. Most notably, the American electric car manufacturer Tesla has built its own camera technology based on radar. The technology is also boosted by BMW, Daimler and Volkswagen, which use the technology in their autonomous vehicles.

*Radar has its limitations - but has a high-profile backer in Tesla*

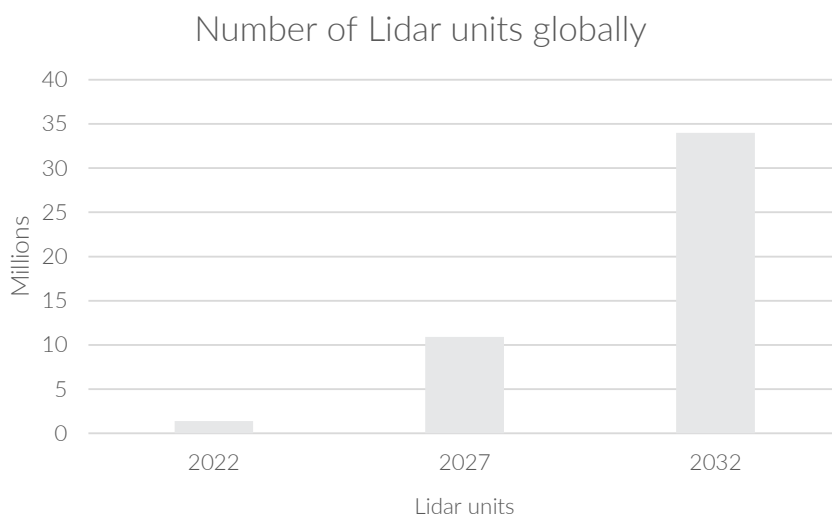
# Terranet - Sensor technology

## Lidar - expensive but accurate

Lidar is an acronym for light detection and ranging. Lidar has been around since the 1960s and has been used to measure distances in a variety of applications. The technology has become widely accepted in the automotive industry, especially in autonomous vehicles. This technology uses near infrared light to image objects and create a 3-D map of the surrounding environment. Lidar sensors sweep around the environment 360 degrees using laser pulses to scan. The laser pulses bounce back from targets, and the time it takes for the light to return is measured. This allows the vehicle to determine the distance to the target. Most vehicle manufacturers (Waymo, GM, Ford and Volvo, etc.) and subcontractors (Velodyne and Veoneer) who intend to develop autonomous vehicles use lidar.

*Lidar - scans and measures distances*

*Detects objects in the vehicle's surroundings*



Source: Statista

## Advantage Voxelflow

Even though lidar is now widely accepted among vehicle manufacturers, the technology has its drawbacks. The sensors are expensive due to the many moving parts in a vehicle and are rather unwieldy from a design standpoint. Lidar's ability to function in poor weather conditions is another drawback. Lidar systems are unable to generate precise images in dust, fog or snow.

*The benefit of complementary technology for both lidar and radar speaks for Voxelflow*

Voxelflow's image resolution is expected to be significantly better than the limited resolution offered by lidar systems. It is also less expensive and is expected to be easier to integrate into vehicles. The system consists of a laser scanner and three cameras that detect the reflected laser beam. In contrast to lidar technology, the light beam is continuously reflected from targets. The company intends for Voxelflow technology to be standard in vehicles that can then be supplemented with other collision avoidance sensors, such as radar and lidar.

*Voxelflow- less costly and easier to integrate than lidar*

# Terranet - Market

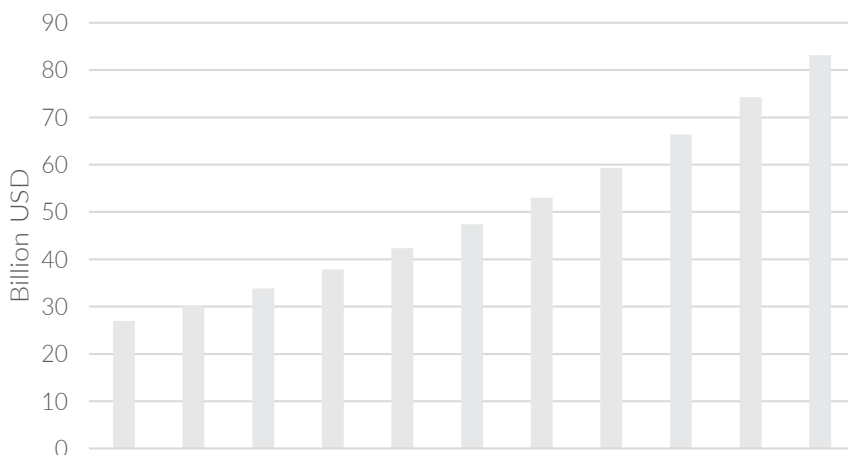
## Autonomous vehicle systems

Autonomous vehicle systems represent a market that is expected to see significant growth. The expectation of growth is largely based on pressure coming from national supervisory bodies and new regulations as well as organisations such as Euro NCAP. The purpose of seeking expanded technical capabilities in autonomous systems and autonomous cars is to reduce the number of road traffic crashes. According to figures from the WHO (World Health Organization), 1.35 million people die each year as a result of road traffic crashes. Human factors account for 94 percent of all road traffic crashes. The Swedish Transport Administration has a vision (Vision Zero) that is based on the fundamental idea that no one should be killed or seriously injured through a road accident. Mangold bases its report on the market for ADAS (Global Advanced Driving Assistance System). The ADAS market is expected to increase by 12 percent on average per year (CAGR) from 2020 to 2030. According to estimates by Markets and Markets Research, the overall value of this market is expected to reach USD 27 billion by 2020 and is expected to increase to USD 83 billion by 2030.

*The purpose of systems that use radar and lidar technologies is to reduce the number of road traffic crashes*

*The use of driver assistance technologies is expected to increase*

ADAS global market



Source: Markets and Market

The market for ADAS consists of a number of segments that overlap with lidar technology. These segments are relevant as TAM (Total Addressable Market), i.e. total market demand for a product or service for Terranet's VoxelFlow. According to a report by Precedence Research, the lidar market is expected to reach USD 3.2 billion dollars in 2027. The market growth rate is expected to reach 28.4 percent on average per year from 2020 through 2027 (CAGR).

*Lidar market a relevant market for Terranet*

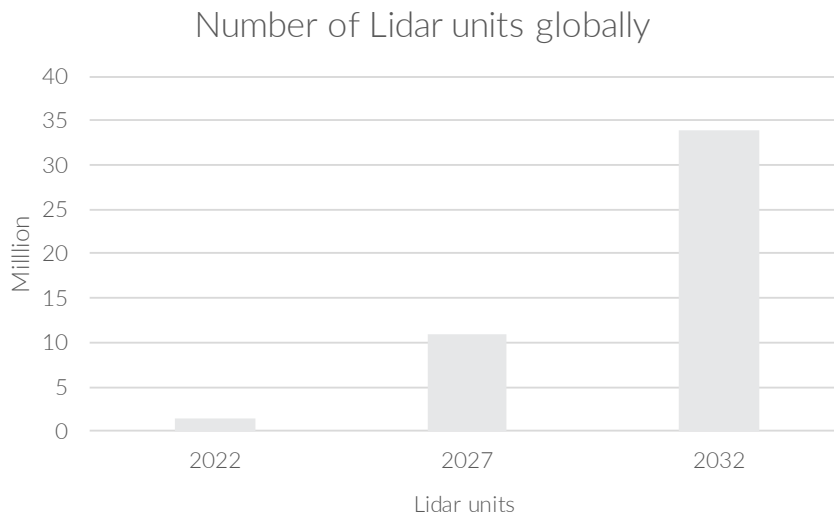


# Terranet - Market

## Players using lidar technology

Waymo, a company in the Alphabet Group (Google), has historically been one of the dominant players in the autonomous vehicle market. When Waymo put its support behind lidar technology, it led to a wave of new start-up companies. Waymo initially used technology from Velodyne, but has since developed its own lidar technology (Laser Bear Honeycomb). This is the technology Waymo intends to license for use in other industries, such as the mining and space industries. Growth is expected to be high for lidar companies. According to Statista, the number of lidar units is expected to increase significantly in the coming years, reaching over 30 million units in 2032.

*Waymo has developed its own Lidar technology*



Source: Statista

The majority of market players have opted to purchase lidar and camera technology through other companies. It is also expected that further consolidation will occur among players working with this technology. This is due to the fact that there are still a large number of companies introducing new technology in the area. Major players in the autonomous vehicle market, such as GM Cruise (General Motors) and Argo AI (partially owned by Ford and Volkswagen), have previously obtained their lidar technology through acquisitions.

*Lidar technology motivates acquisitions*

## MANGOLD - ACQUIRED LIDAR TECHNOLOGY

Argo	Princeton/Lightwave
GM-Cruise	Strobe
Aurora	Blackmore
Aptiv (Delphi)	LedderTech/Innoviz/Quanergy

Source: The company's website

# Terranet - Market cont.

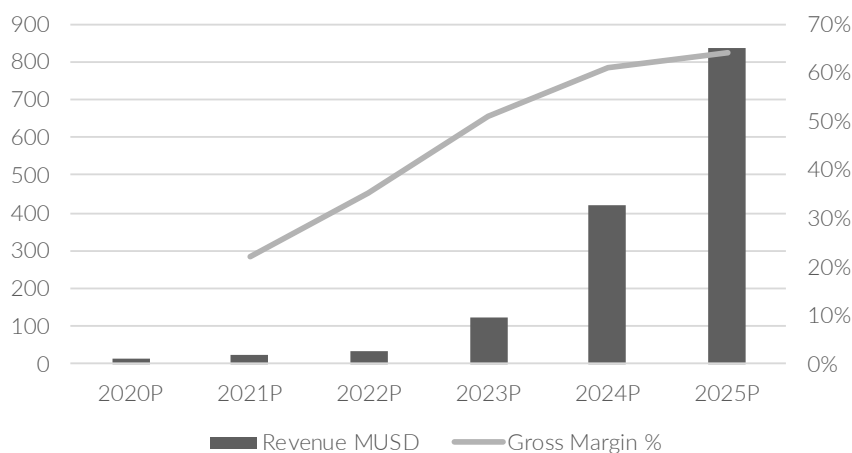
## Lidar companies to Nasdaq

A major player in lidar technology is the American company Luminar. The company was founded in 2012 as a start-up to develop a new type of lidar technology that can be integrated into autonomous vehicles. Its lidar sensor is considered to be a high performance sensor with a long range, something that is important if the technology is to be used for autonomous driving. Volvo Cars has invested in Luminar. The company's technology is expected to be in Volvo cars starting in 2022. Luminar will be listed on Nasdaq and is expected to have a market valuation of USD 3.4 billion.

*Luminar - a billion dollar company on the way to Nasdaq*

*Collaboration with Volvo*

Prognoser Luminar



Source: Luminartech

The American lidar company Velodyne Lidar is a spin-off from its parent company Velodyne, which took place in 2016. The deal was backed by both Ford, which owns 7.6 percent of the company, and Baidu. Velodyne was listed on Nasdaq in the autumn of 2020 via a reverse merger with Graf Industrial Corp. The company's market value amounts to just under USD 3 billion. Its revenue is predicted to increase from USD 100 million in 2019 to USD 685 million in 2024.

*Velodyne Lidar - recently listed on Nasdaq*

Ouster, another American company, recently raised USD 42 million for product development. The company's lidar technology is expected to be both cheaper and easier to integrate than the competition's technology. The company offers a range of different models and its strategy includes turning to other players outside the automotive industry.

*Ouster - a niche player with a broad range of applications for lidar*

The start-up Aeva was founded in 2017 by former Apple engineers with the aim of improving sensor systems and lidar, especially for autonomous cars. The company works with the German subcontractor ZF and is also backed by Porsche, which is a part of the Volkswagen Group. ZF also holds a 40 percent stake in German Ibeo Automotive System, which develops and produces lidar technology.

*New lidar project by former Apple engineers*

# Terranet - Market cont.

German subcontractor Bosch (Tier 1) has developed its own lidar technology that will function both at long distances (motorways) and in the city centre (short distances). The company's lidar system has been launched as a low-cost alternative and made its debut at the Consumer Electronics Show (CES).

*Bosch has developed its own lidar system ...*

French subcontractor Valeo has developed its own lidar technology for the mass market. In 2019, the company took in orders worth EUR 500 million from four manufacturers in the automotive industry (OEMs).

*...as has Valeo*



Source: Pitchbook

## Major deals and collaborations

Major deals that have been concluded recently include Volkswagen, which has committed to buying camera technology from the German company Hella. This is part of their Mobile Vision business, aimed at coordinating operations within the group for the various car brands that will now be included in Car Software Org of Volkswagen. This business area will make investments of EUR 7 billion over the next few years.

*Volkswagen makes an investment and commits to buying technology from German company Hella*

# Terranet - Market cont.

## Mega deals in the autonomous vehicle market

Within the autonomous vehicle market, there have been a number of major deals that have come to dominate the sector. This occurred between 2016-2017 when interest in self-driving vehicles reached a fever pitch. According to reports from the Gartner Group, this is a relatively standard process when a major shift in a new technology takes place. Some of the high-profile deals that have proven to be significant for Terranet and the transition from mobile to mobility are Intel's acquisition of Mobileye and Delphi's (now Aptiv) deal with Nutonomy.

*Tremendous interest in autonomous vehicles*

### MANGOLD - BUSINESS IN AUTONOMOUS VEHICLES

Company	Target Company	USD million	Business Operations	Year
GM	Cruise	1000	Autonomous vehicles for urban environments (maas)	2016
Uber	Otto	680	Start-up with technology for autonomous vehicles	2016
Intel	Mobileye	15000	AI technology for autonomous vehicles	2017
Aptiv	Nutonomy	450	Autonomous vehicles, software	2017
Amazon	Zoox	1000	Autonomous vehicles for urban environments (maas)	2020

Source: Techcrunch, The Verge, CNN

## Major deals point the way - potential partners

The semiconductor company Intel acquired Israeli company Mobileye for USD 15 billion to bring in expertise in the automotive industry and to acquire the company's software, which was needed to develop autonomous vehicles. Through Mobileye's contact network, an agreement has been reached with BMW and for the development of electric and autonomous cars, the iNEXT platform. Intel's strengthened positioning has led to similar additional deals.

*iNEXT - a collaboration with Intel and Mobileye*

The car manufacturer Daimler has initiated a collaboration with the American semiconductor company Nvidia through its Mercedes-Benz brand with a vision to develop advanced autonomous cars with AI technology (artificial intelligence). The semiconductor company Qualcomm has long sought to acquire NXP Semiconductors, which develops semiconductors for the automotive industry and within the IoT (internet of things). Qualcomm eventually had to give up on the deal, as it was blocked by the Chinese government.

*Daimler and Nvidia enter into collaboration*

Aptiv, formerly Delphi with its origins in GM, is among the Tier-1 companies worth noting here. They have a history in the development of radar products as well as the manufacture of self-driving cars. Aptiv acquired Nutonomy to gain access to the company's autonomous vehicle technology. In the table below, we list a number of companies that represent potential partners for Terranet.

*Aptiv active in autonomous vehicle market*

### MANGOLD - POTENTIAL PARTNERS

Semiconductor company ASIC-providers	Tier 1 company
Intel	Veoneer
Nvidia	Continental
Qualcomm	Denso
NPX Semiconductors	Aptiv
Infineon	Bosch
Xilinx	Valeo

Source: Mangold Insight

*Veoneer has begun collaborating with the American technology company Qualcomm in AD and ADAS*

# Terranet - Estimates

## Estimates

In this report, Mangold has assumed that Terranet will realise its vision of having Voxelflow as a complementary technology in semi-autonomous vehicles and will thus break into the lidar market. In our estimates, we have assumed that the company will close a licensing deal and will receive royalties amounting to 50 percent of all revenue. The Total Addressable Market (TAM) is based on development within the lidar market. Mangold has assumed that Terranet will take a 5 percent market share in a base-case scenario. Mangold also assessed that Terranet has the potential to bring in revenue from other forms of collaboration similar to those the company currently has with Disney and Haldex. The company is expected to need a 2-3 year development period before Voxelflow can enter into production and be used as a finished product. Below, we have shown the expected development in sales for Terranet from 2020 to 2030.

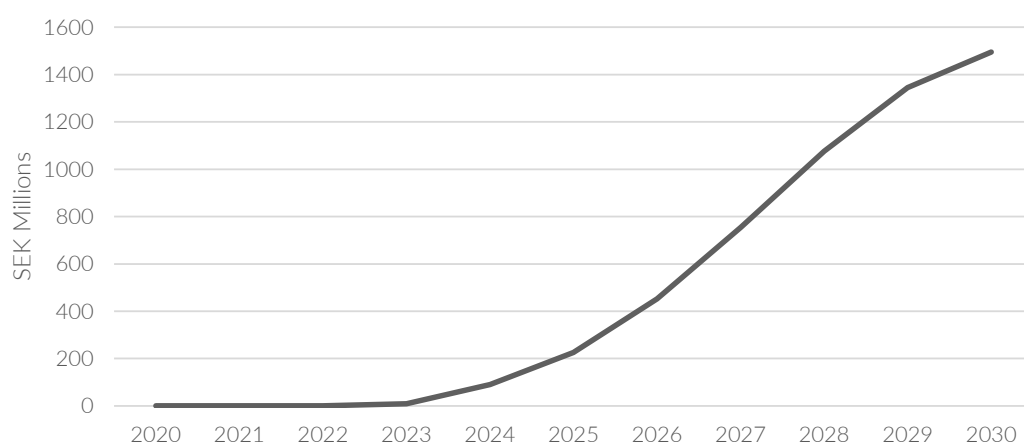
*Terranet is expected to take a small share of the lidar market*

## TERRANET - ESTIMATES

SEK million	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Voxelflow	0	0	0	9	91	227	454	756	1080	1350	1500
Other revenue	10	20	30	40	50	10	10	10	10	10	10
Total	10	20	30	49	141	237	464	766	1090	1360	1510

Source: Mangold Insight

Voxelflow Sales 2020 - 2030



Source: Mangold Insight

We have used the estimates for American lidar company Luminartech in our estimate model when calculating the gross margin and EBITDA margin. We assess that the company can achieve a gross margin of 60 percent and an EBITDA margin of 50 percent at the end of the period. However, we have chosen to calculate using lower margins.

*EBITDA margins of 50 percent are within reach at the end of the estimate period*

## Raising capital

Terranet carried out a new share issue, raising SEK 40 million, which was oversubscribed by more than 200 percent. In addition to the share issue, a warrant program was also adopted with three redemption opportunities through next autumn. This has the potential to raise up to an additional SEK 120 million. The company needs capital to continue the development of Voxelflow.

*The company needs to raise capital to develop Voxelflow*

# Terranet - Valuation

## DCF valuation

Given that the company will see neither sales nor revenue over the short term, we believe that a DCF valuation is the best tool for arriving at an accurate valuation of the company. The comparable companies that are suitable for use in this valuation are in a later phase in the development of their technology, and in several cases, these companies are valued at several billion dollars (e.g. Luminartech).

*A DCF valuation is the best tool to generate a fair value*

We have opted to use an estimate period of 10 years in our DCF, and we have chosen to discount future cash flows with a high discount rate. Mangold has given additional consideration for the company's small size, i.e. below SEK 100 million and revenues and profitability 2-3 years away. This is subject to change as we have previously seen both acquisitions and early investments in companies with similar technology. i.e. the type of autonomous vehicle technology that Terranet is developing.

*Break-even and profitability from 2023*

## TERRANET - DCF

(SEK thous.)	2020E	2021E	2022E	2023E	2024E	2025E	2026E...	2030E
EBIT	-28 751	-45 026	-47 063	-43 169	23 247	57 066	136 610	319 176
Free Cashflow	-35 470	-47 386	-49 040	-43 541	16 344	42 181	98 137	236 960
Terminal value								324 467

Assumptions	Disc Rate	Growth	Tax
	16%	3%	22%
Target price			
Enterprise value	424 283		
Equity value	423 588		
Target price per share	2.50		

Source: Mangold Insight

## Sensitivity analysis

Given that the sensitivity in estimating market share and discount rate affects the fair value, a sensitivity analysis is carried out. In its base-case scenario, Mangold has chosen to use a discount rate of 16 percent and a market share of 5 percent. In our bull-case scenario, the market share increases to 6 percent, and in a bear-case scenario, to 4 percent with varying discount rates.

## TERRANET - SENSITIVITY ANALYSIS

Discount Rate %	4%	Base case	6%
15%	1.99	2.78	3.58
16%	1.77	2.50	3.23
17%	1.58	2.30	2.92

*Upside varies from 63 to 370 percent*

Source: Mangold Insight

# SWOT Analysis Terranet

## Strengths

- Product with unique technology
- Inventor of Voxelflow part of the company

## Weaknesses

- Balance Sheet
- Dependent on key persons

## Opportunities

- Need for new technology
- Collaboration with OEMs and Tier 1 companies

## Threats

- Lidar technology is evolving
- Vehicle manufacturers are developing their own technology

# Appendix - Autonomous vehicles

## Autonomous vehicles

The market for autonomous vehicles, i.e. self-driving vehicles, is expected to have an estimated value of around USD 23 billion in 2020 and increase to USD 37 billion by 2023. The market growth rate is expected to be almost 17 percent on average in the period leading up to 2023.

*High rate of growth is expected for autonomous vehicles between 2020-2023*

The development of self-driving vehicles has taken longer than companies in the sector initially expected. This is due, in part, to problems that have arisen along the way. One of the most widely publicised and debated incidents was when a pedestrian was involved in an accident with an Uber vehicle in Arizona in the US and subsequently died. Another notable case was the discovery that Tesla's security system was potentially vulnerable to hackers.

*Problems with autonomous vehicles*

Self-driving cars still have certain challenges to overcome, the issue of liability being one of the biggest. Another issue is that the technology is still expensive and the general public has not completely accepted the idea of autonomous cars. The advantages offered by autonomous cars are that the technology is expected to reduce the number of road traffic crashes and that it can be used to improve public transport in the future.

*Challenges remain - better outlook in the long term*

Driver-assistance systems are an important part of making self-driving vehicles viable. It is also the first level of self-driving vehicles. Five levels are used to describe the development of self-driving cars.

*Different levels before the self-driving vehicle level is reached*

## MANGOLD - DEGREES OF SELF-DRIVING VEHICLES

Driver Assistance	Provides the driver with assistance to determine distance or speed, lanes or parking assistance
Partial Automation	Assistance provided when steering or braking
High Driving Automation	The vehicle can drive itself under shorter periods
Complete Automation	A driver can take over but does not necessarily have to do so
Self-driving cars	The vehicle manages completely without a driver

Source: Volkswagen



# Appendix - Vehicle market

## The vehicle market

The vehicle market consists of commercial vehicles and passenger cars. Sales for passenger cars are expected to reach 60 million units in 2020. This represents a decrease compared to 2017 when the number of cars sold amounted to almost 80 million. The growth in the number of passenger cars, so-called LVP (Global Light Vehicle Production), is expected to amount to an average of 3-4 percent per year from 2020 to 2026. According to IHS Markit, growth ceilings have been an average of 3.6 percent from 2002 to 2016

*The automotive market is expected to grow by 3-4 percent*

The automotive industry is fragmented with clear product specialisation. Special regulations impose stringent demands on subcontractors. In order to manufacture a vehicle, the end-product manufacturer uses subcontractors in a supply chain that can be divided into different levels. Dealerships are closest to the customer and are where a customer goes to purchase a car. But there are exceptions in this supply chain, for example, the electric car manufacturer Tesla has chosen to only sell directly to consumers. The dealership is thus omitted from the production chain.

*Stringent requirements placed on subcontractors in the automotive industry*

## The automotive industry supply chain

OEM (original equipment manufacturing) - in the automotive industry, consists of car manufacturers. They sit at the top of what can be visualised as a pyramid. OEMs design and market vehicles. OEMs assemble the car and, to a certain extent, manufacture parts. Just below OEMS in the pyramid are the subcontractors who fall into Tier 1. They have a strong connection to the car manufacturers. Tier 1 companies supply OEMs with products specifically designed for vehicles.

*OEMs, Tier1 and Tier2 are part of the automotive industry's production chain*

The Tier 2 company, one step below Tier 1, is a smaller company that supplies Tier 1 with specific products, e.g. semiconductor components.

Tier 3 companies in the automotive industry consist of raw material companies and can supply all parts of the chain with, e.g. metals and plastics.

## MANGOLD - THE TIERSYSTEM

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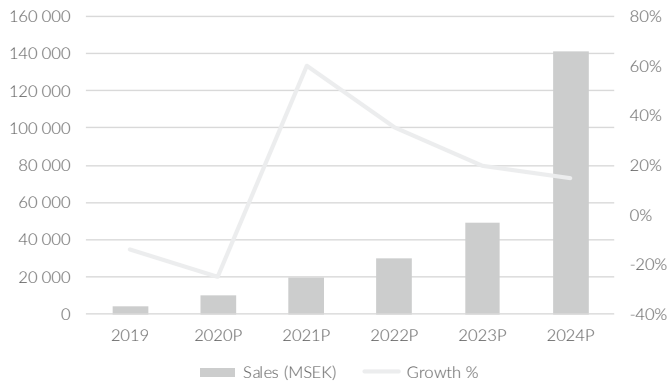
OEM	Tesla, Toyota, GM, Volkswagen
Tier 1	Bosch, Denso, Continental, ZF Friedrichshafen, Magna
Tier 2	Intel, Nvidia, technology companies in the autonomous vehicle market

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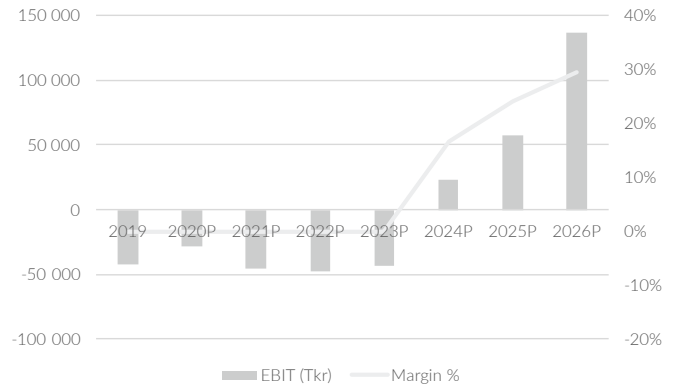
Source: ACEA, Piagroup, Amatech

# Terranet - Appendix Diagrams

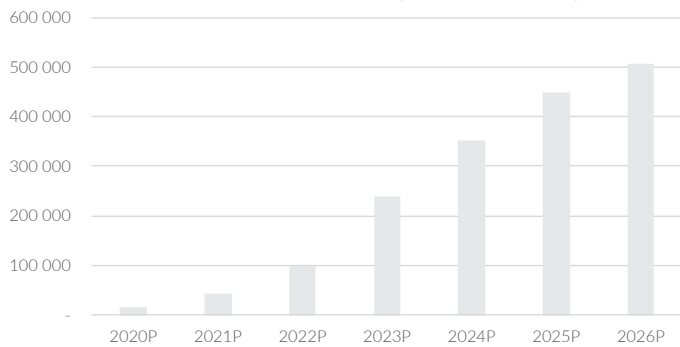
Terranet - Sales and Growth



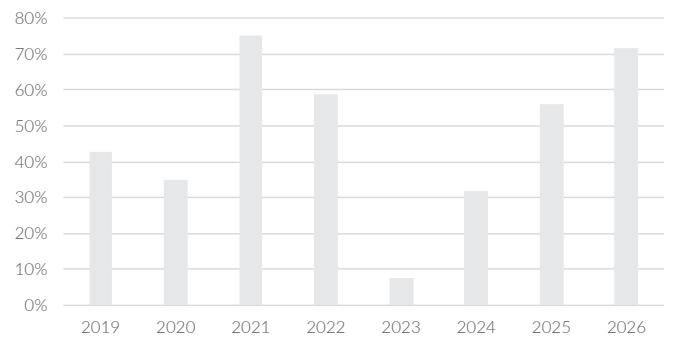
Terranet - EBIT and margin



Terranet - Free Cashflow (SEK Thousands)



Terranet - Equity/Asset Ratio



# Income Statement & Balance Sheet

<b>Income statement (SEK thous.)</b>	<b>2 018</b>	<b>2 019</b>	<b>2020E</b>	<b>2021E</b>	<b>2022E</b>	<b>2023E</b>	<b>2024E</b>	<b>2025E</b>
Sales	8 635	4 510	10 000	20 000	30 000	49 144	141 443	238 608
Cost of goods sold	0	0	-4 500	-9 000	-13 500	-22 115	-63 649	-107 374
Gross profit	8 635	4 510	5 500	11 000	16 500	27 029	77 794	131 234
Gross margin	100.0%	100.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%
Personnel costs	-24 951	-16 555	-12 000	-14 400	-16 800	-19 200	-24 000	-24 000
Other operating costs	-24 080	-20 469	-21 000	-40 000	-45 000	-49 144	-28 289	-47 722
Depreciations	-21 321	-9 680	-1 251	-1 626	-1 763	-1 887	-1 998	-1 799
Operating profit/loss	-61 717	-42 194	-28 751	-45 026	-47 063	-43 202	23 507	57 714
Operating margin							17%	24%
Net interest income/expense	151	-4 482	-4 906	-9 679	-6 453	-3 226	-1 613	-968
Profit after net financial items	-61 566	-46 676	-33 657	-54 705	-53 516	-46 428	21 894	56 746
Taxes	0	0	0	0	0	0	-4 817	-12 484
Net profit	-61 566	-46 676	-33 657	-54 705	-53 516	-46 428	17 077	44 262
<b>Balance Sheet</b>	<b>2 018</b>	<b>2 019</b>	<b>2020E</b>	<b>2021E</b>	<b>2022E</b>	<b>2023E</b>	<b>2024E</b>	<b>2025E</b>
<b>Assets</b>								
Cash & bank balances	11 231	11 569	31 194	114 128	58 635	11 831	26 734	68 403
Accounts receivable	3 124	1 050	1 233	2 466	3 699	4 039	11 625	19 612
Inventory	0	0	740	1 233	1 479	1 818	5 231	8 825
Fixed assets	475	1 224	1 224	1 224	1 224	1 224	1 224	1 224
Total assets	14 425	12 511	16 260	17 634	18 871	19 983	17 985	16 187
	29 255	26 354	50 650	136 685	83 908	38 896	62 800	114 250
<b>Liabilities</b>								
Accounts payable	<b>2 334</b>	<b>2 787</b>	<b>740</b>	<b>1 479</b>	<b>2 219</b>	<b>3 635</b>	<b>10 463</b>	<b>17 650</b>
Liabilities	4 116	12 264	32 264	32 264	32 264	32 264	32 264	32 264
Total liabilities	6 450	15 051	33 004	33 743	34 483	35 899	42 727	49 914
<b>Shareholders equity</b>								
Restricted equity	24 213	50 503	90 503	230 503	230 503	230 503	230 503	230 503
Non-restricted equity	-1 408	-39 200	-72 857	-127 562	-181 078	-227 506	-210 430	-166 167
Total equity	22 805	11 303	17 646	102 941	49 425	2 997	20 073	64 336
Total equity and liabilities	29 255	26 354	50 650	136 685	83 908	38 896	62 800	114 250

Source: Mangold Insight

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Buy – an upside in the stock of at least 20 per cent

Increase – an upside in the stock of 10-20 per cent

Neutral – an upside/downside in the stock of 0 to 10 per cent

Decrease – a downside in the stock of 10-20 per cent

Sell – a downside in the stock of at least 20 per cent