Towards a European Leader in Wind Remote Sensing: Leosphere & Vaisala

Why it makes sense: market positioning and numbers
Lidar technology: Fields of application

- Wind power
- Weather & climate
- Aviation weather
- Air quality & industrial risk
85% of the Leosphere installed base. Where we feel closest to the industry
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WIND POWER

WEATHER & CLIMATE

AVIATION WEATHER

AIR QUALITY & INDUSTRIAL RISK
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Vaisala has considerable presence and track record. Leosphere is new but growing fast in windshear and wake vortex.

- Wind Power
- Weather & Climate
- Aviation Weather
- Air Quality & Industrial Risk
Lidar technology: Fields of application

85% of the Leosphere installed base and where we are most comfortable. Vaisala complementary in terms of technology and footprint.

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Leosphere in key figures

**The Company**

- **Industrial Capacity**
  - >300 Lidar/Year
- **Turnover (2017)**
  - >27,5 M€
- **Employees**
  - >120

**Global presence**

- **Global presence**
  - >1200+ Lidar in 50+ Countries
- **Worldwide partners**
  - >50+
- **Service Centers**
  - 4

**Investment**

- >25M€ invested in R&D last 5 years
...and Vaisala

Employs 1600 professionals worldwide

- EMEA 70%
- Americas 22%
- APAC 9%

Has over 30 offices in 17 countries

- 37% of Vaisala people work outside of Finland

2017 net sales 332.6 million euros

- EMEA 32%
- Americas 38%
- APAC 29%

2017 R&D investments were 11.9% of net sales

- 20% of employees work in R&D activities

Committed to using 100% renewable electricity by 2020

Serves customers in over 150 countries annually
13x the people

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Same R&D focus

Same passion about the environment

11/12/2018
Leosphere brings the complete range of Lidar systems

**WINDCUBE**

Vertical Profiler Lidar

- Ranges: 40 to 200+ meters
- 12 user defined range gates
- Speed Accuracy: 0.1 m/s
- Buoy version

**WINDCUBE**

360° Long Range Scanning Lidar

- Ranges: 3km / 6km / 10km
- Up to 320 range gates
- Speed Accuracy: 0.1 m/s
- Configurable scanning patterns

**WIND IRIS**

Turbine-mounted Lidar

- Range: 50 to 450+ meters
- 10 user defined range gates
- Speed Accuracy: 0.1 m/s
- Hub Height measurement

**WIND IRIS**

Feed Forward Turbine Control Lidar

- Range: 50 to 200+ meters
- 10 user defined range gates
- Integrated to turbine control system

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**GROUND BASED**

**NACELLE MOUNTED**
More complementary than competitive with Sodar according to DNV

**SODAR – Acoustic based remote sensor**
- **Advantages**
  - Low power requirements;
  - Inexpensive;
  - Portable and easy to dispatch without permits.
- **Disadvantages**
  - Potential for echo interactions with trees/structures;
  - Possible insect or background noise interference;
  - Cannot obtain accurate measurements when precipitation is present;
  - Limitations associated with volume versus point averaging;
  - Turbulence and gust wind speed measurements;
  - Cannot site SODAR directly next to a met mast.

**LIDAR – Laser based remote sensor**
- **Advantages**
  - Measures valid data in light to moderate precipitation events;
  - High data recovery, even at upper heights;
  - Portable and easy to dispatch without permits.
- **Disadvantages**
  - Systems contain delicate components;
  - Relatively high initial cost (currently);
  - May require a special power system for remote applications;
  - Limitations associated with volume versus point averaging;
  - Turbulence and gust wind speed measurements.

Source: 2016_DNVGL_Remote sensing. The potential value of remote sensing devices in the development and financing of wind farm projects
And according to us after some initial discussions

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<td>Low aerosols / particulates</td>
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<td>Frequent low clouds, fog and mist</td>
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<td>Higher heights: esp. above 140m</td>
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<td>Security (theft/vandalism) concerns</td>
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<td>Heavy snow conditions</td>
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<td>Remote + extended extreme Cold</td>
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