













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

Why it makes sense: market positioning and numbers













85% of the Leosphere installed base. Where we feel closest to the industry









WIND POWER



WEATHER & CLIMATE



AVIATION WEATHER







85% of the Leosphere installed base. Where we feel closest to the industry Vaisala is #1 in operational weather networks. Leosphere primarily in research







WIND POWER



WEATHER & CLIMATE



AVIATION WEATHER







85% of the Leosphere installed base. Where we feel closest to the industry Vaisala is #1 in operational weather networks. Leosphere primarily in research Vaisala has considerable presence and track record. Leosphere is new but growing fast in windshear and wake vortex





WIND POWER



WEATHER & CLIMATE



AVIATION WEATHER







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

Vaisala is #1 in operational weather networks. Leosphere primarily in research Vaisala has considerable presence and track record. Leosphere brings Lidar technology to complement existing offerings Vaisala has considerable presence and track record. Leosphere brings Lidar technology to complement existing offerings



WIND POWER



WEATHER & CLIMATE



AVIATION WEATHER











#### **4** Service Centers









offices



in

**37%** of Vaisala people work outside of Finland

17

countries

Serves customers in over 1500 countries

annually

2017 net sales



2017 R&D

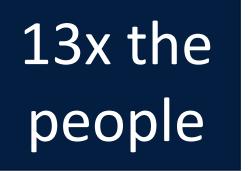
of net

sales

investments were

of employees work in R&D activities







offices

in



**37%** of Vaisala people work outside of Finland

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2017 R&D

investments were

9% of w

of net sales 20% of employees work in R&D activities







## 28 more offices in 15 more countries



annually

#### 2017 net sales



sphere

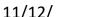
#### 2017 R&D

investments were

of net sales









## 28 more offices in 15 more countries

#### Serving customers in 98 more countries

#### 2017 net sales



#### 2017 R&D

investments were

11.9,

of net sales 20% of employees work in R&D activities







## 28 more offices in 15 more countries

#### Serving customers in 98 more countries

#### 11x the turnover

2017 R&D

investments were

11.9%

of net sales of employees work in R&D activities







#### 28 more offices in 15 more countries

#### Serving customers in 98 more countries

#### 11x the turnover

#### Same R&D focus

Committed to using





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## 28 more offices in 15 more countries

#### Serving customers in 98 more countries

#### 11x the turnover

#### Same R&D focus

# Same passion about the environment



# 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

#### **GROUND BASED**

#### NACELLE MOUNTED





#### More complementary than competitive with Sodar according to DNV

#### SODAR – Acoustic based remote sensor

- = SOund Detection And Ranging
- 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.

# D all

#### LIDAR – Laser based remote sensor

- = LIght Detection And Ranging
- 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

RSD Use Cases / Requirements	SODAR	LIDAR
Near residences		Х
Near Turbines		Х
High atmospheric absorption		Х
Low aerosols / particulates	Х	
Frequent low clouds, fog and mist	Х	
Customer just prefers LiDAR		Х
Higher heights: esp. above 140m		Х
Security (theft/vandalism) concerns	Х	
Ambient Noise		Х
Offshore		Х
Rain		Х
IEC Power Performance Test		Х
Offshore Met Reference Station		Х
Nacelle mounted turbine control		х
Turbine Yaw Alignment		Х
Turbine Control		Х
Heavy snow conditions	Х	
Remote + extended extreme Cold	Х	





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