Data Logging

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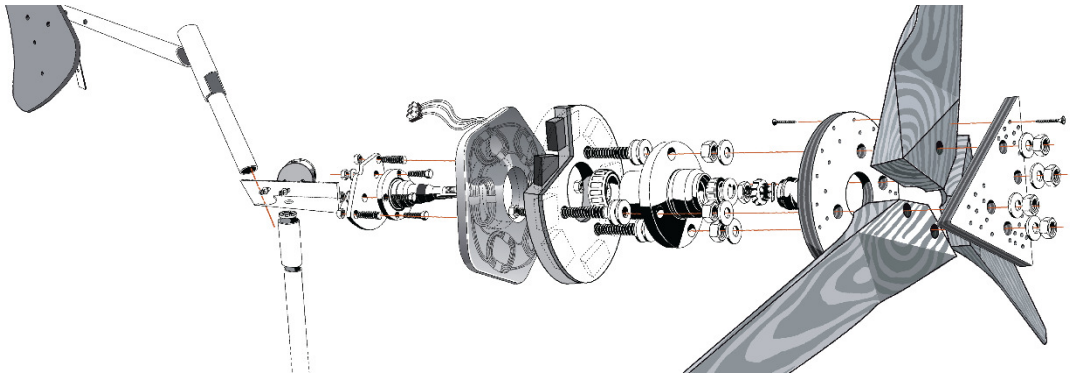
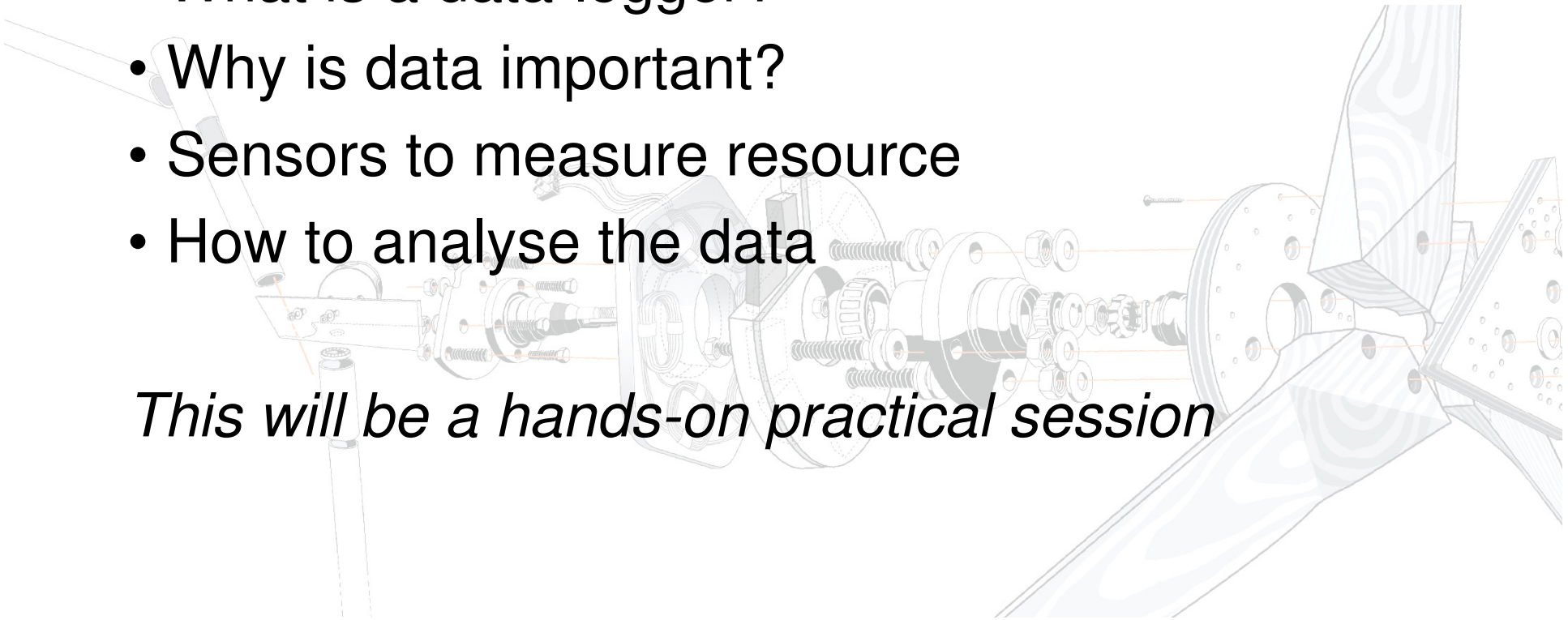
Renewable Energy Innovation



Overview

- What is a data-logger?
- Why is data important?
- Sensors to measure resource
- How to analyse the data

This will be a hands-on practical session



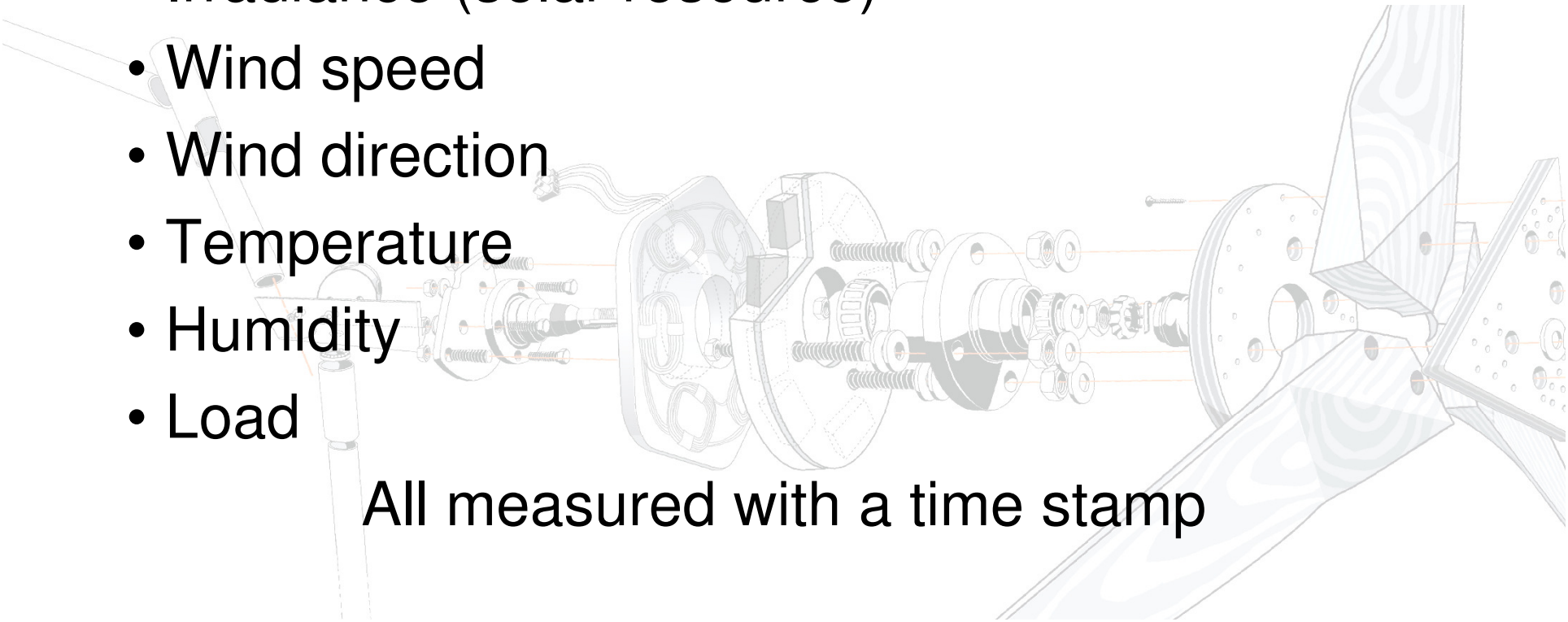
Renewable Energy Assessment

- Renewable energy resources are variable and location specific
- Knowing the real local resource ensures more accurate system design
- Use sensors and a data-logging system to record local data

Parameters to measure

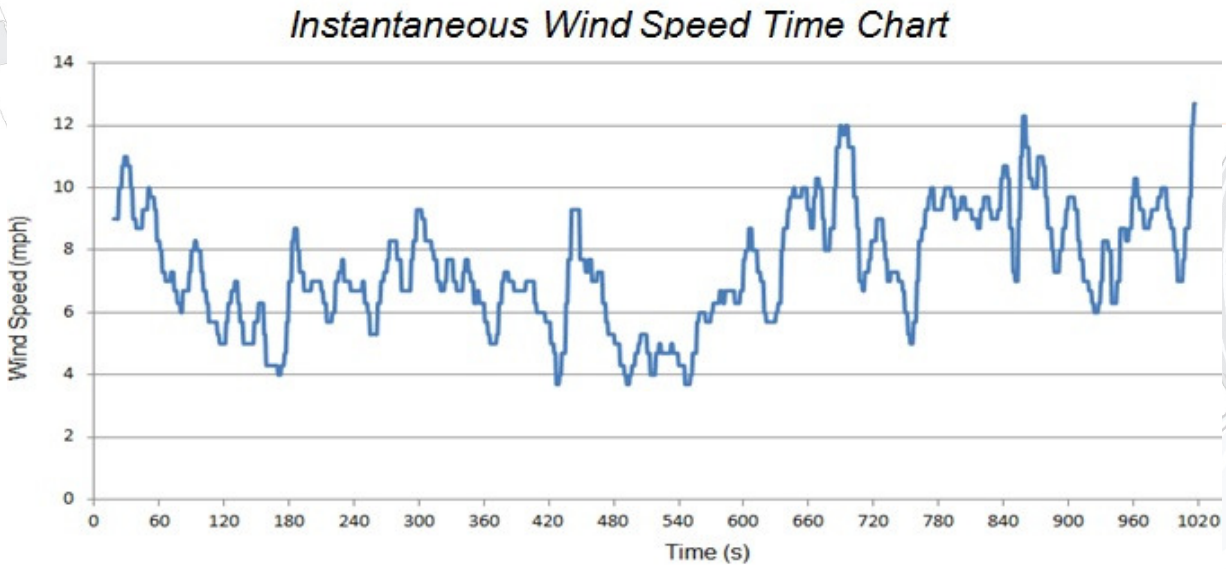
- Irradiance (solar resource)
- Wind speed
- Wind direction
- Temperature
- Humidity
- Load

All measured with a time stamp



Wind Resource Assessment

- Wind resource is highly variable and site specific



Sensors

- Here we are going to cover sensors for measuring renewable energy resources
- Focussing on wind resource
- Many different types and manufacturers
- Usually a compromise between cost and accuracy
- Need to ensure accurate, known calibration

Wind Speed

- Cup Anemometer
- Rotates with wind speed
- Output is a signal with a frequency which varies with wind speed

✘Moving parts

Wind Speed

- Ultrasonic anemometer
- No moving parts
- Also gives wind direction

✘Expensive

Wind Direction

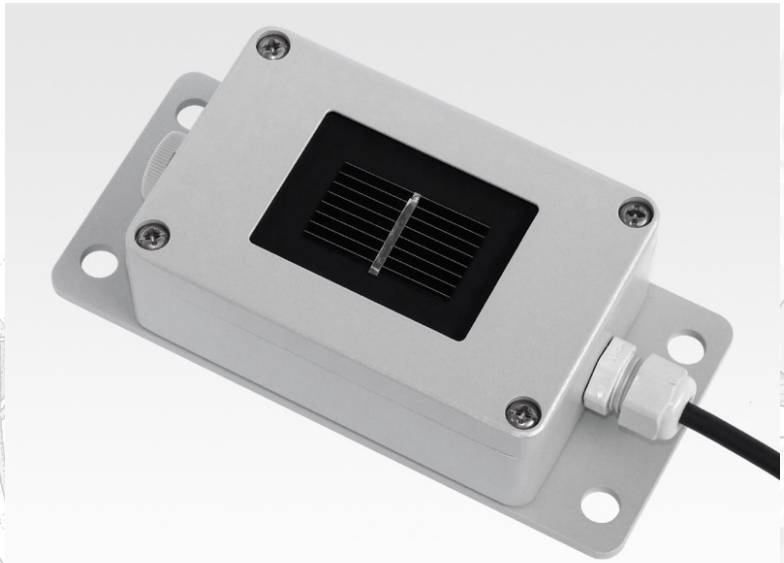
- Large tail ensures tip faces the wind
- Output gives a signal depending upon direction

✘Moving parts

Irradiance

- Measures the solar irradiance
- Lots of different sensor types

Including: PV cell, photo diode, photo resistor and optical methods



✘ Temperature compensation

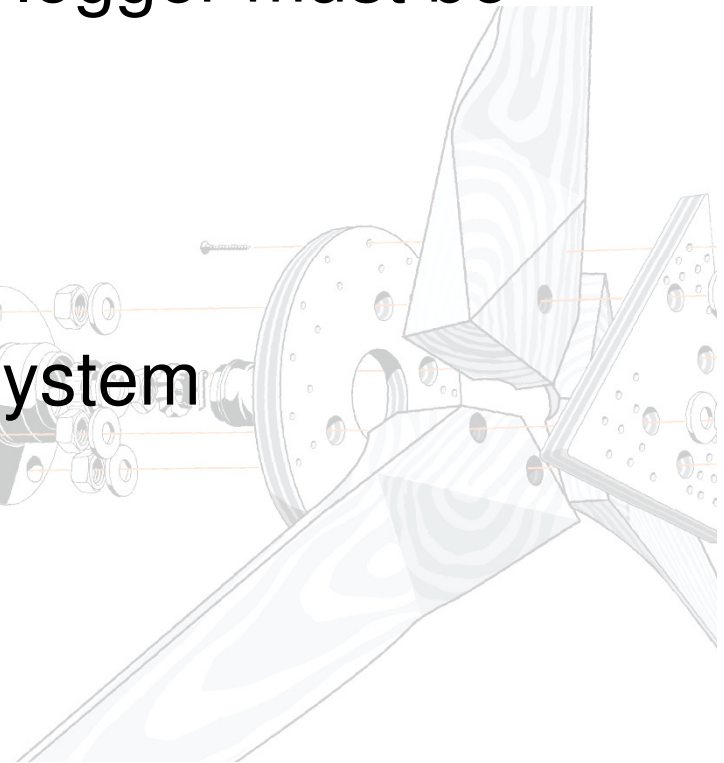
Calibration Factors

- Every sensor has some form of calibration factor
- This converts the output data into a physical reading
- These need to be known for every sensor
- Sometimes variation between sensors
- Accuracy depends upon application

Data Logger Overview

To monitor wind speed the data logger must be able to:

- Record wind speed
- Record wind direction
- Record irradiance (for hybrid system compatibility)
- Must be robust and reliable
- Weather-proof
- Low cost



Available Data Loggers

Many different data-logging systems

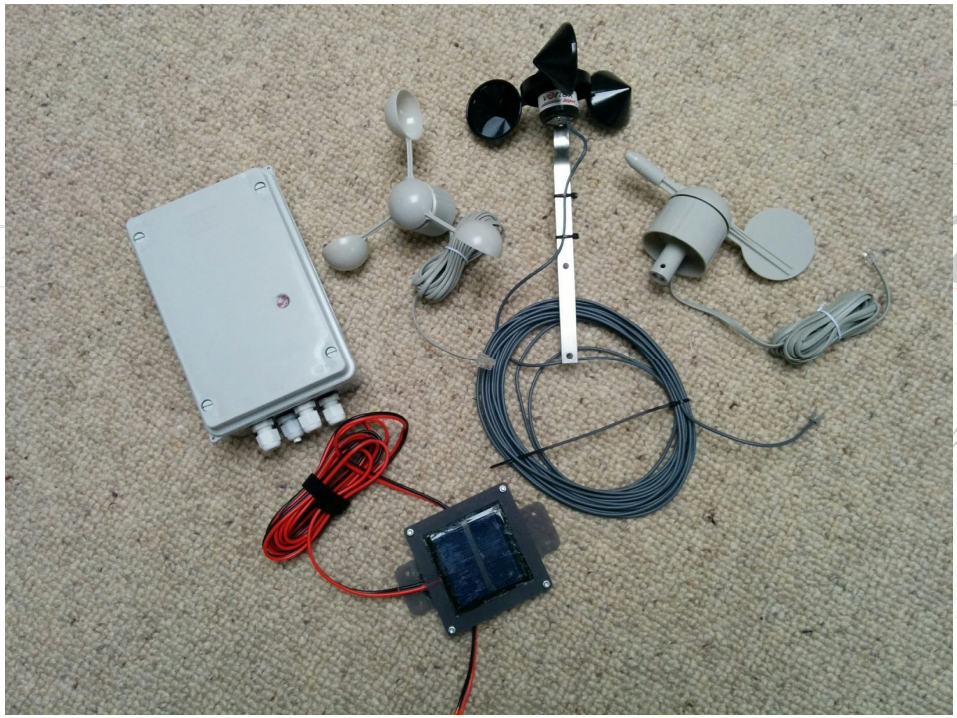
Including:

- Power predictor
  - http://www2.powerpredictor.com/
- Hobo Data Loggers
  - http://www.onsetcomp.com/
- Space Logger
  - http://www.r-p-r.co.uk/spacelogger/w10.php?gclid=CKnG4-uDr8oCFQ2eGwodeG8MoQ

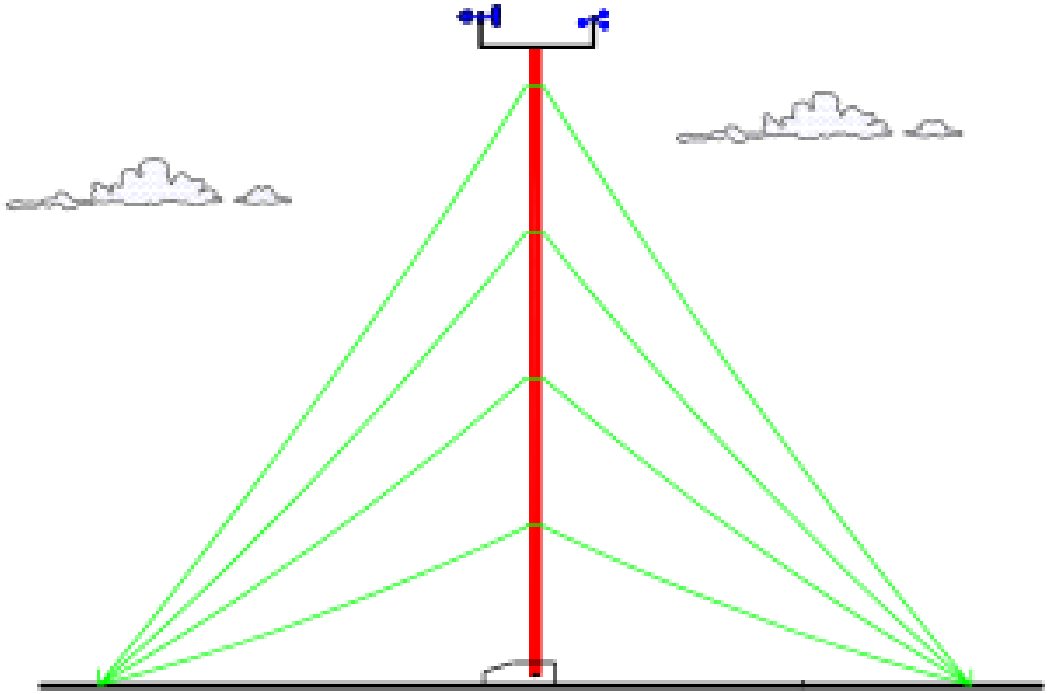
Data Logger

We are using the Wind Logger from

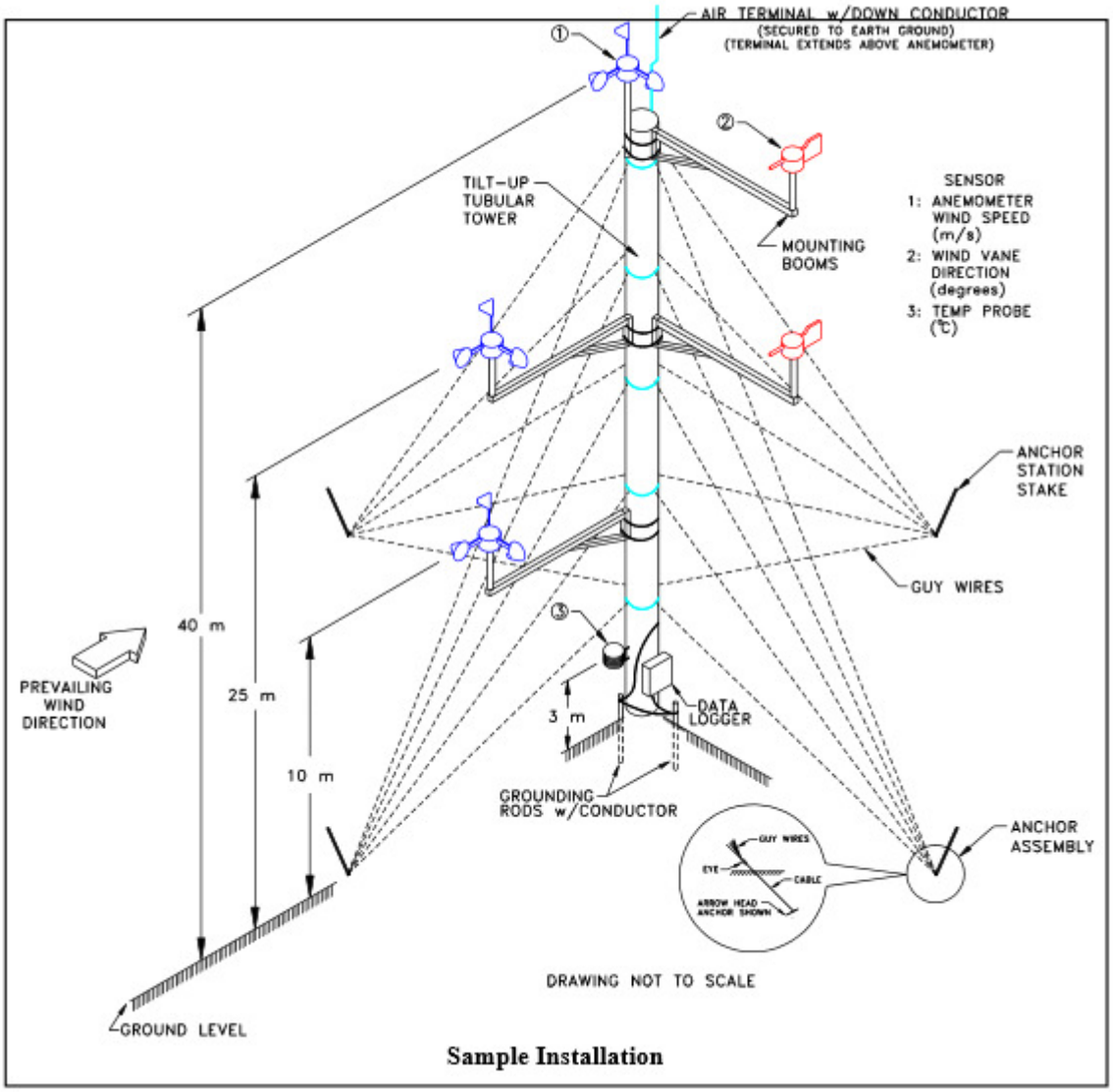
www.RE-Innovation.co.uk



Met Mast Installation



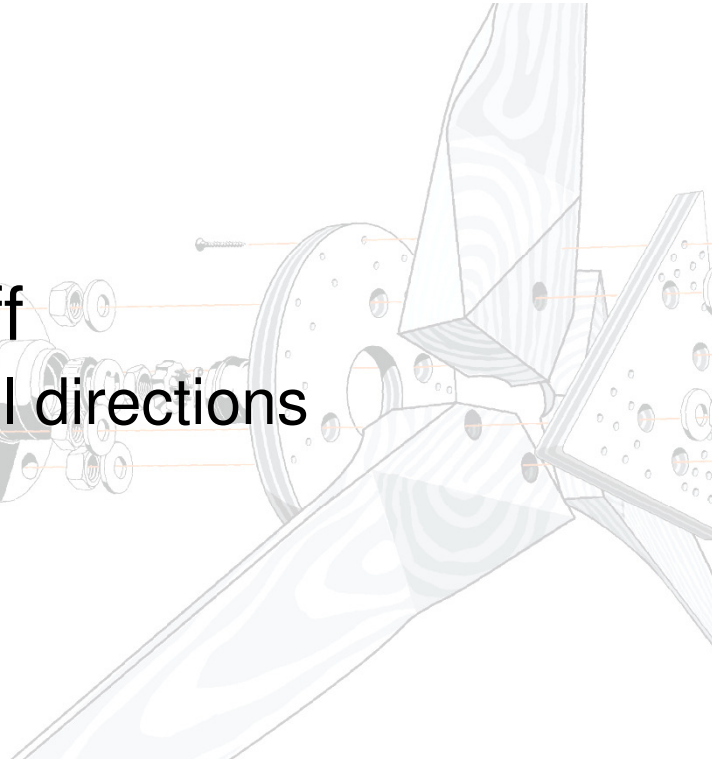
Met Mast



Sample Installation

Met Mast Safety

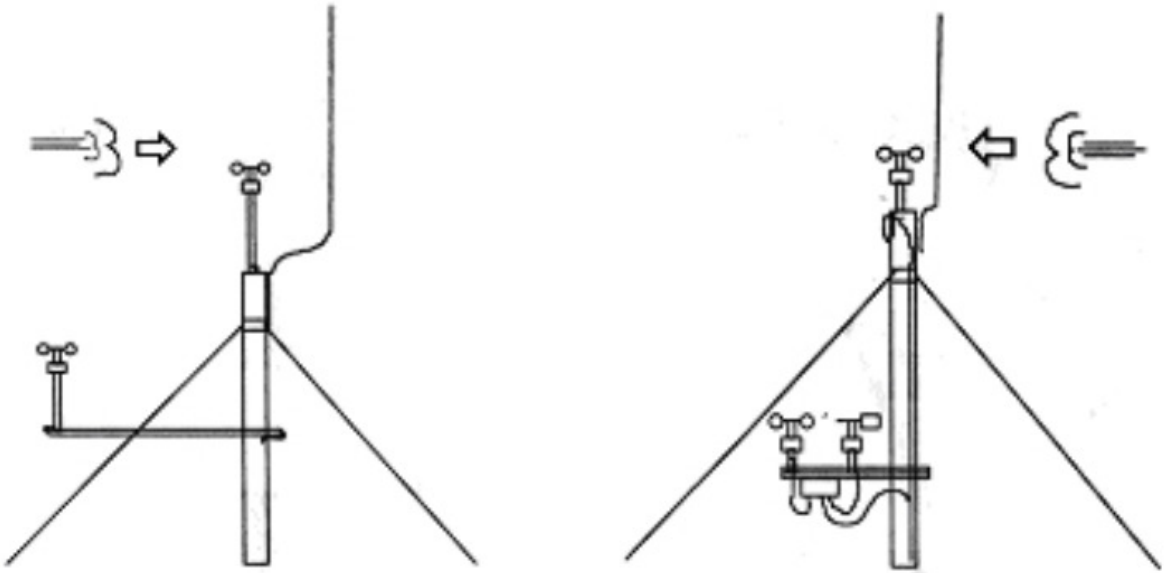
- Tall mast
- Potential to fall down
  - High winds, rope breaking
- Ensure area is fenced/roped off
  - Drop zone is height of mast in all directions
- Signs
  - Warning diagram
  - Written in local language



Anemometer/ Wind Vane Install

- Mount on top of mast
- Or use booms from mast
- Ensure no obstructions
- Ensure tower shadow is not from prevailing wind direction
- Ensure sensors are separated

Anemometer/ Wind Vane Install

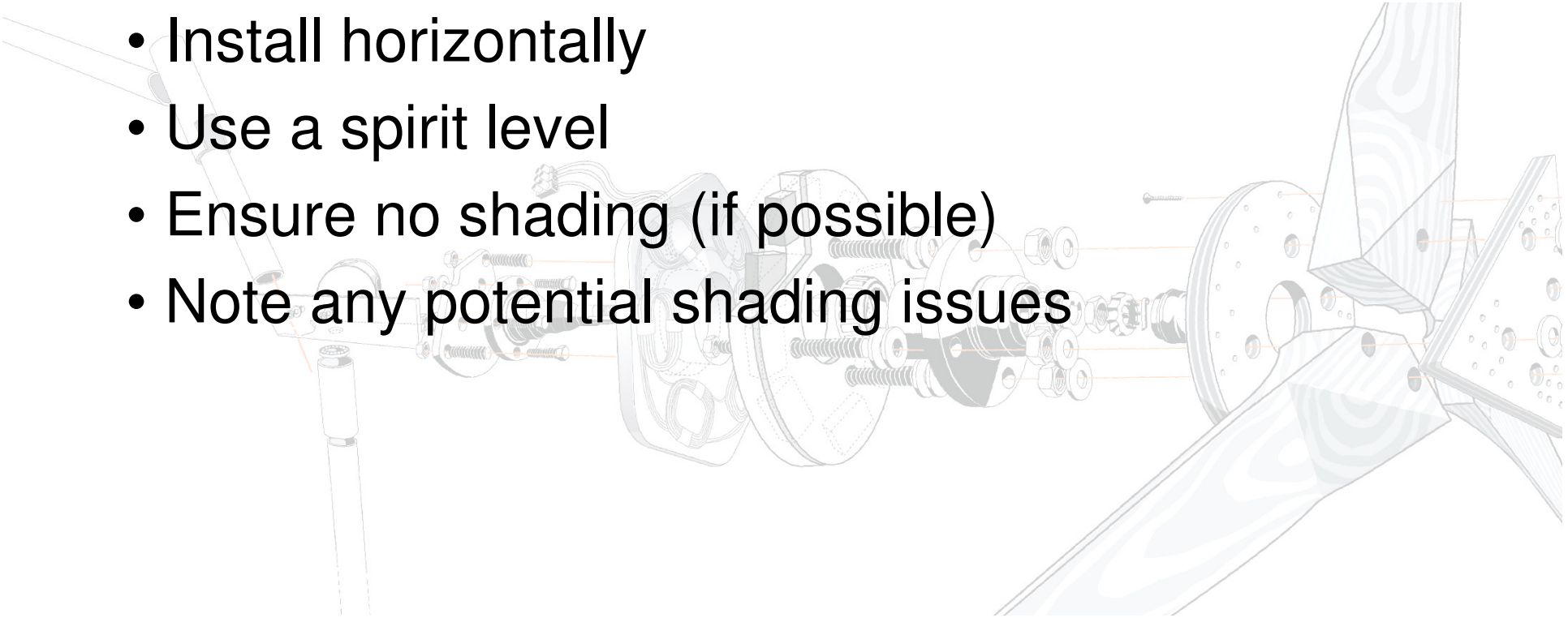


Source: Garrad Hassan

Good (right) and Bad (left)

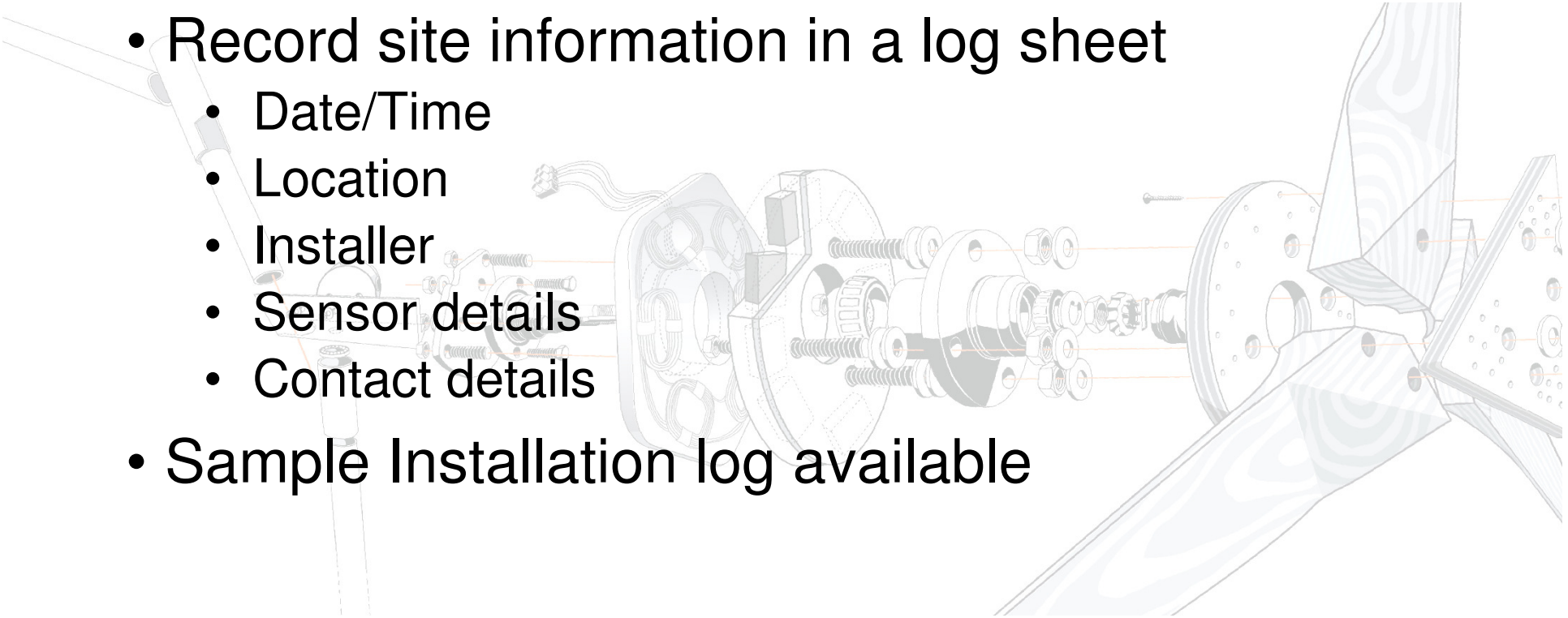
Irradiance Sensor Install

- Install horizontally
- Use a spirit level
- Ensure no shading (if possible)
- Note any potential shading issues



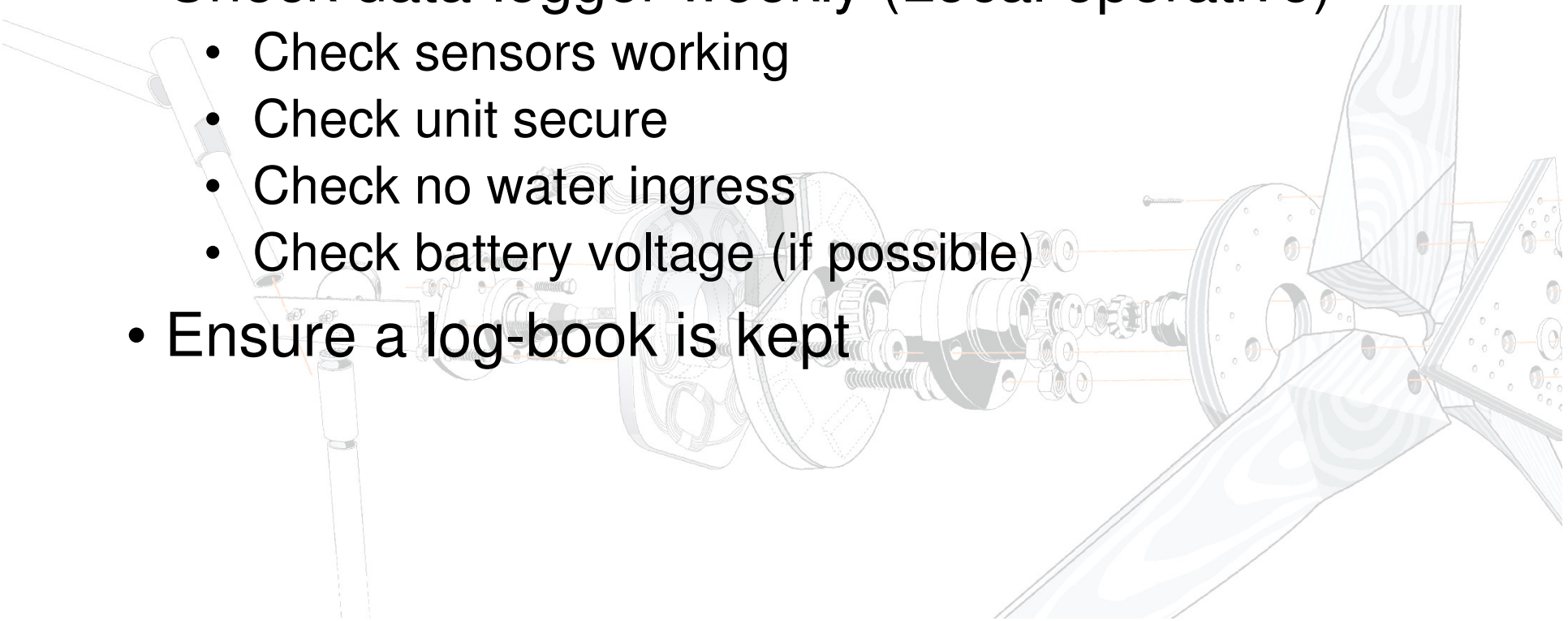
Installation Log

- Record site information in a log sheet
  - Date/Time
  - Location
  - Installer
  - Sensor details
  - Contact details
- Sample Installation log available



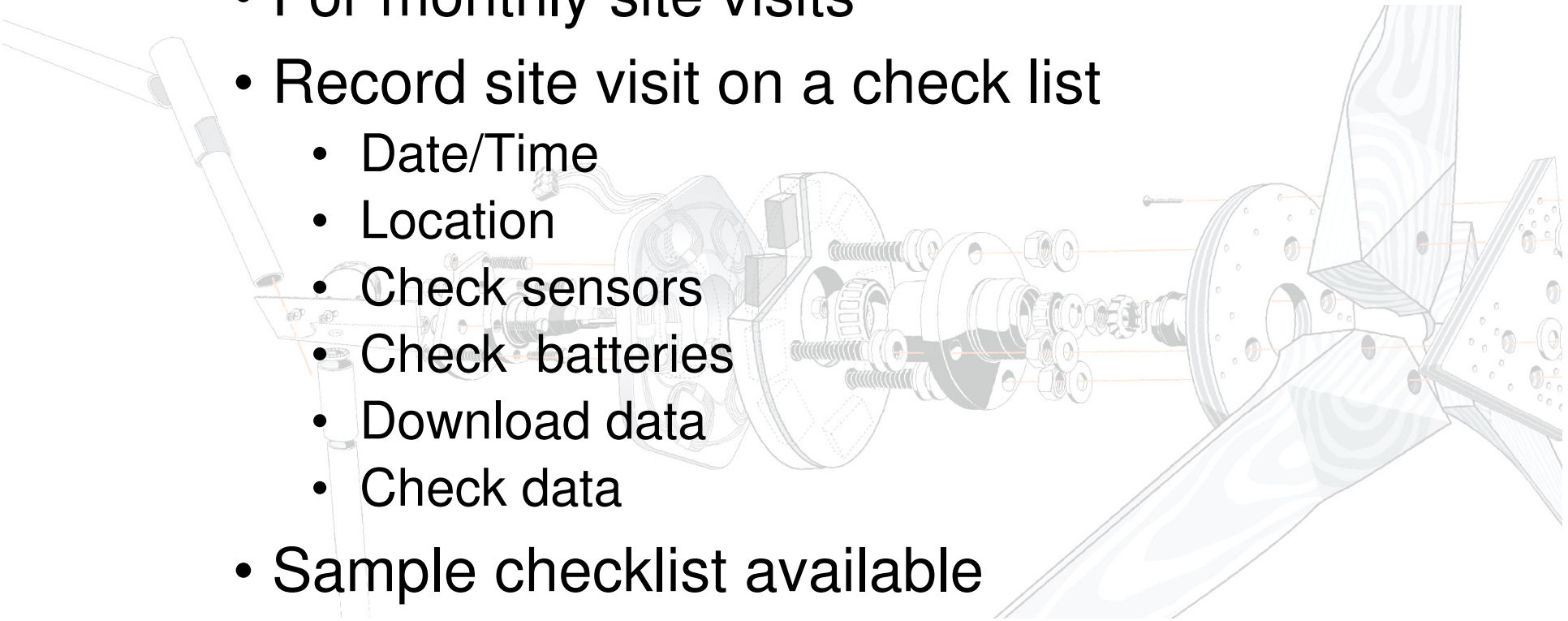
O&M Weekly

- Check data-logger weekly (Local operative)
  - Check sensors working
  - Check unit secure
  - Check no water ingress
  - Check battery voltage (if possible)
- Ensure a log-book is kept

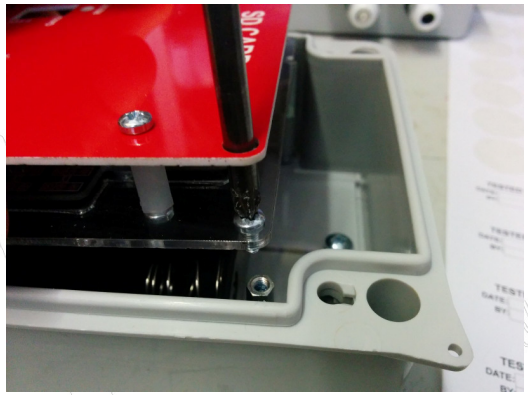


Site Visit Checklist

- For monthly site visits
- Record site visit on a check list
  - Date/Time
  - Location
  - Check sensors
  - Check batteries
  - Download data
  - Check data
- Sample checklist available



Battery Replacement



Takes 3 x D cells
Battery lifetime:
3-6 months

Data Analysis

- Remove SD Card from unit
- Use SD reader to read data to a computer
- 1-32Gb SD cards can be used

Data Conversion

- Data stored as .csv file
- 1 file per day

Ref	Date	Time	Wind 1	Wind 2	Direction	Irradiance Wm-2	Batt V
BB	13/01/2016	11:19:47	0	0	E	38	4.59
BB	13/01/2016	11:20:47	0	0	E	38	4.59
BB	13/01/2016	11:21:47	0	0	E	38	4.57
BB	13/01/2016	11:22:47	2	0	N	38	4.57
BB	13/01/2016	11:23:47	3	0	NW	41	4.57
BB	13/01/2016	11:24:47	15	0	NW	41	4.57
BB	13/01/2016	11:25:47	43	0	W	41	4.57
BB	13/01/2016	11:26:47	3	0	N	41	4.57
BB	13/01/2016	11:27:47	0	0	N	38	4.57
BB	13/01/2016	11:28:47	12	0	W	38	4.57

Data Output

- Data can be read using spreadsheet
- Using some processing we can convert the data into wind speed probabilities
- We can also process the data to create wind rose diagrams
- Use Python scripts

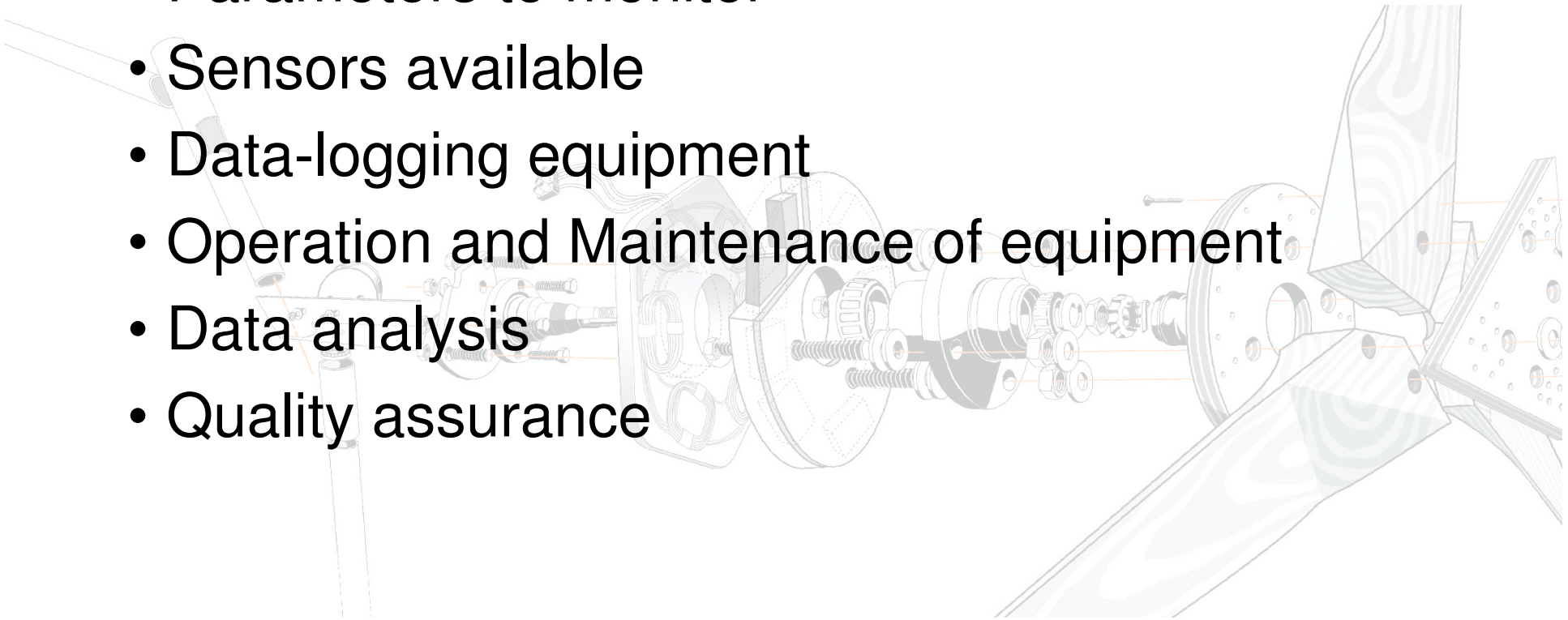
- This is a work in progress

Quality Assurance

- Need to ensure that we are confident about the data we have collected.
- Good installation logs
- Good site visit logs
- Calibration records for sensors
- Ensure data is not corrupted
- Remove any spurious data

Summary

- Parameters to monitor
- Sensors available
- Data-logging equipment
- Operation and Maintenance of equipment
- Data analysis
- Quality assurance



Questions?

Practical Session