Airborne Wind Energy
Where does the industry stand today?
Richard Rullerkamp
Ampyx Power

Airborne Wind Energy concepts
Among novel technologies for producing electricity from renewable resources, a new class of wind energy converters has been conceived under the name of Airborne Wind Energy Systems (AWES). This new generation of systems employs flying uncrewed wings or aircraft in order to reach winds blowing at atmospheric layers that are inaccessible by traditional wind turbines. Research on AWES started in the mid-seventies, with a rapid acceleration in the last decade. A number of systems based on radically different concepts have been analyzed and tested. Several prototypes have been developed all over the world and the results from early experiments are becoming available.

- **Static**
  - Static systems only use the speed of the wind, where crosswind systems use their own speed to create extra power.

- **Cross Wind Drag Mode**
  - Ground-based generator systems don't lose efficiency resulting from having to lift equipment. Airborne generator systems have significant drag caused by the high voltage cable.

- **Cross Wind Lift Mode**
  - Rigid wing systems (gliders) have 1G's power output per n2 wing surface area.
  - Rigid wing systems can be controlled easier and more reliable, resulting in higher cycle efficiency.
  - Rigid wings have higher lifetime.

AWE is gaining market acceptance
- Google owns Makani Power
- Google
- National Geographic ranked tall wind in “Tech Breakthroughs of 2015 that could help power the world”
- Most large utilities have dedicated teams to investigate the potential of Airborne Wind energy
- Shell invested in Kite Power Solutions

Ampyx Power
Ampyx Power shapes the regulatory field
- Ampyx’ Safety Vision
  - Relentless focus on safety, uncompromising safety standards and an impeccable safety record.
  - In June 2014, the European airspace authority (EASA) has issued draft legislation on Remotely Piloted Aircraft Systems (RPAS).

- Ampyx’ Prototypes
  - Ampyx’ prototypes are registered aircraft and comply with stringent civil aviation safety standards.
  - Our focus on safety has been rewarded by the Dutch Airspace Authorities by granting us a special airspace zone for our test site.

- Ampyx Power has entered into a certification program for its commercial and pre-commercial prototypes.

Our future
- Our 250 kW prototype AP3 will be ready in 2017
- We have been testing our 50kW prototype AP2 since 2008 and can extrapolate the data with our dynamic models for the performance of our next prototypes.