Harnessing High Altitude Winds to Deploy Low Cost Power

Maine Startup & Create Week 2014

contact: ben.glass@altaerosenergies.com
“High altitude winds have enough energy to power the Earth one hundred times over.”
Dr. Ken Caldeira, Stanford University Carnegie Institution

Altaeros will provide low cost, flexible power to remote customers by commercializing the first airborne wind turbine, using proven technology.
A Short History of Altaeros...

- **2010**
  - Altaeros formed at MIT
  - Seed round
  - Winner, ConocoPhillips Energy Prize

- **2011**
  - Funding from USDA, MTI, CA Energy Commission
  - Co-founded Greentown Labs

- **2012**
  - Awarded first broad utility patent
  - Establish business development presence in Brazil

- **2013**
  - Reliable BAT prototype automated operation in 40mph+ winds
  - Funding from NSF, NECEF
  - Alaska Energy Authority and Altaeros partner to develop world’s first Airborne Wind Commercial Pilot

World’s first fully functional airborne wind prototype!
Remote Power Is Expensive & Unreliable

$17B
Remote Power Market¹

11GW
Installed Global Capacity²

15-20GW
2020E Capacity³

Diesel generators power 95% of remote power capacity
• High, volatile costs. $0.25 - $2.00+/kWh
• Challenging fuel logistics, generator maintenance

Current wind/solar potential limited in remote areas
• Intermittency leads to high delivered cost
• Installation cost and logistics are prohibitive

Rapidly growing microgrid market
• Remote Heavy Industry: $0.30+/kWh
• Remote Communities & Islands: $0.30+/kWh
• Military & Defense: $1.00+/kWh

¹: Custom Market Research, Dawnbreaker, 2013
Product Value: Buoyant Airborne Turbine (BAT)

Consistent, Low Cost Energy
- 2-3x higher capacity factor than solar/wind
- 80% lower installation cost than tower wind
- Rapid diesel savings, seamless integration
- Equipment payback in 1-5 years

Rapid Deployment, Flexible Operation
- Containerized transport, one day setup
- Automated controls, passive stability
- Robust safety features
- Minimal environmental and noise impact

Significant Ancillary Revenue
- Internet, cellular, imaging, and scientific services boost ROI of airborne platform
BAT Prototype Progress
Product Roadmap

LCOE

$0.40

$0.30

$0.20

$0.10

$0.00

2015

2018

30kW BAT

200kW BAT

Offshore BAT

First commercial deployment

First 200kW BAT sales

High volume turbine production

Low-cost envelope fabric innovations

Deep-water Offshore BAT: LCOE < $0.08/kWh

Ancillary payload revenue

Envelope fabrication process improvement

©Valentin Angerer Photographer
# Disruptive Low Cost Energy

## Remote Levelized Cost of Energy (100-200 kW)

<table>
<thead>
<tr>
<th></th>
<th>$/kWh LCOE</th>
<th>Diesel Fuel</th>
<th>PV Solar</th>
<th>Traditional Wind</th>
<th>Altaeros BAT</th>
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<tbody>
<tr>
<td></td>
<td>$0.10</td>
<td>$0.20</td>
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### Power Consistency
- Diesel Fuel: Dispatchable
- PV Solar: 15-25% Capacity Factor
- Traditional Wind: 15-30% Capacity Factor
- Altaeros BAT: 55-60% Capacity Factor

### Site Flexibility, Transportability
- Diesel Fuel: ✔️
- PV Solar: ✔️
- Traditional Wind: ✔️
- Altaeros BAT: ✔️

### Ancillary Services
- Diesel Fuel: ✔️
- PV Solar: ✔️
- Traditional Wind: ✔️
- Altaeros BAT: ✔️

### Other Drivers
- Diesel Fuel: Fuel volatility, GHG emissions
- PV Solar: Large physical footprint
- Traditional Wind: Crane and foundation required
- Altaeros BAT: 1-2 day setup
Leadership Team

Ben Glass, **CEO & Inventor**
Mitsubishi R&D, SpaceX, Tesla
MIT, Aero/Astro SM

Dan Nadav, **VP Sales & Business Dev**
Head of Sales – W. Region, Gamesa Wind US
Key Account Manager, N. America, REPower

Dr. Chris Vermillion, **Lead Engineer**
UNC Charlotte - Asst. Professor
Toyota Technical Center – Controls

Adam Rein, **Cofounder & Lead Director**
MissionPoint Capital, Bain & Co.
MIT MBA, Harvard MPA

Advisory Board

Sheila Widnall
MIT Aero/Astro Professor
Former Secretary U.S. Air Force

Ratan Tata
Former Chairman, Tata Group (India)

Mauricio Quintana
Former CEO, Clipper Windpower

Scott Fisher
Dir, Alt Energy Serv, NRG Energy

Julian Nott
Sec. AIAA Balloon Tech. Committee

Peter Steenland
Counsel, FAA & Env, Sidley Austin
### Altaeros Vision & Growth Opportunities

<table>
<thead>
<tr>
<th>Offshore Wind</th>
<th>Wind-as-a-Service</th>
<th>IP Licensing</th>
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<tbody>
<tr>
<td><strong>$20B</strong></td>
<td>Reduce upfront cost and operating risk</td>
<td>Autonomous airborne platform</td>
</tr>
<tr>
<td>2020 Global Market</td>
<td>Adapt scalable PPA model</td>
<td>Aerostat and aerospace sectors</td>
</tr>
<tr>
<td><strong>&lt;$0.10/kWh</strong></td>
<td>Guaranteed level of customer savings</td>
<td>Non-energy use, to improve scientific, telecommunication, and surveillance services</td>
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<tr>
<td>100 MW BAT Wind Farm</td>
<td>Faster BAT product adoption</td>
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