DEVORTO
CORPORATION

Building an Aircraft that Never Has to Land

High-Altitude Pseudo-Satellite (HAPS)

HAPS... What is it?

- A solar-power aircraft
- Collect energy during the day
- Run on batteries at night
- Payload lives in stratosphere

Existing satellites

- Require a rocket launch
- Expensive aerospace products
- Confined to prescribed orbits
- Cannot be upgraded or maintained

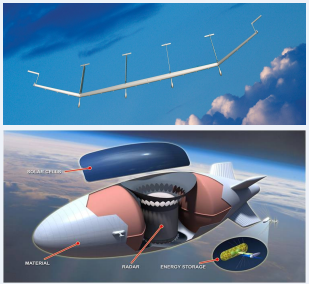
HAPS solves these issues, and...

- Provides atmospheric monitoring (climate/weather)
- Low signal latency (ideal for 5G telecomm relay hub)
- Broadband speed data rates (Internet across the planet)

Alternative Attempts

DARPA

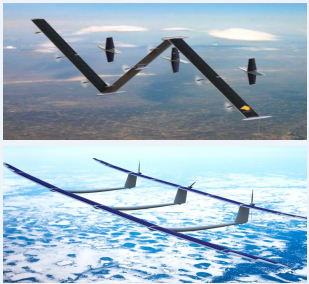
- Spent **$750M** over 15 years
- Both fixed-wing and airship
- All programs **canceled**



SolarEagle and ISIS

Tier-One Aerospace

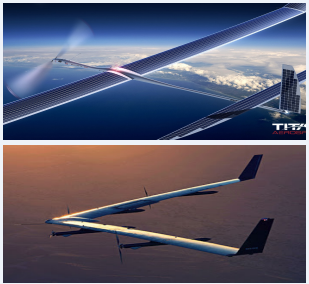
- Fully-optimized fixed-wing
- Several new **exotic** designs
- **None** made it to production



Odysseus and ApusDuo

Tech Giants

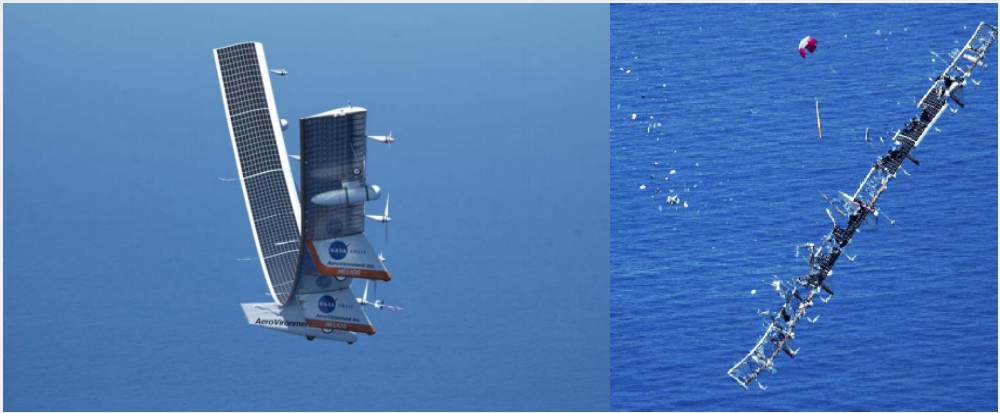
- Acquired at **prototype** stage
- Facebook grounds investment
- Google tried using **balloons**



Solara and Aquila

Problem

Long and slender wings are too flexible



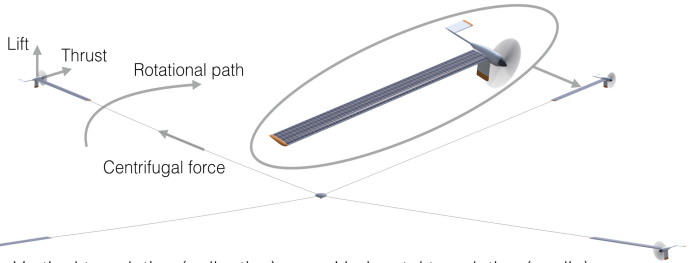
NASA/AeroVironment *Helios*, with deflection from **lack of stiffness**, and its final outcome

Solution

Wings under tension eliminate aero/structural problem

System operates in a state of rotation
Centrifugal forces keep tethers taught

Props overcome aerodynamic drag
Satellite wing surface produces lift



- Vertical translation (collective)
  - Throttle alters velocity and lift
  - Pitch induces spiral trajectory
- Horizontal translation (cyclic)
  - Relative elevation tilts rotor plane
  - Rudder changes tether tension

Tethered Uni-Rotor Network (TURN) uses **10X less power** without sacrificing hover

Business Model

Long-Term Strategy

- Initial products for revenue/profit/investment
- Pave the way for larger TURN embodiments
- Competitive advantages over existing drones

Manufacturing Business Model

- Higher margins from simplified manufacturing
- Offer standard and customized payloads
- Third party retailers and direct sales

Data-as-a-Subscription Service Model

- Equipment manufactured in-house, lower cost
- Autonomy with higher endurance, less labor
- Turnkey solution delivers data to customers

Research	2015	**NASA NIAC ($125k):** HAPS Feasibility
	2017	**PhD Dissertation:** Nonlinear Models
	2018	**AFRL SBIR ($150k):** Proof-of-Concept
	2019	**CIT CRCF ($50k):** Flight Testing
	2020	**AFWERX ($150k):** AHRS Algorithms
Commercialization	Today	**Group 2:** 10-hour endurance drone
	+3mo	**MVP:** Prototyping (ATI)
	+6mo	**Beta Testing:** Final Design (DAR)
	+9mo	**First Sales:** Production (Saxon)
Growth	Beyond	**Group 3:** 7-day endurance
		Group 4: 30-day endurance
		HAPS: Persistent flight with solar

Immediate Focus: Bring Group 2 (<55lb) TURN drone to market

Competition for Group 2 UAS

Multirotor

- Minimal flight endurance
- Less design complexity

25-35 min
5lb payload
$35k - $50k

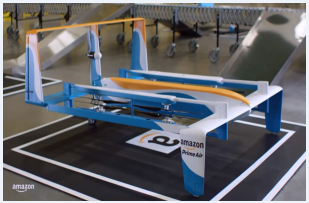
Fixed-Wing

- No hover or vertical takeoff
- Needs launch apparatus

60-90 min
5lb payload
$100k - $175k

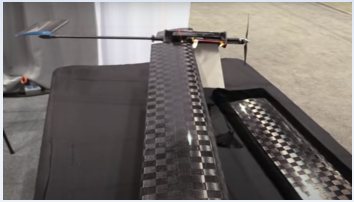
Hybrids

- Compromise between both
- Most complex aircraft design



30-75 min
5lb payload
$125k-$200k

Product and Initial Markets

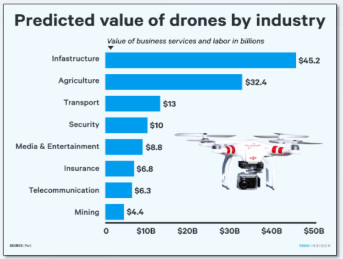


Group 2 Electric TURN Capabilities

- **10-hour** flight endurance
- **Vertical takeoff**; no launch/recovery
- **300 mile range** with hover/loiter
- **Long-range** applications

Initial Markets (02/10/2020)

- *Infrastructure:* Railroads, interstates, pipelines, power lines; need long-range with hover for inspection **($45.2B)**
- *Agriculture:* Farmers do not want to be drone pilots; this endurance allows for data-as-a-subscription **($32.4B)**
- `www.businessinsider.com/commercial-uav-market-analysis`



Traction

Awarded $475,000 of R&D funding

NASA

AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

AFWERX

CIT
CENTER FOR INNOVATIVE TECHNOLOGY

Journals/Conferences/Publications

- PhD Dissertation (2017): Design, Modeling, Control, and Simulation for a Novel Eternal Flight System.
- AIAA Aviation (2015): A Complete Derivation of the Plant Model with Nonlinear Dynamics.
- AIAA GNC (2015): A Complete Derivation and Simulation of the Inner Loop Controller.

Prospective Customers

194TH WING

Southern Company

CAL FIRE
SINCE 1888

YORK COUNTY
FIRE & LIFE SAFETY

Accolades

AFWERX
FUSION XPERIENCE

TOP 500
DEEPTECH STARTUP

newchip

Two Patents Issued

- Vehicle physical embodiment
- Controls for waypoint navigation

Team

Justin Selfridge, PhD
Founder and CEO

7 years at NASA Langley in adaptive control design for experimental aircraft

Al Waddill
President

35 years Head of Sales for Groen Brothers Aviation in advanced vertical takeoff

Industry Partners

ADVANCED TECHNOLOGIES INCORPORATED
AN EMPLOYEE OWNED COMPANY
www.advancedtechnologiesinc.com

DARcorporation
Design • Analysis • Research
www.darcorp.com

SAXON Aerospace
www.saxonunmanned.com

Financials and Potential Growth

Projections for Group 2

- $150k per unit price
- Y1: 32 units for $4.8M revenue
- Y2: 80 units for $12.0M revenue
- Y3: 200 units for $30.0M revenue

Growth from Future Products

- Group 3: $1.2M unit price (7-day endur)
- Group 4: $5.0M unit price (30-day endur)
- HAPS: $20.0M unit price (persistent)
- Aero/Defense: 8X-12X EBITDA

Potential for HAPS

- Telecom Infrastructure **($100B by 2026)**
- Satellite Manufacturing **($271B in 2020)**
- No launch costs and 1/10th the price
- Satellite capabilities for large/medium businesses

Persistent flight is mankind's last great aviation milestone

www.turnuav.com