



# AREN'D

Aircraft for Rhino and ENvironmental Defense



# Speakers/Panel



- Dr. Jean Koster, Prof. University of Colorado
- Student Panel:
  - Ms. Laura Kruger, Project Manager
  - Mr. Andrew Levine, System Engineer
- Mr. Phelps Lane,
  - CEO, HELIOS Torque Fusion Inc.
- Eric Schmidt,
  - Director, Wildlife Protection Solutions



# Outline



The Poaching Problem

Team AREND Project

Discussion

The White House

Office of the Press Secretary



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For Immediate Release

July 01, 2013

## **Executive Order -- Combating Wildlife Trafficking**

### EXECUTIVE ORDER

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### COMBATING WILDLIFE TRAFFICKING

By the authority vested in me as President by the Constitution and the laws of the United States of America, and in order to address the significant effects of wildlife trafficking on the national interests of the United States, I hereby order as follows:

<http://www.whitehouse.gov/the-press-office/2013/07/01/executive-order-combating-wildlife-trafficking>



# Executive Order



Section 1. Policy. The poaching of protected species and the illegal trade in wildlife and their derivative parts and products (together known as "wildlife trafficking") represent an **international crisis** that continues to escalate. Poaching operations have expanded beyond small-scale, opportunistic actions to coordinated slaughter commissioned by armed and organized criminal syndicates. The survival of protected wildlife species such as elephants, rhinos, great apes, tigers, sharks, tuna, and turtles has beneficial economic, social, and environmental impacts that are **important to all nations**.

Anyone who has accustomed himself to regard the life of any living creature as worthless, is in danger of arriving also at the idea of worthless human lives.

*- Albert Schweitzer*



*Wild at Heart*

## The Poaching Problem

# Poaching Cruelty



[www.defenceweb.co.za](http://www.defenceweb.co.za)



Pictures Courtesy of Albina Hume (University of Pretoria)

Picture courtesy of Lowveld Rhino Trust;  
<http://lowveldrhinotrust.org/#>



# Poaching Cruelty



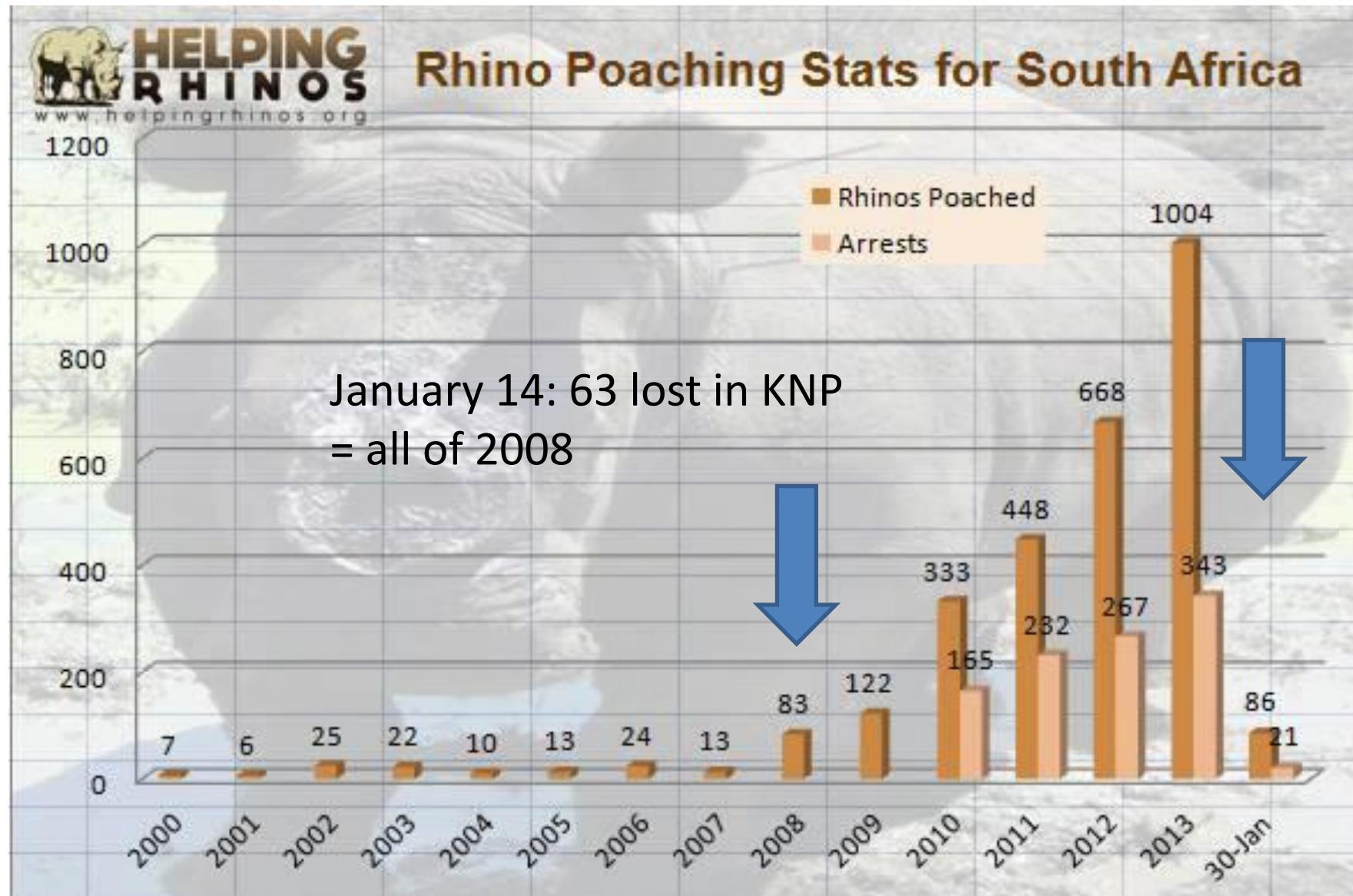
<http://ewn.co.za/2014/01/06/6-rhino-poached-in-Kruger-Park>



<https://www.facebook.com/TheSanWildRhinoSanctuary?ref=stream>

More details on poaching cruelty:  
<http://facebook.com/teamAREN>  
Do not show to small children!

# Exponential Growth



# What we do NOT hear about



**EVERY 4 DAYS,  
A RANGER IS KILLED  
IN THE LINE OF DUTY.**

# Dangerous and Boring



**Dangerous:** they can be ambushed.  
**Boring:** they miss passing poachers.

Drones increase play instinct which keeps them alert and give them advantage.

# Statistics



Rhino poaching statistics

SA	2010	2011	2012	2013	2014
KNP (SANParks)	146	252	425	606	63
MNP (SANParks)	0	6	3	3	0
GP	15	9	1	8	0
LIM	52	74	59	114	6
MP	17	31	28	92	3
NW	57	21	77	87	2
EC	4	11	7	5	0
FS	3	4	0	4	4
KZN	38	34	66	85	8
WC	0	6	2	0	0
NC	1	0	0	0	0
	333	448	668	1004	86

Rhino poaching arrests statistics

South Africa - Arrests	2014	2013	2012	2011	2010
KNP	14	133	73	82	67
MNP	0	0	0	0	0
Gauteng (GP)	0	10	26	16	10
Mpumalanga (MP)	0	34	66	73	16
Eastern Cape (EC)	0	0	0	2	7
Limpopo (LP)	0	70	43	34	36
North West (NW)	4	26	32	21	2
Free State (FS)	0	7	6	0	0
KwaZulu-Natal (KZN)	3	63	20	4	25
Western Cape (WC)	0	0	0	0	2
Northern Cape (NC)	0	0	1	0	0
Total	21	343	267	232	165

# Rhino horn trade route

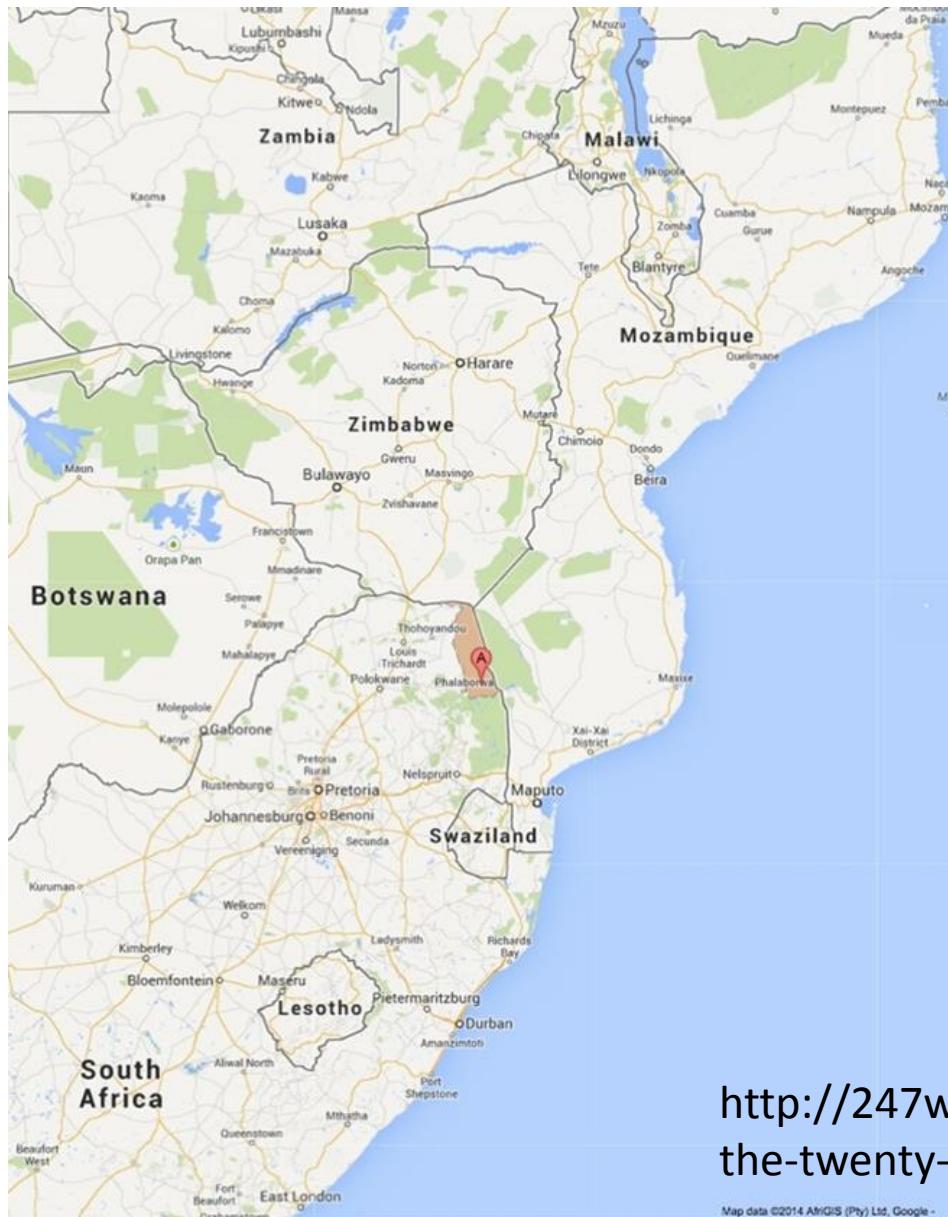


**\$70-80,000/kg Price Tag in 2013**

# Arrest Opportunities



# Kruger National Park

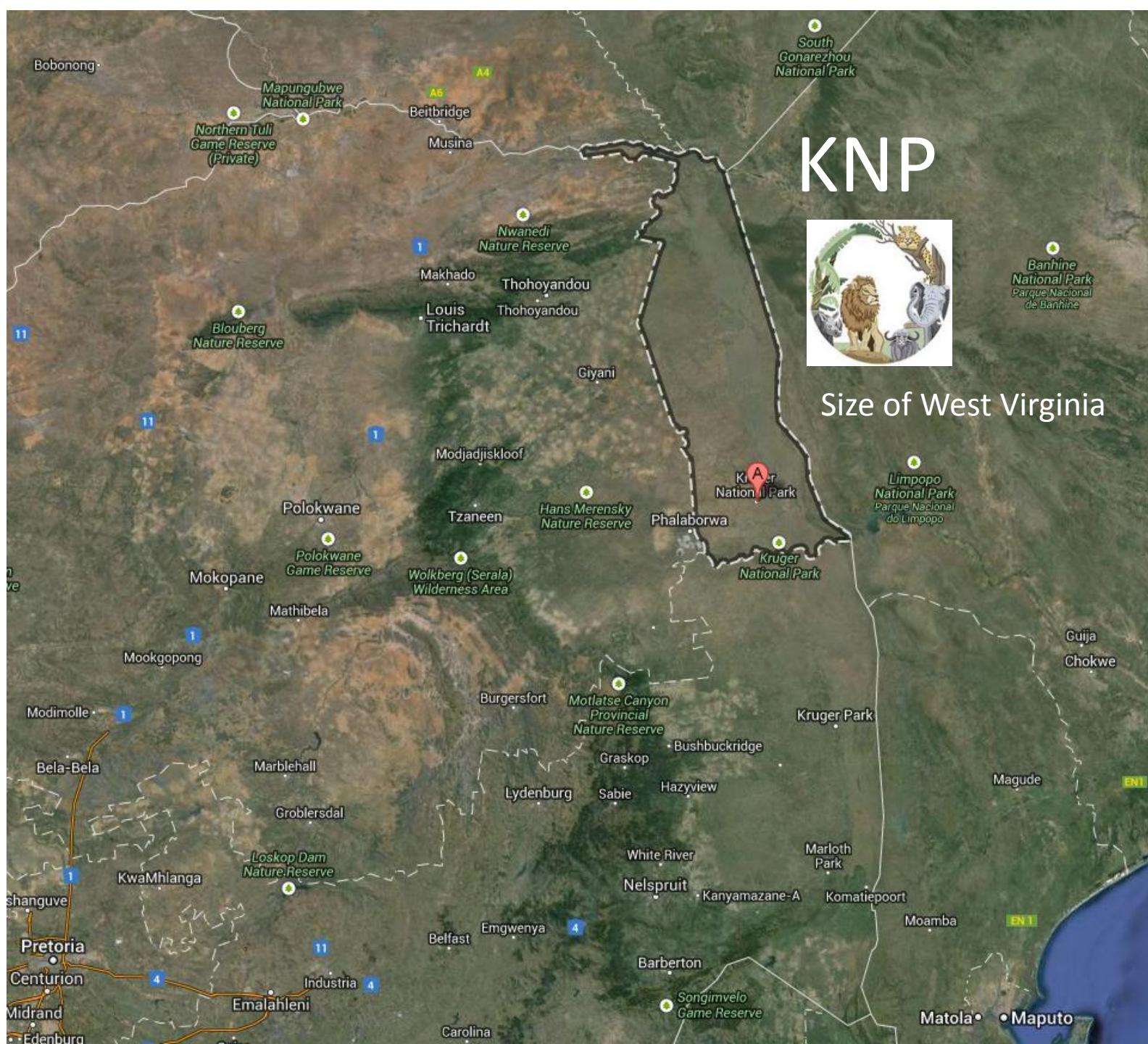


Wall Street Journal:

**2<sup>nd</sup> poorest Nation:  
Zimbabwe**

**12<sup>th</sup> poorest Nation:  
Mozambique**

<http://247wallst.com/investing/2010/07/06/the-twenty-poorest-nations-in-the-world/>



# Dehorning & Relocating



Dehorning did not work: poachers also take stumps that fetch \$50K or less

# Rescue and Arrests



Veterinarians trying to save a poached rhino that survived



**Arrest success < 5%**  
**Poaching success > 95%**



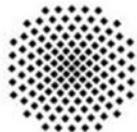
Photos: WO1 Noel Kloppers

Punishments easy to absorb with earnings of \$3-400,000 per horn!



# Team AREN Project

AREN is Afrikaans for Eagle



Universität  
Stuttgart



# AREN'D membership

2/25/2014:



- Four Universities in 4 countries (Colorado, Helsinki, Pretoria, Stuttgart)
- 28 senior and graduate students (aerospace, mechanical, electrical, software engineering)
- Eleven Professors at the four Universities
- 15 engineering advisors from industry
- 6 advisors from wildlife science and management.
- Company affiliations of external engineering advisors:
  - NIST; Airspace Guardian; Four Winds Interactive; Blue Atmos LLC; Helios Torque Fusion; First RF Corp; AMA, NREL; Sand Souci Enterprise; Athena ISR; All Source Analysis; AugustaWestland; SUAS News; National Aeronautical Committee, South Africa; 2 undisclosed.
- Affiliations of wildlife scientists:
  - Denver Zoo; Wildlife Protection Solutions, Denver; Protecting African Wildlife (PAW) Conservation Trust (UK), Centre for Wildlife Management, Pretoria.

# AREN'D Project Objectives



Design, Build, Test, and Fly an unmanned aircraft sensor system to detect and distinguish humans and large animal at an altitude of ~400 ft. AGL in South Africa's National Park system by the end of the Fall 2014 semester.



# AREN'D Stakeholders



- Wildlife Conservation UAV Challenge
  - Organization of a global competition on designing a UAV for anti-poaching efforts and various technology services.
- Helios Torque Fusion Inc.
  - Developer of hybrid propulsion systems.
- Wildlife Protection Solutions Org.
  - a Colorado 501(c)(3) not-for-profit organization
  - international non-profit group dedicated to the conservation of endangered species.
- CU Dept. of Aerospace Engineering Sciences
  - Graduate design course
  - Global Collaborations

# ARENDS GOALS and OBJECTIVES



- Goal: Poachers and rhinos shall not meet
- Ultimately the objective is to prevent the death of any rhino to poaching
- Goal: High Endurance Quiet Electrically Assisted Glider for Harsh Environment
- Create an aircraft to assist the rangers in:
  - Finding poachers on a mission
  - Tracking poachers with horn
  - Finding caches of weapons, horn, other

# Ranger's Primary Objectives



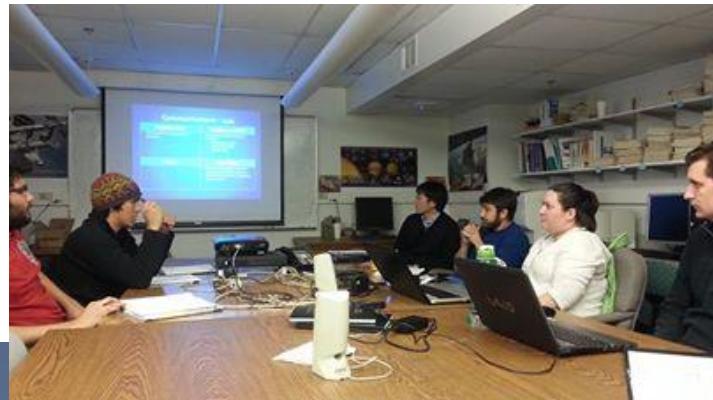
- Ideally poachers should be prevented to enter the park.
- If poachers enter, their presence should be noted a.s.a.p.
- Poachers should be unable to reach the rhino.
- Poachers should be prevented from killing a rhino.
- If poachers succeed they should be arrested within park boundaries.
- If poachers get away it should be known where they went.
- Gather intelligence about poachers and strategies.

# Ranger's Secondary Objectives



- Driving up the cost and risk of poaching significantly
  - Currently arrest rate is at 5%
- Ceasing weapons and equipment
  - Find caches for weapons, equipment, horns
- Better knowledge of animal migration
- Raising awareness of “African Crisis”

# WHO we Are



## Wildlife Volunteers



## Engineering Students





# Conceive, Design, Build, and Operate a UAV that helps fight Rhino Poaching



ASEN 5018/6018 section 18; Spring and Fall 2014



Develop a special, remotely-piloted hybrid aircraft meeting stringent operation-in-wilderness requirements, and equipped with diverse sensors to detect poachers

University Collaborations	Stuttgart, Pretoria, Metropolia Helsinki
Industry Collaborations	Helios Torque Fusion, NIST, Four Winds Interactive; other
Endorsing Organizations	Wildlife Protection Solutions; African Conservation Foundation; Protecting African Wildlife Conservation Trust (UK); Denver Zoo

*Interested in being part of the team?*

The team needs aerospace, mechanical, electrical, computer engineers.

**Skills needed** in structures, composite materials, fabrication, aerodynamics, thermodynamics, controls, (power) electronics, sensors and instrumentation, software, etc.

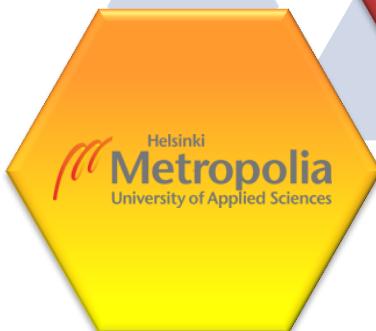
Prof. Jean Koster; [jean.koster@colorado.edu](mailto:jean.koster@colorado.edu)

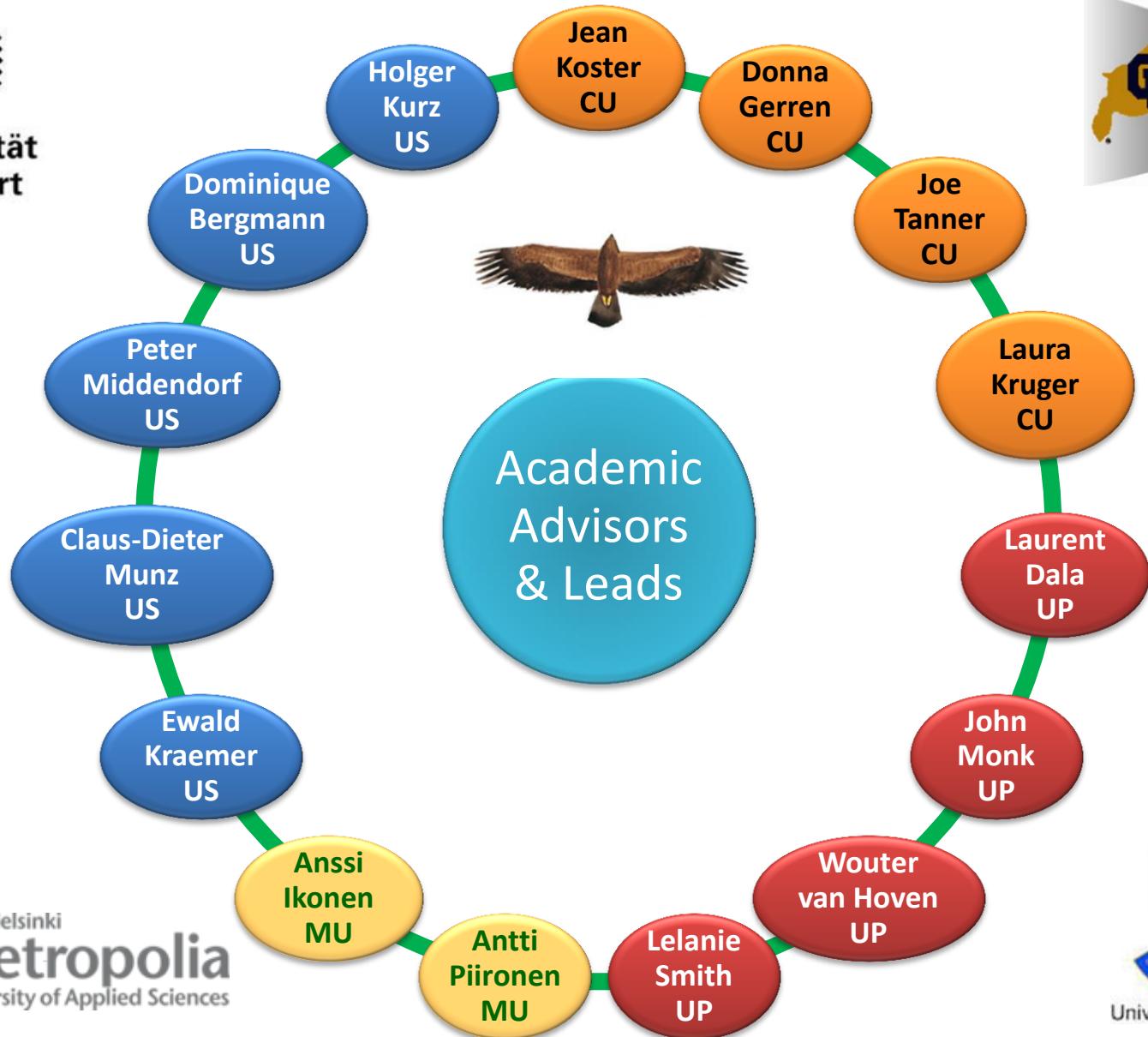
# AREN'D Global Team

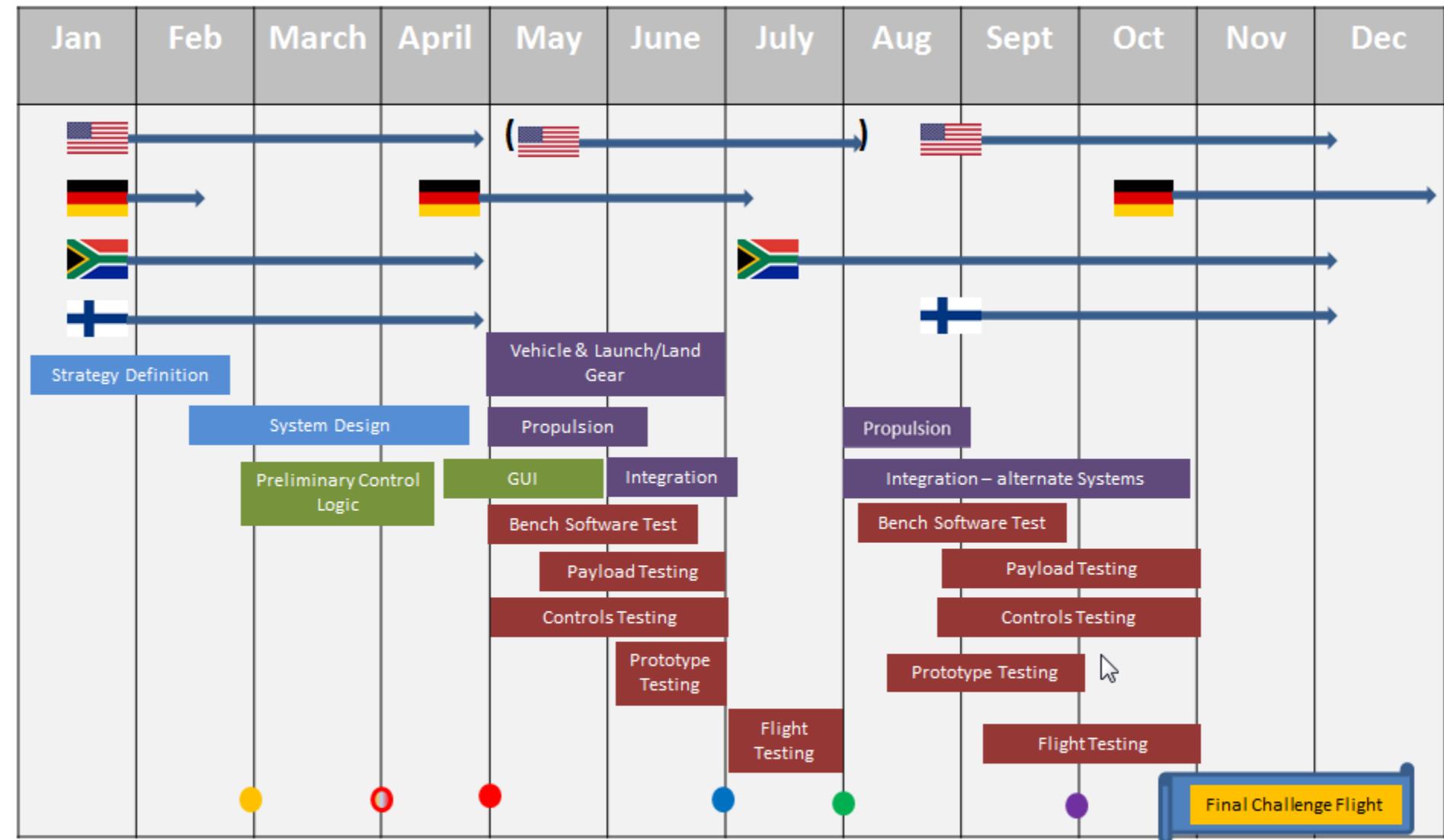
Industry/  
Agency  
Advisors

University  
Advisors

*AREN'D*







Feb. 28 UAV Concept

March 31 Preliminary Design Review

April 30 Critical Design Review

June 30 Flight Readiness Report

July 31 Flight Test Report

Sept. 30 Final Design Report

CU (U.S.) [Jan. 13<sup>th</sup> – May 8<sup>th</sup>], [May 12<sup>th</sup> – Aug. 9<sup>th</sup>], [Aug. 24<sup>th</sup> – Dec. 17<sup>th</sup>]

US (Germany) [Oct. 17<sup>th</sup> – Feb. 8<sup>th</sup>], [April 7<sup>th</sup> – July 19<sup>th</sup>], [Oct. 13<sup>th</sup> – Feb. 14<sup>th</sup>]

UP (S. Africa) [Jan. 6<sup>th</sup> - May 29<sup>th</sup>], [July 1<sup>st</sup> - Dec. 5<sup>th</sup>]

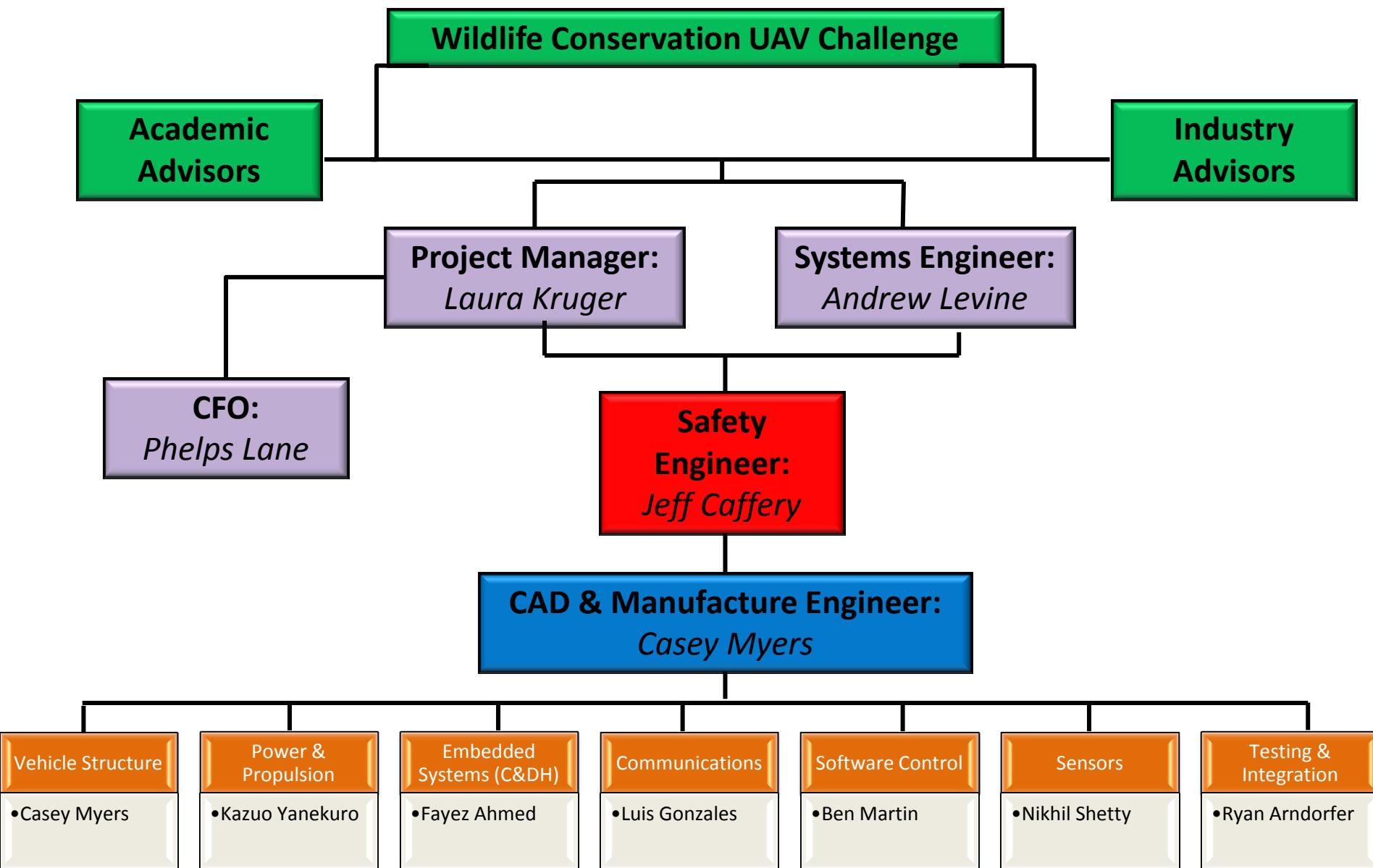
MU (Finland) [Jan-May], [Aug.-Dec.]

Design

Software

Manufacturing

Testing





# Important Dates

wcUAVc



**February 28, 2014: Team Design Concept**

**April 30, 2014: Critical Design Review**

**June 30, 2014: Flight Readiness Report**

**July 31, 2014: Flight Test Report**

**September 30, 2014: Final Design Report**

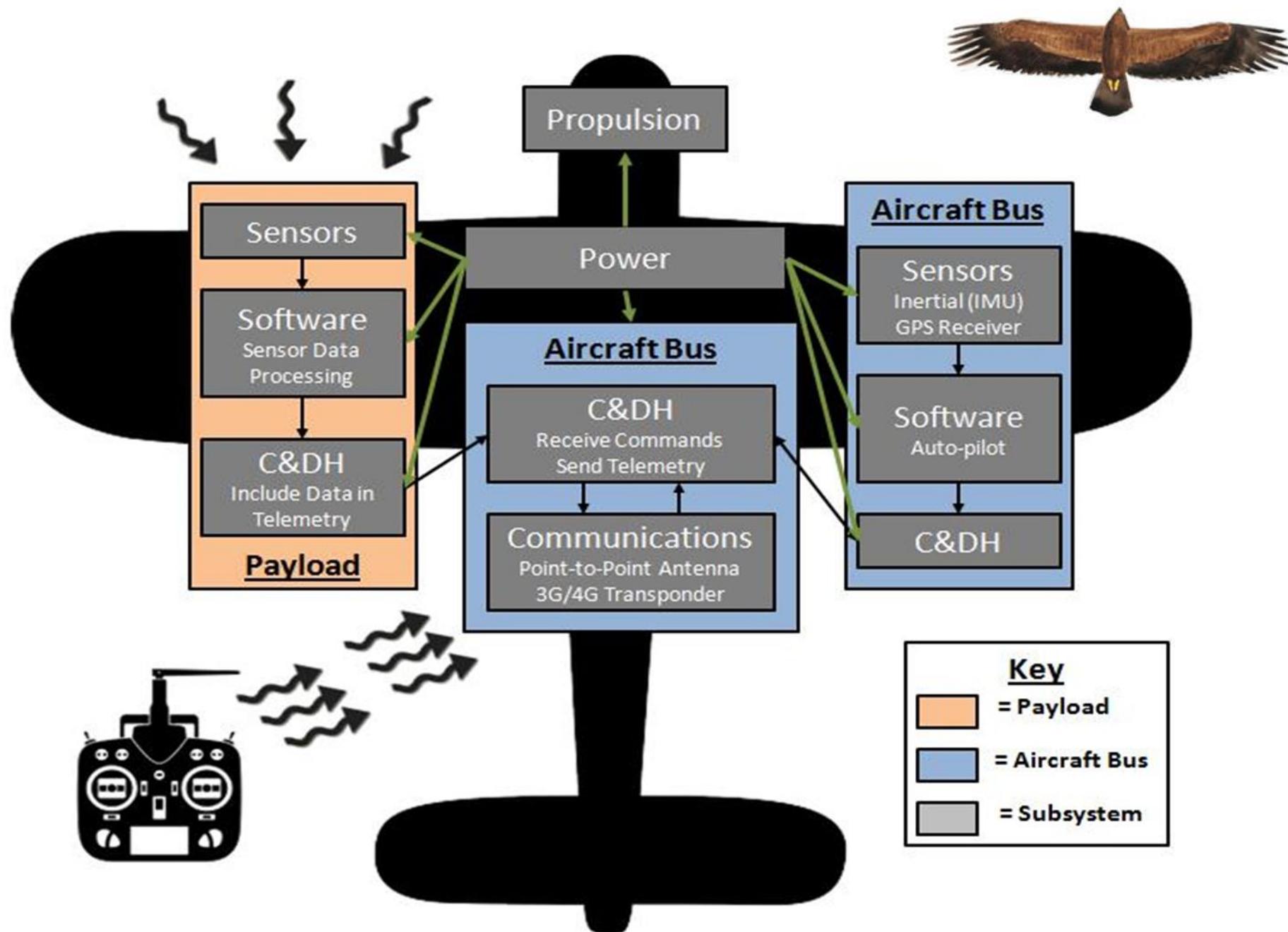
**November TBD, 2014: Competition in SA**

# Requirements/Strategy



- Aircraft mainly for reconnaissance
- System shall handle harsh environment
- Carried by jeep and launched quickly
- Shall be quiet in flight
- Detect poachers; alert Rangers





# Helios Torque Fusion

## Hybrid Propulsion Technology



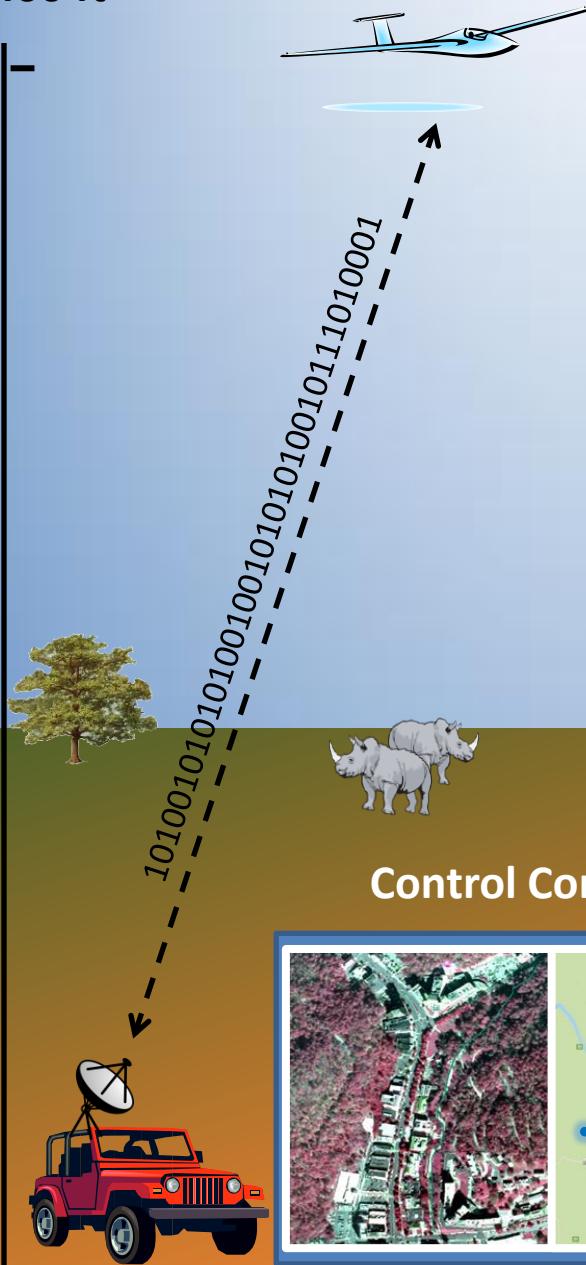
HTF brings hybrid-electric propulsion systems to aircraft. Combines the benefits of electric power with the benefits of liquid fuels, through the use of parallel drivetrains with unique energy sources.

	Quiet, all-electric drive mode	Liquid-Fuel Endurance	Redundant Power Source in Failure Mode	Egress Boost "Dash Mode" without oversizing ICE
<b>Helios Torque Fusion Transmission System</b>	Yes	Yes	Yes	Yes
Electric Drive	Yes	No	No	No
Series-Hybrid Drive	Yes	Yes	No	No
Internal Combustion Engine Drive	No	Yes	No	No

### Advantages:

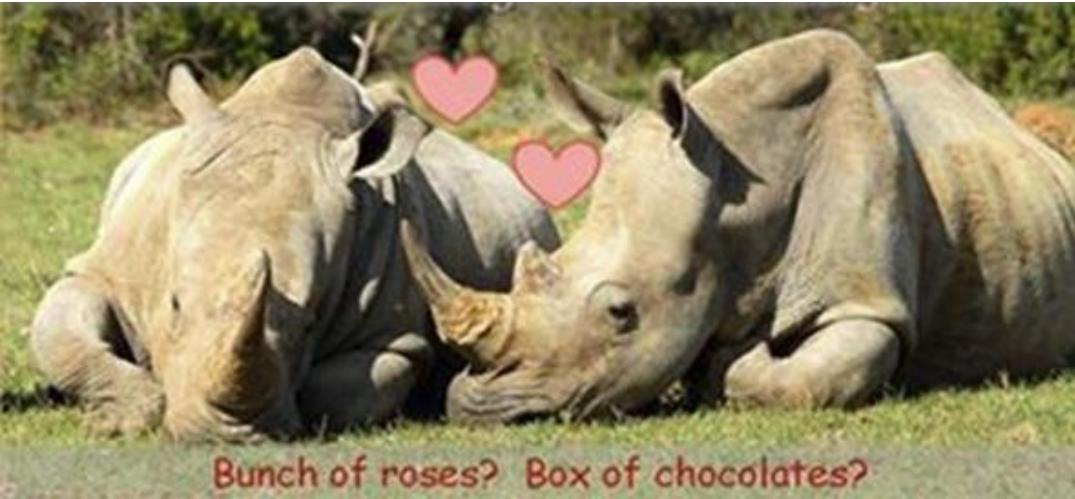
1. Better endurance / longer range
2. Stealth / quiet operation of electric drivetrain
3. Fuel efficiency of hybrid optimization
4. Redundant power supply for emergency operation / failure scenarios

400 ft



## Surveillance and Intelligence Gathering

- Detect Target Mode (humans, rhinos)
- Find and Determine Mode
- Follow and Track Mode
- Engage Mode



Don't be one of the millions  
who turn their back on this



Let's give them a  
chance to celebrate  
more Valentine days!

# Panel Discussion

<http://youtu.be/yccID-2jlfM>

<http://facebook.com/teamAREN>

