NASA Study To Use a Predator B-class Unmanned Aerial System (UAS) In Support Of Arctic/Antarctic Polar Missions

presented by
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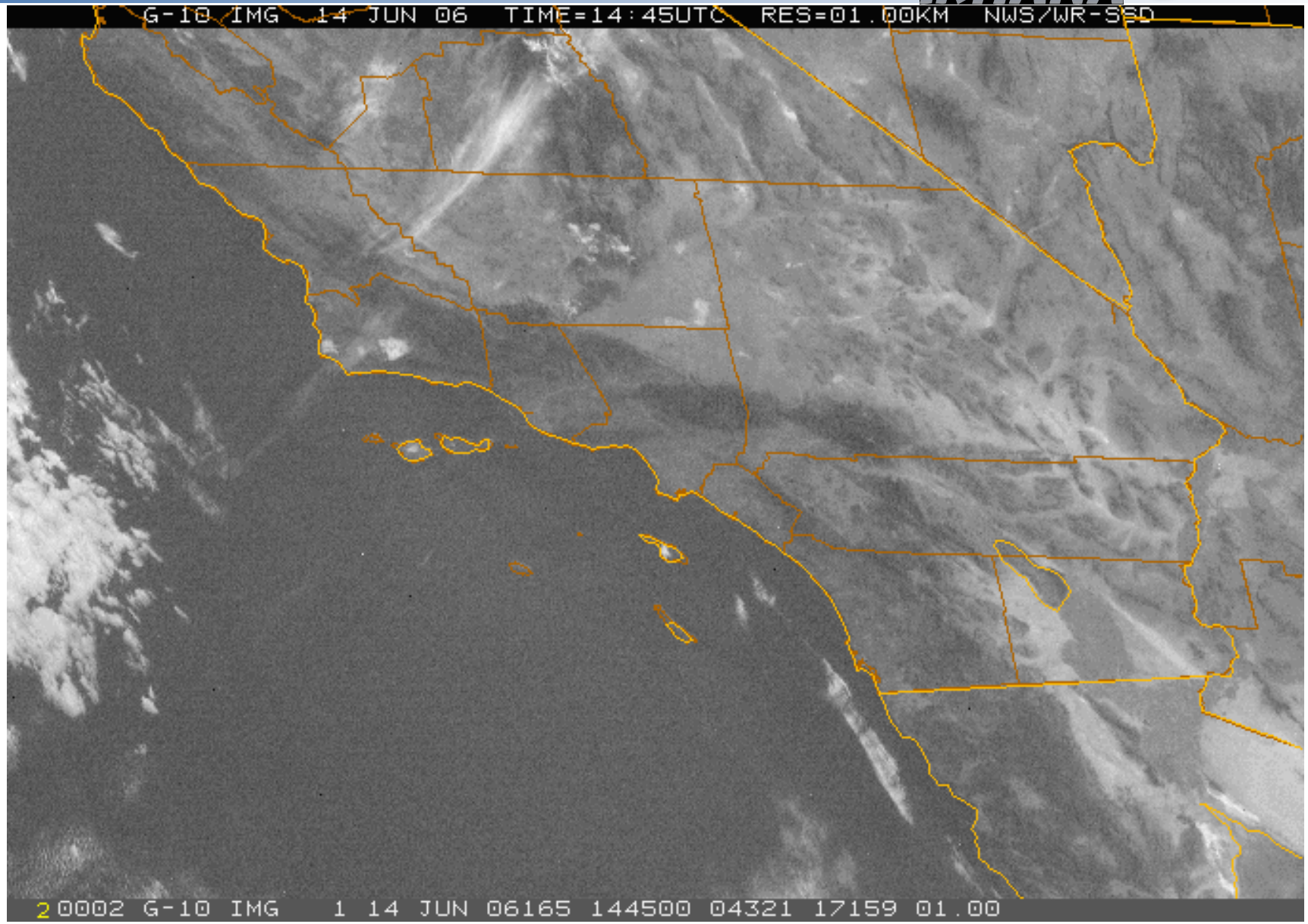
Where is DFRC?

IKHANA



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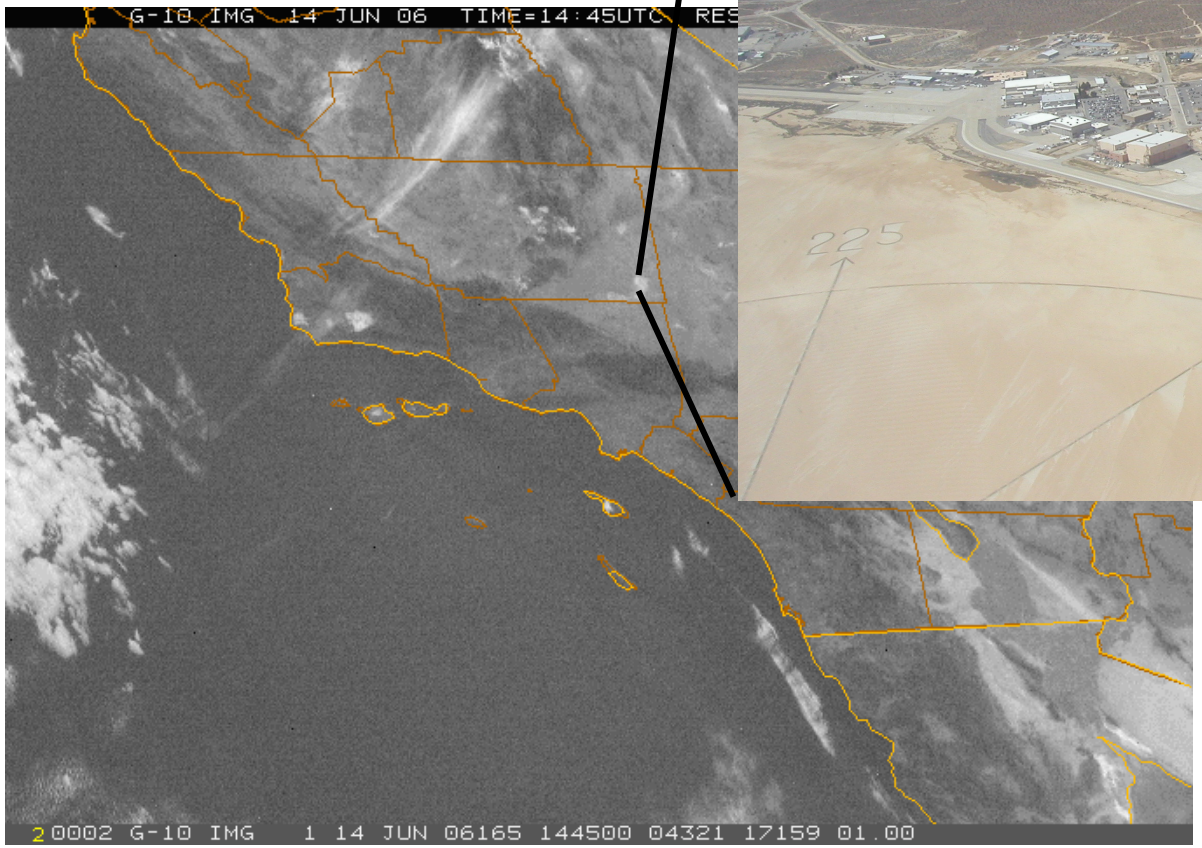

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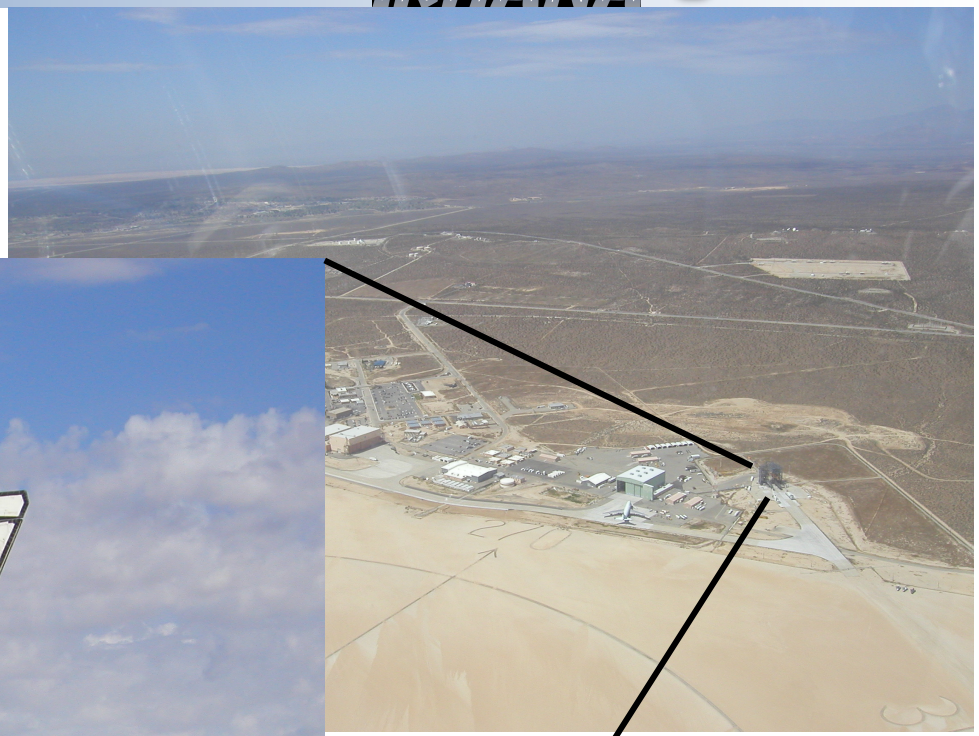

Outline

- Objectives
- Background In UAV
- Aircraft Description
- Current Activities
- Meteorological Requirements
- Summary

Objectives

- **Primary: NASA is assessing the challenges of operating a Predator B-class Unmanned Aerial System (UAS) on/over the Antarctic region.**
- **Secondary: Assess the challenges of operating a Predator B-class UAS on/over the Arctic region.**
- **Goal: To demonstrate that a UAS can be used as a platform for science missions over a region like Antarctic/Arctic**

Background

- **NASA Dryden has been demonstrating UAS capabilities since the early 1970's**
  - 1994-2003 Environmental Research Aircraft and Sensor Technology (ERAST)
  - 2004-Current High Altitude-Long Endurance (HALE)
- **Many milestones were achieved during past UAS programs…….**

Altus II
•Thunderstorm Research
•Forest Fire Recon

Helios Prototype
•World Record Flight
96,863 feet
•Fuel Cell Research

Altair
•Atmospheric/Ocean Research
off California coast

Pathfinder+
•Imaging coral reef and
vegetation over Kauai
•Telecom platform
•Record Flight: 80,201 ft

Why a UAV/UAS?

- **Reduce risk. (If aircraft crashes, pilot will probably walk out of the cockpit uninjured)**
  - Current manned aircraft (like ER-2) is a candidate but is single engine and not as long duration.
- **Long(er) endurance capability.**
- **Slower airspeed in comparison to conventional aircraft**
  - Improve in-situ sampling of the atmosphere
  - Smaller loitering footprints
- **UAV/UAS will, in my opinion, will be an extremely valuable asset for future research.**
- **Reduced ground support**
- **Future aircraft could become virtual "atmospheric satellites"**

General Atomics Aeronautical Systems' Predator B "Ikhana"

Ikhana: "to teach, to inform" *Choctaw*

Predator B Description/Airspeed capability

IKHANA

- **Remotely piloted aircraft built by General Atomics Aeronautical Systems.**
- **Wing span: 66 ft (20m)**
- **Aircraft length: 36 ft (11m)**
- **Aircraft Gross Takeoff Weight: ~10,500 lb (4763 kg)**
- **Max Altitude: 50,000 ft**
- **Max Airspeed: 220+ KTAS*** ***KTAS (knots true air speed)**
- **Max Endurance: 30+ hrs**
- **Payload capacity:**
  - Internal 800 lb (363 kg)
  - External 3,000 lb (1361 kg)

- **Source: General Atomics Aeronautical Systems**

http://www.uav.com/products/predator-b.html

Weather Criteria

- **Wind limits (surface)**
  - Headwind: 30 knots
  - Crosswind: 15 knots
- **Avoid Turbulence ≥ moderate**
- **Upper level winds are sufficient to yield a viable mission plan**
- **Temperature limits: TBD**
- **Avoid thunderstorm/lightning***

* **Some non polar missions may require flights near thunderstorms.**

Current Activities

- **Collecting information on potential sites of operation**
  - Runway types (ice, gravel, paved,etc.)
  - Hangar space and support facilities
  - Fuel access
  - Baseline: McMurdo
- **Gather climate information (surface and upper air)**
  - Focus is on wind and temperature
  - Identify locations with high probability of favorable conditions
- **Identify alternate landing sites**
- **Evaluate satellite coverage for communication and navigation**
- **Determine payload capabilities**

Possible Payloads….

- **No payload has been selected at this time**
- **Potential payload candidates:**
  - Dropsondes (Ordinance)
  - Airborne sensing
  - Remote sensing (imaging)
  - Others…..
- **If this study becomes a project, it is likely that NASA will request proposals.**

Meteorological Requirements

Observations:

- **Multiple soundings for mission planning (~every 3 hours).**
- **Latest Surface observations from alternate sites.**
- **Current satellite images.**
- **This information will be used to verify conditions satisfy weather go/no-go criteria for takeoff.**
- **Forecast conditions (surface and aloft) must also satisfy weather criteria prior to takeoff.**

Meteorological Requirements

Forecasts:

- **Must be able to forecast weather conditions (surface and aloft) with sufficient accuracy as to ensure safe recovery of the aircraft (Primary and alternate landing sites).**
- **Forecasts must be able to cover mission duration (30+ hours).**
- **Forecast for alternate landing sites, including the poles, in the event the aircraft must make an emergency landing.**
- **Forecast soundings that can be used for mission planning purposes.**
- **Goal: Minimize temporal and spatial gaps**
- **Data from aircraft can assist in forecast validation**
- **Requirements same for Arctic mission**

Future Work

- **Need more climate data**
  - Surface data for candidate landing sites
  - Upper air data (where available)
- **Would appreciate your input**
- **Other questions:**
  - Is current forecast model and techniques adequate for our needs?
  - If not, when?

Summary

- Primary objective is to fly over the Antarctica continent, possibly South Pole, to demonstrate the Predator B as a science platform
- Flights over the Arctic is also a possibility, especially as a "Plan B"
- Will need to utilize existing hi-resolution models to generate point forecasts (surface and aloft) out to at least 30 hours
- Assistance from the modeling community to better understand model capabilities in the Antarctic/Arctic and polar regions.
- Type of payload is TBD. If study becomes project, request for payload proposals should follow. Format TBD.
- UAV/UAS will become valuable tool in atmospheric research
- Questions???????

Thank you….

- **Matthew Lazzara for inviting me to the meeting**
- **Jordan Powers for fitting me in.**
- **All the participants for the EXCELLENT presentations**
- **The AMPS modelers for putting up with all my grilling**
- **Look forward to the future…….**