



The Syria Airlift Project

Open-Sourcing Humanitarian Airlift



Mark Jacobsen

Jessie Mooberry



The Medical Crisis in Syria

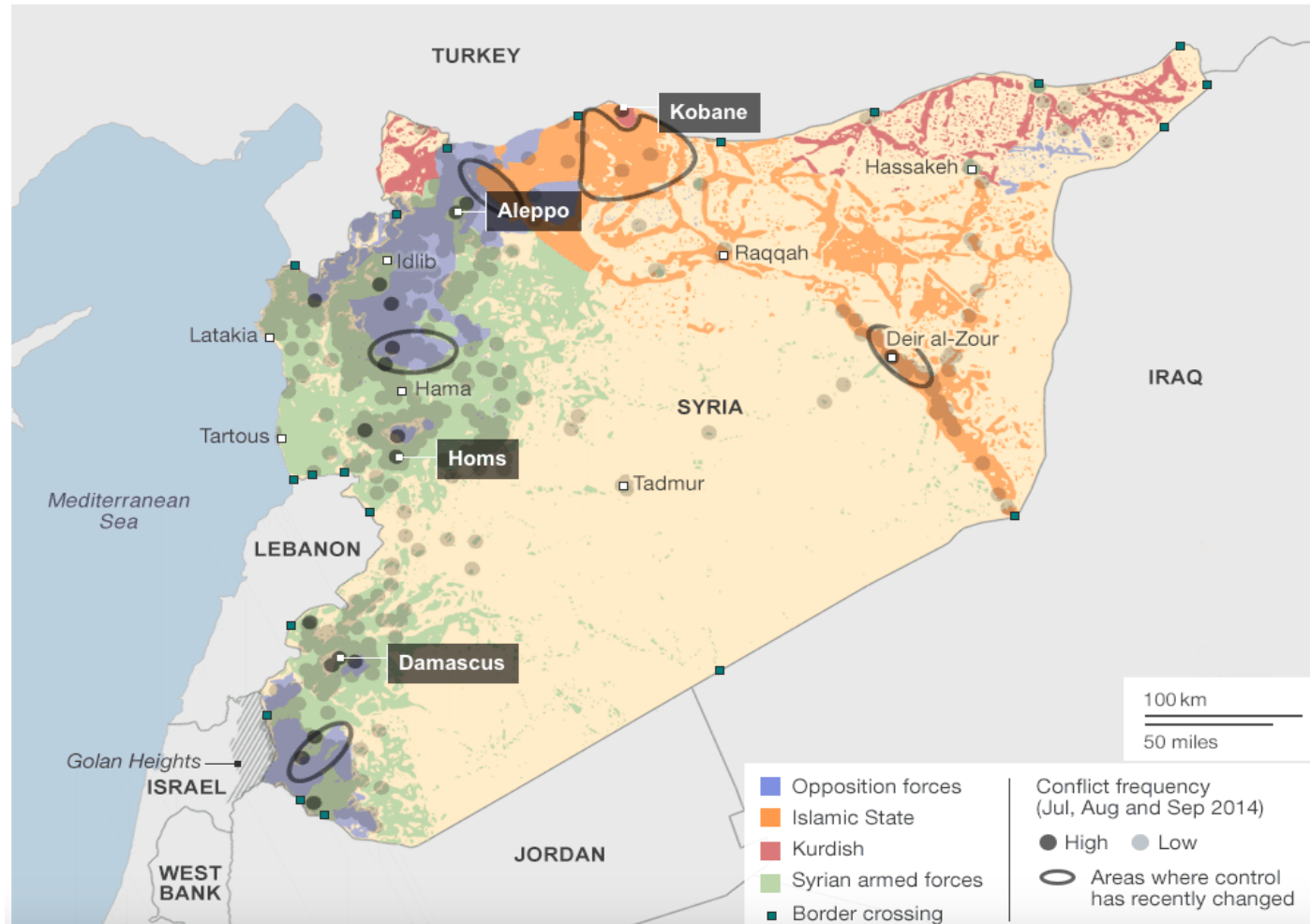


- **212,000** living in besieged areas
- **4.8M** living in hard-to-access areas
- **610** medical personnel killed
- **233** attacks on **183** medical facilities
- Transporting medical supplies punishable by torture & death

“Why do the nations abandon us?”
- Dr. Mohamad, Aleppo



Areas of Need







Swarming Airlift

- Planes cost \$500-\$1000 apiece
- Built from cheap materials like insulating foam and broomsticks
- Aiming for 2kg/4lbs at 50km/30mi range & return (enough to reach Aleppo from Turkey)
- Can iterate to larger designs
- Low mass capability still suitable for medical supplies, vaccines, vitamins, baby milk, etc.





Swarming Airlift

- Survivability
 - Almost impossible for most radars to track
 - Not worth the price of MANPADs
 - Fly at night to avoid small arms
 - Semi-randomized flight plans
 - Cheap enough to absorb attrition
 - Statistical averages more important than individual planes





A Cargo Conveyor Belt

- 5-minute turn-time between flights is doable for a 2-3 man launch crew
 - 12 flights per hour
 - 8 hours/night = 424 lbs/night per launch crew
- We believe 2-minute turn times are possible
That's > 1000 lbs/night per crew
- Key to success: *extreme reliability*





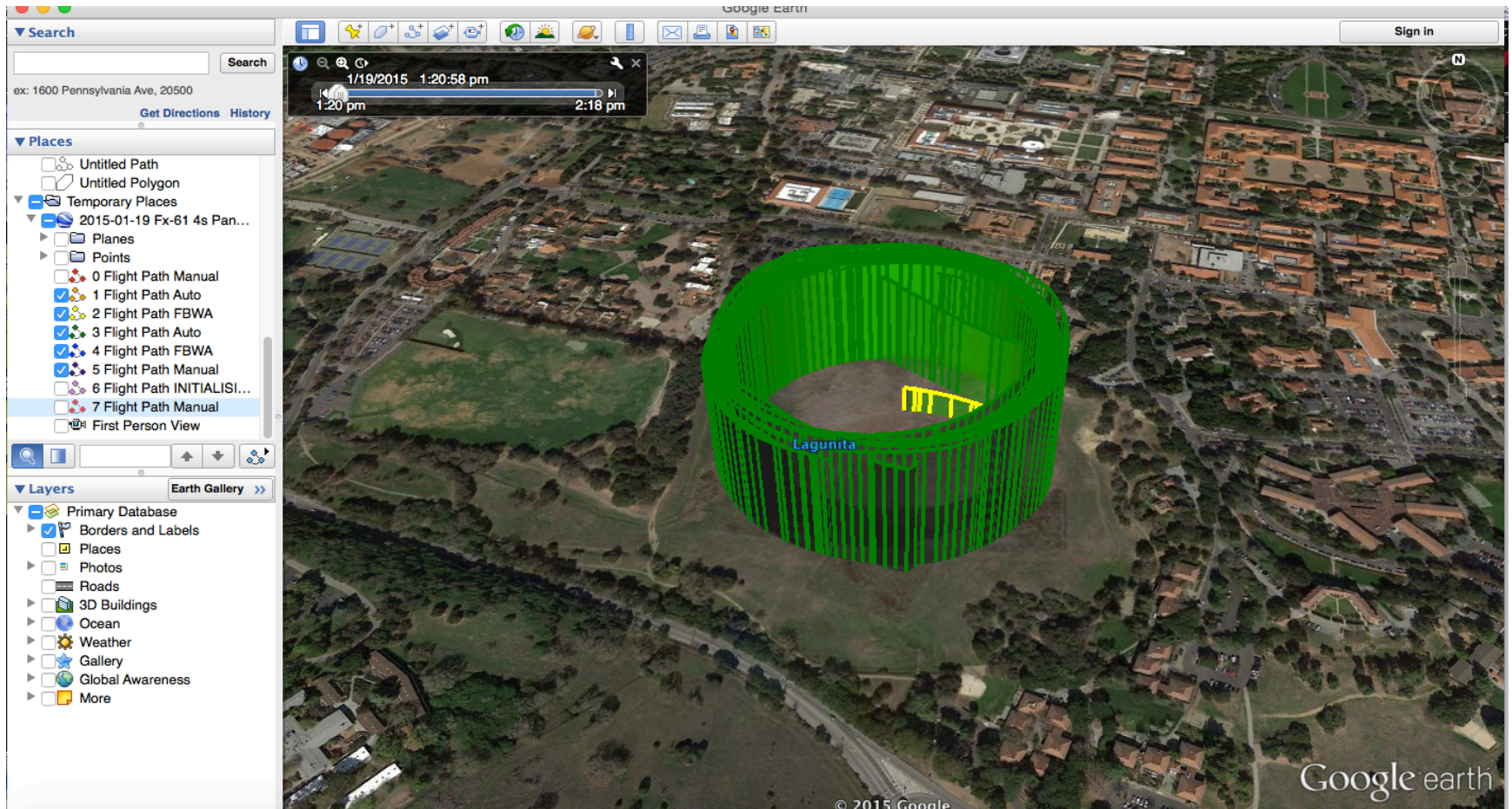
Mission Profile





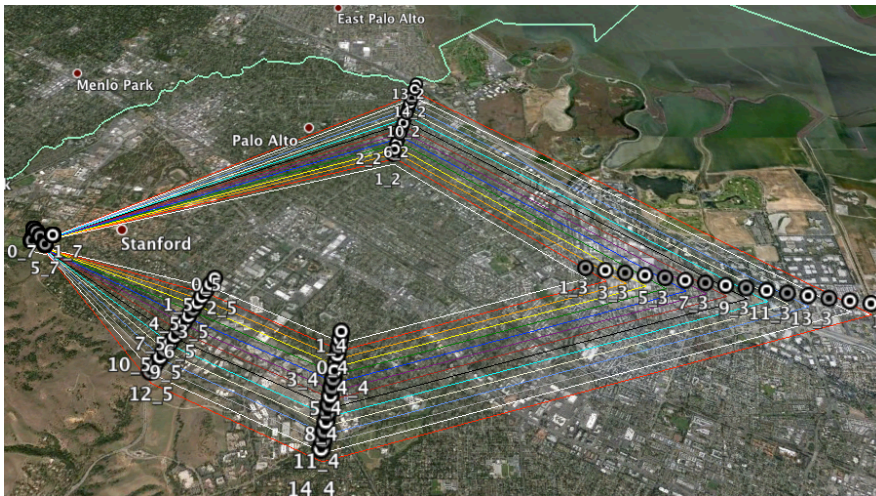
Delivering 1kg at 30km range

(accumulating distance in orbits)





A New Kind of Air Force



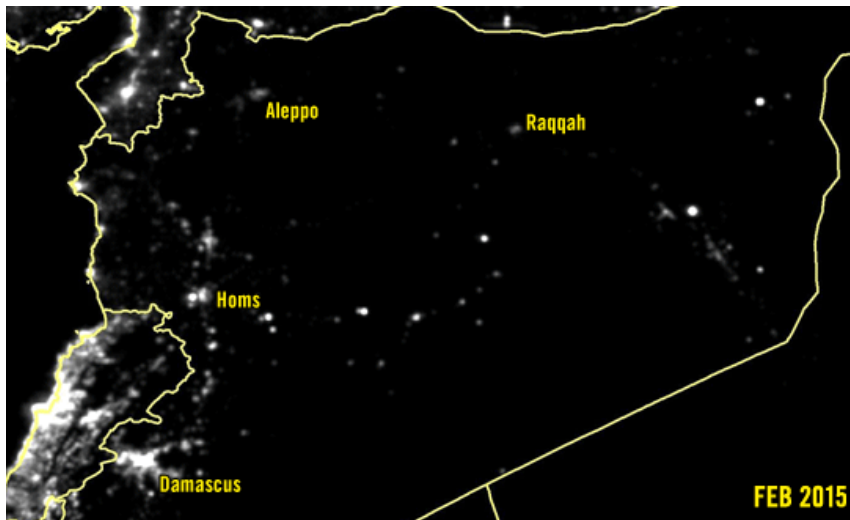
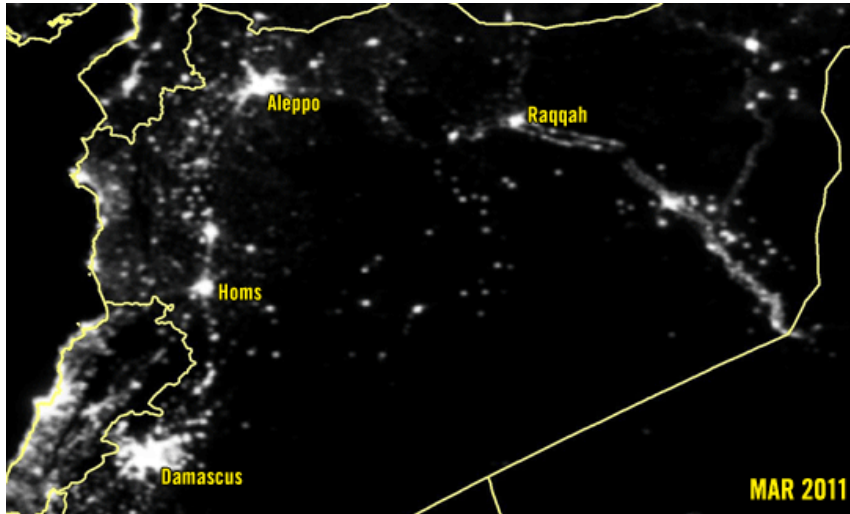


Every Idea is on the Table





“Turn the Lights Back On”







The Volunteer Team

- Stanford PhDs
- A Quaker pacifist
- Engineers from 3D Robotics
- Syrian engineers in Alabama and Germany
- A Science Fiction editor
- A documentary filmmaker
- A Harvard Law student/former AF Intel officer
- The president of an aid group serving Syria
- A Former Syria desk officer from the State Department
- ... and many others!





Where We Are

- All elements of technology under development
- Team working on legal/political issues
- Speaking with many interested stakeholders
- Aiming for pilot project in Turkey in summer
- We need to grow to succeed





The Syria Airlift Challenge





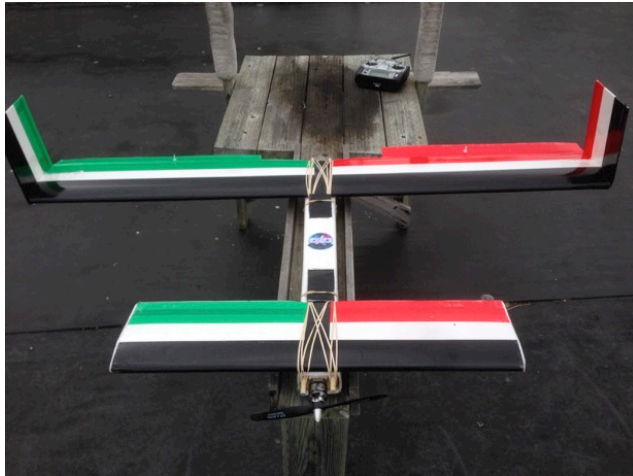
UPLIFT

INNOVATE AID EMPOWER



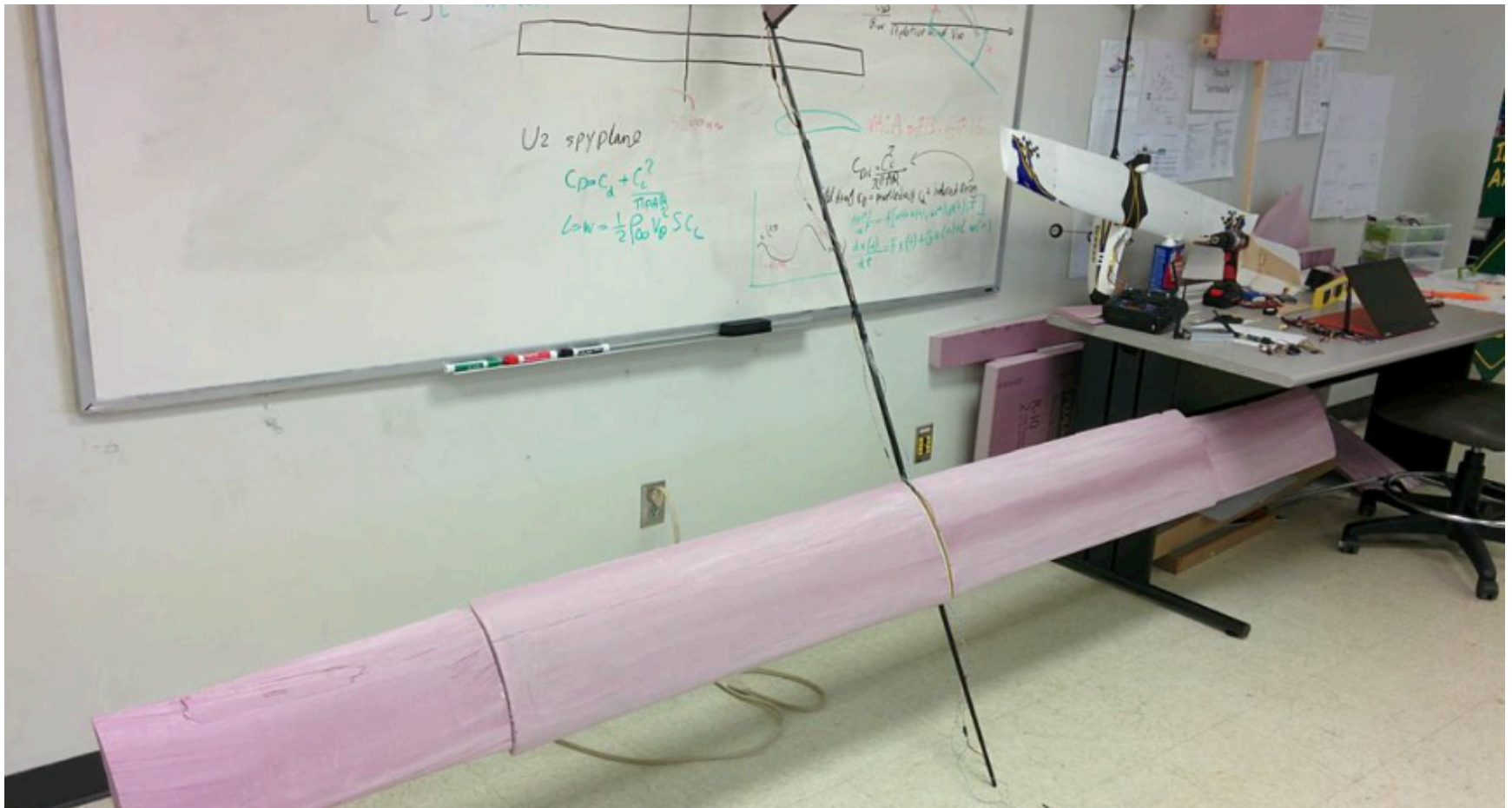


Planes We Operate



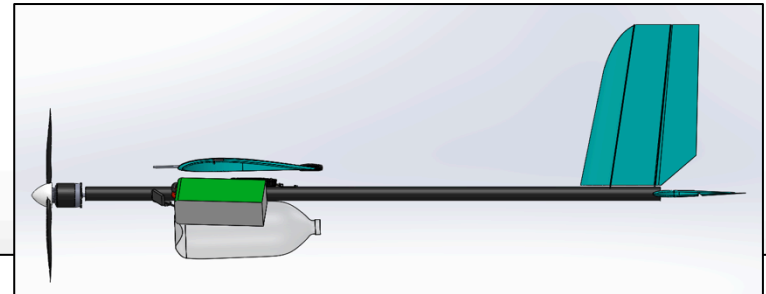
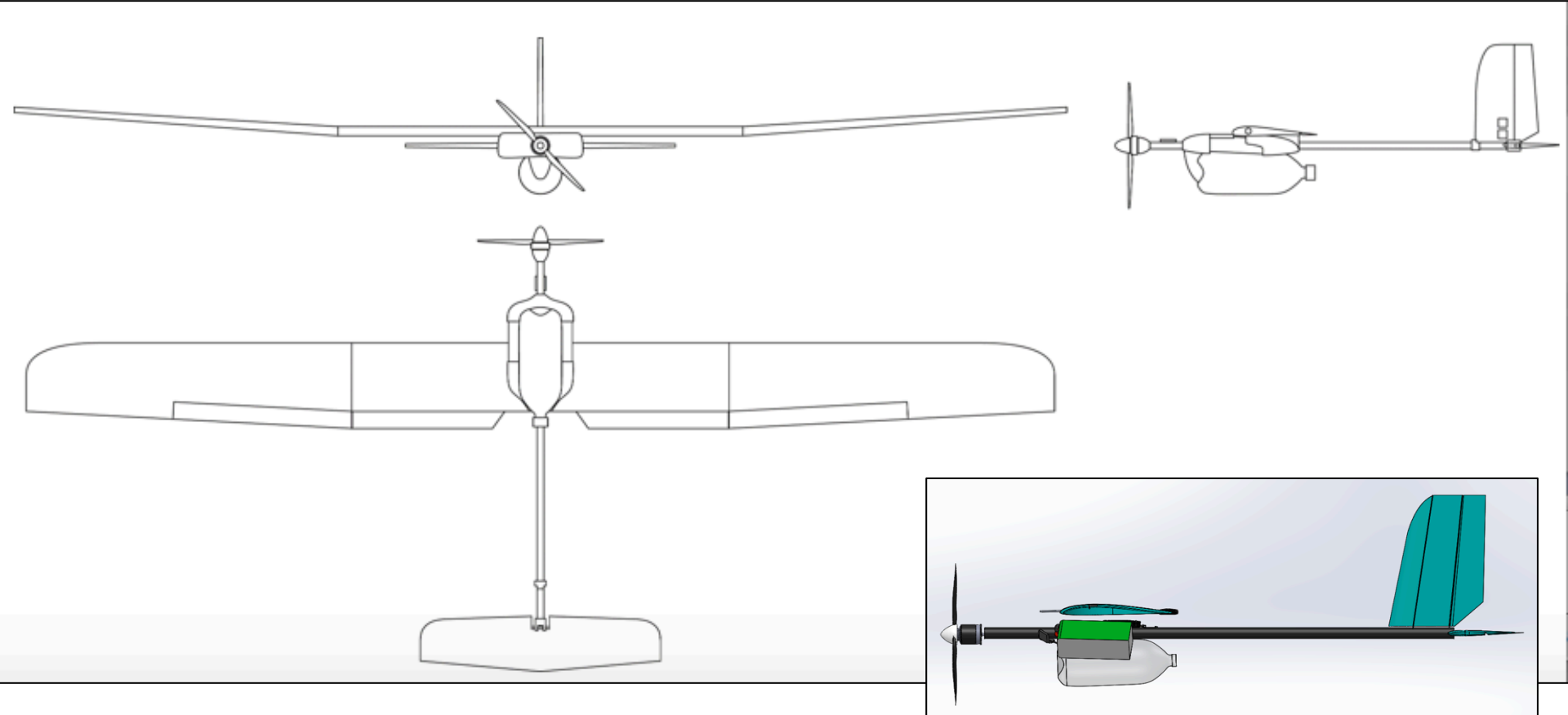


Aleppo 50





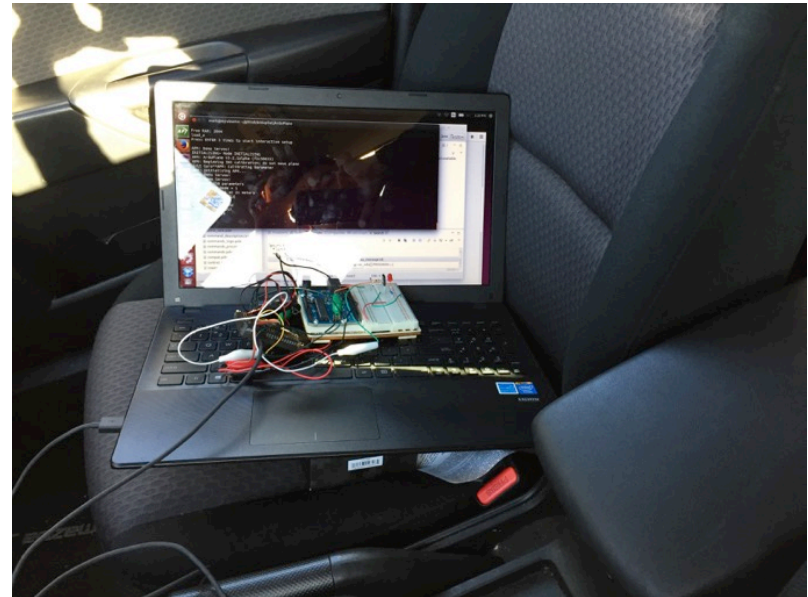
Light Utility Vehicle





Responsible Use Features

- Autopilot self-destruct
- Custom handshake between plane and GCS
- Security certificates
- Remote access denial
- Enforced no-fly zones





Custom ArduPlane Software

```
*sap.pde

bool inside_syria = FALSE;
bool syria_defined = FALSE;
Vector2l polygon[25];

void build_syria(void)
{
    polygon[0].x = 327726855;
    polygon[0].y = 358393878;
    polygon[1].x = 323091965;
    polygon[1].y = 368214431;
    polygon[2].x = 345059871;
    polygon[2].y = 411336193;
    polygon[3].x = 372575689;
    polygon[3].y = 422672444;
    polygon[4].x = 370636834;
    polygon[4].y = 415886048;
    polygon[5].x = 370974321;
    polygon[5].y = 409153921;
    polygon[6].x = 366651648;
    polygon[6].y = 394489162;
    polygon[7].x = 367115031;
    polygon[7].y = 387883922;
    polygon[8].x = 369199528;
    polygon[8].y = 382415577;
    polygon[9].x = 366275365;
    polygon[9].y = 374649535;
```

- Fence In/Out
- Imminent crash detection
- Data link shutdown
- Airdrop CARP
- Security handshake





Testing in Syria with SITL

Console

mark@mj-ubuntu: ~/github/SAPPilot/ArduPlane

```
mark@mj-ubuntu: ~/github/SAPPilot/ArduPlane x mark@mj-ubuntu: ~/github/SAPPilot/ArduPlane
+ options=
+ '[' 0 == 0 ']'
+ options='--master tcp:127.0.0.1:5760 --sitr 127.0.0.1:5760 --sitr 127.0.0.1:5760'
+ options='--master tcp:127.0.0.1:5760 --sitr 127.0.0.1:5760 --sitr 127.0.0.1:5760'
50 --out 127.0.0.1:14551'
+ extra_cmd1=
+ '[' 0 == 1 ']'
+ '[' 0 == 1 ']'
+ '[' 0 == 1 ']'
+ mavproxy.py --master tcp:127.0.0.1:5760 --sitr 127.0.0.1:5760 --sitr 127.0.0.1:5760 --sitr 127.0.0.1:5760
14550 --out 127.0.0.1:14551 --cmd= --map --console
Logging to mav.tlog
Loaded module console
Loaded module map
MAV> INITIALISING> MANUAL> Received 469 parameters
MANUAL> wp load FlightPlan/syria_full.txt
MANUAL> Unable to load FlightPlan/syria_full.txt - [Error: 'FlightPlan/syria_full.txt' not found]
wp load FlightPlans/syria_full.txt
MANUAL> Loaded 13 waypoints from FlightPlans/syria_full.txt
MANUAL> mode auto
MANUAL> 
```

Map

Click: 36.263235 36.681235 (36°15'47.64" 36°40'52.44") (N 37 291694 015639) Distance: 402.5m Bearing 78.5

WP 3 Distance 70 Bearing 55 AltError 5L AspdError -0.9H FlightTime 2:01 ETR 4:06

height 410
height 430
height 440
600
height 450
height 460
height 470
height 480
400
height 490
height 500
200

Software Updater

Entering Syria



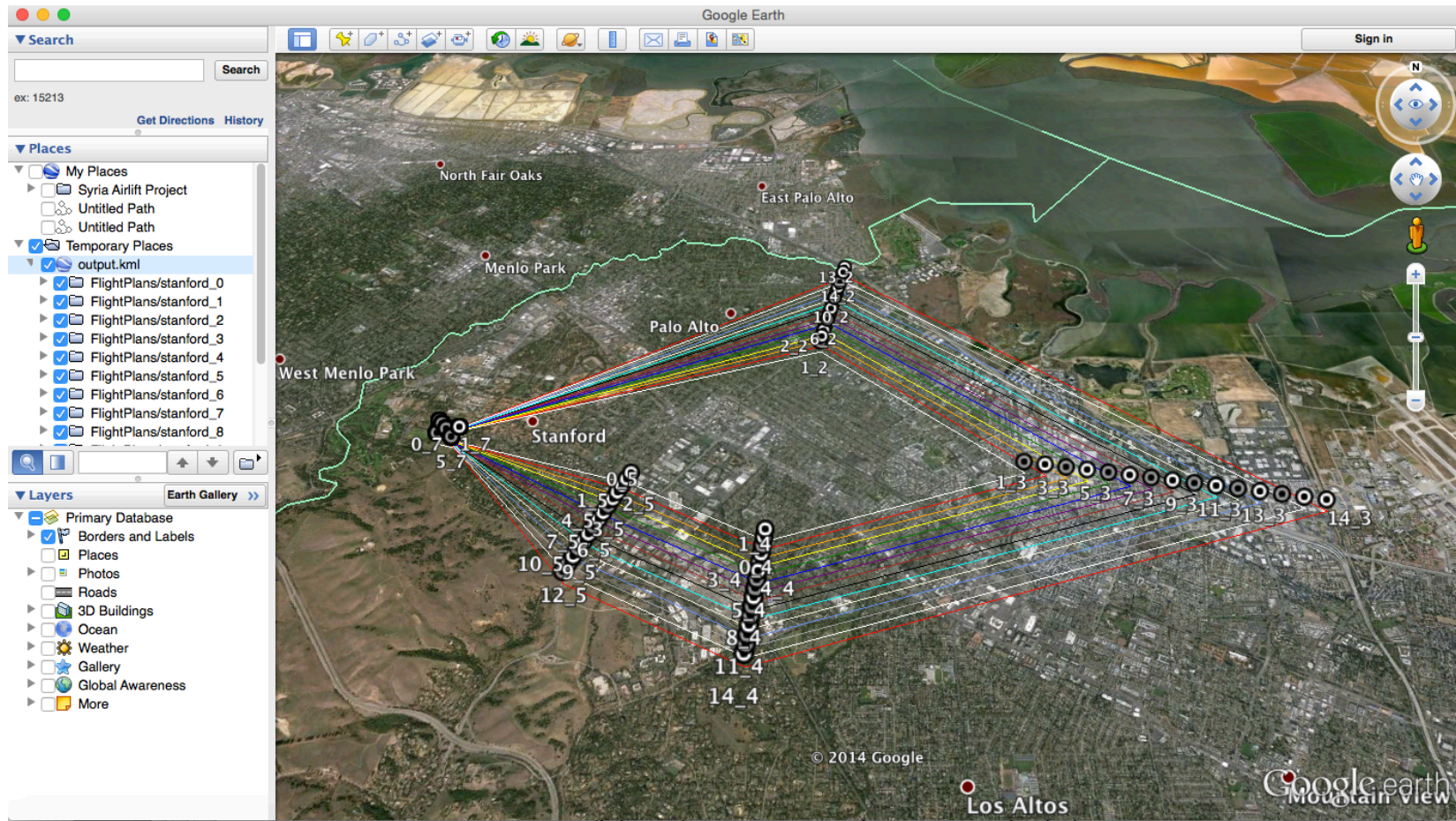
SAP Station

- Two purposes for custom GCS:
 - Engineer out the likelihood of human error
 - Facilitate reliable operation of large numbers of aircraft
- At present, goal is to remove human from loop. We want fully automated flight profiles.





Swarmify Flight Plans






SAP Station: Checklists

Preflight/Launch Aircraft

Confirm Aircraft Type



This flight plan is for an FX-61 Phantom Flying Wing, depicted here. Is this the type of aircraft you are preparing to launch?

Yes, this is the correct aircraft type

No, this is not the correct aircraft type

Disconnected

Preflight/Launch Aircraft

Connect Autopilot

Connect the autopilot to the computer using a USB cable. Once it is connected, select continue

Port: default value Baud: 115200

Connect

Connected

There is a problem connecting the USB cable.

Disconnected

Preflight/Launch Aircraft

Incorrect Aircraft Type

This aircraft is not safe to fly. The aircraft you are attempting to preflight is different than the one specified in the flight plan. Please change the flight plan, or else try again with the correct aircraft type.

Abort Launch

Disconnected

```
<STEP id="aircraft_type">
  <TITLE>
    <EN>Confirm Aircraft Type</EN>
    <AR>AR Confirm Aircraft Type</AR>
  </TITLE>
  <PANEL type="media">
    <EN>aircraft_photo.jpg</EN>
    <AR>aircraft_photo.jpg</AR>
  </PANEL>
  <PANEL type="text">
    <EN>This flight plan is for an FX-61 Phantom Flying Wing, depicted here. I:
    <AR>AR Expanded</AR>
  </PANEL>
  <BUTTON link="connect_autopilot" color="green" visible="true" enabled="true">
    <EN>Yes, this is the correct aircraft type</EN>
    <AR>AR Yes, this is the correct aircraft type</AR>
  </BUTTON>
  <BUTTON link="error_wrong_aircraft" color="red" visible="true" enabled="true">
    <EN>No, this is not the correct aircraft type</EN>
    <AR>AR No, this is not the correct aircraft type</AR>
  </BUTTON>
</STEP>
```



Ethical Tensions

- Drones in a combat zone
- Political effects
- Violating sovereign airspace
- Risks of retaliation
- How to build trusted networks
- Open source vs security requirements





How to Help

- Volunteer
 - Sponsor
 - Donate
 - Follow
-
- Help Uplift Aeronautics grow





Some Software Projects

- ArduPlane: airdrop module
- SAPPlane: enforced no fly zones
- SAPPlane/GCS: security handshake
- SAPPlane: custom failsafes
- GCS: interactive checklists
- GCS: mission scheduling
- GCS: authentication



About four hours ago there was a chemical attack on Sarmin, Idlib. 6 dead, 70 wounded. Sarmin isn't far from the border but the border is closed to all traffic... **If your planes were ready, you could have flown in emergency medicine and gear :-)**

So plz study what happened and use it to explain to donors why this project is necessary





www.syriaairlift.org

@SyriaAirlift

@UpliftAero