Usability test of a prototype UAS (Unmanned Aircraft Systems) awareness interface for public users

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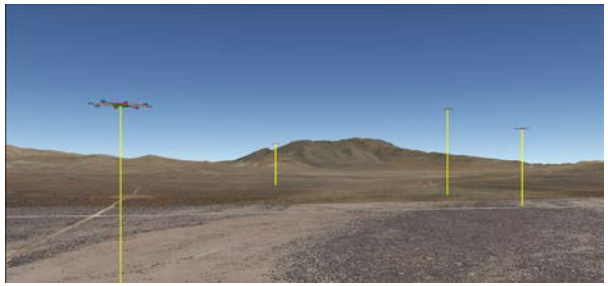
UAS Traffic Management Concept (UTM)



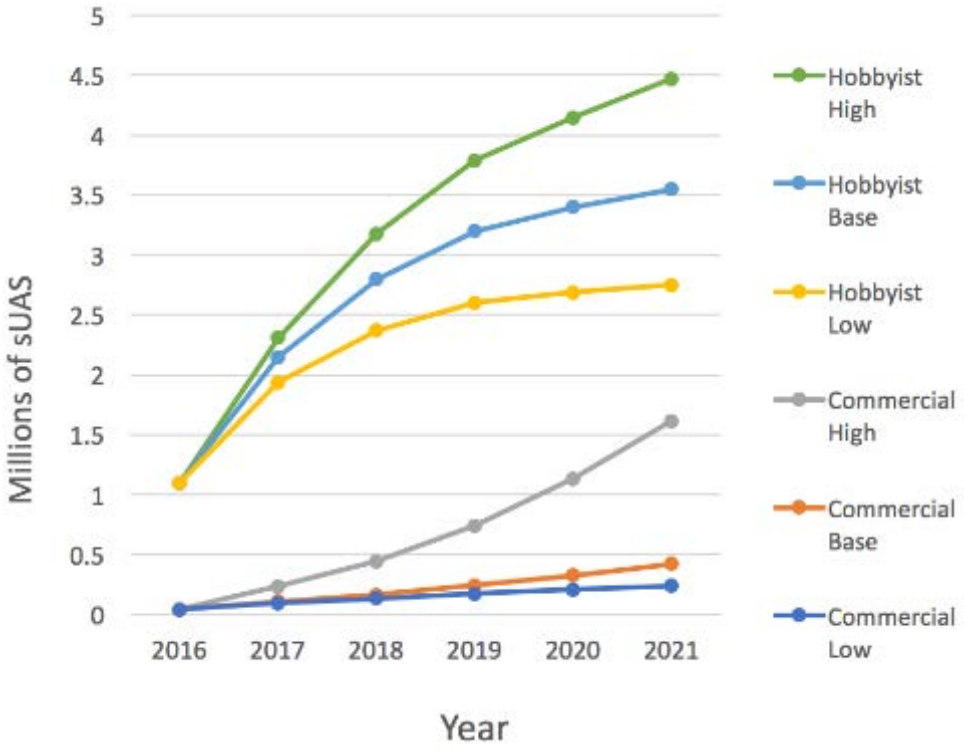
- UTM is being designed to allocate active management of aircraft to automation (with human involvement by exception)
- Experience from manned aviation indicates a non-partisan traffic management system is necessary
- More support from automation will be needed to meet demand (airspace capacity)
- Operators and stakeholders will collaboratively run the system
- UTM is focused on safely enabling small UAS (less than 55lbs) operations in low altitude airspace (Class G, <400ft)

Acronyms
sUAS = small Unmanned Aerial System
UAV = Unmanned Aerial Vehicle

How could the public find out about sUAS?

- The unmanned aircraft fleet of sUAS is forecast to reach 35 times that of manned aircraft in 2020

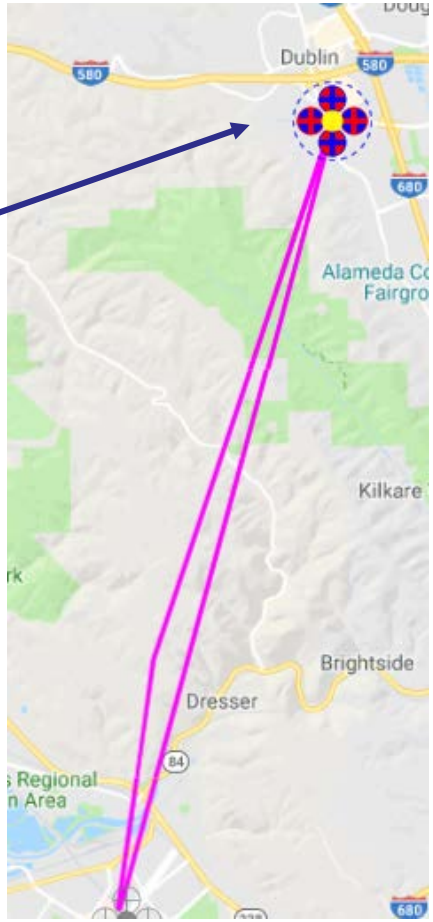
- The public will be recipients of, and therefore benefit from, sUAS services
- Focus groups indicated, with so many different services, the public would like to be able to find out about low altitude operations
- What do the public want to know about sUAS and how would they like to see that information?



From UTM Conops report v1.0 by the FAA (2018)

Suggested features of a public portal

- Map view
- City of operation, location within city
- Start and end time of flight, date
- Make and model of vehicle
- Position of vehicle*
- Mission / purpose/ kind of operation
- Emergency vehicles
- Live flight tracks with altitude, speed, location*
- Unique ID
- Payload
  - If a camera payload, the camera capabilities
- Ability to ask for more information
- How to contact the operator
- Vehicle is physically labelled
- Indication of a valid operation
- Data logging for later review & analysis (with delay)
- Marked high risk areas



* Many operators disagree that exact vehicle position should be shown to anyone outside their crew

A view into sUAS activity

Situation Display

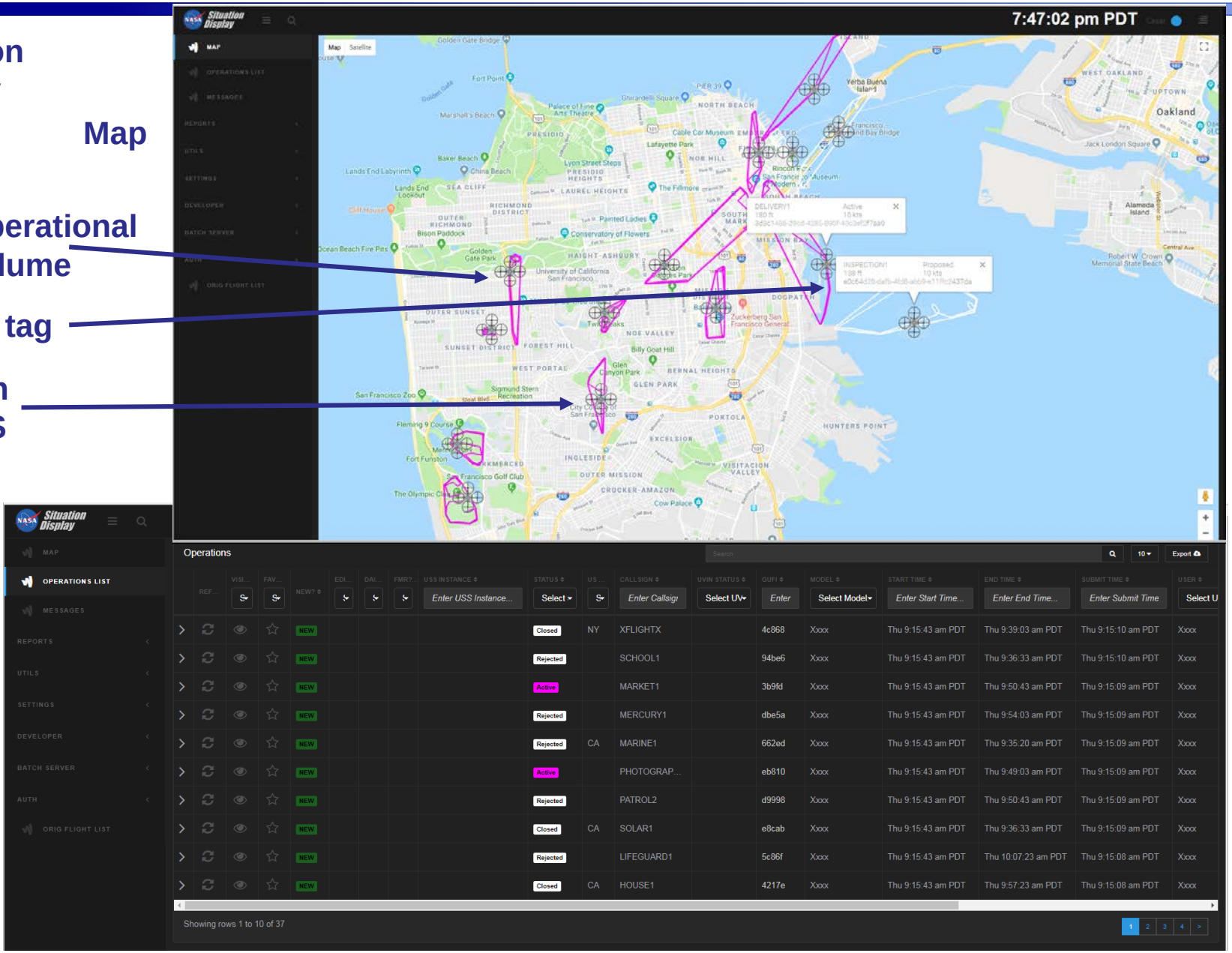
Map

Operational volume

Data tag

Position of sUAS

Table



A prototype public portal tool

Map

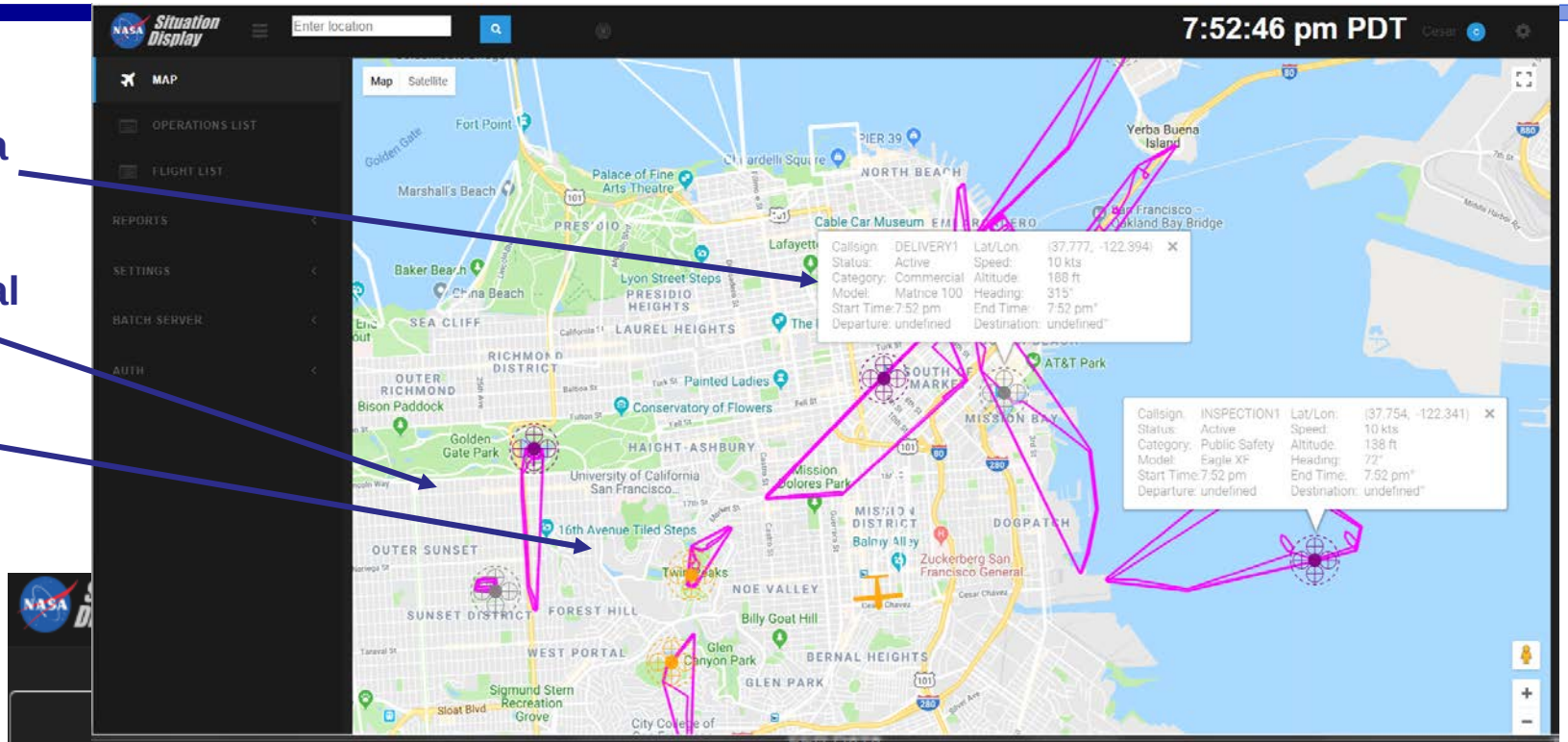
Data tag

Operational volume

Position of sUAS

Table

Drop down of detailed information



CENT...	VI...	F...	SEVICE PROVIDER	STATUS	DEPARTURE CI...	DESTINATION ...	CALLSIGN	CATEGORY
›			SF Drones	Closed	Fremont	Fremont	FIRE870	Public Safety
›			Nor-Cal UAVs	Rogue closed	Fremont	Fremont	INSPECTION353	Public Safety
›			Nor-Cal UAVs	Closed	Fremont	Fremont	DELIVERY6	Commercial
			SF Drones	Active	Fremont	Fremont	INSPECTION874	Commercial

Mission Type: Utilities
Mission Desc: Inspection
Vehicle Class: FixedWing
Payload: Camera
Cruise Alt: 500
Request Details

Make: UASUSA
Model: 3DR Aero
Vehicle Type: Fixed wing
Cruise/Max Speed: 50 mph (43kts) / 110 mph
Energy Endurance: 90 mins

Dimensions: L=36 in, W= 127 in, H= 14 in
Wingspan: 127 inches
Payload Options: N/A
Camera Options: Live video with infrared
Weight & Carry: 10 lbs / 7+ lbs

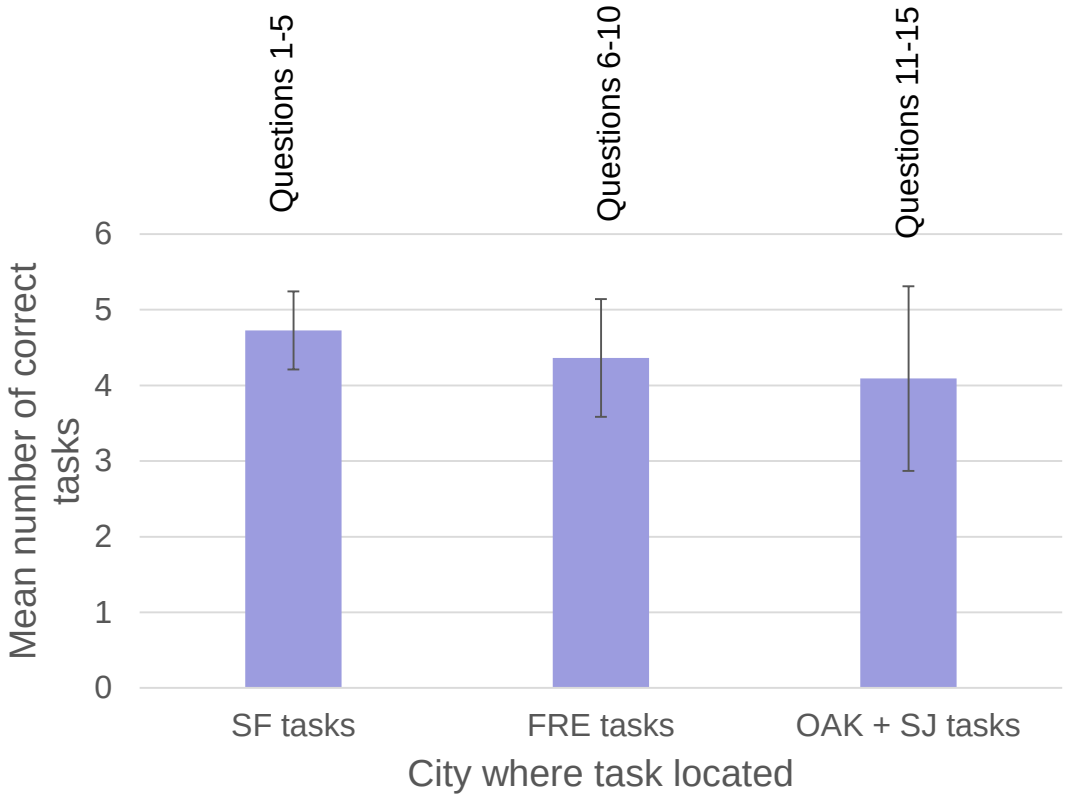
Study method

- Aim: to obtain the public's opinions about the information, features and functions they would want in a public portal tool that shows sUAS activity.
  - The scenario involved 83 sUAS flights in the SF Bay Area
  - Discussion prompts:
    - 19 questions asking participants to find items of information in the scenario
      - 15 questions had definite answers, 4 were subjective
  - 11 participants,
    - aged 21 to 70, 6 male & 5 female
  - Minimal training, on purpose
  - Participants watched the scenario & answered the 19 questions, commenting aloud if they were able
  - They completed the SUS and a short survey
  - Whole experience took approximately 1 hour

Drivers for 19 questions

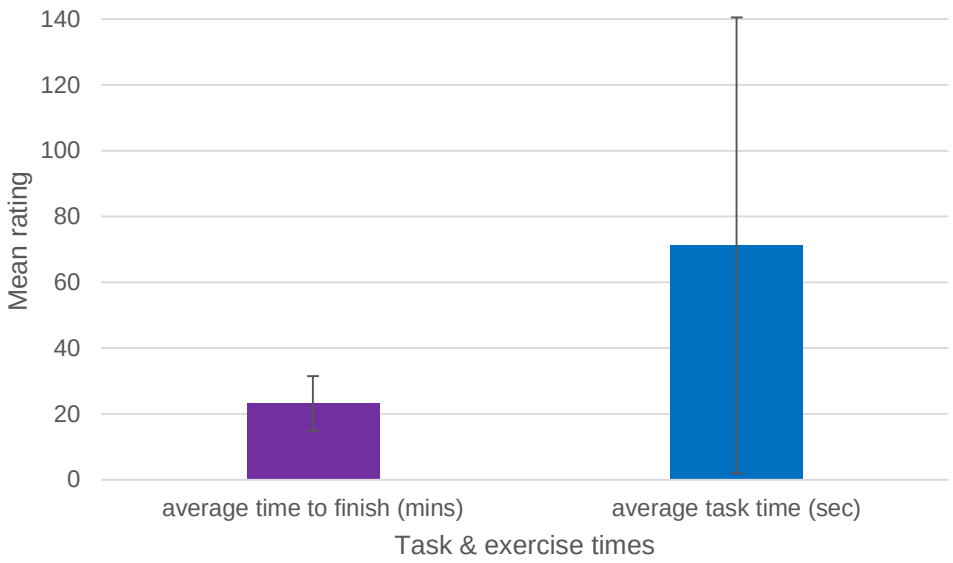
- Reflect actions of a “typical user”
  - Finding information sUAS flights in the SF Bay Area
- Have to go to all sources of information: map, data tag, table and drop-down table
- Use all of the search features: filtering, search by word, ordering, color coding
- 5 questions focused on San Francisco, 5 on Fremont and 5 on Oakland (2) and San Jose (3)
- Known frustrations: no “clear” function, have to back out of searches

Task completion



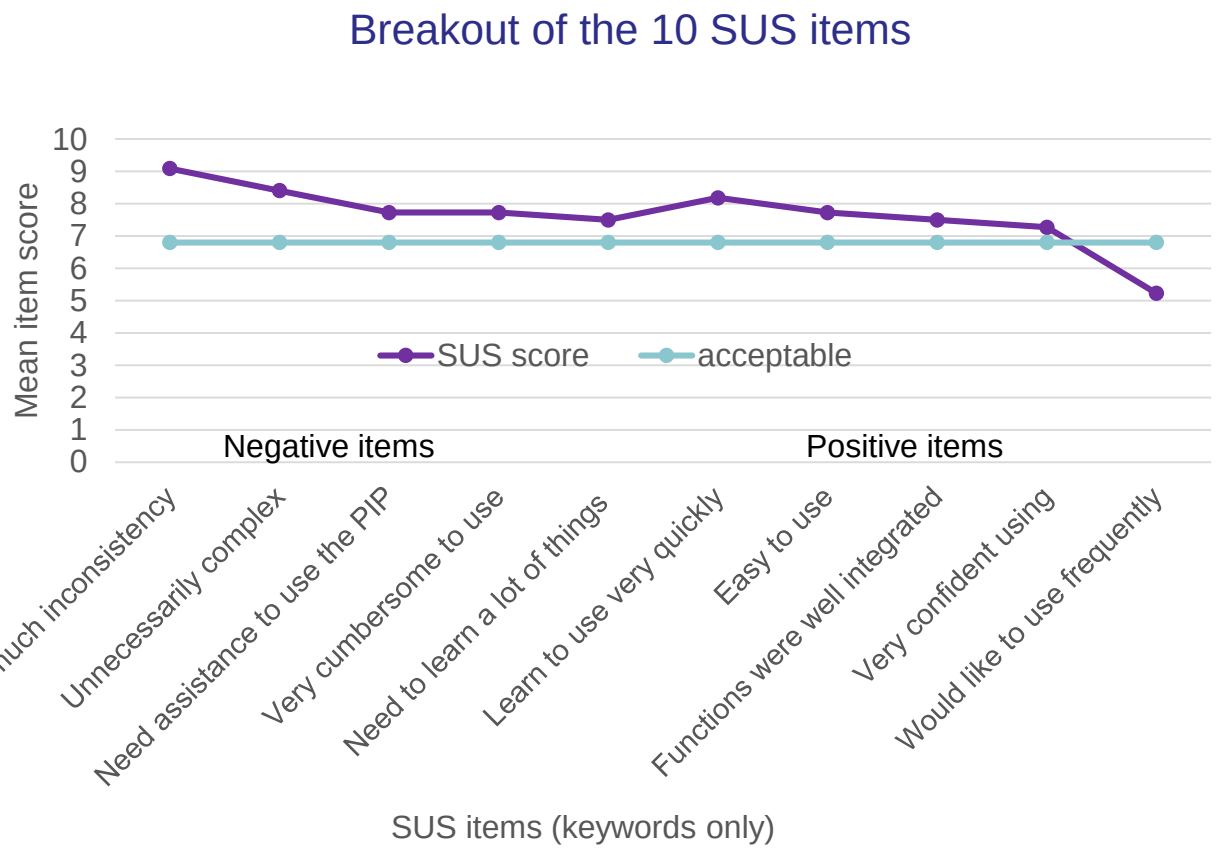
- 87.8% of responses were correct
- <10% of the incorrect responses were given for the first 5 questions
- >60% of the incorrect responses were given for the last 5 questions

Task time to complete



- On average, participants completed all 19 tasks in 23 min & 9 sec
- The quickest took under 14 minutes and the slowest nearly 40 minutes
- On average, the 15 non-subjective tasks took 71.3 seconds each
- The FRE tasks took longer ($\overline{x}$ =100.3 seconds) to complete than SFO ($\overline{x}$ = 59.2 sec) or Oakland/San Jose ($\overline{x}$ = 54.3 sec) tasks
- Why the difference? SFO tasks required fewer steps to complete, OAK/SJC had a task that repeated

Participant assessment of system usability

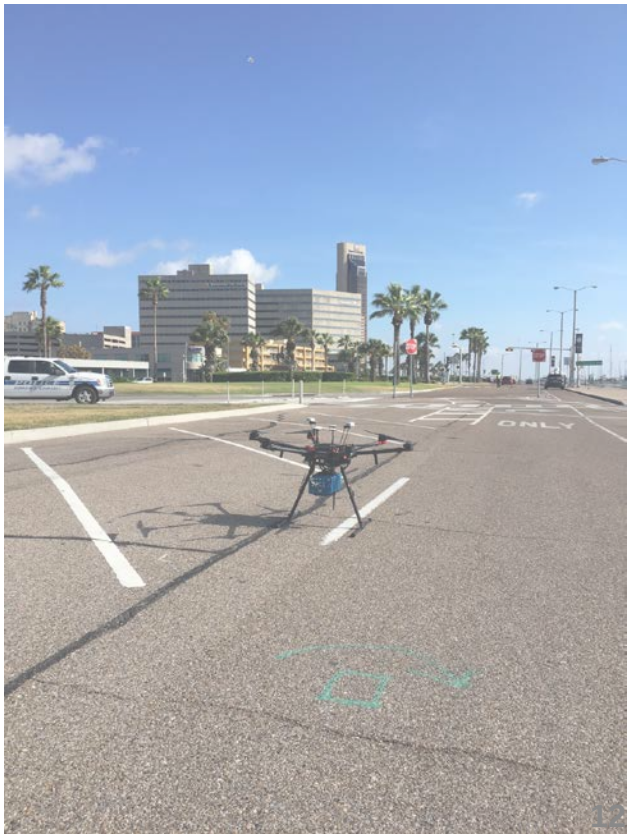


- Mean SUS score = 76.36
- Participants disagreed with negative items and agreed with positive items

Discussion findings

- Participants reported they were:
  - "satisfied" with the public portal tool ($\overline{x}$= 5.7 out of 7)
  - "rarely" had any difficulties finding information ($\overline{x}$= 2.6 out of 7)
  - the ability to identify UAS operations was "reasonably important" ($\overline{x}$= 4.7 out of 7)

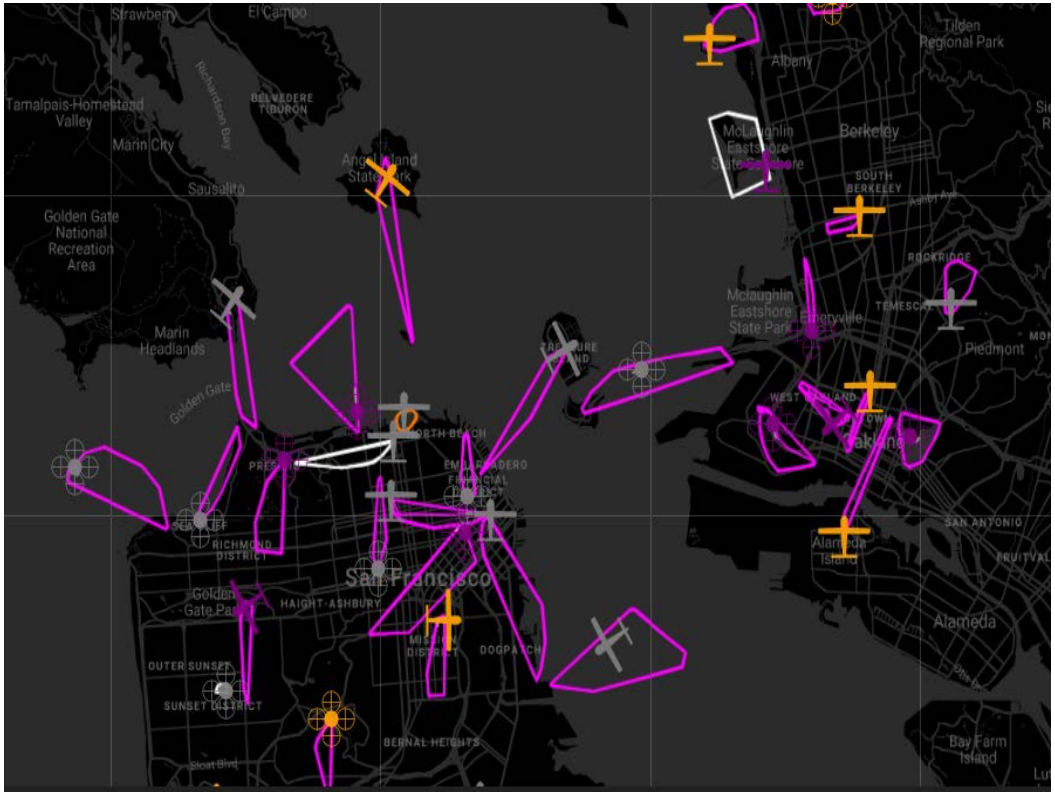
- Distractions: no "clear all" feature, snap-to feature didn't work
- Use terms laymen know
  - E.g., "payload" was not understood by all
- Note that sUAS operations aren't taking place over cities right now
  - Participants had to project their opinions
- Personal privacy & data security
  - Greatest concern but applies to both operators and the public
  - No resolution reached



Summary

- 11 participants took part in a usability test of a prototype public portal tool
  - Looked for information on the interface (as answers to “typical” questions)

- Participants had an 87% success rate, completing the tasks in less than 30 mins
- Participants gave favorable ratings of the public portal tool
- Improvements in some functions and terminology required
- Amount of information could possibly be reduced
  - Which may help to address the issues of privacy



Thank you

Questions?

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http://humansystems.arc.nasa.gov/groups/AOL/