MAE 275 – Homework 1

UAS Notes

* What is the aspect(s) of future UAS you find most exciting? Please relate to your own research or interest
  + Automation and cost reduction of roles traditionally held by manned aircraft
    - Reduces danger for humans
      * Inspection
        + Less dangerous for human inspector
        + More inspections = more safety
      * Soldiers, police
    - Reduces cost of operating large aircraft
  + New warfare tactics
    - Swarms
    - Sensor spoofing, effects
  + Long-endurance flight
    - No need to rest, solar powered
    - Provide internet, real-time imaging, power
* What is the aspect(s) of future UAS you find most disturbing?
  + Constant surveillance, loss of privacy
    - Fly on the wall
  + Airspace safety
  + Reduction of jobs through automation
* What are some of the main hurdles for the future development of UAS?
  + Legislation
    - Need operation regulations from FAA
    - Need governing rules for privacy
    - Court cases already exist, more will comes
  + Public opinion: privacy
  + Dependency on UAS = Dependency on GPS = security risk
  + Batteries suck
* What are the ways that you envision we can use to make UAS beneficial for us, i.e., to maximize their exciting aspects while suppress their disturbing aspects?
  + Clear, well-thought-out regulations for UAS interaction in the airspace
  + Privacy rules concerning UAS operation
  + UAS Traffic Management system (UTM) from NASA

Aviation History and Unmanned Flight

* First automomous flight 425 BC, steam powered pigeon
* First manned flight 1783, hot air balloon
* From beginning, there were ideas for unmanned airborne vehicles in military
  + **Ordinance delivery**
  + **Target drone**
* First unmanned powered flight 15 years after Wright Bros
* Required technologies
  + Gyroscope
  + Radio technology for remote control
    - Proposed by Tesla
* **Desire for reconnaissance after WWII**
  + U-2 loss over USSR highlighted this
  + 1000’s of drone launches over China, Vietnam in 1960’s, 1970’s
    - Ryan Model 147
    - One drone was given ace status for 5 kills
* Helicopter drone: ship launch, cargo, torpedoes, surveillance
* D-20 hypersonic testing (no result)
* Modern
  + Reconnaissance
    - Global Hawk (expensive)
    - Cheap, rail launch drones (Isreal, Germany, etc)
  + Attack
    - Reaper
  + Long-endurance flight
    - NASA Helios (solar-powered drone)
    - Blimps to detect incoming mortars, attacks

Definitions and Terminology

* Unmanned Aerial Vehicle
* Unmanned Aerial System
  + Must be airworthy
  + Includes other systems like ground station
* Remotely Piloted Aircraft

“Drones” and the Future of Domestic Aviation

* Lots of technology advances in recent years
  + Smaller imaging systems
  + Better integrated circuits
  + Advanced wireless commination
* Civilian uses:
  + Commercial Imagery
    - news reporting
    - filmmaking
  + Emergency Services
    - search and rescue
    - disaster response
    - spotting wildfires
    - after-the-fact crime scene investigation
  + Air Science
    - air quality monitoring
    - research into the dynamics of violent storms
  + Surveillance Data
    - surveying
    - wildlife tracking
    - traffic monitoring
  + crop spraying
* Regulations
  + FAA currently working on it
  + Current: <25lb., <400ft alt., line-of-site, daylight
  + Crop spraying is currently allowed in Japan
* Privacy
  + Government surveillance *may* be restricted by 4th amendment
    - Some court cases already exist about aerial observation
  + Personal Surveillance balances between
    - 1st amendment
      * civilians are allowed to record police
    - common law
      * privacy upon seclusion
  + Hard to make legislation that doesn’t violate the constitution or severely restrict usefulness of drones
* Safety
  + Dangerous for unmanned vehicles and piloted aircraft to interact
  + Air traffic control communication with UAS is more complicated by more communication links
  + Drones are small and hard to see
  + What certifications are required?
    - Airworthiness of UAS
    - UAS pilot certification