Background

- FAA-Certified Flight Instructor
- Commercial Airline Pilot
- ENT/Head & Neck Surgeon @ WakeMed
- Medical Director, WakeMed Innovations

Drones @ WakeMed - Overview

- **The Need** – Poor courier reliability, visibility, cost structure
- **Solution Model** Development
  - Developed internal model for theoretical drone network
  - Matched specifications with emerging technology providers
    - Matternet selected as early partner
- **Integration Pilot Program**
  - Federally sponsored
  - Governance at State/Region/Local levels (NC DOT)
- Scoping
  - Partnerships - UPS

UAS INTEGRATION PILOT PROGRAM
U.S. Department of Transportation
Federal Aviation Administration

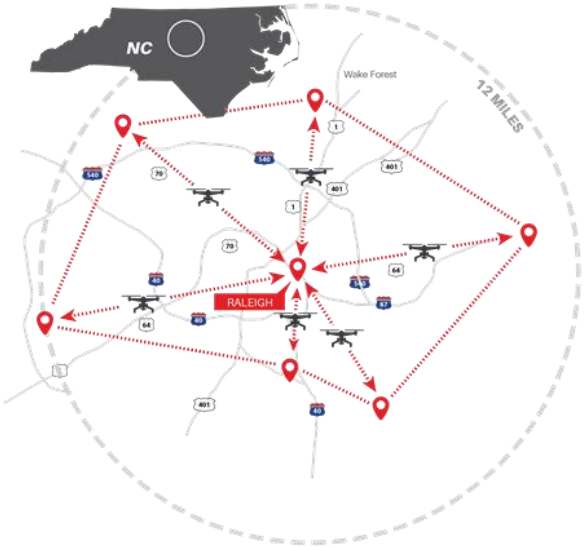
ups

Drones @ WakeMed - Progress

- IPP Selection
  - Healthcare use case is strategic for emerging industry
- First Operating Drone-based Package delivery system in the United States.
- Broad Innovation system focus on **Logistics systems to drive healthcare improvements**
  - Evolving partnership with UPS
  - Novel approach to healthcare system redesign
- **Mobility/Automation** in Healthcare – Broad focus

Drones @ WakeMed – Future State

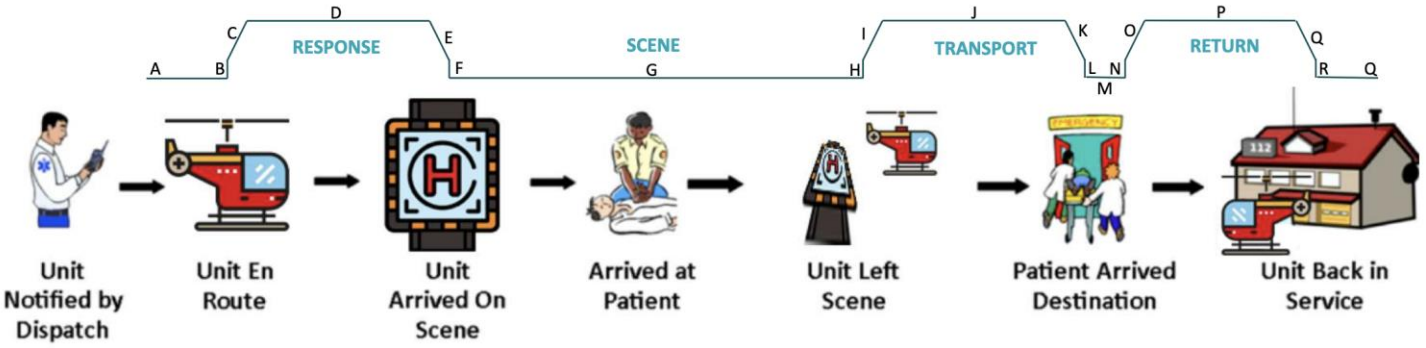
- Healthcare Services + Systems Re-Design
  - Drones and emerging mobility technologies can:
    - Drive expanded services at outpatient/community locations
    - Consolidate services to drive economies of scale
    - Expand our community reach/impact
  - Network: Partner practices, facilities, services
    - Retail pharmacies
    - Community health centers/urgent care



Emerging Mobility Systems in Healthcare

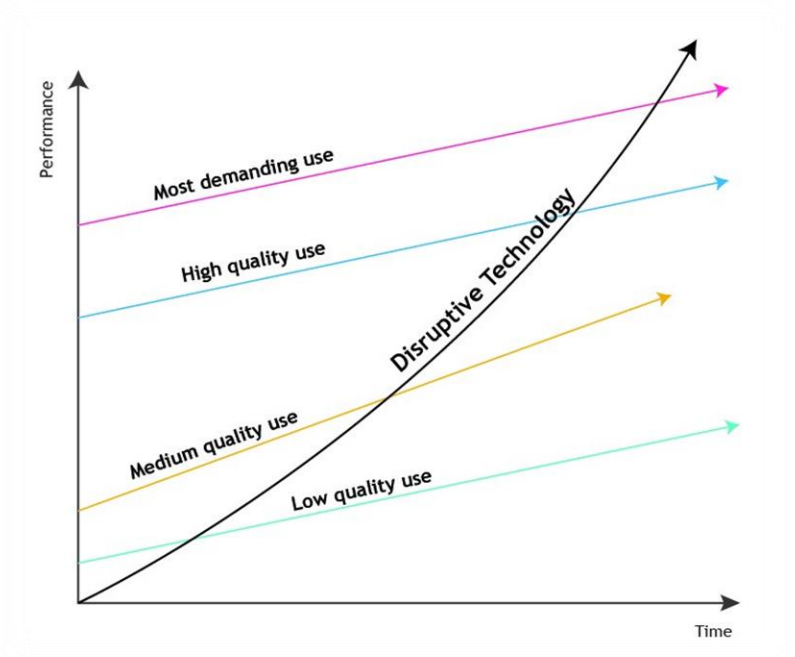
- Expanded footprint for aviation assets utilization in healthcare delivery (sUAS + eVTOLs)
  - Existing Infrastructure
  - Public benefit = public acceptance
  - Lower environmental impact than helos, esp noise
  - Large existing transportation need, and growing
  - Increased utilization with expanded mission profile

$$\text{Total Flight Time} = \text{Response } (B - F) + \text{Transport}(H - M) + \text{Return Time } (N - R). \quad ----(1)$$



Characteristics of "Disruptive Innovations":

1. Technology driver down-market
   - Incumbents are good at incremental improvement (sustaining innovations)
   - Incumbents view technology through lens of current business
2. Disruptive innovations are often cheaper, simpler, and more accessible
3. Technology performance improves over time, meets then exceeds capability of established/dominant technology
4. Disruptive technologies and companies create new markets → up-

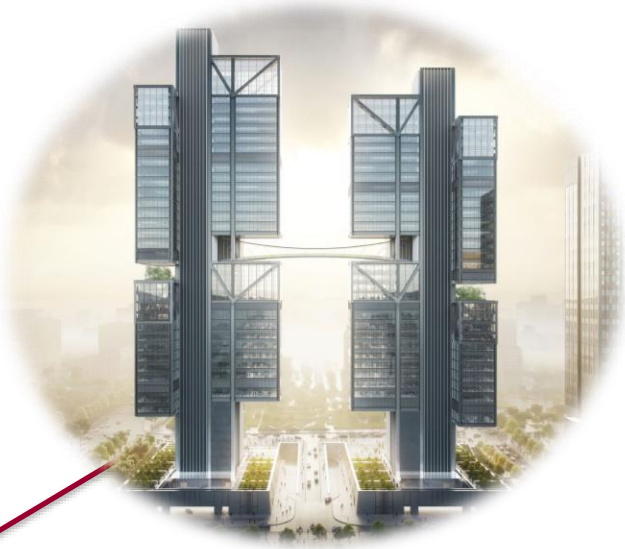


Source: https://medium.com/datadriveninvestor/why-uber-isnt-disruptive-but-netflix-is-disruptive-innovation-explained-198d250f4db0


ups

- “Aerospace” technology
- Regulated as Aircraft
- “Connected”
- ”Smart”/Automated

- Deep ground-side integration
- Interactions at “street level”



- Physically connects locations
- Open to public use
- Built and governed by civic authorities

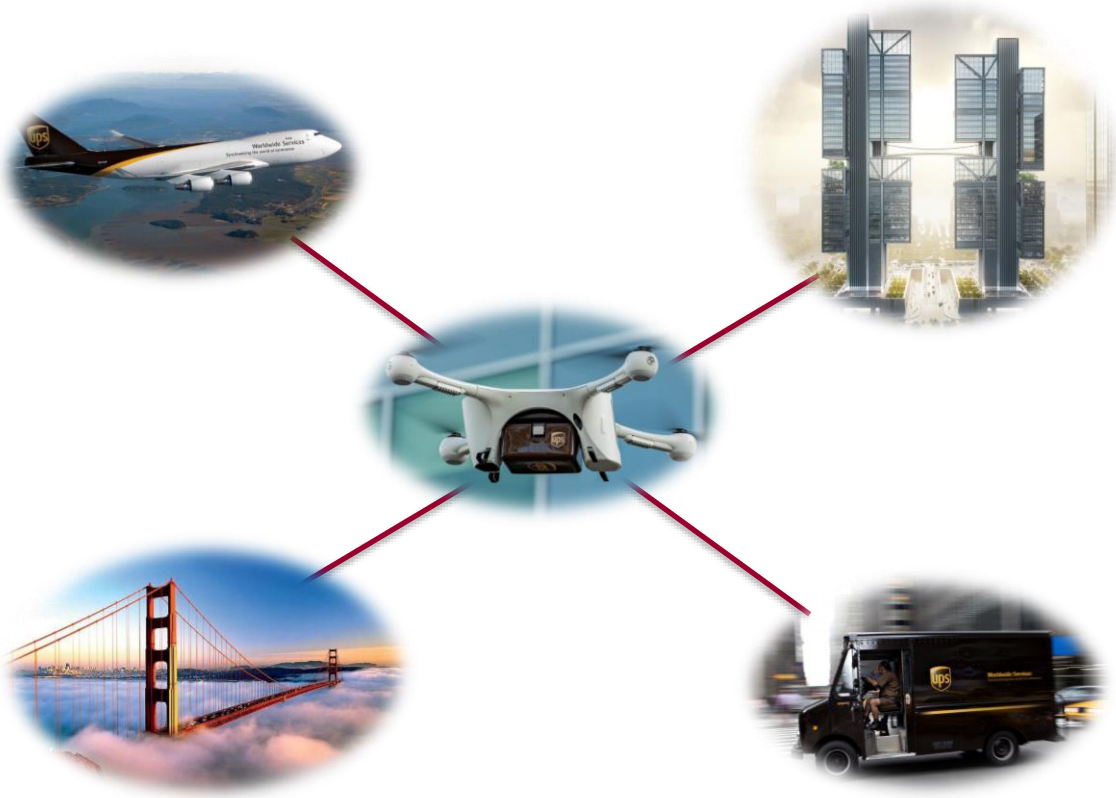
- Supports livability
- Supports commerce
- “Commons” Concept
- Leverages 3rd Dimension


Worldwide Services
Synchronizing the world of commerce

Cyber

Physical

Infrastructure



Cyber

Physical

Infrastructure

"The emerging prototype for a Smart City is one of an urban
Environment with a new generation of innovative services for **transportation**, **energy distribution**, **healthcare**, **environmental monitoring**, **business**, **commerce**, **emergency response**, and social activities."

"Enabling the technology for such a setting requires a viewpoint of Smart Cities as cyber-physical systems (CPSs) that include new software platforms and strict requirements for **mobility**, **security**, **safety**, **privacy**, and the **processing of massive amounts of information**"

Smart Cities as Cyber-Physical Social Systems

Christos G. Cassandras

Division of Systems Engineering & Center for Information and Systems Engineering, Boston University, Brookline, MA 02446, USA

Cyber

Environmental data
Data integration
Interoperability/Open Data Standards
Civic compliance/governance
Vehicle monitoring
Cybersecurity and Privacy

Physical

Vehicles
Sensor networks
Vertiports/Vertistops
Recharging stations
Structural integrations

Infrastructure

Governance ("ground-up")
Integration

Image Credits: Prasit photo

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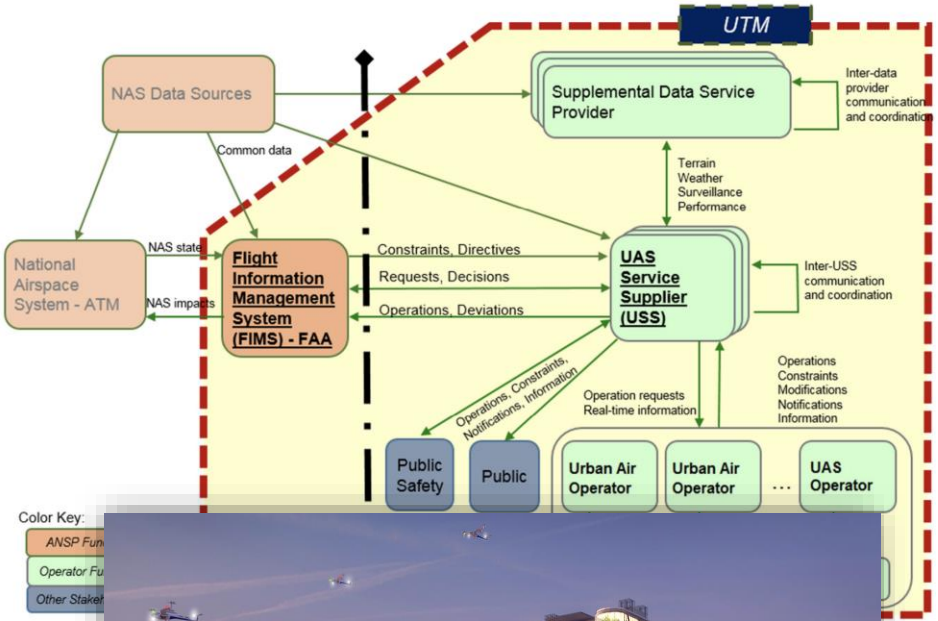
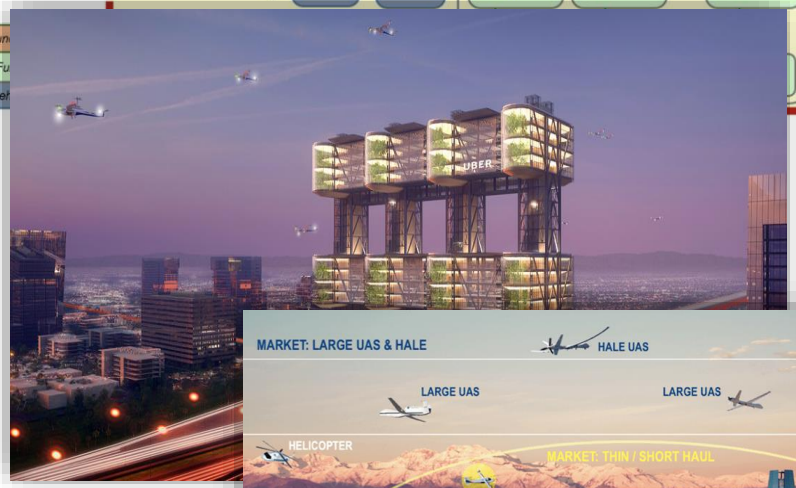
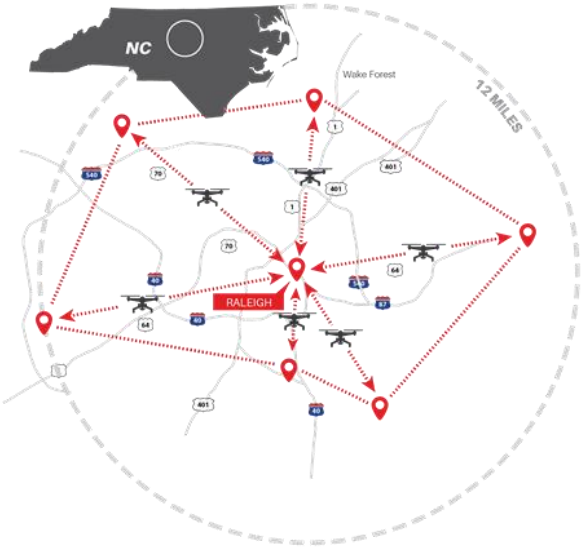




Credit: Lillian Gipson/NASA

Emerging Mobility Systems in Healthcare

- Healthcare Systems are **deeply integrated** into communities
  - We have many discreet "businesses", but the consolidated aim is to **produce healthy communities**
  - Reach every level and aspect of society and enterprise
  - Many "socio-technical" aspects



- Successful communities/cities/economies require robust healthcare systems and services
- **Microcosmic** for "cities", part of the **infrastructure**
- Future State: **Connected → Smart → Responsive**

Credit: Lillian Gipson/NASA

Emerging Mobility Systems in Healthcare

Credit: Lillian Gipson/NASA

Summary/Takeaways

- Early Success paves the way for more advanced operations and concepts
  - Healthcare Markets are strategic, for many reasons
- Drones/eVTOLs/Automated Ground Vehicles could be "disruptive"
  - But require thoughtful development, creation of appropriate "infrastructure" elements and concept
  - Cyber-Physical Infrastructure is a core need
  - Ground-Up Governance is key
- Healthcare use cases are microcosmic for emerging mobility technologies, great proving ground
- Can't neglect the larger implications to society

Thank You!

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