Unmanned cargo aircraft: from anywhere to everywhere

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Platform Unmanned Cargo Aircraft
Topics

- Classes of unmanned cargo aircraft
- Why unmanned cargo aircraft?
- Why now?
- Challenges
- Examples of applications (mission profiles)
- What’s in it for you?
Unmanned cargo aircraft (UCA)

• Urban delivery systems (Amazon etc.)
  – Vertical lift
  – Out of ‘classic’ controlled airspace
  – Sometimes line-of-sight (warehouses)

• Specialized delivery (Matternet, Flying Donkey, Wings for Aid)
  – Limited range/payload
  – Restricted areas, sky tunnels
  – Cost is king
Unmanned cargo aircraft (UCA)

- Long range/high payload systems (Singular Aircraft, Nimbus)
  - Cargo and package delivery, long, thin routes
  - Controlled airspace
  - May become competitors of manned aircraft
  - Infinite design options

- Military systems (K-Max)
  - Force multiplier
  - Special operations
Not this... Source: Naval-Technology.com
...but this...
...or this...

Design by UT-students Van der Aa, Euving, Kinderman, de Leede, and Lerink
...or this... Source: Amazon
Why unmanned cargo aircraft?

- Cost
- Productivity
Unmanned means: lower cost, higher productivity

• No pilots, so
  – Reduced salaries and other cost (One long-distance plane may require 12 crews, excluding back-ups)
  – No cockpit (cargo doors in nose)
  – No fatigue (long flights, efficient cruise speed with turboprop engines)
  – No rest facilities
  – No back-up crew
Unmanned means: lower cost, higher productivity

– No coupling of aircraft and crew: Hertz
– One controller for several aircraft
– Controllers dedicated to airport operations
– ‘Synthetic’ airport lay-outs
Unmanned means: lower cost, higher productivity

• No passengers, so
  – No windows (weak spots in airframe)
  – No pressurized cabin (square, BWB)
  – Simple fire prevention
  – Cargo containers part of structure?
  – Optimized fuselage dimensions (BWB)

• Small is beautiful
Why UCA now?

• Technology is available
• Military UAVs pave the way
• Large areas where infrastructure may hold back growth
• Internet trade; spreading production and consumption
• High value-weight ratio growth
Challenges

• What UCA to build?
  – Payload/range
  – Cost, risk, maximizing advantages ‘unmanned’

• Safety
  – In the air, on the ground
  – Number and qualifications of operators
  – Building a track record

• Certification

• Infrastructure will be there, but when?

• Chicken-or-egg problem; no tradition to build on
Challenges

• Probably more market creation than substitution
• Public opinion
  – MacSween-George (2002): people will accept UCA if informed properly and if they see successful use

Are these problems temporary or principal?
Examples of mission profiles

Scenario 1: 10,000 lbs, 300 nm, 120 KTAS

• Function: Delivery from warehouses to local distribution centers.
• Type of goods: jewelry, DVDs, spare parts (fast movers, like company computers).
• Reasons for using UCA: Road congestion, risk of damage/theft.
• Examples: Frankfurt- German regions, Cardiff-Welsh regions, Germany/Czech Republic-Central/Eastern Europe.
• Comments: It is probably difficult to have enough cargo for a daily delivery. But if 3D-printing takes off,
  – Production can become much more decentralized
  – Parts that cannot be 3D-printed (probably small parts and volumes, need to be transported
Scenario 2: 6.000 lbs, 4.000 nm, 300 KTAS

- Function: Intracontinental transport on thin cargo routes.
- Type of goods: Perishable and time-critical goods
- Reasons for using UCA: Volumes too low for manned cargo aircraft or belly freight, flying via hubs costs too much time
  - Extra distance
  - Transfer time and risk
- Examples: South-North Europe, from Southern to Northern U.S. and Canada, China-Europe (extended range).
- Comments: Markets need to be carefully chosen to prove the concept.
Scenario 3: 6,000 lbs, 1200 nm, 300 KTAS

- Function: Delivery from factories to industrial parks/distribution centers/other factories.
- Type of goods: Semi-finished goods, specialized low-volume raw materials.
- Reasons for using UCA: Speed, reliability, unavailability of other modes (sea, mountains, bad land infrastructure).
- Examples: delivering components from Chinese hinterland to coastal assembly sites, idem in U.S., perhaps possibilities for Eastern European component manufacturers connection to Western European assembly sites.
- Comments:
  - Only possible with established B2B relationships.
  - Potential for kickstarting economic growth in disadvantaged regions.
  - Complementing 3D-printing
What’s in it for you?

• Increased flexibility
  – More (direct) destinations
  – Smaller loads
  – 24/7 service, largely independent of weather etc.
• Safety benefits
  – Less transfer
• Taking shipping into your own hands; UCA in your back yard
• Lower cost?
  – Probably, in case of substitution
• Which benefits (and challenges) do YOU see?
The first commercial UCA (prototype)
Questions?

Discussion!