UNIVERSITY OF TWENTE.





Unmanned cargo aircraft: opportunities and challenges



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Topics

- Why unmanned cargo aircraft?
- Opportunities and challenges
- Some examples of applications
- PUCA





Unmanned Cargo Aircraft: Not this....

Technology.com



Platform Unmanned Cargo Aircraft

....but this... National Aerospace Laboratory NLR





Design by UT-students Van der Aa, Euving, Kinderman, de Leede, and Lerink



Platform Unmanned Cargo Aircraft

...or this... Source: Kaman





....or this... Source: Amazon





Why UCA? 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



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



Opportunities

- Technology is available, integration is key
- Industry: airframe, materials, sensors, planning tools
- Users:
 - Decentralization of production, 3D printing
 - Large areas where infrastructure may hold back growth
 - Internet trade; spreading production and consumption
- Potentially huge market
 - First: new markets, low cost/low risk
 - Then replacement for existing markets: high efficiency





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 and regulation
 - Special demands (populated areas, steep approaches, many players)
- Infrastructure will be there, but when?
- Chicken-or-egg problem; no tradition to build on
- Public opinion



Examples of mission profiles

Scenario 1: 10.000 lbs, 400 nm, 150 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
 - Examples: South-North Europe, from Southern to Northern U.S. and Canada, or (extended range) China-Western Europe.
 - 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



Platform Unmanned Cargo Aircraft

- Organization (development)
- Mobilization (hearts & minds, money)
- http://www.platformuca.org
- Initiation (research)
 - Both technical and economical perspective
 - Needs of users are starting-point



The first commercial UCA (prototype)







Discussion!



