AHS Transformative Vertical Flight Concepts Workshop
NASA Ames Research Center
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Civil Vertical Lift Operators Needs Perspective
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Market Drivers for Civil Vertical Lift
Rich Ouellette, Boeing

Silicon Valley Early Adopter CONOPs and Market Study
Kevin Antcliff, NASA Langley Research Center
Existing Civil Vertical Lift Transportation

Civil VTOL Transportation Characteristics
Relatively short ranges (<200 miles)
Helipad operation (established compact infrastructure)
Short hover time required (<30 seconds)
Close proximity operation (noise sensitivity)

HeliJet - Only scheduled VTOL service in North America
(26) daily trips between Victoria and Vancouver
3 hours 20 minutes by car and ferry
35 minutes by Sikorsky S-76 helicopter @ $275 ticket
65 miles by air (indirect routing due to noise issues)
Do Existing Vertical Lift Concepts Match Civil Transportation Market Needs?

**Existing VTOL:** Payload, range speed, efficiency, cost, noise, safety characteristics
- Helicopters: Dominant solution, but with poor range, speed, efficiency, cost, noise.
- Tilt-Rotors: Greater speed, but with much higher expense (haven’t yet emerged)
- Autogyros: Even lower speed, range, efficiency – but improved cost

**What’s Different?:** Civil VTOL Transport Mission Requirements
- Helipad Takeoff/Landing Locations
  - No sustained Hover Requirement
- High Volume, Close Proximity Operations
  - Severe Noise Constraints
- Non-aggregated trips
  - Need for payload optimized aircraft
- Economic Competitiveness Cost Sensitivity

Focusing on a civil VTOL transportation mission eliminates sustained hover to fundamentally change the sizing requirements.

**Touchdown/Lift-Off Area**
- 50’ Diameter LLA
- 115’ Diameter FATO

**Public Safety Area (PSA)**
- 200’ Diameter PSA

**LLA = Level Landing Area**
- (15m dia)

**FATO = Final Approach and Touchdown Area**
- (35m dia)

**PSA = Public Safety Area**
- (60m dia)
Distributed Electric Propulsion and Autonomy have the potential to be strong enablers of the Civil VTOL Transport mission.
Civil VTOL Competitiveness (After Acceptance) Will Depend on Comparative Vehicle Operating Cost

Total Vehicle Operating Cost per Mile vs Cruise Speed Across Various Transportation Options
Regional Impact

Average Bay Area trip speed of <30 mph increase to 120 mph

3-D alternatives provided to 2-D ground highway congestion

Geographic constraints are removed (mountains, bridges, need for highways...)

Scarce resource constraints are removed (housing cost...)

Synergy with the developing telecommuting technologies

Creates new opportunities for society to reshape itself to utilize resources far more efficiently/effectively through unlimited regional accessibility.

Travel Time: ~35% Higher Average
Income: ~2x National Average
Housing Cost: ~3x National Average