

VTOL Fixed-Wing Market/Business Justification

<https://www.marketsandmarkets.com/Market-Reports/fixed-wing-vtol-uav-market-173456250.html>

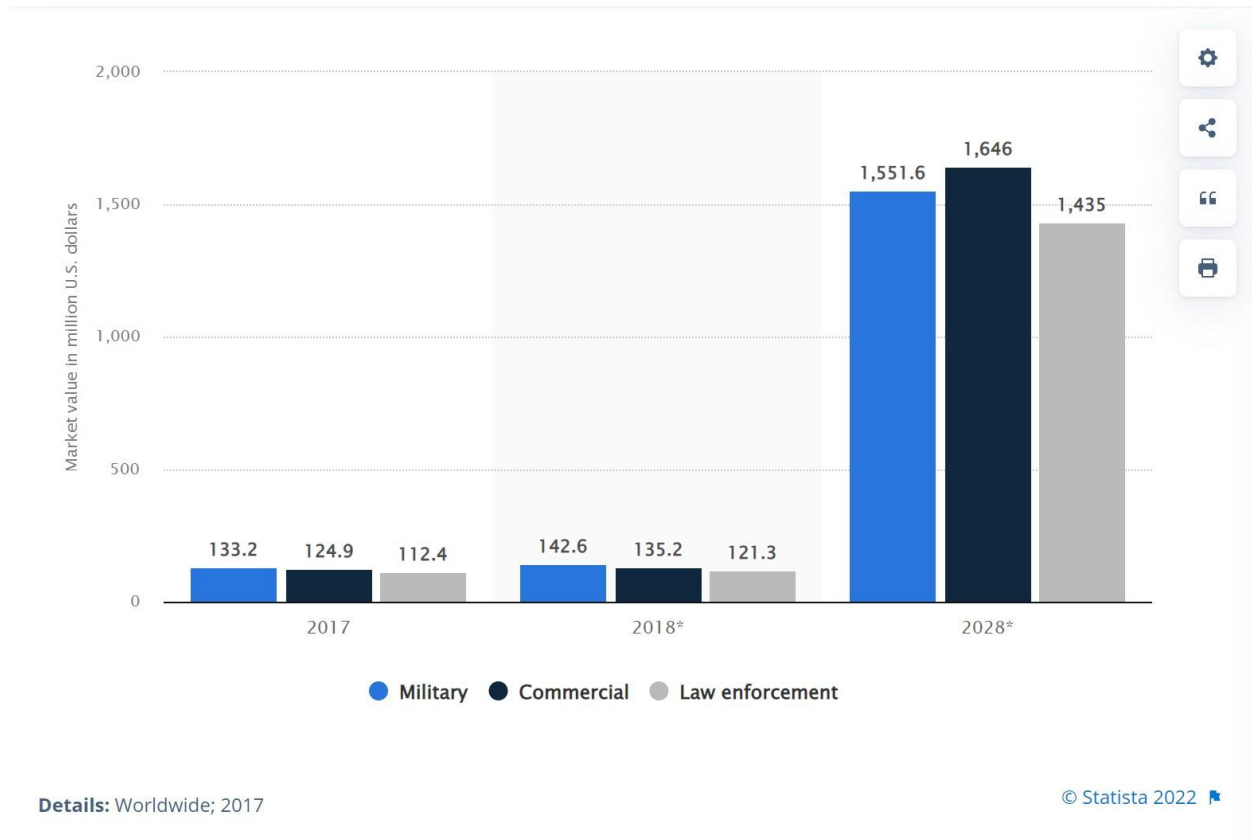
- VTOL UAV Market projected to grow from 842 million USD in 2022 to 4,627 million USD by 2030.
- Key specs w/ highest market shares:
 - < 25 kg (2022)
 - > 10 hour flight time
 - Military/Commercial with the highest projected demand
 - NA is projected to have the largest market, followed by Asia Pacific and Europe
- Key Market Players:
 - ALTI UAS (South Africa), Ukrspesystems (Ukraine), Threod Systems (Estonia), Quantum Systems (Germany), Vertical Technologies (Netherlands), Aerovironment Inc (US), Textron (US), Lockheed Martin (US), Latitude Engineering (US)

Attractive Opportunities in Fixed-Wing VTOL UAV Market



<https://www.statista.com/statistics/939183/global-fixed-wing-hybrid-vtol-uav-market-size-end-user/>

- VTOL Fixed-Wing Market Projections from 2018-2028



Current VTOL Fixed-Wing on the Market (Commercial)

https://www.readymaderc.com/products/details/omp-hobby-zmo-vtol-fpv-airplane-bnfv?gclid=CjwKCAjw5P2aBhAlEiwAAdY7dEet70Dld2Ty9ukPLuluLaPf2dzZaye7Krs9a0NoVmZuT0yYrMeRVRoCwlsQAvD_BwE

- OMP Hobby ZMO VTOL FPV Airplane BNF
- \$1,099 USD
- FPV Drone
- Technical Specs:
 - Built-in GPS
 - 69 mph max speed
 - Heat sinks

- 25 mile max range
- 60 minute max battery life
- 1200mm Wingspan
- 68mm Height
- 1400g Weight
- 5m GPS accuracy
- 28 mph cruising speed
- 3 propellers
- Tilt rotor

Feature	Specs	Feature	Specs
Wingspan	1200mm	Propeller	8*6R/8*6L/ 8*3.8
Fuselage	788mm	Battery	4S 5100 mAh HV
Height	68mm	System	OFS
Weight	1400g	Time of Flight	Max 60 mins
Power	2310KV	Voyage	40km
Body Material	Industrial EPP	Max Flight Speed	110km/hr
GPS Positioning Accuracy	5m	Economical Cruising Speed	45km/hr
One-Click Takeoff and Landing	Y	One-Click Return Home	Y
Automatic course flight	Y	-	-



<https://www.heewing.com/products/hee-wing-t1-ranger-vtol-conversion-kit>

- HEE WING T1 Ranger PNP-VTOL conversion kit
- \$135.15 USD
- Kit for upgrading Hee Wing T1 Ranger to VTOL
- 3 propellers
- Tilt Rotor



T1 Ranger PNP-VTOL conversion pack

Contents of the conversion kit:

- 2x Servo for tilting
- 3x Motor FX-1806-2000kv
- Wing tilting mounts (1x left + 1x right)
- 1x Carbon tail boom
- 1x Rear motor mount
- 1x FX-20A ESC for rear motor
- 2 pairs Gemfan 5126 props
- 33x M2*4 Glue patch Countersunk head screw
- 9x M2*8 prop fixing screw
- 3 pairs 2.0 golden plugs



VTOL
conversion pack

VTOL Fixed-Wing Types

<https://www.thecoronawire.com/types-hybrid-fixed-wing-vtol-uavs-explained/>

- Unmanned Convertiplanes
 - Tilt Rotor UAVs
 - Capable of rotating vertically and horizontally during flight for takeoff/landing
 - Fuselage, wings, tail assembly/empennage, landing gear/undercarriage, propulsion system, transition mechanism
 - Wings typically include control surfaces such as ailerons/flaps to control pitch, yaw, and roll
 - Tail assembly/empennage typically include elevators and fin acting vertically, rudder and tailplane acting horizontally
 - Long distance flight
 - High altitudes
 - Benefits of fixed-wing and rotary-wing UAVs
 - Hovering
 - Increased cost
 - Complicated Transition Mechanism

- Transition Mechanism adds weight
- Transition can only be done above certain altitudes
- Examples:
 - <https://www.autelrobotics.com/productdetail/dragonfish-series-drones.html>
 - Autel Robotic's Dragonfish
 - Enterprise Drone
 - ~\$200k USD
 - <https://www.quantum-systems.com/project/trinityf90plus-mapping-drone/>
 - Quantum System's Trinity F90+
 - Mapping Drone
 - ~\$20k USD
 - <https://irp.fas.org/program/collect/eagle-eye.htm>
 - Bell's Eagle Eye
 - Research Drone
 - Unknown Cost
 - <https://airlogix.io/hammerhead>
 - Airlogix's Hammerhead
 - Delivery Drone
 - Unknown Cost
- Tilt Wing UAVs
 - Usage of propellers on the wings, with the wings stationed vertically for takeoff and landing functions, but rotate horizontally for regular flight
 - Highly complicated transition method
 - Examples:
 - https://ghcraft.com/QTW/pdf/081001_QTW_FS4e.pdf
 - GH Craft's QTW-UAS FS4
 - <https://www.nasa.gov/langley/ten-engine-electric-plane-completes-successful-flight-test>
 - Nasa's GL-10
- Quadplanes
 - Uses vertical propellers for takeoff and landing, and horizontal propellers for forward movement
 - Vertical propellers are disabled after sufficient speed reached
 - Less complicated transition method
 - Added weight decreases overall efficiency

VTOL Fixed-Wing Design Ideas

- Using Pixhawk 2.4.8 (Cloned Pixhawk)
 - 3 propeller Tilt Rotor configuration would most likely work best
 - Two wings attached at front + 'tail' at back with third propeller in cone shape config
 - Reduces weight (5 motors to 3)
 - Does require additional servos
 - May need to do 4 motors with weight considerations
 - <https://www.youtube.com/watch?v=CpLJr1V0AUg>
 - Would need to design a new drone instead of building off existing ModiFly Drone
 - Most connections would remain the same, majority of design challenge would come from new drone body, new parameters, and other flight controller related changes
- Using Flywoo Goku F745
 - Traditional Quadplane configuration (4 arm, either perpendicular to wings or attached separately from wings)
 - Flight Controller has at maximum 4 free serial ports
 - Would not be enough for plane surface controls
 - Requires external airspeed sensor, removing another available port
- Tilt Wing configuration
 - Would greatly increase complexity of the design and build process without much added benefit over other configuration types