U.S. Department
of Transportation
**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

August 27, 2015

Exemption No. 12631
Regulatory Docket No. FAA–2015–1288

Mr. Jared Nelson
Owner
Green Bee LLC
539 Wright Street, #107
Lakewood, CO 80228

Dear Mr. Nelson:

This letter is to inform you that we have granted your request for exemption. It transmits our decision, explains its basis, and gives you the conditions and limitations of the exemption, including the date it ends.

By letter posted to the public docket on April 28, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Green Bee LLC (hereinafter petitioner or operator) for an exemption. The petitioner requested to operate an unmanned aircraft system (UAS) to conduct aerial photography, videography, and inspections.

See Appendix A for the petition submitted to the FAA describing the proposed operations and the regulations that the petitioner seeks an exemption.

The FAA has determined that good cause exists for not publishing a summary of the petition in the Federal Register because the requested exemption would not set a precedent, and any delay in acting on this petition would be detrimental to the petitioner.

Airworthiness Certification

The UAS proposed by the petitioner are the DJI Phantom and DJI Matrix.

The petitioner requested relief from 14 CFR part 21, *Certification procedures for products and parts, Subpart H—Airworthiness Certificates*. In accordance with the statutory criteria provided in Section 333 of Public Law 112−95 in reference to 49 U.S.C. § 44704, and in

consideration of the size, weight, speed, and limited operating area associated with the aircraft and its operation, the Secretary of Transportation has determined that this aircraft meets the conditions of Section 333. Therefore, the FAA finds that the requested relief from 14 CFR part 21, *Certification procedures for products and parts, Subpart H—Airworthiness Certificates,* and any associated noise certification and testing requirements of part 36, is not necessary.

The Basis for Our Decision

You have requested to use a UAS for aerial data collection[1]. The FAA has issued grants of exemption in circumstances similar in all material respects to those presented in your petition. In Grants of Exemption Nos. 11062 to Astraeus Aerial (*see* Docket No. FAA−2014−0352), 11109 to Clayco, Inc. (*see* Docket No. FAA−2014−0507), 11112 to VDOS Global, LLC (*see* Docket No. FAA−2014−0382), and 11213 to Aeryon Labs, Inc. (*see* Docket No. FAA−2014−0642), the FAA found that the enhanced safety achieved using an unmanned aircraft (UA) with the specifications described by the petitioner and carrying no passengers or crew, rather than a manned aircraft of significantly greater proportions, carrying crew in addition to flammable fuel, gives the FAA good cause to find that the UAS operation enabled by this exemption is in the public interest.

Having reviewed your reasons for requesting an exemption, I find that—

- They are similar in all material respects to relief previously requested in Grant of Exemption Nos. 11062, 11109, 11112, and 11213;
- The reasons stated by the FAA for granting Exemption Nos. 11062, 11109, 11112, and 11213 also apply to the situation you present; and
- A grant of exemption is in the public interest.

Our Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. 106(f), 40113, and 44701, delegated to me by the Administrator, Green Bee LLC is granted an exemption from 14 CFR §§ 61.23(a) and (c), 61.101(e)(4) and (5), 61.113(a), 61.315(a), 91.7(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), to the extent necessary to allow the petitioner to operate a UAS to perform aerial data collection. This exemption is subject to the conditions and limitations listed below.

[1] Aerial data collection includes any remote sensing and measuring by an instrument(s) aboard the UA. Examples include imagery (photography, video, infrared, etc.), electronic measurement (precision surveying, RF analysis, etc.), chemical measurement (particulate measurement, etc.), or any other gathering of data by instruments aboard the UA.

Conditions and Limitations

In this grant of exemption, Green Bee LLC is hereafter referred to as the operator.

Failure to comply with any of the conditions and limitations of this grant of exemption will be grounds for the immediate suspension or rescission of this exemption.

1. Operations authorized by this grant of exemption are limited to the DJI Phantom and DJI Matrix when weighing less than 55 pounds including payload. Proposed operations of any other aircraft will require a new petition or a petition to amend this exemption.

2. Operations for the purpose of closed-set motion picture and television filming are not permitted.

3. The UA may not be operated at a speed exceeding 87 knots (100 miles per hour). The exemption holder may use either groundspeed or calibrated airspeed to determine compliance with the 87 knot speed restriction. In no case will the UA be operated at airspeeds greater than the maximum UA operating airspeed recommended by the aircraft manufacturer.

4. The UA must be operated at an altitude of no more than 400 feet above ground level (AGL). Altitude must be reported in feet AGL.

5. The UA must be operated within visual line of sight (VLOS) of the PIC at all times. This requires the PIC to be able to use human vision unaided by any device other than corrective lenses, as specified on the PIC's FAA-issued airman medical certificate or U.S. driver's license.

6. All operations must utilize a visual observer (VO). The UA must be operated within the visual line of sight (VLOS) of the PIC and VO at all times. The VO may be used to satisfy the VLOS requirement as long as the PIC always maintains VLOS capability. The VO and PIC must be able to communicate verbally at all times; electronic messaging or texting is not permitted during flight operations. The PIC must be designated before the flight and cannot transfer his or her designation for the duration of the flight. The PIC must ensure that the VO can perform the duties required of the VO.

7. This exemption and all documents needed to operate the UAS and conduct its operations in accordance with the conditions and limitations stated in this grant of exemption, are hereinafter referred to as the operating documents. The operating documents must be accessible during UAS operations and made available to the Administrator upon request. If a discrepancy exists between the conditions and limitations in this exemption and the procedures outlined in the operating documents,

the conditions and limitations herein take precedence and must be followed. Otherwise, the operator must follow the procedures as outlined in its operating documents. The operator may update or revise its operating documents. It is the operator's responsibility to track such revisions and present updated and revised documents to the Administrator or any law enforcement official upon request. The operator must also present updated and revised documents if it petitions for extension or amendment to this grant of exemption. If the operator determines that any update or revision would affect the basis upon which the FAA granted this exemption, then the operator must petition for an amendment to its grant of exemption. The FAA's UAS Integration Office (AFS−80) may be contacted if questions arise regarding updates or revisions to the operating documents.

8. Any UAS that has undergone maintenance or alterations that affect the UAS operation or flight characteristics, e.g., replacement of a flight critical component, must undergo a functional test flight prior to conducting further operations under this exemption. Functional test flights may only be conducted by a PIC with a VO and must remain at least 500 feet from other people. The functional test flight must be conducted in such a manner so as to not pose an undue hazard to persons and property.

9. The operator is responsible for maintaining and inspecting the UAS to ensure that it is in a condition for safe operation.

10. Prior to each flight, the PIC must conduct a pre-flight inspection and determine the UAS is in a condition for safe flight. The pre-flight inspection must account for all potential discrepancies, e.g., inoperable components, items, or equipment. If the inspection reveals a condition that affects the safe operation of the UAS, the aircraft is prohibited from operating until the necessary maintenance has been performed and the UAS is found to be in a condition for safe flight.

11. The operator must follow the UAS manufacturer's maintenance, overhaul, replacement, inspection, and life limit requirements for the aircraft and aircraft components.

12. Each UAS operated under this exemption must comply with all manufacturer safety bulletins.

13. Under this grant of exemption, a PIC must hold either an airline transport, commercial, private, recreational, or sport pilot certificate. The PIC must also hold a current FAA airman medical certificate or a valid U.S. driver's license issued by a state, the District of Columbia, Puerto Rico, a territory, a possession, or the Federal government. The PIC must also meet the flight review requirements specified in 14 CFR § 61.56 in an aircraft in which the PIC is rated on his or her pilot certificate.

14. The operator may not permit any PIC to operate unless the PIC demonstrates the ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption, including evasive and emergency maneuvers and maintaining appropriate distances from persons, vessels, vehicles and structures. PIC qualification flight hours and currency must be logged in a manner consistent with 14 CFR § 61.51(b). Flights for the purposes of training the operator's PICs and VOs (training, proficiency, and experience-building) and determining the PIC's ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption are permitted under the terms of this exemption. However, training operations may only be conducted during dedicated training sessions. During training, proficiency, and experience-building flights, all persons not essential for flight operations are considered nonparticipants, and the PIC must operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

15. UAS operations may not be conducted during night, as defined in 14 CFR § 1.1. All operations must be conducted under visual meteorological conditions (VMC). Flights under special visual flight rules (SVFR) are not authorized.

16. The UA may not operate within 5 nautical miles of an airport reference point (ARP) as denoted in the current FAA Airport/Facility Directory (AFD) or for airports not denoted with an ARP, the center of the airport symbol as denoted on the current FAA-published aeronautical chart, unless a letter of agreement with that airport's management is obtained or otherwise permitted by a COA issued to the exemption holder. The letter of agreement with the airport management must be made available to the Administrator or any law enforcement official upon request.

17. The UA may not be operated less than 500 feet below or less than 2,000 feet horizontally from a cloud or when visibility is less than 3 statute miles from the PIC.

18. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the private or controlled-access property.

19. The PIC must abort the flight in the event of unpredicted obstacles or emergencies.

20. The PIC is prohibited from beginning a flight unless (considering wind and forecast weather conditions) there is enough available power for the UA to conduct the intended operation and to operate after that for at least five minutes or with the reserve power recommended by the manufacturer if greater.

21. Air Traffic Organization (ATO) Certificate of Waiver or Authorization (COA). All operations shall be conducted in accordance with an ATO-issued COA. The exemption holder may apply for a new or amended COA if it intends to conduct operations that cannot be conducted under the terms of the attached COA.

22. All aircraft operated in accordance with this exemption must be identified by serial number, registered in accordance with 14 CFR part 47, and have identification (N−Number) markings in accordance with 14 CFR part 45, Subpart C. Markings must be as large as practicable.

23. Documents used by the operator to ensure the safe operation and flight of the UAS and any documents required under 14 CFR §§ 91.9 and 91.203 must be available to the PIC at the Ground Control Station of the UAS any time the aircraft is operating. These documents must be made available to the Administrator or any law enforcement official upon request.

24. The UA must remain clear and give way to all manned aviation operations and activities at all times.

25. The UAS may not be operated by the PIC from any moving device or vehicle.

26. All Flight operations must be conducted at least 500 feet from all nonparticipating persons, vessels, vehicles, and structures unless:
    a. Barriers or structures are present that sufficiently protect nonparticipating persons from the UA and/or debris in the event of an accident. The operator must ensure that nonparticipating persons remain under such protection. If a situation arises where nonparticipating persons leave such protection and are within 500 feet of the UA, flight operations must cease immediately in a manner ensuring the safety of nonparticipating persons; and
    b. The owner/controller of any vessels, vehicles or structures has granted permission for operating closer to those objects and the PIC has made a safety assessment of the risk of operating closer to those objects and determined that it does not present an undue hazard.

    The PIC, VO, operator trainees or essential persons are not considered nonparticipating persons under this exemption.

27. All operations shall be conducted over private or controlled-access property with permission from the property owner/controller or authorized representative. Permission from property owner/controller or authorized representative will be obtained for each flight to be conducted.

28. Any incident, accident, or flight operation that transgresses the lateral or vertical boundaries of the operational area as defined by the applicable COA must be reported to the FAA's UAS Integration Office (AFS−80) within 24 hours. Accidents must be reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.ntsb.gov.

If this exemption permits operations for the purpose of closed-set motion picture and television filming and production, the following additional conditions and limitations apply.

29. The operator must have a motion picture and television operations manual (MPTOM) as documented in this grant of exemption.

30. At least 3 days before aerial filming, the operator of the UAS affected by this exemption must submit a written Plan of Activities to the local Flight Standards District Office (FSDO) with jurisdiction over the area of proposed filming. The 3-day notification may be waived with the concurrence of the FSDO. The plan of activities must include at least the following:
    a. Dates and times for all flights;
    b. Name and phone number of the operator for the UAS aerial filming conducted under this grant of exemption;
    c. Name and phone number of the person responsible for the on-scene operation of the UAS;
    d. Make, model, and serial or N−Number of UAS to be used;
    e. Name and certificate number of UAS PICs involved in the aerial filming;
    f. A statement that the operator has obtained permission from property owners and/or local officials to conduct the filming production event; the list of those who gave permission must be made available to the inspector upon request;
    g. Signature of exemption holder or representative; and
    h. A description of the flight activity, including maps or diagrams of any area, city, town, county, and/or state over which filming will be conducted and the altitudes essential to accomplish the operation.

31. Flight operations may be conducted closer than 500 feet from participating persons consenting to be involved and necessary for the filming production, as specified in the exemption holder's MPTOM.

Unless otherwise specified in this grant of exemption, the UAS, the UAS PIC, and the UAS operations must comply with all applicable parts of 14 CFR including, but not limited to, parts 45, 47, 61, and 91.

This exemption terminates on September 30, 2017, unless sooner superseded or rescinded.

Sincerely,

/s/
John S. Duncan
Director, Flight Standards Service

Enclosures

Green Bee LLC

Section 333 Exemption

Dear applicable parties:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 (the Reform Act) and 14 C.F.R. Part 11, Green Bee LLC, operator of Small Unmanned Aircraft Systems ("sUASs") equipped to offer on-demand commercial UAS operations for a host of industries and applications. These include:

- Flare stack inspection,
- Utility-power generation system inspections and patrolling,
- Pipeline inspection and patrolling,
- Filmmaking, cinematography, and videography,
- Precision agriculture,
- Wildlife and forestry monitoring,
- Aerial surveying,
- Construction site inspection and monitoring, and
- Public Entity Support Operations.

hereby applies for an exemption from the listed Federal Aviation Regulations ("FARs") to allow commercial operation of its sUASs, so long as such operations are conducted within and under the conditions outlined herein or as may be established by the FAA as required by Section 333.

As described more fully below, the requested exemption would permit the operation of small, unmanned and relatively inexpensive sUAS under controlled conditions in airspace that is 1) limited 2) predetermined 3) controlled as to access and 4) would provide safety enhancements to the already safe operations using conventional aircraft. Approval of this exemption would thereby enhance safety and fulfill the Secretary of Transportation's (the FAA Administrator's) responsibilities to "…establish requirements for the safe operation of such aircraft systems in the national airspace system." Section 333(c) of the Reform Act.

The name and address of the applicant is: Green Bee LLC

Jared Nelson

539 Wright St #107

Lakewood, CO 80228

Ph: 720-289-8494

Email: greenbee@greenbeeuav.com

Regulations from which the exemption is requested:

14 CFR Part 21

14 C.F.R. 91.7 (a)

14 CFR 91.9 (b) (2)

14 C.F.R. 91.103

14 C.F.R. 91.109

14 C.F. R. 91.119

14 C.F.R. 91.121

14 CFR 91.151 (a)

14 CFR 91.203 (a) & (b)

14 CFR 91.405 (a)

14 CFR 407 (a) (1)

14 CFR 409 (a) (2)

14 CFR 417 (a) & (b)

This exemption application is expressly submitted to fulfill Congress' goal in passing Section 333(a) through (c) of the Reform Act. This law directs the Secretary of Transportation to consider whether certain unmanned aircraft systems may operate safely in the national airspace system (NAS) before completion of the rulemaking required under Section 332 of the Reform Act. In making this determination, the Secretary is required to determine which types of UASs do not create a hazard to users of the NAS or the public or pose a threat to national security in light of the following: • The UAS's size, weight, speed, and operational capability; • Operation of the UAS in close proximity to airports and populated areas; and • Operation of the UAS within visual line of sight of the operator. Reform Act § 333 (a). Lastly, if the Secretary determines that such vehicles "may operate safely in the national airspace system, the Secretary shall establish requirements for the safe operation of such aircraft in the national airspace system." Id. §333(c) (emphasis added) Applicant interprets this provision to place the duty on the Administrator to not only process applications for exemptions under section 333, but for the Administrator to craft conditions for the safe operation of the UAS, if it should be determined that the conditions set forth herein do not fulfill the statutory requirements for approval. The Federal Aviation Act expressly grants the FAA the authority to issue exemptions. This statutory authority by its terms includes exempting civil aircraft, as the term is defined under §40101 of the Act that includes sUASs, from the requirement that all civil aircraft must have a current airworthiness certificate.

The Administrator may grant an exemption from a requirement of a regulation prescribed under subsection (a) or (b) of this section or any sections 44702-44716 of this title if the Administrator finds the exemption in the public interest. 49 U.S.C. §44701(f) See also 49 USC §44711(a); 49 USC §44704; 14 CFR §91.203 (a) (1). Green Bee sUASs are rotorcraft, weighting 55 or fewer lbs. including payload. They operate, under normal conditions at a speed of no more than 50 knots and have the capability to hover, and move in the vertical and horizontal plane simultaneously. They will operate only in line of sight and will operate only within a sterile area. Such operations will insure that the sUAS will "not create a hazard to users of the national airspace system or the public." Reform Act Section 333 (b). Given the small size of the sUASs involved and the restricted sterile environment within which they will operate, the applicant falls squarely within that zone of safety (an equivalent level of safety) in which Congress envisioned that the FAA must, by exemption, allow commercial operations of UASs to commence

immediately. Also due to the size of the UASs and the restricted areas in which the relevant sUASs will operate, approval of the application presents no national security issue. Given the clear direction in Section 333 of the Reform Act, the authority contained in the Federal Aviation Act, as amended; the strong equivalent level of safety surrounding the proposed operations, and the significant public benefit, including enhanced safety, reduction in environmental impacts, including reduced emissions associated with allowing UASs, the grant of the requested exemptions is in the public interest. Accordingly, the applicant respectfully requests that the FAA grant the requested exemption without delay.

AIRCRAFT AND SAFETY PROCEDURES

The applicant proposes that the exemption requested herein apply to civil aircraft that have the characteristics and that operate with the limitations listed herein. These limitations provide for at least an equivalent or even higher level of safety to operations under the current regulatory structure because the proposed operations represent a safety enhancement to the already safe operations conducted with conventional aircraft. These limitations and conditions to which Green Bee agrees to be bound when conducting commercial operations under an FAA issued exemption include:

1. The sUAS will weigh less than 55 lbs.

2. Flights will be operated within line of sight of a pilot and/or observer.

3. Maximum total flight time for each operational flight will be 30 minutes. Flights will be terminated at 25% battery power reserve should that occur prior to the 30 minute limit.

4. Flights will be operated at an altitude of no more than 400 feet AGL or, not more than 200 feet above an elevated platform from which filming is planned.

5. Minimum crew for each operation will consist of the sUAS Pilot, the Visual Observer, and/or the Camera Operator. 6. sUAS pilot will be an FAA licensed airman with a private, commercial, and instrument pilot's certificate.

7. The exemption and all other documents will be present, or rapidly available during operations

8. The UAS will only operate within a confined "Sterile Area" of the flight operations area.

9. A preflight check list will be used and a test flight will be conducted before operations, to ensure the functionality of controls, motors, compasses, gyros, and GPS systems.

10. The operator will obtain the consent of all persons involved and ensure that only consenting persons will be allowed within 100 feet of the flight operation, and this radius may be reduced to 30 feet based upon an equivalent level of safety determination.

11. No flights will be conducted during night, as defined in CFR 1.1

12. Observer and pilot will at all times are able to communicate by voice and/or text.

13. Written and/or oral permission from the relevant property holders will be obtained.

14. All required permissions and permits will be obtained from territorial, state, county or city jurisdictions, including local law enforcement, fire, or other appropriate governmental agencies.

15. If the sUAS loses communications or loses its GPS signal, the UAS will have capability to return to a pre-determined location within the Security Perimeter and land.

16. The sUAS will have the capability to abort a flight in case of unpredicted obstacles or emergencies.

17. The UA will not be operated less than 500 feet below or less than 2,000 feet horizontally from a cloud or when visibility is less than 3 statute miles from the PIC.

18. Before flight weather conditions will be taken into consideration. No flights will be conducted in rain, thunderstorms, low power conditions, and high winds.

19. All aircraft will identification numbers and will be displayed as large as practicable.

20. The PIC will keep the UA away from all manned aviation operations

21. No operations will take place within five nautical miles from a controlled airport.

The UAS operated

Green Bee operates a Matrix and Phantom Both the Matrix and Phantom run on DJI control systems, that will always be used in the fail safe mode. The fail safe mode ensures that when there is a low voltage scenario, or when loss of radio communication takes place the UAV will return to its point of takeoff and land. Both systems have been tested for this and work properly.

Both the Matrix and Phantom have a GPS position hold installed in them. If for any reason the operator stops inputting direction into the controller the UAV will hold its position until further input is provided. Insuring the aircraft will not fly away from its desired position.

Before each flight the operator will conduct preflight assessment of the UAV, using a preflight check list.

Ensuring that:

-proper authorities have been contacted and made aware of operations

-all screws and bolts are tight on the body of the UAV

-all motors and rotors are secure and rotating properly

-landing gear is stable

-cameras and gimbals are secure and working properly

-rotor arms are secure and properly in place

-GPS signal is secured

-compass, location, and altimeter are properly functioning

After lift off:

-GPS hold position is working properly

-all controls in all directions are working

-gimbal is still working

-FPV monitor is working without interference

In summary, I seek an exemption from the FARs set forth above to allow commercial operations of a small unmanned vehicle conducting precision aerial surveys.

Approval of the exemption allowing commercial operations of the Phantom and Matrix for precision survey work will enhance safety by reducing risk. Conventional aerial survey operations, using jet or piston-powered aircraft present risks associated with vehicles that weigh in the neighborhood of 5,000

to 7,000 lbs, carry large quantities of fuel, passengers, and, in some cases, cargo. Such aircraft must fly to and from the survey location. In contrast, the Phantom and Matrix both weighing no more than 10 lbs and powered by batteries eliminates a portion of that risk given the reduced mass and lack of combustible fuel carried on board. The Phantom and Matrix are carried to the survey location, not flown there. The Phantom and Matrix will carry no passengers or crew and, therefore, will not expose any individuals to the risks associated with manned aircraft flights.

Additionally, no national security issue is raised by the grant of the requested exemptions. Given the size, load carrying capacity, speed at which it operates, and the fact that it carries no explosives or other dangerous materials, the Super Swiper poses no threat to national security.

The Phantom and matrix satisfaction of the criteria set forth in Section 333 of the Reform Act— size, weight, speed, operating capabilities, lack of proximity to airports and populated areas, operation within visual line of sight, and national security, provide more than adequate justification for the grant of the requested exemptions allowing commercial operation of the Phantom and Matrix in the commercial precision agriculture and golf course business.

Thank you,

Jared Nelson

Pilot/Owner Green Bee Limited

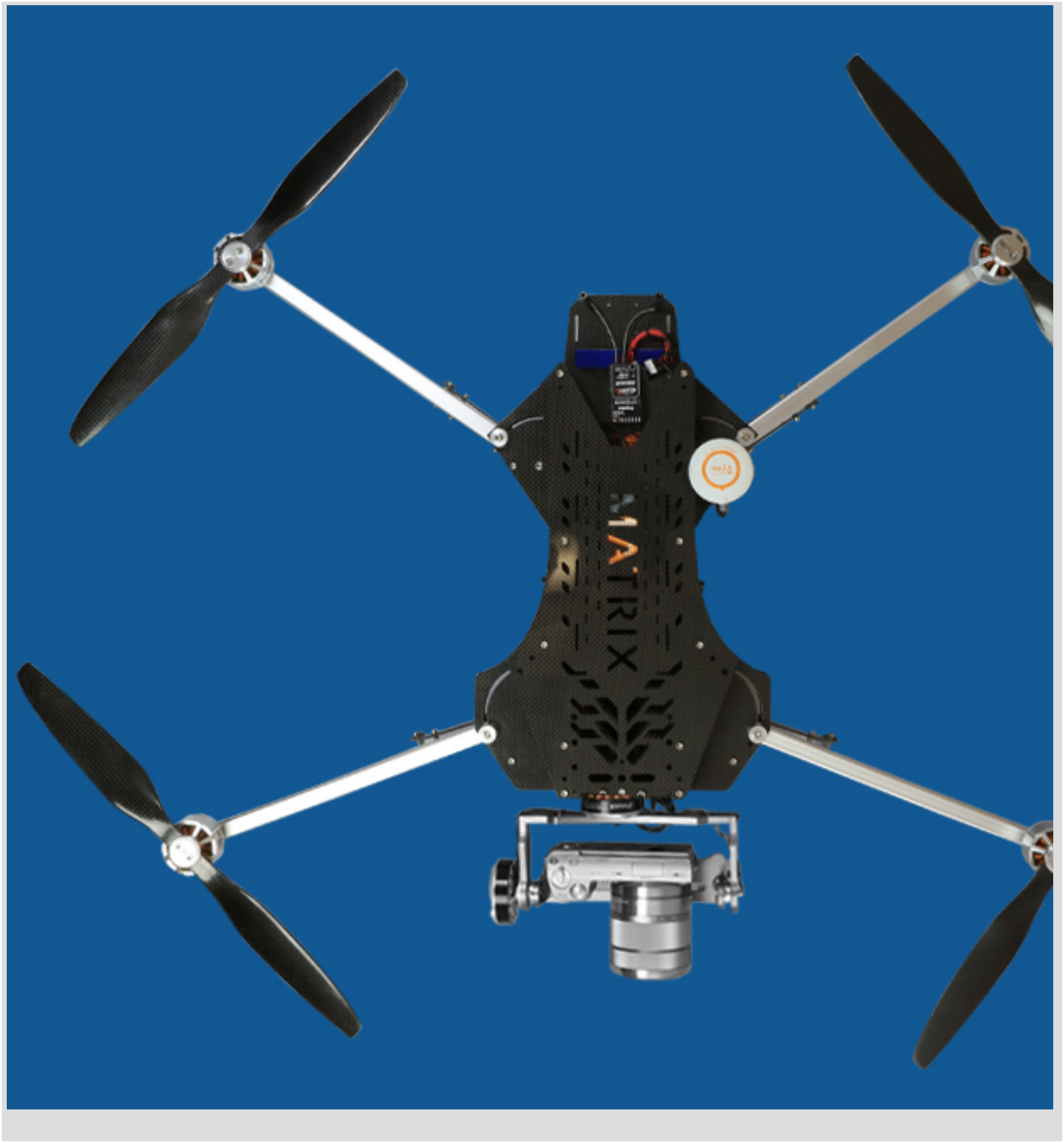
539 Wright St #107

Denver, CO 80228

720-289-8494

greenbee@greenbeeuav.com

Matrix Description and Specifications:



- **Advanced Matrix-E Quadcopter System**
- **Futaba 14SG Transmitter + R7008SB Bidirectional Receiver + Voltage Sensor**
- **4x 15" T-Motor Precision Propellers**
- **2x Structural Beams**
- **C4 Vibration Isolation Deck**
- **Gyrox-5R Brushless Gimbal for Sony NEX-5R/5N/6/7 Cameras (Gimbal is balanced for the NEX 5R Camera & 16mm Prime Lense. Camera & lense are not included.)**

- **CCD Camera & H1 Vibration Isolation Plate for FPV Piloting**
- **iOSD Mark II integration for Switchable Live Video Feed**
- **FPV 8" Monitor with Sunscreen + Battery + Mounting Bracket for Transmitter**
- **FPV Video Transmitter + Video Receiver + Cables + Converter for Sony NEX-5R/5N/6/7**
- **Foldable Arms with Convert-able Sport Mounting Position**
- **Foldable & Adjustable Landing Skids**
- **Foldable GPS Compass with Anti-Slip Bracket**
- **Naza-M V2 Flight Controller + PMU (Power Management Unit) + GPS System (Functions listed on the next line.)**
- **GPS-Lock, Return-to-Home, Course-Lock, Home-Lock**
- **4x Dynamically Balanced Brushless Motors**
- **4x 40A ESCs with Cooling Algorithm**
- **4x 15" Ultra Stiff Carbon Fiber Propellers**
- **8,000mAh 25C 6S (22.2V) LiPo Batteries for Turbo Ace Matrix**
- **B601 Professional Programmable Wall Charger**
- **User Instruction Manual in Flash Drive**

MATRIX PACKAGE FEATURES & OPTIONS

- **Triple Deck Carbon Fiber Architecture**
- **C4 Vibration Isolation Deck to eliminate jello effect on videos**
- **Foldable Arms that locks into portable or operating positions**
- **Naza-M Lite, Naza-M V2 & WooKong Flight Controller Selection**
- **GPS & Compass Functions include GPS-Lock, Home-Lock, Course-Lock & Return-to-Home**
- **Brushless Gimbal for gyro based auto-stabilization or Hard Mount with Vibration Isolation Options**
- **Centrally Located Rotation for camera & gimbal auto-stabilization eliminates the pendulum effect**
- **42mm Brushless Motors dynamically balanced to minimize vibrations**
- **40amp ESCs with Cooling Algorithm overspecced to support extended high torque operations**
- **15inch Extra Heavy Duty Carbon Fiber Propellers to resist flexing and warping under heavier payloads**
- **2.4GHz Standard & Long Range Walkera, Spektrum & Futaba Transmitters, Receivers & Telemetry**
- **Multiple Battery Mounting Positions on both top or bottom of main frame**
- **Single 8,000 & 10,000mah 6S (22.2V) LiPo Battery Options**
- **B601 or Quattro Professional Wall Charger Options**
- **Adjustable Landing Skid for a variety of surfaces**
- **Foldable GPS Compass with Locking Bracket for consistent alignment**
- **Adjustable Arms Mounting Position for aggressive forward sports flight**

- **FPV Live Feed Video available for a selection of cameras**
- **Flash Memory with detailed instructions**
- **Heavy Duty Aluminum Carrying Case will be available to fit Matrix, transmitter, gimbal & more.**
- **Training Package Options including small crash resistant quadcopters & flight simulators**

MATRIX-E SPECIFICATION

- **Dimensions Wingspan (including propellers): Diagonal=1160mm, Front=1040mm, Back=980mm**
- **Dimensions Operating Position (including propellers): W=840mm, L=790mm, H=130mm**
- **Dimensions Folded Position (including propellers): W=295mm, L=830mm, H=110mm**
- **Dimensions Motor to Motor: Diagonal=780mm**
- **Maximum Payload Capacity: Gimbal+Camera+Accessories=3.5LB, Gimbal+Camera+Accessories+8000mah Battery=6.2LB**
- **Maximum Optimal Payload Capacity: Gimbal+Camera+Asscessories=2.5LB, Gimbal+Camera+Accessories+8000mah Battery=5.2LB**
- **Matrix Weight without Payload/Battery: 4.8LB**
- **Typical Operating Weight with Hero3: Matrix+Gyrox-3+VTX& Power (5.33LB)+ Hero3 (.17LB) +VTX+8,000mah Battery (2.5LB) = 8LB**
- **Typical Operating Weight with Sony NEX 5R: Matrix-E+Gyrox-5R+VTX&Power (5.5LB) + NEX-5R+Lense (1LB), 8,000mah Battery (2.5LB) = Total: 10LB**
- **Motors: Diameter=42mm, Height=35mm**
- **ESC: 40amp**
- **Propellers: 2xCW & 2xCCW, 15" Extra Robust Carbon Fiber Constructions, Dual Position Mount**
- **Battery Recommended: 8,000mah 6S (22.2V) 25C**
- **Flight Time: Matrix + 10,000mah Battery = 35min**
- **Flight Time: Matrix + 8,000mah Battery + Vibration Isolation Carbon Plates + Hero3 = 30min**
- **Flight Time: Matrix-S + 8,000mah Battery + Brushless Gyrox3 Gimbal + Hero3 = 22-25min**
- **Flight Time: Matrix-E + 8,000mah Battery + Brushless Gyrox5R Gimbal & Sony NEX-5R = 12-15min**
- **Transmitter & Receiver Recommendation: 2.4GHz, Minimum 6-Channels, Optimal 7-Channels or more**
- **Standard Distance Operations: 300 to 500 feet (Using Walkera Devo 10 & Most Other Name Brand Transmitters)**
- **Long Distance Operations: 4,224 feet (.8miles) to 6,336 feet (1.2miles) (Using Spektrum DX8/DX18 & Futaba 14SG)**

- **FPV Recommendation: 5.8GHz Video Transmitter & Video Receiver + Monitor or Goggles**
- **Wind Tolerance: Class 5**
- **Aluminum Case Dimensions: L=935mm, W=410mm, H=145mm**

CULMINATION OF INNOVATION, EXPERIENCE & EXECUTION

Leapfrogging quadcopter records with ease, the sporty new Matrix is crushing all competitions with its super sized wingspan. Yet, it folds down nicely to fit in a professional aluminum case along with the transmitter radio. Matrix's super efficient 6-cell system powers 4 muscular 42mm brushless motors driving 15" carbon fiber propellers for unparalleled lifting capacity and stability. Conceptualized by master FPV pilots, Matrix is a quadcopter designed for rather than adapted to carrying cameras. To satisfy an almost insurmountable list of high expectations, Turbo Ace engineers set out on a journey of innovation and discovery. Applying more than 85 years of combined helicopter and multi-rotor expertise between our master pilot group, engineers and designers, the Matrix represents an ultimate breakthrough in quadcopter engineering and optimization. To search for the ultimate mix of performance and durability, Turbo Ace developers matched up countless motors, ESCs and propellers combinations followed by series of unrelenting updates and test flights. From planning and implementing the best components on a foldable structure, setting and meeting new milestones in flight time and payload, to executing crucial requirements for flight and camera stabilization, the Turbo Ace Matrix is truly a quadcopter beyond its time.

UNPRECEDENTED PAYLOAD & FLIGHT TIME

Matrix's big breakthrough is a 25-minute flight time carrying the #1 selling GoPro Hero3 stabilized on the ultra fast 2-axis brushless Gyrox3 gimbal. Cutting out the gimbal but keeping the Hero3 on a vibration isolation plate will extend Matrix flight time beyond the amazing 30min threshold. Despite many unrealistic claims, the closest competition offers less than half the flight time. At about 3 times the size of a mid-sized quadcopter, heavier payloads exert disproportionatelly less impact on Matrix flight time than smaller quadcopter flight time. Without exception, even the top selling mid-sized quadcopters with 8" to 10" propellers will max out at 5-6 minutes with Hero3 and gimbal onboard. It's common for both vendors and end users to exaggerate or manipulate payload and flight time by gutting critical components inside quadcopters and cameras.

IDEAL UNOBSTRUCTED AUTO-STABILIZED CAMERA/GIMBAL LOCATION

Tired of propellers and landing skids framing your video? The Matrix's nose offers an ideal location with unobstructed view - no propellers even in wide angle videos, no skid landing when pointed down and no more annoying propellers shadows on the lenses. Although these are nagging issues, there are even more crucial factors in achieving stability. Because traditionally mounted cameras are about 8 inches below the main hub, a quadcopter's roll causes the camera to swing like a pendulum. Although a good gimbal is able to compensate for the roll axis movement, it's unable to address the horizontal movement that causes a video to shift from side to side as if a skater is holding the camera. By moving the gimbal and camera up to the level of the propellers,

the Matrix design has basically eliminated the pendulum effect. Last but not least, gimbals are only as stable as the foundation they are mounted on. Bypassing the weight and slack of unstable undermounted gimbal platforms, Matrix's gimbal is mounted directly on the main frame to prevent oscillation from surfacing.

TRIPLE CARBON FIBER DECK FOR COMPREHENSIVE & VERSATILE INTEGRATION

In housing and supporting an extensive list of stock and upgrade components on a super-scaled quadcopter, Matrix's triple decked carbon fiber structure is extremely strong and versatile. Four foldable arms which double as supporting beams are securely sandwiched between the lower decks along with multiple ventilated ESC positions. The middle deck houses and protects all critical electronic components such as the flight controller, the GPS, LED and other optional systems. Versatile Battery and ESC mounting positions allows the operator to shift CG (center of gravity) upward, downward, forward and backward to accommodate a wide variety of payloads and flight characteristics. Mount the battery below the lower deck for more stable flights or move the battery to the upper deck to increase maneuverability. And to counter balance different camera payloads, you can shift the battery, ESCs and arms into optimal positions for proper CG.

ADDITIONAL C4 VIBRATION ISOLATION DECK TO ELIMINATE JELLO EFFECTS ON VIDEOS

High frequency vibration on cameras is the principal cause of jello effects on videos. Implemented on a vast scale, Matrix's C4 vibration isolation deck offers a comprehensive anti-vibration solution for gimbal, camera and flight controller. In contrast to skimpy isolation plates, rubber bands or balls, Matrix's C4 vibration roadblock encompasses the entire surface and mass of the upper decks including the weight of a top mounted battery to neutralize vibrations. By including an extra layer of vibration dampening for the flight controller, Matrix is also preserving a common practice amongst professional pilots. A flight controller's sensitive gyro system can often misinterpretate vibrations as part of an aircraft movement, leading to adjustments and counter adjustments that generates more vibrations. By addressing the cause and effect of vibrations, the Matrix platform offers the epitome of production quality videos without the risk and disappointment of software stabilization.

FOLDS AND FITS NEATLY INTO A CARRY-ON SIZED ALUMINUM CASE

No more awkward quadcopter with protruding arms and propellers to lug around. Unlike typical folding mechanisms, the Matrix's arms and landing skids are designed to lock into folded or operating positions so you don't have to sacrifice structural integrity for portability. Implementations of slotted tracks enable fast and secured transitions without the risk losing any hardware. For a day out in the park or a hiking trip, you can retract the arms and skids to reduce the footprint. And for traveling, foldable antenna enable the Matrix and the transmitter to slip comfortably into a professional aluminum case without dismounting the propellers and gimbal. Upon arrival at the flight location the operator can adjust the landing skid height to accommodate rougher terrain. An optional aluminum case even includes cutouts for transmitter, batteries, spare parts & tools. Who

knows, you might have a trip planned for Europe and the very versatile Matrix can make a great companion as a carry-on.

DYNAMICALLY BALANCED MOTORS & OVER-SPECCED ESCS

For exceptionally smooth flights, Matrix super muscular 42mm brushless motors are dynamical balanced. Since brushless motors are hand wound, the mass center is usually not in alignment with the mechanical center. Using advanced electronic balancing instruments, our factory spins up each motor then make proper adjustment to bring the mass center into alignment. Then to control and power the motors, Matrix 40A ESCs feature advanced multi-rotor algorithms which offers better performance and reliability than generic helicopter algorithms. Over-specced to sustain unrestrained amperage in higher torque for acceleration, extreme maneuvers and bigger payloads, Matrix is engineered to operating below capacity, so mechanical and electronic components stay relatively cooler even with consecutive flights.

STIFFER & THICKER DOUBLE-POINT MOUNTED 15" CARBON PROPELLERS

No propellers are created equal. 15" Matrix robust carbon fiber propellers are sculpted with extra thick mid-section to resists flex then tapers to efficient blades to cut through the air with minimal resistance. Traditional circular mounts are accidents waiting to happen because the force of rotating propellers will eventually unscrew the crown nuts during flight. Integrated double point mounts on Matrix motors and propellers eliminate this possibility and at the same time improve tracking precision because the propellers are forced to sit flat against the top of the motors. Another benefit of a flat mount is that there are no vulnerable protruding motor shafts. Slight deviations in traditional circular mounting holes or protruding motor shafts are extremely difficult to detect which magnify pitch and tracking variances, a major cause of vibrations and unstable flights. Since end-users are often required to purchase and mount propellers, Matrix's new hassle free mounting configuration is implemented to prevent vibration issues from surfacing.

SELECTABLE MANUAL, ATTITUDE & GPS FLIGHT MODES

A 3-positioned switch is setup on Matrix' transmitter for pilot to select between 3 different flight modes. (1) With Manual Flight Mode, the absence of Gyro assisted flight makes it very difficult for the Pilot to stabilize and maneuver the quadcopter. (2) For 3-axis gyro auto-stabilized flight, the Attitude Flight Mode will automatically keep the Matrix in a leveled and sustainable flight thus enabling the pilot to focus on maneuvering the quadcopter. (3) Finally, the GPS Flight Mode is the most often used mode because it combines the benefit of 3-axis gyro auto-stabilized flight with 4 advanced GPS based functions described below.

GPS-LOCK & RETURN-TO-HOME

Under GPS Flight Mode, (1) one of the most utilized GPS based functions is the GPS-Lock function. Simply release the cyclic stick and allow it to spring to the middle of the control and the Matrix will be locked into a fixed GPS location (longitude-lock and latitude-lock) with a tolerance of 3 to 5 feet radius. Another similar function from the Matrix flight controller, the Barometric-Lock can be activated by moving the throttle stick

to the middle of the control and the Matrix will be locked into a fixed elevation (altitude-lock). A hands-free hover modes is established when the pilot activates both the GPS-Lock and the Barometric-Lock simultaneously and the flight controller takes over. Either lock may also be used independently to hover in a fixed GPS coordinate with pilot controlled elevation or the longitude/latitude. By relinquishing controls to these auto-hover modes, the pilot can better focus on monitoring the video and controlling the camera. (2) Another popular GPS function is the Return-to-Home feature, a preprogrammed failsafe function that's automatically triggered by lose of remote control signals. Upon activation, the quadcopter will hover in place for a couple of seconds before elevating to a preprogrammed height and return to the home position for an automated landing sequence.

GPS BASED COURSE-LOCK & HOME-LOCK

Under GPS Flight Mode, there is dedicated 3-positioned carefree mode switch set up to access (3) Course-Lock, a compass based carefree mode that remembers the initial take-off direction of the flight which is used to consistently orient the quadcopter. Under Course-Lock, the transmitter radio must remain in the initial take-off direction until it's reset or until the quadcopter lands. For example, with the transmitter pointed in the eastward direction, a quadcopter takes off in eastward heading orientation then turns towards a northward heading. Without Course-Lock, a transmitter cyclic (directional) stick moved up towards the east will cause the quadcopter to head northward. Under Course-Lock, a cyclic stick moved up towards the east will cause the quadcopter to head eastward which is consistent with the initial take-off direction. In fact, by keeping the transmitter pointed in the initial eastward take-off direction, the cyclic stick direction will always correspond to the direction of the quadcopter no matter how the heading has changed. At any time the pilot may reset the initial direction by flipping the Carefree Mode Switch in and out of Course-Lock. (4) Lastly, there is another similar carefree mode with a twist. Home-Lock, a home coordinate based carefree mode is very similar to Course-Lock. The difference is that Home-Lock uses the home location as the consistent tail-in orientation for the entire flight. While this allows the pilot to constantly turn and follow the quadcopter, the pilot should not move away from the home location. And because GPS has a tolerance of 3-5 feet, Home-Lock is less precise than Course-Lock. However, as the quadcopter gains more distance from the home position the precision improves dramatically. This is why Home-Lock will not and cannot be activated within a 30-feet circle from the home position. To use Home-Lock, the pilot usually maintains a tail-in orientation until the quadcopter is well beyond the 30-feet circle before assuming that Home-Lock has activated. At this point the pilot can constantly turn and point the transmitter at the quadcopter and the cyclic stick will always correspond directly to the quadcopter's direction. To bring the quadcopter back, the pilot simply pulls the cyclic towards himself - basically a manual controlled return-to-home function. Special caution is required when the quadcopter approaches the 30-feet circle because Home-Lock will automatically switch to Course-Lock. If the quadcopter enters the 30-feet circle from the initial take-off direction so that Home-Lock is equal to Course-Lock the pilot can assume that the quadcopter is under Course-Lock until the quadcopter lands. In summary, an experienced pilot uses the "Normal" flight mode because no help is required from GPS. Both Course-Lock & Home-Lock carefree flight

modes enable the operator to pilot the quadcopter without keeping track of the quadcopter's tail position. This is especially useful if a less experienced pilot is rotating the quadcopter to pan the video. There is much less confusion for beginner pilots to stick with either "Normal" mode or use GPS assisted Course-Lock. Home-Lock is usually reserved for longer distance within-the-line-of-sight flight because it's a bit confusing to operate when it approaches the home position.

ULTRA DURABLE & MAINTENANCE FRIENDLY

All Matrix material and components are selected and built for reliability and durability. Premium carbon fiber is utilized in the main frame for its rigidity and light-weight properties. Wear resistant CNC aluminum is utilized in screw-mounted joints, brackets and posts. Tough Japanese bearings are implemented to guard against higher temperatures. Then for continued maintenance, Matrix is based on a modularized design with strategically placed high tensile strength connectors so it's extremely easy and cost effective to maintain and operate. With minimal disassembly, components can be independently removed and replaced to diagnose and repair problems. As with all Turbo Ace production models, well stocked Matrix parts and upgrades are manufactured in larger volumes and savings are passed on to end-users. Operators are encouraged to keep some backup parts such as spare propellers, screws and batteries for replacement. Complimentary Turbo Ace videos are available online to assist operators in maintaining and upgrading the Matrix.

EXPANDABILITY WITH OPEN ARCHITECTURE & UPDATABLE ONLINE FIRMWARE

Catering to research professionals and avid hobbyists, the Matrix welcomes a full spectrum of specialized modifications. An open architecture supports unparalleled flexibility for arm and frame extensions, variable motor mount options and ample space for peripheral integration. To get a head start on more advanced integrations, you can get an upgrade from the DJI Naza-M Lite to either the Naza-M V2 or WooKong flight controllers that are all supported with continued online updatable firmware. Multiple adjustable mounting positions are pre-drilled to accommodate third party gimbal integration.

FLIGHT CONTROLLER OPTIONS & SPECIFICATION

DJI NAZA-M LITE MULTI-ROTOR STABILIZATION CONTROLLER

- Support Multi-Rotor: Quad-Rotor I4, X4/ Hex-Rotor I6, X6, IY6, Y6
- Supported ESC Output: 400Hz Refresh Frequency
- Recommended Transmitter: PCM or 2.4GHz with minimum 4 channels
- Working Voltage Range: MC: 4.8V~5.5V
- Power Consumption: MAX 1.5W (0.3A@5V), Normal: 0.6W (0.12A@5V)
- Operating Temperature: -10 ~ 50 degree Celsius
- Assistant Software System Requirement: Windows XP sp3 / Windows 7 / Windows 8
- Maximum Yaw Angular Velocity: 200 Degree/Sec
- Maximum Tilt Angle: 45 Degree
- Ascent / Descent: +-6m/Sec
- MC: 25g
- GPS/Compass: 21.3g
- VU: 20g
- Dimensions: MC: 45.5mm x 31.5mm x 18.5mm, GPS/Compass 46mm (diameter) x 9mm, VU 32.2mm x 21.1mm x 7.7mm
- Built-in Functions: Three Modes Auto-pilot, Enhanced Failsafe, Low Voltage Protection, S-Bus Receiver Support, PPM Receiver Support, 2-Axis Gimbal Support

DJI NAZA-M V2 MULTI-ROTOR STABILIZATION CONTROLLER

- Support Multi-Rotor: Quad-Rotor I4, X4/ Hex-Rotor I6, X6, IY6, Y6/ Octo-rotor I8, V8, X8
- Supported ESC Output: 400Hz Refresh Frequency
- Recommended Transmitter: PCM or 2.4GHz with minimum 4 channels
- Working Voltage Range: MC: 4.8V~5.5V
- Working Voltage Range: PMU input: 7.4V to 26.0V (recommend 2S to 6S Lipo)
- Power Consumption: MAX 3.15W (0.25A@12.6V), Normal: 1.638W (0.13A@12.6V)
- Operating Temperature: -10 ~ 50 degree Celsius
- Assistant Software System Requirement: Windows XP sp3 / Windows 7 / Windows 8
- Maximum Yaw Angular Velocity: 200/s
- Maximum Tilt Angle: 45
- Ascent / Descent: +-6m/s
- MC: 27g
- GPS/Compass: 27g
- PMU: 28g
- LED: 13g
- Dimensions: MC: 45.5mm x 32.5mm x 18.5mm, GPS/Compass 46mm (diameter) x 10mm, PMU 39.5mm x 27.5mm x 10.0mm, LED 25mm x 25mm x 7.0mm
- Built-in Functions: Three Modes Auto-pilot, Enhanced Failsafe, Low Voltage Protection, S-Bus Receiver Support, PPM Receiver Support, 2-Axis Gimbal Support

DJI A2 MULTI-ROTOR STABILIZATION CONTROLLER

Based on the technology and design philosophy of DJI's Ace series of high-performance controllers, the A2 offers you a brand new flight experience. The A2 adopts a full metal case design and utilizes high quality components precisely calibrated with temperature compensation in all gyros and sensors, industry renowned flight algorithm in flight control and UAV field.

Peripherals

- * Supported Multi-Rotor: Quad-Rotor: +4,x4; Hex-Rotor +6,x6,Y6,Rev Y6; Octo-Rotor +8,x8,V8
- * Supported ESC Output: 400Hz refresh frequency
- * Supported Transmitter for Built-in Receiver: Futaba FASST Series and DJI DESST Series
- * Supported External Receiver: Futaba S-Bus, S-Bus2, DSM2
- * Recommended Battery: 2S ~ 6S LiPo
- * Operating Temperature: -5°C to +60°C
- * Assistant Software System Requirement: Windows XP SP3 / 7 /8 (32 or 64 bit)
- * Other DJI Products Supported: Z15,H3-2D,iOSD,2.4G Data Link,S800 EVO

Flight Performance

- * Hovering Accuracy (In GPS Mode): Vertical: ± 0.5m; Horizontal: ± 1.5m
- * Max Yaw Angular Velocity: 150 deg/s
- * Max Tilt Angle: 35°

Electrical & Mechanical

- * Power Consumption: MAX 5W (Typical Value: 0.3A@12.5V
- * Built-In Functions: Built-in Receiver; Multiple Control Modes; 2-axis Gimbal Supported; Low Voltage Protection; PC & Bluetooth Ground Station
- * Built-In Functions: External Receiver Supported; Intelligent Orientation Control; Sound Alarm; 4 Configurable Output

- * Total Weight: Total Weight: <= 224g(overall)
- * Flight Controller Dimensions: 54mm x 39mm x 14.9mm
- * IMU Dimensions: 41.3mm x 30.5mm x 26.3mm
- * GPS-Compass Pro Dimensions: 62mm (diameter) x 14.3mm
- * LED-BTU-I Dimensions: 30mm x 30mm x 7.9mm
- * PMU Dimensions: 39.5mm x 27.6mm x 9.8mm

CAMERAS

Aerial camera mounted under quadcopter serves two main purposes. (1) First and foremost, cameras are used for the purpose of recording videos or taking still photographs. Preferably, a DSLR camera is mounted on an auto-stabilized gyro based gimbal (camera mount) to stabilize the camera's horizon. (2) For more experienced pilots, a camera can be used for the purpose of piloting the quadcopter from the point of view of the camera aka FPV (first-person-view) piloting. If the camera is either mounted directly on the quadcopter without stabilization so the pilot can experience the tilt (pitch) & roll of the hexacopter. If the camera is auto-stabilized, OSD (on-screen-display) may be required to overlay artificial horizon and flight status on live feed video.

VIBRATION ISOLATION MOUNT & AUTO-STABILIZED CAMERA MOUNTS ON MATRIX

Employing vibration isolation mount for camera can significantly dampen high frequency vibrations to prevent rolling shutter & jello effects on videos. And for more professional applications, we can optionally add gyro based camera mounts to automatically stabilize cameras to accommodate quadcopter's tilt & roll movements to maintain a leveled video horizon. To control the camera's aim, a dial switch on the transmitter radio enables the pilot to tilt the camera up or down. With the freedom to maneuver and turn the quadcopter from different perspectives, heights and angles, one can achieve an endless variety of high quality shots and videos.

H3 Vibration Isolation Mount

- Vibrations Dampening (for GoPro Hero2/3 & other small cameras)
- GoPro Tripod Mount & Tripod Screw
- Super Light Weight Configuration Enables Dual Battery Setup for Extended Flight Time

Gyrox-3 Brushless 2-Axis Gimbal

- Super Fast Auto-Stabilized Roll-Axis
- Super Fast Pilot Controlled & Auto-Stabilized Tilt-Axis
- Expanded Tilt-Axis Angle Enables the Camera to Point Straight Down

- Optimized Stabilization & Mounting for GoPro Hero3 Camera Only

Gyrox-5R Brushless 2-Axis Gimbal

- Super Fast Auto-Stabilized Roll-Axis
- Super Fast Pilot Controlled & Auto-Stabilized Tilt-Axis
- Expanded Tilt-Axis Angle Enables the Camera to Point Straight Down
- Optimized Stabilization & Mounting for Sony NEX-5R/5N/6/7 Cameras

FPV Live Feed Video

Live feed video enables the pilot or cameraman to see real time videos from the camera's point of view which is synonymous to FPV (first-person-view). In contrast to slower and shorter distanced WiFi video streaming on cameras, aerial FPV requires much longer distance transmission without visible delay. A video transmitter is usually attached to a camera's video-out port transmits the video signals. A matching video receiver located next to the pilot or cameraman receives the video signal that is then plugged into a monitor's video-in port for displaying the video. There are 2 main purposes for aerial FPV. (1) To enable pilot/cameraman to see and frame videos or still shots by adjusting the gimbal and/or the quadcopters location and orientation. (2) To enable pilot to see and fly from the point of view of the camera (view from the cockpit). If a camera is hard mounted without auto-stabilization, the video will reflect the tilt (pitch) and roll of the quadcopter. If a camera is auto-stabilized on a gimbal, an OSD (on-screen-display) may be implemented to overlay artificial horizon and flight data on the auto-stabilized video that does not reflect the tilt and roll of hexacopter.

FPV From 600TVL Camera

- Lighter TVL camera is easy to set up and promotes longer flight time.
- Composite video output & standardized plug enable simple connection to video transmitter.
- Hard mounted on the Hexacopter, TVL camera can be used for FPV piloting & surveillance.
- Mounted on under or above the gimbal, TVL camera can be aligned with DSLR camera for framing your videos and stills.

FPV From Hero3 or HD Camera

- You can see exactly what the Hero3 or HD camera is capturing for framing your video and stills.
- Special cable connector is provided for video transmitter to plug into the Hero3 or HD camera's video out port
- Examples of cameras supported: Hero3 & Sony NEX 5N/6N/7N

STANDARD & LONG DISTANCE TRANSMITTERS FOR MATRIX

Due to safety and equipment concerns, transmitter reliability is crucial in professional quadcopter operations. Without an established standard of verification, it's common place for transmitter brands to overstate operating distance by discounting the importance of reliability. A typical transmitter spec for 2,000 feet range may only be reliable 80% of the time and you can easily lost your equipment in several flights at 300 feet. Only extensive field testing over several months - not biased reviews based on several test flights - are true indicators of consistently reliable operating range.

Walkera F7 Transmitter

- 2.4GHz Transmitter with 7 Channels
- RX701 Receiver with 7 Channels
- Telemetry Installed for Updated Flight Battery Status to Trigger Low Battery Alarm
- Standard Distance of 300-500 Feet
- Build-in 3.5" Color LCD Screen for FPV Live Video Display
- Compatible only with DV04 Camera

Futaba 14SG Long Distance Transmitter

- 2.4GHz FASSTEST Transmitter with 14 Channels
- R7800SB Bi-Directional Receiver with 8 Channels (Optional: R6106HFC Receiver for 6 additional channels)
- S.Bus2 Bi-Directional Protocol for Additional Servos, Telemetry & Other Auxiliary Functions
- Telemetry Voltage Sensor Installed for Updated Flight Battery Status to Trigger Low Battery Alarm
- Ultra Reliable Standard & Long Distance of 1 to 1.2 Mile (Upgradable to EZUHF for up to 25 miles)
- Overwhelmingly Recommended by Professional RC Pilot Groups

TRANSMITTER & RECEIVER OPERATING REQUIREMENTS

Standard remote control transmitters and receivers utilized with the Matrix quadcopter operate under FCC Part 15 (S29DEVO-10, BRWDAMTX11, AZPT14SG-24G, S29TX5803) in either legal 2.4GHz and/or 5.8GHz frequencies. In general, advanced quadcopters require a minimum of 7 channels under the 2.4GHz frequency range: 4 channels for piloting controls, 2 channels for the GPS and 1 channel for controlling the tilt-axis of the gimbal. Extended distance transmitters usually employ several methods

to promote signal strength and reliability. (1) Frequency-hopping spread spectrum (FHSS) is a method of transmitting radio signals by rapidly switching between several frequencies to seek the least amount of traffic. (2) Dual paths diversity enable the signals to reach two receivers or antennas mounted in different locations on the quadcopter so the system can utilize the strongest signal path. Bi-directional communications between transmitter and receiver can also utilize feedback signal strength to traget the best frequencies in real time (3) In case of signal disruptions, algorithm for ultra fast signal recovery enables the transmitter and receiver to quickly rebind for uninterrupted operations. **Products using permitted frequencies without certification will require an amateur radio (ham) license. It is the operator's responsibilities to ensure the use of such products meet their individual countries' federal and local government's rules or regulations for RF devices. If you are unsure of your government's requirement or unable to comply with them, please do not purchase this product. Please do not alter the purchased product in violation of said rules and regulations because Wow Hobbies cannot be held liable for operator's misuse or modification of a legal product.**

Phantom 2 Specifications:

General Features	Ready to Fly, Multifunctional Quad-rotor System Customized H3-2D and H3-3D Gimbal Support Precision Flight and Stable Hovering 25min Flight Time & Smart Battery Auto Return-to-Home & Landing Advanced Power Management Intelligent Orientation Control (IOC) Easy Battery Replacement Self-tightening Propeller Video Downlink Support CAN-Bus Expansion Module
Aircraft	***Weight (Battery & Propellers Included)*** 1000g ***Hover Accuracy (Ready To Fly)*** Vertical: 0.8m; Horizontal: 2.5m ***Max Yaw Angular Velocity*** 200°/s ***Max Tilt Angle*** 35° ***Max Ascent / Descent Speed*** Ascent: 6m/s; Descent: 2m/s ***Max Flight Speed*** 15m/s(Not Recommended) ***Diagonal Length*** 350mm ***Flight Time*** 25mins ***Take-Off Weight*** ≤1300g ***Operating Temperature*** -10°C ~ 50°C ***Supported Battery*** DJI Smart Battery
DJI Smart Battery	***Type*** 3S LiPo

	Capacity 5200mAh, 11.1V ***Charging Environment Range*** 0℃ to 40℃ ***Discharging Environment Range*** -20℃ to 50℃
2.4GHz Remote Control	***Operating Frequency*** 2.4GHz ISM ***Communication Distance (Open Area)*** 1000m ***Receiver Sensitivity (1%PER)*** -97dBm ***Working Current/Voltage*** 120 mA@3.7V ***Built-In LiPo Battery Working Current/Capacity*** 3.7V, 2000mAh