

# UAS America Fund

Unmanned Aerial Systems

A Path Forward

November 2014



**UAS AMERICA FUND**

A PPP FOR AEROSPACE PROGRESS

# Unmanned Aerial Systems are not new nor are they limited in size, scope, and potential benefit

## Unmanned Aerial Systems (UAS) go by many different names:

- UAS / UAV / Drone / Remotely-Piloted Aircraft/Vehicle (RPA/RPV)
- UAS includes many components: aircraft, pilot, software-based control systems, sense/detect-and-avoid and command-and-control systems, communications systems, sensor hardware, video systems, etc.
- Aircraft configurations: fixed-wing (plane), single-rotor (helicopter), multi-rotor (quad, octocopter), and hybrid solutions
- Propulsion options vary, from fuel powered to battery-operated to solar
- Can be remotely piloted or autonomous
- Size varies: 1 lb to thousands of pounds, wingspans <1' to >100', ceilings to FL600+, endurance from minutes to 24+ hours

**There is no one-size-fits-all when talking UAS**

## Usage of UAS today varies as well:

- Military: Intelligence, Surveillance, and Reconnaissance as well as in combat
- Government: Search, rescue, lifesaving, weather prediction, environmental monitoring, public safety, law enforcement
- Commercial: Almost endless applications such as agriculture, surveys/mapping, infrastructure inspections, photography/videography, communications, and delivery
- Recreation: Flying radio-controlled models has been around for 75 years

**Further use of UAS likely hasn't even been contemplated, especially when considering autonomous operations and applications**



# The integration of UAS into our daily lives likely will span significant variances in time, coordination, and benefit

## **Some activities can be immediate:**

- Precision agriculture
- Search and rescue
- Photography / videography
- Infrastructure inspections
- Disaster response
- Flights over private property with landowner permission

## **Other activities are likely further off:**

- Package delivery
- Interactive/Responsive operations
- Air Traffic Control-managed NAS integration
- Autonomous operations
- Extremely highly-populated areas

## **Technological advances are still needed**

## **There is a wide spectrum of regulatory concern**

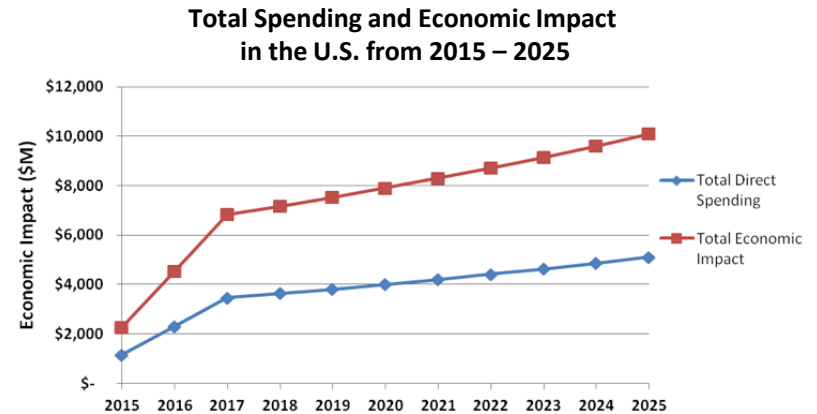
- Safety must always be paramount
- Privacy debate will continue, but not prevail
- Not all flights should be treated equally
  - High altitude vs low altitude
  - Populated vs rural operating areas
  - Flight over public vs private property
  - 3 pound vs 30,000 pound vehicles
    - FAA says 55 lbs is key
    - Big difference between 5 & 50 lbs
    - What about speed & kinetic energy
- UAS-specific certifications must be created
  - Aircraft, Pilots, Operators certificates must be augmented from current FARs



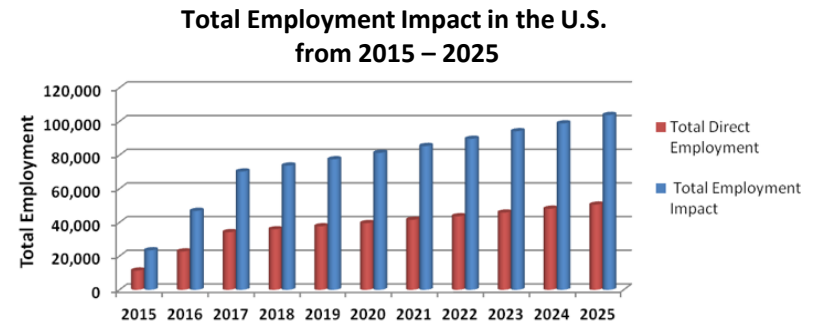
# UAS Opportunity and Economic Impact – U.S.

- Economic impact to U.S. economy:
  - 70,000 jobs will be created in the first three years of integration, with an economic impact of over \$13.6 billion
- U.S. commercial and competitive environment today is characterized by:
  - Over 10,000 companies, pursuits, dreams
  - Commercial demand is dominated mostly by a core set of vertical industries, but other sectors have significant interest
  - No direction or regulation – “The Wild West”!
- U.S. DoD investments will continue at sustaining levels as UAVs create a force multiplier effect in tough budget times
- These figures are likely conservative, and don’t consider global implications

## **Total 11 year economic impact: \$82 billion**



## **More than 100 thousand jobs created**



Source:

*The Economic Impact of Unmanned Aircraft Systems Integration In the United States, AUVSI, 2013*



# Current Landscape of UAS in the United States

## **Growth and development of the national UAS market is being inhibited by insufficient US Government and FAA regulatory progress**

- FAA Progress to the Congressional Mandate is Insufficient
- The FAA is Focused on Activities that Do Not Meet the Near Term Need
- Insufficient Federal Budget

## **Current FAA processes do not provide an efficient path for approval of commercial operations**

- Section 333 exemptions: 100+ in queue, 120d min timeline, discretionary (no objective criteria)
- COA / COW / test sites: Inefficient process for private entities and still very restrictive environment
- Special Airworthiness Certificates: Very restrictive and complicated to obtain

## **American companies are conducting business outside the U.S. or closing up shop**

- The US is falling behind the rest of the world and companies are losing competitive advantages
- Unrealized economic development and high-paying, high-quality jobs are idle
- Lost governmental taxes and fees

## **No appropriate supporting infrastructure exists for advanced UAS operations**



# FAA is Focused on Activities that Do Not Meet the Near Term Need

## FAA is focused on:

- A small UAS rule, likely that will limit commercial operations to line of sight
- RTCA Special Committee 228 work to establish standards for technical infrastructure for routine operations of remotely piloted UAVs in controlled airspace (initial focus transition through Classes E and G Airspace to Class A)
  - FAA roadmap explicitly rules out autonomous operations
  - Extrapolation of MOPS schedules indicates operational dates years from now
- Receiving and responding to COAs and Certificates of Waiver with no objective criteria for approval or rejection

## Effect of FAA's Focus:

- Provides no clear path for routine near term authorization of commercial UAV operations
- No authorization of beyond line of sight operations
- No safety differentiation between impulse hobbyists versus serious, safe commercial operations
- Applies severe limitations for commercial research, development, and testing of UAS

## A proper industry focus would:

- Segment the market (many reasonable options and alternatives exist)
- Focus incrementally on the segments
- Begin where there is demand
- Begin where problems are more tractable
- Some segments do not need regulation



# Market Segmentation is key for moving the industry

## Flight characteristic factors to consider:

- Vehicle size
- Area of operation
- Altitude
- Mission function
- Line of sight
- Flight rules VFR/IFR
- Time of day
- Private property & permission

## Regulatory factors to consider:

- Certificate(s) required (UAS-specific):
  - Air Worthiness, Operator, Pilot, etc.
- Aircraft equipage requirements
- Communications requirements
- Insurance requirements
- Privacy concerns

## Technology issues drive options for path forward:

- Geo-fencing
- Return-to-origin
- Communications links and redundancy
- Currently-available CNS/ATM, SAA & C2 technologies
- Leverage Military experience

## Risks can be mitigated best by grouping the market by like activities

- Low-hanging fruit first
- Probabilistic-based failure rates and corresponding safety implications
- Thresholds determined by kinetic energy calculations?
- Consider non-regulated portions of market



# Initially, reasonable and logical market segmentations, and their associated regulatory requirements, are possible

Example Applications	Regulatory Requirements													Technical Requirements				Certification Requirements			Incremental characteristics of each category			
	Low Altitude (below 400' AGL)	High Altitude (above 400')	Micro UA (< 3 lbs)	Small/Large (>3 lbs)	Non-populated Area	Populated Area	Public Property	Private Property with Permission	Line of Sight	Beyond Line of Sight	Daytime VFR	Nighttime	IFR	Insurance Necessary	Geo-fencing	Return to Origin / Fix	Collision Avoidance System	Constant Position Reporting	Descent Control	Pilot (UAS-specific)		Aircraft (UAS-specific)	Operator (UAS-specific)	
<b>Recreational Flights: Minimal Regulations</b>																								
Hobbyist and recreational flights	●		●		●	●	●	●	●															Base hobby / recreation category
<b>Recreational Flights: Certification &amp; Technical Requirements</b>																								
Hobbyist and recreational flights	●		●		●	●	●	●	●							●			●	●				Adds FPV / BLOS
<b>Commercial Flights - Category 1A (Micro Unmanned Aircraft): Minimal Regulations</b>																								
<b>Close-proximity and Line-of-Sight</b> commercial operations such as: - Training & certification - Aerial photography - Infrastructure inspection - Small-scale precision agriculture - Firefighting, discrete-area SAR - Insurance investigation	●		●		●		●	●	●					●							●			<b>Base commercial Category 1A - Micro Unmanned Aircraft</b>  Additional commercial categories (1B, 1C, etc) expected to be added incrementally, over time and with sufficient supporting information to justify economic impacts and safety concerns. Anticipated future categories: - Increased weight thresholds (5#, 10#, 25#, etc) - Higher tiered altitude limits (floor of Class E or D) - Increasingly robust Pilot certification requirements  UAS-specific pilot certificate will be required
<b>Commercial Flights - Category 2: Minimal Certification / Regulation and Technical Requirements</b>																								
Aerial imaging, Surveys, Photogrammetry, Agriculture, etc	●		●		●	●	●	●	●					●	●	●					●			Adds allowance for flights over <b>populated areas</b> , with geo-fencing and return technology, and <b>nighttime</b> flights
<b>Commercial Flights - Category 3: Pilot, Aircraft, &amp; Operating Certifications Necessary and Technical Requirements</b>																								
Dispersed-area operations such as long-distance BLOS flights for - Search & Rescue - Infrastructure inspection - Agriculture monitoring, etc	●		●		●	●	●	●	●	●	●			●	●	●			●	●	●	●		Adds allowance for <b>BLOS</b> when pilot, aircraft, and operator obtain UAS-specific certification; Adds <b>large aircraft</b> operations when obtaining UAS-specific aircraft certification; Adds requirement for on-board constant position reporting and descent control
<b>Commercial Flights - Category 4: Full Certification Necessary and full suite of Technical Requirements required</b>																								
No restrictions - governed by Operating Certificate(s) and aircraft limitations	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Adds <b>high altitude</b> and <b>IFR</b> allowances; NAS integration necessary if flying in controlled airspace

Across all categories, the following are assumed:  
 - Common-sense operating rules  
 - No careless or reckless flight  
 - Fly in good weather conditions  
 - Respect others' privacy  
 - No-fly restrictions: near airports, over crowds, etc.



# Market Segmentation: Logical examples serve as an initial alternative with a clear roadmap to further rule provisions

## Flight characteristic factors to consider & define:

- Vehicle size
- Area of operation
- Altitude
- Mission function
- Line of sight
- Flight rules VFR/IFR
- Time of day
- Private property & permission

## Regulatory factors to consider:

- Certificate(s) required (new & UAS-specific):
  - Air Worthiness, Operator, Pilot, etc.
- Aircraft equipage requirements
- Communications requirements
- Privacy concerns

## In the current environment, these activities are happening in an uncoordinated manner.

- Proactive advancement of an integrated approach to allow commercial UAS operations across a broad, but reasonable, segmentation, is paramount.

## Critical issues to overcome:

- Safety is paramount
- NAS integration – how, where, when
  - Constant position reporting (ADS-B?)
  - See and avoid acceptable or detect
  - Spectrum allocation and usage
- Equipage requirements drive cost & weight
- Propulsion & launch: options and limitations
- Autonomous operations treated differently?
- SC-228 as-is or industry-developed standards

Even for low altitude and small aircraft ops, considerations are still needed for items such as:

- Standards for geo-fencing & return-to-fix
- Privacy/permissions (trespassing?)
- Definitions still need work: populated areas, day/night limitations, aircraft size, altitude thresholds, VFR/IFR flight, comms links, etc.



# Next steps will allow for a more full commercialization of UAS in a controlled manner across the USA

## **UAS America Fund activities, underway today:**

- Influence FAA's small UAS rule and propose an ultra-small UAS category rule
- Additional advocacy and coalition-building specific to:
  - Standards-setting
  - Infrastructure requirements
  - Legislation, including privacy & safety
- Collaboration with US Congress, FAA, State & Local economic development agencies
- Partnership-building between state & local governments and UAS companies
- Evaluation of investment opportunities, including short- and long-term prospects across platforms, operating entities, and provision of supporting infrastructure
- UAS America Fund has already invested capital into commercializing UAS and leading advocacy efforts

## **Industry activities necessary:**

- Support for further segmentation of UAS markets, aimed to influence future regulatory proposals
- Creation of a standards-setting coalition focused on low altitude operations
  - Low Altitude Focus: collision avoidance, position reporting, and aircraft control
  - Staffed & funded by industry
  - Functioning in parallel to RTCA, but with separate and more discrete focus
- Collaboration with FAA, leveraging worldwide precedents and experience
- Continued research, development, and innovation across the entire UAS sector



# The Need and NEXA Capital's and UAS America Fund's Intent

## What is needed:

- Adoption of our proposed incremental approach to regulation
- Focused effort on:
  - Development and promulgation of industry self-regulation standards
  - Supporting the FAA in development of necessary Governmental standards

## How this can be achieved:

- Through forming an organization focused on developing reasonable industry-based standards for the various segments of the UAS industry
- Gaining support and building consensus across industry leaders, legislators, and FAA

## What does the organization look like:

- A lead
- A small administrative staff for meeting coordination, outreach, etc (~3 FTEs)
- Technical experts dedicated to effort
- Budget to contract for necessary support for:
  - Technical advancement
  - Safety analysis
  - Economic analysis
  - Regulation development
  - Legislative support

**UAS America Fund and NEXA Capital intend to move toward establishment of such an organization in 2015Q1**





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