

# ABCD 2016 DRONE WORKSHOP

PRESENTED BY  
LUKE WYLIE, US AERIAL VIDEO

# OBJECTIVES

- US AERIAL VIDEO INC
- NATIONAL BRIDGE INSPECTION STANDARD
  - CURRENT PRACTICE
  - PROPOSED DRONE SUPPLEMENTATION
- DRONE CAPABILITIES AND REGULATIONS
- IN DEPTH INSPECTION
- 3D MODELING
- DEMO
- DISCUSSION

# US AERIAL VIDEO INC

- FOUNDED IN 2011
- ONE OF FIRST DRONE OPERATORS IN US
- FOCUS PRIMARILY ON CUSTOM SOLUTIONS

# US AERIAL VIDEO INDUSTRIES SERVED

- MAPPING AND GIS
- CONSTRUCTION DOCUMENTATION
- INSPECTION
- MARKETING AND PROMOTIONAL

# NATIONAL BRIDGE INSPECTION STANDARD (NBIS)

- FEDERAL AID HIGHWAY ACT – APRIL 27, 1971
- NATIONAL BRIDGE INSPECTION STANDARD (NBIS)
  - ALL STATES MUST PERFORM ROUTINE INSPECTIONS OF BRIDGES
  - INSPECTOR QUALIFICATIONS DEFINED
  - INSPECTOR TRAINING PROGRAM DEVELOPED
  - REPORT FORMATS DEVELOPED
  - INSPECTION AND RATING PROCEDURES DEFINED, AASHO (CURRENTLY AASHTO)
- NATIONAL BRIDGE INVENTORY (NBI) CREATED

# HISTORY OF THE NBIS



- DECEMBER 15, 1967 – SILVER BRIDGE COLLAPSE
- OHIO RIVER AT POINT PLEASANT, WV
- 46 FATALITIES

# INCREASED NEED FOR BRIDGE INSPECTION



THIS CATASTROPHIC FAILURE FOCUSED NATIONAL ATTENTION ON BRIDGE SAFETY AND FRACTURE CRITICAL MEMBERS.

# CURRENT METHODS



# WHAT DO BRIDGE OWNERS NEED

- EFFECTIVE AND EFFICIENT BRIDGE INSPECTIONS
  - EXISTING METHODS:
    - TRIED AND TRUE – EFFECTIVE.
    - REQUIRES LANE CLOSURES, ROPES ACCESS, SNOOPERS, ETC. - INEFFICIENT.
- AGING INFRASTRUCTURE DEMANDS MORE ATTENTION
- EXISTING FUNDING APPROPRIATIONS ARE NOT ENOUGH TO PROVIDE THE NECESSARY LEVEL OF FUNDING.

## NEED VS. BUDGET

- ASCE 2013 REPORT CARD
  - INVESTMENT BACKLOG FOR NATION'S BRIDGES
    - \$121 BILLION
  - CURRENT ANNUAL SPENDING
    - \$12.8 BILLION

## ADVANCED TECHNOLOGIES

- THE USE OF ADVANCED TESTING AND SENSING TECHNOLOGIES CAN PROVIDE INFRASTRUCTURE OWNERS WITH THE RIGHT DATA AT A DECREASED COST.

# MORE FOR LESS

- MORE, INTELLIGENT, DATA
  - DOESN'T NEED TO BE ALL THE DATA IN THE WORLD
  - NEEDS TO BE THE RIGHT DATA
- PROVIDES OPPORTUNITY FOR IMPROVED DATA BASED DECISION MAKING.
- INSPECTION FREQUENCY COULD DECREASE.
- FUNDS COULD BE DEFERRED TO MORE APPROPRIATE PROJECTS.
- PREDICTIVE MAINTENANCE COULD BE IMPLEMENTED.

## CURRENT PROPOSED UAV SUPPLEMENTATION

- SUPPLEMENT EXISTING NBIS INSPECTION WITH UAVs
  - DECREASES THE NEED FOR LANE CLOSURE, SNOOPERS, ROPE ACCESS, ETC.
  - RAISE AWARENESS TO THE USES OF DRONES IN THE INSPECTION INDUSTRY
  - BRIDGE INDUSTRY HAS BEEN RELATIVELY SLOW TO ADOPT DRONE TECHNOLOGY

# DRONE INDUSTRY PAST AND PRESENT

- AROUND 2010 TRANSITIONED FROM GOV AND MILITARY TO THE PRIVATE SECTOR WITH ADVENT OF QUADCOPTER

## The Economic Impact Of The Commercial Drone Sector

Direct economic impact from the UAV industry in the United States (billion U.S. dollars)



Source: AUVSI

Forbes statista

# CURRENT RULES AND REGULATIONS

- FAR PART 107 (COMMERCIAL OPERATIONS)
- FAA DRONE OPERATOR LICENSE
- BELOW 400AGL, DAYTIME, VFR,
- NO OPERATION IN CLASS B,C,D,E AIRSPACES
- MAINTAIN VLOS (1KM)
- WAIVER PROCESS

# UAS PRACTICAL USES

- 70-80% OF COMMERCIAL OPERATIONS ARE MARKETING
- REMAINING 20-30% ARE AS FOLLOWS:
- VISUAL INSPECTION, MAPPING, AGRICULTURE, INSURANCE, SEARCH AND RESCUE, CONSERVATION, AND EDUCATION

# DRONES IN THE BRIDGE INDUSTRY

- IMAGERY
- DATA COLLECTION

# BRIDGE INDUSTRY PRACTICAL USES: IMAGERY

- VISUAL INSPECTION
- THERMAL IMAGING
- IMAGERY FOR WATERWAY CONDITIONS, EROSION UPSTREAM AND DOWNSTREAM, SCOUR CONDITIONS, PLANT LIFE AND ALGAE GROWTH
- MARKETING OF RELATED PRODUCTS AND SERVICES

EXAMPLES OF  
IMAGERY  
CAPTURED WITH  
DRONE





























CONNOUKESSINE  
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# BRIDGE INDUSTRY PRACTICAL USES: DATA COLLECTION

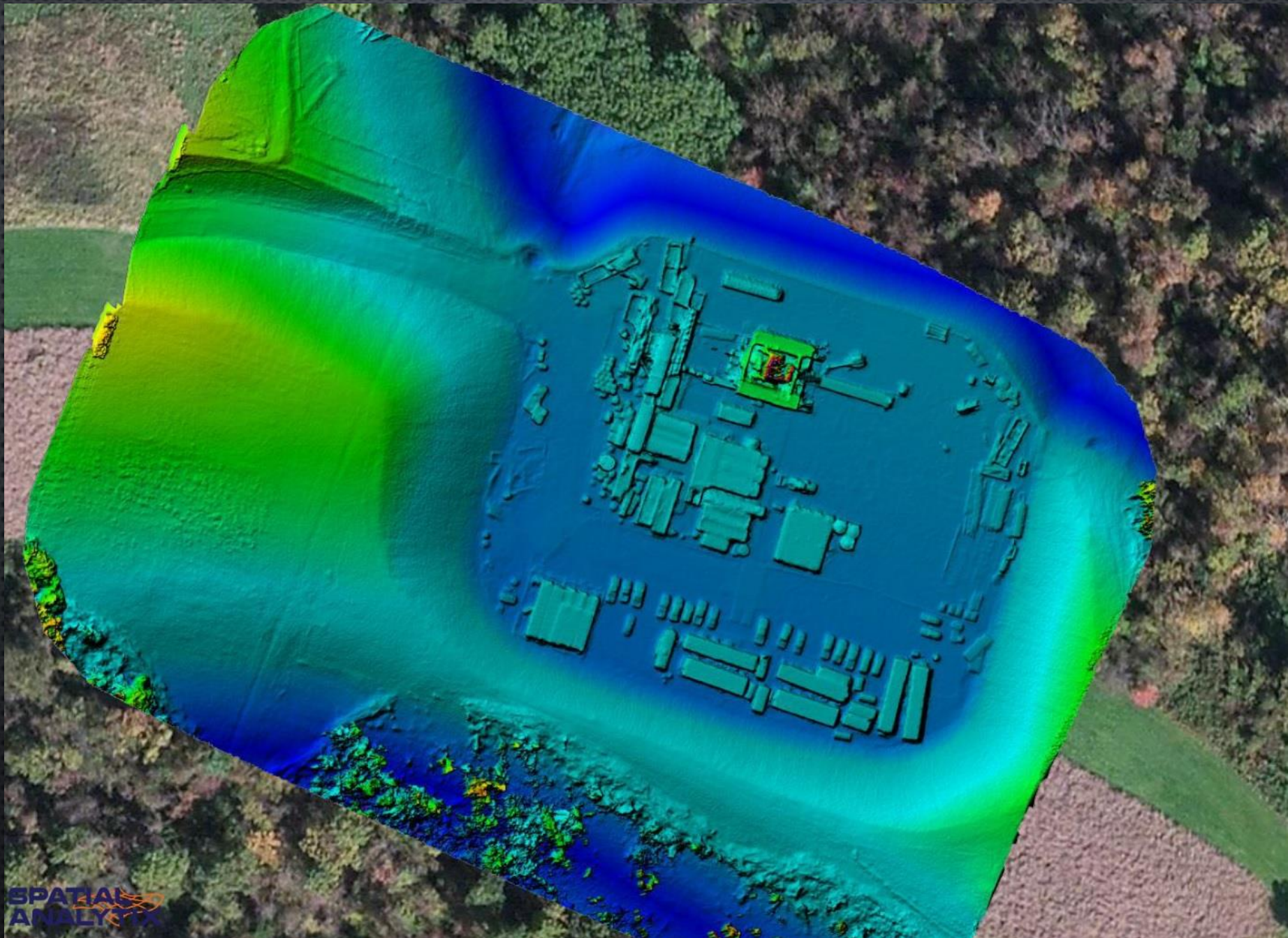
- PRIMARILY PHOTOGRAMMETRY AND LIDAR
- STRUCTURE 3D MODELING
- MAPPING (TOPOGRAPHIC, CONTOUR, ORTHOMOSIAC)
- MATERIAL VOLUMETRICS (RIVER BANKS, STOCKPILES ETC.)
- DISASTER RESPONSE

## 3D MODELING

- EXPORT CAD AND GIS DATA
- MEASUREMENTS CAN BE TAKEN FROM DATA
- 3D VISUALIZATION AND FLY THRU ANIMATIONS
- IMAGES GEOTAGGED FOR REFERENCE
- CAN BE USED WITH THERMAL IMAGING

# 3D POINT CLOUD MODELING





# HANDS ON INSPECTION BENEFITS AND PRE INSPECTION DOCUMENTATION

- OVERVIEW OF BRIDGE (IMAGERY AND 3D MODEL)
- STRUCTURE CLEARANCES
- ROPE ACCESS POINTS
- GENERAL CONDITIONS
- DISASTER RESPONSE

## OBSTACLES TO EFFECTIVE USE

- BETTER SUITED FOR LARGE BRIDGES WITH GREATER CLEARANCES
- GPS PRIMARY NAVIGATION
- AFFECTED BY WEATHER (WIND, RAIN, LIGHTING CONDITION, TEMPS)
- LARGELY LINE OF SITE DEPENDENT
- LIMITED FLIGHT TIMES
- SUSCEPTIBLE TO DAMAGE

# SPECIALIZED DRONE INSPECTION EQUIPMENT

- PROPELLER STRIKE PROTECTION
- SPECIALIZED CAMERA GIMBALS
- LIGHTING SYSTEMS
- REDUNDANT AND MORE ROBUST GPS SYSTEMS
- VISION POSITIONING SYSTEM (LASER RANGEFINDER)
- FIRST PERSON VIEW (FPV) SYSTEMS IN REAL TIME





# PROCESSING THE DATA/ IMAGES

- SOURCES: PRIMARY CAMERA, FPV CAMERA, TELEMETRY, ONBOARD SYSTEMS, GPS LOCATION
- ALL DATA IS STORED ONBOARD ON MICRO SD CARD
- INFORMATION TRANSMITTED TO GROUND STATION
- ABILITY TO TRANSMIT REAL TIME DATA WORLDWIDE
- ALL DATA IS UPLOADED AND LOGGED INTO SECURE CLOUD BASED SOFTWARE



# DISCUSSION