NCDOT Geotechnical Engineering Unit

2018 NCDOT – Geotechnical Consultant Combined Workshop

Cary, NC - June 27, 2018

Unmanned Aircraft Systems and Surveying

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Where we're headed!

WHAT THE BOARD HAS SAID ABOUT UAS

- Article in Newsletter
- FAA and State Regulation of the Flying
- Board Regulation of the Work Product

BOARD POLICIES

- What are policies?
- Where can you find them?

SPECIFIC POLICIES

QUESTIONS

The Board of Examiners for Engineers and Surveyors

THE BOARD:
Four Professional Engineers
Three Professional Land Surveyors
Two Public Members

RESPONSIBILITY:
§ 89C-2. In order to safeguard life, health, and property, and to promote the public welfare, the practice of engineering and the practice of land surveying in this State are hereby declared to be subject to regulation in the public interest. It shall be unlawful for any person to practice or to offer to practice engineering or land surveying in this State, as defined in the provisions of this Chapter

Regulation of the Practice of Engineering and Land Surveying

www.ncbels.org Rules and Laws

- NCGS 89C – The Statute
- NCAC Title 21 Chapter 56 – The Rules in the NC Administrative Code

§ 89C-23. Unlawful to practice engineering or land surveying without licensure; unlawful use of title or terms; penalties; Attorney General to be legal adviser.

Any person who shall **practice, or offer to practice**, engineering or land surveying in this State without first being licensed in accordance with the provisions of this Chapter, or any person, firm, partnership, organization, association, corporation, or other entity using or employing the words "engineer" or "engineering" or "professional engineer" or "professional engineering" or "land surveyor" or "land surveying," or any modification or derivative of those words in its name or form of business or activity except as licensed under this Chapter or in pursuit of activities exempted by this Chapter, … in addition to **injunctive procedures** set out hereinbefore, shall be **guilty of a Class 2 misdemeanor**.

Photogrammetry

Photogrammetry is within the practice of land surveying as defined in GS 89C-3(7):

5. Determining the configuration or contour of the earth's surface or the position of fixed objects on the earth's surface by measuring lines and angles and applying the principles of mathematics or photogrammetry;

What the Board has said about UAS

Board Newsletter Article, Spring 2016

FAA and State regulations for flying

Board Rules for Surveying


North Carolina Board of Examiners for Engineers & Surveyors
10/4/2017
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Rules/Laws
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Corrections
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Renew Online
(c)James West/JWestProductions.com The Freelon Group Architects
Notice
The Fall 2016 newsletter is now available.
Fall 2016 (eReader version)
Fall 2016 (pdf version)
For any Professional Engineer or Professional Land Surveyor that has not yet renewed their license for 2016, the last day to do so

The North Carolina Bulletin

The Newsletter of the North Carolina Board of Examiners for Engineers and Surveyors

May 2016 Spring Issue

Unmanned Aircraft Systems (UAS) in North Carolina

by Richard M. Benton, PLS
Board Vice Chair & Surveying Committee Chair

Popularity

"Unmanned Aircraft Systems (UAS), Unmanned Aerial Vehicle (UAV), Drone, no matter what you call them, it seems you can't pick up a professional magazine anymore without being bombarded by advertisements and articles for this newly emerging technology. Currently UAS are being used for agriculture crop land analysis, quantities , stock pile measurement, topographic surveys, utility line inspection, mineral exploration, geophysical surveys, search and rescue and disaster analysis just to name a few."

Regulation of the Flying

"The Federal Aviation Administration (FAA) has exclusive sovereignty over airspace in the United States (49 U.C. Code) including the airspace above private property. The FAA establishes the operating rules governing that airspace in the form of Federal Aviation Regulations (FAR's) which cover pilot and aircraft certification requirements."

North Carolina Department of Transportation Division of Aviation (NCDOT/DOA) regulation.

Regulation of the Flying

"Engineers and Surveyors using UAS for inspections, aerial photography, topographic surveys, etc. is considered commercial use even if intended for in-house use only."

A PE or PLS must meet all regulations for flying, just as the pilots must meet all regulations for engineering and surveying with respect to any work product produced that falls within the definition of engineering or land surveying in NC Generals Statute 89C-3.

Regulation of the Flying

Any individual or company using UAS technology in NC must meet ALL Federal, State and Local requirements prior to its use on every project.

Failure to meet ALL Federal, State and Local requirements prior to any UAS use may result in a violation of Board Rule 21 NCAC 56 .0701(b): "*A licensee shall conduct the practice in order to protect the public health, safety and welfare.*"

Regulation of the Work Product

UAS mapping is photogrammetry

The difference is the aircraft and metric camera or sensor is being replaced with a smaller unmanned vehicle and a non-metric camera or sensor, it's still photogrammetry.

As with any Engineering or Surveying issue brought before the Board, the licensee will be required to explain his or her actions. An answer like *"the software does it for me"* is not a good idea.

Regulation of the Work Product

"It is the responsibility of the professional licensee to mitigate potential violations involving the use of UAS in North Carolina by ensuring all federal, state, and local requirements have been met prior to the use of UAS technology. It is important to note that UAS technology is like any other tool available to the professional and, therefore, must be used in a way that meets current engineering, surveying, and mapping standards and procedures."

Regulation of the Work Product

"The Rules of Professional Conduct per 21 NCAC 56 .0701(g)(2) requires a licensee who has knowledge or reason to believe that another person or firm may be in violation of the Board Rules (21 NCAC 56) or of the North Carolina Engineering and Land Surveying Act (G.S. 89C), to present such information to the Board in writing in the form of a complaint and shall cooperate with the Board in furnishing such further information or assistance as may be required by the Board."

Regulation of the Work Product

"This should in no way be construed as an attempt to limit competition in this rapidly growing technology but as a duty to protect the public as charged under North Carolina General Statute Chapter 89C-2 *"In order to safeguard life, health, and property, and to promote the public welfare, the practice of engineering and the practice of land surveying in this State are hereby declared to be subject to regulation in the public interest."*

The North Carolina Bulletin

The Newsletter of the North Carolina Board of Examiners for Engineers and Surveyors

October 2017 Fall Issue

Unmanned Aircraft Systems: Old Dog Learns New Trick

by Richard M. Benton, PLS
Board Chair

Advancing Technology

Advances in software and hardware such as flight planning, geo fencing and collision avoidance are making it easier for beginners to enter the market, in some cases, too easy. I recently attended a seminar that spent the better part of the day focusing on UAS technology. The instructor responsible for the UAS portion was a veteran photogrammetrist with over 300 UAS flights. In his presentation he demonstrated how simple the software made the preflight planning and post processing of the data. The final results of the UAS derived data as compared to the previously established GPS control points were amazingly accurate and considering we had just flown a five acre site in less than an hour made it even more enticing.

Advancing Technology

What the instructor did not explain was how his extensive knowledge of photogrammetry enabled him to make competent decisions on how to setup the software so it could make those preflight and post processing decisions.

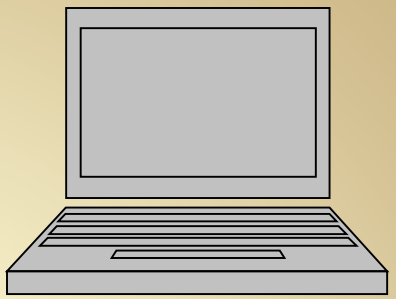
"… began asking him questions about how he handles certain situations based upon existing conditions. The licensee's response was *"I don't have to know that, the software does it for me."* Herein lies the problem. As professionals we must practice in the area of our competency."

Competency and Education

UAS technology is photogrammetry from A to Z. It is incumbent upon the licensee to acquire the additional education and experience needed to competently offer this service.

The Board does not regulate tools but does regulate the practice of engineering and surveying. Should the licensee find themselves in a position having to explain their procedures, an answer like *"the software did it for me"* will not bode well. Remember, it's your license on the line, or in this case, in the air.

Policies/Guidelines



http://www.ncbels.org/policies.html

Policies explain a Board application of the Statutes or Rules, often in response to repeated questions.

The Guidelines give assistance from the Board to provide education on a topic, typically generated by the Board when a need is seen to further educate on an area of practice.

North Carolina Board of Examiners *for* Engineers & Surveyors

Forms | License Lookup | Renewals | Continuing Education | Enforcement | Businesses | Contact

Policies

3D Modeling Policy BP-0607-2 rev.1
Audiovisual System Design BP-0512-1 Rev.1
Commissioning Policy BP-0501-1 Rev.1
Commissioning Validation BP-0507-1
Conservation Easements Policy BP-1502-1
Construction Staking BP-1003-1
Design/Installation of Petroleum Storage Tanks BP-1603-1 Rev.1
Easement Policy for Existing and New Easements BP-1709-1
Elevated Recreational Facilities BP-1112-1
Engineering Surveys BP-1005-3 Rev. 2
Fire Alarm System Design BP-0709-1
Hydrographic Surveys Policy BP-1110-1
Information Transport System Design BP-0607-1
Inspections of Residential Buildings BP 1405-2

Policies (continued)

- Oblique Area Imaging Policy BP-0510-2
- On-Site Wastewater System Design BP-1007-1
- Positional Tie Reporting Policy BP-1012-02 Rev.1
- Responsible Charge for Equipment 0501-2
- Roofing Systems BP-1405-1 Rev 2
- Spill Prevention and Counter Measure Plans BP-1709-2
- Stair Design and Structural Shop Drawings BP-1005-1
- Stream Restoration Services BP-1005-2 Rev.1
- Subsurface Utilities Location Data Policy BP-1012-01
- Truss Placement - Commercial 9906-1 Rev 1
- Truss Placement - Residential 0512-2 Rev 1
- Volume Computation Surveys BP-1007-2
- Wetlands Mapping BP-1005-4 Rev.2

Guidelines

Signing and Sealing Guidelines
Signing and Sealing Building Imaging Modeling/Integrated Project Delivery (BIM/IPD) Projects Guidelines(Rev)
Foundation Repair Company Guidelines
Survey Ties Guidelines (rev)
GIS Inclusions/Exclusions Guidelines
Incidental Streets and Storm Sewer Systems Design
Sample PLAT
Report of Survey Project Documentation Rev.1
Tie Guidelines and Report of Survey Presentation 11-22-2013
Seal Brochure
NCDOI Guidance Paper: Acceptance of Licensed Architect or Engineer Inspections

Mini-Brooks Act, Qualifications Based Selection, GS 143-64.31 et seq. (pdf slide presentations)
Basic Mini-Brooks with abbreviated Design-Build
Supplement of Design-Build Statutes with analysis

Policy Title and Number

Each policy has a descriptive title and a number that indicates that it is a Board Policy (BP) - 2 digit year and 2 digit month of approval – policy number in the month and a revision number if revised (Rev. 1).

Example:

Title: **Construction Staking Policy**

Policy Number: BP-1003-1
(Board Policy approved 2010, March policy # 1)

Policy Approval and Review

Each policy has the date of the Board meeting at which the policy was approved.

Each policy is to be reviewed every three years to see if still relevant or whether it requires revision, has been superseded or should be rescinded.

Example:

Date for Board Approval: 3/11/10 Date Approved: 3/11/10
Date to be Reviewed: 2013 Date Reviewed: _____

Policy Searches

Each policy has the category and keywords listed to allow for organizing the policies and for searching.

Example:

Category(s): Surveying Practice

Keywords: Construction Staking, Surveying

Highlighted Policies

Oblique Aerial Imaging Policy BP-0510-2

Volume Computation Surveys BP1007-2

Wetlands Mapping BP-1005-4 Rev 2

Policies

Oblique Aerial Imaging BP-0510-2

The service of oblique aerial imaging falls within the definition of the practice of land surveying in G.S. 89C – 3(7) based on the information reviewed by the Board on October 12, 2005. The making of the oblique image product where it involves geodesy (including the use of GPS and geodetic reference datums), photogrammetry, or geo-referenced to existing orthos, requires the education, training and experience of a licensed professional land surveyor under G.S. 89C. Further, the production of orthos is within the practice of land surveying.

Such services require that the individuals in responsible charge of the work and the company be licensed with the Board and comply with the Standards of Practice for Land Surveying in North Carolina (21 NCAC 56.1600).

Policies

Volume Computation Surveys BP1007-2

The practice of providing a volume computation survey (sometimes referred to as a quantity survey) falls within the definition of land surveying as defined in GS 89C-3(7)a. and shall be done under the responsible charge of a Professional Land Surveyor. This includes, but is not limited to, the measuring and reporting of quantities of dredging, cut and fill and stock piles.

Policies

Wetlands Mapping BP-1005-4 Rev 2

Wetlands Survey: A survey showing the boundaries of an area delineated as “jurisdictional waters of the US." Wetland Boundaries shall be tied by course and distance to either 1) property corners that are properly monumented and verified, or 2) project boundaries that have been properly monumented, or 3) NC State Plane Coordinates System. This shall be done in a manner that permits future surveyors to readily retrace the wetland boundary. The calculated ratio of precision before adjustments or statement of positional accuracy of such ties must be consistent with the land use classification of the parcel being surveyed as described in Board Rule 21-56.1603.

Policies

Wetlands Mapping BP-1005-4 Rev 2 (Cont'd)

Data collection and platting of these types of wetland boundaries must be performed by or under the direct supervision of a ~~surveyor~~PLS. A PLS or PE may only accept wetlands survey data from a PLS for the purpose of showing the information on survey plats, engineering drawings (other than Preliminary Planning drawings), permits or reports.

Policies

Wetlands Mapping BP-1005-4 Rev 2 (Cont'd)

Any location data generated by delineators is only for the use of the PLS in performing a survey of the wetland boundary and should be noted with a disclaimer to that effect. The preliminary wetland map with a disclaimer by the delineators, that the location data is not to be relied upon for accuracy and is only for appropriate use by a PLS or PE, may be used by a PE for Preliminary Planning Purposes. If equipment other than survey grade accuracy equipment is used on the survey, a statement indicating the equipment, procedure, and position tolerances (21-56.1608) used for the work must be clearly stated on the plat or work product. Only surveyed wetlands may be placed on a property plat.

Policies

Wetlands Mapping BP-1005-4 Rev 2 (Cont'd)

Data provided by a Government Agency can be depicted as long as the source of the information used is disclosed and denoted as lines not surveyed within the plat or report.

The mapping of ~~conservation easements,~~ buffers or other boundaries shall be done by, or under the responsible charge of, a PLS and conform to the same requirements as stated for wetland boundaries.

Guidelines

GIS Inclusions/Exclusions Guidelines

Development of the guidelines
Authoritative
Stated Accuracy
The "Chart"

How does it apply to NCDOT subsurface investigations?

"Inferred limits on boundaries" of rock or trash
Estimated or approximate?
"Inventory, not for reliance upon for accuracy"
Volume estimates of trash or debris

GIS – What does or does not require a PLS?

Development of Inclusions/Exclusions Chart

- The Surveying Committee of the Board
- Based upon the Model Law of the NCEES
- In conjunction with the NC Geographic Information Coordinating Council (GICC).

Board Guideline – GIS Mapping
http://www.ncbels.org/forms/gisinc_excl.pdf

How and when to use GIS data.

GIS – What does or does not require a PLS?

If "authoritative" or to a "stated accuracy"

"Authoritative" as used in the Chart

Authoritative: Authoritative shall mean presented as trustworthy and competent for reliance upon by the public or if provided to a stated accuracy.

Examples of Authoritative are:

Measurements and mapping applications suitable for engineering design, determination of boundaries (including, but not limited to, ownership boundaries, easements, political boundaries, jurisdictional boundaries), the locations of fixed works or topography, enforcement of regulations that pertain to the location of improvements or fixed works, or the certification of declaration of positional accuracy of any spatial data therein.

GIS Mapping – PLS required (or not)

GIS Inclusions/Exclusions Guidelines - April 2008, Revised October 2011

North Carolina Board of Examiners for Engineers and Surveyors

This chart, while not all inclusive, assists in determining items of GIS data that are included or excluded from the definition of Land Surveying in G.S. 89C-3(7).The definition includes all location data that is issued for an authoritative purpose. Authoritative shall mean presented as trustworthy and competent for reliance upon by the public or if provided to a stated accuracy.

Board Description	GICC Data Layer Description	Land Surveying Committee Responses
Orthophotography	Large-scale scanned and rectified aerial photographs	Inclusion
Cadastral	County-based private and public property boundaries including easements	Inclusion
Roads	Centerlines, including rights-of-way	Inclusion
Municipal Boundaries	City/town boundaries	Inclusion
County Boundaries	County borders	Inclusion
ETJs	Extra-territorial jurisdictions – areas not in a municipality, but under authority of the city or town	Inclusion
Surface Waters	Locations and names of streams, rivers, lakes, ponds, etc., including mean high water marks	Inclusion - Locations and names of streams, rivers, lakes, ponds, etc., including mean high water marks and when the survey is done to determine authoritative location of stream, waterway or location of mean high water.
Geodetic Control	Horizontal and vertical survey control locations	Inclusion
Elevation	Ground elevations (depicted as contours, X/Y/Z points, elevation models, TINs?)	Inclusion
Land Use	Cadastral-based land use	Exclusion
Land Cover	Statewide land cover - 1996	Exclusion
Flood Zones	Areas inundated by flood waters (1% annual chance, .2%annual chance, flood ways)	Inclusion
Soils	Soil Survey Geographic (SSURGO) database produced by US Dept. of Agriculture, Natural Resources Conservation Service	Inclusion if used to determine authoritative location of soils. Determination of soils to be done by Soil Scientists.
Public Lands	Non-taxable lands maintained in county cadastral databases	Inclusion
Railroads	Locations of railroad lines including rights-of-way	Inclusion
Airports	Airport/airfield property boundaries and easements	Inclusion
Schools	Point locations of public and non-public grade schools	Exclusion
Colleges/Universities	Point locations of state universities and private colleges and universities	Exclusion
Hospitals	Point locations of hospitals	Exclusion
Storm Surge Inundation	Estimated coastal areas inundated by hurricane storm surge	Inclusion for PEs and PLSs. Models are developed by PEs using data collected by PLS.
Surface Water Intakes	Point locations where communities draw raw water from a lake, river, or stream, treat it, and distribute treated water to customers	Exclusion
NPDES	National Pollutant Discharge Elimination System -locations of individually permitted wastewater discharged into surface waters	Exclusion unless federal, state or local authority requires survey.

Police Stations	Point locations of police stations	Exclusion
Fire Stations	Point locations of fire stations	Exclusion
Landfills	Point locations of municipal/county landfills	Exclusion
Watersheds	Water supply watersheds	Inclusion
Wetlands	Wetlands areas from the US Fish and Wildlife Service, National Wetlands Inventory	Inclusion
Hazardous Disposal Sites	Areas identifying locations of uncontrolled and unregulated, hazardous waste sites (formerly called	Inclusion
Building Footprints	Perimeter outlines of buildings	Inclusion when authoritative location is required, such as Land Title Surveys, Brownfield Surveys, etc.
Future Land Use	Cadastral-based, potential land use based on current zoning	Exclusion
Water Lines	Water pipe distribution network and accompanying	Inclusion
Sewer Lines	Sanitary sewer pipe network and accompanying features	Inclusion
Stormwater Lines	Stormwater network and accompanying features	Inclusion
NC House Districts	Boundaries of NC House Districts	Exclusion
NC Senate Districts	Boundaries of NC Senate Districts	Exclusion
US Congressional Districts	Boundaries of US Congressional Districts	Exclusion
Census Boundaries	2000 US Census boundaries for tracts, blocks, and block groups	Exclusion
Power Transmission Lines	Transmission network and accompanying features	Exclusion for inventory applications. Inclusion where survey is for authoritative location or a stated accuracy.
Natural Gas Pipelines	Transmission network and accompanying features	Exclusion for inventory applications. Inclusion where survey is for authoritative location or a stated accuracy.
Septic Tanks	Point locations of septic features	Exclusion for inventory applications. Inclusion where survey is for authoritative location or a stated accuracy.
Telecommunication Lines	Telephone, cable television, and other communication features such as towers	Exclusion for inventory applications. Inclusion where survey is for authoritative location or a stated accuracy.
Wells	Point locations	Exclusion for inventory applications. Inclusion where survey is for authoritative location or a stated accuracy.
Mineral Rights Boundaries		Inclusion if for authoritative location or stated accuracy of the boundary.
Mining Resources		Exclusion
Greenways		Inclusion when the survey is to determine the fee simple or easement corridor of the greenway.
Sidewalks		Exclusion
Cemeteries		Exclusion if general point location for inventory purpose of locating cemetery. Inclusion if the boundaries of the cemeteries are being determined or established.
Archaeological Sites		Exclusion
Historic Sites and Structures		Exclusion

So What Now?

Great opportunities for collaboration between UAS pilots and PLS surveyors.

Provides the advanced technology tools and the professional knowledge and license of the PLS to best serve the client with accurate efficient mapping and provide for the public protection.

Firms can combine both activities, as has been done by some photogrammetric firms. Licensing with the Board is required.

LICENSING and COMPLIANCE FOR A SURVEYING BUSINESS

If anyone in your firm performs surveying services for customers or clients, even as part of your primary service or product, then the firm must be licensed with the Board.

Rule applies to businesses offering surveying services for North Carolina projects, including businesses located or headquartered in other states.

Forming and Licensing a Business Entity

Forming a Business Entity

Types of Entities and Requirements

Initial Licensing with the Board

Firm Licensure

A firm applying for licensure will fall within one of the following classifications:

- Professional Corporation [G. S. 55B]
- Professional Limited Liability Company [G. S. 57D]
- Partnership (Includes General Partnerships, Limited Partnerships & Limited Liability Limited Partnerships) [G. S. 59]
- Sole Proprietorship
- Pre-69 Corporation
- Chapter 87 Corporation [G. S. 87

Firm Licensure

Link to Business Firm information
http://www.ncbels.org/businesses.html
including the

Contact Mark Mazanek, Director of Firm Licensure at mmazanek@ncbels.org with questions and to receive an emailed application packet.

QUESTIONS