SYLLABUS, SPRING 2024
GISC 5364  Drones & GIS

Instructor: Dr. David L. Kulhavy, Laurence C. Walker Professor, Arthur Temple College of Forestry and Agriculture

Office: Forestry Building, Room 203F; 936 468-2141

Office Hours: 9-12 MW am and 4:30 pm to 5:00 pm MTW or By Appointment

Meeting Times:  M 1-5 pm, For. 221

Course Description: 3 Credit Hours; Planning, establishment, protection, and management of resources using Unmanned Aerial Systems

Prerequisite: GISC 2324 Introduction to Spatial Science; GISC 3390 GIS in Natural Resources, recommended

Course Objectives: Application of drones (Unmanned Aerial Systems, UAS) with geographic information systems to solve management of geospatial applications for resource management. Formulation, calculation, writing and implementation of multiple use UAS management plans. The course will concentrate on a poster, presentation and ArcGIS 10.8.1 database development of a hyperspatial analysis using Pictometry, Google Earth Pro, Surveying, and iNaturalist to create a GIS data base. Students are encouraged to use course material to prepare for the FAA 107 UAS Pilot exam. PPE of safety glasses and hardhats must be worn; oranges are required in certain locations.

Program Learning Outcomes: GISC 5364

The course shall meet the following MS Geospatial Science learning outcomes:
1. Demonstrate understanding and competency of UAS;
2. Demonstrate understanding and competency in the use of UAS in spatial analysis of resources;
3. Demonstrate understanding and competency in UAS safe use and data collection;
4. Demonstrate understanding and competency in planning and administration of UAS-based applications;
5. Demonstrate understanding and competency in oral and written communication skills.

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<th>M. S. Spatial Science Program Learning Outcomes</th>
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1. **A** – Advanced – course supports Program Learning Outcome by providing students with topic-specific information, concepts, applications, and lab activities that increase the students’ skills in making tactical implementation decisions relative to the expected outcomes.

2. **I** – Intermediate – course supports Program Learning Outcomes by providing students with skills to make management decisions.

**Student Learning Outcomes:** Basic competencies of UAS and geospatial analysis will be reviewed (PLO1). Concepts and techniques in the applied applications of UAS and geospatial management will be presented (PLO2). Methods of UAS in management; and safe operation of resources will be discussed (PLO3). Knowledge of applied geospatial management as the foundation for developing and implementing sound resource management will be emphasized throughout the course; this will be coupled with the use of UAS in resource planning (PLO4). Professional ethics as it relates to the practice of applied UAS use will be discussed (PLO4). Oral and written laboratory reports will be assigned to improve communication skills (PLO5).

**Course Goal:** Advanced applied UAS in management will be implemented (PLO1). Concepts and techniques in the application of UAS with geospatial management will be presented and applied. Methods to measure natural resource measurements using UAS will be utilized. Course goals include a professional paper utilizing applied UAS techniques and applications. The UAS Pilot Guide will be covered and reviewed for FAA guidelines.

**Course Topics:**

1. Use of UAS in society; the rapid expansion of UAS in delivery of goods and services will be presented

2. Safe operation of an Unmanned Aerial System following FAA 107 guidelines. The process of the safe use of UAS and airspace.

3. Safe use and operation of the DJI Mavic Mini2 and DJI Mavic Mini3UAS

4. Safe use and operation of the DJI Phantom 4 v.2 UAS

5. Safe use and operation of DJI AVATA

6. Safe use and operation of DJI Phantom 4 RTK Multispectral

7. Use and operation will follow a four-step process of
1) assembly of the Mavic Mini2, Mini3 and Phantom 4 and use of the control system to fly the UAS; 2) conducting a safe fight with a Pilot in Command and a Visual Observer;
2) taking both images and video using the UAS; downloading these into a GIS file;
3) conducting a programmed flight using the DJI Phantom 4 Pro v.2 using Pix4DCapture app of a 10-acre area at 400 feet Above Ground Level at 70/70 endlap and sidelap; downloading the programmed flight into Drone2Map ESRI software; and
4) preparing a orthophotoquad for use in ArcGIS.

8. Use of the Phantom 4 Pro v.2 to measure building heights and testing accuracy of the UAS for heights with GPS turned on and GPS turned off

9. Use of the Mavic Mini2 for foot bridge and culvert assessment for safety and recommendations for repairs

10. Assessment of desire trails using the Mavic Mini 2 and the Phantom 4

11. Use of Mavic Mini 2 for citizen science images for iNaturalist *Drones and Biodiversity* to promote interactive learning using UAS. iNaturalist is the largest depository of flora and fauna images in the world. Images will be acquired at nadir (directly above) vegetation and animals to acquire accurate GPS locations.

12. Comparison of UAS Phantom 4 locational accuracy with *in situ* measurements of Pictometry, Google Earth Pro and What3Words over known survey points

13. Comparison of AeroPoint 2 Ground Control Point accuracy to known survey points and the DJI Phantom 4 Multispectral UAS with Base Station

14. Demonstration of DJI Phantom 4 Multispectral for location of pine seedlings using visible light, NDVI, color infrared and red edge bands. Pine seeding will be located and counted and compared to the locational accuracy of the Multispectral UAS

15. Pest location and assessment using UAS will be conducted for tree hazard rating, fire ant mound location, mistletoe assessment on hardwoods, and crapemyrtle bark scale impact. These will be surveyed and assessed using iTree Design, the CTLA method and visual counts. Images will be uploaded to iNaturalist Drones and Biodiversity.

16. Laws and regulations using UAS will be reviewed and case history examples presented
17. Linear and aerial measurements, and slopes, will be measured comparing UAS accuracy with on-site measurements and *in situ* measurements using Pictometry, Google Earth Pro and What3Words.

18. Projects include using the UAS in assessment for management and development of resources.

19. Project outcomes include safe operation of UAS; preparation of a power point and poster over their project and demonstration of safe operation of the UAS. Knowledge for the FAA 107 UAS Pilot exam will be presented throughout the course. Students are encouraged to study and take the UAS Pilot exam. Stephen F. Austin State University is an authorized FAA testing site. In addition, practice tests will be available.

**Required Readings** As Assigned; UAS Pilot Preparation Guide recommended. The UAS Pilot Preparation Guide will be used as a guide for topics in UAS including airspace, maps, weather and technical skills.

**General Course Policies:**

**Attendance:** Attendance is mandatory for lecture and laboratory. The student is responsible for making the instructor aware of an excused absence. Each unexcused absence will result in a final total point reduction of five percent. Refer to the SFASU Policy Manual on the SFASU web-site for more information.

**Assignments and Grades:** There are 1000 points available in the course: 100-point journal and workbook of sources and timeline, a 200 point applied geospatial management plan with a poster, and a 200 point applied application booklet. A power-point presentation of the applied geospatial application, 100 points. Conducting a programmed flight and creating an orthomosaic, 200 points. Quizzes and applied applications, 200 points. Each student needs to complete a professional poster for a conference and a draft of a manuscript suitable for publication. Each student needs to study for the FAA UAS Pilot exam and if ready apply for the exam. For graduate credit, the student needs to complete an original paper for a conference or publication or both and have this ready for submission by the end of the semester. The paper will need to be in journal format and follow all author guidelines and templates. The paper will be presented in the format for the undergraduate students and serve as a model for their reports.

**Preparation of Applied Geospatial Management and Drones Plan:** You will be expected to show competency in a resource plan for applied geospatial analysis and safe use of drones. The plan for each will be presented in a power point and professional journal. A handout will be provided that describes the data provided and the expectations of the geospatial management plan. At the completion of the term, a professional paper needs to be produced. Topics include impact of Hurricane Harvey;
application of the Anderson landcover analysis to Nacogdoches County over time; analysis of the Ag Pond for chemical and nutritional analysis; implementation of a tree planting program at Stephen F. Austin State University; comparison of drought and full pool level at Lake Nacogdoches for fish habitat; change over time for La Nana Creek; fire ant mound distribution; park recreation planning; accuracy assessment using ArcGIS 10.6.1, GoogleEarth Pro and Pictometry; measurements of land surface area from Pictometry, UAS and GoogleEarth compared to land measurements; using ArcGIS for land reclamation; and plans listed above in 1-17. Asynchronous minutes will be used for drone study guide.

**Other Policies:**

**Withheld Grades Semester Grades Policy (A-54)**
A grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances and is done at the discretion of the instructor of record with the approval of the academic chair/director. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

**Student Academic Dishonesty Policy (4.1)**
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism. **Definition of Academic Dishonesty:** Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit. Please read the complete policy at [http://www.sfasu.edu/policies/student_academic_dishonesty.pdf](http://www.sfasu.edu/policies/student_academic_dishonesty.pdf)

**Course Grades Policy (5.5)**
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average. Please read the complete policy at [http://www.sfasu.edu/policies/5.5_course-grades.pdf](http://www.sfasu.edu/policies/5.5_course-grades.pdf)
Academic Accommodation for Students with Disabilities Policy (6.1)
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/

Responsible Use of Technology
It is expected that all students will only use cell phones, PDAs, laptop computers, MP3 players and other technology outside of class time or when appropriate in class. Answering a cell phone, texting, listening to music or using a laptop computer for matters unrelated to the course may be grounds for dismissal from class or other penalties.

Acceptable Student Behavior
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy 10.4). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed. Please read the complete policy at http://www.sfasu.edu/policies/student-code-of-conduct_10.4.pdf

SFASU values students’ mental health and the role it plays in academic and overall student success. SFA provides a variety of resources to support student’s mental health and wellness. Many of these resources are free, and all of them are confidential. On-campus Resources: SFASU Counseling Services www.sfasu.edu/counselingservices, 3rd Floor Rusk Building, 936-468-2401
SFASU Human Services Counseling Clinic, www.sfasu.edu/humanservices/139.asp, Human Services Room 202, 936-468-1041
Crisis Resources: Burke 24-hour crisis line 1(800) 392-8343, Suicide Prevention Lifeline 1(800) 273-TALK (8255), Crisis Text Line: Text HELLO to 741-741