

The completed and signed proposal should be submitted by the Dean's Office to: curriculumplanning@asu.edu. Before academic units can advertise undergraduate concentrations or include them in their offerings as described in the university catalogs, they must be recommended for approval by the Senate Curriculum and Academic Programs Committee and approved by the Executive Vice President and Provost of the University.

Definition and minimum requirements:

A concentration is a formalized selection of courses within a major.

- A concentration requires a minimum of 15 semester hours of which at least 9 semester hours must be upper division. Specialized concentrations (e.g., BJS Concentrations) may have additional or different requirements.
- A concentration is offered by a single unit and is intended exclusively for students pursuing a particular major. If a concentration consists of courses from more than one college the approval of each college Dean is required.

College/School/Institute: College of Technology & Innovation

Department/Division/School: Dept of Technological Entrepreneurship and Innovation Management

Proposing Faculty Group (if applicable): Aviation

If this is an official joint degree program? No

If "Yes" List all the additional college(s)/school(s)/institute(s) that will be involved in offering the degree program and providing the necessary resources. Note: All units offering this program must have collaborated in the proposal development and completed the appropriate unit and college/school approvals.

Existing degree type and name of degree program under which this concentration will be established: Aeronautical Management Technology

Proposed Concentration Name: Unmanned Aerial Systems

Requested effective catalog year? 2013-14

For deadline dates see: [Curriculum Workflow Calendars](#).

Delivery method: face-to-face, iCourse

Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the Provost and [Philip Regier](#) (Executive Vice Provost and Dean) is required to offer programs through ASU Online.

Campus/Locations:

Indicate all locations where this program will be offered.

- Downtown Phoenix Polytechnic Tempe West Other:

Proposal Contact

Name:	<u>Mary Niemczyk</u>	Title:	<u>Chair, Aviation Programs</u>
Phone number:	<u>480.727.1595</u>	Email:	<u>mary.niemczyk@asu.edu</u>

DEAN APPROVAL(S)

This proposal has been approved by all necessary unit and College/School levels of review. I recommend implementation of the proposed program

College/School/Division Dean name: Please see attached email

Signature _____ **Date:** / /20

College/School/Division Dean name: (if more than one college involved): _____

Signature _____ **Date:** / /20

Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.

1. Overview

A. Description

The Unmanned Aerial Systems (UAS) concentration prepares students for careers in the rapidly growing area of UAS, including operations, remote sensing, data collection and analysis. The UAS concentration incorporates all Aviation Management Technology core courses, as well as UAS concentration courses. This provides an overview of UAS operations followed by detailed knowledge of UAS-specific systems and technology (ground control stations; data links; flight planning and operations, search, detect and avoid technologies; and payloads) and UAS sensor operations. A critical aspect of this academic area of study is the data capture and transfer of the sensor information collected from the UAV. This system-of-systems concentration brings together the most up to date and relevant aspects facing multiple industries today by addressing flight system planning and operations, and the employment of the systems in the congested National Air Space (NAS).

B. Demand

The utilization of Unmanned Aerial Vehicles is increasing with the Federal Aviation Administrations (FAA) development of requirements to operate UASs in the NAS, to be implemented no later than 2015. Emergency response organizations (fire, police) are currently utilizing these vehicles, as are many other governmental entities such as Border Patrol and the US Forest Service. Unmanned Aerial Vehicles are expected to be used in many industrial and civilian applications – aerial photography, pipeline surveillance, farming and mining among others. Employment demand is expected to be high. Students graduating from this program will find employment opportunities as UAV pilot and sensor operators, in both the US and worldwide. This concentration will prepare students to operate small to mid-range platforms that will be used by emergency responders, forestry, agriculture, energy/oil, and other similar industries. Entry-level pay is substantial. UAV jobs for qualified pilots and sensor operators are expected to grow for the long term. According to a Teal Group's 2013 market study, UAV spending will more than double over the next decade from current worldwide UAV expenditures of \$5.2 billion annually to \$11.6 billion, totaling just over \$89 billion in the next ten years. The Teal Group study predicts that the US will account for 65% of the worldwide RDT&E spending on UAV technology over the next decade, and 51% of the procurement. All of these deployed systems will need well educated, trained operators that are cognizant of the UAS complex flight and air space management issues

2. Support and Impact

A. Faculty governance

Provide a supporting letter from the chair of the academic unit verifying that the proposed concentration has received faculty approval through appropriate governance procedures in the unit and that the unit has the resources to support the concentration as presented in the proposal, without impacting core course resources.

B. Other related programs

Identify other related ASU programs and outline how the new concentration will complement these existing ASU programs. (If applicable, statements of support from potentially-affected academic unit administrators need to be included with this proposal submission.)

This concentration will complement the existing ASU aviation degree programs, Aeronautical Management Technology and Air Traffic Management. There are no other flight operations/pilot related programs at ASU.

C. Letter(s) of support

Provide a supporting letter from each college/school dean from which individual courses, or the entire concentration, are taken.

3. Academic Curriculum and Requirements

A. Knowledge, competencies, and skills

List the knowledge, competencies, and skills (learning outcomes) students should have when they complete this proposed concentration. Examples of program learning outcomes can be found at (<http://www.asu.edu/oue/assessment.html>).

Students will:

- demonstrate the knowledge needed to operate aircraft safely in the National AirSpace System (NAS) to include air traffic control; meteorology; aircraft structures, power plants, aircraft design, and aircraft logistics management; laws and regulations, human factors and safety.
- describe UAS component technologies related to UAS vehicles.
- differentiate between the various regulations concerning remotely piloted vehicles within the NAS.
- articulate human factors issues associated with UAS pilots
- demonstrate standard operational procedures for UAS utilization in the NAS.
- explain standard operational procedures for UAV utilizing onboard sensors supporting surveillance and data collection
- integrate UAS component technologies related to UAS vehicles.
- describe regulations concerning remotely piloted vehicles.
- demonstrate incorporation of regulatory procedures in the operation of unmanned aerial vehicles in the NAS.
- utilize UAV systems to leverage technology and aerial perspective
- develop analysis methodologies for information collected from UAV sensors

B. Admissions criteria.

Admission criteria for this concentration will be the same as those for the AMT Professional Flight concentration.

C. Curricular structure

Provide the curricular structure for this concentration. Be specific in listing required courses and specify the total minimum number of hours required for the concentration.

Required Core Courses for the Degree/Major

The following courses are required in addition to university General Education (unspecified courses) and first-year composition courses, which are shown on the major map.

Prefix	Number	Title	Is this a new Course?	Credit Hours
AMT	101	Introduction to Aeronautical Management Technology	No	1
AMT	182	Private Pilot Ground School	No	3
AMT	201	Air Traffic Control	No	3
AMT	220	Aviation Meteorology	No	3
AMT	280	Aerospace Structures, Materials and Systems	No	4
AMT	287	Aircraft PowerPlants	No	4
AMT	308	Air Transportation	No	3
AMT	350	Aircraft Design and Logistics Management	No	3
AMT	396	Aviation Professional	No	1
AMT	408	National Aviation Policy	No	3
AMT	410	Aviation Safety and Human Factors	No	3
AMT	442	Aviation Law/Regulations	No	3
AMT	444	Airport Management and Planning	No	3
AMT	484	Internship	No	3
AMT	491	Aviation Management Capstone	No	3
CTI	101	Success in Technology and Innovation	No	1
ECN	211 OR	Macroeconomic Principles OR	No	3
	212	Microeconomic Principles		
MAT	265	Calculus for Engineers I	No	3
PHY	111	General Physics	No	3
PHY	112	General Physics	No	3
PHY	113	General Physics Laboratory	No	1
PHY	114	General Physics Laboratory	No	1
PSY	101	Introduction to Psychology	No	3
PSY	230	Introduction to Statistics	No	3
TWC	400 OR	Technical Communications OR	No	3
	401	Principles of Technical Communications		
		Technical Electives	No	13
Section sub-total:				80

Required Concentration Courses

Prefix	Number	Title	Is this a new Course?	Credit Hours
AMT	170	Introduction to Unmanned Aircraft Systems	Yes	3
AMT	270	Unmanned Aircraft	Yes	3
AMT	370	Unmanned Aircraft Systems	Yes	3
AMT	470	Unmanned Aircraft Payloads, Sensors, and Control Stations	Yes	3
ABS	485	GIS in Natural Resources	No	3
ABS	486	Introduction to Remote Sensing	No	4
Section Sub-total				19

Elective Concentration Courses

Prefix	Number	Title	Is this a new Course?	Credit Hours
none				
<i>Section sub-total</i>				0

Other Concentration Requirements

E.g. – Capstone experience, internship, clinical requirements, field studies, foreign language skills as applicable

Prefix	Number	Title	Is this a new Course?	Credit Hours
AMT	495	Unmanned Aircraft Systems Operations	Yes	3
<i>Section sub-total:</i>				3
Total minimum credit hours required for				22

Academic Curriculum and Requirements

D. Minimum residency requirement

How many hours of the concentration must be ASU credit? 15

E. Provide a brief course description for each new course.

Course: AMT 170 Introduction to Unmanned Aircraft Systems (3 Credits)

Course Description: This course introduces students to the history of unmanned aircraft systems and current and future developments in civil and military operations. Specific blocks deal with elements that form an unmanned aircraft system: unmanned vehicles, communication, navigation, launch and recovery, control stations, payloads, and support equipment. Other current issues in unmanned aircraft operations will be explored: aviation regulatory system and integration, safety and human factors, ethical and legal issues, and the future unmanned aircraft systems.

Course: AMT 270 Unmanned Aircraft (3 Credits)

Course Description: Introduces elements comprising the unmanned aircraft system (UAS). Includes review of UAS, Unmanned Aerial Vehicle (UAV); system development and certification, selection and design, aerodynamics and airframe configurations, characteristics of vehicle types, design standards and regulatory aspects, airframe design, payload types, and control and stability. Students apply concepts acquired in classroom sessions and construct various unmanned aircraft and train to operate using existing simulators. The final course project is the design, development and construction of an unmanned system. Incorporates UAS data collection and analysis throughout the course. Course concepts enable UAS student pilots to become knowledgeable of aerodynamic aspects of UAV to ensure safety of flight and improved maneuverability. Lecture, lab. Prerequisite(s): AMT 170

Course: AMT 370 Unmanned Aircraft Systems (3 Credits)

Course Description: Students build upon gained knowledge, skills and experience by exploring unmanned aircraft avionics, autopilot systems, first person video (FPV), on-screen displays (OSD), communication systems, command and control (C2), ground control stations (GCS), flight software, and UAV launch and recovery systems. Students continue proficiency in unmanned aircraft operation using simulators and demonstrate team and communication requirements. Students demonstrate their abilities to upgrade and modify their previously constructed unmanned aircraft in order to operate and conduct actual flight-testing. Incorporates UAS data collection and analysis throughout the course. Lecture, lab. Prerequisite(s): AMT 270

Course: AMT 470 Unmanned Aircraft Payloads, Sensors, and Control Stations (3 Credits)

Course Description: Builds on previously gained knowledge and experience. Students utilize long-range communication and data links, UAS sensors, geospatial data collection, and still-imaging mosaicking. Students continue flight training using existing simulators. Students apply concepts acquired during classroom sessions and construct a ground control station, modify and upgrade existing unmanned aircraft with payloads/sensors, train to operate sensors using existing simulators,. Incorporates UAS data collection and analysis throughout the course. Lecture, lab. Prerequisite(s): AMT 370

Course: AMT 495 Unmanned Aircraft Systems Operations (3 Credits)

Course Description: This capstone course will apply students' knowledge and skills gained in previous UAS courses to safely deploy an unmanned aircraft system in response to real-world situation or research. Students will collaborate with other university departments, state or federal agencies, and other organizations and conduct simulated missions in geospatial data collection, search and rescue, and near-space operations. Course blocks includes flight planning and preparation, aircraft preflight and maintenance, launch and recovery operations, payload operations, normal and emergency procedures, and mission planning and execution. Students will continue flight training using existing simulators. Students will be given real-world situations which will require deployment of equipment and systems developed during previous course. Specific emphasis will be placed upon aircraft and payload selection based upon proposed mission analysis. UAS data collection and analysis will be incorporated throughout the course. Prerequisite(s): AMT 470

Note: All new required courses should be submitted in Curriculum Changer and ready for Provost's Office approval before this concentration is put on Curriculum and Academic Programs Committee (CAPC) agenda.

4. Administration and Resources

A. How will the proposed concentration be administered (including admissions, student advisement, retention, etc.)?

The same admissions, advising and retention processes for the other AMT/ATC programs will be utilized for this concentration

B. What are enrollment projections for the next three years?

Number of Students (Headcount)	1 st Year	2 nd Year	3 rd Year
		(Yr. 1 continuing + new entering)	(Yr. 1 & 2 continuing + new entering)
	30	80	130

C. Resources

The new UAS courses will need to be taught by someone with UAS experience. We could start with an FA until enrollments increase to a point where it would be necessary to hire a Lecturer. The core courses for this program will be taught by current AMT faculty.

An additional resource that is being made available is the donation of a CAE UAS simulator. Due to the availability of this simulator, it will enable us to provide immediate high-level instruction, as well recruit students.

D. Primary Faculty

Name	Title	Area(s) of Specialization as they relate to proposed concentration
Marc O'Brien	Sr. Lecturer	Aviation
Jimmy Kimberly	Lecturer	Aviation
Jim Anderson	Lecturer	Aviation
Karrie Shank	Lecturer	Aviation
Verne Latham	Lecturer	ATC
Michael Pearson	Associate Clinical Professor	Aviation Management
Mary Niemczyk	Associate Professor	Aviation Management
Randy Gibb	Sr Lecturer	Flight

5. Additional Materials

A. Major Map

Attach a copy of the “proposed” major map for this degree program and each concentration(s) to be offered. Instructions on how to create a “proposed major map” in BAMM can be found in the Build a Major Map Training Guide.

B. Appendix

Complete and attach the Appendix document.

C. Attach other information that will be useful to the review committees and the Office of the Provost.

APPENDIX
OPERATIONAL INFORMATION FOR UNDERGRADUATE CONCENTRATIONS

(This information is used to populate the Degree Search/catalog website.
Please consider the student audience in creating your text.)

1. Proposed Concentration Name: Unmanned Aerial Systems

2. Program Description (150 words maximum)

The unmanned aerial systems concentration prepares students for careers in the rapidly growing area of UAS, including operations, remote sensing, data collection and analysis. The concentration incorporates all aviation management technology core courses, as well as unmanned aerial systems concentration courses. This provides an overview of unmanned aerial systems operations followed by detailed knowledge of unmanned aerial systems-specific systems and technology (ground control stations, data links; flight planning and operations, search, detect and avoid technologies; and payloads) and unmanned aerial systems sensor operations. A critical aspect of this academic area of study is the data capture and transfer of the sensor information collected from the unmanned aerial vehicle. This innovative concentration brings together the most up-to-date and relevant aspects facing multiple industries today by addressing flight system planning and operations and the employment of the systems in the congested National Air Space.

3. Contact and Support Information

Building Name, code and room number: (<i>Search ASU map</i>)	TECH 101
Program office telephone number: (<i>i.e. 480/965-2100</i>)	480/727-1874
Program Email Address:	aerotech@asu.edu
Program Website Address:	http://technology.asu.edu

4. Delivery/Campus Information Delivery: on campus; iCourse

Note: Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online.

5. Campus/Locations: indicate all locations where this program will be offered.

Downtown Phoenix Polytechnic Tempe West Other:

6. Additional Program Description Information

- A. Additional program fee required for this program? No
B. Does this program have a second language requirement? No

7. Career Opportunities & Concentrations

Students graduating from this program will find various employment opportunities as UAV pilot and sensor operators in both the US and worldwide. In 2015, the FAA will allow UAV to operate in the US National Airspace System that will enable governmental and civilian entities to operate these vehicles for new endeavors or to replace current fixed- and rotor-craft operations. This concentration will prepare students to operate small to mid-range platforms that will be used by emergency responders, forestry, agriculture, energy/oil and other similar industries. Entry-level pay is competitive for this highly specialized field.

8. Additional Admission Requirements

If applicable list any admission requirements (freshman and/or transfer) that are higher than and/or in addition to the university minimum undergraduate admission requirements.) Students pursuing this concentration will have to meet the current criteria required for the AMT Professional Flight concentration.

N/A

9. Keywords

List all keywords used to search for this program. Keywords should be specific to the proposed program.

- Unmanned aerial vehicles
- unmanned aerial systems
- UAV
- UAS
- RPV
- drones
- RPA
- remote piloted vehicles
- remote piloted aircraft

10. Advising Committee Code

List the existing advising committee code to be associated with this degree. UGTIGA

Note: If a new advising committee needs to be created

please complete the following form:

Proposal to create an undergraduate advising committee

**2014 - 2015 Major Map
Aeronautical Management Technology (Unmanned Aerial Systems), BS
(Proposed)**

UOLCTNT

Term 1 0 - 13 Credit Hours Critical course signified by ⚡	Hours	Minimum Grade	Notes
⚡ CTI 101: Success in Technology & Innovation	1		<ul style="list-style-type: none"> • An SAT, ACT, Accuplacer, or TOEFL score determines placement into first-year composition courses • ASU Math Placement Exam score determines placement in Mathematics course • ASU 101 or College specific equivalent First Year Seminar required of all freshman students • CTI 101 required of all freshman students
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition	3	C	
⚡ AMT 182: Private Pilot Ground School	3	C	
⚡ AMT 220: Aviation Meteorology	3	C	
MAT 265: Calculus for Engineers I (MA)	3		
Term hours subtotal:	13		
Term 2 14 - 27 Credit Hours Critical course signified by ⚡	Hours	Minimum Grade	Notes
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition	3	C	
⚡ PHY 111: General Physics (SQ) AND PHY 113: General Physics Laboratory (SQ)	4		
AMT 101: Introduction to Aeronautical Management Technology	1		
<i>Complete 2 courses:</i> Technical Elective	6		
Term hours subtotal:	14		
Term 3 28 - 43 Credit Hours Critical course signified by ⚡	Hours	Minimum Grade	Notes
AMT 280: Aerospace Structures, Materials and Systems	4	C	
AMT 201: Air Traffic Control	3	C	
⚡ AMT 170: Introduction to Unmanned Aircraft Systems	3	C	
PSY 101: Introduction to Psychology (SB)	3		
ECN 211: Macroeconomic Principles (SB) OR ECN 212: Microeconomic Principles (SB)	3		
Term hours subtotal:	16		
Term 4 44 - 60 Credit Hours Critical course signified by ⚡	Hours	Minimum Grade	Notes
PHY 112: General Physics (SQ) AND PHY 114: General Physics Laboratory (SQ)	4		
AMT 287: Aircraft Powerplants	4	C	
⚡ AMT 270: Unmanned Aircraft	3	C	
Literacy and Critical Inquiry (L)	3		
Humanities, Fine Arts and Design (HU) AND Cultural Diversity in the U.S. (C) OR Humanities, Fine Arts and Design (HU) AND Historical Awareness (H)	3		
Term hours subtotal:	17		
Term 5 61 - 75 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ AMT 308: Air Transportation (G)	3	C	

AMT 350: Aircraft Design and Logistics Management	3	C
PSY 230: Introduction to Statistics (CS)	3	
Humanities, Fine Arts and Design (HU) AND Cultural Diversity in the U.S. (C) OR Humanities, Fine Arts and Design (HU) AND Historical Awareness (H)	3	
Technical Elective	3	
Term hours subtotal:	15	

Term 6 76 - 90 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
AMT 370: Unmanned Aircraft Systems	3	C	
AMT 396: Aviation Professional	1	C	
AMT 442: Aviation Law/Regulations	3	C	
AMT 444: Airport Management and Planning	3	C	
Technical Elective	2		
Upper Division Social and Behavioral Sciences (SB) OR Upper Division Humanities, Fine Arts and Design (HU)	3		
Term hours subtotal:	15		

Term 7 91 - 105 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
ABS 485: GIS in Natural Resources	3		
AMT 408: National Aviation Policy	3	C	
AMT 410: Aviation Safety and Human Factors	3	C	
AMT 470: Unmanned Aircraft Payloads, Sensors, and Control Stations	3	C	
TWC 400: Technical Communications (L) OR TWC 401: Principles of Technical Communication (L)	3		
Term hours subtotal:	15		

Term 8 106 - 120 Credit Hours Necessary course signified by	Hours	Minimum Grade	Notes
ABS 486: Introduction to Remote Sensing	4		
AMT 484: Internship	3	C	
AMT 491: Aviation Management Capstone	3	C	
AMT 495: Unmanned Aircraft Systems Operations. CM: In process.	3	C	
Technical Elective	2		
Term hours subtotal:	15		

- Technical Elective
- AMT Elective
- ATM Elective
- PSY Elective
- TEM Elective
- GIT Elective
- TMC Elective

Total Hours: 120
Upper Division Hours: 45 minimum
Major GPA: 2.00 minimum
Cumulative GPA: 2.00 minimum
Total hrs at ASU: 30 minimum
Hrs Resident Credit for Academic Recognition: 56 minimum
Total Community College Hrs: 64 maximum

General University Requirements Legend

- General Studies Core Requirements:
- Literacy and Critical Inquiry (L)
 - Mathematical Studies (MA)
 - Computer/Statistics/Quantitative Applications (CS)
 - Humanities, Fine Arts and Design (HU)
 - Social and Behavioral Sciences (SB)
 - Natural Science - Quantitative (SQ)

- General Studies Awareness Requirements:
- Cultural Diversity in the U.S. (C)
 - Global Awareness (G)
 - Historical Awareness (H)
- First-Year Composition

- Natural Science - General (SG)

General Studies designations listed on the major map are current for the 2014 - 2015 academic year.

Scott Danielson

From: Mitzi Montoya
Sent: Tuesday, August 20, 2013 1:56 PM
To: Scott Danielson
Subject: Re: UAS Concentration Approval

Approved.

Mitzi M. Montoya
Arizona State University
Sent from my DROID

Scott Danielson <Scott.Danielson@asu.edu> wrote:

Dean Montoya,

I am asking for your approval on the attached proposal for a concentration in Unmanned Aerial Systems (UAS) for the BS in Aeronautical Technology Management degree to be offered in the College of Technology and Innovation at the Polytechnic campus. Your approval is needed before I can send the proposal forward to the Provost's office.

Your approval indicates that the proposal has been approved by the Department and College levels of review, and the College has the resources to offer this degree program and that you recommend implementation of the proposed degree program.

Thank you.

Scott Danielson, Ph.D., P.E.
Associate Dean for Academic Programs
College of Technology and Innovation
Arizona State University
480-727-1185

Scott Danielson

From: Russell Branaghan
Sent: Tuesday, August 20, 2013 6:49 PM
To: Scott Danielson
Subject: Re: UAS Concentration Approval

Dear Professor Danielson,

As Chair of the Department of Technological Entrepreneurship and Innovation Management, I approve of this proposal. Thank you for your work on this.

With kind regards,

Russ

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Russell J. Branaghan, PhD
Associate Professor of Applied Psychology
Chair, Technological Entrepreneurship and Innovation Management
Arizona State University, Polytechnic
Mesa, AZ, USA
russ.branaghan@asu.edu

From: Scott Danielson <Scott.Danielson@asu.edu>
Date: Tuesday, August 20, 2013 1:24 PM
To: Russell Branaghan <Russell.Branaghan@asu.edu>
Cc: Douglas Green <DM.Green@asu.edu>
Subject: UAS Concentration Approval

Russ,

Please provide departmental approval as department chair of the attached proposal. Thank you.

Scott

Scott Danielson, Ph.D., P.E.
Associate Dean for Academic Programs
College of Technology and Innovation
Arizona State University
480-727-1185