# Syllabus

Current as of: 16 May 17

<table>
<thead>
<tr>
<th>Approval</th>
<th>Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td>ASOpS/DOS</td>
<td>Adam Mitchell</td>
<td>5/16/2017</td>
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</tbody>
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SATCOM AC, Flight Chief  
Signed by: MITCHELL.ADAM.THOMAS.1176265295

ADVANCED SPACE OPERATIONS SCHOOL  
Peterson AFB, Colorado
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I. SATCOM AC Overview

The SATCOM AC is a nine day course that provides space and communications professionals with a broad overview of space and radio frequency (RF) environments, capabilities and limitations of military and commercial SATCOM systems, threats to all segments of SATCOM, and planning processes.

SATCOM AC GOAL

Provide space professionals an understanding of SATCOM that can be applied to system development, acquisition, employment, and sustainment, as well as the application in joint planning and execution, and Tactics, Techniques, and Procedures (TTPs) development. AFSPC requires SATCOM space professionals to overcome obstacles in a CDO environment CDO in order to support the joint warfighter and national security objectives.

COURSE OBJECTIVES

After graduating from the SATCOM AC, students will be able to:

- Comprehend the characteristics of the electromagnetic spectrum and the space mission elements related to the employment of SATCOM systems
- Comprehend the capabilities, limitations, and vulnerabilities of current and future SATCOM systems, including the space, ground, and link segments
- Comprehend MILSATCOM system threats, countermeasures, and operational considerations and describe an effective employment of MILSATCOM systems
- Apply knowledge of SATCOM equipment, threats, tactics, and operational considerations to effectively integrate SATCOM into joint operations

II. Academic Policies and Procedures

ATTENDANCE POLICY

Attendance during all class sessions is mandatory in order to successfully graduate from SATCOM AC. Students are expected to be on time to all lessons. Absences from class time must be pre-approved by the Flight Commander. Routine medical/dental appointments should NOT be scheduled during class time. Unexcused absences can result in elimination from the course. Students missing more than 10% of the course hours will be assessed and a recommendation forwarded to the ASOpS CC for dismissal by an Elimination Board. The Elimination Board is comprised of the SATCOM AC Flight Commander/Flight Chief, ASOpS/DO, ASOpS/DE, and ASOpS/CC.
STUDENT PARTICIPATION

The course format is informal, and comprised of interactive lecture, discussion, and exercises. Participation is critical to success in reaching the learning objectives, as students typically bring a wide variety of experience and perspectives to the class. Students are encouraged to be prepared and contribute to the class discussions, as well as learn from fellow classmates’ experiences and knowledge. Additionally, students are encouraged to challenge ideas or statements that don’t seem correct -- whether made by instructors or other students -- but to do so for the purpose of gaining understanding. Bottom line: To foster the best possible learning experience, students should be prepared, engaged, and professional.

STUDENT ASSIGNMENTS/HOMEWORK

There are two student assignments that must be completed prior to course start: SATCOM Policy Reading and Questions and the Distance Learning lessons listed in the ASOpS provided welcome letter. Additionally, students will have two homework assignments: a Decibel Math Worksheet and a Link Budget Worksheet. It is highly recommended that all students review the course material from each day to study for upcoming quizzes and block tests.

COURSE MATERIAL

Students will receive a copy of the unclassified courseware on a computer disk on the first day of class. Three paper copy Note-Taker packets (MLO Note-Taker, Block II Note-Taker, Block III Note-Taker) will be provided to students on the first day of class as well. However, paper copies of the courseware will \textbf{NOT} be distributed or made available for student use. If the student wishes to study outside of the classroom, it is recommended they print copies of the courseware or have access to a computer in their home or hotel room. Students should bring additional materials to take unclassified notes. Please note student owned or supplied computers will \textbf{NOT} be permitted in the classroom.
EVALUATIONS

There are three closed-book written tests and two closed-book quizzes at the knowledge and comprehension levels of learning, a commercial exercise and a capstone planning exercise.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Description</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Block I Test</td>
<td>Short Answer / Essay Questions</td>
<td>20%</td>
</tr>
<tr>
<td>Block II Test</td>
<td>Short Answer / Essay Questions</td>
<td>20%</td>
</tr>
<tr>
<td>Block III Test</td>
<td>Short Answer / Essay Questions</td>
<td>20%</td>
</tr>
<tr>
<td>Block IV Quiz</td>
<td>Multiple Choice</td>
<td>5%</td>
</tr>
<tr>
<td>Block V Quiz</td>
<td>Multiple Choice</td>
<td>5%</td>
</tr>
<tr>
<td>Commercial Exercise</td>
<td>Group Exercise and Presentation</td>
<td>5%</td>
</tr>
<tr>
<td>Capstone Activity</td>
<td>Group Exercise and Presentation</td>
<td>25%</td>
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</tbody>
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The minimum passing grade for each graded event is 70%. Students will be provided additional training should they fail a graded event and be given the opportunity to take an alternate graded event. If a student fails the second graded event, an academic board will be convened with the ASOpS/DO, ASOpS/DE, and ASOpS/CC to determine if the student is allowed to continue.

GRADUATION

Students must successfully attend 90% of the lessons, per the attendance policy above, score a minimum of 70% on each graded event, and maintain an academic average of 75% or better to graduate.

ASOpS may authorize a waiver of graduation requirements when students can not complete them due to extenuating circumstances. Consideration will be given to what is in the best interest of the government, service, unit, and the student. Successful completion of the SATCOM AC is followed by a graduation ceremony.

All graduating students should plan on attending graduation. The uniform for graduation is standard class attire, not travel clothes.

ACADEMIC FREEDOM

Academic freedom is the privilege of debate with discretion on any subject related to the ASOpS curriculum within the classrooms. Guest lecturers, faculty, and students are encouraged to support or criticize any objective, policy, or opinion in the pursuit of knowledge and understanding, but with dignity and respect. Bottom line: be professional.
NON-ATTRIBUTION POLICY

Non-attribution Definition: Treating statements made in a school forum (including but not limited to seminar discussion, CD-ROM, and online) as privileged information. Do not attribute any statements to a specific individual.

Non-attribution Policy: Statements, disagreement, and other comments made by individuals or groups in the school forum are safeguarded through the practice of non-attribution. It is acceptable to say a "previous speaker" made a particular statement, but the speaker's name will not be divulged.

Student Responsibility: Individuals who violate the non-attribution policy are subject to adverse administrative and disciplinary action. Military personnel subject to the UCMJ who violate the non-attribution policy are subject to disciplinary actions under the UCMJ. Cases involving civilian personnel will result in a memorandum to the civilian's supervisor describing their violation of the ASOpS academic freedom policy. Students are also subject to faculty board action under AFCAT 36-2223, USAF Formal School, and AFI 51-602, Boards of Officers.

INSTRUCTOR-STUDENT RELATIONS

Students are encouraged to consult with instructors concerning problems with subject matter, grade computations or academic assignments. The Satellite Communications Advanced Course faculty is extremely interested in student success, and will make every effort to help settle any issues. The chain of command for resolving conflicts in academic matters is the instructor, the SATCOM AC Flight Commander/Flight Chief, ASOpS/DO, and the ASOpS/CC.

III. Subject Matter Areas

BLOCK I – SATCOM

OVERVIEW

This block will provide an understanding of the SATCOM enterprise, history, organizations, governing policy, and authorities. It will also discuss how to develop SATCOM TTPs.

BLOCK I GOAL

The goal of this block is to understand how historical events, milestones, capabilities, as well as space treaties, laws, policies and doctrine have shaped SATCOM operations, organizations and command & control.
BLOCK II – SATCOM SIGNALS AND EQUIPMENT PRINCIPLES

OVERVIEW

This block discusses the aspects of the science that drives space mission architecture and spacecraft design. It concentrates on the principles of RF, such as decibel math, modulation, link budgets and power calculations, among many other aspects of signals.

BLOCK II GOAL

The goal of this block is to comprehend the principles of RF communication used in SATCOM.

BLOCK III – SATCOM DESIGN AND OPERATION

OVERVIEW

This block discusses what organizations operate which satellites, basic design principles, and band capabilities. This block focuses on how military and commercial satellites are designed and employed to operate effectively in the space environment.

BLOCK III GOAL

The goal of this block is to comprehend how communications spacecraft are designed and employed to operate effectively in the space environment.

BLOCK IV – CDO ENVIRONMENT

OVERVIEW

This block defines the CDO environment and the need to incorporate this concept into training. It concentrates on the capabilities, limitations, and vulnerabilities of selected foreign military/government SATCOM systems, threats to our space and ground segment of SATCOM systems and the countermeasures to those threats, and the need to understand cyber operations.

BLOCK IV GOAL

The goal of this block is to understand foreign use of SATCOM, their threats to US and coalition SATCOM, how the US pursues space superiority related to SATCOM, and the principles of cyber operations as they relate to the contested, degraded, and operationally limited environment.
**BLOCK V – FIGHTING SATCOM**

**OVERVIEW**

This block discusses information specific to overcome a CDO environment in order to maintain communications.

**BLOCK V GOAL**

The goal of this block is for students to learn how to overcome threats affecting satellite communications systems to a wide range of SATCOM signals and components within different scenarios.

**IV. Notional SATCOM AC Schedule**

*(Students will receive a current schedule on day 1 of the course.)*

<table>
<thead>
<tr>
<th>Lesson Title/Activity</th>
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<tbody>
<tr>
<td><strong>Day 1</strong></td>
</tr>
<tr>
<td>Course Overview &amp; Admin</td>
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<tr>
<td>Commander’s Welcome</td>
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<tr>
<td>Block I Overview</td>
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<tr>
<td>SATCOM History</td>
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<tr>
<td>Policy Affecting SATCOM</td>
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<tr>
<td>Intro to TTP</td>
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<tr>
<td>Command &amp; Control Basics</td>
</tr>
<tr>
<td>SATCOM Organizations</td>
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<tr>
<td>Recap of Day 1</td>
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<tr>
<td><strong>Day 2</strong></td>
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<tr>
<td>Student Study Time</td>
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<tr>
<td>Block I Test</td>
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<tr>
<td>Block II Overview</td>
</tr>
<tr>
<td>Signal Fundamentals</td>
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<tr>
<td>dB Math &amp; Homework Assignment</td>
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<tr>
<td>Antenna Principles</td>
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<tr>
<td>Modulation</td>
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<tr>
<td>Block I Test Review</td>
</tr>
<tr>
<td>dB Math Homework Assignment Review</td>
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<tr>
<td><strong>Day 3</strong></td>
</tr>
<tr>
<td>dB Math Homework Assignment &amp; Day 2 Review</td>
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<tr>
<td>Forward Error Correction</td>
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<tr>
<td>Link Budgets &amp; Power Calculations</td>
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<tr>
<td>Signals Lab</td>
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<tr>
<td>Recap &amp; Review</td>
</tr>
<tr>
<td>Multiplexing &amp; Multiple Access</td>
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<tr>
<td>Student Study Time</td>
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</tbody>
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### Day 4
- Block II Test
- Block III Overview
- Satellite Operations
- Satellite Control Network
- VSAT Networks
- Gateway Operations
- Spacecraft Bus Subsystems
- Recap & Review

### Day 5
- Block III Recap & Review
- Narrowband
- Wideband
- Tour Prep
- Protected Band
- Commercial SATCOM FSS & MSS
- Block II Test Review
- Student Study Time

### Day 6
- Commercial SATCOM FSS & MSS
- Travel & Tours
- Student Study Time
- Block III Test
- Block IV Overview
- CDO Environment
- Foreign Military & Government SATCOM
- Block II Retest Study Time

### Day 7
- Block II Retest
- SATCOM Threats and Countermeasures
- Cyber Threats
- Block IV Review
- Block IV Quiz
- Block V Overview
- OSC Systems & Capabilities
- DSC Systems & Capabilities
- Block III Test Review

### Day 8
- EMI Detection & Reporting
- EMI Geolocation & Resolution
- MSN Analysis
- Signals Lab
- Block V Review
- Intelligence Space Integration
- Block V Quiz
- CAPSTONE Introduction
<table>
<thead>
<tr>
<th>Day 9</th>
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<tbody>
<tr>
<td>CAPSTONE Prep &amp; Delivery</td>
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<tr>
<td>Course Critiques</td>
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<tr>
<td>Classroom Cleanup</td>
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<tr>
<td>Graduation</td>
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