WESTERN REGIONAL PARTNERSHIP AIRSPACE SUSTAINABILITY OVERVIEW

Brief Overview for Policy Makers and Planners of Aviation Sustainability Concerns, Aviation Coordination Best Practices and Aviation Resources

Prepared by WRP MRHSDP&A Committee with Contract Support

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Western Regional Partnership (WRP)

The mission of the WRP is to provide *a proactive and collaborative framework for senior-policy level Federal, State and Tribal leadership to identify common goals and emerging issues in the states of Arizona, California, Nevada, New Mexico and Utah and to develop solutions that support WRP Partners and protect natural resources, while promoting sustainability, homeland security and military readiness.*

The Value of WRP

WRP develops solutions that support Partners and protect natural resources, while promoting sustainability, homeland security and military readiness. In the West, there are significant military assets, infrastructure systems such as energy, transportation and wildlife ecosystems. Leveraging of resources and linking of efforts help to avoid duplication of efforts and encourages sharing of best practices. WRP Partners benefit from interagency and cross-state collaboration and use of WRP tools such as the Web Mapping Application.

The Purpose of this Document

This document highlights aviation encroachment/sustainability concerns and provides information on aviation coordination best practices and aviation resources. This document should serve as a tool for policy makers and planners to better address aviation sustainability issues in a proactive and collaborative fashion. WRP seeks to encourage better information sharing to foster awareness of the interdependencies between Partners and provide for a more symbiotic relationship.

For More Information

For more information on WRP please see www.wrpinfo.org. To participate in a WRP Committee or to receive updates, please complete the information under "mailing list" on the website.

Table of Contents

Introduction

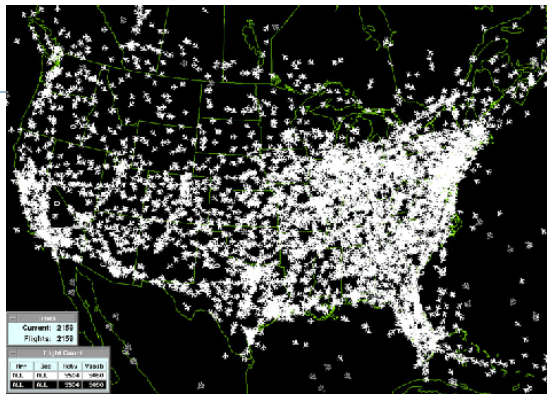
Within the Western Regional Partnership (WRP) region there are significant numbers of aviation users (military, business and general aviation, commercial, etc.) with diverse missions. The WRP region appreciates nearly year-round fair weather, enabling all types of flying missions. Within this region are some of the nation's busiest airports (Los Angeles, San Francisco, Las Vegas and Phoenix Sky Harbor) in terms of passenger boardings and passenger traffic. The region's interconnected military airspace supports air-to-air, air-to-ground, ground-to-ground and air-to-sea operations.

Changes in aviation operations and types of users along with changes in land use patterns can impact aviation missions. This document provides information on the main encroachment/sustainability challenges for aviation operations as well as outlining recommendations and resources available. This is not intended to be a fully comprehensive guide on issues, but instead a primer to highlight items to initiate collaboration and communication. Finally, the document provides background information on the types of airspace; as aviation and airspace are directly related, this background information may prove useful to those unfamiliar with the different types of airspace and their uses.

Aviation Encroachment/Sustainability Challenges

Airspace is a finite resource and competition for its use is increasing. This section of the document addresses the following aviation encroachment/sustainability challenges and offers recommendations regarding management of:

- Land Encroachment/Development
- Changes in Aviation Operations
- Electromagnetic Interference
- New Technologies



Example of Air Traffic in the Continental United States

In most cases aviation encroachment/sustainability challenges can be averted or mitigated with early coordination and communication.

Land Encroachment/Development

Changes on the ground, such as increased development (including commercial and urban) and tall structures may impact aviation users by affecting flight safety. Historically, ensuring compatible land use for aviation focused on areas immediately adjacent to an airport, such as development of a tall structure impacting the ability to safely transit to and from a runway. However, impacts can occur miles away from an airport, such as development immediately under a low-level flight path impacting the military's ability to train pilots or an agricultural pilot's mission to spray crops. Early coordination with airports (military, general or commercial aviation, etc.) can assist in identifying and addressing potential impacts of

development. For example, a development in a certain location with a water feature may attract additional birds to a particular aviation route. Generally, less intense development provides a better buffer for the airport to continue its mission. Examples of sensitive uses near an airport include aboveground storage of large quantities of flammable or hazardous materials. Designations of open land near airports enhance safety in case an emergency landing is necessary. It is helpful to avoid land uses that create visual or electronic inference with air navigation. Working with the airport (air carrier, general aviation, converted military, military, or heliport) early on, can help work through any issues.

Vertical structures (such as Meteorological Evaluation Towers (MET), solar towers, cell towers, real time kinematic (RTK) towers used for auto-steering of construction and farm vehicles, buildings, stationary and airborne wind turbines and other structures) are being built more frequently and at an increasing height. Many structures are built under 200 feet to avoid the FAA rule requiring coordination of any structure 200 feet or taller. In many areas such development does not require notification, which may result in a pilot first learning of the new structure while flying.

Interest in renewable energy (including wind, solar, geothermal, hydro and biomass) has increased dramatically during the last few years. Stationary wind turbines are typically 400 to 500 feet tall and create avoidance zones in low-level flight operations. Wind farms can cover thousands of acres of land, which could require pilots to alter their course of flight. Airborne wind energy systems, essentially tethered kites, may not become airborne until winds are favorable, then lift on short notice. Wind turbines impact airborne radar by causing false returns (via Doppler shift) which could be an impact during military training missions. This Doppler effect significantly impacts validation of airborne radar systems. Siting is a critical component in securing clutter-free airborne radar test areas. Some solar facilities incorporate towers over 600 feet tall; there are plans for facilities with towers of several thousand feet. In addition to energy infrastructure posing structure issues for low-level flying aircraft, such facilities may cause sustained electromagnetic and acoustic interference that can negatively affect ground-based, shipborne, airborne, and submarine-borne sensors, communications, and navigational aids. All renewable energy plants require transmission lines, which can limit aircraft from flying low in those areas, create electromagnetic interference and limit buffer zones. Sometimes, transmission lines may not be readily visible or even known, as they are under 200 feet and therefore not required to follow FAA regulations regarding marking and lighting.

The FAA provided solar project guidance in November 2010 that identified the following concerns from solar parabolic mirrors:

- Temporary vision loss to pilots on arrival or departure or to Air Traffic Control personnel in the control tower caused by glare from parabolic mirrors
- Electromagnetic interference with radar systems

- Penetrations of navigable airspace from power towers that extend into Part 77 imaginary surfaces or the path of radio emitting navigational aids
- Thermal plumes emitted by the power tower that produce upward moving air columns into navigable air space.

FAA guidance provides that solar energy projects shall:

- Not be located in a Runway Object Free Area, Obstacle Free Zone, Runway Safety Area, Taxiway Object Free Area or a Taxiway Safety Area
- Not penetrate "imaginary surfaces"[1] that define the lower limits of airspace
- Demonstrate that glare will not impact airspace safety.
- Comply with Airport Layout Plan land use designations.

The FAA added safety guidance to the 2012 Aeronautical Information Manual, calling for pilots to avoid flying upwind of possible thermal plumes. Thermal plumes are defined as visible or invisible emissions from power plants, industrial production facilities, cooling towers or other industrial systems that release large amounts of vertically directed unstable gases. Thermal Plumes may prove to be a safety concern as they may cause unexpected turbulence, vertical shear, reduced visibility, oxygen depletion, engine particulate contamination, exposure to gaseous oxides, and/or icing. Results of encountering a plume may include airframe damage, aircraft upset, and/or engine damage/failure. If such plumes are located near an airport it can cause turbulence for landing and departure, the most critical phases of flight. Currently, FAA is conducting studies to further characterize the effects of thermal plumes as exhaust effluents.

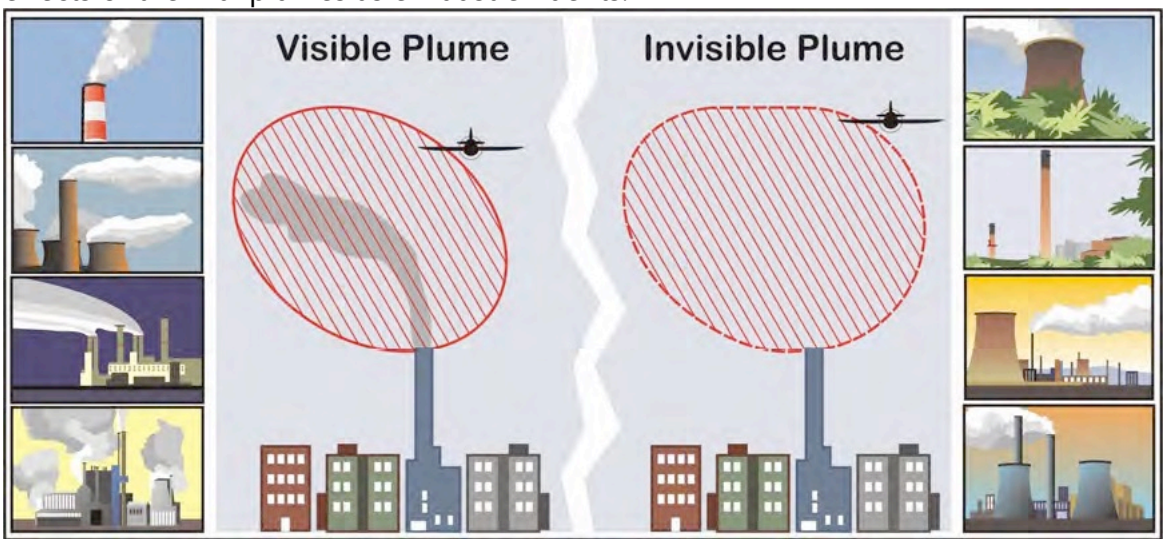


Figure 7-5-2 from FAA's AIM

[1] "Imaginary surfaces" is a term of art used by the FAA. These are notional boundaries in the airspace around civil and military airports where obstructions to air navigation are prohibited.

METs are erected to determine if a particular geographic area is a viable location for the installation of wind turbines. METs are temporary structures that are portable and constructed in a matter of hours. Entities constructing towers consider the potential sites they have identified as proprietary information and therefore have a natural disincentive to disclose them to others. METs are very hard to discern from the air and are of special concern to low level aviation users such as agricultural, first responders, medical transport, and military. The continued construction of these towers within the national airspace system without any marking will increase the possibility of additional accidents and fatalities. For more information on this including best practices on MET Tower notification please see page 20.

Recommendations:

- States have enacted laws that have assisted in developing compatible land use near airports and have also assisted with aviation coordination such as:
    - Notification to homebuyers of nearby general aviation and military airports have assisted in reducing noise complaints
    - Providing additional guidance to cities, counties, towns and schools on compatible land uses near general aviation and military airports has assisted in supporting aviation operations

- It is recommended that at a minimum, any development that requires a general/comprehensive plan amendment or any structures over 50 feet be coordinated with nearby airports to determine if there are any flight operation challenges. Developers should provide such planning information to the local governing jurisdiction in a timely fashion to allow for adequate review and consideration. If airports provide input on a plan, the political jurisdiction is encouraged to hold a public hearing to consider the input and the potential impact on the aviation mission. The airport is encouraged to review planning information and provide input in a timely fashion and be mindful of government's planning process and timelines.
- In 2011, the FAA issued a Safety Advisory recommending that the standard marking requirements that apply to "any construction or alteration exceeding 200 feet above ground level" (14 CFR Part 77.9) be voluntarily applied by the owners of structures, such as MET towers, that are between 50 and 199 feet high. In 2013, the National Transportation Safety Board, noting the voluntary nature of the FAA's advisory, recommended that States enact legislation requiring both marking and notification to a State agency of the location of these structures. Some states have acted in this regard, and other States should be encouraged to do so. Similarly, the FAA should be encouraged to reconsider its decision so that the rules for marking and notification are uniform across the region.
- To assist with communication and situational awareness, government entities are encouraged to share relevant GIS data with each other.
- Airport and airspace managers, planners and those involved in sustainability issues are encouraged to meet with city, county, town, school districts, regional planning entities (Council of Governments (COG), Regional Transportation Plans, etc.) and federal management agencies such as BLM to learn about their future land use planning and to provide points of contact. This should not be a one-time event, and information should be conveyed regarding aviation mission and factors that might impact operations. Tours of airports have also proven to be helpful to show first-hand the necessary elements to sustain aviation operations.
- It should be noted in particular the importance of military installations engaging with Federal, Tribal, State and local entities regarding potential development impacts on the military mission. It is sometimes hard for the governmental entities to know who to contact at the military installation regarding development, and such proactive communication and engagement by the military is necessary. Additionally, the military may view development issues in a very different light due to their mission. Alternative energy is a growing industry and it is important that the military engage early on energy development projects to provide information on potential impacts on the mission and to find ways to mitigate them.

Changes in Aviation Operations

There are various types of manned flight operations such as government (federal, state and local, Tribal and law enforcement) and commercial and general aviation. According to the FAA Aerospace Forecast Fiscal Years 2015-2035, U.S. commercial airline traffic will grow at an average of 2% per year, from 775 million passengers in 2015 to 1.14 billion in 2035. The FAA also forecasts that both airports and general aviation will continue to grow. It is expected that additional airports and expansion of existing airports will be needed to supplement the existing system in order to move more people and cargo. Additional and expanded airports can have both positive and negative impacts for aviation users: while providing more aviation options and economic growth, it may also congest the airspace as more operations are conducted in the same airspace. Commercial airliner designers are evaluating making airliners much quieter with fewer emissions, which may reduce noise and pollution issues in building future airports. New technology such as NextGen is being developed to better utilize airspace and enable more aviation operations in the same area safely and efficiently.

Demand for Unmanned Aircraft Systems (UAS) continues to grow, and is expected to be one of the fastest growing segments in aviation over the next ten years. Unmanned aircraft are currently used for government (federal, including military, state and local, law enforcement), commercial and research purposes. The six test sites selected by the FAA are now operational. Within the WRP region, the State of Nevada was selected as a UAS test site.

Recommendations

When considering aviation impacts from changes in airports, thought should be given not only to additional airports but to changes to the current airports configurations, such as additional gates, runways, etc. For example, building an airport too close to another will create a need for closer communication to ensure no safety issues are created. A best practice in this area is that of the State of Arizona: its state aviation office requires that all airports receiving federal funding must include a military member on their planning board to ensure greater coordination. Such proactive coordination could assist with other users as well.

Airport and airspace managers are encouraged to get involved in existing airspace working groups in their area; if no group exists, they are encouraged to create one to encourage proactive communication with all airspace users toward resolving any potential issues. Such forums enable open communication to help airspace users understand one another's missions and establish points of contacts for issue resolution.

Electromagnetic Interference

Radiofrequency spectrum is a finite resource that is increasingly in high demand by many users including state and federal government and the private sector for such use as wireless

broadband service (smart phones, laptops, tablets, e-readers, etc.). As data usage becomes more intensive (cell phones are used for more than talk service, but also for internet searches, etc.) more competition arises for spectrum that was previously used by aviators for radar and voice communication systems and for national security purposes such as by the Department of Defense.

As UAS operations increase, so do demands on spectrum availability; UAS operations need spectrum for communications (to avoid mid-air collisions and to safely land). Additionally, DoD is using new weapons systems that tend to need a higher data rate for spectrum. There is a vital need to have a secure communications network for new aircraft such as the JSF to ensure information security is protected. The National Telecommunications and Information Administration (NTIA) manages the Federal Government's use of the spectrum while the Federal Communications Commission (FCC) manages all other uses. This resource needs to be carefully managed so that multiple users have the spectrum they need to safely and securely accomplish their mission and not be impacted by other users especially with the increasing demand for spectrum. Efforts are underway to make available a total of 500 megahertz of Federal and nonfederal spectrum over the next 10 years for mobile and fixed wireless broadband use which will greatly increase the amount of commercial spectrum. Not having sufficient use of spectrum at the time needed can have the following impacts on aviation:

- Loss of mission (flight did not occur)
- Navigation and Communication interference (potential loss of communication or jamming of communications channels and impacts to: discharging flares, aircraft weapons radar, aircraft sensors, navigation and voice communications and GPS)
- Safety issues (lack of sufficient spectrum could lead to confusion and miscommunication between aircrews and controller/ground units)

Recommendations

There is a need for:

- Better data collection so that spectrum databases are kept up to date in order to avoid reallocating spectrum based on false data
- Better coordination among users so that there is not an outright loss of bandwidth and to avoid increased crowding (such as DoD systems displaced from other bands moved into existing Testing and Evaluation bands)
- Addressing radios along US-Mexico border (such as those used by truckers and taxi drivers) as they can cause occasional interference and interrupt a frequency
- Increased technology so that spectrum can be worked “smarter” (i.e. scheduling, geographic, etc.)
- Better understanding of existing spectrum users, necessary spectrum bandwidth to complete mission, and potential impacts if spectrum is sold or reallocated

New Technologies

As technology advances, aviation is improved. With these improvements a few elements need to be worked through as aircraft are moving faster and consuming more spectrum and unmanned flights may be flying in what was previously considered manned-only areas. Some of the new technology includes:

- Commercial space launch/private space flight – Flights conducted by non-government entities that reach above 62 miles earth altitude (including launching to the International Space Station). Nine commercial spaceports are currently licensed by the FAA, three of which are in WRP states (in California, California Spaceport (part of Vandenberg Air Force Base) and Mojave Air and Space Port; in New Mexico, Spaceport America.)
- Unmanned Aircraft Systems (UAS) – UAS can range from micro to 737 airliner size. The smaller UAS use line of sight (LOS) communications. Medium and large UAS use both LOS and beyond line of sight (BLOS) for flight. UAS under 55 pounds are considered commercially feasible.
- Tethered Balloons – Although tethered balloons are not new technology, engineering refinement has enabled them to better withstand the weather elements. This technology is now beginning to rapidly expand and is being used for a wide variety of purposes and sensors from airborne radars to cameras, weather sensors to communications, WIFI applications, and even wind turbines. The main aviation safety issue is the tether itself, which is made of strong metal or fiber and not directly above the anchor point, thus needing a wide berth for aircraft to avoid collisions.
- New weapons platforms such as the Fifth-generation jet fighter (e.g. F-22 Raptor and F35 Joint Strike Fighter which are advanced aircraft) have internal weapons bays which reduce detectability on radar (stealthier), have powerful sensors which enhance situational awareness for the pilot and move at fast speeds therefore needing space to maneuver in a safe fashion.
- "Energy kites" – 84 foot-long Airborne Wind Turbines have been flown by Google X. This new technology would enable more wind turbines to be sited in areas that at ground level do not provide sufficient amount of wind. Each kite has 8 propellers that it uses to take off and a tether that keeps it attached to the ground. At 1,400 feet the propellers stop climbing, begin serving as flying wind turbines and the kite starts doing large circles in the sky. Turbines on the kite generate up to 600 kilowatts of energy that is sent continuously down the tether.

Recommendations:

Planners, Airport managers and airspace managers are encouraged to provide information to governmental entities regarding any aviation changes, and to communicate with other aviation users in the area so that there are no surprises. The development and deployment of new aviation technology will allow for additional aviation capacity, making the need for better communication among all users of the airspace ever more important.

Aviation Coordination/Outreach Best practices

In addition to the recommendations listed above, this section highlights aviation coordination and outreach best practices that may be replicated to help address aviation concerns. Such best practices include enhanced communication between users so the aviation missions are more apparent along with specific airspace needs. Examples of such outreach include:

- Planning Coordination – The Arizona Department of Transportation Multimodal Planning Aeronautics Group requires that all airports receiving federal funding include a military member on their planning board to ensure greater coordination.
- Aviation Coordination – Aviation Forums help to ensure an open line of communication and opportunity to work through any issues. An example of such a group is the Arizona Military Airspace Working Group, an informal organization that works together to ensure efficient and safe utilization of Military Special Use Airspace (SUA), permitting users to accomplish their assigned missions. The AMAWG is also committed to developing operational procedures with minimal impact on civilians and other aviation entities affected by military flight training. Items discussed include common range issues, Native American issues, forest fire impacts to low-level routes and SUA, and Department of Homeland Security flight operations. Procedures were established to allow for communication and open lines between civilian and military airports.
- Safety Training - Mid-air collision avoidance (MACA) is a safety program designed to educate the general aviation pilot on the Air Force flying mission in their area. The program conducts safety briefings to pilot groups on the Air Force mission, the type of flying conducted in the special use airspace (SUA), recommendations on how to prevent midair collisions and points of contact to answer any follow up questions the groups may have. Many MACA plans can be found on the Air Force base's website. The MACA program has been very successful in educating general aviation on the usage of Air Force SUA's and how to fly safely in and around them.
- Written Disclosure/Notification - Written notices to homebuyers of nearby airport operations enhance public's knowledge and understanding of airport impacts. This can be done through recorded deed notices and real estate disclosure statements.
- Aviation Support Groups -Aircraft Owners and Pilot Association (AOPA) conducts the following types of outreach:
    - Airport Support Network (ASN): –provides the vehicle for AOPA members to work in concert with AOPA to establish an early warning system when threats arise at an airport. There are over 2,500 volunteers promoting, protecting, and defending America's community airports.
    - Making available safety videos such as Surviving the Wires Environment, "An aviation wire-strike safety awareness video produced by Southern California Edison, Helicopter Association International, and AEGIS Insurance Services Inc., discusses the dangers of low-level flying and basic safety protocols pilots

can employ in the "wires environment."" This video is available through this link: Watch the Video >>

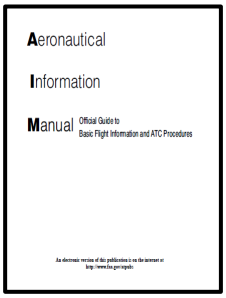
- Providing news updates and educational tools such as:
  - "Protect Your Airport by Promoting it" available through this link: http://download.aopa.org/pic/webinars/AirportsWebFINAL.pdf
  - "The Guide to Obtaining Community Support For Your Local Airport" available through this link: http://www.aopa.org/Advocacy/Get-Involved/Airport-Support-Network/Guide-to-Obtaining-Community-Support-for-Your-Local-Airport
  - "AOPA's Online Communications Tool Kit" available through this link: www.aopa.org/info/comres4u.html

- Aviation workshops - Workshops (AOPA, FAA, Western Service Area Airspace/Range Council, etc.) provide an opportunity to build working relationships and to learn of latest aviation trends and emerging issues
- Aviation Advisory Committees – Committees that include government officials and airport proponents have proven to be successful forums to protect the aviation mission at an airport and address community issues.
- Communication/outreach with Aviation Existing Groups and airspace contacts – Please see WRP contact list for additional points of contacts on aviation matters.
- FAA Safety Team whose mission is to "Improve the Nation's aviation accident rate by conveying safety principles and practices through training, outreach, and education; while establishing partnerships and encouraging the continual growth of a positive safety culture within the aviation community." Website: http://www.faasafety.gov/about/mission.aspx

Aviation Tools and Resources

Relevant Aviation Reports

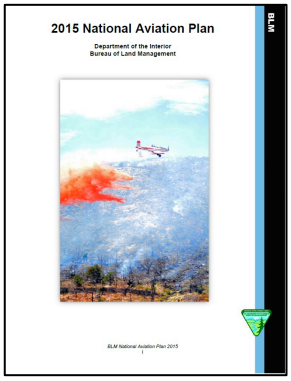
- **Aeronautical Information Manual (AIM) – Official Guide to Basic Flight Information and ATC Procedures**, dated April 3, 2014
    - By: The U.S. Department of Transportation, Federal Aviation Administration
    - Summary: "This manual is designed to provide the aviation community with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States. An international version called the Aeronautical Information Publication contains parallel information, as well as specific information on the international airports for use by the international community. This manual contains the fundamentals required in order to fly in the United States NAS. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the ATC System, and information on safety, accident, and hazard reporting."

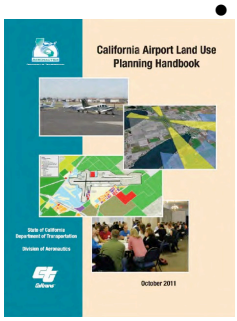


    - Available through this link: www.faa.gov/air_traffic/publications/media/AIM_Basic_4-03-14.pdf

- **Airspace for Everyone document**
    - By AOPA
    - Summary: "In this Safety Advisor, we will examine the airspace structure and how pilots are expected (and required by the Federal Aviation Regulations) to operate within it."
    - Available through this link: http://flighttraining.aopa.org/students/solo/topics/SA02_Airspace_for_Everyone.pdf

- **BLM 2015 National Aviation Plan**
    - By: BLM Fire and Aviation Directorate, National Aviation Office
    - Summary: "This plan provides comprehensive information regarding BLM aviation organizations, responsibilities, administrative procedures and policy. This plan is implemented through BLM Instruction Memorandum."
        - Available through this link: www.blm.gov/style/medialib/blm/nifc/av.Par.81745.File.dat/NAP.pdf





- **California Department of Transportation, Division of Aeronautics Airport Land Use Planning Handbook**
  - By: State of California Department of Transportation Division of Aeronautics
  - Summary: "This Handbook is intended to (1) provide information to Airport Land Use Commissions (ALUC), their staffs, airport proprietors, cities, counties, consultants, and the public, (2) to identify the requirements and procedures for preparing effective compatibility planning documents, and (3) define exemptions where applicable."

  Available through this link: http://www.dot.ca.gov/hq/planning/aeronaut/documents/alucp/AirportLandUsePlanningHandbook.pdf

- **FAA Aerospace Forecast: Fiscal Years 2015-2035**
  - By U.S. Department of Transportation, Federal Aviation Administration, Aviation Policy and Plans
  - Summary, "This forecast looks at how many planes and how many people will fly on U.S. carriers in the future – from 2012 to 2032."

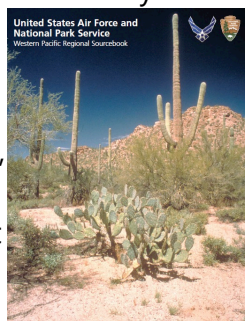
  Available through this link: http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/aerospace_forecasts/2014-2035/media/2015_National_Forecast_Report.pdf

- **Interagency Airspace Coordination Guide**
  - By: US Forest Service and the Department of Interior
  - Summary: "The purpose of this Guide is to promote aviation safety and to promote airspace coordination with respect to environmental issues. This is an educational process that will contribute to a clear understanding of the complex nature of the airspace in which aviators fly. Agency personnel will be able to deal with airspace issues using procedures designed to enhance the coordination of agency flights within the NAS. The Guide promotes safe, consistent, and standardized approaches to issues involving airspace and federal land management responsibilities."

  - Available through this link: http://www.airspacecoordination.org/guide/asguide_full.pdf

- **Land Use Compatibility and Airports**
  - By: Compatible Land Use Planning Task Force
  - Summary: "This guide, developed by the Task Force, is provided as a resource to local planners, governments, and other interested parties and should not be construed as FAA regulations or official agency policy. The

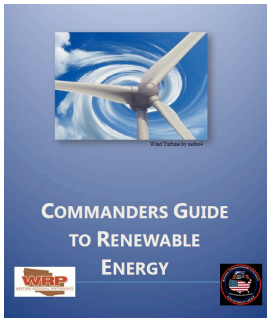
case studies contained within this guide are included as examples to illustrate specific techniques and strategies of how and where some of the compatible land use tools across the country have been applied and implemented. Inclusion of these examples does not in any way represent official endorsement by the FAA. In some instances, approved Part 150 Noise Compatibility Program measures and Noise Exposure Maps have been included as examples for discussion purposes only."
    - Available through this link: http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/planning_toolkit/media/III.B.pdf
- **United States Air Force and National Park Service Western Pacific Regional Sourcebook (October 2002)**
    - By: AF and NPS
    - Summary: "This sourcebook is designed to facilitate better communication and local interaction, so you will be prepared to work with your colleagues to solve problems. Both agencies will benefit from an increased understanding of each other's organization and priorities. While this sourcebook contains a great deal of information, you the user remain the most critical element in fostering a better working relationship in pursuit of your goals."



    - Available through this link: http://www.nature.nps.gov/naturalsounds/PDF_docs/USAFNPSWesternPacificRegionalSourcebook_PDFs/introduction.pdf

Renewable Energy Related Reports

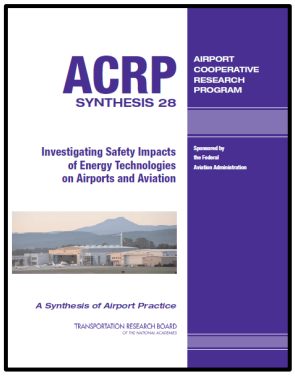
- **Commanders Guide to Renewable Energy**



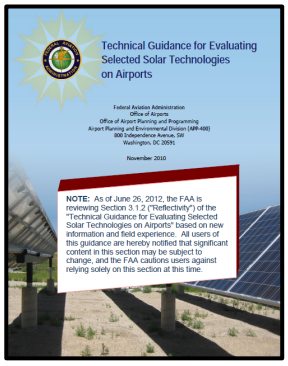
    - By: Range Commanders Council Sustainability Group (November 2012)
    - Summary: "Discussed herein are the impacts that renewable energy infrastructure projects (wind, solar, geothermal, biomass, nuclear, etc.) and off-range transmission have on the member range missions. Also included are tools and strategies for engaging local, state, and Federal agencies, as well as energy developers. Lastly, it will include a compendium of research efforts, studies, testing, and other documentation related to impacts of energy infrastructure on military testing and training."
    - Available through this link: https://www.denix.osd.mil/sri/upload/Primer_RenewableEnergy.pdf

- **Investigating Safety Impacts of Energy Technologies on Airports and Aviation,** Airport Cooperative Research Program (ACRP) Report 28 (2011)
    - By: Stephen B. Barrett and Phillip M. Devita, Harris Miller Miller and Hanson Inc.
    - Summary: "This synthesis study is intended to inform airport operators, aircraft pilots, planning managers, energy developers, legislators and regulators responsible for aviation safety, land use compatibility, airport planning and development, and airport financial self-sustainability about existing literature, data, and ongoing research on physical, visual, and communications systems interference impacts from energy technologies on airports and aviation safety. The energy technologies that are the focus of this report are:
        - Solar Photovoltaic Panels and Farms - Solar photovoltaic (PV) generates electricity from sunlight on light absorbing panels with many panels together representing a solar farm.
        - Concentrating Solar Power Plants - Concentrating solar power (CSP) utilizes mirrors to focus and intensify the sun's heat to boil water and drive a traditional steam turbine for the production of electricity.
        - Wind Turbine Generators and Farms—Wind turbine generators (WTGs) convert energy from wind to electricity either as single units or multiple units also known as farms.
        - Traditional Power Plants - Traditional power plants are fueled by fossil or biofuels and generate base load electricity by boiling water and forcing the steam through a turbine. Cooling systems are necessary to cool the steam for reuse. Peaker power plants are a subset of this category that are being proposed to start up and shut down quickly in response to seasonal fluctuations in energy demand.

      Information used in this study was acquired through both published and preliminary sources and interviews with experts in the fields of aviation and energy.
    - Available through this link: http://www.dot.ca.gov/hq/planning/aeronaut/documents/InvestigatingSafetyImpactsOfEnergyTechnologiesOnAirportsAndAviation.pdf



- **Technical Guidance for Evaluating Selected Solar Technologies on Airports**



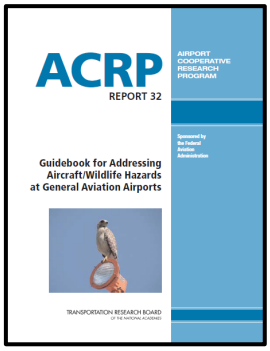
By: Harris, Miller, Miller & Hanson Inc. for Federal Aviation Administration, Office of Airports, Office of Airport Planning and Programming, Airport Planning and Environmental Division (November 2010)
Summary: "Airport interest in solar energy is growing rapidly as a way to reduce airport operating costs and to demonstrate a commitment to sustainable development. In response, the Federal Aviation Administration (FAA) has prepared Technical Guidance for Evaluating Selected Solar Technologies on Airports to meet the regulatory and informational needs of

the FAA Airports organization and airport sponsors. For airports with favorable solar access and economics, this report provides a checklist of FAA procedures to ensure that proposed photovoltaic or solar thermal hot water systems are safe and pose no risk to pilots, air traffic controllers, or airport operations. Case studies of operating airport solar facilities are provided, including Denver International, Fresno Yosemite International, and Albuquerque International Sunport."

- Available through this link: http://www.faa.gov/airports/environmental/policy_guidance/media/airport_solar_guide_print.pdf

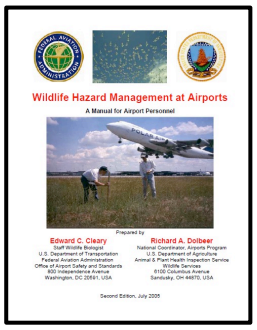
Bird/Wildlife Aircraft Strike Hazard (BASH) Related Reports

- **Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports,** Airport Cooperative Research Program (ACRP) Report 32 (2010)
  - By: Edward C. Cleary, WASHMAN LLC and Archie Dickey, BIOZONE INC., sponsored by the Federal Aviation Administration
  - Summary: "ACRP Report 32: Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports presents the different wildlife challenges that airports may face and the techniques and strategies for addressing them. The Guidebook discusses for airport mangers and other airport personnel at general aviation airports with limited resources (1) the different species that can be found at airports and specific information that will be helpful in identifying and controlling them, (2) the various wildlife attractants and best management practices that can be employed by airport operators to minimize wildlife activity at and around airports, (3) wildlife control strategies and techniques that are most appropriate at general aviation airports, and (4) how to develop a wildlife control program."



  - Available through this link: http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_032.pdf

- **Wildlife Hazard Management at Airports: A Manual for Airport Personnel**
  - By Edward C. Cleary, Staff Wildlife Biologist, U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards and Richard A. Dolbeer National Coordinator, Airports Program U.S. Department of Agriculture, Animal & Plant Health Inspection Service Wildlife Services (2d Edition July 2005)



    Summary: "This manual contains a compilation of information to assist airport personnel in conducting Wildlife Hazard Assessments and in the development, implementation, and evaluation of Wildlife Hazard Management Plans. This manual includes specific information on the nature of wildlife strikes, legal authority, government agency roles and responsibilities, regulations, wildlife management techniques, Wildlife

Hazard Assessments, Wildlife Hazard Management Plans, and sources of help and information. It is emphasized that this manual provides only a starting point for addressing wildlife hazard issues on airports. Wildlife management is a complex, evolving, and public-sensitive discipline, and ecological conditions vary widely across the USA. Therefore, the assessment of wildlife hazards, the development of Wildlife Hazard Management Plans, and the implementation of management actions by airport personnel must be under consultation by qualified wildlife biologists trained in wildlife damage control."

- Available through this link: http://www.faa.gov/airports/airport_safety/wildlife/resources/media/2005_FAA_Manual_complete.pdf

Planning Information

- **Avigation easements -** An agreement that grants the right to fly airplanes over property, even if the practice causes damage, inconvenience, or loss of property value. Such an agreement usually restricts the property owner from building or growing anything over a specified height.
- **DoD related Planning Tools**
  - Air Installation Compatibility Use Zone Program (AICUZ). AICUZ is a Department of Defense (DOD) discretionary program designed to promote compatible land use around military airfields. The military services maintain an AICUZ program in an effort to protect the operational integrity of their flying mission. For more information see: http://www.dtic.mil/whs/directives/corres/pdf/416557p.pdf
  - Joint Land Use Study (JLUS). It is DoD policy to work toward achieving compatibility between military installations and neighboring civilian communities by a joint compatible land use planning and control process conducted by the local community in cooperation with the local military installation. For more information see: http://www.dtic.mil/whs/directives/corres/pdf/303003p.pdf
  - State laws - Many states have enacted laws to provide for compatible land use around military airports. A best practice in this area is the state of Arizona's statutes that provide a compatible land use matrix with guidance on over 40 different types of development near a military airport, require political subdivisions to provide planning information to the military for review and consideration and require noise attenuation of homes and disclosure of the military's activities (airport, high noise and accident potential zone, restricted airspace, and military training routes) to the potential home buyer
- **FAA Airport Noise Compatibility Planning Toolkit**
  - The Airport Noise Compatibility Planning Toolkit implements the FAA Land Use Planning Initiative's (LUPI) short-term recommendations to develop a

land use planning information package for FAA regions. This toolkit is designed to aid regional offices in assisting state and local officials and interested organizations for airport noise compatibility planning around the nation's airports.
    - Available through this link: http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/planning_toolkit/
- **FAA 14 CFR Part 77: Safe, Efficient Use and Preservation of the Navigable Airspace**
    - Summary: "This action amends the regulations governing objects that may affect the navigable airspace. These rules have not been revised in several decades, and the FAA has determined it is necessary to update the regulations, incorporate case law and legislative action, and simplify the rule language. These changes will improve safety and promote the efficient use of the National Airspace System.
    - Available through this link: http://www.gpo.gov/fdsys/pkg/FR-2010-07-21/pdf/2010-17767.pdf and for more information: http://www.faa.gov/airports/central/engineering/part77/#NewRule
- **FAA 14 CFR Part 150: Airport Noise Compatibility Planning**
    - Primary Federal regulation guiding and controlling planning for aviation noise compatibility on and around airports.
    - http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title14/14cfr150_main_02.tpl
- **National Transportation Safety Board Safety Recommendation A-13-21**, which can be found at this link: http://www.ntsb.gov/safety/safety-recs/RecLetters/A-13-021.pdf
- **Memorandums of Understandings** – when airports are near each other, an MOU can help to memorialize operating procedures and provide for communication
- **WRP Web Mapping Application**- The Western Regional Partnership (WRP) developed the Web Mapping Application to assist Partner planning efforts in the region. The application displays spatially referenced data using a common platform and publicly available data. To take full advantage of the mapping tool, WRP partners need only an internet connection, web browser, and WRPinfo.org user account. The mapping application references GIS data contained in the WRP regional GIS database, which includes datasets from WRP state, federal and non-governmental partners. The dataset also includes aviation-related GIS data from the National Geospatial-Intelligence Agency's (NGA) Digital Aeronautical Flight Information File (representing special use airspace and military training routes) and Digital Vertical Obstruction File (DVOF). Please see: www.wrpinfo.org

Tools/Recommendations to address MET Tower safety issues

- **FAA Advisory Circular AC 70/7460 1K "Obstruction Marking and Lighting**", which can be found at this link: http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC%2070%207460-1K.pdf
- **National Transportation Safety Board Safety Recommendation A-13-21**, which can be found at this link: http://www.ntsb.gov/safety/safety-recs/RecLetters/A-13-021.pdf
- **MET Tower Marking to assist with safety issues based on National Agricultural Aviation Association recommendations:**
    - Towers both free-standing and guy-wired should be marked with aviation orange / white stripes with strobe lighting.
    - If guy-wired they should be equipped with:
        - Four high-visibility cable balls on the outer guy wires (one on each at 37m [approximately half way up the tower] with a diameter of 53 cm).
        - 16 foot high-visibility sleeves, one per each anchor on each of the outer guy wires.
    - Marking mechanisms must be maintained frequently to ensure their visibility and attachment to the wires.
    - Obstacles' exact locations should be logged in available databases that exist providing the precise geographical coordinates of the obstacles.
- ADS-B Out-like transponders should be equipped on all towers. For more information please see: http://www.agaviation.org/Files/policyinitiatives/AdvocacyPapers/Tower Issue Paper FINAL.pdf
- **MET Tower Notification ordinances and laws**
    - Many states (among them among them Kansas, North Dakota, Idaho, Missouri, California, Montana, Nebraska, Oklahoma, South Dakota, Colorado, Washington, and Wyoming) and cities throughout the nation have identified the aviation safety issues of placement of MET towers without notification and disclosure and have taken proactive steps to address in state statute or city code. Within the WRP region, the only state that has passed legislation is California. Some examples of best practices in this area are:
        - Site Plans must be submitted for MET towers and a building permit must be obtained which is limited to 3 years but allows for extensions, no specific setback or height limits (other than FAA compliance).
        - MET towers require a Conditional Use Permit
        - MET Reporting System which states that every person owning or leasing a structure that meets certain criteria shall report the state Department of Transportation regarding the structure.
        - MET towers 50 feet or higher must be more visible and are required to be painted, have guy wire sleeves and balls.

Helpful Aviation Websites

- Interagency Airspace Coordination (http://www.airspacecoordination.org/) - This safety oriented website is dedicated to airspace issues involving USDA-Forest Service and the Bureau of Land Management. Airspace issues are constantly changing as a result of our current national situation. Temporary Flight Restrictions are not only for wildfire or disaster related situations but now encompass homeland security issues and public safety.
- AOPA Airport Support Network AOPA has collected data on states that have published **airport economic impact studies:** http://www.aopa.org/asn/stateeconomicreports/
- Background information on **general aviation** by AOPA: http://www.aopa.org/whatsnew/stats/statistics.html
- **FAA Information**
    - Air Traffic 101 http://www.faa.gov/air_traffic/briefing/
    - Airport Planning and Capacity: http://www.faa.gov/airports/planning_capacity/
    - Background information on Commercial, Cargo Service, Reliever and General Aviation Airports: http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/
    - Information on pilots, airports: http://www.faa.gov/aircraft/gen_av/
    - National Airspace System http://www.faa.gov/air_traffic/nas/
    - Next Gen http://www.faa.gov/nextgen/
    - Region Information
        - (CA, NV, AZ) Western-Pacific Region Airports Division http://www.faa.gov/airports/western_pacific/
        - (UT) Northwest Mountain Region http://www.faa.gov/airports/northwest_mountain/
        - (NM) Southwest Region http://www.faa.gov/airports/southwest/
    - Regulations and Policies http://www.faa.gov/regulations_policies/
    - Safety website - www.faasafety.gov
- **National Agricultural Aviation Association** (NAAA) -Ag pilots use aircraft to aid farmers in the production of food, fiber and bio-fuel, while protecting forestry and controlling health-threatening pests: www.agaviation.org
- **State Aviation Journal** -The State Aviation Journal is an electronic publication committed to telling that story as it was then and as it continues today, reporting on the positive contributions of state aviation in the fifty states and territories; stories of life, of adventure, of struggles and of a strong commitment to preserving both our heritage and our future: http://www.stateaviationjournal.com/
- **State Information:**
    - Arizona Department of Transportation Multimodal Planning Aeronautics Group's mission is to "encourage and advance the safe and orderly

development of aviation in the State." Website: http://www.azdot.gov/planning/airportdevelopment

- California Department of Transportation's Division of Aeronautics' goal is to "is to foster and promote the development of a safe, efficient, dependable, and environmentally compatible air transportation system." Website: http://www.dot.ca.gov/hq/planning/aeronaut/
- Nevada Department of Transportation Planning Division, the Aviation Planning Section is responsible for "helping ensure that Nevada's general aviation public and private use airports meet applicable safety requirements and provide maximum utility to their communities and the flying public. " Website: http://www.nevadadot.com/About_NDOT/NDOT_Divisions/Planning/Aviation/Aviation.aspx
- New Mexico Department of Transportation Aviation Division was created to "cooperate with all public and private agencies and organizations, state, local and federal, to encourage and advance general aviation in New Mexico." Website: http://dot.state.nm.us/content/nmdot/en/Aviation.html
- Utah Department of Transportation (UDOT) Division of Aeronautics is responsible for "all UDOT transportation issues involving aviation. It licenses all public-use airports in the state and works closely with airport sponsors and managers to ensure that each functions as an integral part of the statewide system of airports." Website: http://www.udot.utah.gov/main/f?p=100:pg:0::::V,T:,190

Background/Airspace Definitional information

FAA Authority

Pursuant to Title 49 United States Code (U.S.C.), the United States Government has exclusive sovereignty over the airspace of the United States, its territories, and possessions. That sovereignty shall be vested in the Administrator of the Federal Aviation Administration (FAA), who shall develop plans and policy for the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of that airspace. The Administrator may modify or revoke an assignment when required in the public interest; shall prescribe air traffic regulations on the flight of aircraft (including regulations on safe altitudes) for navigating, protecting, and identifying aircraft; protecting individuals and property on the ground; using the navigable airspace efficiently; preventing collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects. The FAA Administrator shall also have the authority to establish security provisions that will encourage and allow maximum use of the navigable airspace by civil aircraft consistent with national security. The Administrator, in consultation with the Secretary of Defense, shall establish areas in the airspace that the Administrator decides are necessary in the interest of national defense; and by regulation or order, restrict or prohibit flight of civil aircraft that the Administrator cannot identify, locate, and control with available facilities in those areas.

National Airspace System (NAS)

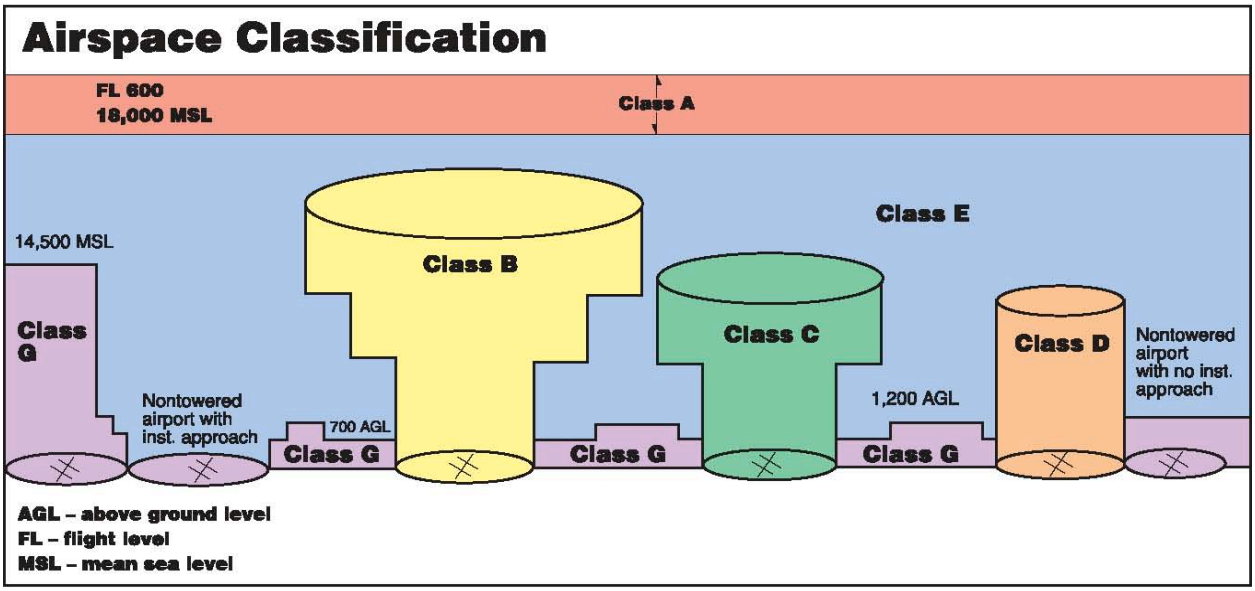
Pursuant to Title 49 United States Code (U.S.C.), the United States Government has exclusive sovereignty over the airspace of the United States, its territories, and possessions. Congress provided that the Federal Aviation Administration (FAA) is exclusively responsible for safely and efficiently managing the National Airspace System (NAS). The FAA develops plans and policies for the use of the navigable airspace and assigns by regulation or order the use of the airspace in a manner that ensures the safety of aircraft and while promoting efficient use of that airspace.

Types of Airspace

Within the (NAS), there are generally two categories of airspace: **regulatory** and **nonregulatory**. Within these two categories, there are four types of airspace: controlled, uncontrolled, special use and other airspace. **Controlled airspace** applies to the majority of the airspace comprising the NAS. This same airspace normally has specific defined dimensions which are subject to certain FAA regulatory requirements and within which air traffic control service is provided to Instrument Flight Rules (IFR) and, to some extent, Visual Flight Rules (VFR) flights. Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace areas.

Types of Controlled Airspace Excerpt from June 25, 2015 FAA report titled, "Aeronautical Information Manual" available: www.faa.gov/air_traffic/publications/media/aim.pdf	
Class A	Generally, that airspace from 18,000 feet mean sea level (MSL) up to and including flight level (FL) 600, including the airspace overlying the waters within 12 nautical miles (NM) of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under Instrument Flight Rules (IFR).
Class B	Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all VFR aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."
Class C	Generally that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 NM radius, an outer circle with a 10 NM radius that extends from no lower than 1,200 feet up to 4,000 feet above the airport elevation. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace.
Class D	Generally that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures maybe Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the control tower prior to entering the airspace and thereafter maintain those communications while in the airspace. Separation services are provided to all aircraft on runways within Class D.
Class E	Generally if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. The types of Class E airspace areas are: Surface Area Designated for an Airport. When designated as a surface area for an airport, the airspace will be configured to contain all instrument procedures. There are Class E airspace areas that serve as extensions to Class B, Class C, Class D, and Class E surface areas designated for an airport. Such airspace provides controlled airspace to contain standard instrument approach procedures without imposing a communications requirement on pilots operating under VFR.

Airspace Classification from the Instrument Flying Handbook, an FAA Publication, accessible through this link:
http://www.americanflyers.net/aviationlibrary/instrument_flying_handbook/chapter_8.htm



Airspace	Class A	Class B	Class C	Class D	Class E	Class G
Entry Requirements	ATC clearance	ATC clearance	Prior two-way communications	Prior two-way communications	Prior two-way communications*	Prior two-way communications*
Minimum Pilot Qualifications	Instrument Rating	Private or Student certification. Local restrictions apply	Student certificate	Student certificate	Student certificate	Student certificate
Two-Way Radio Communications	Yes	Yes	Yes	Yes	Yes, under IFR flight plan*	Yes*
Special VFR Allowed	No	Yes	Yes	Yes	Yes	N/A
VFR Visibility Minimum	N/A	3 statute miles	3 statute miles	3 statute miles	3 statute miles**	1 statute mile†
VFR Minimum Distance from Clouds	N/A	Clear of clouds	500' below, 1,000' above, 2,000' horizontal	500' below, 1,000' above, 2,000' horizontal	500' below,** 1,000' above, 2,000' horizontal	Clear of clouds†
VFR Aircraft Separation	N/A	All	IFR aircraft	Runway Operations	None	None
Traffic Advisories	Yes	Yes	Yes	Workload permitting	Workload permitting	Workload permitting
Airport Application	N/A	• Radar • Instrument Approaches • Weather • Control Tower • High Density	• Radar • Instrument Approaches • Weather • Control Tower	• Instrument Approaches • Weather • Control Tower	• Instrument Approaches • Weather	• Control Tower

*Only if a temporary tower or control tower is present is the exception.
**Only true below 10,000 feet.
†Only true during day at or below 1,200 feet AGL (see 14 CFR part 91).

Uncontrolled airspace describes airspace where air traffic control normally has neither the authority nor responsibility for exercising control over air traffic.

Special Use Airspace (SUA) is a distinct designation to segregate aircraft from aviation operations in order to avoid hazards, and except for firing area, they are noted on aeronautical charts.

Types of Special Use Airspace Excerpt from June 25, 2015 FAA report titled, "Aeronautical Information Manual" available: www.faa.gov/air_traffic/publications/media/aim.pdfhttp	
Military Operating Areas (MOA)	MOAs consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by Air Traffic Control (ATC). Otherwise, ATC will reroute or restrict nonparticipating IFR traffic. Examples of activities conducted in MOAs include, but are not limited to: air combat tactics, air intercepts, aerobatics, formation training, and low−altitude tactics.
Prohibited airspace	Prohibited areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts. An example of a prohibited area is the area around the White House.
Warning Areas	A warning area is airspace of defined dimensions, extending from three nautical miles outward from the coast of the U.S., that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both. Warning areas contain similar flight activities as restricted except they are located offshore.
Alert Areas	Alert areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with Code of Federal Regulations (CFRs), without waiver, and pilots of participating aircraft as well as pilots transiting the area must be equally responsible for collision avoidance.
Restricted areas	Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants.

Controlled Firing Areas (CFA)	CFAs contain activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path.
National Security Areas	National Security Areas consist of airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions will be issued by System Operations, System Operations Airspace and AIM Office, Airspace and Rules, and disseminated via NOTAM. Inquiries about NSAs should be directed to Airspace and Rules.

Other Airspace Areas Excerpt from June 25, 2015 FAA report titled, "Aeronautical Information Manual" available: www.faa.gov/air_traffic/publications/media/aim.pdfhttp	
Military Training Route (MTR)	National security depends largely on the deterrent effect of our airborne military forces. To be proficient, the military services must train in a wide range of airborne tactics. One phase of this training involves "low level" combat tactics. The required maneuvers and high speeds are such that they may occasionally make the see-and-avoid aspect of VFR flight more difficult without increased vigilance in areas containing such operations. In an effort to ensure the greatest practical level of safety for all flight operations, the Military Training Route (MTR) program was conceived. The MTR program is a joint venture by the FAA and the Department of Defense (DOD). MTRs are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet AGL are developed to be flown, to the maximum extent possible, under IFR. The routes at 1,500 feet AGL and below are generally developed to be flown under VFR.
Temporary Flight Restrictions	FAA may impose temporary flight restrictions. The purpose for establishing a temporary flight restrictions area is to: 1. Protect persons and property in the air or on the surface from an existing or imminent hazard associated with an incident on the surface when the presence of low flying aircraft would magnify, alter, spread, or compound that hazard 2. Provide a safe environment for the operation of disaster relief aircraft 3. Prevent an unsafe congestion of sightseeing aircraft above an incident or event which may generate a high degree of public interest

	4. Protect declared national disasters for humanitarian reasons in the State of Hawaii 5. Protect the President, Vice President, or other public figures 6. Provide a safe environment for space agency operations

DoD Aviation

As a general rule, most aircraft-related military operations are performed in strictly defined airspace, designed to accomplish any of several objectives. Typically, three types of airspace are employed: Restricted Areas (RAs), Military Operations Areas (MOAs), and Military Training Routes (MTRs).

- RAs differ from MOAs in that they have more definitive constraints. They were established to denote the existence of unusual, or invisible, hazards to aircraft such as artillery firing, aerial gunnery, or missile engagements. For IFR traffic, air traffic control may route an aircraft through an active MOA if they can do so safely. VFR traffic is not restricted from entering an active MOA (although it is not recommended).
- A MOA is an area of airspace designated for military training activities. MOAs were established to contain certain military activities such as air combat maneuvers, intercepts, acrobatics, etc. Civilian VFR flights are allowed within a MOA even when the area is in use by the military. Air traffic control will separate IFR traffic from military activity. A clearance is not required for VFR operations.
- MTRs are designed for low level, high-speed terrain following training missions. Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity. For example, route segments may be defined for descent, climbout, and mountainous terrain.

There are basically three types of air events normally conducted by the military in such airspaces: test and evaluation (T&E); training; and, operations. Flight testing ensures an aircraft or related system is capable of meeting its design objectives. T&E events are divided into two fields; Developmental testing (DT) and Operational testing (OT). Developmental flight testing is used to validate or investigate a new concept or method with the goal of increasing the developers' knowledge. Operational tests on the other hand are designed to address critical issues regarding an aviation system's preparedness to operate in its intended environment. This includes validating how safe, effective, reliable, maintainable, compatible and logistically supportable a new system will be. Aviation training typically requires an area for developing and practicing aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support skills. Contrary to testing, training focuses on the system operator and not the system itself. Aircraft operations basically encompass all other routine type aviation operations such as routine patrols, search and rescue, and logistical support.

Both test and training events require supporting instrumentation. As a rule of thumb, T&E events are system-under-test focused; precisely structured and conducted; and require significant instrumentation capable of precisely measuring and monitoring specific system performance parameters. Training instrumentation is generally less focused on precise measurements and more on how well the system operators either individually or as a unit were able to effectively employ their aviation asset in meeting an operational assignment. As a result, test missions tend to be limited in number while training missions generally involve significantly more air time, aircraft, and munitions expenditures.

Because aviation operations may be conducted virtually anywhere in the world, the airspace used by the military for test and training not only requires a significant amount for its sheer volume, it must also include geographical features that typically can be expected to be encountered by such units. Thus there is a need to have airspace that is over water, deserts, mountains, etc. and may even include areas that replicate certain urban features. It is also important that as much as possible the airspace be in reasonably close proximity to a military aviation capable installation.

The Department of Defense, upon request, may provide an aviation supporting role to civilian authorities and disaster relief. Certain criteria must be met for DoD to be involved in an emergency response.

Environmental Impacts and Cultural Resources

The National Environmental Policy Act of 1969 (NEPA) recognizes that Federal Government's actions may cause significant environmental effects. The range of these actions include issuing regulations, providing permits for private actions, funding private actions, making federal land management decisions, constructing publicly-owned facilities, and many other types of actions. NEPA requires federal agencies to consider environmental effects that include impacts on social, cultural, and economic resources, as well as natural resources. The preparation of a detailed statement for proposed actions must include the environmental impacts of the proposed action, alternatives to the proposed action, and any adverse environmental impacts which cannot be avoided should the proposal be implemented. The open public NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment (40 CFR 1500.1(c)). The success of a NEPA process heavily depends on whether an agency has systematically reached out to those who will be most affected by a proposal, gathered information and ideas from them and responded to the input by modifying or adding alternatives.

The analysis process may include consultation with other federal and state agencies and Indian Tribes to ensure that all requirements are addressed for cultural, historical, endangered species and others that may be impacted by the actions. Not all new proposed actions will require new environmental analysis. In some instances an existing

environmental analysis document may be relied upon partially or in its entirety where new NEPA analysis will not be necessary (516 DM 11.6) thus avoiding redundancy, and providing a coherent and logical record of the analytical and decision-making process. Where federal agencies have determined that certain actions do not have a significant effect on the quality of human environment both individually or cumulatively, categorical exclusions may be applied. In these situations, neither an EA nor an EIS is required (40 CFR 1508.4). The decision record on an environmental analysis may impose requirements for mitigation and related monitoring and enforcement activities. Monitoring activities which are adopted in a decision record must be implemented as specified.

Although no ground disturbance is associated with changes in airspace management and use (except in rare circumstances), such changes have the potential to affect certain types of cultural resources, including places eligible for inclusion on the National Register for reasons other than their scientific value/information potential. For example, lowering the flight altitude has the potential to introduce additional auditory or visual intrusions which adversely affect the qualities that make certain types of properties significant. Because some historic properties, especially traditional cultural places, may be identified only through consultation with Tribes, and because such places may be adversely affected by aircraft overflight, it is critical that tribal consultation be a part of ongoing sustainability efforts. Likewise, consultation with tribes regarding potential impacts of overflights on religious and ceremonial activities, and on sacred places, is important.

Planners, airspace managers, and decision makers should be familiar with applicable laws, regulations, Executive Orders and Memoranda, and agency policies regarding the need for ongoing government-to-government consultation with Tribes, as well as informal information exchanges. These efforts help avoid conflict and confrontation, and the information shared will enable planners to minimize cultural resource issues related to specific activities. Specific changes in airspace management and use - for example realigning a Military Training Route - may move air traffic away from a heavily populated area but closer to a Tribal ceremonial location. Consultation early in the planning process, when development of alternatives is most practical, will help avoid the adverse effects that would result from such an action.