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Take the free CareerExplorer assessment and unlock a detailed break down of your match with over 800+ careers. Take the free test Air traffic controllers coordinate the movement of aircraft, including within the vicinity of airports and between altitude sectors and control centers, so that they maintain safe distances. Duties Air traffic controllers typically do the following: Monitor and direct the movement of aircraft on the ground and in the air Control all ground traffic at airport runways and taxiways Issue takeoff and landing instructions to pilots Transfer control of departing flights to other traffic control centers and accept control of arriving flights Inform pilots about weather, runway closures, and other critical information Alert airport response staff in the event of an aircraft emergency Air traffic controllers' primary concern is safety, but they also must direct aircraft efficiently to minimize delays. They manage the flow of aircraft into and out of the airport airspace, guide pilots during takeoff and landing, and monitor aircraft as they travel through the skies. Air traffic controllers use radio equipment to communicate with pilots. They also use radar, computers, and other visual references to monitor and direct aircraft movement in the skies and on airport grounds. Controllers usually manage multiple aircraft at the same time. For example, a controller might direct one aircraft on its landing approach while providing another aircraft with weather information. The following are examples of types of air traffic controllers: Tower controllers direct the movement of aircraft and other vehicles, such as snowplows, on runways and taxiways. They check flight plans, give pilots clearance for takeoff or landing, and direct the flow of aircraft and ground traffic in their area of responsibility. Most observe from control towers, managing traffic from the airport to a radius of 3 to 30 miles out. Approach and departure controllers ensure that aircraft traveling within an airport's airspace maintain minimum separation for safety. These controllers give pilots clearances to enter controlled airspace and hand off control of aircraft to en route controllers. They also inform pilots about weather conditions and other critical notices. Terminal approach and departure controllers work in buildings known as Terminal Radar Approach Control Centers (TRACONs). They assist an aircraft until it reaches the edge of a facility's airspace, usually about 20 to 50 miles from the airport and up to about 17,000 feet in the air. En route controllers monitor aircraft that leave an airport's airspace. They work at en route traffic control centers located throughout the country, which typically are not located at airports. Each center is assigned an airspace based on the geography and air traffic in the area in which it is located. As an aircraft approaches and flies through a center's airspace, en route controllers guide it along its route. They may adjust the flight path for safety reasons, such as to avoid collision with another aircraft. En route controllers direct aircraft for the bulk of the flight before handing off oversight to terminal approach controllers. Some air traffic controllers work at the Air Traffic Control Systems Command Center, where they monitor traffic within the entire national airspace. When they identify a bottleneck, they provide instructions to other controllers to help prevent traffic jams. Their objective is to keep traffic levels manageable for the airports and for en route controllers. Air traffic controllers held about 22,900 jobs in 2021. The largest employers of air traffic controllers were as follows: Federal government 93% Support activities for air transportation 3 Most controllers work for the Federal Aviation Administration (FAA). Most air traffic controllers work in control towers, approach control facilities, or en route centers. Many tower controllers and approach and departure controllers work near large airports. En route controllers work in secure office buildings across the country, which typically are not located at airports. Most controllers work in semidark rooms. The aircraft they control appear as points of light moving across their radar screens, and a well-lit room would make it difficult to see the screens properly. Air traffic controllers must remain focused and react quickly to conditions that change frequently. Being responsible for the safety of aircraft and their passengers may be stressful and exhausting. To prevent burnout, the FAA requires controllers to retire at age 56. Work Schedules Most air traffic controllers work full time. The FAA regulates the hours that an air traffic controller may work. Controllers may not work more than 10 straight hours during a shift, which includes required breaks, and must have 9 hours of rest before their next shift. Major airports may operate control towers on a 24-hour basis. Controllers who work at these facilities may work day, evening, or night shifts that include weekends and holidays. Small airports or those that are less busy may have towers that do not operate around the clock. Controllers at these facilities may have standard work schedules.There are several different paths to becoming an air traffic controller. Candidates typically need an associate's or bachelor's degree through a Federal Aviation Administration (FAA)-approved Air Traffic Collegiate Training Initiative (AT-CTI) program, several years of progressively responsible work experience, or a combination of education and experience. In addition, prospective air traffic controllers must be U.S. citizens and must pass a medical evaluation, background check, and FAA preemployment tests, including the Air Traffic Controller Specialists Skills Assessment Battery (ATSA). They also must complete a training course at the FAA Academy and apply before the FAA's age cutoff. Once hired, controllers typically complete on-the-job training that lasts more than 12 months. They also must pass a physical exam each year, a job performance exam twice a year, and periodic drug screenings. Education Air traffic controllers typically need an associate's or a bachelor's degree. To qualify with an associate's degree, candidates must complete their studies in an AT-CTI program. A bachelor's degree may be in any field, including transportation, business, or engineering. The FAA sets guidelines for schools that offer the AT-CTI program. AT-CTI schools offer 2- or 4-year degrees that are designed to prepare students for a career in air traffic control. The curriculum is not standardized, but courses focus on subjects that are fundamental to aviation, including airspace, clearances, chart reading, and federal regulations. Training Most newly hired air traffic controllers are trained at the FAA Academy in Oklahoma City. The length of training varies with the candidate's background. Candidates must apply before the FAA's age cutoff. After graduating from the Academy, trainees are assigned to an air traffic control facility as developmental controllers until they complete requirements for becoming a certified air traffic controller. Developmental controllers begin their careers by supplying pilots with basic flight data and airport information. They then may advance to positions within the control room that have more responsibility. With additional training, controllers may switch from one area of specialization to another. For example, a controller may complete training to transfer from working in an en route center to an airport tower. Other Experience Air traffic controllers sometimes qualify through work experience instead of a degree. Candidates either need up to 3 years of progressively responsible generalized work experience that demonstrates the potential for learning and performing air traffic control work or must have specialized work experience in a military or civilian air traffic control facility. Air traffic controllers who learn their skills in the military are eligible to become civilian air traffic controllers even if their age exceeds the FAA cutoff for applicants. Licenses, Certifications, and Registrations All air traffic controllers must hold an Air Traffic Control Tower Operator Certificate or be appropriately qualified and supervised as stated in Title 14 of the Code of Federal Regulations, Part 65.Personality and InterestsAir traffic controllers typically have an interest in the Persuading and Organizing interest areas, according to the Holland Code framework. The Persuading interest area indicates a focus on influencing, motivating, and selling to other people. The Organizing interest area indicates a focus on working with information and processes to keep things arranged in orderly systems. If you are not sure whether you have a Persuading or Organizing interest which might fit with a career as an air traffic controller, you can take a career test to measure your interests. Air traffic controllers should also possess the following specific qualities: Communication skills. Air traffic controllers must be able to give clear, concise instructions, listen carefully to pilot's requests, and respond by speaking clearly. Concentration skills. Controllers must be able to concentrate in a room where multiple conversations occur at once. For example, in a large airport tower, several controllers may be speaking with several pilots at the same time. Decision-making skills. Controllers must make quick decisions. For example, when a pilot requests a change of altitude or heading to avoid poor weather, the controller must respond quickly, so that the plane can operate safely. Math skills. Controllers must be able to do arithmetic accurately and quickly. They often need to compute speed, time, and distance problems, and recommend heading and altitude changes. Organizational skills. Controllers must be able to coordinate the actions of multiple flights. Controllers need to be able to prioritize tasks, as they may be required to guide several pilots at the same time. Problem-solving skills. Controllers must be able to understand complex situations, such as the impact of changing weather patterns on a plane's flight path. Controllers must be able to review important information and provide pilots with an appropriate solution.The median annual wage for air traffic controllers was $129,750 in May 2021. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $71,880, and the highest 10 percent earned more than $185,990. In May 2021, the median annual wages for air traffic controllers in the top industries in which they worked were as follows: Federal government $137,380 Support activities for air transportation 79,580 The salaries for development controllers increase as they complete successive levels of training. According to the Federal Aviation Administration (FAA), the salaries for more advanced controllers who have completed on-the-job training varies with the location of the facility, the complexity of the flight paths, and other factors. A full explanation of the pay ranges for air traffic controllers can be found on the FAA Pay & Benefits page. Most air traffic controllers work full time. The FAA regulates the hours that an air traffic controller may work. Controllers may not work more than 10 straight hours during a shift, which includes required breaks, and must have 9 hours of rest before their next shift. Major airports may operate control towers on a 24-hour basis. Controllers who work at these facilities may work day, evening, or night shifts that include weekends and holiday. Small airports or those that are less busy may have towers that do not operate around the clock. Controllers at these facilities may have standard work schedules.Employment of air traffic controllers is projected to show little or no change from 2021 to 2031. Despite limited employment growth, about 2,400 openings for air traffic controllers are projected each year, on average, over the decade. Most of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire. Employment Although air traffic is projected to increase in the coming years, the satellite-based Next Generation Air Transportation System (NextGen) is expected to allow individual controllers to handle more air traffic. As a result, the demand for additional air traffic controllers should be somewhat limited over the projections decade. Where does this information come from? The career information above is taken from the Bureau of Labor Statistics Occupational Outlook Handbook. This excellent resource for occupational data is published by the U.S. Department of Labor every two years. Truity periodically updates our site with information from the BLS database. I would like to cite this page for a report. Who is the author? There is no published author for this page. Please use citation guidelines for webpages without an author available. I think I have found an error or inaccurate information on this page. Who should I contact? This information is taken directly from the Occupational Outlook Handbook published by the US Bureau of Labor Statistics. Truity does not editorialize the information, including changing information that our readers believe is inaccurate, because we consider the BLS to be the authority on occupational information. However, if you would like to correct a typo or other technical error, you can reach us at help@truity.com. I am not sure if this career is right for me. How can I decide? There are many excellent tools available that will allow you to measure your interests, profile your personality, and match these traits with appropriate careers. On this site, you can take the Career Personality Profiler assessment, the Holland Code assessment, or the Photo Career Quiz. Marines Air Traffic Controller (MOS 7257) assist in the control of air traffic and vehicles within designated areas. Air Traffic Controllers are the individuals who are in charge of ensuring all landing, taking off and traffic movement inside an airport are performed safely and smoothly. This position is part of Occupational Field 72, Aviation Command and Control Operations. Qualifications and Training Entering into this Marine MOS will require a secret security clearance eligibility or temporary SCI (Sensitive Compartmented Information). At MCAS or MCAF, individuals must have control tower position qualifications on ground control and tower flight data or must possess radar position qualifications on radar final control and radar flight data. This MOS requires individuals to meet the qualifications and prerequisites in MOS 7251, Air Traffic Controller-Trainee. These requirements include stringent eye testing and visual acuity, a minimum ASVAB General Technical score of 110 and meeting physical/medical evaluation specifications. They must complete the Air Traffic Control Basic Course and Marine Air Traffic Control and Landing System Operator Course. Those wishing to move into this MOS must be a Corporal or below with less than 5 years time in service. Certain MOS proficiency must be met for lateral moves. Related Article –Air Force Combat Controller CCT (1C2X1): Career Details What does a Marines Air Traffic Controller do? Marine Air Traffic Controller monitors ongoing operations. Image: marines.mil Air Traffic Controllers are individuals who go through the Air Traffic Control Training program and are deemed skilled enough to advance into the Air Traffic Controller position. Air Traffic Controllers perform duties related to the control of air traffic and vehicles. They control the movement of traffic within airport control zones, expeditionary airfields and remote area landing sites. Air Traffic Controllers can work within control towers, radar facilities and expeditionary air traffic control equipment. This position relies heavily on trust and communication. You have to trust those around you are performing their job accurately. Individuals must communicate effectively with those around them and those in communication via radio to ensure the safety of the people on the aircraft and on the ground. Air Traffic Controllers in towers work in teams, with each team member monitoring different areas. Areas include coordinator, ground, local and supervisor. The Controllers work with all components from the aircraft in the air to the personnel on the ground, to ensure all parts work smoothly together. In this role, Marines will be listening to multiple frequencies at once and are required to be aware of the information on each frequency, plus additional communication they are relaying. In addition to listening to different frequencies, Marines will be monitoring various screens with information on incoming/outgoing aircraft. They perform their job with an emphasis on safety and will issue safety alerts when needed. The Air Traffic Controllers also issue traffic alerts. They ensure all aircraft land and take off safely and coordinate emergency response in the event of an issue. Air Traffic Controllers who work in radar operations must be familiar with all radar equipment and radar operation procedures. When in deployed or field environments, they set up runways or landing zones for helicopters who may need fuel or to drop off troops. To advance skills, Air Traffic Controllers can take the Military Airspace Management Course, MAJIC Course, Terminal Instrument Procedures Course and/or JAIC2C Course. View the Marine Corps video below for more job functions of an Air Traffic Controller. What does an Air Traffic Controller get paid? Air Traffic Controllers are paid based on rank and time in service. This position is stated as open to Staff Sergeant to Private, but individuals must be at Corporal or 12 months after graduation from AC (A1) to enter into MOS 7257. At Corporal level individuals in the Marine Corps can expect to make around $2,100 in base pay a month. It is possible to enter at a lower rank if a Marine completes qualifications and at those levels they can expect to make anywhere from $1,800-$2,000 a month in base pay. According to employee input information on Glassdoor, the average salary for a Marine Corps Air Traffic Controller was just above $45,000 a year. The reported salaries range from around $30,000 to a high of $58,000. Marine Corps base pay can be found in the table below. InsigniaPay GradeRankAbbreviation2023 Minimum Monthly Pay E-1 +4 monthsPrivatePvt$1,917.60 E-2Private First ClassPFC$2,149.20 E-3Lance CorporalLCpl$2,259.90 E-4CorporalCpl$2,503.50 E-5SergeantSgt$2,730.30 E-6Staff SergeantSSgt$2,980.50 E-7Gunnery SergeantGySgt$3,3445.80 E-8Master SergeantMSgt$4,957.20 E-8First Sergeant1stSgt$4,957.20 E-9Master Gunnery SergeantMGySgt$6,055.50 E-9Sergeant MajorSgtMaj$6,055.50 E-9Sergeant Major Of The Marine CorpsSgtMaj$6,055.50 Benefits The Military provides benefits that most civilian jobs cannot compare to. Marines are offered insurance, low-cost life insurance, sick time, 30 days vacation a year and retirement. Enlisted men and women are offered housing, including utilities and maintenance. They also have other benefits such as tuition assistance and access to many recreational locations when living on base. Related Article – Army Air Traffic Controller (MOS 15Q): Career Details Job Reviews Reviews of Air Traffic Controller describe the position as challenging, requiring hard work and discipline. Those who describe it as hard work also note that it is satisfying and often rewarding. Marines are able to provide safe coordination of aircraft and are able to find leadership and life skills. The review below provides a review on the Marine Corps. Image: Indeed The review below describes the multi-tasking and abilities needed for the job. Image: Indeed Civilian Career Opportunities Working as an Air Traffic Controller provides skills that relate to working in the aviation industry as a civilian. Marines can find jobs as Air Traffic Controllers or Radio Operators. The Federal Aviation Administration (FAA) has a variety of available jobs that compares to skills learned in the Marine Corps. Apprenticeship opportunities are available to Marines that support additional civilian career occupation options. Summary Marine Air Traffic Controller monitoring a plane on radar. Image: wikimedia Marines Air Traffic Controller (MOS 7257) provide coordination and communication in airport control zones, airfields and remote landing sites. These individuals can work in tower or radio operations. To enter into this MOS, Marines must first meet the qualifications of MOS 7251. The pay of this position will depend on the rank you hold when completing Air Traffic Controller training. Reviews of this position state that it can be challenging, but rewarding. Civilian positions related to Air Traffic Controller are available as radar operators or various positions with agencies such as the FAA. Related Article –Marine Aviation Supply Specialist (MOS 6672): Career Details Affiliate Disclosure: This post may contain affiliate links. If you click and purchase, I may receive a small commission at no extra cost to you. I only recommend products I have personally vetted. Learn more. An air traffic controller is responsible for ensuring the safe and efficient movement of aircraft in the airspace. They work in air traffic control towers, approach control facilities, or en-route centers, monitoring and directing the flow of air traffic. Their primary objective is to maintain safe distances between aircraft and provide guidance to pilots to prevent collisions or conflicts. Air traffic controllers have a crucial role in managing the movement of aircraft during takeoff, landing, and en-route phases of flight. They use radar systems, communication equipment, and advanced computer systems to track aircraft positions, provide clearances for flight paths, and issue instructions to pilots. They must possess excellent situational awareness, decision-making skills, and the ability to remain calm under high-pressure situations. Air traffic controllers must also have a thorough understanding of aviation regulations and procedures, as they are responsible for enforcing airspace rules and ensuring compliance with established protocols. Their work is essential for maintaining the safety and efficiency of air travel, contributing to the overall functioning of the aviation industry. Air traffic controllers ensure the safe, orderly, and efficient flow of air traffic while maintaining effective communication with pilots and ensuring compliance with aviation regulations. Duties and Responsibilities Air traffic controllers have a wide range of duties and responsibilities to ensure the safe and efficient movement of aircraft: Communication: Air traffic controllers are responsible for maintaining clear and effective communication with pilots. They provide instructions regarding altitude changes, flight routes, speed adjustments, and any necessary changes or deviations. Controllers also relay important information to pilots, such as weather conditions, runway closures, and air traffic congestion. Air Traffic Management: Controllers monitor and manage the flow of air traffic in their assigned airspace. They use radar and other surveillance systems to track aircraft positions, detect potential conflicts, and maintain safe separation between aircraft. Controllers make decisions on the sequencing and spacing of aircraft to ensure efficient traffic flow and minimize delays. Safety Assurance: One of the primary responsibilities of air traffic controllers is to ensure the safety of aircraft and passengers. They monitor the airspace for any potential hazards, such as other aircraft, weather conditions, or obstacles. Controllers provide timely warnings and instructions to pilots to avoid conflicts and maintain a safe operating environment. Emergency Response: In the event of an emergency, air traffic controllers play a critical role in coordinating responses and providing assistance. They communicate with emergency services, guide pilots in emergency procedures, and facilitate emergency landings or diverting flights to alternate airports. Controllers must remain calm and act swiftly to ensure the safety of all involved parties. Navigation Assistance: Air traffic controllers assist pilots with navigation by providing information on the most efficient routes, airspace restrictions, and available navigational aids. They help pilots plan their flight paths and adjust routes as necessary due to weather conditions or airspace congestion. Record-Keeping and Documentation: Controllers maintain detailed records of all communications, clearances, and incidents during their shift. Accurate documentation is essential for future reference, investigation purposes, and to ensure compliance with aviation regulations. Training and Mentoring: Experienced air traffic controllers often play a role in training and mentoring new controllers. They provide guidance, share their knowledge and experience, and help develop the skills and expertise of the next generation of air traffic controllers. Continuous Monitoring and Professional Development: Air traffic controllers must stay updated on the latest regulations, procedures, and technological advancements in the field. They undergo regular training and participate in professional development activities to enhance their knowledge and skills. Types of Air Traffic Controllers Air traffic controllers have different roles and responsibilities depending on the specific area of air traffic control they specialize in. Here are some types of air traffic controllers and what they do: Tower Controllers: Tower controllers work in control towers at airports and are responsible for the safe movement of aircraft on the ground and in the immediate vicinity of the airport. They coordinate takeoffs, landings, and ground movements, ensuring proper spacing between aircraft and vehicles on the runways and taxiways. Tower controllers also provide clearances to pilots for departures and arrivals and monitor weather conditions that may affect aircraft operations. Approach Controllers: Approach controllers work in approach control facilities, also known as radar facilities. They manage the airspace around airports and guide aircraft during the arrival and departure phases. Approach controllers use radar systems to track aircraft, provide vectors to pilots for approach and departure, and maintain safe separation between aircraft. They coordinate with tower controllers to ensure a smooth transition from the en-route phase to the airport vicinity. En-Route Controllers: En-route controllers work in air traffic control centers and are responsible for managing aircraft in the en-route phase of flight. They monitor aircraft on long-distance flights, ensuring safe separation and efficient routing. En-route controllers use radar and other surveillance tools to track aircraft positions, provide route clearances, and handle airspace congestion or rerouting due to weather conditions or air traffic volume. Area Controllers: Area controllers are responsible for a specific sector of airspace within an air traffic control center. They manage the flow of aircraft within their assigned sectors, providing routing instructions, altitude changes, and handling any necessary coordination with adjacent sectors. Area controllers ensure safe separation between aircraft, manage traffic flow, and handle any emergencies or incidents that occur within their sector. Oceanic Controllers: Oceanic controllers specialize in providing air traffic control services over international waters and remote oceanic areas. They monitor and manage the flow of aircraft on long-haul international flights, ensuring safe separation and efficient routing across vast oceanic expanses. Oceanic controllers rely on advanced communication and surveillance systems to maintain contact with aircraft and coordinate with neighboring oceanic control centers. Terminal Radar Controllers: Terminal radar controllers work in radar facilities and are responsible for managing the airspace around busy terminal areas, such as major airports or metropolitan regions. They use radar systems to track aircraft and provide vectors for arrivals and departures, ensuring safe separation and efficient traffic flow within the terminal area. Terminal radar controllers coordinate with tower controllers and approach controllers to facilitate smooth operations in complex airspace. Air traffic controllers have distinct personalities. They tend to be enterprising individuals, which means they're adventurous, ambitious, assertive, extroverted, energetic, enthusiastic, confident, and optimistic. They are dominant, persuasive, and motivational. Some of them are also conventional, meaning they're conscientious and conservative. Does this sound like you? Take our free career test to find out if air traffic controller is one of your top career matches. Take the free test now Learn more about the career test Air traffic controllers typically work in control towers, approach control facilities, or air traffic control centers. These facilities are designed to provide a commanding view of the airspace they oversee. Control towers are located at airports and provide controllers with a direct view of the runways and taxiways, allowing them to monitor aircraft movements on the ground. Approach control facilities and air traffic control centers are equipped with radar systems and other technological tools that enable controllers to monitor and manage aircraft in their respective airspace. The work environment of an air traffic controller is often fast-paced, dynamic, and highly demanding. Controllers need to remain focused and attentive to the multiple screens, radar displays, and communication systems in their workspace. They work in a highly structured and regulated environment, following specific procedures and protocols to ensure the safe and efficient movement of aircraft. The workplace of an air traffic controller also requires strong teamwork and coordination. Controllers often work in shifts, as air traffic control services need to be provided around the clock. They collaborate closely with other controllers within their facility and communicate effectively with pilots, airline operators, and other air traffic control units to ensure smooth and safe operations. Due to the nature of their work, air traffic controllers are subject to high levels of stress and pressure. They must make quick decisions, maintain situational awareness, and handle emergency situations calmly and effectively. The work environment is designed to support controllers' concentration and minimize distractions, with specific protocols in place to ensure accuracy and precision in their operations. Being an air traffic controller can be a rewarding career, but it also comes with its own set of challenges. Here are some pros and cons of being an air traffic controller: Pros: Job Security: Air traffic control is a highly specialized field with a strong demand for qualified professionals. The need for air traffic controllers remains constant, providing good job security and stability. Competitive Salary: Air traffic controllers are typically well-compensated for their skills and responsibilities. The salary is often above average compared to many other professions, reflecting the critical nature of their work. Challenging and Dynamic Work: Air traffic control is known for its fast-paced and intellectually stimulating nature. Controllers face constant challenges, requiring them to think quickly, make split-second decisions, and manage multiple tasks simultaneously. Career Advancement Opportunities: There are opportunities for career progression and advancement within the field of air traffic control. Controllers can move into supervisory or managerial roles, take on specialized positions, or even pursue opportunities in aviation management or training. Impact on Aviation Safety: Air traffic controllers play a vital role in ensuring the safety of aircraft and passengers. By effectively managing airspace, controlling traffic flow, and preventing conflicts, they contribute to the overall safety of the aviation system. Cons: High Stress and Pressure: Air traffic control can be an extremely stressful profession. Controllers must handle intense workloads, make critical decisions under pressure, and maintain concentration for extended periods. The high-stress environment can lead to fatigue and burnout. Shift Work and Irregular Hours: Air traffic control operates 24/7, which means controllers often have to work irregular hours, including evenings, weekends, and holidays. The rotating shift schedule can disrupt personal routines and make it challenging to maintain work-life balance. Responsibility for Safety: Air traffic controllers bear a significant responsibility for the safety of aircraft and passengers. Mistakes or errors in judgment can have serious consequences. The constant pressure to maintain accuracy and ensure safety can be mentally and emotionally demanding. Workload Peaks and High Intensity: Air traffic control can experience periods of high traffic volume or unexpected events that lead to spikes in workload and intensity. Controllers must be prepared to handle these peaks and manage increased stress levels during such times. Initial Training and Certification: The process of becoming an air traffic controller involves rigorous training, assessments, and certifications. The training period can be challenging and demanding, requiring a high level of commitment, dedication, and attention to detail. Air traffic controllers guide aerial traffic to ensure safe aerial safety. They monitor all aircraft in their sector using radar and provide pilots with instructions on where to fly. There are also multiple types of air traffic controllers that operate different parts of aerial traffic. Because of how stressful their jobs are, being an air traffic controller is a very lengthy process that takes many years of training to be fully certified. Air Traffic Controller Duties & Responsibilities Air traffic controllers safely direct aircraft during flights in their sector. Every sector of airspace has at least one air traffic controller. Air traffic controllers have the following 5 responsibilities: An air traffic controller manages air traffic while in control towers. Often, they will use radars to monitor traffic. Air traffic controllers help pilots during flight, such as during emergencies or other problems. Air traffic controllers operate and maintain the hardware and software systems that are vital for traffic control facilities. Air traffic controllers provide directional instructions to all controllers for ensuring safe air traffic. Air traffic controllers formalize reports on problems related to aerial traffic. The 3 Types of Air Traffic Controllers There are 3 types of air traffic controllers: 1. Tower Controllers Tower controllers direct the movement of all vehicles, both aerial and ground vehicles, on taxiways and runways. They also provide airplane pilots with landing and take-off clearance. They're also responsible for safely moving aircraft between runways and stands. 2. Approach and Depart Controllers Approach and Depart controllers are responsible for ensuring that airplanes maintain a safe distance while traveling in the airport's airspace. They also create a sequence for landing for approaching aircraft. 3. Enroute or Area controllers Enroute or Area controllers monitor aircraft at high altitude (over 5,000 feet) after they leave the airport. They guide airplanes during the climb, descent, and en-route flight phase. Air Traffic Controllers Aren't Overworked Typically, air traffic controllers work 8 hours a day for 5 days a week, totaling 40 hours a week. Controllers are normally not allowed to work more than 10 consecutive hours in a shift, and they must have a 9-hour break before their following shift. Controllers also rotate shifts during different times of the day because air traffic control never sleeps and has to work continuously. A College Degree Isn't Always Required To become an Air Traffic Controller, you will generally need either a bachelor's or associate degree from an AT-CTI (Air Traffic Collegiate Training Initiative) program. Potential air traffic controllers should have either a bachelor's or associate degree from an CT-CTI program. However, it is also possible to become an air traffic controller if you have 3 years of proven progressively responsible work experience. How to Become an Air Traffic Controller You have to meet these 5 criteria to become an air traffic controller. 1. Education Air Traffic controllers need an associate or bachelor's degree, often from an Air Traffic Collegiate Training Initiative (AT-CTI) program. These programs provide lessons in aviation, airspace, and other relevant subjects. However, if you have 3 years of proven progressively responsible work experience, you may also qualify. 2. Qualifying Tests Graduates of AT-CTI programs must take the Air Traffic Selection and Training exam and pass the FAA pre-employment test. Upon passing, they may apply for air traffic controller jobs. 3. Training The Federal Aviation Authority (FAA) trains air traffic controllers at the Federal Aviation Academy (FAA) after which they're assigned to job locations to continue training while working. 4. Professional Experience Air traffic controllers may need to have up to 3 years of progressively responsible generalized work experience in any occupation, or a combination of work experience and college education. More work experience is necessary to substitute for less postsecondary education. You could also substitute the professional experience with a 4-year bachelor's degree. 5. Licenses Air traffic controllers must be FAA-certified by passing an exam and meeting experience requirements, usually through on-the-job training after graduation from the FAA academy. Skills and Qualities Necessary to Become an Air Traffic Controller Air traffic controllers need the following qualities: Concentration: Air traffic controllers must be able to concentrate with full focus to ensure aerial traffic safety. Decisiveness: Air traffic controllers must be able to quickly make decisions. Math Abilities: Controllers must quickly calculate airplane, speed, time, distance, and provide recommendations accordingly. Communication Abilities: Controllers must give clear instructions and actively listen to the pilot's responses. Air Traffic Controller Salary The average US traffic controller has an annual income of $120,830. But, some States pay as little as $70,000. It Takes Years to Become an Air Traffic Controller It takes between 5 and 8 years to become a certified air traffic controller. The time to become an air traffic controller depends on the individual and what steps they take. The FAA requires at least 3 years of work experience in an aviation-related field, but you can also meet that requirement by completing a 4-year bachelor's degree. The FAA Academy also trains potential air traffic controllers for between 2 and 5 months, depending on their experience. Next, you're required to complete 2 to 4 years of on-the-job training before you're fully certified. So, the entire process to become a fully certified air traffic controller takes between 5 and 8 years There is An Age Limit for Air Traffic Controllers Yes, aspiring air traffic controllers must be 30 years old or younger on their application period's closing date. The FAA does not permit older applicants because they've determined that older applicants can't realistically complete the rigorous training needed to become an air traffic controller. Air Traffic controllers are also required to retire at 56 years of age since they're likely to suffer from reduced eyesight, memory and hearing loss at that age, which prevents them from working effectively. An Air Traffic Controller is a High-Stress Job An air traffic controller is an extremely high-stress job, since controllers are responsible for ensuring the safety and lives of thousands of people onboard commercial airliners every single day. Controllers must often contend with heavy traffic, bad weather, and potential emergencies. Number of Air Traffic Controllers in the USA and Worldwide The FAA has more than 14,000 air traffic controllers in the institution's 700 facilities in the US. The International Federation of Air Traffic Controllers Association (IFATCA) represents over 50,000 air traffic controllers across 126 countries internationally. So, there are at least 50,000 air traffic controllers internationally. Air Traffic Controllers Can Fly For Free Air traffic controllers only get two round trips per year, and they must be in the domestic USA. This can also not be combined with vacation time. However, some countries allow air traffic controllers to receive a limited number of free flights per year. Air traffic control specialists (ATC) are an elite group of more than 14,000 people working across the country to ensure the safety and flight efficiency of aircraft, pilots, and 2.9 million daily passengers. FAA controllers work from more than 400 locations, including airport towers and radar facilities, monitoring and managing about 50,000 flights a day, during peak travel times. You can help manage the flow of aircraft on runways, guide pilots during takeoff and landing, and monitor aircraft as they travel from the ground, through the skies, and land safely back on the ground. Being an air traffic controller is one of the best, most rewarding jobs in America, and the next generation at the Academy is the best in the world. I witnessed firsthand the dedication, skill, and rigor that our future air traffic controllers bring to their training and the urgent need to do all that we can to recruit more people to join in our shared mission of safety in our skies. - U.S. Transportation Secretary Sean Duffy The FAA has rigorous qualification requirements for air traffic controllers. Health conditions like hearing loss, heart disease, or certain mental disorders could disqualify you for employment. Review our robust medical standards prior to applying. Am I eligible? Applicants must: Be a U.S. citizen Speak English fluently and clearly Be younger than 31 years old before the closing date of the application period Have either one year of full-time work experience or one year of higher education, or a combination of both Be physically and mentally fit and meet standards for vision, hearing, cardiovascular, neurological and psychiatric health Application Process We have streamlined the hiring process by changing the previous 8-step hiring process to a 5-step process. This change will accelerate the time-to-hire for these critical positions by shaving more than four months off the old process. Eligible candidates must complete the following steps: submit your application through USAJobs, take the Air Traffic Skills Assessment (ATSA), and pass medical and security clearances. Upon successful completion of the application process, you will attend mandatory training at the FAA Academy in Oklahoma City. Build your profile on USAJobs and collect the following documents. You will need to upload these on USAJobs when you apply: All applicants: Resume or CV I'm applying based on education: Copy of official/unofficial transcripts. I'm applying based on a Collegiate Training Initiative (CTI): Copy of official/unofficial transcripts and recommendation letter or endorsement certifying they have met the CTI requirements. I'm claiming veterans' preference: Submit either a DD Form 214 Certificate of Release or Discharge from Active Duty or a document from the armed forces certifying that you are expected to be discharged or released from active duty service under honorable conditions within 120 days. If you are claiming 10-point preference, you must also submit a completed SF-15, Application for 10-Point Veteran's Preference, and supporting documents as outlined in the SF-15. Apply to the vacancy announcement on USAJobs ⚠ The documents listed above must be uploaded with your application in USAJobs by the closing date of the announcement or your application will be rejected. Qualified candidates will receive an email from PearsonVUE with instructions on taking the Air Traffic Skills Assessment (ATSA). Air Traffic Control is an aptitude-based profession and the ATSA is a computer-based test that predicts your aptitude to be an air traffic controller. The ATSA is free of charge. You will have 3.5 hours to complete the test in-person at any PearsonVUE testing center (more than 5,000 locations). The longer you wait to schedule, the harder it may be to get a spot at your preferred location. Candidates will receive a score in one of three categories: Failed, Qualified, Well-Qualified. The FAA only selects candidates from the Well-Qualified category. Within a week of taking the ATSA, Well-Qualified candidates will be notified about next steps. Medical and security clearance includes: Drug testing Minnesota Multiphasic Personality Inventory - MMPI2 (psychological evaluation) Medical Exam/Physical* Fingerprinting Federal background check *Some physical impairments/medical conditions are disqualifying because there are medical and/or management reasons to conclude that an individual with such impairment/condition cannot perform the duties of the position without unacceptable risk to his or her own health, or to the health or safety of others (employees or the public). See specific requirements in FAA Order 3930.3C. For more information on medical requirements and a list of common disqualifying conditions please visit our ATC medical qualifications page. Entry-level applicants must complete required training courses and spend several months at the FAA Academy in Oklahoma City. After graduating the academy, individuals are placed in locations across the country and must gain 1-3 years on-the-job experience before becoming a certified professional controller. Controllers work full-time and some work additional hours. Many of our facilities operate continuously (24/7/365), where employees work day, evening and night shifts, along with weekends and holidays. For one of America's most critical jobs ensuring safety of the flying public, we're raising starting salaries by nearly 30% (from $17.61/hr to $22.61/hr) during paid Academy training. You will also receive health benefits, food and housing allowances while at the Academy. Pay continues to increase as you gain more experience and earn professional certifications. Within three years of graduating the Academy, the average certified professional controller earns over $160,000 per year. As a federal employee, air traffic controllers receive a robust benefits package - with a variety of insurance, retirement, leave, and flexible spending options for employees and their families. In addition, air traffic controllers are afforded some unique benefits like an early retirement age and special retirement annuity calculation. Unlike traditional federal employees that need 30 years of service to retire, air traffic controllers are able to retire at age 50 with at least 20 years of service or any age with at least 25 years. This means depending when you embark on your air traffic controller career you may have the time to pursue a second career. Retirement annuity is a guaranteed income for a person during their retirement years. Air traffic controllers receive a more generous annuity than traditional federal employees. Learn More Check out The Air Up There - Miracle in the Air podcast episode to hear about how keeping the skies safe is every controller's top priority. Share this opportunity with people in your community! Still interested in an aviation career but not sure this position is right for you? Learn about more career opportunities at the FAA. Questions? Email us at aviation.careers@faa.gov. Adequate perception of environmental elements and external events Situational awareness or situation awareness, often abbreviated as SA is the understanding of an environment, its elements, and how it changes with respect to time or other factors. It is also defined as the perception of the elements in the environment considering time and space, the understanding of their meaning, and the prediction of their status in the near future.[1] It is also defined as adaptive, externally-directed consciousness focused on acquiring knowledge about a dynamic task environment and directed action within that environment.[2] Situation awareness is recognized as a critical foundation for successful decision making in many situations, including the ones which involve the protection of human life and property, such as law enforcement, aviation, air traffic control, ship navigation,[3] health care,[4] emergency response, military command and control operations, transmission system operators, self defense,[5] and offshore oil and nuclear power plant management.[6] Inadequate situation awareness has been identified as one of the primary causal factors in accidents attributed to human error.[7][8][9][10] According to Endsley's situation awareness theory, when someone meets a dangerous situation, he needs an appropriate and a precise decision-making process which includes pattern recognition and matching, formation of sophisticated frameworks and fundamental knowledge that aids correct decision making.[11] The formal definition of situational awareness is often described as three ascending levels: Perception of the elements in the environment, Comprehension or understanding of the situation, and Projection of future status.[12] People with the highest levels of situational awareness not only perceive the relevant information for their goals and decisions, but are also able to integrate that information to understand its meaning or significance, and are able to project likely or possible future scenarios. These higher levels of situational awareness are critical for proactive decision making in demanding environments. Three aspects of situational awareness have been the focus in research: situational awareness states, situational awareness systems, and situational awareness processes. Situational awareness states refers to the actual level of awareness people have of the situation. Situational awareness systems refers to technologies that are developed to support situational awareness in many environments. Situational awareness processes refers to the updating of situational awareness states, and what guides the moment-to-moment change of situational awareness.[13] Although the term itself is fairly recent, the concept has roots in the history of military theory—it is recognizable in Sun Tzu's The Art of War, for example.[14] The term can be traced to World War I, where it was recognized as a crucial skill for crews in military aircraft.[15] There is evidence that the term situational awareness was first employed at the Douglas Aircraft Company during human factors engineering research while developing vertical and horizontal situation displays and evaluating digital-control placement for the next generation of commercial aircraft. Research programs in flight-crew computer interaction[16] and mental workload measurement[17] built on the concept of awareness measurement from a series of experiments that measured contingency awareness during learning,[18][19] and later extended to mental workload and fatigue.[20] Situation awareness appears in the technical literature as early as 1983, when describing the benefits of a prototype touch-screen navigation display.[21] During the early 1980s, integrated "vertical-situation" and "horizontal-situation" displays were being developed for commercial aircraft to replace multiple electro-mechanical instruments. Integrated situation displays combined the information from several instruments enabling more efficient access to critical flight parameters, thereby improving situational awareness and reducing pilot workload. The term was first defined formally by Endsley in 1988.[22] Before being widely adopted by human factors scientists in the 1990s, the term is said to have been used by United States Air Force (USAF) fighter aircrew returning from war in Korea and Vietnam.[23] They identified having good SA as the decisive factor in air combat engagements—the "ace factor".[24] Survival in a dogfight was typically a matter of observing the opponent's current move and anticipating his next move a fraction of a second before he could observe and anticipate it himself. USAF pilots also came to equate SA with the "observe" and "orient" phases of the famous observe-orient-decide-act loop (OODA loop), or Boyd cycle, as described by the USAF war theorist Col. John Boyd. In combat, the winning strategy is to "get inside" your opponent's OODA loop, not just by making one's own decisions quicker, but also by having better SA than one's opponent, and even changing the situation in ways that the opponent cannot monitor or even comprehend. Losing one's own SA, in contrast, equates to being "out of the loop". Clearly, SA has far reaching applications, as it is necessary for individuals and teams to function effectively in their environment. Thus, SA has gone far beyond the field of aviation to work being conducted in a wide variety of environments. SA is being studied in such diverse areas as air traffic control, nuclear power plant operation, emergency response, maritime operations, space, oil and gas drilling, vehicle operation, and health care (e.g. anesthesiology and nursing).[25][26][27][28][29][30][31] Endsley's model of SA. This is a synthesis of versions she has given in several sources, notably in 1995[32] and 2000.[33] The most widely cited and accepted model of SA was developed by Dr. Mica Endsley,[25] which has been shown to be largely supported by research findings.[34] Lee, Cassano-Pinche, and Vicente found that Endsley's Model of SA received 50% more citations following its publication than any other paper in Human Factors compared to other papers in the 30 year period of their review.[35] Endsley's model describes the cognitive processes and mechanisms that are used by people to assess situations to develop SA, and the task and environmental factors that also affect their ability to get SA. It describes in detail the three levels of SA formation: perception, comprehension, and projection. Perception (Level 1 SA): The first step in achieving SA is to perceive the status, attributes, and dynamics of relevant elements in the environment. Thus, Level 1 SA, the most basic level of SA, involves the processes of monitoring, cue detection, and simple recognition, which lead to an awareness of multiple situational elements (objects, events, people, systems, environmental factors) and their current states (locations, conditions, modes, actions). Comprehension (Level 2 SA): The next step in SA formation involves a synthesis of disjointed Level 1 SA elements through the processes of pattern recognition, interpretation, and evaluation. Level 2 SA requires integrating this information to understand how it will impact upon the individual's goals and objectives. This includes developing a comprehensive picture of the world, or of that portion of the world of concern to the individual. Projection (Level 3 SA): The third and highest level of SA involves the ability to project the future actions of the elements in the environment. Level 3 SA is achieved through knowledge of the status and dynamics of the elements and comprehension of the situation (Levels 1 and 2 SA), and then extrapolating this information forward in time to determine how it will affect future states of the operational environment. Endsley's model shows how SA "provides the primary basis for subsequent decision making and performance in the operation of complex, dynamic systems".[36] Although alone it cannot guarantee successful decision making, SA does support the necessary input processes (e.g., cue recognition, situation assessment, prediction) upon which good decisions are based.[37] SA also involves both a temporal and a spatial component. Time is an important concept in SA, as SA is a dynamic construct, changing at a tempo dictated by the actions of individuals, task characteristics, and the surrounding environment. As new inputs enter the system, the individual incorporates them into this mental representation, making changes as necessary in plans and actions in order to achieve the desired goals. SA also involves spatial knowledge about the activities and events occurring in a specific location of interest to the individual. Thus, the concept of SA includes perception, comprehension, and projection of situational information, as well as temporal and spatial components. Endsley's model of SA illustrates several variables that can influence the development and maintenance of SA, including individual, task, and environmental factors. In summary, the model consists of several key factors that describe the cognitive processes involved in SA:[38] Perception, comprehension, and projection as three levels of SA, The role of goals and goal directed processing in directing attention and interpreting the significance of perceived information, The role of information salience in "grabbing" attention in a data-driven fashion, and the importance of alternating goal-driven and data-driven processing, The role of expectations (fed by the current model of the situation and by long-term memory stores) in directing attention and interpreting information, The heavy demands on limited working memory restricting SA for novices and for those in novel situations, but the tremendous advantages of mental models and pattern matching to prototypical schema that largely circumvent these limits, The use of mental models for providing a means for integrating different bits of information and comprehending its meaning (relevant to goals) and for allowing people to make useful projections of likely future events and states, Pattern matching to schema—prototypical states of the mental model—that provides rapid retrieval of comprehension and projection relevant to the recognized situation and in many cases single-step retrieval of appropriate actions for the situation. The model also points to a number of features of the task and environment that affect SA: The capability of the system and the user interface for conveying important information to the person in a way that is easy to integrate and process. Both high workload and stress can negatively affect SA. Information overload is a problem in many situations. Underload (vigilance conditions) can also negatively affect SA. The complexity of the systems and situations a person is in can negatively affect SA by making it difficult to form accurate mental models. Automation is a major factor reducing situation awareness in many environments (e.g. aviation, driving, power operations). See out of the loop performance problems. This is due to it creating situations where people are forced to become monitors which they are poor at (due to vigilance problems), often poor system transparency with needed information not provided, and an overall reduction in the level of cognitive engagement of people with automated systems.[39] Experience and training have a significant impact on people's ability to develop SA, due to its impact on the development of mental models that reduce processing demands and help people to better prioritize their goals.[40] In addition, it has been found that individuals vary in their ability to acquire SA; thus, simply providing the same system and training will not ensure similar SA across different individuals. Research has shown that there are a number of factors that make some people better at SA than others including differences in spatial abilities and multi-tasking skills.[41] Criticisms of the SA construct and the model are generally viewed as unfounded and addressed.[42][43][44] The Endsley model is very detailed in describing the exact cognitive processes involved in SA. A narrative literature review of SA, performance, and other human factors constructs states that SA "... is valuable in understanding and predicting human-system performance in complex systems."[42] Nevertheless, there are several criticisms of SA. One criticism is the danger of circularity with SA: "How does one know that SA was lost? Because the human responded inappropriately. Why did the human respond inappropriately? Because SA was lost." [45] Building on the circularity concern, others deemed SA a folk model on the basis it is frequently overgeneralized and immune to falsification.[46][47] A response to these criticisms it arguing that measures of SA are "... falsifiable in terms of their usefulness in prediction."[42] A recent review and meta-analysis of SA measures showed they were highly correlated or predictive of performance, which initially appears to provide strong quantitative evidence refuting criticisms of SA.[44] However, the inclusion criteria in this meta-analysis[44] was limited to positive correlations reaching desirable levels of statistical significance.[48] That is, more desirable results hypothesis supporting results were included while the less desirable results, contradicting the hypothesis, were excluded. The justification was "Not all measures of SA are relevant to performance."[44] This an example of a circular analysis or double-dipping,[49] where the dataset being analyzed are selected based on the outcome from analyzing the same dataset. Because only more desirable effects were included, the results of this meta-analysis were predetermined – predictive measures of SA were predictive.[48] Further, there were inflated estimates of mean effect sizes compared to an analysis that did not select results using statistical significance.[48] Determining the relevance of SA based on the desirability of outcomes and analyzing only supporting results is a circular conceptualization of SA and revives concerns about the falsifiability of SA.[48] Several cognitive processes related to situation awareness are briefly described in this section. The matrix shown below attempts to illustrate the relationship among some of these concepts.[50] Note that situation awareness and situational assessment are more commonly discussed in information fusion complex domains such as aviation and military operations and relate more to achieving immediate tactical objectives.[51][52][53] Sensemaking and achieving understanding are more commonly found in industry and the organizational psychology literature and often relate to achieving long-term strategic objectives. There are also biological mediators of situational awareness, most notably hormones such as testosterone, and neurotransmitters such as dopamine and norepinephrine.[54] Phase Process Outcome Objective Tactical (short-term) situational assessment situation awareness Strategic (long-term) sensemaking understanding Scientific (longer-term) analysis prediction Situation awareness is sometimes confused with the term "situational understanding." In the context of military command and control applications, situational understanding refers to the "product of applying analysis and judgment to the unit's situation awareness to determine the relationships of the factors present and form logical conclusions concerning threats to the force or mission accomplishment, opportunities for mission accomplishment, and gaps in information".[55] Situational understanding is the same as Level 2 SA in the Endsley model—the comprehension of the meaning of the information as integrated with each other and in terms of the individual's goals. It is the "so what" of the data that is perceived. In brief, situation awareness is viewed as "a state of knowledge," and situational assessment as "the processes" used to achieve that knowledge. Endsley argues that "it is important to distinguish the term situation awareness, as a state of knowledge, from the processes used to achieve that state.[1] These processes, which may vary widely among individuals and contexts, will be referred to as situational assessment or the process of achieving, acquiring, or maintaining SA." Note that SA is not only produced by the processes of situational assessment, it also drives those same processes in a recurrent fashion. For example, one's current awareness can determine what one pays attention to next and how one interprets the information perceived.[56] Accurate mental models are one of the prerequisites for achieving SA.[22][57][58] A mental model can be described as a set of well-defined, highly organized yet dynamic knowledge structures developed over time from experience.[59][60] The volume of available data inherent in complex operational environments can overwhelm the capability of novice decision makers to attend, process, and integrate this information efficiently, resulting in information overload and negatively impacting their SA.[61] In contrast, experienced decision makers assess and interpret the current situation (Level 1 and 2 SA) and select an appropriate action based on conceptual patterns stored in their long-term memory as "mental models".[62][63] Cues in the environment activate these mental models, which in turn guide their decision making process. Klein, Moon, and Hoffman distinguish between situation awareness and sensemaking as follows: ...situation awareness is about the knowledge state that's achieved—either knowledge of current data elements, or inferences drawn from these data, or predictions that can be made using these inferences. In contrast, sensemaking is about the process of achieving these kinds of outcomes, the strategies, and the barriers encountered.[64] In brief, sensemaking is viewed more as "a motivated, continuous effort to understand connections (which can be among people, places, and events) in order to anticipate their trajectories and act effectively",[65] rather than the state of knowledge underlying situation awareness. Endsley points out that as an effortful process, sensemaking is actually considering a subset of the processes used to maintain situation awareness.[66][43] In the vast majority of the cases, SA is instantaneous and effortless, proceeding from pattern recognition of key factors in the environment—"The speed of operations in activities such as sports, driving, flying and air traffic control practically prohibits such conscious deliberation in the majority of cases, but rather reserves it for the exceptions." Endsley also points out that sensemaking is backward focused, forming reasons for past events, while situation awareness is typically forward looking, projecting what is likely to happen in order to inform effective decision processes.[66][43] In many systems and organizations, people work not just as individuals, but as members of a team. Thus, it is necessary to consider the SA of not just individual team members, but also the SA of the team as a whole. To begin to understand what is needed for SA within teams, it is first necessary to clearly define what constitutes a team. A team is not just any group of individuals; rather teams have a few defining characteristics. A team is: a distinguishable set of two or more people who interact dynamically, interdependently and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life span of membership.—Salas et al. (1992)[67] Team SA is defined as "the degree to which every team member possesses the SA required for his or her responsibilities".[38] The success or failure of a team depends on the success or failure of each of its team members. If any one of the team members has poor SA, it can lead to a critical error in performance that can undermine the success of the entire team. By this definition, each team member needs to have a high level of SA on those factors that are relevant for his or her job. It is not sufficient for one member of the team to be aware of critical information if the team member who needs that information is not aware. Therefore,

team members need to be successful in communicating information between them (including how they are interpreting or projecting changes in the situation to form level 2 and 3 SA) or in each independently being able to get the information they need. In a team, each member has a subgoal pertinent to his/her specific role that feeds into the overall team goal. Associated with each member's subgoal are a set of SA elements about which he/she is concerned. As the members of a team are essentially interdependent in meeting the overall team goal, some overlap between each member's subgoal and their SA requirements will be present. It is this subset of information that constitutes much of team coordination. That coordination may occur as a verbal exchange, a duplication of displayed information, or by some other means.[68] Shared situation awareness can be defined as "the degree to which team members possess the same SA on shared SA requirements".[69][70] As implied by this definition, there are information requirements that are relevant to multiple team members. A major part of teamwork involves the area where these SA requirements overlap—the shared SA requirements that exist as a function of the essential interdependency of the team members. In a poorly functioning team, two or more members may have different assessments on these shared SA requirements and thus behave in an uncoordinated or even counter-productive fashion. Yet in a smoothly functioning team, each team member shares a common understanding of what is happening on those SA elements that are common—shared SA. Thus, shared SA refers to degree to which people have a common understanding on information that is in the overlap of the SA requirements of the team members. Not all information needs to be shared. Clearly, each team member is aware of much that is not pertinent to the others on the team. Sharing every detail of each person's job would creates information overload to sort through to get needed information.[71][72] It is only that information which is relevant to the SA requirements of each team member that needs to be shared. The situation awareness of the team as a whole, therefore, is dependent upon both a high level of SA among individual team members for the aspects of the situation necessary for their job; and a high level of shared SA between team members, providing an accurate common operating picture of those aspects of the situation common to the needs of each member.[73] Endsley and Jones[57][73] describe a model of team situation awareness as a means of conceptualizing how teams develop high levels of shared SA across members. Each of these four factors—requirements, devices, mechanisms and processes—act to help build team and shared SA. Team SA requirements – the degree to which the team members know which information needs to be shared, including their higher level assessments and projections (which are usually not otherwise available to fellow team members), and information on team members' task status and current capabilities. Team SA devices – the devices available for sharing this information, which can include direct communication (both verbal and non-verbal), shared displays (e.g., visual or audio displays, or tactile devices), or a shared environment. As non-verbal communication, such as gestures and display of local artifacts, and a shared environment are usually not available in distributed teams, this places far more emphasis on verbal communication and communication technologies for creating shared information displays. Team SA mechanisms – the degree to which team members possess mechanisms, such as shared mental models, which support their ability to interpret information in the same way and make accurate projections regarding each other's actions. The possession of shared mental models can greatly facilitate communication and coordination in team settings. Team SA processes – the degree to which team members engage in effective processes for sharing SA information which may include a group norm of questioning assumptions, checking each other for conflicting information or perceptions, setting up coordination and prioritization of tasks, and establishing contingency planning among others. In time-critical decision-making processes, swift and effective choices are imperative to address and navigate urgent situations. In such scenarios, the ability to analyze information rapidly, prioritize key factors, and execute decisions promptly becomes paramount. Time constraints often necessitate a balance between thorough deliberation and the need for quick action. The decision-maker must rely on a combination of experience, intuition, and available data to make informed choices under pressure. Prioritizing critical elements, assessing potential outcomes, and considering the immediate and long-term consequences are crucial aspects of effective time-critical decision-making. Furthermore, clear communication is essential to ensure that decisions are swiftly conveyed to relevant stakeholders and executed seamlessly. Collaborative efforts, streamlined processes, and well-defined protocols can enhance the efficiency of decision-making in time-sensitive situations. Adaptability and the ability to recalibrate strategies in real-time are vital attributes in time-critical scenarios, as unforeseen developments may require rapid adjustments to the initial decision. Embracing technological advancements and data-driven insights, and incorporating simulation exercises, can also contribute to better decision-making outcomes in high-pressure situations. Ultimately, successful time-critical decision-making involves a combination of expertise, preparedness, effective communication, and a willingness to adapt, ensuring that the chosen course of action aligns with the urgency of the situation while minimizing the risk of errors. While the SA construct has been widely researched, the multivariate nature of SA poses a considerable challenge to its quantification and measurement.[a] In general, techniques vary in terms of direct measurement of SA (e.g., objective real-time probes or subjective questionnaires assessing perceived SA) or methods that infer SA based on operator behavior or performance. Direct measures are typically considered to be "product-oriented" in that these techniques assess an SA outcome; inferred measures are considered to be "process-oriented," focusing on the underlying processes or mechanisms required to achieve SA.[74] These SA measurement approaches are further described next. Objective measures directly assess SA by comparing an individual's perceptions of the situation or environment to some "ground truth" reality. Specifically, objective measures collect data from the individual on his or her perceptions of the situation and compare them to what is actually happening to score the accuracy of their SA at a given moment in time. Thus, this type of assessment provides a direct measure of SA and does not require operators or observers to make judgments about situational knowledge on the basis of incomplete information. Objective measures can be gathered in one of three ways: real-time as the task is completed (e.g., "real-time probes" presented as open questions embedded as verbal communications during the task[75]), during an interruption in task performance (e.g., situation awareness global assessment technique (SAGAT),[32] or the WOMBAT situational awareness and stress tolerance test mostly used in aviation since the late 1980s and often called HUPEX in Europe), or post-test following completion of the task. Subjective measures directly assess SA by asking individuals to rate their own or the observed SA of individuals on an anchored scale (e.g., participant situation awareness questionnaire;[76] the situation awareness rating technique[77]). Subjective measures of SA are attractive in that they are relatively straightforward and easy to administer. However, several limitations should be noted. Individuals making subjective assessments of their own SA are often unaware of information they do not know (the unknown unknowns). Subjective measures also tend to be global in nature, and, as such, do not fully exploit the multivariate nature of SA to provide the detailed diagnostics available with objective measures. Nevertheless, self-ratings may be useful in that they can provide an assessment of operators' degree of confidence in their SA and their own performance. Measuring how SA is perceived by the operator may provide information as important as the operator's actual SA, since errors in perceived SA quality (over-confidence or under-confidence in SA) may have just as harmful an effect on an individual's or team's decision-making as errors in their actual SA.[78] Subjective estimates of an individual's SA may also be made by experienced observers (e.g., peers, commanders, or trained external experts). These observer ratings may be somewhat superior to self-ratings of SA because more information about the true state of the environment is usually available to the observer than to the operator, who may be focused on performing the task (i.e., trained observers may have more complete knowledge of the situation). However, observers have only limited knowledge about the operator's concept of the situation and cannot have complete insight into the mental state of the individual being evaluated. Thus, observers are forced to rely more on operators' observable actions and verbalizations in order to infer their level of SA. In this case, such actions and verbalizations are best assessed using performance and behavioral measures of SA, as described next. Performance measures infer SA from the end result (i.e., task performance outcomes), based on the assumption that better performance indicates better SA. Common performance metrics include quantity of output or productivity level, time to perform the task or respond to an event, and the accuracy of the response or, conversely, the number of errors committed. The main advantage of performance measures is that these can be collected objectively and without disrupting task performance. However, although evidence exists to suggest a positive relation between SA and performance, this connection is probabilistic and not always direct and unequivocal.[25] In other words, good SA does not always lead to good performance and poor SA does not always lead to poor performance.[79] Thus, performance measures should be used in conjunction with others measures of SA that directly assess this construct. Behavioral measures also infer SA from the actions that individuals choose to take, based on the assumption that good actions will follow from good SA and vice versa. Behavioral measures rely primarily on observer ratings, and are, thus, somewhat subjective in nature. To address this limitation, observers can be asked to evaluate the degree to which individuals are carrying out actions and exhibiting behaviors that would be expected to promote the achievement of higher levels of SA.[b] This approach removes some of the subjectivity associated with making judgments about an individual's internal state of knowledge by allowing them to make judgments about SA indicators that are more readily observable. Process indices examine how individuals process information in their environment, such as by analyzing communication patterns between team members or using eye tracking devices. Team communication (particularly verbal communication) supports the knowledge building and information processing that leads to SA construction.[57] Thus, since SA may be distributed via communication, computational linguistics and machine learning techniques can be combined with natural language analytical techniques (e.g., Latent semantic analysis) to create models that draw on the verbal expressions of the team to predict SA and task performance.[81][82] Although evidence exists to support the utility of communication analysis for predicting team SA,[83] time constraints and technological limitations (e.g., cost and availability of speech recording systems and speech-to-text translation software) may make this approach less practical and viable in time-pressured, fast-paced operations. Psycho-physiological measures also serve as process indices of operator SA by providing an assessment of the relationship between human performance and a corrected change in the operator's physiology.[84] In other words, cognitive activity is associated with changes in the operator's physiological states. For example, the operator's overall functional state (as assessed using psycho-physiological measures, such as electroencephalography data, eyeblinks, and cardiac activity) may provide an indication as to whether the operator is sleep fatigued at one end of the continuum, or mentally overloaded at the other end.[85] Other psycho-physiological measures, such as event-related potentials, event-related desynchronization, transient heart rate, and electrodermal activity, may be useful for evaluating an operator's perception of critical environmental cues, that is, to determine if the operator has detected and perceived a task-relevant stimulus.[85] In addition, it is also possible to use psycho-physiological measures to monitor operators' environmental expectancies, that is, their physiological responses to upcoming events, as a measure of their current level of SA.[85] The multivariate nature of SA significantly complicates its quantification and measurement, as it is conceivable that a metric may only tap into one aspect of the operator's SA. Further, studies have shown that different types of SA measures do not always correlate strongly with each other.[c] Accordingly, rather than rely on a single approach or metric, valid and reliable measurement of SA should utilize a battery of distinct yet related measures that complement each other.[86] Such a multi-faced approach to SA measurement capitalizes on the strengths of each measure while minimizing the limitations inherent in each. Situation awareness is limited by sensory input and available attention, by the individual's knowledge and experience, and by their ability to analyse the available information effectively. Attention is a limited resource, and may be reduced by distraction and task loading. Comprehension of the situation and projection of future status depend heavily on relevant knowledge, understanding, and experience in similar environments. Team SA is less limited by these factors, as there is a wider knowledge and experience base, but it is limited by the effectiveness of communication within the team.[87] Following Endsley's paradigm and with cognitive resource management model[88] with neurofeedback techniques, Spanish Pedagogist María Gabriela López García (2010) implemented and developed a new SA training pattern.[89] The first organization to implement this new pattern design by López García is the SPAF (Spanish Air Force). She has trained EF-18 fighter pilots and Canadair firefighters.[90] This situation awareness training aims to avoid losing SA and provide pilots cognitive resources to always operate below the maximum workload that they can withstand. This provides not only a lower probability of incidents and accidents by human factors, but the hours of operation are at their optimum efficiency, extending the operating life of systems and operators.[91] In first aid medical training provided by the American Red Cross, the need to be aware of the situation within the area of influence as one approaches an individual requiring medical assistance is the first aspect for responders to consider[92] Examining the area and being aware of potential hazards, including the hazards which may have caused the injuries being treated, is an effort to ensure that responders do not themselves get injured and require treatment as well. Situation awareness for first responders in medical situations also includes evaluating and understanding what happened[93] to avoid injury of responders and also to provide information to other rescue agencies which may need to know what the situation is via radio prior to their arrival on the scene. In a medical context, situation awareness is applied to avoid further injury to already-injured individuals, to avoid injury to medical responders, and to inform other potential responders of hazardous conditions prior to their arrival. A loss in situational awareness has led to many transportation accidents, including the 1991 Los Angeles Airport runway collision[94] and the 2015 Philadelphia train derailment.[95] Within the search and rescue context, situational awareness is applied primarily to avoid injury to search crews by being aware of the environment, the lay of the land, and the many other factors of influence within one's surroundings assists in the location of injured or missing individuals.[96] Public safety agencies are increasingly using situational awareness applications like Android Tactical Assault Kit on mobile devices and even robots to improve situational awareness.[97] In the United States Forest Service the use of chainsaws and crosscut saws requires training and certification.[98] A great deal of that training describes situational awareness as an approach toward environmental awareness but also self-awareness[99] which includes being aware of one's own emotional attitude, tiredness, and even caloric intake. Situational awareness in the forest context also includes evaluating the environment and the potential safety hazards within a saw crew's area of influence. As a sawyer approaches a task, the ground, wind, cloud cover, hillsides, and many other factors are examined and are considered proactively as part of trained sawyers' ingrained training. Dead or diseased trees within the reach of saw team crews are evaluated, the strength and direction of the wind is evaluated. The lay of tree sections to be bucked or the lean of a tree to be felled is evaluated within the context of being aware of where the tree will fall or move to when cut, where the other members of the saw team are located, how they are moving, whether hikers are within the area of influence, whether hikers are moving or are stationary. Law enforcement training includes being situationally aware of what is going on around the police officer before, during, and after interactions with the general public[100] while also being fully aware of what is happening around the officer in areas not currently the focus of an officer's immediate task. In cybersecurity, consider situational awareness, for threat operations, is being able to perceive threat activity and vulnerability in context so that the following can be actively defended: data, information, knowledge, and wisdom from compromise. Situational awareness is achieved by developing and using solutions that often consume data and information from many different sources. Technology and algorithms are then used to apply knowledge and wisdom in order to discern patterns of behavior that point to possible, probable, and real threats. Situational awareness for cybersecurity threat operations teams appears in the form of a condensed, enriched, often graphical, prioritized, and easily searchable view of systems that are inside or related to security areas of responsibility (such as corporate networks or those used for national security interests). Different studies have analyzed the perception of security and privacy in the context of eHealth,[101] network security,[102] or using collaborative approaches to improve the awareness of users.[103] There are also research efforts to automate the processing of communication network information in order to obtain or improve cyber-situational awareness.[104] As the capabilities of technological agents increases, it becomes more important that their actions and underlying rational becomes transparent. In the military realm, agent transparency has been investigated as unmanned vehicles are being employed more frequently. In 2014, researchers at the U.S. Army Research Laboratory reported the Situation Awareness-based Agent Transparency (SAT), a model designed to increase transparency through user interface design. When it comes to automation, six barriers have been determined to discourage "human trust in autonomous systems, with 'low observability, predictability, directability and auditability' and 'low mutual understanding of common goals' being among the key issues."[105] The researchers at the US Army Research Laboratory designed three levels of situational awareness transparency based on Endsley's theory of perception, comprehension, and projection. The greater the level of situational awareness, they claimed, the more information the agent conveys to the user.[106] A 2018 publication from the U.S. Army Research Laboratory evaluated how varying transparency levels in the SAT affects the operator workload and a human's understanding of when it is necessary to intervene in the agent's decision making. The researchers refer to this supervisory judgement as calibration. The group split their SAT model research into two efforts: the Intelligent Agent Transparency in Human Agent Transparency for Multi UxV Management (IMPACT) and the Autonomous Squad Member (ASM) projects.[105] Scientists provided three standard levels of SAT in addition to a fourth level which included the agent's level of uncertainty in its decision in unmanned vehicles. The stated goal of this research was to determine how modifying levels of SAT affected user performance, situation awareness, and confidence in the agent. The scientists stated that their experimental results support that increased agent transparency improved the performance of the operator and human confidence on the agent without a significant effect on the workload. When the agent communicated levels of uncertainty in the task assigned, those involved in the experimentation displayed more trust in the agent.[107] The ASM research was conducted by providing a simulation game in which the participant had to complete a training course with an ASM, a ground robot that communicates with infantry. The participants had to multitask, evaluating potential threats while monitoring the ASM's communications on the interface. According to that research, experimental results demonstrated that the greatest confidence calibration occurred when the agent communicated information of all three levels of SAT.[107] The group of scientists from the U.S. Army Research Laboratory developed transparency visualization concepts in which the agents can communicate their plans, motivations, and projected outcomes through icons. The agent has been reported to be able to relate its resource usage, reasoning, predicted resource loss, progress towards task completion, etc.[105] Unlike in the IMPACT research, the agent informing the user of its level of uncertainty in decision making, no increase in trust was observed.[107] Crowdsourcing, made possible by the rise of social media and ubiquitous mobile access has a potential for considerably enhancing situation awareness of both responsible authorities and citizens themselves for emergency and crisis situations by employing or using "citizens as sensors".[108][109][110][111][112][113][114][115] For instance, analysis of content posted on online social media like Facebook and Twitter using data mining, machine learning and natural language processing techniques may provide situational information.[115] A crowdsourcing approach to sensing, particularly in crisis situations, has been referred to as crowdsensing.[116] Crowdmapping is a subtype of crowdsourcing[117][118] by which aggregation of crowd-generated inputs such as captured communications and social media feeds are combined with geographic data to create a digital map that is as up-to-date as possible[119][120][121][122] that can improve situational awareness during an incident and be used to support incident response.[123] A Cloud-based Geographic Information System (GIS) with a display of structured data refers to a system that utilizes cloud computing technology to store, manage, analyze, and visualize geographic data in a structured format. This approach offers several advantages, including accessibility, scalability, and collaboration, compared to traditional on-premises GIS systems. Here's a breakdown of the key components: Cloud-Based Infrastructure: The GIS system is hosted on cloud servers, allowing users to access it over the internet. This eliminates the need for local installations and provides flexibility in terms of resource allocation and scalability. Geographic Information System (GIS): GIS is a framework for capturing, storing, analyzing, and displaying spatial or geographic data. It involves the use of maps and geographical information to understand relationships and patterns. Structured Data Storage: Geographic data, such as coordinates, boundaries, and attributes, is stored in a structured format within the cloud. This could involve databases or other storage solutions that allow for efficient retrieval and analysis. Data Analysis and Processing: The cloud-based GIS performs various analytical processes on the structured geographic data. This may include spatial analysis, overlay operations, and statistical calculations to derive meaningful insights. Visualization Tools: The system includes tools for visualizing geographic data in the form of maps, charts, and graphs. Users can interact with the data visually, making it easier to comprehend complex spatial relationships. Collaborative Features: Cloud-based GIS often facilitates collaboration among multiple users. Team members can access and work on the same geographic data simultaneously, fostering teamwork and information sharing. Real-Time Updates: Cloud-based systems enable real-time updates to the geographic data. As new information becomes available, it can be seamlessly integrated into the system, ensuring that users always have access to the most current data. Integration with Other Cloud Services: Cloud-based GIS can integrate with other cloud services, such as data storage, processing, and analytics services. This interoperability enhances the overall capabilities of the system. Overall, a cloud-based GIS with structured data display provides a dynamic and efficient platform for managing geographic information, making it accessible, scalable, and collaborative for a wide range of applications, from urban planning and environmental monitoring to business analytics and disaster response. See also: Maritime domain awareness There are two training scenarios designed to increase the situational awareness skills of military professionals, and first responders in police and emergency services. The first, Kim's Game, has a more common place in the Marine Corps sniper school and police academies. The name is derived from the novel Kim which references the game to a spy school lesson. The game involves a tray with various items such as spoons, pencils, bullets, and any other items the soldiers would be familiar with. The participants are given one minute to view all of these items before they are covered up with a blanket. The participants would then individually list the items that they saw, the one with the most correct answers would win the game. The same game is played in young scouting and girl guide groups as well to teach children quick memorisation skills. The second method is a more practical military application of Kim's Game. It starts with a field area (jungle, bush or forest) of about five meters wide to 10 meters deep where various items, some camouflaged and some not, to be located in the area on the ground and in the trees at eyesight level. Again, these items would be ones that are familiar to the soldiers undergoing the exercise. The participants would be given 10 minutes to view the area from one place and take a mental note of the items they saw. Once their 10 minutes is up, the soldier would then be required to do a repetition of certain exercises such as burpees, designed to simulate the stress of a physically demanding environment. Once the participant completes the exercise, they would list the items they saw. The points would be tallied in the end to find the winner. Alert state – Military forces on forms of threat Aviation safety – State in which risks associated with aviation are at an acceptable level Brownout (aeronautics) – In-flight visual impairment by pilots Diving safety – Risk management of underwater diving activities Information integration – Cohesive synthesis of information Korean Air Lines Flight 007 – Plane shot down by the Soviet Union in 1983 Self-awareness – Capacity for introspection and individuation as a subject Situated cognition – Hypothesis that knowing is inseparable from doing Situation room – Intelligence operations complex in the White HousePages displaying short descriptions of redirect targets Spatial awareness – Vicinity data in ubiquitous computingPages displaying short descriptions of redirect targets Spatial disorientation – Inability of a person to correctly determine their body position in space Single-pilot resource management ^ For a detailed discussion on SA measurement, see: Endsley, M.R.; Garland, D.J., eds. 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