Efficient Descent Advisor (EDA)
Supporting Greener Aviation

What is the problem?

As an airplane transitions for landing, today's air traffic control procedures often force the aircraft to fly inefficient arrival paths involving frequent changes in vectoring, altitude, and speed in order to maintain safe separation from other aircraft. The frequent changes of this stair-step approach are problematic because they often require added engine power, which increases fuel burn, causing detrimental effects to the environment.

What is the solution?

Continuous Descent Approaches (or CDA) is a next generation aviation concept that enables aircraft to "coast" during the final stages of flight, using less engine power. Instead of approaching an airport in a conventional stair-step fashion, CDA allows aircraft to fly a continuous, gliding descent at low engine power, thereby minimizing fuel consumption, environmental emissions, and noise pollution.

What is NASA doing to help?

While these "green" descent paths are starting to be used during light traffic conditions, the technical challenge is to make them common practice during heavy traffic, where there is greater benefit. Studies indicate that CDA during busy air traffic could reduce fuel consumption by as much as 3,000 pounds per flight for large aircraft, with a corresponding reduction of carbon dioxide of up to 10,000 pounds per flight. These amounts represent 27% less fuel burn and emissions in comparison to a traditional approach. NASA's work focuses on developing the predictive automation needed to enable CDA in heavy traffic conditions and other airspace constraints.

NASA is currently researching the *Efficient Descent Advisor (or EDA)*, a tool for air traffic controllers that synchronizes the descents of all arrival aircraft so that each can maintain a CDA that minimizes noise and

NASAfacts

Continuous Descent Approach (CDA)

CDA + EDA = Less Fuel Burn

Non-CDA Approach

Efficient Descent Advisor (EDA)
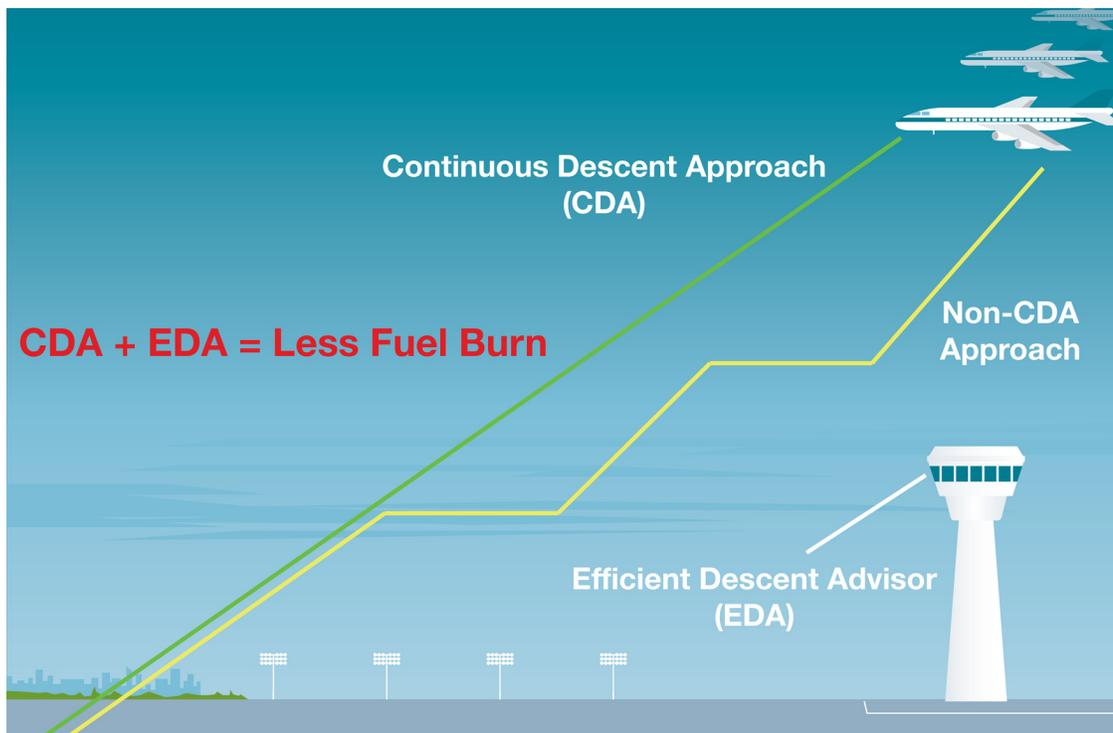
The Efficient Descent Advisor (EDA) enables aircraft to fly a smooth and continuous descent during heavy traffic congestion to minimize fuel consumption, environmental emissions, and noise pollution.

FAA controllers at Denver Air Route Traffic Control Center participate in an Efficient Descent Advisor (EDA) simulation.

Noise profile of existing operations at SFO

Noise profile of EDA operations at SFO

San Francisco International Airport flight test data shows significant noise reduction resulting from idle-thrust descents enabled by the Efficient Descent Advisor (EDA).

emissions while avoiding other traffic and maximizing runway throughput. EDA advises aircraft and controllers of where and when to initiate the descent and the mach/speed profile to maintain in the descent to the meter fix and eventually the runway. EDA works in synergy with NASA's previously deployed Traffic Management Advisor tool, which creates a time-based metering arrival schedule that EDA aims to meet with its CDA solutions for maximum runway throughput. Before being presented to the controller, EDA solutions are probed and adjusted as necessary to avoid separation conflicts with other aircraft along the arrival path, thereby minimizing the chance that a controller will have to disrupt the continuous descent.
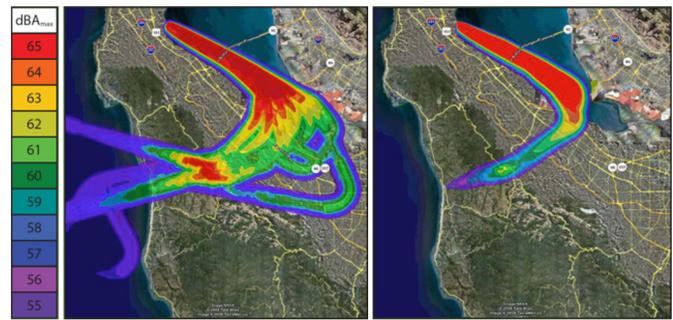
In collaboration with the Federal Aviation Administration (FAA) and United Airlines, operational trials were completed in January 2007 involving continuous descents for transpacific flights into San Francisco. These trials were conducted over 40 days with a United Airlines Boeing 777 flight in commercial service between Honolulu and San Francisco. A prototype version of NASA's EDA decision support tool was incorporated into the trials to resolve separation conflicts while satisfying time-based metering constraints. A benefits analysis suggests Boeing 777 fuel savings of between 200 and 3,000 lbs. per flight and a reduction in carbon dioxide emissions of between 700 and 10,000 lbs. per flight.

In September 2009, field data was collected at Denver Air Route Traffic Control Center to validate EDA trajectory-prediction accuracy. Denver Center

controllers issued pre-scripted EDA clearances to the almost 400 participating flights. Commercial flights were issued clearances involving cruise Mach number and descent-calibrated-airspeed assignments. Once controllers issued these airspeed instructions, they informed downstream controllers that an aircraft was on an EDA arrival with a descent to be guided and controlled using flight deck automation.

Working with controllers and pilots, simulations were conducted in December 2009 to develop the EDA prototype and associated air-ground procedures. Preliminary results indicate that EDA successfully computed conflict-free, on-time arrival solutions resulting in a continuous descent to the meter fix for over 95% of the arrival traffic. Data were collected to assess the accuracy of EDA trajectory computations and their effectiveness in keeping aircraft properly separated and in conformance with their time-based metering constraints.

EDA is designed to interoperate with existing onboard Flight Management Systems, allowing airspace users to maximize their return on their avionics investment. Although EDA is currently being developed as a near-term capability using voice-based clearance delivery, data-link communications will allow for even greater efficiency and workload benefits in the future.

For more information on the Efficient Descent Advisor (EDA), please visit:

www.aviationsystems.arc.nasa.gov.

NASA Facts