Airline/User Centric GreenLandings® Delay, Congestion and Excess CO2 Solution
versus
ATC Centric Time-based Flow Management Program (TBFM)

User Centric Flow Management Solution

1. Airline/user has business control over their aircraft movement and arrival flow (schedule, gates, crew, etc.)
2. Easily scalable for every flight, every day, at every airport, 24/7-365, worldwide.
3. GreenLandings® aircraft movement is deterministic based on the airline's business needs without the need to worry about ATC, sector and sovereign boundaries
4. GreenLandings® works to prevent delays from happening in the first place (Defect Prevention)
5. Easily manages every flight at every airport 24/7-365, starting within months, all day, every day, starting "*day of*" hours prior to landing
6. Immediately reduces random point overloads, which is the root cause of delays, congestion and excess CO2
7. Low risk, fully developed, operational, tested and validated software (FAA Task J and Embry-Riddle University, 2010-2012, GE Aviation 2013, Georgia Tech, 2006, etc.), COTS solution available starting within months
8. Transparently crosses FIR and ATC sector boundaries
9. Capable of reducing ATC structure
10. Reduces controller workload with pilot managed Required Time of Arrival (RTA) flow time for each aircraft, leaving separation to the controller
11. One pilot manages one aircraft to destination
12. Utilizes onboard navigation and communication capability bought and paid for, and already in place on the aircraft
13. GreenLandings® is a fully coordinated, real time, "*day of*" automatic data arrival flow process between users (airlines/operators), ATC and aircraft
14. Highly flexible aircraft movement environment, easy to scale up worldwide
15. Provides all ATC/airlines/operators aircraft specific information on what every IFR aircraft wants to do in the future (airline, GA, etc.)
16. Low cost for users/ATC, with immediate proven, cash benefits
17. Reduces airspace complexity
18. Shovel ready, $100 million, 3-year project to cover the entire US
19. GreenLandings® process has been fully operationally tested and validated by FAA, Embry-Riddle, GE Aviation and others
20. RTA capable Flight Management System (FMS) already installed in the aircraft, allowing pilots to enter a time over a navigational fix, and the airplane automatically adjusts speed to meet that time

ATC Centric TBFM Program

1. ATC maintains control over the movement of the user's aircraft, with zero business/user input into arrival flow
2. Limited scalability to just a few larger airports when congested and internal to each sovereign airspace.
3. TBFM delay is subjective/random as each ATC center assigns each sector's delay to meet the assigned TBFM boundary time
4. TBFM does not eliminate or prevent delay, but targets more efficient delay (Defect Correction)
5. Only manages limited flights, at 20 airports during part of the day based on traffic (e.g., ATL 6 AM-10PM) with limited reach from arrival airport
6. Low impact on random point overloads, reportedly creates adjacent sector overloads and related delays
7. High risk, yet to be fully developed, computationally complex software, after ANSPs already have spent $100s Billions and decades with little impact on delays/congestion (MLS, AAS, CPDLC, GPS, FANS, RNP, ADS-B/C, NextGen, Sesar, etc.)
8. Difficult/impossible to cross FIR/sovereign boundaries
9. Perpetuates or even increases ATC structure
10. Increases controller workload, as controller must separate aircraft, receive time communication for each aircraft, manage flow time/speed for many aircraft
11. 10s of controllers manages one aircraft to destination
12. Full implementation requires new processes and equipage (navigation, communication, etc.) at unknown added cost
13. TBFM has limited, if any, real time automatic coordination between users, ATC and aircraft with, again, zero user business preference inputs
14. Controlled aircraft movement environment, difficult to scale up, notably across national boundaries
15. Limited to no information available to other ATC/users on what other IFR aircraft are doing, or, more importantly, want to do
16. Very high cost for ATC, with limited (none proven) benefits
17. Adds to airspace complexity
18. Multi-Billion dollar, decades long project to cover the entire US, maybe
19. FAA will institutionalize TBFM such that any hope of airlines/operators recapturing control over the movement of their aircraft or reduction of the structure around the airports will be lost for decades.

GreenLandings® Path to "*Day of*" Operational Excellence

Present Day (within 3 to 5 years)

- Requires no new aircraft equipment or ATC equipment
- Current ATC procedures, separation and safety standards
- Operator/airline enlist pilot as goal seeking agent, a unique first for aviation
- Defect Prevention versus Defect Correction process
- Required Time of Arrival (RTA) as Universal Unit of Currency within ATC system
- User driven, ATC coordinated, based on a RTA to current arrival fixes sent to the pilot, hours from landing, inputs business criteria into the aircraft arrival flow
- Integration of enroute GreenLandings® RTA and ATC processes, allowing enroute multiuser GreenLandings® Exchange to pre-sort the arrival flow for every airport so that the local ATC process can more safely and accurately fine tune the arrival sequence
- Reduces and eventually eliminates the random point overloads that cause most delays, congestion and excess CO2
- ATC to act as the "*Honest Broker*" to accept users RTA request and equitably merge competing GreenLandings® RTAs from users (i.e., airlines, GA) at the top airports (GreenLandings® Exchange Process)
- Rapid and easy transition from GDP/MIT/CFMU/TBFM operations to RTA time-based operations
- Removal of structure around airports by slowly moving the arrival fixes closer to the airport
- FMS to meet RTA, +/- 30 second accuracy
- RTA process to allow Constant Descent to 5 NM final at small, less busy airports
- ILS augmented with RNP/PBN for approach and landing precision
- Expand GreenLandings® time horizon such that the arrival GreenLandings® Exchange RTA is coordinated prior to departure, 2nd RTA coordinated and issued shortly after takeoff at a point 30 NM from airport and 3rd RTA coordinated and issued (if required) 1 to 2 hours prior to landing for fine tuning the arrival flow, based on constantly updating the business criteria, winds, airport configuration, etc.
- Best Equipped, Best Trained, Best Served using easily measured RTA compliance metrics

Future (within 5 to 8 years)

- Enhanced ATC procedures and separation standards
- 4D trajectory-based operations (TBO = RTA plus 3D path) using RTA as the Universal Unit of Currency within the airspace system
- Reduced separation standards for operators who equip and train (Best Equipped, Best Trained, Best Served), based on aircraft specific RTA/PBN/RNP and communication capabilities
- Equip aircraft with new avionics based on rapid ROI using proven benefits
- New FMS, +/- 5 second RTA accuracy, real time winds, new wind grid (especially for descent)
- ATC structure reduction
- ADS-B position and intent
- Computerized Conflict Probe for ATC controllers to identify all 4D conflicts (i.e., provide angular separation during climb and descent), manual conflict resolution
- RTA based, constant Descent arrival to 5 NM final at all airports
- ILS augmented with PBN/RNP for approach and landing precision