The research of NASA's Airspace Systems (AS) Program focuses on key capabilities that will increase throughput of the airport environment and achieve the highest possible efficiencies in the use of airport resources such as runways, taxiways, terminal airspace, and gates. The primary capabilities addressed are: (1) Super-density operations, (2) Equivalent visual operations, and (3) Aircraft trajectory-based operations.

Super-density operations will include conflict detection and resolution for closely spaced approaches, reduced aircraft wake vortex separation standards, and less restrictive run-way/taxiway operations. Additional mechanisms to increase the feasible density of operations will also be considered.

Equivalent visual operations will provide aircraft with the critical information needed to maintain safe distances from other aircraft during non-visual conditions, including a capability to operate at "visual performance" levels on the airport surface during low-visibility conditions. Advances in equivalent visual operations for the airport air navigation service provider are also of interest.

Aircraft trajectory-based operations will utilize 4D trajectories (aircraft path from block-to-block, including path along the ground, and also including the time component) as the basis for planning and executing system operations.

NASA's AS Program has identified the following Next Generation Air Transportation System (NGATS) Airportal research activities: Optimization of surface traffic; Dynamic airport configuration management (including the optimal balancing of airport resources for arrival, departure, and surface operations); Predictive models to enable avoidance of wake vortex hazards; New procedures for performing safe, closely spaced and converging
approaches at closer distances than are currently allowed; and modeling, simulation, and experimental validation research focused on single and multiple regional airports; and other innovative opportunities for transformational improvements in airport/metroplex throughput. Inherent within the AS Program approach is the integration of airborne solutions within the overall surface management optimization scheme.

In order to meet these challenges, innovative and technically feasible approaches are sought to advance technologies in research areas relevant to NASA’s NGATS-Airportal effort. The general areas of interest are surface management optimization, converging and parallel runway operations, safety risk assessment methodologies, and wake vortex solutions. Specific research topics for NGATS-Airportal include:

- Airborne spacing algorithms and wake avoidance procedures for airports with closely spaced runways;
- Automated separation assurance and runway/taxiway incursion prevention algorithms;
- Automatic taxi clearance and aircraft control technologies;
- Characterization of wake vortex and atmospheric hazards to flight in terms of aircraft and flight crew responses;
- Collaborative decision making between airlines and air traffic control tower personnel for optimized surface operations, including push back scheduling and management of airport surface assets;
- Dynamic airport configuration management;
- High resolution CFD and real-time modeling of wake vortex strength and location;
- Human/automation interaction and performance standards;
- Integration of decision-support tools across different airspace domains;
- Methodologies and/or algorithms to estimate environmental impacts of increased traffic on the surface and in the terminal airspace, and to reduce the environmental impacts under increased levels of traffic;
- Methodologies to estimate and assess the risk of transformational airspace operations for which little historical risk data may exist and for which operations may be constrained by the potential for extremely rare events;
- Modeling and simulation of single airport operations for validating taxi planning concepts;
- Optimized 4D trajectory generation and conformance monitoring for surface and terminal airspace operations, including departure and arrival planning for individual flights;
- Scheduling algorithm for aircraft deicing and integration with a surface traffic decision-support tool;
- Surface and terminal airspace traffic modeling and simulation of multiple regional airports;
- Virtual towers;
- Other technologies and approaches to achieving 2-3X improvement in the throughput of airportals/metroplexes.