

Gate Turnaround” plays a key role in the National Air Space (NAS) gate-to-gate performance by receiving aircraft when they reach their destination airport, and delivering aircraft into the NAS upon departing from the gate and subsequent takeoff. The time spent at the gate in meeting the planned departure time is influenced by many factors and often with considerable uncertainties. Uncertainties such as weather, early or late arrivals, disembarking and boarding passengers, unloading/reloading cargo, aircraft logistics/maintenance services and ground handling, traffic in ramp and movement areas for taxi-in and taxi-out, and departure queue management for takeoff are likely encountered on the daily basis. The Integrated Gate Turnaround Management (IGTM) concept is leveraging relevant historical data to support optimization of the gate operations, which include arrival, at the gate, departure based on constraints (e.g., available gates at the arrival, ground crew and equipment for the gate turnaround, and over capacity demand upon departure), and collaborative decision-making. The IGTM concept provides effective information services and decision tools to the stakeholders, such as airline dispatchers, gate agents, airport operators, ramp controllers, and ATC traffic managers and ground controllers to mitigate uncertainties arising from both nominal and off-nominal airport gate operations. IGTM will provide NAS stakeholders customized decision making tools through a User Interface (UI) by leveraging historical data (Big Data), net-enabled Air Traffic Management (ATM) live data, and analytics according to dependencies among NAS parameters for the stakeholders to manage and optimize the NAS performance in the gate turnaround domain. The application will give stakeholders predictable results based on the past and current NAS performance according to selected decision trees through the UI. The predictable results are generated based on analysis of the unique airport attributes (e.g., runway, taxiway, terminal, and gate configurations and tenants), and combined statistics from past data and live data based on a specific set of ATM concept-of-operations (ConOps) and operational parameters via systems analysis using an analytic network learning model. The IGTM tool will then bound the uncertainties that arise from nominal and off-nominal operational conditions with direct assessment of the gate turnaround status and the impact of a certain operational decision on the NAS performance, and provide a set of recommended actions to optimize the NAS performance by allowing stakeholders to take mitigation actions to reduce uncertainty and time deviation of planned operational events. An IGTM prototype was developed at NASA Ames Simulation Laboratories (SimLabs) to demonstrate the benefits and applicability of the concept. A data network, using the System Wide Information Management (SWIM)-like messaging application using the ActiveMQ message service, was connected to the simulated data warehouse, scheduled flight plans, a fast-time airport simulator, and a graphic UI. A fast-time simulation was integrated with the data warehouse or Big Data/Analytics (BAI), scheduled flight plans from Aeronautical Operational Control AOC, IGTM Controller, and a UI via a SWIM-like data messaging network using the ActiveMQ message service, illustrated in Figure 1, to demonstrate selected use-cases showing the benefits of the IGTM concept on the NAS performance.