

CLAIMS:

What is claimed is:

1. A method for generating an integrated aircraft clearance, the method comprising:
 - retrieving flight information, preference information (316), environmental information (318), and constraints from a number of sources, wherein the flight information includes at least one of flight plan information, flight scheduling information, and flight status information;
 - processing the flight information (316) against the preference information (326), the environmental information (318), and the constraints; and
 - generating a clearance solution (332) for an aircraft based on the flight information (316), the preference information (326), the environmental information (318), and the constraints.
2. The method of claim 1, wherein generating a clearance solution (332) further comprises:
 - using the preference information (326) to select an available solution within a metering window.
3. The method of claim 1, wherein the preference information (326) further comprises at least one of aircraft preference information and airline preference information.
4. The method of claim 1, wherein the environmental information (318) further comprises at least one of weather information, wind speed and direction, runway availability, and airspace definition.

5. The method of claim 1, wherein processing the flight information (316) against the preference information (326) further comprises:

determining (610) whether a preferred route is available; and

responsive to a determination that the preferred route is not available, selecting (612) alternate routing from configuration data.

6. The method of claim 5 further comprising:

responsive to a determination that the preferred route is available, selecting the preferred route.

7. The method of claim 1, wherein processing the flight information (316) against the preference information (326) further comprises:

determining (618) whether a preferred cruising flight level is available for the airspace; and

responsive to a determination that the preferred cruising flight level is not available, selecting (620) an alternate cruising flight level from configuration data.

8. The method of claim 1, wherein processing the flight information (316) against the preference information (326) further comprises:

determining (622) whether preferred speeds are within air traffic control limits and aircraft performance limits.

9. The method of claim 8 further comprising:

responsive to a determination that the preferred speeds are not within air traffic control limits,

clipping (624) the preferred speeds to air traffic control limits within aircraft performance limits.

10. The method of claim 8 further comprising:
responsive to a determination that the preferred speeds are within air traffic control limits, requesting (626) a trajectory from a trajectory predictor.

11. The method of claim 1, wherein processing the flight information (316) against the preference information (326) further comprises:

determining (628) whether a route selected traverses unavailable airspace; and

responsive to a determination that the route selected traverses the unavailable airspace, selecting (630) alternate routing.

12. The method of claim 1, wherein processing the flight information (316) against the preference information (326) further comprises:

determining (632) whether a clearance should be generated using metering optimization; and

responsive to a determination that the clearance should be generated using metering optimization, determining (634) a dynamic metering window that expresses available runway and airspace resources for a flight in order to perform the metering optimization.

13. The method of claim 1, wherein processing the flight information (316) against the preference information (326) further comprises:

determining (636) whether clearance should be derived using a required time of arrival function;

responsive to a determination that the clearance should be derived using the required time of arrival function, determining (648) whether the aircraft has requested a specific required time of arrival; and

responsive to a determination that the aircraft has not requested the specific required time of arrival, making (650) a controlled time of arrival the required time of arrival.

14. The method of claim 13 further comprising:

responsive to a determination that the aircraft has requested the specific required time of arrival, constraining (638) the required time of arrival to a meter window;

calculating (654) a speed necessary to meet the controlled time of arrival;

determining (656) whether the speed is within performance limits of the aircraft;

responsive to a determination that the speed is within performance limits of the aircraft, performing (644) conflict detection; and

making (646) a clearance available to a flight object manager.

15. The method of claim 14 further comprising:

responsive to a determination that the speed is not within performance limits of the aircraft, finding (640) speed and route combinations by iteratively calling a trajectory predictor;

selecting (642) a speed and route combination from the speed and route combinations provided by the trajectory predictor using the preference information retrieved;

performing (644) conflict detection; and

making (646) a clearance available to a flight object manager.

16. A system for generating an integrated aircraft clearance, the system comprising:

a flight object manager (308) configured to collect flight information and preference information, wherein the flight information includes at least one of a number of flight plans, a number of flight schedules, and flight status information, and wherein the preference information includes at least one of airline preference and aircraft preference;

a clearance generator (306) in communication with the flight object manager and configured to receive the flight information and the preference information along with environmental information, identify a number of constraints and a number of preferences associated with a flight, and generate a number of solutions.

17. The system of claim 16, wherein the preference information (326) includes a number of preferences for at least one of routing, speed schedules, arrival time, and fuel efficiency.

18. The system of claim 16 further comprising:

a trajectory predictor (320) in communication with the clearance generator (306) and configured to receive a function call from the clearance generator (306) and generate a number of trajectory predictions for the clearance generator (306) using the flight information and the constraints identified by the clearance generator (306).

19. An apparatus for generating an integrated aircraft clearance, the apparatus comprising:

a metering manager (330) configured to performs metering optimization by calculating a dynamic metering window for a number of flights using preferences and constraints identified by the apparatus, wherein the apparatus receives the preferences along with flight information from a flight object manager (308), and wherein the apparatus identifies the constraints using the flight information received.

20. The apparatus of claim 19, wherein the apparatus generates a clearance solution (332) for an aircraft based on the flight information, the preferences, environmental information, and the constraints.

What is claimed is:

1. A method for generating an integrated aircraft clearance, the method comprising:
 - retrieving, by a processor unit, flight information, environmental information, and constraints from a number of sources, wherein the flight information includes at least one of flight plan information, flight scheduling information, and flight status information;
 - retrieving, by the processor unit, preference information provided by at least one of the aircraft and an airline, wherein the preference information comprises preferences for at least one of speed, arrival time, and route;
 - processing, by the processor unit, the flight information against the preference information, the environmental information, and the constraints to identify a clearance solution comprising a preferred route and a preferred speed for the aircraft; and
 - modifying, by the processor unit, the clearance solution based on the flight information, the preference information, the environmental information and to satisfy the constraints.
2. The method of claim 1, wherein modifying the clearance solution further comprises:
 - constraining the clearance solution within a metering window identifying a required spacing in time between aircraft at a meter fix.
3. The method of claim 1, wherein processing the flight information against the preference information to identifying the clearance solution comprises selecting a combination of route and speed for the aircraft that most closely matches the preferences.
4. The method of claim 1, wherein the environmental information further comprises at least one of weather information, wind speed and direction, runway availability, and airspace definition.
5. The method of claim 1, wherein modifying the clearance solution further comprises:
 - determining whether the preferred route is available; and
 - responsive to a determination that the preferred route is not available, selecting alternate routing from configuration data.
6. The method of claim 5 further comprising:

responsive to a determination that the preferred route is available, selecting the preferred route.

7. The method of claim 1, wherein modifying the clearance solution further comprises:

determining whether a preferred cruising flight level is available; and
responsive to a determination that the preferred cruising flight level is not available, selecting an alternate cruising flight level from configuration data.

8. The method of claim 1, wherein modifying the clearance solution further comprises:

determining whether the preferred speed is within air traffic control limits and aircraft performance limits.

9. The method of claim 1, wherein modifying the clearance solution further comprises:

determining whether the preferred route traverses unavailable airspace; and
responsive to a determination that the preferred route traverses the unavailable airspace, selecting alternate routing.

10. The method of claim 1, wherein modifying the clearance solution further comprises:

determining whether the clearance solution should be derived using a required time of arrival function;

responsive to a determination that the clearance solution should be derived using the required time of arrival function, determining whether the aircraft has requested a specific required time of arrival; and

responsive to a determination that the aircraft has not requested the specific required time of arrival, making a controlled time of arrival the required time of arrival.

11. A method for generating an integrated aircraft clearance, the method comprising:

retrieving, by a processor unit, flight information, preference information, environmental information, and constraints from a number of sources, wherein the flight information includes at least one of flight plan information, flight scheduling information, and flight status information;

processing, by the processor unit, the flight information against the preference information, the environmental information, and the constraints;

generating, by the processor unit, a clearance solution for an aircraft based on the flight information, the preference information, the environmental information and the constraints;

wherein processing the flight information against the preference information further comprises determining whether preferred speeds are within air traffic control limits and aircraft performance limits; and

responsive to a determination that the preferred speeds are not within air traffic control limits, clipping the preferred speeds to air traffic control limits within aircraft performance limits.

12. The method of claim 11 further comprising:

responsive to a determination that the preferred speeds are within air traffic control limits, requesting a trajectory from a trajectory predictor.

13. A method for generating an integrated aircraft clearance, the method comprising:
retrieving, by a processor unit, flight information, preference information, environmental information, and constraints from a number of sources, wherein the flight information includes at least one of flight plan information, flight scheduling information, and flight status information;

processing, by the processor unit, the flight information against the preference information, the environmental information, and the constraints;

generating, by the processor unit, a clearance solution for an aircraft based on the flight information, the preference information, the environmental information and the constraints;

wherein processing the flight information against the preference information further comprises:

determining whether a clearance should be generated using metering optimization;
and

responsive to a determination that the clearance should be generated using metering optimization, determining a dynamic metering window that expresses available runway and airspace resources for a flight in order to perform the metering optimization.

14. A method for generating an integrated aircraft clearance, the method comprising:

retrieving, by a processor unit, flight information, preference information, environmental information, and constraints from a number of sources, wherein the flight information includes at least one of flight plan information, flight scheduling information, and flight status information;

processing, by the processor unit, the flight information against the preference information, the environmental information, and the constraints;

generating, by the processor unit, a clearance solution for an aircraft based on the flight information, the preference information, the environmental information and the constraints;

wherein processing the flight information against the preference information further comprises:

determining whether clearance should be derived using a required time of arrival function;

responsive to a determination that the clearance should be derived using the required time of arrival function, determining whether the aircraft has requested a specific required time of arrival;

responsive to a determination that the aircraft has not requested the specific required time of arrival, making a controlled time of arrival the required time of arrival;

responsive to a determination that the aircraft has requested the specific required time of arrival, constraining the required time of arrival to a meter window;

calculating a speed necessary to meet the controlled time of arrival;

determining whether the speed is within performance limits of the aircraft;

responsive to a determination that the speed is within performance limits of the aircraft, performing conflict detection; and

making a clearance available to a flight object manager.

15. The method of claim 14 further comprising:

responsive to a determination that the speed is not within performance limits of the aircraft, finding speed and route combinations by iteratively calling a trajectory predictor;

selecting a speed and route combination from the speed and route combinations provided by the trajectory predictor using the preference information retrieved;

performing conflict detection; and

making a clearance available to a flight object manager.

16. A system for generating an integrated aircraft clearance, the system comprising:

a flight object manager configured to collect flight information and preference information, wherein the flight information includes at least one of a number of flight plans, a number of flight schedules, and flight status information, and wherein the preference information includes at least one of airline preference and aircraft preference; and

a clearance generator in communication with the flight object manager and configured to receive the flight information and the preference information along with environmental information, identify a number of constraints and a number of preferences associated with a flight, and generate a number of solutions.

17. The system of claim 16, wherein the preference information includes a number of preferences for at least one of routing, speed schedules, arrival time, and fuel efficiency.

18. The system of claim 16 further comprising:

a trajectory predictor in communication with the clearance generator and configured to receive a function call from the clearance generator and generate a number of trajectory predictions for the clearance generator using the flight information and the constraints identified by the clearance generator.

19. An apparatus for generating an integrated aircraft clearance, the apparatus comprising:

a metering manager configured to perform metering optimization by calculating a dynamic metering window identifying a required spacing in time between aircraft at a meter fix for a number of flights based on differences in speed of the aircraft for the number of flights; and

a clearance generator configured to generate a clearance solution for the aircraft using the dynamic metering window.

20. The apparatus of claim 19, wherein the clearance generator is configured to generate the clearance solution for the aircraft based on flight information, preferences, environmental information, and constraints.