

Interval Management Concept of Operations

Efficiency

Airspace

Systems
Integration

NextGen

Technology
Transition

Dr. Bryan Barmore
NASA

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Interval Management Primer

Interval Management (IM) is a broad description of ADS-B-enabled applications that involve one aircraft positioning themselves relative to another aircraft.

An appropriately equipped aircraft is cleared by the controller, who is using decision support tools, to achieve and/or maintain an interval, in time or distance, relative to one or a few other aircraft.

IM-related work has had several other names in the past:

- Sequencing and Merging
- Self-spacing
- Merging and Spacing

IM consists of both flight deck (FIM) and ground (GIM) components and roles

There are two possible levels of responsibility

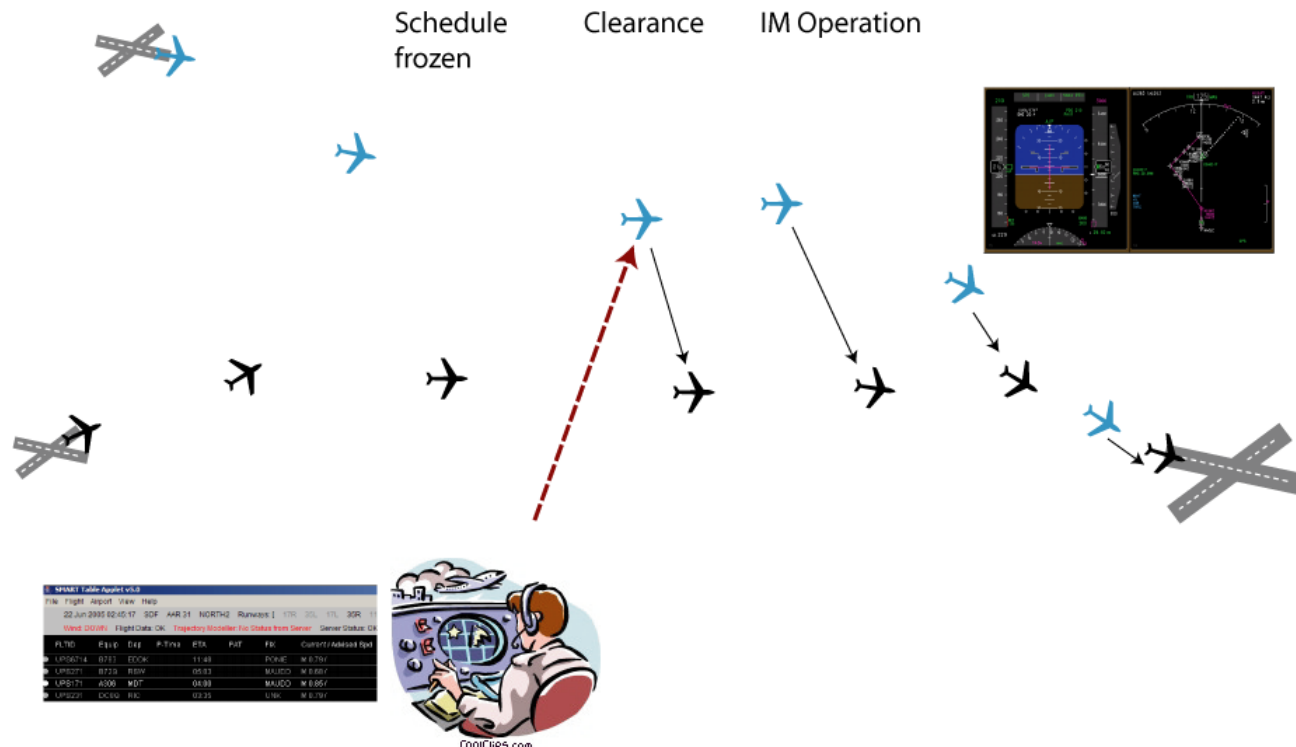
- Spacing (IM-S) – controller has separation responsibility
- Delegated Separation (IM-DS) – flight crew has separation responsibility from target aircraft only.

Interval Management Primer

Controller uses scheduling tool to set up traffic flow.

Flight crew is provided with guidance, mainly speed, to achieve precise and consistent inter-aircraft spacing.

Improved surveillance and tighter control loop allows better balancing of spacing with efficient flight profiles.



Interval Management Benefits

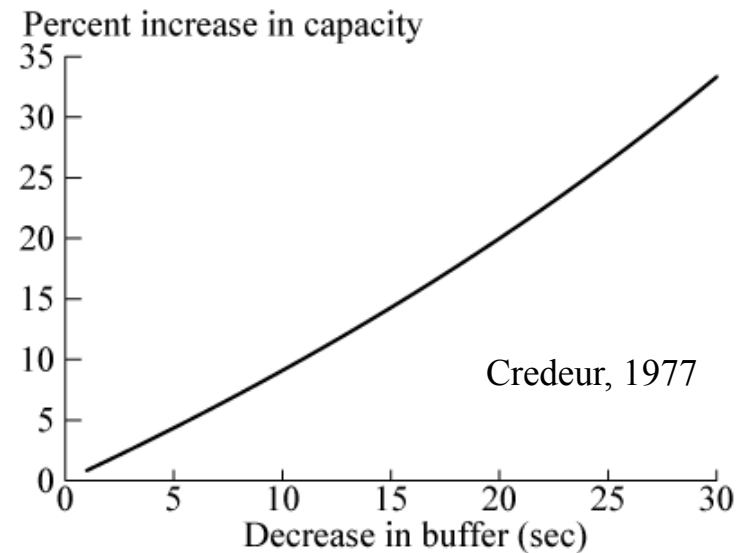
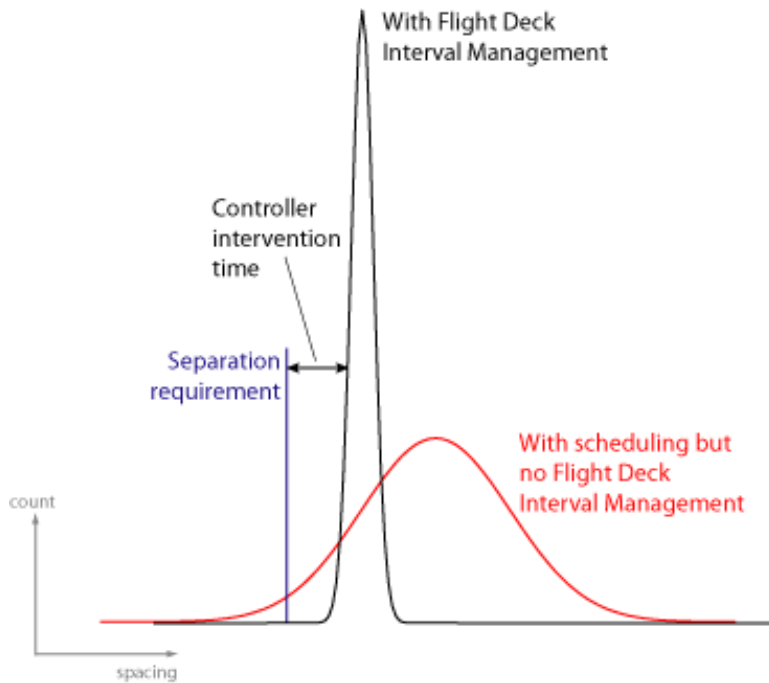
IM combines managing the overall traffic flow with precise guidance for the aircraft to deliver a consistent, efficient flow of traffic.

Benefits include

- Increased throughput
- Reduced tactical maneuvering (especially vectoring)
- Reduced controller workload
- Reduced environmental impact through more use of Optimized Profile Descent (aka Continuous Descent Arrivals)

NASA's Airborne Precision Spacing

For the past decade NASA has been working on an IM application that provides precise inter-aircraft spacing at the runway threshold to increase runway throughput. Concept called Airborne Precision Spacing (APS).

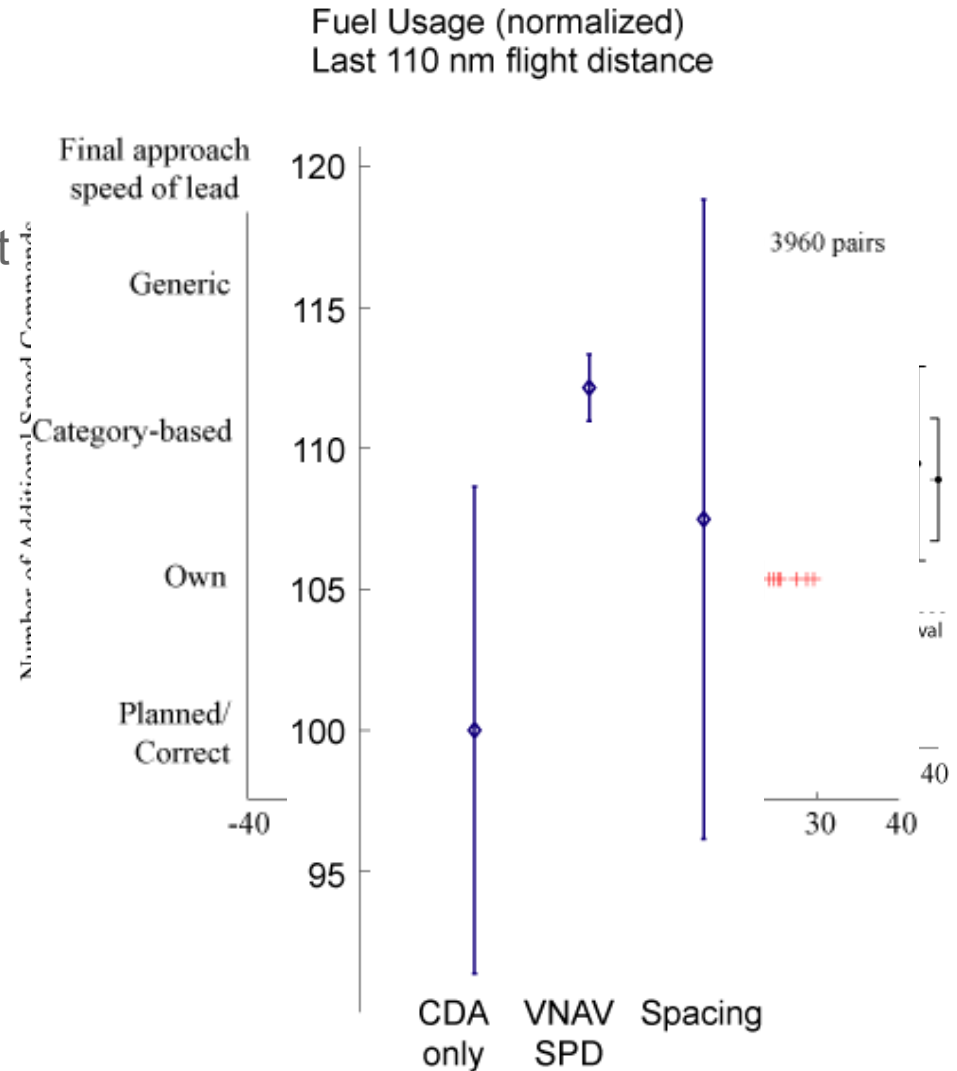


Simulations show 10-20% increase in throughput based on LGA traffic mix

[Hammer and Wang, 2001]

Airborne Precision Spacing Highlights

- Able to increase spacing precision ($\sigma = 3-5$ seconds)
- Long strings of spacing aircraft (at least up to 100) are stable
- Requires approximately 5-6 additional speed changes over standard profile
- Use of final approach speed is critical to achieving desired precision
- Initial look suggests small to no increase in fuel burn over Optimized Profile Descent
 - Fuel use more dependent on VNAV mode than spacing speeds



APS with Dependent Runways

We want to be able to support the full range of arrival and approach operations.

During peak UPS operations the parallel runways are often treated as dependent meaning controller would have to cancel spacing when the aircraft were close to the runway.

It is also expected that in the future IM functionality could be used to support closely spaced parallel runways.

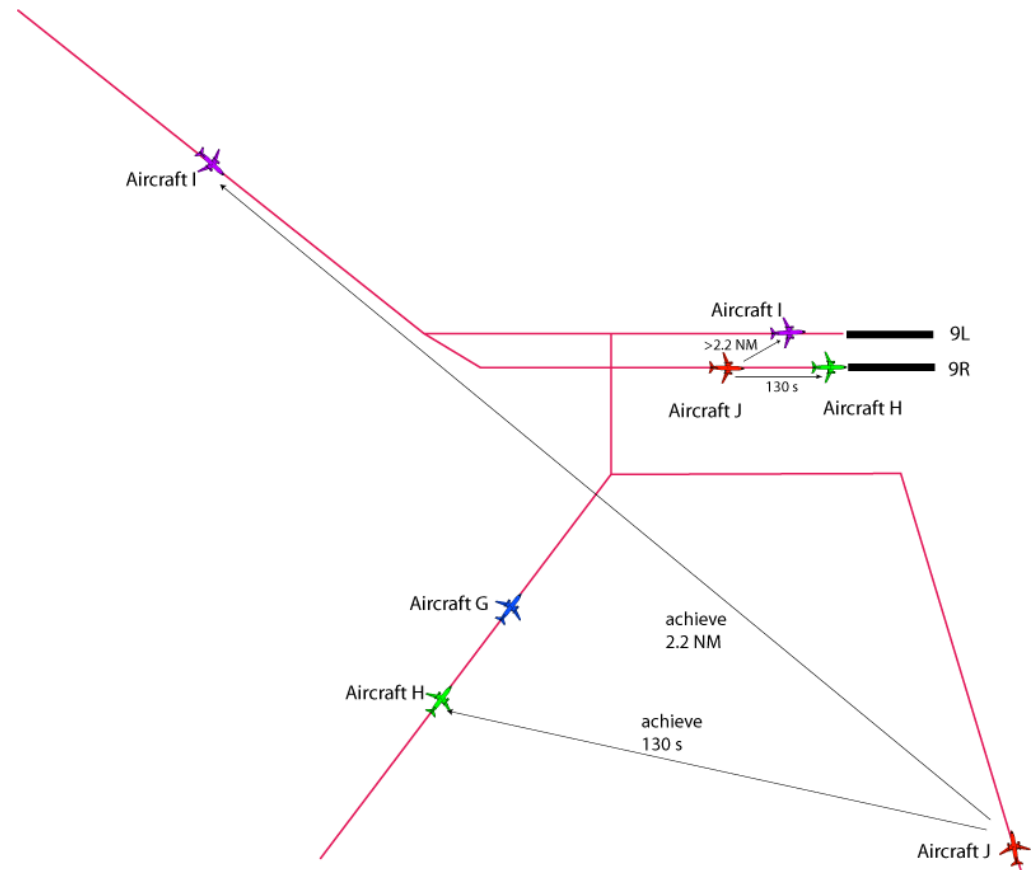
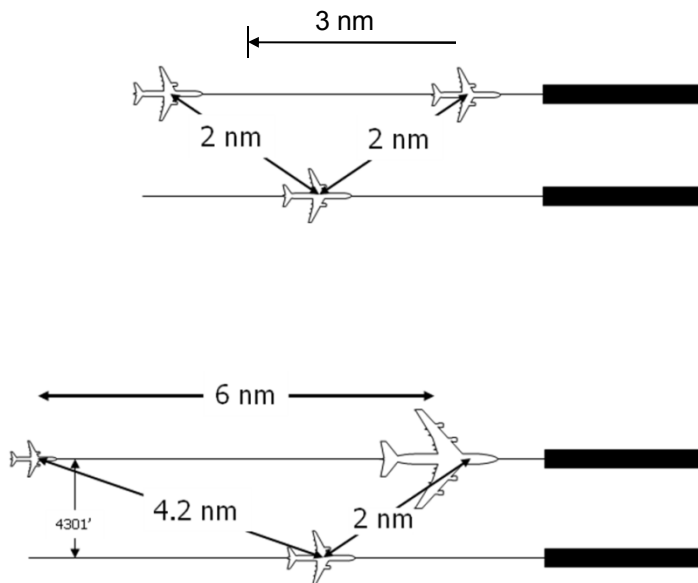
So we are expanding the concept to support dependent runway operations by considering spacing against two target aircraft (common and parallel runway).

See poster and demo tonight for more details.

APS with Dependent Runways

Both in-trail and stagger spacing is considered

Speed guidance provided to achieve the spacing that is the furthest apart



APS Research Plans

Analysis underway for batch study of dependent runway operations

- Showed need for second target aircraft
- Achieving a distance instead of a time makes it easier to meet separation requirements
- Appears to be beneficial when independent operations cannot be run

Human-in-the-loop study planned for May/June for dependent runway operations

- Investigate pilot procedures and displays
- Validate benefits and performance using higher fidelity aircraft models
- Will use datalink (CPDLC) communications; data will be used as part of validation for CPDLC standards being developed by RTCA

A series of batch studies are planned to address near-term implementation questions

- Use distance as the spacing goal at the runway threshold
- Trajectory-based spacing with limited intent information
- Optimizing speed control algorithm parameters
- Changes to planned final approach speed

Integrate with dynamic scheduler for future evaluations

Delegated Separation

Delegated Separation (DS) involves extending IM-S to include the delegation of separation authority to the flight crew of the IM Aircraft.

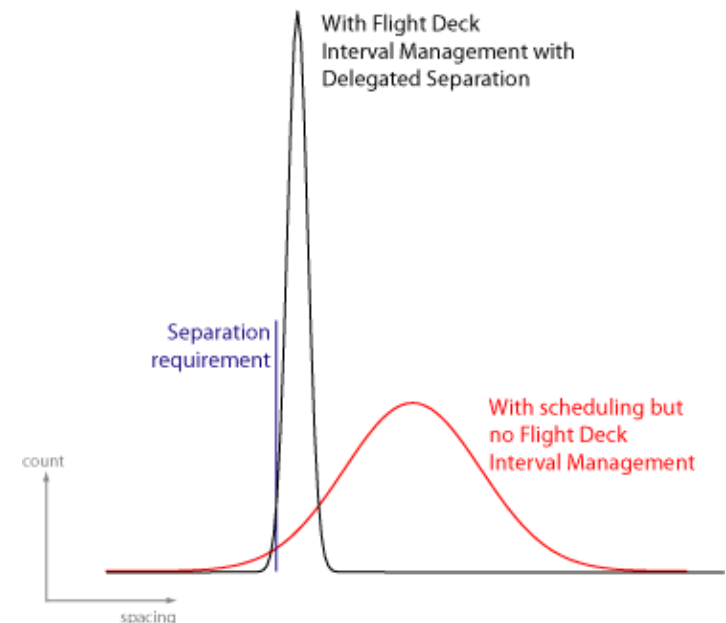
They have the authority and responsibility to maintain separation from their target aircraft.

- Controller is responsible for setting up the operation and separation from all other traffic.

The ADS-B In Aviation Rulemaking Committee (ARC) has identified IM-DS as a major focus area with significant potential for user benefit.

The FAA is working with the ARC and the broader community to define IM-DS operations, roles, responsibilities and standards.

There are significant policy, technology and legal issues to address.



IM Coming Attractions

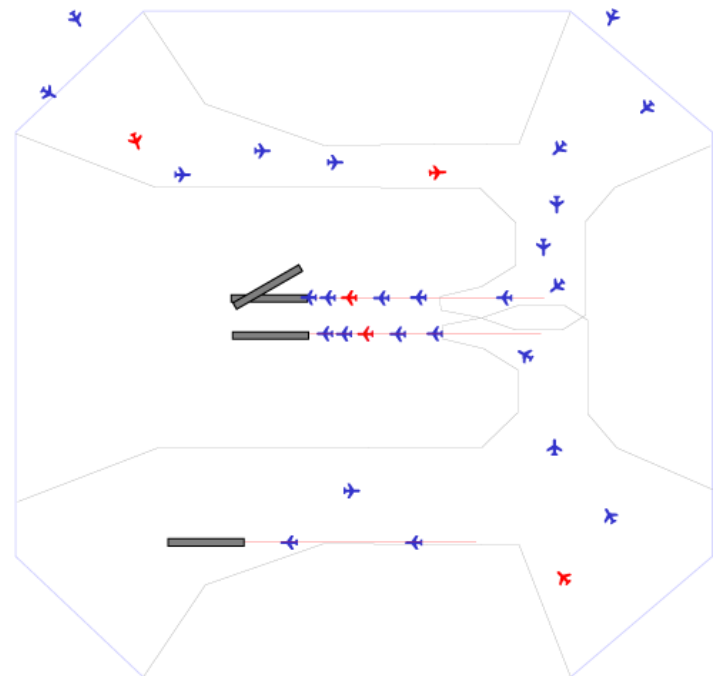
Safety and Performance Requirements for FIM-S will be published by RTCA and EuroCAE in June.

Work on FIM-S Equipment MOPS to start later this year. Publish a combined FIM-S/FIM-DS MOPS by 2013.

FAA is planning flight trials by 2013.

GIM-S deployment by 2014. IM-S (single operational application) use in the NAS at one location by 2015.

Additional development of operational applications that use IM capabilities in a range of environments.



Thank you

