

Tactical Flight Management Concept for Trajectory Based Operations

John Kaneshige¹

NASA Ames Research Center, Moffett Field, CA, 94035

Ramesh Panda² and Gordon Hardy³

Science Application International Corporation, NASA Ames Research Center, Moffett Field, CA, 94035

Mieczyslaw Steglinski⁴ and Shivanjli Sharma⁵

Stinger Ghaffarian Technologies, NASA Ames Research Center, Moffett Field, CA, 94035

and

Jose Benavides⁶

Mission Critical Technologies, NASA Ames Research Center, Moffett Field, CA 94035

This paper introduces the concept of tactical flight management and outlines methods for implementation. In this context, the distinction between strategic and tactical is unrelated to the construction of a flight plan that is composed of a sequence of waypoints. Rather it distinguishes between approaches for generating and guiding aircraft along trajectories that connect these waypoints. This paper focuses on the descent phase of flight where the goal is to fly an idle thrust descent from cruise down to the runway. The conventional approach is to generate a strategic trajectory that optimizes performance while complying with constraints. Guidance is then provided to fly the aircraft along this static trajectory, deviating when necessary by transitioning between guidance modes. The proposed approach is to generate a guidance trajectory that is continually updated to achieve tactical objectives. This motion-based trajectory will represent an extension of the aircraft's current state, and incorporate control laws and mode transition logic as part of the trajectory. This paradigm shift can provide a number of advantages when operating in the highly constrained and dynamic environment of the next generation air transportation system. These advantages include improved constraint compliance, reduced occurrences of mode confusion, and increased situational awareness of what the automation is doing now and what it is going to do in the future.

Nomenclature

ATC	=	Air Traffic Control	OPD	=	Optimal Profile Descent
CMS	=	Controller Managed Spacing	RNAV	=	Area Navigation
FIM	=	Flight Deck Interval Management	RNP	=	Required Navigation Performance
FMS	=	Flight Management System	SDO	=	Super Density Operations
4DT	=	Four-Dimensional Trajectory	TBO	=	Trajectory Based Operations
LNAV	=	Lateral Navigation	T-FMS	=	Tactical Flight Management System
MCP	=	Mode Control Panel	VNAV	=	Vertical Navigation

¹ Computer Engineer, Intelligent Systems Division, Mail Stop 269-1, AIAA Senior Member.

² Senior Simulation Engineer, Crew Vehicle Systems Research Facility, Mail Stop 257-1, AIAA Senior Member.

³ Principal Software System Engineer, Project Management Office, Mail Stop 243-6, AIAA Senior Member.

⁴ Consultant, Intelligent Systems Division, 22296 Skyline Boulevard, La Honda, CA 94020.

⁵ Research Engineer, Intelligent Systems Division, Mail Stop 269-1.

⁶ Controls Engineer, Intelligent Systems Division, Mail Stop 269-1, AIAA Member.