Traffic Awareness for General Aviation (TAGA)
Oliver Reitenbach

A project called “Traffic Awareness for General Aviation (TAGA)” was performed in the Federal Republic of Germany. The project focused on investigating the feasibility and identifying possible safety benefits of performing the “Enhanced Visual Acquisition for See & Avoid” application within German VFR airspace in the vicinity of Frankfurt/Main. The following hypotheses were to be assessed in the project:

• It is possible to enhance the traffic detection probability of General Aviation pilots flying under visual flight rules by means of a Cockpit Display of Traffic Information (CDTI).
• General Aviation pilots are able to monitor a CDTI and to detect in time potential conflicting aircraft on the CDTI during a normal flight performed under visual flight rules.
• It is possible to derive traffic information for the performance of a seeand-avoid application from a Traffic Information Service Broadcast (TIS-B).

In order to meet the objectives of the project, an experimental TIS-B ground system based on the VDL Mode 4 data link technology was installed. The TIS-B service was based on radar surveillance data from the ground radar data network. Three General Aviation aircraft were equipped with appropriate airborne equipment, and a flight trial campaign was performed during May 2002 and April 2003.

Spacing Instructions in Approach: A Stepwise Design
Isabelle Grimaud, Eric Hoffman, Laurence Rognin, and Karim Zeghal

A new allocation of tasks between controller and flight crew is envisaged as one possible option to improve air traffic management, in particular the sequencing of arrival flows. It relies on a set of new spacing instructions. The flight crew can be tasked by the controller to maintain a given spacing with respect to a designated aircraft. To assess feasibility, benefits and limitations of these instructions, after an initial air-ground experiment, two streams of independent air and ground experiments were conducted with a unified perspective. This paper only reviews the ground experiments. They initially focussed on upstream sectors highlighting a positive impact on controller activity and on control effectiveness. However, the application to downstream sectors appeared as an issue. The paper shows how this issue was addressed, in particular how the organisation of roles, working method and airspace have been gradually refined for the effective use of spacing instructions. The proposed working method, though implying significant changes as compared with today, seemed easy to use and assimilate. Overall feedback from controllers was positive. The analysis of instructions and eye-fixations shows a positive impact on controller activity (relief from late vectoring and earlier flow integration). The analysis of inter aircraft spacing on final approach shows more regular spacing than with current day operations. Next step will consist in investigating interactions between upstream and downstream sectors.
A Time-Based Airborne Inter-Arrival Spacing Tool: Flight Evaluation Results
Gary W. Lohr, Rosa M. Oseguera-Lohr, Terence S. Abbott, and William R. Capron

An airborne tool has been developed that allows an aircraft to obtain a precise inter-arrival time-based spacing interval from the preceding aircraft. The Advanced Terminal Area Approach Spacing (ATAAS) tool uses Automatic Dependent Surveillance-Broadcast (ADS-B) data to compute speed commands for the ATAAS-equipped aircraft to obtain this interarrival spacing behind another aircraft. The tool was evaluated in an operational environment at the Chicago O’Hare International Airport and in the surrounding terminal area with three participating aircraft. Research pilots that were completely familiar with their aircraft were used for all test runs, minimizing the possibility of operational errors that might occur due to unfamiliarity. Two basic types of scenarios using different lateral navigation methods were flown: an area navigation (RNAV) path which transitioned onto the final approach course and vector scenarios in which headings were assigned to the first aircraft in the sequence. Data collected consisted primarily of aircraft state data, algorithm outputs, and pilot subjective comments. Both manual and autothrottle speed management were included in the scenarios to demonstrate the ability to use ATAAS with either method of speed management. The results on the overall delivery precision of the tool, based on a target spacing of 90 seconds, were a mean of 90.8 seconds with a standard deviation of 7.7 seconds. The results for the RNAV and vector cases were, respectively, M = 89.3, SD = 4.9 and M = 91.7, SD = 9.0. Pilots stated that the task of tracking the lateral path of the leading aircraft (vector scenarios), and following ATAAS-generated speed guidance was manageable and could be integrated into normal flying duties. Due to space limitations for this article, only limited detail of the ATAAS flight evaluation is possible; more details are provided in “Flight Evaluation and Demonstration of a Time-Based Airborne Inter-Arrival Spacing Tool” [Lohr, 2005].

ASAS – From Concept To Reality
Tony Henley and Mick Pywell

The increasing congestion in the skies of Europe with the attendant delays and costs are well known. By 1999 many studies were being performed on prospective solutions. In that year, a consortium of equipment suppliers, research organisations and service providers considered that none of the individual studies alone could address the problems and that a complete gate-to-gate philosophy was needed, including 4D applications and Airborne Separation Assistance. Thus the MA-AFAS (More Autonomous Aircraft in the Future ATM System) programme was born to investigate a more general solution to the problem. MA-AFAS was part funded by the European Commission under the Fifth Framework Programme, New Perspectives in Aeronautics. MA-AFAS was focused mainly on the airborne side, building previous research on specific aspects of capacity and safety enhancement into an integrated solution that was flown in a very successful series of live trials.

On March 25, 2003, two airliners were positioned at the same height on intersecting tracks over the Mediterranean Sea between Rome and Sardinia. The future conflict was observed by an air traffic controller at Roma Air Traffic Control Centre who instructed one of the aircraft to pass behind the other at a distance of 6 nautical miles. The Flight Management System in the aircraft automatically generated an optimal conflict resolution, in accordance with the instruction, and then guided the aircraft through the manoeuvre. Over the following three days during trial flights for the MA-AFAS programme, this manoeuvre and others were successfully repeated, causing pilots and controllers to remark that it had become routine. ASAS was in the air and working.
Integrated Air/Ground System: Trajectory-Oriented Air Traffic Operations, Data Link Communication, and Airborne Separation Assistance

Trajectory-oriented, time-based air traffic operations, data link communication, and airborne separation assistance systems (ASAS) can play an important role in the transformation of the airspace system. This article reviews several years of research conducted primarily at NASA Ames Research Center. The research promotes an integrated air/ground system combining trajectory-orientation, data link communication, and airborne separation assistance as complementary components of a modernized airspace system, rather than viewing them as competing approaches to modernization. The integrated air/ground system promises capacity, efficiency, and security benefits through trajectory-oriented air traffic management and control. It uses data link to communicate aircraft states and trajectories between pilots and controllers, and it utilizes airborne separation assistance to improve throughput at traffic bottlenecks. This paper highlights benefits of this approach and provides recommendations and guidelines for controller tool and data link implementation as well as a near term concept of ASAS integration. Funding for this work was provided by the Advanced Air Transportation Technologies (AATT) project and the NextNAS project of NASA’s Airspace Systems Program.