

QCARD - A Modelling and Optimisation Tool for Transport Aircraft Design

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The topic of this presentation focuses on a newly developed software system that is the culmination of modelling and analysis techniques described in the Ph.D. research work entitled “Quasi-analytical Modelling and Optimisation Techniques for Transport Aircraft Design” by Askin T. Isikveren. QCARD-MMI, or, Quick Conceptual Aircraft Research and Development, Version 2001, is an interactive MATLAB based conceptual design package, which allows the design of any gas-turbine commercial and business aircraft. The system functionality is specifically tailor-made to predict, visualise and assist in optimising conceptual aircraft designs with emphasis placed on user interactivity. Critical development objectives included acceleration of design response time with a significant increase in design freedom, accuracy and consistency of the results. The package affords a systematic and transparent process to not only conduct analyses with respect to geometry, weights, aerodynamics and performance profiles, but also facilitates coupling of the en route performance subspace to that of economic criteria as defined by direct operating cost (DOC) and profit/return on investment (P-ROI). The package through total user control can create, calculate and analyse 15 configurationally and/or parametrically distinct designs concurrently. Added enhancements to the software system included the introduction of stability and control analysis using the Mitchell code as a basis, and the facilitation of constrained multi-objective optimisation using evolution methods, the Nelder-Mead Simplex search or a “cocktail” of both.



Figure 1. Introducing the QCARD aircraft synthesis system.