

EXPERT OPERATOR'S ASSOCIATE: A KNOWLEDGE-BASED SYSTEM FOR SPACECRAFT CONTROL

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Abstract—This paper presents the Expert Operator's Associate (EOA) project, which studies the applicability of Expert Systems to day-to-day space operations. A prototype Expert System is developed, which operates on-line with an existing spacecraft control system at the European Space Operations Centre, and functions as an "operator's assistant" in controlling satellites. The prototype is demonstrated using an existing real-time simulation model of the MARECS-B2 telecommunication satellite. By developing a prototype system, it is examined to what extent the reliability and effectiveness of operations can be enhanced by AI based support. In addition, the study examines the questions of acquisition and representation of the "knowledge" for such systems, and the feasibility of "migration" of some (currently) ground-based functions into future space-borne autonomous systems.

1. INTRODUCTION

Supervising a spacecraft, interpreting the telemetry received, deciding about the correct on-board operational conditions, reasoning about proper corrections, and executing the appropriate control procedures are complex tasks for modern spacecraft. During the launch phase of the spacecraft, specialists may be at hand, who know about the design of the various subsystems on-board, but in the subsequent operational phases they will usually not be available for immediate consultancy to the operators responsible for safe day-to-day monitoring and controlling of the spacecraft.

The complexity of modern spacecraft systems, and the resulting high demands on the personnel operating them, concerns about the potential for human errors, and the risk of inaccessibility of the people with appropriate expert knowledge, calls for improved methodologies and environments providing computerised support for monitoring and controlling spacecraft.

An essential element in the development of such support is the transfer of parts of the knowledge regarding the procedures for controlling the spacecraft and regarding the design of the spacecraft, from the experts who conceived them, to a system that can be used to assist in working with the spacecraft in the operational phases.

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