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This report covers the second phase of the research activity performed under AFOSR Grant No. 86-0355. The mixed strategy approach to guidance law design, proposed in this research program, has been applied in three-dimensional examples. The examples demonstrate that an optimal mixed three-dimensional strategy has to be developed by a genuine three-dimensional design procedure.					
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22a. NAME OF RESPONSIBLE INDIVIDUAL Dr. James Cloutier			22b. TELEPHONE (Include Area Code) (904) 882-2961		22c. OFFICE SYMBOL AFATL/FXG

TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD.
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INTERIM SCIENTIFIC REPORT
(1 JUNE, 1987 - 30 NOVEMBER, 1987)

Research Title: STOCHASTIC GAME APPROACH TO GUIDANCE DESIGN
(AFOSR Grant No. 86-3055)

Principal Investigator: Prof. J. Shinar
Dept. of Aeronautical Engineering
Technion - Israel Institute of Technology
Haifa 32000, Israel.

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INTERIM SCIENTIFIC REPORT (3)

General

The present report briefly outlines the research activities performed during the second phase of the planned investigation under AFOSR Grant No. 86-3055. This second phase covers the period of 6 months starting 1 June 1987. The actual investigation activity can be separated into two subperiods of 3 months. During each of these subperiods different tasks were carried out:

- (i) - (June-Aug.) - Investigation of the interaction between genuine (kinematic) target maneuver and electronic jinking.
- (ii) - (Sept.-Nov.) - Validation of the mixed guidance strategy concept for a three-dimensional interception geometry.

Interaction Between Maneuvering and ECM (June-Aug.).

This investigation was a direct extension of previous elements in the research program. Part of the results were included in the paper at the AIAA Guidance and Control Conference in Monterey, CA. (17-19 Aug. 1987, (Ref. 1)).

Between the submission of the paper and the meeting with the Project Manager, several additional examples were worked out. These results were discussed in detail with the Project Manager and his Associate.

The main conclusion from the results and the following meeting has been that the two-dimensional model used until this phase in the investigation is a limiting factor for analysing the interaction between the genuine kinematic target maneuvering and the electronic jinking. These two random disturbances, created to confuse the missile's capability to estimate the state variables, act in fact

perpendicularly to each other. For a meaningful analysis therefore a three-dimensional model of the interception is needed.

Three-Dimensional Analysis (Sept.-Nov.)

Based on the conclusions of the meeting with the Project Manager, the investigation during these three months was concentrated to set up a three-dimensional model for designing mixed guidance laws.

Unfortunately, the funding for the second phase of the investigation had not been forwarded to the Technion until the end of December, 1987. For this reason only a small number of examples could be worked out.

These examples confirmed that the commonly used missile design procedure, i.e. implementing two identical 2-D guidance laws in perpendicular planes for a 3-D scenario, yields for the present problem a performance level which is far from being optimal. This leads to the conclusion that an optimal mixed guidance strategy for a 3-D geometry has to be developed by a genuine 3-D design procedure.

The results of this work will be presented as an invited paper at the American Control Conference in June 1988 (Ref. 2). The paper will be forwarded as soon as it is completed.

References

1. Forte, I., Shinar, J., "Improved Guidance Law Design Based on the Mixed Strategy Concept", AIAA Paper No. 87-2384-CP, was presented at the AIAA Guidance, Navigation and Control Conference, Monterey, California, Aug. 17-19, 1987.
2. Forte, I. and Shinar, J., "Application of the Mixed Strategy Concept in 3-D", Invited Paper for the American Control Conference, Atlanta, Georgia, 15-17 June, 1988.