Project Proposal: Developing a Software Tool to Aid Search and Rescue of Missing Aircrafts

1. Introduction

Search and Rescue (SAR) operations for missing aircraft are critical yet complex tasks that require accurate planning and efficient resource allocation. Current SAR methods often rely on traditional tools, which are insufficient for processing and analyzing the vast amount of spatial and non-spatial data involved. This project proposes the development of METUSAR, an innovative software tool that integrates Geographic Information Systems (GIS) with Multi-Criteria Decision Analysis (MCDA) to improve the effectiveness and efficiency of SAR operations.

2. Problem Statement

Missing aircraft incidents pose significant challenges due to vast search areas, limited resources, and the need for quick action. Existing methods struggle with:

- Constructing reliable probability maps from limited data.
- Reducing subjectivity in resource allocation.
- Incorporating dynamic environmental and geographical factors.
- Optimizing search patterns for better coverage.

3. Objectives

The primary goal of this project is to develop a software tool that:

- Combines search theory with GIS and MCDA to produce accurate probability maps.
- Segments search areas based on calculated probabilities.
- Provides SAR planners with tools to compare and select optimal search patterns.
- Reduces the time and resources required for SAR operations.

4. Methodology

1. **Data Collection and Preparation**:
    - Collect spatial data such as terrain, settlements, and signal points.
    - Integrate non-spatial data like last known positions (LKP) and weather conditions.
2. **GIS and MCDA Integration**:
    - Use GIS to capture, store, and analyze spatial data.
    - Apply MCDA methods (SAW, AHP, OWA) to rank and weight decision criteria for probability mapping.
3. **Software Development**:
    - Develop the METUSAR tool using ArcGIS and Visual Basic.

    - Implement modules for probability mapping, area segmentation, and search pattern comparison.
4. **Testing and Validation**:
    - Conduct a case study based on an F-16 crash scenario.
    - Compare results with historical SAR data to validate tool accuracy and efficiency.

5. Expected Outcomes

- A user-friendly software tool that integrates advanced spatial analysis and decision-making frameworks.
- Improved accuracy in identifying high-probability search areas.
- Reduced SAR operation time and resource expenditure.
- A modular system adaptable for various SAR scenarios.

6. Innovation and Significance

This project introduces a novel approach by integrating GIS, MCDA, and search theory into a unified framework. METUSAR offers:

- Real-time data visualization and analysis for SAR planners.
- Systematic and objective resource allocation.
- Enhanced decision-making through interactive tools for ranking and evaluating search patterns.

7. Timeline

Phase	Duration
Data Collection	2 months
Software Development	4 months
Testing and Validation	2 months
Documentation and Review	1 month

8. Resources Needed

- Software: ArcGIS, Visual Basic, supporting GIS libraries.
- Hardware: High-performance computer systems for testing and development.
- Expertise: GIS specialists, SAR planners, and software developers.

9. Conclusion

The METUSAR tool has the potential to revolutionize SAR operations for missing aircraft by leveraging advanced spatial and decision-making technologies. By streamlining the search process and improving resource allocation, the tool can save lives and significantly enhance operational efficiency. This project represents a vital step forward in modernizing SAR methodologies.