



ESCOLA NAVAL

talant de bi-faire



Departamento de Ciências do Mar

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**ARESIBO – Development of demonstrating scenarios
based on CONOPS**

**Dissertação para obtenção do grau de Mestre em Ciências Militares
Navais, na especialidade de Marinha**



Alfeite
2020

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ARESIBO – Development of demonstrating scenarios based on CONOPS

*“If you can’t fly, then run. If you can’t run, then walk.
If you can’t walk, then crawl, but whatever you do,
you have to keep moving forward.”*

Martin Luther King



ARESIBO – Development of demonstrating scenarios based on CONOPS

To my twin sister Patrícia,
My other half.



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Abstract

In the past few years, the emerging cases of cross-border crimes into the external borders of Europe has been a demanding challenge in the operations of the European border security agencies. By these means, the European project “Augmented Reality for Enriched Situation awareness for Border security – ARESIBO” (GA 833805) aims to present an innovative solution to improve situational awareness in border security operations.

The problem of the present dissertation is funded under the Task 2.5 of the project, focused on the definition of four Pilot Use-Cases (PUC) that call for integrated situation awareness and the use of AR technologies in land, sea, and mixed-border domain. Within this standpoint, the main objective of this thesis is the conception of a methodology to develop and validate Use-Cases and demonstrating scenarios, based on the Concept of Operations (CONOPS) analysis of the ARESIBO system.

The method comprises the use of a Systems Engineering (SE) with a Model-Based Systems Engineering (MBSE) approach to guide the development of the Use-Cases, starting with the CONOPS analysis to derive user requirements. The architecture and design of the scenarios are achieved through the combination of the NATO Architecture Framework (NAF) with the Object-Oriented Systems Engineering method (OOSEM), enabling the conception of behavioral UML diagrams. The description of the Use-Cases and scenarios uses the Activity Theory with the FRONTEX Intelligence process to present a full understanding of the activities performed by both illicit and LEA communities.

The result is the definition of four PUC that call for integrated situation awareness with the use of AR technologies: Land-border trespassing, smuggling of goods, human trafficking, and drug trafficking, composed by a conceptual and detailed scenario that associates the flow of the events to be performed with the user requirements and the technological pillars from the CONOPS analysis.

Keywords: Border security, ARESIBO, CONOPS, Use-Cases, Demonstrating scenarios.



Resumo

Nos últimos anos, a emergente dos crimes transfronteiriços nas fronteiras exteriores da Europa tem-se constatado um desafio exigente na forma de atuação das agências europeias de segurança das fronteiras. O projeto Europeu “*Augmented Reality for Enriched Situation awareness for Border security – ARESIBO*” (GA 833805) pretende desenvolver uma solução inovadora para a contribuição da melhoria do conhecimento situacional nas operações de segurança no domínio das fronteiras.

O problema inerente a esta dissertação surge no âmbito da Tarefa 2.5 do projeto: A definição de 4 Casos de Uso Piloto que demonstrem um conhecimento situacional integrado com a adoção de tecnologias de Realidade Aumentada, num domínio terrestre, marítimo, e misto. Assim sendo, o principal objetivo da presente investigação é a conceção de uma metodologia para desenvolver e validar casos de uso e cenários de demonstração, baseados na análise do Conceito de Operações (CONOPS) do sistema ARESIBO.

O método usado compreende o uso de duas abordagens, a tradicional Engenharia de Sistemas, e a Engenharia de Sistemas baseada em modelos, para guiar o desenvolvimento dos Casos de Uso e cenários a partir da análise do CONOPS. A arquitetura e o design dos cenários são definidos pela combinação do *NATO Architecture Framework* (NAF) com o método *Object-Oriented Systems Engineering* (OOSE), que possibilita a construção de diagramas UML comportamentais. A descrição dos Casos de Uso e cenários é feita através da *Activity Theory* e do processo de *Intelligence* utilizado pela agência FRONTEX, de forma a apresentar claramente quais as atividades realizadas pelas comunidades ilícitas e as agências de segurança de fronteiras.

O resultado consiste na definição de uma metodologia que permite desenvolver e validar quatro Casos de Uso Piloto, conforme explicado na definição do problema: Um caso de trespasses de uma fronteira terrestre, um caso de tráfico ilegal de mercadorias, de humanos e por fim de droga.

Palavras-chave: Segurança das fronteiras, ARESIBO, CONOPS, Use Cases, Cenários de demonstração.



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List of Abbreviations and Acronyms

AD – *Architecture Description*

AI – *Augmented Intelligence*

AOO – *Area of Operations*

AR – *Augmented Reality*

ARESIBO - *Augmented Reality Enriched Situation awareness for Border security*

AT – *Activity Theory*

C2 – *Command & Control*

CIRAM – *Common Integrated Risk Analysis Model*

CONOPS – *Concept of Operations*

EAB – *External Advisory Board*

EO – *Electro-Optic*

EU – *European Union*

GCS – *Ground Control Station*

KPI – *Key Performance Indicator*

LEA – *Law Enforcement Agency*

LOS – *Line Of Sight*

MBSE – *Model-based Systems Engineering*

NAF – *NATO Architecture Framework*

OOSEM – *Object-Oriented Systems Engineering Method*

PUC – *Pilot Use-Case*

RADAR – *Radio Detection And Ranging*

RTM – *Requirements Traceability Matrix*

SE – *Systems Engineering*

SMM – *Simplified Meta-Model*

SoS – *Systems of Systems*

UAF DMM – *Unified Architecture Framework Domain Meta-Model*

UAS – *Unmanned Aerial System*

UAV – *Unmanned Aerial Vehicle*

UGV – *Unmanned Ground Vehicle*

UI – *User Interface*

UML – *Unified Modelling Language*

USV – *Unmanned Surface Vehicle*

UUV – *Unmanned Underwater Vehicle*

UxV – *Unmanned Vehicle*

WP – *Work Package*