International Civil Aviation Organization

Middle East Regional Monitoring Agency Board

Seventeenth Meeting (MIDRMA Board/17)
(Virtual, 18 – 19 January 2022)

Agenda Item 4: RVSM Monitoring and related Technical Issues

MID RISK ANALYSIS SOFTWARE (MIDRAS) UPGRADE PROJECT

(Presented by the MIDRMA)

SUMMARY

The aim of this working paper is to highlight MIDRMA's need to upgrade the MID Risk Analysis Software (MIDRAS) by adding new features and simplification of calculating all risk parameters and enhancing the simulation traffic engine with other features.

Action by the meeting is at paragraph 3.

REFERENCES

- MIDRAS Upgrade Project Proposal

1. INTRODUCTION

1.1 It has been more than ten years since MIDRMA Board/11 (Cairo, 27 -29 September 2011) approved the development/purchase of the MID Risk Analysis Software (MIDRAS) which is currently used by the MIDRMA to develop all MID RVSM Safety Monitoring Reports (SMRs).

1.2 This unique software with its specifications and features requires further improvements to facilitate the calculation of all RVSM risk parameters and to help all MIDRMA Member States to overcome problems with their traffic data samples submitted for risk analysis with errors that usually take a lot of time and efforts to correct thousands of traffic data.

2. DISCUSSION

2.1 After ten years of extensive and continuous use of the MIDRAS, the MIDRMA has developed many ideas to facilitate calculations and the ability to overcome many of the problems facing the MIDRMA with regard to the traffic data sample and the repeated requests to the Member States to correct huge errors in their TDS that usually delay the work of the MIDRMA in issuing the safety monitoring report.

2.2 The MIDRMA has collected all the modifications and improvements required for the MIDRAS and present it to the MIDRAS developer Dr. Sameer Alam and his team to present a project proposal for the upgrade of the MIDRAS which is attached in **Appendix A** of this working paper with brief explanation of all the works needed and the cost of this project.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) review and discuss the upgrade project proposal in **Appendix A** of the working paper; and

b) approve the project proposal to upgrade the MIDRAS.

Project Agreement

MIDDLE EAST RISK ASSESSMENT SOFTWARE SYSTEM UPGRADE

PARTIES	
MIDRMA	Middle East Regional Monitoring Agency of the ICAO
Dr Sameer ALAM	Consultant

Project Details	
Project Name	MIDDLE EAST RISK ASSESSMENT SOFTWARE SYSTEM UPGRADE
Project Plan	As Attached (Statement of Work and Project Proposal)
Key Personnel	Dr Sameer ALAM

Project Deliverables	
Software	MIDRAS Updated Software
Technical Report	Hot-Spot Analysis Report
Source Code	N/A

Key Dates	
Project Start Date	15th Jan 2022
Project Completion Date	15th July 2022

Contact Details/Address for notices/invoice	
MIDRMA	Mr Fareed Abdulla Al-Alawi, P.O Box 50468, Kingdom of Bahrain
Consultant	Dr Sameer ALAM, 05-04, 33B Nanyang Av, Singapore 639805

Payment	
Payment Invoice Date	Upon Signatures
Total Consultancy Fee Payable (incl. GST)	100,700.00 USD

Account Details	
Account Name	Sameer Alam
Account Number	537462392001
Bank Name	Oversea-Chinese Banking Corporation Limited Singapore
Bank Address	OCBC CENTRE, FLOOR 9, 65 CHULIA STREET. ZIP Code: 049513
Intermediary Bank	JP Morgan Chase Bank, New York, USA
SWIFT BIC code:	CHASUS33

General Terms & Conditions

1. Confidentiality

The Consultant and the MIDRMA may during the course of this Agreement and in connection with the Services obtain information relating to the other party which is not made available generally by that other party ("Confidential Information"). The receiving party shall:

i. keep all Confidential Information confidential and not disclose it to any person (save as required by law); and
ii. use the Confidential Information only for the purpose for which it was provided and for no other purpose.

2. Data Protection
   i. Both parties will comply with all applicable requirements of the Data Protection Legislation. This is in addition to, and does not relieve, remove or replace, a party's obligations under the Data Protection Legislation.
   ii. The parties acknowledge that for the purposes of the Data Protection Legislation, the MIDRMA is the data controller and the Consultant is the data processor (where "Data Controller" and "Data Processor" have the meanings as defined in the Data Protection Legislation).
   iii. The Consultant will ensure that it has all necessary appropriate consents and notices in place to enable lawful transfer of the personal data to the MIDRMA for the duration and purposes of this agreement.
3. Payment
   i. The Consultant shall invoice the MIDRMA within 30 days of signing of the contract.
   ii. The MIDRMA shall pay the invoice no later than 30 days after the invoice has been received.
   iii. If the MIDRMA does not pay the invoice by the due date for payment the Consultant may suspend provision of the Services until payment in full is received.
   iv. The MIDRMA shall pay the invoice in full without any set-off or deduction.
4. Termination
   i. This agreement commences on the date the last party signs this agreement and expires three (3) months after the Project Completion Date unless terminated earlier.
   ii. This agreement terminates if the parties agree to terminate the agreement in writing at any time.
   iii. The MIDRMA must pay for any work undertaken in relation to the Project up to the effective date of termination which will not exceed an amount equivalent to the payment

Project Agreement
MIDDLE EAST RISK ASSESSMENT SOFTWARE SYSTEM UPGRADE

MIDRMA acknowledges that Sameer Alam is engaged in this contact in his sole private capacity and that the Nanyang Technological University Singapore has neither involvement nor interest in the work and accepts no liability whatsoever.

Neither party shall have any liability for any failure to perform or delay in performing any of its obligations under this Agreement if and to the extent that such failure or delay is caused by reasons, circumstances or events beyond the reasonable control of that party.

This agreement constitutes the entire agreement between the parties in relation to its subject matter and supersedes any previous agreement of the parties, or any other communication or representation made, in relation to its subject matter.

Attachment 1: Project Proposal

Attachment 2: Statement of Works

Signed Sameer ALAM (Consultant)
Date 30/12/2021
Singapore

Signed on Behalf of MIDRMA _____
Date_____
Bahrain

Mr Fareed Al-Alawi
Middle East Regional Monitoring Agency
Email: midrma@midrma.com
P.O. Box 50468, Kingdom of Bahrain

Project Consultant: Dr Sameer Alam
Dated: 20th Dec 2021

PROJECT PROPOSAL: MIDDLE EAST RISK ASSESSMENT SOFTWARE SYSTEM UPGRADE **MIDRAS AI**

ABSTRACT

MIDRAS is a Collision Risk Assessment software system with interactive features for collision risk analysis and visualization for Middle East airspace region. The MIDRAS software integrates the ICAO standard models for collision risk calculations and provides an interactive interface for Collision Risk analysis, scenario planning, Hot-Spot analysis and fast-time air traffic simulation. With the changing dynamics of Middle-East air traffic flow, airspace reconfiguration, new aircraft and increased congestion, the MIDRAS software needs significant upgrades in terms of new Hot-Spot modeling, congestion analysis as well as several other features that are requires to serve the emerging needs of airspace users and ANSPs in the Middle East region. This project proposal outlines the required upgrades and development of new features in MIDRAS software incorporating Artificial Intelligence (MIDRAS AI). These new features and upgrades will enable MIDRMA in making effective analysis of collision risk in the region and gain new insights into emerging traffic dynamics to better manage airspace congestion.

1 INTRODUCTION

Given the continued growth in air transportation, one of the key challenges faced by Air Navigation Service Providers (ANSPs) and airlines is: how to increase airspace capacity without compromising on safety? New air traffic management (ATM) paradigms by ICAO aim for doubling the airspace capacity (2x) while increasing the safety by a factor of 10 by 2030. To achieve such ambitious targets, development of new operational concepts, safety measures and safety performance indicators in the air traffic system are not only expected but also necessary. Reduced Vertical Separation Minimum (RVSM) airspace which ranging vertically from 29,000 feet (FL290) to 41,000feet (FL410), reduces the vertical separation from 2000 feet to 1000 feet, adding 6 extra flight levels. To maintain the safety and integrity of airspace stringent procedures by ICAO are in place.

To achieve these measures, MIDRMA has developed MIDRAS software for collision risk assessment of Middle East airspace. This software system uses ICAO RGCSP Vertical Collision Risk Model for collision risk computation. The ICAO model is based on knowledge of the traffic flows along a given route structure. The software computes Collision Risk equation parameters and process flight data for each member state and computes Collision Risk. The MIDRAS software also provide an interactive interface for collision risk visualization, simulation, modelling of scenarios and Hot-Spot analysis.

2 BACKGROUND

Collision Risk analysis requires an in-depth understanding of not only the nature of air traffic and key parameters which contributes to the overall collision risk but also how the collision risk emerges over time. This understanding will not only aid in the design/re-design of airspace/sectors, but may also assist ATCs in identifying traffic flow management strategies that might lead to increased collision risk under various traffic and sector characteristics.

Such capabilities require a high fidelity air traffic simulation environment that can perform a variety of complex computations and collision risk analysis while presenting the results. It is also desirable that such capability transform into a visual decision making tool that can illustrate how the collision risk builds up in a given airspace. MIDRAS software requires new features, upgrades and correction for comprehensive analysis, detailed insights and data analytic for achieving such capabilities. The new features and upgrades will enable MIDRMA in making effective analysis of collision risk and gain new insights into emerging traffic dynamics in the region. Such features requires Artificial Intelligence capabilities in MIDRAS software (MIDRAS AI) as rigid business rules cannot deal with large possibilities in collision risk modelling with large amount of traffic data for multiple ANSPs.

3 SCOPE OF WORK AND WORK PACKAGES

The MIDRAS AI software will be divided into three Work Packages (WP) as follows. The details of work items covered in each work package is in attached **Annex (Project Work Details MIDRAS).**

- **WP1: New Features in MIDRAS** - This work package will develop new features in MIDRAS software using Artificial Intelligence. This will include new Hot-Spot Detection and Visualization model, Top of Decent analysis, Airway Occupancy statistics and analysis, new metrics for Congestion analysis. This work package will also develop Target Level of Safety Collision Risk Graph generation and display capabilities along with video recorder inbuilt into MIDRAS AI software. These new features will allow MIDRAS AI software to use more comprehensively for airspace risk assessment and proactive safety planning in the face of traffic growth in the region. These features will give new insights and understanding of the collision risk and its co-relation to airspace congestion at strategic level for better airspace design.
- **WP2: Upgrades to MIDRAS** - This work package will upgrade some existing capabilities in MIDRAS software. Such upgrades will include automated Flight input data correction, automated speed/distance errors fixes, features to extend interactive features in terms of Zoom and Pan. The upgrades will also include MIDRAS air traffic simulation timing control which can help user to choose the simulation speed. Such upgrades will allow MIDRAS users to speed up the data processing, and reduce the need for manual intervention for data entry errors, which prevents some flights plan data to be processed using AI algorithms. The enhancement to interactive flight features will allow for better traffic flow analysis and greater understanding of collision risk at crossing points.
- **WP3: Correction to MIDRAS** - This work package will modify exiting features due to changes in the business rules for dealing with RVSM flights entering and exiting at non-RVSM levels. The correction will also include revising data inputs files such as BADA, used in MIDRAS which are outdated and requires corrections. There are some features in MIDRAS which are not required, such as procedural airspace and waypoint due to changes in Middle East airspace redesign/reconfiguration, and need to be removed from the software for better design and process flow. Moreover, there is a need for error messages to be more detailed so that exact issue with the data processing errors can be identified and dealt with. The work-package will address above issues using Artificial Intelligence algorithms.

4 TIMELINE AND MILESTONES

The Work-packages will start concurrently depending upon the architecture of the software and related activities in respective work packages. There can be significant overlaps in the work packages given the nature of project which may requires the output of one work-package as input to others. Each work package is not envisioned in a silo but as interacting and influencing components.

	M1	M2	M3	M4	M5	M6
WP1: New Features in MIDRAS	X			X	X	X
WP2: Upgrades to MIDRAS			X	X		X
WP3: Correction to MIDRAS	X	X	X		X	

5 BUDGET AND COSTING

The total estimated consulting cost for this project is **USD 100,700.00 (One Hundred Thousand and Seven Hundred US Dollars).** This cost does not include travel cost associated with project (training/software installation). The travel cost associated with the project will be covered by MIDRMA. This cost does not include third party software licenses. The cost includes HW/SW requirements for project.

Work Package	Man Hours Required	Consulting Cost (USD per hour)	Consulting Cost per WP USD
WP1	90 Hours	530	47,700
WP2	40 Hours	530	21,200
WP3	60 Hours	530	31,800
Total Hours/Cost	190 Hours		**100,700**

6 PROJECT TIMELINE

The expected duration of the project is Six Months. The expected start date of the Project is **15th January 2022** and the expected completion date of the project is **15th July 2022**..

7 PROJECT DELIVERABLE

Following are the key deliverable for the project (details as per Annex):

1. MIDRAS Software with New Hot-Spot identification and traffic congestion visualization model.
2. MIDRAS Software with updated Input/Output files, Graph display and Error handling capabilities.
3. MIDRAS Software with new business rules for flight plan processing and data analytic features.

8 PAYMENT TERMS AND DELIVERY DATES

The Consultant shall invoice the MIDRMA within 30 days of signing of the contract. The MIDRMA shall pay the invoice no later than 30 days after the invoice has been received. Total cost is inclusive of GST. Any transaction fees such as bank charges, exchange fees etc. will be borne by MIDRMA. The software (MIDRAS AI) will be delivered six months from the start date of the contract. The

software delivery will also include training on the new features of MIDRAS ver 3.0 as well as user manual detailing the features and software functionality.

MIDRAS AI : Project Work Details

Description:
MIDRMA requesting new features/upgrades/correction within MIDRAS software. Requirements for each module are listed separately.

#Module 1. MIDRAS

#	Item	Comments
MIDRAS Input\Supp Data		
1	BADA Database • Update BADA • Future update option by MIDRMA	Outdated, last updated in 2016. Fareed is using BADA mapping for missing ACFT types which is not accurate
2	ASE Mapping • Update in every 2 year from Eurocontrol	Responsibility of MIDRMA to obtain the update from Eurocontrol
3	Aircraft Dimensions.CSV • Update Aircraft Dimension file	Outdated. Need reference of source to update
4	AAD Samples.CSV	Need more information about this file. Purpose, how to update?
5	Procedural Waypoints.CSV • Remove	Procedural separation is no longer required within Middle east region.
6	Waypoint Map.CSV • Remove	No longer required

MIDRAS Input\Flight Data – Processing		
1	State name update • Saudi change to “KSA”	File name “Saudi” should be “KSA”
2	Accept and process flight records with FLs crossing RVSM layer – Entry and Exit levels Currently MIDRAS consider these records as errors.	*MIDRAS is not accepting flight record with FLs outside RVSM airspace* *Examples:* 1. Entry at FL 270 & Exit at FL 430 2. Entry at FL 430 & Exit at FL 250 3. Entry at FL 430 & Exit at FL 310 4. Entry at FL 310 & Exit at FL 430

3	Autocorrect following errors • List each error with “checkbox” • Adjust each traffic data record in error summary based on selected checkbox Errors: 1. Distance of leg is longer than total distance – Exit time 2. Distance of leg is too short – Exit time 3. Flight flying at an unrealistic slow speed – exit time 4. Flight flying at an unrealistic high speed – exit time 5. Flight flying at an unrealistic high speed in levelled cruise – Exit time 6. Time of leg is longer than total Time-Exit time 7. Time of leg is too short – exit time	Fareed is manually correcting all errors and correction related to these errors can be automated. If the flight is landing, discard the waiting time since it is not in RVSM
Sessions : MIDRAS yyyy-mm-dd_time\Logs		
1	Flight data with error in .CSV format • Complete flight data • Add new columns “Error Code and Error Description”	This report will be shared with authorities if required.
2	Error Summary.CSV Correction : Traffic data record line number	Now the line number has a difference of 2

Sessions : Result		
1	Hotspot within airways Center of Risk, hotspot should be within the airways.	Now the marking is showing where there are no airways.
2	More info needed in Help pdf file • Display items labels • Hotspot Manual and explanations	PDF file needs to be edited, File location required
3	Session file • How to load previous sessions into MIDRAS	
4	TLS Graph Graphical representation of : • Calculated technical risk along with ICAO TLS	

	• Calculated overall risk along with ICAO TLS	

#Module 2. Traffic Visualization

#	Item	Comments
1	Speed controller • Need better speed scaling option	Example : Flightradar24.com
2	Zoom pan controller • Zoom and drag options	Hand panning needed. Currently drag option is with right-click, not user friendly.
3	Display Options • What are Convex Hull, Cluster no scaling, the display option checkboxes	Need explanation and change labels to Operational terms
4	Plot risk with congestion	Risk congestion needs to displayed within the simulation display
5	CRM fast simulation Real flight simulation with Safety parameters	This needs to be developed
6	Record video Record and save video of simulation	New feature, needs to be developed
7	Risk plotting • Color options needed	Only green color is showing now, need more colorful presentation
8	Help Manual for visualization Need how to use with details	
9	Time format Change time representation to UTC time format – 24 hour format	
10	Plot TOD points	
11	Airway occupancy Statistics plotting	

#Module 3. Hotspot viewer

#	Item	Comments
1	Opposite crossing Needs to improve	Example: Bahrain-SMR19. Wrong location where no flights permitted
2	Boundary of risk Needs to improve presentation	Better presentation required. Current shapes in green are hard to understand
3	Number within shapes are not clear. Label 'NP' is not showing always while zoom. What is NP with -12 exponent	Need explanation (What is the purpose of these points)
4	Center of Risk, Should be within airways.	Hotspot area is displaying outside airways, needs to be corrected.

5	Representation is not presentable Boundary should represent where traffic flowing	Example : ALSER – point not in boundary-SMR19, although the co-ordinates are checked and those are correct.
6	No Help document	Detailed user guide required

#Current problems

#	Item	Comment
1	MIDRAS unexpected crash	Option 1. Need log/ error why it crashed. Option 2. Debug option is preferred

- END -