

11-12 October 2012, Riga

**Riga Technical University
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Dedicated to the 150th Anniversary and
The 1st Congress of World Engineers and
Riga Polytechnical Institute / RTU Alumni

DIGEST

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Development of Unmanned Air Vehicle features for ice monitoring in Baltic Sea

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Keywords – ice at sea, Unmanned Aerial Vehicle, Gulf of Riga, Maritime traffic

I. INTRODUCTION

This paper describes an innovative approach, where the capability and potential of using the micro class Unmanned Aerial Vehicle (UAVs) for ice conditions recognizance has been already probed practically. The particular experiment has been conducted with the means of UAV, manufactured in Technical University of Riga and equipped with the electromotor, thus considerably minimizing the ecological impact, compared with these UAVs equipped with combustion propulsion. There are seemingly many ways and methods of acquiring the data and information about ice conditions at sea and coastal zone, however, in areas with the dynamic process of ice shifts and movements, there is necessity to have a real picture "in-situ". Precise ice cover information can be of vital importance for ships at sea, especially when such situation has been aggravated. The outcome of experiment is practical proof, that micro-class UAV can be effectively implemented, thou with minor limitations, for local ice conditions reconnaissance and surveillance at sea.

II. GLOBAL WARMING AND ICE NAVIGATION

The notorious process of Global Warming does not affect much practical ice navigation not only in the Polar Regions, but also in the Baltic Sea. Operators and actors of maritime industry should arrange safe and absolutely reliable maritime traffic in heavy ice conditions, so, the leveraged and layered data and information about ice covers at sea become of extreme importance. The data on ice conditions at sea can be in form of assumed forecast or/and factually collected, real data. Nowadays such blocks of information on ice cover at sea can be originated from different sources: ships on sites, coastal surveillance and weather stations, satellites, and aircraft [1].

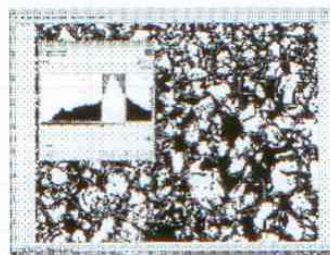
III. CAPABILITIES OF UNMANNED AVIATION

Due to modern rapid developments of UAVs worldwide, there is innovative opportunity to deploy them for needs of ice surveillance and reconnaissance. Direct UAV surveillance and visualization of ice conditions at sea provides the real-time capture of ice situation. Use of UAVs for these purposes massively decreases associated risks and functional expenses. Key consumer of this information is a ship in marine area, which has to use optimal and best passage, once the ice field is expected to be penetrated.

The basic methods of UAV deployment as the means of ice conditions surveillance are as follows: Perspective surveillance; detailed surveillance; pre-planned aerial photo surveying. The methods are being implemented depending on missions, particular situation and location where the UAV is being launched from.

In the process of flight and collecting of visual photo and video data on and ice-openings are being surveyed, with the

aim to clarify their sizing and dimensions. Additionally, the more detailed data on ice thickness, ultimate "breed of ice" and other related ones are being acquired. The thickness of ice packs could be estimated and assumed by mutual comparison of visual and video data, when dedicated data library is being dynamically created and updated, in order to extract provisional ice-thickness from visual images.



Example of GIMP software histogram: manually selected most clear from ice areas on image from UAV (white color areas) with the designation of threshold

IV. RECOMMENDATIONS FOR NAVIGATION IN ICE

All data from particular UAV flight are being processed by specific software GIMP [2], which is suitable for a variety of image manipulation tasks, including photo retouching, image composition, and image analysis. GIMP has many capabilities. It can be used as a simple paint program, an expert quality photo retouching program, an online batch processing system, a mass production image renderer, an image format converter, etc. Every visual color image can be processed and quantified by special GIMP featured capabilities of "layering", "thresholds" and "dynamic masking". The task of processing images from UAV particular flight is to calculate the visual mutual correlations by colors, contrast and brightness of images, in order to create and support Data Base for given flight circumstances.

V. CONCLUSIONS

UAVs, particularly micro-class aircraft, are coast effective, convenient and safe tool for the shipping route planning in complex situation of ice. UAVs might be used from ships of relatively small size. There are great opportunities to use digital technology to process image of ice field. A big scientific, practical and economical potential is in use of UAVs for maritime security.

VI. REFERENCES

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