| | | | | |
|---|---|---|---|---|
| | | Accuracy | Speed | N/A |
| | | | Manoeuvrability | R2IR |
| Cloud | Low | Scope | Speed | F2EO/IR |
| | | | Manoeuvrability | R2EO/IR |
| | | Accuracy | Speed | N/A |
| | | | Manoeuvrability | N/A |
| | Middle | Scope | Speed | F2EO/IR |
| | | | Manoeuvrability | R2EO/IR |
| | | Accuracy | Speed | N/A |
| | | | Manoeuvrability | N/A |
| | High | Scope | Speed | F3EO/IR |
| | | | Manoeuvrability | R3EO/IR |
| | | Accuracy | Speed | N/A |
| | | | Manoeuvrability | R2EO/IR |

Table 3. Results shown for Urban Area as most restrictive for drone usage

## 5. CONCLUSION

Some important, basic considerations in drone employment in disaster relief effort are illuminated in this paper. Although, statistically some platforms had to be preferred, the common opinion is that more than one can do the job. When possible experts on tactical and operational level would employ smaller drone (up to 150kg) instead to request larger strategic level platform (above 150kg).

A contribution of the current work is that it provides a basic modelling basis for reasoning about values and experts opinion and makes such a reasoning explicit particularly featuring disaster relief.

Only single flying platform was considered in this paper. Numbers can boost additionally the capability. Two or three smaller less-capable drones may to equal or exceed the performance of the larger drone employed singly.

Although cost-effectiveness analysis was not introduced, upgrading the sensors to multispectral cameras would permit greater operational flexibility and would offer enhanced operational effectiveness for disaster operations scenario.

A serious limitation to this work is that no explicit simulation solutions that assume weaving in compromises between platform and sensor employment and disaster conditions is being proposed. This challenge will inspire our further research activities. The proposed model needs additional work. In order to follow the weather conditions more accurately and the expert opinions on performance a fuzzy logic model can be introduced.

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## REFERENCE

Adams, S. M., Friedland, C. J. A Survey of Unmanned Aerial Vehicle (UAV) Usage for Imagery Collection in Disaster Research and Management.

American Red Cross (ARC), 2015. Drones for Disaster Response and Relief Operations.

European Emergency Number Association (EENA), 2015. Operations Document – Remotely Piloted Aircraft Systems (RPAS) and the Emergency Services. Brussels, Belgium

Erdelj, M., Natalizio, E., Chowdhury, K. R., Akyildiz, I. F. Help from the Sky: Leveraging UAVs for Disaster Management.

Federation of American Scientists (FAS), 1998: National Image Interpretability Rating Scales, Visited February 2, 2018 https://fas.org/irp/imint/niirs.htm

Hristozov, S., Shishkov, B., 2017. Usability Assessment of Drone Technology with Regard to Land Border Security. *Business Modeling and Software Design*. Barcelona Spain.

Lacher A., Maroney D., 2012. A New Paradigm for Small UAS. The MITRE Corporation. McLean, Virginia, USA.

Lingel, S., Menthe, L., Alkire, B., Gibson, J., Grossman, S.A., Guffey, R.A., Henry, K., Millard, L.D., Mouton, C.A., Nacouzi, G., Wu, E., 2012. Methodologies for Analyzing Remotely Piloted Aircraft in Future Roles and Missions. The RAND Corporation, Santa Monica, California, USA.

Menthe, L., Sullivan, J., 2008. A RAND Analysis Tool for Intelligence, Surveillance and Reconnaissance. The RAND Corporation, Santa Monica, California, USA.

Menthe, L., Hura, M., Rhodes, C., 2014. The Effectiveness of Remotely Piloted Aircraft in a Permissive Hunter-Killer Scenario. RAND Corporation, Santa Monica, California, USA.

Restas, A. RPAS Applications for Supporting Disaster Management. National University of Public Service, Institute of Disaster Management, Budapest, Hungary.

senseFly, 2016. Robots to the Rescue – Researching How Drones Can Save Lives. *Report to the European Commission*. SenseFly Company, 1033 Chesseaux-Lausanne, Switzerland.

Shishkov, B., Hristozov, S., Janssen, M., Hoven, J. v. d., 2017. Drones in Land Border Missions: Benefits and Accountability Concerns. *International Conference on Telecommunications and Remote Sensing*. ACM, New York, NY, USA.

Tanzi, T., Chandra, M., Isnard, J., Camara, D., Sebastien, O., Harivelo, F., 2016. Towards Drone-borne Disaster Management Future Application Scenarios. *ISPRS Congress*. Prague, Czech Republic.

Zlateva, P., Penev, V., Rowlands, G., Georgiev, G., 2016. An Approach for Risk Analysis of Drones Attack to Critical Infrastructure Objects. *6th International Conference on Application of Information and Communication Technology and Statistics in Economy and Education*. UNWE, Sofia, Bulgaria.

Zobl, F., Marschallinger, R., Gräupl, Th., Pschernig, E., Rokitansky, C. H., 2014. Simulationsgestützte Missionsplanung für B-VLOS RPAS im überregionalen Katastrophenhilfeeinsatz. Angewandte Geoinformatik. Herbert Vichmann Verlag. Berlin, Offenbach, Germany.