

Method of Increasing the Identification Friend or Foe Systems Information Security

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Abstract—This article proposes a method of improving information security Identification Friend or Foe (IFF) systems. In this method, a successive transition is made from servicing a separate IFF requester with a system to servicing a network of interrogators of IFF systems that monitor this air object (AO) due to: forming on the aircraft responder the analysis time interval, allocating request signals at this time interval and, when allocating at least one request signal at the time analysis interval, at the end of the analysis time interval, emitting a response signal which includes the spatial coordinates of the AO. This made it possible to exclude the possibility of paralyzing the aircraft responder by deliberate correlated interference of the required intensity by the interested party and, as a result, eliminating the possibility of distortion the detected AO state affiliation information, which increased the information security of the IFF systems.

Keywords—IFF, information security, aircraft responder, request signal, response signal.

REFERENCES

- [1] B. Stevens, F. Lewis and E. Johnson, *Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous*, 3rd ed. John Wiley & Sons, 2015.
- [2] I. Obod, O. Strelnytskyi and V. Andrusevych, *Informatsiyna merezha system sposterezheniya povitryanoho prostoru: monohrafiya*. [Information network of airspace surveillance systems: monograph]. Kharkiv: KhNURE, 2014. (In Ukrainian).
- [3] Y. Ahmadi, K. Mohamedpour and M. Ahmadi, "Deinterleaving of Interfering Radars Signals in Identification Friend or Foe Systems", in *Proc. of 18th Telecommunications forum TELFOR*, Telecommunications Society - Belgrade, ETF School of EE, University in Belgrade, IEEE Serbia & Montenegro COM CHAPTER, pp. 729-733, 2010.
- [4] H. Li, F. Zhao, Y. Li and J. Wang, "One Joint Demodulation and Despreading Algorithm for MOD5", *The Open Automation and Control Systems Journal*, vol. 7, pp. 386-397, 2015. DOI: 10.2174/1874444301507010386.
- [5] J. Pollack and P. Ranganathan, "Aviation Navigation Systems Security: ADS-B, GPS, IFF", in *International Conference on Security & Management, SAM'18*, International Conference on Security & Management, SAM'18, Las Vegas, Nevada, USA, 2018, pp. 129-135.
- [6] Z. Cao and L. Chen, "Security in application layer of radar sensor networks: detect friends or foe", *Security Comm. Networks*, vol. 8, pp. 2712-2722, 2015. DOI: 10.1002/sec.572.
- [7] E. A. El-Badawy, W. A. EL-Masry, M. A. Mokhtar and A. S. Hafez, "A secured chaos encrypted mode-S aircraft identification friend or foe (IFF) system," *2010 4th International Conference on Signal Processing and Communication Systems*, Gold Coast, QLD, 2010, pp. 1-6. DOI: 10.1109/ICSPCS.2010.5709756.
- [8] Y. Zhang, B. Li and S. Li, "A new algorithm of encryption in non-cooperation IFF system," *2008 Fourth International Conference on Wireless Communication and Sensor Networks*, Allahabad, 2008, pp. 129-130. DOI: 10.1109/WCSN.2008.4772696.
- [9] W. Bridge, "IFF System Concept Based on Time Synchronization," in *IEEE Transactions on Communications*, vol. 28, no. 9, pp. 1630-1637, September 1980. DOI: 10.1109/TCOM.1980.1094855.
- [10] W. Bridge, "IFF System Concept Based on Time Synchronization," in *IEEE Transactions on Communications*, vol. 28, no. 9, pp. 1630-1637, September 1980. DOI: 10.1109/TCOM.1980.1094855.
- [11] M. L. Garcia, J. M. Hoffman, J. L. Rowley and D. L. Stone, "Test for Success: Next Generation Aircraft Identification System RF Simulation," *2007 Integrated Communications, Navigation and Surveillance Conference*, Herndon, VA, 2007, pp. 1-10. DOI: 10.1109/ICNSURV.2007.384161.
- [12] H. He, "Techniques of a New Cooperative IFF System", *Telecommunication Engineering*, vol. 5, pp. 15-19, 2002.
- [13] T. Otsuyama, J. Naganawa, J. Honda and H. Miyazaki, "An analysis of signal environment on 1030/1090MHz aeronautical L-band systems," *2017 International Symposium on Antennas and Propagation (ISAP)*, Phuket, 2017, pp. 1-2. DOI: 10.1109/ISANP.2017.8228911.
- [14] T. Otsuyama, J. Honda, J. Naganawa and H. Miyazaki, "Analysis of signal environment on 1030/1090MHz aeronautical surveillance systems," *2018 IEEE International Symposium on Electromagnetic Compatibility and 2018 IEEE Asia-Pacific Symposium on Electromagnetic Compatibility (EMC/APEMC)*, Singapore, 2018, pp. 71-71. DOI: 10.1109/ISEMC.2018.8394048.
- [15] A. Lenshin, N. Tikhomirov and V. Lebedev, "Jeftektivnost' podavleniya RLS s aktivnym otvetom maskirujushhimi i imitirujushhimi pomehami" [Efficiency of suppressing radar with an active response by masking and imitating interference], in *Proceedings of the XX International Scientific and Technical Conference "Radiolocation, navigation, communication"*, Voronezh, 2014, pp. 1323-1331. (In Russian).
- [16] A. Lenshin., Yu. Maevsky., V. Lebedev. "Otsenka jeftektivnosti funkcionirovaniya sredstv radioelektronnogo podavleniya v usloviyah konfliktного vzaimodeystviya s RLS s aktivnyim otvetom" [Estimation of the effectiveness of the functioning of radio electronic suppression in conditions of conflict interaction with the radar with an active response], *Radiotechnical and telecommunication systems*. № 2 (18), pp. 34-42, 2015. (In Russian).
- [17] V. Lebedev, A. Lenshin, N. Tikhomirov. "Effektivnost' podavleniya sistem radiolokatsii s aktivnyim kodovym otvetom prednamerennymi pomehami" [Efficiency of Suppression of Radar Systems with an Active Code Response by Intentional Interference], *Bulletin of the Voronezh Institute of the Ministry of Internal Affairs of Russia*, № 4, pp. 114-121, 2015. (In Russian).
- [18] A. Lenshin and V. Lebedev, "Kompleksnaja metodika ocenki jeftektivnosti funkcionirovaniya radiolokacionnyh sistem s aktivnym otvetom" [Comprehensive methodology for assessing the effectiveness of radar systems with an active response], *Dynamics of complex systems -XXI century.*, vol. 11, no. 2, pp. 60-64, 2017. (In Russian).
- [19] Lincoln Laboratory Massachusetts Institute of Technology, Lexington, Massachusetts, "GPS-Squitter capacity analysis", National Technical Information Service, Springfield, VA 22161, Washington, 1994.
- [20] R. E. Boisvert and V. A. Orlando, "ADS-Mode S system overview," [1993 Proceedings] *AIAA/IEEE Digital Avionics Systems Conference*, Fort Worth, TX, USA, 1993, pp. 104-109. DOI: 10.1109/DASC.1993.283562.

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