SUMMARY
OF SCIENTIFIC WORKS

by Dr. Eng. Atanas Yordanov Ganchev

The scientific works are presented in three categories:
I. Monographic Works
II. Scientific Articles and Reports
III. Scientific Research and Development Activities

I. MONOGRAPHIC WORKS

"Some Aspects of Flight Operations for the Optimization of Ornithological Safety"

Based on improved models of the "Crew – Aircraft" system operation and the implementation of new technological capabilities of the human factor, the possibility of overcoming emerging problems associated with the ornithological safety of aircraft flights has been substantiated. Rational solutions have been proposed, aligned with the geographical and climatic characteristics of the environment and the natural and morphological features of bird species, to avoid mid-air incidents and preserve ecological balance.

The monograph discusses proposals for optimizing the process of air navigation activities organized by state and private aviation operators and airport administrations. These proposals are adapted to the requirements of nature conservation organizations and environmental structures to ensure a high level of aviation safety.

The monograph is divided into three parts and aims to provide answers to the following key questions:

- Improvement and development of the "Crew – Aircraft" system operation for optimizing flight safety.
- Methods for assessing the qualitative characteristics of aircraft structural elements to enhance the efficiency of flight operations.
- Study of the impact of ornithological safety on the performance characteristics of aircraft to optimize flight safety.
- Systems for timely informing the crew about the condition of aircraft structural components.
- Influence of accompanying factors related to flight operations.

II. SCIENTIFIC ARTICLES AND REPORTS

1. Ganchev, A.J. "Analysis of the Current State of the Problem of Bird Strikes Involving Military Aircraft.", International Scientific Conference "HEMUS 2020" – *"Scientific Research and Investment in Technological Innovation: A Crucial Factor for Defense and Security"*, Plovdiv, pp. I-126 – I-138, ISSN 1312-2916.

This work presents a complex of measures for ensuring flight safety in the context of ornithological threats. These include operational and passive protection measures for aircraft, airports, and facilities, as well as ecological restructuring of airport environments to reduce bird attraction. The study emphasizes risk assessment, incident reporting, and the systematic investigation of bird strike events. Bird strike mitigation is approached as a distinct element of aviation safety assurance—*ornithological flight safety*.

2. Kirkov, D., Gencheva, P., Ganchev, A., Kostova, K."Methods for Assessing the Technical Condition and Extending the Service Life of Emergency Rescue Equipment.", University Scientific Conference, National Military University "Vasil Levski", Veliko Tarnovo, pp. 152–163, CD-ISSN 2367-7481, ISSN 1314-1937 (2019).

The study focuses on individual rescue equipment used by aircraft and helicopter crews, made of fabric, ropes, straps, and metal elements. The aim is to perform expert evaluations of their technical condition and explore possibilities for extending their service life. Current methods assess the impact of climate factors on physical-mechanical properties but fail to fully account for material aging. The paper highlights the lack of standardized accelerated aging tests, which are critical in evaluating the manufacturer-declared service life of rescue systems.

3. Ganchev, A.J., "Paths for Minimizing the Negative Consequences of Bird Strikes on Aircraft." International Scientific Conference "HEMUS 2020" – *"Scientific Research and Investment in Technological Innovation: A Crucial Factor for Defense and Security"*, Plovdiv, pp. I-147 – I-155, ISSN 1312-2916.

This article discusses the urgent need for high-level flight safety and the active role of flight crews in preventing bird strikes. It emphasizes the importance of timely and accurate bird strike incident reporting—even minor ones—to help prevent severe consequences. Cooperation between flight crews and airport bird control units is essential for effective ornithological safety.

4. Ganchev, A.J."Assessment of the Reconnaissance Capabilities of Unmanned Aerial Vehicles.", International Scientific Conference "HEMUS 2020" – *"Scientific Research and Investment in Technological Innovation: A Crucial Factor for Defense and Security"*, Plovdiv, pp. I-156 – I-163, ISSN 1312–2916.

This article analyzes how UAVs enhance reconnaissance capabilities due to advancements in autonomous systems, navigation equipment, sensors, and communication technologies. The reconnaissance potential of UAVs is examined with regard to their effectiveness in mission-

specific information gathering, highlighting key performance indicators and system integration in military operations.

5. Ganchev A. J., "Technologies for Countering the Threat of Unmanned Aerial Vehicles." International Scientific Conference "HEMUS 2022" – *"Scientific Research and Innovation for European Security and Defense"*, Plovdiv, p. II-232, ISSN 1312–2916.

Addressing UAV threats requires a multilayered approach integrating various technologies and strategies. Detection systems play a vital role across military, civil, and commercial applications. The paper forecasts the continuous development of commercial UAVs, emphasizing increased autonomy, AI integration, cost-efficiency, and the importance of streamlined regulations for faster innovation across the U.S., Europe, and Asia.

6. Ganchev, A.J., "The Role of Unmanned Aerial Systems in Current and Future Military Conflicts.", International Scientific Conference "HEMUS 2022" – *"Scientific Research and Innovation for European Security and Defense"*, Plovdiv, pp. II-221 – II-231, ISSN 1312–2916.

Modern armed forces increasingly use UAVs for reconnaissance, target acquisition, support, and logistics. The study explores future operational flexibility and the required adaptability of UAVs in diverse terrains. It emphasizes the need for well-trained crews, risk assessment, communication reliability, and regulatory compliance with international humanitarian law and aviation safety standards.

7. Ganchev, A.J. "A Risk Assessment Model for Bird Strikes on Aircraft." Proceedings of the International Scientific Conference "HEMUS 2022" – *"Scientific Research and Innovation for European Security and Defense"*, Plovdiv, pp. II-192 – II-210, ISSN 1312–2916.

The model evaluates bird strike risk by identifying high-risk zones—migration routes, feeding areas, and regions with high bird density—especially near airports and air corridors. It incorporates the use of technical tools such as radars, drones, and satellites to monitor bird movements. The model supports data-based planning and preventive action for improving ornithological flight safety.

8. Ganchev, A. J. "Innovative Solutions for Reducing Bird Strikes with Aircraft." *Proceedings of the International Scientific Conference "Hemus-2020"*, "Scientific Research and Innovation for European Security and Defense", Plovdiv, pp. I-164 – I-178, ISSN 1312–2916.

Bird control methods around airports are constantly being improved and innovated. Bird deterrence measures are increasingly used and optimized due to their effectiveness, simplicity, low cost, and environmental friendliness. Three methods are particularly popular: bioacoustic (transmission of recorded alarm calls, wing flapping sounds from frightened flocks, and predator bird calls), pyrotechnics, and electromagnetic impulse deterrents. The main drawback of these measures is the dependency of their effectiveness on frequency and duration of use, as birds tend to habituate to non-lethal deterrents. Migratory birds in spring and autumn respond strongly to perceived threats due to their weak attachment to the overflown territory and strong instinctual drive.

9. Ganchev, A. J. "Methodological Support for Flight Safety Monitoring, Quantitative Assessment, Analysis, and Practical Forecasting." *Proceedings of the International Scientific Conference "Hemus-2020"*, Plovdiv, pp. I-179 – I-185, ISSN 1312–2916.
The existing legal and regulatory framework for flight safety (FS) defines the behavior of leading airlines, which adhere to international standards. Implementing FS management procedures requires a suitable set of tools and methodological support, including technologies, algorithms, and software. Due to the increase in emergency situations, a methodological framework for effective FS management procedures is necessary. FS management is considered a complex dynamic system, with FS being a mandatory procedure ensuring quantitative assessment of safety levels—since only what is measurable can be managed. An essential but insufficient condition for effective FS management is objective measurement. The ICAO Safety Management Manual provides a practical foundation for these principles.

10. Ganchev, A. J. "Some Solutions for the Use of Unmanned Aerial Vehicles in Military Conflicts." *Proceedings of the 12th International Scientific Conference "HEMUS 2024"*, "Scientific Research, Innovation, and Industrial Cooperation – A Paradigm for Adequate Defense", Plovdiv, ISSN 1312–2916 (in print).

In the context of growing technological complexity in modern warfare, the use of unmanned aerial vehicles (UAVs) is increasingly significant for planning and executing military operations. This paper explores operational implementation and optimization of UAVs across conflict phases. Emphasis is placed on technological advancements in sensor systems, autonomous navigation algorithms, electro-optical surveillance, and precision weapon systems that enhance UAV capabilities. It examines the role of geospatial data and its geometric correction to improve reconnaissance and combat accuracy. The paper provides a critical review of current tactical approaches and offers recommendations for integrating UAVs into strategic military planning to boost combat effectiveness and reduce personnel risk.

11. Ganchev, A. J. "Trends in Innovative Energy Supply Solutions for Unmanned Aerial Vehicles." *Proceedings of the 12th International Scientific Conference "HEMUS 2024"*, "Scientific Research, Innovation, and Industrial Cooperation – A Paradigm for Adequate Defense", Plovdiv, ISSN 1312–2916 (in print).

Numerous tactical constraints in military operations are being overcome through the adoption of innovative technologies. The problem of resource depletion is partially mitigated by adapting tactics and counter-drone measures using effective tools and technical equipment. While supplying sufficient counter-drone systems remains a challenge, progress is being made in propulsion technologies, UAV autonomy, sensor improvements, and enhanced efficiency of onboard weapons. These innovations contribute to more resilient and longer-endurance UAV operations.

12. Ganchev, A. J. "Optimizing Aviation Safety through Ornithological Risk Management." *Proceedings of the 12th International Scientific Conference "HEMUS 2024"*, "Scientific Research, Innovation, and Industrial Cooperation – A Paradigm for Adequate Defense", Plovdiv, ISSN 1312–2916 (in print).

Ornithological risk is a major challenge to aviation safety, especially around airports and during takeoff and landing. Bird-aircraft collisions can cause serious material damage and endanger crew

and passenger lives. This paper explores ways to optimize aviation safety through systematic ornithological risk management. It analyzes current bird activity monitoring and forecasting methods, including radar systems, sensor technologies, and biological and behavioral models. Best practices in prevention and control—ecological, technical, and organizational—are assessed. The study emphasizes the need for an integrated approach involving cooperation among aviation, environmental, and scientific institutions to minimize ornithological risks and achieve sustainable aviation safety.

13. Ganchev, A. J. "Counter-Unmanned Aerial Vehicle Methods." *Proceedings of the 12th International Scientific Conference "HEMUS 2024"*, "Scientific Research, Innovation, and Industrial Cooperation – A Paradigm for Adequate Defense", Plovdiv, ISSN 1312–2916 (in print).

With the increasing use of UAVs in both civilian and military domains, there is a growing need for effective countermeasures. The potential threat from hostile or unauthorized UAVs ranges from reconnaissance and sabotage to precision strikes. This paper presents a systematic overview of existing UAV countermeasures, categorized into three main approaches: kinetic, electronic (electromagnetic), and hybrid methods. It discusses technologies such as electronic jamming, detection and tracking systems (radar, electro-optical, and acoustic), directed-energy weapons, and tactical interventions by specialized forces. The study highlights the importance of an integrated, adaptive approach to meet the evolving UAV threat landscape.

III. RESEARCH AND DEVELOPMENT ACTIVITIES

(TORs, TTORs, TSs, Military Economic Analyses, Projects, Programs, Methodologies, etc.)

This section includes educational and methodological works related to the author's participation in the development of military-economic analyses, applied scientific reports, tactical-technical assignments, research and acquisition projects for military equipment, modernization and improvement of aviation equipment (AE) and its components and systems, as well as documents (TS and TTORs) necessary for the acquisition of defense products for the needs of the Ministry of Defense, the Bulgarian Armed Forces, and their subordinate structures. A total of **93 documents** were developed in the period **2013–2024**.

Between **2020 and 2025**, the author contributed to the development of programs and methodologies for assessing the technical condition and determining the potential extension of the service life of aviation equipment, as well as to documents related to its operational use.

The author has repeatedly participated in commissions for public procurement procedures related to the supply and maintenance of AE for the Bulgarian Air Force.

Since 2020, the author has been involved in the development of **five military-economic analyses**:

1. RVTTI&M, Military Economic Analysis, *"Protection against Unmanned Aerial Systems"*, 2022.

2. RVTTI&M, Military Economic Analysis, *"Development and Sustainment of Reconnaissance Capabilities for the 'Special Forces' Groups of the Joint Special Operations Command"*, 2023.
3. RVTTI&M, Military Economic Analysis, *"Acquisition of High-End Unmanned Aerial Systems (UAS)"*, 2023.
4. RVTTI&M, Military Economic Analysis, *"Development and Improvement of the Initial Flight Training Process for Helicopter Pilots for the Needs of the Armed Forces, Ministry of Interior, and Other Government Institutions"*, 2024.
5. RVTTI&M, Military Economic Analysis, *"Medium- and High-End Unmanned Aerial Systems with Strike Capabilities"*, 2025.

The author has also participated as a team member in the development and implementation of the following projects:

1. Project *"Device for Disposal of Unexploded Ordnance"* under Program 7.2 – 2020.
2. Project *"Aerial Surveillance and Reconnaissance with UAS for the Land Forces"*, 2022.
3. Project *"Acquisition of Light Training Helicopter"* – Contract No. L-PBOP-05-246/08.12.2023 for the supply of two Cabri G2 helicopters with LION Helicopters s.r.o., Czech Republic – 2023.
4. Project *"Development and Optimization of the Initial Flight Training Process for Helicopter Pilots for the Armed Forces, Ministry of Interior, and Other State Institutions"* – 2023.
5. Project *"Installation System for 7.62 mm Machine Gun (PK) on AS 532 AL 'COUGAR' (CSAR) Helicopters"* – 2022.
6. Project *"Acquisition of High-End Unmanned Aerial Systems"* – 2023.
7. National Project under Contract Reg. No. 3-2894/06.12.2022 (ongoing).

The project includes three tasks:

- Research and application of ground, aquatic, and unmanned aerial platforms for logistics, data acquisition, and remote sensory and visual information application.
- Design and development of a sensor system (electro-optical / acoustic / thermal imaging) for detection, tracking, and neutralization (destruction) of drones.
- Dynamic risk and threat modeling in real time during disasters and emergencies using autonomous ground, water, and aerial systems.

Additionally, the author has contributed to the development of **Technical Specifications** for the supply, services, and modernization of aviation equipment aimed at ensuring the airworthiness of military aircraft.

Additional Projects and Technical Documentation

Logistics Support and Maintenance Projects:

1. "Integrated Logistic Support of Pilatus PC-9M and PC-12/45 Aircraft" – 2020
2. "Integrated Logistic Support of AS 532 AL COUGAR Helicopters" – 2020

3. “Integrated Logistic Support of MAKILA 1A1 Aircraft Engines” – 2020
4. “Overhaul/Major Restoration of Aviation Technical Equipment for Mi-24V Helicopters” – 2020
5. “Integrated Logistic Support of C-27J Spartan Aircraft of the Bulgarian Air Force” – 2020
6. “Ensuring Airworthiness of L-410 UVP-E Aircraft of the Bulgarian Air Force” – 2021
7. “Ensuring Airworthiness of ROLLS-ROYCE ALLISON 250-C20J Engines for Bell-206B3 Helicopters” – 2021
8. “Ensuring Airworthiness of Bell-206B3 Helicopters” – 2021
9. “Ensuring Airworthiness of MiG-29 Aircraft of the Bulgarian Air Force” – 2021
10. “Integrated Logistic Support of AS 565MB PANTHER and AS 365 N3+ DAUPHIN Helicopters” – 2022
11. “Portable Non-Magnetic Two-Section Barochamber, Container Type” – 2022
12. “12V Accumulator Batteries” – 13 units – 2022
13. “24V Accumulator Battery” – 1 unit – 2022
14. “Delivery of Overhauled RD-33 Series 2 Engines for MiG-29 Aircraft” – 2022
15. “Support for Operation of Su-25K/UBK Aircraft” – 2022
16. “Jet A-1 Aviation Kerosene” – 2022
17. “Upgrade of Avionics and Systems Components on C-27J Spartan Aircraft” – 2023
18. “Supply of Aviation Technical Equipment for Mi-17 Helicopters” – 2023
19. “Overhaul/Major Restoration of Aviation Technical Equipment for Mi-24V Helicopters” – 2023
20. “Supply of Aviation Technical Equipment for Mi-24V Helicopters” – 2023
21. “Overhaul/Major Restoration of Aviation Technical Equipment for Mi-17 Helicopters” – 2023
22. “Overhaul/Major Restoration of KSA-2 Aircraft Gearboxes for MiG-29 Aircraft” – 2023
23. “Overhaul/Major Restoration of RD-33 Series 2 Engine for MiG-29 Aircraft” – 2023
24. “Aviation Tires of Various Specifications” – 10 units – 2023
25. “PTK-25 Parachute Brake System or Equivalent(s)” – 2023
26. “Refurbished (Used) Auxiliary Power Units – SAPFIR-5” – 2023
27. “Medals and Awards for MoD and Armed Forces” – 20 units – 2023
28. “Tactical Parachute System Type ‘Flying Wing’” – 2023
29. “Integrated Logistic Support of Arriel 2C Aircraft Engines” – 2024
30. “Upgrade of Avionics and Systems Components on C-27J Spartan Aircraft” – 2025

Development of Testing Methodologies and Programs for Aviation Equipment, aimed at assessing technical condition and determining potential service life extension based on air time, calendar service period, number of engine starts, landings, and operating cycles:

1. AI-9V Aircraft Starter Engine
2. An-30 Aircraft
3. AV-72T Air Propellers
4. AI-24VT Aircraft Engine – D-24VT–2020–M1
5. KSA-2 Aircraft Gearbox – I-62–2020–M1
6. BK-53 Hypobaric Chamber
7. Surface-to-Air Missiles (SAM): 5Ya-23, 20DSU, 5V27U(D), 3M9M3E, 5V28E, and 5V55K/R
8. Limit Command Unit BPK-88, Series 3(A) – BPK–88–3(A)–2015–M1

9. Aircraft Engine Item 25 – I–25–2015–M1
10. Aircraft Engine Item 88, Series 2 – I–88–2015–M1
11. Tail Rotor Blade Set (TRB) for Mi-17 Helicopter – TRB-Mi-17–2015–M1
12. Emergency Parachutes S-4U and PN-58, Series 3 – PS–S-4U/PN-58ser.3–2015–MI
13. Landing Gear Struts for MiG-29 Aircraft
14. Landing Gear Shock Absorber Cylinders for MiG-29 Aircraft
15. RU-19A300 Aircraft Engine – RU-19A–2016–M1
16. K-36DM Series 2 Ejection Seats – K-36DM–2021–M1
17. VARTA F20/22H1C-1 Type Aircraft Batteries
18. VARTA 20FP25H1C-R Type Aircraft Batteries
19. KT150E Aircraft Wheels
20. Main Rotor Blades (Part No. 8AT.2710.000) from Mi-17 Helicopter – MRB-8AT.2710.000–2020–M1
21. Autonomous Steering Units, ARM-150M and ARM-150K
22. Drives RP-260, RP-270, and RP-280
23. Electrical Energy Converters PTO-1000/1500M
24. SAPFIR-5 Auxiliary Power Unit – APU-S-5-2021-M1
25. Aviation Equipment Aggregates from L-39ZA Aircraft – AEO-L-39ZA-2022–M1
26. Fuel Lubricant Conductivity Index Monitoring – EC-F-2022–M1
27. Optimal Implementation Plan for the Project "Acquisition of a New-Type Main Fighter Aircraft and Ensuring Integrated Logistic Support"

- Aggregates from L-39ZA Aircraft – AGR-L-39ZA–2023–M2
- Aggregates from Su-25K/UBK Aircraft

28. Autonomous Steering Units ARM-150M and ARM-150K – ARM-150–2023–M2
29. Gas Turbine Engine Modules GTDE-117 – GTDE-117–2024–M1
30. L-39ZA Aircraft – L-39ZA–2024–M1
31. PTK-25SK Brake Parachute System – BPS-PTK-25SK–2024–M1
32. KT100 Brake Packs from MiG-29 Aircraft

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