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AIR AND SATELLITE TRAFFIC CONTROL AND TRACKING

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Abstract. Control and tracking of air and satellite traffic is carried out by official international and state systems. The paper discusses satellite and air traffic control systems.
Key words: UAV, 1CUBEBEL, BSUSAT, EU11S, satellite, aircraft.

КОНТРОЛЬ И СОПРОВОЖДЕНИЕ ВОЗДУШНОГО И СПУТНИКОВОГО ДВИЖЕНИЯ

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Аннотация. Контроль и сопровождение воздушного и спутникового движения осуществляется системами официальными международными и государственными системами. В работе обсуждаются системы контроля спутников и воздушного движения.
Ключевые слова: БПЛА, 1CUBEBEL, BSUSAT, EU11S, спутник, самолет.

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Introduction

The world is witnessing an increase in air and satellite traffic. BSUSat-2, the second BSU nanosatellite, was successfully launched into orbit on 27 June 2023 at 14.34.49. Its capabilities can be used in civil aviation to improve flight safety. Air traffic flight data passes through several ATC (air traffic control) centres, each of which is responsible for its own area of responsibility and, as a rule, does not have detailed information on the further movement of aircraft (aircraft). Therefore, the need for global online aircraft tracking systems has increased dramatically. In September 2023, the Presidential Decree "On State Registration and Operation of Civil Unmanned Aircraft Systems" was adopted. The document is aimed at ensuring the safe use of the airspace of Belarus by civil unmanned aerial vehicles and aeromodels.

1. Satellite traffic

As of 2023, there are more than 2400 active satellites orbiting the Earth [1]. Satellite motion control and monitoring can be performed online (https://db.satnogs.org/satellite/, https://www.space-track.org/, https://bsusat.com/, etc.) or with the help of specialised software, e. g. Orbitron (Figure 1) www.stoff.pl/, SatPC32 www.ams-at.org/product/satpc32-by-electronic-download/, Ha-lloSat https://hallosat.software.informer.com/ and others.

BSUSat-2, the second BSU nanosatellite, was successfully launched into orbit on 27 June at 14.34.49. BSUSat-2 was launched in Russia from the launch complex of Vostochny Cosmodrome on a Soyuz-2.1b launch vehicle with Meteor-M spacecraft № 2–3. The first BSU satellite was launched into orbit on 29 October 2018 in China from the Jiuquan Cosmodrome. The comparative characteristics of the satellites are shown in Table 1.

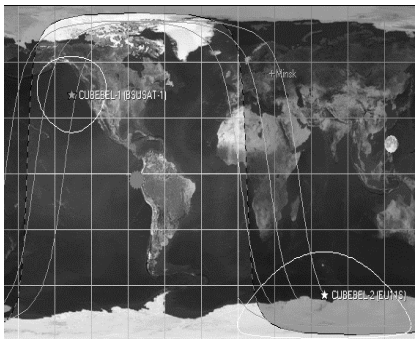

Figure 1 – Image of the position and trajectory of the BSU satellites

Table 1. Orbital parameters and characteristics of the BSU satellites

Satellite name	1CUBEBEL-1 (BSUSAT-1)	1CUBEBEL-2 (EU11S)
ID satellite	WMQB-0532-9164-6364-5821	PIHV-8715-3112-5892-6258
NORAD ID	43666	57175
Number COSPAR	2018-083-E	2023-091-K
Launch date	2018-10-29	2023-06-27
Inclination	97.371	97.656
RAAN	303.192	320.197
Eccentricity	0.0010013	0.0015132
Perigee Argument	110.259	314.294
Major axle	6 806 km	6 934 km
Perigee x Apogee	421 x 434 km	545 x 566 km
BStar (к-т торм.)	0.001247800 1/ER	0.000576660 1/ER
Average anomaly	249.974	45.705
Height (km)	458.624	563.490
Speed (km/sec)	7.633	7.582
Period	1h 33m 07s (93.12 min.)	1h 35m 45s (95.75 min.)
Turns per day	15.46289459	15.03707456
№ coil	27 361	1 443

The satellite passes the orbit in 95 minutes. It passes over Belarus six times a day: three times in the morning and three times in the evening.

2. Air traffic control and tracking

There are more than 200 thousand aircraft flights per day in the world [2]. Satellite traffic control and monitoring can be performed online (www.flightradar24.com/

data/statistics, www.ru. flightaware.com/live/, etc.) or using specialized programmes, e.g. The Flight Tracker (iOS, Android), Flightradar24 (iOS, Android) https://apps.apple.com, https://play.google.com/.

The 1CUBEBEL-2 (EU11S) satellite has a module that could be used by civil aviation to monitor aircraft movements. It is difficult for regional air traffic control centres to control aircraft flights over the oceans and over many areas of land. An example of such a flight, taken from www.flightradar24.com, is shown in the Figure 2.

Part of the BAW9VA flight route is marked with a dotted line and is estimated. The satellite, flying over the ocean, can detect radio beacons from aircraft.

Conclusion

Existing satellite and aircraft tracking and tracking systems can be used in joint measurement systems to, for example, improve real-time position control of satellites, aircraft, and other aircraft.

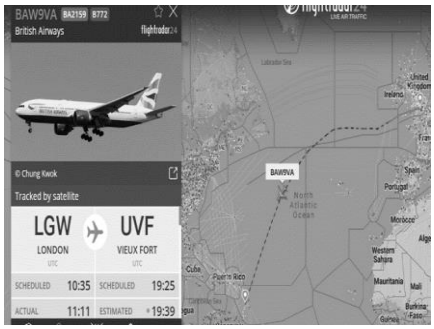

Figure 2 – Image of the position and trajectory of flight BAW9VA

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ДИАГНОСТИЧЕСКИЙ КОМПЛЕКС КОНТРОЛЯ СОСТОЯНИЯ ОБМОТОК ЭЛЕКТРИЧЕСКИХ МАШИН

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Аннотация. Комплекс для мониторинга состояния обмоток электромашин создан для точной и надежной проверки двигателей. Он быстро выявляет возможные проблемы и дефекты, применяя метод сравнения обмоток. Комплекс предоставляет точную оценку состояния каждой обмотки и отображает результаты на панели, помогая оператору принимать решения. Комплекс включает в себя панель с частотным преобразователем, индикатор, кнопки для переключения режимов, сенсорный экран и микропроцессор. Он оснащен кнопкой «STOP» для быстрой остановки в случае аварии и светодиодами для отображения состояния комплекса. Модули управления реле играют важную роль в переключении режимов работы комплекса. Этот комплекс является ключевым инструментом для поддержания эффективной работы электродвигателей в различных отраслях промышленности.

Ключевые слова: диагностический комплекс, контроль состояния, обмотки электрических машин, диагностика.

DIAGNOSTIC COMPLEX FOR MONITORING THE CONDITION OF ELECTRIC MACHINE WINDINGS

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Abstract. The complex for monitoring the condition of electric machine windings is designed for accurate and reliable inspection of motors. It quickly identifies potential problems and defects by using a method of comparing windings. The complex provides an accurate assessment of the condition of each winding and displays the results on the panel, assisting the operator in decision-making. The complex includes a panel with a frequency converter, an indicator, buttons for mode switching, a touch screen, and a microprocessor. It is equipped with a "STOP" button for quick shutdown in case of an emergency and LEDs to display the state of the complex. Relay control modules play a crucial role in switching the complex is operating modes. This complex is a key tool for maintaining the efficient operation of electric motors in various industrial sectors.

Key words: diagnostic complex, state control, electric machine windings, diagnostic.

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Диагностический комплекс контроля состояния обмоток электрических машин разработан с учетом потребностей в надежной и точной диагностике двигателей и обмоток. Его основной задачей является обеспечение оперативного обнаружения потенциальных неисправностей и