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Oleg Ivanovich Zavalishin ·  
Anatoly Nikolaevich Korotonoshko ·  
Dmitry Alexandrovich Zatuchny ·  
Yury Grigorievich Shatrakov

# Information Support and Aircraft Flight Management

Oleg Ivanovich Zavalishin  
Moscow, Russia

Anatoly Nikolaevich Korotonoshko  
Moscow, Russia

Dmitry Alexandrovich Zatuchny  
Moscow, Russia

Yury Grigorievich Shatrakov  
Saint Petersburg, Russia

ISSN 1869-1730

ISSN 1869-1749 (electronic)

Springer Aerospace Technology

ISBN 978-981-16-0087-6

ISBN 978-981-16-0088-3 (eBook)

<https://doi.org/10.1007/978-981-16-0088-3>

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The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

# Introduction

High-quality information support for aircraft (ACFT) is becoming crucial now. This is due to the continually increasing intensity of air traffic. Any interruption in obtaining navigation or any other information necessary to ensure the flight of the aircraft may lead to irreparable consequences. This applies not only to large airliners but also to small aircraft or helicopters, which often have to fly in areas with steep terrain or in poor visibility.

Modern means of monitoring the flight of aircraft are less and less responsive to the modern needs of information support, both for the aircraft crew and ground services that are responsible for radio technical support of flights.

The purpose of this book is to familiarize a wide range of aviation professionals with new methods and approaches to improving the quality of information support for aircraft, developed and implemented currently in the Russian Federation (RF).

The first chapter of this monograph discusses issues related to the introduction of automatic dependent surveillance (ADS) in the Russian Federation. This promising technology has already been the subject of quite a lot of scientific papers published both in the Russian Federation and in other countries that are leaders in the global aviation market. At the same time, much attention was paid to the implementation of ADS in the form of systems such as 1090ES or VDL-4. In this chapter, attention focuses on the program of activities on implementation of ADS in Russia, as well as its implementation in the Arctic and Far Eastern regions and in areas such as agricultural aviation, or to control a swarm of unmanned aerial vehicles.

The second chapter of this book presents algorithms for calculating the reliability of computing blocks used in civil aviation. It should be noted that the correct execution of a large number of computing operations within a minimum period depends on the composition of navigation and other relevant information that is transmitted via data transmission lines to ground air traffic control authorities or onboard the aircraft. In this case, algorithms are provided that are applicable not only to information support for massive aircraft flight but also to modeling the spatial movement of the helicopter.

Although automatic dependent surveillance can become a severe means of information support or information exchange between all interested airspace users if it is fully implemented worldwide, it may not always meet the existing requirements for

the integrity and reliability of transmitted messages. The long and fruitful work of Russian scientists from Spectr LLC, headed by General Director–General designer, O. I. Zavalishin, was devoted to solving this problem. The methods and algorithms developed by them were implemented and successfully operated in the form of local ground-based control and correction stations and the PILOT satellite-optical system. As well as a complex of ground and flight checks makes it possible to provide information support in civil aviation with integrity and reliability requirements that fully meet international standards for different regions and under different conditions. These new technical solutions are described in the third chapter of this book.

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# Abbreviations

AA	Airfield airspace
AAIM	Aircraft autonomous integrity monitoring
ACFT	Aircraft
ACS, mm	Automated control system in the millimeter range
ADS	Automatic dependent surveillance (ADS-B)
ANI	Aeronavigation information,
APNT	Advanced position, navigation, timing
APV	Approach with Vertical Guidance
ARAIM	Advanced Receiver Autonomous Integrity Monitoring
ARP	Automatic radar position
AS	Airspace
ASMGCS	Advanced Surface Movement Guidance and Control System
AT ATC	Air traffic control automation systems
ATC	Air traffic control
ATM	Air Traffic Management
AW	Automated workplace
BMS	onboard multifunctional system
CA	Civil aviation
CDC	Control dispatcher center
CNS/ATM	Communication, Navigation, Surveillance/Air Traffic Management
CNTS	Coordinate and navigation temporary support
CP RET	Radio engineering control point towers
CP	Control point
CPDLC	Controller Pilot Data Link Communications
CS	Complementary system
CTP	Coordinate-temporary provision
DCMW	Decameter wave (decameter range)

DGNSS	Differential Global Navigation Satellite System
DME	ICAO short-range navigation system
DTL	Data transmission lines
EDW	Experimental and designing work
EU ATM	Unified air traffic management system
EU	European Union
FAA	Federal Aviation Administration
FIS-B	Flight information service broadcast
GA	General aviation
GBAS	Ground-Based Augmentation System
GLONASS	Global navigation satellite system (Russia)
GLS	GBAS Landing Systems
GNSS	Global navigation satellite system
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IAC	International Aviation Committee
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMO	International Maritime Organization
Ins	Inertial navigation system
INS	Inertial Navigation System
ITU	International Telecommunication Union
LA	Local airlines
LKKS	Local control and correction system
LORAN-C	Medium frequency ground navigation system
LR	Landing radar
MF	Medium frequency
MFW	Medium frequency wave (or means of communication, depending on the context)
MLS	Microwave landing system
NE AC	Navigation equipment of aircraft consumers
NOTAM	Notice To Airmen
NPA	Non-precision approaches
NPPF Spectr	Research and production company Spectr
OWP	Operator's workplace
PR	Primary radar
PSR	Primary surveillance radar
RAIM	Receiver Autonomous Integrity Monitoring
RB	Radio beacon
REE	Radio-electronic equipment
RESSRN	Radio engineering system for short-range navigation in Russia

RF	Russian Federation
RISATC KA	Russian information system for aircraft traffic control in the Kuril Archipelago area
RNP	Required navigation performance
SARPS	Standards and recommended practices
SBAS	Satellite-based augmentation system
SCFT	Spacecraft
SNS	Satellite navigation system
SRNS	Satellite radio navigation system
SSR	Secondary surveillance radar
STDMA	Self-organizing Time Division Multiple Access
Target detection range of the MARP	The target detection range of the meteorological automatic radar position
The FIS and the CAS	The Federal intelligence service and the control airspace
TIS-B	Traffic information service–broadcast
UAS	Use of air space
USW DTL	Ultra-shortwave data transmission line
USW DTL4 or VDL-4-USW	Data transmission line for civil aviation in ICAO standards (modification 4)
VFR	Visual flight rules
Z/C OBNS	Zonal command onboard navigation system