



AVIATION IN THE XXI-ST CENTURY

INTERNATIONAL CIVIL AVIATION ORGANIZATION
NATIONAL ACADEMY OF SCIENCES OF UKRAINE
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY

PROCEEDINGS

THE FOURTH WORLD CONGRESS "AVIATION IN THE XXI-st CENTURY"

"Safety in Aviation and Space Technologies"

Volume 1



September 21-23, 2010
Kyiv, Ukraine



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SYMPOSIA

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SYMPOSIUM 1. MODERN SPACE AND AVIATION TECHNOLOGIES

Session A. Latest technologies for maintaining aircraft airworthiness

Session B. Diagnostic systems used in aerospace complex

Session C. Power and resource of aircraft strength and durability

Session D. Aerodynamics and flight safety

Session E. Intellectual robotics measuring complexes and systems

Session F. Automation and energy saving on transport

Session G. Information security and confidentiality in aviation

Session H. Computer technologies

SYMPOSIUM 2. AERONAVIGATION

Session A. Communication, navigation, surveillance /air traffic management (CNS/ATM)

Volume 2

RADAR METHODS AND SYSTEMS WORKSHOP (RMSW-2010)

SYMPOSIUM 3. INTERNATIONAL INTEGRATIVE PROCESS IN AIRSPACE AND AVIATION

SYMPOSIUM 4. ENVIRONMENT PROTECTION

SYMPOSIUM 5. AVIATION CHEMMOTOLOGY

SYMPOSIUM 6. ECONOMICS IN AVIATION

SYMPOSIUM 7. HUMAN FACTOR IN AVIATION

SYMPOSIUM 8. AIR AND SPACE LAW: INTERNATIONAL AND NATIONAL ISSUES OF SECURITY

Session A. National legislation harmonization with EU regulations in the area of civil aviation. Legislative regulation of the world market of space services and technologies

Session B. Human rights in air space use

SYMPOSIUM 9. CONTINUOUS EDUCATION. UPGRADING AND RECURRENT TRAINING

SYMPOSIUM 10. AVIATION CONGRESS SCHOOL OF YOUNG SCIENTISTS IN PROBLEMS OF ENVIRONMENT PROTECTION FROM CIVIL AVIATION IMPACT

CONTENTS

<i>B.O. Griaznov, G.S. Pysarenko, A.D. Pogrebniak, S.P. Tymoshenko, A.S. Tugarinov</i> INFLUENCE OF THE METAL SAMPLES SURFACE MECHANICAL TREATMENT ON THEIR FATIGUE STRENGTH.....	11.1
<i>A.I. Bogdanovych, V.E. Zimin</i> Determination of kinetic characteristics and wear activation energy "IIX15" in fuel "TC-I".....	11.4
<i>E.A. Sapeliuk, I.V. Tkachova</i> ARTIFICIAL INTELLECT AND HUMAN REASONING.....	11.7
<i>V.E. Zimin, A.V. Orlov, V.P. Duda</i> INVENTORY MANAGEMENT IN THE AIRCRAFT MAINTENANCE SYSTEM.....	11.11
<i>M. Storozhenko, Y. Brusilo, T. Kuzmenko, N. Shalenko</i> FORMING OF STRUCTURE AND TRIBOTECHNICAL PROPERTIES OF ELECTRIC-SPARK COATING ON THE BASIS OF TiB ₂ -SiC.....	11.15
<i>V.I. Burlakov, O.V. Popov, D.V. Popov</i> SITUATION CONTROL OF COMPLEX OBJECT IN CONDITIONS WITH FUZZY SOURCE INFORMATION.....	11.19
<i>G. Jo. Zayonchkovskiy, V.N. Badakh</i> ESTIMATION OF DYNAMIC PROPERTIES OF HYDROMECHANICAL FOLLOW-UP DRIVES BY USING THEIR DYNAMIC STIFFNESS CHARACTERISTICS.....	11.23
<i>Onder Turan, T. Hikmet Karakoc</i> AEROTHERMODYNAMIC OPTIMIZATION OF AERO-JET ENGINES FOR MIDDLE AND LONG RANGE AIRCRAFT.....	11.28
<i>O. Altuntas, T. H. Karakoc, A. Hepbasli</i> ENERGY ANALYSIS OF PISTON-PROP AIRCRAFTS AT VARIOUS ALTITUDES.....	11.35
<i>L. Zhuravlova, A. Galstyan</i> RELATIONAL DATABASE MODEL FOR STORAGE OF STATISTICAL DATA AND DIAGNOSIS OF GTE WITH THE HELP OF PARAMETERS THAT ARE REGISTERED AT OPERATING CONDITIONS.....	11.39
<i>S.F. Filonenko, V.N. Stadnichenko, A.P. Stakhova, O.N. Troshin</i> RESEARCH OF INFLUENCE OF THERMAL RESISTANCE OF ELEMENTS OF TRYBOSYSTEM ON WEARPROOFNESS OF FRICTION UNITS.....	12.1
<i>A.V. Skrypets, V.D. Tronko, M.M. Asanov</i> DEVICE FOR TEMPERATURE CHANGE REGISTRATION BY FERRIMAGNETIC CRYSTAL..	12.5
<i>Bely Vladimir Nikolaevich</i> AUTOMATIC DIAGNOSTIC SYSTEMS OF POWER EQUIPMENT IN THE AEROSPACE INDUSTRY.....	12.8
<i>A.I. Bondarenko, E.O. Paton, K.V. Sidorenko, S.Y. Gusev, V.V. Shved</i> MECHANISM OF DETECTION OF DISCONTINUITIES IN PIPELINES BY ULTRASONIC GUIDES WAVES.....	12.12
<i>Alexey V. Dergunov, Yuriy V. Kuts, Vitaliy M. Trots, Leonid M. Shcherbak</i> EMPIRICAL MODE DECOMPOSITION IN SIGNAL ANALYSIS.....	12.16
<i>Elena D. Blizniuk, Yuriy V. Kuts, Svetlana V. Shengur, Leonid N. Scherbak</i> CIRCULAR DATA SIMULATION.....	12.21
<i>S.F. Filonenko, O.P. Kosmach</i> ACOUSTIC EMISSION WITH NONLINEARITY OF DEFORMATION AND THRESHOLD CHANGE OF DESTRUCTION RATE OF COMPOSITE MATERIAL.....	12.27
<i>Mykola Kulyk, Olexiy Kucher, Vladimir Miltsov</i> MATHEMATIC MODELS OF AIRCRAFT STRUCTURAL RELIABILITY CALCULATION.....	13.1
<i>S.R. Ignatovich, S.S. Yutskevych, E.Ju. Doroshenko, S.V. Priluckiy</i> METHODICAL ASPECTS OF ALLOY D16AT DEFORMATION RELIEF REGISTRATION UNDER CYCLIC LOADS.....	13.17

<i>M.V. Karuskevich, I. S. Gorbunov, T.P. Maslak, S.V. Schepak</i> NON DESTRUCTIVE OPTICAL METHOD UNDER FULL-SCALE AIRCRAFT TESTING AS A METHOD OF FATIGUE LIFE PREDICTION.....	13.21
<i>O.I. Dukhota, O.V. Tisov</i> INVESTIGATION OF HEAT-PROOF COMPOSITE ALLOYS WEAR PROPERTIES AT CONDITIONS OF HIGH TEMPERATURE FRETTING CORROSION.....	13.25
<i>V.M. Kindrachuk, A.O. Kornienko, O.L. Didenko</i> MODEL OF THE ELASTIC INDENTATION OF A HALF-SPACE BY A NON-IDEAL BERKOVICH INDENTER.....	13.29
<i>V.V. Astanin, G.O. Shchegel</i> ELECTROMAGNETIC EMISSION OF COMPOSITE MATERIALS AT HIGH-VELOCITY IMPACT LOADING.....	13.33
<i>I.V. Pavelko, M.P. Smolyaninov</i> CRITERION OF STRESS CONCENTRATION FOR EVALUATION OF THE LOWER LEVEL OF COMPOSITE MATERIAL STRENGTH LOSS AFTER A LOW-SPEED IMPACT.....	13.42
<i>O.V. Bashta</i> ANALYSIS OF CRACK FORMATION PROCESS AT THE MULTIPLE DESTRUCTION OF ALUMINIUM ALLOY D-16AT.....	13.47
<i>O.P. Timokhin</i> MODELING AND STABILITY ANALYSIS OF LANDING GEAR BY USING OF LMS SOFTWARE Virtual.Lab, Imagine.Lab AMESim AND Matlab\Simulink IN COUPLE.....	13.51
<i>V. Labunets, V. Lazariev, E. Korbut, T. Klimova, I. Kozlova</i> BACTERIOGENIC PRODUCTS USING FOR INCREASING PERFORMANCE CAPABILITIES OF THE DETONATION COATINGS.....	13.55
<i>Mykola Kulyk, Volodymyr Kharchenko, Mykhailo Matiychyk</i> JUSTIFICATION OF INCLINATION OF THE THRUST VECTORS OF THE TWO-ENGINED UAV POWER PLANTS	14.1
<i>Y.V. Gryshchenko, V.D. Gulenko, E.M. Hohlov</i> THE WAYS FOR INDETERMINISM OVERCOMING IN THE ANALYSIS OF FLIGHT CREW ERRORS.....	14.8
<i>M.P. Matiychik, V.V. Kabanyachyi, K.V. Krivenko</i> VITALS SYSTEMS OF PILOTLESS AIRCRAFTS.....	14.12
<i>O.O. Kim</i> ACCELERATION SENSES AND COMFORT LEVEL MODELING FOR THE LIGHT AIRCRAFT FLIGHT IN THE CONDITIONS OF INTENSIVE TURBULENCE.....	14.16
<i>V.O. Kasyanov, A.V. Goncharenko</i> APPROACH TO FLIGHT SAFETY IN TERMS OF THE SUBJECTIVE ANALYSIS.....	14.20
<i>V. Mironovich</i> METHOD OF EVALUATION OF ANALYTICAL AIRWORTHINESS OF PLANES AS OBJECT MANUAL.....	14.24
<i>Ye.O. Shkvar, V.T. Movchan, T.V. Kozlova</i> MATHEMATICAL MODELING OF MANIPULATED TURBULENT SHEAR FLOWS.....	14.28
<i>E. Udartsev, O. Zhdanov, O. Shcherbonos</i> UNSTEADY AERODYNAMIC DERIVATIVE OF WING WITH VORTEX GENERATORS.....	14.32
<i>A.A. Aksenov, V.V. Shmelev, S.V. Zluktov, A.S. Shishaeva, I.V. Moskalev</i> FLOWVISION-HPC: SOLVING COMPLEX AERODYNAMICS PROBLEMS OF AIRCRAFT DESIGNING.....	14.39
<i>A. Saprykin</i> INFORMATION – ANALYTICAL SYSTEMS FOR EARLY DISTINGUISHING IN-FLIGHT NONSTANDARD SITUATIONS.....	14.44
<i>A. Saprykin</i> AN AIRCRAFT AIR SPEED METERING SYSTEM DYNAMICAL ERROR DECREASE.....	14.48

B. Falda, J. Zajac	
AIR TRANSPORT IN POLAND IN THE AGE OF WORLD ECONOMIC CRISIS.....	14.52
J. Kozuba, T. Muszynski	
COMPUTATIONAL FLUID DYNAMICS METHODS USED IN UNMANNED AERIAL VEHICLE DESIGN.....	14.56
K.Y. Ohrimenko, O.V. Manziura, K.K. Eichhorn	
SIMULATION MODELING OF ACCUMULATED ERROR OF DISCRETE DRIVE KINEMATIC CHAIN.....	15.1
V.J. Larin	
INTELLECTUAL ROBOT-TECHNICAL DEVICE FOR DETECTION OF MATTERS.....	15.5
V.P. Kvasnikov, V.J. Larin	
APPLICATION OF THE GUIDED ROBOT-TECHNICAL DEVICES IS IN PLANT CULTIVATION.....	15.8
M.A. Timofeeva, V.L. Shkuratnik	
THE COMPUTERIZED CONTROL OF MEASURING ROBOTIC SYSTEM.....	15.11
G.P. Mikhneva, V.M. Ilchenko	
THE INFORMATION MODEL OF OBSTACLE AVOIDANCE BY THE MOBILE ROBOT.....	15.15
O.V. Boychenko, V.P. Kvasnikov	
AUTOMATION OF THE INFORMATIVE FLOWS IN THE COMPUTER SYSTEMS MANAGEMENT.....	15.19
V.P. Kvasnikov, A.L. Perederko	
VIBRATION MONITORING IN THE ROBOTISED ENGINEERING SYSTEMS.....	15.23
V.P. Kvasnikov, O.P. Stashynsky	
THE ELABORATION OF THE PROGRAM OF CALCULATION OF RATE OF MOVEMENT OF CLEANSING DEVICE.....	15.27
S.V. Golub, B. Khmelnytskyi, V.M. Ilchenko	
APPLICATION OF INDUCTIVE MODELS FOR INFORMATION TRANSFORMATIONS IN A ROBOT IS THE TECHNICAL SYSTEMS OF ENVIRONMENT MONITORING.....	15.31
M.I. Kiselev, O.I. Osmolovskiy	
ENHANCEMENT OF DYNAMIC PRECISION OF COORDINATE DRIVES OF ROBOTIC MEASURING COMPLEXES.....	15.35
Lyubomyr Petryshyn	
POSITIONING OF AEROSPACE VEHICLES IN MULTIDIMENSIONAL METRIC OF GALOIS..	15.39
Z.I. Uskova, S.P. Yarmolenko	
THE APPLICATION OF GAS CHROMATOGRAPHY IN EXAMINATION OF MATERIALS, SUBSTANCES AND PRODUCTS.....	15.43
V.V. Gorin, V.N. Buz, A.V. Dzyubanenko	
MATHEMATICAL MODEL OF CONDENSATION ON THE SURFACE.....	15.47
S.S. Mikhnev, R.O. Peshkurov, T.O. Mitsay	
THE ANALYSIS OF METHODS OF REDUCTION OF DIMENSION OF THE DATA FOR THE SYSTEMS OF ADAPTIVE TRAINING.....	15.51
V.P. Kvasnikov, O.A. Akhmadov, S.O. Ahmadov, B.P. Galevskiy	
SECONDARY STANDARD OF ELECTRICAL POWER FOR INDUSTRIAL BAND.....	15.55
V.V. Drevetskiy, M.M. Klepach, S.P. Vorobjuk, V.M. Ilchenko	
MOBILE AUTOMATIC ANALYZER OF PHYSICO-CHEMICAL PARAMETERS.....	15.60
V.V. Kovan'ko, V.V. Drevetsky, O.V. Kovan'ko, O.Yu. Shepel	
THE QUESTION OF RATIONAL CONSTRUCTIONS OF DEVICES AND MACHINES FOR USE ON THE LUNAR SURFACE.....	15.64
A.K. Shaposhnikov, Yu.V. Zaycev, O. Osmolovskiy	
TRAJECTORY OF MOTION OF MILLING CUTTER AT SHAPE FORMATION OF CONTOUR, FORMED BY INVOLUTE SPLINE.....	15.68

<i>O. Samkov, J. Zaharchenko</i>	
METHODS OF THE RESOURCES DISTRIBUTION BETWEEN THE MODERNIZATION PROJECTS IN AVIATION TECHNICS.....	16.1
<i>V. Kazak, H. Tachinina, Leyva Kanales Maximo Remigio</i>	
THE POSSIBLE METHODS TO REDUCE THE TIME REQUIRED FOR PILOT TO PREVENT EVOLUTION OF ABNORMAL CONDITION IN FLIGHT.....	16.5
<i>V.M. Kazak, D.O. Shevchuk, O.V. Savchuk, K.V. Paliy</i>	
INTELLECTUAL DECISION SUPPORT SYSTEM IN STOCKS RESOURCES MANAGEMENT OF AIRPORT.....	16.9
<i>V. Vorobjov, V. Zaharchenko, A. Silnyagin, S. Iljenko, D. Schebetjuk</i>	
SYSTEM AND PARAMETRICAL QUALITY FUNCTIONING OPTIMIZATION OF AVIONICS LOGICO-DYNAMIC SYSTEMS UNDER TRANSITIVE CHARACTERISTICS.....	16.13
<i>V. Vorobev, V. Zaharchenko, V. Tikhonov</i>	
SCIENTIFIC BASES AND METHODS OF SUPPORT FAIL-SAFE OF THE INTEGRATED COMPLEX «CREW - THE AIRCRAFT - THE ENVIRONMENT».....	16.17
<i>N. Krasnoshapka, T. Mazur</i>	
POWER EFFICIENT ALGORITHMS OF ASYNCHRONOUS-STARTING ELECTRIC DRIVES WITH CURRENTS LIMITING.....	16.20
<i>O.Lysenko, A. Miroshnichenko, S. Ilyenko</i>	
METHOD OF TIMING DISTRIBUTION IN RADIO NETWORKS.....	16.24
<i>R. Yukhimchuk, S. Ilyenko</i>	
THE METHOD OF COMPARATIVE ANALYSIS OF SOFT HANDOVER TECHNOLOGY IN CDMA NETWORK.....	16.28
<i>O. Lysenko, S. Valuiskyi, O. Stepaniuk, A. Nefidova</i>	
THE ALGORITHMS OF CHANNELS' DESTINATION IN MESH-NETWORKS 802.11S.....	16.33
<i>O. Lysenko, S. Valuiskyi, O. Panchenko</i>	
THE OPTIMAL CONTROL OF UAV NETWORK TOPOLOGY	16.37
<i>O. Lysenko, I. Nechyporenko, V. Golovach</i>	
REVIEW THE USE OF SENSOR NETWORKS, PRINCIPLES AND WAYS OF INCREASING THEIR EFFECTIVENESS.....	16.41
<i>O. Lysenko, P. Kirchu</i>	
SYNTHESIS OF THE OPTIMUM OBSERVER OF THE STATE FOR THE UAV ADAPTIVE CONTROL SYSTEM.....	16.45
<i>J. Zaharchenko, R. Ponedilchenko</i>	
WAYS TO IMPROVE THE POSITIONING ACCURACY OF MOBILE SUBSCRIBERS IN CELLULAR NETWORKS.....	16.49
<i>J. Zaharchenko, A. Gerasymchuk</i>	
COMPARATIVE ANALYSIS OF INFORMATION SECURITY SYSTEMS IN WI-FI NETWORKS	16.53
<i>V. Kozlov, N. Sokolova, O. Shyrgaj, M. Tsybko</i>	
DETERMINATION POSSIBILITIES TO USE THE ALTERNATIVE ENERGY IN AIRPORTS....	16.56
<i>A. Aslanyan, A. Belskaya</i>	
DIAGNOSING OF CONTROLLED DYNAMIC SYSTEMS USING THE QUORUM-METHOD....	16.60
<i>O.G. Korchenko, Ye.V. Vasiliu, S.O. Gnatyuk</i>	
MODERN DIRECTIONS OF QUANTUM CRYPTOGRAPHY.....	17.1
<i>Galyna A. Suslova</i>	
RISK MANAGEMENT ENHANCES SAFETY PROGRAMME DECISION-MAKING	17.5
<i>B.E. Zhurilenko, Z.O. Samosud</i>	
THE RESEARCH OF RADIOBUGS SEARCHING.....	17.10
<i>R.B. Prus, V.A. Shvets</i>	
FORMATION OF THE OBJECTIVE FUNCTION IN THE TASKS OF INFORMATION SECURITY MANAGEMENT.....	17.14

S.O. Shmatok, O.K. Yudin, O.S. Shmatok, A.B. Petrenko	
THEORETICAL BASIS OF ANALYTICAL METHODS IN CRYPTANALYSIS IN MARKOV BLOCK CIPHERS.....	17.18
V.A. Temnikov, A.V. Peteychuk	
ORGANIZATION OF PRESHIFT AND INTRASHIFT ACCESS CONTROL OF ATC TO THE RESOURCES OF INFORMATION SYSTEMS.....	17.22
P. Pavlenko, A. Khlevnyi	
EXPERIENCE WITH AUTOMATED DATA MANAGEMENT SYSTEM FOR INDUSTRIAL PURPOSES.....	17.26
A.I. Muzhyk	
SYSTEM ENGINEERING OF MANAGEMENT BY INFORMATION PROCESSES OF NATIONAL AVIATION UNIVERSITY.....	17.30
L.A. Smirnova	
PROVIDING OF PRECISION OF MECHANICAL PROCESSING WHICH REQUIRED ON NC MACHINES BY MEANS MODERN INFORMATION TECHNOLOGY.....	17.34
Y. Zadontsev	
ANALYSIS OF THE PROCESSES OF SPECIALISTS TRAINING ON THE IMPLEMENTATION OF INDUSTRIAL INFORMATION TECHNOLOGIES.....	17.38
V.Y. Kudryakov	
USE OF THE COMPUTER-INTEGRATED AUTOMATED SYSTEMS FOR INCREASE OF EFFICIENCY OF PRODUCTION OF ENTERPRISES OF SPACE-AIR COMPLEX OF UKRAINE..	17.42
V.V. Treytyak	
INFORMATION TECHNOLOGY DECISION SUPPORT SOFTWARE PRODUCTION ORDERS.....	17.46
D.M. Golubchikov, K.E. Rumiantsev	
THE PROBABILISTIC MODEL OF KEYS GENERATION OF QKD SYSTEMS.....	17.50
M. Lutskiy	
IT PENETRATION INTO THEORETICAL AND PRACTICAL SUPPORT OF AIRCRAFT OPERATION.....	18.1
I.A. Zhukov, V.I. Kubitsky	
METHOD OF RENEWAL OF THE LOST PACKETS AT TRANSMISSION IN COMPUTER NETWORKS	18.5
I.A. Zhukov, M.M. Lastovchenko	
BROADBAND DIGITAL TELECOMMUNICATIONS SERVICE INTEGRATED COMMUNICATIONS, NAVIGATION SURVEILLANCE FOR AIR TRAFFIC CONTROL.....	18.9
Chang Shu, Nick A. Vinogradov	
THE METHOD OF ADAPTIVE SHAPING OF THE TRAFFIC FLOWS OF CALCULATING NETWORKS.....	18.13
O. Lytvynenko, K. Tsivinsky	
METHOD OF DECISION MAKING IN SITUATION CONTROL SYSTEM OF ELECTRICAL MOUNTING PRODUCTION.....	18.17
V.Ya. Krakovsky	
PERSPECTIVES OF SPECTRUM SLIDING ANALYSIS APPLICATIONS.....	18.21
K. Yakovishin	
DESIGNING MULTI-SERVICE LOCAL AREA NETWORKS ON THE BASE OF ETHERNET SWITCH'S COMMUNICATION NET.....	18.27
A. Ablesimov	
OPTIMIZATION OF PARAMETERS OF UNLOADING SYSTEM OF GYROSCOPIC FRAMES.....	18.31
S.P. Borsuk	
SCENARIOS ADAPTIVITY IN THE SUBSYSTEM OF ENVIRONMENT MODELLING IN THE AVIATION TRAINING SYSTEMS.....	18.35
N.M. Glazunov	
DYNAMICS, CODING AND ENTROPIES.....	18.39

<i>A.V. Osadchy</i>	
COMPUTER-AIDED DESIGN OF POWER EQUIPMENT IN THE AEROSPACE INDUSTRY	18.43
<i>N.N.Pechurin, A.V.Korochkin, A.N.Berezovskiy</i>	
MODEL OF COMPUTATION FOR SCALABLE CLUSTER SYSTEMS.....	18.46
<i>M.I. Fuzik, V.V. Klobukov, O.S. Zykov</i>	
INTEGRATION TECHNOLOGY OF HYBRID CLOUD COMPUTING INFRASTRUCTURE OF THE UNIVERSITY TO PERFORM THE TASKS OF SCIENTIFIC RESEARCH AND EDUCATION.....	18.50
<i>Y.M. Barabanov, A.M. Grekhov, V.P. Kharchenko</i>	
OPERATIONAL CONCEPT OF REQUIRED COMMUNICATION PERFORMANCE.....	21.1
<i>Yu.V. Chynchenko</i>	
INFORMATION PROCESSING MODELS IN AIR TRAFFIC CONTROL.....	21.5
<i>V.M. Sineglazov, Sh.I. Askerov</i>	
MULTICRITERIA OPTIMIZATION OF ON-BOARD NAVIGATIONAL SYSTEM TECHNICAL MEANS COMPLEX SELECTION.....	21.9
<i>O.I. Varchenko, E.I. Chumachenko, M.P. Mykhaliuk</i>	
CONSTRUCTION METHODOLOGY OF INFORMATION SYSTEMS WITH INTELLIGENT DECISION SUPPORT.....	21.13
<i>Krzysztof Banaszek, Andrzej Fellner, Pawel Trominski</i>	
EGNOS INTRODUCTION TO THE EUROPEAN EASTERN REGION AS THE CHANCE FOR THE AIR REGIONAL TRANSPORT.....	21.17
<i>O.V. Solomentsev, M.J. Zalisky</i>	
SUPPORT OF EFFICIENCY IN EXPLOITATION SYSTEMS.....	21.18
<i>O. Morgun</i>	
COMPUTER MODELLING OF ELECTROMAGNETIC COMPATIBILITY CONDITION ON AIRCRAFT FOR COMMUNICATION, NAVIGATION AND LANDING EQUIPMENT.....	21.22
<i>N.K. Filiashkin., M.P. Mukhina</i>	
DAMPING OF SCHULER'S OSCILLATIONS AS A WAY TO INCREASE THE ACCURACY INERTIAL GYRO VERTICAL.....	21.26
<i>V.M. Sineglazov, R.K. Kadem</i>	
QUALITY ESTIMATION OF UNMANNED AERIAL VEHICLES AUTOMATED DESIGN.....	21.30
<i>V.D. Tronko, A.V. Skrypets, O.P. Slobodyan</i>	
METHOD AND MEASURING DEVICE OF PHASES DIFFERENCE OF INFRA- AND LOW - FREQUENCY RANGES.....	21.34
<i>A.A. Tujakbaev</i>	
MODEL OF THE PLANAR TRANSISTOR FOR MODELLING OF ACTION OF THE PENETRATING RADIATION.....	21.38
<i>O.A. Sushchenko</i>	
MATHEMATICAL MODEL OF INERTIALLY STABILIZED PLATFORM FOR AIRCRAFT OBSERVATION EQUIPMENT.....	21.43
<i>V.G. Vovk, N.B. Macuk, D.I. Gordienko</i>	
ASSESSMENT OF DYNAMIC CHARACTERISTIC OF UNSTABLE OBJECT AT CONSTANT REGIME.....	21.47
<i>S.S. Kostina</i>	
THE AUTOMATION OF RADAR SIMULATION: PRINCIPLES OF CONSTRUCTION, THE OPTIMIZATION OF STRUCTURE AND FUNCTIONING OF SIMULATION SOFTWARE.....	21.51
<i>N. Tupitsin, K. Sydorenko</i>	
GASDYNAMIC METHOD OF UAV LANDING.....	21.57
<i>V.H. Melkumyan, T. Malyutenko</i>	
THE COMBINED METHOD OF COORDINATE DETERMINATIONS USING GNSS.....	21.60

A. Sushich, I. Prichodko	
THE ALGORITHM OF AVAILABILITY DETERMINATION OF NAVIGATION SATELLITES ON A FLIGHT PATTERN.....	21.64
O.P. Tkalich, O.V. Zharova, O.V. Tkalich, O.P. Nechyporuk	
MAINTENANCE OF QUALITY OF SERVICE IN THE COMMUNICATION NETWORK OF THE FOLLOWING GENERATION.....	21.68
G.F. Konahovich, O.P. Velichko, R.S. Odarchenko, Y.O. Petrov	
ALGORITHM OF DEFINITION OF ZONES OF SERVICE OF ACCESS POINTS OF STANDARD IEEE 802.11.....	21.72
V.G. Potapov, O.O. Artamoshkin, M.S. Odarchenko, P.O. Andruhovich, V.V. Nechyporuk	
CALCULATION OF RADIUS OF ACTION OF HIDDEN RADIO-TRANSMITTING DEVICES.....	21.76
E.A. Kovalevsky, I.V. Vasilyev	
EFFECTIVENESS OF ADAPTIVE ARRAY UNDER INFLUENCE OF DIFFERENT INTERFERENCES.....	21.79
V.I. Chepizhenko, S.V. Pavlova	
THE APPROACH TO FORMATION OF INFORMATION-CONTROLLING SYSTEM STRUCTURE SYNTHESIS OF OPERATION SUPPORT OF DIFFICULT TECHNICAL SYSTEMS.....	21.83
L.J. Tereschenko	
CONSTRUCTION OF OBTAINING OPTICAL IMAGE ANALYTICAL MODELS OF INTERNAL STRUCTURE CONTROLLED OBJECTS.....	21.86
I.V. Ostroumov	
MONITORING OF PRIVATE AVIATION FLYING.....	21.90
N.S. Kuz'menko, I.V. Ostroumov	
WEATHER WEB SERVICE.....	21.93
O.M. Klyuchko	
COMPUTER ANALYSIS OF BRAIN CHARACTERISTICS FROM DATABASES IN NETWORKS.....	21.97

MONITORING OF PRIVATE AVIATION FLYING

Two different ways of aircraft flight monitoring in the bottom airspace have been represented. Wireless communication network based conception has been proposed to use for control and navigation.

Introduction

Today general aviation is very fast changing and progressive part of aviation industry. A lot of advantages make general aviation very useful and popular. Nowadays small airplane or helicopter costs like a good new car therefore more and more people use it in their life. So, quantity of helicopters and small airplane is increased rapidly every year.

General aviation in Ukraine also is developed. One year ago our government and Prime minister were changed some regulation documents in aviation. Some changes have been made in documents which regulate flight space using. The main here is that nowadays pilots don't need make request for flight if they are going to flight in the bottom airspace (up to 1500 m under sea level).

It has been first small, but very important step to develop private aviation in Ukrainian airspace. It is very good because nowadays a lot of municipal services can use it. For example air ambulance, police air patrols, crop dusting, rescue team, forest fire fighting and many other services use it. But also we have some problems in this context.

General aviation flying in the bottom airspace must guarantee very high level of safety. Safety fly of general aviation is very important. General aviation accidents statistic data do not look good for counties where many private and commercial aircrafts flight every day. On fig.1 is represented number of general aviation accidents for USA during 1996-2005 years [1]. It shows decreasing tendency but it contains more than enough number of accidents every year.

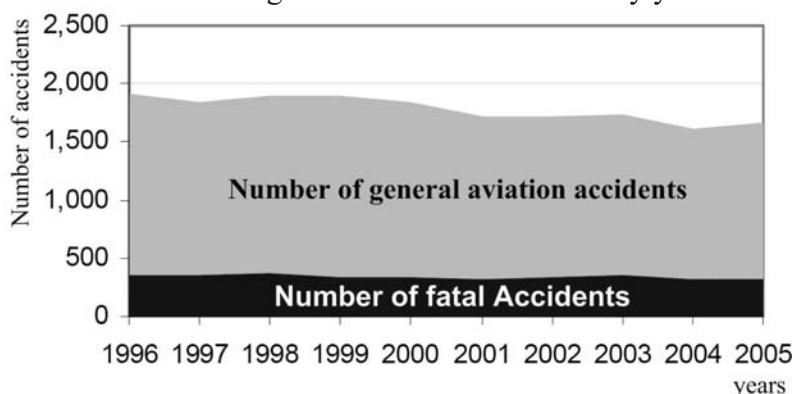


Fig.1. Number of general aviation accidents for USA during 1996-2005 years

One of the big problem which has been connected with general aviation that bottom airspace is not possible to be controlled. It is uncontrolled any radar service and air traffic service. Current radar and secondary radar systems can't cover bottom airspace. It has some technical aspects and depends on reflected ability radio signals from ground.

ADS-B conception

Automatic dependence surveillance broadcast (ADS-B) conception helps here. ADS-B is a cooperative surveillance technique for air traffic control and related applications being developed as part of the Next Generation Air Transportation System.

An ADS-B-equipped aircraft determines its own position using a global navigation satellite system and periodically broadcasts this position and other relevant information to potential ground stations and other aircraft with ADS-B equipment (fig.2). ADS-B can be used over several different

data link technologies, including Mode-S, Universal Access Transceiver, and VHF data link (VDL Mode 4)[2].

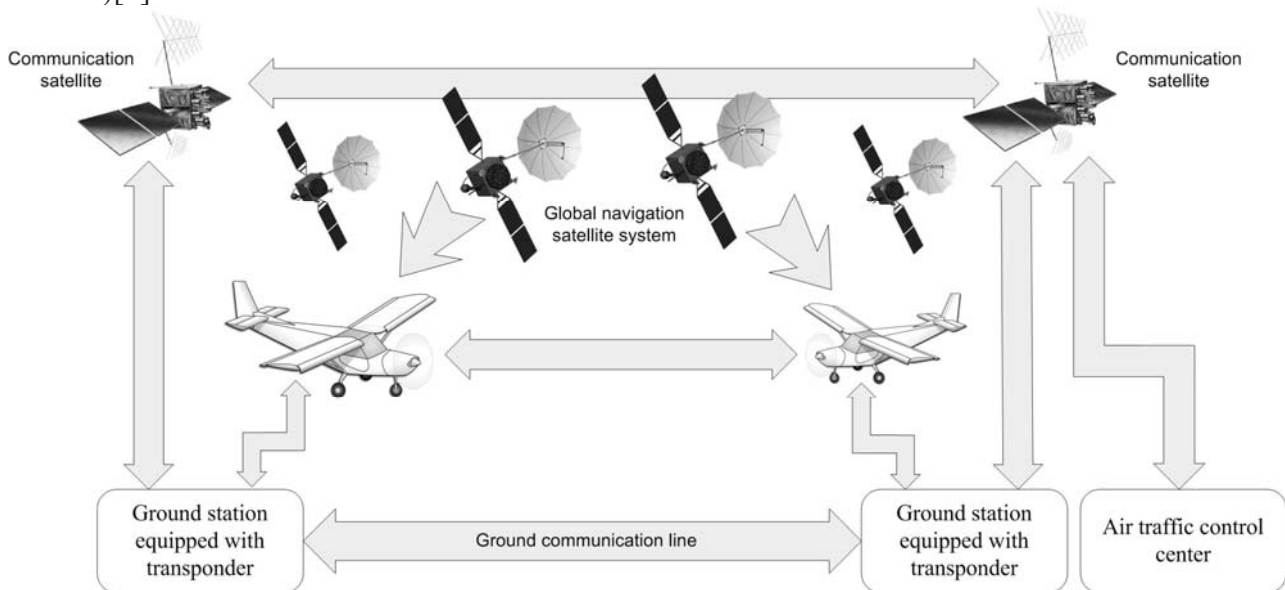


Fig.2. ADS-B conception structure

ADS-B provides accurate information and frequent updates to airspace users and controllers, and hence supports improved use of airspace, reduced ceiling/visibility restrictions, improved surface surveillance, and enhanced safety, for example through conflict management.

ADS-B is the best solution for improve safety of flight not only for general aviation. But development and technical realization of this conception are very expensive and need some time.

Wireless communication networks

Other way to solve the problem of low altitude flying aircraft control is usage of ground wireless communication networks. Nowadays wireless communication networks develop rapidly. Companies which are provided communication service cover more than 98% territory of Ukraine. Cell phone service is very popular and rapidly changing.

Cover area of airspace makes possible to use cell phone system on board of aircraft if the altitude isn't very big. Typical equipment is used to transmit aircraft position and other data to air traffic control (ATC) center by wireless communication ground networks [3-5] (fig.3). Many aviation services may be represented for owners of aircraft on board:

- weather broadcast;
- map information;
- airport information (SID, STAR, Approach procedures);
- communication;
- surveillances data and many other information.

Wireless communication networks are possible to realize navigation function. Different methods will be used to estimate aircraft location in cell organization network. The basic methods are:

- Cell of Origin;
- Signal Strength;
- Time of Arrival;
- Time Difference of Arrival;
- Enhanced Observed Time Difference.

This different methods combination will produce good accuracy of coordinates' estimation. Accuracy of this depends on location of aircraft and base station configuration. If airplane equipped with special devises to work with ground cell based network flies, service provider will estimate coordinates information about location of airplane. Then coordinates of each airplane will be

compared with closed airspace areas location. If the service is recognized illegal crossing of the closed airspace frontier, owner of airplane will be responsible for it.

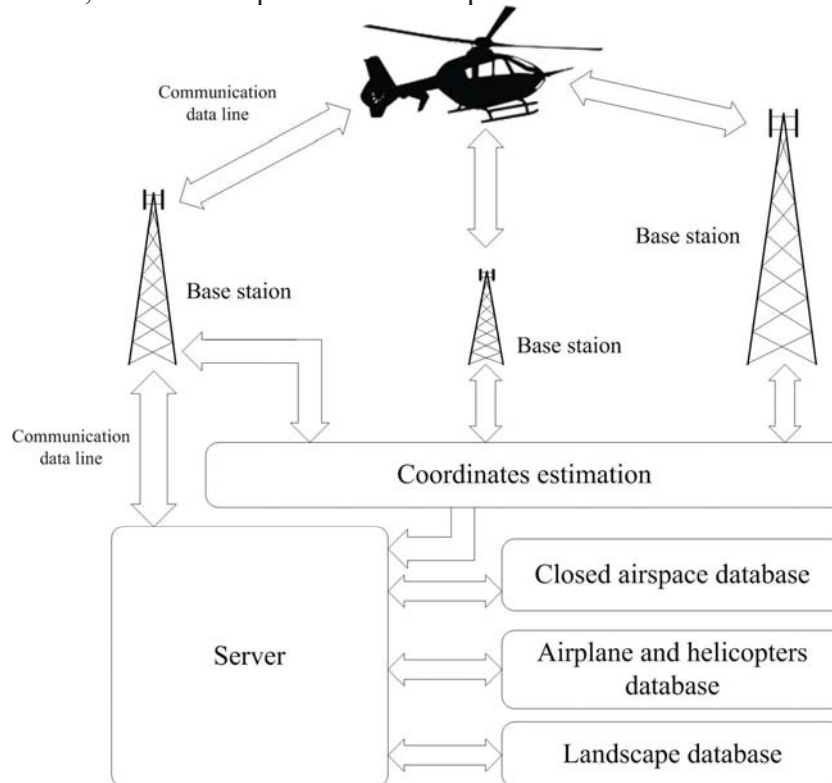


Fig.3. ATC conception based on wireless communication networks

Conclusion

ADS-B conception is the best solution for aircraft control in bottom part of airspace, but it's very expensive and needs time for practical realization in Ukraine area. Wireless communication network has already covered the whole territory but needs an agreement with service provider. Wireless communication network provides communication, high speed data line and positioning therefore realization of this conception is more suitable for our country.

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