Рішення про відхилення фактичного ТС двигунів від їхнього справного стану приймається на основі аналізу характеру та динаміки змін згаданого комплексу діагностичних нев'язок за напрацюванням. Допуски на зміни діагностичних нев'язок в запропонованій діагностичній моделі призначаються аналогічно допускам на зміни діагностичних нев'язок при діагностуванні двигунів НК-8-2У [1]. Загальні принципи розпізнавання станів двигуна, відмінних від справного, аналогічні наведеним у книзі [2].

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J. Stankūnas

INTEGRATED SYSTEM FOR TRAINING OF AVIATION SPECIALISTS

Co-operation between university and industrial potential is one of the most effective ways of organizing expensive studies in a small country. Co-operation between civil universities and military schools and structures is expedient in preparing reserve military specialist. An integrated system for the preparation of the specialists of civil and military aviation is precondition for the development of integrated management system of aviation and air space.

Lithuania boasts a rich tradition in aeronautics and aviation. The beginning can be traced back to 1650 when Kazimieras Semenavicius, a specialist in artillery issued the work "Artis Magnae Artilleriare. Parts Prima", in which the idea of a multistage rocket was developed. The ideas of designing a flying apparatus were further advanced in the work "Samogitian Steam Plane" by the nobleman Aleksandras Griskevicius in 1843–1850, in which the idea of a man-controlled flight of an aerostat was put forward.

In 1919 the Lithuanian Air Force were established. In 1922 the first Lithuanian aircraft DOBI-1 designed by Jurgis Dobkevicius took off. In 1924–1940 Brigadier General and Commander-in-Chief of the Lithuanian Air Forces Antanas Gustaitis who was also a pilot and aviation designer too, designed and constructed nine models of the aircraft named ANBO. Technical characteristics of most of those models were on a par with the foreign analogues of the time. On the initiative of A.Gustaitis a modern aviation plant, suitable not only for repairs, but also for serial production of airplanes was set up. Between the years 1925 and 1939 a total of 65 of airplanes designed by A.Gustaitis were manufactured.

Production of sports gliders and planes was also launched there. Bronius Oskinis, Balys Karvelis were among the outstanding glider constructors.

Lithuania has been always rich in famous pilots. The name of Lithuania was first brought to public attention by the pilots Steponas Darius and Stasys Girenas whose victorious transatlantic flight from the USA to Lithuania in 1933 ended tragically on the European continent. At that time this flight was considered the second longest non-stop flight in the world, marked for high navigational precision. In Lithuania the famous test pilot of the Soviet space shuttle "Buran" Rimantas

Stankevicius was born. Today the Lithuanian pilot-aerobat Jurgis Kairys, winner of the world championship – 2000 in aerobatic figure flying is one of the strongest pilots of the world.

In Lithuania aviation is quite popular and has a good perspective. "Lithuanian Airlines", the national aviation company has a great potential. The Air Force of Lithuania has been under rapid development. Experience of the specialists and favourable circumstances have made design and manufacture of sports planes and gliders possible.

Formation of Lithuanian Aviation began in 1919. In the inter-war period the first Lithuanian airplanes were designed, tested, manufactured and used mostly by the specialists of military aviation. During the period a school of military aviation was founded twice in the country. The first school for military pilots functioned in 1919, managing to train a single class of pilots. In 1932 a school of military aviation was founded again where until the incorporation of Lithuania into the USSR in 1940, pilots and mechanics were trained. In the inter-war period the idea of establishing a higher aeronautics school was considered in Lithuania.

The idea of the university-type aviation school was only put into practice upon Lithuanian's independence in 1990. In 1993 the Antanas Gustaitis' Aviation Institute (AGAI) was established at the Vilnius Gediminas' Technical University (VGTU), which trains specialists both for civil and military aviation of the country.

The Antanas Gustaitis' Aviation Institute of the VGTU is the only university-type aviation school in Lithuania. It was founded in the early 1993s, at the time of a deep economic crisis, under the restructuring of the Lithuanian economy and transition from the planned to market economy. Regardless of the difficulties the Institute succeeded in solving the following problems:

– to establish a basis for providing both civil and military aviation of Lithuania with highly qualified national specialists;

– to establish a centre for co-ordinating and performing scientific work in integrating the Lithuanian aviation into the international system, and for advancement of aviation technologies;

– to minimize the costs for aviation specialists training via co-operation between the available aviation training and technical facilities, research and teaching potential of the VGTU, the Lithuanian Military Academy and other institutions;

– to make military education mandatory for all aviation students;

– to preserve and consolidate the achievements and traditions of Lithuanian aviation.

In a small country, under harsh conditions of transition from the planned to market economy, founding of a university-level aviation institute and solving the above problems was only made possible through the establishment of an integrated aviation system (Fig. 1), the main integral components of which are found in Vilnius or its outskirts.

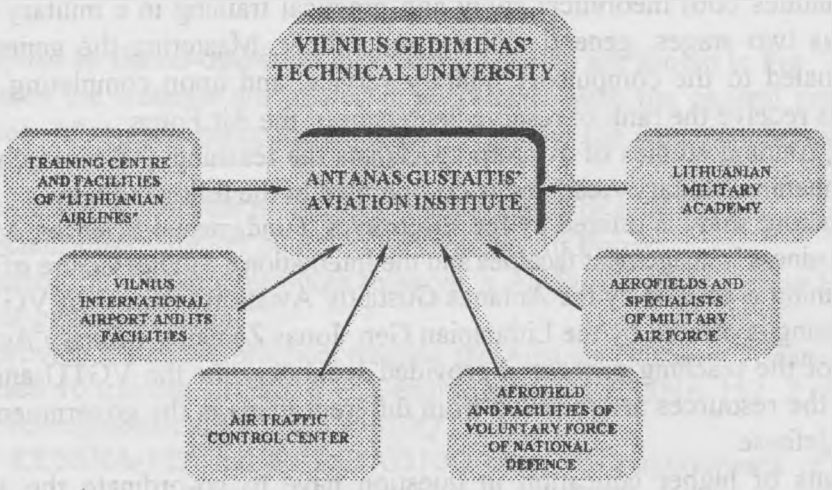

Fig. 1. Integrated system for training aviation specialists

The system covers: departments of VGTU and Antanas Gustaitis' Aviation Institute; Lithuanian Military Academy (Vilnius); potential of the Air Force specialists and equipment; training airfield of the Voluntary Force of National Defense (outskirts of Vilnius); modern national Air Traffic Control Centre (Vilnius); Vilnius International Airport, training centre and technical facilities of the Vilnius-based aviation company "Lithuanian Airlines", famous for their modern equipment and highly qualified staff.

The above institutions have at their disposal the technical facilities required for the training of specialists. Creation of such a basis a new would involve costs ranging to hundred of millions USD. Co-operation between the available training facilities has eased the burden, therefore, the needs of the Antanas Gustaitis' Aviation Institute amounted to only USD 1 mil., which was spent on the acquisition of planes used for training and creation of specific segments of the training basis.

Maximum integration of the available intellectual and technical potential has facilitated in graduating the first diploma engineer pilots, whose training program has not exceeded USD 12,000 (Lt 47,000).

The idea of military training in the system of university education was elaborated while the foundations for the Aviation Institute were being laid, and later it was implemented. The essence of the idea consists in giving up the establishing of the departments of military education in Lithuanian universities and to use, for the purpose, the Lithuanian Military Academy and the Lithuanian Cadet School instead.

The universities have gathered valuable experience in providing fundamental humanist and technical education of a high level. The Military Academy is better accommodated for teaching different military subjects.

At the Antanas Gustaitis' Aviation Institute of the VGTU aviation specialists of six study programs are trained: professional aeronautics (pilots), air traffic control, aviation mechanical engineering, aviation electronic engineering, aviation electrical engineering, aviation transport management.

On the basis of agreement between the VGTU and the Lithuanian Military Academy specialist training follows the approved study models (Fig. 2). The students following the professional aeronautics and air traffic control study programs complete their basic and specialized professional studies as engineers, diploma engineer pilots or diploma engineer air traffic controllers.

The students following the engineering and economics study programs complete their basic course by a Bachelor's degree, following which they may choose specialized studies for the diploma engineer degree or advanced M.Sc. or Ph. Dr. studies.

The Lithuanian Military Academy has a parallel course in military training. Before 1998 this course was usually offered for three or four terms in the fourth and fifth y ears of studies. The scope of military training has expanded since 1998, presently extending over three years of studies. The military training includes both theoretical study and practical training in a military field camp. The military training has two stages: general military and officer. Mastering the general military level requirements is equaled to the compulsory military service, and upon completing the officer level training the students receive the rank of reserve lieutenant of the Air Force.

In organizing training studies of aviation specialists the teaching and research potential of the VGTU and the Lithuanian Military Academy is co-operated in the following way:

– basic engineering study is offered by the Electronics, Fundamental Sciences, Mechanics, Transport Engineering, Business Management faculties and the International Studies Centre of the VGTU;

– aviation training is offered by the Antanas Gustaitis' Aviation Institute of VGTU;

– military training is offered by the Lithuanian Gen. Jonas Zemaitis' Military Academy [1; 2].

The funding of the teaching process is provided separately for the VGTU and the Lithuanian Military Academy, the resources are received from different items in the governmental budget: education-science and defense.

The institutions of higher education in question have to co-ordinate the scope of studies (number of classes given) and the timetables for study and practical training only. The remaining aspects are dealt with independently by both institutions.

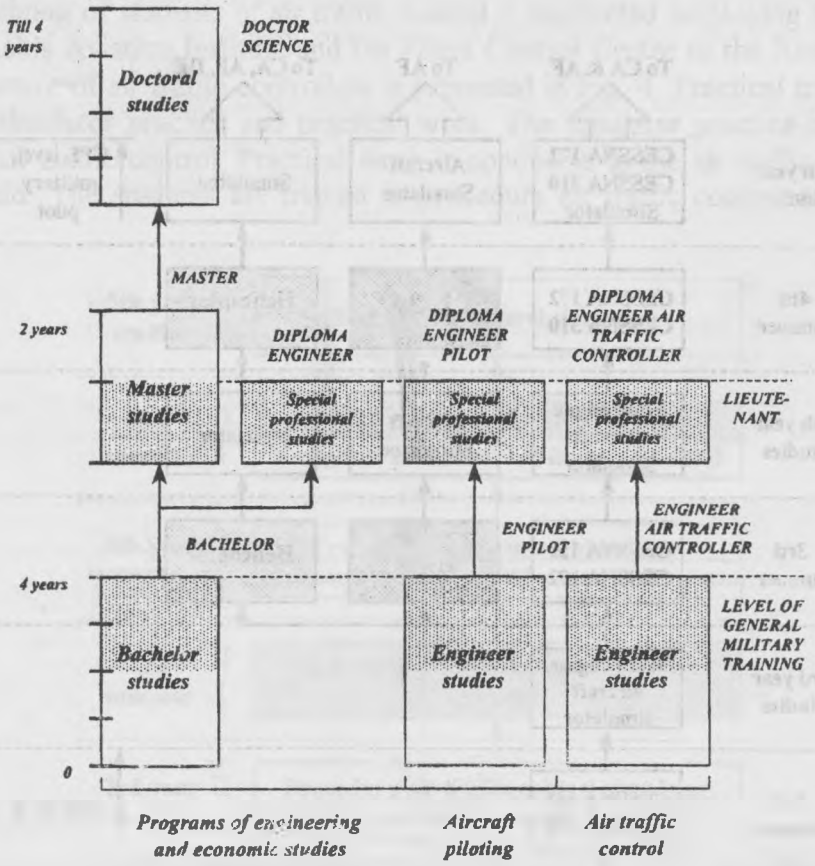

Fig. 2. Study schedules of aviation specialist training:
– only civil studies; – civil and military studies

Evaluation of the final results of the studies is independent as well. Upon the completion of the studies, a respective diploma is issued by the VGTU. The Lithuanian Military Academy issues graduation certificates and confers, in an established procedure, the acquired military ranks.

Practical training program for students of professional aeronautics is one of the most complex and expensive parts of practical training [3]. The program has been implemented through the co-operation between practical training facilities of the Antanas Gustaitis' Aviation institute of the VGTU, Air Force, Voluntary Force of National Defense, and the aviation company "Lithuanian Airlines".

The rules applied to the co-operation of practical training are shown in Fig. 3. During the first three years of studies the students are trained in accordance with the general program and obtain private pilot licenses. After completing the third year of studies the students choose one of the three specializations:

– first specialization – pilots for military air transportation or civil airlines;
– second specialization – fighter pilots, to serve in the Air Force;
– third specialization – helicopter pilots to serve in Air Force, the Aviation Unit of the Ministry of the Interior or general aviation.

In order to provide the above practical training the Antanas Gustaitis' Aviation Institute of the VGTU has purchased 10 training aircraft: 6 one-engine aircraft CESSNA-152, 2 one-engine aircraft CESSNA-172, 2 two-engine aircraft CESSNA-310Q.

The aircraft CESSNA-172 and CESSNA-310Q meet the requirements of the instrumental flight rules (IFR).

The future fighter pilots are trained on the jet aircraft trainers L-39 of the Air Force. Helicopter pilots are trained on the helicopters of the Ministry of the Interior and the Air Force.

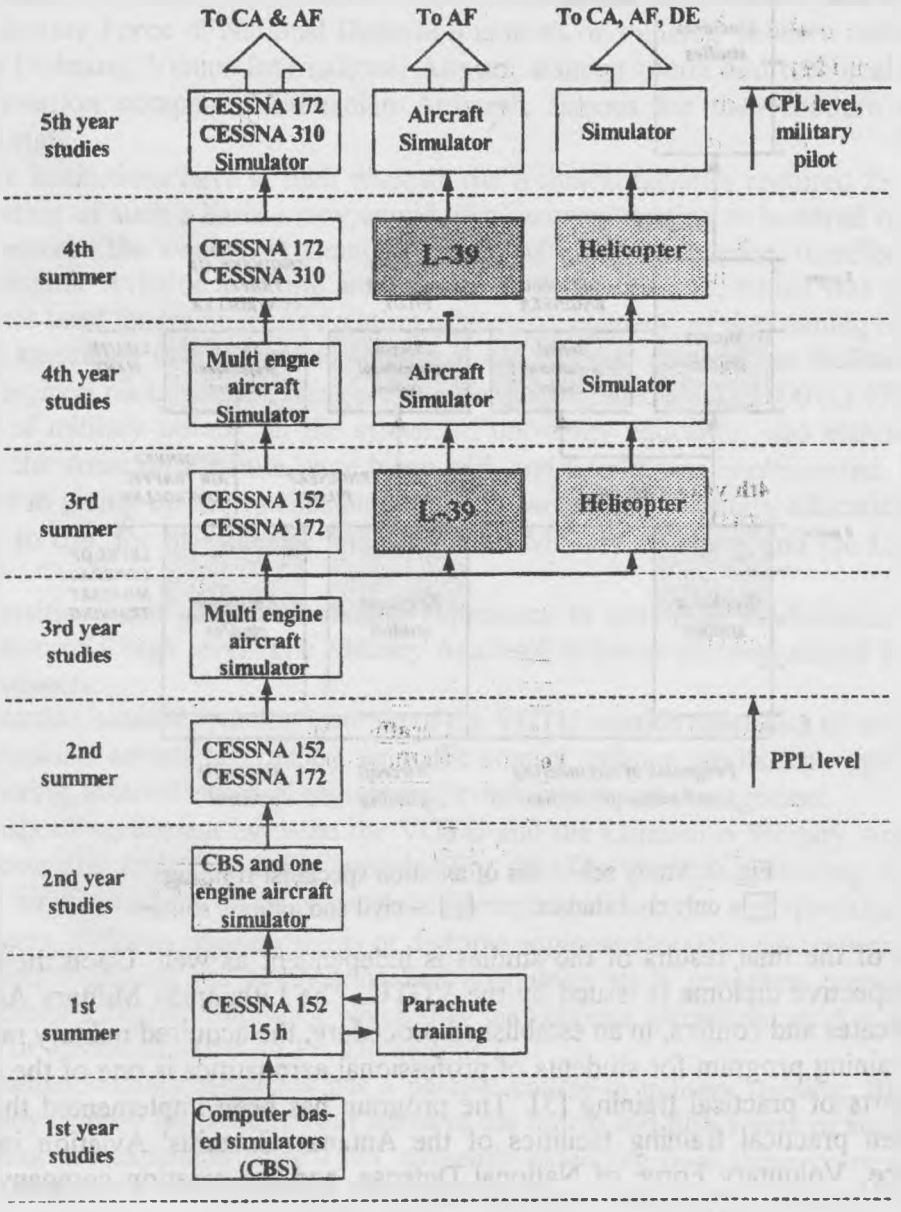

Fig. 3. Structure of practical training in airplane piloting:

□ – practical training at the Antanas Gustaitis' Aviation Institute; ▨ – practical training in the Air Force; ▨ – practical training in the Aviation Unit of the Ministry of the Interior

Flight practice on an aircraft is combined with training in aircraft simulators. For that purpose computer-based simulators, as well as one-engine and multi-engine aircraft simulators of the Antanas Gustaitis' Aviation Institute of the VGTU and also complex multi-engine aircraft simulators of the aviation company "Lithuanian Airlines" are used.

Camping and daily practical training regimes are combined. In first years, fighter and helicopter practical training is conducted in the summer camp regimes. Instrumental, night and route flights, as well as winter flights for senior students are conducted round the academic year.

After one year the students are qualified for the student's license, after two years of studies the pilots are qualified for the private pilot's license, after five years of studies they qualify for the commercial pilot's license in civil or corresponding level license in military aviation

Practical training of students of air traffic control is conducted employing training facilities of the Antanas Gustaitis Aviation Institute and the Flight Control Centre of the Republic of Lithuania. The training structure of air traffic controllers is presented in Fig. 4. Practical training of air traffic control includes simulator practice and practical work. The simulator practice includes tower, approach and area air traffic control. Practical work is conducted in the air traffic control centre and the training airfield. The students are trained in procedure air traffic control and radar air traffic control.

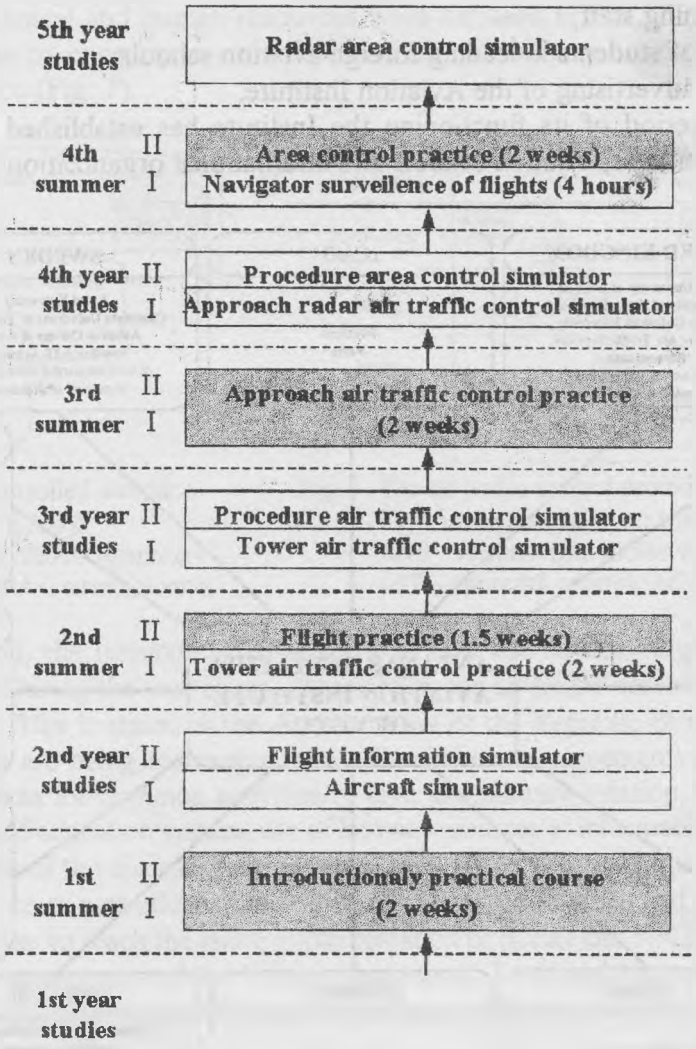

Fig. 4. Structure of practical training of air traffic controllers

□ – AGAI; ▨ – ATC

The simulator training course is provided at the Antanas Gustaitis' Aviation Institute of the VGTU.

Summer practice of air traffic control is arranged by the air traffic control service.

The air traffic control students have a 15-hour flight practice offered by the Antanas Gustaitis' Aviation Institute. In addition, they receive training in a single- and multi-engine aircraft simulator.

In the course of practical training of air traffic control the specialists of the AGAI of the VGTU and the Air Traffic Control system are engaged. Simulators are operated by the licensed ATC leaders.

During the studies, the students are qualified for the student's license and for the professional air traffic controller's license.

Military training of air traffic control students is arranged, together with the students of other aviation specialities, at the Lithuania Military Academy and the Air Force of the Republic of Lithuania.

The development of international co-operation and participation in international projects are main fields of activities of the Aviation Institute. The following scope of this activity is covered:

– acquaintance with the organization principles of foreign aviation schools and their curricula;
– awareness of the operation of foreign aviation enterprises;
– publication exchange;
– training of teaching staff;
– practical study of students in leading foreign aviation schools;
– promotion and advertising of the Aviation Institute.

Over the short period of its functioning the Institute has established close relations with a number of foreign universities, aviation schools and international organizations (Fig.5).

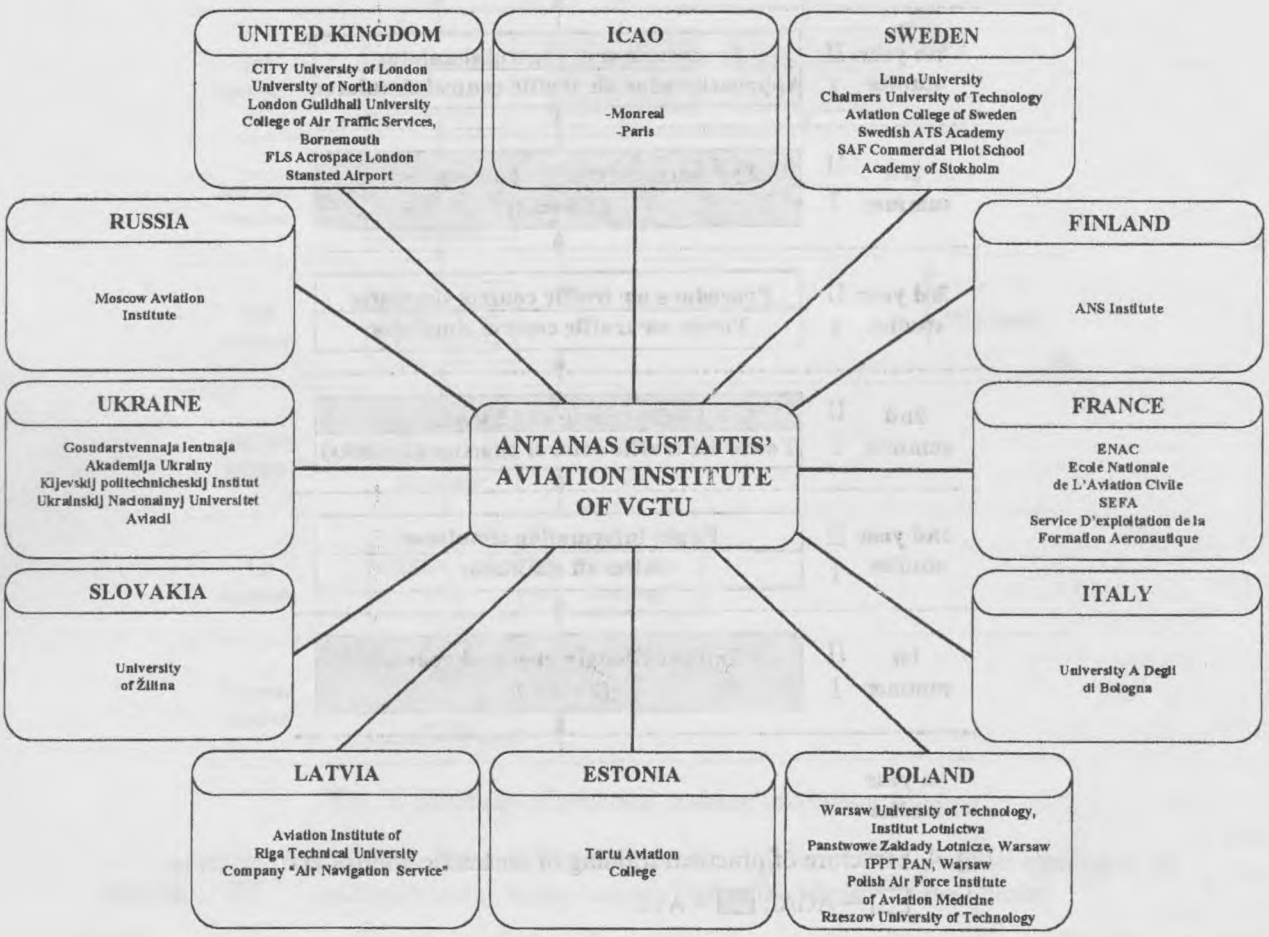

Fig. 5. International co-operation of AGAI

Most relations have been established through direct contacts and with the financial support of the Lithuanian Airlines and the Directorate of Civil Aviation. Some relations were arranged through the realization of individual and the LITTRANS and AVIOEDUCATION TEMPUS projects.

This activity has resulted in training of teachers for major subjects in aviation, elaboration of the Aviation Institute study programmes, organization of practical study course abroad for the Aviation Institute students, acquisition of basic literature for the library of the Aviation Institute, assessment of specialist training level at the Aviation Institute and of the potential of the Institute in comparison with the aviation schools of the other countries, establishment of enhanced inter-library cooperation.

The aviation specialists having a military and civil education give a precondition to create an integrated aviation management system. This statement is confirmed by the experience of our country. In 1997, the Republic of Lithuania and Sweden initiated the project for the development of integrated air traffic management system in Lithuania [5]. The essence of the project was to organize a framework of civil and military management of air space in Lithuania using the same technical means and human resources. The project Air Traffic Management and Air Surveillance (ATMAS) was completed in 2000.

According to the ICAO regulations the civil air space is divided to four parts (Fig. 6). The regulations of legal, technical and human resources were foreseen in the ATMAS project. The prepared framework allows to coordinate activities of civil and military air traffic controller's in the civil and military air space (Fig. 7).

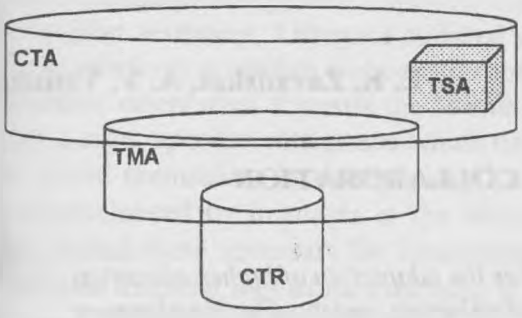

Fig. 6. Division of the controlled airspace (according to the ICAO).
CTA – control area; TSA – temporary segregated area; TMA – terminal area; CTR – control zone

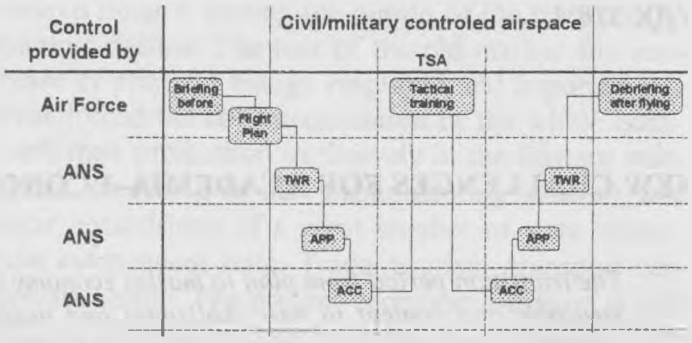

Fig. 7. The air traffic control provider role for a military flight in the integrated air traffic management system:
ANS – Aeronavigation Service; TWR – tower control; APP – approach control; ACC – air control

In the peace period, the integrated management of civil and military flights is performed by air navigation organization. During the war crisis, responsibility for air traffic control has to be delegated to the Ministry of Defense. This is stated in the Aviation Law of the Republic of Lithuania. According to the Law, the flight rules are being rearranged now. The following agreements and projects are in the preparation: the agreements for common activities of civil and military aviation; the project of air space arrangement; the project of education system; use of human resources at information system, etc.

The implementation of the discussed integrated system enables to reach the following goals: to improve the flight security, to ensure effective use of funds, to share functions and responsibilities between military and civil authorities, to reach the entire implementation of ICAO and NATO standards.

As seen from the experience of the Vilnius Gediminas' Technical University, co-operation between university and industrial potential is one of the most effective ways of organizing expensive studies in a small country.

Co-operation between civil universities and military schools and structures is expedient in preparing reserve military specialists. This improves the quality of military training and is cost-effective.

Co-operation between international aviation organizations and foreign aviation schools and universities serves as a basis for maintaining the required level of the study programs and a high quality training of aviation specialists.

Integrated system for the preparation of the specialists for civil and military aviation is precondition for the development of integrated management system of aviation and air space.

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NEW CHALLENGES FOR ACADEMIA–ECONOMY COLLABORATION

The transition period from plan to market economy requires the adaptation of higher education structure and content to new challenges and needs of developing society. The development problems of the country are inseparably intertwined with the aims of the University. Tremendous changes in economy and society, as an avalanche, has descended upon the university. Many problems now have to be solved by universities: fundamental and applied research, know-how transfer, technical expertise, adopting of new standards, consulting, training, modern marketing and management, active participation in regional or state activities, etc. The internationalization of university, international mobility, studies of foreign languages and modernization of studies are other internal university tasks. Therefore, there is constant necessity for permanent training, development and renewing of university academic and scientific personnel.

Lithuania is an East European or Baltic country with 3,7 million of population, located on the east coast of the Baltic sea and surrounded by Latvia, Belarus, Poland, Russia (Kaliningrad enclave). The density of population is 54,8 per sq.km. 68% of the total population live in towns. Administratively Lithuania is divided into 10 counties (provinces), which include in total 11 cities of national jurisdiction.

Vilnius (capital) county is located in southeast Lithuania, and is the largest county in the country. There are 906 thousand residents. All the county's institutions of higher education (three Universities and three academies) are in Vilnius, as well as all the county research and scientific institutions. Thus, the capital has the greatest concentration of academic and scientific elite in the country and the nation. The next biggest concentration of higher educational institutions is in Kaunas county. The county has 757 thousand residents and 6 higher education institutions with more than 17 000 students. Two more counties – Klaipeda and Siauliai – have one higher education institution each and another six counties have no higher education institutions. Concentration of higher education institutions in the few cities has positive and negative aspects. The unemployment rate among higher education diploma owners is higher in the areas with bigger density of higher education institutions but teaching staff quality is higher in the centers where business, industrial, administration and culture activities are more intensive.

In the middle of seventies the Government of Lithuania started implementation *uniformly distribute industry* policy. The development of ten new regional industry centers was declared. The outcomes of this long- range policy are seen very well. The fast growth of main industrial centers was declined, many social problems more or less were solved. The labor force for newly declared