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AND CHINA**



2012 第9届中国航展
AIRSHOW CHINA

NOV. 13-18, 2012
中国·广东·珠海
ZHUHAI, GUANGDONG, CHINA

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Manufacturing

Life in old dogfighter 2

Airlines

Transaero goes for A380 8

Commodity-Money-Commodity

Answers to fleet renewal puzzle.....12

Rossiya shares
An-148 experience..... 18

Airshows

Ralf Schumacher's aviation business..... 24

Aviation market

Soviet-era airliners need replacing.....26

Aircraft

Bombardier in Russia and China 30

Navigation

In the World of High-Tech & Space Navigation 34

Motors

Engines for China..... 40

Business Aviation

Gulfstream's Larry Flynn 46





LIFE IN OLD DOGFIGHTER

Large debts and unsuccessful MMRCA tender participation darken prospects for the famed fighter house.



**General director — General designer
Sergey Korotkov**

In an effort to play down some negative media reports and convince journalists in brighter-than-painted future for the famed fighter manufacturer, the MiG company (Russian Aircraft-Manufacturing Corporation “MiG”) invited media to inspect some of its Moscow facilities. The press tour took place on August 3, 2011. This event was devoted to picturing the MiG as being on the way of recovery. The company is now under leadership of Sergey Korotkov, a renown engineer and project leader from Sukhoi where he led the Su-35 effort.

Background for the press tour was of a mixed nature. The word MiG has long become synonym for a Russian jetfighter: strongly built, agile in the air and lethal in action. Yet, the last twenty years were very difficult for the famed manufacturer to such an extent that it was several times on the

edge of bankruptcy. MiG has barely recovered from mismanagement in post-Soviet times. Its image was further spoilt by the Algerian scandal, when the customer refused to accept newly delivered MiGs finding them of “bad manufacturing quality”.

According to recent media reports, the debts amassed by the MiG company have amounted to 48 billion Roubles. This made the trade union chairman at the Artyom Mikoyan’s Engineering Center (better known as Mikoyan design house) write an open letter to the Kremlin leaders. In this letter, published by the Soviet Russia newspaper, he charges incompetent MiG top managers for closing down the Article 1.42 fifth generation fighter, the MiG AT advanced jet trainer and MiG-110 lightweight ramp freighter projects without much reason behind respective decisions.



WWII war bird MiG-3 at MAKS'2011



Indian AF MiG-29s under overhaul and modernization at MAPO plant

He further accused them for disruption of the Algerian contract on the MiG-29SM/UBT fighter deliveries, which fell through due to the incompetence of certain managers. Next change is for losing the India's MMRCA tender for 126 multirole frontline jets where Russia bid with the MiG-35 improved lightweight fighter. Also, delays with deliveries of MiG-29Ks to India are added to the charges, as well as protracted negotiations with Russian MoD on firming up a Russian navy order for MiG-29K deck fighters.

Screening the MiG company out of the MoD tender for UCAV also rises questions about competence of the MiG leadership. But the biggest concern is the possible sale of some a square kilometer of the Moscow city land, currently occupied by MAPO plant, - the move that may effectively lead the MiG company into closing down.

Banner of Labor

The August press tour was to the MAPO plant named after Dementiev, also known as the Znamya Truda (Russian for "Banner of Labor"). This old factory, tracing his history to the World War II times, is located in the heart of Moscow within five-minute drive from the Kremlin. The press tour revealed some activity in the final assembly shop. Here, a few young workers employed recently work alongside with company's veterans aged sixty and more. The middle-aged people (30-55) are rare there, which makes it all the more interesting to speak to Korotkov and his deputies who fall into that "nearly absent" age. According to Korotkov, the company pays an average salary of Rouble 23,000 (821 dollar at current exchange rate) which is several times less than at the adjacent Sukhoi design house and Irkut's headquarters.

Three years ago MiG's orders almost dried up, but the Russian defense ministry came for rescue. The MoD purchased ex-Algerian MiG-29SMT/UBTs in 2006-2008 and is negotiating buy of more advanced aircraft, the MiG-29K/KUB and MiG-35. According to media reports, at MAKS'2011 airshow in August 2011 the MoD signed for 30 MiG-31 BMs by means of converting earlier versions of the MiG-31 interceptors into this improved model. The work shall include deep upgrade of the 31's onboard systems and restoration of its airframe. The MiG-31 BM is already operational. The Russian air force has a quantity of such planes. Reportedly, out of 180 MiG-31s the Service has, up to twenty are upgraded models.

By now, the Russian air force has received all of the 24 ex Algerian MiG-29SMT single seat fighters and UBT twin seat operational trainers. Early operational experience speaks favorable of the SMT model. This version is reported to be easier to maintain and a pleasure to fly. In part, this is due to the positive effect of using some western components — these replaced most faulty Russian analogues. Furthermore, the improved fighter has state-of-the-art Zhuk radar in lieu of the older N-019 Mech. About 200 MiG-29s are still on the list of the Russian air force assets.

The best MiG's asset is its dedicated and highly experienced team, but this is not enough for a company to be successful in the market-driven economy. Cash is badly needed to renovate production tools and manufacturing methods otherwise newly-made MiGs might lose competitiveness in the global marketplace.

Rumors have it that the MiG leaders gamble on lands the company possesses in Moscow city center: they are in the hands of banks and other creditors lending money to the troubled airframer as it strives for survival. A chance is still there, and a few dedicated customers have sided with the MiG as they want to see their traditional supplier competitive and prospering. But a window of opportunity is closing. It may shut completely should the money raised recently from the MiG's Moscow lands is not spent on the right things.

Manufacturing



Myanmar

With execution of the Myanmar order, the stock of classic Fulcrums (NATO code-name for the MiG-29) at the MiG plants effectively runs out. With that, the production lines at MiG's plants in Moscow, Nizhny Novgorod and Lkhovitsy completely change for the newer MiG-29K/KUB/M1/M2/35 platform. During the August 3 press event, the company demonstrated 24 classic Fulcrum airframes in the final assembly shop of the Banner of Labor.

Of those airframes, two are the Indian air force MiG-29s undergoing modernization to the MiG-29upg version. Most of the remaining examples are incomplete classic Fulcrums intended for Myanmar. MiG says three MiG-29s have been already delivered and three more are being shipped to that customer. Vladimir Barovsky, chief of MiG Engineering Center named after Artyem Mikoyan, says Myanmar ordered "about twenty classical Fulcrums, chiefly MiG-29SE single seat fighters and few MiG-29UB operational trainers". The bulk of these will be delivered this year, but completion of the contact execution "may take place in 2012".

In order to speed up execution of the Myanmar order, the MiG company has improved its classic conveyor method of final assembly. The ancient "belt-style" principle was improved by addition of six specialized "stations" which now makes the assembly process similar to that of Airbus on the A380. The improved conveyor is called "a flow assembly method". MiG general designer — general director Sergey Korotkov says "a few innovations" have been introduced to decrease the lead time down to one year and get better use of the workers, as MiG feels shortage of skilled personnel. "We will continue to innovate in our manufacturing methods so as to increase the [annual] output [of the Moscow plant] from 12 airplanes currently to 24", Korotkov said. The current MiG's backlog is for five years, he continued, admitting that certain customers "do not want to wait their new airplanes that long".

In foreseeable future the Improved Fulcrum line of the MiG-29K/KUB/M1/M2 and MiG-35 models will remain the com-

MiG-29K deck fighters

On August 3, 2011 Sergey Korotkov appeared for the first time in public after his appointment as MiG general director - general designer. He led the ceremony of laying down a MiG-29K/KUB ship-borne multirole fighter of the second production batch. During this event, the MiG demonstrated that parts for two such airframes are already manufactured, including forward and rear fuselage, air intakes and fuel tanks. This makes a minimum set to commence the final assembly process, which started the next day. These two airplanes are intended for the Vikramaditya air group. This Indian navy carrier is now at sea, undergoing trials after being reworked into STOBAR (short takeoff but arrested recovery) through-deck aircraft carrier from the ex-Soviet navy Admiral Gorchkov heavy aircraft carrying cruiser. The ship is expected to sail for India in the first quarter of 2012.

Sergei Korotkov told the invited media that to-date 11 MiG-29K/KUBs have been delivered to the type's launch customer. The remaining five will come to the naval base in Goa province by the end of this year. Thus, the initial Indian navy order for 16 aircraft is about to be fulfilled.

Touching on syllabus of the Indian pilots, Korotkov said that currently they master deck landings in Russia flying

from the Admiral Kuznetsov aircraft carrier of the Russian navy. Meantime, negotiations continue on use of the specialized Nitka land base in the Ukraine built for that purpose. In its turn, India is constructing a similar base of her own.

The follow-on order for 29 more MiG-29K/KUB fighters was signed earlier this year. The deliveries shall commence in 2012. Korotkov claimed the launch customer is "completely satisfied" with the MiG-29K/KUB performance as demonstrated during over a year of operational trials. Since the first MiGs were handed over to the customer in February 2010, the Indian navy pilots have logged more than 1,000 flight hours in this new aircraft type.

Korotkov further said carrier landing and weapons launches in Russia done in the interests of the Indian customer attracted attention of the Russian navy. The latter wants a quantity of MiG-29K/KUBs for its own needs. These MiGs would supplement heavier Su-27K (Su-33) fighters and Su-25U twin seat trainers currently operating from the Russian navy's only carrier Admiral Kuznetsov. Korotkov said: "the Russian defense minister Anatoly Serdyukov set a task before his subordinates to complete contract preparations in coming months". The initial Russian navy order is expected to be for 12-14 aircraft.



Myanmar MiG-29SE under assembly at MAPO

pany's "milk cow". The company's second largest business is modernization of earlier built Fulcrums. Vladimir Barkovsky says right now the MiG company is conducting modernization and upgrade in "four countries". He named India and Peru but refused to reveal the other pair. Upgrade costs vary between 10 and 30% of the sticker price for a new MiG-29SE not counting the price of air-launched weapons, Barkovsky said.

India is the MiG company's largest customer with orders for new MiG-29K/KUB ship-borne fighters and modernization of in-service MiG-29S interceptors and MiG-29UB operational trainers. The latter contract calls for rework of nearly sixty airplanes. Of those six will be done in Russia and "about fifty" in India. Two single seat aircraft and one twin seater are already under flight-tests at the Ramenskoye aerodrome in Zhukovskiy near Moscow. "After these trials are complete, the six Russian airplanes will be shipped to India which then will undertake the modernization work at its own aircraft maintenance station, using Russian kits", Barkovsky said. The Indian air force MiG-29upg features a new radar [believed to be the Phazotron Zhuk-ME previously tried on the ship-borne MiG-29K/KUB], LCD-based indication, a larger ventral fuel tank and the ability to use modern air-launched weapons.

Unfortunate MMRCA bidder

Russia offered the MiG-35D in the Indian competition known as the the Medium Multi-

role Combat Aircraft (MMRCA) tender.

The MiG-35D is a twin seat derivative of the baseline MiG-35 single seater attributed to "4++ generation". It features the Phazotron Zhuk-AE radar with active electronically scanned antenna (AESA), the first such unit developed and flight tested in Russia. Despite its elimination from the Indian medium multi-role combat aircraft (MMRCA) competition, the MiG-35 and its newly developed Zhuk-MA AESA radar demonstrated significant capabilities, including ground-mapping modes and the ability to detect, track and shoot at aerial targets. During demonstration flights, a MiG-35D development prototype destroyed an aerial drone with an air-to-air missile launched by an Indian pilot.

According to an insider in the Russian government, the MiG offer did not pass in the MMRCA tender due to shortcomings in the radar and engine performance. These two items were blamed in an official document from the tender organizers. It was sent to the Rosoboronexport state arms trade agency bidding with the MiG-35. The radar, the Zhuk-MAE from Phazotron is a marvelous piece of cutting-edge technologies, featuring an active electronically scanned antenna (AESA). But as it appears it fell short in performance, not giving the required acquisition and tracking ranges. In its turn, the Klimov RD-33MK engine was described as not compliant to the module principle required by the organizers.



Manufacturing

Speaking to Russian media during the August press tour Vladimir Barkovsky admitted that the Klimov RD-33MK turbofan fell short of the tender specification.

"The engine was made to the Russian understanding of what the module principle is. Apparently, the tender commission wanted an engine built to somewhat different principles. Klimov and Chernyshev [engine companies] briefed the organizers in length about their capabilities and intentions to improve their offering in terms of the engine's module structure. Unfortunately, their arguments were not taken into account". Despite these and other drawbacks, the very same RD-33MK passed the Indian navy requirements and powers the newly-built MiG-29K/KUB ship-borne fighters of the Indian navy air arm.

Touching on the radar, Barkovsky said: "Nobody expected us to actually demonstrate a workable AESA unit. During the MiG-35 flight trials, there were three cases when the Indians asked us to remove the nose cone so as to make sure the aircraft does come with an active-antenna, not the mechanically scanned Zhuk from the MiG-29K. This was after we demonstrated that the radar actually works in air-to-air and ground mapping modes, can select, discriminate and track targets. During the trials, the MiG-35 launched a missile which destroyed a drone using radar data for targeting. Despite claims of our western competitors as though we would never get our AESA working, we did demonstrate workability of our active radar technologies".

But there was one drawback the experimental radar had, namely too small an

antenna diameter, not enough to reach the tender specification to range. "It is true that the experimental radar fitted to the MiG-35 prototype had a smaller antenna size than necessary to meet the specification to range. We told the tender committee that this particular unit is of experimental nature and that in future we will make a larger radar antenna [capable of longer ranges]". Barkovsky insisted that the Eurofighter Typhoon EF-2000 did not come with an active radar at all. "While the Russians demonstrated their radar fitted to the real fighter and working, they demonstrated their radar on a helicopter", he said.

"The positive outcome of the Indian tender is that we made a huge effort on the radar development and demonstrated what nobody expected of us, and thus surprised the many including some in our home country", Barkovsky went on. "We will continue the MiG-35 project because the technology heights we achieved on the development prototype give us and some of our customers a strong belief in the future of this airplane".

The MMRCA tender was a loco that accelerated the project, but the MiG-35 was never meant to be an exclusive for India, he added. The MiG-35 represents a next step in the evolution of the Improved Fulcrum series. "It would be wrong to drop this project now, when we have achieved some very encouraging results. This airplane is still present in plans of the MiG company and our customers".

The Russian air force is considering ways of improving its light weight fighter fleet that would balance new aircraft deliveries and modernization of earlier delivered

airframes. "It has to be a compromise between buying new and upgrading existing assets", Barkovsky believes.

Speaking of the immediate future for MiG, he says the company will aggressively market the ship-borne and land-based MiG-29K/29M "which is based a new platform with new avionics, improved engines, new construction materials, larger fuel stores and new weapons. We believe this platform has a lot of potential in it and can generate sales over a long period of time. We will develop this platform further on the way of more fifth-generation technology insertions such as the active radar, new optics and other sensors, state-of-the-art ECM and so on. We have already implemented fully digital fly-by-wire on the MiG-29K and flight-tested AESA radar and newest composite materials on the MiG-35". According to Barkovsky, the MiG-29K has highest share of composite materials in airframe of all serially produced Russian fighters, with 12% of airframe surface made of composites.

Farewell to Article 1.42

The MiG company has decided to give up ideas on any further practical use of the Article 1.42. The letter is a technology demonstrator created in frame of the MFI (Russian for the Multirole Frontline Fighter) project, an ill-fated attempt to produce a rival to the USAF F-22A Raptor. The Article 1.42 made two flights in 1999 and 2000. The airplane has been grounded since then. It was seen recently staying in line with other experimental MiGs at the company's flight-test base at the Ramenskoye aerodrome in Zhukovsky near Moscow. In the past few years various MiG leaders have several times spoken of their intent to put the Article 1.42 back into an airworthy condition and perform up to twenty more flights in order to fully attest technologies developed in frame of the MFI project.

Commenting on the decision to give up further use of the Article 1.42, Vladimir Barkovsky said the project failed due to "the position of certain vendors who did not want to carry risks associated with



Article 1.42

this program. As for the MiG company, we tried hard to get the most out of this demonstrator". The Article 1.42 was the first full-scale demonstrator of the super-cruise-capable and agile fighter to have assembled in Russia. It featured unstable "canard" aerodynamics layout (a combination of a large delta wing and foreplanes) and digital "fly-by-wire" control system. Barkovsky says the demonstrator flew with aerodynamics instability of 15%, while the MFI was to have that of 25% in order to fully exploit the merits of its aerodynamics layout. Among advanced technologies tried on the Article 1.42 he specially mentioned a wide-scale use of big welded airframe parts made of Aluminum-Lithium alloys.

Skat UCAV

On 3 August Sergey Korotkov said MiG is working together with Sukhoi on a future UCAV using experience gained on the Skat program. The latter was demonstrated to a tiny group of the Russian media at MAKS' 2007 and never appeared in public again. Until recently the Skat was thought to have been shelved.

The MiG company describes the Skat as a stealthy multipurpose unmanned combat air vehicle intended for striking pre-loaded stationary targets, suppression of enemy air defense system in conditions of severe ECM and anti-aircraft fire. The UCAV shall be able to successfully engage evasive and heavily protected land and sea targets, and conduct its operations either autonomously or as part of a larger aviation strike force made up of manned and unmanned aircraft.

The Skat is powered by a single Klimov RD-5000 non-reheated turbofan (an RD-93 derivative in use of the Chinese FC-1 export fighter now in service with Pakistan air force as the JF-17 Thunder). The engine produces a maximum thrust of 5,040kgf. The Skat has a maximum takeoff weight about ten tons, zero-level speed in excess of 800 km per hour, max Mach number 0.8, practice ceiling 12,000m, and range up to 4,000 km. The weapons load is 2,000kg. It can be carried internally in two bays each mea-

suring 0.65 vs 0.75 vs 4.4 meters. Typical load would be two anti-radiation or anti-ship missiles of the Kh-31P/A type or two KAB500 series guided bombs of 500kg caliber. The Skat's wingspan is 11.5m, length 10.25m, height 2.7m.

Vladimir Barkovsky says that at this point of time he cannot foresee whether a next-generation MiG would be a manned or unmanned aircraft. "This depends on maturity of technologies available to us at a time decision will be made to launch development [of the next-generation MiG] in honest", he told the media. Touching on the Skat, he said it was "a technology development program during which we assembled a full scale unmanned combat air vehicle with stealth features. We conducted a huge amount of studies in aerodynamics, gas dynamics and other areas. This helped us create a technology base for next phase of our studies which we continue to carry out".

Extensive wind-tunnel testing on various Skat configurations were done at TsAGI, the Central Aero-Hydrodynamics Institute named after Nikolai Zhukovsky. During the tunnel testing the MiG tried to determine an optimal combination of UCAV in terms of size for a specified payload and combat efficiency.

Russian air force

Russian air force commander held a press conference at MAKS' 2011 opening day using this opportunity to present the service's modernization plans. During this event, Gen. Aleksander Zelin touched on only one MiG development programs among many others being materialized by the service. He agreed with the statement that the T-50 is a good replacement for the heavy Su-27 fighter, while at this time there is no replacement for lighter MiG-29. The PAKFA is understood to have MTOW of 37 tons, some ten tons above the respective figure for the MiG-29K. In future, the Russian air force may commit to development of an advanced lightweight fighter similar to the USAF F-35 Lightning II.

The Russian air force commander said: "Our first priority is the Sukhoi T-50 (official designation PAKFA, acronym for Future Aircraft Complex of Frontal Aviation). This machine is better suited to Russia with her large territories, and allows force projection over distances. But I think we also need a lighter fighter, in the class of the F-35. In this class our industry is offering the MiG-35... We have not yet dropped the MiG-35D from consideration".



Airlines



Transaero, Russia's second largest carrier after Aeroflot, signed MoU with Airbus for four A380s, deliveries slotted for late 2015.

Signatures onto the document were applied on October 28, 2011 by the airline's general director Olga Pleshakova and Airbus executive vice president for Europe, Asia and Pacific Christopher Buckley. Thus Transaero became the first A380 customer in Russia, CIS and Eastern Europe. The A380s will supplement and later replace Boeing 747-200/300/400s Transaero is using on high-density scheduled and charter flights originating in Moscow Domodedovo airport. The Russian carrier selected high density cabin configuration seating nearly 700 passengers in a three class arrangement.

Olga Pleshakova commented that "Our airline has amassed a huge experience in operating wide body transports seating five hundred and more passengers, and is now ready to place the world's largest passenger plane on our route network. I am sure the operations of airplanes such as the A380 will give a big impulse to further development of air transportation system in Russia, especially to improvement of airport infrastructure, while Transaero passengers will enjoy a quality new service on non-stop long-haul services".

Airbus is "convinced" that the A380 will generate more sales in Russia. According

to Airbus recent market forecast, Russian air transportation volumes will grow with average annual rate of 5.6% in the next twenty years (6.2% in 2011-2020 and 4.9% in 2021-2030), which is above the world's average, at 4.8%. This, coupled with high concentration of air traffic in the Moscow air knot, creates a solvent demand in the A380.

The recent deals with Transaero, on the A320neo at MAAKS'2011 and on the A380 two month later is a big win for Airbus, since Transaero has long been strongly "Boeing-oriented" airline. Today, its fleet is composed of 68 Boeing



Chris Buckley and Tom Enders

airplanes and three Tupolev Tu-214s. At MAKS'2011 Transaero signed agreement for eight A320neo thus becoming the type's first customer in the whole of Russia, CIS and Eastern Europe. "Furthermore, they are taking up to 20 today's A320s from leasing companies starting in 2013", Buckley told reporters during the show. "This is certainly a bitter news for Boeing since Transaero has a large Boeing fleet", he observed happily.

The recent Russian market assessment from Airbus sees the need for 1,006 new passenger planes worth US dollar 95.2 billion in the period of 2011-2030. The European manufacturer believes 839 single-aisle, 145 twin-aisle and 22 very large aircraft will be procured by Russian carriers in the 2011-2030 timeframe. Today, the Russian commercial airliner fleet is 519 unit strong, and is expected to grow to 734 units in 2020 and then over to 1,058 in 2030. As of October, 11 Russian airlines

operate 183 Airbuses, including five Airbus Corporate Jetliners, a single A310 and 15 A330s, the rest being narrow bodies. These figures were given by Christopher Buckley at the Wings of Russia international aviation forum held in Moscow.

The current intake of new airplanes by Russian carriers is 80 to 90% is made of

imported products. By Airbus estimates, the share of passengers carried by Russian airlines on western-made aircraft increased from 16% in 2005 up to 80% in 2011. Still, a worthwhile portion of the traffic is generated on outdated Soviet-era fuel-thirsty jets. The current Russian fleet is "a mix of old and new", with 40% mainline and large regional aircraft described as modern, 38% as middling and 22% as old. Average Boeing aircraft age is 16 years, Airbus 6 years. "We expect that Russian carriers will soon replace older Boeings such as the 737 Classics, and some 767s and 747s, since those appear rather old and needing replacements", Buckley observed.

Market forecast

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As of early October, 11 Russian airlines operated 183 Airbus jets, including five Airbus Corporate Jetliners, a single A310 and 15 A330s, the rest being A319/320/321 passenger narrow bodies. These figures were given by Christopher Buckley at the Wings of Russia international aviation forum held in Moscow in October 2011. He said that 80 Airbuses are "on order".



A380 economy cabin

Airlines



Transaero operates three Tu-214 narrowbodies on lease from IFC

The current intake of new airplanes by Russian carriers is by 80 to 90% is made of imported products. "This is because there is not enough production of modern indigenous designs today", Buckley commented, "The local manufacturers are unable to supply enough modern aircraft to meet the market demand, but this may change in the future when the SSJ100 and MS-21 production is up and running".

Another key advantage of western suppliers is cheaper capital for aircraft financ-

ing schemes, but this is now questioned due to another series of disturbances on the world's financial markets. Assessing the current condition of the world's financial markets, Buckley said "it is not as bad as has been reported in the press. At the same time, we are looking at additional ways for funding aircraft deliveries, including those to Russian carriers".

Touching on the theme of low cost carriers (LCC) in Russia, he said that non of the current discounter airlines (Sky Express,

Avianova) operating there is "of classic model". They must rather be described as "hybrid business models". At the same time, Airbus finds local tourist charter operations as "well organized, well developed, and offering attractive holiday packages", which "provides a sharp contrast to local low-cost operations". While observing high growth rates of air traffic and rather high influx of modern western airplanes, Airbus finds route network insufficiently developed across the country, with the only exception of Moscow area where the traffic is highly — and sometimes unnecessary — concentrated, which is one of the negative factors for LCC development.

That said, Airbus believes that LCC certainly have prospects in Russia and a market niche there. "There is a big opportunity there for the future, although it is a bit of a challenge", Buckley comments. World's leading low cost carrier Ryanair expect 95% of its passengers to buy tickets through Internet. With further expansion of the World Wide Web, more Russians will follow the world's trend, and this further improves business case for discounter airlines.

Airbus notices that of five top Russian airlines — Aeroflot, S7, Transaero, UTair and Rossiya — non are in an alliance



Korean Airlines A380



A380 flies at MAKS'2011

(Aeroflot + Rossiya merging process has only started and is difficult to assess at this stage). "There is a little bit of consolidation, but we'd probably argue it needs to be more. Today, we see the top five competing against each other in quite a few markets, and smaller airlines competing against them as well. Certainly, there is a big opportunity for these five, or two-three of them if they start talking of, let's say, a stronger market", Buckley commented. The European manufacturer expects that two or three of the biggest Russian carriers may find it suitable to form an alliance in near future. Such a move shall help them optimize their current route network, improve fleet management and thus attain higher gains.

By Airbus estimates, the share of imported passenger jets in the Russian airline fleet increased from 2% in 1994 to 16% in 2005 and then up to 75% in 2011. It is expected to further grow and reach 80% in 2012 in the view of the Tu-134 and Tu-154 retirements. Yet, a worthwhile portion of the traffic is still generated on outdated Soviet-era fuel-thirsty jets, which produces an impact on profitability of operations.

The current Russian fleet is "a mix of old and new", with 40% mainline and large regional aircraft described as modern, 38% as middling and 22% as old. Aver-

age Boeing aircraft age is 16 years, Airbus 6 years. "We expect that Russian carriers will soon replace older Boeings such as the 737 Classics, and some 767s and 747s, since those appear rather old and needing replacements", Buckley observed.

Alliance or Rolls?

So far Airbus delivered 59 A380s to seven airlines in the world, out of 236 ordered (not counting the Russian airline customer, which is yet to firm up its commitment). Since entry into service in 2007, these airplanes have carried over 16 million passengers and amassed over 300 thousand flight hours. Some airlines achieved and maintained 99% reliability on the A380, while the fleet average is just about 98%.

Transaero has not yet selected engine type for its A380s. Meantime, powerplant is said to contribute up to 35% of the A380-800's US\$375.3 million sticker price. The airlines have two motor types to choose, from Engine Alliance and Rolls-Royce. Today, their shares of this market are 43% for the GP7200 and 57% for the Trent 900 respectively. As of late October, eleven of the sixteen A380 airline customers have selected the British motor. Thirty Trent-powered aircraft are already in service. The Trent 900 has logged about one million flight hours in more than 103 thousand flight cycles.

On the eve of Dubai show Rolls-Royce announced that it introduces the first of a two-phase performance improvement for the Trent 900 engines. Motors now delivered to A380 operators have a one-percent improvement in specific fuel consumption. Second-phase improvements due to enter service during 2013 will deliver a further 0.8-percent reduction in fuel burn. All the improvements introduced focus on improving air flow and cooling.

The first performance improvement package includes new elliptical leading edges (ELEs), tighter low-pressure tip clearance and a new hard coating for the high-pressure compressor drum. The second performance-improvement package will cover the following elements: optimized fan blade tip clearance, better cooling of the turbine case, improved sealing for the low-pressure turbine, ELEs for the engine section stators, re-profiling of engine frames and upgrades to the air system.

These improvements have been largely influenced by the progress made with Rolls-Royce Trent 1000 and Trent XWB engines on the Boeing 787 Dreamliner and Airbus A350XWB. Last month a Trent XWB test engine on an A380 testbed being used for A350XWB development. Other new features have come from the Trent 700EP turbofan, and also from the V2500Select and the latest versions of the AE3007. More than half of the improved features will be retrofitable during overhaul.

Sales prospects

Airbus is talking to large airlines in the region about the A380, especially to those which already operate big wide body transports. Aeroflot is a natural suggestion. Buckley says Airbus and Aeroflot have been doing a joint study on employment of A380s on the Russian carrier's route network, specially mentioning the long haul services from Moscow to NY and Russia's Far East destinations: Khabarovsk and Vladivostok. Besides, there have been rumors about Russian tycoons having an interest in a VIP version of the Airbus giant.

Vladimir Karnozov

ANSWERS TO FLEET RENEWAL PUZZLE

Russia's largest lessor Ilyushin Finance Co. offers solutions to regional and commuter operators.



An-158

In a wake of the Yak-42 crash in September, Russia's president Dmitry Medvedev asked the Russian government to consider ways to speed up replacement of old airplanes not compliant to the upcoming air worthiness requirements. Shortly after, prime-minister Vladimir Putin chaired government's session with fleet renewal on the agenda, and asked the ministries of finance, economic development, transportation, industry and trade to prepare their recommendations on the matter. The ministries are expected to formulate their position by the year-end so that to have the fleet renewal encouragement measures in place early next year.

In its part, Russia's largest lessor Ilyushin Finance Co. (IFC) has done extensive studies on possible aircraft finance solutions. This work shall help find ways to material-

ize the Russian president's initiative so that it brings to life a very efficient fleet renewal program beneficial to the Russian public, passengers, airlines, manufacturers and financial institutions.

As of October 2011, IFC assets included 30 mainline airliners of the Il-96, Tu-204/214 families and six regional jets of the An-148 type. To-date, the company's order portfolio has exceeded 150 aircraft. IFC has been successful enough in placing Russian mainline airliners with Russian and Cuban carriers and helping them achieve profitable operations on the Il-96 wide bodies and Tu-204/214 narrow body transports. This effort culminated in the fact that IFC-placed Tupolev narrow bodies of the Russian origin have managed to achieve utilization rates similar to the Airbus A320 and Boeing 737NG families.

Their monthly flight time figures reached and stabilized at 300-400 hours. This gave IFC a firm footing to make next step forward. At MAKS'2011 the lessor firmed up order for fifty next-generation Irkut MS-21-300 narrow body twinjets with deliveries due to start in 2019.

Having established a stable market presence in the narrow body segment of the aviation leasing, IFC began looking to expand its aviation business. In the first decade of this century, the company made strong commitment to a new generation family of large regional jets from Antonov. As of today, IFC acquired six 68-seat An-148-100Bs and placed them with Rossiya, one of the top five Russian carriers. The An-148 began revenue operations on Russian routes in December 2009. This endeavor has

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allowed IFC to taste the market of regional jets. As the confidence, knowledge and experience of the company's team grew, IFC began looking at ways to expand its business in the given market sector.

Starting in the middle of the past decade, IFC conducted a series of comprehensive studies aimed at finding suitable leasing solutions for airlines operating regional and commuter aircraft. Most of these studies were conducted in the interest of Russian clients, but researchers also studied the Latin American, Chinese, Middle East and other markets, where the company either has customers or talks to potential clients.

In general, these studies convinced IFC that the solvent demand is there. There are market niches that the company can serve and thus expand its business. With that, the lessor's order portfolio has tended to shift towards small commercial jets and regional airplanes. The recent additions were the CS100 (seating 110 to 125 passengers depending on cabin configuration) and CS300 (130-145) from Bombardier and the An-158 (86-99) from Antonov. Announcing new aircraft purchases at Paris 2011 and MAKS 2011 air shows, the lessor said that it is most interested in arranging aircraft leasing solutions namely in the regional and commuter sectors of the aircraft leasing business.

As it appeared, the An-148 aircraft family alone, although very capable in terms technical and economical, could not provide a comprehensive answer to the needs of regional and commuter operators. Researchers found out that in many practical cases it has to be a combination of jets and turboprops in the fleet of a given airline to allow it operate profitably and efficiently on the market that is indeed a very demanding one.

Wings of Russia international aviation forum held last month in Moscow provided a good platform for IFC and other market players to share their findings with aviation community and discuss the ways to go. Deputy general director Andrei Lebedinets was one of the forum's key speakers. He started his speech with the following observation. The aviation leasing

market for the narrow body airliners is already well developed in Russia and the rest of the world, it is rather rewarding and stable. Sadly, same cannot be said of regional and commuter aircraft.

He reminded that in September 2011, after a chain of crashes of Yak-42, Tu-134 and An-24 airplanes, the Russian aviation authorities decided to implement additional flight safety measures. Their respective directives order outfitting regional and commuter airplanes with air traffic collision avoidance systems and ground proximity warning systems. In order to comply with the stricter regulations coming into force in January 2012, the airlines must invest into additional equipment to be fitted to most of their in-service airplanes.

Having done an in-depth analysis, IFC came to conclusion: it is not necessary to upgrade the whole fleet for compliance with the upcoming stricter regulations. Many airlines now face a dilemma: whether to invest in their physically old and morally outdated airplanes or procure newer assets. "Hence, there is a need in financial solutions and instruments, and here we are, offering out services", Lebedinets said.

Large regional jets

IFC did a study on actual condition of the current Russian airliner fleet being used on scheduled passenger services.

In the cabin capacity between 70 to 100 seats there are two types of Soviet-era aircraft needing replacement. The Yak-42 tri jet is present in 69 examples, most of which are employed on scheduled passenger services. The Tu-134 twin jet fleet has 57 active airplanes in service with commercially viable and operationally strong airlines. The actual number of operable Tu-134s in Russian register is somewhat bigger (183 according to GosNIIGA's statistics), Lebedinets admits, but IFC's analysis takes account of only those that actually fly scheduled passenger services in the central timetable.

In most instances the Yak-42 looks like passable with fuel burn and remaining life time resources. IFC finds this type suitable for modernization and upgrade work. So, the Yak-42 does not need an urgent replacement and can serve (after upgrade) for another five to seven years. This cannot be said of the Tu-134. That type is described as fuel-thirsty airplane and having limited lifetime resources. Making the old Tupolev compliant to the stricter airworthiness regulations demands considerable investment, which is hard to justify. This means that remaining Tu-134s are likely to be withdrawn from service in a short time.

Of western aircraft, the 737-500, and other 737 Classics, are described as "needing replacements". There are some eighty



Yak-42D



An-158 crew station

737-500s in the Russian inventory. Some of them, including certain UTair examples, have undergone upgrades and got winglets fitted. But the vast majority is found too old to upgrade and too expensive to operate due to high maintenance costs. This finds reflection in a deplorable punctuality of flights operated by old Boeings. IFC finds that replacing these aircraft will be on the agenda in two-three years time.

With the need to cater for traffic growth taken into account, IFC estimates the Russian market demand in the 70-100-seat category at 130 aircraft by 2020. Modern indigenous designs with the given seating capacity are the SSJ100 from Sukhoi and the An-148/158 from Antonov. IFC and Sberbank Leasing have already placed Russian-made An-148s with two Russian airlines and seek ways on placing more such aircraft with domestic and international carriers. "Together with Aeroflot group of companies we are putting together plans for an increase of the An-148 numbers at the group's disposal", Lebedinets said.

Structuring aircraft finance packages for regional carrier is a complex matter, he insisted. If an airline is looking to acquire used western aircraft to replace its Tu-134s, it may find that most of used airplanes with similar seating capacity, available, say, in North America, do not comply with the upcoming Russian regulations. To attain compliance, they need investment and time to implement

upgrades. So, when a financial package is being structured, leasing companies and banks need to assess risks carefully. Some of those pertain to the airline itself. Will a particular carrier be able to master new type in reasonable time, establish and maintain a profitable operation using them? To answer this and other questions, the lessor has to assess the economics of the airline client, its business model, its personnel and the potential to support profitable growth.

For some airlines, used western airplanes can prove a workable solution. In the case of modern indigenous or western aircraft, the fleet renewal appears rather costly. "At best, a brand-new regional jet sells at 25 million dollars, and an airline needs at least 3-5 aircraft at a time to start scheduled services on new type. In most instances, this requires risk sharing between several financial institutions, otherwise the risks look too high for one financier to bear", Lebedinets says.

In many cases the An-148/158 family is the right answer, IFC insists. The baseline model An-148-100 has proved capable of high utilization on real route network of Rossiya and Polet airlines. Lebedinets insists that all six of Rossiya's An-148-100Bs are air worthy. On average, each airplane demonstrates monthly utilization rate of 280-300 flight hours. Individual record was set in August 2011 by the RA-61704, with 403 flight hours.

Immediately after entry-into-service the figures used to be far worse. But Rossiya team demonstrated its professionalism and dedication. In cooperation with aircraft and engine manufacturers, their vendor and the lessor, Rossiya has managed to overcome deficiencies and attain operational profitability. According to the airline's commercial director, utilization of 300 flight hours per airframe allows profitable operations on the airline's route network. This finding encouraged IFC to firm up orders for 56 additional An-148/158 family aircraft.

Basing on the vast experience of the Il-96 and Tu-204/214 financial lease deals, and the early An-148 experience, IFC has formed a comprehensive customer support packages that go far beyond aircraft financing. A specially established daughter company runs a spare parts depot and sends its technicians to assist airline customers in the case they need urgent technical support from a competent team of engineers and mechanics. Together with S7 Training, IFC has established a center that offers airline customers services on crew training, using a complete range of computer classes and simulators, including a Class D full flight simulator for the An-148. Low output of production aircraft remains a bottleneck. The industry promises to ramp up annual output of An-148/158 family aircraft to 12 next year and then up to 36 in three-four years' time.

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Small regionals and commuters

Situation with the aircraft with "below 50" seating capacity is far worse than upper segments, IFC analysis has revealed. In addition, the number of old aircraft needing replacement is comparatively large. The lessor has counted 174 An-24/26 regional turboprop aircraft and 74 Yak-40 tri jets still flying passenger services inside Russia. Employed on commuter services are 26 L-410 and 15 An-28 turboprops, along with 348 An-2 piston biplanes.

There is also a handful of more modern Embraer E-120 Brazilia, An-38 and An-140 turboprops. These generate a very small share in the traffic. Once again, IFC counted only those aircraft that actually fly scheduled passenger services, whereas actual number of the listed type airplanes still on the register is much larger (the An-2 especially). Some of them are used as corporate transports or fly charter services, others operate in the interest of agriculture and other industries. Over fifty Yak-40s have been converted into VIP transports, but these do not count, too.

The average age of the Russian regional and commuter fleet is nearly 30 years. Coupled with high fuel burn, this makes the lion's share of it needing urgent replacing. Judging by pure economic considerations, this entire fleet had bet-

ter been written off entirely. But this is not possible from the social point of view. In many cases these outdated airplanes flew much needed services to remote destinations, which cannot be otherwise serviced by any other means of transport.

This is the case in the Far East, Siberia, Extreme North and other vast and rarely populated regions of Russia. The economics of operations in these regions is such that does not enable to generate a profit large enough to structure a financial package for fleet renewal on commercial terms. This sad finding has been made after a thorough evaluation of all aircraft types available on the primary and secondary markets. Lebedinets said his company ran a competition between various aircraft suppliers in order to select suitable aircraft types. Types considered came from ATR, Bombardier, Embraer, Antonov and AVIC. Besides, IFC also studied the Twin Otter, L410, Saab 340/2000, Dornier and other airplanes available on the secondary market.

As part of its extensive studies, IFC did route network analysis and tried to find a combination of aircraft types for a comprehensive fleet solution to a regional airline. With several solutions to particular airlines put together in a bigger plan, IFC tried to find a business case for forming a pool of

30-50 aircraft in order to justify a local MRO station and a personnel training center equipped with all necessary facilities such as spare parts depot, computer classes, flight simulators etc.

Basing on the market analysis, the lessor has estimated immediate needs of the Russian air transportation system in the smaller aircraft at 100 units in the 30-50 seat class, at 50 units in the 20-30 seat class and at 300 units at 10-20 seat class. Altogether, this sums up in a requirement for 580 airplanes with number of seats up to one-hundred.

The smaller fleet renewal is a big problem and a headache in the scale of whole Russia. Wings of Russia participants said they see some signs of encouragement in growing understanding of this fact from the side of local authorities and, more recently, the central government and the presidential administration. A number of local administrations have already made decisions to provide subsidies from their regions' budgets to socially important air transport services. These include diamond-rich Yakutia autonomous republic, as well as the Khabarovsk and Krasnoyarsk Regions. "There are some good practices already, and their examples rise in numbers", a Wings of Russia key speaker said.



An-140

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Suggestions

Taking part in open public discussion on the matter of Russian fleet renewal, IFC suggests the following to the Russian government. To expand coverage of the government measures under the Order no.90 dated 18.02.2008 and the Order 466 dated 26.06.2002 to regional and commuter airplanes placed with local airlines on the financial and operating lease terms. Originally, these governmental measures had been invented to slash bank interest rates for commercial credits granted to airlines or leasing companies taking new indigenous aircraft designs on financial lease terms. Furthermore, IFC offers to include certain foreign made aircraft into this scheme, provided they have a substantial share of Russian industrial participation. Besides, IFC asks the law makers to give aircraft owners (including banks and leasing companies) more rights in pulling their airplanes out of airlines in case the latter proved unable to pay rents on time.

The lessor is further asking the government to abandon import tax on large turboprops, seating 50 to 75 passengers. Today, such aircraft are subjected to import tax and value-added tax on top of it, altogether making a 42% extra charge to the sticker price. "We ask for this even though we understand that this would produce somewhat negative effect on sales of the Russian-made An-148 seating 68 to 75 passengers", Lebedinets said. "But this measure would help arrange much needed replacements for the aged fleet".

It has been calculated that aircraft with 30-50 seats need governmental subsidies covering up to 60% of their acquisition price. The aircraft with capacity below 30 seats need that up to 90%. Economics of operating small passenger airplanes in the remote, rarely populated regions allow only covering direct operating cost (fuel, maintenance and training, payments to ground and flight crews). Besides, due to conditions of the ground infrastructure in those regions, an airplane can have only limited utilization due to poorly equipped destination airports, in most instances allowing only day light operations. Quality of airline staff is a big issue: young, capa-

ble pilots, engineers and technicians tend to apply for a job with mainline, rather than regional, carriers due to much higher salaries the former can afford to pay their staff. English language skills are another factor: to master a foreign-made airplane and operate it according to English manuals is a big issue for regional and commuter airlines. The Russian government is expected to make a decision and implement new measures of state support to fleet renewal by the year-end.

Conclusion

Russia's president and prime minister have publically acknowledged the urgent need for a speedy fleet renewal of Russian airlines as part of measures aimed at creating a healthier air transport system in the country. While solutions in the wide body and narrow body aircraft sectors have been largely found, these are yet to be worked out in relation to the smaller passenger fleet. Today, there is only a handful of western equipment present in the given market niche, a total of only sixty imported aircraft (28

CRJ, 23 large turboprops seating 40-75 passengers, and 10 commuter aircraft). Local aircraft manufacturers are present in this sector with the SSJ100 and An-148/158 jets, along with the An-140 turboprop, but their numbers are small, and production output needs to ramp up substantially to meet the solvent demand. The current situation in the market for smaller passenger aircraft is fairly complex, needing clever, well thought out and balanced solutions. There is a hope that the skills, knowledge and experience amassed by certain "market driving forces" on structuring aircraft financial packages for larger aircraft and implementing complex deals in challenging economic environments in Russia, developing world and pariah countries will finally work out how this issue shall be resolved. One of such "driving forces", IFC has a competent team and vast experience of handling demanding tasks in the interests of local and overseas customers. Together with other leasing and consulting companies in Russia, it can help the governments and the airlines to find the way out.



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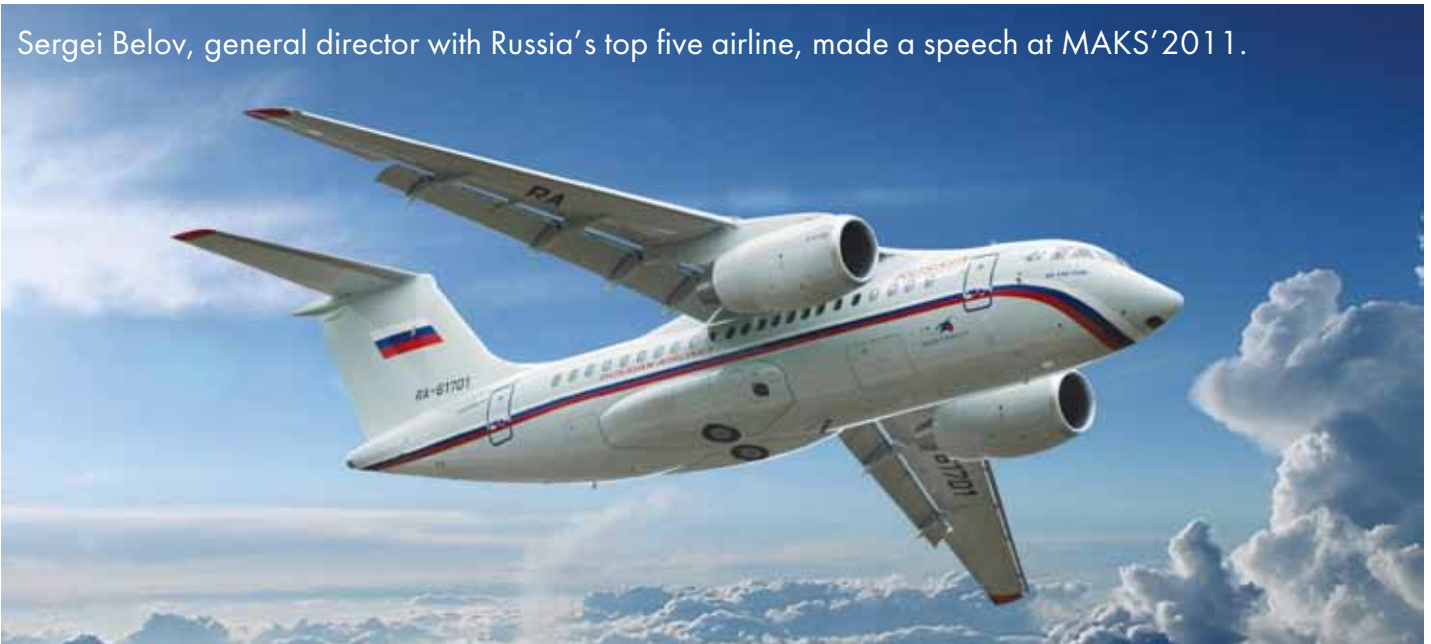
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ROSSIYA SHARES AN-148 EXPERIENCE

Sergei Belov, general director with Russia's top five airline, made a speech at MAKS' 2011.



This is a first time when we, at Rossiya airline, share our data on the An-148 operations openly with the aviation community. This conference is held in the press center of the MAKS 2011 air show, and I am happy to see here many familiar faces of industry partners, colleagues from other airlines who came along with the

members of the media. Here present are: general director at Ilyushin Finance Co. (IFC) Alexander Rubtsov, president and general designer at Antonov state company Dmitry Kiva and president of Motor Sich engine maker Vyacheslav Boguslaev. Decision to share data on the An-148 operations was made on our initiative. We believe that 1.5 years of revenue service is sufficient time to speak of a new airplane's strengths and deficiencies, and draw some preliminary conclusions. The theme of this conference is "the An-148: Introduction into revenue service". I am happy to observe that this topic made so many people flock here today.

The An-148 is a very advanced, state-of-the-art design with lots of cutting-edge technologies in it. Still, there is always a room for improvement. This airplane continues to evolve as a platform and as a product. Number of its applications widens. We'll share with you our data, experience, and results of activities.

Rossiia airlines

With main base in St. Petersburg, Rossiya is among top five Russian carriers with a fleet of 29 aircraft: 3 Boeing 767 wide bodies, 5 Boeing 737-500, 9 Airbus A319 and 6 A320 narrow-bodies plus six An-148 regional jets. It is a 100% state owned enterprise and since earlier this year under control of the Russian flag carrier Aeroflot and a member in the Aeroflot group of companies with six smaller Russian airlines. In first seven months of this year Rossiya demonstrated a 10% growth in passenger numbers, and expects to carry between 3.3 and 3.4 million passengers in the whole of 2011. Today, the domestic and international flights are roughly balanced, but the latter rises faster. According to the newly developed strategy of the Aeroflot group, Rossiya's annual traffic volume shall quadruple and reach 12 million in 2015.

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But I would like to make one important point beforehand: to me, drawing far-going conclusions on the results of a-year-and-a-half-long revenue operations could prove premature. Today, it is too early to issue a verdict on this airplane. too early to paint the overall picture only with black or white color. Period of initial operations after entry into service (EIS) requires very careful attention to every issue arising in operation and keeping airplanes airworthy. Furthermore, as we were going through the difficult and decisive period of the initial revenue operations, we tried to improve a lot of contractual documents in order to get the most out of our airplanes in terms commercial.

The An-148 belongs to large regional jets. By seating capacity this airplane is the smallest in Rossiya fleet. But it occupies a prominent place in our inventory. First off, I'll give you some statistics on operational activities for seven months of 2010 and 2011. These make possible to assess dynamics of changes. Average strength of our An-148 fleet was 3.6 and 6 units respectively, number of passengers carried: 73 thousand and 226 thousands accordingly.

By mid-August 2011 our An-148 fleet had amassed 15 thousand flight hours and carried 420 thousand passengers. That's roughly within 1.5-year time after EIS. My understanding is that a fleet of six large regional jets attributed to the latest generation can form a capable aviation grouping. Such a grouping is able to transport half-a-million passengers annually when coupled with well-functioning support system and good network of routes. For 2012 we plan to carry 520 thousand passengers on 5,230 An-148 round trips lasting 21,800 FH (with expected seat loading factor of 75%). Such a transport capacity is enough to satisfy solvent demand in any of the Russian provincial cities. Our base in St. Petersburg is, of course, not a regional airport. That's more. Initially, we operated the new type on routes that are by no means regional. The reason to that was a purely technical one. It was easier to serve the airplane in St. Petersburg and Moscow.

On EIS the share of St. Petersburg — Moscow flights was very high, at 75% initially. Then it subsided down to 54% on average for the whole of 2010. Today, it is merely 16%. The An-148 is not the right airplane to serve the St. Petersburg — Moscow route. Hence, as we mastered operations on the new type, we were increasingly using the An-148 on "more regional" services, those connecting St. Petersburg to the smaller cities and towns in Russia, and, later, abroad.

By now we have reached the target figure for average flight time: two hours. Today, the airplane serves 24 regional routes with average seat loading factor of 76% (for economy class cabin the figure is 81%). This provides some evidence to the following statement. Rossiya has launched full-scale revenue operations on the An-148. The summer 2011 became first high season during which the new type were operating in the environment it was purposely designed for.

What place does the An-148 occupy in the operational activities of our airline? Past year its share in the grand total of our flight time was merely 5%. This year it stands at 17%. Today, we carry 12% of all our passengers on An-148s, and make 20% of all flights using this type. Needless it to say this could not be possible without sufficient ground support, servicing and maintenance.

Let's talk about flight time generated in the seven months of the past and this year. Clearly, figures for January and February 2010 speak of a low utilization. This was so due to teething problems we ex-

perienced on the new type. We strived hard to solve them. When you look at figures in the table provided for May and June 2011, you may notice that all six airplanes we got so far from the industry were air worthy. Their monthly flight times have been on rise. In June we had 212, 235, 260 and 270 FH per airframe. That's only revenue flights: the total number of flight hours was a bit higher as we used our airplanes for flight training, to get more pilots qualify in the type. In July 2011 the flight time per airframe averaged at 270 FH. In August the figure exceeded 290 FH, some airframes went beyond the 300 FH mark.

By mid-August 2011, the D-436-148 engines on our An-148s had amassed over 30,000 working hours. Since EIS, we have never had in-flight shutdowns. There was one case of engine flameout on the ground, when the pilots disengaged thrust reverser at the end of the landing run. We carefully studied that case and worked out solutions to avoid such situations in future.

Let me draw your attention to flight times one more time, this time to daily utilization. Here, statistics speaks for itself. After some improvement work on our airplanes was done, the figures went up. Last year the daily utilization went beyond eight hours per airframe. In the first half of 2011 the daily utilization went beyond 9.5 hours. In my view, this is a fairly good utilization for a regional jet.

We compare the An-148 with the Boeing 737-500 and the Airbus A319 also present in our fleet. When we do this,





some people say "Oh, these fall into different classes, you cannot compare the incomparable". But we do compare, in a belief the An-148 is a new generation regional jet, and so it shall compare to the narrow bodies that operate alongside it out of the same hub. Furthermore, the principles of the An-148 operations are the same with those of the narrow body types in our fleet. What do we see? Current utilization rates are similar to the Boeing Classics, and a bit worse those for the Airbus. This means the An-148 has taken its place in the line of our aviation assets. And it holds the line.

Hourly fuel burn: we have gone below two tons per block hour, at 1,995kg compared to 2,622kg for the Boeing 737-500 and 2,547 for the A319. Average fuel burn per kilometer flown, have been going down in reflection of ongoing changes in the flight geography and seat loading factor. Being a smaller airplane, the An-148 burns less fuel per trip than the Boeing 737-500 or the Airbus A319. This is beneficial to us: we can decrease our expenses by placing a regional jet on thin routes previously operated by larger narrow bodies or replace them temporarily during low seasons.

As I said before, the past year was some sort of operational trials for the An-148. More than that, these trials were held on the account of our airline. During that period, we were structuring a new system of interaction between An-148 project participants. There was a reason behind this. Rossiya is a commercial airline. We try to make a profit in competing environment.

We want the airplanes we buy from the industry or take from leasing companies to help us generate more profit.

Last year Rossiya held five flight and technical conferences on the An-148. We continue this practice in 2011. I observe with pleasure that the statistics under discussion at these conferences no longer gives pieces of evidence to the governmental structures on taking administrative measures. Nor does it provide excuses for top manager changes in the industry. These conferences are devoted to finding ways to improve the product together with the aircraft developer, airframe and engine manufacturers, their vendors and suppliers. Flight and technical conferences are beneficial to them and us as well, as we manage higher gains from operating the An-148. For same reason we continue to revise our contractual base: discontinue old agreements and enter new ones. Meetings on regular basis enable us put together and implement various prrams

of joint activities aimed at improving the technical side of things: line and base maintenance, servicing, conduct of flight operations, decreasing labor hours, keeping the airplane operational at a lesser expense.

The airplane has proved capable of operating regional air routes. For our part, we did huge work in relation to airports. Most of them were not ready to serve this airplane and support flight operations on the type. Today, we do not have problems with airports we fly to. Some of them have even prepared advanced technological procedures in relation to the An-148. One airport has proved that it can, on a reliable basis, serve an An-148 in 30-35 minutes. Turnaround of 30 minutes in a Russian airport is quite an achievement. We hope all other Russian airports will one day be able to be that efficient!

At the same time, we understand that we can get more out of the airplane. Technical capacity of the airplane is yet

Malfunctions fixed

Addressing malfunction reports coming from the airline customers, the industry has issued and implemented nine servicing bulletins and nearly one hundred technical solutions. The industry issued 125 new technological passports to vendor items. Among malfunctions reported and fixed there were the following. At landing run on snow-covered runway an engine flameout was registered, after the pilots turned off the thrust reverser. This was caused by large amount of snow entering the air intake. The issue was fixed by changes to the design of the thrust reverser. With changes introduced, the airplane can land on runways with a thick snow cover. Second issue was oxygen masks dropping during flight preparations. Remedy came in the form of improved aircraft system management software. Third, pilots reported about slow main landing gear extraction process at landing. The cause was traced to springs in the strut force-bearing mechanism. The whole fleet has been outfitted with new springs.

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Fuel Burn

According to the An-148 flight manual's charts, the hourly fuel burn in typical cruise varies between 1,400 kg (M=0.7, Alt. 9,000m) and 2,000 kg depending on speed (up to M=0.79) and weight of aircraft. Most popular regimes (Mach 0.74-0.77 at 11,000m altitude) come with hourly fuel burn between 1,650 and 1,750 kg. Ivchenko Progress is working on the AI-28, a next-generation turbofan with extremely high bypass ratio. It promises a 10-15% reduction in fuel burn compared to the current D-436-148 from the same developer. Rossiya pilots found out the airplane normally burns 4.2 tons of fuel on a 1,500-km flight with full cabin. They believe that in case of a 2,500-km flight with full cabin the block fuel can be reduced from 6.5 tons down to 6 tons through better usage of airspace and reduced separation minimums.

Rossiya crews in St. Petersburg had a few chances to check for the An-148's advertised climatic performance in very hot and cold conditions. During the sultry summer of 2010, the D-436-148 motors got started at ambient temperature of 38 degree Celsius. The winter of 2009/2010 was frosty, yet the motors got started at -38 Degree Celsius. The airline exhibited the RA-61703 at India Aviation 2010 in Hyderabad, India in the heat of the 2010 summer there.

to be exploited in full. We can certainly attain higher utilization levels. In August we operated one airplane in a special mode, under a favorable regime arranged especially for this purpose. Our target was to achieve utilization of 400 FH in a calendar month. Such usage is beyond boundaries for short haul passenger airplanes. But we ran this experiment in order to give the airplane and our personnel a thorough test. The purpose was to attest the maintenance program developed for this type and the given destinations. It was necessary to make sure the maintenance program can withstand high utilization and short turnarounds.

Today, our An-148 fly scheduled pas-

senger services to 30 destinations in Russia and 5 in the European Union. Commencing international services was preceded by audits done by our partners. These audits highlighted some issues with the aircraft design and servicing techniques. We addressed them carefully. This proved helpful to Rossiya as we were passing SAFA inspections. Our airline also passed IOSA audit with the An-148 on the list of types Rossiya had applied with. Commencing European services became another milestone Rossiya has achieved in mastering commercially viable operations on the new aircraft type.

Fuel burn reduction program

Rossiya has put together a long-term fuel reduction program for the An-148. Our program is of complex and comprehensive matter. It calls for changes in the airplane design, including weight reduction for certain airframe and interior components. Furthermore, the program calls for better usage of de-rated thrust modes at takeoff whenever possible. Today, the An-148 flight manual prescribes maximum thrust mode for takeoff. The airline finds this exorbitant and seeks approval for de-rated thrust in certain cases so as to decrease fuel burn. Besides, the manuals prescribe certain techniques of using thrust reversers, which the airline also wants to correct for the sake of savings.

When completely materialized, this program can bring a notable 7-8% reduction in fuel consumption. The An-148-100B has a highly accurate system for measuring fuel flow and the amount of fuel remaining in the tanks. Our specialists make use of it when working on program implementation. Rossiya flight crews found out that the An-148 flight manual contains rather accurate charts on fuel burn, well correlating to the real figures in their practice. At the same time, the pilots find it possible to achieve some fuel burn reductions through better usage of airspace. Separation minimums can be used to correct flight mode for lower fuel flows. It is not about changing the airplane (it has got all necessary clearances already). The question is about a better use of air-

space, with respective permission from air traffic controllers.

Using the fuel saving issue for excuse, some people offer retrofit the airplane with another engine type, promising a 5% fuel saving. (Editor: Sergei Belov refers to the idea to fit a special version of the PowerJet SaM.146 engine to the An-148). I understand that every manufacturer and the country where one is based, try hard to lure more customers in. But such an offer makes me smile at those guys. Clearly, this would require huge investments, whereas we can get same reductions using the existing D-436-148 motors. Doing so look like a lot more clever way of addressing the issue of savings.

Wrapping up, I say: we already know a lot about this airplane, but not everything. The airplane gets improved, we get our ground and flight crews better trained. The industry improves as well. We help the industry by sharing experience of our pilots and maintainers. Although I urged people not to jump at conclusions about the An-148, I would like to make one general remark. In my view, the design targets were met, and the resulting airplane has won a lease of life. The airplane has been accepted by pilots, engineers and maintainers. More importantly, the airplane has been accepted by the passengers, flight attendants and those who serve our flights in the airports.



Commodity-Money-Commodity



Statements during Q/A session

In 2007, we signed a financial lease agreement with Ilyushin Finance Co. (IFC) on the An-148-100B, placing six firm orders and nine options. First airplane delivered in October 2009 and commenced flying revenue services in December. Deliveries were complete the following year. But something else also happened in 2010. Our airline used to be considered as a base for forming a larger carrier, RosAvia. In the end, however, Rossiya became part of the Aeroflot group. Our strategy is changing accordingly, as it must correspond to the Aeroflot development strategy and that of six other

airlines in the same group. Together we try to form a common route network and coordinate our fleet renewal plans.

I can make a statement here at MAKS 2011: the decision to go for six more An-148s has been made. This will increase our fleet to 12 units. Right now we are negotiating delivery terms. According to plan, two aircraft shall come next year, another pair in 2013 and the remainder in 2014. Should new Aeroflot strategy now under development call for further increase in our fleet, we will consider follow-on orders. Much depends on the airplane as a product. It must meet our expectations, and these tended to rise as

we feel taste of An-148 operations. It may happen that we ask the industry for nine more airplanes, i.e. choose to execute the original options. Besides, other airlines members in the Aeroflot group are also looking at the An-148. If they also go for it, we shall be coordinating our procurements.

I am speaking of additional An-148s, not the An-158. Baseline version has the right size, it fits well into our route network. In my view, it is not necessary to increase the cabin size to 90 or 100 seats, which was the main point for inventing the An-158. The An-158 trades range for more seats. This is not what Rossiya wants: we do need the range of the An-148.

There are few diversion airports around our hub in St. Petersburg. Often, Murmansk up north serves as a diversion in case the hub gets unavailable due to weather conditions. At the same time, Rossiya can get higher gains through an increase in the An-148 seating capacity. (Editor: by means of installing five more economy class seats in the same cabin [now with 8 business and 60 economy seats] on the account of certain equipment and through better use of cabin space).

Expressing preference for the An-148, I am not against the An-158. What important is interoperability and parts inter-

An-158

Antonov says the An-158 stretch has 16% larger seating capacity, 12% lower DOC per seat and 9% lower fuel burn per seat than the An-148-200. The comparison is made for high density single-class cabin arrangement. The former can take 99 economy passengers at 30in pitch compared to 85 for the latter.



Commodity-Money-Commodity

changeability. The latter's introduction is for the good from the viewpoint of the industry expanding its client base by adding more airline customers. Some airlines may find An-158 an interesting proposition and place orders. The more orders the An-148/158 family wins, the better for the customer support system. Production can get more streamlined, spare parts can sell cheaper and get available easier. This can be in case the difference between the An-148 and the An-158 is confined to a fuselage plug.

Crew training

During 2010 and first half of 2011 Rossiya qualified 14 line instructors, 5 simulator instructors, 3 instructors on type conversion and 4 examine pilots. To operate its fleet efficiently and with high utilization, Rossiya needs six crews per airframe. Pilots shortage was acute shortly after EIS. In an effort to ease it, IFC contracted Transas of St. Petersburg to create a Level D full flight simulator (FFS) along with computer classes and procedure simulators. First such device has been installed at a special center in Moscow Domodedovo airport, which is a joint undertaking between IFC and S7 Training. The FFS can emulate over 300 failures as part of the crew training process. Besides, Antonov has developed an engineering stand into a full-grade FFS. The device called KTS-148 has been approved by the aviation authorities for airline pilot training. This FFS is located at Antonov headquarters in Kiev.

Recent figures

By middle of October 2011 the Russian-made An-148 fleet had logged 20,000 FH, according to VASO plant in Voronezh, which makes these airplanes in cooperation with Antonov plant in Kiev. In addition to over twenty destinations in Russia, the type has been flying to Western Europe since March 2011, when St. Petersburg — Berlin service was open.



An-148 Full Flight Simulator at S7 Training in Moscow Domodedovo airport



Airshows

RALF SCHUMACHER'S AVIATION BUSINESS

Winner of the Formula -1 car races bought a 10% stake in Europ Star.



Ralf Schumacher

Ralf Schumacher, winner of the Formula-1 car races, revealed to the media on September 14 that he bought a 10% stake in Europ Star business jet aviation company (<http://www.europ-star.com>) based in Austria. Speaking at Jet Expo 2011 in Moscow — Vnukovo, he said he holds rights to further expand its share in this company, which manages his business aircraft. Ralf Schumacher has been Europ Star client since 2006.

Werner Welz, CEO and Accountable Manager at Europ Star, said his company employs 73 people and has ten business aircraft in management (including a Legacy 600 stationed at Vnukovo), and owns two. The company has recently opened an office in Riga and has plans to open a technical support office in Moscow. For this purpose it entered partnership with Russian entrepreneur Dmitry Markov. Europ Star decided to expand into Russia because it is “a big country with wealthy people which devel-

ops fast and also because this expansion goes in the direction of Asia”, Welz said.

Ralf Schumacher said he has a valid pilot license and that the first airplane he flew was a Piaggio Avanti. Remarkably, such an aircraft, belonging to Wind Jet, was on display at Jet Expo 2011. Piaggio Aero has announced that the P.180 Avanti II acquired type and production certificates from the Russian aviation authority, the Air Register of Interstate Aviation Committee (Russian acronym ARMAK).

Embraer in Russia

On the same day of September 14, Jet Aviation group president Daniel G. Clare and Embraer Executive Jets president Ernest J. Edwards signed for enhanced maintenance service for the Legacy 600 and 650 in Russia using existing facilities at Vnukovo-3, a business aviation sector of Moscow-Vnukovo airport (VKO).



Wind Jet – operated Piaggio Aero P.180 Avanti II



Embraer Legacy

Under agreement with Vnukovo administration, Jet Aviation established its presence here in 2007, and won Embraer approval in 2009. Embraer says the new agreement will lead to creation of on-site stock in Moscow and a 24/7 AOG maintenance support to Legacy operators. This new service will be implemented by December 2011. Jet Aviation and Embraer have agreed to invest more into Moscow facilities, and

qualify more local mechanics in Embraer products, together with FlightSafety.

The Brazilian airframer displayed its flagship Lineage-1000, which was here on display last year and "generated a very high interest among Russian customers".

Also, Embraer exhibited the Phenom 300 and Legacy 650 for the first time at Jet Expo. The airframer says it has 34 business aircraft operating in Russia and CIS: these

were sold to local customers but not necessarily registered in their home countries. Last month the company delivered first Phenom 100 to a Ukrainian customer who uses it for flights to Moscow and other Russian cities. Second Phenom 100 shall deliver next month. Embraer believes this will lead to Phenom sales in Russia.

Vladimir Karnozov



Phenom 300, Legacy 650 and Lineage 1000 at Jet Expo 2011

SOVIET-ERA AIRLINERS NEED REPLACING



Since the beginning of the new century, the Russian civil airplane market has been one of the most dynamic in the world; it saw speedy replacement of Soviet-era aircraft by more modern Boeing and Airbus designs.

GosNIIGA, the State Scientific Institute of Civil Aviation, says that during the past ten years Russian airlines acquired 740 new and used passenger airplanes, and still have the requirement for additional 700-850 mainline airliners and 300-350 regional aircraft by 2020. The institute predicts that imported rather than locally produced machines be prevailing in meeting the respective solvent demand.

In September Russia's president Dmitry Medvedev and prime-minister Vladimir Putin spoke of the necessity for the Russian government to take additional governmental measures stimulating Russian airlines to merge into bigger structures (that are believed to be safer to fly) and

replacement of aging Soviet airplanes. The reason for this is too many crashes that occurred here recently, as Putin put it. The last drop was the crash of a chartered Yak-42 at take off from the Jarovslavl airport, killing the crew and ice hockey players on board.

The Kremlin leaders voiced two slogans: "Merge or close down" in regard to airlines and "get properly equipped or withdraw from service" in relation to Soviet era airplanes still flying. Medvedev further said the Russian government "will be forced to make a hard decision" on renewal of the nation's airliner fleet. He added that it is not the survival of local manufacturers that should not be a top

priority for the government, but the safety of passengers. If domestic makers could not provide modern safe airplanes in sufficient numbers, then Russia should buy them elsewhere, he clarified.

Medvedev said that albeit budgetary expenses are going to be high, he is ready to give the Russian government "go-ahead" for development of a comprehensive program for fleet renewal "which requires big money".

Kremlin-controlled banks reacted immediately. They said they would support the fleet renewal effort if the government provides subsidies for import of western jets worth US dollar 3.5 billion. Vladimir Dmitriev, chairman of VEB, one of the Kremlin's

system-forming banks, even said his structure is ready to fund development of a new regional airplane. The latter would be jointly created by Russia and "other leading aviation nations". He specially mentioned "France and Italy" or "Canada and Brazil". This new airplane would go after the ATR42/72, targeting short-range markets. This makes a first case when a prominent Russian bank voiced such an initiative.

According to statistics from GosNIIGA, Russian airlines run a fleet of 5,251 airplanes and helicopters, while that of general aviation amounts to 1,970. Of this number passenger airplanes takes 1,591, and 986 of them are in active service. Respective figures for helicopters is 1,921 and 1,027, light airplanes 252 and 1,415, dedicated freighters 324 and 152.

Among mainline passenger airliners there are still about two hundred Ilyushin quads, Tupolev and Yakovlev tri-jets featuring rather high fuel consumption. These are first candidates for replacement with more advanced western designs. Further down the league there are some three hundred Tupolev, Yakovlev and Antonov regionals. These are also strong candidates for replacement.

Some of the Soviet-era aircraft have very small hours on their wings, such as the RA-42434 that crashed in September with the Locomotive ice hockey team on board. It was operated by Yak-Ser-

vice airline that hired this Yak-42D from the Khrunichev Space Center. The ill-fated airframe was assembled in 1993, and logged 2997 cycles and 6391 FH: very modest figures, less than 15% of manufacturer's assigned lifetime of 35 calendar years and 40,000 flight hours.

Calls for urgent measures to replace aged Soviet airplanes seem a bit odd: most Russian airlines have already renewed their fleet to a large extent. On passenger services they operate 380 mainline and 61 regional airplanes of foreign origin. In 2008 the number of imported passenger airplanes exceeded that of indigenous ones, and this year their population is twice large the Soviet relics. By passenger traffic, imported airplanes generate 83%, compared to 6% for modern indigenous types and 11% for older domestic designs (figures for 2009-2010).

A uniform import custom tax of 20% is still in place, but recently adopted amendments to the general rule allow most popular western aircraft types to get imported without any fee.

The recently voiced new programs are likely to have been invented to support financial lease businesses of top Russian banks. Sberbank, VEB and VTB established their special leasing arms in 2008-2010 and already placed some 150 modern western jets with local airlines.

GosNIIGA predicts the Russian air traffic to grow at annual rate of 7.5 to 8.5% in 2010-2030. This creates further room for new placements, and the three top local banks want this market for themselves.

The recent Russian market assessment from Airbus sees the need for 1,006 new passenger planes worth US dollar 95.2 billion in the period of 2011-2030. Executive vice president for Europe, Asia and Pacific Christopher Buckley says the European aircraft maker expects to win "half of that market". He adds: "We are talking not only about replacing Soviet-era aircraft, but also about replacing older western aircraft", such as the Boeing 737 Classics. "We expect to see more Airbus, but likely with fewer airlines", he continued, pointing at the consolidation process getting momentum in the Russian air transportation market.

This year the passenger traffic in Russia is expected to go beyond 160 billion pkm, thereby exceeding the record 1990 level. Let us remind the readers that the breakup of the Soviet Union brought about a system crisis in the Russian aviation with sharp fall of the industrial output and solvent demand in the air transportation market.

As a result of the crisis, the number of civil aerodromes has been, until recently, on a steady decline. This century it has further shrunk by 1.5 times. This year may bring



Aviation market

an end to this tendency. The number of active aerodromes has stabilized at 332, of which 120 are classified as airports.

After a sharp drop in the 1990s, the Russian air transportation industry then stabilized and went on rise again. In the past ten years Russia's gross domestic product has increased by 60%, enabling the air traffic volumes grow by 2.8 times. In the given timeframe the average growth rate was 10.7%. The traffic rose from 53 billion pkm to 147 billion pkm in 2010. The number of passengers carried in 2010 was 57 million, or 12% up to the previous year. In The cargo traffic rose by 1.9 times. During the first eight months of 2011, Russian airlines carried 42.6 million passengers, which is 12% more that same period last year.

This century the Russian airline industry has been rising 2.5 times faster the world's average. It will continue to grow fast, with 7.5% a year on average in the foreseeable future, GosNIIGA believes. In 2020 the air traffic volume is expected to reach 300 billion pkm, and then go to between 0.53 and 0.7 trillion pkm in 2030.

Today, the 2010 annual financial turnover of all Russian airlines is estimated at 16 billion dollars, 30% up to 2009. Five largest airlines (Aeroflot, Transaero, S7, UTair and Rossiya) generated 8 billion dollars (half the total) and 86 billion pkm (over 60%). They survive the crisis well, which is not the case with smaller carriers. In 2009 35% of all Russian airlines (responsible for 22.5% of air traffic volumes) were generating losses. As the economy recovered, their share decreased to 22.3% (10.5% respectively). At the same time, 15% of all Russian airlines still in business remain in a shaky financial situation. This prompts Kremlin to take measures on stimulation of consolidation process in the industry, in a belief that larger airlines would prove more financially stable and safer-to-fly.

The Kremlin's call for higher consolidation is often heavily criticized by industry players, especially small and medium sized companies with private capital participation. These believe the new policy favors large government-controlled airlines, such as Aeroflot. It is feared that a bigger



half of the 158 airlines registered in Russia today will either have to close down or get devoured by larger ones. In their turn, the government officials believe this process, although painful, will do good to the public and lead to a healthier industry. In terms of market share, small airlines are insignificant. Today, 160 smallest airlines generate only 13% of the industry's volumes. But some of them do very important job of serving rarely populated areas in the Extreme North, Siberia and Far East.

This century saw radical changes in the structure of the Russian civil fleet. Today, the core is made of 550 western jets, whereas in 2000 their number was merely 46. The most recent figures from GosNIIGA say the fleet has 625 mainline passenger airliners (68% imported) and 377 regional airplanes (23%), 26 specially-built business jets (all imported), and 128 freighters (11%). The share of western aircraft in Russian passenger traffic rose from 18% in 2000 to 84% in 2010 and in cargo traffic to 75%.

Yet, the Russian register still contains quite a few (195) of indigenous passenger mainline airliners: 10 Ilyushin Il-96-300s, 9 Tupolev Tu-214s, 11 Tu-204-100s, 6 Tu-204-300s, 14 Il-62Ms, 66 Tu-154Ms, 14 Tu-154Bs, 63 Yakovlev Yak-42s and two Sukhoi Superjet 100 (SSJ100).

The regional (and commuter) aircraft of the local origin are: 9 Antonov An-148s, 183 Tu-134s and 216 Yak-40 jets, plus turboprops: 2 Il-114, 4 An-140, 227 An-24/26, 5 An-38 and a single Il-14

piston. However, out of 644 such aircraft on the list, only 321 are operational (including 99 Tu-134s, 129 An-24/26s and 78 Yak-40s), with only 225 (60, 124 and 26 respectively) actually being used on passenger services in the central timetable (scheduled passenger operations). A big portion of Tu-134s and Yak-40s have been converted into VIP jets or corporate transports.

The Kremlin is set to make the FAP-128 standard effective in 2012. This guiding document contains air worthiness requirements demanding regional (and commuter) aircraft to be equipped with mid-air collision avoidance systems and ground proximity warning devices. Today, such apparatus is absent on most of the surviving Tu-134s, Yak-40s and An-24/26.

Although kits are available for retrofit, it does not make economic sense to install expensive devices on old airplanes. Many of them have to retire on the ground of expiring calendar lifetimes by 2015. This is the case with most of the Tu-134s and Yak-40s. Only half of the old Antonov turboprops is expected to stay in service after 2015, with the rider that their operators do commit to the FAP-128-required extra expenses.

In the recent years, the share of new airplanes coming to the Russian airlines off assembly lines has been about 30%. The remainder is from secondary markets. If the new rules are implemented as planned in 2012, it will be difficult for many small airlines to find suitable replacements to their Soviet airplanes. In fact, most of used

regional and commuter aircraft easily available abroad are not equipped with TCAS and proximity warnings. In the given circumstances, the answer is the CRJ100/200 jets and ATR42/72 turboprops, as well as the An-148 and An-140. At the same time, current generation of the Embraer jets has not been certified in Russia.

Intake of new and used passenger airplanes since 2006 has been averaging at 106 units per year, including 85 imported. In the first eight months of 2011 the number of incoming aircraft was 100. Respective figures for the whole of 2010, 2009, 2008, 2007 and 2006 are 90, 130, 140, 80 and 90. In the 2006-2011 timeframe the number of new indigenous designs entering revenue operations amounted to 31 passenger planes, 8 freighters, and 107 helicopters versus 424, 17 and 290 imported.

There is one thing definitely beneficial to the Russian operators and the environment. Due to the intensive fleet renewal in the 2004-2010 timeframe, local carriers increased their traffic volumes by approximately 40% while keeping roughly the same fuel consumption. The share of ICAO Chapter III compliant aircraft in the air traffic over Russia rose from 40% in 2000 up to 98% in 2010, and that of Chapter IV to 65%.

GosNIIGA estimates that, if the traffic grows 6-8% annually, the Russian airlines will need between 1,000 and 1,200 airplanes by 2020, including 700-850 mainline airliners and 300-350 regional air-



craft. In addition, they will take between 55 and 90 dedicated freighters.

In terms of competitive designs available from local manufacturers there are four modern types in the most popular 70 to 200 seat segment: the MS-21, Tu-204SM, SSJ100 and An-148/158. Russia still keeps a heavy tax of 20% on imported airplanes with actual number of seats from 160 to 218 and from 51 to 110. This tax is maintained in order to facilitate entry into service for the above mentioned indigenous designs. At the same time, the local industry does not have much to offer in the segment below 70 seats. There is only 48-seat An-140 turboprop produced in very small numbers at Samara-based Aviacor plant. But the given sector is going to be the most problematic for Russian airlines in the view of the FAP-128 introduc-

tion. The latter dictates speedy withdrawal of the Soviet-era Tu-134s, Yak-40s and An-24/26.

GosNIIGA predicts that the share of western passenger aircraft in the Russian fleet in terms numerical will grow from 40% currently to 60% in 2020. At the Wings of Russian international aviation forum Buckley of Airbus was asked to comment on this. He was further asked, why Airbus does not count the local manufacturers among serious competitors?

Buckley answered: "I am sure Russia will be producing many good aircraft for many years to come. It's got to be the Superjet and it's got to be the MS-21. The big question for us at Airbus is how quickly will the Russian industry be able to produce these aircraft. Market share for western aircraft will go up to 80% next year, — it is purely because it has got otherwise be 30-40 SSJ100 or MS-21s, or Tu-204s coming into the Russian market in 2012. It is all about the speed of production and how long will it take to ramp up production of these airplanes. Aviation and aircraft industry has such a historic place in Russia! At government level and industrial level, the Russians always wanted to build their own passenger aircraft. Right now Airbus and our colleagues from Boeing simply take the opportunity, since there is a market need that the local industry is unable to fulfill. But in ten years time the tide can shift toward the Russian industry products".



Vladimir Karnozov

BOMBARDIER IN RUSSIA AND CHINA



The Canadian manufacturer is seeking to expand in the largest emerging markets.

Adding a completely new C Series mainline airliner to its families of successful regional jets (CRJ) and turboprops (Dash 8/Q series), Bombardier is seeking to expand its market presence. This can be done by eating out a portion of the cake which is today shared by Airbus and Boeing. Fighting for a better place under the Sun, this year the Canadian maker has been especially active in Russia and China.

Last year the Canadian regional jet had a big success in Russia, with 19 deliveries of CRJ100/200 aircraft. According to statistics from Russia's State Scientific and Research Institute for Civil Aviation (GosNIIGA), in 2008 Russian operators took a pair of CRJs, and in 2009 added nine more. Early in 2011 the Russian fleet of the type rose to 28 units, and has been rising further as the year draws to a close.

In its press release at MAKS' 2011 aerospace show, the manufacturer stated that "nearly sixty regional jets and turbo-

props, as well as many business jets" are in service or on order in Russia. All this shows a very positive dynamics. It could not have been in place without the operators being satisfied with performance and economics of their new assets.

A freshly arrived CRJ100 was on display at MAKS' 2011: the side VQ-BNE stood right in the middle of the static line. Certainly, the type deserves a central place, as it is now the most popular regional jet type in the 50-seat category. By the way, the Brazilian rival does not have any regional airplanes flying on domestic passenger routes inside the world's biggest country, which makes Bombardier's success in Russia more remarkable.

According to GosNIIGA, on the Russian route network the Canadian regional jet demonstrates fuel efficiency similar to that of the twice larger Boeing 737-500, at 500 gram per ton kilometer. By far and large, the Boeing 737-500 is a standard one-

hundred seater in the Russian commercial jetliner fleet today. What does this mean to airlines? It means that they can use a CRJ with similar level of profitability on their existing routes, while doubling flight frequencies. In turn, this makes their services more convenient and attractive to travelling public and leads to an increase in passenger numbers.

The recent success of the Bombardier jets in Russia drew attention of the Russia's biggest aircraft lessor Ilyushin Finance (IFC). Although previously this company tended to buy only indigenous jets, this year it made decision to diversify its order portfolio by adding Ukrainian and Canadian products into it. At MAKS' 2011 IFC landed the deal for 30 Bombardier C Series twin jets worth two billion US dollars by catalogue prices.

Chet Fuller, senior vice president for Bombardier Commercial Aircraft, and Alexander Rubtsov, IFC general director applied their signatures under a preliminary

purchase agreement that calls for the acquisition of three CS100s and seven CS300s (with options for ten more) and purchase rights for another ten of the new Canadian narrow bodies. Bombardier did not reveal the value of the deal, quoting only the CS300's 66 million dollar sticker price.

Speaking to journalists at MAKS' 2011, Alexander Rubtsov described the C Series as "the best in its class". He further noted that the new Canadian twinjet "fits perfectly in between the An-158 and the MS-21 we have already ordered".

In terms of seating capacity, this is indeed so: the Antonov can take up to 99 passengers while the MS-21-200 will seat from 150 to 162 people depending on pitch and cabin comfort levels. The deal in question is yet to be finalized, though. "There is large amount of work ahead of us, as we need to finalize the main purchase agreement and get approval of the company's council of directors," Rubtsov said. "Next year the purchase agreement can be finalized. The aircraft being acquired are intended for customers in Russia and outside it", he added.

While at MAKS' 2011 Bombardier representatives preferred to keep silent when meeting journalists, their colleagues at Jet Expo' 2011 and Aviation China 2011 in September were a lot more open and talkative. The Canadian manufacturer ran a press conference at the business aviation show in Vnukovo airport of Moscow, where it pictured itself as market leader. Bombardier will continue to sell more business jets into Russia and CIS than other OEMs in foreseeable future, claimed Christophe Degoumois, regional vice president.

He said that from 2011 to 2020 the region of Russia, CIS and Eastern Europe will take 735 deliveries, with Bombardier providing roughly half of that total. He observed that the local fleet rose fast, from 100 business jets in 2004 to 380 in 2010.

Degoumois gave relative figures for deliveries in 2001-2010 to Russia and CIS (excluding very light jets). Bombardier claims 47% market share against Gulfstream and Dassault each with 15%, Embraer with 9%, Cessna with 8% and Hawker with the remaining 6%. Same kind of statistics for the past five years



Chet Fuller, senior vice president for Bombardier Commercial Aircraft, and Alexander Roubtsov, IFC general director applied their signatures under CS100/300 preliminary purchase agreement

was: Bombardier leads with 49% against 14% for Gulfstream, 12% for Dassault, 9% for each Embraer and Cessna, and 7% for Hawker. More recently, in the period of 2009 — first quarter of 2011, Bombardier delivered 44% of all business jets to the region, while Dassault was responsible for 22%, Embraer and Cessna each had 11%, Gulfstream and Hawker 6% each.

The company's delivery outlook forecasts that Russia and CIS will take 525 deliveries in 2011-2020 timeframe and 1,010 more in 2021-2030. The regional fleet will grow from 380 aircraft in 2,010 to 845 in 2020, and then over to 1,765 in 2030. This comes with a rider that most Russian owners tend to register their business jets outside of their home country.

Meantime, fresh statistics from GosNIIGA gives Russian-registered fleet of properly imported business jets at merely 26 units, among them five Challengers. Russia's united business aviation association estimates the number of business jets serving interest of Russian owners at 300-

350 units. Russian businessmen are believed to be among those who seek Global 7000&8000, the newest business jets on offer from Bombardier, with list prices at 65 and 67.5 million dollars respectively.

Bombardier's forecast is built on predictions of GDP growth, which is currently 4.5% yearly for Russia compared to world's average of 3.1%. Degoumois specially mentioned high wealth concentration in Moscow, which is currently the world's second largest city by the number of billionaires (fifty reside here) after New-York City. Another factor stimulating further growth of business aviation is notable recent improvements in legislative base (through air traffic control liberalization law that came into force in November 2010) and infrastructure (Degoumois specially mentioned renewed airport facilities in Tatartan, Krasnodar and other cities in Southern Russia).

At Aviation Expo' 2011 in China, Air Fleet correspondent had a chance to interview Benjamin Boehm, vice-president,

Aircraft

international business, commercial aircraft. Our first question was about the C Series cabin mock up on display. Obviously, it was a big expense to bring such a big and fragile exhibit to Beijing. Was the money well spent? Mister Boehm insisted that this expense was “definitely justified”. “We had this mockup at Paris air show and it moved directly from Le Bourget to Aviation Expo in Beijing. It is going to be in Korea next and then go to the Middle East”.

Air Fleet asked about significance of the Chinese sales to the C Series program. “Let me start with an overview of the Chinese market: in the next twenty

in it and with a lot of luggage space inside the cabin. When you are travelling in China, you understand that this is very important. We had this in mind when we designed the one-hundred seater, being the smaller family member. The CS100 design is focused on hot and high airports, longer distances and short runways. It is a part of their national strategy [of People’s Republic of China, PRC] to develop regions in the west of the country.”

Canadian aircraft are well known in China already. Over eighty airplanes built by Bombardier operate in this country, among them the CRJ and Dash 8/Q series regional

“Bombardier is focused on developing a very strong relationship with China. This is very important to us. We believe it is also very important for China’s national economy. We would like to be involved in win-win relationships with PRC in rail transportation and in air transportation”.

Benjamin Boehm made another point, from the company’s strategy point of view. “We come from a small country in terms of market size. We see a lot of benefits in working closely with China, which is a big country with large and growing inner market. This relationship can help our company to develop, and expend our growth in future.



Challenger business jet and CRJ regional aircraft

years we will see more deliveries in China than in all of Europe for airliners with 150 seats and less. So it was very important for us to bring the C Series mockup to the aviation show in Beijing”, Boehm answered. Importantly, Aviation Expo’2011 was the first time the C Series mockup appeared in Asia.

The reason for the manufacturer to move the mock-up round the world from one exhibition to another was to give the show visitors understanding as to what kind of airplane Bombardier can produce. Boehm continued: “The airplane you can see here on display in a cabin mockup form is a unique design, well suited for the Chinese market. The airplane is available in a high density layout with many people

aircraft, as well as the Learjet, Challenger and Global business jets. On the eve of the Dubai show an unidentified local operator landed firm order for six CRJ 900 Next Generation with option for five more. This deal is worth 264million dollars by catalogue prices or 491million with the option taken into account.

Observing Bombardier’s recent activities in China, one can notice a number of big deals with the PRC governmental structures and manufacturers on commercial aircraft including local production. Similar deals have been reached on Bombardier locomotives and trains. This makes some people believe China and Bombardier are in a strategic agreement. “Is this true?” we asked mister Boehm.

We see China as not just a place for selling things like trains and airplanes, but as a resource for research and development, source for good quality subassemblies and parts. In future, we will continue our efforts, further developing even stronger relationships, both in aerospace and railway”.

Commenting on the recent market forecast for China from ADR that predicts 3,682 mainline passenger airliners and 901 regional aircraft sales in 2011–2030 timeframe, Boehm said: “Bombardier will have a fair share”. Released at Aviation Expo’2011, “China Market Outlook for Civil Aircraft 2011–2030” from AVIC’s Aviation Industries Development Research Center of China (ADR) predicts that the Chinese pas-



CRJ100 at MAKS'2011

senger airliner fleet, 1,506-unit-strong as of end 2010, will grow to 5,118 units in 2030. Deliveries will include 98 aircraft in 400-seat-plus capacity, 406 in the 300-seat class (250-399 seats), 789 in the 200-seat class (181-249), 2,458 in the 150-seat class (121-180) and 413 in 110-seat class (101-120). Furthermore, 517 large(61-100 seats) and 437 small (30-60) regional aircraft will go to the Chinese airlines.

How many of new aircraft coming into China are going to be from Bombardier? "We will have a fair share in the markets where we have competitors. But in the markets we do not have competitors, which is, perhaps, the case for the 100-seat version [CS100], we can get a share close to one-half", Boehm said.

We further asked whether Bombardier pretends for one-digit or two-digits as we speak of the Chinese market? The answer was: "Two-digit. Certainly not one digit, in terms of market share in China, I believe!"

There are some other manufacturers that want to have big sales in China, too. These encompass not only Airbus and Boeing, but also local airframers, including COMAC with the C919. Does C Series compete with C919? "Even when the C Series is full, it cannot complete with the C919 as the latter is over twenty seats bigger. So, we do not compete with the C919".

However, the CS300 has rather spacious fuselage. If at some point in future a discounter airline be looking at ways how to squeeze more people into this airplane, it may consider six abreast seating. Boehm says this is not the way the situation is being

viewed by the manufacturer. "On a larger airplane we can put up to hundred forty five people into the C Series. On a smaller airplane we can put up to a hundred and twenty five people into it". To insure passenger comfort levels, airlines need considering seating capacity against flight duration. In most instances the factory's configuration looks like a good proposition.

COMAC market forecast released at Aviation Expo 2011 places the C Series in the "120 seat" aircraft size category together with Airbus A318/319, Boeing 737-600/700, Boeing 717, Boeing 737-200/300/500, McDonnell Douglas DC-9/MD-87 and Yakovlev Yak-42. The C919, Airbus A320, Boeing 737-800 and -400 are one step up the ladder, in the "160 seat" category. Bombardier gives CS100 capacity at 110 passengers in standard cabin configuration or 125 in maximum capacity. Respective figures for the CS300 (whose fuselage is 3.1 meters longer than CS100's) are 130 and 145 respectively.

Bombardier was the first airframer to present its vision of the next generation narrow body jet to the global aviation community. This happened at Farn-

borough' 2004, when the new airplane was unveiled by its "father" Gary Scott. More recently, Airbus has introduced the A320neo and Boeing brought about the 737 MAX. What shall be done to the initial design of the C-series to make it competitive against these newer models?

Boehm has the answer: "The C Series will always maintain its edge for two main reasons. First: the MAX and the Neo are targeted for a larger seating capacity, that currently with the A320 and 737-800. Remember that the C Series is a smaller airplane, only 130 seats typically in the CS300. That's important: we are not even going to compete in the prime sweet spot. Even when we do compete with our airplane against the MAX and the Neo, we will still have double-digit advantage. Our airplane was designed as all-new: new engine, new aerodynamics, new systems, advanced light weight materials. Entire fuselage is made of Al-Lithium, which makes it 5-10% lighter than those made from normal Aluminum. The MAX and the Neo are merely re-engineing: they took a 20-year-old airplane and put a new motor on it. When you do this you will never get the economic savings you can get from an all-new airplane."

In its handouts, Bombardier claims that the C Series aircraft family will offer a 15% cash operating cost advantage and a 20% fuel burn advantage. Apparently, this comparison is for the long-serving Boeing classics with similar seating capacity. While Russia's Ilyushin Finance has already signed for the C Series, Chinese customers are yet to present themselves. But they may well be among those unidentified customers who are already on Bombardier's list.

Vladimir Karnozov



Navigation



MOSCOW DESIGN BUREAU
COMPAS

IN THE WORLD OF HIGH-TECH & SPACE NAVIGATION

Compas MDB is an up-to-date research & production complex majoring in development and manufacture of consumer professional equipment for high-precision navigation operated by signals of GPS/GLONASS satellite navigation systems (GALILEO in the long run).



Communication technologies for the 21 century soldier was first presented to general director of Russian Technologies State Corporation S. Chemezov at The International Aviation and Space salon MAKS-2011

The company has a rich history starting from 1918, when the Soviet government issued a decree on establishing a plant for manufacturing telegraph devices. Compas MDB created the first ever powerful (for that time) transmit-receive airborne radio station of up-to 5,000 km operational range, which provided the record-break-

ing flight, Moscow — North Pole — Vancouver, by Valery Chkalov's crew aboard ANT-25 between 18 and 20 July 1937.

In 1948, Compas Design Bureau was detached to become an independent structure dealing with the development of navigation and communication equipment. As an item of the radio navigation equipment products, the Bureau developed a radio direction finder called 'Golden Arrow', which was helpful in assisting the crew in adverse weather conditions to find the direction of required maneuver, so as to reach the airfield and carry out landing. The modern radio direction finder is an automatic portable device of relatively low energy consumption, featuring wide use of the digital signal processing techniques and almost maintenance-free.

When developing hardware, the staff of Compas MDB relies on the most up-to-date technologies, for the company mainly specializes in supplying products for aviation and rocket-and-space facilities.

In the 1970s, the digital signal processing techniques were largely used in the enterprise's innovative developments. Those techniques helped to dramatically reduce the weight, size and power consumption of the hardware, and to create: For the Air Force — A-723 radio navigation receiver-indicator which operated with Alpha and Omega ground radio navigation phase systems of global coverage, as well as with pulse phase systems, including Chaika and Loran-S; For the Navy — Mars-75 multi-frequency phase radio navigation system

designated for supporting ship navigation, executing hydrographic and operational works, as well as servicing flights of aircraft at speeds not exceeding 1,000 km/h.

The GLONASS, GPS and GALILEO global satellite navigation systems are subject to active radio interference, due to the low strength of signals emitted by space vehicles. On the horizon of earth surface, they are 40 decibels weaker than natural radio noises. The signals of such a low level are effectively suppressed by radio electronic warfare facilities, where a noise interference transmitter of 1 watt's power would disturb the operation capacity of satellite radio navigation systems' hardware within a radius of 32 km.

In order to level down the influence of natural and artificial interference, we have created satellite navigation equipment which features a higher level of interference immunity.

Taking into account the imperatives of our era, the hardware is being worked out for aviation and guided weapon systems,



ARK-35-1 automatic radio compass

and the research and development works are going on to enable the accomplishment of combat tasks in the environment polluted by enemy radio electronic countermeasures. To jam the new equipment, an enemy would need jamming stations of such a high capacity that would make them easily discoverable and vulnerable for destruction by appropriate means.

The enhancement of digital components of navigation hardware allows minimizing the share of analogous devices. When the hardware is mounted on different vehicles, their capabilities have to be modified in conformity with specific tasks and parameters of a vehicle. In terms of analogous equipment, it would mean serious problems of adaptation, up to restarting the development cycle. For the digital equipment, in most cases it is enough to update the software, thus obtaining new qualities of the product.

In order to enable efficient execution of all the above mentioned procedures before mounting a product in vehicles, the satellite navigation system simulator, modeling GLONASS/GPS/GALILEO, has been developed. The development of the satellite navigation system simulator turned to be a complex task, with the use of most modern techniques of digital signal processing. The range of the functions fulfilled by the simulator in the industrial and research field is very broad. It includes, for example, definition of technical solutions at the stage of consumer navigation equipment (CNE) development, adjustment and settings, the assessment of work quality during the production process at the manufacturing plant, issues of incoming inspection and periodical checks during the CNE life cycle, training technical staff in oper-

ating it, conducting a complex of scientific and laboratorial researches, as well as in-line simulation with the goal of defining a place for mounting the CNE in the vehicle, including highly dynamic systems, working out scenarios of CNE-mounting vehicle movement in the prescribed trajectories with the consideration of complex impacts of atmosphere, ionosphere (radio wave propagation conditions), and use of a priori and a posteriori information on the location of satellites in the space grouping at a certain time period.

The A-737 basic product (airborne GLONASS/GPS satellite radio navigation systems receiver-indicator) was developed in the 1980s, primarily for the military aviation. Today, the products of this series are mounted almost in all the aircraft. The purpose of our equipment is to define the position vector of an aircraft, i.e. three location constituents, three velocity constituents, and to receive the exact time reading, since the use of satellite navigation enables to tie to the unified time system.

The A-737 product provides the basis for several modifications which support additional functions and enhance the product capabilities in precision of position finding. For instance, the A-7371 product brings together the capabilities of satellite navigation and navigation based on terrestrial pulse and phase radio systems. Such a technological solution is due to the fact that the interference resistance of receiver-indicators of satellite navigation systems is not very high, and as for the signals of pulse-phase systems, it is much more difficult to jam them. In combat environment the use of two-system equipment would largely enhance the capabili-

ties of combat operations when enemy uses electronic countermeasures.

The next modification is A-737D, which supports differential operation mode. The results of navigational measurements defined by the satellite navigation systems' receiver-indicators contain errors. One of them is related to the inaccuracy of data about the space vehicle movement parameters (ephemeral information). Since the distance is measured from the vehicle to space vehicles, and such distances are used for calculating the vehicle's position, the precision of the whole system depends on the accuracy of definition of space vehicle position. The second error is related to the fact that the signal emitted by the space vehicle goes through the ionosphere, troposphere, where it is refracted and twisted, and, therefore, the measured distance to the space vehicle proves to be inaccurate. To get rid of these errors, especially when high precision in position finding is required, for example, in the guided weapons operational employment, the differential error-corrections are used. These corrections are formed by the terrestrial segment of the system, enabling to increase the precision to single meters, which is essential for destroying pin-point targets.

In the same time, we were given a task of creating equipment for the guided high-precision weapons. This task had to be primarily solved for the correctable aviation weapons. We created the satellite navigation hardware specially for that purpose. During the testing of the product by means of the differential mode, we succeeded in achieving the circular probable error calculable in single meters. The hardware belonging to this class is mounted to the correction-enabled aviation weapons.



**Local differential system (LDS)
on-board segment**



LDS ground segment



GNSS signal simulator

Navigation



GNSS GLONASS/GPS receiver-indicator



Navigation cartographic map pad



Antenna units

Compass MDB currently deals with the issues of development and production of radio navigation systems in various lines: small size automatic direction finders for all aircraft of military and civil aviation (ARK-32, ARK-35, ARK-40); a series of A-737 aviation receiver-indicators for the high precision position finding of different vehicles by GLONASS/GPS satellite navigation system signals (GALILEO in the long run) and terrestrial radio navigation pulse-phase and phase systems;

- products for ground-supported trajectory measurements of boosters, upper-stage rockets and space vehicles (disposable load);
- map-enabled navigation pads, providing the planning and execution of flights on air-routes and any prescribed routes out of the air
- routes, as well as the aircraft special employment tasks, operates with signals of GLONASS/GPS satellite navigation systems;
- equipment of navigational medium formation: local system of differential error-corrections, retransmitter of satellite signals;
- instrument-guided landing system for aircraft (helicopters) onto aircraft carriers and unequipped landing sites;
- portable receiver-indicator for the personal use of signals of GLONASS/GPS satellite navigation systems (GALILEO in the long run);

- a number of aeriads of different purposes;
- dedicated jam resistant consumer navigation equipment operating with GLONASS/GPS satellite navigation systems for aircraft of all kinds and purposes;
- monitoring, security and centralized control systems for rail transport;
- dedicated navigation equipment for the control systems of automobile transport.

One of the main lines of activities of Compass MDB, OJSC is the development of navigation complex for helicopter to land onto ship.

We have successfully created such system. Its main difference from the standard

systems is that it operates in the mode of relative navigation. That is, when the system is activated, the aircraft 'ties' itself to the center of landing pad of the ship. And wherever the ship was going, and whatever was the helicopter movement, its position is always defined relating to the center of the helipad.

We expect that the successful test results open up new alternatives of using the system in civil industries. Today, the topical issue is providing the helicopter communication with shelf-based drilling plates, ensuring flights of deck-based aviation of the icebreaking fleet, scientific research ships and other sea vessels.



Navigation

In order to remove the mentioned shortcomings of the system, the space system of search and rescue is now under development. It envisages two-way data exchange between the distressed and rescue services. The system being developed is comprised of three segments:

the space segment is represented by navigation space vehicles of GLONASS/GPS satellite navigation systems, as well as satellites of global communication systems;

the user segment includes emergency radio buoys designed both for being mounted to mobile vehicles (ARB) and for the personal use (ARB-N). There is also a tendency for using radio beacons in certain fixed installations, with the purpose of sending warning signals in critical conditions (for example, in case of ecological or other emergencies);

the control system consists of the Unified Coordination Center (UCC), which collects information about emergencies observed, and a network of regional command and control posts. UCC functions include the monitoring of the whole system too.

The emergency radio buoys define their positions through GLONASS/GPS navigation signals. When simultaneously using two global satellite positioning systems, the probability of finding exact position of ARB increases much. An emergency message formed in ARB is delivered to UCC through the radio channel of global satellite communication systems. The emergency message contains ARB's identifier, the exact position of the ARB at the time of sending emergency signal or message, the accident time and the accident characteristic. UCC forms a response (acknowledgment) to the received emergency message; it goes to the distressed ARB through the channel of global communication systems.

This system does not require development of the communication system, since there is a possibility of using the formerly developed and currently operating global satellite communication systems which allow not only organizing a two-way communication channel, but all-weather and round-the-clock radio communication.

The main advantage is that there are no interruptions in the communication sessions. Therefore, the information about the distressed will be delivered to UCC within the minimum time.

The use of the two-way data exchange will enable the fast and effective coordination of actions of search-and-rescue teams and those in distress; therewith, the distressed will be informed that their distress signal has been detected and the search-and-rescue services have initiated a rescue operation.

The enterprise's future plans are related with improvement of the radio navigation equipment, increase of the interference resistance, integration with other navigation systems, precise control of air-dropped loads, logistics navigation systems and complexes of transport communications, navigation products of general usage.

Mikhail Pestrakov,
Commercial Director, Director
for Special Projects and Special
Missions at Compass MDB, OJSC



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ACAE CJ-1000A

Despite huge advances of local manufacturers, China still needs foreign engines and outside help with propulsion technologies.



CJ-1000A in the center of AVIC stand at Aviation Expo 2011

People's Republic of China (PRC) has very ambitious plans for development of local aircraft manufacturing industry that would not only fulfill the needs of the growing domestic market, but also be able to sell indigenous designs worldwide. The Modern Arc family of regional turboprops, the ARJ-21 regional jet, the C919 narrow body jetliner and the proposed wide body transport form a complete range of civilian aeronautical products for airlines from a single source. The K-8 Karakorum affordable single jet, the L-15 LIFT supersonic twin jet trainer and a single piston screener and initial trainer, the L7, together give a complete line of military trainers. The FC-1 lightweight multirole fighter, somewhat larger canard-equipped J-10 fighter and the most recent



Safran CEO Jean-Paul Herteman and COMAC president Jin Zhuanglong at Aviation Expo 2011



Salut general director Vladislav Masalov with ODK chief Andrei Reus

J-20 twin engine heavyweight combat jet potentially give China a good line of potentially competitive products able to sell well internationally. This is indeed so in the view of flyaway prices for "made in China" products, which tend to be substantially lower than the competition.

The local industry has achieved great results in the past few years on the ways of modernization, introducing and mastering advanced technologies. Still, there are several links missing in a complete chain. Modern power plant is one of those missing links. That's why China goes to the manufacturers in the United States, Canada, Western Europe, Russia and Ukraine for modern engines. Without foreign help in that area, the above mentioned "home-grown" aeronautic products appear unable to compete internationally.

In some cases China buys motors directly from foreign suppliers, for installation on indigenous aircraft designs. The Pratt&Whitney is contracted to supply turboprops for the Modern Arc, General Electric for the ARJ-21 and CFM International for the C919. Russian firms supply RD-93 and AL-31F series engines to equip Chinese "home-grown" fighters, and D-30K-series turbofans to certain non-maneuverable aircraft intended for governmental organizations. Ukraine has been chosen to provide engines for L-15 LIFT and other local designs. Thus meeting the urgent needs in competitive motors,

PRC government and industry control structures continue to invest into "home-grown" alternatives, which one day may lead to self-reliance in the area of aircraft engines.

Perhaps there are two good examples to illustrate this point. While buying in quantities the AL-31F series engines, China has developed a broadly similar motor, the Tai Hang, and flight tested it on the J-10. There is a list of "local alternatives" of same kind. Second example can be the CJ-1000A, a "home-grown" motor for the C919. A sort of contingency power source in the case something goes wrong with the CFMI LEAP-1C's availability. China's AVIC Commercial Aero-Engine Co. Ltd (ACAE) exhibited its motor at Aviation Expo 2011. The exhibit was "unveiled" on the show opening as a brand-new product despite the fact that its "development prototype", the SF-A, was once on display already, at Shanghai Industrial Fair. It is interesting to notice that the CJ-1000A scaled down (yet still rather large) mockup occupied the center place on the AVIC's stand, the largest one at Aviation Expo 2011.

Although the very appearance of the CJ-1000A in the middle of the AVIC stand site created some nervousness at nearly SAFRAN's, where a scaled-down LEAP-1C mockup, there is little this French company and its US partner General Electric could do about it. Meanwhile, MTU of Germany, which also had

a stand at Aviation Expo, told reporters that it has been talking to the Chinese on a possible role in the CJ-1000A project. Ukraine is also seeking a role in what can be a "real alternative" to the LEAP-1C.

From military into civil

In a wake of the big success with sales of the AI-25TL and AI-222K-25F motors, Ukrainian engine companies Motor Sich and Ivchenko Progress are seeking ways to expand their presence in the Chinese market. In pursue of that, they are especially active in two directions: a 10-tonne fighter engine and the 15- to 20-tonne motor for commercial jetliners. The original AI-222 with a maximum thrust of 2.5 tons was developed for the Yakovlev Yak-130 advanced jet trainer. The latter's production takes momentum at Russia's United Aircraft Corporation (UAC) plants in Nizhny Novgorod and Irkutsk under orders of the Russian and Algerian air forces. The AI-222 engine was offered to China and sold in small numbers early this century. Some twenty engines were delivered and found their places in the Hongdu L-15's four development prototypes.

Satisfied with the AI-222 performance, China ordered a customized version of the Ukrainian jet outfitted with an afterburner. As a result, the AI-222K-25F (F for "forsazh" or afterburner) and -25FK (FK for "forsazh, kotokyi", or afterburner shortened) were developed, former with a standard afterburner

Motors



Chengdu J-10A fighter powered by Russian AL-31FN engine

design and latter with "shortened" one, for the customer to choose from. China demanded some changes to perfect the design, and after these were introduced, the resulting version took over the designation AI-222K-25F. Development motor was flight-tested on the L-15 LIFT in October 2010. The LIFT suffix (for "Lead-In Fighter Trainer") refers to a more capable version of the L-15 able to attain supersonic speeds and carry a punch of modern air-to-air and air-to-surface guided weapons.

Past summer Motor Sich president Vyacheslav Boguslaev told local media that a deal on 250 AI-222K-25Fs was being prepared. This fall it became known that the firm order has been placed. Engines for China will be manufactured at Motor Sich main plant in Zaporozhie, Ukraine. Moscow-based Salut, a major industrial partner on the AI-222 project and supplier of such engines to the Russian air force, fabricates certain modules for the Chinese version of the motor. The Chinese order calls for AI-222K-25F deliveries to start later this year and be completed in three years' time.

Progress general designer Igor Kravchenko said the AI-222K-25F design is "mature



AL-31FN (mod.) with swivel nozzle at Aviation Expo 2011

enough and already fit for series production" while its ground and flight testing continues. "We will get all necessary certificates in time the first deliverable [L-15 LIFT] aircraft is ready for customer acceptance", he insisted. The AI-222K-25F develops 4,200kg of thrust at full afterburner, enabling the 9,800-kg-MTOW L-15LIFT to accelerate to Mach 1.6. With sticker price of \$10 million, the Chinese twin jet is expected to sell well in the domestic and international markets.

Kravchenko stressed that the AI-222K-25F is the first-ever Ukrainian engine to have been fitted with an afterburner. "With its development, Progress company has mastered reheat technologies which we are now seeking to apply on a fighter engine in the class of thrust up to 20 tons", he said. In its primary 10-tonne version, this engine may replace Russia's Klimov RD-93 on the FC-1 and its Pakistan air force version the JF-17 Thunder.

"China's market is growing which make us look for expansion of our presence in this market and mutually beneficial cooperation with the local industry. Luckily, we have some products that are of interest to the Chinese customers", Kravchenko continued. Progress-developed, Motor Sich-built AI-25TL series motors already power serially produced K-8 Karakorum jet trainers and the Aero L-39s. The bigger part of the Chinese rotorcraft fleet flies on Ukrainian engines (Motor Sich built Klimov TV3-117 series engines power the Mi-8/17 series helicopters procured by PRC in over three hundred copies). The recently awarded contract for 250 AI-222K-25Fs further strengthens positions of the Ukrainian's engine makers in the Chinese market. This creates ground for further expansion.

"We are looking for new programs with Chinese partners", Kravchenko said, naming motors for fighters, medium and heavy weight helicopters and commercial passenger jets as possible market segments to expand the Ukraine engine maker's presence.

As per the Ukrainian participation in the Chinese indigenous engine for the CO-MAC C919 twin jet narrow body, this has not yet been decided. Talks on the subject have been going on for about three years already since the very decision by China to develop an indigenous motor for the C919 as a contingency. Meantime, Russia's United Engine Corporation asked

Progress to develop a combustor for the Perm Motors PD-14 engine that is intended for the Irkut MS-21, a competitor to the C919. "We are working on the combustor with intend to flight-test it next year", Kravchenko said.

Progress is also working on the AI-28 in the thrust class of 7 tons with a super-high bypass ratio, targeting further evolved An-148/158 regional jets. It would offer 10-15% fuel savings compared to the standard D-436-148 turbofans. "This engine is going to be a bit heavier, but fuel savings shall well compensate for weight increase". The AI-28 is a scaled down version of the AI-436 (thrust range 12-15 tons) once offered on the MS-21 but rejected in favor of the Perm Motors PD-14 and Pratt&Whitney PW1000G. "I believe we offer the best design for a future commercial engine", Kravchenko says, "but it is up to our Chinese partners whether to go with us or somebody else".

Bestseller

As it became known during Aviation Expo' 2011, China has placed additional orders for AL-31 series fighter engines. Russian state arms trade agency Rosoboronexport clinched two big contracts earlier this year, one for more than one hundred and fifty AL-31Fs as replacements to earlier delivered engines of same type that power the Chinese air force Su-27/Su-30MKK/MK2

fighters. Engines under this contract will be assembled by Ufa-based UMPO factory.

The second contract is for more than one hundred and twenty AL-31FN engines to power newly built Chengdu J-10 fighters. Engines under this contract will be supplied by Moscow-based Salut plant. At Aviation Expo 2011 Salut general director Vladislav Masalov said that his company started fulfillment of the above mentioned contract in summer. He added that negotiations continue on a second batch of nearly 140 AL-31FNs and that a follow-on contract is expected to be signed in October.

Masalov further said that the grand total of Salut-made AL-31 series engines in China "is nearing one thousand units". To serve them, Salut established partnerships with Limin corporation and Tyan Li company in Chengdu on deliveries and manufacturing of spare parts to both AL-31F and AL-31FN. Besides, under the special agreements, Russian provides all necessary maintenance and repair documentation to the Chinese partners that allow them to do the respective sort of work locally. Due to the big Chinese orders placed recently, Salut faces many issues pertaining to ramping up production, Masalov said. This year the company has to increase its production output by 30-40% to fulfill the Chinese contracts. "Certainly there is some pressure on us, with bottlenecks being metal and vendor items", Salut head said.



J-10 powered by Russia's AL-31FN

Motors



Hongdu L-15 LIFT powered by Ukrainian AI-222K-25F engines



TV7-117 at United Engine Corp. stand

Domestic orders for Salut products are important, but in terms numerical are shadowed by those from the foreign client. This year Russian MoD placed an order for a dozen of AL-31FM1 engines. These are intended for improved Flanker series aircraft, such as the Su-27SM. Negotiations continue on forty more such motors in 2012-2013 timeframe. Separately, talks are ongoing on AL-31FM2 engines for the heavier Su-34. Salut continue R&D on the 14.5-tonne thrust AL-31FM2 and more powerful AL-31FM-3, Masalov said.

Salut is doing work on next-generation engine for the PAK FA (Sukhoi's inner designation T-50) fifth generation fighter. This new engine will replace the Item 117 that currently powers PAKFA development prototypes and selected for initial production batch. By the end of this year two draft designs (from Salut and ODK) shall be completed and submitted to MoD for selection. Salut and United Engine Corporation (Russian acronym ODK) have agreed in general to cooperate on the new engine R&D and manufacture irrespective of

whose design wins. According to it, Salut will be responsible for low and high pressure compressors and the nozzle.

Besides, ODK and Salut made decision on concentration of design resources in one place in Moscow. For this purpose the Salut's site on the Dudenovsky prospect is selected as most convenient. Decision was made to move there the A.M.Lyulka design house which developed the baseline AL-31 and Item 117 engines, as well as the Chernyshev plant's design bureau. At the same time, Salut will remain an independent company in foreseeable future, Masalov said when answering our questions when Salut can be included into ODK.

Diameter matters

Aviation Expo 2011 became the first international show where SAFRAN of France was able to say that three most important and interesting narrow body jetliner manufacturers selected its joint product with GE to power their new models. COMAC (stand B-1) selected the LEAP-X1C for the C919, Airbus (represented at the show through EADS with stand E-1) went for the

LEAP-1A in the case of the A320neo and, more recently, Boeing (stand B-3) chose the LEAP-1B for the 737 MAX.

At its Y-1A stand in the Hall E1-E2 of the China National Convention Center (CNCC), SAFRAN exhibited a full-scale mockup of the LEAP-X engine with a 73-in diameter fan. But the company has to admit that this exhibit, although new, is already outdated, since COMAC and Airbus have both notified the engine maker that they want a bigger fan, of 78 inches.

This very recent requirement seems to have appeared after Boeing's announcement, earlier this month, of the 737 MAX and the choice of the LEAP-1B as an exclusive engine for this model. But due to already very short ground clearance of the nacelle's air intake, Boeing has to limit the fan diameter. As Boeing representatives told journalists during the show in Beijing, the company is yet to choose an exact figure for fan diameter, and is now choosing it in the range between 66 and 69 inches. To be able to increase the 737's engine fan from the current 61 inches (for the CFM-56-7), Boeing is considering changes to the nose landing gear: the ground clearance can be increased by a longer length of the nose gear strut.

It is believed both Airbus and COMAC went for larger fan diameter in an effort

to ensure superior fuel burn to that of Boeing's version of the LEAP. COMAC came first with the requirement for fan diameter enlargement from 73 to 78 inches. Airbus is understood to have been talked into same decision by the engine manufacturer who tries to attain maximum commonality possible between the LEAP-1C for COMAC C919 and LEAP-1A for A320neo.

Meantime, the LEAP-X1 core has passed bench testing and next major milestone in the program is expected in

the middle of 2013 when fully-assembled engine will commence bench trials. If COMAC manages to stay on time with the C919 development, first flight-test of LEAP-1C may happen by the end of 2013. The A320neo would follow later, but both designs may have their entry-into-service close to one another in 2016. By Boeing's estimates, their 737 MAX can follow with EIS in 2017.

Vladimir Karnozov



LEAP-1C mockup at Aviation Expo 2011



COMAC C919



GULFSTREAM'S LARRY FLYNN

The newly appointed Gulfstream Aerospace president is bullish about the Russian market.



The newly appointed Gulfstream Aerospace president is bullish about the Russian market, and claims the US airframer "sells all models here". Larry R. Flynn spoke to us at Jet Expo 2011 in Moscow Vnukovo airport in the middle of September. He personally attended five shows at Vnukovo, while Gulfstream Aerospace exhibited at all six held so far.

Before his appointment effective September 1, 2011, Larry Flynn served as Gulfstream Aerospace marketing and sales director with the US-based business aircraft manufacturer. He had run the product support division of the Savannah, Georgia-based General Dynamics subsidiary from 2001 through 2008. In the new position at Gulfstream, he reports to Joe Lombardo, who headed the firm before him and now works in the position of executive vice-president at General Dynamics aerospace group. Lombardo became a General Dynamics vice president in 2001 and Gulfstream Aerospace president in 2007.

"Larry Flynn has a broad base of operational and customer-focused experience

that will serve him well as he leads Gulfstream into the future," Lombardo said of Flynn's promotion. "His direction of Gulfstream's marketing and sales organization has given Larry exceptional insight into the needs of our increasingly international customer base. I'm confident that he will capitalize on that knowledge to enhance the company's positioning as a global leader in business aviation."

At Jet Expo 2011 we asked Flynn about the purpose of attending Jet Expo 2011. "The Russian market has been important to us, and we have had quite success in this market, particularly over the last five years. It started to grow ten years ago but it nearly quadrupled over the last five years", he observed. Flynn refused to provide exact numbers, but claimed "We sold a little bit of everything: G150, G200 and now getting into the 280, and also G450, G550 and G650. The larger cabin airplanes have been a little more popular than the mid-cabin due to the range, and the ability of these airplanes to go from continent to continent".

Business Aviation



This Gulfstream IVSP side RA-10201 is a rare example of a bizjet properly imported into Russia

Gulfstream Aerospace president attributed company's success to better-than-competition client support in the past five years after Jet Aviation established its presence at Vnukovo-3 dedicated business aviation center. "We are the only OEM that has a service facility here through our sister company. We also have a field service representative in Moscow and parts inventory at Vnukovo".

Flynn added that Gulfstream Aerospace is committed to the Russian market. "It has

been good for us in the past and, I believe, it will be so in the future. We have a right product mix from the G150 to the G650. It has been proven to be correct since we sell all models here".

Touching on the G650, the most exciting and hottest product in the company's line of business jets, he said: "The program has gone well, we are back flying. The airplane is progressing towards type certificate and entry into service in the

second quarter of next year. We do have Russian customers for this new airplane". The company previously revealed that first G650 is slotted for delivery to a Russian customer in late 2013.

However, it is unlikely that this and other airplanes going to Russian clients will actually get registered in their home country. Despite considerable easing of import rules for western airplanes in the past three years, Russian business aircraft owners appear reluctant to place their possessions into the national aviation register. This statement was made by GosNIIGA, the State Scientific Research Institute of Civil Aviation and Russia's largest aircraft lessor Finance Co. (IFC) which shared results of their fleet analysis at this month's Wings of Russia international aviation forum in Moscow.

GosNIIGA says only 25 business jets have been properly imported into Russia and are placed into the national register. These include three Gulfstream jets, and the side RA-10201 in particular, depicted here. This Gulfstream IVSP is operated by UTair airline in the interest of fossil fuel company SurgutNefteGaz.



Gulfstream G550 crew station

Vladimir Karnozov

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