From Russia with intent

Irkut may have modest sales goals for its MC-21 narrowbody, but this clean-sheet blend of home-grown and Western advanced technology is a challenge to Airbus and Boeing

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Go back in time to March 2008. What if Bombardier never launched the CSeries aircraft family with Pratt & Whitney’s geared turbofan engines? What if Airbus never responded two years later by deciding to re-engine the A320? And what if Boeing wasn’t forced to respond to the A320neo a year later by launching a more aggressive revamp of the then-43-year-old 737? There would still be a need to replace the A320 and 737NG families, but what would it look like?

One answer to that question might be in a flight line hangar in East Siberia.

As the Russian aviation industry’s first clean-sheet attempt in the large narrowbody segment in decades, the Irkut MC-21-300, which was publicly unveiled in Irkutsk on 8 June, is designed to be longer, wider and yet lighter than the A320 or 737-800. It is also filled with technologies, such as a composite wing and a 6,000ft-altitude cabin, that still remain beyond the reach of Airbus and Boeing in the single-aisle market.

Irkut still faces many challenges in bringing the MC-21 family into production and finding it a niche in the global market. FlightGlobal’s Ascend consultancy projects the Russian airliner family will deliver 771 examples over the next 20 years, claiming a 3% share of the global market in the single-aisle segment. And Irkut’s in-service support plans may limit the appeal of what should otherwise be a competitive aircraft.

“Airlines in emerging markets may find it much easier to lease/buy and operate a new or used 737 or A320 than take a new Russian jet, and operating cost per seat could be very similar. So the MC-21 has hurdles to overcome,” says Ascend senior consultant Richard Evans.

But those hurdles do not include how the aircraft looks on paper.

Upgaging by airlines is shifting the heart of single-aisle demand from about 150 seats to about 180 seats. As a result of their re-engining decisions, Airbus and Boeing can only respond by cramming more seats into the available cabin area of the A320neo and the 737 Max 8, which are optimised for 150-160 seats.

Irkut, however, could respond by sizing the MC-21-300 to be 2.8m (9.2ft) longer than the 737 Max 8 and 4.7m longer than the A320, allowing the heart of its aircraft family to carry 180 passengers in two classes or about 211 in a single-class layout.

ROOMIER CABIN

Another constraint inherited by the re-engined A320 and 737 families is the diameter of the fuselage. As airlines increasingly shorten turnaround times at the airport gate to increase capacity or deploy single-aisle aircraft on longer, transatlantic routes, a slightly wider fuselage would increase comfort and accelerate the boarding and off-loading process.

Starting with a clean sheet of paper, Irkut gave the MC-21 a 4.06m diameter fuselage – 10cm wider than the A320 and 30cm wider than the 737. That is enough to preserve the...
18in diameter seat found in the A320’s six-abreast row, while also widening the aisle by nearly 4in. The 24in (0.61m)-wide aisle is intended to allow passengers enough room to slide by the service trolley on the way to the lavatory on a long flight. The concept echoes Boeing’s original response to the A320 in the late 1980s. The short-lived 7J7 project, which was cancelled in 1989 over concerns about the maturity of the unducted fan engines, featured a fuselage with a diameter of 4.17m, bridging the gap between a sub-4m diameter for a narrowbody fuselage and the 5.06m diameter of the widebody 767 fuselage.

While a wider fuselage offers more room in the cabin, the additional size usually comes with the trade-off of a higher empty weight and increased drag, which reduces fuel efficiency. However, Irkut has set the list price of the MC-21-300 at about $78 million, or about 15% less than the A320 and almost 25% lower than the A321, says Kirill Budaev, Irkut’s vice-president of sales and marketing for the MC-21 family.

Avoiding the costly complexity of an autoclave is one way for Irkut to hit that price point. Another factor keeping costs low is the value of the Russian rouble. With the structure, one of two engine options, half of the installed avionics and final assembly based in Russia, the MC-21 enjoys a structurally lower cost-base than American and European rivals.

The lower price does appear to come at the expense of innovation. As a clean-sheet design, Irkut had more options for inserting new technology than Airbus and Boeing. Fly-by-wire is a good example. Replacing mechanical linkages from the control stick to the control surfaces with electronic signals is not new to the single-aisle sector. Airbus introduced fly-by-wire to commercial airliners with the A320 in 1988. Boeing is adding an electronic-controlled actuation for the spoilers of the 737 Max, although the ailerons, rudders and elevators remain mechanically actuated.

**WINNING FACTORS**

Irkut is also installing a full fly-by-wire system in the MC-21, but the design takes the technology one step further in commercial airliners. The Rockwell Collins-supplied flight control computer takes inputs from the pilots’ sidestick controllers in the MC-21 cockpit. Airbus still uses a passive control stick, meaning the two controllers are de-coupled and provide no tactile feedback to the pilot. Active sidesticks have only recently entered the production stage, with BAE Systems supplying coupled sidestick controllers with positive feedback in the cockpits of the Gulfstream G500 business jet, Embraer KC-390 military transport and Bell Helicopter 525 super-medium helicopter. Irkut selected a similar technology developed by French supplier Ratier-Figeac, now a subsidiary of United Technologies Aerospace Systems.

Another innovation the MC-21 brings to the single-aisle sector is the air management system in the cabin. Boeing introduced a 6,000ft altitude pressure in the cabin of the widebody 787-8, offering passengers more comfortable and denser air than the 8,000ft pressurisation of the A320 and 737. Despite relying on a metallic fuselage, Irkut is matching the 787’s cabin pressurisation in the MC-21.

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Production costs are an Irkut trump card

In its MC-21, Irkut revived and updated the Yak-242 concept of the early 1990s
FARNBOROUGH
MC-21

Tallying up the MC-21’s strengths — a longer and wider fuselage, uniquely crafted composite wings, fly-by-wire with active sidestick controllers and a 787-like air management system — offers a compelling narrative. Combined with the Pratt & Whitney PW1400G geared turbofans — or slightly inferior, Russian-made Perm PD-14 engines — the MC-21-300 is the logical next step in single-aisle aircraft design, exceeding the A320 and 737 in several key areas.

MODEST GOALS
Despite its strengths on paper, the MC-21 has modest sales objectives. Last year, Demchenko said he would be delighted if the MC-21 family claimed 10% of the single-aisle market. But Irkut has sized the MC-21 supply chain to be capable of building 72 aircraft per year at peak rate. If Airbus and Boeing succeed in raising single-aisle output to 60 aircraft per month each, Irkut’s supply chain is sized to deliver only 5% as many aircraft.

For all of its technical merit, the MC-21’s actual performance remains unproven. The wings fabricated by AeroComposite have yet to enter a round of full-scale static testing. The first assembled MC-21-300 rolled out on 8 June in Irkutsk. The performance of the PW1400G engines installed under the wings is well-known, but the reliability of its many advanced systems is still unknown even to Irkut. The company has only recently commissioned an iron bird to check out electronic components and software at a system level.

Irkut is an unfamiliar entity on the global commercial aircraft market. The roots of the MC-21 can be traced to the Yakovlev Design Bureau concept for the Yak-242 that first emerged in the early 1990s, when Irkut was simply a production house for Yakovlev trainers and Sukhoi’s two-seat fighters. A decade later, Irkut revived and redesigned the Yak-242 with a wider fuselage, composite wings and a modern cockpit. It was also rebranded as the Irkut MC-21 for development and production.

Dmitry Rogozin, head of Russia’s state-owned defence industry, has called for Irkut to revert to the Yak-242 designation when the MC-21 enters service, but Irkut has shown no interest in making that change.

So far, Irkut has focused on selling to an effectively captive market of state-controlled airlines within Russia and former Soviet states. Ten customers have placed more than 175 orders, including the 100 split between Aeroflot and IFC.

Foreign sales will be pursued after type certification, but will not come easily. The world’s fastest-growing market in China already has a competing, state-controlled single-aisle with the Comac C919. Other large markets in the USA and Europe face political obstacles to completing deals.

Irkut currently builds the fuselage and assembles the completed aircraft in a factory shared with assembly lines for the Su-30 fighter and Yak-130 military trainer. It is understood that US and European regulators will not certificate a civilian aircraft assembled in the same bays as combat aircraft. Irkut plans to transfer Su-30 and Yak-130 assembly to another location eventually, but until then the foreign market will be limited.

With the aircraft’s low acquisition cost and competitive performance, the MC-21 is most likely to appeal to markets in regions such as Asia, Latin America and Africa, Budaev says.

GLOBAL NETWORK
A global customer base would require Irkut to support that fleet, but its philosophy is focused on limiting upfront investment and relying on international and third-party suppliers. Irkut has signed a memorandum of understanding with Lufthansa Technik, for example, to provide a range of maintenance services.

“They have quite a wide network. We could rely on such a big player and then if airlines say we’re used to working with another MRO provider we could authorise them,” Budaev says. “We don’t need to build our own infrastructure for [the] MC-21.”

Irkut also plans to rely on international supplier networks like P&W, Collins and auxiliary power unit maker Honeywell, he says.

In order for that element of the plan to work, however, Irkut must thwart growing pressure within Russia to replace Western suppliers. Aircraft electronics specialist Kret, for example, is developing an integrated avionics suite to replace the partially Western-sourced system now installed on the MC-21.

“We are trying to keep a balance,” Budaev says. “We need to satisfy our Russian aviation industry because we need to force them to develop and we expect that sooner or later local Russian manufacturers will be at least at the same level as other ones. But it’s very early to say. We will start with a set of suppliers that we chose, then let’s see what the markets say.”

Though the jet looks good on paper, performance remains unknown and Irkut faces political and logistical hurdles on international markets.