many hypersonic products (for example, the Scientific Production Association "Mashinostroenie") and even in serial production. Sure, the ICAO requirements still far from allowing to use such velocities in the main aviation, but time passes quickly and tourists in space aren't new. Tu-144D (range of flight 5 330 km with 15 tons of target load) and Concorde (range of flight 7 200 km with 13 380 kg of target load) had a speed of two Mach numbers and this advantage over time compared to subsonic aircrafts did not give a qualitative gain, and technically it greatly complicated the aircraft and its exploitation. In Figure 7, this situation is represented graphically [10, 13]. The goal is to get the new competence of the corresponding technical level in 2025.

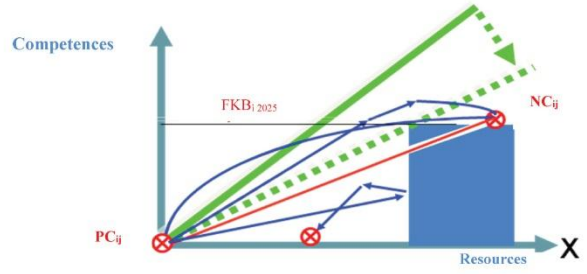

Figure 7: Geometric representation of the achievement of new competences in the context of the year 2025

According to Forcite, a certain fundamental knowledge base (FKB) has been obtained that corresponds to the year 2025, but in order to end up from the professional competence (PC) in the new competence (NC), it is necessary to realize a growth trajectory.

$$NC = PC_i + \mathrm{FKB}_{2025} \tag{4}$$

The growth trajectory with a small (monetary) resource rests on the restriction (1), and in a large one it allows to reach the level of the new competence (2) in the parabolic trajectory. On its way, the growth trajectory encounters a restriction in the form of a green line (3), which does not allow us to realize a parabolic trajectory, i.e., even greater monetary resource is required to straighten the growth trajectory (4). If you lower the green line to contact with the blue level, limiting the time of project implementation, then the achievement of a new competence will be possible only through the "tunnel effect", i.e., some blowout through the time shift. It is illustrated on the picture with a red line (5). This approach allows us to give some more examples. The second example is related to the use of kerosene as a fuel. At a very long distance, a significant fuel reserve is required, which is up to half the take-off mass of the aircraft [9]. The relative mass of fuel $\overline{m_T}$ depends on a number of parameters uniquely determined in the requirements specifications and characterizing the intended purpose of the aircraft, as well as parameters characterizing the flight operation of the aircraft. This moment can be illustrated by the dependence that follows from the Breguet formula (1), expressed in terms of the fuel relative mass:

$$\overline{m_T} = 1.18\frac{1-e^{-\frac{LC_p}{KMa}}}{0,97} \tag{5}$$

Thus, for the A-380-800F, the fuel mass is 296 tons (0.53) with a maximum take-off weight of 560 tons. For the B777-200LR, the fuel mass is 202 tons with a maximum take-off weight of 347 tons. If you take off with half the volume of fuel tanks, then the take-off weight of the aircraft will be reduced not by 25%, but by 35% due to a reduction in the weight of the design of the wings, chassis and all other units that differentially depend on the take-off weight of the aircraft [8, 9, 11]:

$$1=\frac{\partial m_{af}}{\partial m_0}+\frac{\partial m_{eu}}{\partial m_0}+\frac{\partial m_F}{\partial m_0}+\frac{\partial m_{eq}}{\partial m_0}+\frac{\partial m_{sl}}{\partial m_0}+\frac{\partial m_{tl}}{\partial m_0} \tag{6}$$

The third example is even more radical. If you change the air-jet engines, for example, to the electric with the use of solar panels on a huge area of the washed surface of the aircraft performed according to the the "flying wing" scheme. Roughly considering that the aircraft can be two times lighter (the relative mass of fuel in conventional kerosene long-haul aircrafts tends to 50%) and fly beyond the Sun endlessly.

Sounds fantastic? But when the European Space Agency has developed the apparatus "Philae", placed on the spacecraft "Rosetta", which was launched on March 2, 2004 to the comet 67P/Churyumova - Gerasimenko. Who took seriously the aspirations and claims of Europe to the Space? Who could have guessed that, after ten years of flying in space, the apparatus would find, overtake a comet in the Universe and a successful landing would be made on it? The separation of the apparatus "Philae" from "Rosetta" happened on November 12, 2014, at 9:35 UTC. A 7-hour lowering of the comet to the surface followed after that. This is the first successful landing on the comet in history. These three examples illustrate possible technical solutions that change the situation radically and give a radical breakthrough. From the aircraft existence equation and the square-cube law, it follows that it is necessary to reduce the dimension of the aircraft, which gives a radical (up to 5 times) gain in terms of differential masses [5-9, 11].

Reduction in the range of flights radically reduces the take-off weight. Figure 8 shows the scheme of routes from Chicago to Singapore in the traditional – through Europe, and the new – through the North Pole and the polar regions of Russia. The dimension can be reduced by one third only by means of direct non-stop flight. This geopolitical position of Russia should give a competitive advantage. Evolutionarily overtaking we cannot win, we need to get new "unseen" qualities that allow us to offer an exclusive service or products in the market leaving competitors behind in terms of prime cost and quality of life.

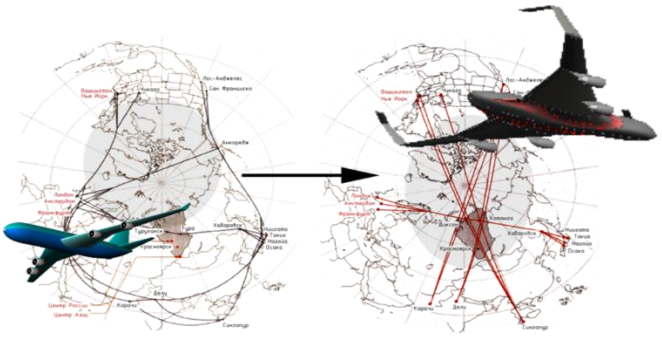

Figure 8: Cross-polar routes

4. CONCLUSIONS

1. The dimension of the long-haul aircraft of large passenger capacity depends on the range of flight. Flights through the polar regions can reduce the range of intercontinental flights by 10-20%, which will reduce the dimension of aircrafts by 20-30%.

2. The aircraft made according to the "flying wing" scheme allows to increase the range of flight by 15-20% and to reduce the take-off weight in comparison with the aircrafts made according to the "classical" and triplane scheme.

3. The application of the "flying wing" scheme allows the realization of a long-haul aircraft with a take-off weight of up to 500 tons.

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