Kazan State Technical University named after A.N.Tupolev
Department of Structural Mechanic

RN69 – Vladimir A. Pavlov, Airat I. Shigapov, Vitaly V. Pavlov

KAZAN 2007

In immense open spaces of Russia further and further pipelines are moving ahead in which gas and oil flow, there are new deposits in the seas and oceans of the World outside the country, such as the Shtokman's. For their construction and operation the new types of transportation capable to transport larger cargoes, serve watches and supervise a condition of pipelines are required, and thus to overcome longer distances and have opportunities of vertical take-off and landing. While such transport in the World is not present. Helicopters with their low speeds of flight, greater consumption of fuel, low carrying capacity and dependence on weather conditions cannot solve the specified problems.

Pic. 1

The high-speed air transport having opportunities of vertical take-off and landing is necessary. Such flying vehicles have reached the greatest development in the USA. It is B-22 «Osprey» which reaches speed of 550 km/hour, keeping all other lacks of a helicopter (Pic. 1). Besides it has dangerous modes of transition from helicopter flight to plane and back and has no opportunity to take-off and land in a plane mode even at presence of runway, though this is extremely necessary in operation from high-altitude air stations, in transportation of maximum permissible cargoes and in emergencies.

Pic. 2

In KSTU named after A.N.Tupolev authors of this article offered and patented the idea of essentially new wing of plane which was given the name « Pavlov's plane wing ». This wing in the form of rotating axi-symmetrical disk from which during take-off and landing blades of helicopter type are put forward, transforming the wing into the blades of rotor allowing the plane to hover and move vertically. Such rotor can operate in weather conditions, its blades at parking and in cruise flight are taken back into the wing, and put forward from it having centrifugal forces of rotation which extend the blades and do them very rigid, capable to resist to any wind influences. At the beginning of rotation before flight and at its stop after flight the helicopter blades have low centrifugal forces and can be destroyed by wind directly in aerodrome or on deck of ship. « Pavlov's plane wing » does not have such mode, and it can be used instead of traditional wing practically in any types of planes, transforming them in vehicles of vertical take-off and landing (VTOL) which we sometimes call «Discolyot» (Pic. 2).

Helicopters of one-rotor scheme have one more unfavourable feature: rotation of the rotor is carried out through a gear by engine located in fuselage and the moment applied to the rotor under the third law of Newton rotates helicopter aside, opposite to rotation of the rotor. They call it jet moment of helicopter for which compensation helicopter has a tail rotor located as it is possible further from the centre of gravity of the helicopter on a tail beam inside of which transmission gear is located, those having not low weight and demanding expenses of capacity of the engine and attentive operation.

« « Pavlov's plane wing » can be mounted on VTOL under the scheme «Turbodiscolyot» which has no jet moment because capacity for rotation of wing (rotor) is transferred from the engine in the form of gas jet. The jet moves in the wing

and follows through nozzles located on its perimeter, forcing the wing to rotate. On fuselage connected to the wing through the bearing, only the moment of friction (not the jet moment) is transferred, releasing VTOL from gears to transmission and the tail rotor. Compensation of the moment of friction and course control at covering are carried out on the basis of the principles developed and patented by authors of the article.

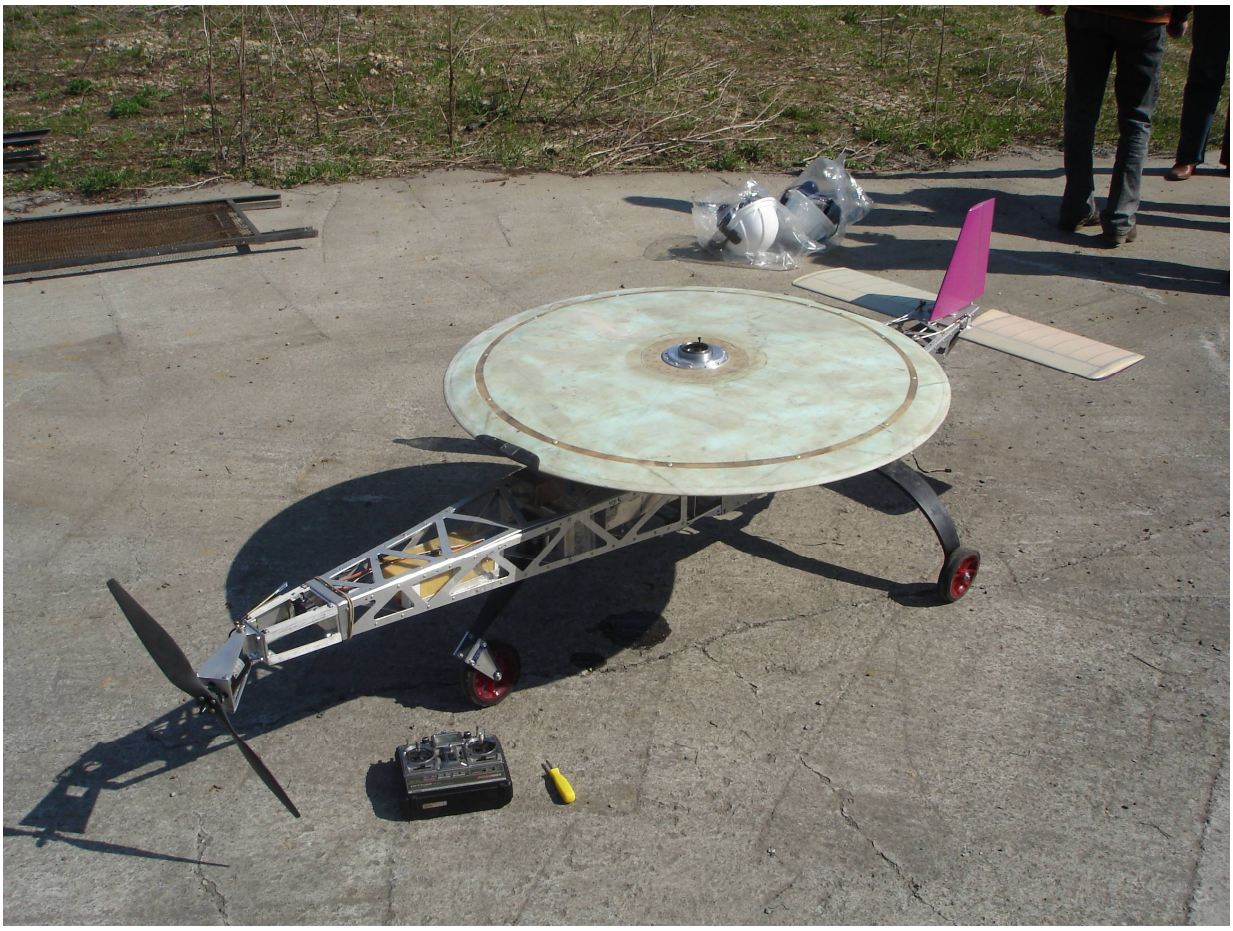
Now KSTU named after A.N.Tupolev has not only idea of this wing. The laboratory on creation of VTOL is organized which designs VTOL under scheme of Discolyot and Turbodiscolyot. One model small-dimensional routine-piloted flying vehicle (RPFV) " Discolyot " has passed flying tests. It is a model of cross-section scheme having two disk wings located on the ends of traditional wing, somehow externally reminding V-22 «Osprey» (Pic. 3).

Pic. 3

The first experience of flights of RPFV and the researches carried out in a wind tunnel have shown that the disk wing has good characteristics peculiar to a wing of small lengthening allowing to create even supersonic VTOL.

Designing was finished and tests of RPFV «Discolyot» with one disk wing

created as the carrier of equipment with weight up to 10 kg were begun, for purposes of research of atmosphere, supervision over ground objects, delivery of small cargoes, use as targets and target indicators. Main qualities of RPFV «Discolyot» are: absence of special starting installation and device for landing, an opportunity to stop above interesting object. Speed of flight, height, range and performance of necessary functions can be formulated by the customer and reached after completion of described RPFV (Pic. 4).



Pic. 4

The team of laboratory executes VTOL project of «Turbodiscolyot» type with take-off weight of about 3 tons, 6-8 passengers. Speed of flight can be chosen over a wide range up to 900 km/hour. Depending on requirements of the customer the project can be modified. Cost of first experimental vehicle is equal to the sale price of one serial V-22 «Osprey» (certification and batch production need a special talk). It can be VTOL of any type at will of the customer, but the new project and corresponding expenses are necessary for this purpose. The team can undertake a project of VTOL of superheavy class, for example, on the basis of Antonov's plane «Ruslan» or IL-76. The most complex, probably, will be creation of a supersonic rescuer. All these works can be carried out only together with those firms which

produce specified planes or their analogues.

It would be desirable that we were heard by those to whom it may concern. But, if you hear, do not go for consultation to those who produces helicopters. They will suggest you to buy a helicopter and will not want to hear that there can be a flying vehicles which are three times faster (they struggle for 10-20 km/hour), that carrying capacity can be 10-15 times more, that it is possible to consume 2 times fuel less.

We are a department which for 40 years is engaged in helicopters and trains students to «Helicopter design».

Head of project:

Prof. Vladimir A. Pavlov – department of structural mechanics of Kazan State Technical University

Contacts:
KSTU named after A.N. Tupolev, 10 house, Karl Marks St, Kazan, 420111, Russia
Phone. +7 843 264 53 66
Fax. +7 843 236 66 92