

**ACTIVITY 7.1.1. THE GREENING OF AIR TRANSPORT**

**AREA 7.1.1.1. Green aircraft**

**AAT.2012.1.1-3 Propulsion**

**ACTIVITY 7.1.4. IMPROVING COST EFFICIENCY**

**AREA 7.1.4.2. Aircraft operational cost**

**AAT.2012.4.2-3. Propulsion**

**Project Idea:**

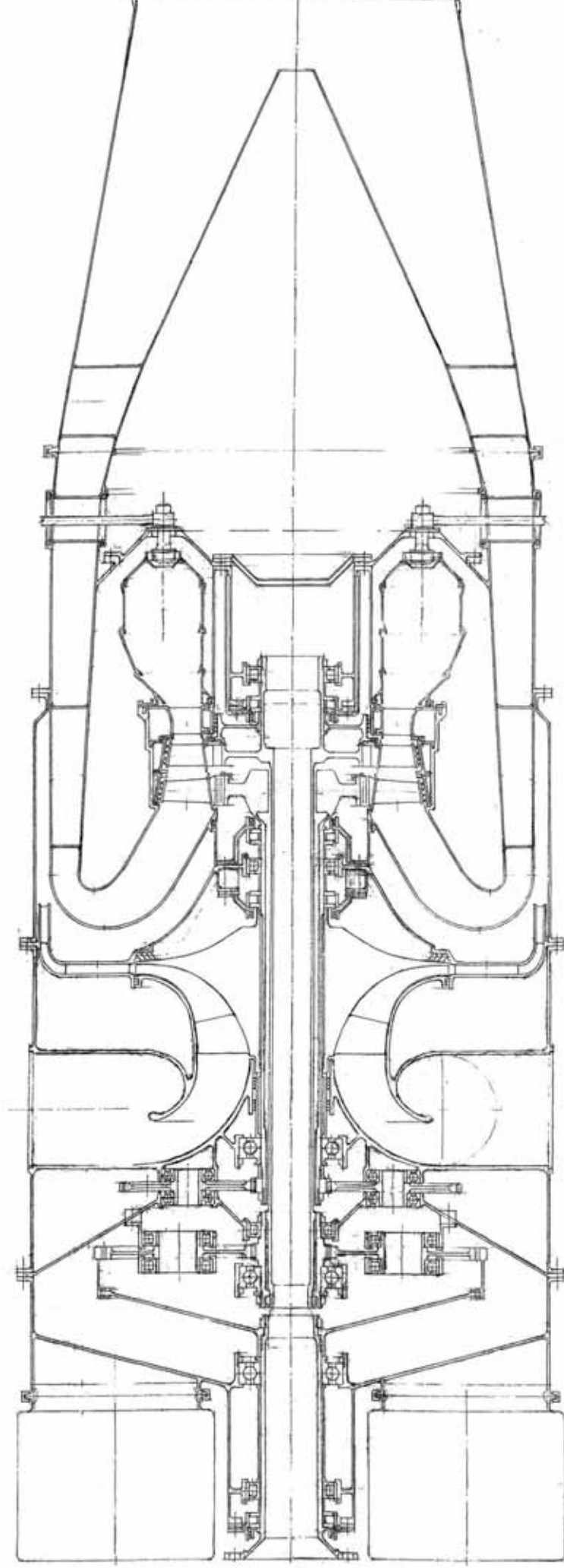
**Small-size gasturbine engine of variable  
thermodynamical cycle with counter-  
rotating turbine**

ADVANCED ENGINES

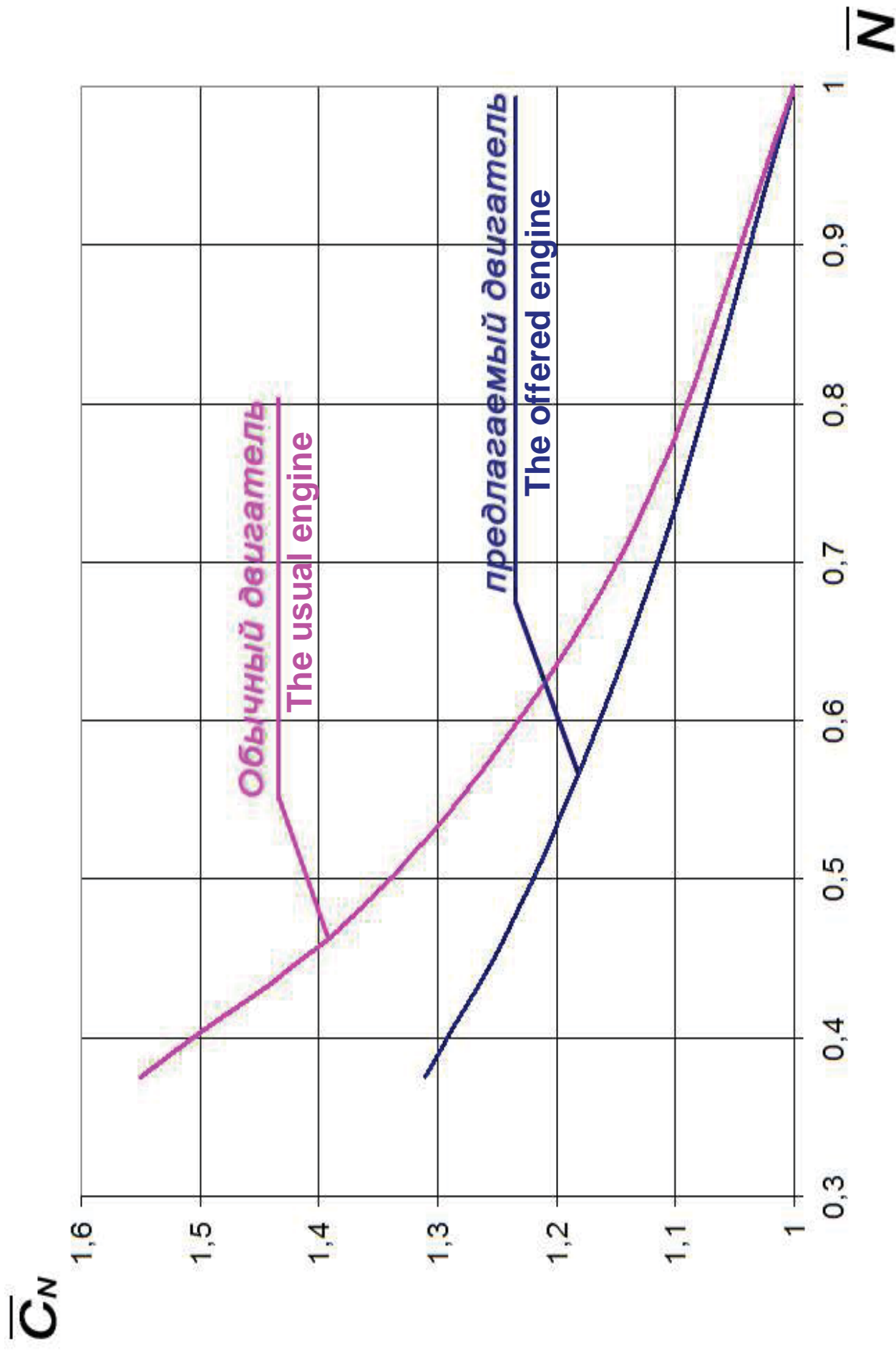


## Engine expected parameters

Power = 400 ... 800 h.p.;  $C_N = 0.25$  kg/h/hp



# ADVANCED ENGINES



## Technical approach:

- Design of variable thermodynamical cycle engine has: air inlet, centrifugal compressor with variable guide vanes (VGV), annular combustion chamber, two-stage axial counter-rotating turbine without guide vane between stages, output.
- LP turbine is compressor turbine (CT), and HP turbine is free turbine (FT).
- Changing of cycle is realized by changing of  $n_{FT}$  and of compressor  $\alpha_{vGV}$ , i.e. changing of  $n_{FT}$  changed expansion ratio in compressor turbine, and changing of  $\alpha_{vGV}$  changed  $n_{CT}$ .

## Advantages and possibilities of variable cycle:

- Wide range of parameters measurement on all engine modes;
- Optimization of joint operation of engine and aircraft;
- Reducing of gas temperature or rotor speed without decreasing of engine power, during different engine failures and faults;
- Wide range on compressor stall margin on appearing of different failures and wear in turbine or compressor;
- Insure of required engine thrust on high temperature of open air without increasing of gas temperature;
- Keeping up the temperature in combustion chamber on all modes without adjustment, that optimizes combustion chamber emission in engine flight cycle;

### Advantages and possibilities of variable cycle:

- Increasing of engine power without increasing of gas temperature;
- Insuring of required tapping air from the compressor and compressor turbine rotor power without decreasing of power and increasing of gas temperature;
- Gas temperature is not increased and power is not decreased upon worsening of performance of inlet, compressor, combustion chamber, turbine, output on 2%;
- Engine starting and engine acceleration are improved;
- Noise reduction.

## Expected Impact:

- Weight and dimensions decreasing, 80kg; (700×410×410) mm;
- Save of engine prototypes development cost and time, their development and certification by 40%;
- Production and operational costs saved by 20-25%;
- SFC reduced by 10-15%;
- CO<sub>2</sub> and NO<sub>x</sub> emissions reduced by 10-15% and 25-30%, correspondingly;
- Noise reduced by 5-6 dB;
- Improve of engine reliability, durability and life cycle by 50-60%.

ADVANCED ENGINES



***Thank you for your attention***

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