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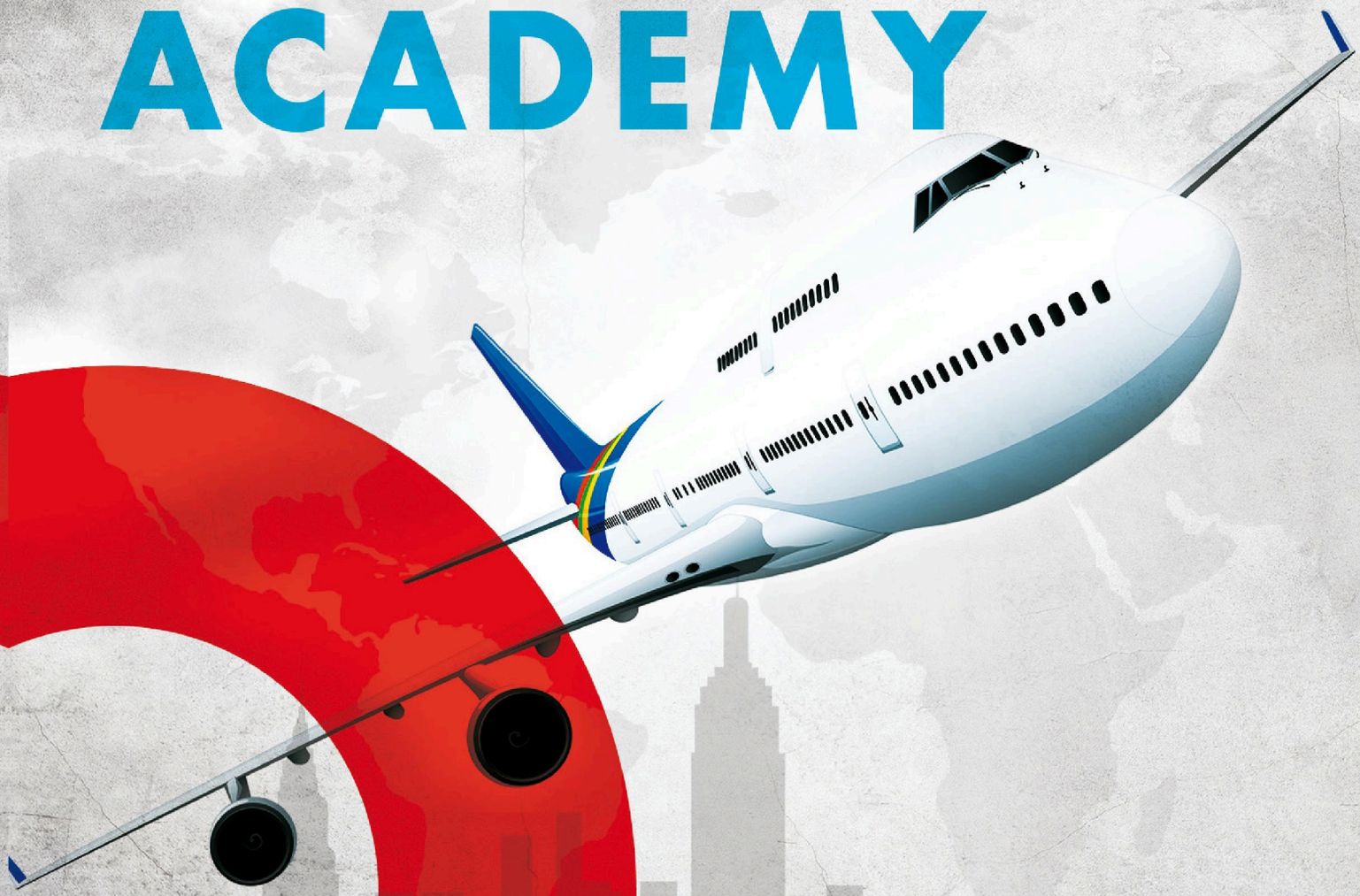

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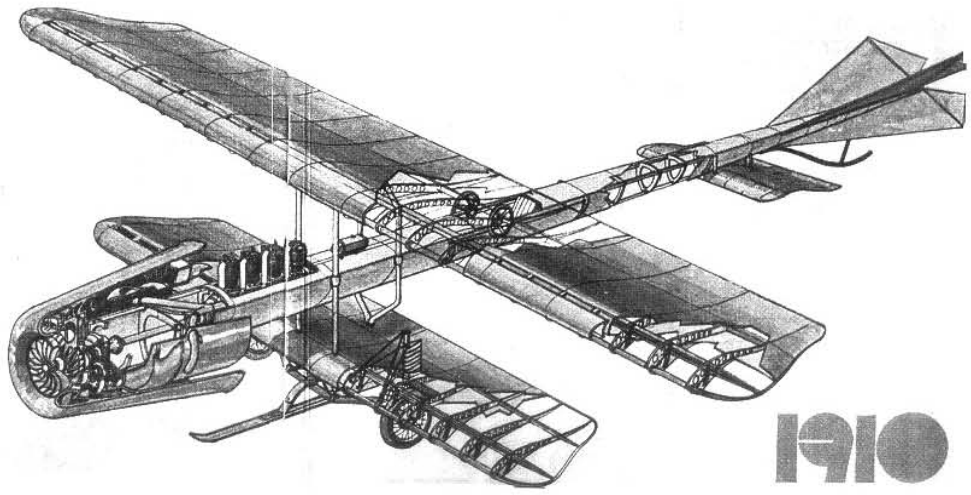

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C O N T E N T S

ASPECTS REGARDING THE KINEMATIC ANALYSIS OF POWER TRANSMISSION FROM HELICOPTER DESIGN

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Abstract: *The main power transmission of helicopters is a complex technical system, which fulfills its functional role of transforming the kinematic parameters from the turboshaft into the kinematic parameters necessary for the optimal operation of the main rotor of the helicopter. The paper presents a method of kinematic analysis of the power transmission for the main rotor and the anti-torque rotor of a helicopter. Based on the kinematic diagram of this mechanical transmission, the angular velocities and the transmission ratios achieved by the double-planetary gearbox of the main and the secondary transmission are determined.*

Keywords: planetary gear, anti-torque rotor, power stage, transmission ratio, IAR 330 Puma

1. INTRODUCTION

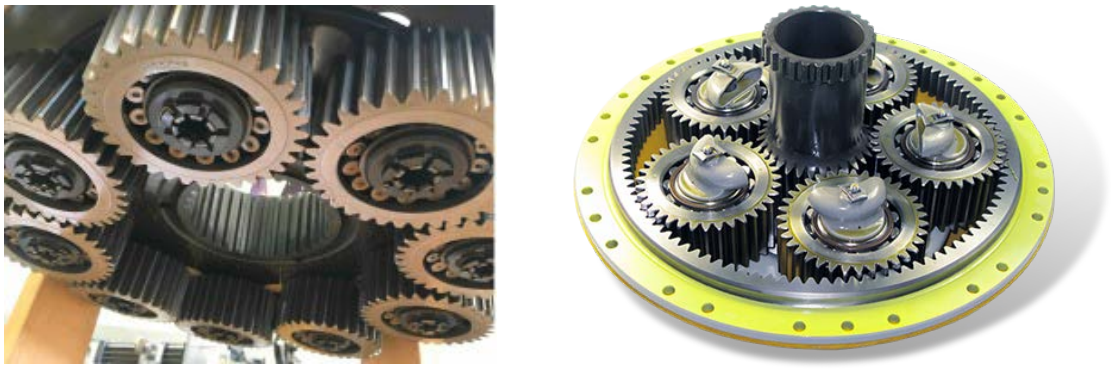
The mechanical power transmissions used in helicopter design have the functional role of transmitting to the main rotor and anti-torque rotor, the rotational motion and torque developed by turboshafts of the helicopter, while achieving (simultaneously) considerable reduction of angular speeds and torque increase.

In designing these power transmissions of helicopters, the following conditions are required):

- the weight of the mechanical transmission should be minimal;
- the reliability to be as high as possible, by adopting optimal design and technological technical solutions;
- regardless of the operating mode, the power transmission should operate without noise and vibration;
- ensuring an easy maintenance activity;
- ensuring a power transmission cooling system as efficient as possible, in any flight situation;
- the mechanical efficiency of the power transmission to be as high as possible.

Planetary gearboxes and gearboxes with fixed axles are used in the design of these mechanical transmissions. Planetary gearboxes have been adopted as a constructive solution for helicopter power transmissions due to the achievement of very high transmission ratios (i = 8… 3600) [3], ensuring a high load-bearing capacity, ensured by the degree of coverage of the gears. For the transmission of the same child, with the same transmission ratio, the planetary gearboxes in the design of helicopters have a weight 4… 6 times lower compared to the usual gearboxes with fixed axles.

For optimal dynamic balancing, the planetary gearboxes are equipped with several satellites, so that structurally and cinematically, only one satellite is considered active, the other satellites being passive, shown in (Fig.1).



a b

FIG. 1 Planetary gearboxes of the helicopter [6, 7]

2. STRUCTURAL ANALYSIS OF HELICOPTER POWER TRANSMISSION

The main power transmission of helicopters is a complex technical system, which fulfills its functional role of transforming the kinematic parameters from the turboshaft into the kinematic parameters necessary for the optimal operation of the main rotor of the helicopter.

Following the kinematic flow shown in (Fig.2), at the entrance to the mechanical transmission, the rotational movement and the torque are transmitted by means of a bevel gear, in which the gears have curved teeth. This technical solution has been adopted due to the advantages of conical gears with curved teeth: they operate at high peripheral speeds, up to 40 m/s; they have a quiet operation, a high degree of coverage, a very high reliability.

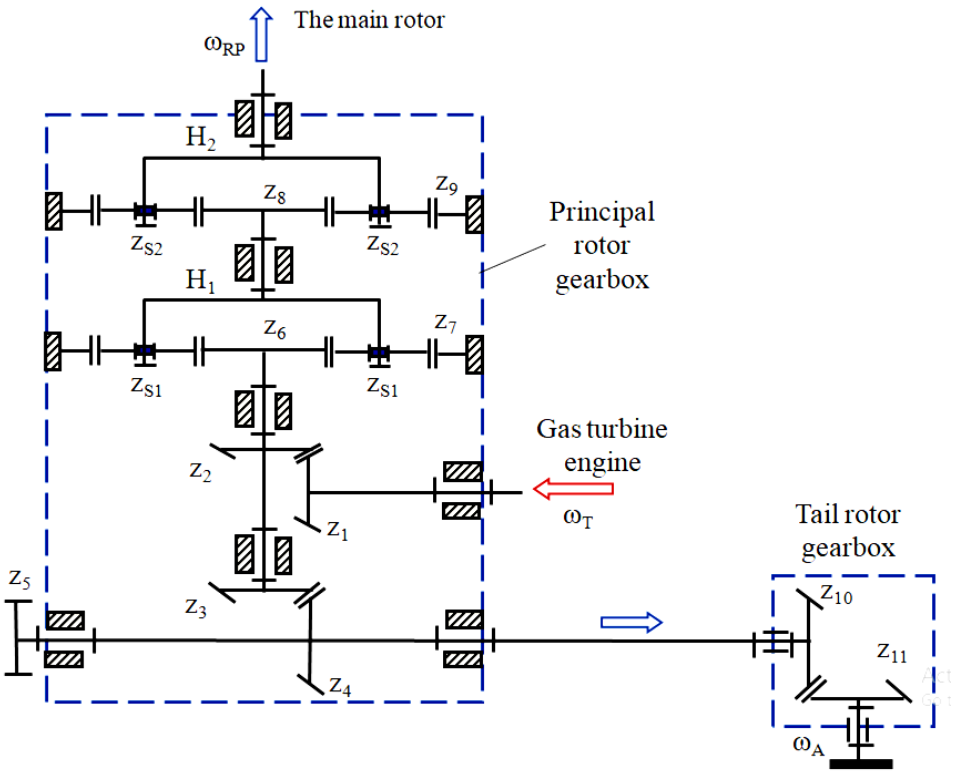


FIG. 2 Gear-train diagram of the power transmission of the helicopter [2]

The driven bevel gear is mounted on the vertical shaft of entry into the planetary transmission. At the top of the vertical input shaft is mounted the satellite carrier arm of the first stage of the planetary mechanical transmission. The two power stages of the planetary mechanical transmission are constructively identical and are connected in series.

Each power stage of the planetary mechanical transmission consists of two centrally gear wheels, the first movable, having external toothing of gears, and the second fixed to the gear casing, having internal gearing.

From a constructive point of view, as many satellites as possible were placed, equidistantly, in order to dynamically balance the mechanical transmission. In this case, the problems from the geometric point of view were also observed: the condition of proximity of the satellites, the condition of mounting, respectively the condition of coaxiality of the central wheels.

3. DETERMINATION OF THE KINEMATIC PARAMETERS OF THE POWER TRANSMISSION

For the kinematic analysis of the main mechanical transmission of the helicopter, based on the gear-train diagram (FIG.1), for the planetary mechanisms is applied the method of motion inversion, known in the professional literature as "Willis principle" [1]: subtract the speed of each kinematic element component, the angular velocity of the satellite carrier arm, thus transformed into a mechanism equivalent to gears with fixed axles.

The transmission ratio of gear partially achieved by the bevel gear is given by the relation [1]:

$$i_{1-2} = \frac{\omega_T}{\omega_2} = \frac{\omega_1}{\omega_2} = \frac{z_2}{z_1} \tag{1}$$

Considering that the driven bevel wheel *2* is mounted on the same vertical shaft as the central wheel *6*, it results that the angular velocities of the two constructive elements are equal: $\omega_2 = \omega_6$.

For the first power stage of the double-planetary gearbox, from a kinematic point of view, the relationship between the angular velocity of the central wheel *6* and the satellite carrier arm H_1 can be written:

$$\frac{\omega_6 - \omega_{H_1}}{\omega_7 - \omega_{H_1}} = -\frac{z_7}{z_6} \tag{2}$$

Since the central internal toothing of gears *7* is fixed, respectively the angular velocity $\omega_7 = 0$, the relation (2) becomes:

$$\omega_{H_1} = \frac{z_6}{z_6 + z_7}\omega_6 \tag{3}$$

The connection between the two stages of the double-planetary gearbox is made by means of the satellite carrier arm H_1 and the central internal toothing of gears *8*, resulting in $\omega_{H1} = \omega_8$.

For the second power stage of the double-planetary gearbox, the relationship between the angular velocity of the central wheel *8* and the satellite carrier arm H_2, has the form:

$$\frac{\omega_8 - \omega_{H_2}}{\omega_9 - \omega_{H_2}} = -\frac{z_9}{z_8} \tag{4}$$

where the angular velocity $\omega_8 = 0$, resulting in:

$$\frac{\omega_8}{\omega_{H_2}} = 1 + \frac{z_9}{z_8} \tag{5}$$

or:

$$\omega_{H_2} = \frac{z_8}{z_8 + z_9}\omega_8 \tag{5'}$$

Substitute the relation (3) in the calculation relation (5 '), obtaining:

$$\omega_{H_2} = \frac{z_6 z_8}{(z_6 + z_7)(z_8 + z_9)}\omega_6 \tag{6}$$

For the constructive variant of the main power transmission of the helicopter, the total transmission ratio is given by the relation:

$$i_{T-RP} = \frac{\omega_1}{\omega_2} \cdot \frac{\omega_6}{\omega_{H_2}} \tag{7}$$

or:

$$i_{T-RP} = \frac{z_2}{z_1} \cdot \frac{(z_6 + z_7)(z_8 + z_9)}{z_6 z_8} \tag{8}$$

The transmission ratio for the mechanical system of secondary force to the anti-torque rotor is determined by applying the calculation relation:

$$i_{T-RA} = \frac{z_2}{z_1} \cdot \frac{z_4}{z_3} \cdot \frac{z_{11}}{z_{10}} \tag{9}$$

Depending on the characteristic and performance parameters of the IAR316B and IAR330 [4, 5 and 8] helicopters, the speeds and moments of torsion that occur during operation have been determined, (Fig.3) for the main areas of the main power transmission of these helicopters:

- zone A - at the entrance to the main power transmission of the helicopter;
- zone B - at the entrance to the first stage of the double-planetary reducer;
- zone C - at the entrance to the second stage of the double-planetary reducer;
- zone D - at the exit of the main power transmission of the helicopter.

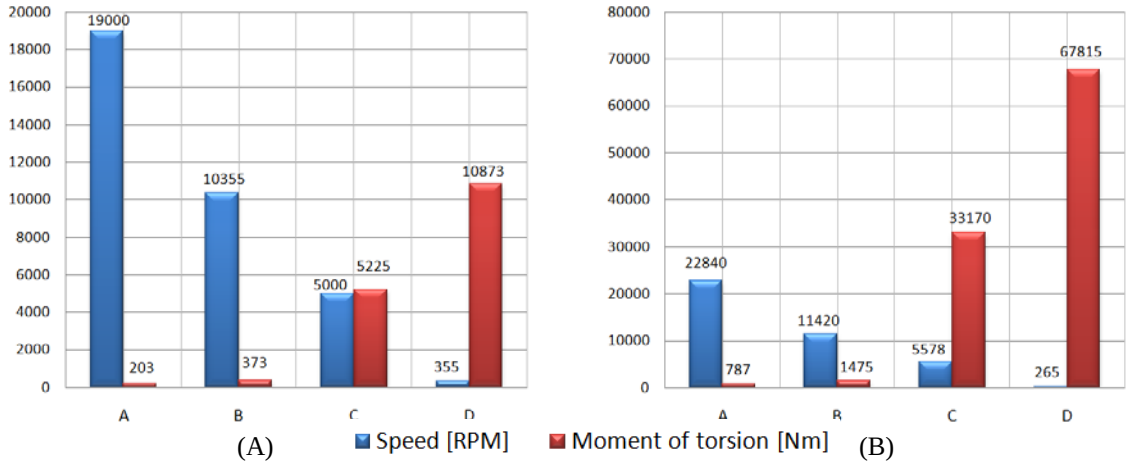


FIG. 3 Speeds and moments of torsion distributions in the four areas at the main power transmission of the IAR316B (A) and IAR330 (B) helicopters

4. CONCLUSIONS

By constructively adopting an optimal number of teeth of the gears with fixed and movable axes, a very high total transmission ratio is obtained at the main force transmission, respectively a necessary transmission ratio at the anti-torque rotor, to counteract the torque achieved during operation main rotor.

Future work on planetary transmission performance will be solved with the help of software tools.

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PROPELLER BLADE ICE ANALYSIS

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Abstract: *Atmospheric phenomena can influence flight safety through a series of manifestations of the air masses in the flight area. Such a dangerous manifestation is the icing that can seriously affect the performance of aircraft and lead to flight events. The article draws attention to the phenomenon of icing as located on propellers, a phenomenon which is analyzed on both a 2D (aerodynamic profile) and a three-dimensional (three-blade propeller) geometry, using the Qblade freeware tool, and in the case of icing formed on the NACA 0009 leading edge. The aerodynamic analysis proposed for comparison provides graphical and numerical data relevant for an assessment of the degree of influence of icing deposits in the analyzed case, the proposed geometries and the generated numerical data can be exported and exploited later, by using software analysis tools.*

Keywords: *icing, NACA 009, Qblade analysis, aircraft propeller.*

Acronyms and symbols

c_l	*Lift coefficient*	*AoA*	*Angle of attack*
c_l/c_d	*Gliding ratio*	β	*Local twist angle*
c_p	*Pressure coefficient / power coefficient*	*T*	*Thrust*
c_d	*Drag coefficient*	ρ	*Air density*
c_m	*Pitch coefficient*	*D*	*Propeller diameter*
b	*chord*	*Q*	*Torsion*
α	*Local angle of attack*	*P*	*Available power*
n	*Rotation (rot/sec)*	c_n	*Normal force coefficient*

1. INTRODUCTION

Icing manifests itself as deposits of transparent or opaque ice that adhere to certain construction components of an aircraft, especially those exposed to stream. Icing can affect the wing, tail, propellers (on the leading edges), antennas, windshield, Pitot tubes, carburetors or intake engines of jet engines, see Fig. 1.1. It can be found in the case of flights in: altocumulus clouds (weak icing) depending on the isotherms in which it flies; altostratus clouds (0^o isotherm); nimbostratus clouds (glass icing); stratocumulus (moderate icing). [1]

The most common forms of icing that are dangerous for flight safety are: in the form of frost, sometimes with moderate intensity (amount of super cooled water with values of $0.6 / m^3 < 0 < 1.2$ g/m^3); in the form of ice that rarely appears (glassy ice); the icing in the cumulonimbus clouds and the frontal atmospheric zones have strong intensity (they affect the entire surface of the aircraft). [1]

FIG. 1.1 Ice buildup on aircraft surfaces, [2, 3]

Icing can affect the aerodynamic performances of aircraft depending on the quantity and especially the shape of the ice deposits, the contamination of the aerodynamic surfaces producing changes regarding the aerodynamic coefficients, according to the graphs in Fig. 1.2. According to specialist references [5] the area prone to ice contamination is up to 60% of the blade length, see figure 1.3.

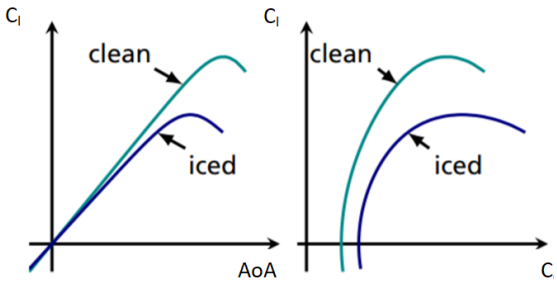


FIG. 1.2 Modification of aerodynamic coefficients due to icing

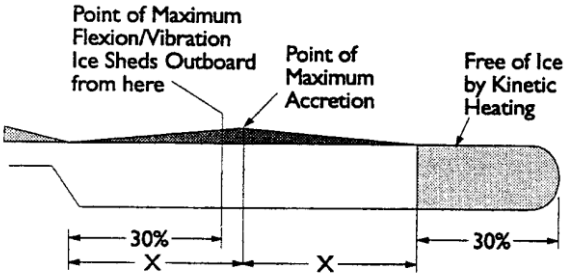


FIG. 1.3 Areas contaminated by ice below freezing point [5]

The favorable temperatures for the icing are for: stable clouds for the range 0^{o}-10^{o}C, in which case the icing appears less frequently for a temperature below -18^{o}C; and for unstable clouds for the range 0^{o}-15^{o}C, but with frequent icing down to -30^{o}C, [5].

The protection of aircrafts against the adverse effects of icing is essential with respect to flight safety. Icing is commonly caused due to the impact of super cooled water with any part of the external structure of an aircraft during flight. Specific warnings for piston propulsion systems icing are not normally included in aviation-specific weather forecasts and pilots need to be prepared to deal with this situation based on their own knowledge and experience. The main objective of this study is to highlight the influence of icing on the propellers of combustion engine-powered aircrafts.

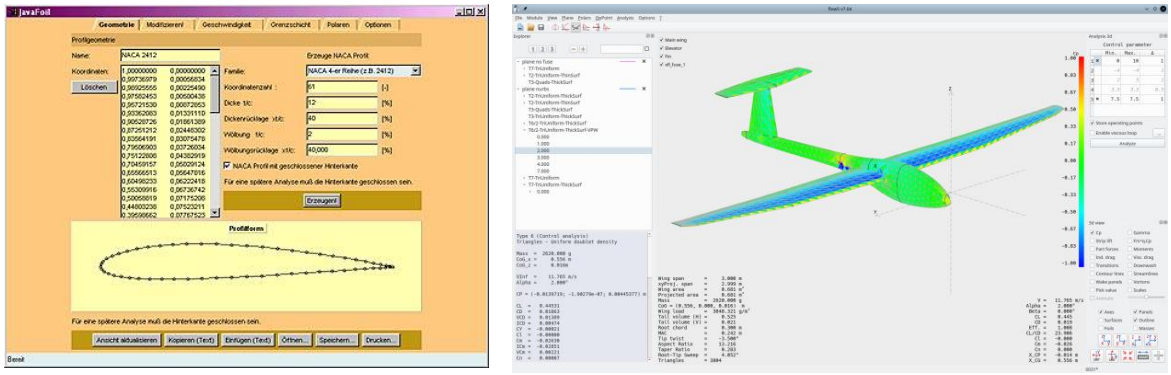
Partial approaches from this study were presented at the ATMOSPHERE AND HYDROSPHERE 2020 conference (fourth edition) at Vatra Dornei organized by Stefan cel Mare University of Suceava. [14].

2. METHODS AND INSTRUMENTS USED IN THE ANALYSIS OF ICING

To highlight the effect of icing on rotating lifting surfaces, a comparative analysis of two clean / frosted theoretical geometries is used in two relevant analysis cases: the two-dimensional case (compared aerodynamic profiles) and the 3D case (compared triple propellers).

The evaluation of the aerodynamic parameters of the frosted / non-frosted airfoils can be done with a series of freeware / trial tools, as follows: Javafoil [6, 7] for 2D geometries, XFLR5 [8, 9] for 2D / 3D geometries, Profiles [10] for 2D geometries, Qblade [4] for 2D / 3D geometries, Flow5 [11] for 2D / 3D geometries, see figure 2.1.

The instrumentation of the aerodynamic analysis in this study is realized by means of the freeware Qblade [4] which offers a geometric module and an aerodynamic analysis module. With the help of the geometric module, airfoils and rotating lifting surfaces (propellers with vertical axis and horizontal axis) can be configured, and the aerodynamic module offers possibilities for multi-parametric numerical analysis.



a b

FIG. 2.1 Freeware/trial software, a. Javafoil, b. Flow5.

The proposed comparative aerodynamic analysis provides relevant graphical and numerical data for an assessment of the degree of influence of icing deposits in the analyzed case, the proposed geometries and the generated numerical data can be exported (see annex) and used later using software analysis tools.

3. THEORETICAL ELEMENTS OF ROTARY LIFTING SURFACES

The 3D geometric element subjected to the icing influence analysis is a rotating lifting surface (three blades), having the characteristics shown in Fig. 3.1.

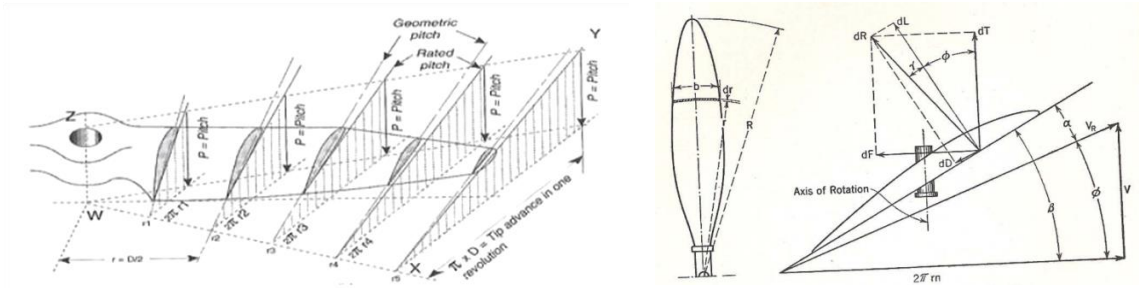


FIG. 3.1 Propeller geometry, [12]

The relevant geometric parameters for our analysis and the characteristic aerodynamic coefficients [12, 13] are as follows:
-power coefficient (c_p) equation 3.1:

$$c_p = \frac{P}{\rho \cdot n^3 \cdot D^5} = 2 \cdot \pi \cdot c_m \qquad 3.1$$

-traction coefficient (c_t) equation 3.2:

$$c_t = \frac{T}{\rho \cdot n^2 \cdot D^5} \qquad 3.2$$

-moment coefficient (c_m) equation 3.3:

$$c_m = \frac{Q}{\rho \cdot n^2 \cdot D^5} \qquad 3.3$$

4. PROPELLER ICING ANALYSIS

4.1 2D analyses

To highlight the influence of icing on a propeller, we chose to perform an aerodynamic analysis on a blade section (aerodynamic profile) NACA 009, in the case of a light (theoretical) icing, which includes the following steps:

a. geometry of the two airfoils, see Fig. 4.1.

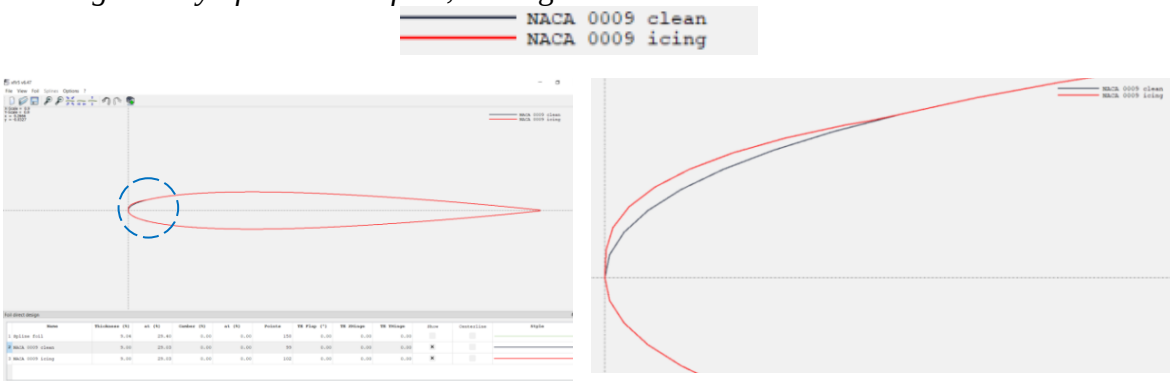


FIG. 4.1. Airfoils for analysis

b.analysis conditions (atmospheric and kinetics), table 4.1:

Table 4.1. Analysis conditions

Parameter	Value	Parameter	Value
Air density	1,225 kg/m^3	Reynolds number	100000
Air viscosity	1,5x10^{-5}	Angle of incidence	-10°... 10°
Analysis	viscous	Boundary layer	yes
Iterations	100		

c. grapho-numerical results and interpretation, see figures 4.2-4.7.

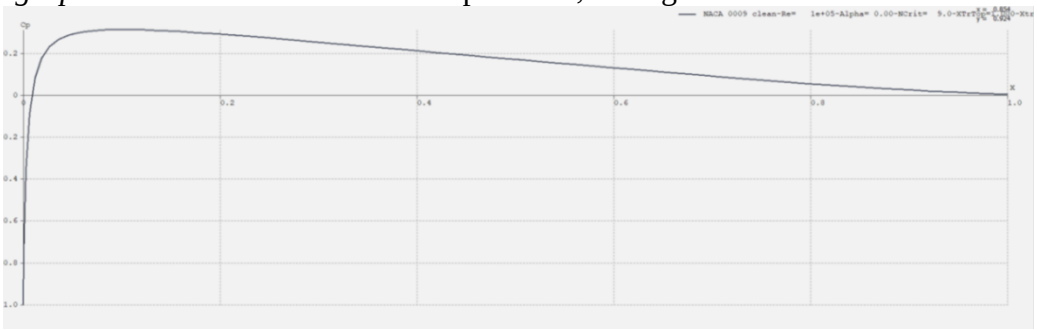


FIG. 4.2 Pressure coefficient distribution (C_p) vs airfoil chord without icing

In the case of the profile not affected by icing (fig.4.2), according to the zero AoA distribution of the pressure coefficient (C_p), the overlapping values for intrados versus extrados are observed due to the symmetrical geometry of the airfoil.

According to the distribution at AoA = 0° of the pressure coefficient C_p at zero angle of attack, it is obvious the creation of an area with turbulent potential on the attack board, due to the irregular geometry in the case of the icing profile (Fig. 4.3).

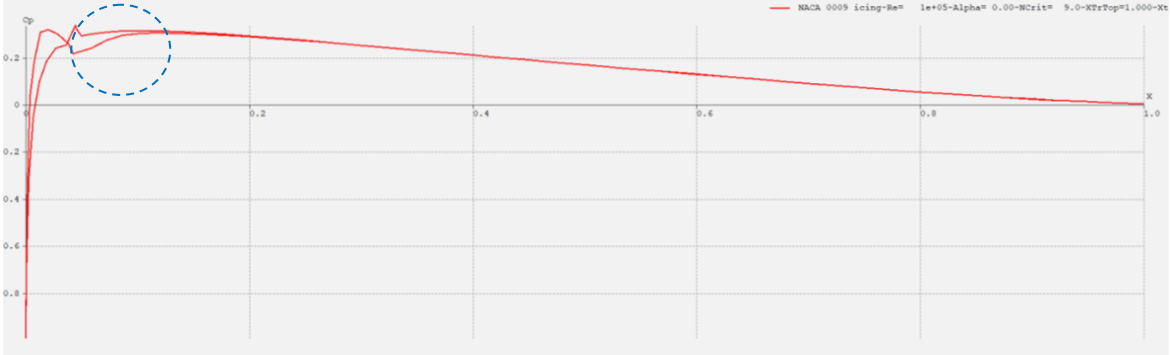


FIG. 4.3 C_p vs airfoil chord with icing for AoA=0°

Figure 4.4 shows an obvious decrease in the values of the lift coefficient (Cl) after the AoA=6° for the airfoil affected by icing, with a $C_{lmaxclean}$ = 0.79 versus $C_{lmaxicing}$ = 0.65 for the AoA=8°. According to figure 4.5 C_d variation, the icing increases the drag especially after the angle of attack of 3°.

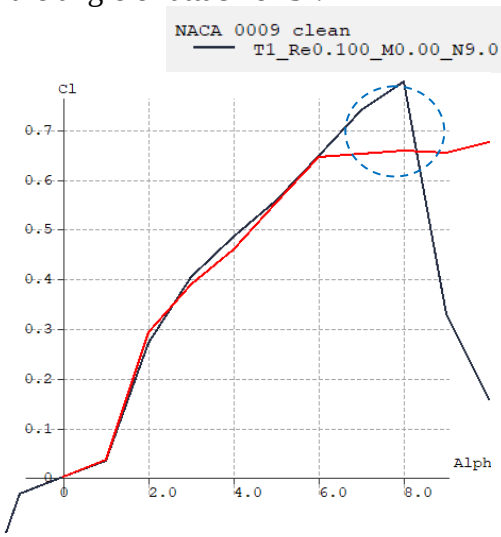


FIG. 4.4 Lfting coefficient variation (C_l) vs AoA (alpha)

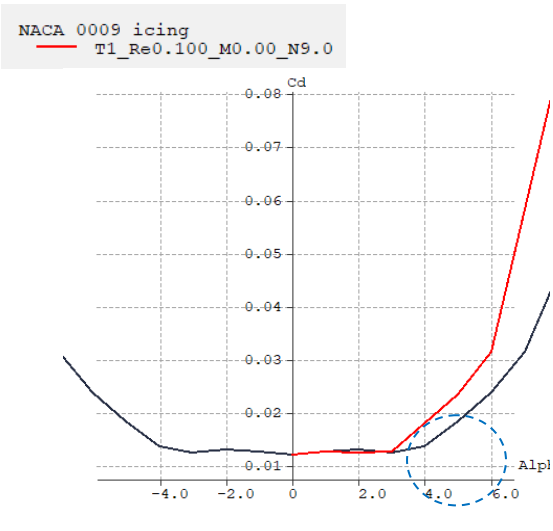


FIG. 4.5 Drag coefficient variation(C_d) vs AoA (alpha)

According to figure 4.6, the icing phenomenon affects the aerodynamic fineness / gliding ratio (C_l/C_d) with the increase of the angle of attack after the value of 3°, which has a direct influence on the decrease of the airfoil efficiency (see figure 4.7).

d. bi-dimensional aerodynamic analysis conclusions

Given the choice of small icing deposits on the leading edge of the airfoil, the comparative analysis of the two geometries shows an alteration of the relevant aerodynamic coefficients, especially after the angle of attack of 3°, AoA at which the airfoil of the propeller blades operates in current mode.

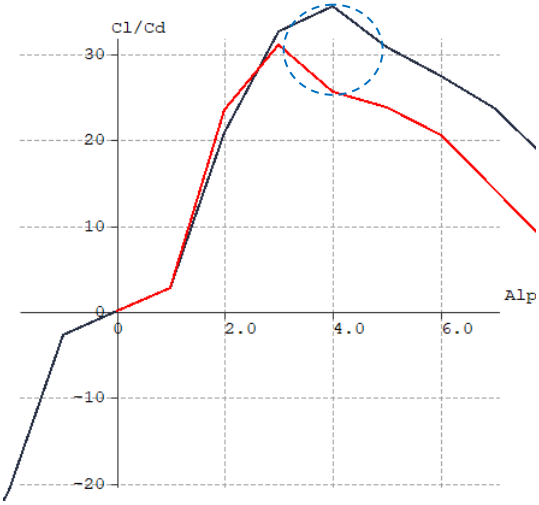


FIG.4.6 Gliding ratio variation (Cl/Cd)) vs AoA (alpha)

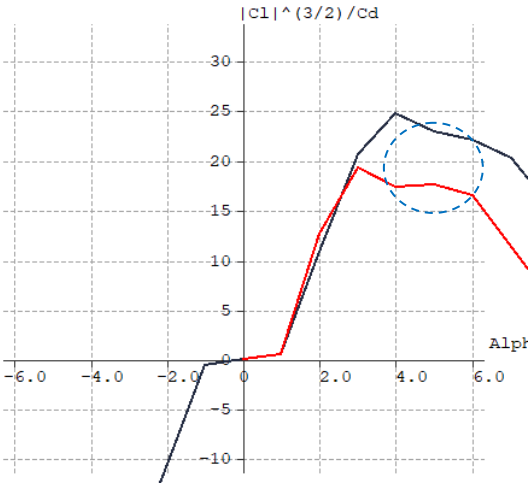


FIG.4.7 Airfoil efficiency variation (Cl^3/Cd^2)) vs AoA (alpha)

4.2. 3D analysis

To highlight the influence of icing on performance on a three-bladed propeller, we chose to perform a three-dimensional aerodynamic analysis on a theoretical geometry, with a slight icing present on the central area of the blade (according to Figure 1.3), the analysis steps being as follows:

a. definition of the theoretical geometry of the two (triple) propellers, having the characteristics and performances from table 4.2, see also figure 4.8.

Table 4.2. Propeller performances and characteristics

Features	Value	Features	Value
Diameter	2100 mm	Hub diameter	100 mm
Blade nmber	3	Airfoil	NACA 009
Blade form	Eliptical	Absolut twist angle	22º

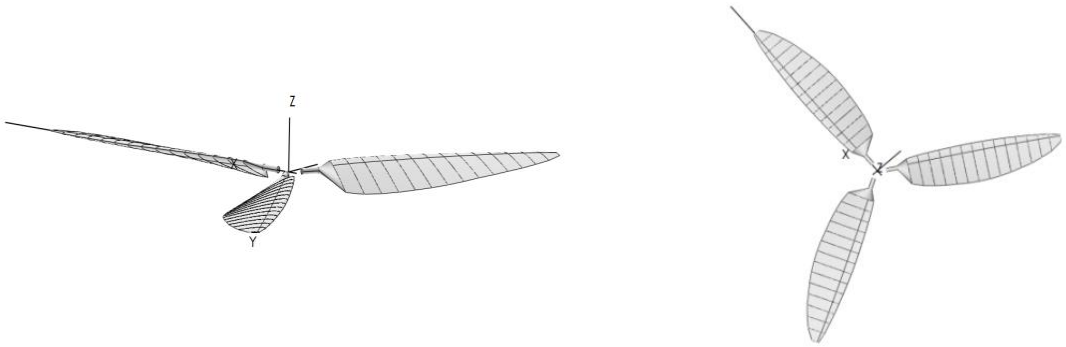


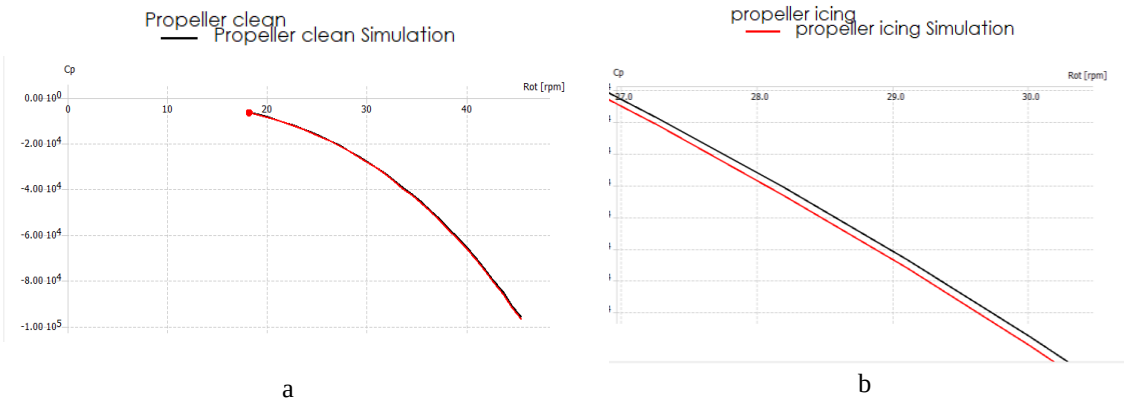
FIG. 4.8 Theoretical propeller for comparative analysis

b. analysis conditions (atmospheric and kinetics), table 4.3:

Table 4.3. Analysis conditions

Parameter	**Value**	**Parameter**	**Value**
Air density	1,225 kg/m^3	Angle of incidence	-10º... 10º
Air viscosity	1,5x10^{-5}	Boundary layer	yes
Analysis	viscous	Iterations	100

c. grapho-numerical results and discussions, see figures 4.9 – 4.10



a b

FIG.4.9 Power coefficient variation (C_p) vs rotation speed
(a. whole values interval, b. details)

According to figure 4.9a we observe a similar variation for the two geometries and the decrease of the values of the power coefficient (c_p) over the whole range of the speed value of the propeller (fig. 49b). Figure 4.10 shows a decrease of the traction coefficient (c_t) for the icing propeller geometry over the entire speed range.

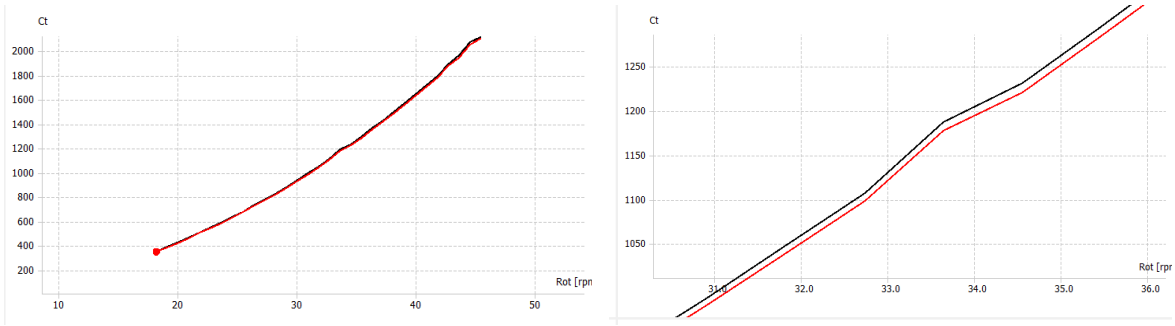


FIG.4.10 Traction coefficient variation (C_t) vs rotation speed
(a. whole values interval, b. details)

The torque coefficient (C_m) has a divergent variation of the values of the two geometries (non-icing / icing propeller) as the rotational speed increases, see figure 4.11.

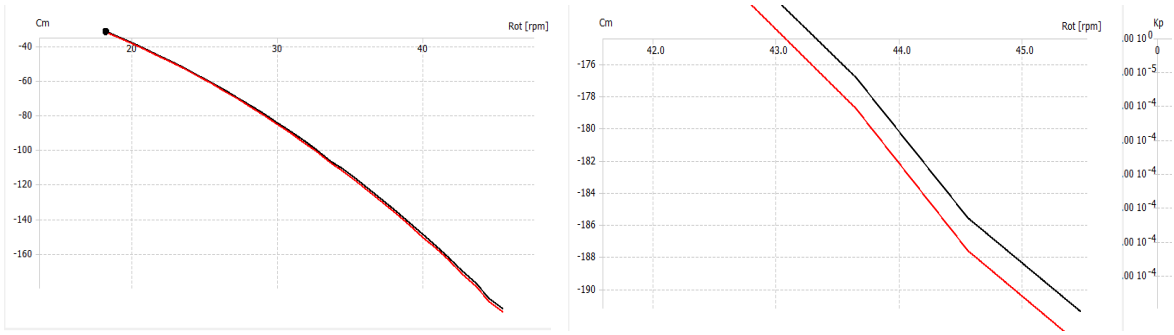


FIG.4.11 Moment coefficient (C_m) vs rotation speed
(a. whole values interval, b. details)

Figure 4.12a shows a decrease in the value of the normal force expressed by the coefficient c_n depending on the local value of the radius (pos/m), the presence of icing in the central area of the blade (0.48 ÷ 0.52 pos/m) indicates a reduction in value characteristic coefficient cn, (see figure 4.12c).

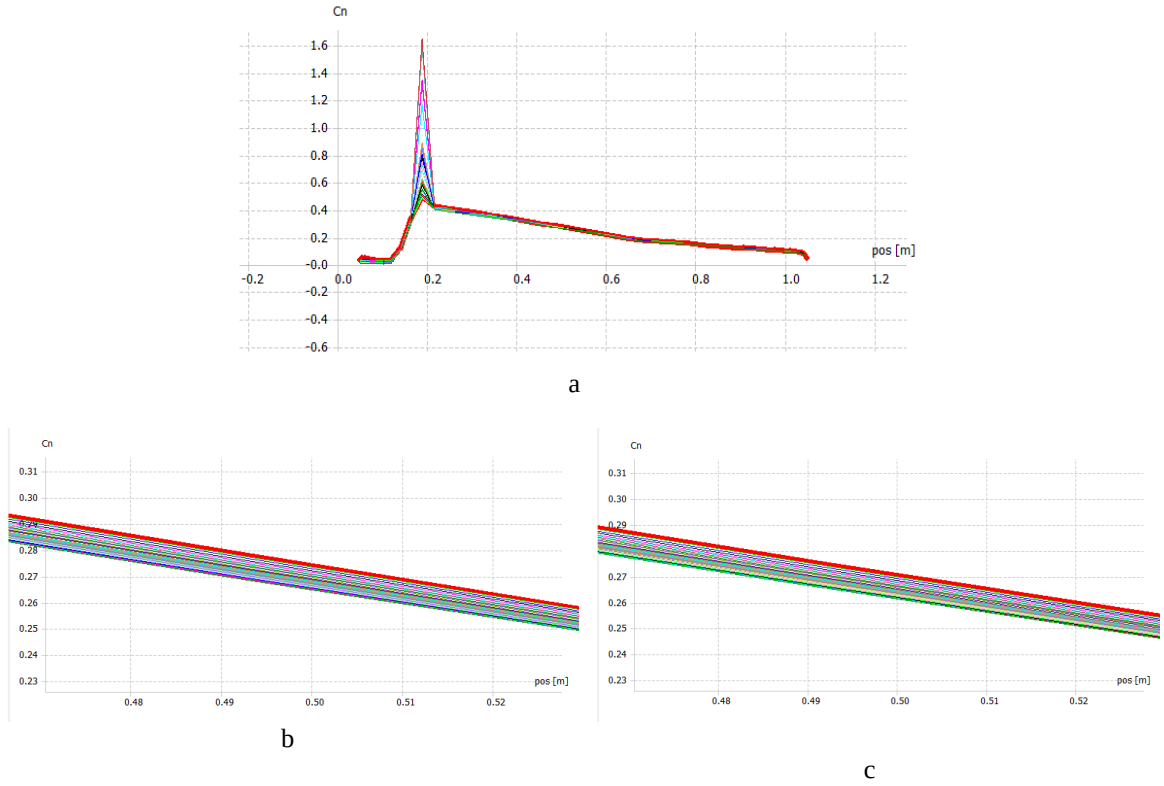


FIG.4.12 Normal axial force coefficient variation (C_n) vs local radius
(a. whole values interval, b. details for non-icing propeller, c. details for icing propeller)

d. conclusions of the 3D aerodynamic analysis

In the case of 3D analysis, a small icing deposition indicates a change in the values of the relevant coefficients, values obtained in the case of theoretical geometries similar to the propellers used by general aviation aircraft.

CONCLUSIONS

The article highlighted the influence of the presence of a small icing deposit defined on the central area of a theoretical propeller using a freeware tool that provides results with a limited degree of confidence in the calculation method and the numerical code used.

The limits of the aerodynamic analysis are influenced both by the degree of reproduction of the icing geometry on the leading edge of the profile and by the degree of confidence of the numerical method that substantiates the approach of the software instrumentation.

The main results revealed a significant influence of icing on the aerodynamic and performance variables of propellers of combustion engine-powered aircrafts. Thus, the lift coefficient, the drag coefficient and the pitch moment coefficient variables were significantly altered in icing contamination leading the aircraft to unstable flight conditions. If no intervention is considered, the risk of flight events is considerably high.

For a refined multi-criteria comparative analysis of icing cases, the instrumentation of a real situation is considered both from an atmospheric and kinetic point of view (aspect transposed in the quantity, area and shape of the icing) and from a geometrically relevant point of view, similar to an aircraft or of a 1: 1 scale construction element.

Future study directions are based on a 2D and 3D geometric parameterization of icing deposits in conditions of atmospheric and kinetic similarity that reproduce scenarios with high degrees of confidence. The 2D and 3D aerodynamic analyzes will use CFD instruments based on finite element methods and will be applied to the actual geometries of the rotating bearing surfaces (propellers) of the operational aircraft.

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ANEXES

Propeller geometrical data without icing

Blade Export File Created with QBlade v0.96 64bit v0.96 on 20.08.2021 at 20:07:32

Radial Position [m]	Chord Length [m]	Twist [deg]	Pitch Axis Offset [m]	Thread Axis in [% chord]	Airfoil Name
5.00000e-02	2.00000e-02	0.00000e+00	0.00000e+00	2.50000e-01	Circular Foil
1.12500e-01	2.00000e-02	0.00000e+00	0.00000e+00	2.50000e-01	Circular Foil
1.75000e-01	1.70000e-01	-2.60000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
2.38000e-01	2.00000e-01	-2.40000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
3.00000e-01	2.15000e-01	-2.20000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
3.63000e-01	2.25000e-01	-2.00000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
4.25000e-01	2.30000e-01	-1.80000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
4.87500e-01	2.35000e-01	-1.60000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
5.50000e-01	2.35000e-01	-1.40000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
6.13000e-01	2.30000e-01	-1.20000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
6.75000e-01	2.20000e-01	-1.00000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
7.38000e-01	2.05000e-01	-9.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
8.00000e-01	1.85000e-01	-8.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
8.63000e-01	1.65000e-01	-7.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
9.25000e-01	1.35000e-01	-6.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
9.87500e-01	1.00000e-01	-5.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
1.05000e+00	4.00000e-02	-4.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean

Propeller geometrical data with icing

QBlade Export File Created with QBlade v0.96 64bit v0.96 on 26.01.2022 at 21:14:59

Radial Position [m]	Chord Length [m]	Twist [deg]	Pitch Axis Offset [m]	Thread Axis in [% chord]	Airfoil Name
5.00000e-02	2.00000e-02	0.00000e+00	0.00000e+00	2.50000e-01	Circular Foil
1.12500e-01	2.00000e-02	0.00000e+00	0.00000e+00	2.50000e-01	Circular Foil
1.75000e-01	1.70000e-01	-2.60000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
2.38000e-01	2.00000e-01	-2.40000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
3.00000e-01	2.15000e-01	-2.20000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
3.63000e-01	2.25000e-01	-2.00000e+01	0.00000e+00	2.50000e-01	NACA 0009 clean
4.25000e-01	2.30000e-01	-1.80000e+01	0.00000e+00	2.50000e-01	NACA 0009 icing
4.87500e-01	2.35000e-01	-1.60000e+01	0.00000e+00	2.50000e-01	NACA 0009 icing
5.50000e-01	2.35000e-01	-1.40000e+01	0.00000e+00	2.50000e-01	NACA 0009 icing
6.13000e-01	2.30000e-01	-1.20000e+01	0.00000e+00	2.50000e-01	NACA 0009 icing
6.75000e-01	2.20000e-01	-1.00000e+01	0.00000e+00	2.50000e-01	NACA 0009 icing
7.38000e-01	2.05000e-01	-9.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 icing
8.00000e-01	1.85000e-01	-8.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 icing
8.63000e-01	1.65000e-01	-7.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
9.25000e-01	1.35000e-01	-6.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
9.87500e-01	1.00000e-01	-5.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean
1.05000e+00	4.00000e-02	-4.00000e+00	0.00000e+00	2.50000e-01	NACA 0009 clean

C_p vs rotation

Export File Created with QBlade v0.96 64bit on 26.01.2022 at 20:59:59

Propeller clean Simulation		propeller icing Simulation	
Rot [rpm]	Cp	Rot [rpm]	Cp
1.81891e+01	-6.27941e+03	1.81891e+01	-6.34570e+03
1.90986e+01	-7.25669e+03	1.90986e+01	-7.33349e+03
2.00080e+01	-8.32650e+03	2.00080e+01	-8.41478e+03
2.09175e+01	-9.49930e+03	2.09175e+01	-9.60017e+03
2.18270e+01	-1.08242e+04	2.18270e+01	-1.09388e+04
2.27364e+01	-1.21646e+04	2.27364e+01	-1.22941e+04
2.36459e+01	-1.36667e+04	2.36459e+01	-1.38124e+04
2.45553e+01	-1.52863e+04	2.45553e+01	-1.54495e+04
2.54648e+01	-1.70279e+04	2.54648e+01	-1.72101e+04
2.63742e+01	-1.89005e+04	2.63742e+01	-1.91030e+04
2.72837e+01	-2.09003e+04	2.72837e+01	-2.11247e+04
2.81932e+01	-2.30382e+04	2.81932e+01	-2.32859e+04
2.91026e+01	-2.53227e+04	2.91026e+01	-2.55953e+04
3.00121e+01	-2.77445e+04	3.00121e+01	-2.80437e+04
3.09215e+01	-3.03256e+04	3.09215e+01	-3.06530e+04
3.18310e+01	-3.30624e+04	3.18310e+01	-3.34196e+04
3.27404e+01	-3.59532e+04	3.27404e+01	-3.63421e+04
3.36499e+01	-3.93401e+04	3.36499e+01	-3.97625e+04
3.45594e+01	-4.22104e+04	3.45594e+01	-4.26681e+04
3.54688e+01	-4.56203e+04	3.54688e+01	-4.61153e+04
3.63783e+01	-4.91860e+04	3.63783e+01	-4.97202e+04
3.72877e+01	-5.29466e+04	3.72877e+01	-5.35221e+04
3.81972e+01	-5.68965e+04	3.81972e+01	-5.75152e+04
3.91066e+01	-6.10354e+04	3.91066e+01	-6.16996e+04
4.00161e+01	-6.53528e+04	4.00161e+01	-6.60646e+04
4.09256e+01	-6.98785e+04	4.09256e+01	-7.06402e+04
4.18350e+01	-7.46257e+04	4.18350e+01	-7.54394e+04
4.27445e+01	-7.99135e+04	4.27445e+01	-8.07817e+04
4.36539e+01	-8.48777e+04	4.36539e+01	-8.58027e+04
4.45634e+01	-9.09396e+04	4.45634e+01	-9.19239e+04
4.54728e+01	-9.56890e+04	4.54728e+01	-9.67349e+04

C_p vs rotation

Export File Created with QBlade v0.96 64bit on 26.01.2022 at 21:03:03

Propeller clean Simulation		propeller icing Simulation	
Rot [rpm]	Ct	Rot [rpm]	Ct
1.81891e+01	3.51583e+02	1.81891e+01	3.48733e+02
1.90986e+01	3.86737e+02	1.90986e+01	3.83600e+02
2.00080e+01	4.22901e+02	2.00080e+01	4.19457e+02
2.09175e+01	4.61507e+02	2.09175e+01	4.57743e+02
2.18270e+01	5.05543e+02	2.18270e+01	5.01448e+02
2.27364e+01	5.42705e+02	2.27364e+01	5.38264e+02
2.36459e+01	5.85543e+02	2.36459e+01	5.80739e+02
2.45553e+01	6.30182e+02	2.45553e+01	6.25004e+02
2.54648e+01	6.76334e+02	2.54648e+01	6.70767e+02
2.63742e+01	7.24831e+02	2.63742e+01	7.18860e+02
2.72837e+01	7.73771e+02	2.72837e+01	7.67384e+02
2.81932e+01	8.24857e+02	2.81932e+01	8.18038e+02
2.91026e+01	8.78145e+02	2.91026e+01	8.70880e+02
3.00121e+01	9.32198e+02	3.00121e+01	9.24479e+02
3.09215e+01	9.88796e+02	3.09215e+01	9.80599e+02
3.18310e+01	1.04723e+03	3.18310e+01	1.03855e+03
3.27404e+01	1.10697e+03	3.27404e+01	1.09778e+03
3.36499e+01	1.18718e+03	3.36499e+01	1.17748e+03
3.45594e+01	1.23058e+03	3.45594e+01	1.22035e+03
3.54688e+01	1.29419e+03	3.54688e+01	1.28342e+03
3.63783e+01	1.36146e+03	3.63783e+01	1.35013e+03
3.72877e+01	1.42777e+03	3.72877e+01	1.41586e+03
3.81972e+01	1.49894e+03	3.81972e+01	1.48645e+03
3.91066e+01	1.56982e+03	3.91066e+01	1.55673e+03
4.00161e+01	1.64099e+03	4.00161e+01	1.62729e+03
4.09256e+01	1.71698e+03	4.09256e+01	1.70265e+03
4.18350e+01	1.79211e+03	4.18350e+01	1.77713e+03
4.27445e+01	1.88703e+03	4.27445e+01	1.87140e+03
4.36539e+01	1.95832e+03	4.36539e+01	1.94202e+03
4.45634e+01	2.06791e+03	4.45634e+01	2.05093e+03
4.54728e+01	2.11205e+03	4.54728e+01	2.09437e+03

C_m vs rotation

Export File Created with QBlade v0.96 64bit on 26.01.2022 at 21:06:50

Propeller clean Simulation		propeller icing Simulation	
Rot [rpm]	Cm	Rot [rpm]	Cm
1.81891e+01	-3.13971e+01	1.81891e+01	-3.17285e+01
1.90986e+01	-3.45557e+01	1.90986e+01	-3.49214e+01
2.00080e+01	-3.78477e+01	2.00080e+01	-3.82490e+01
2.09175e+01	-4.13013e+01	2.09175e+01	-4.17399e+01
2.18270e+01	-4.51007e+01	2.18270e+01	-4.55784e+01
2.27364e+01	-4.86582e+01	2.27364e+01	-4.91766e+01
2.36459e+01	-5.25641e+01	2.36459e+01	-5.31248e+01
2.45553e+01	-5.66158e+01	2.45553e+01	-5.72205e+01
2.54648e+01	-6.08138e+01	2.54648e+01	-6.14646e+01
2.63742e+01	-6.51740e+01	2.63742e+01	-6.58725e+01
2.72837e+01	-6.96677e+01	2.72837e+01	-7.04157e+01
2.81932e+01	-7.43167e+01	2.81932e+01	-7.51158e+01
2.91026e+01	-7.91335e+01	2.91026e+01	-7.99855e+01
3.00121e+01	-8.40742e+01	3.00121e+01	-8.49810e+01
3.09215e+01	-8.91931e+01	3.09215e+01	-9.01558e+01
3.18310e+01	-9.44639e+01	3.18310e+01	-9.54845e+01
3.27404e+01	-9.98700e+01	3.27404e+01	-1.00950e+02
3.36499e+01	-1.06325e+02	3.36499e+01	-1.07466e+02
3.45594e+01	-1.11080e+02	3.45594e+01	-1.12284e+02
3.54688e+01	-1.16975e+02	3.54688e+01	-1.18244e+02
3.63783e+01	-1.22965e+02	3.63783e+01	-1.24300e+02
3.72877e+01	-1.29138e+02	3.72877e+01	-1.30542e+02
3.81972e+01	-1.35468e+02	3.81972e+01	-1.36941e+02
3.91066e+01	-1.41943e+02	3.91066e+01	-1.43487e+02
4.00161e+01	-1.48529e+02	4.00161e+01	-1.50147e+02
4.09256e+01	-1.55286e+02	4.09256e+01	-1.56978e+02
4.18350e+01	-1.62230e+02	4.18350e+01	-1.63999e+02
4.27445e+01	-1.70029e+02	4.27445e+01	-1.71876e+02
4.36539e+01	-1.76828e+02	4.36539e+01	-1.78756e+02
4.45634e+01	-1.85591e+02	4.45634e+01	-1.87600e+02
4.54728e+01	-1.91378e+02	4.54728e+01	-1.93470e+02

C_n vs propeller radius (partial selection)

Export File Created with QBlade v0.96 64bit on 26.01.2022 at 21:05:15

pos [m]	Cn	pos [m]	Cn
5.14671e-02	3.41813e-02	5.14671e-02	3.08218e-02
5.14671e-02	3.08218e-02	5.14671e-02	2.87991e-02
5.58598e-02	4.76439e-02	5.58598e-02	4.35905e-02
5.58598e-02	4.35905e-02	5.58598e-02	4.00628e-02
6.31523e-02	4.58045e-02	6.31523e-02	4.20451e-02
6.31523e-02	4.20451e-02	6.31523e-02	3.87924e-02
7.33018e-02	4.03834e-02	7.33018e-02	3.72505e-02
7.33018e-02	3.72505e-02	7.33018e-02	3.45285e-02
8.62488e-02	3.48793e-02	8.62488e-02	3.22565e-02
8.62488e-02	3.22565e-02	8.62488e-02	2.99453e-02
1.01917e-01	2.98897e-02	1.01917e-01	2.76319e-02
1.01917e-01	2.76319e-02	1.01917e-01	2.56290e-02
1.20215e-01	3.18929e-02	1.20215e-01	3.00860e-02
1.20215e-01	3.00860e-02	1.20215e-01	2.86672e-02
1.41035e-01	1.27271e-01	1.41035e-01	1.25376e-01
1.41035e-01	1.25376e-01	1.41035e-01	1.23676e-01
1.64255e-01	3.26282e-01	1.64255e-01	3.24057e-01
1.64255e-01	3.24057e-01	1.64255e-01	3.22063e-01
1.89739e-01	4.87896e-01	1.89739e-01	6.21311e-01
1.89739e-01	6.21311e-01	1.89739e-01	5.10598e-01
2.17337e-01	4.20703e-01	2.17337e-01	4.18895e-01
2.17337e-01	4.18895e-01	2.17337e-01	4.17258e-01
2.46887e-01	4.06810e-01	2.46887e-01	4.05231e-01
2.46887e-01	4.05231e-01	2.46887e-01	4.03802e-01
2.78216e-01	3.91157e-01	2.78216e-01	3.89768e-01
2.78216e-01	3.89768e-01	2.78216e-01	3.88357e-01
3.11140e-01	3.75153e-01	3.11140e-01	3.73878e-01
3.11140e-01	3.73878e-01	3.11140e-01	3.72722e-01
3.45466e-01	3.57666e-01	3.45466e-01	3.56533e-01
3.45466e-01	3.56533e-01	3.45466e-01	3.55509e-01

THE LEGENDARY HORIA AGARICI BETWEEN MYTH AND PROPAGANDA

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***Abstract**: Captain Horia Agarici has certainly become a legend. His story has become a myth, and myths must live on. After all, they can't even be touched by time. The notoriety of the famous aviator was also preserved due to Păstorel Teodoreanu's poem, made into a song by Gherase Dendrino in the summer of 1941: "He went hunting, Agarici / He went to hunt Bolsheviks…"[1], a fashionable hit between 1941-1944, a period during which Romania was leading a crusade against communism! Broadly speaking, Horia Agarici's life was accessible to the general public after 1989, and it appeared, in part, even on the ultra-publicized Wikipedia [1]. But most of the details were brought to light, naturally, by post-communist newspapers. Horia Agarici (born April 6, 1911, Lausanne, Switzerland, d. 1982, Constanța, Romania) was a major aviator in the Romanian Air Force, one of the elite aviators of the Romanian Army during the Second World War, a poet and a Romanian author [2]. For his extraordinary deeds of bravery during the Second World War, he was also nicknamed "The Savior of [the city of] Constanța"[3].*

***Keywords**: Agarici. pilot, aviation, The Second World War.*

1. INTRODUCTION

Horia Agarici went down in history. He was the first Romanian aviator to shoot down three enemy bombers in a single air battle [4]. However, in order to be correct, it should be mentioned that the reputation of the "Savior of Constanța", which the aviator has today in Romania, is an exaggeration. The six Soviet twin-engines could not have wiped the city off the map, even if they met with no resistance. Sorin Turturică notes that: "General Gheorghe Jienescu, the commander of the Romanian Royal Air Force, understood that he was wrong to leave Constanța defenseless. To divert attention from this, he called on the media to focus on the three bombers shot down by Agarici. Thus, Lieutenant Horia Agarici benefited from huge publicity. The newspapers and the radio presented the deed to him in detail, and within a short while, a song composed by Gherase Dendrino and based on a poem by Păstorel Teodoreanu came out to honor him. It began as follows: "He went hunting, Agarici / He went to hunt Bolsheviks"[2]. He became known as the "Bolshevik Hunter", a name which, given his discreet nature, he probably did not even appreciate [5].

[1] The original lyrics were: "What do you hear coming from afar, O Leano? / Agarics, / He went to hunt the Bolsheviks / He left the horizon" (translation by Florian Bichir).

[2] Ion Dicezare, ace of the war and a group colleague claims that he was composed on June 23, 1941 at the restaurant "Tanti Lenuța" in the "saved city" - Constanta - by the taraf there. During the party given by Georgescu "The Snake" in honor of Agarici, Ion Țaralungă, our great aviation and naval painter, claimed from archival sources, including the testimony of radio master lllescu, that the text belongs to Păstorel Teodoreanu, idea claimed by ROMANIAN WINGS.

2. UNDER INVESTIGATION BY THE INTELLIGENCE BUREAU

In July 1941, General Ion Antonescu came to Constanţa to award Agarici a medal of honr and talked to him for about half an hour. They're talking about the war, the Hurricane, and the legendary fight. It was too much for the denigrators, and the next day the false rumor circulated in the Squadron that Horia was wearing a green Legionnaire's uniform! It was hilarious that the hero had been arrested on the spot and referred to the Court Martial at that time for such a ridiculous challenge. It was said that when Ion Antonescu came to the beach to decorate Horia Agarici, the aviator unpacked his jacket and asked the General to pin the decoration on his green, Legionnaire shirt. The episode is not real. The Second Intelligence Bureau (a military structure) investigated the origin of this legend and concluded that it had been put into circulation by Legionnaire sympathizers on the front. Secondly, Antonescu was not the man to tolerate such an insult from a lieutenant and for Horia Agarici, serious consequences would have probably followed.

In fact, in 1953, referring to this episode, Agarici wrote that had he shown the General his green shirt, he could have been given "hell, right then and there!" [5]. Documents in the custody of the CNSAS must be kept private in their circumstances. If in 1946 it was established without any doubt that Agarici was not a legionnaire, two years later, in 1948, the note was almost designated by a captain of theirs. The explanation is simple. The intelligence officers had begun to fill the prisons, and Soviet councilors or party members had taken over and were now fully installed in their seats of power.

It is certain that Horia Agarici does not receive very commendable notes from the Special Intelligence Service (SSI). A note from August 1946 summarized the notes on the aviator: "From the Special Intelligence Service the above-mentioned is known from the file 3089 vol. 56, tab 307, note of the General Staff - Information Section, Nr. 322070 of 16 September 1942, by which it signals that on the evening of 5 Sept. 1942, at the « Halelor » restaurant in Ploești, a group of legionnaires who were still active at the time participated in a party, in a repaired room, where they placed the portrait of Corneliu Z. Codreanu. Among those who participated in that party was Lt. aviator AGARICI HORIA.

It is suspected that it was about organizing a group, disguised as a party, and for the day of September 8th 1942, a new meeting was held at the same place and with the same people. With No. 24948 of 22 Sept. 1942, it is answered to the General Staff, that on the evening of 5/6 Sept. 1942, Lt. aviator AGARICI HORIA, had lunch with several aviation officers, at the restaurant « Halelor Centrale », in Ploești, leased by brothers Dumitru and Niculae Călinescu, a party that lasted until 7 o'clock in the morning, mentioning it is known that the place does not have separate rooms, but only a small terrace, on which usually climbs the disguise Stângaciu Virginia, with different individuals.

It is mentioned that Lt. aviator AGARICI HORIA, did not come to Ploești especially for that party, because he had been appointed since February 1942, and he was invited to the Târgșor Aviation Group. In addition, when he was not on a mission, he used to party with many different friends, through various places in the city. Since the above-mentioned date, Lt. aviator AGARICI HORIA has not been seen on the premises and according to the intelligence on the matter, he had gone on a mission, probably to the front.

It is noted that the "Securitate" brach of the Ploești Police Questor received several complaints against the Călinescu brothers, that they would contribute for the families of the imprisoned Legionnaires, with amounts of 26,000 lei per month.

It is shown that indeed, the place was auctioned, under the legionary regime and this situation forced the above to a quota for "Legionnaire Aid", but after the fall of the Legionnaire regime, the Călinescu brothers gave up their donations, for which reason they received telephone threats, that they would suffer for their attitude.

The head of the Ploiești Securitate claims that the named CĂLINESCU DUMITRU requested the help of the police, in order to catch a messenger of the Legionnaire movement who had come to ask them for money, so it is assumed that the complaints were made out of revenge.

At the General Directorate of Police, the former aviation captain AGARICI HORIA is known from doc. no. 19735, 1942, because of a note of the General Staff - Section II Intelligence, that on the evening of September 5th 1942, a group of Legionnaires together with AGARICI HORIA, partied at Ștefaniuc's restaurant "Halelor", in Ploești, and it was suspected that the party had been a camouflaged Legionnaire assembly.

Ploiești City Police reports that Lt. aviator AGARICI HORIA was moved to the Târgșor - Prahova Aviation Group in February, and that when he was not on a mission, he was having parties in the city of Ploești, with his friends. It is confirmed that the aforementioned on the evening of September 5/6, 1942, he dined at the restaurant "Halelor" with several officers and then partied until 4 in the morning, together with the owner of the place.

AGARICI HORIA was not been seen since then and is believed to have been deployed on the frontline. In the same case, J. Nr. 45330/942, we find the address of the Presidency of the Council of Ministers, Nr. 27729 of November 14, 1942, which requires information whether the aviator Capt. AGARICI HORIA, from an NCO school in Mamaia, was participating in the Legionnaire meetings of the village of Basarabeni, as he had often been seen, on a motorcycle, outside the city, going towards the said rural area, where he used to meet T.R. TEODORESCU, at the Basarab Collection Center and ȘERBAN CONSTANTIN, both leaders of the Legionnaire organization.

At the Special Intelligence Service, the named person is known from file No. 25, table 306, by which known Legionnaire CERNEA - the owner from Tunari - is reported to be spreading the rumor that “Lt. aviator AGARICI wears the green Legionnaire shirt under his aviator jacket". In reality, the subject of the said description was not and is not a Legionnaire. In File 26, tab 16, there is a note from July 24, 1941, which indicates that the Legionnaire circles had adapted by means of a new type of propaganda, by the statements that most acts of bravery are due to the legionary elements, and in this context quoting AGARICI HORIA.

Such versions of historical biographies were intended to create propaganda in favor of the Legionnaire movement. In file 30, tab 484, there is an informative note out of 24 which states that the legionaries began an intense informative activity with the German Legation, seeking to convince the Germans that the Legionnaires are their sincere collaborators, for which purpose they provided the information that the hero pilot AGARICI HORIA had been tried and convicted, for the fact that he expressed his beliefs openly, spreading Legionnaire propaganda in the military and even having asked to be allowed to wear a green shirt.

In file 56, pages 307–308 there is an informative note from the Intelligence Service of October 28, 1942, by which AGARICI HORIA is reported to have been seen repeatedly, riding his motorcycle Basarab - Constanța, to get in touch with T.R. TEODORESCU, from the Basarab Collection Center and ȘERBAN CONSTANTIN, both leaders of the clandestine Legionnaire organization.

The verifications made for this purpose, and communicated with Nr. 47705 of November 9, 1942, shows that according to the population of Com. Basarab - Constanța, AGARICI HORIA allegedly took part in some parties in the pub of a Legionnaire called ȘTEFAN, together with several other Legionnaires, including the so-called ALEANDRESCU PUIU, former collector, who was the spiritual leader of the movement, ȘERBAN CONSTANTIN, a main pilot in Legionnaire propaganda and TEODORESCU GHEORGHE, a platoon leader.

AGARICI HORIA was coming by car or motorcycle from Constanța, but it could not be proved that he had taken part in the Legionnaire meetings. By an informative note from January 1944, the said AGARICI HORIA is reported as a Legionnaire sympathizer during his service at the "Mamaia" Shooting and Air Bombing School, during which he was observed in the entourage of several notorious Legionnaires.

As a confirmation of this mutual affinity, which the pilot enjoyed within the Legionnaire circles, it is mentioned that the Legionaries used to hum with predilection the song: "Agarici went hunting". In file no. 52, we find the address of the General Staff - Section II Counter-Intelligence No. 2118406 of 2.VIII.1942, accompanied by an informative note stating that a very brave young aviator shot down several Russian bombers, knowing how to fly on a Russian silhouette plane.

The superiors of the young aviator, enthusiastic about his success, proposed him for a medal, but on the day when the decoration was to be made, the general asked him how he had managed to act with such bravery and how he had so much courage, the young aviator took off his military coat, pointed to the green shirt, saying that it represented his courage and his very soul. Then the general refused to give him the decoration and erased it according to the table that had been approved.

With such propaganda systems, it has come to Ploiești that many other former Legionnaire supporters had once again shown their impudence and threatened the peaceful citizens, whose mentality refuses to believe what the interested parties had said. The Special Intelligence Service, on August 12, 1942, responding to the General Staff, shows that the new aspect of the legionary propaganda mentioned in the raised note is known to that Service, a few months before and this propaganda is designed within clandestine Legionnaire circles, in order to maintain the morale of the memories of the movement, sometimes claiming that the fake episode had happened to Lt. av. AGARICI HORIA, whose decoration shows that it was to be awarded by the former Marshal I. Antonescu.

At the Capital's Police Prefecture, it is now known, from the information and verifications made on the field, that HORIA AGARICI took part in several naval air battles since 1943/1944, by order of the Ministry of the National Apostle, and was assigned to the 1st Pipera Hunting Base. In the circle of his superiors and acquaintances, he is indicated as an evil element, being often punished for misconduct and negligence in office.

He is also known to have been suffering and is being treated for an illness that made him almost unfit for service. Also, the commander of the 1st Pipera Hunting Base informs that while AGARICI HORIA was on duty at the Constanța Naval Bases, in 1941, while we were at war with the U.R.S.S., he shot down several Russian planes during an air battle.

On this subject, a public rumor began to circulate that on occasion of the ceremony during which medals were supposed to be awarded, Lt. AGARICI HORIA had opened his jacket, showing his green shirt and asking that those decorations be attached to his green shirt.

According to the commander's statements, AGARICI HORIA, taking note of these versions of the story, wrote a memorandum to General JIENESCU, then Undersecretary of State for Air Command, asking him to communicate through the press that those versions were inaccurate and that the appointee was not a Legionnaire.

In response, several intelligence reports noted opposite facts. For example: "PROPOSITIONS: We believe that this report, together with the attached items, should be presented in the final report to the Director of the Security Police of this Police Headquarters, in order to dispose on the necessary steps to be taken". Another note from 19 July 1948 added: "February 1941: from the inquiries made at the Pipera Air Flotilla, we established that Commander of 47 Hunting Squadron AGARICI is a fanatical Legionnaire and does not shy off from carrying out a lively Legionnaire propaganda among the Air Force officers and soldiers".

"January 28, 1946 - February 1, present year, Commander SARACELI from the British Mission, accompanied by Capt. AGARICI, were reported to have been to Galaţi and Brăila together, photographing port facilities, workshops, docks and warehouses as well as some uninhabited positions. In one of these cities, the local Soviet Commander banned them from entering the port. After having lunch with the Soviet port Commander, the two received permission to enter the port to take pictures" [6].

2. „I HAVE BEEN ACCUSED EITHER OF ANGLOPHILIA, OR OF LEGIONARY SYMPATHIES, AND EVEN OF BOLSHEVISM"

For years, Horia Agarici struggled with this story of Legionarism. Although "Signaling Serv. S.S.I. of July 11, 1941 established that all the above were nothing but legions of Legionary propaganda, in reality Agarici was not and is not a legionnaire".

As early as 1943, Horia Agarici had written a memorandum to the Minister of the Air Command. Here is the "Report No. 12 Confidential-Personal, of March 18, 1943 to the Minister of the Air Command": "I feel compelled to respectfully report that one day after Mr. Marshal Antonescu's visit to the 53rd Squadron in Constanța, from July 1941 until today, I have suffered unjustly and continuously the slanders spread among the military and civilians throughout the country, which are supposed to demonstrate that I am a Legionnaire.

The first time I found out about this was the day after the visit reported above, from Lt. Av. Toma Lucian Eduard (now Captain Aviator, dead), who, after being evacuated in the city of Constanța on the evening of his visit, communicated to us the next day, at the table, in front of all the navigating personnel of the Squadron, the following, which he had overheard while back in the city: it was said that the Marshal congratulated me on the battle of July 23, 1941 and wanted to distinguish me with the Mihai Viteazul medal of honor, and that I would have then unbuttoned my coat, full of emphasis, requesting that my decoration be attached to the green shirt ... which I had been allegedly wearing under my military coat. Everything is a lie, as all the officers who were present know. When the Marshal was kind enough to speak to me, the Marshal congratulated me, told me that he had decorated me, and then he was kind enough to keep me informed about the material (flying material) and the methods of maintenance and combat. Later, when I saw that this absurdity communicated to us, and too soon, by Lt. Av. Toma Lucian, was spreading all over the country, I first suspected Lt. Av. Thomas Lucian himself of having spread this rumor, but I could not prove anything.

This is all I proved: the next day after the visit of the Marshal, Lt. Av. Toma Lucian was the first to tell the story of the green shirt at the table, in front of Capt. Georgescu Emil, Second Lt. mechanic Gomolea Matei, Chief Master Sgt. Rădulescu Andrei, Master Sgt. Popescu Constantin, Master Sgt. Comenceanu Eugen (†), Master Sgt. Cordescu Petre, Master Sgt. Bânceanu, all part of the 53rd Hunting Squadron, then in Mamaia. After that and until today, absurd rumors followed constantly, which always insisted on the fact that, for reasons of my Legionaire sympathies, I would have been punished, taken to camp, exiled, imprisoned in the mountains, etc.

At one point, my father, out of his mind, went to the General Staff, to General Mazarini, and to other senior officers, for clarification and to suppress these rumors once and for all. There he was told not to worry because these rumors have no basis for all possible controls and that they are based on an agreement between Legionaries to spread rumors that anyone who had carried out any act of bravery brought to the notice of the country, would be labeled a Legionnaire. General Dragalina, much higher in rank and with other possibilities, accused by the legionaries on the radio, expressed his denial in the newspapers, which closed the mouths of the slanderers. I, too small in rank and disregarding rumors started on such an absurd basis, did nothing but report to the Air Force and the M.S.M. where I was called and from a military point of view, I shed light on the truth, without denying the lie in the press. I was also advised by General Mazarini and other senior officers, both from the Land Forces and from the Air Force. However, it turned out that I was wrong, because the lack of an adjustment, from a civilian point of view, had the consequence that the rumors, resumed from one end of the country to another, following the attention given to me according to the MCG Communiqué (Communiqué of the General Headquarters No. 2), continued in a more and more fanciful manner, with the result that today there are a lot of people who, even if I tell them personally that I never had anything to do with the Legionnaires, would not believe it. What is even more serious is that there are high-ranking people in civilian positions and senior officers, who, based on this rumor, came to be convinced that the stories of the Legionnaires and myself were true.

Anyway, due to the fact that I am not too malleable with any arrangement and due to some envy, probably aroused in some people, this rumor can be used against me successfully at any time, if I do not end it. In view of the above, and in order to be able to deploy quietly and with peace of mind and all my unbridled work power, to the front, where I know I will go trying, I am honored to ask you to intervene and approve for me to obtain permission to publish a disavowal note for three days in three major newspapers". Horia Agarici proposed a model of denial: "DISCLAIMER: Air Force Capt. Av. Agarici Horia categorically denies having had the slightest relationship with the Legionnaires, announcing that he was not interested in or ever sympathized with this movement. All the rumors so far have been just unfounded fantasies. At the same time, Capt. Av. Agarici Horia announces that he will immediately prosecute anyone who will be proven to support such rumors. For this, please contact .... (Here is the address of CFA or SSA or of my parents: Constantin Agarici, Alexandru Lahovari Street, Aleea Biserica Albă No. 1 or my own address: Bul. I. Brătianu No. 24, all from Bucharest, as will be approved). I propose to publish this denial for three consecutive days, the first day in a corner of a front page, at least in a newspaper, and the other two days, somewhere in the body of the newspaper, in three newspapers, for which I propose "The Universe", "The Courier" and "Life".

Since there is not the slightest justification, since I have never had anything to share, not even affinity, with the Legionaries, as there is no one in the family, among acquaintances, among friends, among comrades, in all my life, who isn't aware of how little I have to do with politics, which I cannot bear, least of all Legionarism, since I have been accused either of Anglophilia, or of Legionary sympathies, and even of Bolshevism, etc., by persons who do not deserve to be quoted here, I have the right to respectfully ask you to kindly forward this Report to the Minister of the Air Command, allowing me to accompany him if necessary. In any case, in view of my imminent deployment, and considering that this situation can no longer last, I respectfully ask you to admit the urgency, forwarding this report hierarchically to the Minister of Air Command, with the request that it be solved favorably.

Cpt. Av. Agarici Horia."Unfortunately, his effort was in vain, as the accusation would follow him until the end of his life, being taken over by the communists[3]!

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[3] Sorin Turturică claims that the confusion is explicable: Horia had a cousin, Costachel Agarici, with whom he was a comrade in the fighter aviation, and the latter was imprisoned by the communist regime.

ROMANIAN MILITARY PARATROOPERS - 80 YEARS OF HISTORY (1950-2021)

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Abstract:*In 2021, the military paratroopers celebrated 80 years of existence, since their establishment as a specialty, within the Romanian Aeronautics, later as a distinct specialization and generating, in turn, new military specialties, all vital for a military that wants to be modern and proficient. This specialty, established in the Romanian armed forces at the beginning of the Second World War, was an attempt to respond to and align with the needs and, why not, the modernity of the time. Passed through the difficult test of August 1944, disbanded immediately after the war and reborn from its own ashes in 1950, it managed, despite many hardships and sacrifices, some of which were particularly painful, to impose itself as an elite job profile in the panoply of the contemporary Romanian military. Side by side with the Air Force pilots, who always supported them with aircraft and aerodrome infrastructure, the paratroopers wrote history for modern Romania.*

Keywords*: military paratroopers, aeronautics, aerodrome, elite military specialty.*

1. THE EVOLUTION OF THE PARACHUTE TROOPS IN ROMANIA DURING THE COLD WAR

Although the Air Force Command was concerned since the summer of 1948 with the establishment and preparation of a detachment of paratroopers to transform into a parachute battalion during the war and to perform specific air landing missions, it was not completed until the late 1950s [1].

By *Order of the Minister of Armed Forces of the Romanian People's Republic, no. 123239 of October 18, 1950*, [2] on November 1, 1950, the 1st Parachute Battalion was established in Tecuci, within the Aviation Training Center, subordinated to the Military Air Force Command (CFAM).

Based on *Order no. 001179 of January 23, 1951* issued by the Ministry of Armed Forces through the General Staff, on February 6, 1951, the Parachute Battalion changed its deployment from Tecuci to Botoşani, becoming subordinated to the 1st Military Region. After only three months, the battalion was brought back to Tecuci within the Aviation Training Center, where there were better training conditions. Captain Vasile Cosma, the commander of the unit, being appointed commander of the 13th Mixed Aviation Division from Ianca, at the command of the Parachute Battalion was appointed lieutenant-major Grigore Baştan.

He commanded the unit until 1964, when he was admitted to the studies of the Military Academy, after which he was responsible for the parachuting activity within the Command of the Air Defense of the Territory and the Command of the Military Aviation.

In 1971 he was promoted to the rank of major general, after, on May 20, 1970, he set a national height record, with a parachute of 9,500 meters.

At the command of the parachute unit, lieutenant-colonel Gheorghe Şoimu (1964-1969) and lieutenant-colonel Neagu Oţeleanu (1969-1980) followed.

In November 1951, the Parachute Battalion was deployed in the Buzău garrison, at first temporarily in the barracks of a transmission unit. The troops participated in the construction of their own barracks on the northwestern edge of the Crâng forest and thus began the epic of the Romanian military paratroopers in Buzau.

2. THE EVOLUTION OF THE PARATROOPER UNITS BETWEEN 1950 AND 1980

Trying to respond to the ongoing process of transformation of the military body and the need to adapt to the new tasks it received from the country's political leadership, in the complex international politico-military context after World War II, paratroopers suffered over time numerous structural transformations that marked its evolution.

On February 1, 1958, the Research Company was established in the annexed state, intended for the preparation of research elements in the enemy's device launched by parachute. The company was subordinated on the line of combat training to the Intelligence Directorate of the General Staff, remaining further, from an administrative point of view, subordinated to the parachute unit. In September 1962, a research company and a transmission company were created, and in July 1963 the Parachute Research Battalion was established within the Parachute Regiment. Major Vasile Crăciun was appointed commander of the battalion. In June 1976, the unit became independent, the 404th In-Depth Research Battalion, subordinated to the Intelligence Directorate of the General Staff.

On February 1, 1973, the 60th Parachute Regiment came under the command of the Territorial Defense Command, and the following year, it was awarded the honorary title "Băneasa-Otopeni", in recognition of the heroism of the soldiers of the first parachute battalion in the August 1944 battles.

On May 1, 1977, when the Military Aviation Command was established, the 60th Băneasa-Otopeni Landing-Parachuting Regiment came under his command, and in June 1980 its name was changed to the *60th Băneasa-Otopeni Parachute Regiment* [3].

3. THE CONCEPT OF USE AND DEVELOPMENT OF PARACHUTE TROOPS BETWEEN 1950 AND 1990

The use of air landing in modern combat actions forced decision makers to give due role to the preparation of airborne troops, knowing that no major offensive action could be conceived without performing the maneuver vertically, in order to quickly penetrate their own forces into the opponent's encampment.

In 1951, the Military Air Force Command issued ***Instructions for the use of airborne troops in modern warfare***, stating that *[…] in modern warfare, the process of air landings will be used on a larger scale than in the past. […] Troops airborne by covering some of the successive defense areas, by preventing the influx of operational reserves to the front, by disorganizing the enemy supply system and especially by interrupting the communications system linking troops to their material base, can greatly contribute to increasing the pace of the offensive ground troops. […]* [4].

In October 1962 the unit participated in a two-way application with Romanian, Soviet and Bulgarian troops, in the Dobrogea region, where it had for the first time a large number of aircraft (12 Li-2 aircraft), which took off from the aerodrome. Bobocu, on the route Giurgiu, Varna, Cavarna and Topraisar. The parachuting was carried out north of Topraisar, staggered on patrols, from a height of 600-700 m, together with Soviet paratroopers.

In 1980, with the reorganization of the superior structures subordinated to the General Staff and the establishment of two more army commands, three more parachute units were established, so that each of the four existing armies could materialize the vertical maneuver with one of these regiments: 64th Parachute Regiment, in the Titu garrison, destined for the 1st Army, 60th Parachute Regiment, in the Buzău garrison, destined for the 2nd Army, 56th Parachute Regiment, in the Caracal garrison, destined for the 3rd Army and the 62nd Parachute Regiment, in the Turia Fields garrison , for the 4th Army. The deployment of each unit took place near a military airfield, on which aircraft made available for training and embarkation could land as soon as possible in order to carry out combat missions.

The 60th Băneasa-Otopeni Parachute Regiment continued its activity in Buzău, responding, from now on, to the challenges that the new units will face in a short time, in a competition that will prove beneficial for the development of the troops. of paratroopers. Part of the unit's frames formed the cores with which these structures set off.

Based on the *Order of the Minister of National Defense no. M.C. 346 of 30.07.1980,* Colonel Achim Alstani, former chief of staff of the 404th Reconnaissance Battalion, was appointed commander of the 60th Parachute Regiment "Băneasa-Otopeni". On January 3, 1983, Lieutenant-Colonel Gheorghe Constantinescu was appointed to command the unit, Colonel Achim Alşstani being appointed, based on the Order of the Minister of National Defense no. M.C.03, head of the Parachute Section of the Military Aviation Command.

On July 1, 1986, within the regiment was established *Parachute training, training and specialization course*, the first military training unit in the parachute troops, designed to train military paratroopers and part-time soldiers, future reserve personnel. Colonel Mina Perju was appointed to command this structure. He was followed on command, until 1990, by Major Nicu Murgu and Colonel Ştefan Spânu.

On July 16, 1988, at the command of the 60th Parachute Regiment, Lieutenant-Colonel Alexandru Săulescu, his former chief of staff, was appointed.

The 56th Parachute Regiment, established in the Caracal garrison, by *Order of the Minister of National Defense no. O.G. 0008 / 02.04.1980*, set off with a group of personnel from the 60th Parachute Regiment. Lieutenant-Colonel Dan Gabor, former head of the artillery at the 60th Parachute Regiment, was appointed commander of the unit, who in 1988 was to be appointed head of the Parachute Section of the Military Aviation Command. Chief of Staff of the unit.

The 62th Parachute Regiment, established by *General Order no. 8 of 02.04.1980 of the Minister of National Defense* in the Câmpia Turzii garrison, also had, as its basic nucleus, a group of personnel from the 60th Parachute Regiment, to which were added an important number of personnel from the units of the 4th Army, the Military Intelligence Directorate and other structures. The commander of the unit was appointed lieutenant-colonel Alexandru Plăieşu, former head of reconnaissance at the 60th Parachute Regiment. Major Dumitru Sterian, former chief of staff of the 56th Parachute Regiment, followed the command of the unit in 1983.

The 64th Parachute Regiment was established according to the *approval of the Minister of National Defense no. C.L.00757 of June 30, 1980.*

A nucleus consisting of 13 personnel and 7 civilian employees from different research units and from the 60th Parachute Regiment, laid the foundations of the new unit, deployed in the barracks of Titu aerodrome. Lieutenant-Colonel Tănase Niculescu was appointed commander of the regiment. He was followed by colonel Dumitru Horghidan (1984) and Lieutenant-Colonel Radu Cantuniari (1986).

Further subordinated to the Military Aviation Command, for the coordination of the parachute troops, in 1980 the Parachute Section was created, destined to solve the new problems appeared regarding the organization, endowment and management of the parachute units. The new structure was to be imposed as an interface between the parachute units and the Military Aviation Command, as well as with the armed armies, and formed the nucleus that, in 1990, gave birth to the Parachute Troops Command.

A permanent concern was the search for the most modern solutions for parachuting personnel, equipment and materials, by improving the existing means of launching and introducing new types. In addition to the existing covers and containers, parachuting systems with shock absorbers (SPPA) have been successfully tested and introduced, starting with 1987, with which important quantities of materials and equipment could be parachuted in the area of combat actions. Improvements were further made to the B.G.-7M and B.G.-3 M parachutes, while experimenting with new types of parachutes.

The jumps were performed during this period from AN-2, AN-24T, AN-26 planes and from the MI-8 helicopter, that were subordinated to the Military Aviation, but, among the problems that the parachutists did not manage to solve then, nor later, it was that of air transport capacity. If a parachute regiment had been used together, the military aviation could not provide it with sufficient means, which gave rise to many questions from the planners of the operations. In many cases, theoretically, the option of transporting troops in several echelons (waves) or civil aviation was used, which, during the war of the entire people, would have had to make available the transport capabilities it had. The problem of transport planes has been and will be one of the thorniest and will often weigh heavily in the planning of airborne actions, but especially in decisions about the future of paratroopers.

4. THE EVOLUTION OF PARATROOPER STRUCTURES AFTER 1990

Like the entire Romanian army, the paratrooper troops were in full combat training program in December 1989, after most of the troops had participated, with special efforts, on the front of gathering crops that year.

Considered at that time as being among the most prepared units of the Romanian army, the decision makers appealed to them from the first moments and introduced them in the hottest places (Timisoara; Bucharest / Romanian Television, Royal Palace, Bucharest Hotel; Otopeni / Military and international airport). Following the intervention to guard and defend these objectives, 15 paratroopers (cadres and military in term) lost their lives.

On November 30, 1990, the Paratrooper Troops Command was established, subordinated to the Military Aviation Command, by transforming the Paratrooper Section from this command. On the basis of the same order, at the same time, by restructuring the four parachute regiments, three parachute brigades, the parachute battalions and the special mission battalions were set up (each brigade had between 2 to 4 paratrooper and special mission battalions), as well as the Paratrooper Training Center. Colonel Dumitru Sterian, former commander of the 62nd Parachute Regiment, was appointed Commander of the Paratrooper Troops.

On December 1, 1990, the command changed its name to the **Paratrooper Troops Inspectorate,** and on March 1, 1991, it became the **General Inspectorate of Paratrooper Troops**, and in 1992 returned to the name of **Paratrooper Troops Command.**

On March 15, 2001, the Paratrooper Troops Command passed from the Air Force General Staff (SMFA) to the Land Forces General Staff (SMFT). At the end of 2002, the Parachute Troops Command was disbanded. Within the SMFT, two parachute training and flight safety and parachute coordination offices have been established.

The **Paratrooper Training Center** was established in the Buzău garrison, in the barracks of the 60th Parachute Regiment and staffed, for the most part, with personnel from this unit and from the "**Course for training, improvement and specialization of paratroopers**", whose successor was on the line of military education. Lieutenant-Colonel Mircea Moraru, former commander of the 60th Parachute Regiment, was appointed commander of the institution.

On 01.08.1991, the title of the structure was changed to the **Center for Advanced Training of Paratrooper Troops,** and on 25. 10.1992 it received the honorary title "Major General Grigore Baştan".

On June 1, 1997, the Center was transformed into the **Application School for Paratroopers,** subordinated to the General Staff of Aviation and Air Defense.

On July 1, 2001, on the occasion of the 15th anniversary of the establishment of the first educational structure in the Romanian parachute troops, the **Museum of the Parachute Troops** was inaugurated within the school, designed to protect and preserve the cultural and historical heritage of the weapon and to promote the image of the military paratrooper as an elite fighter in the Romanian Army. On January 15, 2008, by order of the Minister of Defense, the **Parachute Museum** was affiliated to the National Military Museum.

On August 1, 2002, the **Paratroopers Training School** was directly subordinated to the Land Forces General Staff, and the school commander was also appointed paratrooper inspector.

On April 17, 2003, the **Reconnaissance Training Center,** commanded by Colonel Niculae Vochin, was trasnferred from the 404th Research Battalion to the Paratroopers Training School.

On August 1, 2005, the Paratroopers Training School was transformed into the **Special Operations Forces Training School,** subordinated to the Land Forces General Staff. Its structure included the **Special Forces Training Center** (commanded by Colonel Alexandru Rusu), the **Military Intelligence Training Center** (commanded by Colonel Ioan Cobiliţă, later by Colonel Niculae Vochin) and the **Reconnaissance and Paratroopers Training Center** (commanded by Colonel Corneluş Mardare). Colonel Mircea Moraru was appointed commander of the Application School. Colonel Mihail Pîrlog, Colonel Mircea Tănase, PhD, and Colonel Vasile Cerbu followed at the command of the school.

On September 1, 2008, following the continuation of the restructuring process of the Romanian army, and implicitly of the military education, the School of Application of the Forces for Special Operations "General-Major Grigore Baştan" was transformed into the **Training Center for Special Forces,** subordinated to the School of Training for Combat Units. At the command of the new structure, Lieutenant-Colonel Doru Enache was appointed. He was followed by Lieutenant-Colonel Alexandru Teodorescu and Lieutenant-Colonel Gabriel Carpiuc.

Starting with 1997, jumps were made from the C-130 Hercules plane, of American manufacture, part of the Romanian army and which ensures the simultaneous parachuting on the two side doors or on the hatch of 60 paratroopers equipped for combat, as well as transport and disembarkation. of 80 fighters, which is a major advantage in terms of transporting and parachuting subunits in the area of combat actions. At the same time, the AN-2, AN-24 T and AN-26 planes, as well as the MI-8 helicopter remained in the equipment of the military aviation and at the disposal of the parachute troops.

In 1998, the endowment of the research groups and special missions from the parachute units with PSD-2M parachutes, "wing" type, high-performance parachutes, with a high speed of horizontal movement and with a high precision of landing, for the execution of parachutes type *HAHO / HALO (High Altitude High Opening / High Altitude Low Opening).* Starting with 2004, we started to experiment and homologate a new complete parachute for personnel, according to the western model, *PSP (Standard Parachute for Personnel).* The parachute is manufactured in Romania by S.C. Condor S.A. (former Parachute Factory), with it can be executed jumps from low height (up to at least 100 m), compatible with NATO parachuting technique.

5. RESTRUCTURING-OPERATIONALIZATION-INTEGRATION

An integral part of the force structure of the Romanian Army, after a first stage of quantitative development of the organizational structures, the paratrooper troops were subjected to the same extensive reform process, some units being transformed into special forces structures, others being disbanded.

The paratroop barracks were, in turn, disbanded, and paratrooper and special mission battalions were also disbanded or transformed into battalions of special operations forces, subordinated to this new structure established at the General Staff level.

The existing paratrooper and special forces structures, operationalized and engaged in missions together with the alliance partners, proved, through the level of training achieved, that they were no better than the other structures of the Romanian army that acted in the theaters. of operations.

The concerns of some states to set up, maintain and use parachute structures both for carrying out missions in the range of special operations and for those specific to airborne troops, in the depths of the enemy device or their own troops, confirm the opportunity to maintain and further prepare these structures. and in the staff of the Romanian army.

Parachuting missions will be credited in the future as effective solutions to achieve the most diverse objectives, characteristic of airborne troops or other structures.

Romanian paratroopers carry on a history that was built in 80 years of work, hard work, joy and pain, self-denial for the idea of growing this military specialty. Today, they are engaged on the upward trajectory of confirming the place they occupy in an army that wants to be of high-class professionals. Those who will be destined to carry the battle banner of military paratroopers must be aware of the noble but heavy burden at the same time of a glorious tradition that must be carried over the waves of the times to come.

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CONSIDERATIONS ON THE IMPLICATIONS OF THE WARSAW TREATY IN THE DEVELOPMENT OF THE NATIONAL DEFENSE INDUSTRY

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Abstract: *The historical moments of the end of the Second World War have generated a very complex European security environment on the international geopolitical scene. The Cold War had begun, the Iron Curtain Restrictions System had been established, and in 1949 the Washington Treaty was signed, forming the North Atlantic Alliance (NATO), a military system with the mission of ensuring security on the European continent. In 1955, at the initiative of the USSR, the European communist states concluded the Warsaw Pact, officially called the Warsaw Pact or the Treaty of Friendship, Cooperation and Mutual Assistance. It was, in fact, also a military alliance formed in response to the North Atlantic Alliance, out of a desire to defend against possible threats or attacks from the NATO system. This article is a study of this period, in which we will give an important place to the analysis of the implications of the Warsaw Pact in the development of the national economic environment, especially of the national defense industry. Despite the unprecedented achievements in the production and export of weapons and ammunition systems, the stability of the Eastern European security environment has been severely affected by the pursuit of undemocratic strategies by Russian state actors, expressed through threats and actions of energy blackmail, intensification of cross-border tensions, attempts to strain relations between states, maintain border conflicts (even between treaty states), as well as annexation of territories using armed force and the strategy of persistent conflict. Such aspects have intensified after the events of the early 1990s, following the abolition of the Warsaw Pact and the dissolution of the Soviet Empire.*

Keywords: communist states, military treaty, conflict, economic environment, defense industry.

1. INTRODUCTION

Following the official end of the Second World War, the Western European states, which were the great capital of the Western world, pursued a consistent policy of protecting their economic system, especially the economic and military interests of German troops, concentrated in the area of West Germany, which, as "losers", were rearmed to form the basis of the future Bundeswehr, the regular army of the FRG. Moreover, the concern of Western European states was growing exponentially due to the USSR's desire to expand, which was intended to keep its military forces at full capacity and to impose forms of government on European states, especially those in the East. undemocratic. In fact, W. Churchill, the Prime Minister of the United Kingdom, warned of the USSR's intentions in a speech at the Westminster College in Fulton (March 5, 1946) in the United States. the appearance of the Iron Curtain, dangers that imposed an Anglo-American alliance, as a factor of the balance of power in the area.

In 1947, a treaty of mutual support, collective defense and mutual assistance was concluded in Dunkirk, between Great Britain and France, for the situation in which Germany, once again becoming a European military power, would attack the territory of one of them. Later, between 1947 and 1949, due to the Soviet-led operation to blockade Berlin, some Western European states considered themselves threatened and found it increasingly difficult to bear the Russian presence in Central Europe. Thus, following this operation (1949) we witness the division of the German state into West Germany (FRG) and East Germany (GDR), as well as the later division (in 1961) of the city by the construction by the GDR of the Wall. Berlin ("The Wall of Shame"), symbol of the division of Europe [1]. The wall was designed as a military target, with projectors, observation points, and barbed wire, embodying the inability of the Soviets and Westerners to cut through Berlin and conclude a peace treaty at the end of World War II.

The Treaty of Brussels was concluded in 1948 between the United Kingdom, France, Belgium, Luxembourg and the Netherlands [2], in order to intensify economic, cultural and social cooperation between them, to ensure security guarantees in their area of responsibility (cf. art. 4) and, most importantly, to warn the United States that, following the war just ended, in accordance with art. 51 of the UN Charter, measures are needed to intensify the defense against the hostile attitude of the Soviet Union. The treaty was ratified by all participating states, the accession of other states was done by invitation, and the exit from the treaty could be done after at least 50 years. Subsequently, following negotiations between the USA and Canada, the coordinates of the formation of a North Atlantic Alliance consisting of the armies of some democratic states from the continents of North America and Europe are established. At the same time, the great initiating powers invited Denmark, Norway, Iceland and Portugal to participate in the Brussels Military Treaty.

Also in 1948, in Czechoslovakia, amid events of economic reconstruction, the intensification of the operation to expel ethnic Germans, the organization of democratic elections and the infiltration of special services agents from Great Britain and the USA (acting as "agitators") [3], the desire of European states to stop the stationing of Soviet troops on their territory increased after the end of the Great War. These conditions, as well as the USSR's refusal to withdraw its forces on its national territory, in 1949, 12 founding countries (France, Great Britain, USA, Canada, Belgium, Luxembourg, the Netherlands, Denmark, Iceland, Norway, Italy and Portugal) signed in Washington a treaty laying the foundations of NATO. This treaty guarantees principles such as: individual freedom; democracy; the rule of law; resolving conflicts peacefully; security guarantees; economic collaboration; defensive solidarity with NATO states under attack from outside the alliance; territorial defense of North America and Europe north of the Tropic of Cancer; avoiding contradiction with other treaties; supremacy of the UN Charter; non-modification of the provisions of the treaty for 10 years; meeting of the NATO Council when necessary; NATO membership of other states is by invitation, with documents being filed in Washington; the treaty can be denounced after 20 years with US notification, etc. [4].

2. THE WARSAW PACT, MILITARY TREATY OF THE COMMUNIST STATES, CONCLUDED IN THE CONTEXT OF THE START OF THE COLD WAR AND THE ESTABLISHMENT OF THE IRON CURTAIN

The integration of the FRG into NATO and the ratification by some Western countries of the measures established by the Paris and London Accords accelerated the creation of the Warsaw Pact of the Communist States, under the command of the USSR.

The politico-military initiative belonged to Nikita Khrushchev since the beginning of 1955 and was signed by the partner communist states in Warsaw on May 14, 1955, amid tense events caused by the outbreak of the "Cold War" and the establishment of "Cold War". The Iron Curtain. The motivation of this treaty was in the mirror of that of the Washington Treaty, that is, it would "defend" the communist system from any attempt by the capitalist system to transform Eastern European states into capitalist states.

In essence, the Warsaw Pact (1955-1991), officially called the Treaty of Friendship, Cooperation and Mutual Assistance, was a politico-military alliance of communist countries in Europe led by the USSR, in response to the threat posed by NATO, for defending against a threat from Western states. Thus, on May 14, 1955, in the capital of Poland, on the occasion of the "Conference of European States for Peace and Security in Europe". all the communist states in Eastern Europe (Soviet Union, Albania, Poland, Czechoslovakia, Romania, German DR and Hungary) signed this pact, with the exception of Yugoslavia, the members of the pact agreeing to respect the principle of sovereignty and independence of each partner state and defend each other if they were attacked. It later turned out that this treaty was not a counterweight to the NATO system, in many cases being used by the Soviets to stifle attempts by some Eastern European states to sever ties with the communist system (the case of Hungary, 1956 and Czechoslovakia, 1968).

The Hungarian Revolution of 1956. The death of Stalin (1953) created in Eastern Europe (especially in Poland and Hungary) some hope of a possible change. Thus, a group of young Hungarian students in Budapest, in solidarity with the Polish movement and their national leader, Gomulka, organized a rally of sympathy on October 23, 1956, thus laying the foundations of the Hungarian Revolutionary Movement [5]. The soviet troops violated the provisions of the military treaty and intervened armed in the Hungarian capital, suppressing, in two weeks, the revolutionary movement of young Hungarians. As a result, Nagy Imre's attempt to remove Hungary from the USSR-led communist alliance and install a milder communist system failed on November 4, 1956, marking a difficult time in both Hungarian and European history.

The Cuban Missile Crisis of 1962 it was a Russian initiative that could have generated a nuclear catastrophe, or an international crisis that could have ended with a nuclear confrontation between the US and the USSR, with the theme of deploying Soviet projectiles with nuclear charges in Cuba. This crisis lasted 38 days (October 14 - November 20) and remained in the history of military art as the time when the "Cold War" could become a nuclear war [6].

The Czech revolutionary movement of 1968 was another example of activating the Warsaw Pact. Alexander Dubcek, chairman of the Czechoslovak Communist Party, led the Czech revolutionary movement whose program was to: denounce the Warsaw Pact; the implementation of a democratic reform program capable of bringing prosperity and freedom to the people; the preparation of the national army to defend, by fighting, if necessary, the sovereignty of the country, etc. In response to the program of the revolutionary movement, on the night of August 20-21, 1968, Soviet soldiers (23 divisions), along with troops from other Warsaw Pact countries (Hungarians, East Germans, Bulgarians, and Poles) invaded Czechoslovakia [7]. Only Albania and Romania refused to participate in the intervention. This fact brought Nicolae Ceausescu a change of attitude to the Western world, which considered him a hero for daring to oppose the Soviets. He denounced the invasion both as a violation of international law and as a violation of the principles of mutual non-interference in internal affairs, saying that collective self-defense against external aggression was the only authorized mission of the Warsaw Pact.

Later, history took revenge on Alexander Dubcek because in 1989, after the Velvet Revolution, Vaclav Havel was elected President of the country, and Alexander Dubcek was President of the Czechoslovak Parliament.

Warsaw Pact and NATO forces have never clashed, but for 35 years they have been active parties in the Cold War. In the late 1980s, Mikhail Gorbachev, the then leader of the USSR, proposed replacing the Brezhnev Doctrine with the Sinatra Doctrine, which officially gave Eastern European countries the right to do what they wanted. As a result, it was clear that the Soviet Union was abandoning its strategy of force to control the Warsaw Pact countries, and as a result, immediately after 1989, a number of major changes took place among Eastern European countries: the new governments no longer they were interested in maintaining the Warsaw Pact; in January 1991 Hungary, Czechoslovakia and Poland announced that they would withdraw from this military organization by 1 July 1991; Bulgaria took the same decision in February 1991; on 3 March 1991, at the Prague meeting, the pact ceased to exist and was officially dissolved on 1 July 1991; on 12 March 1999, Hungary, Poland and the Czech Republic (former members of the Warsaw Pact) joined NATO; In March 2004, Estonia, Bulgaria, Latvia, Romania, Lithuania, Slovenia and Slovakia also joined the NATO military system.

In conclusion, on the European continent, the collapse of the communist system led to the official dissolution of the Warsaw Pact and it's going down in history, with the signing of official documents in Moscow on July 1st, 1991.

3. IMPLICATIONS OF THE WARSAW TREATY ON THE DEVELOPMENT OF THE NATIONAL DEFENSE INDUSTRY

During the 1950s, a careful analysis of the situation of the Romanian state army, carried out at the level of the country's leadership and of the heads of the categories of forces, on the subject of its endowment and the development of the defense industry, found that this field needs important investments. As a result, its development and refurbishment have begun. At the level of the treaty, the Soviet Union, Poland, Czechoslovakia and Hungary, as recognized economic forces in the Eastern European economic environment, contributed decisively to the start of military production processes, offering Romania manufacturing licenses, machines and tools necessary for the production of individual weapons. combat equipment, military equipment and weapon systems, as well as ammunition of all kinds. These investments in the Romanian defense industry, in the construction of fortifications on the border with Yugoslavia and in the southern part of the Romanian Black Sea coast, have generated a weakening of our economy and the massive sale of gold from the reserve of the State Bank of Romania. Romanian state a budget effort equivalent to "the equivalent of about 90 tons of gold" [8].

All imports of military equipment contracted with the Soviet side were included in the endowment of the Romanian army in addition to the combat equipment manufactured by the national defense industry. Thus, after 1951, the Romanian state acquired important quantities of means of combat for our air forces (62 IAK-23 airplanes, one IAK-17 school airplane [9] and multiple MiG 15 airplanes). Subsequently, in compliance with the agreements with the Russian state, Romania continued the process of streamlining the defense industry, mass armament and equipping its forces with weapons, weapons systems and ammunition, concluding agreements with Czechoslovakia, Poland and Hungary.

From Poland 7.62mm SKS rifles were purchased, STAR type trucks and artillery ammunition for 122mm cannons. Anti-aircraft model 57mm SZ-60 guns were purchased from Hungary, together with infantry and ammunition, SKS rifles, 85 pcs. T34 tanks, 85mm artillery ammunition and radio stations. Other 85 pcs. T34 tanks, S-102 airplanes and 7.62mm SG-43 machine guns, were purchased from Czechoslovakia [10]. The payment for these products was made, in part, with goods of interest to the producing countries, and the rest in gold and currency.

During the years 1952-1954, the investments of the Romanian state, made in the national defense industry, were not at the desired level, fact for which, the implementation of Joseph Stalin's strategy of mass arming of the states from the Soviet bloc was difficult to bear. for the Bucharest regime. In this situation, Gheorghe Ghiorghiu-Dej, in order to bear the wave of expenses related to the import of weapons and military equipment, decided to sell a significant part of the gold reserve (from 209.4 tons to 49.7 tons) [11]. In addition, cereals (2 million tons) and meat or meat products were exported to cover these debts.

After the events in Czechoslovakia (1968), the development of the Romanian state led to the improvement of the situation of the national defense industry and the improvement of the military system. This aspect was confirmed in 1970 by Nicolae Ceaușescu, who mentioned: *"Strengthening the country's defense capacity is a vital necessity for the construction of socialism and communism in Romania, and therefore, our party will pay full attention in the future to equip the army with modern means, good military and political training of soldiers"* [12], performance achieved through the more efficient exploitation of internal resources (human, political, military, scientific, economic, financial, demographic, etc.), at the disposal of the development of the national defense system.

The need of strengthening the Romanian state and its defense capabilities is justified by the frequent threats exerted by the great military powers on states rich in economic resources, and their attempt to use armed force to expand their spheres of influence over areas rich in energy resources, such as and to suppress the tendencies of sovereignty and independence of less militarily endowed states. Thus, we can say that since the political decision-maker will prioritize the defense sector and intend to develop it, the country's economy must support it as an important vector of achieving this goal. Moreover, the creation and modernization of production capabilities for military equipment and their sizing were planned according to the structure, size and objectives of the military force, its organization, doctrine, strategy and tactics of its use in operation and combat. These issues were already dictated by the USSR at the Moscow Conference (January 1951), through which Romania had to adopt an expensive, difficult-to-maintain military structure [13].

The Bucharest regime was aware of the efforts of the Romanian state, but *"Taking care of economic development, strengthening Romania's economic strength, we will implicitly strengthen the country's defense capacity"* [14]. The president also declared that *"Life proves that no matter how strong you are economically, you still need some weapons that you know how to handle if necessary."* [15]. Therefore, ensuring a strong defense capability will depend directly on the capability of the defense industry and the degree of support from the other branches (machine building industry, energy, steel, chemical, electronics, etc.). More, *"A war of defense can only be a people's war, and victory will be achieved not only on the battlefield, but through the general struggle of the whole people."* [16].

In other words, solving the problem of equipping the armed forces with the necessary combat equipment will implicitly require the consideration of other state institutions, including the forces of the Patriotic Guards, whose structures had to be properly equipped and specific to each.

The attitude taken by the Romanian state towards the events in Czechoslovakia (1968) strained Romania's relationship with the USSR, thus affecting the possibility of our defense industry to produce licensed military equipment. In addition, the USSR postponed the supply of 50 MiG-21 fighter jets to the Romanian army, 9 MiG-21 school fighter jets, 66 BTR-60 armored car carriers and 41 GRAD rocket launcher systems [17], motivating the inability to honor these contracts due to priorities to other states. Two years later (1970), following a visit to Moscow, Ion Gheorghe Maurer (then prime minister) returns with a new request that included several landmarks, as follows: BTR-60 PB armored car carriers, 14,5mm Anti-aircraft KPVT machineguns, 7,62mm PKS and PKT machineguns, Maliutka antitank rockets, spare parts and subassemblies for MiG-21 PFM, MiG-21 U and MiG-21 PF fighter jets, SPG-9 rocket launchers, etc. [17]. With the only exception of the MiG-21spare parts, all other parts were accepted to be produced under license by the Romanian state.

Plans for imports of military equipment, to be carried out between 1976 and 1980, included the purchase of 300 tanks, 50 9K31 Strela 1 launcher systems together with 1,500 missiles, 250 9K32M Strela 2 launcher systems with 3,000 related missiles, 4,000 K13M air-to-air missiles, 4,000 R3R air-to-air missiles and about 1,000 radio systems, including KUB and OSA-AKA close-range anti-aircraft missile systems [17]. During this period, the specialized units trained specialists in anti-aircraft missiles, they were mastered "The main concepts of air aggression and anti-aircraft response as dimensions of the vertical component of modern warfare" [18] and anti-aircraft missile launchers were experienced in the Cape Midia Range and in the ranges provided by the Soviet Union to Warsaw Pact member countries.

CONCLUSIONS

Analyzing the implications of the Warsaw Pact for the development of the national defense industry, we consider that at least the following conclusions are necessary:

- During the communist period, during the functioning of the treaty, Romania made great financial efforts to ensure and strengthen the country's defense capacity, in the face of threats that emerged after the end of the world conflagration, the performance of our defense industry in the ability to supply military equipment, from 45% in the ‘60s to 75% in the early ‘70s;
- Although the Cold War is over, the interest of state actors in arming and improving military production capabilities has grown exponentially, hybrid threats have emerged and amplified (economic, psychological, geophysical, ethnic, religious, etc.), and technological gaps. they could no longer be ignored, as they were sources of political, economic and military instability, as evidenced by the conduct of armed conflicts in various parts of the globe;
- The threats and the continued presence of the Russian military force at the border of some Eastern European states should be a warning signal for all states in the area, including Romania, in the sense of understanding that the preparation for the high-intensity technological war requires the revival of industry. defense, a new technology, superior combat capabilities of weapons systems, intelligence and high capabilities, decisive in balancing the balance of power, in common operations.

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PRODUCTION AND EXPORT OF MILITARY PRODUCTS IN THE CONTEXT OF ROMANIA'S FOREIGN POLICY BETWEEN 1968 AND 1989

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Abstract: *Since 1960, after massive investments in the refurbishment of factories and more specifically, of the factories producing military equipment, weapons and ammunition, the evolution of the national defense industry has been constant, Romania managing to produce more than necessary for its own armed forces, the surplus being exported to obtain a substantial contribution to the state budget. The performance of the domestic defense industry was known worldwide, with military products manufactured in the country being purchased by the Warsaw Pact member states, as well as by countries in the Arab world, Asia, Latin America and Africa. In this article we will analyze and highlight the peak period of the Romanian military industry, as well as its export performance, as the sale of military equipment on the international market has contributed substantially to stabilizing the trade balance of the Romanian state and paying off the national debt.*

Keywords: defense industry, export, ammunition, military equipment.

1. INTRODUCTION

Due to its specificity, the concept of the defense industry is not one often addressed in the literature, but for which multiple definitions can be identified. A fairly practical definition, presents the defense industry as *"a branch of industry which contains industrial sectors for the production of goods for military use"* [1] (weapons, ammunition and combat equipment), but also *"Industrial sectors that produce civilian goods, useful to military structures"* [2] (unarmored vehicles, electronic equipment, etc.). Another definition presents the defense industry as a structure consisting of *"economic sectors intended for the production of goods, services and technology having as final consumer the armed forces"* [3].

When we talk about the development of the defense industry of a state, we must mention that, no matter how developed that state, on its territory, not all the equipment necessary for the armed forces can be manufactured by its own forces (it would be a utopia to believe this), as it is impossible for all industries involved in the arms effort to be equally technologically developed, especially if we take into account the diversity of force categories and types of weapons involved in military operations, of weapons and weapon systems, the particularities of the terrain, the weather conditions, the season, etc.

The production and export of military equipment or trade in weapons, ammunition and weapons systems are a basic component of the economic system.

Thus, from the retrospective study on the situation of Romania's foreign trade, during the years 1968-1989, it can be seen an extension of import-export relations and economic cooperation with the communist treaty countries, with some developing countries, including states developed of the capitalist system. The Romanian state has signed important bilateral trade agreements, long-term technical-scientific and economic cooperation agreements, as well as a large number of cooperation agreements and protocols, for various branches of economic activity, including the defense industry. The analysis of how they were carried out took place periodically, within the intergovernmental framework of the joint commissions, the number of countries with which the Romanian state developed trade and economic relations was increasing, from 110 in 1970 to 152 in 1980, following that it should fall to 142 in 1989 [4].

2. THE MANUFACTURING AND EXPORT OF LAND FORCE SPECIFIC WEAPON AND AMMUNITION SYSTEMS

From the analysis of the possibilities offered by the national defense industry, for the manufacture of armored cars and cannons, the modernization of T54 and T55 tanks, as well as for the provision of spare parts, in the early 70s the Romanian state allocated significant funds to refurbish the at Mizil (built in 1951). The problem of manufacturing subassemblies was only the first step, because our ultimate goal was for these fighting machines to be produced in Romania, in its entirety, thus avoiding their acquisition, at high cost, from other Member States of the Treaty. This idea was the subject of discussions at CAER, in Czechoslovakia (1973), where, at the meeting of the Standing Committee, the Romanian delegation, led by General C. Șandru, expressed the desire for the Romanian state to obtain the necessary licenses for the production of school airplanes, cars. combat equipment, missile systems, radio stations, ships, aviation ammunition and AG-9 launchers [5]. So, the desire to expand the manufacturing capabilities of military equipment, through the care of Romanian researchers or under license, represented, in the '70s, a desideratum and an ambition of the politico-military leadership of the Romanian state. Thus, the production of missiles, cannons, weapons and related ammunition, trucks, trucks and TAB amphibious armored personnel carriers, optical systems and transmission equipment, helicopters and airplanes was started.

Later, in the 80's, the Romanian army was manufactured and equipped with A-436 2×30mm, model 1980 towed anti-aircraft cannon, aimed at defending troops and targets against low-flying, low-velocity targets [6]. These systems of combat with the air enemy were verified in the firing range of Capul Midia, after which they entered the endowment of some anti-aircraft artillery units within the Romanian Land Forces, they being also the subject of export requests.

Also in the 80's, the aircraft factory from Bacău started the series production, under license, of the BM-21 GRAD rocket launchers, while the Mechanical Enterprise Mija, after an intense research work, managed to produce an anti-tank complex installed on TAB amphibious armored personnel carriers (having as reference the Russian origin 9M14M missile)[1]. In this context, according to the archives, during the 80's, the special products exported by Romania reached the amount of 246.6 million lei, 140% higher than the anticipated amount, the difference coming from the capitalization of these products on

[1]Known as Maliutka, which in Romanian is translated "little girl".

third markets and not from export to treaty countries[2]. The main Romanian military products, capitalized for export during this period (armored personnel carriers, 122mm launchers, 14.5mm ZU-2 machine guns, 7.62x39mm machine guns, semi-automatic rifles and submachine guns, 40mm AG-7 launchers, 73mm launchers, were quite sought after due to their technical complexity and tactical efficiency.

The issue of exports of military products was the most delicate issue in international relations, the country's leadership being forced to carefully analyze the geo-political context and the partner countries concerned. A special situation was the experience with the state of Pakistan, which, during the 1970s, insisted on purchasing ammunition made in Romania, only that this ammunition was of Soviet origin, the Soviet partner had to be informed and then his agreement obtained. Tense relations between India and Pakistan have led the Romanian authorities not to comply with the demands of Islamabad and thus avoid creating tensions with India or the USSR, military exports to the state of Pakistan would certainly have inflamed these relations.

In 1976, Manea Mănescu, the Romanian Prime Minister of that time, forwarded a letter to his Chinese counterpart, Hua Guofeng, asking to the Beijing leadership, on behalf of Romania, for equipment, production lines, military products and technical documentation specific to the production of submarines, destroyers, Rolls Royce engines for supersonic aircraft, 7.62mm machine guns, 152 mm, 130 mm, 122 mm and 100 mm artillery rounds, 23mm cannons, as well as the purchase of 2 bombers, type HJ 5[3]. From the requested, China decided to support the Romanian state with equipment and technical documentation for the production of: 82mm bombs, 122mm rounds, 7.62mm machine gun, submachine gun barrels, lines, tools and dies needed to produce 14.5x114mm, 20mm and 30mm cartridges. All the other requested products being rejected by the Chinese side [7].

In the 1980s, the value of national defense output peaked. More than 80% of the needs for the Romanian army were covered by domestic production, Romania continuing to export various types of military equipment, weapons and ammunition, from infantry weapons, artillery bombs, grenades and cartridges, to tanks, armored personnel carriers, fighter jets and helicopters, most of which were manufactured under Soviet licenses. Statistical data from that period showed that the export of Romanian military equipment reached the value of 620 million USD, our country being on the ninth place in the top of the states exporting military products. The level of development of the defense industry, the maximum load of production capacity, shows that, at that time, the national defense industry had become the engine of a strong industry, benefited from elite researchers, and some results of military research were successfully applied. and in the civilian environment, most of the profile factories also have sections destined for civilian production.

The efficiency of the work in this field, validated by the quantity of the exported products and by the impressive sums received, determined the country's leadership to expand the activity and to set up new factories and factories, better endowed with more efficient resources. Thus, in the mid-1980s, the factories in Filiași, Dragomirești and Plopeni also came into operation.

[2]The 246.6 million lei collected are divided as follows: 44.4 million lei from contracts with socialist countries, representing approximately 60% of the anticipated value and 202.2 million lei from contracts with other countries, representing approximately 20.5% of the value anticipated.

[3]Medium-sized bombing and reconnaissance aircraft made in the People's Republic of China by copying the Soviet-origin aircraft IL 28. It was copied without the consent of the Soviet Union, being exported under the name Harbin Hong 5 (simple order) or HJ 5 (double command).

We can say that the national defense industry had become a real colossus due to the huge quantities of products manufactured and exported, the foreign exchange contribution to the budget and the approximately 200,000 people who worked in this industry.

The arms trade brought very high profits, the value of the revenues reaching in the analyzed period (1968-1989) over 6 billion dollars. Statistics in this area show a number of already traditional partners, including the Soviet Union, North Korea, Vietnam, Iraq, Libya, Angola, Egypt, Algeria and Ethiopia, some of them at the end of the communist regime (1989), having to return to the Romanian state important sums from the values of the imported military products during the analyzed period.

In conclusion, the export of military products, for the land forces, had become a very profitable commercial activity for the Romanian state, the funds obtained from these trade relations being used to pay some external debts that Romania had accumulated in the post-war period.

3. THE MANUFACTURING AND EXPORT OF NAVAL FORCES SPECIFIC PRODUCTS

In the period 1968-1989, the production and export of means of combat specific to the maritime area were affected due to the attitude of the Romanian state towards the USSR and towards the other partner states, members of the Warsaw Pact, involved in the invasion operation of Czechoslovakia (1968). At that time, the Romanian head of state received applause from the "west", but from the "east" he chose to stop visas for manufacturing licenses of naval equipment and to stop the export of shipping to Romania. In these conditions, Romania sought alternatives and, finally, with the financial and technical support of the Chinese[4], authorities, started the construction of fast attack ships based on the model imported from China, but also of some ships of its own design, at the shipyards. from Mangalia and from Drobeta-Turnu Severin [8]. However, the ambition of the supreme leader of the Romanian state to equip the maritime fleet with submarines was very high, as a result of which, in 1977, discussions were held for the acquisition of these ships from France. Unfortunately, the discussions on this topic were not successful, France refusing to export submarines to Romania.

In 1980, after several discussions, the Soviet Union agreed to supply a submarine to Romania, the parties signing a delivery agreement negotiating the type of ship (a medium-sized model), the technological standards in the field, the price (40 million dollars) and delivery time. Only after 5 years (1985) the submarine "Dolphin" was delivered to the Romanian side, in secret, together with the ammunition and the complete set of accessories and spare parts [5]. The list of negotiations on the acquisition of the submarine also contained some conditions of the Soviet side, the most interesting being the proposal that the Romanian state agree with the extension of the validity of the military treaty for another 20 years. In these conditions, it was appreciated that the Soviet strategy represented for Romania an irrefutable offer, especially since our communist leader cared a lot about this acquisition.

[4] The financial assistance obtained from China consisted of two preferential loans: one amounting to $ 100 million, due in 1979, and the second amounting to approximately $ 50.7 million, payable in ten. equal annual installments, due in 1990, both of which are interest-free (the latter was in fact the value of machinery purchased from China).

[5] The submarine to be delivered is part of the Kilo class - a high-efficiency attack submarine used against nuclear submarines. It has a length of 72.9 m and a width of 10 m, its shape being like an elongated drop of water, which, together with the rubber membrane used for its complete coating, makes it easier to move in immersion.

Moreover, the signing of this agreement was a sign of reconciliation between the two countries, and later began the production of ships on our shipyards, with documentation and under a Soviet license.

In the context of the achievements of our defense industry, we must mention the fact that, in the naval environment, the most important construction was the ship Admiral Muntenia, at the Mangalia Shipyard (1979-1985), a ship of Romanian design, equipped with high-performance weapons, at sea. Romanian side, considered the largest military ship built in Romania, the ship Admiral Muntenia was launched on August 2, 1986. In 1990, its name was changed to the Destroyer Timisoara, later, following technical improvements, the ship came to be called the Mărășești Frigate [9].

In conclusion, analyzing the dynamics of the development of the Romanian naval military industry, in the period 1968-1989 and taking into account the important acquisitions, as well as the export of military equipment in the naval field, made in that period, we can say that this stage was beneficial for naval forces. and the performance of naval equipment has risen to the level of modern armies.

4. THE MANUFACTURING AND EXPORT OF AIRFORCE SPECIFIC PRODUCTS

At the beginning of the 20th century, the world was delighted to receive among the great engineers and inventors three pioneers of aviation: Traian Vuia (1872-1950), Aurel Vlaicu (1882-1913) and Henri Coandă (1886-1972), three Romanians who „ *"Throughout their lives, they have shown that almost nothing is impossible, not even flight."* [10]. Immediately followed by the First World War (1914-1918), a huge conflict of property that brought more than 38 million civilian and military casualties to humanity, mainly due to the emergence and use of new weapons in land, naval or air combat, such as aircraft, machine guns, anti-aircraft artillery, tanks, submarines and poison gas. The First World War was also the first major conflict that included the plane as a weapon of attack and anti-aircraft artillery as a weapon of retaliation against airstrikes, the first plane being shot down on September 19, 1916 (the date of the day of the Romanian anti-aircraft artillery).

The plane quickly became an important weapon of the theater of military operations. At the beginning of the conflict, bombers, then fighter jets, flew into the airspace. Subsequently, some aircraft were equipped with cameras and acted as aerial research aircraft, with the mission of discovering and transmitting information about the combat device (fire system, control system, logistics base, combat reserve, etc.) of the opponent.

Immediately after the end of the war, considering the effectiveness of aircraft in combat and operation, a series of production capacities for aeronautics were established in Romania, as follows: in Bucharest (1919), the Romanian Aeronautical Arsenal; in Arad (1923), Astra Aircraft Factory; in Constanța (1924), Air Transport Company; in Brașov (1925), the Romanian Aeronautical Industry (IAR), an important role in this industry having the association of the Astra Aircraft Factory with the Romanian Government and with two French companies (Lorraine - Dietrich and Bleriot - Spad). The profitable operation of these industrial structures, in the period between the two wars, shows that the Romanian aeronautical industry had become strong, managing to have at the end of the second conflagration about 2,500 aircrafts produced in Romania, of which more than 1,400 at Romanian Aeronautical Industry (IAR), Brașov.

During the 1950s, at the urging of the USSR, much of the aeronautical production capacity was destroyed, with the rest being transformed into tractor or truck factories, with the aviation industry remaining dormant until 1965, when the country's leadership moved to reconsider aeronautical production capacity, as a country with traditions in the

production of helicopters and military aircraft. The period of the 60's followed, when Romania, from desire to deed, completed the stage of research and technological training and, starting with 1968, started the process of manufacturing aviation equipment in Romania. Thus, the first steps were taken to apply for Soviet manufacturing licenses for some categories of aviation equipment. In this regard, a Romanian delegation led by General Vasile Ionel, during a visit to Moscow, presented a list of products that the Romanian state wanted to produce, under Soviet license, as follows: MiG-21 fighter jets, destroyers, cannons and BTR-60 amphibious armored personnel carriers.

The Soviet Union was neither pleased nor interested in the Romanian state's proposal to switch to the production of modern fighter jets and helicopters, as the member states of the communist treaty were not allowed to exceed the imposed threshold of technological independence. Thus, Romania was forced to resort to some agreements and partnerships with other states outside the treaty. In 1970, for the production of helicopters, Romania initiated a collaboration with the French company Aérospatiale, for the manufacture of Puma and Alouette III type aircraft, under the name of IAR 330, respectively IAR 316B.

The manufacture of helicopters was profitable, so that by 1980 (in about 10 years), IAR Brașov produced 145 such devices distributed in part to the Ministry of Defense [11], and some were exported to France, which was an unprofitable business because the license was of French origin, so the price was very low. Under these conditions, part of the production was sold as military equipment to some countries in South America and Africa, with the consent of NATO.

regarding the production of airplanes, we went on a collaboration with the USSR, unprofitable for the Romanian state, because at the end of 1979 Romania produced only a few training airplanes. In 1979, the Romanian-Yugoslav collaboration on the manufacture of an IAR 93 fighter jet in Craiova began [12], intended to support ground troops and attack at low altitudes. In fact, this device was the only fighter that was manufactured under the communist treaty, without being of Soviet origin. A series of variants of this aircraft followed (IAR-95, IAR-S, IAR-99) all built in Craiova, but the ambition of our communist leader was too great, he wanted this supersonic aircraft to reach at least a speed of 2, 5 Mach. In reality, the engines sold by Rolls Royce did not even reach a speed of 2 Mach, because for the communist countries this company sold technologically outdated engines. Probably this reason, corroborated with pressure from the leadership of the communist treaty, on August 1, 1985 the Romanian state leadership decided to stop the program of manufacturing supersonic aircraft, the factory in Craiova will build civil aircraft type AG 6 (agricultural aircraft) and IAR-705 (medium courier transport aircraft).

The first commercial jet aircraft, ROMBAC 1-11, in the communist area of Europe (except the USSR) was built under the license of an aircraft from England, courier medium, BAC 1-11, before 1989, at the Bucharest Aircraft Company (today Romaero Băneasa). On January 28, 1983, the plane made the inaugural flight with passengers, on the route Bucharest-Timisoara, and on March 23, 1983 it had the first external flight on the route Bucharest-London.

The manufacturer was to manufacture 80 ROMBAC 1-11 aircraft, but only 9 aircraft of this type were built (plus two unfinished), all aircraft being purchased by TAROM and Romavia. TAROM has sold seven of them to other airlines in Africa and Asia. The plane had a pilot and a co-pilot, the passenger capacity was 119 people, and the maximum distance was 3,500 km.

There were at least some serious reasons why this project failed: Romania's economy had deteriorated and the supply for the construction of model 1-11 had decreased substantially; growing currency restrictions have delayed the delivery of imported components; the market provided by the Romanian state did not show the expected interest; Due to too much engine noise, some airports in Europe have banned the landing of this type of aircraft.

CONCLUSIONS

Following the analysis of the production and export system of military equipment, specific to the context of Romania's foreign policy, we consider that at least the following conclusions are required, as follows:

- At the end of the analyzed period (1968-1989), the situation of the Romanian defense industry changed radically in a very short time. With the installation of the new regime and the transition to a market economy, the national defense industry entered a downward slope which led to a drastic decrease in the number of Romanian factories and factories of armament, ammunition and military equipment (from 100 in 1989, to 15 economic units with state capital), under the coordination of the Ministry of Economy;

- As a result of the change of system in the late '80s, Romania entered the stage of transition to a market economy, a process accompanied by profound legislative and institutional reforms, which involved significant costs (shock therapy through price liberalization, restructuring and deindustrialization economy), including on foreign trade, which also suffered the impact of the abolition of CAER. The level of exports fell by almost half in 1990 compared to 1989, only after 2000 did it manage to surpass it;

- From a logistical point of view, the Romanian army was on an ascending slope, the effort of the Romanian industry being characterized by: the complete endowment of the army with equipment and products manufactured by its own defense industry; the weapons systems were in line with the Warsaw Pact; most of the military capabilities were developed during the '80s, and successfully coped with the export of military products (the volume of exports exceeded the figure of 800 million USD per year), Romania being the fifth country in the world in the export of weapons and ammunition; the defense industry had covered more than $ 7.5 billion of the country's total debt, with military research findings also applicable to civilian production; some factories had a dual production, ie military capabilities could be supplemented with civilian capabilities and vice versa; there were over 220,000 employees working in the military sector.

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THE VFW 614 FOKKER PROJECT AND THE ROMANIAN AERONAUTICAL INDUSTRY IN THE 1970[s]

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***Abstract**: In a '70s meeting of the Socialist Republic of Romania's (RSR) Defense Council, Nicolae Ceausescu decided to have Romanians build a short-courier aircraft capable of ensuring passenger traffic, domestic and foreign, over short distances. Based on these indications, a contact was designed and several offers were obtained for the joint construction of such an aircraft: the British company "BAC" for an aircraft to be designed and developed at the request of the Romanian side, the British company "Hawker Siddeley, for the HS 748 aircraft, already manufactured in a military version, subject to obtaining the approval of the English government, the French company "SNIAS", for the Nord-262-Fragatte aircraft which did not meet the Romanian requirements and, finally, from the West German company VFW Fokker, initially for the F. 98 aircraft, manufactured in the Netherlands, and then for the VFW 614 aircraft, both of which were introduced in Bucharest in September 1972 and May 1973, respectively. In the following study, the evolution of the negotiations with the West German side and the causes of the final failure in taking over the VFW-614 model for Romanian domestic production are presented and analyzed.*

***Keywords**: plane, Romania, VFW-614, Fokker, Romanian-West German relations, espionage*

1. INTRODUCTION

In May 1970, in a meeting of the RSR Defense Council, Nicolae Ceaușescu decided to build in Romania a short-courier aircraft capable of ensuring passenger traffic, domestic and foreign, over short distances.

Based on these indications, a contact was made and several offers were obtained for the joint construction of such an aircraft: the company "BAC" from the United Kingdom for an aircraft to be designed and developed at the request of the Romanian side, the company "Hawker Siddeley", still from Great Britain, for the HS 748 aircraft, already manufactured a military version, subject to obtaining the approval of the English government, the company "SNIAS" from France, for the Nord-262-Fragatte aircraft which did not meet the Romanian requirements and, finally, from the West German company VFW Fokker for the F. 98 aircraft, manufactured in the Netherlands and then for the VFW 614 aircraft, both of which were introduced in Bucharest in September 1972 and May 1973 respectively [1].

2. PROJECT DEVELOPMENT

Due to the fact that the VFW 614 aircraft would be quieter, the only one in the class of short-haul aircraft featuring a turbo-jet engine and cargo transformation possibilities, for the needs of the military, negotiations began in 1973 with VFW-Fokker from RF Germany for cooperation in the manufacture of the VFW-614 aircraft [1].

By the agreement concluded on June 29, 1973 between the Bucharest Aeronautical Group and the company VFW-Fokker, the two parties agreed to cooperate in the manufacture and sale of the VFW-614 aircraft by setting up a joint venture for production and sales, based in Romania. Negotiations were cumbersome on both sides, showing distrust, numerous returns, delays, etc.

Consequently, only on July 2, 1977, the documents establishing the Romanian-West German joint venture were signed in Bucharest, with the main objective of manufacturing a series of 100 VFW-614 aircraft, of which 50 were to be sold to third parties [2].

Due to the high price of the aircraft manufactured in Germany (according to the data known to the Romanian authorities, the West German government subsidized 1.3 million marks each aircraft), as well as due to the financial difficulties of the company, the production of the aircraft was stopped in December 1977. As a result, the company was no longer able to meet the conditions for the joint venture to enter into force. Only two days after this decision, Constantin Stanciu from MCECEI and Schäffler H. from VFW Fokker signed the protocol “On the results of the negotiations of December 22-23, 1977 between the representatives of the Romanian government and VFW Fokker regarding the cooperation within the V.F.W. 614”. Among other things, this protocol states that the partners of the joint venture "Romavia" have decided to develop a concept defining the means and ways to ensure the entry into force of the cooperation, taking into account the conditions modified by the decision of the federal government and the agreement to examine the continuation of the program by presenting appropriate commercial premises.

3. PROJECT ELABORATION AND CONTRIBUTORS

Constantin Stanciu and Mihai Pacepa participated in the elaboration of the concept, and the discussions with the West-German partner took place on January 12, 1978 in Bucharest. On this occasion, two options were discussed, namely: the development of simultaneous aircraft manufacturing in Bremen and in Romania, the development of single-line manufacturing in Romania. The West German company put a series of disadvantageous conditions on the Romanian side, some of them even accepted by Mihai Pacepa: guarantees to cover the production costs at VFW Fokker that could not be covered by sales, the purchase by TAROM of a number of aircraft etc.). Subsequently, the first option was abandoned and the discussions focused on the option of fully transferring the VFW 614 program to Romania, by purchasing the remaining parts and subassemblies, based on a contract with each company participating in the construction of the aircraft. However, they did not assume the role of sole supplier nor did they grant guarantees on the quality of the goods transferred to the Romanian side, remaining for the latter to assume the risk of the entire business.

The Romanian specialists consulted after the failure of Mihai Pacepa claimed that even if these parts and all the documentation had been purchased at a convenient price, without the support and guarantee of German designers or manufacturing companies, the plane could not be built on time or obtained certification flying. In fact, it was known to the Romanian side that all 16 planes built by VFW Fokker, model 614, had some technical shortcomings that the West German company had not been able to completely remove, due to the small production series.

The Federal Government, under the leadership of Chancellor H. Schmidt, has agreed to resume the manufacture of the aircraft in Germany, only if the German company VFW-Fokker will present appropriate commercial conditions and will not take additional risks, as the company also bears part of the losses resulting from stopping the VFW-614 program.

The protocol concluded with the German side on December 23, 1977, established a program for the development of a concept for further cooperation in the manufacture of this aircraft that takes into account, in addition to production needs for Romania, the wishes expressed by the US Federal Express for the purchase of modified VFW-614 aircraft.

Following the elaboration of the concept, the German company informed the Romanian side that Federal Express USA no longer wanted those planes and, as a result, in May 1978 the possibility of taking over the entire program to manufacture the VFW-614 exclusively in Romania was discussed.

The negotiations for the transfer of the aircraft production in Romania were conditioned by the company Fokker of direct negotiations between the Romanian side and each of the suppliers of components for this type of aircraft: with the company Fokker-Bremen for fuselage, equipment and general assembly, with the company Fokker-Amsterdam for the aircraft wing, with Messerschmitt-Bolkow-Blohm-Hamburg for the rear fuselage of the aircraft, with Fairey and Sabca-Belgium for spoilers, ailerons and flaps, with Rolls-Royce for the M-45 H engine that equipped this aircraft. There were a total of over 85 main equipment suppliers involved in the construction of the aircraft and with each Romanian side had to negotiate the acquisition of documentation and components.

At the end of 1978, there were no alleged external beneficiaries for this type of aircraft, although initially there were some concrete requests in this regard. Both the American company "Federal Express" and the Ministry of National Defense in Bucharest requested a modified version of the plane, which involved lengthening it by two meters and building a cargo model. In the end, even M.Ap.N. said they did not need this type of aircraft.

However, the negotiations were continued by General Mihai Pacepa, Constantin Stanciu and Vasile Pungan, in the unfavorable conditions mentioned, in which an important role was played by the West German citizen of Romanian origin Rolf Spitra, businessman and, apparently, agent of influence of the Romanian espionage, in the German space[1].

In May 1978, with the direct approval of Mihai Pacepa, a delegation of five specialists from VFW Fokker, which included Rolf Spitra, visited all the objectives of the Romanian aeronautical industry to "convince" of the technical potential of the Romanian parties takeover of VFW 614 aircraft.

Later, in the autumn of 1978, based on the instructions of Nicolae Ceaușescu, a delegation consisting of representatives of MCECEI and the Bucharest Aeronautical Group (GAB) left for the Federal Republic of Germany, in Bremen, to continue discussions with VFW Fokker.

[1] IM Pacepa presented to the dignitaries from Bucharest Rolf Spitra as the most influential person through whom the Romanian state could obtain the project and the manufacturing technology of the "VFW 614" plane. Subsequently, the DGIE established that he was a former West German intelligence and counterintelligence agent, the owner of a small construction company and a real estate agency in FRG, and in the "Fokker" transaction IM Pacepa was the one who introduced him, with all the opposition of the representatives of VFW "Fokker". The friendship between the two became famous after 1974, with Rolf Spitra waiting for IM Pacepa at the airport when he arrived in Germany, providing him with "Fokker" planes or procuring various valuable goods. Instead, when Rolf Spitra came to Romania, he was taken to various foreign trade companies or his expenses for spending holidays on the Romanian coast were borne. Significantly, after the failure of IM Pacepa, Rolf Spitra was banned by the German state from traveling to Romania.

According to the mandate, the Romanian delegation had to obtain the purchase of the goods and documentation necessary for the construction of the VFW 614 aircraft in Romania and at half the price established in the documents for the establishment of joint ventures. Payment was to be made only after inventory and receipt of the goods. The planes that were to be bought by TAROM had to be certified and good, and the payment of the last installments of the contract of DM 500,000 had to be made only after the inventory of the goods and documentation.

However, the management of VFW Fokker refused, invoking the agreed contractual conditions, to grant any guarantee to the assets transferred to the Romanian party, not being responsible for their quality either. Also, the company did not guarantee that all the documentation and components included in the lists drawn up at the end of the 614 Program were still in its custody of 500 thousand DM. The termination of the contract must take place by the end of October 1978. In order to postpone or avoid the payment of the third installment, the Romanian side requested the management of VFW Fokker to re-discuss some articles of the contract negotiated at the end of August 1978 and on to which the West German representatives returned when, in October 9-17, the same year, a Romanian delegation participated in negotiations in the FRG. This created irritation at the level of the management of VFW Fokker, whose director Schäffler sent a telex to General V. Bucur, the Romanian head of the aviation industry appointed to the negotiations, in which in addition to the "astonishment" of the West German side the principles presented by the German company were never accepted, it was announced that from its point of view the negotiations could be considered as failed [3].

On the same day, October 26, 1978, the management of Rolls-Royce, the manufacturer of the engine for the plane wanted by the Romanians, announced in a letter to the Bucharest authorities that it would ”not resume production of the engine for VFW 614 at Rolls-Royce of the documentation, SDVs, equipment and know-how to allow the takeover of the engine manufacturing […] the difficulties would be difficult to overcome” due to the improper conditions in the Romanian industry. As for the consultancy in the construction of the engine, the British company did not have the possibility to provide it, VFW 614 being an out-of-production model.

4. THE PROJECT OUTCOME & CONCLUSIONS

Finally, a direct response was given to the Bucharest leadership's attempt to procure state-of-the-art technology in the field of aviation. It could be deciphered during the negotiations carried out by the Romanian representatives in the FRG, when the representatives of the German company declared that their interest is only to sell and not to help the Romanian side in continuing the manufacture of this aircraft. During the talks, the West German representatives showed their lack of interest in selling the program to the Romanian side, referring to the "capitalization of the program in another way" and the fact that all their expenses for this program were taken over by the FRG government. One of the principles put forward by the German side was that everything should be sold: the materials and equipment needed for the construction were to be delivered as they were then, whether or not they were under warranty or defective. No engine was delivered (hence the suspicion that the German side was afraid of a technology theft), and VFW was obliged to return any engine produced to Rolls-Royce. The means of production were retained by the German company for its own needs, and the primary components and parts were delivered selectively. In terms of documentation, the German company undertook to deliver only one copy, not agreeing with the delivery of the originals or microfilms.

Even existing aircraft in various stages of assembly could not be delivered for various reasons, only new completed aircraft. The planes, from the moment they were on the Romanian territory, lost their LBA airworthiness certificate (which restricted their right to fly).

In addition, the exclusive right to manufacture the plane by the Romanian side was for only 3 years (the Romanian representatives had asked for at least 10 years). All this showed, if necessary, that VFW Fokker, and thus the West German state, did not want to sell the 614 Program to a socialist country, but that, for political reasons related to the Bucharest regime, it was delayed a negative response in this regard.

In addition, in September 1978, the government in Bucharest managed to conclude a contract with the English company BAC for the construction of an aircraft similar to the one requested by the West German party. As a result, both parties became disinterested in the VFW Fokker project.

REFERENCES

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[3] Arhivele Consiliului Național pentru studierea Arhivelor Securității (în continuare A.C.N.S.A.S.), fond Documentar, dosar nr. 3447, vol. 35, f. 89.