R E S U M E

On the fact of the investigation of the accident with the Mi-8MTV-1 helicopter RA-25114 at the Anapa airport on 26.09.2017.

Abbreviations and terminology used in the text of the Audit' Report:

FAAT MT RF	Federal Agency of Air Transport of Ministry of Transport of RF;
FSST MT RF	Federal Service of the Supervision on Transport of Ministry of the Transport of RF;
NTERAT GA-93	General Maintenance and Overhaul Manual of Civil Aviation;
FMM CA-85	General Flight Manoeuvres Manual of Civil Aviation;
FOOM CA-87	General Manual of Organizing of the Flight Operations of Civil Aviation;
FPTP	Flight Proficiency Training Programs in Civil Aviation of RF (Unified Programs of Civil Aviation of MT of Russian Federation, General Rules of the Training of the Flight Personnel for aircraft & helicopters);
PPLG Aircraft	General Rules of Support of the Airworthiness of Civil Aircraft of RF;
AFOM	Airline's Flight Operations Manual;
AQM	Airline' Quality Manual;
AMM	Airline' Maintenance Manual;
LMS	Line Maintenance Station
FOM	Flight Operation Manual of Mi-8T helicopter;
MM	Maintenance Manual for each type of aircraft;
RTO	Time Limits of Maintenance;
MS	Maintenance Service;
AI	Aviation Incident;
Captain	Commander of the aircraft;
AC	Aircraft (helicopter);
VFR	Visual Flights Rules;
SVFR	Special Visual Flights Rules;
IFR	Instrumental Flights Rules;
SAS	Separate Air Squadron
MTU VT MT RF	Inter-Territorial Board of Air Transport of the Ministry of Transport of Russian Federation
FSST	Federal Service of Supervision on Transport of the Russian Federation (FSST RF);

1. Circumstances:

REPORT ON EMERGENCY ACCIDENT, AFTN connection

MI-8MTV-1 RA-25114 URKA ANAPA ЧП-Z

ГГ УУУЕЫЦЫЬ УУУУБНЬЬ УУУУЛІНЬЬ УУУВЫВЫЬ УУУВЗГЗА УУУВЗДЗЬ
261542 УРККУЬДУ
ON 26.09.2017 LOCAL TIME 15.21 (UTC 12.21), AIRPORT OF ANAPA, RUSSIAN FEDERATION. HELICOPTER MI-8MTV-1 TAIL NUMBER RA-25114, REGISTRATION RUSSIAN FEDERATION OPERATOR JSC -PANH- AIRLINES= METEOROLOGICAL CONDITION METAR URKA 261200Z 08014G21MPS CAVOK 21/03 Q1018 R04/010070 TEMPO 07020G27MPS RMK QFE759/1013= CPT-INSTRUCTOR REDCHENKO S.B. CPT AVEDIKYAN S.V. FLIGHT NUMBER PNH9732, TRANSPORT FLIGHT FOR PASSENGERS TRANSPORTATION POINT OF DEPARTURE – AIRPORT OF ANAPA POINT OF DESTINATION PIPE-LAYING VESSEL PIONEERING SPIRIT IN THE INITIAL MOMENT OF THE START UP HELICOPTER' ENGINES, AFTER BEGINNING OF THE MOVEMENT OF ROTOR BLADES THE TECHNICIAN OF THE GROUND HANDLING BRIGADE SIMONOV A.Yu. LOCATED IN THE PLANE OF ROTATION ROTOR BLADES, IN THE RESULT OF SLIDE SHOCK IN THE FIELD OF HEAD RECEIVED CRANE-BRAIN TRAUMA. HE WAS HOSPITALIZED IN THE HOSPITAL OF ANAPA CITY WHERE AT 17:45 (LOCAL TIME) HE DIED FROM RECEIVED TRAUMAS. FOUR MEMBERS OF CREW, ALL CITIZENS OF THE RUSSIAN FEDERATION, PASSENGERS 20 PEOPLE, CITIZENS OF FOREIGN STATES. THE HELICOPTER DOES NOT HAVE DAMAGES. THE FIRST DEPUTY OF DIRECTOR GENERAL OF JSC = PANH = SKORIKOV A.A.

Extract from the daily Flight Safety Information Bulletin of the Flight Safety Inspection of Federal Agency of Air Transport of the Russian Federation (FAAT) dated on 26.09.2017. (Exhibit D-1)

WEATHER CONDITIONS:
METAR URKA 261200Z 08014G21MPS CAVOK 21/03 Q1018 R04/010070 **TEMPO 07020G27MPS** RMK QFE759/1013
***METAR URKA 261200Z 08014G21MPS -** Type of report – METAP, Airfield – URKA (Anapa), observation date – 26.09.2017, observation time – 1200 GMT (1500 local time), 08014G21MPS – direction and wind speed at the ground – 080° 14 м/sec, with gusts up to 21 m/s, note - airfield pressure 759 mm - mercury column/1013 гПа
** **TEMPO 07020G27MPS** - at times 070° wind of 20 m/s, with gusts up to 27 m/sec.

Crew 4 people, all citizens of the Russian Federation:
Cpt.-instructor Redchenko S.V., Co-pilot –Captain Avedikyan S.V.
Passengers - 20 people, all citizens of foreign countries.
Point of departure: - Anapa airport.
Destination - pipe-laying vessel - **Pioneering Spirit.**
The aircraft does not have any damages.

2. <u>Investigation:</u>

Carried out by the commission appointed by the order of the head of the Southern Inter-Territorial Department (MTU) Rosaviatsii dated on September 27, 2017 No. 259-P consisting of:
Marchenko S.V. - Chairman, acting. Head of the Flight Standards Department of Southern MTU Rosaviatsii (Rostov-on-Don).
Artemyev VA - Deputy Chairman of the Commission - Senior State Inspector on Flight Safety (GIBP) at the Krasnodar airport of the Department of Flight Safety Inspectorate of the Southern MTU Rosaviatsii;
Members of the commission:

- Gubanov A.V., Senior State Inspector of the Department of Airworthiness Support of Civil Aircraft of Southern MTU Rosaviatsii (Rostov-on-Don);

- Grishin V.N., State Inspector of the Department of the State of Flight Safety Inspectorate at the Anapa Airport of the Southern MTU Rosaviatsii
- Saenko A.A., Deputy Head of Flight Safety Inspection of JSC "PANH" (by agreement);
- Sarukhanov O.G.., head of Flight Safety Inspection of Open JSC «Anapa airport» (by agreement),

in the period between September 27, 2017 and October 6, 2017 conducted the investigation of the emergency incident with the helicopter Mi-8 MTV-1 RA-25114 of the JSC "PANH" occurred on September 26, 2017 in airport of Anapa.

The investigation was completed on October 6, 2017. Full Report on the results of the investigation of aviation event (emergency incident) occurred at the airport of Anapa with Mi-8MTV-1 helicopter tail number RA-25114 of JSC "PANH" on September 26, 2017 is attached on 13 sheets (since No.1 to No.13).

3. **Crew' members**:

3.1. **IOGP Requirements**:

The data on the crew shown in the Investigation Report are verified and completed, all crew members' checks are completed in time and in full. All crew members did not have any incidents in past. Flight time of all three crew members complies with the requirements of the International Association of Oil & Gas Producers (IOGP) - "Aircraft management guidelines", Report #390, Appendix 5A, "Experience & qualification level", July, 2008, updated in August, 2013. p.137-139, "recommended requirements for the flight personnel of helicopters" for multiengine helicopters with maximal Take of Mass (TOM) over 5700 kgs' as follows **(Exhibit D-2)**:

- **Cpt.** – valid License of Line Pilot (LLP) for the appropriate type of helicopter, flights according to Instrumental Flights Rules (IFR) for this helicopter type;
  Total flight hours should be not less than 3000 hours, and as a Captain not less than 1500 hours, total flight hours on similar helicopter' type operation is to be not less than 500 hours, as a Captain of the contract type helicopter flight record shall be not less than 100 hours.
- **Co-pilot:** valid License of the Pilot of Commercial Aviation (H) for the appropriate helicopter type (LPCA), IFR flights on the appropriate helicopter type.
  Total flight hours should be not less than 500 hours, multi-engine helicopter flights hours should be not less than 500 hours, as Co-pilot of the contract type helicopter flight hours should be not less than 50 hours.
- **Flight Engineer/Flight-mechanic** should have a valid Flight License of Flight-mechanic; total flight hours should be not less than 2000 hours.

Actually:

Cpt-instr.: **Redchenko S.B.:**

Total flight time (flt. hrs.) TTL/Cpt: 15040/12131: Mi-8T=11173/8466, Mi-8MTV-1=741/741, Mi-8AMT=164/164;

Co-pilot- Cpt. under supervision: **Avedikyan S.V.:**

Total flight time (flt. hrs.) TTL/Cpt: 3415/634, Mi-8T=403/19, Mi-8MTV-1=2617/488, Mi-8AMT=395/127;

Flight Engineer (FE) **Batyrev V.N.:**

Total flight time (flt. hrs): 4550 f.h., Mi-8T/MTV-1/AMT: 1671 f.hrs;

ACRE' Note:

There are no remarks to the experience and flight hours of the crew' members.

3.2. In the medical center of the airport of Anapa, a medical examination of the crew members was carried out:

- Captain under supervision (co-pilot): - **Avedikyan S.V**.

The act of a medical examination for intoxication (alcohol, drug or toxic) enclosed;

Medical conclusion: On 26.09.2017 at 17.40 LT the state of alcoholic intoxication is not revealed **(Exhibit D-3)**;

-Captain-instructor: - **Redchenko S.B.**
The act of a medical examination for intoxication (alcohol, drug or toxic) enclosed;
Medical conclusion: On 26.09.2017 at 18.25 LT the state of alcoholic intoxication is not revealed **(Exhibit D-4)**;

Flight Engineer (FE) - **Batyrev V.N.**
The act of a medical examination for intoxication (alcohol, drug or toxic) enclosed;
Medical conclusion: On 26.09.2017 at 19.00 LT the state of alcoholic intoxication is not revealed **(Exhibit D-5)**;

Aviation technician: **- Ziberov A.S**.
The act of a medical examination for intoxication (alcohol, drug or toxic) enclosed;
Medical conclusion: On 26.09.2017 at 20.37 LT the state of alcoholic intoxication is not revealed **(Exhibit D-6)**;

ACRE' Note:
In accordance to the medical examination, there are no signs of using alcohol or narcotic substances by all members of the crew.

3.3. Data on aviation technician Simonov A.Yu. and Ziberov A.S. are following:
Simonov A.Yu. - aviation technician, License: Airframe & Engines, work experience since November 1992. Retraining for Mi-8MTV-1 - 08.07.2009, retraining on the Mi-8AMT - 24.04.15;

Ziberov A.S. - aviation technician, License: Avionics, work experience since July 2011. Retraining on Mi-MTV-1 - 24.12.2016;

ACRE' Note:
There are no remarks on the formulation of the validity periods for certificates of civil aviation experts. By the order of the Director of JSC "PANH" #No.131 dated 21.11.2012 both specialists are allowed to perform independent maintenance. The pages of the journal on safety instructions are attached to the materials of the commission's investigation, no remarks.

3.4. ACRE' experts conducted the thorough analysis of the content of explanatory notes of crew members about the event, with an emphasis on events that occurred during the engine start-up process:
- Captain-instructor **Redchenko S.B.:** ".. After the reading by the crew of the check list "before start up", two aircraft technicians stood on the distance of about 3 meters away from the end of the blades at an angle of 30-40* from the axis of the helicopter. Captain showed by the left hand (?) about readiness to start-up of left engine. After the confirmation by the aircraft technician Simonov A.Y. on the beginning of the start-up, the Captain gave the command to the flight engineer to start-up the left engine.
During startup and at the beginning of rotation of the rotor blades, I saw that aircraft technician Simonov A.Y. made a movement forward, and then he fell from the blow of the rotor blade. The engine was stopped immediately". (**Exhibit D-7)**
ACRE' Note:
In the explanatory note of the Captain-instructor Redchenko S. B. before the signature the date of the event and of the explanatory note was indicated - 26.09.2017 - the day of the accident.

- **Captain under supervision (Co-pilot): - Avedikyan S.V.**: "… In one minute (after the launch of the APU), the Flight mechanic showed a simulated signal to the technician Simonov A.Y. that will start the left engine. Literally a minute later the technician Simonov A.Y. waved by his hand, which meant that we can start the left engine. The Flight mechanic, having released the rotor, pressed the "Start" button.

I watched the engine start on the instruments. After about 5-7 seconds of the launch, by the peripheral vision, I noticed that the technician Simonov A.Y. fell on the concrete. At the same time, I heard the phrase of the Captain-instructor Redchenko S.B. "The technician was hit, turn it off." Flight mechanic Batyrev understood the command and immediately switched off the engine". (**Exhibit D-8)**
Date: 27.09.2017., i.e. the next day after the event (?), signature - Avedikyan S.V.

Flight Engineer (FE) - Batyrev V.N.: "…Aircraft technicians Simonov and Ziberov stood on the left-front of the helicopter within sight on a safe (in which we were absolutely sure) distance from the ends of the main rotor blades ....
About a minute later Simonov A.Y. submitted a conditional signal (waved by his hand) that it was possible to start the engine. At the command of the pilot-instructor "Launch", I simultaneously deactivated the carrier screw and pressed the "Start" button.
At that moment my attention was focused on the "Start" panel and on the instrumentы readings.
Where was the aircraft technician Simonov A.Y. I did not see. Approximately on the 5^{th} -7^{th} second of the launching, I noticed by a sideways glance how Simonov somehow jumped aside from his place. At the same time, I heard the phrase of the Captain-instructor Redchenko S.B. "The technician was hit, turn it off".
"Aviation technician Simonov A.Y. was an experienced specialist, who worked on helicopters for more than 20 years. What prompted him to approach the rotating blades of the rotor, defies logic".
Date: 27.09.2017., i.e. the next day after the event (?), signature – Batyrev V.N. (**Exhibit D-9).**

Aircraft technician - A.S.Ziberov: "…On September 26, 2017 about 15.30 L.T. I and aircraft technician Simonov A.Y. left the board of the helicopter and moved to a safe distance from the area swept by the rotating rotor blades. After that Simonov A.Y. gave the command to the launch of the APU. I was on the right side of Simonov A.Y. Then, at the moment of startup the engine No. 1, I looked towards the tail boom so that the main rotor blade did not strike the beam.
A few seconds later, with my side vision, I saw that Simonov A.Y. fell. I immediately gestured to the crew about the termination of the launch…." (**Exhibit D-10)**

ACRE' Note:
Explanatory note of the captain-instructor Redchenko S.B. is dated by September 26, 2017, and explanatory notes of the captain Avedikyan S.V., flight engineer (FE) - Batyrev V.N. and aircraft technician - A.S.Ziberov are dated by September 27, 2017, i.e. were written on the next day after the event, which seems strange.

4. **Auditing Center "Risks Evaluation" (ACRE):**
ACRE' experts carefully studied the content of the "Report on results of the investigation of the aviation event (emergency incident) that occurred at the airport Anapa with the Mi-8MTV-1 helicopter #RA-25114 of the JSC "PANH" on September 26, 2012, prepared by the investigation commission created by the order of the head of the Southern Inter-Territorial Department of Rosaviatiya (FAAT). ACRE' experts had a number of questions that were not clarified or incorrectly interpreted by the members of investigation commission.
So:

4.1. Presented data of crew members and ground personnel were analyzed. There were no comments on the training of crew members and ground personnel.

4.1.1. In section 3 of the "Analysis" (p.10), the circumstances of the incident were described;

4.1.2. It is noted that in the same day, on September 26, 2017, the first flight to the helipad of the pipe-laying operator "PIONEERING SPIRIT" and back was carried out at 08.24.UTC (11.24 local time);

4.1.3. From the Report of the Investigation Commission (p.10):
"On the basis of the application 261126 on the use of the airspace the crew of Mi-8MTV-1 RA-25114 JSC "PANH" at 12.00 UTC has begun the preparing to operate the flight to the helipad on pipe-layer "PIONEERING SPIRIT". The helicopter was prepared for re-flight. In order to ensure a stable startup of engines in a strong wind conditions, the helicopter on the parking place was set against the wind at the of approximately 60°."

4.1.4. From the Report of the Investigation Commission (p.10):

"Cpt. listened ATIS* information and gave command to the crew to report on readiness.
ATIS is the generally accepted transliteration from English ATIS (automatic terminal information service), an automatic transmission of meteorological information in the area of the aerodrome.
"CPT-instructor asked ATC dispatcher for the permission to start-up engines at parking place No16".
"At 12.17 (UTC) crew* requested permission to start-up engines"
"At 12.19 (UTC), crew* received a start-up permit."

ACRE' note:

In the Section 3 of the "Analysis," the investigation commission juggles with the terms "Cpt" and "Cpt-instructor", carefully avoiding a clear indication of who occupied the left-pilot's seat (PIC) and who-the right-hand seat (Cpt-instructor):
"Cpt. listened to ATIS and instructed the crew' members to report on readiness. Cpt-instructor asked the ATC dispatcher permit to the engines' launch at the parking place No16.
At 12.17 (UTC), crew* requested start up clearance;
At 12.19 (UTC), crew* received clearance to start up."

ACRE' note:

*"Clearance to start-up requests the Captain, which either gives the command to Flight mechanic to start-up engines, or starts the engine itself" (Flight Ops Manual of Mi-8MTV-1). The term **"crew"** is used to depersonalize specific crew members (Cpt., Cpt.-instructor, Flight Mechanic), who launched (namely, who pressed the engines' start-up button?).
"The launch of APU and the left engine performed by the flight crew members in accordance with Flight Ops Manual (FOM/FM) requirements." **Who exactly?** (The Commission does not specify!)

ACRE' note:

The crew consists of 3 people: Cpt., Cpt-instructor and Flight mechanic. **The question is: "Are they all of three simultaneously pressed the button "Start"?** The item 3.2.4.5.of "Flight Manual (FM) Mi-8MTV-1 reads: "General instructions on the interaction of crew members in the process of starting, warming up and testing the engines **(Exhibit D-11):**
а) engines are started by the PIC or by its command by Flight mechanic;
б) startup, warming up and testing of engines is performed in accordance with the paragraph 8.2. of Flight Manual;
в) before starting engines, crew must perform a control check in accordance with the checklist, section "Before engines start";
г) start-up, warm-up, engine testing is allowed **only to Cpt.** (!) while the whole crew must be at their cabin seats";

ACRE' note:

There is a contradiction between items **(а)** and **(г)**, since item **(г)** abolishes item **(а).** Therefore, instead the word **"crew",** the commission should have unequivocally indicated in the Report - **"Cpt".**

4.1.5. From the transcript of the recording of the crew's talks it was determined that the Cpt-instructor discussed with technicians A.Simonov and Ziberov A.S. transmission of the information by gestures: "Cpt. showed to technicians "from the propeller" and received confirmation."(?)

ACRE' note:

Thus, it is confirmed that the technician did not use the helicopter' intercom to communicate with the crew, which, of course, made it difficult for the technician the communication with crew in the event of unforeseen situations, which, in fact, happened.
Unlike fuselages of Mi-8/T/MTV/AMT helicopters family does not have an intercom connector (SPU) outside on the front part of the fuselage near front landing gear. Therefore, in order to communicate with the crew, the helicopter technician should use SPU' socket located in the passenger cabin, just behind the sliding door, links.

All documents of Mil helicopters family (Flight Manual, Maintenance Manual) designate only the possibility of communication by SPU, without specific location of the SPU connector. Nevertheless, the possibility of communication "Crew-Technician" by SPU on helicopters Mi-8 and its modifications (MTV/AMT) exists and therefore is indicated in all operational instructions and manuals.

4.1.6. In the "Flight Manual of Mi-8MTV-1 helicopter' there are warnings:

Para 2.5. GENERAL FLIGHT LIMITATIONS

Item 2.5.7. Maximum wind speed

2.5.7.1. Maximum wind speed when starting, stopping engines and the hovering, take-off and landing **(Exhibit D-12):**

Table 2.4

Wind direction	Permissible wind speed, m/sec	
	At main rotor starting and stopping	At take-off, hovering & landing
Headwind 0°	25	25
Side wind right 90°	10	10
Side wind left 270°	15	10
Distant wind 180°	8	10

Starting and stopping engines, hovering, takeoff and landing are permitted produce at wind speed and directions relative to the course helicopter, shown in Fig. 2.1.1. **(Exhibit D-13)** and Fig. 2.1.2 **(Exhibit D-14);**

2.5.7.3. Taxiing day and night is allowed at a wind speed not exceeding 15 m/sec, in any direction of the wind to the longitudinal axis of helicopter, as well as at headwind up to 25 m/sec. **(Exhibit D-12);**

4.1.7. In "Flight Manual of Mi-8MTV-1" **item 8.2.2.** "Operational limitations" repeated **Exhibit D-15;**

1. Permissible wind speeds for starting/stopping the engine:
- headwind - 25 м/sec.
- side wind right 90° - 10 m/sec.
- side wind left 270° - 15 m/sec.
- distant wind - 8 м/sec.

4.1.8. In "Flight Manual of Mi-8MTV-1" **item 8.2.3.** "NORMAL OPERATION" there are some warnings **(Exhibit D-16)**, marked by yellow color:

WARNINGS:

1) It is allowed to start and shut down the engines only at a wind speed not exceeding the values indicated in Table 2.4. and in item 8.2.2. (Exhibit D-17):

…….

…….

7) IN CASE OF STRONG GUSTY WIND HAVING A SPEED OF 15 TO 25 M/SEC, THE MAXIMUM CLEARANCE BETWEEN THE SOPINNING BLADES OF THE MAIN ROTOR AND THE TAIL BOOM IS PROVIDED WITH THE HELICOPTER SO POSITIONED THAT IT IS BLOWN BY THE LEFT SIDE HEADWIND AT AN ANGLE OF 45°.

ACRE' note:

According to the text of the Commission Report, section 3, page 10:

"Helicopter was prepared for the second flight. In order to ensure a stable start-up of the engine in a strong wind, the helicopter on parking place was placed against the wind at a heading of approximately 60°".

4.1.9. In the "PANH" Airline's Flight Ops Manual (AFOM) of Mi-8MTV/AMT" in **chapter 5.2.** indicated **(Exhibit D-17):**

"The maximum meanings of the lateral and associated wind components of Mi-8MTV/AMT equal to the table 2.4 and are following (Table 2.4A):

Wind direction relative to helicopter	Permissible wind speed, m/sec	
	during spinning & stopping the main rotor blades	at take-off and landing
Headwind 0°	25	25
Side wind right 90°	10	10
Side wind left 270°	15	10
Distant wind 180°	8	10

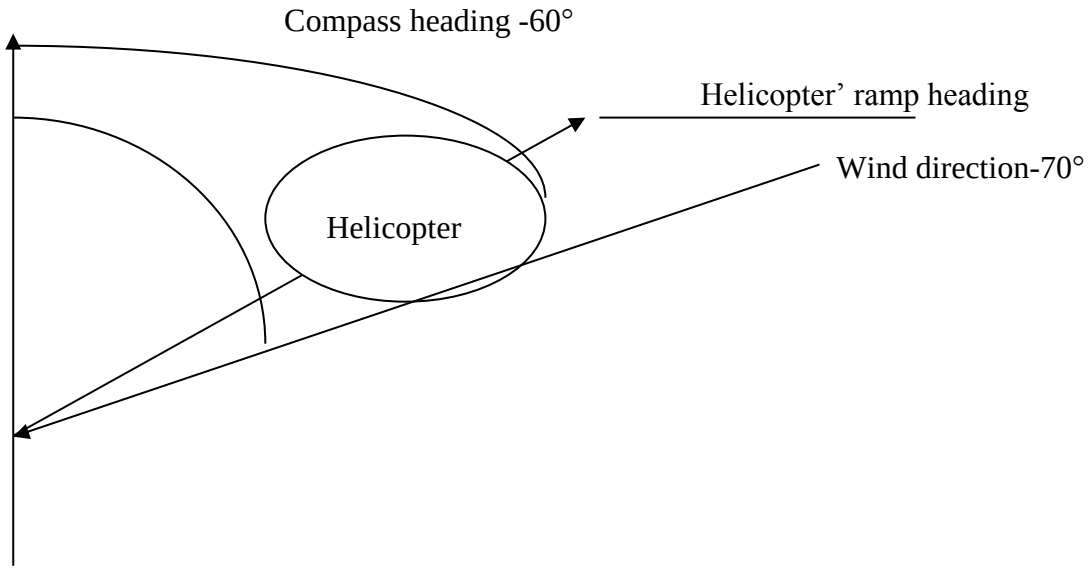
In this case there is a discrepancy between the **text of Warnings No.7** and the text of the **Commission's Report**. The above mentioned **ACRE' Note** from the text of the Accident Investigation Report is: ***"Helicopter was prepared for a second flight. In order to ensure a stable start-up in a strong wind, the helicopter was placed against the wind at a rate of approximately 60°".***

As it shown below the wind direction was about 70°, therefore, practically helicopter was placed close to headwind. It is O'k for the start-up the engines.

ACRE' Note:

The wind direction relative to the helicopter is the angle between the longitudinal axis of the helicopter and the direction from which the wind is blowing (meteorological wind).

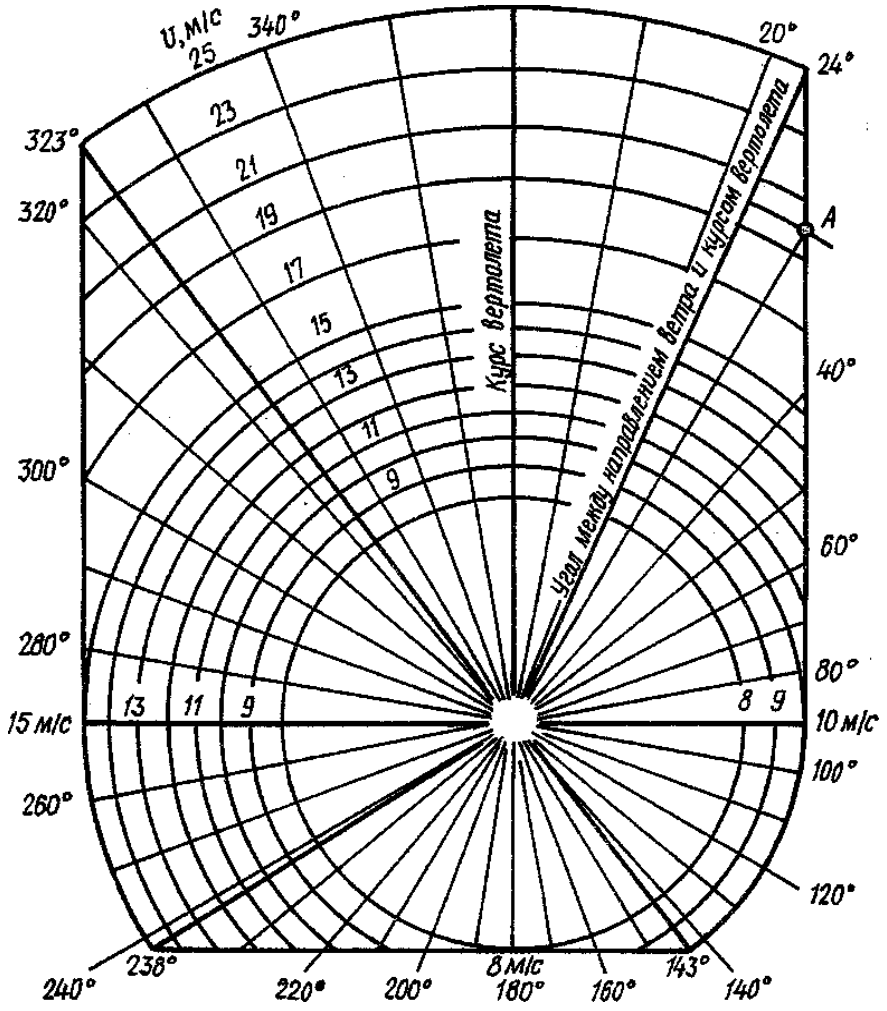
The course of the helicopter is the angle between the north direction of the magnetic meridian and the longitudinal axis of the helicopter. For the start-up engines the helicopter allocated with the magnetic course of MK-60°. The wind direction according to actual weather at start-up was 70°, the force of the wind, taking into account gusts at the time of the start-up, was approximately 19 m/sec. that is, opposite-lateral at the angle of 10° to starboard.



The wind speed in actual weather is taken into account gusts; in the forecast - without taking into account gusts of the wind. Therefore, it turns out that the helicopter engines were launched in accordance with Mi-8MTV-1 Flight Manual without violating the wind restrictions.

Therefore, parking the helicopter **"against the wind with the course of about 60°"**, as the commission writes **"to ensure a stable launch in a strong wind"** is completely contrary to the text of the operation documents of the helicopter ("Mi-8MTV-1 Flight Manual" and "PANH" Flight Operations Manual").

The maximum wind speed depending on its direction relative to the course of helicopter during spinning, stopping the main rotor and taxiing reflected in the diagram below (Exhibit D-18):



Example: At wind direction 30° from the right side the maximal wind speed consist of 20 m/sec, point A.

ACRE' Note:

Features of piloting Mi-8MT/MTV-1: "Starting, switching off and testing of engines": "Starting of engines, their warming up and testing is allowed at a speed of headwind not more than 25 m/sec., the side wind from the right - no more than 10 m/sec., the lateral wind from the left - no more than 15 m/sec., the tail wind - no more than 8 m/sec."

Thus, the position of the helicopter at the start of the engines ensured a steady startup of its engines in the conditions of the strong wind of 20-21 m/sec. I.e. parking the helicopter against the wind before start-up of its engines is the most correct solution.

The maximum actual wind did not exceed 15 m/sec. with gusts up to 21 m/s, the helicopter was parked almost against the wind, so the wind was allowed up to 25 m/sec. The forecast wind 27 m/sec was not confirmed by the actual weather therefore the crew was not taken it into account.

In order to exclude the impact of the main rotor blade on the tail beam at the start of engines and in terms of aerodynamics and physics, the blade in the azimuth 150° right-to-rear should be at its highest position (the sum of the resultant airflow from the wind and the rotational movement is maximum in the azimuth 90°, but, taking into account the effect of inertial forces, its upward movement continues up to azimuth 150°). The blade reaches its lowest position in the azimuth of 330°, therefore in the sector 300°-360° there are maximum risks of the collision with obstacles.

As follows from Table 2.4A above and the diagrams, the **maximum permissible wind speed is 25 m/sec**. T**he crew, in accordance with the limitations of the Flight Ops Manual and the actual weather, should have run the engines, and therefore the flight!**

From the Report of Investigation Commission:
Actual weather at the airport of Anapa (UTC time):
1200: wind 070° -13 gusts 21 m/sec, good conditions, air temperature +21°C, dew point temperature + 03°C, pressure 759 mm Hg., landing forecast: at times the wind 070°-20 gusts 27m/s
1203: the wind 070° -15 gusts 21 m/sec.
1204: wind 070° -14 gusts 21 m/sec.
1227: wind 070° -11 gusts 18m /sec.
1230: 070° -12 gusts 20 m/sec, without significant cloudiness, air temperature + 20° C, dew point temperature + 03°C, pressure 759 mm Hg.
Aerodrome warning 2 (UTC time):
Effective 26.09.2017 between 1200 and 1800 surface wind speed 20 m/sec, maximum 27 m/sec, amplification is projected. The time of compilation is 11.00 UTC (14.00 Moscow time).
ACRE' note:
From the Commission' Report:
"The crew carried out the procedures for starting left engine. With the untwisting of the main rotor, the Captain and the Flight mechanic noticed with a sideward eye that technician Simonov A.Y. fell on the concrete.
"At 12.27 (UTC) the crew reported to the dispatcher: "25114, stopped the launch, waiting for an ambulance." To the extreme incident a strong gusty wind (up to 21 m/sec) was promoted. Before the start and during the beginning of rotation of the main rotor blades the swinging of blades was observed. According to the agreement with the crew, two aircraft technicians were involved in the process of the start of engines, one was watching the engine start - Simonov A.Y., the other - Ziborov A.S. observed the tail beam, in order to avoid a possible impact of the rotor on the tail beam in case of strong wind. The aircraft technicians were on the left in front of the helicopter within sight of the crew."
ACRE' note:
The role of aircraft technician Ziberov A.S. is not clear - his observation on the tail beam **could not prevent a possible impact the rotor blade with tail beam**, **besides, he had no communication with the crew on aircraft intercom (SPU)**. The crew in this case would certainly feel the impact, and the sensor of the speed indicator in the cockpit would necessarily work.
From the Report of Investigation Commission:
1. Page 11, *"Note: When starting engines, a specialist of Maintenance Service providing engines start-up (Simonov A.Y.) is obliged visually monitor hazardous areas and, if necessary, take all measures (?) to prevent unauthorized persons against the entering into hazardous areas, using for this purpose signals attracting the attention or assistance of other persons in the vicinity (clause 5.7.9, NTERAT GA-93 - Manual on Operation & Repair of Aviation Equipment in Civil Aviation of Russian Federation-93)".*
ACRE' note:
However, the original text of the item 5.7.9 of "*Manual on Operation & Repair of Aviation Equipment in Civil Aviation of Russian Federation-93 (NTERAT CA-93)"* has a completely different version:
"**item 5.7.9. Starting and testing of engines is prohibited** if the braking systems of the wheels and if the engine management, power plant monitoring devices are faulty, and **if there is no reliable communication between the launching and the providing** (except as specified in the Maintenance Documents).
At starting and testing the engines, it is also forbidden:
- to carry out the other works on the aircraft, except for those specified by the technology of starting and testing the engine;
- to the specialist launching engines - leave the workplace in the cockpit;
- to the specialist ensuring start-up - to be in dangerous areas ahead and behind the aircraft, in the plane of rotation of the propellers, **under the helicopter rotor blades**, to leave the workplace established for him."
Moreover, item 5.7.7. *NTERAT GA-93* states: "On aircraft equipped with a SPU (intercom),

allowing two-way communication between the launching and providing, **the start of engines is made only using this two-way communication**. If it is impossible to use the SPU (intercom), it is allowed to use the visual start-up scheme developed by the airline, subject to sufficient security measures. In all cases, the commands and signals provided are used.
Specialists providing engines start-up are required to strictly follow the established rules of action at start-up, the launching specialist command, and the rules of moving in the parking place". (Annex 1.5, NTERAT GA-93)". **(item 5.7.7 Exhibit D-19)**

ACRE' note:

In this case, there were no reasons preventing the use of the SPU (intercom), especially since starting and testing of engines **is prohibited in the absence of a reliable connection between the launching and providing specialists.** (item 5.7.9, NTERAT GA-93); **(Exhibit D-19)**
Also, there were no reasons **for the launching specialist (technician) to be under the helicopter' rotor blades**. **(Exhibit D-19)**

Conclusion:

Thus, the experts of ACRE state that:
a) Crew violated items 5.7.7, 5.7.8, 5.7.9 and 4.2.5 of regulatory document - "*Manual on Operation & Repair of Aviation Equipment in Civil Aviation of Russian Federation-93- NTERAT GA-93"*;
b) Engineering staff (technicians) violated items 5.7.7, 5.7.8, 5.7.9 and 4.2.5 of regulatory document NTERAT GA-93.
c) item 5.7.8 of Regulatory document NTERAT GA-93: "Permission to startup engines before taxiing the commander receives from air traffic control and to perform the startup - from the specialist who maintains the aircraft.
d) item 5.7.9 of Regulatory document NTERAT GA-93: Starting and testing of engines is prohibited ... **if there is no reliable connection between the launching and by the providing start-up technician** (except in the cases stipulated in the Maintenance documentation).When starting and testing the engines, it is also forbidden: - for the technician providing the startup - to be in the dangerous areas in front and behind the aircraft, in the plane of rotation of the propellers, under the helicopter rotor, to leave the workplace established for him;
i) item 5.7.10 of Regulatory document NTERAT GA-93: "If there is a danger to the people or the aircraft during the start-up or testing of the engine, any officials staying in the parking place must immediately set the signal (command) to shut down the engines". (Dokipedia: Chapter 4, "Flight Operating Manual for Crews").

2. **From the Report of Investigation Commission:** "During the start-up of the left engine at the spinning (at the beginning of the rotation the rotor made one complete revolution) of the rotor blades (the swiping motion of the seventh blade from the beginning of rotation happened) the collision to the ground-based maintenance specialist Simonov A.Y., participated in the launch of engines happened."

ACRE' Niotes:

Thus, both the crew and aircraft technicians violated the paragraph 4.2.5. NTERAT GA-93, which sounds:
item 4.2.5. "At the start of the engines before taxiing, the crew requests the permission of the traffic control and **the technician, who provides the start-up**; at temporary airfield – the technician providing the start-up. The start-up is carried out **with the obligatory use of communication equipment SPU (intercom)**, and on the aircraft, where such means are not available - with the use of commands and signals (Appendix 1.6) between the launching and the initiating. (Order of the Department of Air Transport of the Ministry of Transport of Russia of June 20, 1994. No.DV-58 "Approval the Manual on Maintenance and Repair of Aviation Equipment in Civil Aviation of Russia" –NTERAT GA-93").
A strong gusty wind (up to 21 m/sec) promoted to the extreme incident. Before the start-up and during the beginning of the rotation of the main rotor, swinging of the blades was observed **(wind 70* 20 m/sec, gusts up to 27 m/sec).**

Attached for the information "Crew helicopter' control check card" at the flights on Mi-8T RA-22769 helicopter" approved by General Director of JSC "PANH" 27.04.2016 (pages 146-147 of the Investigation Commission Report) contains the section **"Before engines start**" where in the item 9 in the "Content of the control operation" indicated – **"Aviation technician"** and in column 3 - the answer of "Flight Mechanic": **"ahead 3-5 meters from the ends of rotor blades". (Exhibit D-20)**

Also, in the submitted copy of the page number **152**, "Flight Ops Manual" of Mi-8T item 9.7.2. "Helicopter' checklist. Crew readiness", subparagraph 9.7.2.1. "Before engines startup of the Mi-8T" the item **"Aviation technician"** is indicated, and Flight Mechanic responds **"Ahead, 3-5 meters from the ends of the rotor blades". (Exhibit D-20)**

4. The attached "Check list of flight crew" at the performing flights by the helicopter **Mi-8MTV No.RA-25114",** approved by the General Director of JSC "PANH" 07.07.2016 (pages 148-151 of the Investigation Report), **not contains the section "Before engines start" (p.151),** and after **item b** "At working APU", the section of check-list **"Before taxiing out"** comes at once. **(Exhibit D-21)**

Conclusion (of investigation commission):

"Crew' checklists of the Mi-8T/MTV-1 helicopters, presented in the Flight Ops Manual of Mi-8' modifications, were used in the corresponding chapter of the Airline' Flight Operating Manual AFOM (Russian abbreviation is RPP) of JSC "PANH".

ACRE' Notes:

It is shamefully not noticed that in Flight Ops Manual Mi-8MTV/AMT there are no whole pieces of text as in the similar subparagraph 9.7.2.1. as in Flight Ops Manual of Mi-8T helicopter.

In the item 2.3.5.2 (page 6) of the Investigation report the commission noted: "There are no notes/remarks to the technical condition of the airframe, engines, and avionics". Right here: "PANH" Airlines" is fully equipped by the technical documentation; there are no comments on its condition"(Why!?).

4. However, as it shown by the careful analysis of the contents of the text of the Mi-8MTV/AMT "Flight Ops Manual" carried out by the ACRE' experts, neither in Mi-8MTV-1/AMT "Flight Ops Manual", nor in the checklist of flight crew at performing flight operations by Mi-8MTV-1 helicopter No.27 #RA-25114 there is no subparagraph similar to the sub-item of "Flight Ops Manual" of the Mi-8T helicopter #9.7.2.1 "Before startup engines Mi-8T captain asks **"Aviation Technician"**, and the Flight Mechanic answers: **"Ahead, 3-5 meters from the ends of the blades".**

In the same "Flight Ops Manual" of Mi-8MTV helicopter (item 1.2.1.) is stated that "Manual for the flight operation of the Mi-8MTV-1 helicopter" is the main flight- and technical document determining and regulating for this type of the helicopter the specific rules of its flight operation, equipment and method of flight performance, taking into account the features of its piloting."

In the paragraph 1.2.2 of "Flight Ops Manual" is shown: "The requirements and instructions of this "Flight Ops Manual" are mandatory for the entire flight crew during the flight operations of this type of helicopter."

For the sake of justice, it should be noted that **in the maintenance schedule of Mi-8MTV-1 helicopter** "Safety measures", May 07/03 and April 20/16, TM3556-BE-G in the item 2.21 was noted: **"During testing the engines, it is prohibited to stay in the zone swept by the main rotor blades and in the area of anti-torque propeller. It is forbidden to be closer than 25m from the helicopter, with the exception of the technician observing the launch." (Exhibit D-22, text marked by yellow color).**

In item 2.22 "Approach to the helicopter is allowed only when running engines on a small gas, while remember that the **most dangerous areas where the blades pass most low, are the left front and right rear." (Exhibit D-22, text marked by yellow color)**

In the section 4 "Conclusion" of the Commission Act states:

page 12:

"The reason of the emergency situation was the location of technicians providing engines startup on the ground in a plane covered by rotary blades of the helicopter, therefore the requirements of safety measures set forth in the Maintenance Schedule of Mi-8MTV-1 part 1, items 2.21 and 2.22 were violated:

2.21. During the engines startup, it is prohibited to stay in the zone swept by the helicopter's main rotor blades and in the area of antitorque propeller (maintenance schedule of Mi-8MTV-1, part 1, "Airframe and Powerplant", **(Exhibit D-23)**.

2.22. Approach to the helicopter is allowed only when running engines is on the mode small gas, while remember that the most dangerous areas where the blades pass most low, are the left front and right rear. **(Exhibit D-23)**.

Aviation technicians occupied the position of the helicopter in front on the left, i.e. **they were in the most dangerous zone"**.

From the Commission' Report:

In the technological instructions for the execution of scheduled operations on the Mi-8 helicopter, issue #1 technological card №1.20.34, **the distance of 3-5 m from the end of the blades is indicated**: *item 1. Stand on the distance of 18-20 m from the helicopter (3-5 m from the end of the blades) on the side of the engine being started".*

The accompanying factor that influenced on the aviation event is a strong gusty wind up to 21 m/sec, registered by the meteorological service of the airport of Anapa (Vitiazevo) ".

ACRE' Notes:

Indeed, the commission on investigation confirmed that "An accompanying factor, influencing the on aviation event **was a strong gusty wind up to 21 m/sec**., registered by meteorological service (AMSG) of the airport of Anapa (Vitiazevo)".

However, in its "Conclusion" the commission ignored it and did not indicate the fact of the presence of a meteorological warning #2 on the aerodrome, which was immediately followed by the information on the actual weather at the Anapa airport and reflected in the Investigation Commission Report on the page #7:

"Aerodrome Warning #2 (UTC Time)":

"Effective on September 26, 2017 in the period between 1200 and 1800, **surface wind speed 20 m/sec, maximum 27 m/sec, and the increase is projected**. The time of compilation is 11.00 (14.00 Moscow time)". And this fact is ignored by the commission in the Report Conclusion (p.12!).

ACRE' Note:

From the Commission' Report (page 12):

"At the beginning of the spinning of main rotor, with a gusty wind, the blades perform the most powerful flapping movements, in which the blade can fall to a **value sufficient to strike a person close to the rotation zone of the rotor."**

"The sweep of the blade with a gusty wind is most likely and cannot be compensated by the constantly acting centrifugal force or aerodynamic forces acting on the blade (due to the small N_{rb}-rotor rotation speed ~ about 10%)."

Conclusion:

1. In case of startup engines, both aviation technicians **should not have been in the dangerous zone swept by the main rotor blades (!);**
2. Crew violated items 5.7.7, 5.7.8, 5.7.9 and 4.2.5.of regulatory document - "*Manual on Operation & Repair of Aviation Equipment in Civil Aviation of Russian Federation-93-* NTERAT GA-93";
   b) Engineering staff (technicians) violated items 5.7.7., 5.7.8., 5.7.9 and 4.2.5.of regulatory document NTERAT GA-93.
3. c) item 5.7.8. of Regulatory document NTERAT GA-93: "Permission to start up engines before taxiing the commander receives from air traffic control and to perform the startup - from the specialist who maintains the aircraft.

4. d) item 5.7.9. of Regulatory document NTERAT GA-93: Starting and testing of engines is prohibited ... if there is no reliable connection between the launching and by the providing start-up technician (except in the cases stipulated in the Maintenance documentation).When starting and testing the engines, it is also forbidden: - for the technician providing the startup - to be in the dangerous areas in front and behind the aircraft, in the plane of rotation of the propellers, under the helicopter rotor, to leave the workplace established for him;

4. SHORTCOMMINGS DETECTED (by commission) AT THE INVESTIGATION

4.1. The Investigation Commission determined that crew' checklists of Mi-8MTV/AMT helicopters in the chapter "Before starting engines", after the operation "Shut-off cranes", did not contains the control operation **"Aviation technician"** and the report form of "Flight mechanic": "Ahead, 3-5 meters from the end of the rotor blades":
Contents of the control operation: "Technician"
The report form of the Flight mechanic: "Ahead, 3-5 m from the ends of blades of the rotor"
This item of the control operation could ensure the necessity of above mentioned requirements for the crew.

V. SUMMARY of AUDITING CENTER "RISKS EVALUATION" TO THE REPORT of THE COMMISSION OF SOUTH INTERTERRITORIAL DEPARTMENT OF ROSAVIACIA (FAAT) ON THE RESULT OF THE INVESTIGATION HELICOPTER' EVENT MI-8MTV-1 #RA-25114 JSC "PANH" AT THE AIRPORT OF ANAPA on 26.09.2017

1. From the standard **"Typical Instruction on labor protection for the crew members of Mi-8"** Approved by the Order of the Head of Federal Services of Air Transport" #5, dd 01.07.1999. **Section 3 "Safety Requirements in the Process of the performing of flight task" (Exhibit D-23)**

1.1. The main condition for ensuring the safety of crew members in the process of completing of flight task is the exact compliance to the requirements of the "Manual of Flight Operation", "Mi-8 Flight Manual" and "Technology of the crew work of Mi-8 helicopters". (item 3.1, page 9 of the Instruction). **(Exhibit D-23)**

1.2. The helicopter' commander (captain) can start the engines only after the technician report on the readiness of the helicopter to operate flight, carry out a control inspection of the helicopter and after performing control check before engines startup. (item 3.2, page 9 of the Instruction, **Exhibit D-23).**

1.3. Before startup the engines, the helicopter commander must make sure that the chokes are under the wheels of the chassis, **and there are no foreign objects and people near the helicopter and in the rotor-disc area.** (item 3.3, page 10 of the Instruction, **Exhibit D-23)**

1.4. The helicopter commander must give the command "from propellers" and after receiving the answer (from technician) "Yes from propellers" make sure **that the aircraft technician is out of the rotor-disc area - in front - on the left in the area of view.** (item 3.4, page 10 of the Instruction). **(Exhibit D-23)**

1.5. The signal of the aircraft technician to immediately turn off the engines must be immediately executed by the crew. (item 3.4, page 10 of the Instruction, **Exhibit D-23)**

ACRE' Note:

On the basis of the "**Tipical Instruction on labor protection for the crew members of the Mi-8 helicopter", the JSC "PANH" Airlines" must developed its own "Manual on labor protection", taking into account all types of helicopters operated by the "PANH" Airlines.**

In the Investigation Commission Report, there is no mentioned of the existence of such an **Instruction** in the "PANH" Airlines". Undoubtedly, if such an Instruction in the "PANH" Airlines" was not developed to the moment of the accident in the Anapa airport, now it should already be developed;

1.6. Attached to the Act of the Investigation Commission "Instruction on interaction and technology of work crew members of a helicopter Mi-8" does not carry any meaning for the investigation of the accident, because it designated for the helicopters Mi-8 (not for Mi-8T/MTV) and does not reflect issues of safety for ground personnel. (p. 178-182, **Exhibit D-25**).

2. Historically on helicopters of Mil family Mi-8T/MTB/AMT, there is no external socket for the aircraft intercom system (SPU), which makes it difficult the interaction the ground personnel to the crew during startup and testing engines.

To use the internal socket of the SPU in the transport cabin **(photo - Exhibit D-24)** it is necessary to keep the helicopter's entrance door open, which during the engine start-up causes discomfort to passengers and maintenance personnel (page 6, item 4.1.5 of the current report).

ACRE' Note:

It is necessary to raise a question before Mil Designe Bureau about the modification of the fleet of Mil helicopters for the installation of an external socket (SPU).

3. It is necessary to exclude subparagraph **a)** in item 3.2.4.5 of the "Flight Operation Manual (FOM) of the Mi-8MTV-1 helicopter", since, in its content, subparagraph **d)** already effectively annuls the entire item **a)**; (page 3, item 4.1.4. of current Report).

ACRE' Note:

a) In case of startup engines, both aviation technicians should not have been in the dangerous zone swept by the main rotor blades, but they were, as it reflected in the Act of the Investigation Commission.(!).

b) Thus, the crew – captain and flight mechanic **were obliged not to make start-up of the engine, as they both observed that both technicians were located in the dangerous zone swept by main rotor blades**.

4. The Investigation Commission determined that crew' checklist of Mi-8MTV/AMT helicopters in the chapter "Before starting engines", after the operation "Shutoff cranes", did not contains the control operation **"Aviation technician"** and the report form of "Flight mechanic": "Ahead, 3-5 meters from the end of the rotor blades":

Contents of the control operation: "Technician"

The report form of the Flight mechanic: "Ahead, 3-5 m from the ends of blades of the rotor"

This item of the control operation could ensure the necessity of above mentioned requirements for the crew.

5. The Investigation Commission deliberately or because of a lack of sufficient qualifications did not reflect all the above-mentioned nuances of the accident investigation in the Anapa airport and did not reflect some of the most important details of the incident:

- did not assess the compliance of the actions of the crew with the requirements of "Airline's Flight Operations Manual (AFOM);
- did not asses on the analysis of meteorological conditions (wind speed and direction) in the airport of Anapa (forecast and actual wheather);
- did not asses Captain' decision on the departure;
- did not give an assessment of the activities of the "PANH" management with regards to the maintenance technical documentation ("Flight Operations Manual (FOM) of the Mi-8MTV1

/AMT helicopter"), in which absence the important information on the engine startup procedure of Mi-8MTV-1/AMT and the actions of Technicians and Flight Mechanic, similar to the Flight Operations Manual of the Mi-8T helicopter and the Mi-8T Flight Manual.

- also, an assessment of the actions of both aviation technicians were not made, the cause of their violation of the Labor Safety Instruction was not identified.

VI. Auditing Center' Position

6.1. Analysis of the content of the Report on results of investigation of aviation events at the airport Anapa has shown that in the activity of "PANH" Airlines" there are serious shortcomings in the area of the monitoring the content of the operational documentation, including in the field of labor protection and safety regulations, namely:

- A separate manual on labor protection and safety regulations during the maintenance of Mi-8MTV/AMT helicopters in "PANH" Airlines" is not available;
- systematic approach in the work with the crews and technical personnel of the "PANH" Airlines" for compliance with safety labor and health regulations is not conducted;
- Crew violated items 5.7.7, 5.7.8, 5.7.9 and 4.2.5.of regulatory document - "*Manual on Operation & Repair of Aviation Equipment in Civil Aviation of Russian Federation-93*-NTERAT GA-93";
- Engineering staff (technicians) violated items 5.7.7., 5.7.8., 5.7.9 and 4.2.5 of regulatory document NTERAT GA-93.
- Both the crew and ground personnel (aircraft technicians) deliberately violated the item 5.7.9. of Regulatory document NTERAT GA-93: "Starting and testing of engines is prohibited ... if there is no reliable connection between the launching and by the providing startup technician (except in cases stipulated in the Maintenance documentation).

6.2. Also, it can be assumed that aircraft technicians deliberately violated the item 5.7.9. of Regulatory document NTERAT GA-93: "During starting and testing the engines, it is also forbidden: - for the technician providing the startup to be in the dangerous areas in front and behind the aircraft, in the plane of rotation of the propellers, under the helicopter rotor, to leave the workplace established for him";

6.3. The Investigation Commission determined that in Flight Operation Manual of Mi-8MTV-1 as well as in crew' checklist of Mi-8MTV-1 helicopters the chapter "Before starting engines", after the operation "Shut-off cranes", did not contains the control operation **"Aviation technician"** and the report form of "Flight mechanic": "Ahead, 3-5 meters from the end of the rotor blades":
Contents of the control operation: "Technician"
The report form of the Flight mechanic: "Ahead, 3-5 m from the ends of blades of the rotor"
This item of the control operation could ensure the necessity of above mentioned requirements for the crew.

6.4. Unfortunately, ACRE states that Captain and Captain -instructor did not stop violations of regulatory documents by aircraft technicians during starting helicopter engines, did not require them to leave the rotation zone of the propellers and moreover, they themselves contributed to these violations by making a decision and launching the engine without reliable communication with ground (SPU-connector) personnel and when both aircraft technicians were in the rotation zone of the main rotor blades;

6.5. The Investigation commission stated in its Report: "Analysis of video materials, crew members' negotiations, inspection of the scene of the incident shows that ground maintenance specialists providing engine start-up on the ground were in a plane swept by the helicopter' rotor blades than they violated the safety requirements set out in the Maintenance Regulations of the helicopter Mi-8MTV-1, part 1, items 2.21, 2.22. " **(Exhibit D-22).**

6.6. Auditing Center "Risks Evaluation" (ACRE) urges the Customer to conduct a repeat aviation audit of "PANH" Airlines" operations, taking into account the fatal incident at the Anapa airport, and also taking into account the fact that more than 6 months have passed since the initial audit.

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