

МЕЖГОСУДАРСТВЕННЫЙ АВИАЦИОННЫЙ КОМИТЕТ INTERSTATE AVIATION COMMITTEE

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*Исх. 05-552
от 23.02.96*

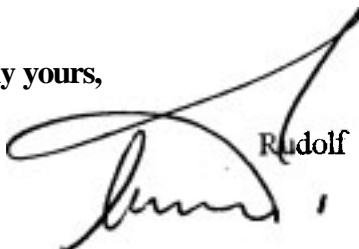
To: Mr. J. Danaher
NTSB
490 L'ENFANT PLAZA East S.W.
Washington D.C. 20594-2000
USA

Dear Mr. Danaher!

I am sending you the Final Report of the "D-Caribbean" - balloon accident.

I hope that this pitiable case demonstrated to us as well as to the World Aviation community the favourability of mutual efforts of the professional investigators for truth's achievements. Because without it the safety flight prophylactic will be impossible.

Sincerzly yours,



Rudolf A. Tejmourasov

DEPARTMENT OF STATE
OFFICE OF LANGUAGE SERVICES

(Translation)

LS No. 149311
JS+PH+YS+TM
Russian

REPORT

on the Aviation Incident
Involving the Balloon "D-CARIBBEAN"

on September 12, 1995, in the
Vicinity of the Town of Bereza

(the Republic of Belarus)

Brief Description of the Incident

In the period from September 9, 1995, through September 12, 1995, a Swiss aeronautics club held a balloon race for the Gordon Bennett Cup. The balloons took off in Zurich (Switzerland) at 17:00 hours (UTC) on September 9, 1995. In accordance with the wind direction and velocity at the flight altitude, 3 balloons (D-CARIBBEAN, N69RW, and 1636S) entered the airspace of the Republic of Belarus at different times on September 12, 1995.

The balloon D-CARIBBEAN was shot down by an Air Force attack helicopter in the vicinity of the town of Bereza at 08:54:20 hours, and it crashed to the ground at a point with the geographic coordinates 52° 33' 58" N, 25° 01' 42" E.

An investigation was conducted under the leadership of the Belarus State Commission by the [CIS] Interstate Aviation Committee with the participation of specialists from scientific research organizations as well as representatives from the United States of America and the Federal Republic of Germany.

1. BACKGROUND INFORMATION

1.1. Information on the Crew Members

Crew Commander: Alan Bernard Fraenckel

Born April 12, 1940. Transport aviation pilot license no. 1619899. Authorized to fly multi-engine and single-engine aircraft (land- and sea-based) (B-707, B-720, B-757, B-767, CV-240, CV-340, CV-440, LR-JET, CE-500, L-1011) as a line pilot; balloons, as a commercial pilot; and helicopters, as an amateur pilot. Total flying time in civilian aircraft: 10,000 hours. He has been making checkup flights on balloons regularly, at least since 1992.

Pilot: John Stuart-Jervis [sic]

Born September 11, 1927. Transport aviation pilot license no. 1883680. Authorized to fly multi-engine land- and sea-based

aircraft, single-engine aircraft, and helicopters as a transport and commercial pilot (DC-3, CW-46, G-73, SD-3, IA-101, G-73T), and balloons as an amateur pilot. Total flying time on civilian aircraft: 14,000 hours.

1.2. Information on the Airship

The balloon was manufactured in 1990. Registration date: July 30, 1990. Factory number: 0317. Date on which certificate was issued: August 3, 1995; valid up to August 31, 1996. Equipped with the GPS satellite navigation system and with an ultra-short-wave and short-wave radio set, a secondary radio transponder, two oxygen tanks, and an SN No. T 2861 barograph (Annex 1).

According to estimates made by the Aeronautical Federation of Russia, at the time of interception it had a flying weight of approx. 400 kilograms.

Type of airship: "D-CARIBBEAN" balloon. Registered owner: Blenk, Gottlieb. Operating company: Fahrtengruppe Soukup & Thomas. Manufacturer: Ballonbau Woerner GmbH. National affiliation (according to markings): Germany

Registration marks of the airship: the inscription "D-CARIBBEAN" on the balloon envelope; no identification marks on the gondola.

1.3. Damages to the Airship

After being hit by rounds of machine-gun fire, the balloon envelope tore and partially burned. After the crash the gondola was deformed along the vertical axis.

1.4. Other Damage

Apart from the balloon, there was no damage caused to other objects.

1.5. Meteorological Data

Meteorological conditions at the time of the incident:
Low-gradient field of increased pressure (763 mm of mercury); cloud cover: scattered cumuli at an altitude of 600 m; upper limit: 1,500 m. Wind at the altitude of interception:

- according to data supplied by the balloon crew (from the logbook): direction 105 degrees[,] 6 to 7 m/sec;
- according to the forecast by the weather bureau at Brest Airport: unstable, up to 6 m/sec.

Conditions of natural light during the aviation incident: daytime, natural illumination by sunlight with reflection from clouds.

1.6. Communications

Contact was not made between the crew of the balloon D-CARIBBEAN and ground-based air traffic control centers in Belarus and [or] Poland at ATC frequencies or emergency frequencies (see Annex 2).

Before the moment of impact, the radio set was tuned to the emergency frequency 121.5 MHz, but (according to satellite monitoring data) there was no emission at this frequency in the area of the incident at the time corresponding to the event.

The second radio set (according to the findings of studies undertaken at the NTSB laboratory in the U.S.) was tuned to the frequency 154.515 MHz. It does not seem possible to explain the significance of this tuning, since neither the list of communications centers issued along with other aeronavigational data to the participants in the race before the take-off, nor other sources of aeronavigational information (Jeppesen) give the frequency of 154.515 MHz.

According to materials obtained from an interview with a participant in the race, the pilot of balloon N69RW, D. Levin, it has been determined that the organizers of the race did not provide the participants information on communications channels with air traffic control centers in the airspace of Belarus. Thus, the crew of balloon N69RW, which tried to establish radio contact with the

Minsk ATC center at a frequency of 133.8 MHz, received this channel from a control center in the territory of Poland. The D-CARIBBEAN crew, as indicated in the report by the head of the Department of Civil Aviation of the Republic of Poland, did not establish radio contact with the Polish ATC centers and did not receive information on the communication frequency of the Minsk ATC center.

The possibility cannot be fully ruled out that the D-CARIBBEAN crew did try to contact ground dispatchers but was not heard, since the distance of steady radio reception on ultra-short-wave radio sets at a flying altitude of 2,000-2,500 m is approx. 200 km, whereas the distance to Minsk exceeded this. A call on this frequency could have been picked up if there had been another airship aloft whose radio set was tuned to the frequency of **133.8** MHz, or if a radio set had been turned on at the Brest VRTs [expansion not known], where this frequency is monitored (from 07:00 to 09:00 hours, as the subsequent inquiry determined, there was no monitoring). However, attempts to make radio contact on the frequency of 133.8 MHz by the N69RW crew through the AFL101 show that if the D-CARIBBEAN crew was receiving on this frequency it could have also tried to make radio contact.

On the basis of the above facts, it can be said with a fair degree of certainty that the D-CARIBBEAN crew did not make radio contact with the ATC dispatchers.

The most likely reason is that the crew did not have the necessary aeronavigational data.

1.7. Information on Airfield

The incident occurred outside [an] airfield.

1.8. Flight Recorders

An SN No. T 2861 barograph was aboard. After the crash the cover of its case was damaged. The technical condition of the barograph after the incident made it possible to decipher the barometric altitude of the balloon's flight (see Annex 3). Recording of altitude was possible throughout the flight.

1.9. Information on the Fraaments and the Impact

The balloon's gondola landed at a point whose geographical coordinates are given above, at 150-200 meters from the Brest-Minsk railroad. The gondola was not destroyed; deformation consisted of compression of the gondola frame along the vertical axis. The remnants of the burned envelope of the balloon were found 250-300 meters from the gondola.

1.10. Fire

The fire on the envelope occurred as a result of ignition of the balloon's working medium (hydrogen) when the envelope was hit by armor-piercing/incendiary 12.7-mm shells from the machine gun of the Mi-24B attack helicopter. There are minor (focal, local) traces of fire on the gondola covering. Fire-fighting measures were not taken.

1.11. Survival Factors

A search for the balloon was undertaken by a ground search and rescue team from a military unit. It was begun at 09:00 hours and completed at 11:30 hours. Remnants of the burned envelope and the gondola with the bodies of the crew members without signs of life were discovered on site.

1.12. Tests and Studies

No special tests were conducted during the investigation.

The following studies were conducted:

- forensic;
- retracing the trajectory of the balloon and of the attack helicopter;
- analysis of the operability of the onboard equipment.

The results of these studies are presented in the annexes.

2. ANALYSIS

2.1. The Flight of the D-CARIBBEAN Balloon to the National Border of the Republic of Belarus

The aeronautical race for the Gordon Bennett Cup was held to determine the winner in attaining the maximum flight distance in a fixed time (72 hours). The flights commenced at 17:00 hours (UTC) on September 9, 1995, in Zurich, Switzerland.

The D-CARIBBEAN balloon (according to logbook entries) reached an altitude of 3,000 feet by 19:00 hours on September 9, 1995, concerning which the crew made its first entry in the logbook (fig. 1 of the Annex).

Around 21:00 hours the D-CARIBBEAN crossed the German border approx. 60 km east of Stuttgart and continued flying in a north-northeast direction at an altitude of 2,400-2,600 feet.

The balloon remained in German airspace from 00:00 hours on September 10, 1995, at an altitude of 2,400 feet, ascending to 10,000 feet, after which it entered the airspace of Poland at 07:30 hours on September 11, 1995.

In Polish airspace the D-CARIBBEAN flew at an altitude of 10,000-10,600 feet. At 13:00 hours it passed Poznan and Wrocław; at 16:00 hours, Bydgoszcz; at 20:00, Olsztyn; and at 23:30, Szytno.

At approx. 02:00 hours on September 12, 1995, the D-CARIBBEAN passed Lomza and approached the 150-kilometer line before crossing the national border of Belarus.

According to a report by the Civil Aviation Department of Poland, the D-CARIBBEAN did not make contact with the Polish ATC authorities. Its secondary transponder was turned off. The following was noted in regard to the other balloons:

1. The N69RW entered the flight information region [FIR] of Warsaw on September 11, 1995, at 06:08 UTC and left it on September 12, 1995, at approx. 09:14 UTC at flight level FL 124. The coordinates of this last point of location: 53:00 N, 24:00 E. The

crews of other balloons that made radio contact with the Warsaw ATC authorities (Warszawa Radar) did not report their entry into the Warsaw FIR, and the last radio contacts with the crews were recorded in the following order respectively:

- the DQUEE balloon: Sept. 11, 1995, at 14:28 UTC at FL 104, location at a distance of 12 nautical miles east of NDB [nondirectional beacon] CHO;

- the balloon PHKTS: on Sept. 11, 1995, at 13:50 UTC at FL 40, location at a distance of approx. 25 nautical miles east of VOR/DME [VHF omnidirectional range/distance measuring equipment].

The direction of the balloons' flight can generally be characterized as north-northeast, and then east. The mean altitude remained within FL 60-120.

2. The crews of the 3 balloons, namely, the N69RW, the DQUEE, and the PHKTS, established and maintained radio contact with ATC authorities. They transmitted reports on their location at approx. 1-hour intervals because of the limited capacity of their batteries. The crew of the N69RW was transferred to communications with Minsk ATC on a frequency of 133.8 MHz on the recommendation of the Warsaw ATC center long before it crossed the boundary of the Warsaw FIR. All three balloons were equipped with secondary transponders operating in mode A with the codes: N69RW, 4260; PHKTS, 4252; DQUEE, 4251.

2.2. Circumstances of the Incident

2.2.1. Analysis of the Organization of the Flight at the Stage of Consideration of the Plans

On March 31, 1995, the Belarus Center for Organization of Air Traffic (BCOAT), the agency responsible under para. 1.1, AIC 06/93, for servicing air traffic in the Minsk FIR, received a request (RD 311655 LSZHYOYX) via AFTN [Aeronautical Fixed Telecommunications Network] from the President of the Aeronautics Club of Switzerland, Mr. Bruno Scherrer, for a possible flight of no more than 20

balloons in the airspace of Belarus during a balloon race for the Gordon Bennett Cup to be held from September 9-12, 1995.

The above request was different from form no. 2 of the application to carry out a flight in the airspace of Belarus, which is presented in the annex to the "Aeronautical Information Circular of the Republic of Belarus" (AIC 06/93 of June 1, 1993): for example, it does not give the registration marks and call signals of the airships (in accordance with the norms of the ICAO, Annex 7 to the International Civil Aviation Convention indicates that balloons are a category of lighter-than-air piloted flying apparatus and must have a registration certificate and appropriate markings), nor the date, time of entry, flight route in the airspace of Belarus, nor the airfields of departure and landing. However, considering that the missing information could not be known to the organizers of the race for various reasons, this request can be looked upon as an application to carry out a flight; subsequently, the Committee for the Use of Air and Space and the Control of Air Traffic ("Belaeronavigatsiya"), as the agency responsible under para. 1.1, AIC 06/93, for state regulation of the use of the airspace of Belarus, issued a decision accordingly.

On April 3, 1995, the Committee for the Use of Air and Space and the Control of Air Traffic of the Belarus Ministry of Transportation and Communications ("Belaeronavigatsiya") sent a letter (their No. 2.6-326) asking all competent authorities to evaluate the request.

While the competent authorities were deliberating, a second request was received from the organizers of the race on June 8, 1995 (RD 081724 LSZHYOYX). All the addressees, including the Belarus Ministry of Defense, agreed to make the airspace of Belarus available to the organizers of the race.

On June 9, 1995, on the basis of replies received from competent authorities, "Belaeronavigatsiya" notified the BCOAT in a letter (their 3/171-238 of June 9, 1995) that there were no objections to the flight of balloons in the airspace of Belarus. Because the Instructions on Record-Keeping in the Central Office of the Belarus Ministry of Transportation and Communications, № 20/Ts

of Jan. 31, 1994, did not contain an established procedure for transmitting special documents, this letter was transmitted by fax to the BCOAT, where its receipt was not recorded. (This communication was not received at ATC Center 570.) In addition, this same letter instructed that the president of the aeronautics club be notified of the permission for the flight and that the necessary steps be formulated).

To carry out the instructions to the BCOAT and in accordance with para. 13 of the Regulations on the Procedure for Using the Airspace of the Republic of Belarus, a telegram (RD 121343 of June 12, 1995) was sent to the president of the Aeronautics Club of Switzerland, stating that Belarus had no objections to the flight of balloons through its airspace and that the specific permit numbers would be issued promptly after receipt of the flight plans.

The organizers of the race evidently interpreted the content of RD 121343 of June 12, 1995, as permission to use the airspace of Belarus. The clarification that the specific permit numbers would be promptly issued after receipt of the flight plans for each balloon indicates at least that:

- flights in the airspace of Belarus would be provided for by the competent ATC authorities (BCOAT, ATC Center 570);
- the competent agencies of the BCOAT took into account the peculiarities of the flights of the virtually unguided balloons and decided to change the existing procedure for issuing permits to use the airspace of Belarus, according to which the permit number must be given in block 18 of the flight plans and transmitted to the applicant together with the permit on the basis of his preliminary application (para. 2.4., Annex to AIC 06/93).

The reply to the organizers of the race was not recorded in the "Permits" logbook as required under para. 3.1. of the BCOAT's Technology of Dispatcher Work with Airline Companies. Despite agreement on the request concerning the possibility of using the airspace of Belarus by the balloons participating in the race, the competent organizations of Belarus also failed to record their agreed permission to conduct the flights.

The organization of steps to provide for the flight in accordance with the letter of June 9, 1995, from "Belaeronavigatsiya" called for:

- transmittal of information on the flight of balloons (the flight plan, or by other channels) to the appropriate operational services in Belarus;
- formulation of prohibitions and temporary restrictions on the use of airspace related to the flight of the balloons, in accordance with the meteorological and air conditions, and notification of the services by established procedures;
- determining, in consultation with the ATC authorities of neighboring states, the procedure for obtaining and transmitting information on the flight of the balloons;
- determining the procedure for carrying out work shifts and the cooperation of route and extra-route sectors to provide for the flight of the balloons;
- determining the main and reserve frequencies as well as the procedure for maintaining radio contact in controlling the flight of the balloons in the airspace of Belarus, and providing notification of this to the organizers of the race.

Note 1: 1. Not a single one of the enumerated steps was taken.
2. Steps to provide for the flight of the balloons in the airspace of Belarus were not brought to the attention of ATC Center 570 or the Anti-Aircraft Defense Central Command Post [AAD CCP].

2.2.2. Analysis of Steps to Provide for Flyover on the Day of Takeoff

On September 9, 1995, from 09:32 hours until 14:40 hours, via AFTN (UMMMZDZX, UMMMZUZX) the BCOAT received 19 flight plans on the flight of 18 balloons.

Note 2: Two identical flight plans were received for balloon HB-BVZ (pilots M. Imstepf, K. Fried).

All the flight plans were drawn up in accordance with a single model and had the same differences from the form stipulated for guided (aerodynamic) airships, namely:

- the permit number was not indicated;
- the airfield of departure was not indicated, but the geographical point of departure was given;
- the time and place of entry into the airspace of Belarus (FIR Minsk) were not indicated;
- the airfield of landing was not indicated;
- the "Route" chart showed: "drifting in the wind in an easterly, then northeasterly direction."

For these reasons, and since information was missing in the registration book in regard to the previously issued (June 12, 1995) permit, the specialists in the BCOAT work shift did not include the flight plans in the 24-hour flight schedule in preparation. In accordance with Section 4 of the Technology of the Dispatcher's Work in BCOAT Planning in the Event of Receipt of Flight Plans without Permit Numbers for the Use of Airspace, they either should have redone the permit and included the flights in the current schedule, or should have alerted the applicant that he was prohibited from entering the airspace of the Republic, and then filled in the "Prohibition" logbook. This was not done, however, because the flight plans did not indicate the possible entry of a balloon into the airspace of Belarus. The flight plans that were received were classified as mistakenly sent.

As a result, the specialists in the BCOAT work shift did not transmit to the sender the permit number for entry into the airspace of Belarus; nor was notice given of a prohibition.

Note 3: The lack of information on the flight route, the points of entry into and exit from Belarus, and the time of crossing the national border was due to the specific characteristics of the balloon's flight (drifting in the wind), and these data could not be known in advance.

Nonetheless, on that same day, from 12:28 hours to 14:40 hours, the BCOAT transmitted via AFTN (UMMMbbbb and UMMMPObb [?]) 4 flight plans to the air defense agencies of Belarus for the flight of balloons from Sept. 9-12, 1995, including the D-CARIBBEAN's flight plan. The information received by the work shifts was not passed on to AAD, since it was missing in the current flight schedule.

From 18:15 hours to 20:19 hours on Sept. 9, 1995, the BCOAT received 17 telegrams via AFTN (UMMMZDZX and UMMMZUZX) announcing the departures of balloons. The telegrams received were not processed for the reasons cited above; consequently the ATC and Anti-Aircraft Defense [AAD] work shifts were not notified either. At the same time, a notification of prohibition was not issued to the applicants.

Thus, by the morning of Sept. 12, 1995, the ATC centers of the competent ATC authorities and AAD system were not prepared to provide for the declared flights of the balloons.

The following factors account for this unpreparedness:

- no preparations were made to provide for the Gordon Bennett Cup race, including communications with the organizers of the flyover and with auxiliary groups in the neighboring country;
- the flight plans and notifications of departures were ignored because of their formal discrepancies with the accepted (for guided airships) structure of these documents;
- specific ATC centers both in the competent bodies of the ATC system and at the AAD Central Command Post (CCP) had no information on the possible entry of balloons into the airspace of Belarus.

2.2.3. Execution of the Flight from the 150-km Line to the Crossing of the National Border of Belarus

At 02:00 hours, when passing Lomza (the Republic of Poland), the D-CARIBBEAN was located 150 km before the entry to the airspace of Belarus.

In accordance with the requirements of para. 4.1.4. of RAC [possibly: Rules of the Air and Air Traffic Control] 1-1.7 of Russia's AIP [Aeronautical Information Publication] (Russia's AIP

is in force in Belarus), before approaching-within 200-150 km of the national border, the crew should have requested permission from the ATC center of the competent ATC authority to **fly** over the national border. Such a request was not made. Nor did the crew comply with para. 4.1.5. of RAC 1-1.7 of Russia's AIP, which stipulates that if there are direct ground-based communications channels between the ATC authorities of Belarus and the neighboring country, the crew could obtain permission to fly over the national border from the ATC center in Warsaw. In flying over the national border the crew did not fulfill the requirement of para. 4.1.9 of RAC 1-1.8 of Russia's AIP, under which it should have notified the dispatcher at the ATC center of the competent ATC authority of the actual time and level (altitude) of the flight.

It can be assumed that the crew was resting in the period from 23:00 hours on Sept. 11 to 03:10 hours on Sept. 12, 1995, since no entries were made in the logbook-during this time, whereas they had been made at 1-hour intervals previously, most likely when the pilots took a break in turns. Moreover, the crew apparently had no possibility of establishing contact because of a lack of necessary aeronautical information (see Section 1.6 of this report).

At 05:10 hours to 05:21 hours (UTC), at altitude of approx. 10,000 feet, the D-CARIBBEAN entered the airspace of Belarus (see Fig. 2 in the Annex). It should be noted that at 05:10 hours the crew recorded the balloon's coordinates in the logbook:

N 52.48.01 and E 23.50.06; Altitude 8,400 feet, wind 093/12.

2.2.4. Analysis of the Organization of the **Escort** of the Flight and the Interception of the Balloon D-CARIBBEAN

2.2.4.1. Receipt of Initial Information

According to the data of the onboard recording apparatus (the SN No. T 2861 barograph) and the crew's onboard documentation (the logbook and onboard chart), the D-CARIBBEAN piloted **by** Alan Bernard Fraenckel and John Stuart-Jervis crossed the national border of Belarus in the vicinity of the town of Khvoyniki at a point with the geographical coordinates 52° 48' 1" N, 23° 50' 06" E on Sept. 12, 1995, during a period of time from 05:10 hours to 05:21 hours (UTC) at an altitude of 2,500-2,600 meters (approx. 8,400 feet)

on a heading of about 100-110°. In violation of the AIP, the crew did not make two-way radio contact with an ATC center of an authorized ATC agency either indirectly or through other airships, and did not obtain permission to enter the airspace.

At 06:00 hours the crew entered the balloon's coordinates in the logbook:

N 52.40.00; E 24.08.06; altitude 9,200 feet; wind 108/16. This indicates that the crew knew its location in the territory of Belarus.

At 06:34 hours the balloon was sighted by an officer at a border station.

During the next 7 minutes, information on the balloon was transmitted through the operational command units of the Border Guards to the AAD CCP and was received by the duty officer at 06:41 hours. One minute later, AAD forces on duty were commanded to go on No. 1 alert.

At 06:44 hours, a duty officer at the AAD command post in Baranovichi reported that the radar station had observed on the screen of a radar set in Brest an unsteady **blip** characteristic of a small target, located at a distance of 80 km, azimuth 40°, at an altitude of approx. 2,000 m and moving at a velocity of 20 km/hour.

Note 4: Based on a comparison of the D-CARIBBEAN'S flight trajectory obtained from the onboard information sources with the radar station's data on the small target, the Commission ascertained that the "small target" was the - IBBEAN balloon.

Thus, information obtained from two independent channels concerning the visual and instrumental observation of an object that had entered the airspace of Belarus starting at 06:44 hours gave grounds for identifying the object as a balloon, whose

location and flight altitude were known. Since the duty officer at the AAD CCP had no information on piloted balloons, this was probably why the balloon was judged to be an automatic drifting aerostat or sounding balloon (a meteorological probe), especially as the D-CARIBBEAN's white envelope made it resemble unmanned sounding balloons.

It must be pointed out that the AAD organs did not give the "all-alert" [?--REZHIM] signal upon discovering the airship that had violated the airspace of Belarus, nor did they communicate to the competent ATC authorities the place, time, and nature of the violation. This ruled out participation by the competent ATC authorities in identifying the airship, although the authorized ATC organs had information from the AAD forces on the flight of the balloon. [Translator's note: Here and through p. 21, revisions are shown double underlined (additions) or with ~~strikes~~ (deletions).]

Applicable documents in the armed forces of Belarus prescribe the following actions by AAD forces upon detecting balloons that violate the airspace;

"...measures shall be taken to ascertain the nationality and classification of the aerial target, after which a decision shall be made concerning forced landing or destruction.

"...balloons...violating the national border of the Republic of Belarus shall be destroyed if their flight threatens the security of air traffic or if they have a military purpose.

"The right to make a decision to open fire by AAD personnel and equipment is given to the commander [and] chief of staff of the AAD troops."

Thus, in order to decide to employ force in accordance with applicable regulations, it is necessary to have information that:

- the balloon is violating the national border;
- the balloon belongs to one class or another (purpose);
- the balloon represents some degree of danger to the flights of airships or the security of the Republic of Belarus.

2.2.4.2. Actions Taken by ATC Authorities and AAD Forces to Identify a Balloon

Starting at 06:44 hours, all the actions taken by the ATC authorities and the AAD forces, initiated mainly by the AAD CCP, were directed at establishing the fact of the crossing of the national border by the balloon and at identifying it. Inasmuch as the daily schedule of flights did not contain information on requests to enter the airspace of Belarus from neighboring countries, it was necessary to obtain additional information on takeoffs of balloons in the territory of both Belarus and neighboring states. To this end, the AAD CCP requested this information continually from 06:52 hours to 08:10 hours. Thus, at 06:56 hours, requests were received at the ATC center in Brest, and at 07:00 hours at the ADS (airfield dispatcher station) in Grodno. In all cases the reply was negative: "no applications for balloon flights and no takeoffs were made."

Note 5: At 07:00 hours the D-CARIBBEAN crew recorded the next location entry in its logbook: N 52.40.08; E 24.30.09.4[;] altitude 8,100 feet; wind 101/13.

At 07:01 hours, in Sector No. 2 ("west"), a request came via AFL101 on frequency 133.8 MHz from the crew of airship N69RW for permission to enter the airspace of the Minsk aviation complex at flight level 80. A dispatcher at the BCOAT ATC center made contact with Warsaw and, receiving information on the direction of the N69RW's flight toward Vilnius, did not reply to the request and did not give permission.

The nature of the request from the N69RW airship and the lack of information on the flights of the balloons lead us to assume that the dispatcher did not identify this airship as a balloon.

Note 6: It was subsequently determined that Polish ATC authorities were contacted by the balloons N69RW (from 06:08 hours on Sep. 11,

1995 to 09:14 hours on Sep. 12, 1995), DQUEE (14:28 hours on Sep. 11, 1995), and PHKTS (13:50 hours on Sep. 11, 1995). Contact was maintained at approx. 1-hour intervals.

(Reply of the Civil Aviation Dept. of the Ministry of Transportation of the Republic of Poland to the request of the Investigation Committee)

At 07:02 hours, a duty officer at the AAD CCP requested data from the corresponding military authorities in Poland in regard to the takeoff of balloons from Polish territory, and received a reply containing information on the takeoff of an unmanned sounding balloon from the Lomia area.

From 07:14 hours to 07:16 hours, the AAD CCP transmitted information to the authorized bodies of the BCOAT concerning the detection of a balloon in the vicinity of the town of Pruzhany.

AT 07:21 hours, the ATC Center made a backup transmission of information to the AAD CCP concerning the takeoff of a meteorological sounding balloon in Lomza (Poland) at 04:40 hours.

Later, from 07:25 hours to 08:10 hours, the AAD CCP requested information from the national aviation club (07:25 hours), the Airfield Dispatcher Station in Grodno (07:40 hours), and ATC Center 570 (08:10 hours) regarding scheduled takeoffs of balloons. It received negative replies.

Note 7: The D-CARIBBEAN crew flew over the territory of Belarus without radio contact with competent ATC authorities, which is a violation of the flight rules for Belarus— which are Published in the AIP. The rules for holding races do not contain information on these AIP requirements. The crew's onboard documentation (the logbook, onboard charts,

reference materials) did not contain any information whatever on the operating frequency of the appropriate sector of the ATC station for the airspace of Minsk (133.8 MHz). Also lacking were pages in the navigation guide (Jeppesen) relating to the territory of the Republic of Belarus.

This may account for the crew's violation of the flight rules and radio contact rules.

At 07:40 hours, the D-CARIBBEAN crew made the following entry in its logbook: N 52.37.2; E 24.43.6; altitude 8,800 feet; wind 105/11.

Thus, by 08:10 hours, the AAD services had the following information at their disposal:

- balloons had not taken off in the territory of Belarus;
- the ATC authorities and AAD services did not have information on scheduled flights of balloons from the territory of neighboring states;
- an unmanned meteorological sounding balloon had been launched in the territory of a neighboring country (Poland) in the vicinity of Lomza at 04:40 hours.

On the basis of all these facts it was determined that the balloon detected in the vicinity of the town of Pruzhany had violated the national border of the Republic of Belarus. In addition, the Erroneous judgment was definitely made at this time that the observed object was a meteorological balloon launched in Lomza (Poland).

LSNo. 149311-B/PH+BL

2.2.4.3. Actions of the Air Defense and Air Force Personnel
on Duty Regarding the Reaction to the Violation of the
National Border (Airspace)

At 08:18 hours, a report was received at the AAD CCP from the airbase duty officer about the visual sighting of a balloon in the area of the Osovtsy military airfield. Two minutes later (at 08:20 hours) the AAD CCP ordered the takeoff of a Mi-24B military interceptor helicopter, which took place at 08:26 hours.

The mission was defined as follows:

- classifying the target;
- destroying [it] upon an additional command if the balloon had any suspended loads.

This decision would have been justified if the balloon had been unmanned, i.e. if its flight could not be intercepted by any means but destruction, since the flight of an unmanned balloon would have constituted a threat:

- to ~~scheduled~~/flights from the Osovtsy airfield/~~(for weather reconnaissance/01/10/00/Hours/0000/2100/Hours/01/12/00/Hours)~~;
- to scheduled flights from the Baranovichi airfield (beginning at 06:00 hours);
- to flights along the international air routes R11B and V11T; - and flights along 10 local airline routes;

The object could also have penetrated into the restricted area with radius of 5 km to an altitude of 5,000 meters.

An analysis of the possibilities of classification and identification of the object showed that:

1. The regulations defining the conditions for an interception of the flight do not contain clear-cut methodological instructions on how to establish whether a balloon is manned or unmanned. The fact of the existence of a suspended load on the balloon cannot be a criterion for considering that it is unmanned, since the gondola (a suspended load) is the only place where a crew can be located.

2. In violation of the marking rules, the D-CARIBBEAN balloon did not have identifying markings or a national flag on the

gondola. The observers on the ground (an officer of the border troops and a resident of the village of Zubachi [?--partly illegible] did not even notice the writing on the sides or the bottom of the gondola. This was also confirmed by the examination of the gondola on the ground. At the same time, the examination of photographs which the commission had at its disposal showed that the writing on the D-CARIBBEAN on the balloon's envelope was located somewhat below the equator of the balloon and occupied about 20% of the perimeter (if the writing appeared on two sides) or about 10% of the perimeter (if the writing appeared on one side only) and may not have been noticed by the crew [of the interceptor?] (see Annex No. 5).

Furthermore, taking into account that the helicopter was about 50 meters above the balloon, the crew observed the gondola, but could not see its inside since that (according to the helicopter crew) was covered.

Thus there are reasons to assume that the above circumstances could lead to a mistake in identifying the balloon.

The Mi-24B helicopter, tail No. 21 (call index 90335) took off at 08:36 hours and was under the direction of the flight control officer and the guidance station of the Osovtsy airfield. At 08:44:40 hours began the process of guidance of the helicopter interceptor toward the target (the balloon). During the guidance under ground command, the helicopter rose to an altitude of 2,000 meters. At 08:49:30 hours, the crew visually detected the balloon at a relative bearing of about 90 to 100 degrees ("at 3 to 4 o'clock"), and received the command to approach to a distance of no less than 50 meters in order to determine the presence of a suspended load. At 08:49:45, the operations officer in charge of the guidance repeated the inquiry whether a suspended load was present, to which he received the crew's affirmative reply (helicopter commander: "there's a suspended load; I have not yet identified what it is"; pilot-operator: "some kind of gondola").

The information on the presence of a suspended load was reported to the AAD CCP duty officer, and by him directly to the Commander of the AAD troops, who, based on the ensemble of previously received (unauthorized crossing of the state border, launching of an unmanned weather probe from the Republic of Poland) and newly incoming information (the presence of a suspended load, /~~а/гондоль~~/), made the decision to destroy the balloon, which was transmitted at 08:51:35 hours to the crew of

the interceptor helicopter: "90335, I am 'Radial'nyy'; destroy the balloon." At 08:51:40 hours the helicopter commander accepted the order ("335, I understand, destroy") and clarified the nature of the target ("335, white balloon with suspended load, at altitude of 2,200 m. Attack").

Note 8:

1. In all stages of the initiation and implementation of the order to destroy the balloon, no other command (or recommendation) for additional inspection of the target was given.

2. In violation of the requirements of the Basic Flight Regulations (OPP-85, Annex 1, p. 128), neither the guidance station nor the helicopter crew made any attempt to establish radio contact with the violator on the international emergency frequency 121.5 MHz.

The balloon crew also did not use the aforesaid frequency.

The helicopter crew fired twice (at 08:52:55 and 08:54:20). The envelope was ignited and the balloon began falling. The balloon struck the ground at a point with the geographic coordinates 52° 33' 58" N, 25° 01' 42" E.

2.3. Condition and Actions of the Crew of the Balloon D-CARIBREAN

Analysis of the crew's condition was performed on the basis of the results of the forensic medical examination.

It was determined that the death of the crewmembers occurred as a result of numerous mechanical injuries to the body, incompatible with life, connected with a fall from a great height.

2.3.1. Physical Injuries

Physical Injuries	Crew	Passengers	Other Persons
With fatal outcome	2	0	0
Serious	0	0	0
Insignificant/absent	0	0	0

2.3.2. Results of the Forensic Medical Examination

The chronic pathology of the cardiovascular system identified in the pilots during the forensic medical examination basically corresponds to age-related changes and, on condition of adequate compensation, does not counterindicate making balloon flights.

The simultaneous sudden loss of operational fitness in the two pilots all at once during the last 50 minutes of the flight (counting from the time of the last entry in the flight log) due to acute disorders in the cardiovascular system is highly improbable.

However, we cannot rule out the possibility that the crew experienced chronic fatigue in the concluding stage of the

three-day flight, resulting from the combined effects of the following factors:

- altitude hypoxia (making a flight at an altitude of 2,500-3,000 m over 3 days);
- disturbance of the sleep and waking schedules;
- psychoemotional stress related to a competitive flight over the territories of several countries;
- the presence of age-related pathological changes in the organism.

The fatigue that occurred in the crew (who most probably were sleeping after the last entry in the flight log) may serve to explain the lack of an appropriate reaction to the noise of the helicopter and the first short burst from the machine gun.

The chemical substances whose origin we were not able to determine definitively in the forensic medical examination might be medications (biostimulants) that may have been used by the crew in therapeutic doses in the process of making the flight, to prevent fatigue.

The morphologically pathological changes that were identified, in the form of disruption of the blood supply to the heart muscle and the entire organism (edema of the brain and lungs), are a reaction of the human organism to prolonged action of the factors of altitude hypoxia, in the context of the existing chronic pathology.

Thus, from the results of the forensic medical examination it follows that possibly there was a reduction in operational fitness of the pilots resulting from the presence of chronic fatigue in them by the time the three-day flight ended, as well as signs of acute disruption of the circulation (in the context of pronounced age-related pathology), caused by altitude hypoxia, which might manifest itself in a delayed or inappropriate reaction to the noise of the helicopter and the first burst of machine-gun fire.

2.4. Analysis of the Situation and Its Conformity to ICAO Regulatory Documents

The conformity of the circumstances to ICAO regulatory documents was determined in two areas:

- comparison of the marking of the D-CARIBBEAN balloon with that required by ICAO standards (Annex 7 to the Convention on International Civil Aviation);
- comparison of the procedure of interception of the D-CARIBBEAN balloon by an interceptor helicopter of the Air Force of the Republic of Belarus with the regulations imposed by the ICAO Interception Guide (Doc. 9433-AN/926 [i.e., AN1926?--see later pages of this report]).

The requirements of ICAO standards for marking of balloons (aerostats) call for:

- the presence of national and registration symbols.

Note 9: In the inscription "D-CARIBBEAN," the code "D" designates affiliation with Germany, according to the "List of National Symbols of Airships Issued by the ICAO"; "CARIBBEAN" is the registration symbol.

- the symbols must be located in two diametrically opposite places near the maximum horizontal circumference of the aerostat.

From the materials at the disposal of the Investigating Commission, it is not possible to determine unambiguously the presence of symbols on two sides. It is also not possible to establish the height of the symbols, but measurements based on photographs permit us to estimate that the height approximately meets the requirements, which call for a size of 50 cm.

- the balloon must have an identifying plaque made of fire-resistant material, fastened in a visible place.

The gondola of the D-CARIBBEAN balloon did not have an identifying plaque. Moreover, no such plaque was discovered in the area where the gondola and envelope fragments fell.

In violation of the terms of races, the race participant's number was not fastened to the gondola, and the national flag was inside the gondola (on the floor) and could not be made out from outside.

Based on a comparison of the procedure of interception of the D-CARIBBEAN balloon by an interceptor helicopter of the Air Force of the Republic of Belarus with the regulations (provisions in force and special recommendations) imposed by the ICAO Interception Guide (Doc. 9433-AN/926 [but see below]), the following was established:

1. The D-CARIBBEAN balloon was an unidentified airship, with respect to which it was not possible to provide "positive identification using means in addition to visual observation: i.e., via coordination with air traffic service agencies and/or using a secondary surveillance radar."

The D-CARIBBEAN balloon could not be reliably observed using the primary radar of the ground equipment employed in the Republic of Belarus because of its low (less than 50 km/h) ground speed.

Note:

Results of study of the balloon's equipment in the NTSB laboratory show that the code 2774 (or 2777) was set on the transponder of the D-CARIBBEAN balloon's secondary radar system, and it was not carrying a current at the moment of impact of the balloon on the ground.

2. An interception should be made as an extreme measure and should be limited to identifying the airship and to directing it away from the restricted area (¶ 2.5a, 2.5b). In this connection, the airship being intercepted must have the capability of avoiding the restricted area (¶ 2.8c), which refers to piloted airships and is not applicable to balloons that do not

have the capability of maneuvering in the horizontal plane. Therefore it is also impossible to fulfill the requirements for implementing instructions of the interceptor in the area of changing flight direction.

Moreover, the crew of a manned balloon cannot meet the requirements of giving signals to the crew of an interceptor by swinging the airship (§ 4.1.4), blinking the navigation lights, lowering the landing gear, and [or] turning on the landing lights.

Thus, based on comparison of the incident's circumstances with the ICAO's required standards and regulations, as well as the rules of races for the G. Bennett Cup, it has been established that:

- the marking of the D-CARIBBEAN balloon did not meet the requirements fully, since the gondola did not carry the race participant's numeric symbol or identifying plaque. The national flag was inside the gondola and could not be seen from outside;
- neither the code assigned to this balloon (4262) nor the code required for setting on a civilian airship being intercepted (7700 in mode A) was set on the onboard transponder of the secondary radar system. In addition, it has been established that the onboard transponder was turned off;
- the helicopter's sortie to intercept the D-CARIBBEAN balloon was carried out in accordance with §§ 1.1.2, 1.2.1a, and 1.2.2c of the [ICAO] Interception Guide (Doc. 9433-AN1926 [but see above]);
- in violation of § 2.5a, the intercepting helicopter did not carry out the necessary identification of the D-CARIBBEAN balloon being intercepted, and made no attempt to force it to land.

At the same time, a number of requirements of the aforesaid Guide cannot be applied to balloons, since they relate to unguided airships.

The unfulfillable requirements include:

- compliance by the balloon being intercepted with the interceptor's commands to change course and route, on account of lack of the capability of maneuvering in the horizontal plane;

- giving conventional signals to the intercepting aircraft by swinging, blinking the navigation lights, lowering the landing gear, and/or turning on the landing lights.

3. CONCLUSION

The aviation incident with the D-CARIBBEAN balloon in the airspace of the Republic of Belarus was caused by the use against the balloon of the combat weaponry of the intercepting helicopter of the Armed Forces of the Republic of Belarus and was the consequence of the combination of the following factors:

3.1. Unauthorized flight into the airspace of the Republic of Belarus by an unidentified balloon, with no radio communication with it, on account of:

- deviations [from standard operating procedure] in the actions of the personnel of the authorized agencies of the Republic of Belarus Air Traffic Organization in the area of failure to comply fully with regulatory documents in force when receiving and processing applications, flight plans, and departure telegrams concerning the flight of a group of balloons participating in the race for the G. Bennett Cup, which led to uncertainty concerning issuance of a permit for the flight of balloons into RB airspace without including them in the current schedule of flights or making an alternate decision to prohibit this flight.

- deviations [from SOP] in the actions of the balloon crew in the area of noncompliance with the requirements of the flight regulations for RB airspace, published in the Compilation of Air Navigation Information (AIC of the Republic of Belarus), with respect to maintaining radio contact, using onboard identification systems for [?] the secondary radar system, requesting and obtaining the appropriate permit for flying into RB airspace and crossing the state border, which can be explained by the inadequate level of organization of the races (in particular, the documents submitted by the Swiss aeronautics club do not contain information on the specific frequency channels for communication with the authorized agencies of the RB Air Traffic Organization; the special rules for entry into RB airspace are absent; etc.)

3.2. Errors by RB antiaircraft defense elements in the identification and classification of the airship that violated RB

airspace, caused by:

- non-compliance with the requirements of regulatory documents by AAD personnel upon the discovery of the airspace-violating balloon, with respect to giving the special "all-alert" [?--REZHIM] signal, and with respect to using the international emergency frequency 121.5 MHz when preparing to intercept, which (in combination with the D-CARIBBEAN balloon's deviations in its markings from the requirements of Annex 7 to the Convention on International Civil Aviation and of the Race Rules) made it more difficult to identify the object;
- deficiencies of the regulations in force in the Republic of Belarus for the interception of balloons and other small-sized, low-speed targets, due to the lack of clear and unambiguous methodological instructions for identification and classification of objects, which does not preclude possible errors in the use of weapons against the aforesaid targets.

The international regulations for interception of civilian airships (Doc. 9433-AN1926 [but see above]) cannot be fully applied to balloons and other motorless airships that drift on the wind in the area of the possibility of carrying out the commands of an intercepting airship; they require supplementation and updating.

4. RECOMMENDATIONS TO PROVIDE FOR SAFETY

4.1. To the aviation authorities of the Republic of Belarus:

4.1.1. to draw up amendments and additions to the regulations for interception of airships that violate the airspace of the Republic of Belarus, providing methodological instructions for the ground services and the crews of interceptors in the unambiguous identification and classification of objects, which will preclude errors in their identification;

4.1.2. to update the regulatory documents governing the interaction of the Air Traffic Organization and Anti-Aircraft Defense services, in order to preclude the possibility of the loss (omission) of information about planned and actual flights of airships of various kinds in RB airspace.

4.1.3. to check the correctness of the inventory, shown in air navigation information to be published, of all restricted areas for flights of civilian airships, and where necessary to update it in accordance with Annex 4 to the Chicago Convention on International Civil Aviation (ICAO).

4.2. To the organizers of sports competitions involving aeronautics, exhibition and demonstration flights, and overflights of balloons and other motorless flying machines that make use of the principle of drifting on the wind:

4.2.1. to revise the documents containing the regulations for such flights, in the area of providing crews with full air navigation information, taking into account the special features of the flights and air traffic control, as published in the relevant compilations (AIC), and ensuring effective monitoring of their readiness for the specific flights;

4.2.2. to draw up additional requirements to ensure the markings of airships.

4.3. [We] request the International Civil Aviation Council to review the issue of supplementing and amending the standards and recommendations for the practice of the **ICAO** with respect to balloons and other motorless flying machines that drift on the wind, including the interception regulations (Doc. 9433-AN1926), in accordance with the analysis carried out during this investigation.

R. A. Teymurazov, Chairman of the Commission for Investigating
[signature] Aviation Incidents in Air Transport of the
[CIS] Interstate Aviation Committee;

V. Ye. Ovcharov, Head of division; Deputy Director of the
/s/ V. Ovcharov Scientific/Technical Center of the
Interstate Aviation Committee;

L. K. Shcherbakov, Deputy Director of the State Scientific
Research Institute "Aeronavigatsiya";
[signature]

Yu. V. Nastenkov, Deputy Director of the Administration of the
Interstate Aviation Committee;
[signature]

A. V. Klyuyev, Head of subdivision of the
[signature] Scientific/Technical Center of the
Interstate Aviation Committee;

G. S. Ivanov, Deputy chairman of subcommission, Interstate
Aviation Committee.
/s/ G. Ivanov

GENERAL CHART OF FLIGHT OF THE D-CARIBBEAN BALLO Обзорная схема полета воздушного шара D-C

1
2
PANEL 1
OF 2

ГЕРМАНИЯ

04.00 №9400 ft
11.09.95 г.
00.00 №9300 ft
ДРЕЗДЕН

БЕРЛИН

06.00 №10400 ft
12.00 №10200 ft
ПОЗНАН

ВРОЦЛАВ

20.00 №6800 ft

16.00 №7100 ft
12.00 №8000 ft

ПРАГА

ЧЕХИЯ

-31-1

08.00 №6800 ft

04.00 №2600 ft

МИНХЕН

10.09.95 г.
00.00 №2400 ft

ВУЛГАРТ

09.09.95 г.
19.00 №3000 ft

ЦЕРИХ

ШВЕЙЦАРИЯ

АВСТРИЯ

7.5 9.0 10.5 12.0 13.5 15.0 16.5

BALLOON IN THE PERIOD FROM 09-09-95 THROUGH 09-12-95
D-CARIBBEAN В период с 09.09.95 по 12.09.95 г.

ФЛ. 1

-31- 2

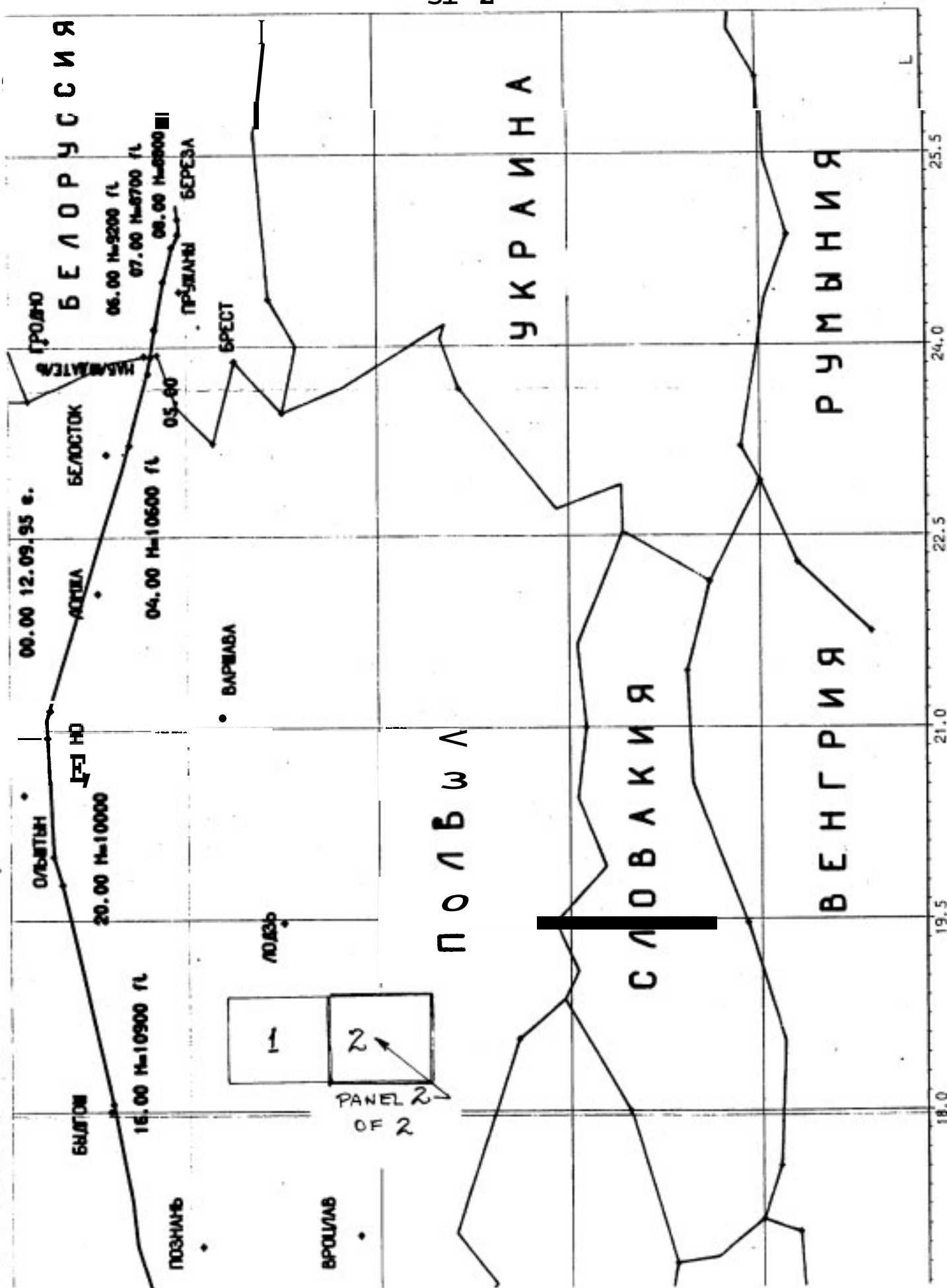
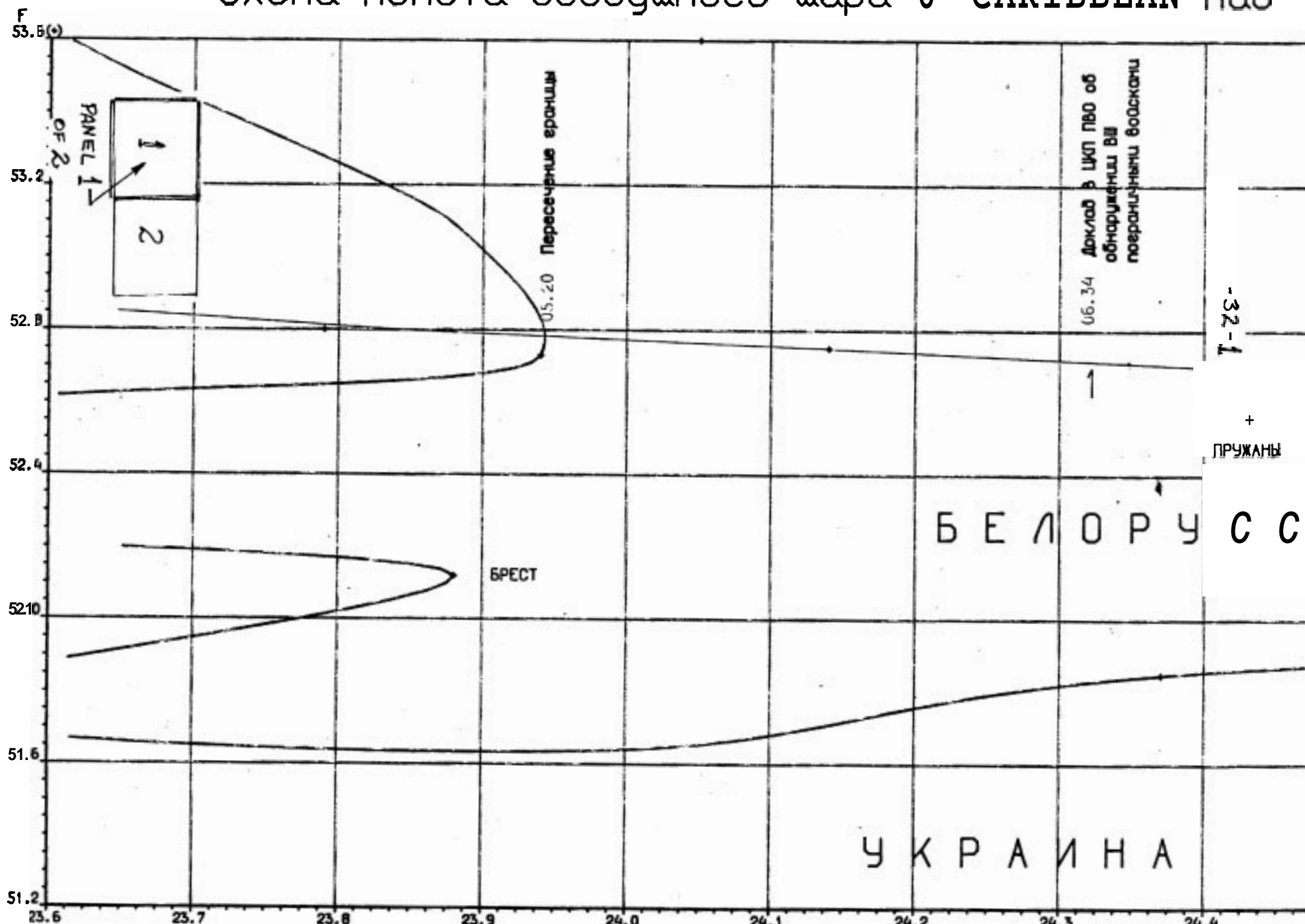
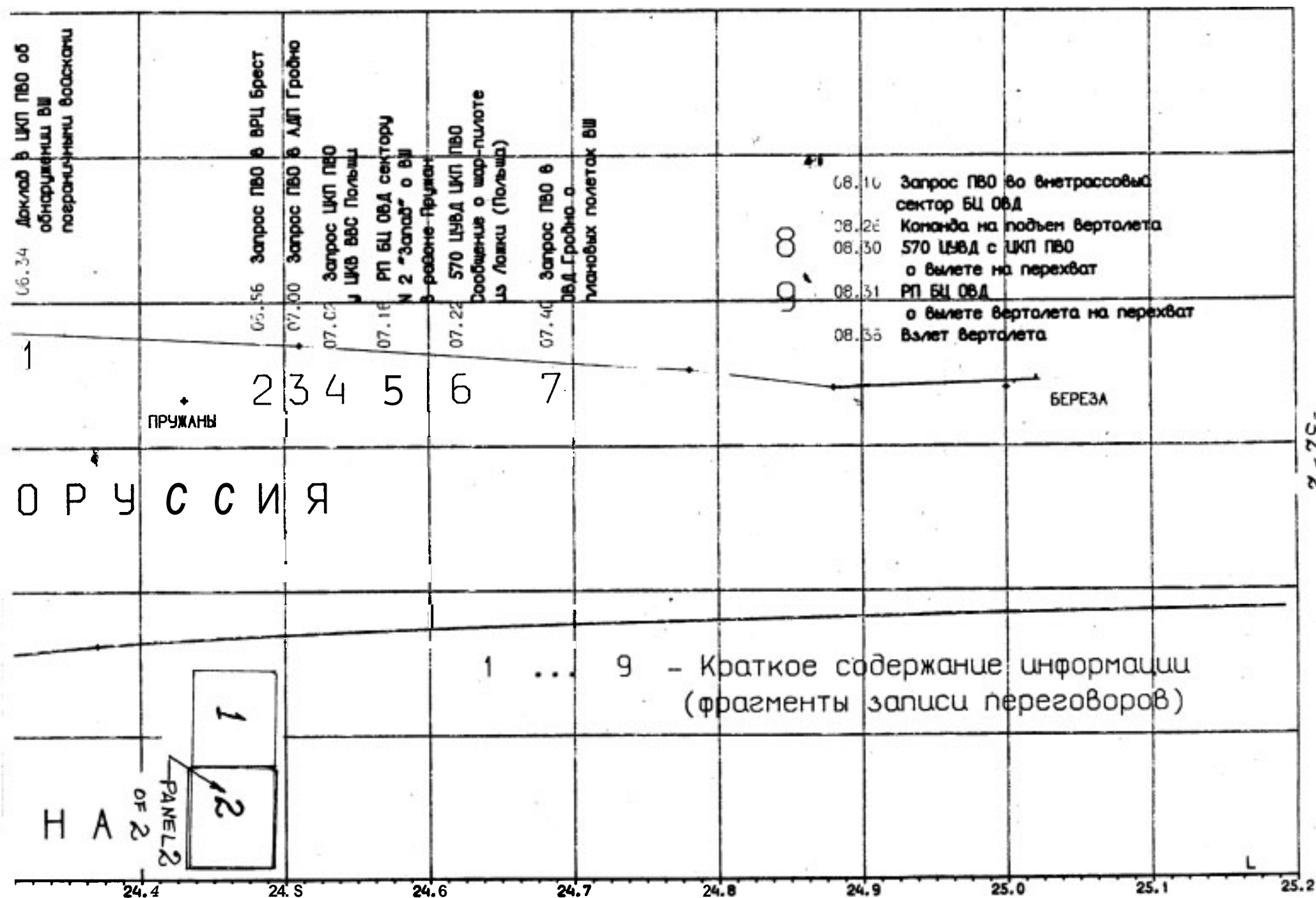


CHART OF FLIGHT OF THE D-CARIBBEAN BALLOON OVER THE TERRITORY OF BELARUS AND UKRAINE Схема полета воздушного шара D-CARIBBEAN над территорией Беларуси и Украины



OVER THE TERRITORY OF THE REPUBLIC OF BELARUS

BEAN над территорией Республики Беларусь



ANNEXES

- NQ 1. Information about the D-CARIBBEAN balloon
- NQ 2. Data from the onboard barograph
- NQ 3. Onboard log
- Nº 4. Records of deciphered conversations of authorized air traffic organization agency
- Nº 5. Studies of flight of balloon and intercepting helicopter

(2 pp.)

Marking: D-CARIBBEAN Status: VZ 09/14/95
 Volume: B [?] Aircraft roll: 656 (gas balloon)
 [Translator's note: Blotch on copy may conceal some information.]
 Operating permit/Revocation

Model: K-1000/3-STU
 Manufacturer: Ballonbau Wörner GmbH [Woerner Balloon Makers, Closed Corp.]
 Year built: 1990 Registry date: 07/30/1990
 Craftsman: 0317 [?] Max. TOW: 0 [takeoff weight]
 Location: Augsburg-Gablingen ICAO code: [--]

Owner: Blenk, Gottlieb
 Street: Hinter dem Schwalbeneck 13 Owner Type: EE
 Town: D-86152 Augsburg

Registered user: Blenk, Gottlieb
 Street: Hinter dem Schwalbeneck 13
 Town: D-86152 Augsburg

Shipping co.: unknown
 Headquarters: [--]
 No.: [--] Start:
 End:

Delivery work: None

Special license: [--] until: [--]
 Conditions: None Time limits: None
 GenCat: PR [?]

Engine: [--]
 Propellers: [--]

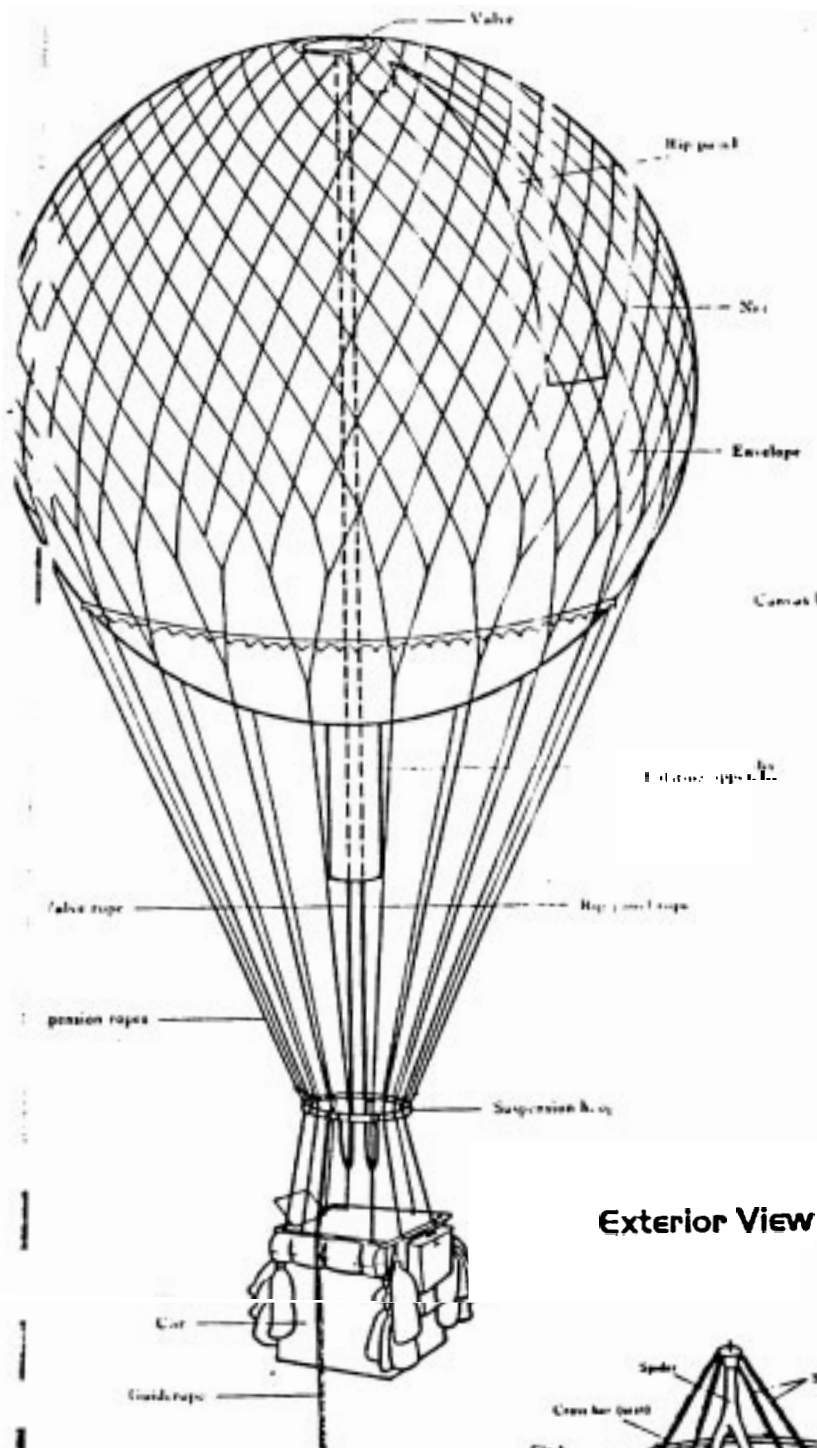
Insp. cert. N°: 38 [?] Type of inspection: U LTA* No.: [--]
 LTB: I-B7 [?] Ballonbau Wörner [, town of] Horgau
 Status: ZUG [?] *[LTA = airworthiness cert.]
 Issue date: 08/03/1995 Valid until: 08/31/1996

Op. time total 248 Op. time, ground: 0 Op. time, Jnp: 26
 [Translator's note: Jnp may = annual reinspection]

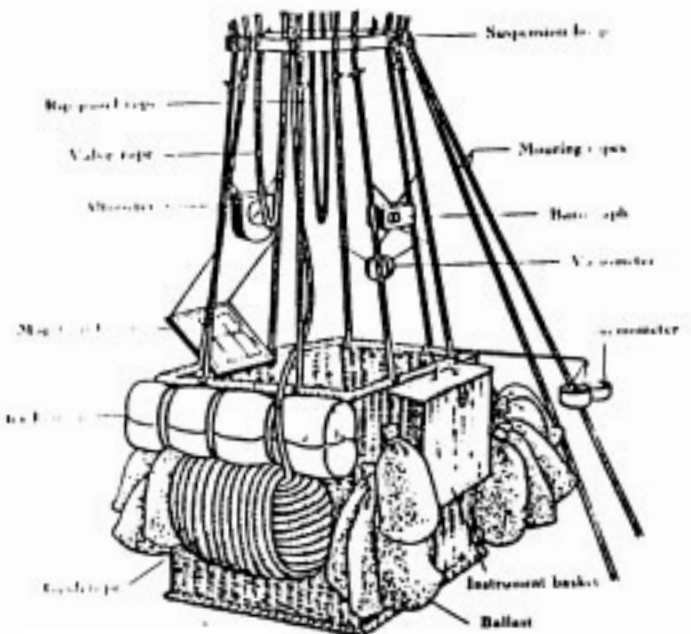
Advertising: None
 Aerial photography: None
 Calibration flights: None
 Glider towing: None
 Towing of loads: None
 Agriculture & forestry: None
 Setting down of passengers and objects: None

VHF-S/E: [--] HF-S/E: [--] VHF-NAV: [--] UHF-NAV: [--]
 ADF: [--] Marker(s): [--] Transp.: [--] DME: [--]
 ELT: [--] RNAV: [--] W-radar: [--] D-radar: [--]
 Radar altim.: [--]

THE GAS BALLOON

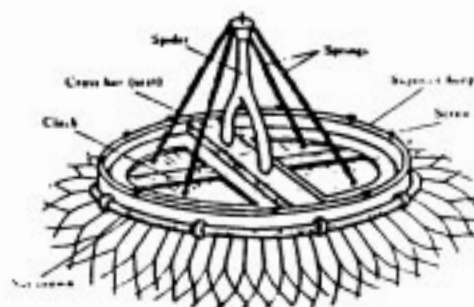


THE BASKET

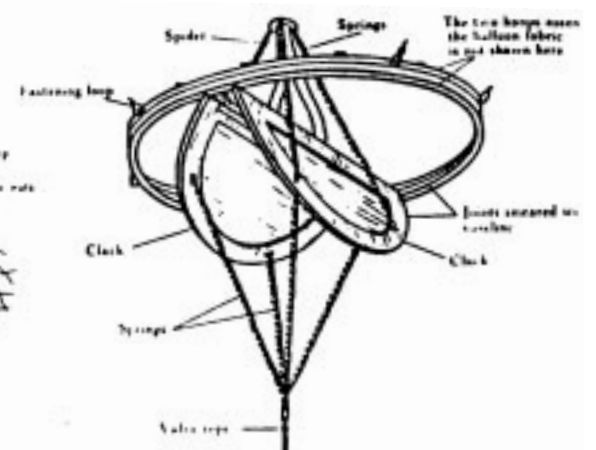


THE VALVE

Exterior View



Interior View



Approved.

-Head of IAC group of experts

[signature]
September 21, 1995

R. A. Teymurazov

RECORD

of assessment of condition of the SN T2861 barograph
taken from the balloon that suffered the accident on 09-12-95
in the area of the town of Osovtsy

A commission consisting of: chairman Yu. V. Nastenko
members M. I. Khrolovich
V. Ye. Ovcharov

opened the SN T2861 barograph and assessed its condition.

Findings:

1. the barograph has mechanical damage to the upper cover; the front part of the cover (where the lock is) is broken off;
2. the plate on which the drum with the data recording medium is slightly bent; the axis of the drum is bent;
3. the data recording medium is fastened to the moving drum with a ring-shaped rubber band;
4. the drum can be easily turned by hand within a clearance of 30"-40"; outside the clearance, with rubbing around the immobile part of the structure;
5. there is a template for interpreting [the record], executed on transparent film.

The barograph was not disassembled; the paper recording medium with the drum was removed to be processed at the URAPI ATB MVL and PANKh of Belavia Airline.

[Translator's note: "URAPI" is not known to us; ATB = aviation technical base; MVL could = local or Moscow airlines; PANKh = "application of aviation to the national economy."]

Chairman of commission:	[signature]	Yu. V. Nastenko
Members	[signature]	M. I. Khrolovich
	[signature]	V. Ye. Ovcharov

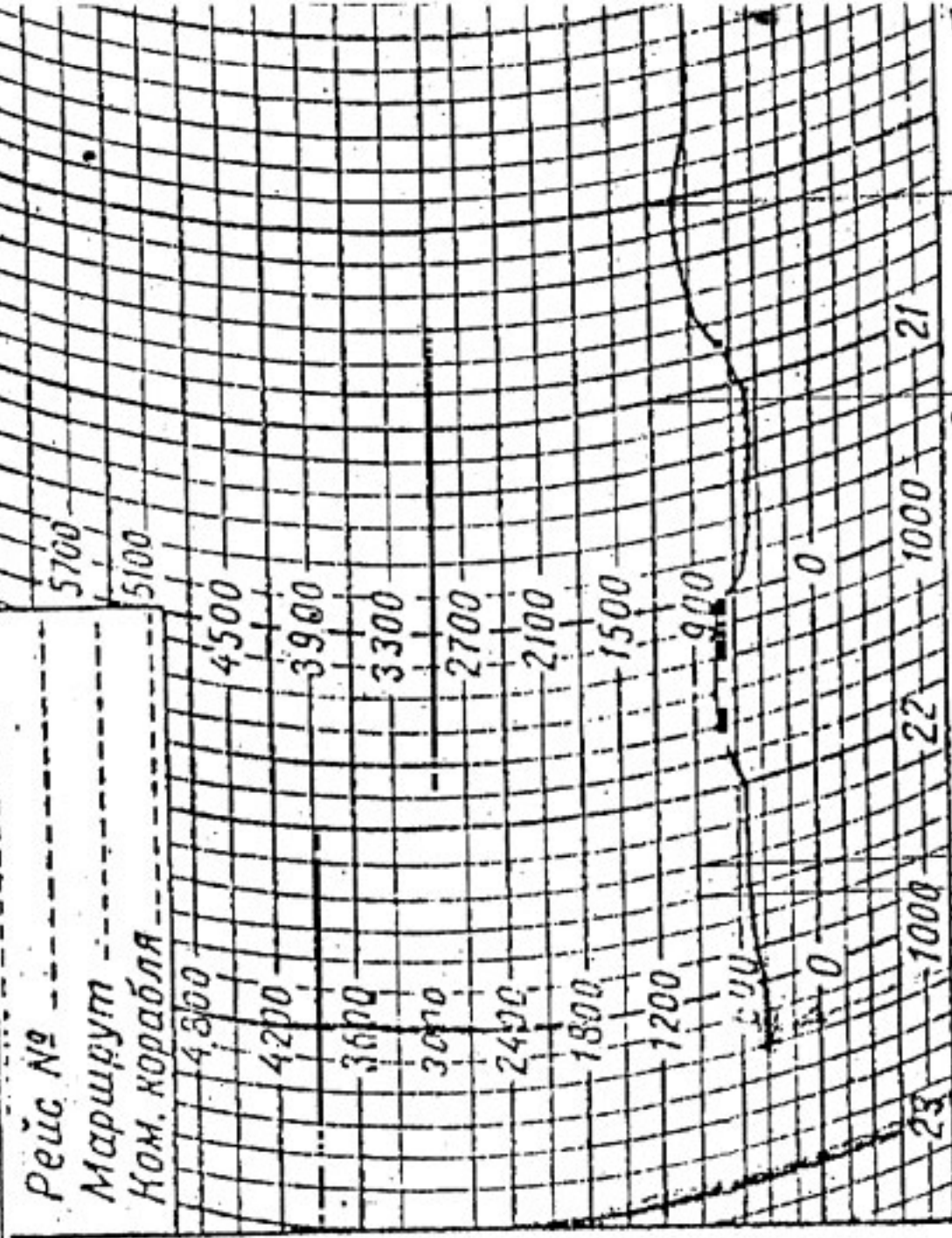
20.09.95 14:04 FAX 48 531 235236 Flugunfall (FUS)

0002

Рейс №

Маршрут

Ком. корабля



18:41

time of launched

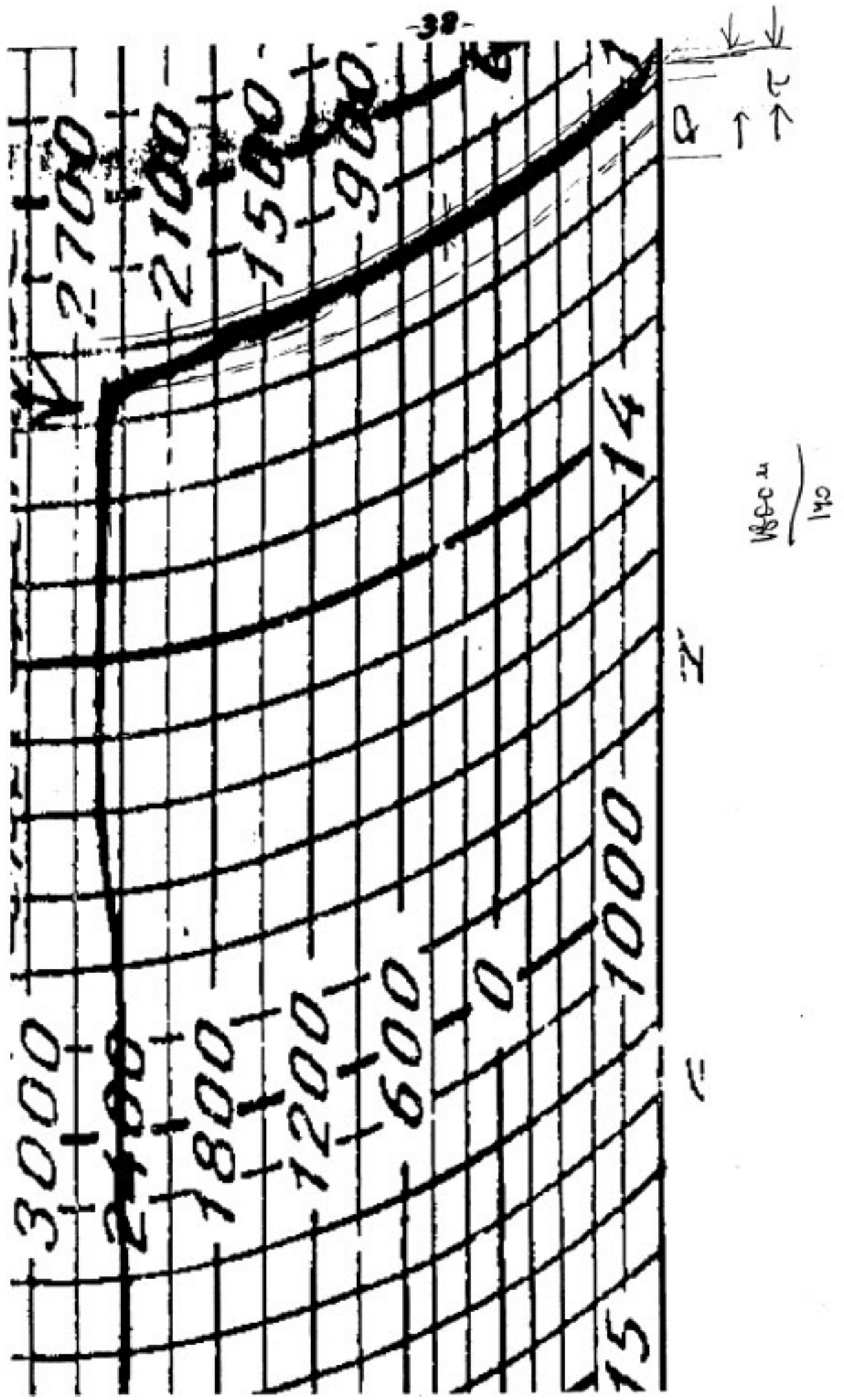
10 minute

1 hour

At 62:42

Elevation of launch point 569 meters

above MSL. *Aden*



DATE	TIME	ALT	TEMP	WIND	WAVE	SEA
------	------	-----	------	------	------	-----

1900	3000	4730.6	09.8	057/7	33.5 + 4	
1900	1900	4733.9	9 18.8	075/5	33.5 + 4	
2100	1900	4736.8	9 21.3	027/5	33.0 + 4	
2200	1900	4742.2	9 22.5	350/7	33.0 + 4	1
2300	2800	4742.4	9 26.3	002/6	33 / 4	
2400	2400	4756.6	9 28.4	020/6	33/4	
0100	2600	4800.8	9 30.3	010/6	33/4	
0200	2400	4808.4	9 32.6	016/7	33/4	
0300	2500	4814.9	9 35.7	021/5	33/4	
0400	2600	4818.7	9 39.0	025/7	33/4	
0500	2900	4826.9	9 44.7	010/7	33/4	
0600	3000	4833.8	9 45.3	369/9	33/4	III 1
0700	6800	4841.8	9 49.6	040/9	27/4	
0800	6800	4845.1	4 54.3	070/4	27/4	II
0900	8500	4848.5		060/15	25/4	
1000	7800	4855.2	10 14.3	28/9	25/7	
1100	6000	4902.0	10 35.6	030/10	25/4	
1200	8000	4907.7	10 50.6	055/12	25/4	
1300	7800	4914.0	11 02.7	046/12	25/4	---
1400	6500	4925.8	11 21.6	030/14	25/4	I
1500	6500	4936.7	11 38.6	054/17	24/4	
1600	7100	4942.6	11 59.1	076/13	24/4	I
1700	6800	4959.0	12 09.4	075/13	23/4	I
1800	7200	5007.9	12 18.1	030/12	22/4	

POSITION DATA

Launch Date: 9-9-95

Launch Time: 1810 Z

Latitude: N 47 37.6

Longitude: E 009 03.0

34 bags + 4 H.O

T/O 1810 Z

-40-

ANNEX 3

SUN 0830Z

6017

2300--4158 NNW 7-12

4400 - 021/7

5200 - 038/6

6000 - 041/5

7000 - 056/8

8000 - 089/9

9000 - 058/15

10000 - 067/20

11000 - 068/20

12000 - 069/23

12668 - 069/23

200 mb

NW to S Polar

E-TO UArctic (A.12)

700 mb

NE NW from Bulg

Cast Black 1900 Mon

600 mb

int Tracking at 1900 mb

MGN 1600Z

1240 308/12

1700 313/13

2140 324/12

2620 321/14

3080 340/14

3500 355/15

4000 358/15

4490 012/15

5100 02/14

5610 205/13

6000 012/13

6500 018/13

6990 010/14

7400 020/13

7800 008/14

8100 025/14

01713161466

ANNEX 3

age

(sp. & bas).

POSITION DATA

Launch Date:

Launch Time:

Latitude:

Longitude:

DATE	TIME	ALT	LAT	LONG	TRK & SPD	BAI	REMARKS
	1900	6800	50 18.9	12 27.1	037/12	22/4	E
	2000	6800	50 27.7	12 38.0	40/8	21/4	
	2100	7300	50 38.2	12 46.7	025/13	21/4	
	2200	7500	50 48.2	12 50.7	020/11	21/4	11
	2300	9300	50 57.3	12 59.3	040/7	19/4	
	2400	9300	51 02.5	13 08.6	047/8	19/4	
	0200	9400	51 15.9	13 22.2	025/10	14/4	
	0330	9200	51 32.3	13 41.4	038/13	19/4	
	0515	9400	51 51.6	14 05.0	035/13	19/4	
	0600	9600	52 00.9	14 16.1	037/15	19/4	
	0700	9800	52 11.8	14 36.8	047/17	19/4	
	0800	10000	52 23.2	15 06.1	060/20	19/4	
	0912	10400	52 31.6	15 34.5	077/19	19/4	
	1000	9800	52 37.0	15 52.1	042/16	18.5/4	
	1100	10200	52 44.1	16 17.4	072/14	18/4	
	1212	10200	52 49.8	16 42.5	057/15	18/4	11
	1300	11200	52 55.1	16 56.3	063/15	16/4	light snow
	1400	10900	52 57.8	17 18.8	065/14	16/4	
	1500	11300	53 02.1	17 40.3	068/16	16/4	1
	1600	10900	53 06.2	18 03.4	75/13	15/4	11
	1800	11000	53 17.0	18 51.3	067/17	13/4	
	1900	10500	53 23.0	19 17.8	066/18	13/4	
	2000	10000	53 29.6	19 46.8	071/20	13/4	
	2100	10700	53 33.6	20 21.0	087/19	13/4	1

Minsk
 DTIS
 1272
 JMA/PAK
 125.9
 TWT 118.3

FOR VIC 2010Z POS 53.30.0 E 19.500 TRK 070 SPD 16 knots STILL FLY

③

POSITION DATA

Launch Date:
hunch Time:

Latitude: _____
Longitude: _____

[illegible]

3173 To vic N 52 36.5 E 24 470 105°/11 K 27.11 R₁₂

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ANNEX 4
(10 pp.)

DEPARTMENT OF STATE
OFFICE OF LANGUAGE SERVICES
Translating Division
TRANSLATION

LS No. 149311
 Russian
 YuSh/

TEXT OF DOCUMENTED COMMUNICATIONS DURING THE FLIGHT OF THE BALLOON D-CARIBBEAN
 IN THE AIRSPACE OF THE REPUBLIC OF BELARUS

#	Time (UTC)	Who spoke w/ whom	Excerpts from the text	Notes
1	2	3	4	5
1.	6:56	air traffic controller from the Air Traffic Control. Center (VRC) speaking with AA Defense VRC AAD VRC AAD VRC AAD VRC AAD VRC AAD	<p>Yes Have you released any balloons? What? Have you released any probe balloons? Oh, this is a hard question; one moment, let me check OK, I'm waiting Hello? Yes No, they say they have not released any I read you, OK</p>	Fragment 2 on the balloon's flight chart
2.	7:01	Crew of airship AFL 101 speaking with Minsk air-traffic	<p>Crew(C): Minsk air traffic control, N69RW calling. A/T controller (ATC): Repeat, [please], who is calling? C: He is requesting permission for N69RW to enter zone at flight level 80.</p>	Fragment 3

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7:02	controller via FM, sector 2 West; 133.8	ATC: N69RW? C: Yes, yes, requesting permission to enter zone at flight level 80. ATC: OK. C: What should [we] ask him?	
7:03	Sector 2 West speaking with Warsaw; Lovushka microphone	West to Warsaw: Do you have anything [moving] toward us in Rudka, Sir? Yes... No, Sir, it is simply the airship radioed that some idiot Bukvar [aircraft bearing letter markings? - trans.] NRW [is] at flight level 80. I don't know whether he is going toward Vilnius or toward us in Rudka? Just a moment... toward Vilnius, right? (Bukvar is indistinctly mentioned in the conversation.)	
7:14	Center 570, UVD (Air Traffic Office)Navi gator on duty speaking with Central Command Post of Air Defense Agency	Andryukha, greetings! There's a small balloon in the area of Pruzhany at the altitude 2 to 2500. Yes, it's moving on course 90; let's say it's shifting eastward. I see. So, to ensure air-traffic safety, keep this in mind. I am keeping it in mind. I see. OK, thanks, Sasha, any idea where (it) is from, no? Well, as a preliminary matter, from the Polish side. So the Poles let it through? OK, I read you.	
7:15	Center 570, via Lovushka microphone	...In the area of Pruzhany, 2-2.5 thousand, a balloon. ...A Pole, most likely. ...[illegible] there [illegible] in the area of Pruzhany, 2 to 2500, moving on course 90. ...where from? Poles? Yes. ...in the area of Pruzhany, 2000-2500, course 90 (telephone call to [the city of] Baranovichi): Good afternoon, Captain Kurushko here. So... the Air Defense organs have detected a balloon, its altitude is around 2500. Course 90 degrees, so it's possible that it would drift into your flight zone. OK, see what resources you got. Is that: the balloon there?	
7:16	RP [Dir. Finder?- trans.]of	RP to West: an air balloon has been detected in the area of Pruzhany at flight level around 2000-2500, it's	Fragment 5

		the Belarusan Center of the OVD [Air Traffic Agency] via [illgbl]	drifting on a 90-degree course. ATC: In the area of Pruzhany, right? OK.
	7:16	Sector 2 West Air traffic controller via [illgbl]	West, to senior officer: an air balloon has been detected in the area of Pruzhany, 2 to 2.5. In the area of Pruzhany, yes, OK.
8.	7:17	UVD center 570, via Lowushka microphone	Over Pruzhany, 2000-2500. (in English) Yes, Sir. Delta, Oscar, Sierra, Alpha, Zulu. Just a moment. Sir, there's a balloon not far from Pruzhany, flight level 2000 meters. Yes. Name of airship? (in Russian) He wants to know, as there any letter code [on the] Pruzhany [airship]? How can I explain it to him? Tell him: east of Brest. How many kilometers? Tell him: northeast of Brest, 70 kilometers. And what is Brest's call sign? UMBB. (in English) Sir, hello, Sir, this balloon is not far from navigation point UMBB. 70 kilometers northeast. Northeast of UMBB, Brest. 70 kilometers northeast of UMBB. Stay tuned. (in Russian) Anything else? Drifting at 90 degrees. (in English) This is only one balloon, no more. No, only one. (in Russian) Descending to 1500. I see, I get it. Descended to 1500 and... (in English) I don't understand you. We.. . (indistinct). Phone operator? Kiev? Kiev? (in Russian) One second, please. Do we have Kiev's telephone number? (in English) No, we don't have that number. We don't have it. (in Russian) I think Warsaw is asking for the phone number in Kiev. But we don't have it. He's surprised that we don't have it. It's a different country now.

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			<p>He does not know, either? He does not.</p>	
9.	7:21	RP [Dir. Finder?-trans.] of the OVD Belarusan Center, via telephone	<p>Brest, it was reported to Air Defense that there was a balloon at 2000 meters; now it's descended to 1500 meters, and it's on a 90-degree course. Was at 2000, now they are reporting that it's at 1500. OK, I will keep that in mind.</p>	
10.	7:22	Navigator on duty at center 570, UVD, speaking with AAD CCP	<p>Sasha? Savchukov. Sasha, a Pole has called from somewhere, from Warsaw, I think. He was trying to inquire about the balloon. Wanted to know about the balloon, didn't they? We just talked to the Air Defense Operations Department. Of Poland? Yes, of Poland. The information is that at 7:40 local time a meteorological probe balloon was released somewhere in Poland, in Lomza. So the border guards saw it at 9:[54?] local time. What time are you giving me? Local? I am giving you local time. The border guards saw it at [illegible] at 5000 meters. They fixed its location at 1500 meters near Pruzhany. OK. There's a meteorologist standing nearby, he says that there's a hole in that balloon. It gained altitude and now it's descending and will fall somewhere. OK, visually... the commander of the [border] post observed that it does not have a suspended load. So, what shall we say, ADA [?] for example? OK, I see. Thanks, Sasha.</p>	Fragment 6
11.	7:22	Center 570, UVD, via Lovushka microphone	<p>I think this is DOSAAF [Voluntary Society for Assistance to Army, Air Force and Navy]. He is asking what kind of balloon is flying along the airway. DOSAAF or something like that. So you have anything on that balloon? How would I know? Some balloon, balloon [Polish for balloon - trans.]... No, he simply wanted to know the direction, and also how many of them, a Lot or just one. Rsk the Air Defense. He was calling from some center, I think from Warsaw, that's what I thought. So, a balloon was discovered in the vicinity of Pruzhany, it was at 2000</p>	

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			<p>neters, and now it has descended to 1500. (Indistinct)... from Lomza [it] took off at 9:34, but this is local... the border guards... without suspended load... Osovtsy. Yes, all information has been transmitted, no suspended load... from the Lomza area, Polish, it flew here. But why not shoot it down? No suspended load, it's falling by itself. They are doing what they want, they don't care. But maybe there's about 36 kilos of heroin in there.</p>	
12.	8:07	telephone convers. between air traffic controller Minov (Brest) and Shkalinsky, Head of KGB office for Brest oblast	<p>S. (Shkalinsky) I have an urgent problem, can you give me some advice? M. (Minov) Go ahead. S. Is any notification given when they launch those meteorological probes or balloons from the Polish side? M. so... S. Is there a notification that goes to us? To air traffic controllers? Y. I don't get it. What pressure? [pressure sounds similar to notification - trans.] S. Notification. M. Notification -- no. S. So they just launch them arbitrarily? They do whatever they want? M. They launch the same things from the observatory here, and sometimes they give notice. But lately there have not been any launches. There's no information whatsoever. S. But the Poles... (indistinct) M. The Poles give us nothing. S. But here's the real-life situation: there's a balloon hanging in the air in the Kamensky region; possibly it's a probe from the Polish side. M. No, they give us none. S. But the Air Defense people, they are trying to make a decision. Whether to call in a helicopter and shoot it down or not to shoot it down. What do they have in that basket? M. I don't know, but usually they have a box there, a small transmitter and nothing else in that box. S. In short, there was no official notification. M. Nothing, they give us nothing. S. I see, thanks.</p>	
13.	8:30	Telephone conv. between	<p>Kurushko (navigator on duty). Pashkevich - an order just came in, at ...[?] local time, they are sending up</p>	<p>Fragment 8</p>

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		<p>navigator on duty, UVD center 570 and Air Defense and Air Force CCPS</p>	<p>an interceptor from Pruzhany. K. From Pruzhany? P. Yes, from Pruzhany. It will go to the Osovtsy area, where there is a balloon at 2000 [meters]. K. I see. What time? P. Takeoff when ready. K. To what altitude will it climb? P. Well, the balloon is at 2000...[?] about 2000. K. What are they sending from Pruzhany, an MI-24? P. Yes. K. I see. So it will go toward Pruzhany or thereabouts? P. It will go from Pruzhany in the direction of Osovtsy. K. From Pruzhany in the direction of Osovtsy. I see.</p>	
14.	[?]	<p>RP (Dir. Finder?-trans.) of the OVD Belarusan Center, via telephone</p>	<p>A helo from Pruzhany will arrive later. Then, after MI-24, it will go to the Osovtsy area, and will look for the balloon there. If you have heard, a balloon from Poland has flown here, somewhere in the range of 2300 meters; I let him establish communications with you. Approximately 07:20. I see. What's the call signal? Must work it out with Brest. - I don't know the call signal yet; let me ask the military people. ...[illegible], takeoff when ready. - Brest, sorry, correction: call signal is 90335.</p>	<p>Fragment: 9</p>
15.	[?]	<p>navigator on duty, UVD center 570 and Air Defense and Air Force CCPS</p>	<p>P. (Pashkevich) (Central Command Post) K. (Kurushko) So, he'll have to work it out with Radial. P. With Radial? K. He must get in touch with Radial and with Brest and work it out. So up to what altitude is he to climb, in order to...[illegible] cover? What ceiling? P. up to 2000. K. Up to 2000. Roger. What's his call signal, if I can have it? P. 90335. K. I understand. He must work it out with Brest. P. OK. K. And must not deviate toward Baranovichi. P. I see, I see. He sees it visually, [moving] toward Osovets.</p>	
16.	8:42	<p>Radio exchange</p>	<p>CCO: 335 to Radial. HC: 335 here; proceeding to your</p>	

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between a
Combat
Control
Officer
(CCO) and
the
helicopter
crew (HC)

remote..., course: 90 degrees.
CCO: Roger. **Proceed on the same** course.
HC: Altitude 500 meters.
CCO: Keep the altitude of 500 meters.
HC: This is 335, approaching your
location at **400** meters, course 90
degrees, [need] conditions for approach.
CCO: **90335**, this is Radial, continue
approach to location on a 90-degree
course.
HC: Roger.
CCO: **335**, 30 degrees to the left.
HC: Roger. 30 degrees to the left.
CCO: To **335**, it will be 6-7 on this
course. **335**, [proceed in a] straight
[line?] on the same course.
HC: Straight, with landing; course as
instructed.
CCO: **No**, perpendicular to the landing.
HC: Roger, perpendicular, 60-degree
course.
CCO: To 335: I hereby advise you that
the balloon will be on your right, with
a distance of about 6.

PAUSE

CCO: **335**, 30 degrees **on the right**.
HC: This is **335**, so far I don't observe
[it].
CCO: Roger; it's the sun.
CCO: **335**, 60 degrees on the right.
RC: Roger, 60 degrees.
CCO: The balloon's altitude is about
1500-2000 meters, above. Climb [to]
1000.
HC: Roger, climb [to] 1000.
CCO: **335**, **look**, above, 1000-1200 **up**.
335, turn right toward the location.
HC: Roger, turn right toward the
location.
CCO: The balloon is above you, about
1000 meters higher. **On the right**, with
cloud cover as background, **that's** where
it should be, or [seen] through the
breaks in the cloud cover; that big
cloud, the one that's higher.
HC: I see it. **Am** at 1000 meters.
CCO: **335**, you observe the balloon; look
to the right, anything higher?
HC: I **see it** above me.
CCO: **335**, do you observe the balloon?
HC: This is **335**, I don't **see** it because
of the cloud cover.
CCO: Roger. The balloon **is** in the
breaks in the cloud cover. Permission
given to climb to 2000 toward the
location. From the location we will
perform the approach from scratch.

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		<p>HC: Roger, climbing to 2000 meters. CCO: 335, make a right turn to get on 30-degree course, and [make a] right. HC: Roger, right turn, 30-degree course. CCO: 335, altitude control. 335, look to the right behind the cloud, distance 10-8. HC: Roger. CCO: The balloon is white. HC: This is 335, I observe the balloon, at 90 degrees, approaching. CCO: 335 confirmed, at 90 degrees, approach no closer than 50. HC: Roger. CCO: With vertical separation.</p>
8:52		<p>HC: 335 climbed to 2000; it is approximately 200-300 meters above [me]. CCO: Roger. Any suspended load? HC: There is one hanging there, but so far I have not determined what it contains.</p>
	AAD CCP speaking with the Air Force	<p>Is there a suspended load? Yes, there is.</p>
	AAD CCP speaking with AAD Commander	<p>Comrade Commander, [I] have visually detected a helicopter; there is a hanging load, there is one. Your decision? Destroy!</p>
		<p>CCO: Roger.</p>
8:53		<p>CCO: 90335, this is Radial; destroy balloon.HC: HC: Roger, destroy balloon. CCO: 90335, please give account.of your actions as you go. HC: Affirmative, [I am] attack[ing]. CCO: 90335, destroy balloon. HC: Roger, destroy. CCO: 90335, cannot see you because of clouds; [need] information regarding your actions. 90335, do you see the balloon? HC: 335: I see the balloon. CCO: Have you received the order to destroy balloon? HC: Yes, we have. CCO: Who issued the order? HC: Radial CCO: Roger, I confirm.</p>

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		<p>HC: This is 335; the balloon has been destroyed. CCO: Roger, 335, I see it being destroyed; please watch the gondola as it falls. HC: Roger</p>
8:56		<p>CCO: Location tie-in, area 335 -- location? HC: 335: The gondola will fall approximately 4 to 5 kilometers east of Bereza. CCO: Roger, permission to descend [illegible] meters. HC: Roger, descend [illegible] meters.</p>
8:57		<p>CCO: 90335, your actions? HC: 335: I am following the fall. CCO: Roger. Observe safety measures.</p>
8:58		<p>HC: Roger. CCO: 335, altitude check. HC: 335: 1500. CCO: Roger. HC: Radial, what is to be done with the suspended load, who is going to pick it up? CCO: 90335, this is Radial, I granted permission to descend to 200, while following the gondola and fixing the location on the map: then, proceed according to orders. HC: Roger, permission to descend to 200.</p>
8:59		<p>HC: Descent to 200, fixing the location, then proceed according to orders from the superiors. Roger. CCO: 335, need more precise map location for the fall. HC: Roger. CCO: 335, on the basis of visual observation, does the gondola have any equipment, components? HC: 335 to Radial: can't tell what was in the gondola, maybe equipment, but no people. CCO: Roger.</p>
9:00		<p>CCO: 335, do not descend below 200 meters. HC: Roger. 200 meters.</p>

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			<p>CCO: Roger. Permission to descend to 200 meters, then hover over the area. HC: 335: descended to 200. CCO: Roger. Do you observe the progress of the fall? HC: Not yet. CCO: Clouds, probably. Permission to make a turn over the location of the fall. 335, check remaining fuel. HC: 335: 1600. CCO: Roger. HC :335: east of the town of Bereza along the railroad track, about ...[illegible] meters in the forest. CCO: Fell in the forest, right, 335?</p>	
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DEPARTMENT OF STATE
OFFICE OF LANGUAGE SERVICES
Translating Division
TRANSLATION

ANNEX 5.

(21/11/95)

LS No. 149311e
Russian
TM/

Annex

Results of study of the flight
*of the balloon "D-CARIBBEAN" and MI-24V helicopter no. 90335 during the
final segment of the flight.*

Moscow, 1995

Study conducted by:

[a signature appears beside each entry below]

V. Ye. Ovcharov development of the program of study and
modelling algorithm, analysis,
compilation of report;

V. M. Polyanskiy development of the modelling project,
and the modelling itself;

O. G. Lysenko initial processing of flight data,
construction of timelines;

A. M. Gorshkov construction of timelines;

V. A. Trusov construction of overview diagrams;

A. S. Belan spectral analysis of acoustic
information;

V. I. Ustimenko decoding of acoustic infuriation.

. The purpose of the analysis was:

- to construct the trajectory on which balloon D-CARIBBEAN and Mi-24V interceptor helicopter no. 90335 were moving during the final segment of the flight;

- to determine precisely the process parameters of the gunfire from the Mi-24V helicopter;

- to ascertain and analyze the actions of the flight crew of the helicopter during the flight segment when balloon D-CARIBBEAN was being intercepted.

The following background materials were used in the study:

- the in-flight altitude record of balloon D-CARIBBEAN during the final segment of the flight;

- the readout from the SARPP-12 [flight data recorder] system on Mi-24 helicopter no. 90335;

- calibration charts for the SARPP-12;

- a copy of the recordings from the MS-61 tape recorder on Mi-24V helicopter no. 90335;

- the trim angle of the Mi-24 helicopter as a function of airspeed (from helicopter avionics);

- estimated characteristics of the balloon.

1. To synchronize the flight data and acoustic information on the flight and the attack of the Mi-24V helicopter interceptor we used the binary "open fire" command on the SARPP-12 readout and the sound of the shots on the MS-61 microphone recording. This revealed that:

-the first shots from the machine-gun were fired during the time interval between 08:52:55 and 08:53:04 (UTC), which corresponds to 1004-1013 seconds relative time on the SARPP-12;

-the second round of shots occurred during the time interval between 08:54:17 and 08:54:20 (UTC), which corresponds to 1087-1090 seconds relative time on the SARPP-12.

2. Based on the recording altimeter data, it was found that the altitude of the balloon [text truncated at bottom of page]

Coordinates at which the balloon descended:

$\phi = 52^{\circ}33'58''$ north latitude

$\lambda = 25^{\circ}01'42''$ east longitude

To determine the coordinates of the balloon's location at the time it was hit by the machine-gun burst, estimates were made of its descent trajectory. In doing so, it was assumed that:

- the balloon descended as a body in free-fall;
- the horizontal component of its velocity coincided with windspeed;
- the aerodynamic resistance of the "gondola/suspended load system" was found from the geometric dimensions of the gondola and the drag coefficient C_d . This value (as estimated by the Aeronautics Federation of Russia) was 0.5 to 0.6. According to the same assessment, the weight of the balloon at time it was shot down was about 400 kg.

Thus we obtain the following:

$$dV_{yb} / dt = 9.81 - \{ \hat{\mu}(H) * C_x * S * V_{yb}^2 \} / 2 * m_b$$

$$V_{xb} = U \cdot \sin \delta$$

$$V_{zb} = U \cdot \cos \delta$$

$$\Phi_{bc} = \Phi_{bi} - Z_b(t_d) / R$$

$$\lambda_{bc} = \lambda_{bi} - X_b(t_d) / R \cdot \cos \Phi$$

$$dX_b / dt = V_{xb}$$

$$dZ_b / dt = V_{zb}$$

where: V_{xb} , V_{yb} , V_{zb} - are the eastward, northward, and vertical velocity of the balloon;

S - is the area of the bottom of the gondola, roughly 4 m^2 ;

$\hat{\mu}(H)$ - is air density as a function of altitude;

m_b - is the mass of the "gondola/suspended load system";

U - is wind speed (according to data from the log and [text truncated at bottom of page]);

δ - is wind direction, which was 105° according to the same data;

Φ_{bc} , λ_{bc} , Φ_{bi} , λ_{bi} - are the geographic latitude and longitude of the balloon's position at the moment firing commenced and the moment of impact, respectively;

R - is the radius of the earth, which is
 $6.366 \cdot 10^6$ m

X_b, Z_b - are the linear coordinates of the
 balloon's horizontal movement during the
 time of its descent relative to its
 point of impact; and

t_d - is the time over which the balloon
 descended.

By modelling the movement of the balloon, we obtained the
 coordinates of the balloon's location at the moment firing on
 target commenced (659 m West and 177 m South of the point of
 impact), which allowed us to determine the coordinates of the
 helicopter at the same moment in time (1259 m and 177 m,
 respectively) because, as the crew of the helicopter reported,
 the shots were fired on an easterly (90°) course at a range of
 600 meters.

3. The trajectory of the helicopter's motion within a
 horizontal plane was obtained by modelling based on the recorded
 values for flight data from the SARPP-12 readout, taking into
 account the helicopter's roll trimming. We did so using the
 following system of differential equations:

$$dX_h / dt = V_{true} \cdot \sin\psi + U \cdot \sin\delta$$

$$dZ_h / dt = V_{true} \cdot \cos\psi + U \cdot \cos\delta$$

$$d\psi / dt = 9.81 \cdot \operatorname{tg}(\gamma - \gamma_{trim}) / V_{true}$$

where: X_h and Z_h - are the linear coordinates of the helicopter within the same system as the balloon;

V_{true} - is true airspeed obtained from instrument airspeed corrected for altitude;

ψ - is the helicopter's magnetic heading;

γ , γ_{trim} - are the current and trimming values (see figs. 4 and 5) [text truncated at bottom of page]

The results presented below (fig.1) were obtained from modelling and analysis of the flight data and acoustic information.

At 08:49:30 (UTC) (788 seconds on the SARPP-12), the helicopter crew spotted a hot-air balloon at a distance of about 5.5 km at an angle of about $100-103^\circ$ to its right on a flight heading of about 60° ("at the 3:30 position"). The balloon's elevation was 1020 meters; the helicopter's (instrument) speed was 195 km/h.

At 838 seconds (08:50:20 UTC), the tactical control officer at Osovtsy airfield queried whether the balloon had a suspended load.

Maneuvering on a starboard heading ($20^\circ-15^\circ$ banking) and climbing, the helicopter acquired an altitude of 2420 m by 910-912 seconds and was on a heading of roughly $240^\circ-250^\circ$, with

instrument speed of 140 km/h. At this point in time the balloon, at an altitude of 2550 m (above sea level) was sighted at a distance of 2.1 km. At 915 seconds (08:51:26 UTC) the helicopter crew, continuing the approach, detected a suspended load on the balloon and so reported to the ground control center (Crew: "A suspended load has been spotted"). Distance at that moment in time was 1.7 km.

Note 1: Based on the geometric dimensions of the gondola as known from ground observation, and judging from photographs and other sources (such as advertisements), we may accept that the distance from the bottom of the bag to the gondola was about 8 m, and the height of the gondola was about 1.5 m (bag diameter was 12 m, with a volume of approximately 1000 cubic meters). The angular distance from the bag to the gondola at the helicopter's true distance was 15.5 angular minutes. At any rate, the human eye can discriminate no less than 7.15 angular minutes (*Handbook of Engineering Psychology*, ed. B. F. Lomov, corresponding member of the USSR Academy of Sciences, Moscow, Mashinostroyeniye publishing, 1982, p. 58).

Thus, from the ratio of the actual angular dimension of the balloon and the threshold value for the discrimination of sight, we may accept that the crew was correct in discerning the presence of a gondola.

Without additional commands to approach and identify the balloon [text truncated at bottom of page]

At 947 seconds, the helicopter commander reconfirmed that the balloon was white color and that it had a suspended load.

Note 2: It was natural for the crew to call the balloon white, since the pilots were convinced that they were looking at a weather probe painted precisely that color. This is likewise confirmed by the fact that, when the tactical officer reported "a white balloon" (08:49:25 UTC), the gunner commented, "Of course it's white!"

Between 950 and 991 seconds, the helicopter made a left turn with variable banking (up to 23°) and levelled off on a heading of 130°-140°. By 1000 seconds, at a range of 1075 m, the weapon (a free-swinging, nose-mounted machine-gun) was being prepared to fire from the forward gunner's compartment.

Note 3: At a range of 1075 m, the lettering on the bag, if it was on a portion of the sphere visible to the crew, would have been 16.7 angular minutes high and about 10 angular minutes wide (accounting for spherical distortion), i.e., they would have been above the threshold of discrimination. The crew found no markings. The explanation for this may be that the lettering was on the side of the balloon not observed by the crew. A thumbnail estimate shows that the probability of the lettering being in the crew's field of vision is roughly 0.15 to 0.2.

At 1001-1002 seconds (08:52:53 UTC), the "Fire" command was given and was repeated 6 seconds later. A binary command to open fire (depressing the firing button) is recorded on the SARPP-12 over 9 seconds (1004-1013 seconds). However, analysis of the acoustic information showed that beginning at 1011 seconds there are three short bursts from the machine-gun lasting 0.85 seconds, 0.5 seconds, and 0.4 seconds (cf. "Dynamic Spectrograms", figures 2 and 3).

Note 4: Apparently some delay in firing occurred; there is subsequent indirect confirmation of this in the command to reload the machine-gun (1041 seconds - gunner: "Attempt- to reload").

The bursts missed the balloon -- 100 meters to the right (as reported by helicopter crew members upon questioning).

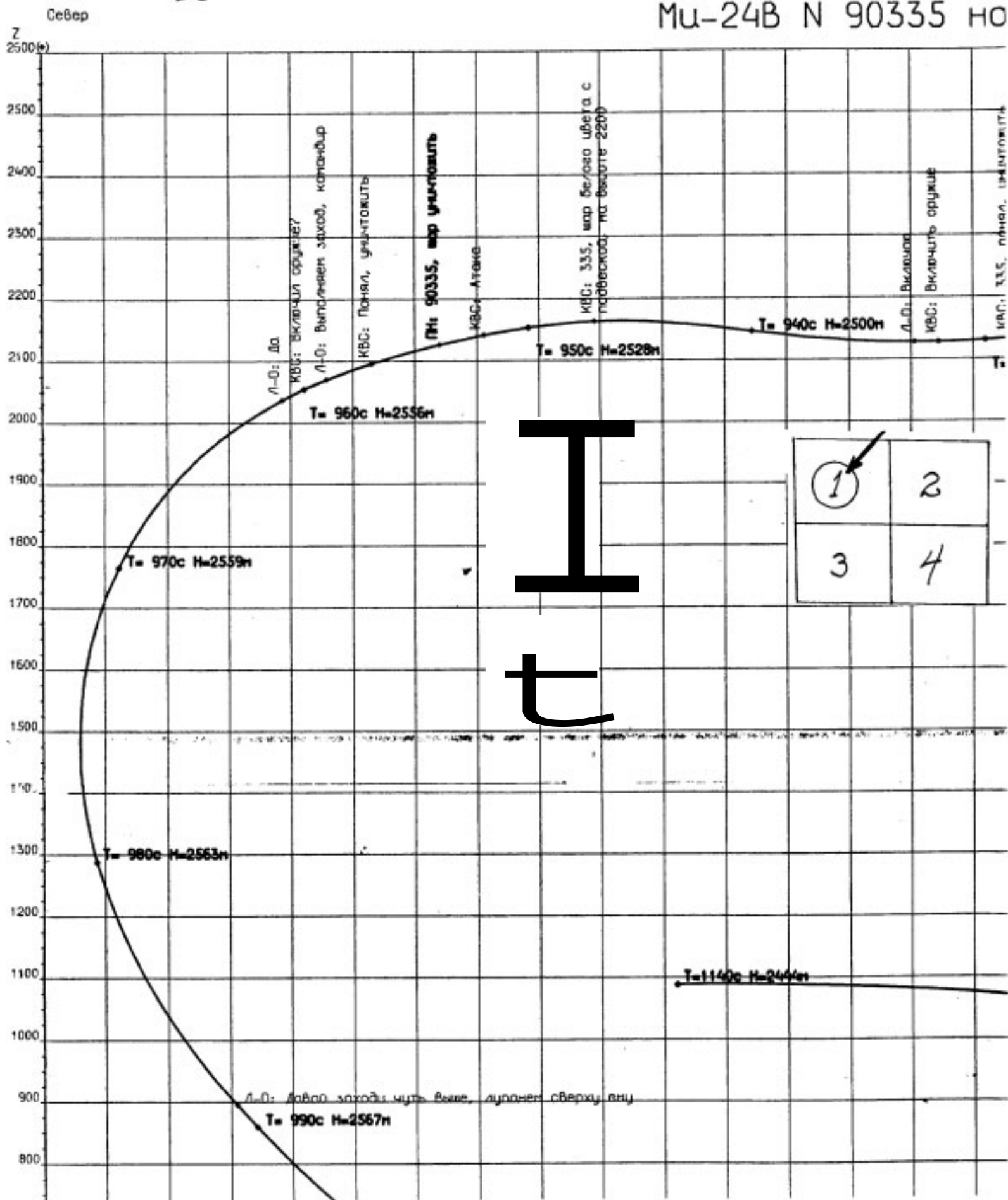
Starting at 1014 seconds, the helicopter crew began executing a maneuver to repeat the pass. During the time interval 1017-1020 seconds, the helicopter got closer to the balloon, a distance of 575 meters, than at any other time during the entire interception (until firing for effect).

The maneuver to make another pass was a non-standard-rate turn with variable banking (15°-40°). As of 1080 seconds (08:54:11 UTC), the helicopter had come out of the maneuver onto the line of attack. At 08:54:20 UTC, on a 90° heading, at an altitude of 2600 m (above sea level) and a speed of 153 km/h, a single 0.4-second burst was fired on the balloon at a range of 600 meters, which ignited the bag of balloon D-CARIBBEAN.

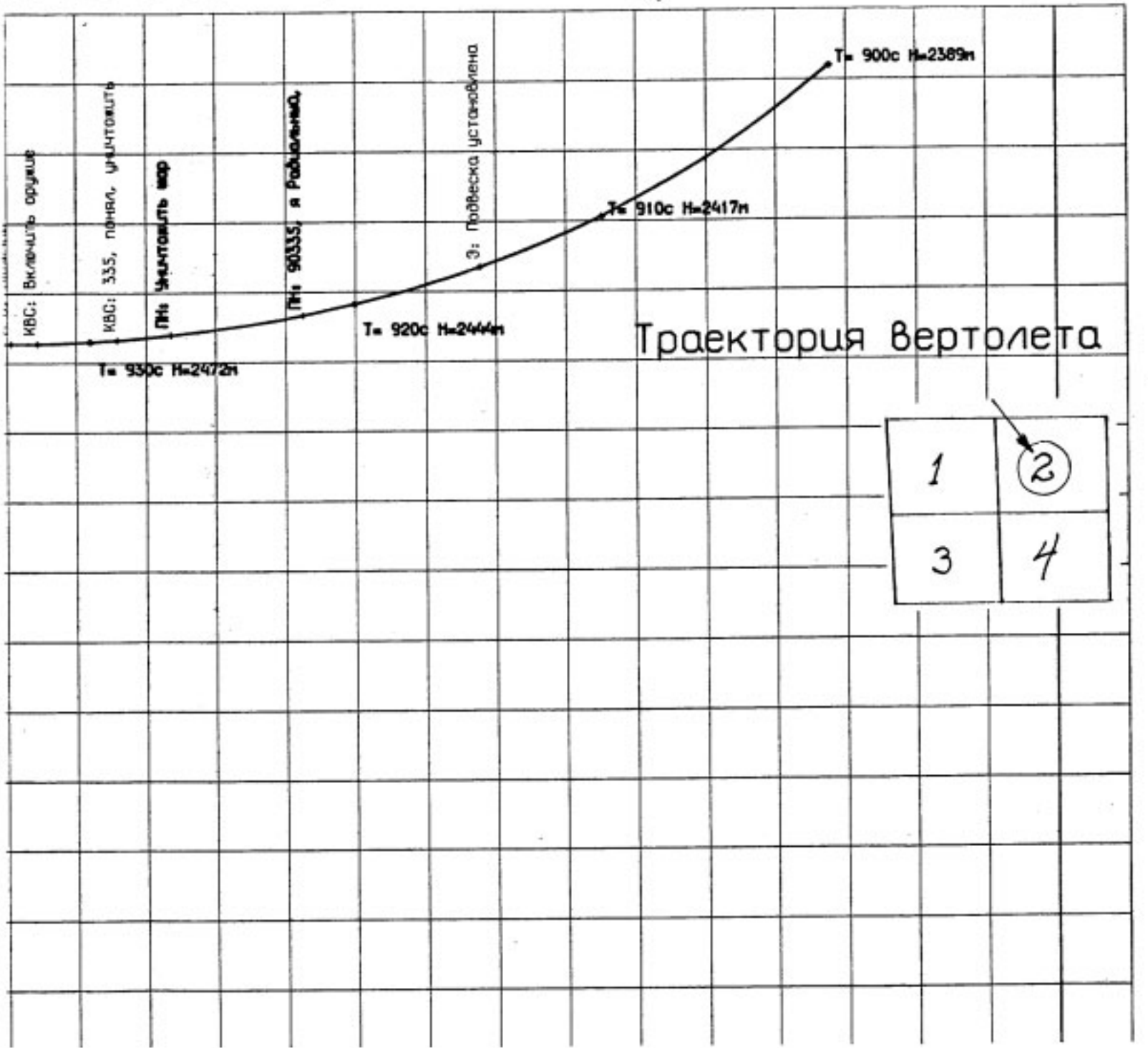
FIG.1 FLIGHT PATH OF THE D-CARIBBEAN BALLOON AND THE INTERCEP

- 63 -

Рис.1. Траектория воздушного шара D-Му-24В N 90335 по

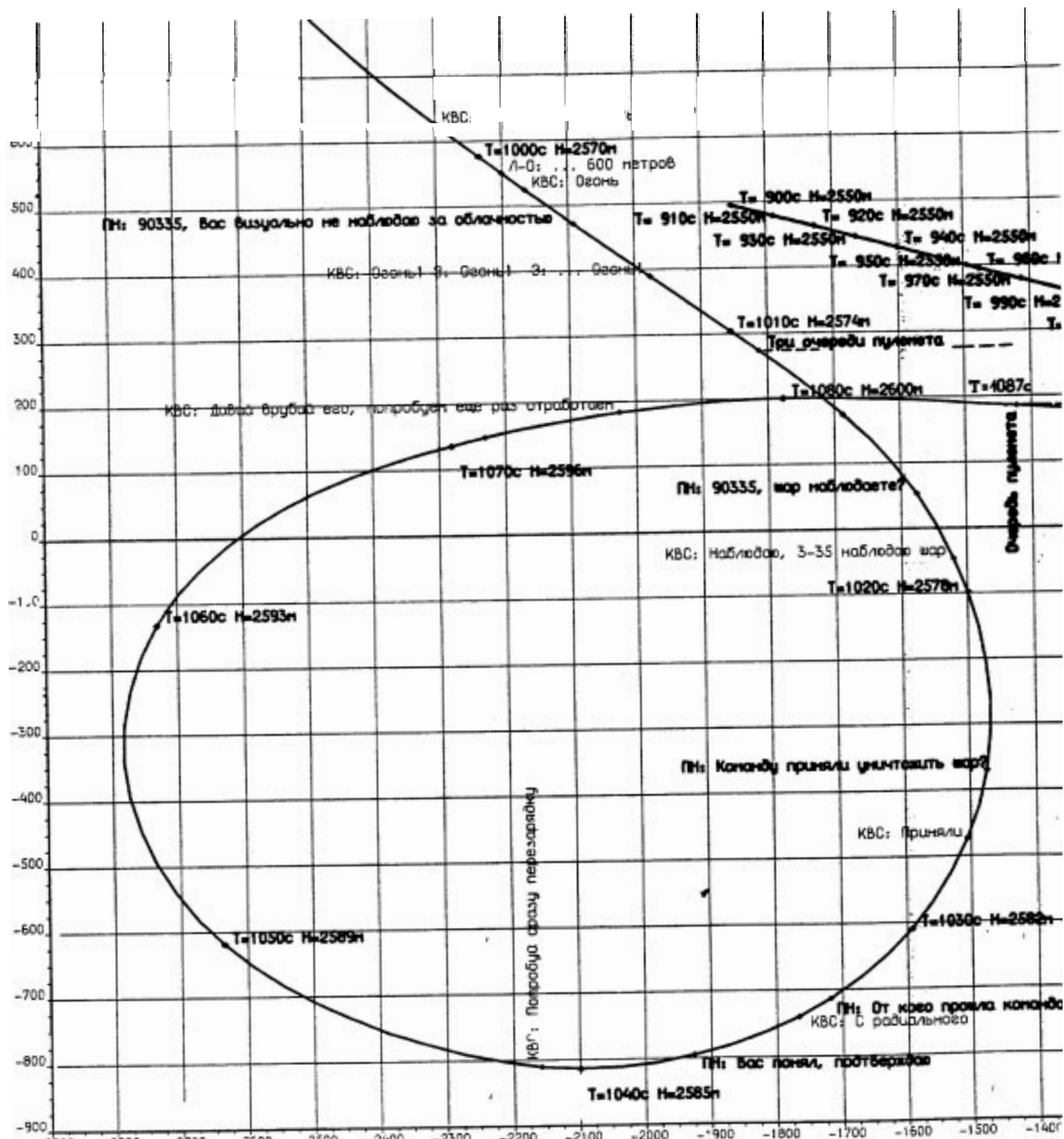


PERCEPTING Mi-24V HELICOPTER No.90335 IN THE INTERCEPTION PHASE
ра 0-CARIBBEAN и вертолета-перехватчика
35 на этапе перехвата - 64.



- 65 -

1	2
3	4



-66-

1	2
3	4

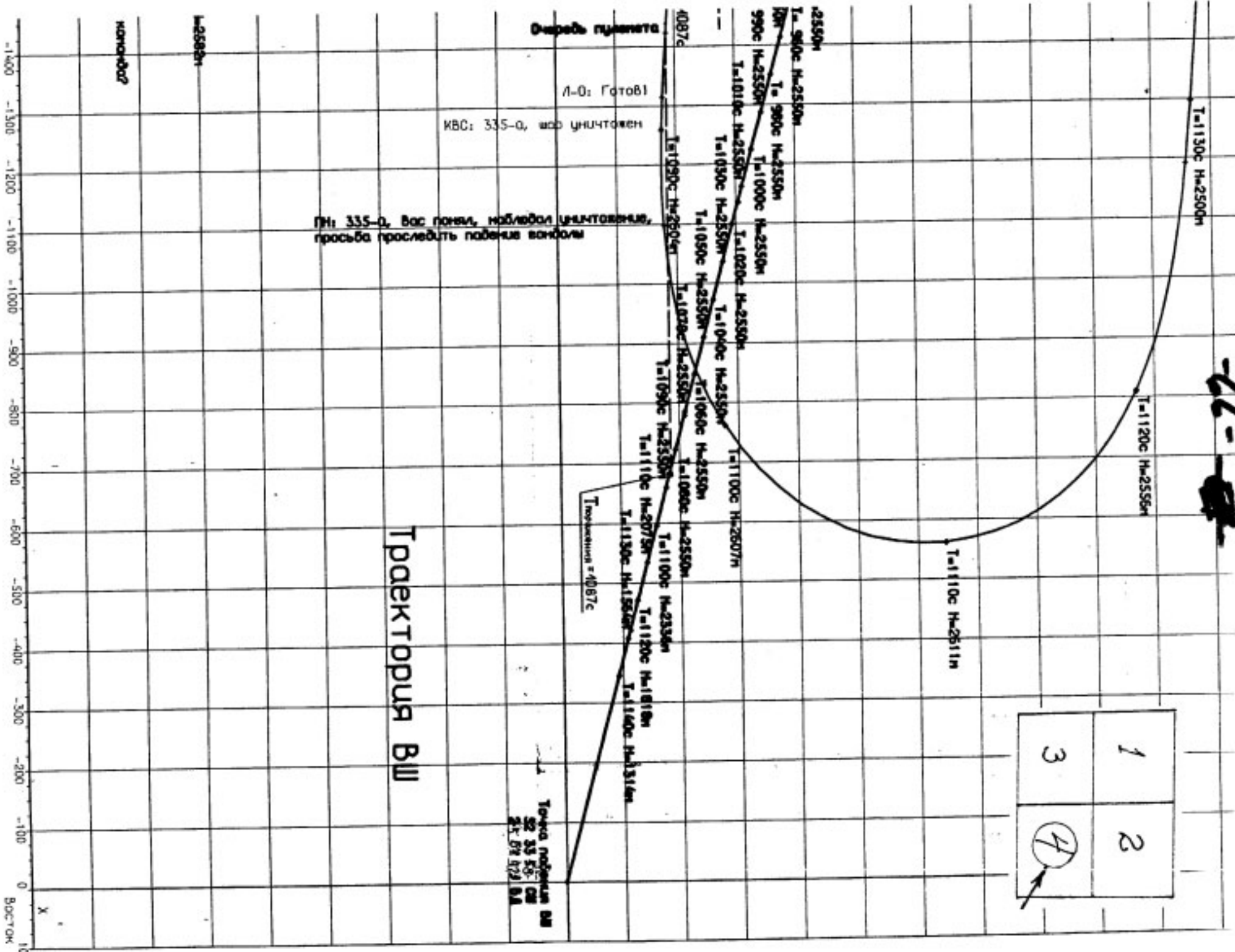
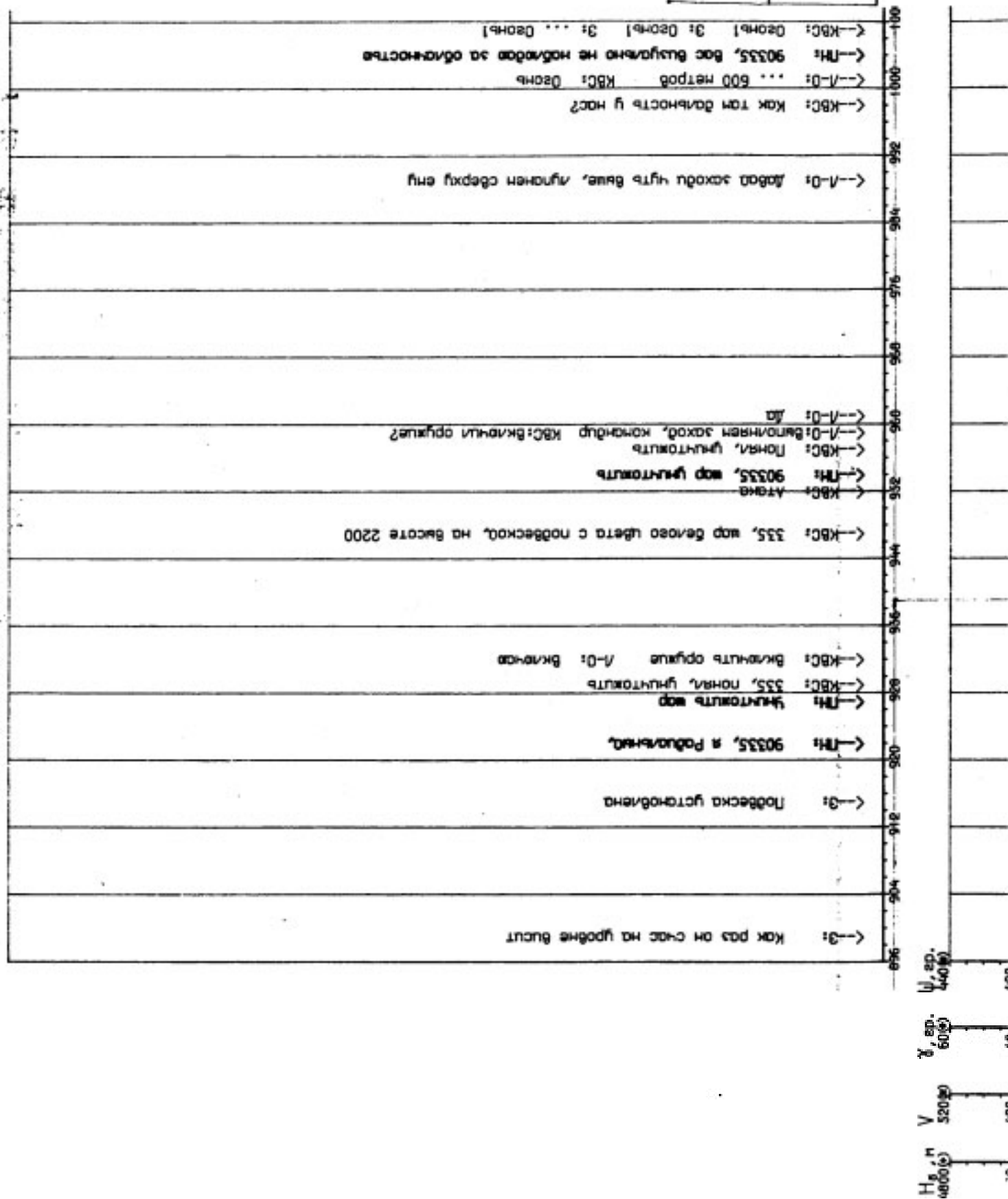


FIG. 6 RECORD OF THE FLIGHT PARAMETERS OF M1-24V

1	2
3	4



иета Му-24В N 90335, на этапе перехвата
иВ HELICOPTER No. 90335 IN THE INTERCEPTION PHASE

Tin Okepeju University

<--TH: 90335, map habmodate?
<--KBC: Habmodae, 3-35 habmodae map

<—ПН: Команды погрузки и разгрузки мор?
>--КБС: Погрузка

<—UH: 07 kono prozina komandaz? KBC: C podalybnogo

>--TH: bac non-av, notBepand

1981-2000: Annual Report of the U.S. Census Bureau

<--KBC: Jeder Bsp. ist, notwendig eine pa. Diagonale

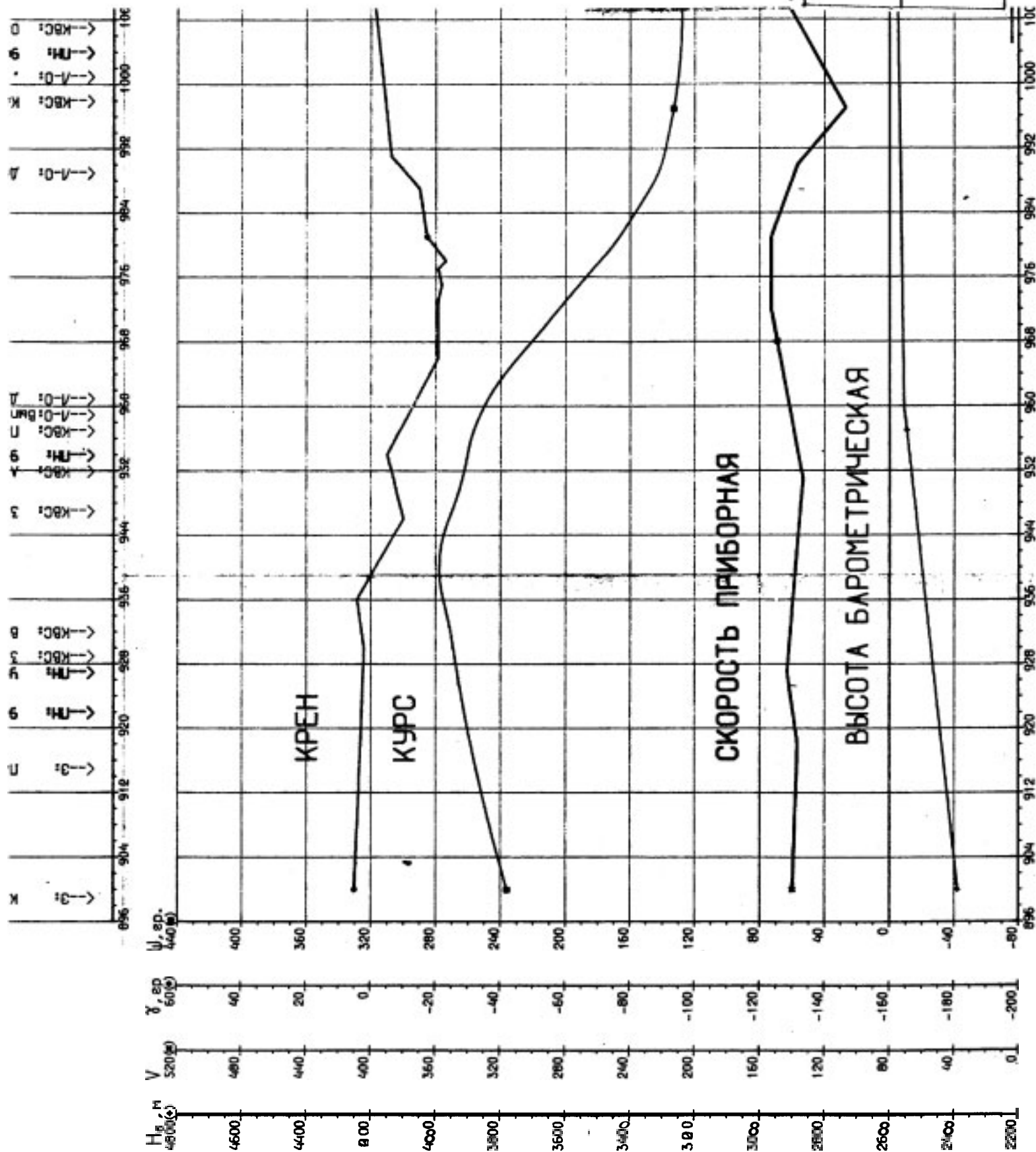
Questa pagina
 <--V-D: Foto1 KBC: 335-Q, war ginchtojen
 335-Q, bac ponia, haladon ginchtojen,
 procha procha ponia ginchtojen

1	2
3	4

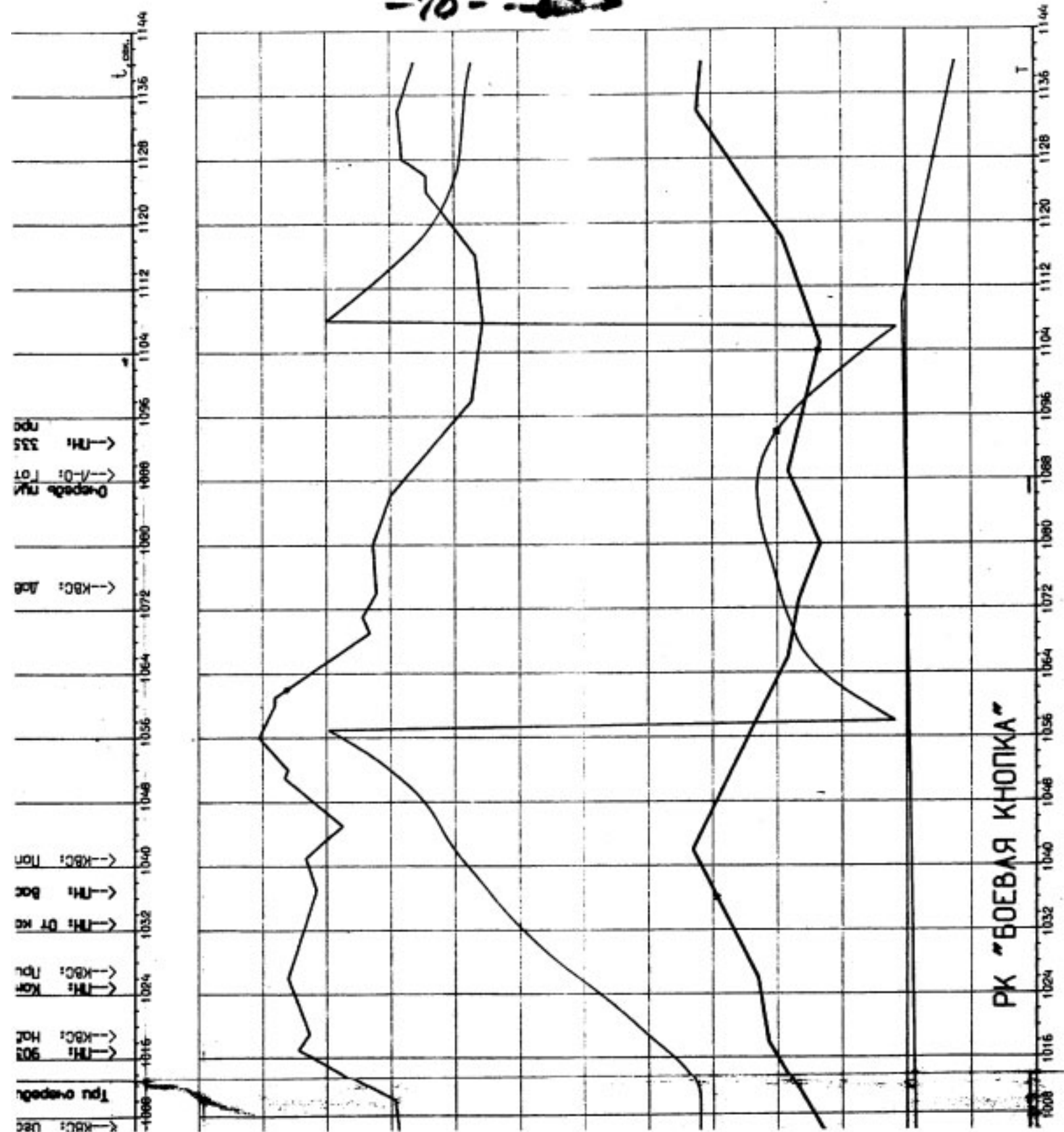
- 48 -

[illegible]

1	2
3	4



-70- -



РК "ВОЕВАЯ КНОПКА"

1	2
3	4

Table of decoded flight data recorded by the SARPP-12 system of
MI-24V helicopter no. 90335.

T[ime]	Banking angle	T[ime]	Instrument speed	T[ime]	[unknown]	T[ime]	Firing button
0.0	2.1	0.0	0.0	0.0	0.0	0	0
1.0	2.1	15.0	0.0	15.0	0.0	1004	0
2.0	3.2	18.0	0.0	36.0	50.0	1005	1
3.0	2.1	21.0	38.9	60.0	200.0	1013	1
7.0	0.0	36.0	156.3	90.0	350.0	1014	0
10.0	3.2	38.0	153.1	120.0	450.0		
14.0	1.1	47.0	184.4	150.0	611.1		
18.0	1.1	48.0	165.6	180.0	666.7		
20.0	5.4	72.0	190.6	210.0	666.7		
23.0	-1.3	84.0	171.9	240.0	611.1		
25.0	4.3	96.0	193.8	270.0	555.6		
30.0	4.3	99.0	190.6	300.0	500.0		
32.0	2.1	131.0	165.6	330.0	555.6		
34.0	2.1	162.0	200.0	420.0	555.6		
37.0	1.1	198.0	231.3	450.0	500.0		
39.0	2.1	226.0	243.8	510.0	450.0		
41.0	2.1	229.0	237.5	600.0	450.0		
42.0	5.4	252.0	260.0	630.0	666.7		
45.0	3.2	270.0	263.3	660.0	888.9		
50.0	9.6	282.0	256.7	690.0	1000.0		
62.0	0.0	296.0	266.7	720.0	1222.2		
70.0	1.1	302.0	256.7	780.0	1500.0		
75.0	-11.3	342.0	260.0	810.0	1600.0		
78.0	-10.0	360.0	263.3	840.0	1850.0		
81.0	-16.2	396.0	256.7	870.0	2055.6		
83.0	-19.6	414.0	260.0	900.0	2388.9		
87.0	-19.6	432.0	276.7	960.0	2555.6		
90.0	-10.0	450.0	270.0	1110.0	2611.1		
94.0	1.1	468.0	266.7	1140.0	2444.4		
129.0	-5.0	486.0	266.7				
133.0	4.3	504.0	280.0				
137.0	4.3	522.0	270.0				
141.0	9.6	540.0	270.0				
144.0	6.4	558.0	266.7				
149.0	6.4	576.0	256.7				
152.0	9.6	594.0	260.0				
162.0	5.4	601.0	256.7				
166.0	12.9	617.0	203.1				
180.0	1.1	619.0	206.3				
190.0	3.2	630.0	203.1				
198.0	3.2	648.0	165.6				

206.0	6.4	666.0	200.0
212.0	6.4	684.0	218.8
228.0	1.1	698.0	225.0
231.0	2.1	711.0	221.9
237.0	3.2	720.0	206.3
246.0	2.1	738.0	193.8
250.0	3.2	756.0	193.8
255.0	2.1	774.0	196.9
261.0	5.4	792.0	193.8
270.0	2.1	810.0	181.3
275.0	3.2	828.0	165.6
280.0	1.1	900.0	140.0
284.0	3.2	918.0	136.7
288.0	2.1	927.0	143.3
290.0	3.2	954.0	133.3
297.0	3.2	972.0	153.1
300.0	0.0	981.0	153.1
308.0	5.4	990.0	136.7

[data truncated at bottom of page]

338.0	2.1	1026.0	171.9
342.0	2.1	1042.0	212.5
348.0	8.6	1066.0	153.1
354.0	3.2	1073.0	146.7
356.0	5.4	1080.0	133.3
360.0	3.2	1089.0	153.1
367.0	5.4	1105.0	133.3
371.0	3.2	1118.0	156.3
378.0	3.2	1134.0	209.4
396.0	3.2	1140.0	206.3
399.0	5.4		
402.0	3.2		
408.0	5.4		
415.0	3.2		
423.0	3.2		
427.0	5.4		
432.0	3.2		
437.0	3.2		
439.0	2.1		
440.0	5.4		
446.0	3.2		
453.0	3.2		
459.0	6.4		
463.0	4.3		
478.0	4.3		
482.0	3.2		
487.0	9.6		
493.0	4.3		
500.0	3.2		
504.0	5.4		

508.0	5.4	
511.0	10.7	
519.0	1.1	
522.0	-10.0	
526.0	-15.0	
527.0	-13.8	
534.0	-13.8	
537.0	-11.3	
541.0	1.1	
543.0	1.1	
547.0	-1.3	
558.0	7.5	
570.0	7.5	
576.0	3.2	
580.0	3.2	
589.0	25.4	
591.0	54.2	
594.0	24.2	
603.0	1.1	
608.0	3.2	
612.0	1.1	
615.0	3.2	
621.0	0.0	
623.0	8.6	
628.0	3.2	
631.0	5.4	
633.0	1.1	
645.0	17.3	
651.0	2.1	
659.0	16.2	
663.0	15.0	
686.0	15.0	
690.0	12.9	
697.0	12.9	
1707.0	8.6	[data truncated at bottom of page]
720.0	-10.0	
728.0	-2.5	
738.0	-11.3	
744.0	-2.5	
756.0	5.4	
771.0	25.4	
788.0	18.5	
801.0	19.6	
810.0	16.2	
819.0	17.3	
828.0	9.6	
846.0	3.2	
864.0	2.1	
873.0	3.2	

-74-

- 14 -

876.0	0.0
882.0	3.2
897.0	5.4
918.0	3.2
930.0	2.1
936.0	4.3
946.0	-10.0
954.0	-5.0
966.0	-20.8
973.0	-20.8
975.0	-21.9
977.0	-20.8
978.0	-23.1
981.0	-17.3
987.0	-15.0
991.0	-6.3
1010.0	-1.3
1017.0	28.8
1019.0	25.4
1026.0	32.0
1037.0	23.1
1041.0	26.5
1045.0	15.0
1051.0	33.0
1052.0	32.0
1056.0	41.0
1060.0	36.0
1061.0	36.0
1069.0	6.4
1071.0	8.6
1074.0	4.3
1080.0	5.4
1086.0	0.0
1098.0	-25.4
1108.0	-28.8
1116.0	-26.5
1124.0	-11.3
1126.0	-11.3
1128.0	-3.8
1134.0	-2.5
1140.0	-7.5

Fragment of transcript of communications
by the crew of Mi-24 helicopter no. 21 [sic]

Time		Voice	Content of communications
SARPP-12 relative	UTC [h:m:s]		
850 sec	08:51:38	GC(TO)	- 335, report en route: altitude of balloon, what's there, what kind of suspended load
856 sec		AC	- This is 335, I have reached 2000, it's about 200-300 higher
862 sec		GC(TO)	- Understood
873 sec		GC(TO)	- 3-35, is there a suspended load?
878 sec		AC	- There's a suspended load hanging, haven't determined what that is there yet
882 sec		GC(TO)	- Understood
894 sec		C	- Altitude of balloon is 2300
899 sec		C	- It's hanging right on a level with us now
915 sec		C	- suspended load confirmed
922 sec		GC(TO)	- 90335, this is Radial
927 sec	08:51:38	GC(TO)	- Destroy the balloon
929 sec		AC	- This is 335, understood, destroy
932 sec		AC	- Arm weapons
933 sec		C	- Arming
947 sec		AC	- This is 335, balloon is white with a suspended load at altitude 2200
952 sec		AC	- Attack
954 sec	08:52:05	GC(TO)	- 90335, destroy the balloon
957 sec		AC	- Understood, destroy

959 sec C - We're making a pass, commander

960 sec AC - Are the weapons armed?

961 sec C - Yes

968 sec C - Fire at will, right?

977 sec GC(TO) - 335, watch out while firing to
make sure shells don't fall on
any populated areas

982 sec AC - Understood

989 sec C - Let's go in a little higher,
we'll hit the bull's-eye from
above him

998 sec AC - What's our range

1001 sec C - 600 meters

1002 sec - Fire

1004 sec GC(TO) - 90335, I can't get a visual on
you because of the cloud cover

1007 sec AC - Fire!

C - Fire!

C - ... (unint) fire

1008 sec AC - ... are interfering

1010 sec C - ... (unint)

1011 sec 08:53:02 - shots (3 bursts)

1013.5 sec C - Take that, and that, and that,
too

1017 sec GC(TO) - 90335, do you see the balloon?

1019 sec AC - I see it, this is 3-35, I see
the balloon

1025 sec GC(TO) - Did you receive the command to
destroy the balloon?

1027 sec AC - Command received

" 1032 sec C - Anything more?
1033 sec GC (TO) - Who gave the command?
1034 sec AC - Radial
1037 sec GC (TO) - Understood, I confirm
1041 sec AC - Attempt reload, right now
1046 sec C - Take that, and that, and that,
and that, too, and that
1046 sec C - Take that, and that, and that,
too, and that, too
1075 sec AC - Go ahead and cut him up, we'll
have one more go at it
1086 sec C - (unint)
1087 sec - Shots (one burst)
1089 sec 08:54:20 C - Done!
1090 sec AC - This is 3-35, balloon destroyed
1093 sec GC (TO) - Number 335, understood, I saw it
destroyed, please track descent
of the gondola

Legend: AC - Aircraft commander
C - Crew (some one of the crew members)
GC (TO) - Ground control [(tactical officer)]
... (unint) - unintelligible

Division chief, [signature] A. Belan
NTTs KRAP MAK [unknown]

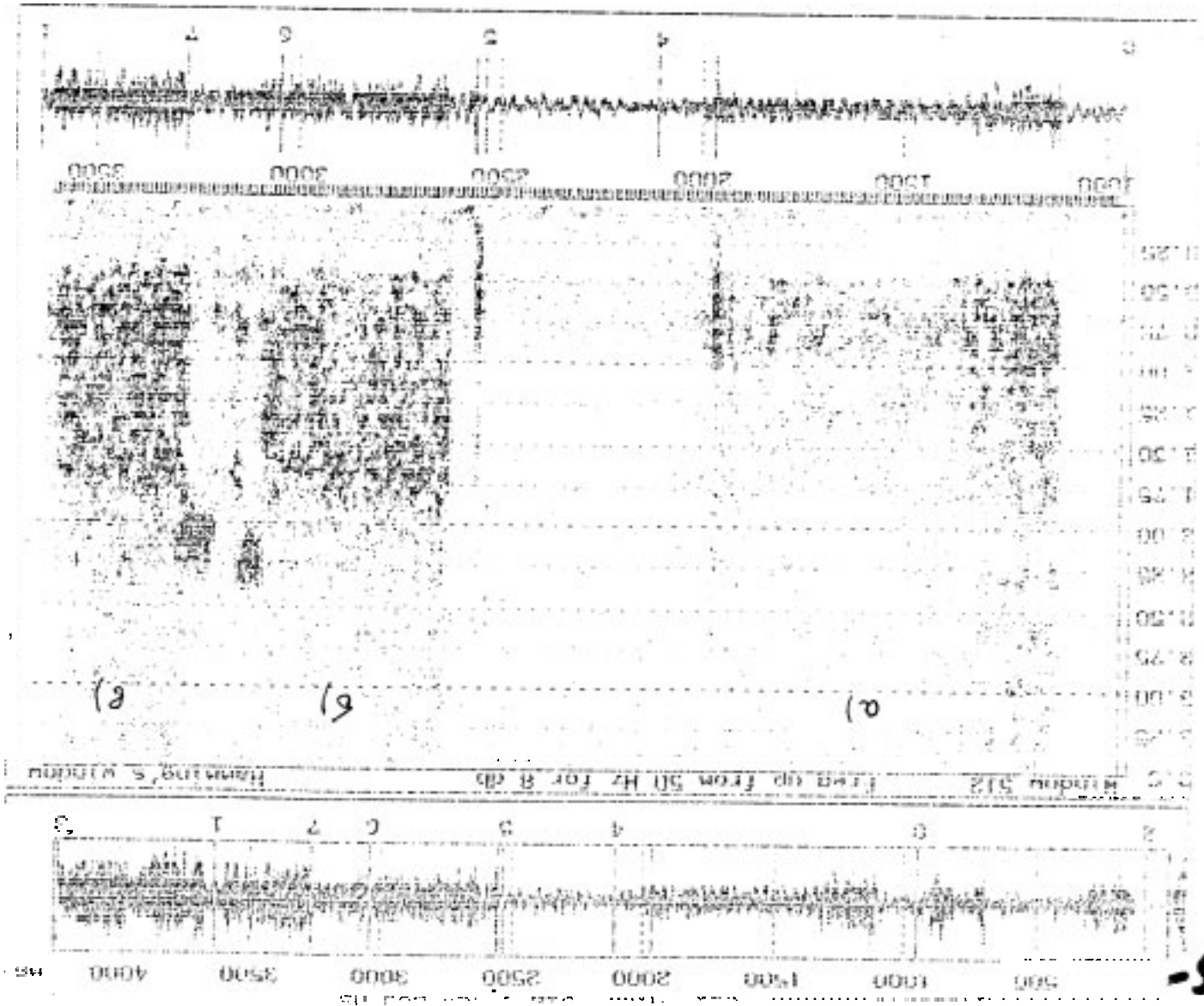
Chief specialist, NTTs [signature] V. Ustimenko
KRAP MAK [unknown]

Fig. 2. Dynamic spectrogram of acoustic effects of a portion of communications beginning at 08:51[illegible]:02. The spectrogram shows 3 bursts (a, b, and c) lasting 0.85 seconds, 0.5 seconds, and 0.4 seconds.

[consult original for figure]

[information truncated at top of page]

FIG. 2. Динамический спектрограмм звуковых эффектов
 в начале сообщения с момента 08:51:02.
 На спектрограмме видны 3 сигнала (a, b, c)
 длительностью 0,85; 0,5; 0,4 с



-75-

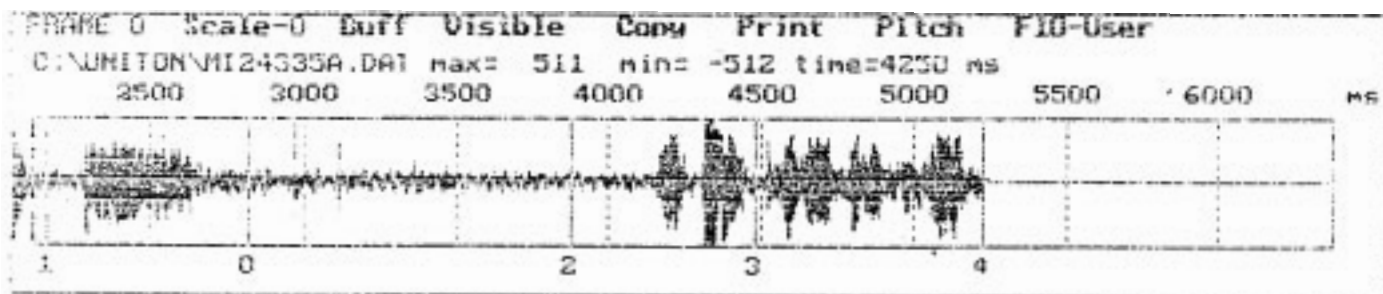
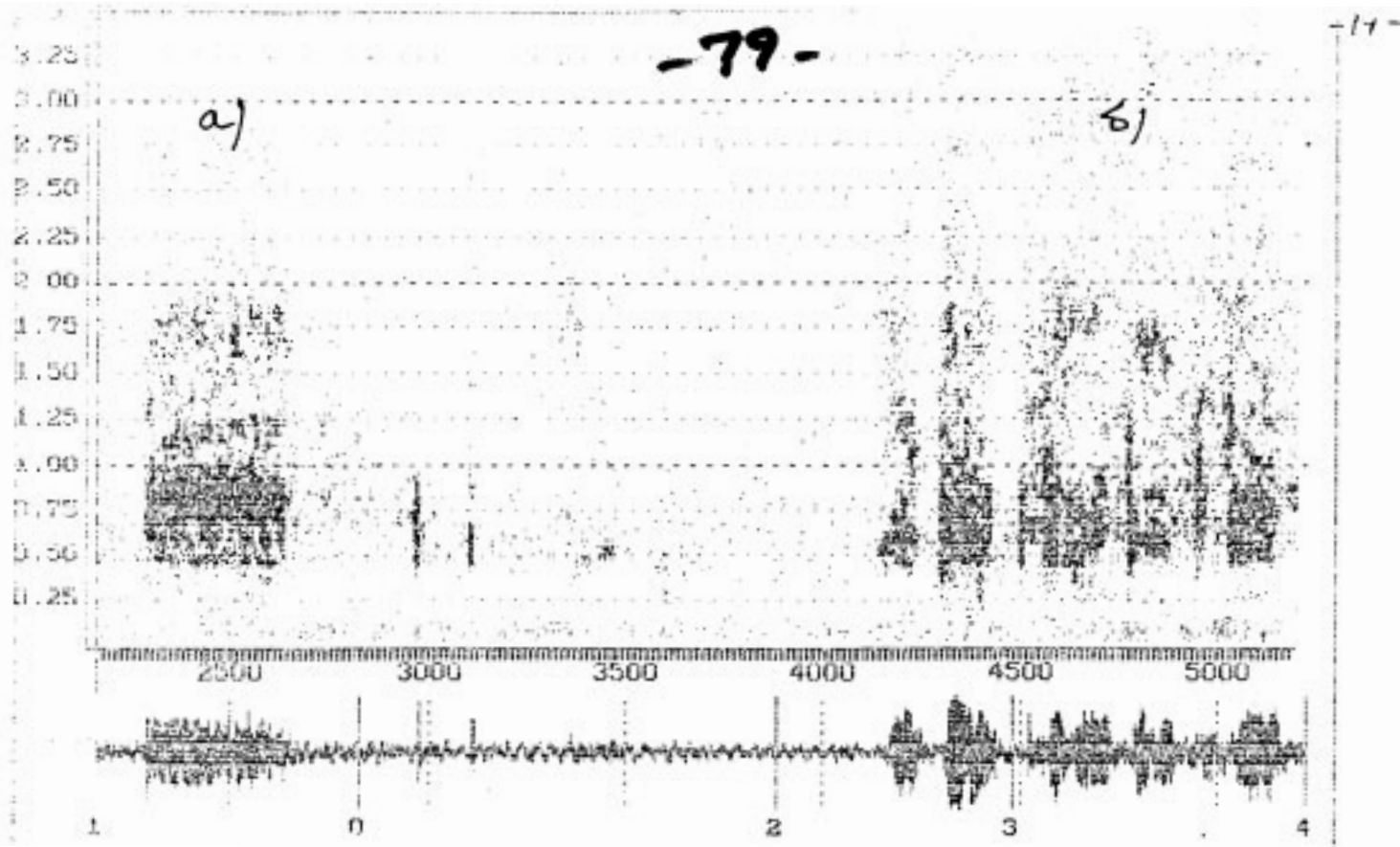


Рис. 3. Динамическая спектрограмма участка переговоров
с момента 08:54:20 (а-очередь длительностью
0,4с; б - речь "Готов")

[text at top of page truncated]

[consult original for figure]

Fig. 3. Dynamic spectrogram of a portion of communications
beginning at 08:54:20 ("a" is burst lasting 0.4
seconds; "b" is the word "Finished")

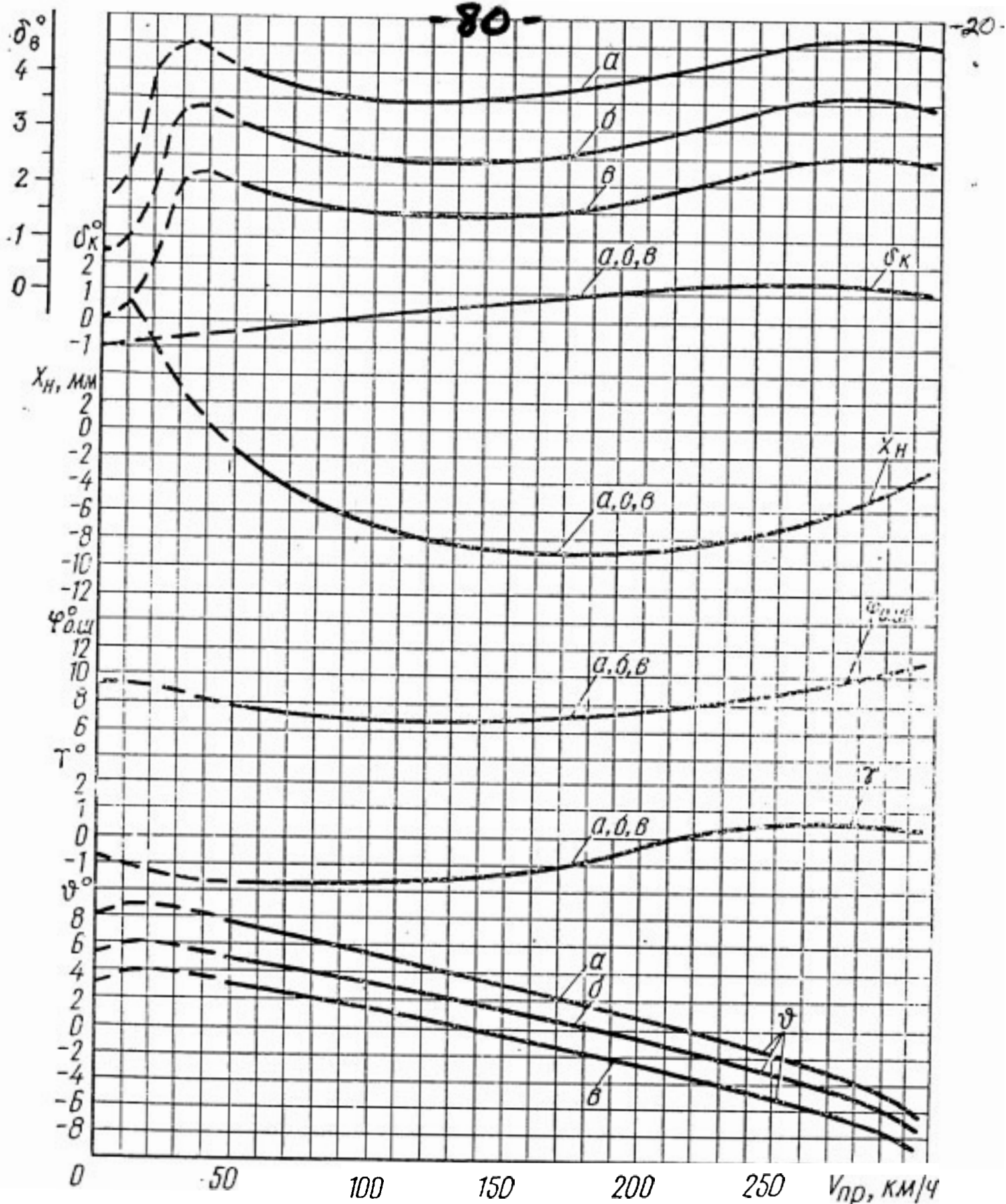


Fig. 4 [numeral "4" is handwritten]. Trimming curves as a function of s'traight-linelevel flight of a helicopter with a normal center of gravity

центровки:

$a - X_T = 112 \text{ mm}$; $\delta - X_T = 50 \text{ mm}$; $\theta - X_T = 215 \text{ mm}$

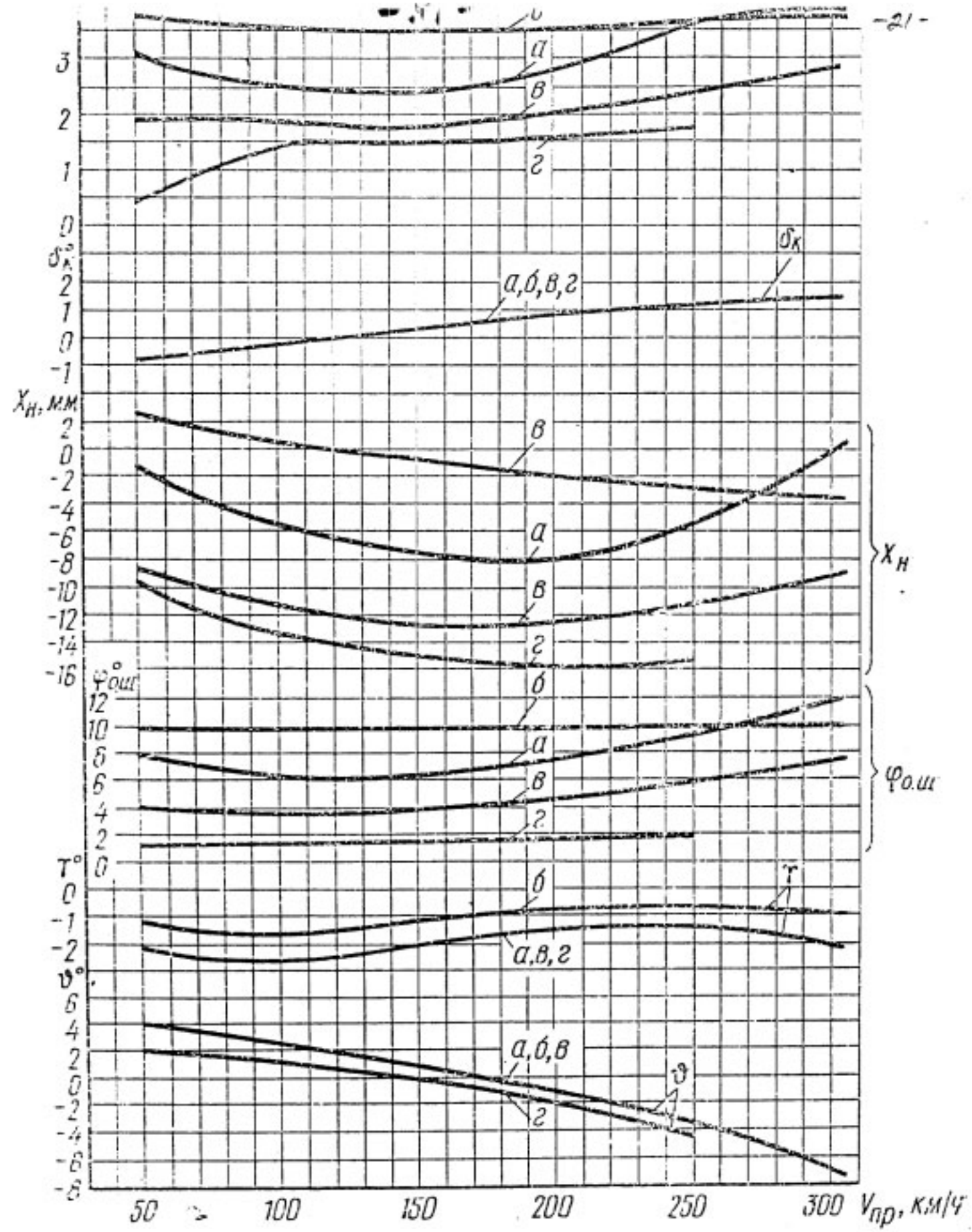


Fig. 5 [numeral "5" is handwritten]. Trimming as a function of speed for various straight-line flight modes of a helicopter with a normal- [text truncated at bottom of page] ным полетным весом ($X_T = 50$ мм):

α — горизонтальный полет; β — взлетный режим двигателей; γ — моторное планирование с $V_H = 5$ м/с; δ — самовращение несущего винта