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CONTENTS

Space Reserch

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Physics

National Security

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ACTUALITY OF SATELLITE MONITORING

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ABSTRACT. *In the current paper, satellite methods for research of gas content of the atmosphere are presented. The stress is on the satellite methods and the measurement geometry. A generalized characteristic of the absorption specters of the atmospheric ozone and gases into the optic range is presented when research with land and satellite appliances and apparatuses.*

An evaluation of the satellite methods is made when measuring the content of small gases.

Scientific results are presented which are received by satellite experiments and the perspectives of satellite research are laid down.

KEY WORDS: *satellite methods, gas content of the atmosphere*

Study of the gas composition of the atmosphere through various methods is carried out for many decades. The interest in this problem significantly increased in recent years due to the following main reasons:

- the significant increase of content of gases and aerosols with anthropogenic origin in atmospheric composition;
- better understanding of the various physical mechanisms affecting the change of the gas and aerosol composition of the atmosphere, the different characteristics of the environment and in particular the weather and Earth's climate.

Earlier the attention were focused on the rise of carbon dioxide concentration (CO_2), but today estimates are that the concentrations of some other trace gaseous components (TGC) as CH_4, CO, N_2O, CFCs and etc. in the near future could possibly affect the Earth's climate more substantially than the rise of CO_2 concentration solely.

The change in the gas composition and its potential impact on the climate stimulate creation and functioning of various systems for monitoring of gas composition of the Earth's atmosphere. Systems located on the Earth's surface

measure changes in the content of O_3, CO_2, H_2O and many other TGC. Still more attention is paid to the airplane and aerostatic measuring of the TGC. Derived in this manner data constitute a large amount of important information about the spatial - temporal variations in the content of the TGC and about the intensity of their sources.

A significant contribution to obtaining such information have the satellite measurement methods [3, 4, 7, 11 ... 14]. Their role in the future will undoubtedly increase, which is due to the possibility of getting global uniform three-dimensional information about the content of many TGC with good frequency for long period of time.

SATELLITE METHODS AND GEOMETRY OF THE MEASUREMENTS

For the study of the gas composition of the atmosphere, three satellite passive methods are subject of intensive use (Fig. 1).

- Method of transparency (TRA) in which information about the content of the TGC is derived from the solar radiation absorption spectra on the appearance and setting of the sun behind the horizon of planets (possible use of the moon and stars);
- Method of thermal radiation (TR) using the measurements of the spectral and (or) the angular dependence of the atmospheric own radiation;
- Method of reflected and scattered solar radiation (RSSR), in which information about the content of the TGC is derived from measuring the radiation in the ultraviolet (UV), visible (VIS) and near-infrared (NI) region of the spectrum.

In the recent years we observe development of various laser methods for probing of the atmosphere, including the characteristics of its gas composition. Laser experiments are under planning and preparation. Significant amount of information about the content of the TGC in the Earth's atmosphere will be obtained by the above - mentioned three passive satellite methods.

The satellite measurements of TGC use two types of measurement geometries: nadir and tangential (to the horizon of the planets), substantially differing in spatial resolution.

While with tangent geometry can be achieved relatively high vertical resolution (1 ... 4 km depending on the angular aperture of the satellite device), resulting with the average experimental characteristics of the composition of the atmosphere (300 ... 500 km and more), at nadir measurements the situation is reversed: the vertical resolution is 8 ... 10 km and better, and the horizontal can reach approximately 10 km. The height (upper limit) of probe at distant methods is determined by the sensitivity of optical devices, the optical density in specific areas of absorption and the geometry of measurement.

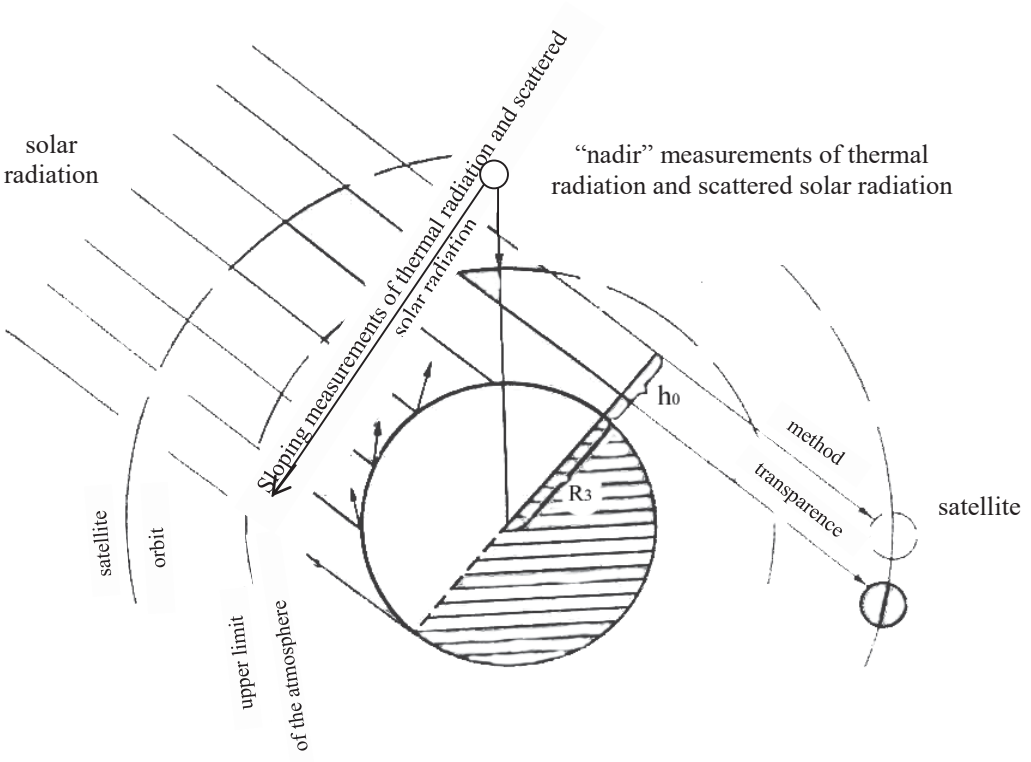

Figure 1. Satellite passive methods and geometry of measurements of TGC (h_0 - informative height, R_3 - the radius of the Earth)

In this regard, almost all modern indirect methods in the thermal region of the spectrum are based on the assumption of local thermodynamic equilibrium (LTE).

Frequency of measurements (number of measurements in days) varies depending on the different methods and is determined by the orbits of the satellites, the operating modes of satellite equipment and the geometry of measurement. For TRA method the number of measurements per day is around 30 when using the Sun as a source, and can reach 103 ... 104 with methods TR and RSSR. The level of global coverage of the Earth's expanse by satellite observations is determined by the method, the characteristics of the orbit, the geometry of the observation, the characteristics of satellite equipment and the operating modes. TR methods are characterized with greatest information capacity and TRA method with use of only solar radiation is characterized with the poorest. A comparative analysis of the indirect methods show that various methods have their advantages and disadvantages. In this connection it is important to create the optimum combination for launching of a global system for monitoring of the TGC consisting of land, air, aerostatic and satellite measurements.

In all the above mentioned areas, the effectiveness of scientific research is inextricably linked to the creation of tools and instruments for conducting measurements with high accuracy. Among the various types of modern measuring instruments, the top positions belong to the optical, electron - optical and opto-electronic devices and equipment.

STUDY OF THE REMOTE OBJECTS VISIBILITY WITH VIEWFINDERS OPTICAL DEVICES AT VARIOUS BACKGROUND BRIGHTNESS

The suggested methodology provides a full scale of characteristics of the studied distant objects based on the brightness of the background against which they are tested, determined by the effectiveness N_0 at the center of the field of vision of the peep-sight, at determining the marginal illumination at the center of the visual field, at different field angles β, when determining the shape coefficient and the diameter of the aberration spot ρ, by determining the effectiveness $N_{\rho,\beta}$ and by taking into account the influence of aberration scattering and field angle and determination of marginal illumination in the image plane accounting for the above factors, in terms of highlighting of the peep-sight optical system by the Sun, Moon and planets.

1. Determining the coefficient K_d reflecting the partial use of the area of the pupil of the eye:

(1) $$K_d = d / \delta ,$$

where: d – diameter of the instrument's exit pupil;
δ – diameter of the pupil of the observer's eye.

The size of the pupil diameter is determined depending on the brightness of the background. If the diameter of the eye pupil $d \geq \delta$, than the coefficient K_d shall be considered equal to 1.

1. Calculation of the coefficient K_δ reflectring the Stiles-Crawford effect, which characterizes the ratio of the aggregate effect of light passing through the exit pupil of the instrument with diameter $d = 2x_1$ to the aggregate effect of light on the observer's eye pupil with a diameter $\delta = 2x_2$, which vary in dependence to the background brightness:

(2) $$K_\delta = Sx_1 / Sx_2 ,$$

where: $x_1 = d/2$, a $x_2 = \delta/2$.

3. Measuring of the effectiveness N_0 in the center of the visual field of the viewfinder according to the equation:

(3) $$N_0 = \Gamma^2 (K_d^2 \tau_{o.s.} \tau_{atm})^{1-n} ,$$

where: τ_{atm} – coefficient of light transmittance of the atmosphere;

$\tau_{o.s.}$ – coefficient of light transmittance of the optical system of the device:

(4) $$\tau_{o.s.} = 0{,}99^{l_{sm}} 0{,}95^{N_{cr}} 0{,}94^{N_{fl}},$$

where: $N_{cr} N_{fl.}$ – number of crown and flint optical elements with no adhesive;

$l_{sm.}$ – total length of all the optical elements in the system;

n – exponent, which reflects the influence of the background brightness.

4. Definition of marginal illumination E_0 in the center of the visual field according to the equation:

(5) $$E_0 = E_N / N_0,$$

where: E_N – observed marginal illumination with the naked eye

(6) $$E_N = cB^n,$$

the value of E_N is determined depending on the brightness of the background B.

5. Measuring the effectiveness N_β for field angles β_i according to the equation :

(7) $$N_0 = \Gamma^2 (K_d^2 K_\delta \tau_{o.s.} \tau_{atm})^{1-n} \cos\beta,$$

where: $K_\beta = K_d^2 K_\delta \alpha_\beta$

α_β – vignette value in field corners β;

6. Definition of the form coefficient of the aberration spot at the ratio *l/h* – length to width of the rectangular aberration field.

(8) $$q = E_{l,h} / E_\rho.$$

7. Calculation of the diameter of the aberration circle according to the equation:

(9) $$\rho = \sqrt{lh/\pi}.$$

8. Definition of marginal illumination of the object in the image plane E'_ρ using the calculated ρ.

9. Definition of effectiveness $N_{\rho,\beta}$ of the accounting of the impact of the aberration scattering spot in the viewfinder and field angle β.

(10) $$N_{\rho,\beta} = N_\beta E_H / E'_\rho q.$$

10. Definition of marginal illumination $E_{\rho,\beta}$ considering the influence of aberration scattering spot in the viewfinder and field angle β.

(11) $$E_{\rho,\beta} = E_H / N_{\rho,\beta}.$$

11. When the researched elongated object has wide spectrum under the marginal illumination $E_{\rho,\beta}$ a coefficient $E_{\rho,\beta}$ is introduced to define $E_{col.}$

(12) $$E_{col.} = E_{\rho,\beta} P_{col.}$$

In determining the visibility of distant point objects studied in case of illumination by the Sun or planets, it is necessary to know the illumination of the optical parts by the Sun E_s, the angle of the lateral illumination of the viewfinder optical system α_s or respectivly by the planets, the background brightness B_{pl} by the planets, the angle of lateral illumination α_{pl} and angular dimension of the illuminating source *L* (or the solid angle of the illuminating source).

For this purpose:

1. Calculation of the illumination of the planets on the inlet of the viewfinder:

(13) $$E_{pl} = B_{pl} w.\cos\alpha,$$

where $\alpha = 2\pi(1-\cos L/2)$.

2. Calculation of the brightness coefficient r_α of the viewfinder protective glass and other optical components, illuminated by the planets or the sun at angle α.

3. Definition of the brightness of scattered light background in a lateral illumination from the sun B_s or planets B_{pl}.

(14) $$B_{s,pl} = \frac{E_{s,pl}.r_\alpha}{\pi},$$

where $E_s = E_\perp \cos\alpha$

$E_\perp = 13{,}5.10^4 lk$ for the atmosphere.

VIEWFINDER OPTICAL DEVICES

In determining the light balance of visual optical and electron- optical devices for monitoring of remote objects from the orbiting space stations, taking into account the effects of different optical characteristics of the device, the brightness of the background against which the observations are carried out , the influence of aberration spot scattering, the parameters of the scale, theoretical

and experimental research was carried out and are designed “Vizir B 3x40” for observation of remote objects as part of the photometric equipment “Rainbow” and Vizir – target 15 K for remote monitoring with the spectrozonal equipment “Spectrum 15K”.

Vizir – target 15 K

Spectrozonal equipment “Spectrar 15 K” consist of two main sections. The first section constitutes an optical mechanical structure designed to targeting and optical processing of the researched data signal, and then transmit the signal to the recording unit, which is designed to evaluate the signal, to strobe and convert it into digital indication and to perform recording on magnetic tape.

Targeting of the equipment is provided by "Vizir - target 15 K" (Fig. 3), representing a viewfinder optical system (Fig. 2) with the following optical characteristics:

1. Magnification of viewfinder-target – $3{,}16^{x}$
2. Visual field – 14º
3. Diameter of the inlet opening – 18 mm.
4. Diameter of the exit pupil – 5 mm.
5. Distance of the exit pupil – 26,7 mm.
6. Resolution – 19´´
7. Marginal locked focus of eyepiece for sharpness of the image ± 4 diopters
8. Value of the smallest division of the grid:

- horizontal - 1º
- vertical - 1º

9. Capacity for signal pass $\tau = 0{,}52$
10. Geometric vignetting $\alpha_{\beta} = 1{,}0$
11. Size of the spot of scattering $lh = 11'2'$

Photometric calculation according to the proposed methodology is presented in Table 1.

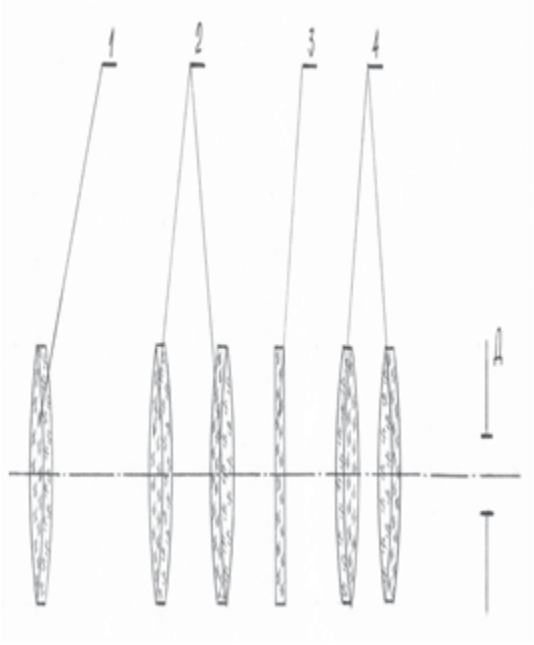

Fig. 2. Optical system of "Vizir – target 15 K"

Fig. 3. Vizir – target 15 K

Table 1. Photometric characteristics of Vizir target 15 K

№	Characteristics	Background brightness B [kd/m^2]			
		$B \leq 10^{-4}$	$10^{-4} < B < 0{,}05$	$0{,}05 < B < 20$	$20 < B < 4200$
1	K_d	5/7	5/6	1	1
2	K_δ	1,3	1,14	0,9	0,8
3	N_0	3,45	6,2	7,77	8,68
4	E_H, lk	10^{-8}	10^{-7}	10^{-6}	10^{-5}
5	E_0, lk	$2{,}9.10^{-10}$	$1{,}61.10^{-9}$	$1{,}29.10^{-8}$	$1{,}61.10^{-7}$
6	N_β	3,4	5,934	7,66	8,46
7	q	1,33	1,33	1,33	1,33
8	ρ	2,7	2,7	2,7	2,7
9	E_ρ	10^{-9}	10^{-8}	10^{-7}	10^{-6}
10	$N_{\rho,\beta}$	2,56	4,464	5,763	6,361
11	$E_{\rho,\beta}$	$3{,}91.10^{-9}$	$2{,}24.10^{-8}$	$1{,}74.10^{-7}$	$1{,}57.10^{-6}$
12	P_{red}	39	39	20	2,2
13	E_{red}	$1{,}525.10^{-8}$	$8{,}74.10^{-8}$	$3{,}47.10^{-7}$	$3{,}46.10^{-6}$
14	P_{green}	48	48	24	3
15	E_{green}	$1{,}877.10^{-8}$	$1{,}08.10^{-7}$	$4{,}16.10^{-7}$	$4{,}72.10^{-6}$

Optical viewfinder Vizir B 3x40

Equipment "Rainbow" consists of two main blocks. First one called OM (Optical-mechanical) is an opto-mechanical structure whose task is to guide through the viewfinder system the electrical photometer to analyze the monitoring of the atmosphere.

Vizir B 3x40 (fig. 6), with optical system as shown in Figure 5, has the following technical characteristics:

1. Magnification of the viewfinder – $2,6^x$
2. Visual field – 23º
3. Diameter of the inlet opening – 40 mm.
4. Diameter of the exit pupil – 6 mm.
5. Distance of the exit pupil – 22,5 mm.
6. Resolution – 23”
7. Marginal locked focus of eyepiece for sharpness of the image ± 4 dptr.
8. Value of the smallest division of the grid:

- horizontal -1º30
- vertical - 1º30

9. Total length of the viewfinder – 380 mm.
10. Weight of the viewfinder – 0,850 kg.

Photometric values are presented in Table 2.

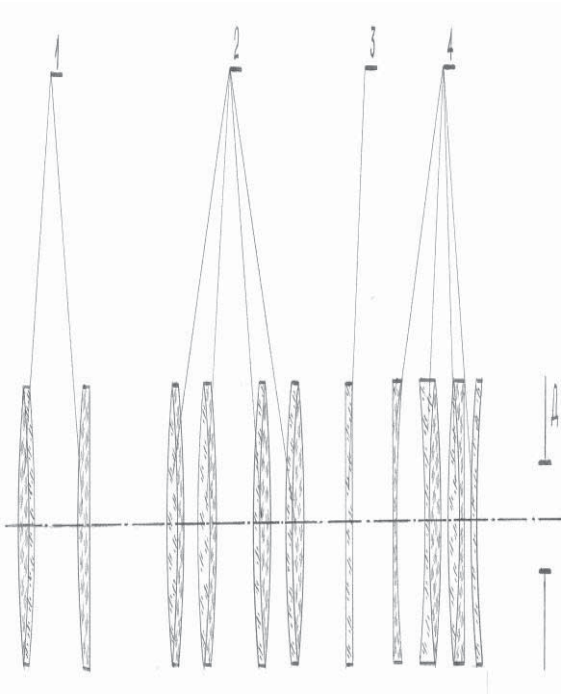

Fig. 4. Optical system of Vizir B3x40

Fig. 5. Vizir B 3x40

Table 2. Photometric characteristics of Vizir B3x40

№	Characteristics	Background brightness B [kd/m^2]			
		$B \leq 10^{-4}$	$10^{-4} < B < 0{,}05$	$0{,}05 < B < 20$	$20 < B < 4200$
1	K_d	5/7	1	1	1
2	K_δ	1,3	1	0,8	0,7
3	N_0	2,18	3,94	4,39	5,34
4	E_H, lk	10^{-8}	10^{-7}	10^{-6}	10^{-5}
5	E_0, lk	$4{,}59.10^{-10}$	$2{,}54.10^{-9}$	$2{,}28.10^{-8}$	$1{,}87.10^{-7}$
6	N_β	2,94	3,88	4,33	5,26
7	q	1,27	1,27	1,27	1,27
8	ρ	17	17	17	17
9	E_ρ	10^{-9}	10^{-8}	10^{-7}	10^{-6}
10	$N_{\rho,\beta}$	2,31	3,06	3,41	4,14
11	$E_{\rho,\beta}$	$4{,}33.10^{-9}$	$2{,}27.10^{-8}$	$2{,}93.10^{-7}$	$2{,}42.10^{-6}$
12	P_{red}	39	39	20	2,2
13	E_{red}	$1{,}68.10^{-8}$	$1{,}28.10^{-8}$	$5{,}86.10^{-7}$	$5{,}32.10^{-6}$
14	P_{green}	48	48	24	3
15	E_{green}	$2{,}08.10^{-8}$	$1{,}56.10^{-7}$	$7{,}03.10^{-7}$	$7{,}26.10^{-6}$

Fig. 6. Zoom viewfinder Vizir 8 – 20x50

Table 3. Photometric characteristics of Vizir 8 – 20x50

№	Characteristics	Background brightness B [kd/m^2]			
		$B \leq 10^{-4}$	$10^{-4} < B < 0{,}05$	$0{,}05 < B < 20$	$20 < B < 4200$
1	K_d	5/7	1	1	1
2	K_δ	1,34	1,22	1	0,9
3	N_0	3,49	6,31	7,04	8,54
4	E_H, lk	10^{-8}	10^{-7}	10^{-6}	10^{-5}
5	E_0, lk	$3{,}77.10^{-10}$	$2{,}09.10^{-9}$	$1{,}68.10^{-8}$	$2{,}09.10^{-7}$
6	N_β	3,82	5,04	5,63	6,84
7	q	1,31	1,31	1,31	1,31
8	ρ	4,3	4,3	4,3	4,3
9	E_ρ	10^{-9}	10^{-8}	10^{-7}	10^{-6}
10	$N_{\rho,\beta}$	2,46	3,36	3,75	4,55
11	$E_{\rho,\beta}$	$4{,}30.10^{-9}$	$2{,}46.10^{-8}$	$1{,}91.10^{-7}$	$1{,}73.10^{-6}$
12	P_{red}	39	39	20	2,2
13	E_{red}	$1{,}59.10^{-8}$	$1{,}76.10^{-8}$	$6{,}15.10^{-7}$	$5{,}84.10^{-6}$
14	P_{green}	48	48	24	3
15	E_{green}	$2{,}29.10^{-8}$	$1{,}72.10^{-7}$	$7{,}73.10^{-7}$	$7{,}98.10^{-6}$

PHOTOMETRIC DEFINITION OF EFFECTIVENESS OF ELECTRONIC OPTICAL DEVICES FOR MONITORING OF THE ATMOSPHERE

The essence of the method is to study the marginal sensitivity at certain parameters. Value that characterizes the sensitivity of the device is represented by the marginal energetic illumination of inlet orifice by the signal/noise ratio or by the limit value of the flow emitted from the object at a certain level of noise.

The methodology of the energetic study of electron optical viewfinders has significant specificities compared to that of optical and opto-electronic devices. Since electron optical instrument consists of optical, photoelectronic, electrotechnical and luminescent devices, when determining the parameters it is necessary to apply different methods of research and coordination of the characteristics of these devices. For each of the methods it is necessary to take into account the size and nature of the required information regarding the researched object, allowing to detect the object and to determine its limits or to provide a detailed study of its structure. Depending on these conditions changes not just the range of the tested objects, but the sequence of stages of power calculations [1 ... 3].

Upon detection of remote objects, it is necessary to specify the following conditions:

- marginal contrast brightness of the observer's pupil of the eye;
- light-technical characteristics of the surveyed object;
- taking into account the impact of the atmosphere;
- examination of marginal illumination of the photocathode by alleged irradiance of the object and its background;
- comparing the results with marginal contrast sensitivity of the eye at specified observation conditions.

In order to determine the effectiveness of electron optical instruments a methodology is proposed, developed on the basis of theoretical research and experiments conducted by the author, which provides study of the possibility of detecting remote objects in an environment of varying brightness of the background.

1. Calculation of the effective energetic illumination of the image on the photocathode $E_{ef_{fk}}$:

(15)
$$E_{ef_{fk}} = \frac{A_{il}}{n\Gamma^2 L^2} \int_{\lambda_0}^{\lambda_k} (\sqrt{\lambda} + \rho_\lambda e_\lambda)\tau_{\lambda_f} \tau_{\lambda_{op}} \tau_{\lambda_{atm}} d\lambda ,$$

where:
- A_{il} – area of the inlet lens;
- Γ – magnification of the optical system;
- e_λ – energetic illumination of the inlet;
- L – observation distance;
- $\lambda_0 ... \lambda\kappa$ – spectral range of the research;
- ρ_λ – spectral coefficient of the reflected filters;
- τ_{λ_f} – spectral transmittance of the applied filters;
- $\tau_{\lambda_{op}}$ – spectral transmittance of the optical system;
- $\tau_{\lambda_{atm}}$ – spectral transmittance of the atmosphere.

2. Calculation of impact of external noise fluctuations on the image brightness by the coefficient determining the image contrast:

(16)
$$K_{sch_i} = \frac{1}{2N_{fk}} \sqrt{\frac{t}{2\lambda} S_{\lambda_{\max}} E_{ef_{fk}}} ,$$

where:
- N_{fk} – quantum output of the the photocathode;
- t – the time of the experiment;
- S_λ – spectral sensitivity of the the photocathode.

3. Determination of the coefficient that characterizes the signal/noise ratio for the dark current K_{sch_t} :

(17)
$$K_{sch_t} = \frac{E_{ef\,fk} S_{\lambda_{\max}}}{I},$$

where: J_t – dark current at the photocathode;

$S_{\lambda_{\max}}$ – maximum spectral sensitivity of the photocathode.

4. Calculation of the signal/noise ratio at measuring of the noise which results from the information signal implification by the electronic-optical converter and the dark current:

(18)
$$K_{sch} = \frac{E_{ef\,fk} S_{\lambda_{\max}} \sqrt{t}}{\sqrt{4e_\lambda N_{fk}^2 E_{ef\,fk} S_{\lambda_{\max}} + J_t^2}}.$$

5. Calculation of the background brightness on the exit of electron optical viewfinder:

(19)
$$B' = K_{sch}\left(\frac{\tau_{\lambda_{op}} K_d^2 K_b}{4\Gamma_{EOP}^2}\right)\left(\frac{D}{f'_{ob}}\right)$$

where: K_d – coefficient accounting for the Stiles-Crawford effect;

K_b – coefficient accounting for the impact of the pupil of the eye;

Γ_{EOP} – optical zoom of the electronic - optical converter;

D – diameter of the inlet;

f' – back focal length of the lens.

6. Defining of the diameter of the observer pupil of the eye and the coefficients K_d and K_b for B'.
7. Calculation of the exponent n and n' respectively for B and B'.
8. Calculation of the effective illumination $E_{ef\,fk}$ of the object on the photocathode:

(20)
$$E_{ef\,fk} = \frac{2e_\lambda N_{fk}^2 K_{sch} + K_{sch}\sqrt{4e^2 N_{fk}^4 + J_t^2 t}}{tS_{\lambda_{\max}}}.$$

9. Calculation of the effective illumination of the background image on the photocathode:

(21)
$$E_{ef\,fk\,fon} = \frac{A_{ob} R_{ef}}{nA_{fk}},$$

where: R_{ef} – energetic illumination of the object;

A_{fk} – area of the photocathode of the electronic-optical converter.

10. Determining the image contrast K:

(22)
$$K = \frac{E_{ef\,fk_{ob}} + E_{ef\,fk_{fon}}}{E_{ef\,fk_{ob}} - E_{ef\,fk_{fon}}}.$$

11. Determining of the marginal image contrast K':

(23)
$$K' = \frac{1+K}{1-K}.$$

12. Determining of the effectiveness N_{EOV} of electron optical viewfinder:

(24)
$$N_{EOV} = \frac{K' A_{ob} (D^2 t K_d^2 K_b)^{1-n'} (\Gamma_{EOP} f'_{ob})^{2n'}}{o{,}25^n 4 (f'_{ob})^2},$$

where: n – exponent that characterizes the influence of the background brightness.

13. Calculation of the marginal illumination of the viewfinder:

(25)
$$E_{EOV} = E_H / N_{OEV},$$

where: E_H – marginal illumination observed with naked eye.

Using the proposed methodology were conducted experimental studies of electron optical instruments – Figure 7 and Figure 8 and Table 3 shows results of an exemplary application of an electronic-optical device Parallax represented on the Figure 7.

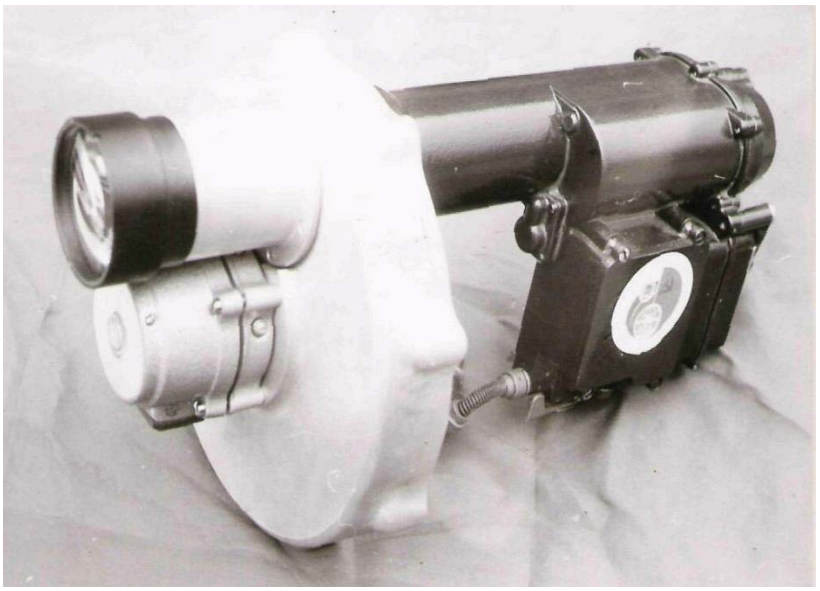

Figure 7. Electron optical viewfinder for testing of particular atmospheric emissions in the near infrared part of the optical spectrum

Figure 8. Electron-optical instrument Parallax

Table 3. Photometric characteristics of electron-optical instrument Parallax

№	Characteristics	Background brightness [cd/m^2]	
		$B = 1.10^{-5}$	$B = 1.10^{-3}$
1	$E_{ef\,fk}$	5,88	5,88
2	K_{sch_i}	0,12	0,12
3	K_{sch_t}	0,02	0,04
4	K_{sch}	0,19	0,19
5	B'	$7{,}7.10^{-6}$	$7{,}8.10^{-2}$
6	K_d	1	1
7	K_b	1	1
8	n	0	0,24
9	n'	0	0,53
10	E_H	10^{-8}	10^{-7}
11	K'	1,45	1,56
12	N_{OEV}	44	44
13	E_{EOV}	$2{,}75.10^{-11}$	$4{,}07.10^{-9}$

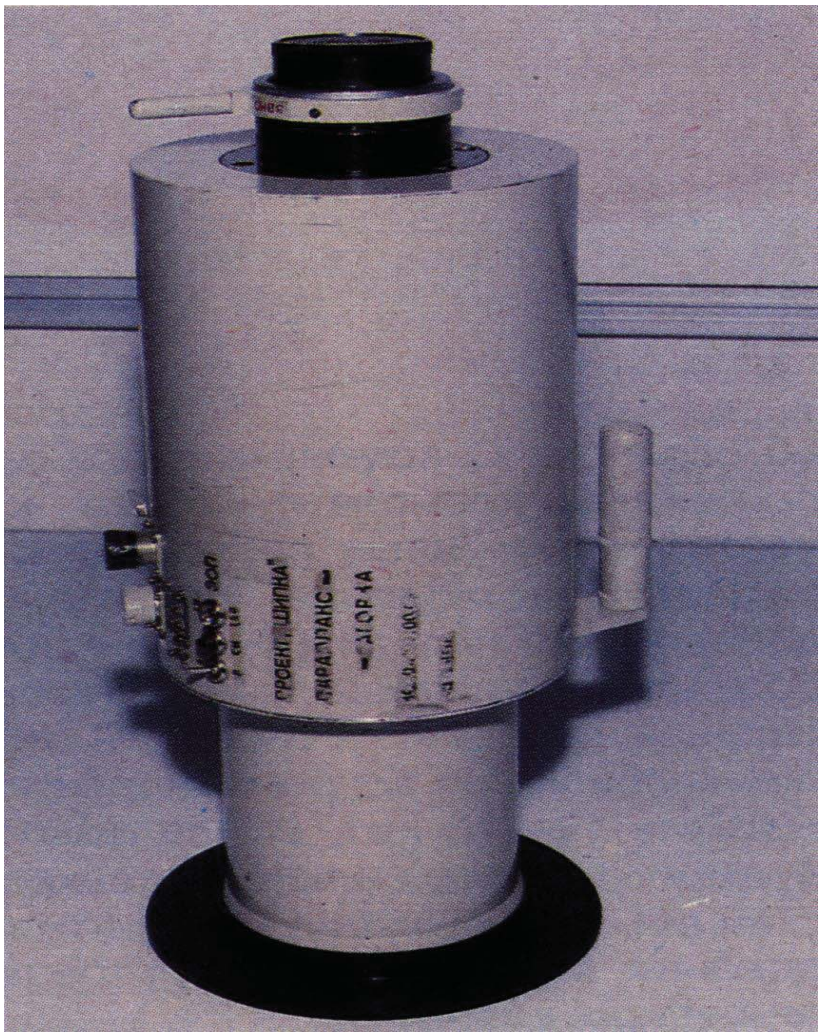

Figure 9. Parallax Zagorka

METHODS AND MEANS FOR MONITORING OF THE ATMOSPHERE THROUGH OPTICAL-ELECTRONIC DEVICES

IMPULSE PHOTOMETRIC EQUIPMENT "THERMA"

The necessity of conducting research at orbital stations and by sub-satellite measurements required the development of a wide range of scientific research equipment.

Impulse photometric equipment "Therma" is designed for high spatial and temporal resolution research of the distribution of the intensity of natural optical emissions in the Earth's atmosphere and light disturbances in the vicinity of the orbital station "Mir". High spectral sensitivity and spatial resolution allows the study of rapidly changing areas of light as occultation stars, lightning activity, pulsating auroras, polar arcs and others.

Information from impulse photometric equipment "Terma" (fig. 24) in the form of a stream of photons is converted, formed and transmitted through

electronic - digital block to the on-board system for data collecting and processing “Zora”.

Fig. 10. External view of impulse photometric equipment “Terma”

Technical characteristics
Spectral range of the integral channel: 200-630 nm.
Number of narrowband spectral channels 4.
Average width of the photometric channel 2,5±1 nm at level 0,5.
Main lens - diverging lens with inlet 82 mm.
Field of view (angular): 15 ', 30', 1°, 2°.
Angular field of view of the viewfinder 23°.
Viewfinder magnification 2.6^{x}
Sensitivity threshold of the equipment without interference filters - 10R (relay) at a wavelength of 600 nm.
Transmission coefficient of interference filters: $\tau = 30\%$
Temporal constant: 10^{-4} s.
Dynamic range of measuring with the equipment: 2.10^{5}.
Range of targeting the equipment in the carrier $\pm 8°$.
Torque of the device into the carrier 100 g/sm.

Power consumption ≤ 30Wt
Weight of the equipment without container 8 kg
Weight of the container 5 kg
Weight of the individual reservists accessories 1 kg
Overall dimensions of the equipment 540 x 315 x 315 mm.

Operating mode of the equipment: optional speed of information recording, optional sensitivity, aperture size, time for measurement and position the equipment.

Optimal mode is possible only if there is a priori information about the surveyed heterogeneity. Unlike quantitative measurements, qualitative measurements show the dynamics of change and the properties of the target object. This necessitates more detailed examination of the characteristics of application and use of photometric methods.

The brightness of a specific point in the image plane of optical-electronic tract, in the absence of heterogeneity is determined by the expression:

(26)
$$E(x,y) = \int_{\sim}\int_{\sim} E(x,y,\xi,\eta)\tau(\xi,\eta)d\xi d\eta\,,$$

where:
- (x,y) – coordinates in the image plane;
- (ξ,η) – coordinates in the plane of the diaphragm;
- $\tau(\xi,\eta)$ – Translucence through the diaphragm depending on the settings;
- $E(x,y,\xi,\eta)$ – value of the luminous flux at a point on the the image plane with coordinates (x,y).

Researched heterogeneity diverges light rays and changes the image formed by rays passing through each point of granularity. Brightness at that point of the image $E^{|}(x,y)$ will be equal to:

(27)
$$E^{|}(x,y) = \int_{\sim}\int_{\sim} E\{x, y[\xi + \varepsilon f\cos\alpha][\eta + \varepsilon f\sin\alpha]\}\tau(\xi,\eta)d\xi d\eta,$$

where:
- ε – angle of deflection of the light rays at a point of the heterorogeneity in the corresponding image region with coordinates (x,y);
- α – angle defining the direction of deflection of the light beam from the same point of heterorogeneity;
- f – focal length of the photometric part.

If the function $E^{|}(x,y)$ changes smoothly with the variation of ξ and η then at small angles of deflection of the light rays the sensitivity G can be represented as follow:

(28)
$$G=\frac{dE^{|}}{Ed\varepsilon}=\frac{f\int\limits_{\sim}\int\limits_{\sim}\left[\frac{dE}{d\xi}\cos\alpha+\frac{dE}{d\eta}\sin\alpha\right]\tau(\xi,\eta)d\xi d\eta}{\int\limits_{\sim}\int\limits_{\sim}E(x,y,\xi,\eta)\tau(\xi,\eta)d\xi d\eta},$$

(29)
$$G=G_{\xi}\cos\alpha+G_{i}\sin\alpha,$$

where: G_{ξ},G_{η} - measurements sensitivity at deflection of light rays relative to the axes ξ and η.

For convenience expression (29) can be represented in the form:

(30)
$$G=G_{\xi}\left(\cos\alpha+\frac{G_{\eta}}{G_{\xi}}\sin\alpha\right).$$

As a result of the heterorogeneity arises further shift of the light source image in a direction which is characterized by the angle β.

Illumination of an image point without a heterogeneity is equal to:

(31)
$$E=\delta_0 h_a,$$

where: h_a - size of the projection of the illuminated part of the plane (ξ,η) in a direction perpendicular to the vector of displacement of the image of the light source relative to the diaphragm.

In the presence of heterogeneity, the image illumination $E^{|}$ changes and becomes:

(32)
$$E^{|}=\delta^{|}h_{\gamma},$$

where:

(33)
$$\delta^{|}=\sqrt{\varepsilon^2 f^2+\delta^2+2\varepsilon f\delta_0\cos(\alpha-\beta)},$$

(34)
$$h_{\gamma}=\alpha+ar\cos\frac{\delta_0+\varepsilon f\cos(\alpha-\beta)}{\sqrt{\varepsilon^2 f^2+\delta_0^2+2\varepsilon f\delta_0\cos(\alpha-\beta)}}.$$

The sensitivity of measurement when $\varepsilon\to 0$ is equal to:

(35)
$$G=\frac{f}{\delta_0}\left[\cos(\alpha-\beta)-\frac{dh_a}{d\alpha}.\frac{\sin(\alpha-\beta)}{h_a}\right].$$

but as far as:

(36)
$$G_{\xi}=\frac{f}{\delta_0}\left[\cos\alpha-\frac{dh_a}{d\alpha}.\frac{\sin\alpha}{h_a}\right].$$

(37) $$G_\eta = \frac{f}{\delta_0}\left[\sin\alpha - \frac{dh_a}{d\alpha}.\frac{\cos\alpha}{h_a}\right].$$

Then: (38) $$G = G_\xi \cos\beta + G_\eta \sin\beta$$

At a circular diagram $\frac{dh_a}{d\alpha} = 0$ and then:

(39) $$G = \frac{f}{\delta_0}\cos(\alpha - \beta).$$

When using the deduced ratios should be taken into account that they are effective for rapidly developing processes with small angular deviations. During Application of shift diaphragms in the apparatus allows obtaining of maximum amount of information about the experiment, and in the reverse case at the wrong choice of aperture size can be missed many details from studied process.

SATELLITE SPECTROPHOTOMETER FOR MONITORING OF THE ATMOSPHERE

The spectrophotometer is designed for research of the spectral and energetic characteristics of the atmosphere, in particular ozone, sulfur dioxide and other gases (Fig. 36).

The spectrophotometer for atmosphere research consists of a step motor 1, which via a kinematic unit 2 is connected with two mechanical axes 3 and 4. To the axis 3 is mounted a reflective element 11 and to the shaft 4 - reflective element 21. The two reflective elements 11 and 21 are connected in such a way that during their scanning movement their reflection planes remain mutually parallel.

In front of the reflective elements there are two dimming (antireflective) blends, respectively 12 and 22, through which passes the radiation from the researched object 51.

On the optical axis of the reflective element 11 are arranged alternately lens 13 and optical coupler 14, mechanically connected to the step motor 15 controlled by microprocessor system 50. On the one outlet of the optical coupler 14 is mounted the start of the lightguide 16, and to the other outlet is mounted a photoreceiver 17, whose outlet is electrically connected to the unit for signal processing 18, and the outlet of unit 18 is connected to the microprocessor system 50. Units 11, 12, 13, 14, 15, 16, 17 and 18 form the photometric tract 10 of the spectrophotometer. In a similar manner to the optical axis starting from the reflective element 21, part of the said spectrometric tract 20, are placed in succession lens 23 and optical coupler 24, mechanically connected to the step motor 25, also electrically connected to the microprocessor system 50. One input of the optical coupler 24 is connected to the optical lens 23, into the second

input is connected the end of the light guide 16, the third input via light guide 26 is connected to the photo converter 27, and the fourth is connected via light guide 28 with a reference source 29. At the output of the optical coupler 24 is placed inlet diaphragm 30 mechanically connected via reducer 31 to the step motor 32, which is electrically connected to the microprocessor system 50. On the optical axis from the output of the optical coupler 24, passing through the aperture 30 is positioned a concave diffraction grating 33, mechanically connected via reducer 34 to the step motor 35, electrically connected to the microprocessor system 50. On the axis of the motor, between him and the reducer 34 is mounted the stationary converter "angle-code" 36, whose outlet is also connected to the microprocessor system 50. Opposite to the concave diffraction grating 33 is positioned Rowland circle 37 and behind its outlet slits are positioned photoreceivers 38 ', 38 ", 38"' ... 38n, which outlets are electrically connected respectively with the signal processing blocks 39 '39 ", 39 "' ... 39n, whose outlets are connected to inlets of the multiplexer 40. The outlet of the multiplexer 40 is electrically connected to the microprocessor system 50. To signal processing blocks 39 ', 39 ", 39"' ... 39n is connected an attenuator - range switch 41. In front of the photo transducer 27 is positioned tracking system 42, directed towards the Sun and mechanically connected to the converter "angle-code" 43, whose outlet is electrically connected to the microprocessor system 50. Blocks 21 to 41 form the spectrometric tract 20 of the spectrophotometer.

Operation of the spectrophotometer comprises of the following steps: the light flow emitted or reflected by the research object 51 passes through dimming apertures 12 and 22 respectively and falls onto the reflective elements 11 and 21 of the scanning system. The purpose of dimming blends 12 and 22 is to protect the lenses 13 and 23 of side illumination. Scanning reflective elements 11 and 21, put in motion by step motor 1 via kinematic block 2 and mechanical axes 3 and 4, scan the object according to a certain law, preset and controlled by the microprocessor system 50. Light signals reflected by the reflective elements 11 and 21, fall on lenses 13 and 23 respectively and after corresponding transformation enter the inlets of the optical couplers 14 and 24. The optical coupler 14 allows the input optical signal to pass directly to the photoreceiver 27 or deflect at an angle of 90° and via lightguide 16 to enter one of the inlets of the optical coupler 24. The latter allows consecutive passing of light flows from the lens 23, the internal calibration reference source 29, from the optical converter 27 and from the lightguide 16. From the outlet of the optical coupler 24 the optical signals pass through a inlet diaphragm 30 of the dispersing system. After the dispersion of the signal from the diffraction grating 33, monochromatic light flows enter through corresponding outlet slits of the Rowland Circle 37 on the relevant photoreceivers 38', 38", 38"' ... 38n-1, 38n. The photoreceivers from 38' to 38n-1 operate in mode of “parallel scan” and the

photoreceiver 38n operates in one of the modes “calibration” or “consecutive scan”. Electrical signals from the photoreceivers 38' to 38n, processed by the signal processing blocks 39', 39", 39"' ... 39n, via the multiplexer 40 enter the microprocessor system 50. The enhancement factor in the signal processing blocks 39', 39", 39"' ... 39n is regulated by an attenuator- range switch 41 controlled by microprocessor system 50.

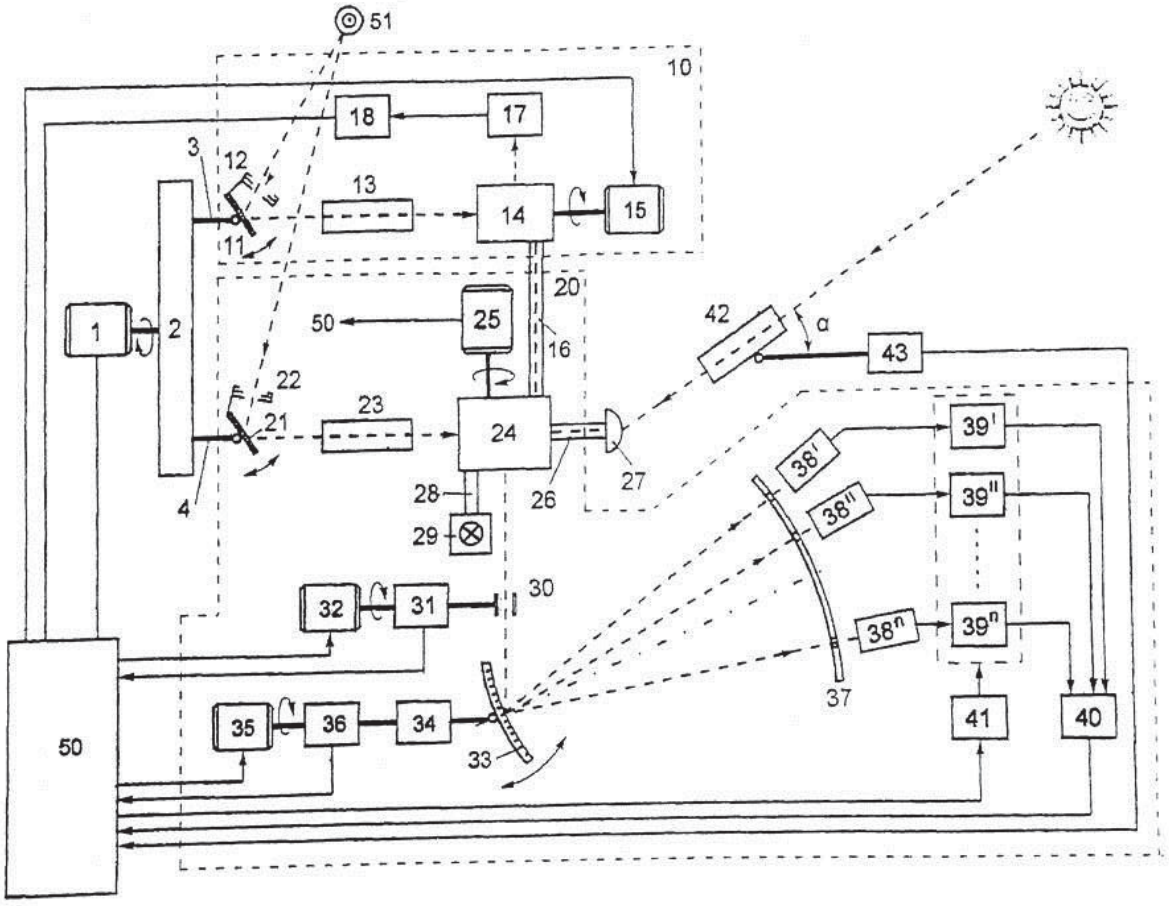

Figure 11. A spectrophotometer for monitoring of the atmosphere

Tracking system 42 performs continuous monitoring of the center of the solar disk, so the calibration signal enters the optical converter 27.

Reflecting the height of the sun is performed by the converter “angle - code” 43 connected to the microprocessor system 50. Here is performed the information processing.

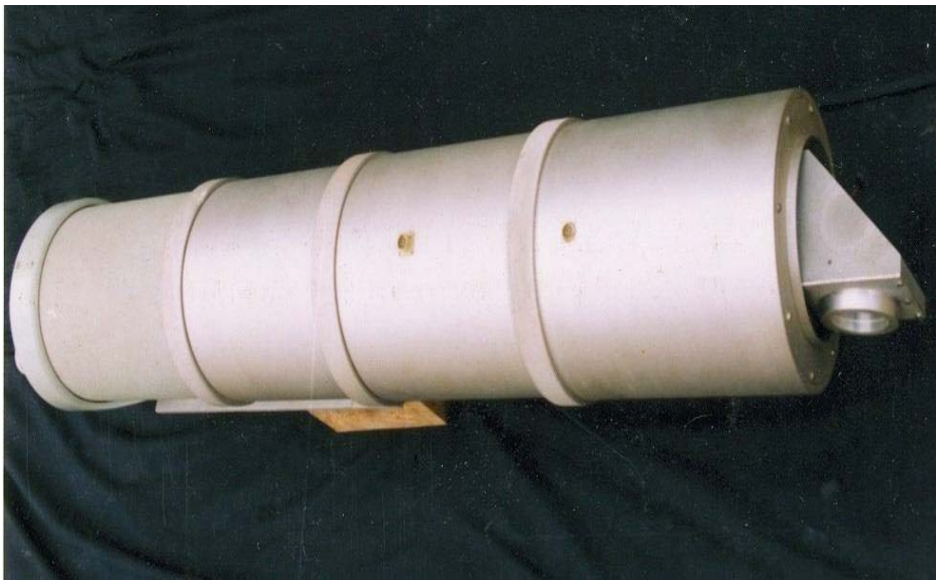

Figure 12. Satellite laboratory spectrophotometer

SATELLITE SPECTROPHOTOMETER FOR ENVIRONMENTAL MONITORING

I. Technical field

The invention relates to a spectrophotometer for monitoring of the environment. Its application is in satellite remote methods for environmental research.

II. Background of invention

There are spectrophotometers for testing of the characteristics of gases in the atmosphere, consisting of inlet lens, entrance diaphragm, a diffraction grating driven by a step motor, an outlet diaphragm, photo detectors and electronic amplifier. Such spectrophotometer operates on the principle of consecutive scanning (based on dispersive diffraction grating).

It is also known a multispectral equipment “Fragment”, designed to operate aboard the space crafts on Earth orbit, which contains scanning system, lens, optical splitter, spectral filters, amplifier and a system for signal processing.

The disadvantage of these known devices are the low spatial resolution, limited spectral area of research, poor accuracy, poor reliability, slow performance and poor repeatability of the results on calibration.

It is also known the equipment mounted on satellites "IUE", consisting of inlet lens, dispersion system and recorder. The disadvantage of this equipment is the low reliability and poor accuracy.

It is also known an ozone spectrometer consisting of an optical system, diffraction grating, a system of outlet diaphragms and calibrating device. A disadvantage of this spectrometer is its poor functionality.

Existing devices are not able to photograph the research object, which significantly decreases the effectiveness of research.

III. Object of invention

The object of invention is to provide a satellite spectrophotometer for monitoring a of the environment, without those drawbacks.

IV. Thecnical summary of the invention

The problem is solved by inventing of a satellite spectrophotometer for environmental monitoring, consisting of spectral and photometric tract and channel for transmitting of a satellite image.

The advantages of the invention are improved accuracy, smaller weight, overall dimensions and energy consumption, increased spatial and temporal resolution, speed, better reliability and increased volume of useful information.

V. Description of the drawings

An example embodiment of the invention is shown in Figure 1, showing the block diagram of a satellite spectrophotometer for environmental monitoring.

VI. Example of an embodiment of the invention

As shown on Figure 1, the satellite spectrophotometer for environmental monitoring consists of dimming aperture 1, located in front of a flat scanning mirror 2 with fitted to it reference source 3, related to both photometric and spectrometric channel and representing the input scanning system controlled by a step motor 22. The step motor 22 is connected mechanically via gear drive 23 to the scanning mirror 2 and electrically to the photoelectric converter angle - code 24 for carrying out of a feedback. Opposite to the scanning flat mirror 2 on

the same optical axis is located concave mirror 5, and between them is mounted fixed prism 4 which guides one fraction of the optical signal to the spectrometric, and another - to the photometric tract of the spectrophotometer. Concave mirror 5 from the spectrometric tract is optically connected to a flat mirror 6, which in turn - via inlet diaphragm 7 and through the concave mirror 8 - to a diffraction grating 9, mounted on a moving carriage 10 and then trough a camera lens 11 and an outlet diaphragm 12 to sensor 13.

Reflecting prism 4 is optically connected also with the photometric tract, that is trough the flat mirror 14, lens 15, interference filter 16 and optical lens 17 to the sensor 18. The sensors 13 and 18 parts respectively of the spectrometric and photometric tract, are connected to microprocessor system (MPS) 19 through an analog-to-digital converters (ADCs) 20 and 21.

The step motor 25 via a mechanical block 26 is mechanically connected to the carrier 10 of the diffraction grating 9, and the photoelectric converter angle- code 27 is electrically connected to the motor 25. The camera 28 is connected to the microprocessor system 19.

VII. Operation of the satellite spectrophotometer

The flat scanning mirror 2, driven by the step motor 22 and the gear drive 23 performs scan at angle $\beta = \pm 45°$, which is regulated by feedback performed by photoelectric converter angle - code 24. The optical signal reflected by the concave mirror 5 and the flat mirror 6 through the inlet diaphragm 7 falls on the concave mirror 8 and a parallel beam is passed to the diffraction grating 9, mounted on the carrier 10. The monochromatic signal from the diffraction grating 9 passes through the camera lens 11 and the outlet diaphragm 12 onto a sensor 13. The electrical signal from the outlet of the sensor 13 is digitized in the ADC 20 and submitted as an 8-digit binary code for processing in the MPS 19. The smooth scanning of the diffraction grating 9, mounted on the movable carriage 10, is performed by a mechanical block 26, coupled to the step motor 25, while the feedback for the position of the diffraction grating 9 is provided via the photoelectric converter angle-code 27.

Part of the optical signal from the reflective prism 4 enters in the photometric channel and reflected by the flat mirror 14 falls through the lens 15 on the interference filter 16. From there the monochromatic optical signal is focused through the lens 17 on the sensor 18. The resulting electrical signal is passed to the ADC 21 and in the form of an 8-digit binary code enters into the MPS 19.

The internal calibration of the spectrometric and photometric tract is performed at a closed dimming aperture 2 and the reference signal from the calibration refference source 3 is recorded as a minimum threshold sensitivity of the apparatus. The external calibration of the spectrophotometer is performed

by rotating of the inlet scanning system on 180° to the basic position (0°), i.e. in the direction of the solar disk. The functional scheme allows the researched spectral range to be scanned continuously or discretely without changing the mode of operation of the diffraction grating 9, by selective permission of passing of electrical signals as a function of the current angular position, recorded by the photoelectric converter angle - code 27. The measurement process and the registration are completely automated. The optical signal from the reflective prism 4 flows through the semitransparent flat mirror 14 to the lens of a video camera 28. Once the microprocessor system 19 detects information signal over a certain level, signal is passed to the camera 28 and is videorecorded a particular process, a phenomenon with "extreme" physical characteristics. Camcorder 28 provides perception of an image in the visible part of the optical spectrum. At a reduced illumination of the background and darkness an option is provided through electronic optical converter - amplifier the brightness of the image (module converting the infrared radiation from the object into visible) to obtain video information from the studied objects, processes and phenomena.

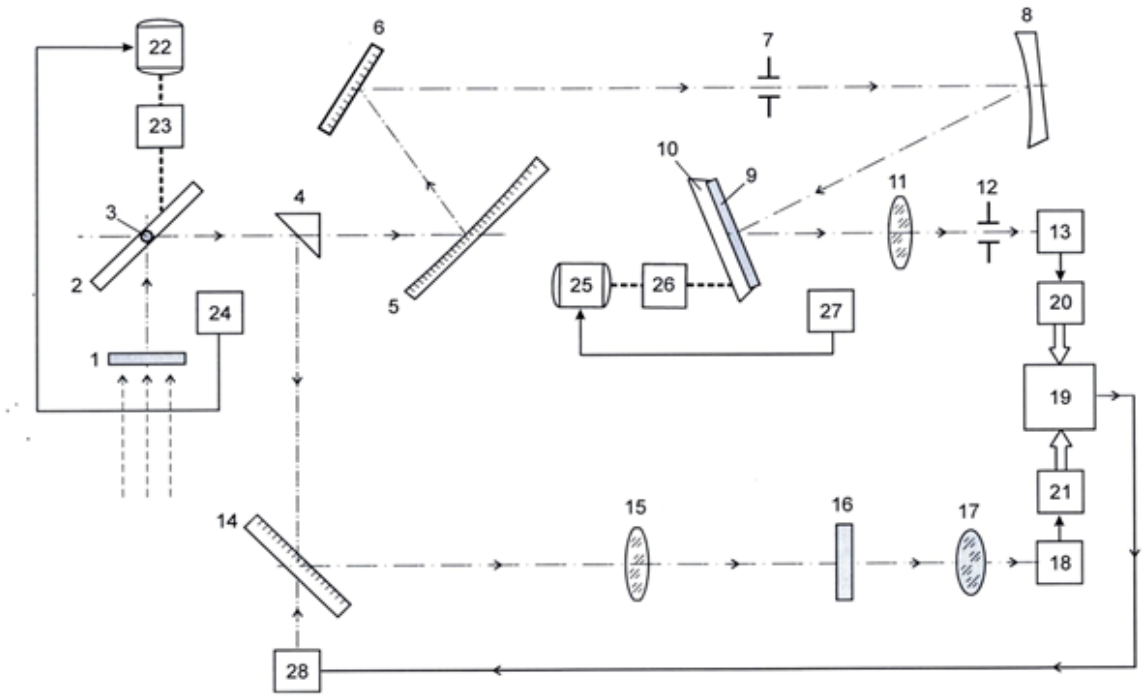

Figure 13. Satellite spectrophotometer for monitoring of the environment

PATENT CLAIMS

Satellite spectrophotometer for environmental monitoring consisting of dimming aperture 1, flat scanning mirror 2, reference source 3, reflective prism 4, concave mirrors 5 and 8, flat mirrors 6 and 14, inlet diaphragm 7, diffraction grating 9, lens 11 and 15, outlet diaphragm 12, sensors 13 and 18, interference filter 16, optical lens 17, microprocessor system 19, analog-to-digital converters (ADCs) 20 and 21, step motors 22 and 25, gear drive 23, photoelectric converters angle-code 24 and 27, mechanical block 26, where the dimming aperture (1) is positioned in front of the flat scanning mirror (2) with mounted in it reference source (3), which constitute an input scanning system of photometric and the spectrometric tract and are mechanically coupled to the step motor (22) via the gear (23). The photoelectric converter angle-code (24) is electrically connected to the step motor (22) and opposite to the flat scanning mirror (2) on the same optical axis is positioned concave mirror (5) and between them is fixed the reflecting prism (4), optically connected to the concave mirror (5) of the spectrometric tract, and to the flat mirror (14) of the photometric tract. The concave mirror (5) is connected optically with the flat mirror (6), which in turn through the inlet diaphragm (7) has an optical connection to the concave mirror (8) and from there to a diffraction grating (9) mounted on a movable carrier (10). The diffraction grating (9) is connected optically through the lens (11) and the outlet diaphragm (12) to the sensor (13). The flat mirror (14) of the photometric tract is connected optically through the lens (15), the interference filter (16) and the optical lens (17) to the sensor (18). The sensors (13) and (18), respectively parts of the spectrometric and photometric tracts, are electrically connected to microprocessor system (MPS) (19) through the analog-digital converters (ADCs), respectively (20) and (21). The step motor (25) via a mechanical unit (26) is mechanically connected to the carrier (10) of the diffraction grating (9). The photoelectric converter angle-code (27) is electrically connected to the electric motor (25), the reflective prism (4) via the semi-transparent flat mirror (14) is optically connected to the input of the camera (28) and to same camera is connected the MPS outlet (19).

PROSPECTS FOR SATELLITE RESEARCH

Interesting experiments planned in the near future will enable to determine the amount of many TGC (O_3, H_2O, N_2O_5, N_2O, CF_4, HNO_3, CH_4, SO_2, CO, CO_2 and etc.). It is supposed substantial development of the system for atmospheric research with the use of geostationary satellites.

CONCLUSION

The analysis of the current state of satellite research for studying of the gas composition of the atmosphere has led to the following conclusions:

1. In recent years, using a variety of satellite methods, have been obtained a large amount of unique information about the content of the TGC in the Earth's atmosphere. Have been studied their spatial - temporal variations on different spatial and temporal scales, have been detected and assessed the contents of the new TGC, has been received new information about the stratosphere dynamics.
2. The satellite system for studying of the gas composition of the atmosphere is an important part of the global system for monitoring the state of the environment, and in this regard, an important part is the task of optimum combination of land, air and aerostatic systems for research of TGC.
3. Different satellite methods and geometries of measurement have different advantages and disadvantagesand and substantially complement one another. When creating a satellite system for monitoring of TGC in order to increase its effectiveness and informativeness, it is appropriate to combine optimally different methods, considering the various requirements for detection and measurement of TGC when solving scientific and applied problems.
4. Modern developments in satellite methods for studying of the gas composition include expanding of the list of tested TGC, increasing the accuracy and altitude range, increasing the spatial resolution in measurements, complex determining the physical condition of the atmosphere. Solving these problems is related to establishing of a unique satellite equipment, precise research of the optical characteristics of the TGS, improving the physical basis of remote measurement, including the development of new tools and equipment.
5. Of great importance in creating of satellite-based systems for monitoring of TGS is the metrological equipment of measurements, an organization that needs extended laboratory and field research on the ground.

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NOISE MEASUREMENT IN ELECTRONIC-OPTIC TRANSFORMERS

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ABSTRACT *- The transformation of the photoelectroms into photons by a electronic-optic transformer (EOT) is accompanied by a chain of processes which result in decrease in the relation signal/noise and also in worsening the characteristics of the EOT at lower levels of illumination. Such processes are the ion feed-back and diffusion of the amplification coefficient, and as a result of which scintillations appear with a different brightness and partly loss of photoelectrons. The decrease of the relation signal/noise of a real EOT in contrast with the theoretical value is characterized by a coefficient which is called noise-factor and which is a measure for the losses of information in EOT.*

The relation signal/noise is defined as a mean level of the brightness of a uniformly luminous screen, divided into the mean quadratic aberration of the brightness from this same mean level. When measuring the relation signal/noise of EOT, which is designed for visual devices, the analyzed area of the screen should correspond to the eye resolution and the noise is measured in the band of the eye frequency.

KEY WORDS *- noise, measurement, electronic-optic transformer*

The transformation of photoelectrons into photons by an electronic-optic transformer (EOT) is accompanied by a number of processes resulting in decrease of the signal/noise ratio and worsening the characteristics of the EOT at low illumination levels. Such processes are ion feedback and gain factor dissipation, as a result of which scintillations of variable brightness appear on the EOT's screen, as well as partial loss of photoelectrons. The decrease of the signal/noise ratio of a real EOT, compared to the theoretical value, is characterized by the so-called noise factor which is also a measure of information losses in the EOT.

The signal/noise ratio is defined as the mean brightness level of a uniformly luminous screen, divided into the brightness's mean quadratic deviation from this mean level. When measuring the signal/noise ratio of an EOT intended for use in visualdevices, the analyzed screen area should correspond to eye resolution and noiseis measured in the eye frequency range.

The functional diagram of thesignal/noise ratio measurement equipment is shown in fig. 1.

With the help of neutral filters, the input brightness of emission source 1 is adjusted in such a way as to make it equal to 3.1 O'^{5} cd/m^{2}. The size of diaphragm 2 is chosen so that its image on the photocathode of EOT 4 overlays the diameter of analyzing diaphragm 8, reflecting in the EOT's photocathode plane an element with diameter of 0,2 mm. From the EOT's screen, the image is transferred to the photocathode of a modular low-noise EOT amplifier of the image's brightness. The signal is recorded by a sensor-photoelectronic multiplier (PEM) 9, located behind diaphragm 8. The signal from the PEM passes through low-frequency filter 10 featuring range of 0-30 Hz. This factor, together with the amplification EOT, provides to harmonize the measurement circuit's frequency range with the eye frequency characteristic. The filter factor is equal to 10. The measurement is performed using two voltmeters: digital integrating voltmeter 11 featuring time constant of 10 s, which measures the signal's constant component, and statstic voltmeter 12, which measures the effective voltage of the signal's variable component. The ratio of the constant component to the mean quadratic deviation (MQD) is the signal/noise ratio. The measurement process involves a sequence of operations. To focus the system, emission source brightness is set at 3.1 O'^{4} cd/m^{2}, after which the brightness is reduced to 3.10'^{5} cd/m^{2} and an automatic record is made of three values of the signal's constant component and three values of the MQD.

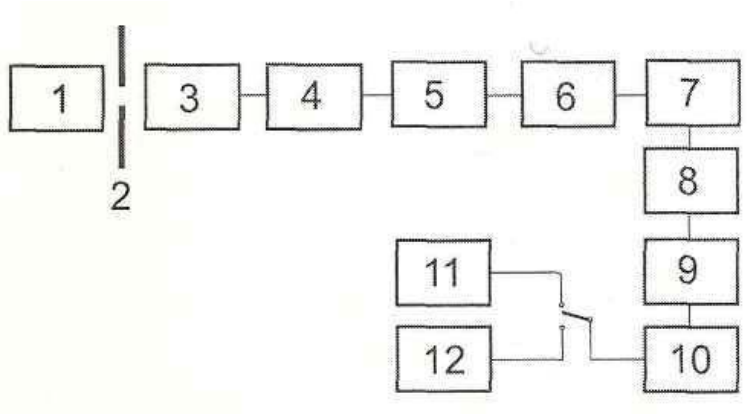

Fig. 1. Functional diagram of the signal/noise ratio measurement equipment:
I - radiant energy source; 2 - diaphragm; 3 , 5 - image transfer optic; 4 - the examined EOT; 6 - image amplifying EOT; 7 - microlens; 8 - analyzing diaphragm; 9 - sensor; 10 - low-frequency filter;
II - statistical voltmeter; 12 - digital integrating voltmeter.

The averaged value of the constant component is divided into the averaged value of the MQD and is recorded as the signal/noise ratio. During the measurement process, the emission source voltage is controlled continuously and the luminance of the EOT's photocathode is checked from time to time. The dependence of the signal/noise ratio on the measurement tract's frequency characteristic and the luminance E_k of the EOT's photocathode are examined. The dependence of the signal/noise ratio on E_k is checked at constant frequency range of the measurement tract and changing luminance of the EOT's photocathode from 10^5 to Hf[l] Ix. It turns out that the dependence of the signal/noise ratio on E_k may be described by the expression:

$$signal/noise \approx E_{\text{K}}^{\text{B}}$$

where β = 0,42.

The deviation of the theoretical value of β = 0,5 is explained by the available dark background, which affects materially the signal/noise ratio at low luminance levels of the EOT's photocathode.

The effect of the equivalent range frequency of the measurement tract's $\Delta f_{\text{ek}}$with respect to the signal/noise ratio of the examined EOT has been investigated, thereby confirming the theoretical reverse proportional dependence of the signal/noise ratio on $\sqrt{\Delta f_{ek}}$. The equivalent range

frequency is determined based on the tract's amplitude-frequency characterristic $R(f)$, using the formula:

$$\Delta f_{ek} = \int_0^{\infty} R^2\ (f) df$$

The noise-factor F is a parameter determined by the ratio:

$$F = \frac{(signal/noise)_1^2}{(signal/noise)_2^2}$$

where $(signal/noise)_1$ and $(signal/noise)_2$ are accordingly the signal/noise ratio at the EOT's input and output, determined at the same frequency Δf Its effect on the EOT's characteristics is equivalent to the F- fold reduced sensitivity of the photocathode

$$(signal/noise)_1^2 = \frac{1}{2e\Delta} f$$

where e - electron's charge.

At operating voltage between the cathode and the micro channel plate (MCP), providing electron energy of 3-5 kV, the noise-factor's value varies between 4-5 and decreases when increasing the accelerating voltage, whereas the factors affecting this parameter are:

$$F = \frac{1}{D}(1 + v)$$

where: D - the sum of electrons in the microchannel plate, determined as the ratio of the number of scintillations on the screen and the number of electrons falling onto the photocathode; v - relative variation of the scintillations' amplitude, comprising the effect of the microchannel plate's spatial noises

$$\text{V} = \frac{\gamma^2}{E}$$

here: E — mean scintillation energy;

γ - standard mean deviation.

According to formula (5), the noise-factor reducing means are mere reduction ofv, i.e. obtaining a more adequate amplitude distribution with small relative variations of the scintillations energy. When reducing v, the plate's gain-factor increases. The optimum is reached at gain of 10^4, whereas further increase of the plate's gain up to 10^5 results in reverse ion relation and increase of the

noise-factor.

Based on this, the amplitude distribution has been obtained, which can be used to determine the mean value of E and the standard deviation/. The complete distribution of the scintillations by energy, which can be used to determine the mean value of the scintillations' energy E, the mean quadratic deviation/ and the electron total factor D, is shown in fig. 2.

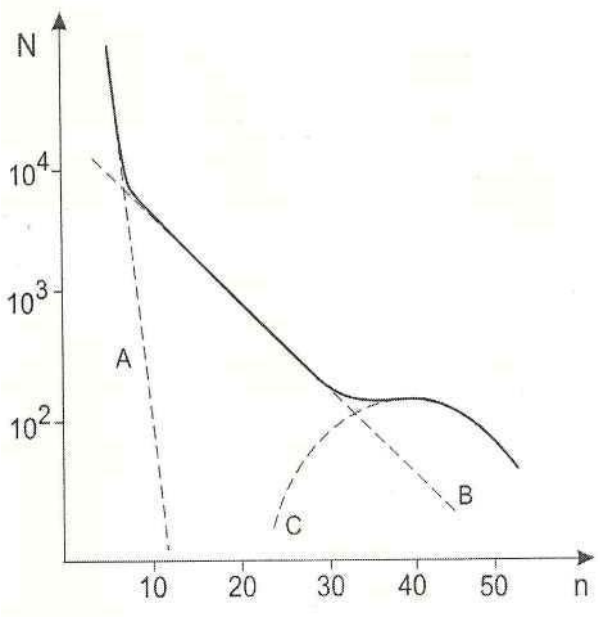

Fig. 2. Amplitude distribution of the examined EOT with MCP: along the x-axis - the scintillations' energy, along the y-axis - the scintillations' number; A - exponential distribution substantiated by the dissipation in the MCP's walls and low secondary electronic emission factor; B, C - distribution substantiated by the ion feedback mechanism.

In conclusion, it should be noted that the possibility to measure the EOT's noises provides for more efficient assessment of its technical characteristics and properties, using objective means. Unielectron amplitude distributions have been obtained, enabling to measure the signal/noise ratio and the noise- factor.

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ACTUALITY OF THE SCIENTIFIC AND APPLIED RESEARCH

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ABSTRACT: *The contemporary science is developing with extremely fast pace. The current material emphasizes on the timeliness of the scientific job and the scientific and applied research. Special attention is being paid of the "inner" and "outer" motivation of the scientists when choosing the problems and the approach of the methodology in the scientific research. The role of the scientific leader has been defined as a highly knowledgeable person who knows the trends in the scientific development, the market needs and who is very well prepared to look in advance into current problems and niche markets.*

KEY WORDS*: scientific and applied research*

The scientists are the most important and identifying factor for the development of science. Scientists have always played a crucial role in the scientific development and scientific and technological progress but in the current stage their role and responsibility seem to increase as to the humanity and earth survival. It s enough to mention nuclear energy production and the probability of a nuclear war, laser technology and the threat of "star wars", genetic engineering and the threat of creating new bacteriological weapon, the mass industrialization and the threat of ecological catastrophe.

The paper gives a professional characteristic of the scientist. However, this is a very difficult task because of the complexity and diversity of the scientific research which are defined by the differences in the scientific research in the different branches of science, by the different character of the job in the consequent stages of the cycle "research – application" (fundamental research, applied development, designer-constructor and technological activity), by the different position which the scientist occupies in the hierarchy of the organization (scientific leader, scientific organizer, scientific researcher, etc.) The personal qualities of the scientist, their talent and qualification , their way of thinking, inner and outer motivation for scientific creativity have a great influence on the success of the scientific process.

The contemporary science is characterized by a more profound differentiation [2]. It's difficult to enumerate the subjects and the specialties in

the different sciences because they are constantly increasing. Differentiation ensures going deeper when researching the facts and laws in the certain processes and phenomena and is a reason for the great progress in the scientific knowledge. It requires the contemporary scientist to be a good narrow specialist. The era of the universal scientists, of the Aristotles in the science, has gone away a long time ago. At the same time, there is a controversy between the integrity and complexity of the processes and phenomena. It is necessary to strengthen the integration links between the different sciences, subjects and specialties when researching complex processes and phenomena. It is not a coincidence that the new important discoveries are made in the cross sciences like physical chemistry, biochemistry, biophysics, molecular genetics, etc. To understand the complexity of the phenomena, to effectively take part in the integration relationships, the scientists must have brad fundamental knowledge as well. Consequently, the contemporary scientists should incorporate the good narrow specialization with broad fundamental base. At the same time, the narrow specialists cannot be universal specialists, regardless of their broad fundamental knowledge. The function of the universal specialist is taken successfully by the scientific team which integrates different narrow specialists.

The contemporary science is characterized by the changes and complications of the methodology of the scientific knowledge. The scientific researchers have to be able to use complex technology and appliances which are getting more and more broadly used in the research activities. The mathematization and cybernation of all sciences, the use of computers in the experiments and the processing of the results, the mathematical modeling of the natural and social processes make it necessary to know the basics of all these methods by every contemporary scientist.

Science as a social system is developed by its own internal laws. They define the “inner motivation” of the scientists when choosing the problems and the methodological approach in the scientific research. All these internal laws should not be overlooked. Their significance can be an obstacle for the scientific progress. The contemporary science is only a part, a subsystem from a bigger system – society and its development, functions and tasks ate defined by the relationships with this greater social system.

Having in mind the necessity to develop, the society forms its social contracts with science, i.e. there is an “outer motivation” in the selection of the problems, approaches and the methodology of the scientific research.

At the moment the institutionalization of science is increasing at a great speed and rate. Science is becoming an object of social management by government and other organs. A government policy is formed in the science, i.e. the role of “outer motivation” increases in its development. It was only in the past when university professors, together with their lecturing and teaching practice, took part in scientific research on subjects which they wanted, as we

can say “to satisfy their scientific curiosity”. The contemporary scientists should get used to working on the basis of preliminary prognoses, to consider the existing scientific organization, to be able to see the basic and complex problems which are extremely important for the society development, to be able to clearly identify the goals of their scientific research. They have to be ruled by the “inner”, as well as by the “outer” motivation in their jobs. Neither of them should be underestimated. The correlation between them is basically defied by the character of the scientific research. This way the end of the cycle applied research – experimental – construction development – implementation” can bring the beginning of new research.

Science has turned into a direct production power and it has become a vital factor for the technical, economic and social progress. The cycle “research – applied development – implementation” is greatly shortened. The fast implementation into practice of national and foreign scientific results becomes very up-to-date and is the main goal of the currently continuing reorganization in the structuring and management of the scientific front – a new economic mechanism and programming structuring in the science, the increase of the contract financing of the scientific research, etc. this brings new elements in the professional characteristic of the contemporary scientist. Regardless of the fact that there are scientists constructors, technologists, implementers, every scientist should include the implementation method of thinking, to seek and foretell a possible implementation of the results in reality, to participate in the development and implementation, to search multiplication of the effects. It is necessary to create such psychological attitude and such way of thinking and activity. We can point out many positive examples of such changes in Bulgarian Academy of Sciences during the recent years.

A basic moment in the professional characteristic of the contemporary scientist is that he has to be able to work as part of a team. [1]. The team method of scientific research is becoming more popular because of the deepening differentiation and the necessity of effective integration links between the “narrow specialists” when getting to know the complex phenomena in nature and society. The scientific collective ensures “the broad specialist” with deep knowledge in many “narrow” scientific subjects, universal methodical and methodological preparation and better information which are necessary when scientifically solving the problem. The lonely inventors and the “Edissons” in the science are now in the past. The scientific collective is turning into a collective subject of the scientific research and gradually takes the role of the individual subject in this respect. [5].

The work of the scientific collective brings many significant changes in the professional characteristic of the scientist researchers. Depending on their role in the research process, they can become methodologists, experimenters, theorist, etc. The scientist experimenters in the contemporary collective should maintain

themselves as creative people. And this is the reason why regardless of the division of labor in the research process in the collective, they should have certain qualities and knowledge of a methodologist, experimenter, theorist, etc.

There are complex relationships and links among the three basic types of scientists who participate in the research process (scientific leader, scientific researcher and scientific organizer) as well as among the scientific researchers among themselves. One of the most discussed problems is the contradiction and the unity of the individuality and the collectiveness in the creative process of the collective. Undoubtedly, the scientists in the scientific collective should sacrifice part of its individuality, to put it under the control of the aims and goals of the collective and the division of labor in it. At the same time the collective, with its conditions of tasks, with the competency of the separate scientists and rich methodological and informational possibilities, is the place where the individual creative skills can be fully developed. What is more, the participation in collective "brain attacks", "expertise evaluations", "conferences of ideas", etc. creates a specific beneficial environment for such development. The question is for the personal estimation of the achievement of the separate scientist in the collective. Every scientist pursues demonstration, approval and social respect. This is one of the drivers in their creative activity. Some methods of estimating the activity of the scientists do not stimulate their participation in collective tasks. For example the fact is emphasized in how many scientific papers the author is the only one or the first author in the reports for habilitation.

The job of the scientific leaders of the scientific collective is very responsible. They have to be very knowledgeable, to know the trends in the scientific development, the social necessities of the scientific provision of its development, to have a broad preparation which enables him to see the "big picture" and the links among its aspects, to have analytical, synthetical and heuristic skills, to be honorable scientists, to have self-criticism towards their own work and towards the collective work which they manage, to be able to work with people and evaluate them objectively, to create prerequisites for democracy and tolerance to the different opinion which do not coincide with their own and which are highly important for the science.

With the institutionalizing of the science, the role of the scientific organizers has increased dramatically. The skills which the scientific organizers have to possess mean that they have to be selected amongst the scientists. Science is being managed, it is not administered. It is true that with program structuring of science, the manager of the scientific program and of the program collective combines the characteristics and activities of the scientific leaders and the scientific organizers. They have to be prominent scientists and at the same time very good specialists in the sphere of the scientific organization of the scientific research.

It is impossible to create science in isolation, within the borders of one country. Science is constantly internationalizing, regardless of the fact that there are big differences in the statute of the science and scientists in the different countries [4]. International scientific cooperation becomes necessary for its development. The contemporary scientists should know foreign languages in order to be able to communicate with their colleagues abroad. This requirement is specifically valid for small countries like Bulgaria. It is a fact that about 99% of the whole world scientific information is in foreign languages. On one hand, international cooperation is necessary for the scientific development and experience exchange and on the other hand – the turning of the science into a direct productive power and the shortening of the cycle "research – applied development – implementation" force the scientific organizations and their management to keep the results with greater economic value secretive so that later they can copyright them and obtain the greatest profit out of their implementation in life. International competition in the economy becomes competition in science. International cooperation should follow strictly "the rules of the game" of the international economic cooperation. Consequently, when announcing their scientific results, the scientists should take into consideration not only their wish to show their colleagues what they had achieve, to ensure priority in science but also they have to take into account their countries' interests.

The relationship between stability and mobility takes an important place in the scientists' characteristics. Mobility in science is more dynamic and stronger in comparison with the other jobs and it continues to increase significantly.

There has always been professional mobility amongst the scientists. For example Mayer graduated medicine but he discovered the law of energy conservation; Pasteur is a chemist who started with crystallography and later he created classical microbiology, immunology and sets the basics of the classical biotechnologies [3]. But professional mobility in the past was not so popular. Its increase in the contemporary situation is determined by the fast differentiation of science and by the need of the scientists to regroup in order to solve certain problems for a short time. The differentiation of science leads to the creation of new sciences and scientific branches on the borders between two or more existing sciences (interdisciplinary sciences and subjects).

Their formation and initial development is done by scientists from existing sciences and branches owing to the professional mobility of these scientists who change their subjects or specialty. More often this so called horizontal professional mobility is done by the change of the narrow specialty (for example a physiologist with basic medicine education becomes a biochemist, pharmacologist, immunologist or internist) but also it is not rare that they change the basic specialty(for example molecular biologists become scientists with different university education: biologists, medicals, physicists, chemists).

The broadened mobility of the scientific workers is dictated by the necessity to regroup in problem or program collectives in order to solve certain problems. This mobility is often connected with change of the work place and with the formation of new organizational structures. It can affect not only the single person but also whole collectives.

The scientists' mobility can also be done in vertical direction, in change of the position which the scientist occupies in the management hierarchy of the scientific research. The scientist can become scientific leader or scientific organizer or vice versa. The professional mobility of the scientists is necessary for the contemporary science and it will go further and deeper with its future development. It creates favorable conditions for increasing the efficiency of the scientific research. But of course, not every mobility is justified and useful. One should not go into extremes and mobility should not be absolutized. Only the reasonable mobility of the scientists is beneficial and useful. The excessive and unnecessary mobility can lead to the opposite effect – decrease of efficiency of the scientific research and slowing down the scientific development.

Therefore an important moment in the scientists' characteristics is their ability and psychological attitude to professional mobility. It requires the contemporary scientists to combine their narrow preparation with general and broad fundamental knowledge. The preparation of scientists should be in compliance with the prognoses for development and differentiation of science and the advantage is being given to newly developing branches.

These are generally the characteristics of the contemporary scientists. The problem of the preparation of these scientists is not of less importance. It can be discussed in a different paper and here only some of the points will be mentioned.

The production of scientific workers becomes one of the basic problems of the contemporary society which is being regulated and solved in a scientific manner by the scientific organizations. A key moment in the human resources policy is the selection of young people who had shown certain skills that are needed for scientific work. The process should begin from the university (diploma work) and with the active participation of professors in order to start the creative activity of these young people and to ensure possibilities for demonstration of their talents. The contestant principle when selecting young scientists should be introduced everywhere. It eliminates the chances of subjectiveness. The urge should be streamed towards elimination of the current weaknesses and disadvantages of the contestant system which has to be improved and not restricted or annulated. In order to increase the quality of the scientific workers and their effective use, all newly hired scientific associates, assistants and specialist with university education in the scientific organizations and organizations for scientific services and implementation, should be selected by a contest.

The limited volume of the paper does not allow the problems for postgraduation role, educational courses, the continuous seminars, youth schools, individual qualification, national and foreign specialization, language qualification, doctor's dissertation, scientific reviews and scientific discussions, etc. for the preparation of contemporary scientists, for intensive development of the scientific potential of the personnel. It is necessary to emphasize that highly qualified scientists are prepared basically in the stationary scientific organizations. Many documents are right in emphasizing the importance of the quick professional and language qualification and long-term specializations with priority for the young scientific personnel. This is a leading principle in the human resources policy of the Bulgarian Academy of Sciences. The Academy developed and implemented a system for selection and qualification of young scientists and specialists with university education according to which all newly hired young people are given the conditions of qualification and evaluation which are very similar to these of the postgraduation conditions. It is a pity but it can be concluded that the situation with the young people in the Bulgarian science is not very satisfying. The percentage of young habilitated scientists is very small.

Science is a very dynamically developing system. Even the most qualified and knowledgeable scientists will fall behind if they do not make constant efforts for their improvement. Rendering the priority to the qualification of young scientists, this fact should not be oblivionized.

The talented scientists can demonstrate their abilities only when there is a high general scientific level of the collective. This is the reason why the differentiated fast qualification of the talented young scientists should be combined with the increase of the general scientific level of the whole collective.

However good and effective the system for selection and qualification of the scientists in the scientific organizations is, still there are a number of people who are not capable of scientific work. So the problem is what can be done to improve the effective selection system and to release the "plain masses" in science. Practice has shown that it is extremely difficult, especially with scientific workers with many years of work experience. There are many factors involved, including social ones. It is easier to get rid of incapable people at the beginning of their work. The system of attestation of the personnel provides a mechanism for releasing of incapable scientific workers even in later periods of their work experience. It is a pity that both regulated mechanisms for selection do not operate properly for the time being. Of course, we can think of other methods for selection: periodical dismissal and redirecting of part of the personnel in every branch, economic forces by limiting the salary, etc. but according to the author the current mechanism are good as long as they are put into practice. The problem could be solved by working with these scientists

(especially the managers) to change their psychological attitude and elimination of the possible subjectiveness when solving the problem. .

It can be concluded that striving for high quality and efficiency of the scientific research is impossible without the preparation of highly qualified and active personnel whose professional characteristics correspond to the requirements of the contemporary science.

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LOGISTICS APPROACHES TO THE ORGANIZATION OF TRANSPORT AND WAREHOUSE PROCESSES

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ABSTRACT: *The report analyzes the current approaches to the organization of transport and storage processes in modern manufacturing. Special attention is paid to a "Just in Time" and "Kanban" systems.*

KEY WARDS: *logistic, transportation, "Just in Time", "Kanban" systems*

Nowadays transportation and storage organization processes are based mainly on logistics. Logistics can be defined in different ways but for the purposes of this paper it will be defined as a set of methods and tools for an integrated management of the flow of goods from the initial place through the movement phases to the place of permanent consumption in order to ensure a high level of customer service at minimum total costs.

The logistics approach distinctive features in the organization of the described processes are the following:

- logistics is based on the integration and cooperation of different levels of the production process in its integrity and unity. It includes all activities connected with delivery, storage, handling of raw materials, final products, their dispatching and transportation to users. Transport and storage processes are part of them;

- for the implementation of the above mentioned activities optimal solutions are sought. The main goal is to reduce costs and to ensure a high level of customer service. The application of this approach provides logistics expenses reduction. The expenses are mainly related to supplies, transportation and stock storage.

The traditional organization of transport and storage processes is based on their formation as relatively independent activities for which specialized autonomous units are formed. - storage and transport sectors. Their modern

organization is performed by a logistic unit (or units built at different levels), which address the issues interconnected with others, resulting from the material flow movements. Some companies hire specialized logistics firms.

The reduction of logistics costs can be achieved by:

 Selecting the right system of ordering.

The following systems are popular:

- a system of rhythmic order - orders are made at regular intervals. The maximum availability of materials, which should be reached after receipt of the next delivery, is clarified beforehand. Therefore it can be defined as a system with a fixed periodicity of the order. The quantity of the order may be identical or different for different cycles. It depends on the spending of the stock. The amount of the contract is the difference between the set maximum stock and the reached availability at the date of the order.

- Point of order system. Point of order is the stock level of material, which indicates that it is necessary to make the next order. That is why, it is also defined as an indicative or implying stock. Point of order ensures the continuity of the production process before the arrival of the ordered quantity. In this system, the period between two orders, and the maximum supply can be variable but the amount of the order is fixed. Its application requires a permanent monitoring of stocks;

- an optimal system – this system also uses a point of order. It depends on the average daily consumption, on the term of order and the guarantee stock or

$$D = b.t_n + Z_g$$

where:

D - is the point of order (indicative stock);

b – an average daily consumption;

t_n - a term of execution;

Z_g - guarantee reserve.

In this system, the period between two orders may not be the same, the size of the order can also be different. It depends on the consumption of the material between two deliveries. The advantage of the system is that it is not necessary to monitor continuously the level of stock. The maximum stock is determined and it does not change anymore. There are two fixed levels of stocks.

The above mentioned systems determine the time of the next order, so that no extra materials are kept in storage.

 Optimization of the size of order.

It is based on minimizing the sum of costs of orders and their storage.They are in a diverse dependence of the size of the order. The following formula could be used [2]:

$$n_{oj} = \sqrt{\frac{2C_{nj}N_j}{C_j P_j}}$$

Where:

n_{oj} - is the optimal batch size;

N_j - production assignment for the j-th type of output;

C_j - cost of j-th type of output;

P_j - percentage of S_j cost for production storage;

C_{nj} - preparatory-closing costs for the type j th output.

The above model is applicable for the following conditions:

-when various materials are ordered independently;

- mixed orders are not accepted;

- the annual consumption needs are well-known and they are evenly distributed throughout the year;

- production of raw materials is not seasonal;

- time between order and delivery does not change;

- there is no discount for larger quantities purchases, etc.

When we take in consideration the purchase expenses with a discount, optimization passes through the following stages:

- the optimal size of the order is given in the above formula;

- The total annual costs of the optimal order are calculated and compared for a minimum amount suitable for a discount. The minimum quantity is selected.

 Application of the "just in time" (JIT) principle. Compliance with this principle means matching the time of delivery of the material (component product) with the emergence of any needs for it. In this aspect the principle can be regarded as a basic one in the relationship supplier-customer [3]. These are the independent entities linked in the production chain or individual units performing consecutive parts of the process within the enterprise. It results in reduction of stocks and costs of storage since the moments of products completion and products consumption coincide. To achieve the above mentioned, it is necessary to work on demand, in which the period of its completion is precisely defined. The order proves that there is a real need for it.

Supply "just in time" in the enterprise can be done by "Kanban" (literally postcard plate) principle. However, it is not correct to identify both systems. The

"just in time" principle can be applied without "Kanban" system, but “Kanban” can not be applied alone.

"Kanban" system can be defined as a "synchronous production supply" since the required units are produced (or supplied) in the required quantity at a precise moment.

Requirements for successful implementation of the system [4]:

- constantly maintaining a high quality of production;
- there is no waste since devices capable of processing are ordered only;
- flexibility of the labor force - workers qualification must allow them to assess accurately the required quantities and deadlines, as well as to serve different jobs and work as a team;
- reliable system for preventive maintenance and repair in order to avoid unplanned shutdowns that can interfere with the timely execution;
- serial or mass-production, which is administered by work in small production batches distributed differently over time;
- standardization of components and operations, thereby increasing their repeatability;
- discipline and commitment of all staff.

When "just in time" supply takes place between individual companies the following requirements should be met:very good cooperation and high discipline of providers; problem solving and product final design involvement; limiting the number and maintaining a relatively constant suppliers; shortening distances between companies and consumers.

The economic results of the system application are:

-stocks reduction, since nothing is bought, manufactured or supplied before a real need occurs. Availability of stocks 'conceals' real problems and their reduction saves costs and makes it possible to find and solve real problems.

- saving space - reducing the need for storage;
- increasing labor productivity;
- providing high quality output.

Performance evaluation in the warehouse is done by indicators[2] They include:

- coefficient of warehouse area utilization(K_w):

$$K_w = \frac{A_{ea}}{A_{ta}}$$

where:

A_{ea} - is the effective area of the warehouse (m^2);

A_{ta} - the total area of the warehouse (m^2).

- coefficient of warehouse volume utilization (K_v):

$$K_v = \frac{V_n}{V_T}$$

where:

V_n - is the warehouse net volume;

V_T - total volume of the warehouse.

- turnover rate of material resources in the warehouse (V_{tm}):

$$V_{tm} = \frac{Q_a.t}{a}$$

where:

Q_a - is the average availability of materials in the warehouse during a specified period (Mg или kg);

t - the period duration (days);

a - materials consumption during the analyzed period.

- coefficient of rate capacity vehicles utilization in the warehouse. It can be calculated using the formula given above.

- level of mechanization of warehouse work (D_m):

$$D_m = \frac{t_m}{t_m + t_p}.100,$$

where:

t_m - is the time of manual processing (h);

t_p - time of mechanized processing (h).

- labor productivity in the warehouse (Π):

$$\Pi = \frac{Q}{P_n}$$

where:

Q - is the amount of materials undergoing warehouse processing during a specified period;

P_n - is the number of man shifts invested in material processing for the same period.

- cost of storage per work load (C_S) [5]:

$$C_S = \frac{P}{Q_C},$$

where:

P - are the operating costs of the warehouse for a specified period (*Euro*);

Q_C - the cargo turnover of the warehouse during the same period (Mg).

In conclusion it could be said that the improvement of the analyzed production processes organization can be achieved by:

- using the modern transportation organizing concept applied to basic manufacturing processes and the organization of the auxiliary activities;
- development of alternatives and selection of the best one in already existing logistics system; the solution of all problems can be done within the existing system. There are two possibilities: formation and development of own production units or use the services of specialized companies;
- improving the operation of the warehouse. One way of doing that is the use of the "Kanban" which provides the effective management of material flows.

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ANALYSIS OF MODERN LOGISTICS SYSTEMS

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ABSTRACT: *The report analyzes the logistics system performs certain functions, operations and processes with tangible, intangible, and mixed flows. For any specific case concrete systems are constructed=*

KEY WARDS: *logistic, transportation, logistics system*

Logistics system consists of various numbers of organizational logistics elements. They are its smallest, indivisible functioning parts. In this way logistics system performs certain functions, operations and processes with tangible, intangible, and mixed flows. For any specific case concrete systems are constructed. Logistics systems are formed in order to provide opportunities for effective transformation of resources associated with activities in supply chains and networks which support the normal functioning of the life cycle of each company's products.

Modern references do not offer any specific definition for a logistics system. The prevailing concept in logistics is the logistics chain (fig 1) and rarely the logistics channel. Therefore there is no specific definition for a logistics system.

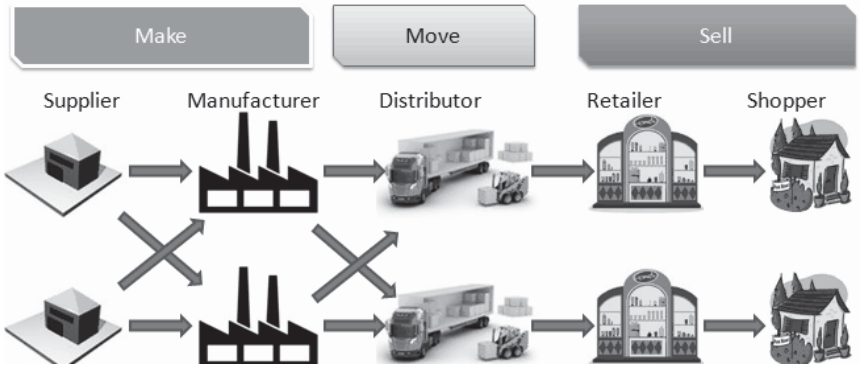

Fig. 1 An example of a logistics chain

From a systemic perspective the logistics system is presented as a phenomenon which is structured in order to achieve a pre-determined mission and goals through the implementation of certain functions using certain resources. This is achieved by activation of all units of the company to provide a synergy in their actions. Usually this approach amplifies and multiplies the abilities and intuition of the strategic leaders. The synergy effect is the basic requirement for an effective functioning of a firm. Its level measures the efficiency of the firms operation.

A system is a set of elements associated within certain relationships. Networks are systems where components are sources or nodes and links, material, information, financial flows or information about these elements. A logistics system becomes a logistics network, if the distances between the elements are much longer than the range of the elements. This applies in general for external logistics systems. As for internal logistics systems it depends on the distance to the leading source – the logistics manager.

The term system productivity is a generalization of the notion of a machine system. Therefore, many definitions and principles of machine systems theory and analysis systems can be transferred to the logistics systems execution [2, 3, 5, 8]. On one hand machine system executes orders. It processes, transforms and moves physical parts of a particular equipment both manually and automatically. Independent persons in a deterministic way work in automatic machine systems. They have only a limited degree of freedom. Examples of such systems are machines for printing, chemical and fully automatic production lines. Special logistics systems for machine automatic execution are - high bay stores (HBS), automatic sorting systems and management control systems, automatic guided vehicles (AGV).

There are fundamental differences between machine systems and performance in the production systems besides the similarities in the implementation systems. Operations entirely depend on the people. They serve different customer orders and service. The systems of factories, companies, logistics centers, network traffic management, where organizational logistics networks are built are a good example of a technical performance.

Initiated by any incoming orders with different content, the implementing systems running processes, which are characterized by productivity and cycling, generally have a number of dependencies.

To cope with the differing demands, the implementing systems have several modes and are partially decentralized. The kinetic chain machine systems are determined by the structure; the chain of logistics systems and networks depend on the companies' structure and strategies. Therefore, the main task of engineering logistics is to develop strategies for the design and operation of implementing systems.

The system performance functions are determined by constructive and functional requirements. The design, sizing and optimization of the system depends on the client, which specifies performance results and objectives, defines connections, interfaces and framework conditions, quality and quantity. For this purpose, customers can choose among the following specifications:

- resulting;
- functional;
- technical.

The result specification defines the type of the output product only and allows for different solutions on the methods, technologies, structures and processes that remain open.

The functional specification defines specific processes and methods, thus limiting the number of selected features and solutions.

The technical specification describes materials, components, system structure , and in addition identifies the specific methods and processes.

The type of specification is determined by the client's objectives and competencies o and the system type. The functional specification is complemented by a technical specification of the critical elements for the engine system.

For internal logistics systems and performances the specification is made by combining the functional specification of the critical processes.

Implementation systems are networks of stations generating certain services and performances.

Apart from manufacturing and administrative processes the logistics system is within all points and executive systems. It can be considered stationary in terms of structural aspects and dynamic in terms of process aspects.

Some problems, such as process optimization, can be solved more easily from a dynamic perspective. For other problems, such as the design of the systems or networks, the stationary aspect is preferable. For the tasks of modern logistics Both aspects must be considered for the tasks of modern logistics. Consequently, logisticians need to think about the processes, structures and systems as a whole.

The structural aspect includes analysis of the structure, functions, capacity and performance of the system or the network in a static position. From this perspective, the task of logistics is a systematic optimization [5,7]. This means that logistics system or network must be designed and sized, organized and operated to meet the requirements most effectively under certain restrictions.

The first step in the optimization of the system is its structure analysis and potential analysis. In this way the points and the configuration of the system are checked in order to see the reliability of performance and its effectiveness.

The assessment includes material flows, data flows and information between the points. However, looking at the logistics system from a stationary point of view only might result in loosing track of its inner processes. This could be prevented by using Chandler principle [8], which means that the structure follows the processes. According to the process orientation processes and their strategies must be developed before the structure is designed. However, this is only partly possible because all processes depend on the structure of the system.

The process aspect deals with the material flows analysis and the information about their movement in the system. An analyst examines the sequence of activities in the logistics chain and consumption time at the points. Here, the logistics task from a dynamic point of view is to optimize the process. The most effective processes of logistics chains management must meet the preliminary requirements for their selection, design and combining.

The first step is a process of analysis which evaluates the point's efficiency in the performing chains. This analysis assesses whether the system meets the objectives of customer, specifications orders and the expectations of beneficiaries.

The basic principle in the design process is to identify the characteristics of all processes in one system or network. Only then it is possible to measure the points of logistics networks and define the relationship in order to calculate the costs and achieve overall optimum.

The clean process approach is often overlooked because there is no competitive process and no synergies are possible.

In [3, 4] Dr. John Gattorna focused on the challenges that companies faced today in order to develop more responsive supply chains to customer's demand. Responsive supply chains are by definition, highly integrated. Li & Fung supply chains are indicative. Managing through cross-functional teams (clusters), Li & Fung achieved internal integration, that penetrates the operations, and external integration with upstream suppliers and downstream customers. "As a bottom line I have to say that Dynamic Alignment is an integrated process which helps each company to:

Understand the real needs and expectations of its customers.

Develop a new customer segmentation based on their real needs and expectations.

Identify the unique generic supply chain, which will provide maximum satisfaction to the customers of each specific segment.

Develop the appropriate new Leadership Style, Organizational Structure, and Business Sub – Cultures capable to develop the appropriate for each Customer Supplier Segment Business Strategy, accompanied with the required Strategy Mix".

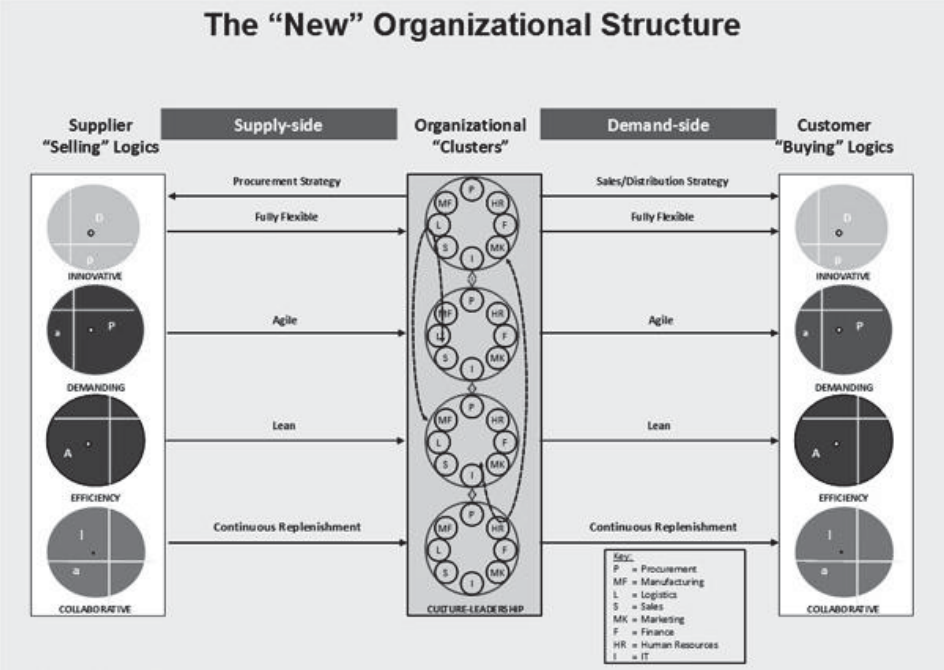

Fig 1. The New Organizational Structure

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RESEARCH OF MATHEMATICAL METHOD OF OPTICAL TRACT OF A SPECTROPHOTOMETER

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ABSTRACT: *The fundamental principle of work in optic – electronic devices is based on the fact that the controlled value causes alteration of the distribution of the brightness in the area of the device analysis, or a shift of the light spot towards the analyzer, altering the corresponding image of the signal at the exit of the photoreceiver. In this case this form of the signal is determined by the distribution of the brightness and the type of the analyzer. When designing an optic – electronic device, one of the main tasks when calculating the optic system is the determination of this distribution.*

The results of the calculation are in fact a choice of signal for the photoreceiver, which allows the evaluation of the quality of optic system in optic–electronic device. The results can be also used when modeling of following electronic waves in the device.

KEYWORDS: *optical tract, spectrophotometer*

The fundamental principle of work in optic–electronic devices is based on the fact that the controlled value causes alteration of the distribution of the brightness in the area of the device analysis, or a shift of the light spot towards the analyser, altering the corresponding image of the signal at the exit of the photoreceiver (one or a few) and in this situation this signal form is defined by the distribution of the brightness and the type of the analyser [11]. In this connection, when designing an optic–electronic device, one of the main tasks when calculating the optic system is the determination of this distribution.

When solving a greater part of the practical tasks for the distribution of the brightness, it is a good idea to use diffraction magnification, the correctness and the use of which are defined by the Rayleigh Criterion [3, 12]. This is based on the fact that the monochromatic aberrations are only few in the devices with a small number of openings. Besides that, the contemporary optical-electronic

devices have optic elements which optic characteristics are similar to the diffraction ones. With such characteristics of the optical system and the light diameters of the elements, they play a significant role when forming the information signal at the exit of the photoreceiver of the optical-electronic device. [6, 7, 9, 10, 13].

In the diffraction zoom, the distribution of the brightness can be obtained with the help of the Huygens–Frensel principle which is an integral transformation over a certain distribution of complex amplitudes, set in a certain complex amplitudes distribution and is positioned in a certain initial plain and it allows the structure definition in the sun field in a random plain [5]. When fulfilling the proportions:

(1) $$L^3 >> \frac{\pi}{\lambda}\left[(x_{\max} - \xi_{\max})^2 + (y_{\max} - \eta_{\max})^2\right]$$

where: L – distance between the above mentioned plains;
λ - wave length of the radiation;
$\xi_{\max}, \eta_{\max}, x_{\max}, y_{\max}$ - characteristic sizes of the initial and formed distribution.

The integral Huygens–Frensel looks like [4].

(2) $$U(x,y) = \frac{ik}{2L}\iint_s U_0(\xi,\eta)\exp\left\{-\frac{ik}{2L}\left[(x-\xi)^2 + (y-\eta)^2\right]\right\}d\xi d\eta,$$

where: $U_0(\xi,\eta)$ and $U(x,y)$ - complex amplitude distribution in the initial and analyzed plains;
ξ,η and x, y – coordinates in the initial and analyzed plains;
S – part of the initial plain in which the complex amplitude distribution is set;
$k = \frac{2\pi}{\lambda}$ - wave number.

In order to take into account the influence of the diaphragm and the light sizes of the optical elements which play a huge role in the image formation, the integration (2) is necessary to be performed by the optical parameters by the method of the gauss diaphragms [4,14]. It means to equal the non-aberration lens with focal distance f and the light radius R with a function of amplitude permeability in Gaussian law. Such a definition of the function of the optical elements permeability allows the consideration of the light diameter, the linear

movements δ_x, δ_y towards the optical axis and the angles α_x, α_y at which the beam axis is changed after they pass the optical elements. Such permeability function is:

(3) $$T(x,y) = \exp\left\{iK\left[\frac{(x-\delta_x)^2 + (y-\delta_y)^2}{2F} + \alpha_x x + \alpha_y y\right]\right\},$$

where: $\frac{1}{F} = \frac{1}{f} - \frac{i}{KR^2}T(x,y)$, can be considered as a permeability function of a general optical element because when $f \to \infty$, $\alpha_x = \alpha_y = 0$, this formula means permeability through diaphragm with radius R and the center is moved at vector $\{\delta_x, \delta_y\}$ from the optical axis and at $|F| \to \infty$ - permeability through an attenuant.

The propagation of radiation by means of an optical system can be described as consecutive transformation of complex amplitudes distribution multiplied by the permeability function of the optical element [1, 2, 8]. After a certain number of optical elements is surpassed, the function of the points scattering $h(x, \xi)$ will be Gaussian function and respectively for the brightness distribution gets the formula [1].

(4) $$h(x,\xi) = \frac{\left(\frac{iK}{2\pi}\right)^{\frac{n}{2}}}{\sqrt{d_1 d_2 ... d_n \det(Aij)}} \exp\left[-\frac{iK}{2}\frac{\det(Bij)}{\det(Aij)}\right],$$

where: *det(Aij)* и *det(Bij)* – determinants which are:

(5) $$\det(Bij) = \begin{vmatrix} l_1 & -b_1 & 0 & c_1 - x \\ -1 & l_2 & 0 & c_2 \\ 0 & 0 & l_n & c_n - \xi\frac{d_n}{d_{n+1}} \\ c_1 - \frac{x}{d_n} & c_2 & c_n - \frac{\xi}{d_n} & 0 \end{vmatrix}$$

(6) $$\det(Aij) = \begin{vmatrix} l_1 & -b_1 & 0 & 0 \\ -1 & l_2 & 0 & 0 \\ 0 & 0 & l_{n-1} & b_{n-1} \\ 0 & 0 & -1 & l_n \end{vmatrix}$$

in which:

$$l_j = d_j\left(\frac{1}{d_j}+\frac{1}{d_{j+1}}-\frac{1}{F_j}\right);$$

$$b_j = \frac{d_j}{d_{j+1}};\quad c_j = \alpha_j - \frac{\delta_j}{F}, \text{ при } j = 1, 2 \ldots n;$$

d_j - distance on the optical axis between the first and the $j^{\text{-th}}$ element.

α_j - angle, at which the $j^{\text{-th}}$ element moves the axis beam;

δ_j - shift of the optical element;

x, ξ - coordinates in the initial and analyzed plain;

n – number of optical elements in the optical tract;

$$\frac{1}{F_i} = \frac{1}{f_i} - \frac{i}{kR_j^2}$$

Formula (4) is non-uniform quadrant form of the variables x and ξ.

(7) $$\frac{iK}{2}\frac{\det(Bij)}{\det(Aij)} = \frac{a_{11}x^2 + 2a_{21}x\xi + a_{22}\xi^2 + 2m_1x + 3m_2\xi}{\det(Aij)}.$$

The coefficient of this form a_{ij} and m_j, at i, j = 1,2 are defined by the differentiation det(Aij) at x and ξ.

$$a_{11} = \frac{\partial^2}{\partial x^2}\left[\det(Bij)\right]\Big|_{\substack{x=0\\ \xi=0}}$$

$$m_1 = (-1)^{n+1}\left(\frac{2\Delta n}{d_1}\right); \qquad m_2 = \frac{1}{d_{n+1}}(\Delta n + dn\Delta n)$$

When the function of point scattering is known, it is not difficult to find the light scattering. The given formulas allow modeling the operation of the optical-electronic device, numerous calculations (for different random points) the passing of the radiation through the optical tract and every time the shift of the position of the optical elements or parameters of the sun radiation are noted.

We can conclude that the results of the research allow the choice of a photoreceiver signal which characterizes the optical tract of an optical-electronic device which can be used for modeling of next electronic blocks of the device.

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BUILDING SECURE MECHANISMS WITH THE SOFTWARE PROGRAM AVAST FREE ANTIVIRUS

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ABSTRACT: *In this paper some secure mechanisms with antivirus software program are built. Nowadays it is very obligated that each system and network administrator has to analyze different vulnerabilities and flaws in their computer and network system. The using of antivirus software program is necessary for stable and secure maintaining off all computer resources and processes in the selected system.*

KEY WORDS: *Computer and network security, Antivirus software, Avast, Processes, Vulnerability, Windows 7.*

1. Introduction

One of the important and obligated tasks to each system administrator and cyber-professional is to secure protection of the user identity and personal data. Securing online shopping and banking is of crucial importance for safety online operations. Most of the internet hyperlinks present malicious cyber-attacks that can cause huge damages on computer and network resources. One solution to this complex problem is related to the installation and configuration of special anti-virus software program [1],[2],[3],[4],[14],[15],[16],[20],[22].

This paper is structured as follows. First, in section 2, a related work for the feature and quality of different freeware antivirus software is made. After that, in section 3, a sophisticated implementation of Avast free antivirus software into operating system - Windows 7 Enterprise is performed. The conclusions and recommendations are made in section 4.

2. Related work

In [20] analysis of Attacking antivirus by Feng Xue is presented. In [15] quality of freeware antivirus software in the selected operating system by, Muhammad Ahsan Rasool and Abdul Jamal is made. In [16] a comprehensive privacy issue of antivirus apps for smartphones by Neema Shakya is presented. In [4] vulnerability analysis for evaluation methodology and theoretical model for antiviral behavioral detection strategies by Eric Filiol, Grégoire Jacob and Mickaël Le Liard is made.

3. Implementation of Avast free antivirus software

In fact, Avast offer to their computer clients three types of antivirus software - free antivirus, internet security [22] and premier. In this paper only the type of free antivirus is analyzed and configured. The current version of the program engine was 2015.10.0.2208. This program secures protection for home, mobile, and business hosts. The following experiments only with education intend and purposes were made The security mechanisms for host users are characterized by [1],[2],[3],[4],[14],[15],[16],[20],[22]:

- Intelligent antivirus and anti-malware detection. The malware concept includes within itself some viruses, worms, Trojans, spyware, rootkits, and different types of adware [1],[2],[3],[4],[14],[15],[16],[20],[22].
- Scanning the home network (routers and switches) security. This tool protects the host from home network threats including DNS hijacking and weak passwords [22].
- Browser cleanup process [1],[2],[3],[4],[14],[15],[16],[20].
- Securing the Pay and bank online operations and connections [21].
- Securing Anti-hijack protection in order to log in to the real banking web site [1],[2],[3],[4],[14],[15],[16],[20],[22].
- Protecting the hosts with silent firewall against hackers.
- Anti-spam protection [1],[2],[3],[4],[14],[15],[16],[20],[22].
- Automatic patching of security holes for different computer applications [1],[2],[3],[4],[14],[15],[16],[20],[22].
- Preventing the misuse of user private data and etc.

The first very important setting is related to the setup “active protection” that consists of “file system shield [21],[22]”, “mail shield” and “web shield [21]”. It is shown on fig.1.

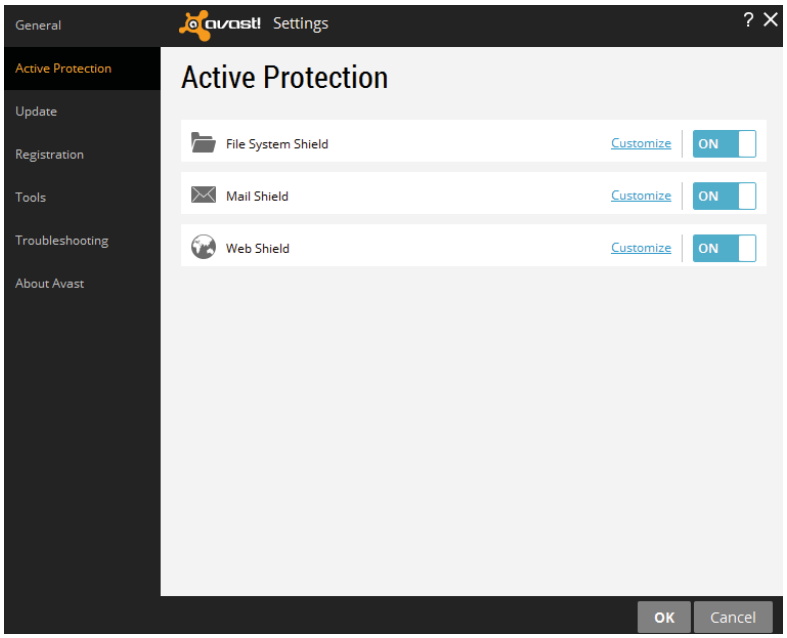

Fig. 1. The setup - "Active Protection"

The setup "file system shield" consists of the different important configurations. The submenu "scan when executing" is recommended to be set with the following settings:

- enabled for "Scan programs when executing" [3],[4],[19],[20],[21],[22];
- enabled for "Scan scripts when executing";
- Enabled for "Scan libraries (DLLs) when loading". Shown on fig.2.

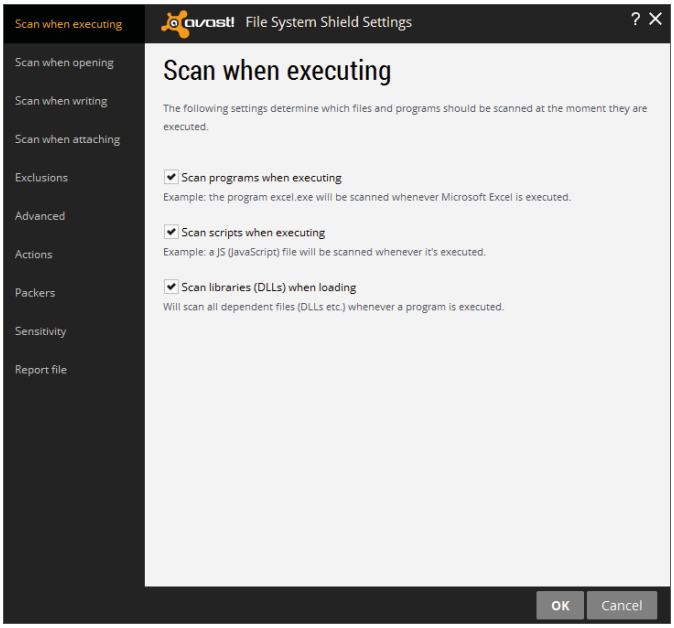

Fig. 2. The submenu "scan when executing"

The submenu "Scan when opening" is recommended to be set with the following settings:

- enabled for "Scan documents when opening [2],[3],[17],[18]";

- Enabled for “Scan all files”. Shown on fig.3.

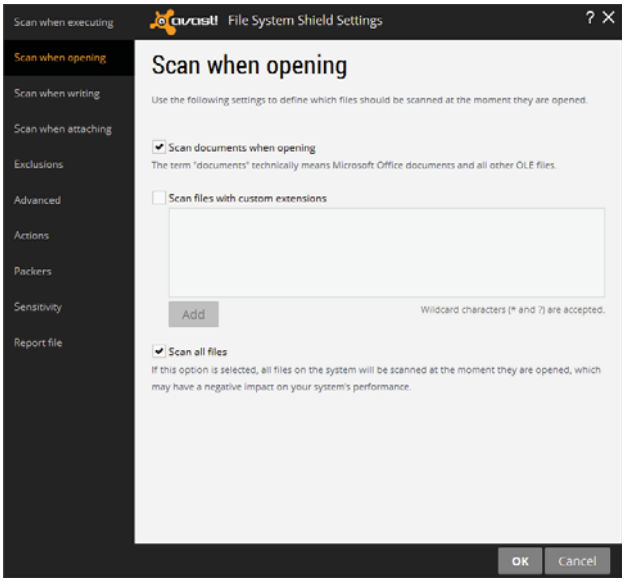

Fig. 3. The submenu “Scan when opening”

The submenu “Scan when writing” is recommended to be set with the following settings:

- enabled for “Scan files when writing”;
- enabled for “Scan files with default extensions [4],[5],[15],[16]”;
- Enabled for “Scan all files”. Shown on fig.4.

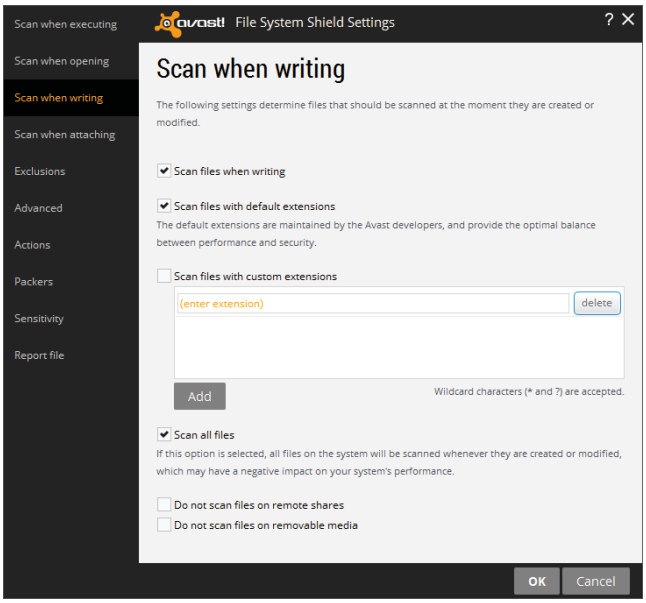

Fig. 4. The submenu “Scan when writing”

The submenu “Scan when attaching” is recommended to be set with the following settings:

- enabled for “Scan auto-run items when removable media is attached”;

- Enabled for “Scan diskette boot sectors on access [13],[14],[22]”. Shown on fig.5.

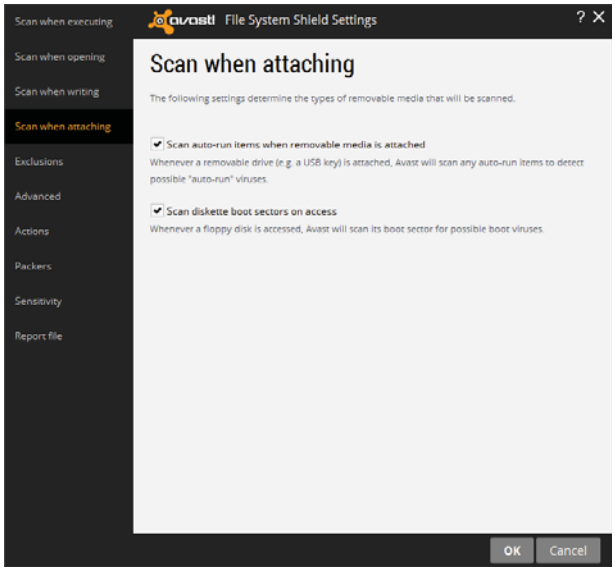

Fig. 5. The submenu “Scan when attaching”

The submenu “Exclusions” is recommended to be set with the following settings that are shown on fig.6.

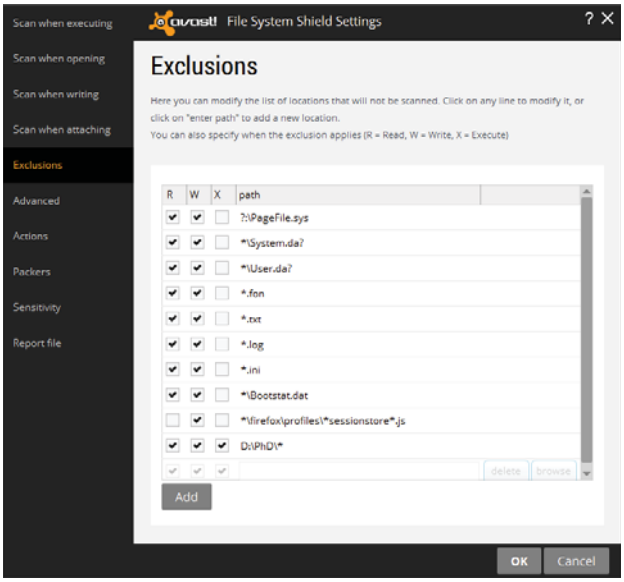

Fig. 6. The submenu “Exclusions”

The submenu “Advanced” is recommended to be set with the following settings:

- enabled for “Do not scan verified systems DLLs” [9],[10],[11];
- enabled for “Use transient caching”;
- enabled for “Use persistent caching”;
- Enabled for “Optimize scanning during file copy operation”. Shown on fig.7.

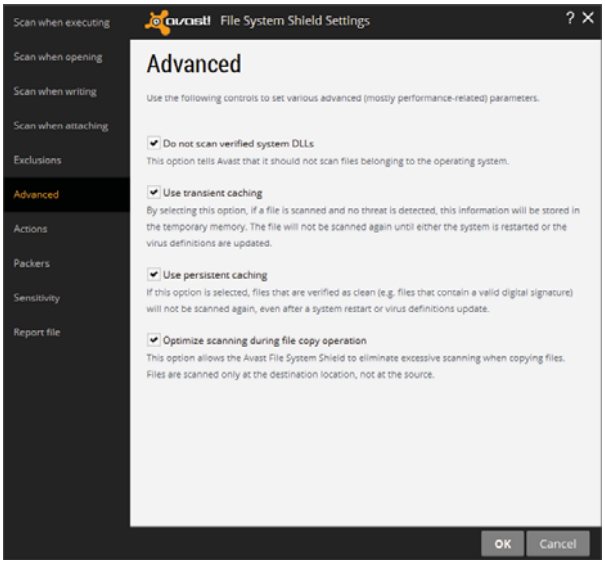

Fig. 7. The submenu “Advanced”

The submenu “Packers” is recommended to be set with the following settings:

- Enabled for “All packers”.

The submenu “Sensitivity” is recommended to be set with the following settings:

- enabled for “Use code emulation”;
- enabled for “Test whole files (may be very slow for big files);
- Enabled for “Scan for potentially unwanted programs (PUPs) [5],[7],[8]. Shown on fig.8.

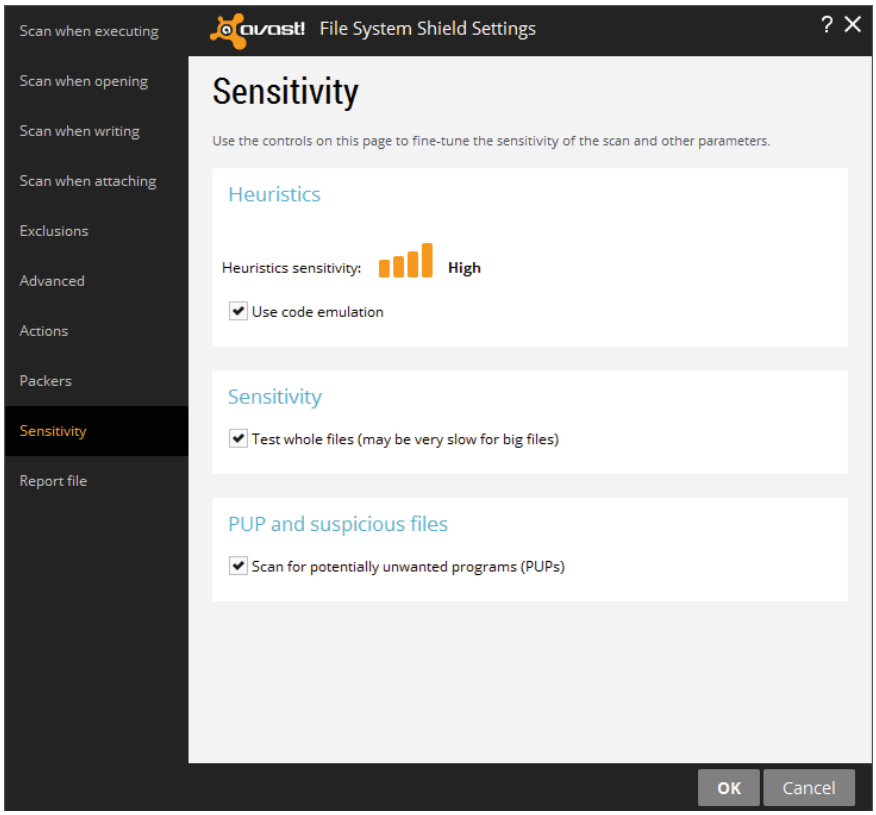

Fig. 8. The submenu "Sensitivity"

Thanks to this program each plain user, system and network administrator and cyber-professionals could obtain detailed information about the vulnerability status of the determined operating system. This research on the operating system Windows 7 Enterprise 32-bit is made [1],[2],[4],[6],[12],[21],[22].

4. Conclusion

Each security professional, system administrator and even plain computer user must always observe and detect the vulnerabilities, flaws, weaknesses, exploits and other specific software that can cause a total compromise of the selected operating system integrity and total shutdown of the affected confidential resources. Therefore, the attackers or cyber-criminals are able to obtain all computer and network resource completely unavailable forever. Thereby, it is important to be made the correct configuration of the following antivirus software program in the selected computer system and therefore the risk of cyber-attacks, viruses, worms, spyware, rootkits and other malicious programs could be reduced.

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MONITORING FOR SUSPICIOUS NETWORK TRAFFIC IN PRIVATE COMPUTER SYSTEM

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ABSTRACT: *In this paper monitoring of suspicious internet and network connection for one host with operating system Windows 7 Enterprise 32-bit is made. Presenting a special graph of the amount of information coming into, and out of the selected computer system is it is extremely important for the proper functioning of communications and processes. Nowadays it is very obligated that each system and network administrator has to analyze different vulnerabilities and flaws in their computer and network systems. The using of traffic monitoring program is necessary for stable and secure maintaining off all computer resources and protecting the user data integrity.*

KEY WORDS: *Computer and network security, Internet Connection, Processes, Traffic, Vulnerability, Windows 7.*

1. Introduction

Neither the system and network administrators nor plain computer users have to scan, analyze and observe each internet and network connection in order to protect the stable and secured state of their private data. Therefore, it is recommended to be installed specialized software that has the functionality to analyze, monitor and display all Internet and network traffic. In case there is increasing the level of the uplink data, then this means that there is a penetration in the computer system and one or many malicious users manipulate the data of the target host victim [1],[2],[3],[4],[5],[7],[10],[11],[14].

This paper is structured as follows. First, in section 2, some measurement techniques for analyzing, scanning, monitoring and observing the internet and network connections are made. After that, in section 3, only one host with ip address 1.1.1.2/24 is scanned and monitored. The final conclusions and recommendations are made in section 4.

2. Related work

In [2] a HTTP traffic measurements on determined networks by Vladimir Deart, Vladimir Mankov and Alexander Pilugin, is made. In [4] a detailed categorization of malicious behaviors using ontology-based cognitive agents by, Umar Manzoor, , Samia Nefti and Yacine Rezgui is presented. In [5] autonomous malicious activity inspector - AMAI by Umar Manzoor, Samia Nefti and Yacine Rezgui is presented and used. In [7] the software PRTG Network Monitor by Paessler, A. G. is explained. In [8] a comprehensive server virtualization and network management by Dirk Paessler is analyzed and performed. In [10] network traffic monitoring and analysis tools by Chakchai SO-IN are presented and classified. In [12] network monitoring based on flow measurement techniques by Michiel Uithol is performed.

3. Implementation of the monitoring software

The experiment in specialized Wireless Local Area Network (WLAN) is made. This network has consisted of 18 hosts and each of them has used a 150Mbps Wireless N USB Adapter TL-WN721N. In the computer laboratory a 150Mbps Wireless N Router TL-WR741ND has been used. The Dynamic Host Configuration Protocol (DHCP) in the router's configuration has been activated on purpose each host to obtain a valid IPv4 address, network mask, default gateway and DNS server address. The network id of this WLAN is 1.1.1.0/24. The research host had the following ip address 1.1.1.2/24.

BitMeter was the used network monitoring software [1],[3],[4],[5],[7],[11],[14]. The following experiments only with education intend and purposes were made. The scanning host has used Microsoft Windows 7 Enterprise SP1 operating system. The on-screen stopwatch of the program is shown on fig.1.

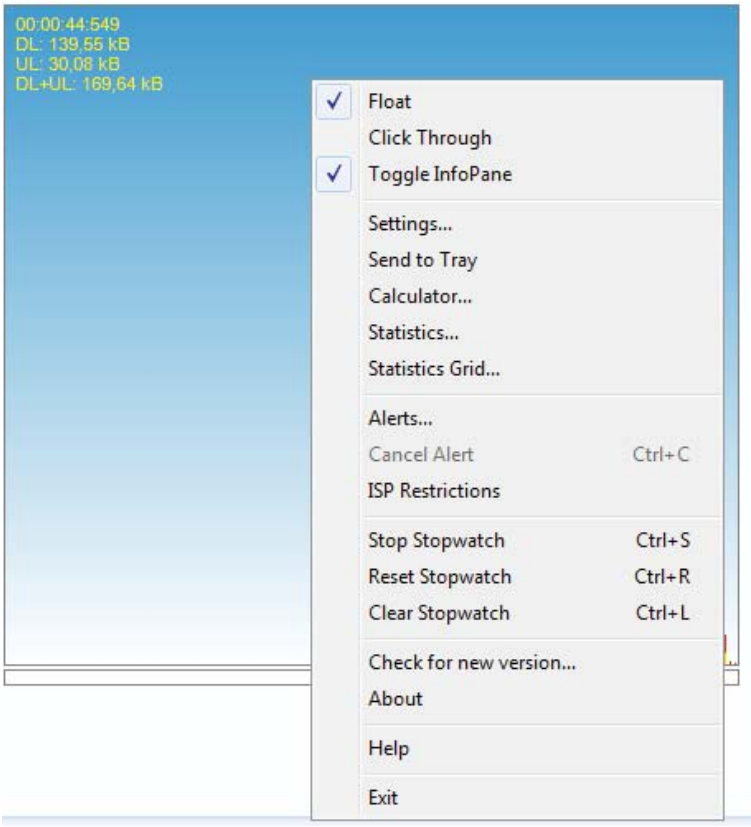


Fig. 1. The on-screen stopwatch of software program BitMeter

This software is a bandwidth meter and the user is able graphical to observe the upload and download speed over time. BitMeter is freeware and free of charge without any trial period and it requires the .NET framework version 1.1 or later. It was made by Rob Dawson who is a freelance software developer from Manchester in the UK.

The program is consists of the following control components:

- float options;
- click through;
- toggle infopane;
- general settings;
- sending to tray;
- calculator options [1],[3],[4],[5],[7],[11],[14];
- statistics options;
- statistics grid;
- alerts options;
- ISP (Internet Service Provider) restrictions [1],[2],[3],[4],[5],[9],[12];
- stop, reset and clear stopwatch;
- checking for new software version;
- About information and help menu.

The upload and download speeds as well as the display updates every second, and the average current speeds are represent on fig.2.

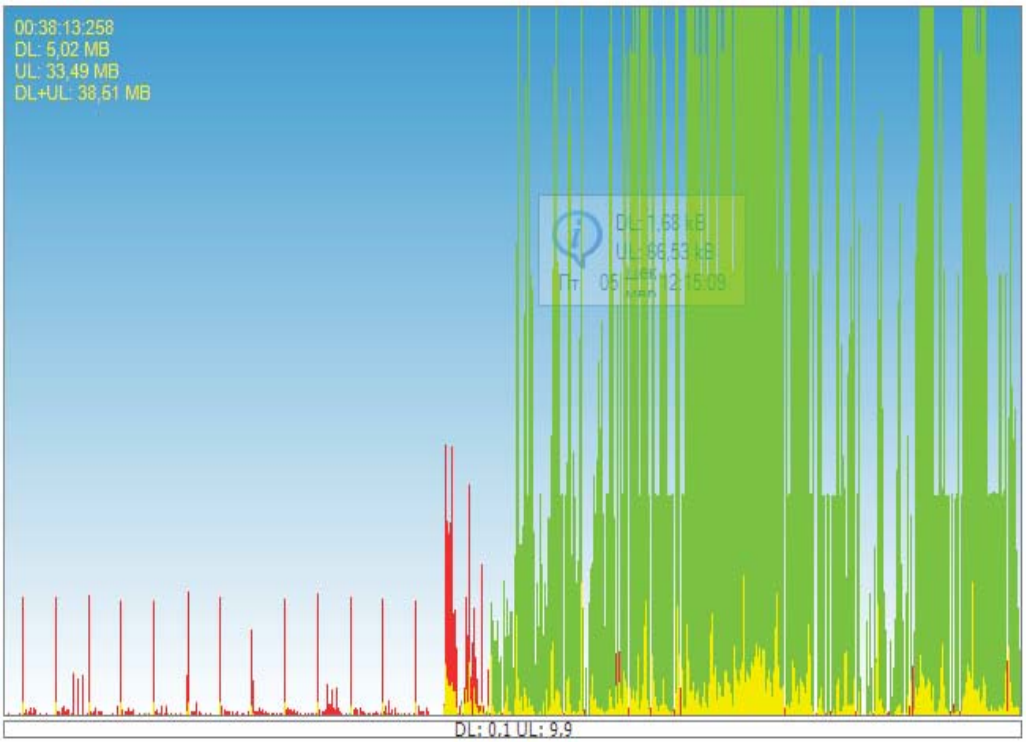


Fig. 2. The current upload and download speeds.

Another function is related to display statistics for the last few hours, the last few days and the last few months. This is shown on fig.3.

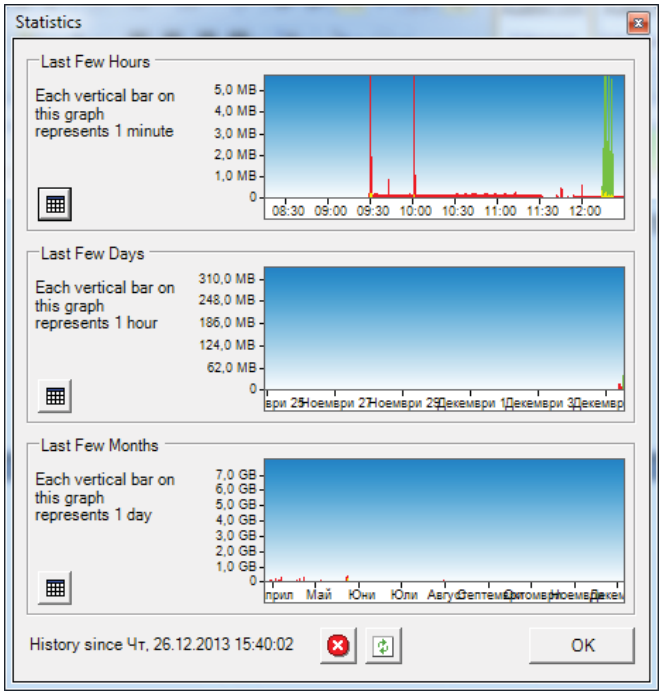


Fig. 3. Statistics information

This program has a specially designed calculator that can calculate how long it will be downloaded a given amount of information [1],[5],[10],[13],[14]. This is shown on fig.4.

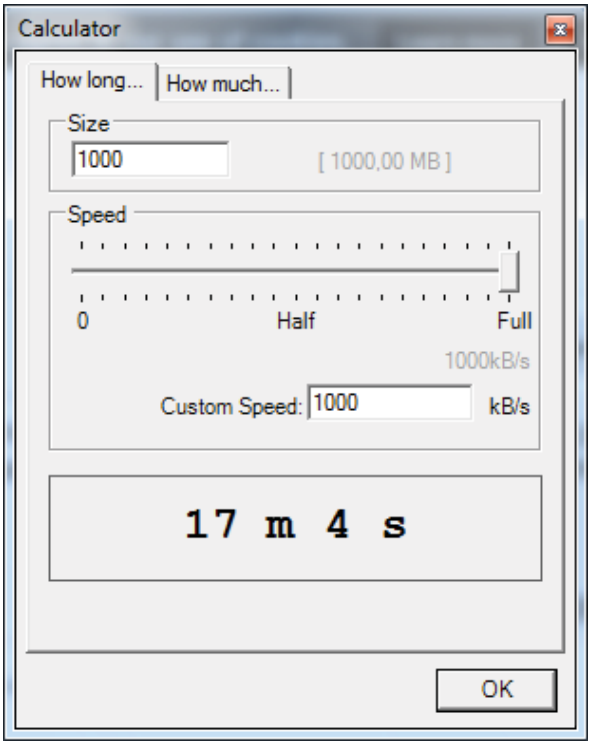


Fig. 4. The applied calculator

When there is a size of 1000 MB and the custom download speed is 1000 kB/s then the given amount of information will be retrieved for 17 m and 4 s.

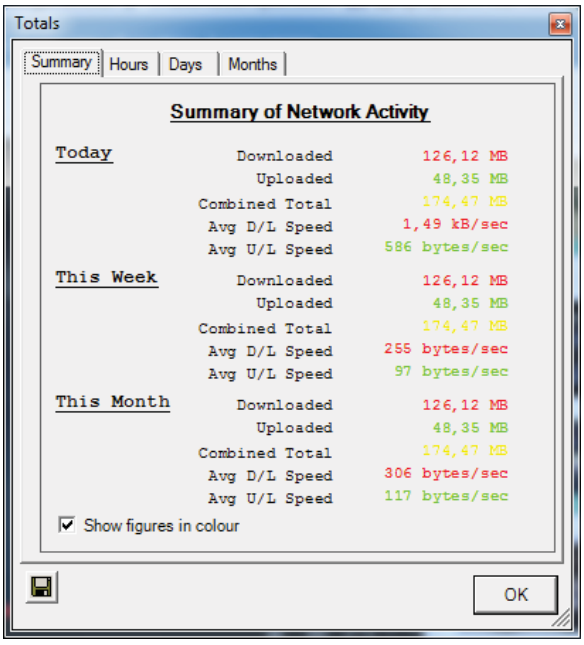
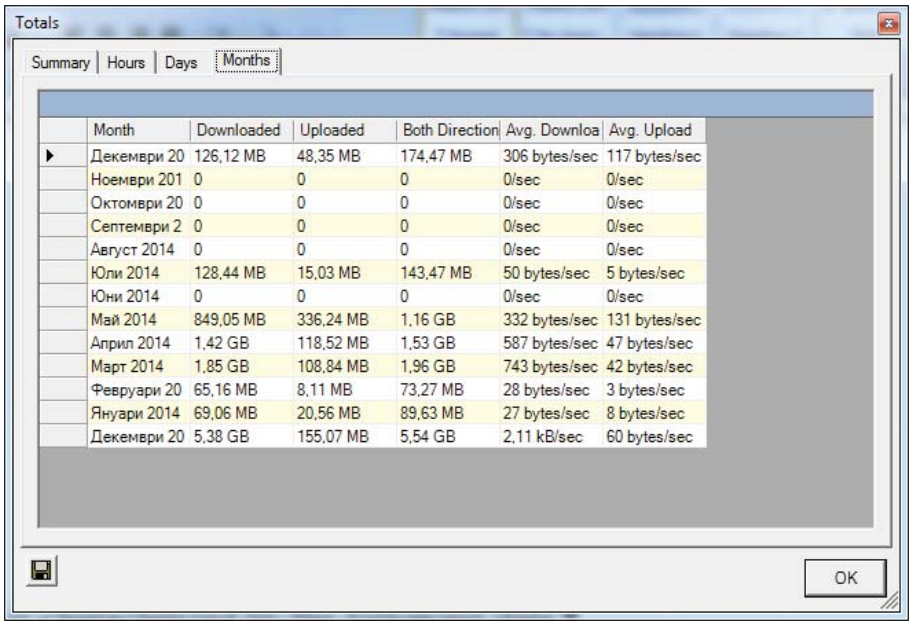


Fig. 5. The summary of network activity

Fig.5 is characterized by the following data:

- downloaded megabytes per day, week, month [14];
- uploaded per day, week, month;
- combined total per day, week, month;
- Average Download/Upload speed per day, week, month [2],[4],[7],[10],[14];
- Average Upload/Download speed per day, week, month;



Month	Downloaded	Uploaded	Both Direction	Avg. Downloa	Avg. Upload
Декември 20	126,12 MB	48,35 MB	174,47 MB	306 bytes/sec	117 bytes/sec
Ноември 201	0	0	0	0/sec	0/sec
Октомври 20	0	0	0	0/sec	0/sec
Септември 2	0	0	0	0/sec	0/sec
Август 2014	0	0	0	0/sec	0/sec
Юли 2014	128,44 MB	15,03 MB	143,47 MB	50 bytes/sec	5 bytes/sec
Юни 2014	0	0	0	0/sec	0/sec
Май 2014	849,05 MB	336,24 MB	1,16 GB	332 bytes/sec	131 bytes/sec
Април 2014	1,42 GB	118,52 MB	1,53 GB	587 bytes/sec	47 bytes/sec
Март 2014	1,85 GB	108,84 MB	1,96 GB	743 bytes/sec	42 bytes/sec
Февруари 20	65,16 MB	8,11 MB	73,27 MB	28 bytes/sec	3 bytes/sec
Януари 2014	69,06 MB	20,56 MB	89,63 MB	27 bytes/sec	8 bytes/sec
Декември 20	5,38 GB	155,07 MB	5,54 GB	2,11 kB/sec	60 bytes/sec

Fig. 6. Information during the months

Thanks to this program each plain user, system and network administrator and cyber-professionals could analyze and obtain detailed information about the internet and network connections status of the determined operating system. [1],[2],[4],[6],[8],[9],[13],[14].

4. Conclusion

Each security professional, system administrator and even plain computer user must always observe and detect the vulnerabilities, flaws, weaknesses, exploits and other specific software that can cause a total compromise of the selected operating system integrity and total shutdown of the affected confidential resources. The conclusion that can be made is that when the user has not uploaded any data anywhere on the internet in space, but the program also takes into account a certain amount of information, then it means that someone may have hacked into the computer system and thus began to manipulate the confidential data of the user.

Acknowledgements

This paper is supported by the Project BG051PO001-3.3.06-0003 "Building and steady development of PhD students, post-PhD and young scientists in the areas of the natural, technical and mathematical sciences". The Project is realized by the financial support of the Operative Program "Development of the human resources" of the European social found of the European Union.

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CRYSTALLIZATION KINETICS OF UNIAXIALLY ORIENTED POLY (ETHYLENE TEREPHTHALATE)

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ABSTRACT: *Using Tian - Calvet differential calorimetry the crystallization kinetics at isothermal conditions from rubbery state of amorphous as-spun poly (ethylene terephthalate) (PET) filaments has been investigated. The Avrami's equation was applied for analysis of the obtained experimental data. It has been shown that the mechanical impact significantly influences the process of the samples crystallization. It was established that poly (ethylene terephthalate) fibers crystallizes one-, and two-dimensionally from preexisting nuclei. These results are in accordance with the assumption of the quasi-crystallization centers existing in the amorphous PET, formed during the fibers spinning. Mechanical influence arrests the quasi-crystallization centers destruction during the polymer transition from glassy to the rubbery state.*

KEY WORDS*: poly (ethylene terephthalate), filaments, Tian - Calvet calorimetry, crystallization kinetics, Avrami's equation.*

1. Introduction

The flexible chain polymers are widely used in different areas of technology, but most frequently in the production of fibers, films, etc.
The final structure of the polymeric filaments is determined is defined primarily from the melt spinning conditions and of the follow manufacturing process. During of the fibrillate process in the fibers are formed zones with an increased degree of orderliness of the macromolecular segments, meso- and crystalline phases with different perfection. Under appropriate conditions the above

mentioned entities can be converted into crystal nucleus, and they are and they are so called semi- or quasi-crystalline nuclei.

Established as a result of the fibrillate super molecular structure in the amorphous polymeric fibers influence the process of their crystallization [1].

The object of the present investigation is Poly (ethylene terephthalate) (PET) that is a crystallizable thermoplastic polymer of wide application often in the form of fibers and films. The relatively low crystallization rate allows depending on the cooling conditions the molten PET to be converted to almost completely amorphous as well as semi crystalline filaments.

Processes accompanying the fiber forming and orientation download of polyethylene terephthalate (PET) have been extensively studied in the resent years [2-6]. For the evaluation of the crystallization ability of the fiber forming polymers and in particular of the undrawn PET fiber, it is not sufficient knowledge of the basic thermodynamic characteristics of the phase transition. Complete characterization of the crystallization of the amorphous PET fibers requires the availability of data concerning the influence of the applied at their formation mechanical influence on the kinetics of crystallization, which is not sufficiently studied.

The receipt of additional data regarding the influence of the experimental conditions on the crystallization kinetics of amorphous PET fibers would contribute for more clarification to the role of the applied mechanical impact on their structure and physical properties.

2. Materials

The experiments were performed with undrawn PET filaments produced from industrial installation of the company "Furnet" (France).

Basic fibrillate conditions and the initial physical characteristics of the studied PET fibers are given in table 1. Using the data for the studied fibers density (Table 2) it was determined and their degree of crystallinity. Birefringence of the fibers was measured using a polarizing microscope "Amplival-Pol. D", by use of rotatable compensators with a range (0 ÷ 130) λ. The coefficient of the amorphous fiber orientation (f_a) had been established using the Stein's equation [7]:

$$\Delta n = f_c x \Delta n_c + f_a (1-x) \Delta n_a + \Delta n_p \qquad (1)$$

, where: Δn is the birefringence of the fiber;

Δn_c, Δn_a are specific birefringence respectively of the crystalline and amorphous phases;

Δn_p is the birefringence due to a defects in the filament shape;

f_c, f_a are coefficients of axial orientation of the crystal and amorphous components of the fiber respectively;

x is degree of the filaments crystallinity.

Birefringence due to non uniformity in the fiber form (the so-called effect of Wiener) Δn, usually have values from 0,01 to 0,03 so that in the application of equation (1) it is most often neglected. The value of Δn_a = 0,275 is taken from the literature [8].

Table 1. Basic fibrillate parameters and initial physical characteristics of the studied PET fibers.

N	V_f, *m/min*	*v*, *m/s*	ρ_l, *dtex*	ρ, *kg/m*^{3}	α, %	$\Delta n.10^3$	$f_a.10^3$
1	1950	0,7	400	1342,0	3,6	16,1	58,54
2	1100	0,7	600	1336,0	0,8	6,1	22,18
3	1950	0	110	1344,5	5,4	20,0	72,72
4	1950	0,9	110	1340,0	1,6	18,4	66,90

, where: N – sample number;

V_f *m/min* - speed of fibrillate;

v, *m/s* - speed of the cooling air;

ρ_l, *dtex* - linear density;

ρ, *kg/m*^{3} – density;

α, % - degree of crystallinity;

Δn - birefringence;

f_a - coefficient of amorphous orientation.

As it can be seen from table 1 the values of the coefficient of amorphous orientation (f_a) of the individual samples have too large differences. At the same time the samples degree of crystallinity (Table 2) determined by the density is less than 5,5%.

Consequently, the selected samples are suitable for testing the effect of pre-orientation on the crystallization kinetics of from rubbery state.

3. Methods

Kinetic studies on the fibers crystallization were carried out using a heat conductive calorimeter type Calvet [9] at isothermal conditions. From the theory

of the method follows that the heat power generated in a given time in the calorimetric cell is determined by the following formula:

$$q = p\left(\Delta T + \tau_k \frac{d\Delta T}{d\tau}\right) \tag{2}$$

, where: p - coefficient accounting the heat losses in the calorimeter;

τ_k - constant characterized of the calorimeter inertness;

ΔT - the temperature difference measured from the thermal batteries between the standard and the sample.

The degree of completion of phase transition of first kind at some stage of the transition is expressed by the ratio between the released amount of heat up to this moment and the integral heat of the process.

If with τ_0 signify the moment corresponding to the start of the process, the amount of heat separated in the interval of time from τ_0 to τ_1 will be equal to:

$$Q_\tau = \int_{\tau_0}^{\tau_1} q d\tau = p\int_{\tau_0}^{\tau_1}\left(\Delta T + \tau_k \frac{d\Delta T}{d\tau}\right)d\tau \tag{3}$$

, where: p - coefficient accounting the heat losses in the calorimeter;

τ_k - constant characterized of the calorimeter inertness.

Therefore the completion level of the process at a given moment τ_1 will be given by the ratio:

$$\alpha = \frac{Q_{\tau_1}}{Q_{\text{int}}} = \frac{S_{\tau_1}}{S_{\text{int}}} \tag{4}$$

, where: S_{τ_1} - area under the curve described by the recording devices until the moment τ_1;

S_{int} - entire area of the peak conforming to the integral heat effect.

Interpretation of results can be performed on the basis of the equation of Avrami [10], which in logarithmic form looks as follows:

$$\lg\left[-\lg(1-\alpha)\right] = \lg k_n + n\lg\tau \tag{5}$$

, where: α - the portion of the substance that is crystallized up to the time τ;

k_n - constant contained parameters of the nuclei formation and the crystals growth;

n - constant dependent on the type of nuclei formation and the crystals growth.

If the relationship (5) is presented in coordinates: $\lg[-\lg(1-\alpha)]$, $\lg\tau$, graphically can be determined the crystallization parameters k_n and n.

4. Results and Discuss

In order to establish the influence of the applied in the fibrillate process mechanical impact on the "cold" crystallization, it was necessary during the colorimetric experiments to preserve the received at fibrillate orientation. For this purpose, the fibers were prepared in two different ways:

into parts with length of about one millimeter;

rigidly attached at both ends using special device.

Samples prepared under the first method are able to relax at temperatures lower than the crystallization temperature and at temperatures higher than the initial glass transition temperature. For the fibers prepared by the second way this option is turned off.

Kinetic dependences of the crystallization of fibers prepared under both described above methods are presented in Fig. 1.

As can be seen from the figure, the samples prepared under the second method crystallize faster, what was expected because in the fibers with fixed ends are kept the quasi-crystalline nuclei formed during the fibrillate process.

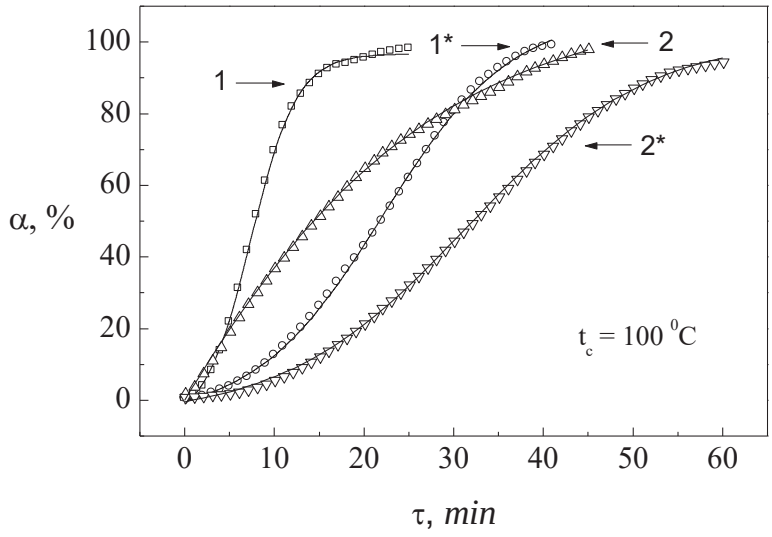

Figure 1. Kinetic dependencies of crystallization of PET fibers prepared in two different ways: 1 and 2 - rigidly attached at both ends, 1* and 2* - into parts with length of about one millimeter.

The fibers prepared at the first way run two processes - crystallization and relaxation of the internal stresses, which is reflected in the kinetic dependence - compare curves 1* and 2* with 1 and 2.

In the initial stages of the course of crystallization (α < 0,5), the rate of this process in the fibers with fixed ends (1 and 2) is larger than the samples in the free state - comparing curves 1 and 1 * 2 and * 2. It is known that during the polymer transition from glassy to rubbery state is defrosted the segment mobility of macromolecules, which allows them to relax and take more advantageous conformational states. Moreover, arises meta-stability of the existing in the amorphous phase areas with a higher degree of order – begins demolition of these entities, which leads to a reduction in the amount of the polymer crystallization nuclei.

In the fibers with fixed ends the possibility of relaxation of the frozen stresses is eliminated. This allows preserving of the ordered structure formations arising as a result of the applied tensile stress under the fiber forming. The absence of relaxation in the fibers with fixed ends obstructs the flow of the processes of disorientation in them, and thus the destruction of the existing in the amorphous phase quasi nuclei. This means that the volume concentration of the crystallization nuclei in the fibers with fixed ends will be greater from that in the fibers in a free state, which explains the more rapid running of the initial phase of crystallization in them. At the end of the crystallization process $(\alpha > 0{,}8)$ there is a delay of the crystallization in the fibers with fixed ends, which results in a reduction in the slope of the kinetic dependences in comparison with the fibers in a free state. The probable reason for this fact is that in the amorphous fibers are kept frozen stresses occurring during the process of fibrillate under the action of the mechanical tensile stress.

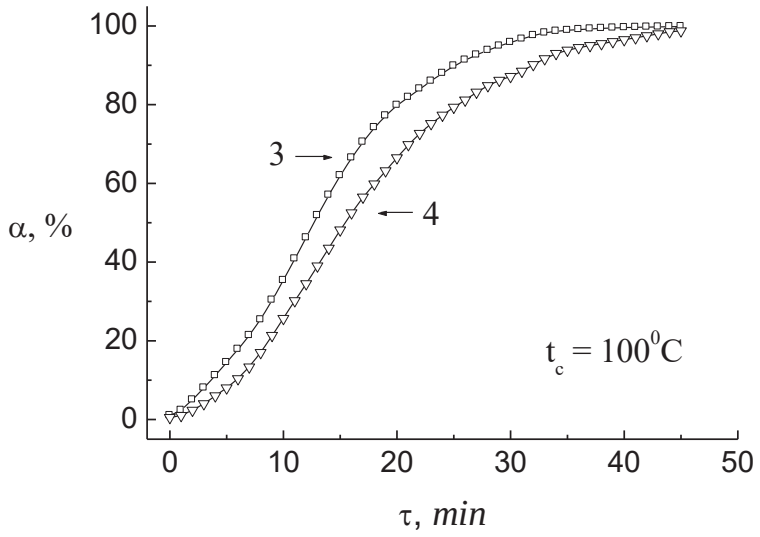

Figure 2. Kinetic dependencies of crystallization of samples 3 and 4 produced at one and the same speed of fibrillate but at different speeds of the cooling air.

The preservation of the fibers length during the crystallization impedes the accompanying process of rearranging of the macromolecular chain segments at the transition from glassy to rubbery state. This means that in these samples the areas volume in which the crystallization is hampered is larger. The energy needed for transferring of a macromolecular segment from the amorphous phase on the surface of the growing crystal will be larger for the fibers with fixed ends. As a result, the growth of the crystal formations in these areas is slowed or completely stopped.

In the following experiments were tested only fibers with fixed lengths. In Fig. 2 are shown kinetic dependences of the crystallization of fibers with different preliminary orientation. Samples are produced at one and the same speed of fibrillate, but at different speeds of the cooling air, which determines the difference in their orientation. The fibers obtained at higher speeds of the cooling air have a smaller value of the amorphous orientation factor (f_a).

As can be seen from Fig. 2 with an increase in the velocity of the cooling air the fibers crystallization speed decreases. This can be explained by the reduction of the crystallization nuclei concentration in the objects obtained at higher speeds of the cooling air. Probably, the observed effect is due to the more rapid cooling of the polymer melt and accelerating of the transition "melt - fiber". Therefore, the structure of the formed fiber has a decreased concentration of nuclei in comparison with the objects obtained at lower speeds of the cooling air, causing the delay of the "cold" crystallization.

The processing of the kinetic curves using the Avrami's equation is given in Fig. 3.

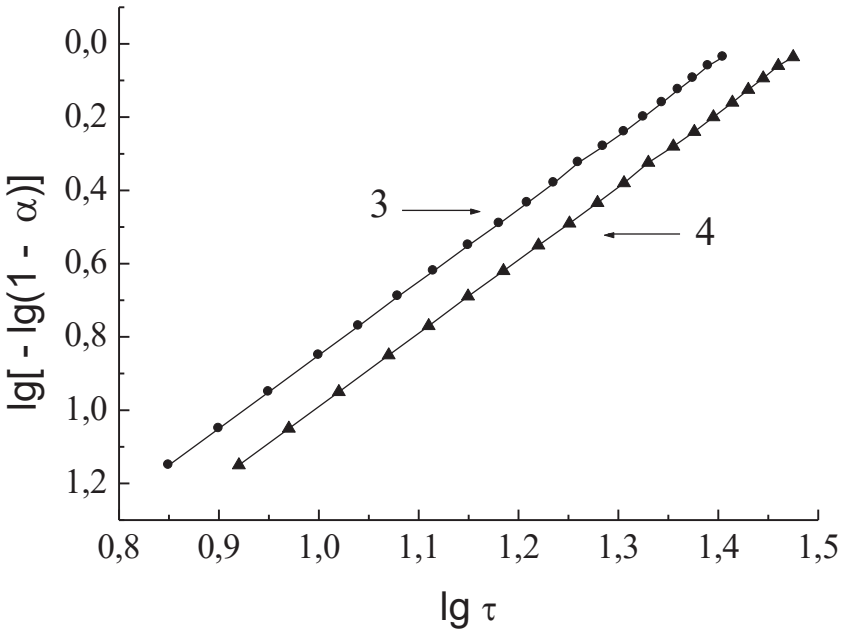

Figure 3. Dependence of *lg [-lg (1 - a)]* from *lg τ* for crystallized PET fibers produced at one and the same velocity of fibrillate, but at different speeds of the cooling air.

The processing of the kinetic data by applying of the Avrami's equation allows the identification of the parameters of the crystallization process (Table 3) as well as some basic relations.

As follows from the table 3, the parameter *n* in the Avrami's equation ranged from 1,70 to 1,79. Considering the obtained values of the parameter *n* and in accordance with the formulated on the basis of theoretical and experimental analyze conceptions [11, 12], it can be assumed that the growth of the crystal formations is predominantly one-dimensional (cylinders) and two-dimensional (lamellas).

Table 3. Data from isothermal crystallization kinetics of PET fibers obtained by Avrami's equation.

N	t_c, ^0C	$\tau_{0,5}$, *min*	$\tau_{0,9}$, *min*	*n*	*-lg* k_n
1	100	10,5	20	1,79	1,77
2	100	11,33	23	1,70	1,88
3	100	9,75	18	1,79	1,73
4	100	15,0	29	1,79	1,87

where: *N* - sample number;

t_c, ^0C - crystallization temperature;

$\tau_{0,5}$, *min* - half time of crystallization;

$\tau_{0,9}$, *min* - time for realization of 0.9 of the crystallization;
k_n - parameter in the Avrami's equation.

Fractional values of *n* can be explained by simultaneously realization of crystallization and improving the orderliness in the crystalline regions, i.e., process of secondary crystallization which for PET is highly expressed. It should be emphasized that the values of the parameter *n* depend on several factors such as the crystallization temperature, the shape and size of the sample, the heterogeneous influence of the cuvette walls, the examination method and others.

Therefore, in order to draw clear conclusions about the morphology of the crystal formations is needed additional micro and macro information about the crystallization mechanism and the nature of the occurring in the crystallized PET fibers structural changes. Taking into account that the calorimetric technique is sensitive predominantly to the crystal growth [12], in the present case must be concluded that the crystallization is realized by a heterogeneous mechanism of nuclei formation. Therefore, the structure formation in the studied borders of variation of the fibrillate parameters is to such an extent developed that all the centers of crystallization arise on ready polymer nuclei.

5. Conclusions

The influence of the applied during the fibrillate mechanical impact on the "cold" crystallization of amorphous PET fibers prepared in two different ways was studied.

The tested samples were prepared as follows:
into parts with length of about one millimeter;
rigidly supported at both ends.

It was found that the applied upon formation mechanical impact has a significant influence on the crystallization kinetics from rubbery state.

Values of the parameter *n* in the Avrami's equation allow assuming that the growth of the crystal formations is predominantly one-dimensional (cylinders) and two-dimensional (lamellas).

The observed results can be explained by the role of mechanical stress in the processes of preservation in the fibers of quasi nuclei as well as areas with frozen internal stresses.

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Original Contribution

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MODEL FOR THE INTENSITY OF ABNORMAL TEMPERATURES ON THE TERRITORY OF SHUMEN REGION

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ABSTRACT: *Their effects on crises can be significant material and financial damage, and sometimes casualties. Therefore, to improve the performance of state bodies involved in prevention, it is necessary to make scientifically based estimates of the incidence and causes of encountered extreme weather and climate events over the next few years. One way to solve this important practical problem is by developing a statistical model for the intensity of the (extreme weather and climate events) anomalous temperatures. Therefore in report justifies the thesis that the observed trend of warming and drought, and increased frequency of extreme weather and climate events, which in combination with other factors cause crises.*

KEYWORDS: statistical model, anomalous temperatures, crises management

Introduction

In the coming decades, climate changes are expected to lead to increased frequency and scale of disasters [2, 4, 5]. More frequent and more powerful storms and floods, droughts and long – term devastating forest fires, extreme high and low temperatures can have a significant detrimental effect on society. Therefore, it is necessary to unite the efforts of all institutions and their active involvement in the activities for the implementation of flexible mechanisms for compensation and the weakening of climate change. This policy will significantly reduce the social, economic and environmental damages and losses.

Extreme heat can take casualties and are a prerequisite for the occurrence of forest fires. Extreme cold temperatures may cause sagging wires of power lines by causing serious damage to the electricity transmission network. In critical situations can fall into a number of industries.

In this regard, the objectives of the report are:

1. To examine the trend of the intensity of abnormal temperatures on the territory of Shumen region;

2. To justify measures to improve the work of state bodies involved in preventing or eradicating the harmful consequences of emergencies.

The report justifies the thesis that the observed trend of warming and drought, and increased frequency of extreme weather and climate events is one of the causes of such crisis situations such as natural disasters.

Hypothesis is justified by developing a statistical model of the intensity of anomalous temperatures in the territory of Shumen Region for the period 1990 – 2012.

Exposition

Since climate change is real and we cannot stop the anomalies in temperature, precipitation and sea level rise, global challenge is to learn (how to be able to) to manage climate risks as appropriate. Climate change is a long process and it is therefore necessary flexibility to adapt to the risks associated with climatic extremes and formulate strategies to deal with them

Climate change may lead to more frequent and more severe storms and hail, floods, landslides, fires, snowdrifts, long droughts and extreme temperatures. They are actually a result of dangerous weather. As dangerous we can determine these weather events that can cause financial damage and threaten the health and life of people. According to the World Meteorological Organization (WMO) phenomena are all dangerous weather conditions that are potentially destructive or risky to people. Forecasting of hazardous events and conditions of their formation requires the development of models to predict their location and frequency. It is vitally important, as affected areas and population could be alerted in advance and thus to avoid casualties.

Anomalous temperatures are on the one hand extremely low temperatures in the spring, autumn and winter – cold, on the other – extremely high temperatures in summer – heat. They not only hamper the daily activities of man, but cause various accidents and crisis situations. In recent years there have been unusual phenomena such as high temperatures in winter and relatively low temperatures in the summer.

Table 1

year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
number of anomalous temperatures	9	28	33	29	37	13	14	13	14	18	29	34
year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
number of anomalous temperatures	25	25	30	18	29	28	36	23	23	33	68	21

One of the main tasks of the National Institute of Meteorology and Hydrology (NIMH – BAS) is the information protection of society. The site of the Institute offers the latest information on potentially hazardous weather phenomena in real time and for the near future in the country, the latest satellite and radar images, measurements of temperature, pressure, precipitation and cloud cover information. Dangerous phenomena are distinguished in four color

codes according to the hazard of their manifestation [6, 7, 8]. Based on these characteristics is processed and presented in Table 1 information regarding the extremely low and extremely high temperatures in the region of Shumen during 1990 – 2013.

As is known [3], the main statistical method for the study of relationships in which the factor variables and resulting variables are quantitative characters is regression analysis. In it, the magnitude to be estimated (extrapolated) for a future period of time is represented by a mathematical function of time, called the smoothing function. Its parameters are determined by point statistical estimates based on data in previous moments of time. Very often we choose the smoothing function to be a polynomial of s-th degree. If the selected polynomial degree is not consistent with the empirical data, all made to date calculations should be repeated using a polynomial of higher degree [1]. If instead of a simple polynomial the Chebyshev polynomial is used, the conciliation of the degree of the polynomial to the empirical data is performed much easier. This is the reason to analyze the frequency of extreme weather and climate events by orthogonal polynomials of Chebyshev [3]:

$$L(t) = \sum_{n=0}^{s} \hat{C}_n . Z_n(t) = \hat{C}_0 Z_0(t) + \hat{C}_1 Z_1(t) + \ \ldots + \hat{C}_n Z_n(t) \qquad (1)$$

$\hat{C}_n$, $n = 0,1,\ldots,s$ are statistical estimates of the coefficients, $Z_n(t)$ is a polynomial of Chebyshev from n – th order, defined on the set $\{ t_1, t_2, \ldots, t_N \}$.

Regression coefficients are calculated using the formula:

$$\hat{C}_j = \frac{1}{H_j} \sum_{i=1}^{N} v_i Z_j(t_i) \ \ (j = 0,1,\ldots,n;\ n < N), \qquad (2)$$

where $H_j = \sum_{i=1}^{N} Z_j^2(t_i)$ and v_i - number of extreme events (days) in the i – th year.

Orthogonal polynomials of Chebyshev with a first coefficient, which is equal to one, shall be determined as follows:

$$Z_o(t) = 1$$
$$Z_1(t) = t^1$$

and then by the recurrent formula:

$$Z_{j+1}(t) = t\, Z_j(t) - \frac{H_j}{H_{j-1}} Z_{j-1}(t) \quad (j = 1,2,\ldots) \qquad (3)$$

$$\mathrm{H_j} = \frac{(\mathrm{j!})^2(\mathrm{N+j})(\mathrm{N+j-1})\ldots(\mathrm{N-j})}{4^{\mathrm{j}}[(2\mathrm{j}-1)]^2(2\mathrm{j}+1)}, \frac{\mathrm{H_j}}{\mathrm{H_{j-1}}} = \frac{\mathrm{j}^2(\mathrm{N}^2-\mathrm{j}^2)}{4(2\mathrm{j}-1)(2\mathrm{j}+1)} \ \ (\mathrm{j} = 1,2,3,\ldots) \qquad (4)$$

The assessment, which is accepted to be called "smoothed function" has the form:

$$\hat{L}(t_j) = \sum_{n=0}^{r} \hat{C}_n \hat{Y}_n(t_i) \qquad (5)$$

$$\hat{C}_n = \frac{\sum_{i=1}^{m} v_i . Y_n(t) . w_i}{\sum_{i=1}^{m} Y_n^2(t_i)}, \ n = 0,1,\ldots,s \qquad (6)$$

$$Y_n(t_i) = \frac{Z_n(t_i)}{\sqrt{w_i}}, n = 0,1,\ldots,s \quad \text{and} \ w_i = \frac{\sigma_0^2}{\sigma_i^2} \qquad (7)$$

is a summary of the polynomial (1). $Y_n(t_i)$ are called Chebyshev polynomials with weight, as they report the relative importance (severity) w_i of the i-th measurement.

The introduction of the weights of the measurements allows for smooth phenomena, as for the data from a meteorological station as well as for the data from different weather stations.

Model: Be investigated anomalous temperatures within the region of Shumen for 1990 – 2012 and the trend of development for the next five years.

We find the optimal degree of the polynomial describing the evolution of the anomalous temperatures. For optimal shall be accepted this degree n of the polynomial in which the value of the dispersion σ^2practically ceases to decline.

The meanings of the argument are given stepwise, $h = 1$ and the weight $w = 1$, as observations of different weather stations with equal accuracy.

After substitution in (3), taking into account (4) and the data in Table 1 for the number of dangerous temperatures within the region of Shumen, a Chebyshev polynomial $Z_n(t)$ of 7-th order, defined on the set $\{t_1, t_2, \ldots, t_{23}\}$:

$$Z_o(t) = 1$$
$$Z_1(t) = t^1$$
$$Z_2(t) = t^2\, Z_1(t) - \frac{H_1}{H_0}\, Z_1(t) = t^2 - 44$$
$$Z_3(t) = t^3\, Z_2(t) - \frac{H_2}{H_1}\, Z_2(t) = t^3 - 79\, t$$
$$Z_4(t) = t^4\, Z_3(t) - \frac{H_3}{H_2}\, Z_3(t) = t^4 - 112.43\, t + 1470.92$$
$$Z_5(t) = t^5\, Z_4(t) - \frac{H_4}{H_3}\, Z_4(t) = t^5 + 145\, t^3 + 4043.95\, t$$
$$Z_6(t) = t^6\, Z_5(t) - \frac{H_5}{H_4}\, Z_5(t) = t^6 - 176.82\, t^4 + 7621.47\, t^2 - 46804.67$$
$$Z_7(t) = t^7\, Z_6(t) - \frac{H_6}{H_5}\, Z_6(t) = t^7 - 207.85t^5 + 11852.57t^3 + 164807.13t$$

and the relationships $\frac{H_j}{H_{j-1}}$ for $j = 1, 2, \ldots, n$; $N = 23, n < N$ and the estimates of the smoothed regression coefficients $\hat{C}_n$ of the polynomial (5) of Chebyshev are given in Table 2.

Table 2

n	0	1	2	3	4	5	6	7
$\frac{H_j}{H_{j-1}}$	44	35	33.43	32.57	31.82	31.03	30.15	29.18
$\hat{C}_j$	26.48	0.7876	0.1053	0.0133	0.0013	0.0010	-0.00002	0.00001

Table 3 summarizes the calculation of the abnormal temperatures.

Finding the dispersion about the smoothed curve required calculation the sum of the squares of the deviations S_n by the formula:

$$S_n = \sum_{k=1}^{N} w_k\, v_k{}^2 - (\hat{C}_0^2 H_0 + \hat{C}_1^2 H_1 + \cdots + \hat{C}_n^2 H_n) \qquad (8)$$

and the relations

$$\frac{S_n}{N-n-1} = \frac{1}{N-n-1}\sum_{k=1}^{N} w_k [v_k - \sum_{j=0}^{n}(\hat{C}_j)_e Z_j(t_k)]^2 \quad (9)$$

for $n = 0,1,2,3,4,5,6,7$ using (4).

Table 3

t	v	$(v-\hat{C}o)^2$	Z_1	$v*Z_1$	Z_2	$v*Z_2$	Z_3	Z_4	Z_5	Z_6	Z_7
1	9	305.55	-11	-99	77	693	-462	2 508.00	-12 540	58 140.00	-250 449.23
2	28	2.31	-10	-280	56	1568	-210	228.00	4 560	-52 854.55	387 057.90
3	33	42.51	-9	-297	37	1221	-18	-1 074.86	10 260	-58 140.00	204 913.01
4	29	6.35	-8	-232	20	580	120	-1 628.57	9 120	-21 141.82	-113 840.56
5	37	110.67	-7	-259	5	185	210	-1 637.14	4 620	19 750.91	-281 605.59
6	13	181.71	-6	-78	-8	-104	258	-1 280.57	- 720	45 065.45	-248 052.59
7	14	155.75	-5	-70	-19	-266	270	- 714.86	-5 220	48 845.45	-82 261.26
8	13	181.71	-4	-52	-28	-364	252	- 72.00	-7 920	33 970.91	109 857.90
9	14	155.75	-3	-42	-35	-490	210	540.00	-8 460	8 198.18	237 902.10
10	18	71.91	-2	-36	-40	-720	150	1 037.14	-6 960	-19 080.00	254 114.69
11	29	6.35	-1	-29	-43	-1247	78	1 359.43	-3 900	-39 354.55	160 363.64
12	34	56.55	0	0	-44	-1496	0	1 470.86	0	-46 800.00	0.00
13	25	2.19	1	25	-43	-1075	-78	1 359.43	3 900	-39 354.55	-160 363.64
14	25	2.19	2	50	-40	-1000	-150	1 037.14	6 960	-19 080.00	-254 114.69
15	30	12.39	3	90	-35	-1050	-210	540.00	8 460	8 198.18	-237 902.10
16	18	71.91	4	72	-28	-504	-252	- 72.00	7 920	33 970.91	-109 857.90
17	29	6.35	5	145	-19	-551	-270	- 714.86	5 220	48 845.45	82 261.26
18	28	2.31	6	168	-8	-224	-258	-1 280.57	720	45 065.45	248 052.59
19	36	90.63	7	252	5	180	-210	-1 637.14	-4 620	19 750.91	281 605.59
20	23	12.11	8	184	20	460	-120	-1 628.57	-9 120	-21 141.82	113 840.56
21	23	12.11	9	207	37	851	18	-1 074.86	-10 260	-58 140.00	-204 913.01
22	33	42.51	10	330	56	1848	210	228.00	-4 560	-52 854.55	-387 057.90
23	68	1 723.91	11	748	77	5236	462	2 508.00	12 540	58 140.00	250 449.23
S_n	**609**	**3255.74**	-	**797**	-	**3731**	-	-	-	-	-
H	-	-	**1020**	-	**35420**	-	**1184040**	**11018821.14**	**1227096000**	**$3.4*10^{16}$**	**$1.24*10^{20}$**

The values of the dispersion σ^2 for the different grades is given in Table 4.

$$\sigma^2 \approx \frac{S_1}{N-2} \approx \frac{S_2}{N-3} \approx \frac{S_3}{N-4} \approx \frac{S_4}{N-5} \approx \frac{S_5}{N-6} \approx \frac{S_6}{N-7} \approx \frac{S_7}{N-8}$$

Table 4

n	0	1	2	3	4	5	6	7
σ^2	147.99	112.26	94.18	84.03	80.33	30.32	28.52	20.73

The table shows that the ratio (9) practically steady drops at s = *3*. Therefore, the optimal degree of the polynomial is s = *3*.

But before we write down the empirical formula finalized, it is desirable to evaluate the errors in the determination of its parameters and to round up the found meanings of the parameters, taking into account the errors. In this

example, the dispersion σ^2 of the measurement results is assessed by the magnitude $\sigma^2 \approx \frac{S_3}{19} = 84.03$.

So the average square errors in determining the parameters $\hat{C}_0, \hat{C}_1, \hat{C}_2$ and $\hat{C}_3$ are evaluated by the following values:

$$\sigma(\hat{C}_0) = \sqrt{\frac{\sigma^2}{23}} \approx 3.6534\ ;\ \sigma(\hat{C}_1) \approx 0.0824;\ \sigma(\hat{C}_2) \approx 0.0024\ ;\ \sigma(\hat{C}_3) \approx 7.0968 * 10^{-5}$$

We round that found previously definitions of the parameters, taking into account the amount of numbers of decimal places of the errors above.

From (5) we calculate the smoothed values of the polynomial $\hat{L}(t) = \sum_{j=0}^{3} \hat{C}_j Z_j(t)$ and then the extrapolated values for anomalous temperatures.

Therefore, the pattern of change of days with abnormal temperatures within the region of Shumen by Chebyshev polynomials for a period of 23 years is as follows:

$$\hat{L}(t_j) = \hat{C}_0 + \hat{C}_1 t + \hat{C}_2(t^2 - 44) + \hat{C}_3(t^3 - 79\,t) = 21.85 - 0.2632 * t + 0.1053 * t^2 + 0.0133 * t^3$$

The calculated values of $\hat{L}(t_j)$ for each of the years studied and the extrapolated values for the next five years are shown in Table 5 and the trend is denoted by star.

Table 5

year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
anomalous temperatures	9	28	33	29	37	13	14	13	14	18	29	34	25	25
$\hat{L}(t_j)$	19.77	21.70	23.05	23.88	24.29	24.35	24.14	23.74	23.23	22.69	22.20	21.84	21.70	21.84
Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013***	**2014***	**2015***	**2016***	**2017***
anomalous temperatures	30	18	29	28	36	23	23	33	68					
$\hat{L}(t_j)$	22.36	23.32	24.82	26.92	29.72	33.29	37.70	43.05	49.41					
trend										56.86	65.48	75.35	86.54	99.15

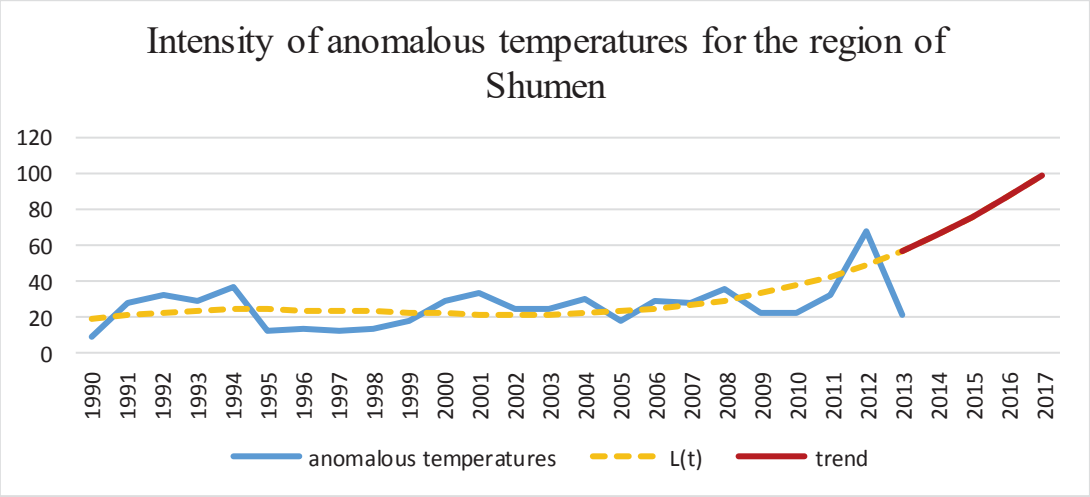

Fig. 3 Model of the intensity of anomalous temperatures for 1990-2012 on the Shumen region, and the estimated trend for the next five years.

The presented statistical model of anomalous temperatures on the territory of Shumen region can be accepted as optimistic. It is visualized in Figure 3. From the figure and the model calculations in Table 5, it is clear that the tendency of days with abnormal temperatures is to increase.

For pessimistic can be considered the model presented in the fourth degree of the polynomials of Chebyshev. Therefore, a model of change of days with abnormal temperatures within the region of Shumen for a period of 23 years, is as follows:

$$\hat{L}(t_j) = \hat{C}_0 + \hat{C}_1 t + \hat{C}_2(t^2 - 44) + \hat{C}_3(t^3 - 79\,t) + \hat{C}_4(t^4 - 112.43\,t + 1470.92) =$$
$$23.76 - 0.4094 * t + 0.1053 * t^2 + 0.0133 * t^3 + 0.0013 * t^4$$

The calculated values of $\hat{L}(t_j)$ for each test years and the extrapolated values for the next five years are shown in Table 6 and the trend is denoted by star.

Table 6

year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Number of anomalous temperatures	9	28	33	29	37	13	14	13	14	18	29	34	25	25
$\hat{L}(t_j)$ s=4	22.95	21.99	21.68	21.82	22.21	22.72	23.23	23.65	23.91	24.00	23.93	23.71	23.42	23.16
year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013***	**2014***	**2015***	**2016***	**2017***
Number of anomalous temperatures	30	18	29	28	36	23	23	33	68	21				
$\hat{L}(t_j)$ s=4	23.04	23.23	23.91	25.30	27.64	31.22	36.34	43.34	52.59					
trend										64.49	79.47	98.00	120.55	147.66

Therefore, the statistical model of abnormal temperatures on the territory of Shumen region has the visualization in Figure 4.

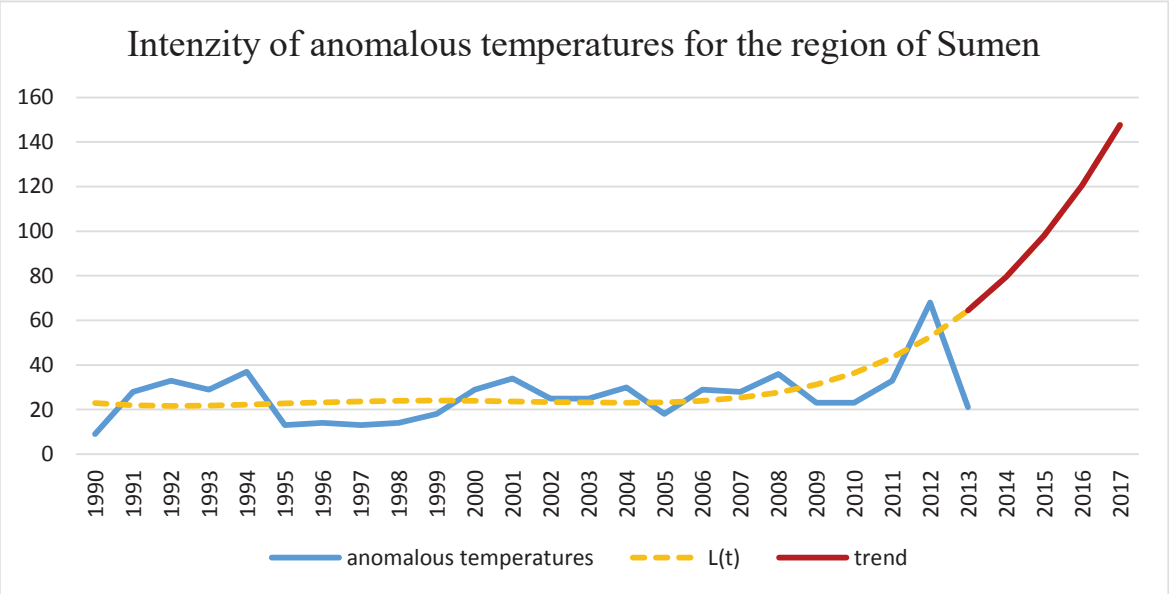

Fig. 4 Model of the intensity of anomalous temperatures for 1990 – 2012 on the Shumen region and the trend for the next five years.

From Figure 4, illustrating the second model, we can see a trend of increasing the number of days with anomalous temperatures for one year, but it is steeper.

Conclusion:

Extreme climate and weather events cause extensive damage to infrastructure and high costs for the economy and society. Sectors whose development depends to a large extent by temperature, such as agriculture, forestry, energy and tourism, can be greatly affected.

From the research done on both models of change in the number of days with abnormal temperatures in Shumen region shows that despite the observed warming and drought globally, in the short term tends to increase. The first model (Fig. 3) expressed by a third order polynomial is more optimistic, since the curve of the increase in days of abnormal temperatures is smoother. Also, when calculating the trend for the next five years, we can see a gradual increase in the number of days with anomalous temperatures for one year. The data for 2013 which are not included in the calculations (21 pieces), are about 30% of the values for 2012. This shows that the model will likely need to be adjusted, taking into account the data for subsequent years or taken with less weight for the years having minimum or maximum values of the extreme climate and weather events.

The second model (Fig. 4) expressed by a polynomial of fourth degree is more pessimistic, because the curve of the increase in days of abnormal temperatures is steeper and in the calculation of the trend for the next 5 years there has been a sharp increase in the number of days with abnormal temperatures.

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APPROACHES ABOUT EVALUATION ON THREATS' INFLUENCE UPON SOCIAL ORGNIZATION

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ABSTRACT:
The analysis about margins of negative effect of threats' influence upon security system's vulnerability is a basic component in the process of organizing counteractions to encroachments on company security. While the estimation of influence is being made, the following factors should be taken into consideration: the likelihood for the threat to appear, the continuance of its existence, the time about keeping the asset's value and to what extent its defence is appropriate.

KEY WORDS: *Company security system, evaluation on assets, sources of threat, vulnerabilities, threats, indefensibility, mechanisms, methods, contrivances for counteraction,security environment, management, protection, encroachments.*

First of all, for making one effective analysis about margins of negative effect of sources of threats' influence on security system's vulnerability in the process of organizing counteractions to encroachments on company security, it's necessary for the efforts to be directed to opportunely and entirely identification of threat's sources that jeopardize reaching organization's objectives, their prioritizing depending on the degree of danger and negative influence.

The development of information society causes not only the accumulation of different kinds of threat's sources, but also the growth of their potential, motivation, the capacities for threats' realization, the means and forms of their working.

Nowadays, global security environment is determined by the development of traditional and the appearance of new asymmetric threat's sources characterized by a high stage of contingency and unpredictability and disruptive effect caused by their activity.

International terrorism, the dissemination of weapons of mass destruction, the transnational organized crime, the corruption, illegal traffic in arms and weapons, people and goods, drug-traffic, the disruptive influences upon

information systems and network, money laundering, the acts of bankrupted countries and governmental regimes, industrial espionage, unfair competition and so on are the activities belonging to threat's sources in global aspect and they are the heralds of the main characteristics of very complex and dynamically variable security environment.

Studying the interdependence and interpenetration of asymmetric threat's sources, knowing their composition and possible influences are the prerequisites for optimal identification and making an objective analysis and estimation of their influence upon social organization.

„Identifying threat's sources is realized on the basis of „different factors, including capacity, intention, influence, intensity of attack and so on" [1].The application of one inclusive and comprehensive approach about threats' identification minimizes the danger not to recognize the events and processes which future development would imperil the social organization.

Identifying not only the definite source of the treat on principle, but striving for detailed studyof its nature, structure and organization, motives and conditions of appearance, its basic components and their main constituent parts, methods and forms of impact, the symptoms for appearance gives the right objective idea for the threat. This is exactly the appropriate basis for proactive strategies' application to influence upon conditions and reasons of emerging, capabilities, intentions, motivations and courses of threat's sources, forms, contrivances and symptoms of appearance and also for creating one adequate system of measures for defence against their influence and integrated reliable counteraction management policy to potential encroachments of threat's sources on system's vulnerabilities.

One of the most important moments in the process of identifying the threat's source is defining the so-called „critical indicators". „Critical indicators are important indices for passing processes and the eventual ultimate condition of consecutions"[2]. Critical indicators are signs for appearance of the definite threat's source which emergence is an indication for the gravity and the irreversibility of influence on social organization as well as a sign of the difficulty and the impossibility to counteract to threat's source and to minimize the damages [8]. Defining these symptoms is of crucial significance for realizing the opportunity to counteract reliably to the threat or to neutralize detected influences of the threat's source.If the critical indicators aren't recognized or are underestimated, the processes of negative impact would attain uncontrollable character and cause permanent disturbances in the organization's sustainability and prevent from reaching its objectives.

Recognizing the critical indicators also would enable an effective and efficient management of organization's resources used to counteract to threat's sources. Resource expenditures for neutralizing non-essential forms and symptoms of the threat's source appearance would restrict the opportunity for

defence against their advent with critical significance for organization and would hamper application of proactive strategies for counteraction.

Creating a detailed and comprehensive picture of the nature, the motivation, working methods of the threat's source is realized on the basis of identifying, analysis and evaluation on past and current manifestations of the threat's source and prognosis about its future development.

The process of attaining information about past and current activity of the threat's source is a huge task that includes historical survey on detected, averted and neutralized activities of the source, data about breaches of order and incidents relative to symptoms of one threat's source, the results of current investigations or revealed symptoms of source's impact and so on.

This gained data should be systematized and data processing is advisable in order to make possible their computer processing and optimizing the information process. The processed data allow the basic characteristics of the threat's source to be defined as well as symptoms before emergence, making further analysis and evaluation on their influence upon social organization's functioning.

One of the most important activities in the process of identifying threat's sources is predicting their development and dynamics of changes in the root of the matter, the motivation, the capacity, the methods of working and the symptoms and so on. The high complexity of security environment and the sources of threats hampers predicting future manifestation of the source but it's possible to predict tendencies and parameters related to future development of threat's sources and the risk for social organization on the basis of knowledge about past and current activity of the threat's source as well as applying the models and conceptions about strategic management.

The source of threat is being evaluated through considering the following factors: the presence of the source in the security system of the social organization, the capabilities for negative impact, the motivation and intention to cause the threat, the activity of the source in the past, trustworthy information about the direction of the threat's source towards organization and preparation for making a negative impact or encroachment.

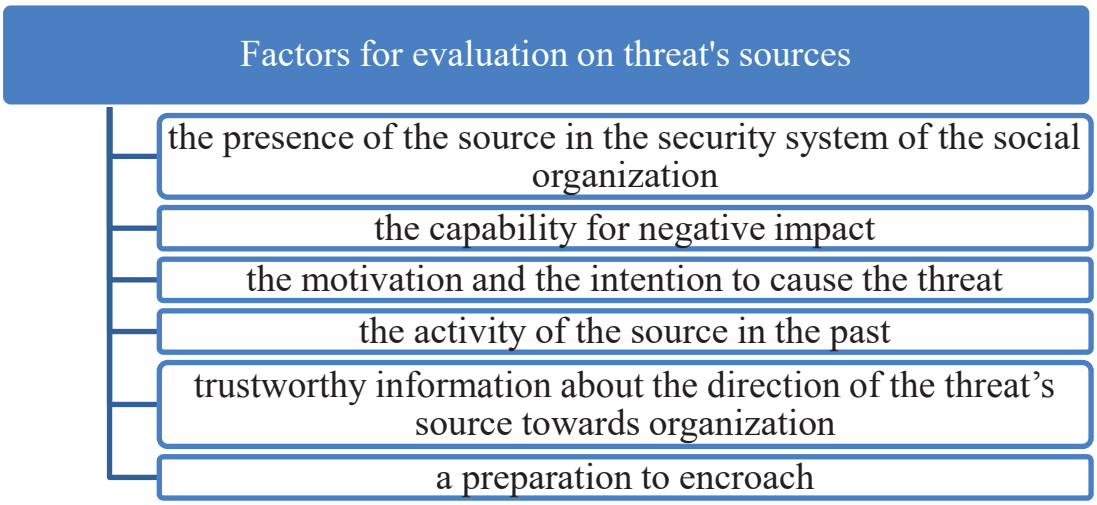

Figure.1. Factors for evaluation on threat's sources

Identifying of threats could be made through different techniques as review and analysis of documents, interviewing, filling in question forms, working groups formed to identify indefensibility, scenario analysis, brainstorming, auditions and inspections, investigating the incident and so on. The organization of the activity includes formation of structures with set purpose to analyze and evaluate the threats – self-dependent structures or as a part of some analytical units, but also working groups which task is to identify threats and encroachments on social organization.

Identifying threat's source as a crucial moment in the process of counteracting to encroachments is an extremely significant prerequisite for having an objective evaluation on the environment in which organization operates as well as threats and evolving risks in connection with implementation of the mission.

High complexity of the security environment and dynamics of its changes make difficult and even impossible complete identifying of threat's sources. Regardless of the scope of gained data about potential threats for organization, the complete knowledge about threat's sources is impossible as well as the entire information about threats' characteristics that have been already identified.

This impossibility doesn't concern counteraction management in the sphere of security and determines the requirement for prioritizing threat's sources in conformity with the level of danger for social organization [8].

The objective impossibility to entirely identify threat's sources means that the efforts should be directed to optimal identifying of basic, critical to organization's functioning threats and also to creating one reliable system made of mechanisms and procedures for defence and control in order to prevent and neutralize the negative influence of the threat's source and minimize the harmful consequences [8].

After identifying the threat's source the next step of the organizational process of counteracting to encroachments on organization is turned out to be the analysis of adverse effect's level while the sources of threats are influencing upon the vulnerability of the security system [8].

Evaluation on influence must be made considering the probability for the threat to appear, its life period, the time for saving the value of the asset and expedience of its defence. The likelihood of threat's appearance is influenced by following factors[9]:

- Attractiveness of the asset;
- Accessibility to the asset for deriving benefits;
- Possibilities for creating a threat;
- The possibility for threat's appearance;
- The possibility to use vulnerable places [8];

Many methods suggest using tables and various combinations of subjective and empirical measures. Each organization should select the most appropriate and trustworthy method which gives reproductive results.

For the time of this analysis the information is being processed which is gained by characterizing social organization, identifying the vulnerabilities, analysis of protection mechanisms and procedures of security system. The aim is on the basis of this analysis and analysis of security system's mission (its role for guaranteeing reliable functioning of organization), critical meaning (the value and significance of the system for social organization) and the sensitivity of the security system (components and units with high potential stage of vulnerability) to be defined the levels of heavy effects on social organization [5].

Defining the level of heavy effects on social organization is made through using qualitative and quantitative indices for evaluations on encroachments as each of the groups has its advantages and disadvantages. Qualitative indices for evaluation on encroachments are used for defining the likelihood and the potential of identified encroachments' influence on organization that creates conditions for encroachments to be prioritized. Basically the used technique is the matrix ,,probability-influence'' which estimates the probability and negative influence on the basis of particular scale.The positions on the matrix are the comparative significance of the encroachment.

The main advantage of using qualitative indices is that they prioritize encroachments and allow identification of security system's units which need immediate improvement of indices in terms of their vulnerability [8].

One defect which could be noticed is that qualitative indices for evaluation don't propose the opportunity for doing specific quantitative measurements of the size and intensity of negative influence.

Quantitative analysis aims to measure in a quantitative way the general influence of the encroachments on organization through using instruments like sensitivity analysis, decision tree, analysis „Monte-Carlo''. The purpose of this is creating a model of the organization and its units considering identified risks and analysis of their all-round influence through using statistics stimulation.

The basic advantage of quantitative indices is namely the presence of opportunity to measure comparatively the size and intensity of the influence. The faults are connected with shortage of meaning's clarity of quantitative indices for analysis under condition of digital expression of measurements and the necessity for additional interpretation at qualitative aspect. Besides while the size and the intensity of influence is being identified quantitatively, the following indicators must be clarified – frequency of threat's source influence on definite vulnerability of the system for particular time period, approximate value of each influence, weigh number defined on the basis of subjective evaluation on comparative influence of threat's source upon concrete vulnerability.

The detected negative influences actually could be measured by quantitative indices as profit loss, the costs for restoring the system, the level of efforts needed for damages to be removed caused by successful activity of the threat's source when the encroachment is realized and so on.

Other influences as loss of public thrust and reliability, destroying reputation and organization interests and abilities for completing the mission can't be measured quantitatively because they have qualitative features.

On the basis of prioritized significance of qualitative indices and characteristics for evaluation on the influence of threat's sources upon security system's vulnerabilities, one appropriate rating can be proposed that uses qualitative categories in relation to influence's magnitude – high, medium and low stage. [8].

High stage of negative influence is a result of threat's source's influence upon vulnerabilities that has for consequences inflicting extremely huge losses of resources and property, doing harms and impeding the implementation of the mission for social organization as well as its reputation and interests and also inflicting losses of human life or other serious injuring.

Medium stage of negative influence is provoked by negative influence that causes enormous losses of resources and property; these losses could not do harms, disturb or impede the implementation of the mission for social organization as well as its reputation or interests but their results could be staff injuring.

Low stage of negative influence is a fact when there is an influence resulting to losses of some temporary resources and property or affecting the implementation of organization mission or its reputation and interests. (Table 3)

Table 3: Stage of threat's source's influence on the vulnerability

The magnitude of influence	Defining the influence
High	The influence of threat's source upon vulnerability causes extremely huge losses of resources and property, serious disorder as well asharms or impeding the implementation of the mission for social organization and its reputation and interests; inflicting losses of human life or other serious injuring.
Medium	The negative influence of threat's sourcecauses huge losses of resources and property and also could do harms or disturb and impede mission implementation, organization reputation and interests; staff injuring.
Low	The negative influence of threat's sourcecauses loss of some temporary resources and property or affects mission implementation of organization or its reputation and interests.

Qualitative indicators are quite reliable and enable prioritizing the encroachments and adequate planning the measures for optimization of the security system and auspicious protection for social organization from threat's sources.

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THE COMPANY SECURITY SYSTEM – A CONTRIVANCE TO COUNTERACT TO ALL POSSIBLE ENCROACHMENTS

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ABSTRACT:
Usually the business organizations all together underestimate and don't have knowledge about the basic kinds of threats and encroachments for organization. In this context the report aims to form a standpoint on the gist of the term ,,company security'' and also to define the company security system as a general contrivance for counteraction to all possible encroachments.

KEY WORDS: *company security system, turbulence, security environment, management, business organization, protection, in- and outside factors, encroachments, counteraction.*

The economic system of each society consists of many business organizations. For this reason the successful, complete and effective solution of tasks in front of economic security of each country depends on effectiveness of their activity.

Usually the business organizations all together underestimates or don't have a knowledge about the basic kinds of threats and encroachments for the company. In this context the report is thought to form a standpoint on the gist of the term ,,company security'' and to define the company security system as a general contrivance for counteracting to all possible threats.

According to Krasimir Manev ,,Business is an economic activity which is realized by a entrepreneur on his own risk and under his responsibility with the purpose for gaining the profit. Business is an activity and its decisive final result is the profit and nothing else"[1].

According to Gencho Sandev ,,The company is the self-dependence system (subject) with powers of legal entity that produces and offers production, does activities and renders services"[2].

Indefensibility, threats and encroachments of business organization brings to deflection of one or more results of one or more future events towards their anticipated value.

There are various definitions for company security that differ more in the their word game than in their character and scope. Some of them are discussed below:

Felix Balachev defines the company security as a complex of interrelated undertakings and activities for defence (physical and informational) of legal entities as well as their material and intellectual property, technical and human resources and their rights and judicial interests against anti-governmental encroachments with reason to ensure sustainable functioning of the business and to create conditions for sustained and successful activity.

According to Krasimir Manev „Company security reflects on the ways and levels of business organization's interaction with external and internal environment in which it operates and develops"[3].

Nikolaj Caprev considers company security as a complex of interrelated premeditated undertakings and activities that are worked out as an integrated system called „A concept for company security". Company security could be defined as a complex of specific activities (efforts) and a structure for physical and informational defense of people, financial resources, material and intellectual property with the purpose to ensure sustainable functioning and to create conditions for sustained and successful work.

According to B. Asenov „Company security includes those factors and conditions in one particular company which guarantee realization of set objectives and tasks by its management" [4].

Company security is supplied by the system consisted of production and economic, administrative, legal, organizational and interpersonal relations practiced in the company. They are created on the bases of existing laws and other normative acts in the country as well as on the basis of inner legal regulations and orders issued by company owner and manager.

Gencho Sandev considers „Company security as a state of its comparative sustainability reached by activities for prevention, revealing and neutralization of various dangers and forms of influence" [5].

Emil Vasilev defines company security as a category with high stage of abstract level that is a relative matter. According to him:

„Company security is cumulating activities realized within business organization because of avoiding, prevention, detection, revealing, intercepting and suspending of unfair competition" [6].

This characteristics' unification of examined approaches for analysis of the term – company security provides the following definition about company security:

- Company security is a mix of interrelated undertakings and activities realized in business organization with purpose to prevent, reveal and neutralize different threats and forms of encroachments.

Future of business organization is impossible without incessant attaining of knowledges and skills needed for counteracting to all kinds of encroachments against company. In connection to this the protection of threatened businessman's company is assured by creation of effective system for company security.

Business organization is defined as an open system which is influenced by various factors. Some of these factors are positive but others are negative and several ones are marked with high level of risk and also can be responsible for business organization's bankruptcy. Because of this identification of destabilizing factors and sorts of encroachments is the foundation where the company security management should be sub-structured.

As an aim company security suggests highlighting and solving different tasks. This is bound up with basic management functions that are planning, organizing, staffing with employee motivation, management and controlling in autonomous management system designed for company security (Figure 1).

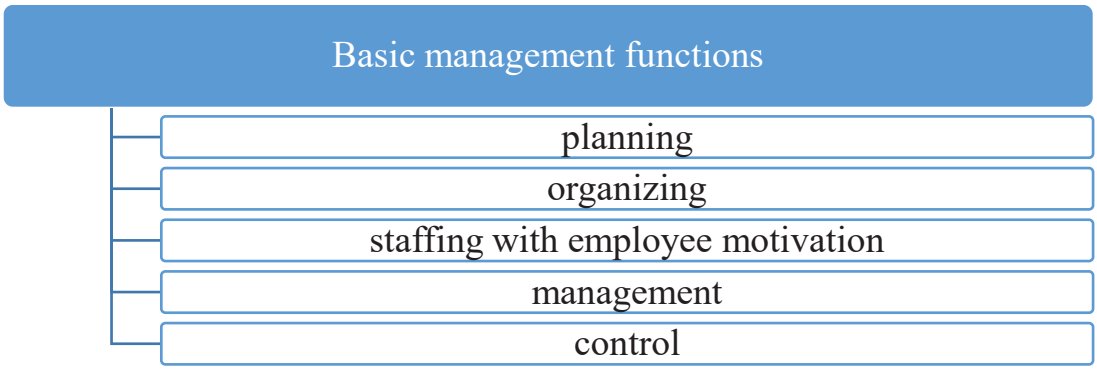

Figure1. Basic management functions

Planning is a process which includes defining the goals and adopting the decision about what actions will be undertaken to achieve these purposes.

Organizing includes usage and coordination of main company resources so that intelligence plan can be completed. These are people, resources, time and money.

Staffing with employee motivation is an activity for attracting and keeping competent and highly skilled personnel in all particular directions that is able to carry out the planned undertakings. This includes also training and improvement of qualification.

Management. The duty and the right of the security service manager is properly to manage, guide and organize the activity of the security section. The

responsibility of the entire management for the company belongs first and foremost to the top management [10].

Control. It's always needed the report on done tasks and activities. How are the planned undertakingscarried out? To what extent is the schedule for separate tasks observed?

Mechanisms for management and functioning are accumulation of statement acts, legal norms, methods, measures, strengths, contrivances and communications which all help the subject to influence on the object for accomplishing the objectives of the system.

The security system will do the current tasks when it works or when considers its functions as practical actions for accomplishing business objectives under condition of competitiveness, economic risk, threats and encroachments.

The company security could be studied not only as a management system but as condition and a process too [5].

As a condition it must be evaluated through expert evaluation by specialist that finds through different specific instruments the existing encroachments against the company and expresses the grounded supposal about availability of their forms, means and methods, related to particular symptoms. Usually the availability of encroachment is detected when it has already been initiated and then this fact should be complied with current status of the security system in the company. The affair in question is to what extent the existing company security system is adequate to forms, contrivances and methods against the revealed encroachments and whether its reconstruction is necessary if it doesn't exist at all.

As a process the company security might be improved and directed through management, judicial, technical and informational and other special actions.

The company security system is built on the basis of particular principles. Observation on each of them in combination with the rest guarantees the effectiveness of the company security system. The main principles for creating such system are the following ones (Figure. 2):

- Follow the policy and the strategy of the company [10];
- Observation on the balance between human rights and security requirements;
- complexity;
- the priority of measures for prevention;
- uninterruptedness;
- legality;
- the planning activities;
- economy;
- coordination and interaction;
- the proper combination between public awareness and confidentiality

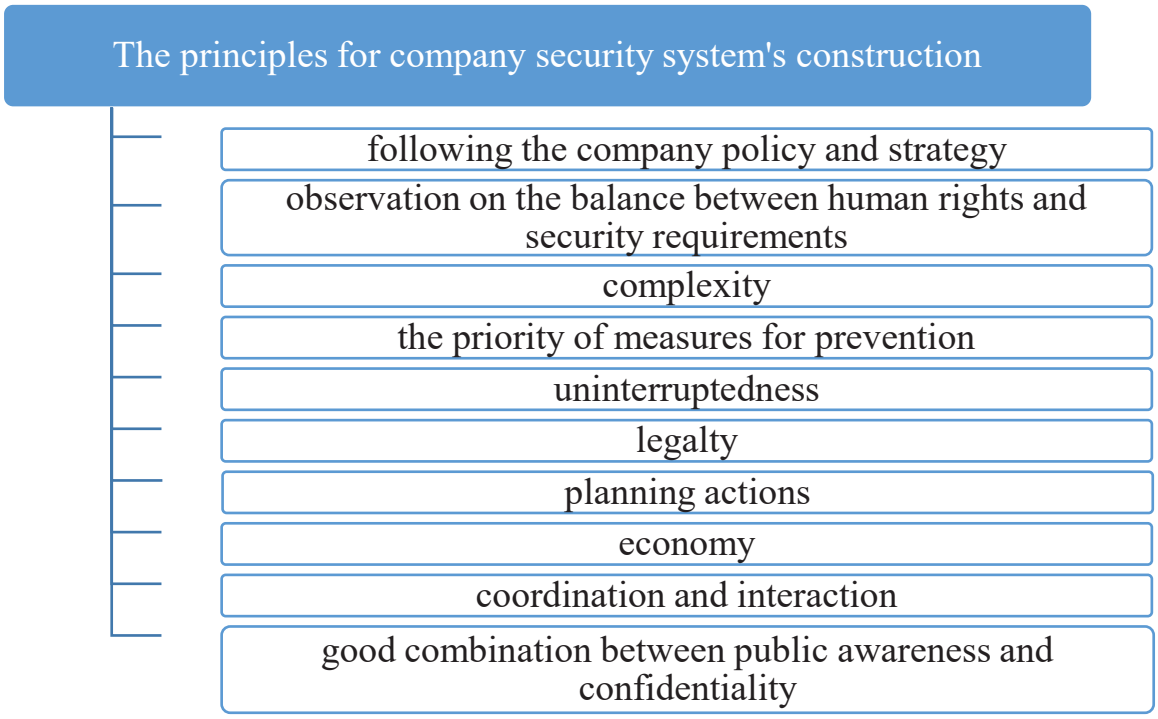

Figure. 2. Principles for security system's construction

The subject of company security consists of two groups of units that take care of this activity in the company and external organizations.

First group includes these subjects that are a part of company organization. First group embraces the special subject – security structure, half-special – the unit ,,human resources'', the law unit, financial unit, the entire staff who is taking care of the security.

Second group includes these subjects that are outside the company scope and doesn't depend on its management. These are first and foremost the governmental and public institutions that create conditions for ensuring the company security.

The objects of security are company staff (managers, shareholders, substructures, services, partners, assistants and experts); different kinds of company activities (production, sales, management, supplying and so on); the properties and resources of the company (material, technical, informational, intellectual and so on) [10].

Working out one successful company security system requires clarifying the questions concerning its sufficiency and the need for it. For the purpose of this, practical system should be worked out that includes researching, analysis, organization and realization of defense measures, complied with the specifics of each object. All of this must be primarily considered and elaborated as united system called ,,A concept for company security''. This conception aims to structure the basic (starting-off) point of views as a method for understanding and explaining the crucial idea for defense that defines objectives, tasks and

priorities of company security building and development . The necessity of company security's application is formed by its elements so that the need for their separate or total application gives the answer to the question about necessity of applying the company security. On the other hand the need is defined by various factors like the company locality and its production business establishments, the competitiveness in relevant sphere and criminological background.

There is sufficiency when each element of the company security system is dosed, properly set, interrelated with others and answering adequately to threats.

Usually destabilizing factors of organization possess multiple characters and specific ways of influence. In connection to this organization's protection must be built by adequate complex of prevention activities, revealing and neutralizing different kinds of dangers, threats and encroachments.

On this very basis the company security is defined as a condition of its comparative sustainability and is accomplished by cumulating of prevention activities, revealing and neutralizing different threats and encroachments.

Because of their complex character and the necessity for rational combining and usage, these activities could not be done only by structures of business organization which are responsible for economic tasks. This sets the pattern for building specialized security system.

According to Emil Vasilev company security system means activities for defense the business against encroachments, that are practically organized in business organization under the guise of specialized autonomous management system.

According to Gencho Sandev, company security system unifies many end interrelated elements that secure sustainable functioning of the system and accomplishment of business objectives. Compound elements of such system are the subject and the object of the security, management mechanisms and those for functioning as well as practical activities for guaranteeing the security.

The usage of forms, contrivances and methods for counteraction depends on the will of affected business organization. It's possible for organization not to understand that it's the subject of encroachment or through realizing this it refuses to take actions for defense. Taking whatever actions deliberately by this suffered business organization with the purpose for defense itself is a fresh start for a new sort of business relations – on the occasion of company security

These relations exist between same subjects but through different forms, contrivances and methods. Affected business organization turns into initiator for creating company security system. And vice versa the initiator of concrete encroachment is suffered by the form, contrivances and methods of company security. The raising disadvantages for initiator are fair vendetta because of the initiated disloyal relations.

In practice activities related to company security don't have repeated situations and ready solutions. Each case is unique.

The company security system complies with forms of different encroachments as a concrete, practical manifestation of the form of abstact generic term ,,company security''. The company security system in one business organization is actually the defined company security in conformity with aspects [10].

In reality the kind of encroachments against business organization complies only with the company security system like a form. This is because the particular business organization is not capable to oppose to each form of encroachment as self-dependence, management system for company security [10]. The company security system must be united because of the necessity for easy and effective management and it could oppose to all possible forms of encroachments notwithstanding the numbers of initiators.

The company security system is considered not to be too expensive for its owner.

The purpose of the company security system is revealing threats, examining the defensibility of the objects, creating a system for assets' protection, averting and detecting the incidents and crimes, revealing encroachments, security [10].

The company security system should be built in the way in which it secures prevention so that it goes ahead before the events, not after them. Averting the crime or incident is more useful and profitable for business than revealing one [10]. The prevention activities create value and don't make expenditures for unplanned, low effective and late activities. This is possible through providing the forestall information about external environment, duly supplying with internal information, analysis of received data and on the basis of this the levels and basic directions of threats and encroachments are defined.

The company security system should oppose to all spectrum of threats and encroachments to accomplish its objectives.

According to Emil Vasilev, ,,At structural aspect the company security system is organized as company security service. The company security service means organizational structure of its systems to assure company security. Security service is material equivalent to company security like a system. This organizational structure is characterized by its hierarchical levels, positions of particular security employee as its detached elements, jobs' descriptions for each position contributed to individualize the particular structural elements, organizational links concerning coordination and subordination which weld together organization's structure's elements.'' [6].

On the basis of examined and systematized aspects of company security system company security service can be built and functions and tasks of separate

units in the hierarchy can be expressed in concrete form setting the following formulations:

- The defence of company security is a function of business organization as a whole and it's introduced and made by its security structures depending on their competency and in conjunction with their due functions and given powers, contrivance and methods for action [10].

- The company security system [10] is the only form of counteracting to different forms of all kinds of encroachments. In connection to this the company security service as a material expression about the real situation of the company security system turns out to be general contrivance for counteraction to all possible threats.

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