TRIZ-Summit cup – 2020/2021

Category 8-10 years

Nomination «Inventive activity»

Problem 1. All-purpose vehicle on the Mars. A Mars mission is described in one science-fiction story. A spaceship landed in a valley with a very uneven surface: everywhere there were hills, pits and stones. The spacemen quickly prepared an all-purpose vehicle – with wheels and big inflated tires. However, passing through the first steep hill the all-purpose vehicle fell on its side. And then… No, of course the inventor did not appear in the story. And what do you think, what would he propose to do? Please, take into account that the astronauts did not have an opportunity to remake this all-purpose vehicle (problem from the book by G.S. Altshuller «And then came the inventor»).

Analyze the test solution (given in the book): find the conflict pair, formulate the contradiction, IFR, describe, what technique is used for solving the contradiction. Propose other variants of solution.

Problem 2. The driver for Lunokhod (Moon-walker). Do you enjoy driving a model of a racing car with the aid of remoter control or to drive a training car along a complicated path? And now imagine that you are the driver of a Lunokhod (Moonwalker) – a real vehicle which is able to move throughout the Moon surface. In November 1970 the automatic spaceship «Luna-17» delivered to the satellite of the Earth the first apparatus, which performed the first direct exploration of the Moon surface. Lunokhod was controlled by a group of 11 persons, which constituted alternating crews: the command leader, the driver, antenna operator, navigator and onboard engineer. During the training session of the drivers at the Moondrome a problem appeared – the control of the Lunokhod was affected through telecast, i.e., the driver sees the Lunokhod on the screen, while the command, which it fulfills, is actually fulfilled only after a lapse of 3-5 seconds (time of the signal reaching the Moon, passing backwards and the time of signal processing) – this is very unusual for the driver and requires long training: «The engines are switched on. The Lunokhod rushed forward and immediately stood still – the driver ordered it to stop and the machine fulfilled the order. And the man could not explain, why the experiment was stopped, – it seemed to him that the Lunokhod moved sidewise. Control through television appeared to be far from being simple. There was a lack of space to which the human eyes are accustomed. After a lapse of 15 minutes the driver stood up from his armchair. And though it was rather cool in the room, one could twist his shirt for sweat – work at the screen required immense stress. Spending several hours near the screen, the driver got «immersed» in the environment and the Lunokhod became obedient, however, next day everything started from the very beginning – the newly acquired habits became dissolved». The situation is clear: the habits of driving the Lunokhod through television should be

retained for the longest possible period of time, but it is impossible to spend the entire time on training. What could you propose for the driver in terms of continuing to improve his skills of remote driving in everyday life? Formulate the contradictions, IFR and consider the available resources.

Nomination «Fantasizing»

Task 1. The novel «Rendezvous with "Rama"» by Arthur Clarke contains a description of a spaceship of invaders, the size of which amount to 50 kilometers. Use the technique of «magnifying» and describe the biggest spaceship, which you can imagine.

Task 2. In the science-fiction long short story by Genrikh Altov «The Third Millennium» it is described how the people disintegrated the planet of Jupiter into gas and dust (technique «Disintegration»). A huge cloud of dust appeared around the Sun. The cloud is as dense as the atmosphere of the Earth. It is possible to fly in it from one planet to another on jet airplanes and even on balloons. Clouds are gathered in the interplanetary cloud as well as thunderclouds, lightnings glare. Think of a story about the adventures of children, who went to Mars on a balloon.

Nomination «TRIZ tools»

Task 1. Space exploration implies amazing adventures, unusual discoveries, the joy of cognition of the unknown. This kind of research also has a purely practical application. You know, of course that Teflon coat, wireless electric tools, location-based services and many other inventions, which make our life safer and more comfortable, were made in space industry. The tasks in the nomination «TRIZ tools» will be associated exactly with such inventions.

1) Collect a card catalogue of «space inventions», which became widely spread in everyday life.

2) Formulate the contradictions, which are resolved in these inventions.

3) Propose the unusual application of these inventions for solving problems, which haven't yet been stated.

Task 2. Tales, myths and legends – it happens very often that this is the only opportunity to know how our distant ancestors lived. While it is so interesting to know what occurred on our Earth many centuries ago, what stories they told each other, what our ancestors thought about and what their dreams were. Would it be desirable for you that after a lapse of many thousand years people would know about your family, your friends and your city? Invent a fairy tale, a myth, a legend or a science –fiction story, which would be so interesting that it will be retold even after hundreds of years.

Nomination «Research».

Task 1. Since the very beginning of space exploration the human beings were accompanied (and sometimes substituted) by animals. For more than 60 years of space

research fairly different animals took part in space missions. Very interesting experiments organized in orbit, are associated with growing plants. Much time passed before it became possible to create such conditions, under which the plants not only increased their herbage, but also bloomed and yielded fruit. Thus, a topic for research is: «Animals and plants in space». You could choose for your research a more particular topic.

- Card-catalogue «Animals in space». Species of animal, date of space flight, duration of stay in space, goals of the experiment, results of the experiment.
- Card-catalogue «Plants in space». Species of plant, the date of дата полета в space flight, duration of staying in space, goals of the experiment, results of the experiment.
- Card-catalogue «Devices for supporting vital activity of animals in space». What problems were solved via each of these devices.
- Card-catalogue «Devices for supporting vital activity of plants in space». What problems were solved via each of these devices.
- What problems concerning adaptation of animals and plants to staying in space haven't yet been solved? Propose possible solution of these problems.

Nomination «TRIZ videos»

Task 1. Are there any places in your city, associated with space exploration? Make a newspaper report concerning a visit to the museum, exhibition or a scientific center. Try to interview specialists, who are connected with space research.

Task 2. Illustrate the process of inventive problem solving with the aid of cinema or animation. Think of stories, in which a problem appears, try to provide a detailed comment on what the contradiction consists in and what ideal solution it is necessary to find as well as what techniques are used for solving.

Videos should be short (from 2 to 10 minutes). It is necessary to indicate the names of the whole team, which prepared the video: screenplay writer, operator, mixer, actors, etc.

This work is directed at forming the methodological material for teaching TRIZ. The web-site of TRIZ Summit contains the videos, which were submitted to the previous TRIZ Summit Cup:

http://triz-summit.ru/ru/contest/competition/video/

https://www.youtube.com/channel/UCjMNOjboWRBQA72DJvaC7ew/featured

The tasks of TRIZ Summit Cup-2020/2021 were prepared by M.S.Rubin, N.V.Rubina, nomination «Fantasizing» was prepared by P.R.Amnuel.

Nomination «Inventive activity»

PROBLEM. Soft landing on Mars.

Mars mission is the dream of many space explorers. The first artificial object, which touched the surface of the Red planet was the Marswalker PrOP-M (Device for evaluating possibility - Mars). Soft landing took place on December 2, 1971. Let us try to pass a part of the route to Mars together with the landing apparatus, Marswalker and its designers. Thus, the landing apparatus reached the borders of Mars atmosphere and the aerodynamic (air) braking begins. A system of parachutes is activated for carrying out a soft landing.

Problem 1. In order to launch the functioning of the parachute system it is necessary to activate an auxiliary parachute – it has a small size, however, generates the necessary draught for complete opening of the main parachute. The auxiliary parachute should open no earlier and no later than the moment of landing apparatus entrance to the atmosphere of Mars. What can be a signal for actuating of the powder motor on the cover of the auxiliary parachute? (formulate IFR and consider the resources).

Problem 2. The next stage is the activation and opening of the main parachute. It is

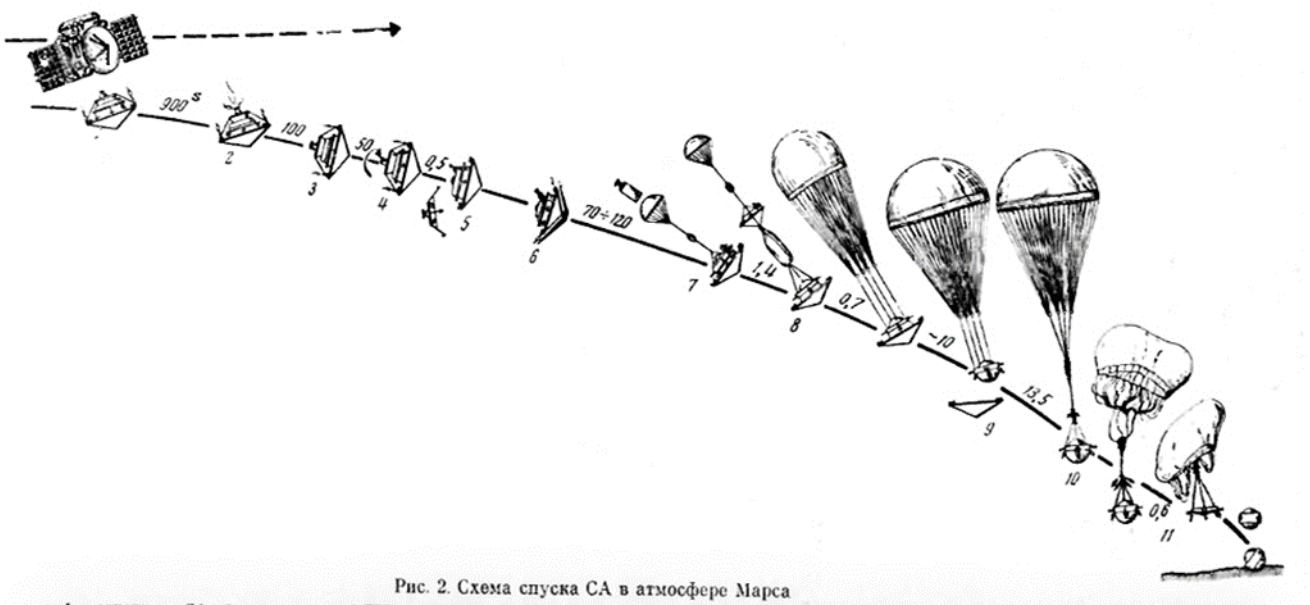
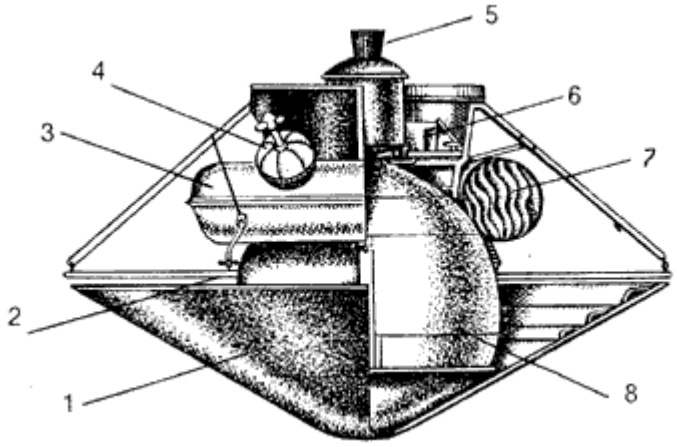


Рис. 2. Схема спуска СА в атмосфере Марса

1 — отделение СА; *2* — включение РДТТ; *3* — программный разворот СА; *4* — закрутка СА; *5* — отделение фермы; *6* — прекращение закрутки, подача питания на РВ; *7* — начало введения ПС, включение ПВМ, подача питания на научную аппаратуру; *8* — введение основного парашюта, включение ТМ, ПВУ, РК и научной аппаратуры; *9* — разрифовка парашюта, отделение аэродинамического конуса, включение РВБВ; *10* — расчековка крепления ТДУ, перецепка ПС; *11* — включение ТДУ, конец передачи на ОА

necessary to implement several operations: to open the parachute section, remove the upper cover, perform the complete opening of the main parachute section and finally, to

arrange for preventing covering the station by the main parachute. Analyze the brake system of the landing apparatus, single out the non-desirable effects, which occur as a result of braking and formulate the contradictions. What devices are used for elimination of non-desirable effects?



Landing apparatus of the station "Mars-2":

1 — aerodynamic cone; 2 — antenna of radio altimeter; 3 — parachute container; 4 — engine of the actuation of auxiliary parachute; 5 — engine of landing apparatus withdrawal; 6 — devices and apparatuses of control system; 7 — main parachute; 8 — automatic Mars station

This story has an unusual and interesting continuation.

Problem 3. Did you ever try to imagine what remained of used-up apparatuses which remained on the moon, Mars and Venus? Research of results of rational activity on the planets and their satellites has not yet taken the form of a self-contained field, however, there are fairly many publications on the topic of «space archeology». It might seem that landing places of all apparatuses, which explored planets and satellites are exactly known, but… here is how this problem is described by Vitaly Yegorov: «Addressing the web-site HiRise, I discovered only the photograph of 2007 under the title of center of Soviet Mars 3 Landing Ellipse. It was a revelation for me, since I was so sure about the omnipotence of NASA and HiRise, that I expected to see the exact indication, where our station is located. Neither did the quick web-search yield a result. I.e., it was evident that Mars-3 was never found. I downloaded a full-scale photo (1.3 GBt), opened it and understood, why nobody managed to find the station during 5 years. (*The photo has the resolution of 30 cm per pixel, i.e., an object with the size of 30 cm corresponds to one dot. «Mars-3» is an object with the size of 1.5 m – on the photo this is 6X6 dots*). Imagine a search of a round-shaped object with the width of 1.5 meters on a rectangle with the dimensions of 6 by 20 kilometers. I know that many readers now think that it was necessary to write a program, which would itself search for a station. But I think that such a search wouldn't be possible until the artificial intellect is created. Yes, such a program could single out interesting boulders of corresponding size. But there are thousands of such objects there, since there is a crater nearby, from which pieces of rock flew in different directions».

What would you propose under such conditions? How is it possible to find «Mars-3»? And, what is the most important, why should one explore the results of rational activity (activity of the humans) on the planets and satellites, what useful information could be obtained?

PROBLEM. Dangerous planet. An extraordinary planet is described in one science-fiction story. Everything on this planet is like a situation on Earth: the same atmosphere, same animals and plants. However, insects and birds fly with ultrasound speed. Let us avoid specifying, how they manage to do this. The point lies somewhere else. You probably know that collisions of aircrafts with birds leads to accidents. And in our case the air is filled with live «bullets» and «shells»… Two spacemen landed on this planet and they were saved with great difficulty. Even an armored all-purpose vehicle was quickly destroyed by ultrasound «flies»… Imagine that you yourself take part in a mission to such planet. Propose how to make yourself and the crew safe.

Let us now imagine a reverse situation. Rational life is discovered on a planet explored by us. However, the speed of changes, the speed of reactions of reasonable beings in comparison to people is decelerated many times. What is a moment for a human being is a number of years for an inhabitant of this planet? How to stabilize the contact, how to conduct the negotiations?

Nomination «Fantasizing»

Task 1. Nowadays the spacemen enter the outer space in such spacesuits, which offer an opportunity to breathe and protect from radiation. Is it possible for a human to live in space without a spacesuit? In reality, it is not possible as yet, but the science fiction authors wrote how it could be implemented. Please, invent a method for achieving that. Use of the techniques of fantasizing.

Task 2. In Hall Clement's novel «Expedition "Gravitation" » the action takes place on a planet, where the force of gravity is 800 times higher than on Earth. Think of a fantastic planet, which is different from the Earth by some other parameter. Describe the adventures of the crew of a spaceship on this planet.

Nomination «TRIZ Tools»

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1) Collect a card catalogue of «space inventions», which became widely spread in everyday life.

2) Formulate the contradictions, which are resolved in these inventions.

3) Propose the unusual application of these inventions for solving problems, which haven't yet been stated.

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Nomination «Research»

Task 1. Since the very beginning of space exploration the human beings were accompanied (and sometimes substituted) by animals. For more than 60 years of space research fairly different animals took part in space missions. Very interesting experiments organized in orbit, are associated with growing plants. Much time passed before it became possible to create such conditions, under which the plants not only increased their herbage, but also bloomed and yielded fruit. Thus, a topic for research is: «Animals and plants in space». You could choose for your research a more particular topic.

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- What problems concerning adaptation of animals and plants to staying in space haven't yet been solved? Propose possible solution of these problems.
- What problems concerning adaptation of animals and plants to staying in space haven't yet been solved? Propose possible solution of these problems. Is it possible to create such conditions in orbit, which are similar to complicated natural systems, like a forest, a field, etc., where animals and plants interact with each other? Do such projects exist and what problems are associated with implementing these projects?

Task 2. In each family there are stories, which are inherited by each next generation: from the granddad, who came to Russia from Chicago, from the grandma, who saved the lives in the front, etc. Some of the events are tragic, others are funny, but all of them remain in the memory by their brightness, they are gladly retold many times, they are transferred from father to son. Actual stories are enriched with legendary details. Describe a story of your family: since what times and from what places your family starts, what deeds were performed by your ancestors, what special stories accompanied the history of your family. Write such things about your family, which you would like to share. Having written down the story of your family, make a comment to this story. Then imagine that your story is read in the 25th century and the readers don't know anything else about our epoch. How will our civilization look like,

if it is studied only based on the history of your family? What would you change in your story, so that it would be understood by people many centuries after?

Nomination «TRIZ videos»

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Task 2. Illustrate the process of inventive problem solving with the aid of cinema or animation. Think of stories, in which a problem appears, try to provide a detailed comment on what the contradiction consists in and what ideal solution it is necessary to find as well as what techniques are used for solving.

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TRIZ-Summit Cup – 2020/2021

Category 15-17 years

Nomination «Inventive activity»

Problem 1. It is known that the diffraction of the sunlight is associated with decomposition into a spectrum. The astronomers suffered from that greatly. In the telescope lenses the light from the Sun, planets and stars is also diffracted. And the space objects become encircled with multicolored aureoles, which is a hindrance for those, who want to observe them attentively. This phenomenon is called «chromatic aberration». Great British physicist Isaac Newton thought that one cannot get rid of it. Propose a method for manufacturing lenses, which would not yield any chromatic aberration.

Problem 2. Though only strong and healthy people can become spacemen, everything will be able to happen to them at the space stations of the nearest future. It is not impossible that a complicated operation could take place in space. On Earth the patient is put on an operation table, where the patient, the table and tools, as well as the doctors are held in one position by the force of gravity. However, it is not going to be so simple under the conditions of weightlessness. At a glance, one might think that it is possible to screw the table on to the floor. But the doctors cannot be screwed on. They should be able to move. Neither can one screw the tools on, as well as vessels with preparations. Neither can one tie the patient to the operation table – you never know what sort of injuries he could have received. And if the operation is serious and requires large cutting of the body, it will also be necessary to prevent the internal organs of the person being operated from «flying». Propose the structure of the operation room, tools and devices for fairly different operations under the conditions of weightlessness.

Nomination «Fantasizing»

Task 1. The «multi-store scheme» proposed by G.Altshuller includes four methods («stores»), with the aid of which one could invent a new fantastic idea. Study this scheme. Invent and describe the ideas of the third and fourth stores for the object «spacesuit».

Task 2. In the science fiction novel «Integral Trees» by Larry Nieven people live on a planet, which has the form of a huge tree, which flies in space in an orbit around the star, which is similar to the Sun. In the novel «The world is a Ring» by Paul Sheffield people live on the surface of a huge ring, which rotates around a star. Think of and describe a fantastic planet, use for this purpose some technique of fantasizing. Write a short story about the adventures on the invented planet.

Nomination «TRIZ Tools»

Task 1. Using a morphological table (See «short analysis of the problem «On the black box of civilization») formulate a research theme, subproblem for the problem concerning the "black box" of civilization. Collect the examples and problems on the topic selected by you. Analyze the collected information. What methods for information transmittal could you propose? What, in your opinion, could be done today in order to preserve the information on our civilization?

Task 2. Space flights and research is the dream of many generations of bold people. This kind of research also has a purely practical application. You know, of course that Teflon coat, wireless electric tools, location-based services and many other inventions, which make our life safer and more comfortable, were made in space industry. The tasks in the nomination «TRIZ tools» will be associated exactly with such inventions.

1) Collect a card catalogue of «space inventions», which became widely spread in everyday life.

2) Formulate the contradictions, which are resolved in these inventions.

3) Propose the unusual application of these inventions for solving problems, which haven't yet been stated.

Nomination «Research»

Problem of «The Black Box of Civilization». (op.cit.: G.S. Altshuller, I.M. Viortkin, "How to Become a Heretic. Life Strategy of Creative Personality", problem book; collection of articles "How to Become a Heretic", Petrozavodsk, "Karelia", 1991, p. 166-168).

"In big modern airplanes there is a so-called built-in "black box". It is intended for recording the modes of flight. In case of an accident, it is easy to clear out the reasons of the accident and to point out the guilty persons. If the accident took place because of the fault of the aviators or because of some faults in the airplane structure, the analysis of the recording will allow to make the future flights safer. The "black box" is unable to prevent the accident, which takes place, neither can it help the victims of the accident, and it is not included with its functions. Its main goal is the work "for the sake of tomorrow"; "black box" enables to learn by studying the mistakes of the others.

Lately they started to equip the ocean liners with such devices. It is evident that in the nearest future "black boxes" will become obligatory attributes of all kinds of public transport and probably – of motorized kinds of personal transport.

During all epochs the people, who undertook daring travels, who were getting ready to tragic events, tried to translate their experience to the descendants as well as the description of the events which took place. Usually, such records were conducted during the periods of history, which were tragic for the people: in the besieged cities, in

prisons, in the state of expectation of the nearing death. Recollect the Kumran manuscripts, the diary of Scott's Polar expedition, the recording of self-monitoring of Alain Bombard.

As a rule, people start to compile such "bequests" at the last moment, when the lack of time and corresponding conditions is felt so vividly. Therefore, we know only separate records which miraculously survived till the present day. One should prepare to everything in advance – including catastrophes (maybe, above all else to the catastrophes).

Our Earth is no less vulnerable than any other kind of "public transport". In old times the action of certain mystical forces "from above" were considered to be reasons for future "end of the world". Recently this role was transmitted to mysterious space invaders, which are hostile to the citizens of the Earth. Nowadays they say that our main enemy are we ourselves and predict a genetic, social, demographic, nuclear, ecological and other crises of this kind. In general, it is not so important, which circumstances can lead to the disaster, due to these or other unknown reasons, the most important thing is that it is basically possible. It means that it is necessary for the Earth to have its own "black box". It has to record the real reasons of the possible tragedy, preserve the record intact for the required period of time and inherit it to future generations: the experience, especially negative and global, is priceless.

Only the future will be able to answer the question concerning the importance of the "black box" for the planet. Only one thing could be said for sure: this problem is not artificial. If it is not "burning", – excellent, it means that we have time to prepare for the solving of this problem calmly and scrupulously. If we are pressed for time, what's to be done? – We should manage to do what we can do. In other words, the sooner the development of this problem starts, the better.

The solution of this problem largely depends upon the scales of the possible disaster. Several variants are possible:

a) Half of the population of the Earth will disappear as a result of a disaster. The connections between the cities will be retained. The former infrastructure will be preserved to a certain extent.

b) Several dozen thousands of people will remain on Earth. There will be practically no contacts. The remaining population will quickly degrade and address primitive crafts and primitive technology. A lot of time will pass before the conditions for a tangible breakthrough are created.

c) Rational life will completely disappear from the Earth. After 100-150 years conditions will be created, which are acceptable for human life, but who knows, when the renaissance of the Human Mind will take place – "only Allah knows this".

d) All kinds of life will disappear from the Earth. Time of reviving of the conditions is a billion years.

Let us analyze the most difficult variant – the last one. If it is possible to invent something for settling an aggravated conflict under milder conditions, the problem will most probably be solved.

Thus, here are the conditions of the problem. After a lapse of 100-150 years the disappearance of all kinds of life on Earth will take place. Possible revival time is one billion years. How to transfer the "black box" at such a time distance? What should be written in it?

These are very complicated questions. For example, the issue of technology of data transfer. It has to be borne in mind that it is not known today, to whom the data should be transferred: who knows, what form the rational life is going to take a billion years after our era… And is it going to emerge on Earth all by itself? How to assist in the revival of rational life? How to preserve the genetic pool of our flora and fauna? How to arrange for such a situation that the information will be received by the humans in time: that means, at such a moment, when the humans are able to understand the received message and it wouldn't be late? How to arrange for such conditions under which all information could be easily deciphered? How to preserve the record with such a great lapse of time? What's to be done, in order that our distant descendants should believe in the information received, so that they should not take it for a silly joke of their compatriots?

Not yet less unclear is the issue of the content of the "black box". Most likely, "the box" should consist of two parts: "operational" (concerning the reasons of the accident) and "stationary" (concerning the culture and knowledge accumulated on Earth). How to make constant additions to "operational" part, including directly the moment and subsequent time? What's to be written in the "stationary" part? "All knowledge of the world"? What in particular? What are the criteria for selection? What could we recommend to our rational descendents, so that they could prevent analogous disasters?

There are many questions…

What are the positive features of this problem? As of today, "Data transfer" is a topic for a discoverer, absolutely free from competition, at least, for the nearest 30-50 years (let us hope that the common sense will win and humanity will understand the problem earlier than the disaster happens). This is one of the few topics, which are completely devoid of negative sides. The topic is utterly noble. Utterly socially useful. The scale of the topic is superb. It is evident even now that this is a topic which can be developed in a lifetime, and not only one life will be needed for that. The topic has social and technological aspects, i.e., it is suitable for a person with any specialty.

(It is possible to predict in advance that there would be some prudish objections to this problem: when a house is on fire, one should not make records concerning the reasons of the fire, but carry buckets with water. Possible catastrophe of the civilization states many problems, the majority of which is as yet perceived rather abstractly. The

major part of the population of our planet continues to work at the enterprises of their countries, i.e., continues to take part in the annihilation of nature. Only a few people clang the bell and try to extinguish the flaring flame. However, nobody, not a single person on Earth ever approached the problem of "the black box"! Who knows, perhaps a letter sent to the future, which a billion years far from us, is more important than two today's buckets of water…)".

Nomination «TRIZ videos»

Task 1. Are there any places in your city, associated with space exploration? Make a newspaper report concerning a visit to the museum, exhibition or a scientific center. Try to interview specialists, who are connected with space research.

Task 2. Illustrate the process of inventive problem solving with the aid of cinema or animation. It could be both engineering solutions and inventions in non-engineering fields.

Videos should be short (from 2 to 10 minutes). It is necessary to indicate the names of the whole team, which prepared the video: screenplay writer, operator, mixer, actors, etc.

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TRIZ-Summit Cup – 2020/2021
Category: students

Nomination «Inventive activity»

Problem 1. It is known that the diffraction of the sunlight is associated with decomposition into a spectrum. The astronomers suffered from that greatly. In the telescope lenses the light from the Sun, planets and stars is also diffracted. And the space objects become encircled with multicolored aureoles, which is a hindrance for those, who want to observe them attentively. This phenomenon is called «chromatic aberration». Great British physicist Isaac Newton thought that one cannot get rid of it. Propose a method for manufacturing lenses, which would not yield any chromatic aberration.

Problem 2. Though only strong and healthy people can become spacemen, everything will be able to happen to them at the space stations of the nearest future. It is not impossible that a complicated operation could take place in space. On Earth the patient is put on an operation table, where the patient, the table and tools, as well as the doctors are held in one position by the force of gravity. However, it is not going to be so simple under the conditions of weightlessness. At a glance, one might think that it is possible to screw the table on to the floor. But the doctors cannot be screwed on. They should be able to move. Neither can one screw the tools on, as well as vessels with preparations. Neither can one tie the patient to the table – you never know what sort of injuries he could have received. And if the operation is serious and requires large cutting of the body, it will also be necessary to prevent the internal organs of the person being operated from «flying». Propose the structure of the operation room, tools and devices for fairly different operations under the conditions of weightlessness.

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Nomination «Fantasizing»

Task 1. In the cycle of novels by Greg Eagan «Orthogonal Universe» the action takes place in the Universe, where the light speed depends upon the wavelength. Imagine and describe a universe, in which some other law or a physical constant is modified.

Task 2. In the cycle of novels by Stephen Baxter and Terry Pratchett «The Long Earth» the worlds are described, in each of which an Earth exists, which is different from our planet by the following feature: at a certain stage the evolution took a different form than in our reality. In on case the dinosaurs did not die, in another case all planet appeared to be covered with woods, the third planet had no people but had rational dogs… Think of a space factor, which some time ago changed the development of evolution on Earth and describe, which form the planet took in our time due to the action of this factor.

Nomination «TRIZ Tools»

Task 1. Using a morphological table (See «short analysis of the problem «On the black box of civilization») formulate a research theme, subproblem for the problem concerning the "black box" of civilization. Collect the examples and problems on the topic selected by you. Analyze the collected information. What methods for information transmittal could you propose? What, in your opinion, could be done today in order to preserve the information on our civilization?

Task 2. Space flights and research is the dream of many generations of bold people. This kind of research also has a purely practical application. You know, of course that Teflon coat, wireless electric tools, location-based services and many other inventions, which make our life safer and more comfortable, were made in space industry. The tasks in the nomination «TRIZ tools» will be associated exactly with such inventions.

1) Collect a card catalogue of «space inventions», which became widely spread in everyday life.

2) Formulate the contradictions, which are resolved in these inventions.

3) Propose the unusual application of these inventions for solving problems, which haven't yet been stated.

Nomination «Research»

Problem of «The Black Box of Civilization». (op.cit.: G.S. Altshuller, I.M. Viortkin, "How to Become a Heretic. Life Strategy of Creative Personality", problem book; collection of articles "How to Become a Heretic", Petrozavodsk, "Karelia", 1991, p. 166-168).

"In big modern airplanes there is a so-called built-in "black box". It is intended for recording the modes of flight. In case of an accident, it is easy to clear out the reasons of the accident and to point out the guilty persons. If the accident took place because of the fault of the aviators or because of some faults in the airplane structure, the analysis of the recording will allow to make the future flights safer. The "black box" is unable to prevent the accident, which takes place, neither can it help the victims of the accident, and it is not included with its functions. Its main goal is the work "for the sake of tomorrow"; "black box" enables to learn by studying the mistakes of the others.

Lately they started to equip the ocean liners with such devices. It is evident that in the nearest future "black boxes" will become obligatory attributes of all kinds of public transport and probably – of motorized kinds of personal transport.

During all epochs the people, who undertook daring travels, who were getting ready to tragic events, tried to translate their experience to the descendants as well as the description of the events which took place. Usually, such records were conducted during the periods of history, which were tragic for the people: in the besieged cities, in prisons, in the state of expectation of the nearing death. Recollect the Kumran

manuscripts, the diary of Scott's Polar expedition, the recording of self-monitoring of Alain Bombard.

As a rule, people start to compile such "bequests" at the last moment, when the lack of time and corresponding conditions is felt so vividly. Therefore, we know only separate records which miraculously survived till the present day. One should prepare to everything in advance – including catastrophes (maybe, above all else to the catastrophes).

Our Earth is no less vulnerable than any other kind of "public transport". In old times the action of certain mystical forces "from above" were considered to be reasons for future "end of the world". Recently this role was transmitted to mysterious space invaders, which are hostile to the citizens of the Earth. Nowadays they say that our main enemy are we ourselves and predict a genetic, social, demographic, nuclear, ecological and other crises of this kind. In general, it is not so important, which circumstances can lead to the disaster, due to these or other unknown reasons, the most important thing is that it is basically possible. It means that it is necessary for the Earth to have its own "black box". It has to record the real reasons of the possible tragedy, preserve the record intact for the required period of time and inherit it to future generations: the experience, especially negative and global, is priceless.

Only the future will be able to answer the question concerning the importance of the "black box" for the planet. Only one thing could be said for sure: this problem is not artificial. If it is not "burning", – excellent, it means that we have time to prepare for the solving of this problem calmly and scrupulously. If we are pressed for time, what's to be done? – We should manage to do what we can do. In other words, the sooner the development of this problem starts, the better.

The solution of this problem largely depends upon the scales of the possible disaster. Several variants are possible:

a) Half of the population of the Earth will disappear as a result of a disaster. The connections between the cities will be retained. The former infrastructure will be preserved to a certain extent.

b) Several dozen thousands of people will remain on Earth. There will be practically no contacts. The remaining population will quickly degrade and address primitive crafts and primitive technology. A lot of time will pass before the conditions for a tangible breakthrough are created.

c) Rational life will completely disappear from the Earth. After 100-150 years conditions will be created, which are acceptable for human life, but who knows, when the renaissance of the Human Mind will take place – "only Allah knows this".

d) All kinds of life will disappear from the Earth. Time of reviving of the conditions is a billion years.

Let us analyze the most difficult variant – the last one. If it is possible to invent something for settling an aggravated conflict under milder conditions, the problem will most probably be solved.

Thus, here are the conditions of the problem. After a lapse of 100-150 years the disappearance of all kinds of life on Earth will take place. Possible revival time is one billion years. How to transfer the "black box" at such a time distance. What should be written in it?

These are very complicated questions. For example, the issue of technology of data transfer. It has to be borne in mind that it is not known today, to whom the data should be transferred: who knows, what form the rational life is going to take a billion years after our era… And is it going to emerge on Earth all by itself? How to assist in the revival of rational life? How to preserve the genetic pool of our flora and fauna? How to arrange for such a situation that the information will be received by the humans in time: that means, at such a moment, when the humans are able to understand the received message and it wouldn't be late? How to arrange for such conditions under which all information could be easily deciphered? How to preserve the record with such a great lapse of time? What's to be done, in order that our distant descendants should believing the information received, so that they should not take it for a silly joke of their compatriots?

Not yet less unclear is the issue of the content of the "black box". Most likely, "the box" should consist of two parts: "operational" (concerning the reasons of the accident) and "stationary" (concerning the culture and knowledge accumulated on Earth). How to make constant additions to "operational" part, including directly the moment and subsequent time? What's to be written in the "stationary" part? "All knowledge of the world"? What in particular? What are the criteria for selection? What could we recommend to our rational descendents, so that they could prevent analogous disasters?

There are many questions…

What are the positive features of this problem? As of today, "Data transfer" is a topic for a discoverer, absolutely free from competition, at least, for the nearest 30-50 years (let us hope that the common sense will win and humanity will understand the problem earlier than the disaster happens). This is one of the few topics, which are completely devoid of negative sides. The topic is utterly noble. Utterly socially useful. The scale of the topic is superb. It is evident even now that this is a topic which can be developed in a lifetime, and not only one life will be needed for that. The topic has social and technological aspects, i.e., it is suitable for a person with any specialty.

(It is possible to predict in advance that there would be some prudish objections to this problem: when a house is on fire, one should not make records concerning the reasons of the fire, but carry buckets with water. Possible catastrophe of the civilization states many problems, the majority of which is as yet perceived rather abstractly. The

major part of the population of our planet continues to work at the enterprises of their countries, i.e., continues to take part in the annihilation of nature. Only a few people clang the bell and try to extinguish the flaring flame. However, nobody, not a single person on Earth ever approached the problem of "the black box"! Who knows, perhaps a letter sent to the future, which a billion years far from us, is more important than two today's buckets of water…)".

Nomination «TRIZ videos»

Task 1. Are there any places in your city, associated with space exploration? Make a newspaper report concerning a visit to the museum, exhibition or a scientific center. Try to interview specialists, who are connected with space research.

Task 2. Illustrate the process of inventive problem solving with the aid of cinema or animation. It could be both engineering solutions and inventions in non-engineering fields.

Videos should be short (from 2 to 10 minutes). It is necessary to indicate the names of the whole team, which prepared the video: screenplay writer, operator, mixer, actors, etc.

This work is directed at forming the methodological material for teaching TRIZ. The web-site of TRIZ Summit contains the videos, which were submitted to the previous TRIZ Summit Cup:

http://triz-summit.ru/ru/contest/competition/video/

The tasks of TRIZ Summit Cup-2020/2021 were prepared by M.S.Rubin, N.V.Rubina, nomination «Fantasizing» was prepared by P.R.Amnuel.

Short analysis of the problem of "black box of civilization". © M.S.Rubin.

The problem of "black box of civilization" was proposed as a generator of new research topics and a source of Noble Goal for researchers.

"G.S. Altshuller and I.M. Viortkin single out three tiers of topics:

- special technological topics, special scientific and special art topics, for example, inventing the rockets;
- general technological topics, general scientific and general art topics, for example, space exploration development;
- the topics, which concern civilization on the whole (social-technological, social-scientific, social-artistic, etc.), for example, planning a cosmic civilization or a civilization with television.

From the point of view of research, it is most efficient to work with the topics of the third tier – at the level of problems, which are common to the entire mankind. Here we find the largest perspective for development of topics and the least probability "to get stuck" in unimportant topics or find ourselves in the situation of severe competition with other researchers. As an example, I would like to present at least one problem of the universal level. It refers to the problem of creating a "black box" for the case of world disaster. ("How to Become a Heretic", Karelia, 1991, p. 166-168).

Fairly few TRIZ specialists worked on proposed problem, still less is the number on this topic. The problem is complicated and we decided to propose certain approaches to it. This is only our opinion and we don't assert that it is the only approach to the problem of "black box" of civilization.

Straight from the outset we would like to reject such solutions, which are obviously weak. For example, creation of systems collecting data from each inhabitant of the Earth and placement of this information on some satellite of Earth or Venus. Despite the obviousness of non-feasibility and non-ideality such ideas are expressed. In this case the research theme will be interesting and strong, when it is directed at solving contradictions, which are inherent to the problem of "black box" of civilization (for example, the information should be so profuse, so that all aspects of civilization should be reflected, and should be scanty, so that it would be easier to store it and to transfer it to the descendents; or the place of storage should be near so that it would be easier to place information and should be far, so that the information should be safely preserved in case of disaster), and should maximally approach the ideal final result (for example, the force of disaster, destroying the civilization, ITSELF preserves it for descendents).

During the TRIZ conference of schoolchildren and students "ICARiada-2001" a morphological table for analysis of the problem was proposed:

1. What object	1.1 Family	1.2. House	1.3. City	1.4 Country	1.5. Whole world	……..
2. To whom, where	2.1. To other people	2.2. To other state	2.3. To descendants after 50 (100, 1000) years	2.4. Civilizations of other countries	2.5. Uninhabited land	……..
3. Goal	3.1. Preserve information	3.2. Avoid mistakes	3.3. Preserve civilization	3.4. Revive civilization	3.5. Broaden the boundaries of civilization	3.5. Call for assistance
4. Resources	4.1. Resources of system being preserved	4.2. Resources of exterminating force	4.3. Resources of contemporary external environment	4.4. Resources of environment, in which “Black box” suddenly finds itself	……..	
5. Reasons of catastrophe	5.1 Natural	5.2. Social conflicts	5.3. Natural calamities	5.4 Inter-personal conflicts	5.5. Terror and crime	…….

This table can be used for wording of many subproblems, for example, variant (1.3-2.3-3.2-4.1-5.1) could be worded in the following way: how to preserve information about contemporary Petrozavodsk for the generations of people of the 22nd century for the purpose of avoiding the repetition of mistakes made by the city itself, if it is going to change in the process of natural evolution. The level of formulated problems and their acuteness could be changed according to the personal taste.

There is a broad choice of directions for conducting further research word on the topic of “black box of civilization”. It is possible, for example, to specify the axes of a morphological box: their number and content. It is also possible to compile a collection of particular problems, gathered together as part of the general topic собранных в рамках общей темы “black box of civilization”. It is possible to perform the analysis of each of the subproblems: formulate the contradictions of IFR, analyze the resources. It is possible to create the hierarchy of the problems related to the topic of “black box of civilization”. It is possible to collect the information concerning the most frequent reasons for the ruin of civilizations. Rather fruitful could be the analysis of methods for reviving the information, which are used in archaeology and in history. In fact, there are very many opportunities for conducting research work.

Very efficient could be putting together different card catalogues (See the article by M.Rubin “Personal card catalogues are the foundation of creativity”, the article is published at the web-site General Theory of Strong Thinking GTST (in Russian: OTSM)-TRIZ-technologies http://www.triz.minsk.by/e/221001.htm) on the topic of “black box of civilization”.

It is possible, for example, to start with the card catalogue of "black boxes" – with aircrafts of different types, ocean liners or other systems. It is a matter of curiosity to identify the nature of the information being recorded, basic problems and contradictions of "black boxes", to forecast their development. It could turn out, for example that

"black box of civilization" is the logical continuation of ordinary "black boxes". At the same time, it is possible to propose new ideas and solutions in this field.

Very important is the following question: what in particular should be transferred to the descendants or invaders concerning the perished civilization. In order to get the answer, one could make use of another card-catalogue – concerning KEY FINDINGS (cultural monuments), with the aid of which it was possible to disclosed the secrets of perished civilizations.

I will quote only one example. In order to study the perished civilization of Maya it is very important to decipher the alphabet of this nation. It became possible to do this mainly with the aid of two documents:

- manuscript “The Message concerning state of things in Yukatan” belonging to the times of conquest of Maya Indians by the Spaniards, where, in particular, a reduced Maya alphabet was quoted with its "TRANSCRIPTION" with the SPANISH letters;
- records of old myths (the books of Chilam Balam) made in the 16th century with LATIN LETTERS and reflecting the language of Maya as of beginning of our era.

The information on modern (existing) languages of Maya and the languages of the Spaniards as well as the information about the Spanish language of the 16th century.

It is curious to note that the "black box" of civilization survived till the present day in the form of a bi-system: first of all, these are the cities of Maya with temples, inscriptions on their walls, pictures and drawings, as well as a key to deciphering all this – the alphabet, which we just mentioned.

In the most difficult variant (all kinds of life vanish from the Earth) the colloquial language will naturally disappear. That is what happened to Sumerian texts: they were completely deciphered, but nobody knows how this language sounded. It is necessary to combine an object or action (shown in different situations) with its written or phonetic (speech) counterpart. This is something like TV commixes intended for those who learn foreign languages.

An example of a "black box" of the civilization of ancient Maya brings us to an interesting thought. The thing is that the manuscript of " The Message Concerning State of Things in Yukatan" is the basic, most complete and accurate document about the ancient civilization – was compiled by the Spanish bishop Diego de Landa. It was under his guidance that al most all written and other heritage of Maya was destroyed (it was for his activity that De Landa received the rank of the bishop). The manuscript written by De Landa was a kind of a report on the “work” done in terms of extermination of heresy. A curious hypothesis emerges: the reason, which leads to a catastrophe (for example, the Spaniards in the person of Diego de Landa) ITSELF creates a "black box" (famous manuscript of the Bishop). The second document – a key to the deciphering of

the Maya texts – "The Books of Chilam Balam", written with the help of Latin letters – have approximately the same origin as the manuscript of De Landa. The Spaniards prohibited the use of native alphabet by Maya people and the people started to write down the ancient texts using Latin alphabet, which was allowed. The situation is the same: the Spaniards through their prohibitions THEMSELVES made Maya people to create a document devoted to their culture, which would be understandable for the descendants. One more example, which we already recollected: the eruption of Vesuvius destroyed Pompeii; however, it preserved this city for us having poured a tock layer of ashes on it.

Thus, the force, which leads to a catastrophe, ITSELF creates a "black box" at the moment of the catastrophe. What's this? A hypothesis, an ideal variant for solving the problem or a regularity of forming "black boxes" of civilizations? A card-catalogue of KEY FINDINGS leading to the deciphering of culture of perished civilizations will help to answer the question: What helped to decipher the information about the life of the people. In connection with this one can recollect numerous examples of key findings of ancient animals: mammoths, Neanderthal men, dinosaurs.

Universally known, for example, is the finding of a well-preserved dinosaur from the family of allosaurs. This finding was so important for the science that the remainders of this dinosaur was called by its name – Big Al. Not only the skeleton was preserved, but also the print of the heart. The scientists managed to reconstruct with absolute accuracy the peculiarities of behavior of allosaurs, their live environment, speed of motion and habits. It became possible to make a biography of Big Al: what injuries it received at what age, under what conditions these injuries could be received, what this dinosaur (who lived 45 million years ago) died from. Already old and ill Big Al went to the river during a dry summer. There was no rain and the water did not come. Visorless, it waited for the water to come in the bed of a dried river. Soon the water came, but Big Al died already. River mud covered its body and preserved its body for us for many millions of years. The river, which killed the dinosaur ITSELF, preserved the information about it.

Probably, only with one force, which destroyed the civilization, it won't be possible to find an absolutely reliable mechanism for creating a "black box" at the required moment. Then a new problem appears: what's to be done so that the "black box" should be useful and necessary under the conditions of a normal life without catastrophes. It would permit to make the entire project of creating a "black box" of civilization much less expensive, to make the probability of its implementation higher, would provide for reliability of its functioning during the period before the catastrophe.

Like each super-problem, the project "Black box" yields a whole spectrum of problems and topics for research. I will present one more of them, but before that –one card from my card catalogue:

"Who will survive in the catastrophe".

"Since the moment of entrance to the nuclear epoch the superpowers face a dilemma – whose survival should be provided for first in case of a large-scale conflict: population of the country the highest echelons of power? At the very start of his 8-year stay in office President Reagan, having discarded all prejudices of "cold war" with its orientation at civil defense, proclaimed that it is possible to be a winner in a nuclear war, but only in such case, if the survival of the highest civil and military leaders. The procedure of evacuation is provided for the representatives of the highest echelons of power, the survival of which is considered to be necessary for "provision of non-interrupted succession of state power" – totally for more than 1000 persons". ("Komsomolskaya pravda", August 26,1989).

Similar programs exist not only in the USA, but also in other countries. As a result of implementation of such projects, such a situation is quite possible, which implies that only “the highest echelons of power” will remain on Earth after the catastrophe. Are those exactly the people, who have to remain and continue rational life on Earth? They can be leaders of states, which will not exist. Will these people be able to survive themselves, without their manages? If the modern civilization is able to provide for survival only of a small part of mankind, what people should survive in this case? What social mechanism should provide for such a selection? What should people be occupied with during the compulsory "vacation", until the appropriate conditions on earth are restored? Will it be able to answer all these questions without solving the problem of “black box of civilization?”