



Today the Science Fiction Fan Club presents our new section "Electronic Games Club" (see page 6). Therefore, the proposed text is addressed first of all to those science fiction fans who have already studied the articles of the section "For All Professions" and know how to handle programmable microcalculators "Elektronika B3-34", "Elektronika MK-54" and "Elektronika MK-56".

MIKHAIL PUKHOV

THE REAL TRUTH

"A huge meteorite crashed at cosmic speed into our spaceship and pierced through it, leaving a hole in the skin the size of a human head. The air rushed out with a whoosh."

"The pilot finally made up his mind and, by pressing a button, sent the last remnants of fuel into the reactor. The cosmonauts were overwhelmed by a tenfold overload. The thousand-ton bulk of the ship trembled and slowly moved upward. People were saved."

Such scenarios are abundant in the stories of novice science fiction writers coming to the editorial office of TM. It is difficult to review such works. Intuitively, of course, it is clear that after a collision with a "huge meteorite" nothing will remain of the spaceship, and the "last remnants of fuel" will not be enough to ensure the take-off of a "thousand-ton ship" from any decent planet even with a "tenfold overload". But what arguments can be used to back up these intuitive considerations? I can't do cumbersome calculations using the appropriate formulas every time - about ten stories come to the fiction department every day. Where can I get time for these checks?

Fortunately, this year a new section "For all professions" was opened on the pages of the magazine, and an "Elektronika MK-54" programmable microcalculator appeared in the editorial office. Since the mistakes of our authors can easily be divided into several clearly defined classes, I have compiled a dozen programs for the PMK, which contain the most typical fantastic situations. Entering various considerations into the typewriter regarding the size of the "huge meteorite" and the magnitude of its "cosmic velocity", after a minute I get a number, on the basis of which I answer with a clear conscience: "Unfortunately, with the most optimistic assumptions about the size and speed of the meteorite you invented, the diameter of the hole it would make in the hull would significantly

exceed the length of the spaceship, that is, the latter would have simply been vaporized, so the fascinating adventures of your heroes after such a collision could in no way take place. We are returning the manuscript..."

Among my test programs is one that calculates takeoff from non-atmospheric planets and landing on their surface. Anyone who has carefully studied the materials of the section "For all professions" will understand it without difficulty. This is the program:

00. ИПД 01. $Fx < 0$ 02. 09 03. $\uparrow$ 04. ИП8 05. $\div$
 06. XY 07. ПП 08. 90 09. ИПА 10. $Fx \neq 0$ 11. 43
 12. $Fx < 0$ 13. 33 14. 2 15. $\times$ 16. $\uparrow$ 17. ИП4 18. ИП3
 19. - 20. $\times$ 21. ИПВ 22. Fx^2 23. + 24. $F\sqrt{}$ 25. ИПВ
 26. - 27. $\div$ 28. $\uparrow$ 29. ИП8 30. $\times$ 31. БП 32. 90
 33. ИПД 34. $Fx \neq 0$ 35. 86 36. ИПЗ 37. Fx^2 38. $F\sqrt{}$
 39. ИП7 40. - 41. $Fx < 0$ 42. 87 43. ИПВ 44. ИПА
 45. С/П 46. П1 47. П2 48. $Fx \neq 0$ 49. 43 50. $\div$ 51. П8
 52. ИП5 53. ИПД 54. + 55. $\div$ 56. ИП6 57. $\times$ 58. ПЗ
 59. ИП4 60. - 61. ИП2 62. $\times$ 63. ИПВ 64. + 65. ПВ
 66. FBx 67. + 68. 2 69. $\div$ 70. ИП2 71. $\times$ 72. ИПА
 73. + 74. ПА 75. ИПС 76. ИП2 77. ИПО 78. $\times$ 79. -
 80. ПС 81. ИПД 82. ИП1 83. - 84. ПД 85. В/О
 86. ИП6 87. ИП9 88. С/П 89. Сx 90. П1 91. XY 92. П2
 93. $Fx < 0$ 94. 50 95. ИПЗ 96. БП 97. 59

Detailed instructions for this program (conditionally it is called "Lunolet-1") and a description of an exciting computer game that can be played with its help are given on page 6. But let's return to checking the materials received by the editorial office.

I must say that, in addition to numerous letters, visitors come to us quite often. As a rule, these are very unusual people. One carries a new project or a working model of a perpetual motion machine or a propellant; the other tells about meetings with Bigfoot and the Mesozoic dinosaurs that miraculously survived to our days. And two years ago, a man appeared in the editorial office

who categorically claimed that he allegedly... fell to us from the future, from the end of the 21st century!

This man visited us for two weeks. Every time he told us something about the future. We listened attentively to everything (as it should be in the line of duty) and recorded his stories on a tape recorder. However, there was nothing special about them - any of us could come up with something similar if we wanted. And how could we check? Then he disappeared somewhere, and soon everyone forgot about him.

And recently a thought arose: now that I have my verification programs, I can use the PMK to analyze this person's stories. After all, everything was recorded on tape, and the tapes are kept in the archive!

It took some time for the search and preparatory work. And here in front of me is a transcript of an old tape recording. Next to it is the ready-to-compute Elektronika.

Get ready, too. Enter the Lunolet-1 program into your PMK and switch the machine to calculation mode. We will work together.

Here is one of his stories. (Our brief comments are in parentheses.)

I've flown a spaceship only once in my life.

Of course, in my youth, like many of my peers, I dreamed of becoming a cosmonaut. But these dreams were dispelled at the very first medical examination: overloads of more than three G's made me feel sick. Those who could not withstand five G's were not allowed to further tests. Reluctantly, I had to take back my documents. I applied for computer engineering, successfully earned my diploma six years later, and - irony of fate! - I was sent on assignment to the Moon, to the S. P. Korolyov Center. I have been working there ever since.

After inorganic oil was found in the neighborhood, the Center grew greatly. Now it is a real city with a population of about three thousand people. The domes covering it are connected by tunnels. Like in the subway, only the walls are transparent. These are, roughly speaking, large pipes stretched right across the lunar surface. One of the tunnels leads to the airport terminal. The spaceport of the Center is an extensive complex, it serves the entire Solar system. By the nature of my work, I often visit the port, because ships are packed with electronics, sooner or later something goes out of order, and repairing computer equipment is my specialty and direct responsibility.

The incident I mentioned occurred in the summer of 2087. Our work is cyclical: four months of work, two months of rest. Usually on Earth. Relatives also come to stay sometimes - the Earth-Moon passenger line opened a long time ago. That summer my son, Sergei, came to visit me. I haven't seen him for several months, during which time he has grown a lot. He's almost twelve, and he raves about space exploration. My wife and I hoped that an independent trip to the moon would make him very happy. And he himself, as she reported, did not sleep at all the night before the flight.

But when I met him at the airport terminal, he looked disappointed.

"Nonsense!" he said. "You sit in your seat, the stewardess carries candy and water in tubes. Just like on an airplane. No overload. Even though it's weightless, they don't allow you to float in the air. They make you sit in your seat and buckle up. If only I could sit at the wheel myself in the control room and press the levers..."

He sighed bitterly and was sad for about five minutes as we made our way home. Then he went for a walk. He returned half an hour later, even more disappointed: "They don't let me go to the surface, they don't give me a spacesuit, everything is ordinary, the trees and people are like on Earth." There is no moon. The gravity is less, but he is not interested in that after two days of weightlessness on board the liner. It was getting late, so I put him to bed. And then I went to bed myself - I had to work tomorrow morning. I promised to take him with me: it's interesting there - computing machines, manipulators and so on.

But the next morning I got a call - there was an urgent matter. I wrote everything down, then made coffee. Sergei was already on his feet. When we had breakfast, I informed him that the plans had changed, so let him stay at home for now. He was outraged at first, but then resigned himself to the necessity. I explained that I would be away for an hour and a half.

"Dad!" he said. "Where are you going?"

"To the spaceport."

"Ah," He waved his hand in disappointment. "I've already been there. It's boring there. They won't let you anywhere."

"I'm not going to the port," I explained. "I'm going to the local lines. It's a small area off the main field. The airliners you flew on aren't there. Only local lunolets."

"Real ones?" he inquired.

"Certainly not toy ones. But they are small - only two tons of empty weight. Or rather, empty mass. Everything here weighs six times less than on Earth."

"I know," Sergei waved it off. "What are you going to do there?"

"Work," I shrugged. "The cyberpilot on one of these machines has failed. We'll have to take a look. If it's nothing, I'll do it on the spot. But if it's something serious..."

"Will you go to the control room?" His eyes widened.

I couldn't help but burst out laughing.

"What control room! It's just a cabin, with two chairs. You can't turn around."

"But are the instruments there?" He continued the interrogation. "Are the controls there?"

"Of course," I said innocently. "Where else would they be?"

"Take me with you," he demanded.

"But it's not a game," I tried to explain. "It's a job..."

"Dad!" he said. "You promised me."

"Just don't tell Mom," I said, giving up.

A few minutes later, the electric car was speeding us towards the spaceport. The streets were deserted at this hour - everyone was at work. Shortly before the airport terminal, we turned into a side tunnel leading to the service exit. Sergei was in high spirits, humming something.

At the checkpoint, I showed my ID to the watchman.

"And who is this?"

"He's with me," I said. "This is my son."

"Where's his ID?" asked the watchman.

"He's not supposed to have one. He's just a kid."

The watchman thought for a minute. This situation was obviously new to him.

"All right, let him go. Under personal responsibility."

We were given spacesuits without any problems. Of course, it was too big for Seryozha, but only a little bit - it's not that small for me.

"These are standard oxygen tanks," the watchman warned. "They have enough air for two hours. Will that be enough?"

"Of course. An hour is enough for me with a guarantee. Twenty minutes there, twenty minutes back, ten minutes on the spot. Well, ten for all sorts of complications."

"I see," the watchman said good-naturedly. "Just don't let there be any complications. Ok?"

I lowered the visor and we went through the airlock. A short time later, we were walking under the blue light of the Earth. It was the middle of a moonlit night - there's a new moon on Earth right now.

To say that Sergei was delighted is to say nothing. He was stunned. He didn't seem to expect to be given a spacesuit. A real one, with an individual life support system. On Earth I would have weighed a hundred and fifty kilograms in this, and Sergei would have weighed a good hundred. We carefully walked along the smooth regolith - no one had laid artificial pavement here; they had removed large stones, and that was all. Not for important people. But the path was well maintained. Many people had walked here before us - all those who worked on the distant lunar bases and strongholds. Builders, scientists, engineers...

"And what's over there?" Sergei regained the ability to ask questions. His voice sounded unfamiliar in my headset. He was pointing to the right. There, the massive buildings of the industrial block protruded from the horizon.

"You're not interested in this, Seryozha," I said. "They pump oil there and drive kerosene out of it. For engines."

I waved towards the spaceport. "And they also produce liquid oxygen."

"For spacesuits?" He pronounced the word "spacesuit" with a special expression. I grinned at him:

"And for spacesuits, of course. But mostly they take it to the same gas stations. After all, fuel will not burn without an oxidizer."

We walked in silence for a while. It became a little more difficult to walk - the path climbed to the top of the usual flat hill for the Moon. A hundred more steps and we reached our destination. The parking lot of the lunolets opened up to our eyes.

There were about two dozen of them - old but reliable machines. In the first approximation, it is a rounded cone three and a half meters high, supported by four shock absorbers of the "spider leg" type. The entire upper part is transparent, for easier viewing. This is the very "cabin" that my son was so eager to enter.

On the side of each lunolet there was an identification number - two digits inscribed in luminous paint and surrounded by a black border. Ours was on the edge. Without further adventures, we climbed inside. At the sight of the numerous dials, Sergei's eyes lit up.

"Is this a real ship?" he asked.

I understood. On Earth, there are similar machines in every recreation park. Attractions. Get in the hatch and experience all sorts of sensations.

"It's the best," I said.

"And how do you fly it?"

I chuckled.

"It's as simple as that. This box here," I pointed with my finger, "is called cyberpilot. If you need to get, say, to the Tsiolkovsky base, you type a task on the console, then press this button, and the cyber pilot safely delivers you where you need to go. But right now it's the one that's malfunctioning."

This calmed Sergei down for a while. He probably expected something in the spirit of earthly attractions, when he gives the introductory ones and throws you in different directions. I carefully removed the seal from the cyberpilot and slid the front panel. "Everything looks fine." I gave the voltage to the circuit. The dials on the console came to life.

"Where to look for damage?..."

"And what kind of levers are these?" I heard Sergei's voice.

I turned around. It turns out that he has settled into the second chair. He played cosmonaut. He pointed to the levers of the manual engine control.

"It's for landing," I explained. "Cyberpilot will always take you where you need to go, but it doesn't know the area. Maybe there's a crack, say, or some kind of rock. Then you need to give a small impulse, slow down the descent

a little so that the machine skips a dangerous place."

I turned back to the cyberpilot. However, it wasn't that simple.

"And how do you give an impulse?" Sergei asked.

"You're bothering me," I said. "How should I know? However, look: it says "Fuel consumption" and the numbers are, yeah, in kilograms. The lever is here, so you're going to use up 65 kilograms of fuel. And near the right lever there is 'Time' and also numbers. This is probably the time in which you are going to use up your fuel. Less time means more thrust, and if the time is longer, the thrust is correspondingly less."

"Now the lever is at the number three. So if you give this command to the engine, it will use up 65 kilograms in three seconds."

"Is that a lot?"

"I don't know," I said. "In my opinion, it's like nothing."

"And how to give the command to the engine?"

"How do I know?" I snapped. "You're bothering me. The remote control is probably locked, and the tanks are empty. Look at it," I pointed at the indicator. "Do you see? 'Fuel', four hundred. It's just that! And the scale is two and a half tons."

"And how..." he continued the interrogation.

"Leave me alone!" I commanded. "You're bothering me. If you say one more word, we'll go home right now. And I'll send you back to your mom."

He fell silent resentfully, and I took care of the cyber pilot. I scored a control test - it passed normally. I typed the second one - it's also in full order. What are they, crazy? A perfectly serviceable machine. I scored the third test. And then it started...

(While the narrator is working with computer technology, we will work a little bit. Let's not forget about our main task - to bring it to light. The climax, apparently, is approaching, it's time to press the keys of the PMK. The program has been entered, we form and send the alarm signal Γ to register 9: $Cx \div BII \ BII \uparrow \Pi 9$. Now the initial data. It happens on the Moon, the acceleration of gravity is $1.62m/s^2$. We type $1.62 \ \Pi 4$ on the keyboard. The mass of the ship without fuel is two tons, here you need to add the mass of the narrator along with the spacesuit (150kg) and his son (100kg). We dial $2250 \ \Pi 5$. The engine is obviously powered by kerosene and liquid oxygen, the expiration speed is $3660 \ m/s$. We type this number on the keyboard and press $\Pi 6$. The queue for the maximum acceleration. According to the narrator, he gets sick at three G's. We type $9.81 \uparrow 3 \times \Pi 7$ on the keypad. The speed and height are equal to zero - press $0 \ \Pi A \ \Pi B$. The fuel reserve is 400 kg. $400 \ \Pi J$. We enter the life support resource in seconds into the register. There was air in the cylinders for two hours, the heroes of the story walked to the parking lot for twenty minutes, they were busy for twenty minutes, and they still had to throw twenty on

the way back. They have exactly one hour left "for all sorts of complications." We dial $3600 \ \Pi C$ and, accordingly, $1 \ \Pi 0$. The initial data is entered. Press B/O and C/ Π . After a second, the height lights up on the screen - zero. Press XY. On the screen, the speed is also zero. Everything is right. You can fully expect the upcoming events. And they are undoubtedly about to follow.)

...Not a single control test was passed. I glanced at my watch: forty minutes had passed since we left the airlock. It's time to go back. I reached for the switch to take the voltage off the equipment and looked at my son. He continued to play cosmonaut: he pressed some buttons, contemplated the curves dancing on the screens. The traction control levers were in the same position. He put his index finger on the big red key. A vague premonition stirred in my head.

"Don't you dare!" I shouted.

But it was too late. There was a rumble below us, flames shot up behind the transparent hood, a monstrous blow threw me into a chair, and my eyes went dark...

(This means that the remote control was not locked after all and the command passed to the engine. Not particularly convincing, of course, but we are interested in the factual side of the matter. A two-ton machine, a measly 65kg of fuel, and suddenly - a "monstrous blow"! Fortunately, it is not difficult to verify this episode. Let's give the same command to our remote control: $65 \ \Pi \Pi 3 \ C/\Pi$. The numbers flash on the screen, then... the emergency signal lights up! Surprisingly, the overload really exceeded the permissible one, the narrator lost consciousness and for some time after the engine cut-off he will not be able to control the lunolet. Press C/ Π again.)

...When I woke up, I could see nothing but sky outside. How long was I unconscious? I don't know. But we were falling, falling at a terrifying rate! Obviously, during my unconsciousness the rocket had passed the top of the trajectory and was now hurtling downward. Sergei was reaching for the controls. But the games were over. For a second I couldn't come to my senses, but a second later I was at the console. What could I have done in such a situation? I only noticed the indicator readings - speed eighty, altitude three hundred and something.

"Dad!" Sergei shouted.

What could I have done? Without changing the engine mode, I hit the red key. The overload hit us again...

(On our indicator, the flight altitude is 169m - we round up to integers everywhere. Press XY. The speed is $84m/s$. Well, let's assume the check is over. The speed is still more or less, but the altitude in the story is overestimated twofold. You can put the PMK aside... However, while he was getting to the console, two more seconds passed. Two seconds of free fall with the engine off. But where can you fall in two seconds? Unless it's the moon - not the sky! All right, to clear our conscience, we send the appropriate command: $0 \ \Pi \Pi 2 \ C/\Pi$. Altitude 334 and speed 81 are displayed on the screen. Incredibly, the numbers match! Why does he claim that

the lunolet was falling? It's unclear. But we are entering a new command: 65 III 3 C/II. The Γ signal is back - extreme overload! We press C/II again and wait for the result.)

...When I woke up, we were falling again. I rushed to the red key, but my gaze fell on the altitude indicator. Almost a kilometer! And the numbers were growing! So we weren't falling at all - we were rushing up with the speed of a jet fighter! And last time, of course, we went up too! I was misled by weightlessness. We were really falling, but we were falling up! And I, the fool, by turning on the engine, only aggravated our already difficult situation. But now there is time to collect my thoughts...

(It turns out it's not so easy to take him at his word! We have another shutdown. The altitude is 916m - indeed, almost a kilometer - the speed is 166m/s. Approximately 600km/h. It's not enough, of course, for a fighter, but... can this be considered a serious mistake? Let's be objective, let's leave the narrator the right to artistic exaggeration. Anyway, he doesn't seem to be going to turn on the engine yet, so our PMK can also be given a break.)

..."Dad!" said Sergei, climbing out from under me. "Why did you say that 65 kilograms is like nothing?"

"Leave me alone!" I ordered. "Get into the second seat and buckle up!"

I watched him do it and buckled up myself. The figures on the altitude indicator were increasing, but slower and slower. There was no hope for the cyberpilot, I'd have to do it myself. But for now, perhaps, it would be better not to do anything. It was pointless to go up. Going down (and next to the red button I saw another one, "Reverse thrust") would be even worse. When we start to fall, then... I set the levers to 25kg and 2 seconds in advance and waited. Yes, I was very wrong about those kilograms. They seem to have a lot of power.

"Dad!" Sergei spoke up. "Will we be able to fly into space?"

"Give me a break!" I shouted, but suddenly my heart sank. The child didn't realize that we were on the verge of death, it was a game to him! "Seryozhenka," I said as gently as I could, "you and I will fly into space again. But for now, please be quiet..."

We have already taken off almost ten kilometers. The numbers on the speed indicator reached zero and began to grow slowly, now with a negative sign. When the speed reached about thirty meters per second, I pressed the red key. By this time, the altitude had decreased to almost nine kilometers. The free flight lasted exactly two minutes...

(Finally, there is a new figure that can be verified. Two minutes with zero thrust. Command: 0 III 120 C/II. After stopping, the altitude is 9175, the speed is minus 28. Again, it all adds up! New command: 25 III 2 C/II. The machine calculates the maneuver.)

...This time the overload was tolerable. Numbers flashed on the indicators. The altitude didn't change much, but we were climbing again! Well, were we going to hang around

at this altitude until we run out of fuel? And all the oxygen?! In desperation, I set the levers to positions 10 and 10 and reversed the thrust. The lunolet turned upside down with its engine. Far below, I saw the buildings of the Center, the vast fields of the spaceport and a tiny speck of the site from which we had so carelessly launched...

(After the stop, our altitude is 9151, the speed is slightly less than five meters per second and, indeed, it is directed upwards again. Enter the command 10 III 10 III -/ C/II. After stopping, the altitude is 9044m, the speed is 26m/s with a minus sign. We're falling again, and pretty fast.)

...The speed of the fall increased faster than I expected. I decided to slow down: I removed the reverse, set 25kg and 5s and pressed the red key. But it didn't give in. Apparently, these consoles are designed so that the new command is blocked until the old one is executed. It was only when ten seconds had elapsed that the ship spun downwards again. But when it turned off, we remained at the same nine kilometers and again, albeit very slowly, we were climbing!

(Command: 25 III 5 C/II. The result: altitude 8984, speed two and a half meters per second, again with a plus sign. Is he really going to spend the rest of his life here?)

...No, I decided, it wouldn't work that way. Even if I manage to set an acceptable descent speed - say, five meters per second - and maintain it until the lunolet lands, how long will it take? Half an hour? An hour? There won't be enough fuel for sure. Yes, and oxygen...

"Dad!" My son asked again. "There are only two hundred liters of fuel..."

"Two hundred and ten!" I snapped. "But be quiet!"

We were already falling again, faster and faster. There was only a little more than half of the fuel left. Damn it, if we managed to get here with half the fuel, then the remaining half should be enough to return! If, of course, we spend it wisely... But how can we do that?

I decided to wait as long as possible, and then give a sharp braking impulse. I set the levers to positions 100 and 3 in advance. This time the free flight lasted one and a half minutes. We were already rushing at fighter speed again, but only down. We were just over two and a half kilometers from the surface when I pressed the red button. Overloads hit us again...

(One and a half minutes of free fall. 0 III 90 C/II. Height 2652, falling speed 143. About 500km/h. But the comparison with the fighter, as we agreed, is not a mistake, but just hyperbole. We introduce 100 III 3 C/II. On the screen, of course, the letter Γ. The overload again exceeded the permissible value. Isn't it too often? Anyway, we press C/II. Altitude 2123, speed minus 32.)

...When consciousness returned, the altitude dropped by half a kilometer, but the speed decreased to thirty meters per second. The maneuver was a success! I could try to go further at the same speed, and repeat the maneuver somewhere closer to the surface. But how do I keep up the speed? I decided to experimentally select the right thrust.

To begin with, I gave 10kg in 20 seconds. The weight returned to us again, though less than on the Moon, but the speed still increased. By the end of the maneuver, it had reached 50 meters per second. I increased the thrust: the same ten kilograms, but now for 15 seconds...

(Repeat both maneuvers. 10 III 20 C/II. Height 1314, descent speed 49. 10 III 15 C/II. Altitude 515, speed 58. Too much!)

...The speed was increasing anyway, and there was only half a kilometer left to the lunar surface. The fuel reserve is 80 kilograms. There was nothing to do. I gave 35kg in a second and a half - and, of course, I blacked out again...

(Command: 35 III 1.5 C/II. The screen displays Г - an overload. C/II. Result: altitude 390, descent speed 17. Approximately 60km/h. That's already better.)

...When I came to my senses, I realized that the maneuver was a success. It was still almost 400 meters to the surface, and the speed had dropped more than three times! Seventeen meters per second is the speed of an electric car! I already knew how to save it. I sent 22kg in 22 seconds. I was born on March 22nd. Sergei was born when I was 22 years old. And anyway, 22 is a lucky number for me...

(Command: 22 III 22 C/II. Numbers flash on the screen.)

...I really guessed right! The speed did not change much, only in tenths. The height decreased evenly: 250... 200... 150... 100... 50... And suddenly it dawned on me that we were about to crash into the surface of the Moon, the shock absorbers would not hold! There was 33kg of fuel left. Leaving the flow lever at the same level, I yanked the

second one down to the stop - 0.7 seconds - and pressed, pressed, pressed the red key. But it yielded only when there was less than a second left before the fatal impact. Another overload...

(On the screen: altitude 13.5, speed 17.5. Command: 22 III 0.7 C/II. Г - overload! Press C/II again.)

...Surprisingly, I only seemed to black out for a tiny fraction of a second. When consciousness returned to me, the speed was the same and we were only 7 meters away from the surface. The engine was silent. Subsequently, I have often wondered how this could have happened. Was it an engine failure? I don't know. But at that moment I had no time to think. My finger was on the key. I repeated the command, sending the last drops of fuel into the engine. I did it the moment I opened my eyes. A new blast of acceleration...

(Height 7, speed 17. It all fits together! But the engine of the lunolet and our Elektronika could not be energized at the same time! Let's try to understand the situation - we have time. Check the fuel reserve. IIIД. The indicator shows 11kg. This means that the engine has used its 22kg. Then why the same speed? Look at the time for which the engine was turned off. III2. On the screen, 21 seconds. Wow, "a tiny fraction of a second"! However, this cannot be considered an inaccuracy of the narrator: it looked like that, and how can he know how long he was unconscious? He doesn't have equipment like ours! And the following happened: the flow rate was set too high, the engine not only completely extinguished the speed, but also accelerated the lunolet up again. Only after that did it turn off for 21 seconds, during which time the Moon pulled the ship back down to itself. And he thinks it's an "engine failure"! But all right, let's

Consultant of this section - Hero of the Soviet Union, USSR cosmonaut Yu. N. Glazkov

A SOFT LANDING!

An electronic fantasy game for the PMK class "Elektronika B3-34"

The Lunolet-1 program (see page 1) can be used not only for numerical simulation of spacecraft maneuvers in the immediate vicinity of non-atmospheric celestial bodies or as a textbook, but also as the basis for a number of electronic games for programmable microcalculators. Today we introduce readers to one of them. The player must, by adjusting the thrust of the engine, land the ship on the planet, and the speed at the moment of contact with the surface should not

exceed the selected value, for example 5m/s (soft landing). To play this game, you need to perform the following preparatory operations after entering the program into the PMK:

1. Generate and send an alarm signal to register 9. For example, the letter Г: Cx ÷ BП BП ↑ П9.

2. Enter into the machine's memory the constants and initial values of the variables: (acceleration of gravity on the surface of the planet, m/s²) П4; (mass of the ship without fuel, kg) П5; (rate of expiration of combustion products, m/s) П6; (the maximum acceleration that astronauts can withstand without losing consciousness, m/s²) П7; (initial height, m) ПA; (initial velocity, m/s, and the upward direction is considered positive) ПB; (fuel reserve, kg) ПД.

Either the current time or the time remaining before the deadline can be stored in register C (for example, if the life support resource is limited). To implement the first option, you need to type the command: 0 ПC 1 +/- П0; to

implement the second: (resource, s) ПC 1 П0. If the player is not interested in time, the C and 0 registers can be omitted.

All source data is entered in any order.

Now you need to press B/O and then C/II. The game has started. Each move can be divided into two stages: analysis of the situation and input of initial data for the next maneuver.

SITUATION ANALYSIS

When stopped, the current altitude value lights up on the screen. The current speed is called with the XY command on the indicator. After that, if desired, any constant and variable values can be recalled from memory (they are stored in the same registers where the corresponding initial data was entered), to make any calculations on the PMK. After that, you can proceed to the next stage.

enter the last command: 22 III 0.7 C/II. Yes, but there's only 11 kilograms of fuel left, and it's set to 22! The letter Г lights up on the indicator. Overload? This time, the machine signals a more important incident: the engine has been ordered to exceed the available fuel supply. When it runs out of fuel - which will happen in exactly 0.35 seconds - it will shut down completely. Press C/II. Numbers flash on the screen, and suddenly zero lights up. The surface! Check the speed: 3.7m/s. Great landing!)

...The engine was silent. I was lying in an armchair in the gentle embrace of the familiar lunar gravity. The lunolet, rocking on shock absorbers, stood not far from the place from where we started. The indicators showed a speed of less than four meters per second and a time of 350. So we flew for less than six minutes...

I turned my head - how is my Sergei? He lay motionless, his eyes closed.

"Seryozha," I called.

He didn't move.

"Seryozha!" I shouted. He remained motionless.

I struggled out of the chair - the straps wouldn't let me go. I don't remember how I undid the buckles, how I found myself next to him. I shook him, tugged at him, to no avail. I don't know how long it went on. And then suddenly...

His loud happy laugh rang out in my headset!

He was still playing! He was pretending to be a cosmonaut killed by the overload!...

Later, of course, I told many people about this adventure. Everyone was amazed how I, who was at the controls for the first time, managed to make such a successful landing. Only one friend, a selenologist by profession, listened attentively and said: "Not bad! But I think in such a situation sixty would have been enough for me!" He meant that he would not have spent three hundred and something kilograms of fuel for the landing, as I did, but only sixty. I don't understand how this can be done - after all, sixty-five kilograms were burned at the start, which means that at least the same amount should be used by the end! However, he did not go into details. It would be enough, period! These selenologists are dashing fellows - they race their lunolets all over the Moon. They know better.

Seryozhka, of course, also boasted about everything. His version of what happened sounded something like this: "Dad landed the ship on the Moon, but I lifted it into space!" His friends, of course, were very jealous of him.

And he didn't say anything to his mother. Because he promised.

(The story has come to an end. But, in fact, our work is finished. Let's put the PMK aside. What inaccuracies were found? None. Just a couple of exaggerations. And our program can't check facts like the last one...)

If anyone wants to find out if that dashing selenologist was right, do it yourself. Pump fuel into the tanks and go for it. But please do not forget to reduce the weight of the lunolet by 100kg before launch. Like this: III5 100 - II5. Until you gain experience, do not take your child with you!)

INPUT OF THE INITIAL DATA FOR THE MANEUVER

The engine mode during the maneuver is determined by the fuel consumption and the time for which this consumption is made, and is set with the command: (consumption, kg) IIII (time, s). If it is necessary to accelerate the descent, then the command IIII +/- is given (reverse thrust, see figure). Reverse is very useful when landing on planets with weak and especially negative gravity. To transfer the typed command to the engine, the C/II button must be pressed in an emergency situation. If it was associated with overloads, when stopping at the next altitude in register 2 is the time of free fall. It is displayed on the indicator with the command IIII2.

The game ends when, at the next stop, 0 lights up on the indicator (in some cases, a small positive number may appear instead of zero, such as 0.00001). The values of speed and other variables at the moment of landing are called to the indicator with the same commands as in a normal situation. When starting a new



Normal braking. To transfer the mode set from the console to the engine, press C/II (left).

Reverse thrust. To transfer the set mode to the engine, press IIII +/- C/II (right).

game, a new set of initial variables must be entered, and constants, if they remain unchanged, may not be entered. Then press B/O and C/II.

When you gain experience and learn how to confidently land on any planet, try to answer two questions about the story "The Real Truth":

1. How can we explain the boastful statement of a dashing selenologist that he would need less fuel to land than he spent on takeoff? What are the physical phenomena behind his words?
2. What is the fundamental difference between the situations described on page 1 ("The pilot finally made up his mind and with a push of a button sent the last of the remaining fuel into the reactor...") and on page 6 ("I repeated the command, sending the last drops of fuel to the engine...")? Why would a determined pilot fail in the first case, but in the second, as we know, everything ended quite well?

In the next issue, we will introduce you to several more electronic games based on the "Lunolet-1" program.