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The Mishin Diaries, a new significant primary source of space history information

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ABSTRACT

Vasily Mishin (1917–2001) was a prominent Russian engineer and scientist: one of the pioneers who made spaceflight a reality. In 2014 diaries that were maintained by Mishin from 1960 to 1974 (the Mishin Diaries) had been transcribed and published and can now serve as an extensive resource for first-hand historical information about that fascinating period of time. The original Diaries are now owned by the Perot Foundation and copies were generously provided by them to the Moscow Aviation Institute for this transcription project. The actual publication was made possible by Mishin's students, co-workers, family members as well as numerous spaceflight historians and enthusiasts.

1. Introduction

Vasily Mishin (18.01.1917–10.10. 2001) was one of the 'founding fathers' of the Soviet spaceflight program. After Sergey Korolyov's death in 1966, Mishin led the Soviet human space program until 1974. He held the position of Chief Designer and served as head of the firm we now know as the Rocket and Space Corporation Energia [3].

Mishin was a key technical person as a member of 'Korolyov's Design Bureau' on early rocket projects, including R7 'the Mother of all Soyuz launchers', N1 'the Tzar Rocket' and the whole L1 and N1-L3 manned lunar programs. After Korolyov, he was in charge of the Soviet manned Moon program and witnessed the first efforts on the Salyut orbital stations and the Apollo Soyuz Test Program.

In 1974 Mishin left the industry and accepted a position as the Chair of the Rocket and Space Systems Department of the Aerospace School at Moscow Aviation Institute (MAI). In 1989 he became the Rector's Advisor where he remained until his death in 2001.

That might have been the end of the story, except for the end of the Soviet Union and Perestroika that now allowed people to start discussing these programs in public. Since the late 1980s Mishin was free to write about the N1-L3 program, describing in detail what the mission profile was to be with specific performance data about the giant N1 launch vehicle [4]. For researchers in the West, this began a flood of totally new information (Figs. 1–9).

Mishin was also permitted to travel abroad. During the 42nd IAC in Montreal in 1991 he was the center of attention following the presentation of his paper. And so Academician Mishin's presentations with details of those programs became known and popular in the international space history community.

2. The notebooks

During his whole long life Vasily Mishin stored dozens of his notebooks. He recorded the brief estimations of space hardware they built, drafted important letters, saved meeting minutes, registered phone calls and to-do's, his thoughts and opinions during failure investigations, etc. Mishin used both book size daily planners and pocket notebooks, some of which he would take to Baikonur to record important events.

He never planned to publish these notes. After Mishin left the Chief Designer position at the Central Design Bureau of Experimental Machine Building (now RSC Energia) in 1974, he destroyed some 'too sensitive' pages, but kept the rest of the notebooks. During his MAI tenure, Mishin sometimes would return to his old pages to add remarks and use the blank pages for new notes and drafts.

In the late 1980s and early 1990s, after the Soviet Union collapsed, Vasily Mishin, his colleagues and their families found themselves in what they perceived to be a different country, not much interested in space, space history and space education. Life was difficult at that time. So when in 1993 it became known that Sotheby's was planning a large Russian Space History auction, Mishin offered his old notebooks for sale as historical memorabilia, keeping no copies for himself. 'There is nothing of interest in

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0094-5765/

Fig. 1. Vasily Mishin (1917–2001).

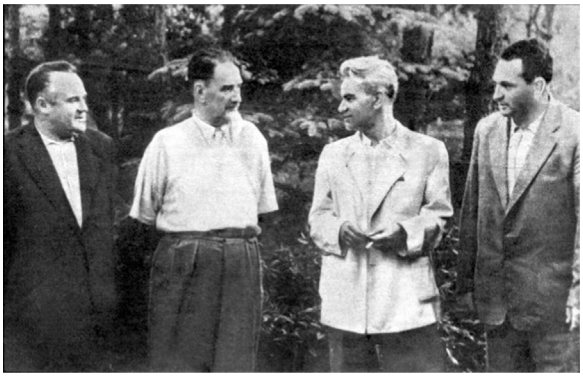

Fig. 2. The iconic photo of Soviet rocket and nuclear scientists (from left to right: S. Korolyov, I. Kurchatov, M. Keldysh, V. Mishin).

them', he told those who would ask. Not without slyness it probably was: who would be interested in those old space program notebooks if society is not interested in the space program itself?..

Mishin's old notebooks would become one of the Sotheby's pearls. Charles Vick remembers these weeks in New York quite well[1].

3. Sotheby's

"October 22, 1993 was a cold, overcast day in New York City. Charles Vick and David Woods made special arrangements with the staff of Sotheby's to view the collection of items that they had assembled for a huge Russian Space History auction. There were such fascinating items as the Cosmos-1443 VA re-entry capsule, an engineering version of the Voskhod-2 EVA airlock, a Krechet lunar program space suit, and many other items. These were all stored in a big warehouse, some still in their original shipping crates from Russia."

"In one conference room was a cardboard box, filled with a collection of 31 small, well worn notebooks. These were the set of personal diaries that had been made available by Vasily Mishin, covering the period from 1960 to 1974. To historical researchers, they represented one of the most valuable items there. It was obvious that they contained a wealth of information about the day to day happenings during one of the most fascinating periods in time: the depth of the Cold War when Russia and America were competing for political supremacy in the arena of world opinion."

[1] By rights, Charles was among the first people to get access to the Diaries given his lifelong interest and research achievements in Soviet space program history – *Dmitry Payson.*

Fig. 3. The cover of 'Why Didnot We Fly to the Moon' by Vasily Mishin, a first public first-hand evidence of the Soviet manned lunar program [4].

Fig. 4. Vasily Mishin and Charles Vick at the IAC.

Fig. 5. Vasily Mishin is inducted into the IAA (International Academy of Astronautics).

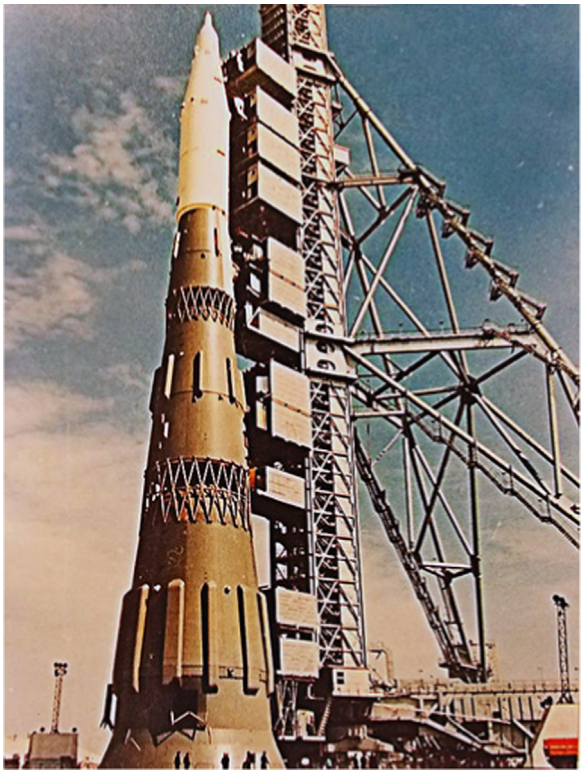

Fig. 6. N1 launch vehicle from the Soviet manned lunar program is closely associated with Vasily Mishin's name.

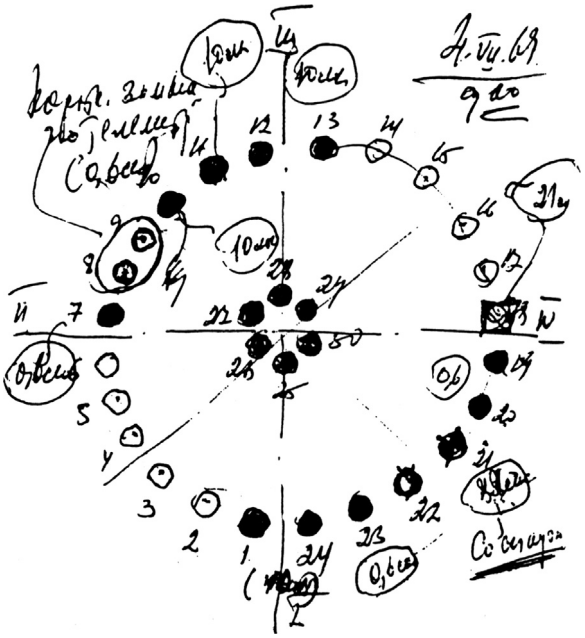

Fig. 7. Mishin's draft of the N1 first stage engines during 1969 failure investigation [1].

The auction was held on December 11, 1993. 226 individual items were sold for a grand total of $6.8 million: far exceeding Sotheby's original estimate. Prices ranged from $633 for the Lap Plotting Board that Vyacheslav Zudov had used on Soyuz-23 to $1,652,500 for the Soyuz TM-10 re-entry capsule. It was later revealed that the famous American industrialist: H. Ross Perot had recognized the significance of many of the auction items and had out bid all of the others to assemble them into his personal collection. His wish was that they remain together in the hopes that

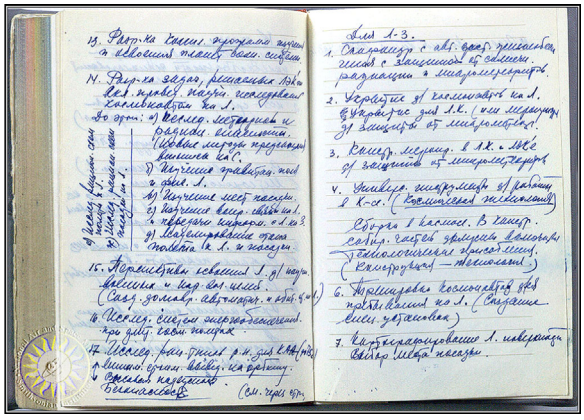

Fig. 8. Copy of pages from the manuscript Diaries at the Smithsonian Air and Space Museum (1).

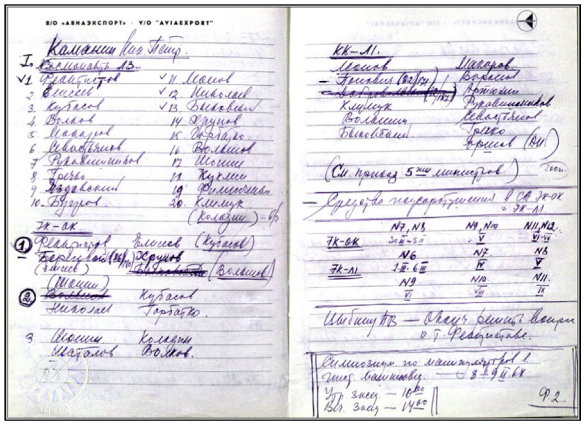

Fig. 9. Copy of pages from the manuscript Diaries at the Smithsonian Air and Space Museum (2).

one day they could be returned to Russia, to a facility much like the Smithsonian Air and Space Museum in Washington DC where many of them are on display today.

The Smithsonian display includes copies of a number of pages from the Mishin Diaries, one of many items that Mr. Perot made a special point to obtain. Vasily Mishin is quoted as saying that the diaries 'took an utmost effort of mine…They are my private diaries, which I started in 1958–59, and kept up through 1974. Some of the entries were made promptly in the wake of events, others written down as recollections. I put my soul into them.'

The Sotheby's catalog stated that 'A brief survey of Mishin's diaries gives some idea of the riches they hold. (The first volume) begins with a sort of memoir or summary of the Soviet space program in 1960 and '61, and delves shortly into outline form, and then into a chronology. The first portion was written not long after Gagarin's epochal flight in April 1961; and we may well imagine that it was at this time that Mishin began to see how his place at the heart of great events afforded him a special privilege as their chronicler… Any attempt at telling the history of the space race without the material in these notebooks will be second-rate.'

Copies of the diaries were made available for a number of people and some information was extracted from them, but no one ever published any of his or her findings from any of those examinations. It appeared that the information content hidden in the pages of those tiny 31 volumes would eventually be lost to time.

4. Diaries go east

After Mr. Perot had purchased the diaries and given them to his Perot Foundation which now legally owns them, it was clear that the Foundation had the right to prevent any access to them. Instead, the Foundation had graciously made copies of them available to a number of researchers with the proper credentials.

In order to transcribe them it was obvious that someone was needed who was fluent in both Russian and English, and who came from a technical background where he would know the personalities involved, the organizations they worked for, and the technical terminology that filled those pages. Dr. Maxim Tarasenko of the Moscow Institute of Physics and Technology was asked to take a look at one section, to do a translation of it, and then gauge the scope of a grant application that would be necessary to fund the rest of the project. We include in this paper his translation of the Diary items for a few days surrounding the second N1 launch attempt in July 1969. Maxim filled in abbreviations and clarified personalities and organizations with italics or footnotes. The example of this translation effort is provided on pp. 5–7.

The results were very encouraging. It seemed that if Maxim could find the time and funding for all of the diaries, the end product would be an incredible resource for researchers. Charles Vick and David Woods began looking into securing a grant for that purpose. Before any progress was made on the grant we were shocked to learn that Maxim had died in an automobile accident on 14 May, 1999. It seemed as though the Diaries would never be transcribed.

After Mishin's death in 2001, Moscow Aviation Institute recognized that a memorial project should be organized to pull together all of Mishin's works. We were able to contact the Perot Foundation and request that copies of the Diaries be made available for this project. Permission was granted and we made special arrangements to get the copies delivered to Moscow to begin the translation project.

In 2002 the project team was organized by the Moscow Aviation Institute Aerospace School's Dean, Mishin's student and long time associate Prof. Oleg Alifanov, and Dmitry Payson who had been fortunate to work with Mishin in 1998–2001 helping him to arrange chapters for the memoirs book that would later be also included in the Diaries publication. Ivan Moiseev of the Moscow-based Institute of Space Policy was in charge of most of the deciphering effort and methodology. The project was strongly supported by Mishin's family members, including his wife Nina, daughters Vera, Kira and Elena, and grandchildren Vasily and Maria Danilov. Vasily Danilov was able to secure the deciphering effort material support. During the final phase Maria Matveeva joined the team to help complete the book layout.

AN EXAMPLE OF EARLY DIARIES TRANSLATION BY MAXIM TARASENKO

20.VI.69

18?0 – Rollout of *[N1 rocket No]* **5L to SP** *(launch pad)*

2.VII.69

1800 – GK on N1-L3S *(The session of the State Commission on the launch of the N1-L3S complex)*

————————————————

There are **Re***marks* **after "rehearsal"**

1. **on sys***tem of* **targeting**
2. **non-herm***eticity* **of helium syst***em*

————————————————

1. **Moiseyev Yevgeniy Georg***ievich*
2. **Patrushev Vl***adimir (Vladislav?)* **Semen***ovich*
3. **Shabarov Yevg***eniy* **Vas***ilievich*
4. **Dorofeyev Boris Ark***adievich*
5. **Finogeyev Vl***adimir* **Petr***ovich*

————————————————

6. **Utkin Iv***an* **Iv***anovich*
7. **Demonov. (LOMO)** *LOMO: Leningrad Optical and Mechanical Association – optical instruments*

————————————————

To Stanishevskiy - form the document *[i.e., prepare formal protocol of the session]*

3.VII.69

800 – Beginning of prelaunch preparation

On the facing page:

Console of fueling – 12-05

(Moiseyev, Kitayev, Dorofeyev et al.)

Guest room (GK et al.) – 15-93 *[probably a miswritten time when members of the State Commission (GK) collected at the Guest Room at the pad]*

1705 – Finished fueling of Bl*ocks* **V, B, A** *[with oxidizer]*

————————————————

Leak in the valve of IGN VK-5 (Voltsifer) *Voltsifer: TsKBEM representative responsible for valves*

————————————————

1740 – Beginning of loading of fuel into Bl*ocks* **A, B, V**

1930 – End of loading Bl*ocks* **A, B, V with fuel**

2100 – Beginning of loading of O2 *into* **GB**

————————————————

2308 – Readiness 2:10 (before launch)

Launch sequence

On the facing page: **Smirnitskiy** *(Head, Main Administration of Missile Armament at the Strategic Rocket Forces)* **Morozov**

Preparation for launch – N*ormal*

Launch is a failure

(see 4.VII.69)

————————————————

900

Drawing showing the layout of the 30 rocket engines on the first stage of the N-1, with remarks, showing at what time after lift-off which engine shutdown.

Short circuit according to telemetry (*at* **0.6 s** *after lift-off***)**

Necessary to look through TM *(telemetry)* **of KORD (engine monitoring system) system for engines NN 7,8,19,20,23,11**

(Who gave signal "failure"!?)

1. **ODN – en***gines* **N 7,18 – abnormal in compar***ison* **with N 28**
2. **ODN and GDN on N 7 – contradictory**
3. *(Engines)* **NN 7,8,19,20,23 – switched off at – 0.6 sec**
4. **All engines, excl***uding* **N 18, switched off at T approximately equal to 10 sec**
5. **0.3 sec before KP** *(liftoff indicator switch) [there was a]* **short circuit of LK in** *(unclear)* **of engines NN 8 and 9**

S.A. – Called to L.I. and A.N.

(S.A. – Sergey A. Afanasiev – the Minister of General Machine-Building of USSR)

(L.I. – Leonid I. Brezhnev, the General Secretary of the Central Committee of CPSU)

(A.N. – Alexey N. Kosygin – the Chairman of the Council of Ministers of the USSR)

(A.N. is dissatisfied with results of the 2 launches)

Eng*ine* N 7 switched off at t=0.6 sec after KP inder PRM of KORD

En*gine* **N19 switched off under engine N7**

En*gine* **N20 switched off simultaneously with the en***gine* **N19 under** *[command from]* **KORD**

(Next engine N18 was by that time not in the norm)

Short circuit of LK at 0.3 sec before KP *(before liftoff)*

Diagram showing layout of 30 engines on the first stage of the N-1, colored in accordance with timing of their shutdown

1600 – Consideration of results of processing of tele*[metric]* **measurements in RB (rocket block or stage)**

Commands for start – N*[ormal]*

Oscillations of GDI are similar to oscillations of EU-28

Reaching of the intermediate level *[of thrust]* **by the engine N9 has been delayed by 0.29 sec**

All engines reached GS (full thrust)

At t=KP+0.6 s switched off

En*gine* **N7 (KORD by PRM)**

En*gine* **N19 → KORD**

En*gines* **NN 8,20 → KORD**

At t = 10.2 sec all remaining en*gines* **switched off** *[by]* **SU** *(Guidance System)*

1. **In the area of engines NN 12,13 temperatures rise starting from 7**th **second up to 140 °C**
2. **Sharp rise of t[***emperatu]***re at KP** *[lift off]* **in the area of engine NN 10,11**

Finogeyev Vl. Petr

At t=9.3 s disruption of the system of power supply due to destruction of BKS (onboard cable system – short circuit)

Chain scheme plus Chart with layout of engines

High temperature from t=7

Necessary to say to subcommission:

1. **Engine***(s?)* **Kuznetsov –** *Chief Designer of rocket engines for the N-1 rocket***)**
2. **Temperatures and loads (Degtyarenko –** *Deputy Chief Designer of TsKBEM***)**
3. **Power supply (Iosifyan –** *Chief Designer of VNIIEM – N-1 power supply system***)**
4. **SU (+KORD) (Finogeyev –** *Deputy Director of Science and Research Institute of Automatics and Instrument Engineering (NIIAP – N-1 guidance system***)**
5. **SAS (Shabarov –** *Representative of TsKBEM – responsible for ground testing at the cosmodrome***)**
6. **S***[ystem of]* **meas***[urements]* **(Dorofeyev –** *Lead Designer of the N-1 at TsKBEM***)**

"KORD" (Kupavin, Dorofeyev)

A.G.Iosifyan

System of power supply at t – 0.6 s had a sharp flash *(increase)* **of electrical power.**

Temperature of air incoming into DGG (additional? gas generator)

Flashes of the current consumed by KORD system *[occurred]* **at t=0.6 s and 8.8 s.**

V.P.Barmin

"About the status of the launch *[pad]***"**

As a result of the explosion the right launch construction is destroyed, service tower is heavily damaged.

All special technical equipment within the launch construction is damaged

Internal part and the left launch construction are not damaged.

Launch construction can be restored. That would be faster and cheaper.

Possibility of restoration of the tower is unclear.

5.VII.69

1) **G.N.Degtyarenko**
2) **Rumynskiy (NII-88)**

Fig. 10. Memoirs of Rocketman, 2013.

3) **Semyonov**
4) **Akimov N.I. – TsUKOS –** *(Main Administration of Space Means: Space Operations for the Ministry of Defense)*
5) **–v/ch** *(Military Unit)* **Gorki**

1) **Temperature in the region of engines 6,7,8,9,10,11,12,13 and 26,27**
2) **Vibration overloads in the area of engines 7,8,9 and in the area of engines 15,16,17.**
3) **Conventional overloads**
4) **DkhO, DMO (Compare to 3L)**
5) **T***emperatur***es in the area of EGG**

Most of the Diaries' content was deciphered to form the book by 2004. However, it took an unexpectedly long time to have the legal issues settled, including all kinds of clearances, some really needed and some that seemed excessive.

In 2013 a brief overview of the Diaries' content, accompanied with essays by Mishin's contemporaries and associates was published in Korolyov City with a circulation of 500 copies as 'Записки ракетчика', 'Memoirs of the Rocketman' [5] (Fig.10).

It was Vladimir Rachuk, General Designer of KBKhA JSC, one of Russia's leading rocket engine enterprises, who joined the process in 2013 to support the final effort. As a result, in early 2015 the 3-volumes of the Mishin Diaries were finished and presented to the public. The 'paper' circulation was minimal, so it was decided to have the books openly published online as a set of three PDF files (Fig. 11).

The 3-volume edition contains the completely deciphered Vasily Mishin daily notes (based on the Sotheby's notebooks and those still owned by the Mishin family) with the reference section prepared by Ivan Moiseev. The book includes chapters of Mishin's

Fig. 11. Mishin Diaries 3-volume paper edition.

Fig. 12. Mishin Diaries book presentation at URSC.

Fig. 13. Diaries presentation. From right to left: V.Khubaeva (Mishina), V.Vachnadze (former RSC Energia Director of Manufacturing), O.Alifanov (Moscow Aviation Institute), A.Kuzin (URSC), T.Dragnysh (Literaturnaya newsp.), G.Nechitailo (RAS).

Fig. 14. Dmitry Payson demonstrates the copies of the Diaries manuscript.

unfinished memoirs with Dmitry Payson's literary adaptation as well as some of Mishin's earlier works. We included Vasily Mishin's paper on rocket technologies' usage for aircraft design, a research project Mishin called his 'swansong'. In his letter of November 20th, 2014 H. Ross Perot highly appreciated the project results (Figs. 12–14).

In January 2015 the Mishin Diaries were presented in Moscow in the headquarters of the United Rocket and Space Corp (URSC). The paper version was published in very small circulation. However, the complete digital version of the Diaries is also available at http://www.mishindiaries.com (with a mirror at http://дневникимишина.рф) (Fig.15) [2,6,7].

5. Diaries in context

The Diaries are not an easy reading at all. We consider them to be an authentic source providing a structural framework for space history research of the 1960s and 1970s, a frame of reference for more detailed and multi-faceted studies. In a sense, the Diaries join the fundamental writings comprising the fundamental resource base, like 'Rockets and People' by Boris Chertok [8], 'Hidden Cosmos' by Nikolai Kamanin [9], 'The Way it Was' by Yuri Mozzhorin [10] et al. However, the key feature of the Vasily Mishin Diaries publication project is our deliberate refusal of any actualization or editing except for pointing to obvious misspellings and anachronisms. The plan was to deliver the Diaries to researchers working at their own studies and looking for additional first-hand evidences.

However, one can never say in advance. Recently the education materials were located in the Internet that mention the Diaries (still in their manuscript form as displayed at Smithsonian) [11] as an important artifact of the historical space program (Fig. 16). 'One Man Who Kept a Diary' seems an archetype character for youngsters adding some intrigue in otherwise less entertaining 'rocket science'.

Technically, what we call the Diaries are actually the daily work notes, brief minutes of meetings, plans and nota bene's that by no means were originally intended for publication or even for sharing with somebody else. This explains the unique openness and relevancy of the notes (no a-posteriori editing) as well as obvious problems with the deciphering. The most characteristic issues include handwriting recognition as well as abbreviations and arbitrary notations. Fortunately, most of the vocabulary and word usage issues associated with the Diaries are rather country, epoch and industry specific than reflect Mishin's personality and background – if otherwise, even a Russian publication effort, not to mention any bilingual research, would be extremely complicated. The large quotation hereinbefore provided in Maxim Tarasenko's

Fig. 15. Mishin Diaries online (http://www.mishindiaries.com).

translation demonstrates the text specifics very clearly. However, the Diaries' English translation and making available for international researchers would be a natural follow-on project. It is known that in 2004 NASA issued a request for a deciphering effort, but it is still unclear if any publicly available results were achieved [12,13].

The Diaries list 2200+ persons, most of whom worked in the rocket and space industry or were otherwise dealing with the rockets, spacecraft and their systems. Mishin provides personal estimates very rarely, but records the person's positions as applied to any technical or organizational problems. Thus, the Diaries provide a vast amount of first-hand materials for the history of spaceflight personnel.

Mishin often mentions enterprises, institutions, design bureaus and ministries. Information of this kind is helpful for a better understanding of what was going on in the national space industry in the 1960s and early 1970s. However, there is a problem of the exact recognition of the particular firms involved, as different names are used for the same entrants based on the official nomenclature, geographical location or company's leader's name. For example, 'Chelomei', 'OKB-52' and 'Reutov' mean the same enterprise we now know as OJSC Military Industrial Corporation Scientific and Production Machine Building Association.

This paper is not aimed at abstracting the Diaries. For a very detailed analysis in English we recommend, for instance, online source [14]. This is not a space history story. Rather, we tried to describe ways the authentic historical sources travel in time and space, and how people collaborate in historical studies.

Fig. 16. One Man Who Kept a Diary [11].

6. Conclusion

The Mishin Diaries project took much more time than was originally planned. Now that it is finished and everybody can download the three volumes containing the first-hand historical evidence of the early days of spaceflight we would like thank everybody on two continents who made this publication possible, with special thanks to H. Ross Perot and Vasily Mishin's family. We believe this is a good example of international cooperation in our common history and for our common future.

References

[1] В.П. Мишин. Дневники. В 3-х томах./Воронеж: Кварта, 2014. (V.P. Mishin. Diaries in 3 volumes/Voronezh, Quarta Publishers, 2014) – in Russian.
[2] Mishin's Diaries project web site, ⟨http://www.mishindiaries.com⟩.
[3] Vasili Pavlovich Mishin. Available online at Russian Space ⟨Web:http://www.russianspaceweb.com/mishin.html⟩.
[4] V. Mishin, Why we did not fly to the Moon (Почему мы не слетали на Луну), Moscow, Znanie, 1990.in Russian.
[5] V. Mishin, Memoirs of the Rocketman (Записки Ракетчика), Korolyov Publ., 2013.
[6] Diaries of the Designer/Science and Technology of Russian Federation web site, ⟨http://www.strf.ru/eng/material.aspx?CatalogId=94456&d_no=94624⟩.
[7] Transcribed diaries of V. Mishin presented to the public/RSC Energia official web site, January 22, 2015. ⟨http://www.energia.ru/en/news/news-2015/news_01-22.html⟩.
[8] B. Chertok, Rockets and people, A. Asif (ed.), Siddiqi (NASA History Series) (NASA SP-2005-4110), vol. 1–4, 2005–2011.
[9] N. Kamanin, Hidden Cosmos (Скрытый космос). vol. 1–4., Moscow, Videokosmos, 1995–2001 (in Russian).
[10] The Way it Was (Так это было)/Mozzhorin Yu. et al. Korolyov, TsNIIMash, 2000 (in Russian).
[11] S. Paris, 20th Century: Race to the Moon: Teacher Created Materials, January 15, 2013. Available online: ⟨https://books.google.ru/books?id=DWkE9l6xxC0C⟩.
[12] A. Siddiqi, Privatising memory: the soviet space programme through museums and memoirs, in: Martin Collins, Douglas Millard (Eds.), Showcasing Space: Artefacts Series: Studies in the History of Science and Technology, The Science Museum, London, 2005, pp. 98–115.
[13] A. Siddiqi, People and archives, in: Dominic Phelan (Ed.), Cold War Space Sleuths: The Untold Secrets of the Soviet Space Program, Springer, London, 2012, pp. 217–253.
[14] New Insights from the Mishin Diaries/Pausanias: The Lost Guide personal web site, March 11, 2015. ⟨http://pausanias.blogspot.ru/2015/03/new-insights-from-mishin-diaries.html⟩.