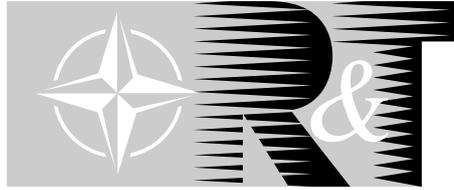


NORTH ATLANTIC TREATY ORGANIZATION



RESEARCH AND TECHNOLOGY ORGANIZATION

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RTO AGARDograph 338

Kingdom in the Sky – Earthly Fetters and Heavenly Freedoms. The Pilot’s Approach to the Military Flight Environment

(le Royaume au ciel – Fers terrestres et libertés célestes. La démarche du pilote vis à vis de l’environnement aéronautique opérationnel)

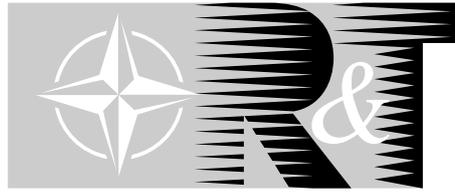
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This AGARDograph has been sponsored by the Human Factors and Medicine Panel (HFM) of RTO.



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Kingdom in the Sky – Earthly Fetters and Heavenly Freedoms. The Pilot’s Approach to the Military Flight Environment

(RTO AG-338)

Executive Summary

This book provides insight into the psychology of the Russian flyer. While working under extremely difficult conditions, the flyer continues to do the best job possible out of a sheer love of flight. The book focuses on the flyer, considered by the author as either the pilot or other aircrew members, and the flyer’s constant struggle to overcome the procedures dictated by ground-based directors while enjoying the thrill and emotional high of flight. While describing these freedoms of flight, the author takes the reader through all the turmoil and travail of in flight emergencies, unpopular ground-directed missions, and, ultimately, aircraft mishaps resulting in the loss of lives. It describes through detailed studies and interviews the difficult conditions placed upon the flyers because of a system inadequately prepared to address known human factor issues. Dr Ponomarenko points out that all too often the flyers are blamed for problems beyond their control, but they deal with these problems in a way that reflects upon the basic character of all flyers – a character that is almost spiritual (their human spirit). He also reminds the reader that it is the responsibility of those on the ground to improve the conditions of the flyer. Those improvements can come from the knowledge learned from detailed studies and the appreciation for the flyers’ mission.

The prologue sets the stage. It is an overview of the book and, at the same time, a testament of Dr Ponomarenko’s ability to reach beyond the grasp of the usual flight doctor. Chapter 1 provides details of the problems associated with aircraft accident investigations and the impact these investigations have on the flyer’s dignity. Chapter 2 describes many of the dangers associated with flight, as well as the skills necessary to overcome those hazards. Chapter 3 is an excellent description of the current state of human factor issues and flight safety. Data are presented to support the author’s claims. Chapter 4 goes into an interesting explanation of ergonomics and its relationship to flight safety. It is interesting to note the similarity with Russian ergonomic problems and the same types of problems encountered throughout the world. Chapter 5 matches the role of the flight doctor with the operational requirements of the flyers. Chapter 6 identifies the problems encountered when one is too conservative toward a profession that requires radical, rapid, and sometimes fatal in flight decisions. Chapter 7 explains to the flyer how to maintain a healthy body – both physically and mentally. Chapter 8 concludes with an uncommon insight into the flyer’s soul. The chapter is an excellent summary of all the research, reports, and lessons learned during Dr Ponomarenko’s life while working with the flyer and within the establishment. His frustration shows, yet his love for the flyer comes through loud and clear.

le Royaume au ciel – Fers terrestres et libertés célestes. La démarche du pilote vis à vis de l'environnement aéronautique opérationnel

(RTO AG-338)

Synthèse

Cet ouvrage donne un aperçu de la psychologie de l'aviateur russe. Tout en travaillant dans des conditions extrêmement difficiles, l'aviateur continue de fournir la meilleure prestation possible, animé par un véritable sentiment d'amour pour le vol. Le livre privilégie l'aviateur, qui peut être pour l'auteur soit le pilote, soit les autres membres de l'équipage, et met en lumière sa lutte constante pour surmonter les procédures dictées par les contrôleurs au sol, tout en profitant des frissons et de l'exaltation qui accompagnent le pilotage d'un aéronef. L'auteur décrit ces libertés, et en même temps renseigne le lecteur sur les bouleversements et l'angoisse éprouvés lors des situations critiques en vol, ainsi que sur les missions malaisées commandées du sol, et, enfin, sur les accidents d'avion ayant pour conséquence la perte de vies humaines. Il décrit, par le biais d'études détaillées et d'entretiens, les conditions difficiles que les aviateurs doivent supporter, en raison du fait que les systèmes sont mal adaptés à l'être humain. Le Dr Ponomarenko fait remarquer que trop souvent, les pilotes sont mis en cause suite à des événements qui sont indépendants de leur volonté, mais que la façon dont ils tentent de résoudre ces problèmes reflète bien le tempérament fondamental de l'aviateur, tempérament qui est presque spirituel (leur esprit humain). De la même façon, il rappelle au lecteur qu'il y va de la responsabilité du personnel au sol de faire en sorte que les conditions de travail du pilote soient améliorées. Ces améliorations dépendent des connaissances acquises lors de la réalisation d'études détaillées et du respect de la mission du pilote.

Le prologue pose le décor. Il donne un aperçu du livre qui témoigne en même temps de la capacité du Dr Ponomarenko de saisir des éléments qui ne sont pas à la portée de la majorité des médecins de l'air. Le chapitre 1 donne le détail des problèmes associés aux enquêtes sur les accidents d'aéronefs et l'incidence de ces enquêtes sur le mental des pilotes. Chapitre 2 décrit les dangers associés au vol, ainsi que les techniques permettant de s'affranchir de ces risques. Le chapitre 3 donne une description très complète de l'état actuel des connaissances dans le domaine des facteurs humains et de la sécurité des vols. Des données sont présentées pour étayer les affirmations de l'auteur. Le chapitre 4 présente un exposé très intéressant de l'ergonomie et son rapport avec la sécurité des vols. Les parallèles qui existent entre les problèmes ergonomiques rencontrés par les russes et les mêmes types de problèmes rencontrés dans le monde entier sont à noter. Au chapitre 5, le rôle du médecin de l'air est confronté aux besoins opérationnels des pilotes. Le chapitre 6 identifie les problèmes soulevés par une approche trop conservatrice d'une profession qui exige la prise rapide de décisions radicales en vol, qui ont parfois des conséquences fatales. Le chapitre 7 explique au pilote comment mener une vie saine tant mentalement que physiquement. Le chapitre 8 conclut par un aperçu peu commun de l'âme du pilote. Ce chapitre fournit un admirable résumé de l'ensemble des recherches effectués, des rapports publiés et des enseignements tirés par le Dr Ponomarenko au sujet des pilotes pendant sa longue carrière. Sa frustration est évidente, mais aussi l'amour qu'il porte au pilote, qui est reçu cinq sur cinq.

Contents

	Page
Executive Summary	iii
Synthèse	iv
Foreword	vi
Prologue	viii
List of Figures and Tables	xiv
Human Factors and Medicine Panel Officers	xv
Chapter 1 Flying Safety: An Issue of Man's Dignity in the Sky	1
Chapter 2 Man's Psychology of a Dangerous Profession	19
Chapter 3 Pilot's Right of Error: Who is Guilty?	37
Chapter 4 Ergonomics Applied to Aviation Technology and Flying Safety	57
Chapter 5 Prevention of Dangerous Flight Factors	79
Chapter 6 Psychological Problems of the Professional Training	95
Chapter 7 Health, Safety, Perspectives	113
Chapter 8 Is there a God in the Flyer's Soul?	129

To the officers of the Russian Scientific-Research and Testing
Institute of Aviation and Space Medicine the author dedicates this book.

FOREWORD

*Vsevolod Ovcharov,
Candidate of Science (Aviation Technology),
First Class Test Pilot, Colonel (Ret).*

The work of the flyer is to some extent, irrational in nature. It consists of a complex combination of knowledge in intuition, of volitional acts, and spontaneous decisions of intellectual and physical work. The flyer may or may not be intelligent, generous or thrifty, clever or not clever. This may all be true until the time of a forthcoming mission. I have witnessed prompt in-flight reactions in sluggish thinkers: I observed events of selfishness, which were difficult to foresee on the ground, in subjects notorious for their egocentric highly pragmatic attitudes.

I have sometimes criticised the author for idealising the flyer. Some years have passed since my last landing, when I embraced for the last time my aircraft and kissed its armoured cheekbone. Now I am retracting my criticism – the flyer is a man of the highest order... V.A. Ponomarenko has understood this, in greater depth than I have, and his book relates all about it.

There is no uniformity style, content, and spirit in this book. The reader will see the proofs and an invocation hymn to the aviator, and a belittling of those who don't see in aviation its essence. In details of abstract reasoning, and of accurate quantitative investigations, he attempts, and in my opinion, succeeds to create a unity by combining all physical and psychological limitations of the spirit.

The motif of the book, which covers a great variety of data, contains two main thoughts: 1) the profession of the flyer (more dangerous than that of the most dangerous profession) demands inner freedom and those qualities which give freedom; and 2) those who determine the strategy and plan a life in aviation (including instructors and commanders) should proceed from this first and main premise.

This is not a call for anarchy. What I said about the qualities assuring an inner freedom, include first of all, professionalism in all its manifestations, as well as psycho-physiological personality traits related to performance, knowledge, skills, and sound habits. This is what gives a pilot the right and obligation to

use all the capability of his aircraft when necessary, as in special flight situations, in non-standard environments, or in combat.

The main requirement of civil and military aviation in peacetime is flying safety. This requirement is controversial, since any flying activity presumes practically the maximum use of the equipment, i.e. profitable and "on-time" transportation in civil aviation and maximum combat efficiency in military aviation. Moreover, to assure flying safety, one needs to consider the reliability of the technology. Reliability of technology means a decreased risk level will lessen the useful output of the equipment at the expense of physically unsubstantiated limitations of the operational conditions. The single way to sell this controversy is to reject the technology standard approach in favour of a man centred or an anthropocentric approach. In my opinion, this is confirmed by the impressive achievements of the American space program by recruiting astronauts among experienced test-pilots, at the time in their early training, which allowed the use of simulation to insure astronaut performance, but not to replace him.

This book addresses a variety of anthropocentric approaches, and is to aviation as monograph manuals, technical reports, lectures, and oral presentations are to the author's students and followers of his teachings.

The disciples of this school are many – ground crews, cosmonauts, military and civilian pilots, engineers, and physicians, even (secretly) many aviation commanders and top instructors. The representatives of the last two categories did not subtly convert anthropocentrism, this happened thanks to the soundness of theories, and argumentatives, talent, energy, and uncompromise (frequently at personal loss) of the school founder: the author of this book. The monograph you're just beginning to read actually consolidates all that was worked out by the author (his colleagues and pupils) in the areas of physiology, psychology, psychophysiology, and specialised fields in aviation medicine. The data presented are often unique. Sometimes they are even shocking. After a

flying career of 50 years it seems that government “deafness” to aviation problems is a great error, when about half the flying military personnel is grounded five to seven years due to hardships of work conditions, service and social environment. Under the current socio-political conditions, 80% of the instructor pilots are former mediocre cadets, 40% do not like their tutorial duties, and 70% do not have any didactic inclinations. Yet they are the flying instructors. How can we speak of successful flying activity, if only 5 to 10% have marked flying abilities, whereas a potential ace, which could become the pride of the aviation and country, did not enrol in aviation due to various causes?

At times I feel the tide of hope and pride for our scientists, colleagues, and co-workers, when I read about major improvements in the sophistication of technology, implemented through laborious efforts, but mainly, through systematic theoretical and experimental studies.

The book includes:

- fundamental and applied flying safety research;
- psychological and didactic problems of man’s safety;
- problems of scientific and ergonomic supervision of research in development, testing and operation of aviation technology;
- problems of timely strategically directed prophylaxis of dangerous flight factors;
- health problems and socio-psychological flying safety factors and many others.

I feel compelled to cite all the issues discussed in the book. The issues are all important to the flying profession – selection and training, non-traditional approaches to find the cause of aviation accidents by evaluating aircrew activity, problems of organisation and direction from flight surgeon activity, as well as special training (psychological, physical, and occupational) of aircrew on new aircraft in extremely difficult flight conditions, and problems of ergonomic design of the aircrew cockpit, and, finally, spirituality of the flying profession. The book is permeated with profound love for aviation and the aviator. And this love has its sources. A world-renowned scientist, he has lectured authorities of the USAF and Russian Air Force. He is a leader whose opinion impacts high-ranking officials of the Armed Forces and their deputy’s decisions, a specialist whose concepts and proposals are implemented into hardware and manufacturing of the world’s best fighter aircraft. This man started his career in aviation as a young

Wing flight surgeon, and learned there to handle a fighter plane. That unexplainable magic of flying, which is simply described as space perception and control of one’s movement in space, instantly took him over forever. He later said that he learned to fly, in order to understand as fully as possible the essence of flying and the life of his experimental subjects and patients. I believe that passion for flying represents envy of such vanity which the pilot experiences just before flying and right after the mission, which gives him (her) a circle of closeness to colleagues. He has been penetrating the flying mystery. Moreover his sharp and paradoxical scientific mind prompted him to solve this mystery, and he has solved it. Being a scientist and a flyer, he rationalised what the pilot frequently, only vaguely, perceives, or hides behind an armour of irony. The author gives explanation to those who want to understand. But unfortunately not all want to comprehend this. I guess that striving to disclose the mystery was one of the compelling motives, which led Ponomarenko to choose aerospace medicine. This is a field in which he climbed the traditional steps of a scientific career – candidate and doctor of sciences, and later he also consolidated the investigation of problems related to “man in aviation”. He broadened the concept of common motions and created a new concept of man as the system-generating point in aviation technology from creation and evolution to functional failure.

Yes, the author has reached the pinnacle of his career: he is an academician, a professor, a doctor of medicine, a prize-winner, and a general – awarded many medals. Presently, all these awards might even compromise him. But his case is special. All was obtained not in compliance to the system, but in defiance of it by principled attitudes, conceptual substantiation, disputability ideas, ponder of arguments, uncompromised moral position, and to be sure, by titanic work. This book cannot be classified to a definite genre. Some of it is lyrical, and some is physics.

I read and re-read this and other books by Vladimir Ponomarenko, and one thought depresses me: why is it that all he writes is not accepted by those who depend upon the life of aviation and the life in aviation? I am inspired by the fact that, just as droplets, little by little, the ideas of the author have emerged. The droplet grinds the stone – gutta cavat lapidem. I hope I will live to see the triumph of his concepts.

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Prologue

“In aviation cowards are not chided they are washed out”

Captain S.S. Ivanov, First Class Air Force Pilot

The dwellers, i.e., the flyers, are the bearers of the human spirit. They are life-loving, simple, cheerful, warm hearted people, and have an excellent sense of humour. They are self-controlled, patient and possess a great stamina, are capable to endure life's blows and to react to all types of life's situations. This is not idealisation and iconisation of the profession. This is the image, which the soul maintains about life experienced and lived in an aviation command. However, the strategic aim of the book compels me to tell about the Achilles' heel of aircrews flying safety psychology and, even more so the destiny and life of man in this dangerous profession. The philosophy of this psychological problem consists in the fact that more than 100 individuals support one pilot in flying safety as a social phenomenon, without including the aircrew in this psychological problem. The attitude of the 'superiors' managing flying safety is service guided – do not admit danger; while the aircrew has its own operational aim – overcome the emerging threat to their life. In other words the aircrew estimates the seriousness of the danger based on a concrete threat. There might be a small difference in opinions but in real life, it sometimes becomes a 'knot' of inconsistencies despite the will of the flyer. And the most insulting is the fact that, though the 'knot' is based on one set of rules, the flyer must untie and loosen with another set of rules.

Presumption of guilt starts when rules and a succession of events during a complicated flight dictate a strict sequence of actions, and the psychological essence of the emergency frequently changes the performance. Moreover, there are no laws regulating the situations, they are just a matter of fate. This represents the psychological drama of the aircrew – the operational evaluation of the actual degree of flight danger frequently does not coincide with the legal one. The difference in the interpretation is due to the fact that the aircrew operates in another space and time. The performance of instructions in a given urgency situations is tactical. Behavioural strategy is determined by concrete psychic reaction to time in space awareness. In other words, one of the typical errors in an emergency situation is incorrect time perception. Decisions and performance are personal manifestations. The flyer's strongly sense that flying safety is achieved through danger (M. Gallay), and it is officially recognised that the less the danger, the greater the safety. The flyer's

daily life is well protected by legal norms, government standards, flight operation and regulations, etc. and only in an occupational situation, as flying emergency, is he helpless. Our aviation literature does not discuss the problem of the right of life in emergency occupations. In the flying occupation most administrators want only to command, only a few accept responsibility. For example, the decision to land aircraft with wheels up or without engine thrust, but not to eject above a residential area, proceeds from the right of life. Thus one is psychologically justified to assert that the flyer's right to life is his personal moral property! Similarly, the establishment of the moral limits of this 'property' is influenced by professional and personal maturity. The latter is included in the understanding of aviation community responsibility, i.e., by those who guarantee flying safety. The following episode serves as example (pilot, Russian hero, V. Gorbunov):

“Gorbunov was on a sortie to test the stability and controllability characteristics of a test aircraft built by Special Design Bureau named after A.I. Miloyan. The aileron control suddenly broke. The ailerons move smoothly causing left banking. By only pushing the control stick and pedals to the right does the aircraft maintained a straight and level flight.

Gorbunov decided to land his aircraft on an airfield. With great effort he recovered from a role and maintained glideslope and began to descend. At an altitude of about 30 meters above the ground level, just before flare-out, there was a strong swing in role axis of steering – Gorbunov warded it off and stopped the descent. All extreme movements of the control stick to the right could not correct the banking and the ailerons spontaneous deflection. He gave full throttle in trying to climb. The aircraft started to move above the runway with an increasing left banking (up to 45 degrees). A height of approximately 80-100 meters the planes nose dipped. Ejection became impossible, below were the base buildings and living quarters. Gorbunov instantly move the control stick to the banking side, this resulted in a normal attitude of aircraft. The control surfaces were fully deflected to the right side, and he reduced the after-burn thrust in

both engines, the left engine was on full rotation and the right engine on minimal. He performed repeated barrel rolls in order to align the required angle for climbing and takeoff. The aircraft rolled on a left trajectory and he avoided the residential area, then climbed and reached the unintended area. The manoeuvre was successful." (Magazine "Wings of Homeland", 1992, N9, p. 32; V. Selivanov).

Thus the flyer stands up for his right to life all alone in the sky. This example clearly illustrates that Gorbunov was limited to his own locomotor skills. If he had relied on automatism, his life would belong to Heaven! What an exceptional intellectual capability of moving the aircraft in space! After all, he actually turned upside down, and this deliberate action was the key to his salvation. The pilot distinctly saw and mentally steered the space, which was possible only through his own personal evaluation of the events (crisis).

Regrettably, figuratively speaking, today one esteems more a "yes sir" pilot "trimmer", than a pilot persona. At the same time one should admit that pilots (aircrew) usually respond positively to both fair and unfair reprimands. However, the ace flyer is 'spiritually' and feels deeply insulted when his motivations are misunderstood, especially when ground personnel cannot share his 'spiritual' need of air autonomy. Behavioural independence is the individual manifestation of the flyer's persona.

Thus the 'knot' of complex controversies is tied, which the flyer must untie in an emergency situation when alone in the sky. In practice, the aircrew is well founded and legally dependent on all his training for safety. However in an emergency situation the pilot is very reliable when he can be independent. Probably it was not by accident that Russian flyer Michael Gromov, founder of the Flying Testing Institute at Zhukovsky, fought for the right of the flyer to be creative and independent. He repeatedly stated that independent flying and thinking is a must.

Mandatory prerequisites for such independence are love of flying, professionalism, competency, good cultural lifestyle, and self-improvement as a human and a flyer. My life experience and research have convinced me that the psychological factor of independence stimulates creative individuality, a natural gift of the flyer, with high aims, and high morals. However, socially, the life-philosophy of flying safety has always been inflexible: individuality generates individualism, the positive role of which is very questionable. Frequently, in evaluating flying safety, we have all come up with opposite results.

I have encountered this dilemma for the first time as the senior flight surgeon of the 382nd Air Defence Fighter Regiment. Since what follows concerns my personal experience and people who I trust with great value, I will attempt to be mostly exact. I will write about the social and psychological specifics, a flying safety time period covering about 30 years of aviation (1962-1992). In considering human states of the soul and conscience under routine and emergency flight conditions, I stumbled on a serious moral problem i.e., the proper meaning of the word truth in Air Force aviation. I write to the esteem of only those who are worthy of it, to recognise malingering hypocrisy, and bootlickers. Unfortunately, life and Air Force aviation in all its 'greatness' can frequently be a 'let down' because of deception, injustice, and power abuse. It would be naive and hasty to portray myself as a truth-seeker, a fighter for a 'pure sky', a defender of the rights for the flyer, etc. In aviation, truth is the runway, it may be short, long, illuminated, darkened, warm or ice coated. The truth is complex – it is objective and subjective, it is your pride in your shame. Truth is created in the history of the aircraft and the flyers. Therefore I will try to write only that which I saw with my own eyes, what I did eyewitness myself, and, more precisely, what I experienced as a participant. I will attempt to be honest and kind about my years in the Air Force, which is still carrying on and growing. I hope these words create in the flyers the special state of soul, which is called "flying". This reminds me of the Bible when God punished the serpent for trickery by forbidding it to fly. And this is not just a metaphor, but a painful conviction I have reached i.e., that "flying" is a specific spiritual state, invisibly supported by the space energy of living matter in the universe. More about this later. The different parts of my book will cover the history of my life in the Air Force. I am convinced that independence means the right of not being afraid of the pronoun "I". "I" in aviation means responsibility and honour. My reminiscences about service in regiment are not 'fiction', since they are directly related to the flying safety problem as a special cross of the flyer's life.

Despite my professional training in aviation medicine, upon my arriving at the regiment, I immediately fell my psychological incompetence: the inability to understand the flyer as a person who cannot be characterised only based on his heart rate. First of all, I was struck to realise that intellect, flying talent, and human nature does not depend on one's educational level. In mid '50s I was the only officer in the regiment with a higher education, but I lacked understanding of flying motivation. My first commander G. F. Panchenko, and later L.A. Pitersky, only expressed their thoughts figuratively, but were

also exemplary officers. Most of these flyers were veterans of the Great Patriotic War. In the wing, flyers and ground technical personnel were fanatically devoted to aviation. I learned that the climatic conditions of the geographic location of the regiment with its surrounding operational units, coupled with unsatisfactory radio navigational support and frequent high state of combat readiness, made flights unsafe. Nevertheless, flyers had been taking off even in fog, and this was considered especially 'smart' flying. The high-level of mastery and skill of the flyers completely neutralised the danger of the sorties. But we have experienced interactions seen in other flying aspects – the flying safety was deliberately placed on the shoulders of the departing flyer, while the shoulders of the leaders were soothed by the 'real environment'. Maybe, my impression might have been erroneous, but I was constantly haunted by the thought that takeoff on alert was much more important than the later safe landing, as mentioned to me by a second senior lieutenant S Kolesnikov.

Men in flight have been valued for their achievements, without taking into account the price they have paid. This was corroborated by tactical flying training, when, after a successful, extremely difficult 'enemy' interception under cloudy night conditions, all hurried to the movie projection of 'shooting gun', showing the results of the interception. The flyer in his sweat soaked and worn garment patiently waited for either reprimand or encouragement. It seemed to me unfair, but the flyers did not feel any discomfort, they enjoyed the individual freedom in flight, where all, or almost all, depend on them alone. This represented a special flying pride. But at that time I had no clue what it was. It is noteworthy that 25 years later I observed the same situation while participating in a carrier landing flying safety study.

One of many successful MiG-29K landings on the carrier was performed by my test pilot T. Aubakirov. I ran with others to the aircraft to see a smiling pilot still sitting in cockpit. They thoroughly examined the aircraft, and were pleased that the plane sustained the impact acceleration. Later, at the ground control post, I became convinced that the more difficult the flying conditions, the more the unexpected events happen in-flight, and the more civil are the orders from the ground--the more one values the flyer's personality.

The sky always excites and inspires the flyer, but the earth frightens him. An emergency landing due to low fuel is neither an extraordinary event, nor a 'gift' for the flying safety 'piggy bank'. After a sortie, the pilots frequently landed with a critically low fuel,

when the primary airport was unexpectedly closed due to fog, at a base runway under conditions of lower than permitted ceiling, minimum meteorological conditions and sometimes even lower than common sense would allow. But for the flyers of my wing it was not a special hardship when their aircraft stopped on the taxiway due to complete fuel expenditure, as long as the movie confirmed the target hit. It may be strange to say so, but such an unsafe policy generated in both flyers and commanders the need to 1) improve professionalism, and 2) improve the skill to recognise dangers not as a stressor, but a catalyst to mastery. The thoughts were never spoken, but the eyes of the flyers spoke for them. The first inkling of this psychology was the discovery that flyers communicated with each other intimately and honestly but not in a 'collectivist atmosphere'. They not only knew the price of their mission, but also humanely appreciated what each pilot had done fearlessly and alone in the sky.

On a distant countryside air base the flyers merged, and blossomed, unselfishness, goodness, good humour, and an understanding at comprehending the meaning of life. I was amazed by the cognitive activity of these people by their uncompromising right to creative solutions of tactical tasks used in the flying operational dynamics of the technical characteristics of the aircraft. On the initiative of most creative persons in the wing such as Captains P. Alatartsev, Yu. Proskuryakov, V. Surpin, M. Khodkevich, N.T. Tenitsky, S.S. Ivanov, K.V. Bichev, and Lieutenant Colonels V.F. Korolyov, V.P. Zubchenok, L.I. Morozov, V.A. Sidorov, procedures for the destruction of low speed high performance targets, the reconnaissance and scouting unmanned balloons, were developed. The same flyers, led by their commanders, worked out ways to increase takeoff speed, prolong non-stop missions, ability to land aircraft's after flameout, landing with faulty altitude and speed gauges during cloud penetration, night landing with headlights, squadron flight formations under poor weather conditions, interception at extremely low altitudes, etc. The flyers of our wing successfully transitioned to the new type aircraft, MiG-17F, MiG-19PM, not only without simulators, but even without flight operational manuals!

The flyers learned on mainly principles by word-of-mouth. The main result was a profound joy for discovering and acquiring new knowledge. Even the peers cannot conceive the pride felt by the flyers when they flew for the first time in the newly acquired aircraft. When an in-flight emergency occurred, each pilot considered it his duty to land the aircraft. One may say that life has no price, but for

the flyer life is too valuable and happy to simply give it up. We're not concerned with ideology but with something much deeper – belief in success or self-confidence. As a member of the flying community, the official responsible to enforce flying safety standards, I constantly faced problems of moral choice. And the most difficult choice concerned the balancing of the moral incentives which frequently conflicted with requirements of the flying rules.

February 1960. Due to whether conditions the runway had been closed for 30 days. Suddenly, the airfield is 'opened'. Deputy wing commander M.A. Nyrkov decided to permit sorties not only to the aircrew of the combat alert element but also pilot S.S. Ivanov. His duty was limited to night flying. This was a gross violation of flying safety rules. I was asked to approve the planned schedule and flights, but the flyer had not rested. There was no potential replacement. I examined the flyer and approved the sortie.

Serafimovich takes off in a MiG-29 (total flight time of this type of aircraft is 20 hours). During landing with low visibility the aircraft guidance controls breakdown. The flyer reports to ground control the emergency in encoded form. The chief controller in the tower, after a long silence, replied "Roger". Then again silence. On the neck of the controller I see drops of sweat. Suddenly I hear the crying of the enlisted ground observer: "Undercarriage is down". The pilot landed without incident and told his commander: "Excuse me, I nearly let you down". He was put in for an award, the commander and I, the senior flight surgeon, were reprimanded. Each of us accepted additional responsibilities, which was not covered by any paragraph and although we were all castigated, we were satisfied for a well-done job. Yes, complicated knots have been tied in the life of air defence aviation wings whose main responsibility was to protect the sky frontiers. Later, I began gradually to understand the causes of the fatal accidents in which some of my comrades were lost – they were unaware of their flying capabilities, or more precisely of their psycho-physiological reserves with regard to flying safety. In those days the flyer's reliability was, by all means, much greater than the reliability of aviation technology. Flyer reliability is the style of man's behaviour, his spirituality, and his dignity. We felt somewhat uneasy when the system of flying safety control generated, figuratively speaking, the "offences".

For example, a flyer is told to sortie under poor weather conditions, which forces him to prematurely abort his mission and return to the base. Those who ordered him to fly knew that the weather was not

suited for landing. But while flying in the clouds the pilot optimistically reports (on tape recorder) that he sees the runway. He tries to justify the trust placed in him, but this could lead to a tragic outcome. The above relates to the so-called "unwritten laws" and there are a lot of them.

It is difficult to relate this too bravery, when elder comrades equate the risk of their welfare and carrier to the risk of the life of others. Another striking thing was a slogan about flying safety which was used to simplify the complex aspects of combat readiness even for first-class flyers. Moreover, un-ready 'aces' were assigned combat duty in most severe weather conditions. Yes, daily wing activity was not always subordinate to the commander. Too many bosses decided too many fates, and they did not bear responsibility for the life of Air Force Patriots. Yet, the love of flying was 'fanatic'. For me, as the senior flight surgeon, it was extremely stressful, since out of 52 flyers, 38 were first-class pilots, and 46 had serious diagnoses: sequelae of wartime. They need to be examined not only clinically, but also for their flying qualification. I repeatedly requested that Defence Minister R.Ya. Malinovsky, through the regional Air Defence Commander, and obtained permission to fly on the aircraft trainer MiG-15 in combat readiness missions. From this moment I started the true, not the book, learning of the pilot persona in the meaning of his profession. Flight instructor V.Ye. Ivanov, the wing deputy commander, and squadron leaders, all gladly welcomed me, and each demonstrated the capabilities of the aircraft and their own. I was able to observe the character, the manners, and habits, the level of teaching skills of 'my' flyers. Of course some rules were side-stepped. But maintaining the performance of my 'sick' flyers was excellent and their arterial pressure and heart rate were more stable in flight than in pre-flight examinations. This all led to a spatial feeling of reciprocal confidence and to the determination (consideration) of flying workload standards. Numerous in-flight psychological investigations were performed, but they will not be discussed here. In flight, the pilot has been recognised as human. I wish to stress here, that a successful in-flight emergency depends not so much on his automated actions but on his intellectual abilities. In the past, the term 'intellect' was used predominantly in a sarcastic sense. My observations gave me the objective proof that mind and spirit have the leading role in the flyer's performances. Spatial orientation, information processing, decision taking, risk strategy of performance in emergency are all determined by his intellect, and his conscience helps his brothers in heaven. The flyer's performance is basically individual, but the persona of the flyer, as

well as that of the entire aircrew depends on the flying community. They share a single 'spiritual field'. Flying determines the spiritual affinity, and the latter, in turn, evokes the feeling of satisfaction. In fact, combat sorties consist of two aircraft. Wing-to-wing is a sacred aviation love. Love of flying represents protection from the danger, a condition for creativity. It is a pity that then as now many high-ranking generals think that creativity in flight is chimera, sense in the air the 'good boys' do not create, but act as 'fools'. However in the spirit of creativity, the love of flying, respect for creativity reigned among elements and squadron leaders in my beloved wing. I was convinced of this once more by observing the test flight by commanders Vasilij Gavrilovich Ivanov, Alexander Vasilyevich Fedotov, Valentin Petrovich Vasin, and Alexander Savvich Bezhevets. They were all recipients of the title "Hero of the Soviet Union", but their main deed was that they were faithful and true to their subordinate flyers. Then, as now, I am proud of the fact that the commander in an aviation community is first of all the authority in the sky and on earth. The spiritual climate in my wing allowed for unity and innovation. "Do as I do", is only a partial technique used by the commander who taught us to act according to our conscience, to love, to reason, and not to harm others. This is a moral angle of attack, which supports the flyer and will not allow him to fall down in the true meaning of the word. The commander is always our soul, but not someone to 'piggyback' on, he does not impose his ideas, but he arouses patriotism. The spiritual influence on the flyer does not consist of preaching love of heaven, but by example of his own love. I feel no embarrassment in writing these lines, since I am setting forth the actual truth about my commanders. The flyers of my wing had a roof over their head, and the name of that 'roof' was – Commander.

Allow me to cite an example of an unusual decision taken by a pilot who saved the prestige of the former USSR. But this decision could have cost dearly without a 'roof' over his head. He knew the consequences for his decision taken with the wing deputy commander L. I. Morozov against orders and rules. This concerns an incident which happened on our airfield in 1961. At 5:30 a.m. the Air Defence Command centre gave the order to intercept in aircraft. For unknown reasons the aircraft of the potential foe had not been stopped and continued to fly. Captain I. Chumakov had received the order from a ground tracking station "Detect and destroy the target". Chumakov rapidly intercepted the aircraft which was a Caravelle, a commercial plane. Then another plane joined him. It was pilot N. Lebyodushkin, on a MiG-19. He came so close to

the target aircraft that he could recognise passenger and children's faces in the windows. Following the orders of L. Morozov, both pilots began to accompany the aircraft for landing, but did not shoot it down as ordered. The weather in the meantime deteriorated, they manoeuvred the "Caravelle" to the landing approach. They pierced the first cloud ceiling somewhere around the middle radio beacon, and then the "Caravelle" began banking at more than 30 degrees. Witnesses recall the scene with horror. Both fighter planes circled and the "Caravelle" landed successfully on the runway. Our fighter pilot, landed second, using the braking parachute suddenly stopped on the taxiway due to empty fuel tanks. Minutes later pilot I Chumakov also landed with empty fuel tanks. Pilot I. Chumakov had deliberately ignored the order to shoot down the trespassing aircraft and had refused to use the on-board weapon system, risking losing his career and even his life. It was a fact, and all the wing pilots approved his conduct [independent decision]. The flyer should curb evil duties required from him, even at the expense of someone's life. But his soul does not allow him to be a 'criminal'. In an operational regiment the flyers taught me to understand the meaning [essence, import] of their profession. They nurtured my love of sky and aviation, they guided my scientific thinking and, to defend my principals, they brought me to recognise a shining soul and path leading to the truth. In this connection I wish to share another occupation concerning the teaching of pilots and aviation flight surgeons. In the military community most are not fond of aviation medicine, and they ask rhetorically: why is there not 'tank medicine'.

In the Air Force, the flight surgeon is a confessor who listens to the flying doubts, personal problems, his fears and hopes for a long prolonged and happy life in the sky. All this requires purity of thought, self-confidence and honesty. If such a climate exists in the flying community, it is attributable to the flight surgeon. The general practitioner may become a highly qualified physician, but he will never be a flight surgeon, for he may be 'born' only in his own wing. If the aviation spirit is lacking in the wing, they will never have a good flight surgeon.

In aviation, physicians combine all sorrows and joys of the flyers. He establishes the broader communication with commanders, families, clinical consultation expertise, special services, in other words with all who influence the fate of the flying crews. From my favourite 382nd defence wing, many became experienced and renowned aviation medicine specialists. We have lived and worked in a socialist society, but anyone of "humble fools", called in

Russia as “sovki” (plural from “sovok” – literally “dustbin”) could respect the Homeland with reverence and veneration as its worthy sons did.

For people outside aviation many things may appear strange and incomprehensible. How can we explain to them the motto of our wing commander: “If your fate is to crash, you should select yourself and be a hero in the battle to your last breath”. This adage means that the flyer should reserve the last decision for himself. Actually, every profession has its own morality.

With best wishes the regiment sent me off to postgraduate education and training at the Institute of Aerospace Medicine, hoping that science will help me defend their honour and dignity. This was mostly need for accident investigations.

During the 30 years covered in this book, I made many [flyer] friends, and more than 50 have gone to eternal rest. With many of them I was close and with many I flew during my familiarisation with aviation problems. The causes of their deaths were different; in many instances they were absolutely innocent.

For more than 25 years I have dedicated my activity to study the human factors in flight. I have investigated the psychological aircrew behaviour patterns in emergency and complex flight. I participated in the design of the cockpit interior, the instrument panel, new systems of flight navigation parameters displayed on CRTs, automated control systems, and all types of emergency warning intra-cockpit devices. I have followed the evolution of all flying machines ergonomics up to 3-4 generations. My single aim was to create favourable conditions for reliable and efficient in-flight performance. The danger lurked in all stages of aircraft and flyer life. In-flight simulation and on-ground trainers initiating the real [true] environment, we obtained valuable information elucidating the causes of unreliable crew performance. I have especially felt their lack of legal protection of psycho-physiological limitation standards in unusual living conditions, even of the right to opt for action, which were dictated by the situation in the air. All aircrew behaviour in cases of an emergency, proceeds from the assumption

[presumption] of aircrew guilt [human error]. The flyers knew this and many of them have suffered their cruel injustice because of assumptions of their role in flying accidents. The search was always for culprits not for the actual causes. The attitude was – the main cause of all accidents is a human factor. The investigation, as a rule, was accompanied by a “tug of war” between aircraft manufacturers and users of [aviation] technology. In this book the flying safety problem will be viewed psychologically as a moral one, and that of a dangerous profession. Based on the results of theoretical and practical experimentation performed jointly with psychologists and physiologists, as well as with test pilots, I feel compelled to show the usefulness of psychology for all aviation specialists. In each chapter there will be a systematic presentation of information about the main leading human factor reliability components. In my book one may find the proof that the flyer is frequently only a vector of a flying accident, and only rarely its source. Attention will be drawn to the source of many problems not related to the aircrew. The discussion will cover accidents and guilt of the flyer. The book will also demonstrate the role of the pilot in the defence of his right to life; the role of his internal, metaphysical, cultural and education.

Possibly, the content of my book may provoke some criticism which I will welcome. This will indicate that the reader is concerned about the fates of our flying brothers, as expressed by N. Oreshina, in Aviation Country.

The independence of judgement will support the interest of the reader. In this book there is a lot of “darkness”, but, as in the picture “Black Square”, by the Russian painter Malevich, based on his (her) background and spirituality, one will inevitably see the light through the blackness. Here our light is a visible way to the “Good”. The flyers scrupulously observe the maxim by M. Gromov: “It is necessary to be an objective judge of one and never to accuse others or circumstances”.

We all need to strive in aviation to avoid circumstances called “dangerous factors”. To some extent, this is the essence of this book.

List of Figures and Tables

Figures:		Page
Figure 1	Dependence of flying on complexity of intra-cockpit equipment.	64
Figure 2	Dependence of aviation incidents on ergonomic indices of the man-machine interface system.	64
Figure 3	Emotional stress and attention reserves of the flyer in a rotary aircraft in dependence of altitude.	67
Figure 4	Dynamics of flyer's cardiac rate during landing approach in automated control regime in instrumental flight rule conditions of various visibility degrees.	67
Figure 5	Dependency of flyer's error incidence based on class-rated qualification of pilots.	98
Figure 6	Dependency of flyer's shares incidence on regularity of flying duty accomplishments.	99
Figure 7	Dependency of error rate during transition on Individual-psychological qualities of flyers.	99
Figure 8	Deterioration of flying performance accuracy after three-week suspension from flying duties.	100
Figure 9	Dependency of aerial target distance detection and acquisition on layoff duration in flights for the given type of flying drill.	109
Figure 10	Dependency of flyer errors for monthly total flying time. Solid line - flyers of first year training, broken line - experienced flyers.	109
Figure 11	Total flying time per Major Air Force Command, Feb. 1991-March 1992.	110
 Tables:		
Table 1	Constructive defects of equipment in 4th generation aircraft as causes of erroneous actions.	38
Table 2	Ergonomic defects of technology and flying safety, revealed in fourth-generation rotary winged aircraft.	39
Table 3	The productional implementation of ergonomically oriented research and development work.	42
Table 4	Disposition of some control organs and levers.	45
Table 5	Comparative estimation of two versions of instrument panel layouts for flight information presentation and control organs location.	45
Table 6	Characteristics of the use by the flyer of non-instrumental signals in fighter aircraft MiG-21.	46
Table 7	Percent distribution of the visual attention of the flyer on cockpit displays and out-of-cabin inspection during performance of simple and complex tasks on a MiG-23. (A.A. Krivonos data.)	46
Table 8	Characteristics of flyer's activity during failures of autopilot control system.	48
Table 9	Aircraft steering errors during ground target acquisition related to deficiencies in the information display system.	65
Table 10	(Untitled)	67
Table 11	Results of human factor contempt and neglect admitted by fourth-generation aviation technology.	68
Table 12	Anthropometric discrepancies between required and actual dimensions of some fighter-aircraft cabins.	70
Table 13	Some discrepancies in required (standardised) and actual geometric allocations of flyer's controls.	70
Table 14	Discrepancies requested Air Force requirement specifications and actual out-of-cabin view for some third-generation fighter aircraft.	70
Table 15	Aviation mishaps with fighter aircraft of the second, the third, and the fourth-generations as a function of structural changes.	73
Table 16	Data of USAF aviation accidents, caused by spatial disorientation from 1971 to 1985.	84
Table 17	Perception quality of two signals on the HUD.	89
Table 18	Flight performance scores at low altitude.	90
Table 19	Comparative evaluation of flight information gathering using head-down and head-up displays.	90
Table 20	Probability of efficiency and reliability changes in utilising of head-up and head-down displays (shown in percentages).	90
Table 21	Comparison of aileron elevator control movement standard deviations (conditioned units), utilising two types of indicator scales.	91
Table 22	Demographic characteristics of former USSR air force flying personnel rank and age distribution, (percent).	96
Table 23	Some results of psychological optimisation of flight combat training.	104

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14. Abstract			
<p>This book provides insight from a Russian perspective into the psychology of the flyers (pilot and other aircrew members), and their constant struggle to cope with the procedures dictated by ground-based directors while enjoying the thrill and emotional high of flight. The author takes the reader through the turmoil of flight emergencies, unpopular ground-directed missions, and, ultimately, aircraft mishaps. He describes the difficult conditions placed upon the flyers by a system inadequately prepared to address human factor issues, and points out that it is the responsibility of those on the ground to improve the conditions of the flyer. Those improvements can come from knowledge based on research and appreciation of the flyers' mission.</p> <p>Chapter 1 provides details of the problems associated with aircraft accident investigations and the impact these can have on the flyer's dignity. Chapter 2 describes many of the dangers associated with flight, as well as the skills necessary to overcome those hazards. Chapter 3 describes the current state of human factor issues and flight safety. Chapter 4 deals with ergonomics and their relationship with flight safety. Chapter 5 matches the role of the flight surgeon with the operational requirements of the flyers. Chapter 6 identifies the problems encountered when one is too conservative toward a profession that requires radical, rapid, and sometimes fatal in flight decisions. Chapter 7 explains how the flyer can maintain a healthy body and mind. Chapter 8 summarises the research and lessons learned by the author while working with the flyer and within the establishment.</p>			



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