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EDITORIAL

The contribution of Romanian psychologists to Dumitru Prunariu's spaceflight

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Abstract

The article analyzes the role of psychologists in the success of the *Soyuz 40* mission in May 1981, marking the 45th anniversary of the first Romanian spaceflight. The paper documents the complex process, coordinated by Dr. Valeriu Ceaușu at the *Centre for Aeronautical Medicine (CAM)*.
Psychological selection began in 1977, evaluating 200 engineers based on the "activity information circuit model". A *select-in* strategy was used, aiming to identify the best performing candidates, resulting in a final cohort of five candidates
Assistance in the preliminary preparation phase was carried out through observational participation. The objectives were: evaluation of the candidates' adaptation in real conditions, development of the capacity for self-knowledge and self-control, stress management, harmonization of the group climate, and initiation in flight psychology.
The *"Informatia"* research program, carried out on the *Salyut 6* station, included seven tests aimed at assessing the impact of weightlessness on cognitive and decision-making processes. The results indicated a temporary decline in performance in the first few days, followed by a recovery based on a state of euphoric mobilization.
The pre-launch and in-flight psychological support aimed at managing the tension caused by the uncertainty of the final selection at Baikonur and ensuring ambient comfort, through specially created video and audio programs.
Each chapter contains an **international practice section**, which presents the psychological activities carried out by the main space agencies, *NASA, Roscosmos, ESA*.
The conclusions emphasize that psychologists have made significant contributions to all stages of the cosmic program with Romanian participation, demonstrating their ability to prepare professionals for extreme demands.

Keywords

space psychology, astronaut psychological selection, astronaut training, space psychological support

1. Introduction

May 14, 2026, marks 45 years since Dumitru Prunariu and Leonid Popov took off with the *Soyuz 40* spacecraft for an orbital flight of 7 days, 20 hours and 42 minutes, forming a space complex with the *Salyut* 6 station, already in orbit.

To better understand the significance of this event, a brief socio-historical contextualization is necessary. The space epic began with the surprising launch by the USSR of the first artificial satellite of the Earth, *Sputnik 1*, on October 4, 1957. It was the beginning of a fierce competition, which reached its climax on July 20, 1969, when the *NASA mission Apollo 11* placed the first two astronauts on the Moon. The United States was emerging as the undisputed winner of the space race, and the two competitors raised the stakes at the level of the socio-political systems they represented. This is how what was called "space diplomacy" appeared, with the objective of strengthening alliances. The United States launched the *SpaceLab* program in 1983, and space shuttles, in association with *European Space Agency* and then, in 1998, the *International Space Station* (*ISS*). The USSR had created, as early as 1966, the organization for space scientific cooperation *Interkosmos* (Steimle & Norberg, 2013), in which the countries of what, with naïve sincerity, was called the "socialist camp", as well as from

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allied nations, participated. Since 1976, *Interkosmos* has been extended to space programs with humans on board. After a while, this political segregation eased, and common missions emerged. In 1975, the USA and the USSR organized the joint mission *Apollo-Soiuz*, Russia has been co-opted into the *ISS* and sent astronauts from Western countries into space.

The "conquest" of space was an ideologically grounded technological race. The history of spaceflight is inseparable from the geopolitical context that generated it. The rockets that took humans into space were originally vehicles carrying nuclear weapons, and the space race was essentially a battle for the "soul" of humanity: which political system — communism or capitalism — is capable of "producing" the future? And yet, beyond ideology, space flight is an undertaking of extreme complexity, which can only be accomplished through science and technology of the highest level, created and controlled by super-competent, inventive and courageous professionals.

Romania was invited by *Interkosmos* to propose candidates in the spring of 1977. From the somewhat hasty way in which things happened in the months that followed, it can be assumed that it was a surprise. The objective set before the Romanian side was to select a group of potential candidates, engineers, but not necessarily pilots. Of these, the Soviet side was to choose two, in early 1978, to be included in a program of several years of effective training, for a mission in space. The time available for this task was only one year, at the risk of missing, or losing, the chance for a Romanian to join the international community of spacefaring nations. The Romanian side asked for more details regarding the selection and training of candidates, but did not receive a response, and an information visit of Romanian specialists to the USSR was postponed several times, until it was definitively canceled. Under these conditions, the preparation activities were marked by two critical conditions: time pressure and uncertainty.

Specialists from various fields were part of this effort: doctors, psychologists, military and civilian researchers, officers, and pilots. Medical and psychological evaluations were carried out by the *Centre for Aeronautical Medicine*[1]. Responsible for the psychological component was psych. dr. Valeriu Ceaușu, the head of the *Psychology Laboratory*[2], one of the outstanding personalities of Romanian psychology in the twentieth century (Mureșan & Mânzat, 2023; Popa, 2004). With him worked a whole team of psychologists, who contributed to this project.

Curiosity made me check to what extent the internet's memory preserves information about their participation in this event, singular for now, in the history of Romanian psychology. *Google search* found the two collective volumes in which there are chapters dedicated to the contributions related to Dumitru Prunariu's flight: *Dimensiuni psihice ale zborului aerospațial* (Ceaușu, 1985c) and *Solicitări psihice la aviatori și parașutiști (Ceaușu, 1987b)* (fig. 1). Nothing more than the covers, without any content information, much less the names of the authors.

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[1] CAM has an impressive history. The selection and medical evaluation of aviators began in 1918 (!), under the leadership of the military aviator doctor Victor Anastasiu (1886-1972). He fought as a pilot and was wounded, over Bulgaria. In 1920, he obtains, by royal decree, the establishment *of the Institute of Aeronautical Psychophysiology*, which had different names over time. Since 2000 it has been called *the National Institute of Aeronautical and Space Medicine* "Gen. av. dr. Victor Anastasiu".

[2] Valeriu Ceaușu (1924-1991) came to the CAM in 1959, created *the Psychology Laboratory* which, since 1961, has been integrated into the current methodology of selection and evaluation of airborne, military and civilian personnel.

Figure 1. The collective volumes of the *Laboratory of Aeronautical Psychology*, edited by Valeriu Ceaușu. (foto M. Popa)

We also turned to some popular artificial intelligence applications, *Perplexity*, *Gemini*, *ChatGPT,* and *Co-pilot*, with the most advanced models available for free. We successively asked them a set of questions on the subject of the Romanian cosmic flight. The results exhibited significant inconsistencies and a lack of specificity. The applications evoke a series of psychological procedures related to Prunariu's flight, but with that general, non-specific character that Melumad and Yun (2025) referred to as '*shallow knowledge'*, and the sources of information declared are irrelevant or unrelated to the questions. This fact demonstrates that the answers were based on generic resources on the subject. Although AI applications recognize the existence of a Romanian psychological science program during the mission, its description does not reflect reality, but includes topics taken from any other similar program.

Things are no better in terms of nominating psychologists, either. Three of the apps used admitted, to their praise, however, that they could not give any names. *ChatGPT* offers a few names, some of which are real, but unrelated to Prunariu's flight, and the others are invented. *Gemini* suggests searching for psychologists in the "*Journal of Hygiene, Psychology and Aeronautical and Space Medicine of the years 1981-1985",* a journal that never existed.

These findings motivated me to submit this testimony, which could be useful for completing the picture of Romanian psychology, which was then in a difficult period of its history. What I propose is to reconstruct the contribution of the psychologists involved in Dumitru Prunariu's cosmic flight project. Some of them are gone, others I have lost contact with. After almost half a century, some memories have disappeared. I relied especially on the reports in the collective volumes mentioned above, but also on the personal notes from that period.

We structured the presentation on the four major activities carried out: psychological selection, assistance during the preliminary training period, in-flight scientific program, assistance in the pre-launch phase and during spaceflight We have described them with the maximum accuracy allowed by the available information 45 years after the event. At the end of each chapter, we have added a section dedicated to international practice in that field.

2. Psychological selection

The initial selection base was aeronautical engineers employed in the Ministry of National Defense. Because the number of those available proved to be too small, the recruitment was extended to civil engineers from aeronautical institutions. In total, 200 people, aged between 26 and 36, were recruited, all men. We did not find information about possible sorting of applications based on file criteria. Even if, given the ideological load of those years, we can assume that this criterion existed, the extremely short time available, and the crisis of candidates, probably limited its impact.

Those who accepted the challenge entered the medical and psychological selection program, which was carried out sequentially, first the medical evaluation, and then the psychological one, which meant three days of tests for each candidate. At that time, CAM lacked validated medical and psychological standards for space missions. But this problem was faced by both the USSR and the USA in the pioneering phase of spaceflight. As a result, the selection model used in Romania, both from a medical and psychological point of view, was the one in use for pilots on supersonic fighter jets. While a *select-out* strategy was used for pilots, the emphasis for cosmonaut candidates was placed on a *select-in* strategy. This was justified by the fact that, unlike pilots, where there was the possibility of directing during training to less demanding aviation categories, in the case of cosmonauts this option did not exist, and the risk of elimination during training had to be minimized. At the same time, the specific demands of cosmic flight, described by Soviet and American researchers, were also considered (Ceaușu, 1985b).

The psychological selection was based on the "model of the informational circuit of activity" elaborated by Ceaușu (1976). It describes the work activity as a circular process, composed of the following stages:

- *Information constitution*: detection, and integration of sensory inputs;
- *Information processing:* conceptual-logical processing, problematization, decision-making, memorization;
- *Decision*: cognitive component, effector component, level of assumed risk;
- *Motor skills*: verbalization and motor activity (coordination, speed, precision);
- *Self-control*: attention processes, situational awareness;
- *Self-regulation*: volitional mobilization, emotional balance, relational component, risk management, etc.

Their evaluation was carried out through standardized tests, specialized devices, as well as through an in-depth psychological interview. The methods used were mostly designed by Valeriu Ceaușu. Among other things, a new system for processing and interpreting the results was also applied, which included the computerized elaboration of the psychological profile. The specific actions of this phase were supported by Valeriu Ceaușu, together with psychologists from the laboratory: Maria Magureanu, Maria Nicoleta Drăghici, Marian Popa, and Dr. Vasile Teodorescu.

At the end of the medical selection, only 60 candidates were declared fit (30%). They entered the psychological selection stage, at the end of which 5 received approval of fit (8.3%). Cumulatively for the two selection components, the positive selection rate was 2.5%. The five candidates made up the group that entered the preliminary training program that took place in the country, before being sent to the USSR for the final selection.

International practice

Before a man flew into space, Soviet and American scientists did not have an answer to two fundamental questions: will he survive the conditions of such flight, and if so, will he retain his physical and mental functionality so as to perform complex tasks? The big unknowns were the high *G* forces, at takeoff and re-entry into the atmosphere, and the state of weightlessness in orbital flight. Beyond the effects on the internal organs, they could also have a major psychological impact. Psychiatrists of the time spoke of the "detachment from the Earth" effect, which could degenerate into psychotic episodes or total detachment from reality. It was estimated that in the absence of familiar sensory inputs, the human brain would begin to hallucinate within minutes. The overloads induced by accelerations of more than 8 times the natural gravitational acceleration could block blood circulation to the brain and, implicitly, its functional incapacitation.

The theory of psychological selection requires the analysis of the workload, or, in our case, exactly this essential thing was not possible. As a result, the solution could only be the use of a proxy workload, which naturally led to the search for future space flyers among military pilots.

In the USSR, the first candidates were sought among pilots of jet aircraft *Mig15*. In his memoirs, Yuri Gagarin, who was to become the first man in space, evokes the selection procedures he went through (apud Santy, 1994). They included modified variants of well-known Western tests, such as: *MMPI*, *Thematic Apperception Test*, *Eysenck Personality Inventory*, *Rorschach* and *Personality Scale of Taylor*. In addition to these, other batteries of tests were used that targeted factors such as stress tolerance, concentration and behavioral stability (Musson, 2020).

In the United States, President Eisenhower decreed that the first astronauts should be recruited exclusively from among military test pilots, considered the most suitable due to their technical skills, discipline and experience in extreme risk situations. The program followed two complementary psychological approaches (Collins, 1985; Harrison & Fiedler, 2011b; Link, 1965):

- the *Select-In* model, focused on identifying the skills and positive traits necessary to fulfill the tasks of the mission (professional prominence, motivation and decision-making capacity).
- the *Select-Out* model, focused on detecting and eliminating candidates with psychopathological vulnerabilities or traits that could compromise safety (neuroses, personality disorders, phobias or substance abuse).

The candidates were subjected to evaluations with diversified batteries of tests.

- Intelligence and Aptitude Tests: About 12 tests, including the *Wechsler Adult Intelligence Scale (WAIS), the Doppelt Mathematical Reasoning Test, and the Miller Analogies Test.*
- Personality and projective tests. 13 tools, including the *Minnesota Multiphasic Personality Inventory (MMPI), the Rorschach Test (inkblots), the Thematic Apperception Test (TAT), the Bender Visual Motor Gestalt Test, and Sentence completion tests.*
- Socratic introspective exercises: Candidates had to answer profound questions such as *"Who am I?"* and *"Whom would you send on a mission if you could not go?"*, providing clues about self-perception and group dynamics.

In addition, for the stress resilience assessment, candidates were subjected to extreme physical demands.

- *Sensory isolation*: 3 hours in a dark, soundproofed room to assess adaptation to the absence of external stimuli.
- *Extreme physical stress*: Exposure to vibrations, high centrifugal forces, temperatures of 54°C for 2 hours and the "*cold pressor*" test (keeping the feet in ice water).
- *Complex behavior simulation*: Using a panel with 12 different signals that require rapid reactions to measure reliability in confusing situations.

In the end, out of 31 pilots tested intensively, 4 were eliminated for reasons of "psychological inadequacy" and 20 for medical reasons. The remaining ones formed the group *Mercury Seven*, which gave the first American astronauts. Their profile was described by Wolfe (1980) under the label *Right Stuff*, which includes a combination of exceptional individual qualities capable of guaranteeing success under conditions of maximum demand. Notably, the selection protocol stipulated that the results of psychological evaluations should not be included in the personal file, so as not to affect their existing professional status.

Although unofficial, the moon landings marked the end of the space competition between the US and the USSR, based on the egos of the political system. Defeated in this first stage, the USSR changed the paradigm of cosmic exploration, turning to quasi-permanent space stations, dedicated to pragmatic objectives: technology, planetary research and, why not, military applications. The USSR launched *Salyut 1* (1971), followed by *NASA*, with *Skylab* (1973), and this series continued in the following years and decades. After the disappearance of the USSR, joint space programs with international crews were developed, which are still in operation today.

The space station stage brought some significant changes from the perspective of human resource management in space. First of all, the missions became longer, in the order of months, which massively amplified the impact of some already known factors (weightlessness, isolation, fatigue, interpersonal compatibility, conflict prevention and management). Secondly, the division of labor on board appeared, by separating the roles: those responsible for controlling the on-board systems, researchers, payload specialists. Having different tasks to perform, and they also had to be selected on different criteria. Moreover, their training emphasized different things. Those differences were such as to give rise to a certain lack of homogeneity of skills, which posed risks to flight safety. Finally, missions with international cooperation have created a new problem, that of intercultural adaptation within crews.

The factors described above can generate a cocktail of psychological risks, the main ingredients of which are: adjustment disorders and psychopathological states, asthenia, degradation of cognitive functions, errors with serious effects, or ruin of interpersonal relationships. Psychological selection is considered the first protective barrier against them (Kanas & Manzey, 2008; NASA, 2016).

In Russia, *Roscosmos* understood even earlier than *NASA* that the main threat to a long-duration mission was not technical failure, but the psychological degradation of the crew and the breaking of trust ties with the ground control center. According to a secret report of the *CIA*, developed just one year before the selection of Romanian cosmonaut candidates, the selection of Soviet cosmonauts followed, in general terms, the criteria for the selection of military pilots (Central Intelligence Agency, 1976). The report mentions the existence of dissatisfaction with the efficiency of psychological selection and the need to improve it. Thus, starting with 1973, the psychological selection methodology has entered a process of reconstruction, to increase the validity and fidelity of in-flight performance prediction, not only in relation to training performance. As a result, the Russians have turned psychological selection from an appendix of medical selection into a strategic component of the mission's success (Santy, 1994).

Currently, the Russian selection methodology includes a computer-controlled psychomotor testing program to assess piloting skills, along with personality assessment. It also emphasizes learning skills, logical thinking, speed of mental processes, stability in isolation, group dynamics and collectivism (preference of group values over individual ones), and the ability to self-control in monotonous environments (Roscosmos, 2025; Schmidt & Spychalski, 2021)

In the USA, paradoxically, interest in selection based on psychological criteria was lower than in the USSR. This fact has been the subject of many critical opinions (Collins, 1985; Helmreich, 1983; Santy, 1994), which have gradually led to a change in approach. In the '70s and '80s, *NASA* considered the profile of the researcher capable of collaborating effectively in a heterogeneous group, in prolonged missions (Collins, 1985). Psychological selection in the '70s was dominated by the *Process Communication Model (PCM),* developed by clinical psychologist Taibi Kahler (Kahler, 1979, 2008). *PCM* was a method of psychological evaluation based on six personality types, co-present in everyone, hierarchically structured in the form of a "condominium", which allows the communication style to be adapted according to the "language" preferred by the interlocutor. The selection based on this model aimed to foster effective collaboration under conditions of extreme stress. The selection also emphasized emotional stability, communication skills, and teamwork skills. For example, simulations such as "a day in the life of an astronaut" and *feedback* between group members to see who is liked by their peers in living conditions. In terms of personality traits, the *Big Five* model was used, with a special focus on agreeableness, conscientiousness, and emotional stability (Schmidt & Spychalski, 2021).

The selection process was anchored in the philosophy of the *Select-out* clinical (elimination of those with latent pathologies) by the end of the '80s (Kass & Kass, 1999; Santy, 1994). The positive selection rate was very low. In 1978, for the selection of *Group 8* of NASA astronauts, over 8000 candidates were primarily evaluated, of which 208 were invited for final examinations, 35 (0.44%) being retained. (Mullane, 2018). In 1984, for the selection of *Astronaut Group 10*, out of almost 5000 applications received, 17 candidates were admitted, which means a percentage of 0.34% (NASA, 2024).

In our time, the selection of American astronauts takes place through the cooperation of several organizations within the *NASA*, having a central role *Behavioral Health and Performance Group* (Cox et al., 2013). The methodology is currently based on *the Competency Model* and "*Soft Skills*". This represents a refinement of the model *Right Stuff*, with the shift of emphasis from the "test pilot", capable of solving any problem on his own, to the empathetic "team player", necessary for missions to Mars (Barrett et al., 2017; Roberts, 2025). A two-phase strategy is applied. In the first, those with psychiatric risk are eliminated (*Select-out*), in the second, of the *Select-in,* rigorously, behavioral competencies are evaluated: self-care and team care, communication skills, situational leadership, intercultural skills, interpersonal relationships and conflict management.

The assessment of these competences is carried out by methods validated by *NASA Human Research Program* (2022): personality questionnaires (e.g., *Big Five*); structured interviews; group simulations in which candidates are put in situations with extreme cognitive load (Musson, 2020); peer evaluation (e.g.: "*Which of the other colleagues would you rather be stuck in a capsule for 6 months with?*") (Landon et al., 2018); *Family resilience*, which assesses how well the astronaut's family can handle the stress of prolonged absence, as well as teamwork skills, motivation, reasoning and decision-making capacity (Beven et al., May, 2018). Roberts (2025), appreciates that space missions in the 21st century require an increase in interest in psychic selection criteria such as cognitive flexibility, problem solving under stress and uncertainty and, especially, teamwork. To these must be added the importance of adapting to conditions of cultural and gender diversity,

The European Space Agency (*ESA*) selected the first astronauts between 1977 and 1978 (the *Spacelab*), for the position of 'mission specialist', capable of working in international teams. The selection strategy was twofold: *Select-out* clinical (elimination of those with latent mental pathologies, or emotional instability) and *Select-in* (identifying those with personality traits that favor peak performance and group cohesion under stress). The evaluation methodology was developed by *German Aerospace Center* (*DLR*), which focused on three main objectives: cognitive abilities (processing speed and selective attention, spatial orientation, memory and time-scarce logical reasoning); personality (*Big Five*, emotional stability, panic resistance); group behavior (direct observation in simulated tasks)

(Fassbender & Goeters, 1992; Goerres, 1977; Goeters & Fassbender, 1992). Special attention was also paid to intercultural adaptability (tolerance for ambiguity, non-aggressive communication skills, intrinsic motivation) (Kanas et al., 2009; Santy & Jones, 1994)

The selection campaigns carried out by *ESA*, in the years 2008-2009 and 2021-2022, had as their main objective to create cohesive crews composed of people from more than 20 member states. For *ESA* the priority is to identify the ”ideal social operator”. Because *ESA* does not own its own manned launch vehicles (using US or Russian services), European astronauts must be "ambassadors" capable of integrating into any organizational culture (Sandal et al., 2022). *ESA* works closely with *German Aerospace Centre* for psychological testing. The process is a very rigorous one, being divided into distinct phases of cognitive assessment and behavioral assessment (Golemis et al., 2013; Maschke et al., 2011; Mittelstädt et al., 2016):

- psychomotor and cognitive assessment (working memory, distributive attention and spatial orientation under time pressure);
- group evaluation (*assessment center* exercises, where psychologists evaluate group dynamics, the ability to provide constructive feedback, assuming leadership-follower, conflict management). Added to these are personality assessments, which are based on *the Temperament Structure Scales* and *the NEO Personality Inventory Revised*.

In China, a newcomer to the space power club, an ambitious space program is underway, reminiscent of the competition in the early years of space exploration. The selection of *taikonauts* has gone beyond the phase of purely military criteria and is now multidisciplinary. Candidates who pass medical tests are subjected to psychological screening. Psychology is seen as a component of "mission readiness". The criteria taken into account are personality traits, resistance to stress and experience in risk conditions, exceptional emotional stability, social skills and resilience, interviews with candidates, but also with their families (Golemis et al., 2013). Experience in emergency or risk situations (e.g. military aviation) is considered a positive indicator (China Space Report, 2016). Among the methods used are: real-time EEG monitoring (to detect cognitive load and fatigue), desert survival exercises (to explore hidden personality traits), cultural criteria (e.g., married candidates are preferred) (Shengjun, 2024).

Systematic validation of psychological selection has long been neglected; the success of the missions being mistakenly considered a sufficient proof of validity. Statistical validation was difficult to achieve due to small samples, lack of systematic performance criteria, and privacy policy restrictions. *NASA*, for example, banned for decades the collection of data on the individual performance of astronauts (Powell, 2001; Schmidt & Spychalski, 2021).

Evidence of the validity of psychological selection in the *Roscosmos system*:

- Psychophysiological indicators (heart rate, skin conductance), used as predictors of emotional stability in crisis conditions, measured on the ground, had an accuracy of over 80% in predicting the cosmonaut's ability to make correct decisions in the first 30 seconds of a real flight anomaly (Kanas & Manzey, 2008).
- Expert assessments using the so-called "prolonged clinical observation method" in various ground contexts (isolation, sleep deprivation, skydiving) have proven to be superior to any standardized tests. Even "social adaptability" scores better predicted the integration of foreign cosmonauts.
- Myasnikov and Zamaletdinov (apud Harrison & Fiedler, 2011a) reported that subjective expert assessments (flight psychologists) conducted during these endurance tests have a criterion validity superior to any standardized test. They demonstrated that the "social adaptability" scores correctly predicted the integration of

foreign cosmonauts (into the *Interkosmos*) in Russian crews, the pages of the personal diary subsequently confirming clinical observations made 2 years before the flight.

Validity Assessments in the *NASA Selection System*:

- Use of structured interviews and tests such as *MMPI* resulted in disqualification rates during ground training of about 8.5% for psychiatric problems, confirming the effectiveness of the medical filter (Kanas, 2015).
- In *Project Mercury*, isolation and physical stress tests have been validated *post-hoc*, showing that the selected volunteers were superior to non-volunteers in terms of flight performance and motivation (Collins, 2003).
- *Limitations of the "Select-out" model*: It has not been proven that the elimination of pathologies (according to DSM-IV), has the criterion validity for identifying the competences of effective interaction in the group (Powell, 2001).
- *Superiority of aptitude and intelligence predictors*: Existing data suggests that measures of intelligence and skills can predict performance more accurately than commonly applied personality tests. In particular, "fluid intelligence" (analytical, creative and practical ability) is considered essential for solving novel tasks, being a more robust predictor of success than crystallized knowledge (Powell, 2001).
- *Big Five* data analysis for a period of 15 years, from the *Space Shuttle,* showed that astronauts with low scores in neuroticism are perceived as more desirable flight partners (Landon, 2022). Musson et al. (2004) applied, between 1989 and 1995, *Personal Characteristic Inventory* (*PCI*) to 259 candidates in the final stages of their astronaut training, and 147 of them also applied for a revised version of the *Big Five*. The results highlighted a cluster consisting of: *Conscientiousness* ($r \approx .30$) - the strongest statistical predictor for technical performance and compliance with procedures; Agreeableness - positively correlated with the success of long-term missions (*ISS*), as it reduces interpersonal conflicts and *Low neuroticism* - essential for emotional stability under stress.
- *Inconsistency of personality predictors in analogous environments*: The validity of personality traits as predictors varies significantly depending on the context. For example, "motivation to achieve" correlated positively with adaptation in submarines, but has been associated with lower performance ratings in Antarctic environments, which raises doubts about its universal validity for spaceflight (Powell, 2001).

Procedures used by *ESA*, in the 2008-2009 selection, which focused on intercultural competences and *leadership* have been reported to have significant success in training multinational crews (Landon, 2022).

Statistical trends cannot exclude individual variations or unpredictable destructive behaviors. The history of spaceflight is marked by such bad incidents:

- *Conflict and isolation*: Crew *Apollo 13* had major tensions with the ground control. In missions *Salyut* and *Skylab 4*, fatigue led to periods of hostile silence and even interruption of communication with the mission control center (Arone et al., 2021; Collins, 1985, 2003; Kanas, 2015; Stuster, 2010) .
- *Mental health problems*: Sensory delusions have been reported (*Soyuz 21*), depressive states (*Soyuz T14*) and even threats to open the sunroof in space, amid acute professional frustrations, which led to the

implementation of sunroof locking systems (Berger, 2024; Dunn, 1995; Weitekamp, 2011, March 7).

All this highlights the fact that, although the "psychological fabric" of astronauts is an important factor for the success of missions, selection cannot meet this challenge alone. Complex training and preparation, including from a psychological point of view, is the second barrier of protection against behaviors below the required performance standard.

3. Psychological assistance in the preliminary training phase in Romania

The five Romanian candidates who passed the medical and psychological filter were included in a preliminary training program, carried out in the country, between August 15, 1977, and January 22, 1978. The fundamental objective was to bring everyone in a condition that would maximize their chances of facing the final selection exam, which was to take place in the USSR. This period was not designed as an additional selection filter but, as we will see, not all candidates will go to the next phase. The training program had the following components: knowledge of the Russian language, increasing physical fitness, acclimatization flights on a subsonic reactive aircraft (*MiG 15*, dual command) and acquiring basic theoretical knowledge of cosmic flight.

The idea of including a psychologist in the coordination group, as well as my proposal for this role, belonged to Valeriu Ceaușu. Together with him, I set the guidelines of the activities I was going to carry out, among them being the keeping of a professional diary, which was to provide a basis for objective, post-factum analysis. The presentation below is based on the chapter in the collective volume in which we described this professional experience (Popa, 1985), as well as some journal entries, which can now be made public.

Group K

The group of cosmonaut candidates and the coordination team, constituted what, in official documents, was called *Group K*. This encoding can induce the idea of a secret operation, shrouded in mystery. In reality, this was not the case at all. Although it was not publicized at that time, our activity was not secret, and we were never asked to keep discretion about what we do. Everywhere we went, everyone was aware of the group's purpose.

In the spirit of the objective stated at the beginning of this article, I want to make known here the names of the members of Group *K*. Some of them have never been mentioned publicly, which is unfair in relation to the effort they have made.

Group of cosmonaut candidates (in alphabetical order):

- Eng. Constantin Cristescu
- Cpt. Eng. Dumitru (Mitică) Dediu
- Eng. Cristian Guran
- Eng. Ioan Ludoșan
- Eng. Dumitru-Dorin Prunariu

Apart from D. Dediu, an engineer officer in the Ministry of National Defense, the others were civil engineers, employed in aeronautical institutions. Only two candidates had practical flying experience on sports aircraft. Four were married, only one of whom had no children. Their average age was close to 28 years, but in fact, four of them formed a homogeneous age group (25-27 years), while the fifth had turned 35.

Coordination team:

- Lt. Col. Constantin Georgescu, squadron commander and *MiG-15* pilot – team leader
- Cpt. Eng. Viorel Burlan – physical training instructor (performance athlete, martial arts specialist)
- Lt. Maj. Florin Sava – Russian language teacher
- Marian Popa - psychologist

Medical assistance was provided by specialist doctors from the *CAM* and, as the case may be, by doctors from the locations where we were.

Locations and objectives

The group was successively deployed to several places, depending on the objectives of the program:

- Poiana Brașov, at the recovery chalet for military aviation pilots: physical training, learning the Russian language.
- Bacău, at the *Military Aviation Training Centre*: physical training, Russian language, aeronautical psychology theory, theoretical training for flight and acclimatization flight with the *MiG-15 aircraft*.
- Bucharest, at the *Centre for Aeronautical Medicine*: physiological training, with emphasis on vestibular training, notions of aeronautical medicine, Russian language, and at the *Military Technical Academy* (theoretical training on spaceflight).

The entire activity was carried out under the authority of the *Military Aviation Command*, recently re-established (May 1, 1977), led by Maj. Gen. Gheorghe Zărnescu.

Challenges

The psychological assistance and support activities for Group *K* cannot be fully understood without an overview of the conditions under which they were carried out. The most important thing to mention is the uniqueness of this type of training and, implicitly, the lack of previous experience, at national level, in the selection and training of a group of cosmonaut candidates. They include in this category, not only the lack of knowledge, but also the absence of adequate institutional and legislative infrastructure. The most important challenges generated by this context can be classified into the following categories:

- *Institutional*. The coordination of activities was assigned to the *Military Aviation Command*, which had to cooperate with other institutions in the absence of an adequate legislative framework. The uncertainties of the legal and administrative status of candidates have always created problems with a negative psychological impact. One of the repetitive references in the diary is about a government decision that was supposed to solve the many problems regarding the status of candidates[3].
- *Logistics.* The lack of adequate legal support generated numerous logistical problems, which had to be solved through improvisations, often under time pressure. The most pressing of them was that, for several months, the payment of salaries to those outside the Ministry of National Defense was difficult to achieve.
- *Organizational.* The coordination group met for the first time on the day of the establishment of *Group K* for the departure to the first location. I went straight into the activity, with a daily schedule built under the pressure of an urgent timeline that generated a certain pressure and physical and mental overload, sometimes with counterproductive effects. A particular aspect of the program was its limited variety, dictated by the limited content of tasks. This was a source of monotony, with an oppressive effect on morale. Typically, the working day was divided between studying Russian and physical training. The first was carried out according to an intensive plan, including common classroom activity, for 3-4 hours, plus individual study, at least two hours. Physical training began in the morning with gym exercises and

[3] I did not find anywhere in the journal that this phantom GD had ever been approved, at least until the selection in the USSR was completed.

outdoor runs (2-3 km). In the afternoon, sports games were organized and, occasionally, swimming sessions or other physical activities. Later it was concluded that sometimes it was exaggerated, both in terms of intensity and the volume of physical training. The cause of this situation was the pressure of the stakes and the lack of information about the exigency of the final Soviet selection. Even if these two main activities have been added, at various times, the flight activity and theoretical courses, there is still not enough variety.

From the perspective of finality, the *K Group* had a unique characteristic: although the performance of the tasks required the cooperation of the candidates, the spaceflight was to be reserved for only one of them. The candidates were in a competitive training regime, in which the members collaborated partially (mutual support), but in reality, they competed for the only place available. This situation created, on the one hand, a sense of collective identity, and on the other hand, a high emotional pressure, which presented a risk of conflict, nervousness, anxiety, fear of failure or demotivation.

The Soviet or American programs of that period offered an almost certain prospect of flight to all those in training, if not "now", then "next time". In the *Interkosmos* program there was no a "next time".[4] Although our goal was not to choose the one who would fly, everyone was aware that if they were to fly, only one of them would be chosen. And this was likely to generate competitive feelings.

In addition to the challenges to which the candidates were subjected, I must also mention those to which I myself have been subjected. As a student, I had learned about participatory knowledge, but I had never imagined that I would be in a position to practice it, and still so soon[5]. At that time, it had been only one year since I graduated from college, and my professional experience came, for the most part, from the laboratory work carried out in the few periodic secondments at *the CAM*, from the "Aurel Vlaicu" *Higher School of Aviation Officers*, where I was employed.

Specific activities

In the spirit of Gold's typology (1958) Regarding the roles that a psychologist can adopt in participatory observation, we considered that, in the given context, the most appropriate status was that of "participant with the status of explicit observer". This situation posed two major challenges. On the one hand, I was faced with the problem of legitimizing the permanent presence in the group, which could be perceived by the candidates as a threat. This risk was all the greater as I had, with some of them, experience during laboratory selection. Secondly, immersion in the group created the risk of subjective distortion of assessments. On the other hand, the major advantage of being an observer participant was that it allowed me to build a relationship of trust and facilitate access to all forms of training, including free time. Although the presence of an observer could cause subtle changes in behavior on the part of the candidates (*Hawthorne effect*), it was a risk taken. The fact that the group was constituted on competitive premises further amplified those challenges.

The first step in controlling these challenges was to become aware and reflect on them in depth. What helped the most, however, was certainly the fact that I developed authentic personal relationships

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[4] Except for Bulgaria, which also benefited from the second flight, the first being interrupted for technical reasons, in the coupling phase with the *Salyut 6* station.

[5] On this occasion, I realized, and I told my students, many years later, that they should not risk appreciating what will be useful to them later, and what will not, from what they learn in college. I would even say that it is precisely seemingly useless things that can make a difference later.

with all the candidates and that I showed a real interest in all the components of the program, in which I participated with them: in the Russian language classes (intermittently, I admit), in the physical training program (in full), in the flight (my request to be included in the *MiG-15* flight program was approved – experience that then helped me throughout my career as an aviation psychologist), to the common activities during free time. It also mattered that we were close in age. During the internship in Bacău, I was even a roommate of one of the candidates. Under these conditions, we have all come to develop authentic personal relationships, in parallel with professional ones. As for the need for objectification, I was helped by the entries in the professional diary and the practice of retrospective evaluation at the end of each day (both required detachment), as well as the periodic meetings with Valeriu Ceaușu, which required a professional, objective analysis.

Mainly, psychological assistance during this period focused on four major objectives, which I will summarize below.

a) Deepening psychological knowledge in conditions of adaptation to real requests.

The psychic characteristics outlined during the psychological selection, however detailed and complex, configure a pattern of behavior specific to the artificial, laboratory environment. Participatory observation offers the chance to enrich psychological knowledge in real, specific conditions in relation to the task for which they were selected. Let's not forget that, until the flight into space, the candidates were going to go through another complex and demanding training program, for several years, far from the country, even if they had family with them. The success of the adaptation at this stage was to be crucial for achieving the final goal.

The most important aspects we followed were motivation and mobilization under pressure, general adaptation, resistance to stress, relationship conduct, conflict management, and performance in different training categories. The methods used were varied: direct observation in current tasks, individual and group discussions, engaging in joint activities (e.g. sports games, recreational moments). I would highlight, in particular, the value of sports games as an observation medium, due to the attenuation of the defensive and self-image protection mechanisms that manifest themselves in formalized actions.

One of the major problems I encountered was that I had to weigh the assessment of individual adaptation with the impact of the conditions mentioned above. Adaptation is the result of the interaction between personal characteristics and the work context, which had to be taken into account.

b) Developing the capacity for self-knowledge and self-control

The status of a participant in the life of the group gave me the unique chance to amplify my personal experience with the candidates. Evaluation under laboratory conditions is based on a subject→ psychologist relationship, where the arrow indicates the major direction of the flow of information. In real life, I also set out to build a psychologist → subject information flow, through which I would contribute to the development of personal self-knowledge and to increasing the capacity for self-control in demanding situations. In current terms, what I did then would fall within the scope of personal development procedures, but I must admit that, at the time, I had not heard of this phrase.

Concretely, we proposed to the candidates to participate in their own knowledge, using several means. First, we discussed with each of them, separately, the results of the selection assessment, stimulating them to relate analytically, including critically, to them. Secondly, we trained them, during individual or group discussions, to analyze their behavior in various situations, to objectify the perspective and reduce states of tension. I based myself on the idea that a lucid person, willing to rational self-appreciation, has a better chance of dealing with complex situations. The results of this action differed greatly from candidate to candidate, depending on the capacity for self-analysis and decentralization but, overall, the objective was achieved.

Finally, we initiated and practiced the technique with the candidates. *autogenic training* (Schultz & Luthe, 1959; Stetter & Kupper, 2002), widely used in demanding professions, in sports and even in the training of cosmonauts (which I did not know at the time) (Cowings et al., 1986; Toscano & Cowings, 1982). We have pursued, on the one hand, immediate effects, in terms of adaptation to current demands and, on the other hand, long-term effects, by arming ourselves with a self-control and self-regulation tool potentially useful in the advanced phases of the training program. We carried out the exercises in group sessions, through heterosuggestion, followed by the analysis of the effects felt. The candidates' reports confirmed immediate positive results in terms of recovery after exercise, reduction of tension states, and facilitation of the onset of sleep.

c) Support for stress management and harmonization of the group climate

The conditions of the preliminary training period, described above, created inevitable premises for some negative psychological developments. Basically, candidates were required to make an intense effort in a partially dysfunctional context and in relation to a goal that, at that time, was nevertheless floating in a certain uncertainty. For this reason, many behaviors that could be labeled as coping problems were merely normal manifestations in relation to conditions below the level of legitimate expectations.

The intensity of the daily schedule generated compliance pressure that required strict timing. Any deviation from compliance pressure, even minor, was a potential source of interpersonal irritation. The accumulation of these "cracks" posed a risk to the stability of the group, which we could not afford. The context had all the ingredients to generate the stress of the training camp: isolation from familiar environment, physical and mental overload, the monotony of the program, the tension induced by a high-stakes goal. Combating the effect of monotony required careful sounding of the mood and, in collaboration with the other members of the coordination group, taking appropriate measures at critical moments. A positive effect was achieved by consulting the candidates on detailed aspects of the daily program. Their suggestions were treated carefully and accepted, if they did not harm the objective. This resulted in a significant reduction in stress, without giving up training objectives.

One thing that could not be neglected was the pressure from families, different for each candidate, which sometimes became extremely difficult to manage. In fact, family related stress played an important role in the final configuration of the group of candidates.

Each candidate reacted to the conditions of the period in a particular way, depending on their personal context and individual characteristics. Regardless of the constraints, all candidates demonstrated resilience and found resources to fight these conditions. Suffice it to mention that, at one point, out of the need to recover after sustained physical effort, the candidates agreed to pay for their own access to the swimming pool of a hotel in Poiana Brașov. Without this kind of commitment, we would probably have faced failure, because the number of candidates in this phase was very small.

During this period, interpersonal relationships in the group of candidates had a moderate level of competition. This helped boost engagement and maintain a high tone in training. In this context, one of the constant directions of psychological assistance has been to promote functional interpersonal relationships, to mitigate and mediate tensions within the group and the group with the rest of the coordination team. Without missing some rough edges, especially under the effect of the stress of the training camp, the group climate did not reach significant conflict levels at any time. Each member of the coordination group, in his field of activity, noticed competitive feelings among the candidates, but these always remained within manageable limits. Despite occasional, inevitable roughness, interpersonal relationships remained at least fair, when they were not exactly warm and friendly.

In retrospect, the factors that contributed to maintaining the cohesion of the group and managing pressures were, in order: *the leadership* provided by the head of the coordination group (a military pilot with command experience, who approached difficult situations with calm, confidence and even humour); very good cooperation between the members of the coordination team (a prerequisite for the identification and operative dissemination of tensions); the presence of a psychologist, whose main concern was precisely to maintain balance and temper negative manifestations.

Towards the end of the period, we resorted to *Method of objective assessment*, invented by Gheorghe Zapan (1984), centered on the following theme: "*Suppose you were appointed commander of a space flight, and you can choose a teammate. Name one of the members of the group you prefer, and motivate this choice. Also, appoint and motivate a member of the group you wouldn't choose*". The objective was to have an image of the perception that each candidate has in the eyes of the others, at the end of a common experience of several months. Despite the inherent subjectivity, by cumulating them, these appraisals ensure what Zapan called "objective appreciation". The results can be materialized both quantitatively (number of choices/rejections received, reciprocal) and qualitatively, through the graphic representation of the network of preferences and the analysis of motivations.[6]

For such a small group, quantitative analysis is of little relevance. Particularly significant from a psychological point of view, however, were the motivations with which the candidates supported their preferences. Their analysis outlines an idealized profile of their favorite cosmic teammate. The essential quality, placed by all in the first place, is professional competence. It is correlated with high capacity for learning, intelligence, and creative adaptation to unusual situations. The second component of the portrait accumulates traits of a propensity nature: tenacity, work power, tendency to surpass oneself, competitive spirit, firmness in decisions. Along with them, the favorite cosmic teammate is perceived as a pleasant person, with a high culture and varied interests, cooperative and endowed with a sense of humor.

d) Initiation in the aviation psychology and cosmic activities

The official program of preliminary training also included a theoretical training component. It contained, in addition to knowledge of space flight, an aeronautical psychology module. Its role was, on the one hand, as a form of preparation for the acclimatization flight with *the MiG-15*, and on the other hand, as an incipient form of training for participation in what later received the name of the (psychological) experiment *Informatia*.[7]

We organized this training in the form of colloquiums, with minimal formal requirements. The topics of the discussions included the fundamental problems of human adaptation to the conditions of air and cosmic flight, information loading and dynamics, decision-making stress, risk management, the effects of weightlessness, etc. The reference medium was, of course, limited to the

[6] Later, during my career, I introduced "objective appreciation" as a method of current evaluation of pilot students, at the end of each year of training. The scores obtained, together with the results of the sociometric test, applied simultaneously, were the basis for the validation of the psychological selection exam, carried out in the CAM.

[7] This experience was the basis for holding, in the '80s, an aeronautical psychology course for student-pilots in the first year of the aviation school. It is interesting to note that "*Lessons in flight psychology*" were taught as early as 1912, to the students of the second series of the Cotroceni flight school, by the graduates of the first series, as preparation for flying on Farman airplanes (ing. av. Gh. Negrescu, graduated in 1911, with the license no. 2 in Romanian military aviation, "Din amintirile unui vechi aviator", Editura Militară, 1977, p.2)

conditions of the time. The basic source was Valeriu Ceaușu's book on the psychology of flight (1976), along with sporadic references to US space programs.

Although, as I said, the preliminary preparation did not pursue a selection purpose, at the end of the period two candidates left the group. Without going into detail, this was due to the combination of two main factors: significant difficulties in adapting during training, and explicit pressure from families. In essence, it can be said that their motivation for this undertaking was not sufficient to counterbalance the difficulties and external pressures.

On January 23, 1978, the three remaining candidates (D. Dediu, C. Guran and D. Prunariu) left for the USSR for the final selection stage. After a month of "severe" evaluations, as Prunariu mentions (1985), on February 20, we learned that the Russian side decided that D. Dediu and D. Prunariu would be included in the flight training program in the USSR, while C. Guran remained in the country as a reserve. On the same day he entered the *CAM* the first batch of candidates for the next cosmic flight, an action that will be extinguished soon after, without ever being resumed.

International practice

Within *NASA*, during projects *Mercury* and *Apollo*, the involvement of psychologists in the training phase was limited. However, monitoring the basic vital functions of the group of candidates, as well as psychological well-being, was part of the nursing program during the trainings (Link, 1965). Recruited from among test pilots, the astronauts in this group had a culture of "deep aversion" towards psychologists (Musson, 2006). Under their pressure, after 1962, *NASA* prohibited the collection of performance data during training, which blocked the validation of selection and training methods (Harrison & Fiedler, 2011a). As a result of reasoned criticisms (Helmreich, 1983; Santy, 1994), this approach has been gradually abandoned. From resistance to intervention, we have moved on to an integrated support system. Psychologists are involved in the development of training programs for behavioral health (recognition and management of stress, sleep problems, and circadian rhythm). Also, emphasis is placed on the formation of group interaction, leadership, and subordination skills (Powell, 2001). During the training phase, astronauts participate in various procedures and programs designed to enhance human performance in space (Harrison & Fiedler, 2011a; Kanas, 2015; Landon, 2022):

- *Spaceflight Resource Management:* Adapted from aviation (*Crew Resource Management*), this program trains four essential elements: information sharing, communication efficiency, supportive behavior, and *leadership/followership*.
- *Expeditionary skills training*: Astronauts are trained in skills such as self-care, conflict management, intercultural adaptation, and group life.
- *National Outdoor Leadership School*: Candidates attend survival courses in extreme environments (e.g., the Arctic) to practice *leadership* and cohesion under stress
- *Operations in extreme environments*: Training takes place in the Aquarius underwater habitat, which replicates isolation and artificial life conditions in space.
- *Spaceflight Cognitive Assessment Battery (WinSCAT):* A computerized tool used to establish a baseline level of cognitive functions during training, useful for subsequent monitoring in flight.
- *High-fidelity simulations:* 45-60 days training in isolation rooms (such as *HERA* or *SIRIUS)* where psychologists observe group dynamics and the emergence of the "third quarter phenomenon" (low morale mid-mission).

In the USSR/Russia, *Roscosmos* has been focusing on intense psychophysiological monitoring and human factor engineering since the ’70s. The central objective was to assess the "psychological readiness for the mission". This included psychological compatibility, personality analysis, and the type of role they play in interacting with others. It was also aimed at familiarizing themselves with psychological reactions during flight and emotional stability in stressful situations. To this end, *Roscosmos* use various procedures and programs (Central Intelligence Agency, 1976; Gazenko, 1980; Kanas, 2015; Kanas & Manzey, 2008; Musson, 2020):

- *Surdokamera (Silence Room):* A fundamental procedure where candidates are sensory isolated for up to 15 days, sometimes with sleep deprivation, to assess emotional stability and the ability to stick to a dense schedule without external stimuli.
- *The "Homeostat" device:* Used to assess crew compatibility through a task whose success depends on the timing of reactions to achieve a common balance. Prunariu (personal communication, March 4, 2026) remembers that he went through this test, together with Popov, receiving congratulations for the ease with which they synchronized in positioning the pointing needle. The cohesion scores obtained at this device gave negative correlations with the level of interpersonal conflict in long-term missions. Their validity was also confirmed by the fact that crews that showed indices of 'harmonious interaction' maintained 15-20% higher productivity under conditions of chronic fatigue in orbit ((Santy, 1994).
- *Skydiving training:* Used as a stress research tool, cosmonauts must solve logical problems or report technical data during free fall, under cardiac and EEG monitoring. Prunariu also went through this type of training. However, it was later restricted due to the high risk of accident and endangerment of *Interkosmos* missions (personal communication, March 4, 2026).
- *Psychoprophylactic training*: It is a form of psychological training on the dangers of spatial asthenia (chronic fatigue, irritability) and methods of compensating for sensory deficits.

In the book dedicated to his cosmic experience, Dumitru Prunariu mentions the importance of psychological training during training in the USSR (Prunariu & Stark, 1982). This type of training was not explicit, but implicit, by engaging in analogous situations: flying, parachuting, survival training in special conditions (personal communication, March 4, 2026). An important role in the *Roscosmos* It plays a role in monitoring communications during training and their psychological analysis, to determine the level of stress, frustration, anxiety and conflict (Gushin et al., 1998). With the Joint Program *Shuttle-Mir* (1995-1998), psychologists from the US and Russia began to collaborate to harmonize training methods for multinational missions (Harrison & Fiedler, 2011a).

Within *European Space Agency* (*ESA*), the training period is designed to transform candidates from individuals with outstanding individual qualities into effective crew members capable of functioning in complex multinational missions, such as those on the *ISS* or from future expeditions to Mars. Along with technical competence, the second major objective is the development of psychosocial competences: leadership, cohesion, coordination, stress management and coping, intercultural competences, and language competences. The training is carried out in cooperation with *NASA* (e.g., flight training program), or is built on similar models (e.g., training in analog environments – caves, arctic environment). To reduce cultural barriers and promote a common space culture, astronauts *ESA* learn Russian and can live for short periods with families in Russia, during the years of preparation for the *ISS*. *ESA* promotes the identification of common elements between members of different nationalities in order to create a new cultural identity of the crew, a method that has proven successful on the *ISS* (Bishop, 2011; Kanas, 2015; Landon, 2022; Manzey & Schiewe, 1992).

In China, the taikonaut training program is based on isolation training and simulations, with a focus on preparing for long-duration missions. To this end, they are trained for long periods of more than 100 days in the Beijing lunar station simulator (Kanas, 2015; Wu & Wang, 2015). During this time, they are subjected to behavioral monitoring with a focus on mood, interpersonal tensions, resistance to stress and isolation, autonomy in situations of interruption of communications with the ground. Adapted Western techniques are used to monitor group cohesion and the working climate. Unlike Western models, programs in China tend to be influenced by collectivist values, which can make it easier to train crews for long-term missions (Draguns & Harrison, 2011).

In addition to the formative purpose, which is fundamental, the preparation period also functions as an additional mechanism for filtering astronauts. The effort to adapt to intense and prolonged stresses brings to the surface fragilities or latent pathologies. *Roscosmos* can eliminate a cosmonaut at any time during the program if a psychological incompatibility occurs. During the pioneering space period, about 10% of candidates were rejected in the very first month of training, largely due to failure on stress tests (Central Intelligence Agency, 1976). If *NASA*, although once entered the astronauts' corps the dropout rate is very low, field exercises, such as survival in the Arctic or underwater training, are used, at least informally, as an additional level of selection for the designation of astronauts on the *ISS* (Musson, 2006). The use of simulators and situational interviews during training eliminates unsuitable candidates, as these tasks require a minimum level of effective mental functioning (e.g., judgement under pressure) that cannot be simulated in the long term (Roe & Hermans, 2006).

4. Space Scientific Research Program

Dumitru Prunariu had on board the space complex *Soiuz 40-Salyut 6* the status of researcher. The mission's protocol included over 20 scientific experiments, 15 of which were carried out by Romanian researchers. Starting with 1979, several meetings with Soviet specialists took place, as a result of which the experiments to be carried out in the cosmos were approved. They covered three areas: astrophysics and nuclear physics (*Astro-1*, *Astro-2*, *Minidoza* and *Integral*), space technologies (*Capilar* and *Nanobalanta*), space medicine and psychology (*Imunitatea*, *Pneumatic*, *Balisto*, Reo *Interferon, Neptun*, *Guler*, *Informatia*) (Prunariu & Stark, 1982; Șerban, 2016; Surcel, 2011).

The scientific program *Informatia* was developed by Valeriu Ceaușu, with whom Ilie Puiu Vasilescu, Mircea Toma and Mihai Aniței worked. We must specify from the beginning that this program was aimed only at the Romanian cosmonaut and was carried out only during the flight. The main objective of the experiment was to highlight the changes that the specific factors of cosmic flight (overloads, weightlessness, the feeling of cloister, sensory deprivation and increased responsibility) induce psychic processes. The following were particularly followed: variations in psychological arousal (mental energy mobilization), speed and precision of thought processes, decision-making, coordination of movements, emotional reactivity, and efficiency of attention.

The experiment consisted of seven tests (Ceaușu, 1985b): *Psychotonus*, *Calculation*, *Centering*, *Reading*, *Sta-Ball*, *Risk*, *TV report*. With the exception of the TV report, all the others were conceived in *the Psychology Laboratory* of *CAM*.

1. *Psychotonus*. It is a test designed to evaluate the capacity for mental effort from a subjective and objective perspective (Ceaușu, 1987a). The subjective component involves self-assessment on a scale from 0 to 100 of five defining factors for effort capacity.

The objective component consists of the free association of numbers (*ASLN*) and is based on Shannon's concept of information entropy (1948). The subject must write numbers from 0 to 9 on a form, with the request that the sequence be random. If, for example, the number 2 is followed by the number 3, according to the counting stereotype, this brings a small amount of information (small entropy). However, if 2 is followed by a more "distant" number, therefore less predictable by the counting stereotype; this brings a greater amount of information (high entropy). The hypothesis is that, under the effect of fatigue, the brain tends to resort to stereotypes to a greater extent, to conserve its energy. This means that certain (stereotypical) numerical pairs will tend to occur at a higher frequency than others. At the same time, pairs removed from the (less likely) counting stereotype will appear less frequently. The analysis of the data of this test involves laborious calculations, for which a specialized software was necessary, created at the *Polytechnic Institute of Timișoara*[8]. Before being used in space, the sample was tested in a transoceanic flight, on a crew of *Boeing 707* (Ceaușu & Năstoiu, 1987), The test was also proven valid in a study on the mental fatigue curve, on a sample of 200 student pilots. They were tested for a week, at the beginning of each school day and after the last class hour (Aniței & Popa, 1987).

2. *Calculation*. It consists of simple arithmetic calculations, performed under time pressure.
3. *Centering*. It assesses the quality of perceptions, aspects of decision-making, hand-eye interaction, and the ability to self-control by marking the center of circles.
4. *Reading*. It consists of reading a text aloud, at the first reading, with recording. It analyzes neuropsychic dynamics, verbalization, and emotion control.
5. *Sta-bil* (Stabilization of the ball). It electronically simulates the sliding of a ball on an inclined plane, the subject having the task of keeping the ball as long as possible in the central part of that surface by operating a lever. Evaluates the hand-eye interaction in the steering movements, in the conditions of delayed feedback, aiming at the speed of reaction and the ability to restructure skills. The device was made in collaboration with the *Polytechnic Institute of Timisoara*.
6. *Risk*. The subject is faced with situations of uncertainty, in which he can choose his working conditions, respectively the level of risk assumed, depending on the confidence he shows in his own qualities and possibilities. The device was made in collaboration with *the Polytechnic Institute of Bucharest*.
7. *TV report*. It analyzes behavior in front of the TV camera, determining aspects of the influence of flight factors on mental activity, such as stage fright or self-confidence. It can be considered complementary to the evidence of *Reading*.

The *Informatia* program was applied in three distinct phases of the mission: before the flight (all the tests), during the flight (five tests: *Psychotonus*, *Calculation*, *Centering*, *Reading*, *TV Report)* and after the flight (the same five tests, only once, three days after landing). It should be noted that D. Dediu performed the same tests, in parallel with D. Prunariu, before and after the flight.

Without overemphasizing the generalization potential of an experiment with a single subject with one control, the analysis of the results led to some interesting and useful conclusions (Ceaușu, 1985a):

[8] For those who find computer analysis trivial, we remind you that this happened in the years 1980-1981!

- In the first 3-4 days of the flight, there is a slight decline in mental performance - a decrease in the speed and efficiency of information processing processes.
- After this period, performance increases and sometimes even exceeds that before the flight.
- The onset of fatigue usually occurs faster in flight than on the ground. This leads to the idea that the work-rest cycle must be adjusted according to specific rules in flight, compared to those on the ground.
- Exposure to the flight environment, at least for a cosmonaut on the first mission and for a similar duration to this flight, tends to generate a slight state of euphoria, with a positive effect on mobilization in the task.

Referring to the performance at these tests during the flight, Prunariu (1985) made some interesting observations. In his opinion, technical and medical experiments involved him only as an operating agent (he acted on pre-established commands, observed and transmitted information read on screens), and the results did not have a meaning that concerned him personally. By contrast, the psychological tasks involved him personally, which induced him "a special psychological setting", which he describes as a "need for prestige" associated with a "slight fear of failure". If in the case of the other experiments, the one who "worked" was the equipment, in the case of the psychological experiment he was the one who worked, and the data referred to his performance, which had a significant mobilizing effect.

International practice

Space psychology research is carried out in two different contexts: on the ground, in so-called "analog" spaces, and in-flight. Analogue environments represent terrestrial conditions, natural or artificial, with characteristics similar in some respects to spaceflight. They are used as terrestrial substitutes for space conditions, for the study of human performance, the health and well-being of crews. Subjects can be astronauts in training, or volunteers who will never fly in space. The most common analogue media are: *research stations in polar areas* (real isolation and constant danger, immediate evacuation impossible); *underwater and underwater habitats* (crews are totally dependent on life support systems and limit immediate exit to the surface, just like in space); *isolated room simulators* (specially built habitats, where environmental variables can be strictly controlled to study the state of isolation and coercion) (Bishop, 2011; Musson, 2006). The longest isolation experiment (*March-500*) simulated a round-trip flight to Mars. It lasted 520 days (2010-2011) and took place in a complex of isolated modules at *Institute for Biomedical Issues* in Moscow. The subjects were six male volunteers (three Russians, two Europeans and one Chinese), who lived in total isolation, without access to natural light or direct atmospheric air (Basner et al., 2014).

From the point of view of historical evolution, space psychological research followed, similarly to selection, the phases of space programs.

First stage includes the period between the preparation of space flights (late '50s) and the completion of the *Apollo* lunar program (1969). The fundamental question that was sought at the time was whether a man can survive the impact of environmental factors, even under the protection of the cabin and the flight suit. The second question was whether it can also function efficiently under these conditions. The tests to which the American astronauts in the *Mercury* program were subjected have become legendary. This emphasized survival, resistance to extreme physical stressors (rapid alternating exposure to extreme temperatures, vibrations, centrifugal forces, sensory isolation in dark rooms). This type of physical and mental training, alike, was the basis of the phrase *Right Stuff*, invented by Wolfe (1980). This type of training has remained in the history of *NASA* by its draconian character, later considered excessive, justified only by the lack of knowledge regarding the conditions of survival in the extra-planetary environment.

Research from the period *Mercury–Gemini–Apollo* emphasized individual resilience, acute stress tolerance, and the ability to function in a team under pressure (Kanas & Manzey, 2008). During the flight, were tracked: psychological reactions to launch, separation and re-entry into the atmosphere; ability to maintain cognitive performance in short missions; data on mission stress and cabin behavior (Harrison & Fiedler, 2011a).

Interestingly, this information was not obtained through explicit research protocols, but through methods that we can call "opportunistic": observations made by mission control personnel, analysis of logbooks, operational reports or personal diaries of astronauts. At the time *NASA* did not have a scientific program dedicated to psychological research in flight. And this was because the first detachment of astronauts had been selected from among the test pilots, the elite of American military aviation. They were the ones who flew advanced experimental aircraft, facing exceptional challenges and considering themselves exceptional. Through their professional culture, they were inclined to perceive medical and psychological evaluations as potential threats to their own status[9]. As a result, they wanted to spend as little time as possible in relation to psychologists and psychiatrists[10]. Their antipathy to behavioral science led to the premature cancellation of a large study on the mental stress and performance of astronauts, conducted by scientists of *NASA* in the first years of the project *Mercury*. This has had long-lasting effects on research in the field of space medicine and psychology at *NASA* (Santy, 1994).

In the USSR, *Roscosmos* showed an open interest in psychological research during cosmic flights, since the beginning phase of their space program (*Vostok, Voskhod; 1961–1965*). The main objectives were to assess emotional stability, physiological reactions during flight, and in-flight clinical data collection to validate cosmonaut selection. The methods used were medical reports and clinical observations.

Stage Two began with the first permanent orbital stations (*Salyut 1* - 1971, *Skylab* – 1973) and continued until 2000, with the *Mir* and the *Space Shuttle* program. With the transition to longer and more complex missions, and having diversified crews (pilots, payload specialists and researchers), *NASA* recovered interest in scientific research in the field of behavioral sciences (Harrison & Fiedler, 2011b; Helmreich, 1983; Santy, 1994). The main objectives were to study the psychosocial effects of long-term missions, to develop countermeasures for isolation and mission monotony, to optimize the selection and training of mixed crews. The literature highlights the shift from individual measures to monitoring team dynamics and psychosocial interventions (Harrison & Fiedler, 2011a; Kanas & Manzey, 2008). A large-scale study from this era, carried out by Helmreich and Wilhelm (1987), is based on the idea that human error and crew coordination deficiencies pose greater threats than lack of technical competence. On this assumption, the authors isolated two fundamental dimensions of personality: *Instrumental features* (goal-oriented and goal-oriented) and *Expressive features* (oriented towards interpersonal behaviors), both of which are essential for the command of complex, multi-crewed spacecraft. The results highlighted the so-called "honeymoon effect", which suggests that high motivation during workouts can mask the negative influence of personality, its traits becoming stable predictors of performance only after the individual settles into the job routine.

[9] During the *Apollo 13 mission*, after the explosion that compromised the moon landing, astronauts Jim Lovell, Jack Swigert and Fred Haise removed their biometric sensors, much to the dissatisfaction of doctors at the control center in Houston.

[10] This attitude is still valid today in the world of military and civilian pilots.

Research carried out under the aegis *Roscosmos* focused on the new working environment created on orbital stations. Gushin et al. (1998) studied audio and computer communications between space simulation crews and ground control personnel during two ground isolation experiments, for 135 and 90 days. In-flight research on the stations *Salyut* and *Mir* focused on studying the long-term effects of microgravity on sleep, mood, and cognitive performance; monitoring crew dynamics in flight; testing of countermeasures applied in the mission. Regular assessments of cognitive performance and affective status were also carried out during long missions, including clinical trials and measures to promote mental health in flight (Gushin et al., 2021; Lyssakova & Lysakov, 2021).

This stage was also characterized by international cooperation on orbital stations. As a result, appeared joint US-Russian research on multinational crews in the program *Shuttle-Mir*. One of these highlighted several critical psychological difficulties, such as depressive episodes, feelings of loneliness and sociocultural isolation, highlighting the need for rigorous long-term support strategies. The results demonstrated the fundamental importance of intercultural competences, tolerance to prolonged periods of low stimulation and the ability to cohabit in an isolated environment, providing essential data for the optimization of training and the coordination of international missions (Kanas, Salnitskiy, Weiss, et al., 2001).

Another research, in the same context, studied psychosocial dynamics for 4.5 years. The results refuted the "third quarter" hypothesis (the degradation of the group climate at the beginning of the third quarter of the mission), identifying instead a novelty effect, in the first phase of the mission, and a decrease in perceived support from the leader, after the middle of the mission. Although no evidence was found for space asthenia, the study confirmed the phenomenon of displacement of tension and negative emotions from crew members to mission ground control personnel, and subsequently to higher-level management, highlighting the complexity of interactions between groups in orbit and those on the ground (Kanas, Salnitskiy, Grund, et al., 2001).

European Space Agency, in cooperation with *NASA*, aimed at this stage to harmonize the psychological monitoring tools applied in flight (electronic diaries, short cognitive batteries, sleep monitoring, adaptation of protocols to multinational teams) and to develop countermeasures applicable in international missions (Harrison & Fiedler, 2011a).

Stage Three (2000 - present) is marked by the interest in establishing permanent bases on the Moon, and further, in the flight to the planet Mars (Barger et al., 2012; Bell, 2023; Shengjun, 2024; Smith, 2024). To get an idea of the current orientations of space psychology research, we turned to *Scispace AI Agent* (https://scispace.com/). For the period 2020-2025, it found 83 scientific articles on ”space psychology” published in scientific journals, which can be grouped into seven thematic clusters:

- Mental health and psychological well-being: 27 articles (32.5%).
- Countermeasures and technological interventions: 19 articles (22.9%).
- Neurobiology and physiological mechanisms: 14 articles (16.9%).
- Future preparation, nursing, and support services: 12 articles (14.5%).
- Isolation, confinement, and analogue environments (ICE): 6 articles (7.2%).
- Sleep and circadian rhythms: 3 articles (3.6%).
- Team dynamics and communication: 2 articles (2.4%).

As can be seen, the first two clusters, mental health, well-being and psychological protection of the crews in long-term space travel, accumulate the majority of published studies (55.4%)

5. Pre-launch and in-flight psychological support

In the first half of 1981, after three years of complex training, the two Romanian cosmonaut candidates entered the phase prior to spaceflight. In this last stage, we record three types of contributions of Romanian psychologists: support for carrying out the psychological experiment in space, assistance in the launch phase, ensuring a comforting environment during the flight.

As for the operative support for carrying out the psychological experiment, it was provided by Valeriu Ceaușu in two forms: firstly, by prior training, in the USSR, on the procedures of the experiment, and secondly, by being present in the Flight Control Center, for its entire duration, for operational support. However, as he mentions (1985b), everything worked according to plan, and he didn't have to intervene.

The assistance in the period prior to the flight was not provided by a psychologist, but by the crew doctor on the Romanian side, a position for which Lt. Col. Dr. Vasile Teodorescu was appointed. At the time, he was a member of the psychology laboratory team, with psychophysiological evaluation attributions. In his account of his experience as a crew doctor, Teodorescu (1985) affirms, on the one hand, the importance of the psychological component of the interaction with the crew, and on the other hand, the advantage that the experience of working in the psychology laboratory gave him. This capacity put him in contact with the candidates since the selection phase.

His job began on April 23, 1981, when he participated in an information meeting in the *Cosmonauts' Town* (or Star *Town* – a closed-regime locality, where cosmonauts live and prepare space flights). On this occasion, it was announced that the training of the crews was over, and the two Romanian candidates obtained the qualification "excellent". From April 27 the activity moved to the *Baikonur Cosmodrome*, where he spent most of his time with the two cosmonauts. Beyond the current problems of preparing for flight, he evokes the most sensitive psychological problem felt by the two candidates: "*who will fly?*".

If during the preparation period in the country this problem was hypothetical and distant, and yet it was felt, we can imagine how acute it had become in those days, when there were about two weeks left until the launch. The tension was in the air, and the role of the crew doctor was to dissipate it as much as possible and shift the focus to the success of the missions, which was a common interest. Despite this situation, naturally, the two performed their tasks professionally, participating together in relaxation activities in their free time. The official confirmation of the crew chosen for the mission took place on May 12, just two days before the launch, and from this moment the crew doctor divided his attention, with different objectives, to each of the two. Despite the natural psychological impact, they still maintained a professional, goal-oriented attitude.

On the evening of May 14, 1981, Dumitru Prunariu, together with Leonid Popov, was in the cabin of the ship *Soyuz 40*. A little over four years had passed since the spring of 1977, when he had agreed to enter the selection process for an uncertain future flight into space. At 8.17 p.m. the launch started, and what followed became history. To ensure mental comfort during the space mission, the Romanian Television, in collaboration with Valeriu Ceaușu, produced a program composed of fragments of approximately 20 minutes, recorded on videotapes. In total, around three hours of the program were provided, which had varied content. It should be noted that the program was recorded in color, and Ceaușu (1985b) noted that he was well received by cosmonauts[11].

[11] At that time, the Romanian Television had not yet started broadcasting color. Daily color transmission only began in 1985 (http://www.tvr.ro/istoric-alb-negru-si-color_2223.html).

Figure 2. Dumitru Prunariu, preparing for a medical experiment, on the *Salyut 6* space station. On the left panel, the audio cassettes with the crew members' favorite music. (*Source: D. Prunariu's personal archive*)

Referring to this program, Prunariu remembers that they watched it only once, about 30 minutes. The cosmonauts preferred to listen to music from the audio cassettes brought by each one, depending on their personal preferences. An important advantage of ambient music was that it allowed you to continue activities, unlike video recordings that blocked attention on a screen. The officially established schedule provided 8 hours of activity, 8 hours of sleep, and 8 for administrative tasks and free time. However, for the full fulfillment of the scientific program, 12 hours a day were also worked. Under these conditions, the preferred entertainment was looking at the Earth through cabin porthole (Prunariu, personal communication, March 4, 2026).

International practice

During the pioneering space period, there was no explicit psychological monitoring during flight. Monitoring was limited to vital functions and basic medical telemetry (Harrison & Fiedler, 2011a). The study of group dynamics and tensions between crew and ground began with the *Skylab* and *Salyut* missions, and this involved the establishment of psychological monitoring of the crews.

Roscosmos set up a *psychological support group* since the '70s, which actively supervised the compatibility and morale of the crews. For this, spectral voice analysis was used to detect emotional stress during radio communications (Gushin et al., 1998). A common practice, which has been imposed over time, consists of the so-called "countermeasures", materialized in the sending of favorite foods, surprise gifts from the family, and music, through resupply vehicles, to combat "space asthenia". Such a role played the mission itself *Soyuz-40* of Popov and Prunariu, for the crew *Saliut 6*, which had been in space for more than 60 days at the time. From the perspective of long-haul flights, *Roscosmos* is considering a complex psychological support program (Gushin et al., 2021; Rozanov et al., 2022)

For *NASA*, "the strike on *Skylab*", which I mentioned earlier, was a turning point in terms of managing relations with flight crews. The incident was the result of the accumulation of stressors generated by poor mission management (Bor & Hubbard, 2006; Stuster, 2010):

- *Unrealistic time scheduling*. Planners on the ground had programmed almost every minute of the astronauts, using unrealistic time estimates for complex tasks.
- *Treating astronauts as "robots"*. The control center in Houston had eliminated any relaxation period

from the program, shortened meal times and those needed to prepare for experiments.

- *Prohibition of recreational activities*. Astronauts were initially forbidden to spend time looking out the window at Earth or the Sun, their favourite relaxation activities.
- *Physical and mental exhaustion*: The crew sacrificed the first three days of planned rest to try to make up for the delays in the program, reaching a state of extreme fatigue and low morale.
- *Lack of empathy from the ground crew*: Astronauts began to perceive the Control Center as lacking support and empathy for the real difficulties on board.

Following this event, NASA learned several important lessons:

- *Recognizing the importance of leisure*: Rest periods and free time are essential for the success of long-term missions.
- *Introduction of the "Task List"*: All activities that did not strictly depend on the station's orbital position were taken out of the rigid minute-by-minute schedule and placed on a flexible list, which astronauts could manage according to their condition.
- *Increased autonomy*: It was decided to give astronauts greater freedom to schedule their own activities, recognizing that the fast, sustained pace of short missions cannot be maintained in long-duration missions.
- *Mediation sessions* ("*Bull Sessions*"): To resolve tensions, discussions were held between the crew and the ground, a procedure that became a model for managing disputes.
- *Changing the paradigm of selection and training*: The incident demonstrated that selection based only on individual resilience is not sufficient for long missions, and an assessment of flexibility and group dynamics is also necessary.

Currently, *NASA* is implementing a computerized and structured crew monitoring system. On *ISS*, astronauts are required to participate in private audio-video discussions (15-20 minutes) with an operational psychologist every two weeks (Kanas, 2015). Monitoring is also practiced through *WinSCAT* (*Spaceflight Cognitive Assessment Tool*), a battery of computerized tests that measure memory and attention to detect cognitive fatigue (Powell, 2001). In the spirit of the concept of behavioral health, social support is practiced, which consists of weekly family conferences and, more recently, access to mobile phones for private communication with the Earth (Landon et al., 2021). In orbital missions, counseling sessions, crisis intervention or even short intervention psychotherapy are organized, through private audio-video connections. For interplanetary flights, intervention guides are developed, and at least one crew member is trained to recognize severe problems and intervene appropriately (Kanas & Manzey, 2008).

The European Space Agency focuses on the supervision of multicultural and linguistic factors in multinational missions. It is monitored how the styles of *leadership* (directive vs. participatory) influences cohesion (Sandal & Leon, 2011). Under the Chinese space program, psychologists are monitoring the impact of long-term weightlessness on memory and sensory information processing (Shengjun, 2024)

6. Conclusions

Dumitru Prunariu's Space Flight was a unique opportunity for Romanian psychology to participate in a scientific project of historical scope. The Psychology Laboratory of the *CAM*, led by Valeriu Ceaușu, was involved in this project for its entire duration, between April 1977 and May 1981. The ways of involvement described in this article are, in principle, similar to international practice at the time, from selection to psychological research during the flight.

The pattern of our contribution was similar to the *Interkosmos* model. To what extent we can talk about the importance of this contribution to the finality of the program is a subject of debate. There is no question that credit should be given primarily to the long years of specialized training in the USSR, which was at the time one of the world's two space powers. Without overestimating our role, I am convinced that Romanian psychologists were nevertheless part of the success of this flight. In a period of one year, from April 1977 to March 1978, Romania selected, including psychologically, five cosmonaut candidates, whom it went through a basic training program. Three of them passed the selection tests in the USSR. Two successfully completed an intense training program, which they graduated with a qualification of excellence, and one executed a mission in space without reproach.

Added to these is the development of a scientific psychology program, carried out in flight, developed in collaboration with technological research and higher education institutions in Romania. An additional argument, not to be neglected, is also the quality of Dumitru Prunariu's adaptation to the status of "the first Romanian to fly in space", as well as his subsequent professional career. All of them undoubtedly confirmed the intellectual and personality qualities for which he was admitted to the group of five candidates who began the race for space in 1977.

During the training period in the country, two important officials, who came on control and information visits to group *K*, evoked optimistic prospects regarding Romania's future participation in space flights. In August 1977, in Poiana Brașov, a senior officer from the military aviation management evoked the prospect of associating ourselves with the American space program! A few months later, in November, in Bacău, the head of a space research organization announced that by 1990 a few dozen Romanians would fly into space! Both situations created emulation among the candidates, but neither of these predictions came true.

It's been 45 years since then. Dumitru Prunariu remains the first and, for now, the only Romanian cosmonaut. The flight of another Romanian into space does not have a predictable perspective. Until it happens again, we are left with the satisfaction of having made an honorable contribution to this event.

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