Memories of Buran
(To the 15th Anniversary of the First Launch)

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Early this year the whole world was shocked by tragic news: the first American space shuttle Columbia was destroyed and burned down with all the crew when entering the dense atmosphere. The real cause of Columbia destruction will hardly be discovered soon. At the same time the information available suggests that the crash resulted from the damage of the left wing heat shielding.

Fig. 1. Buran at the launching site (photo with the autograph of G.Ye. Lozino-Lozinskii).
As is well known, a similar space shuttle Buran was developed in the USSR in the 80s and made a successful space flight 15 years ago (see Fig. 1). Was its heat shielding durable and reliable? What flaw detection methods were employed in building this unique aircraft? Was it destined to meet the same tragic fate as Columbia did? No one can unambiguously answer these questions now. At that time, I happened to take part in developing nondestructive methods and means of flaw detection of some of its constructional elements, and I personally can confirm that everything was done to exclude any trouble, at least from the heat shielding tiles.

The leaders of the NPO Molniya, which was building Buran, invited our Research Institute of Mechanics and Applied Mathematics at the Rostov State University (now Vorovich RIMAM RSU) to take part in joint development of methods and means of acoustic emission (AE) diagnostics of heat shielding elements together with the department headed by Professor V.V. Konnov. At that time I was just working as the Head of Laboratory of Acoustic Emission at RIMAM RSU, and we had wide experience in joint development of methods and means of AE diagnostics of articles and units of high importance together with different organizations, including the designers of the Buran engines.

All the work on the Buran themes at our institute was directly supervised by our director Academician I.I. Vorovich, a laureate of a number of USSR and RF State Prizes, and by A.S. Tripalin, deputy director for experimental work. A simplified diagram of AE diagnostics method for heat shielding is shown in Fig. 2. A tearing off load $P$ was mechanically applied to heat shielding elements, for example, glued tiles [2, 3]. The material to be tested had a highly porous structure which caused significant attenuation of the high-frequency AE signal components. That is why we initially were strongly doubtful of the possibility of applying AE methods for testing the given material. To solve this problem, we had to develop special high-sensitive AE probes with low resonance frequency (about 160 kHz) and low-noise narrow-band preamplifiers [3]. The AP-51EM special instruments were designed and modernized for receiving the AE signals and restoring the intensity of AE events flow $N_a$ corresponding to the flow of damage events [3].

Figure 3 shows an example of restoring the damage flow obtained in loading one of the tiles. It was found that a reliable AE registration corresponding to buildup of microdamage inside the

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1 Vladimir Vasilievich Konnov, Prof., Dr. of Sci. (Tech.), laureate of the RF State Prize, Head of the Department of Physical Methods of Nondestructive Inspection at the NPO Molniya [1].