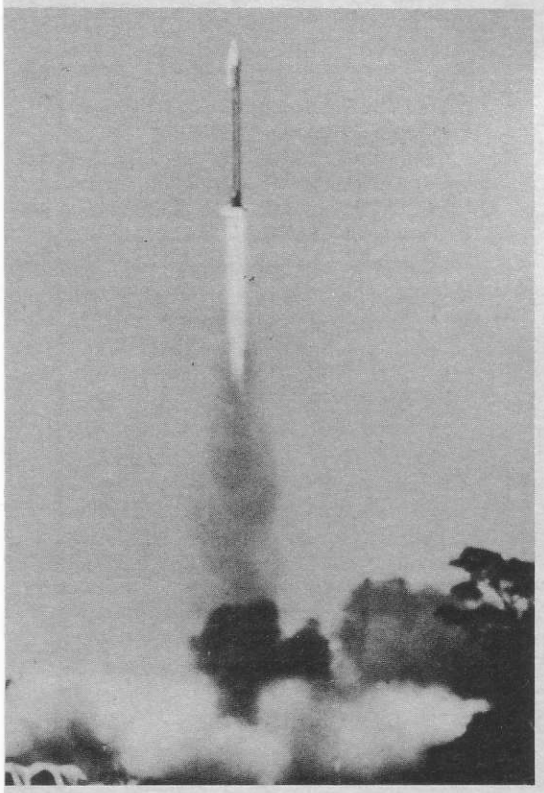
In Orbit

by James E. Oberg

The RISE, FALL, AND RISE OF OTRAG

The rumors have been whispered urgently in small groups and passed from colleague to colleague in brief, cryptic handwritten notes: "OTRAG lives!" As 1980 drew to an end, a group of renegade space engineers, which had been written off as a cold-war casualty, suddenly seemed to have taken a new lease on life. If their brief history is any evidence, their future is bound to be even more sensational — and the fireworks will not all be in the sky.

OTRAG is German meaning Orbital Transport and Rockets Inc. The group, headed by a visionary and charismatic rocket technician named Lutz Kayser, was organized in the mid-1970s to fulfill the premise that cheap, expendable launch boosters can put satellites into orbit far more economically than highly sophisticated reusable systems (such as the Space Shuttle) or even reasonably advanced and heavily subsidized expendable systems, like the European Space Agency's Ariane. This claim made the nongovernment group something of an aerospace outcast, and although Kayser raised funds privately and arranged for a test range outside Europe, he stepped on too many toes and, when the going got rough, had no friends left.



On May 17, 1977, the first firing and launch of an OTRAG rocket took place from a test range in central Africa.

Top engineers laughed at his rocket design, but he fooled them all — because it worked. For the rocket body, he used construction pipe. The propellants were cheap industrial chemicals. No turbopumps were used; the fuel was fed by air pressure. The engines were lined with ablative porcelain, and the fuel valves were driven by motors originally designed for windshield wipers. The engines did not gimbal (rock back and forth to steer the vehicle); instead, engines on opposite sides of a great cluster of rocket units were designed to throttle up and down, tilting the whole vehicle as needed.

Kayser made a deal with the government of Zaire, in central Africa, to lease a large test range near the equator in return for a share of the ultimate space-freight revenues. In the spring of 1977 Kayser's engineers set up a four-motor unit, with an umbilical tower lashed together from tree trunks, and fired it. As planned, it reached an altitude of more than ten miles. The concept worked; within two years OTRAG expected to place test satellites into orbit.

But other opinions about OTRAG soon far outweighed the technical successes. Kayser's group was suddenly accused of building military bombardment rockets either for West German neo-Nazis or for South African would-be atomic bombardiers. Tales of vicious atrocities against the small native population in the test range began to filter out. A chorus of angry cries emanated from the embassies of a dozen African countries, and their screams were soon reechoed by the Communist world. Here was yet another NATO military adventure aimed at aggression in Europe and at counterrevolution in Africa!

The claims were so silly that Kayser felt awkward answering them. No, everybody in the test zone is just fine — come and see (but the United Nations refused). No, these are not military missiles; they would take far too long to fuel and fire. No, we would never do business with South Africa; we'd lose too many other paying customers. No, the Russians can't possibly think we are a war base; their spy planes fly over regularly and take plenty of pictures of what we're doing.

But the anti-OTRAG campaign grew in scope and intensity. The West German government, its diplomats harassed in Africa, took an unsympathetic view of the whole OTRAG affair and began tax investigations. In a major popular magazine in the United States, free-lance journalist Ted Szulc published an OTRAG "exposé" that looked like it could have been dictated in Moscow (even the names of the German villains were misspelled in the Cyrillic style!). As these confirmatory anti-OTRAG stories spread, Moscow repeated them in its own internal and overseas propaganda organs, whipping up anti-German anxieties at home and anti-European paranoia in Africa.

Then, in early 1978, the purpose of this whole discrediting campaign from Moscow (for such was its origin) was plainly written in blood. A band of would-be rebels from Shaba province in Zaire (formerly the independence-minded Katanga, until the United Nations sent an army to crush it and the Algerians kidnapped and murdered its president) crossed the border from Angola and attacked Kinshasa, a major mining center. They claimed to be innocent victims of the OTRAG depredations, and because of the anti-OTRAG smoke screen, most African states did not publicly disagree. In reality, they were exiled Katangan soldiers returning home after many years abroad — with East German training and weapons.

But the "war of liberation" (the

Communist press never mentioned that the attackers had come from outside the country) soured in an orgy of looting, rape, and murder directed at the population of Kinshasa in general and at several thousand Belgian engineers and their families in particular. When the French Foreign Legion finally arrived (aboard U.S.-flown transports), there was little fighting to do — the Katangan troops had headed for the border in stolen trucks piled high with booty.

Whatever the success of Zaire's survival, its government saw the handwriting on the wall. OTRAG was a lightning rod for trouble, and early in 1979 Zaire unilaterally terminated its agreement with the German rocketeers (it was completely illegal, of course, but the World Court in The Hague was not interested in hearing the case). In Germany OTRAG's funds dried up, as German government accountants squeezed off loopholes and kept close watch on the corporate headquarters. It seemed that OTRAG had been effectively strangled, although the major Soviet objective in the whole propaganda offensive was apparently the destabilization and possible destruction of the pro-Western Zaire regime. (Zaire provides the United States with several vital industrial minerals, including uranium.)

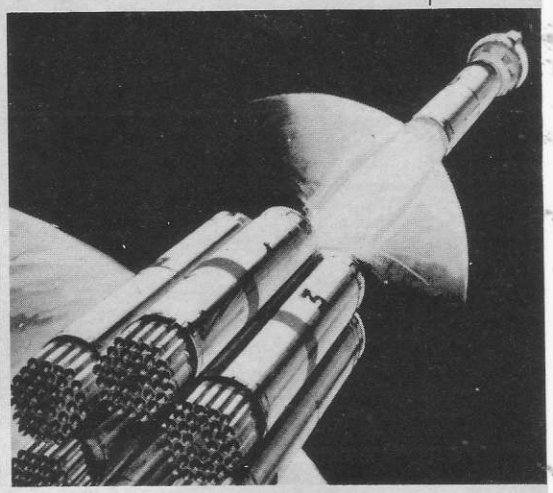
Throughout 1979 and 1980 there were unsubstantial rumors about OTRAG representatives circling the world in search of new equatorial launch sites. (Launching a rocket at the equator utilizes the maximum rotational velocity of the Earth, thereby allowing minimum energy expenditure to achieve orbit.) But no Third World country was willing to accommodate them because of their tarnished reputation and because of the possibility of a new Soviet propaganda offensive aimed at any new host government. OTRAG engineers — those still on the much-reduced payroll — began looking into launching from converted freighters at sea or from offshore platforms in international waters.

But last October a new rumor filtered out of the International Astronautical Federation Conference in Tokyo: OTRAG had reached an agreement that could solve their financial problems and their launch-site problems in a single blow. Unconfirmed reports said that Libya's erratic dictator, Muammar Khadafy, agreed to support OTRAG in return for the launching of several spy satellites. Khadafy's violent anti-Israel politics might suggest that he is interested in OTRAG more for what they were falsely accused of (military missiles) than for what they can actually provide (low-cost launch services), but the details of Kayser's latest African deal are still secret.

The appearance of the OTRAG missile is as unconventional as the political sideshow that surrounded it. Unlike familiar rocket boosters, which are stacked one stage atop the other, the OTRAG design calls for successive "lower" stages, consisting of dozens of long, narrow cylinders wrapped around the outside of the "upper" stages, to peel off in an onionlike fashion, stage by stage. The staging concept has not been test-flown (but it was used for the first successful American satellites and moon probes, so it certainly is feasible). Perhaps, if the rumors are accurate, the OTRAG-Libya Connection will provide the opportunity for the ultimate proof — placement of test satellites into Earth orbit within a year or two. Maybe the OTRAG fireworks have just begun. ★

James Oberg is a computer expert at NASA's Mission Control in Houston. He is also a prolific author on spaceflight and astronomy topics and is regarded as one of the West's leading authorities on the Soviet and Chinese space programs. All opinions expressed are based on his own personal research and analysis and cannot be construed to reflect NASA policy. His column appears monthly.

Lutz T. Kayser, founder and head of OTRAG, holds a model of his low-cost heavy-launch-vehicle concept.



The largest OTRAG launcher would utilize six first-stage boosters wrapped around subsequent stages, seen placing a payload in orbit in this rendering. (All Photos Courtesy Theo Pirard)

Astro Stuff

'HAIRY STAR' HAD CLOSE SHAVE

The bright comet of 1843 performed a death-defying act. Its perihelion brought it a mere 81,000 miles from the sun's surface, one-third the distance from the Earth to the moon. The comet swept through the corona and would have gone through prominences as well, had solar activity not been at minimum. The fearless visitor emerged unscathed and undisturbed either in motion or in appearance.

THE GREEN FLASH

The "green flash" is not a comic-strip hero. It has nothing to do with auroras, the zodiacal light, or the counterglow. It is unique. It is similar to other sky glows only in that it is caused by the sun and our atmosphere.

To see it, watch the sun setting behind a sharply defined horizon. As the last thin crescent approaches the horizon, it will appear to flatten into a short straight line. It can now safely be viewed through moderate-power binoculars. If conditions are right, the narrow line of the sun resolves again into a thin yellow crescent above which a green fringe may appear. The ends of the fringe are brighter than the central portion. As the sun disappears, these ends move together for just a second, producing a bright green flash.

Don't expect to see it every time. But when you're set up for a night of observing and waiting for the skies to darken, why don't you look for the green flash? (Based on an item in *The Observer*, the newsletter of the Jackson (Miss.) Astronomical Association.) ★

Susan Beard