

*Ranger 7* was the first American spacecraft to show us in the Western World some of the details of the Moon's surface on 28 July 1964, and five days later, commenting on the significance of this feat, I had a full page in the *Daily Telegraph*, with large pictures, from this historic flight. It had the head-line "Man on the Moon in Six Years' Time". I was out by one year, man was on the Moon in five years! I detailed three steps to the Moon, *Surveyor*, *Gemini* and *Apollo*, all three being designed, constructed and tested at the same time.

I first saw the *Surveyor* unmanned spacecraft, conceived to soft-land on the Moon, at the end of March 1966, when I revisited the Hughes Aircraft Company in Los Angeles; the same company which had designed and built *Early Bird*, the first synchronous communication satellite. *Surveyor* was the logical successor to *Ranger*, designed to study further details of the Moon's surface. This was essential to refute once and for all the 'Dust Theory' proposed by Professor Tommy Gold of Cornell University, according to which several meters of fine dust covered the Moon. This would have made landing by man almost impossible.

Seven *Surveyor* spacecraft were launched between May 1966 and January 1968, two of which crashed and did not soft-land as they were designed to do. The five successes returned thousands of excellent photographs which allowed the choice of suitable landing sites for the later *Apollo* astronauts. The other success of *Surveyor* was the novel system of down-pointing radar combined with retro-rockets, which together allowed an automatic computer controlled soft-landing of both *Surveyor* and later *Apollo*. When I saw the first *Surveyor* in Los Angeles, I was again greatly impressed by the ingenuity of the design and the great testing facilities for it, imitating space by providing nearly complete vacuum and very low temperatures.

It was the size of these test chambers that was so grand, as the *Surveyor* in its folded position was 3 meters tall and the same in width. It was considered essential to test the whole spacecraft under the conditions of space, and not only each individual part separately. The correctness of this philosophy was attested by the success rate of five to two, which must be considered as good.

The other impressive reaction which *Surveyor* and *Gemini* conveyed to me was the slow, but unswerving path which turned the dream of manned flight to the Moon into the reality of technological progress. The long term planning was now seen to pay off, as part after part of the most daring expedition, ever undertaken by man, took its allotted place in this gigantic scientific enterprise. That there would be initial failures, and that these would continue into *Apollo*, was only to be expected, as any historian of technology will confirm.

*Apollo* will always remain for me the outstanding example of what scientific temper can achieve by foresight and planned execution of a large project.

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