

LAUNCH PAD

The Science Museum in London attracts over 3 million visitors a year and is renowned for its extensive collections. Most people in the UK can recall a visit in their childhood and all the 'push-buttons'. Launch Pad is the museum's recently opened interactive gallery and, unlike other galleries in the museum, has its origins in the educational department. It is, in many ways, a museum within a museum, with its own facilities and staff. The intention is to provide an experience rather than an interpretation of objects.

Launch Pad occupies a prominent area at the entrance of the museum and is bright, colourful and usually teeming with visitors. The exhibits are interactive and participatory and the emphasis from the outset has been on technology rather than scientific phenomena. Exhibits are ruggedly constructed with tubular steel frameworks clad in brightly coloured industrial hosing, which gives the entire exhibition a characteristic style throughout.

The project was well funded for a project in the UK, and sufficient for some 30 people to be involved in the setting up phase. Many of the exhibit ideas were originated within the Launch Pad team. Initial ideas were handed on to a development team to produce prototype exhibits for testing, and then on to a design team to transform the prototypes into versions for final display. Launch Pad is now run by a small group from the original development team.

Location:	Science Museum, Exhibition Road, London SW7 2DD
Date opened:	July 1986
Floor area:	900sq m
Number of exhibits:	65
Number of staff:	11 permanent 3 temporary
Number of visitors:	800,000 p.a.
Opening times:	Mon-Sat 10-6, Sun 2.30-6 Closed 1 Jan, Good Friday, May Day Bank Holiday and 24, 25 Dec
Entrance fees:	Free

LAUNCH PAD

Dr Anthony Wilson



Anthony Wilson did research into atmospheric physics at Oxford and Toronto universities before becoming a physics teacher. He joined the Science Museum as a lecturer in 1977 and is now Head of Education there. He was responsible for establishing the Launch Pad project and for the educational side of its development. In addition to numerous articles and reviews, Dr Wilson is the author of four books for school use and, jointly with Sue Watt, of the Launch Pad book.



The view across Launch Pad from the entrance.

Launch Pad is a permanent gallery of interactive exhibits in the Science Museum in London. With a main theme of *technology*, it opened in July 1986 with a total of 65 exhibits on a 900sq m site on the ground floor of the Museum.

The name Launch Pad was chosen in the hope that, for at least some of the many young visitors who will come to it, it will be the starting point for an exciting journey of discovery, where new interests and enthusiasms are awakened. For a few people whose interests might have lain elsewhere, Launch Pad may be one of the factors directing them towards careers in technology and industry.

How did it come about?

Since its inception in the mid-19th century, the Science Museum has always seen its role as more than just collecting and conserving historical artefacts; using them for educational purposes has been an important aim too. The principle that some of its exhibits should be working models or demonstrations, provided simply to explain how the historical objects work, is therefore well established.

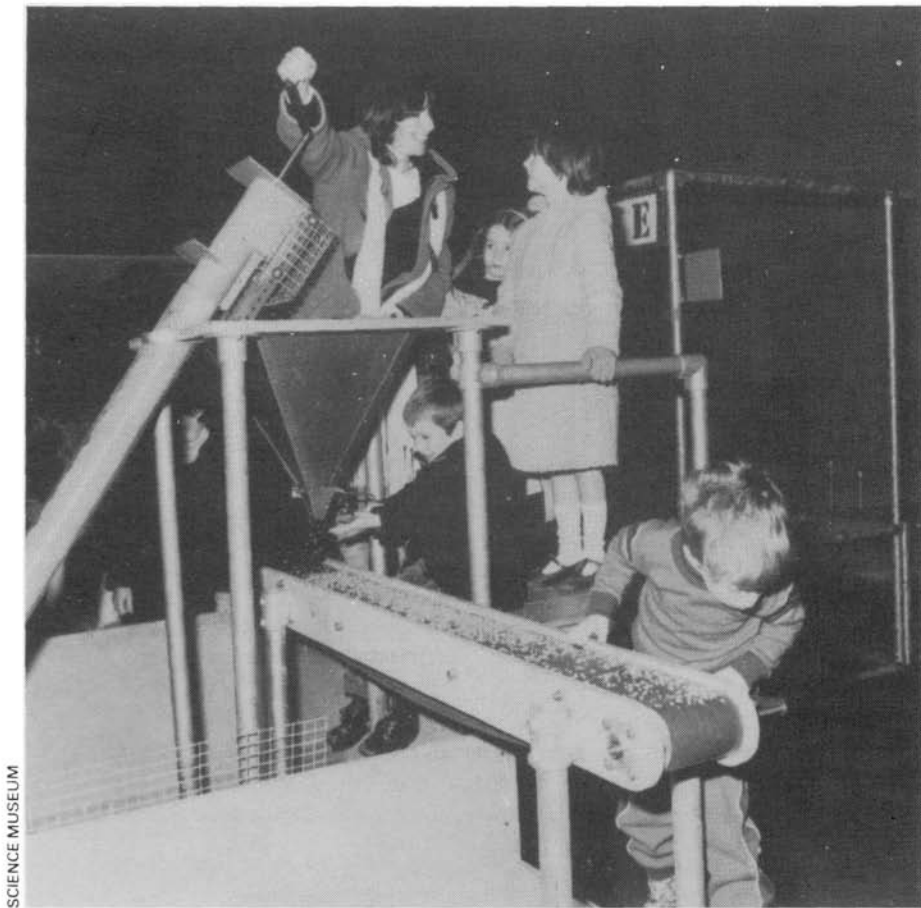
An important step in implementing this policy was the setting up in the 1930s of the Children's Gallery in the basement of the Museum. This contained (and at the time of writing still contains) many exhibits which are not historical but are visitor-activated demonstrations, chosen to illustrate basic scientific principles and phenomena. A number of them are fully interactive in the sense that visitors are able to handle the equipment directly rather than operate it remotely through push-buttons or crank handles.

In the late 1970s the Museum was allocated space in a large building a few miles from South Kensington. A proposal was framed for putting into this building a number of 'science centre-type' exhibitions which would contrast with the historical collection-based displays at South Kensington. In the event, this proposal did not go ahead and the building was allocated for use as a store. One part of that proposal, for a 'Hall of Experiments', survived however and eventually became Launch Pad.

In the summer of 1981 the Science Museum played host to a travelling exhibition of interactive exhibits, the Ontario Science Circus. Although its visit was a brief one, the public response to it – both from teachers bringing school groups and from family groups coming at weekends – was extremely enthusiastic. There was no doubt that this was the sort of thing the public liked and wanted.

More specifically, we learnt three things from the visit of

the Science Circus. The first was the importance of having staff available in such an exhibition, to mingle with the visitors, answer enquiries, help them, and generally act in the way a host does at a party. The role of these people was different from that of the usual type of museum warder. Their presence produced a welcoming atmosphere and enhanced the visitors' enjoyment of the exhibition, but also made it possible to include among the exhibits many which would



SCIENCE MUSEUM

The prototype 'Grain Pit' under test. This exhibit requires visitors to cooperate in shifting grain around an endless circuit using lifting and transportation mechanisms found in industry. This is a popular exhibit which children operate with great determination and intense concentration.

never survive in a traditional style gallery because of the risk of misuse, injury to the visitor or pilferage.

The second lesson concerned educational objectives. When asked what objectives they had in mind in choosing exhibits for the Circus, the staff were adamant that not only had they not drawn up such objectives, but that to do so would have been counter-productive. It was essential, they said, to choose exhibits that were fun rather than exhibits that made particular points. If one went for fun the educational merit might follow, but the reverse was not necessarily true, and exhibits that were not fun would not be used.

Third, our evaluation of the visit of the Circus made it clear that successful interactive exhibits are likely to be ones that give quick reward. The average time spent at each exhibit in the Circus was only 54 seconds. So anything that did not catch the visitor's attention and give some sort of reward in the first few seconds was unlikely to be a success.

Later in 1981 and on several subsequent occasions, the Museum put on small 'Discovery Room' exhibitions over school holiday periods. In each of these a range of equipment



The 'Train Wheel' exhibit. Why do some wheels negotiate the curves on tracks and others fall off? Could it be due to the shape of the wheel or just luck, and was it luck that early train wheels were the right conical shape?

usually used in lecture demonstrations was adapted and made available for the public to use directly. Once again, the response was remarkable. Even at times when the Museum was virtually empty, the Discovery Room would invariably be well supported.

In 1983 the Museum's Director, Dame Margaret Weston, resolved that we should install an interactive centre in the South Kensington Science Museum provided adequate external funding for the project could be found. Approaches were made to the Department of Industry (as it then was), whose Industry/Education Unit was actively promoting educational ventures intended to interest young people in technology and increase their awareness of the role of industry, and also to the Leverhulme Trust. In the event, both applications proved successful and substantial grants were obtained to enable the project to go ahead. Since the Department of Industry's grant



These gears are held down with magnets and can be arranged in a variety of configurations to obtain different ratios and direction of rotation.

was only to be spent on equipment and the Leverhulme grant was to support personnel, the two dovetailed well together. The grants were conditional on the Museum's making available to other groups in the country information about its exhibits that would enable them to copy them as economically as possible.

As our ideas crystallised over several years, it became clear that if Launch Pad was to meet its aims, it should be more of a technology centre than a science centre, concentrating on 'ideas in action' rather than 'ideas in the abstract'. By consciously opting for a technology centre we also gave ourselves the challenge of trying to do something slightly new, since nothing calling itself an 'interactive technology centre' existed at that time. Considerable effort went into working out how interactive technology exhibits would be different from interactive science exhibits. The extent to which we have successfully imbued Launch Pad with the flavour of technology rather than science can only be judged by looking at the exhibition itself.

Setting up Launch Pad

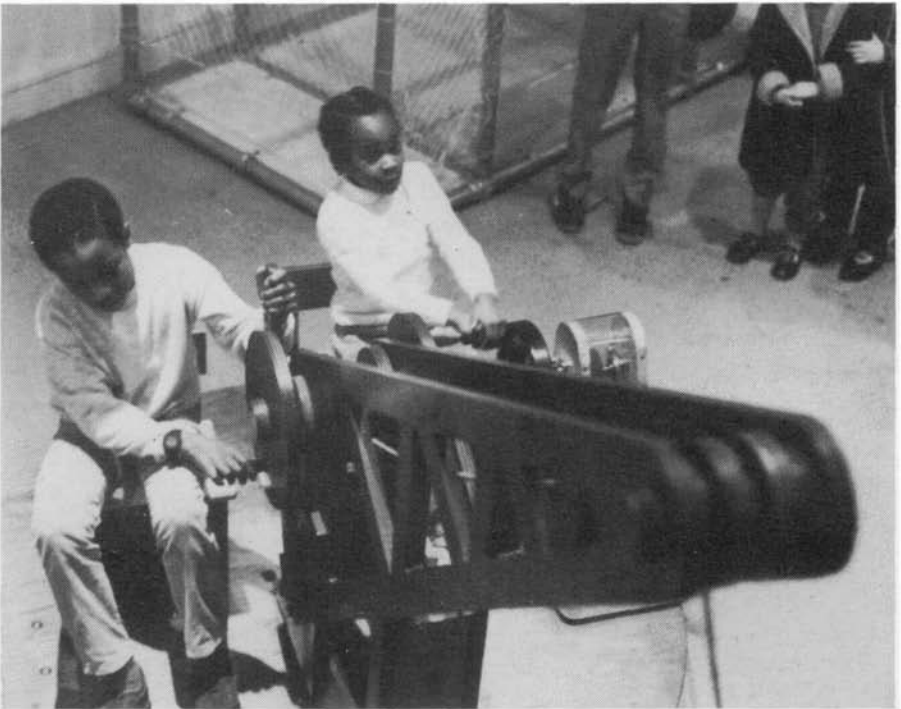
Establishing an exhibition of fully interactive exhibits would be an entirely new venture for the Science Museum, both in what was to be attempted and in the way it was to be done. The project originated in the Museum's Education Service and the Education group was to play a steering role in the development of Launch Pad with particular involvement in the selection of exhibits. Once open the gallery would run as part of the Museum's Education Service.

A special Research and Development team was brought into being to develop the exhibits. The planned procedure was one in which an exhibit would be developed to a prototype stage at which it would be assessed, and if accepted it would go on to the stage at which it could be tried out with visitors. Later this became known as a 'test bed style exhibit'. Exhibits at this stage were characterised by the use of a scaffolding frame system (Kee-Klamp) – a design concept developed by the project's design section, which proved most successful and was later updated for the final versions of the exhibits.

After testing, the exhibit would probably require modification and further development; perhaps new possibilities had been seen as a result of the way visitors used it, or deficiencies revealed which needed putting right. Eventually a stage would be reached at which the exhibit was deemed to be ready to go into Launch Pad.

It was originally expected that this final step, bringing each exhibit up to the standard needed to ensure its long-term survival in Launch Pad, would be a small one which would not require any major design and production effort and would be an extension of the work of the Research and Development team. In 1984 however, it was decided that this last stage in the preparation of exhibits should be upgraded and given greater prominence. A more radical re-engineering and re-design of the test bed style exhibit would have to take place with attention to the visual appearance of the exhibit, the shape of the structure that supports it, its colour and the finishes of the materials used, as well as to the safety and ergonomic considerations which are important at every stage of the exhibit's development. A third group, known as the Production Unit, was set up to undertake this work.

More information about the role of each of the three groups in the Launch Pad team is given in the following sections.

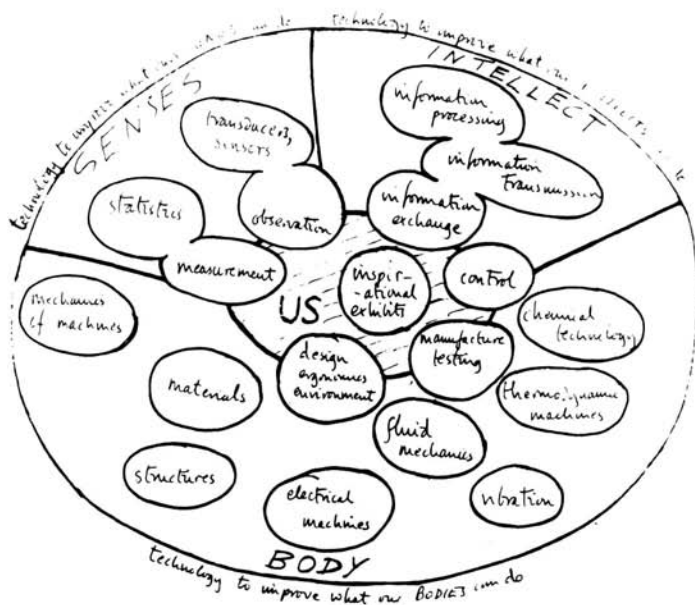


The crane requires cooperation between the two operators to pick up sacks. These two finally succeeded and were applauded by onlookers.

The Education Group – selecting the exhibits

The Education Group in Launch Pad consisted at the outset of three senior members of the Museum's permanent education staff, all of whom had teaching experience, had been involved in running Discovery Rooms in the Museum, and had visited interactive exhibit centres in North America and elsewhere. Later they were to be joined by new members of staff who would become part of the Operating Team for Launch Pad. The role of this group was to refine and define concepts, select the exhibits, monitor their development, assist with their testing and evaluation, and provide the written support materials to accompany them. To help with the last of these functions a writer/editor was appointed for a two-year period from mid-1985.

There was no shortage of ideas for exhibits to go into Launch Pad. The problem was to select a set of exhibits that would work well with a wide range of visitors, offer a variety of tasks and interactions and illustrate the principles and processes used in as many different areas of technology as possible (see diagram). A list of exhibit ideas was built up



Launch Pad is about technology and this diagram shows the subject areas considered when planning the project.

from a variety of sources. Many were generated in brainstorming sessions involving Museum staff and outside consultants. Others were flashes of inspiration that came to individuals as they went about their daily tasks, while many, particularly in the early stages, were gleaned by looking at the most successful exhibits in other interactive centres around the world. Some of these ideas were impractical, other trivial or rather too frivolous, but eventually the list numbered nearly 400.

To select which ones should go forward for development it was necessary to develop a consensus within the Launch Pad team of what was meant by a successful interactive technology exhibit. Criteria were drawn up and incorporated into an exhibit selection chart which allowed one to assess the



Big Optics. Most people expect magnifying glasses to be curved but this one is flat and made up of wedge shape rings. Great for photographs of your friends.

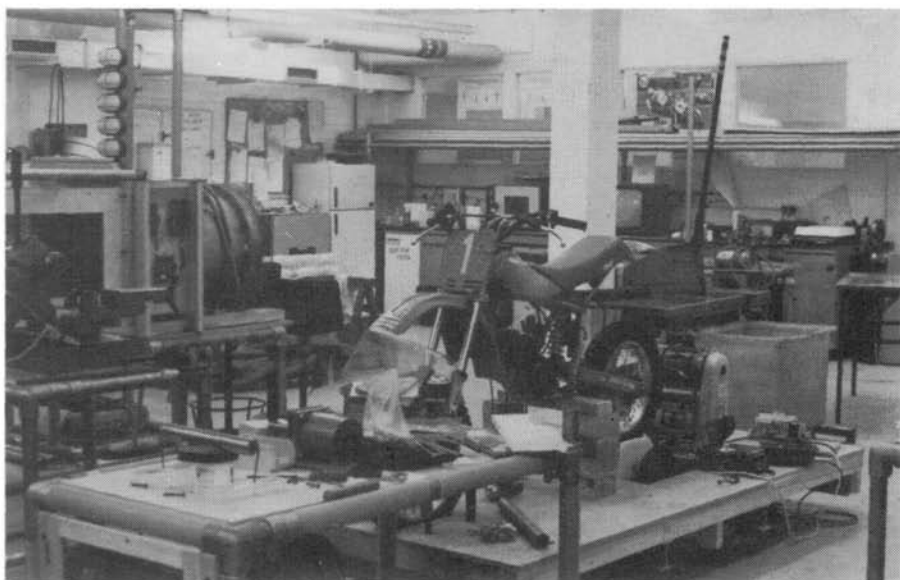
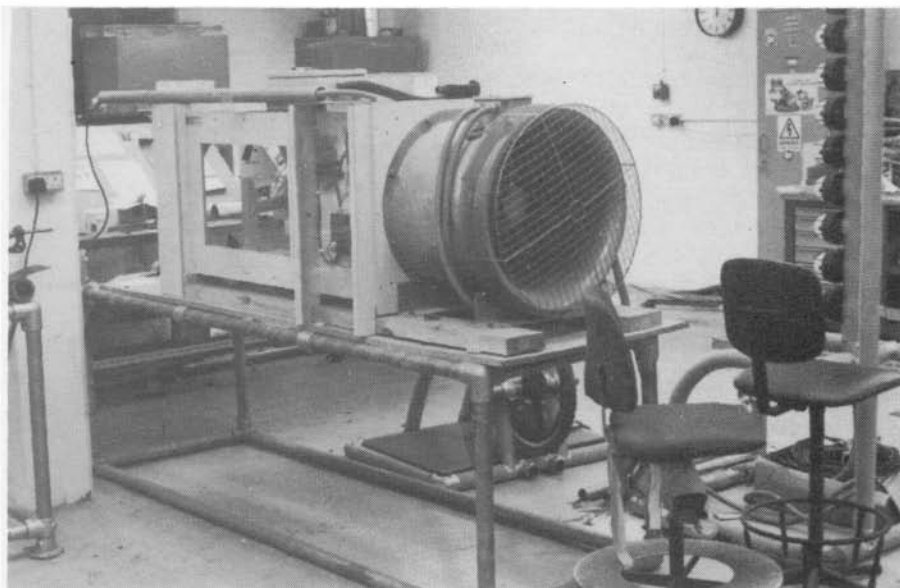
potential of an exhibit idea in a reasonably objective way. In the event we did not use this chart very much, but its occasional use was invaluable in making sure we did not stray too far from what we had set out to do and as an exercise in training new members of staff.

A series of exhibit selection meetings was held throughout the first year of the development project. At each meeting a number of ideas were put up for review and invariably the process sparked off new ones. Sometimes the ideas would be grouped on a particular theme (electrical exhibits, exhibits relating to energy or power, or to the uses of fluids, and so on). Others looked at particular types of exhibit (exhibits in kit form for visitors to assemble, puzzle exhibits, exhibits intended to appeal to the very young and so on). On average, at each of these meetings, two or three new exhibits were chosen and ideas about them tossed around before they were handed to the research team for development. As the exhibit list grew longer, it was reviewed from time to time to make sure we were not neglecting a particular type of exhibit or a particular area of technology, and that we were continuing to interpret the word 'interactive' as broadly as possible.

The Research and Development Team

Its leader, the project's Technical Manager, was a Science Museum curator, seconded to Launch Pad, and an engineer with project management experience. In addition to setting up and running the Research and Development team he had overall responsibility for financial control of the project. In this he was assisted by the Project Co-ordinator who also had responsibility for chasing up suppliers and played a facilitating role in very many other ways. The three R&D staff were specially recruited for Launch Pad and brought to the project experience in applied science research as well as some educational experience. Together with the Electronics Engineer they formed the nucleus of the group. Each exhibit was assigned to one of these four for development. Technical support was provided by a team of six technicians, two of them electronics specialists.

An area of approximately 300sq m (3000sq ft) in the basement of the Museum was cleared and fitted out for the Research and Development Group, providing them with office space, laboratory and workshop areas, and storage. In what was a departure for the Museum, the senior R&D staff worked closely alongside and with the technicians, an arrangement that was felt to be essential in this kind of development work. Each researcher was responsible for



The development workshop in the Science Museum's basement where prototype exhibits are built and tested, and a close up of the wind tunnel used to develop the flight exhibit. The tubular metal frame system seen here is also used for the exhibits on display.

taking a number of exhibit ideas and working them through the prototype stage to the test bed stage where they could be tried out with visitors. In this they collaborated with education staff, one of whom was also assigned to befriend each exhibit.

The R&D group also included in the early stages of the project an Engineering Draughtsman who was later transferred to the Production Unit.

From October 1985 a junior Research and Development Assistant played an invaluable role in bringing members of the public into the research area to test exhibits, and also monitoring results. This function was subsequently taken over by members of the operating team.

The Production Unit

The decision to establish a separate Production Unit to take over the test bed style exhibits and develop them into a finished state was not taken until the project was well underway. As a result the unit itself did not come together until half way through the development phase. It was led by the Exhibition Manager who has a background in engineering as well as in two and three-dimensional design. He had the



The Salt Bowl. Salt which is packed solid acts as if it were a fluid when air is blown through it.

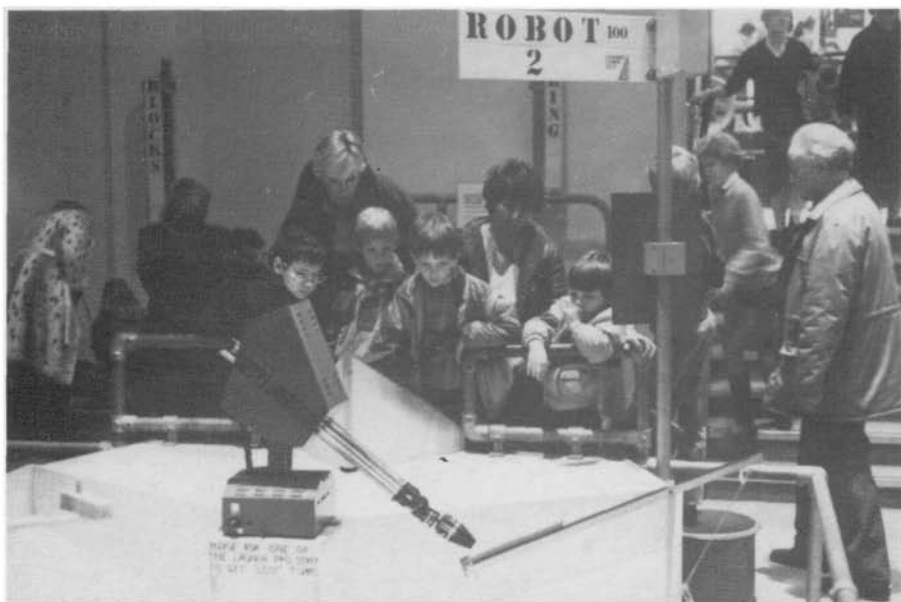
assistance of an Engineering Draughtsman, a Product Designer and a Graphics Specialist, plus a part-time Co-ordinator who was destined to transfer to the Operating Group. Technicians assigned to the Production Unit assisted in assembling some of the exhibits.

Most of the exhibits were made (in several parts) by outside contractors. Finding contractors willing to take on this type of one-off production-finish work proved extremely difficult. In the end the structural frameworks for the exhibits were constructed by light engineering companies, and the exhibits themselves by model-makers, plastics companies, individual machinists and the Museum's own workshops.

In addition to their work on the exhibits the Production Unit were also responsible for the design and production of all graphic materials associated with Launch Pad (with the exception of the booklet), with the preparation of the Launch Pad site and with the design and construction of the gallery



Air bubbles pumped into viscous silicone fluid rise at different rates depending on size. Finding or making a hand pump robust enough proved to be a problem.



The controls for the robot arm require a delicate touch whereas the spinning gyro wheel demands much more vigorous handling. These two exhibits highlight the problems of reliability and safety which interactive exhibitions raise.

and its furnishings such as the lighting, seating, demonstration area and staff bases.

There was no room to accommodate the Production Unit staff in the same area as the Research and Development Group, so a separate production base had to be established in another part of the Museum basement.

Testing the exhibits

The testing of exhibits played an important part in the development process. Individual exhibits were tested by inviting members of the public in small groups to come into the development area and try them out. By this means one could quickly gauge the likely success or otherwise of an exhibit.

On three occasions, chosen to coincide with the busy holiday periods in the Museum, larger presentations of exhibits under development were staged. Known as 'test beds', these exhibitions proved invaluable as a means of testing exhibits and gaining operating experience to help in planning Launch Pad. In particular they allowed us to subject exhibits to continuous public use over a period of weeks, and thus to experience and come to terms with some of the problems of mechanical breakdown and wear-and-tear that would be met in the longer term in Launch Pad. The test bed exhibitions also brought to light a number of potential safety hazards.

As well as teaching us a lot, the test bed exhibitions were a boost to morale and generated a good deal of useful publicity.

Support materials

For many Launch Pad visitors the experience of using an exhibit, discovering what it does and the potentialities it offers, is enough. Others, however, want to go further, to understand how it works, learn the name of the principles involved and to find out about the applications. From the start we regarded it as essential to provide help for these people, while at the same time we were sure it would not be right to cover our exhibits with text, pictures, diagrams etc. After much debate and some experimentation, it was eventually decided that the general pattern of exhibit support would be as follows:

- 1 Nearly all exhibits would carry a panel giving – a brief instruction on its use, sometimes in the form of a question

- a very brief explanation of what is going on
 - an indication of the applications of the principle illustrated by the exhibit.
- 2 Where appropriate, the exhibits would also carry about 400 words of more detailed explanation with diagrams and photographs in the form of a 'bat'. This is a plastic board shaped like an enlarged table-tennis bat which visitors can detach from the exhibit and hold for comfortable reading. It carries four or five hinged cards with the text and diagrams on them. In this way the material is presented bit-by-bit and the visitor can go into as much depth as he/she wants.
 - 3 A looseleaf file on each exhibit would be held at 'information bases' in Launch Pad. These files would include more technical information such as manufacturers' brochures on the equipment used in the exhibit, relevant reprints from New Scientist or Scientific American and other pertinent information.
 - 4 A 48-page Launch Pad booklet, reproducing much of the information on the bats in a form in which visitors can take away and read at leisure. It would also act as a souvenir of the visit, and help to show how the individual Launch Pad exhibits illustrate a broader picture of what technology is and what it does for us.

More specific teaching materials for use by school groups visiting Launch Pad will be prepared later.

Preparing the site

Launch Pad occupies a prime site at the front of the Science Museum with direct access to Exhibition Road, the Museum's main entrance, and the main goods lift. The area is 900sq m (9000sq ft) and the site is T-shaped. The floor level of the cross-piece of the T (Gallery 1) is higher by 1.2m (4ft) than the floor level of the upright of the T (Gallery 4). Access between the two levels is by two parallel flights of stairs. A wheelchair ramp (external to the site) also connects the two levels. The ceiling height is in excess of 4m (13ft) everywhere except in the western half of Gallery 4 where it is only about 2.5m (8ft). The site had previously been used for short term exhibitions and required complete refurbishment for Launch Pad. This involved:

- new electrical wiring to accommodate a maximum load of 100kVA
- installation of a new overhead electrical distribution system (three-phase and single-phase) so that individual

- exhibits requiring electric power can be sited anywhere and plugged in by an overhead umbilical cable
- demolition of a party wall between the two parts of the T
 - provision, adjacent to the main exhibit areas, of a service room, a schools' briefing room and ladies and gents toilets
 - cold water supply and runaway points at two separate locations
 - water-resistant floor covering in the north half of Gallery 1
 - heavy duty carpeting elsewhere
 - venetian blinds on all windows so that light levels can be controlled
 - drinking fountains at two locations
 - a public address system
 - a telephone system linking various parts of the site
 - a goods lift for moving exhibits between the two levels
 - redecoration

All the exhibits that use water are located at the north end of Gallery 1. As a safety precaution each of these exhibits incorporates its own sump, a plastic tray which will contain all the water in the exhibits and prevent it from spreading in the event of a leak developing. The original plan was that none of these exhibits would be permanently plumbed in, but they would be filled and emptied when necessary using hoses. This arrangement was unsatisfactory, however, because of the frequency with which the exhibits were found to need emptying and refilling as stagnant water tended to collect in the sump trays. The water exhibits have therefore been permanently plumbed in and a procedure instituted for regularly flushing out the sump trays with clean water.

The exhibits requiring low light levels are sited in the low part of Gallery 4. Illumination for the remainder of the site is provided by high-efficiency metal halide lamps mounted on the overhead electrical distribution system. No gas or compressed air supply is available in these galleries. Exhibits needing compressed air incorporate their own compressors.

Additional furnishings within the main exhibit area include two staff bases, a small area where demonstrations can be done, barriers at the entrance and exit. A glass screen with lockable doors separates the Launch Pad site from the rest of the Museum.

Costs

Setting up Launch Pad cost a little over one million pounds. The grant of £350,000 from the Leverhulme Trust covered staffing costs for all personnel in the Research and Develop-

ment Group and the Production Unit, with the exception of the Project Manager, the Exhibition Manager the two Project Co-ordinators, and the Chief Technician and Technician in the Production Unit.

The grant of £350,000 from the Department of Trade and Industry covered all the materials and equipment costs for setting up the Research and Development Group and for the development of 99 exhibits and demonstrations up to the test bed stage.

The decision to produce the exhibits to a higher standard of design and production than originally envisaged increased their cost and the Museum put in an additional £60,000 from its own resources to help meet this.

The main contract for preparing the site was worth £170,000. A significant part of this expense arose from the need to replace the electrical wiring and switchgear right back to the Museum's main distribution point. Gallery furnishings, which included everything apart from the exhibits themselves (ie the glass wall entrance, the lights, computerised advance booking and ticketing systems, seats and other furniture, etc) cost a further £120,000.

This sum, together with hidden costs such as administrative and office services, salaries of staff not paid from the Leverhulme Grant, provision of workspaces, and other overheads, brought the contribution made by the Museum from its own funds and those of the Property Services Agency to a total of between £300,000 and £400,000.

The lessons

We discovered a lot from the experience of setting up Launch Pad. Much of it was peculiar to our own particular set-up, so we only single out here three main lessons which we believe are worth passing on:

- There are great advantages to be gained by 'going public' at a very early stage and by continuing to put on small public exhibitions at intervals as the project progresses. (On the debit side, the holding of such exhibitions does, of course, divert some resources from the mainstream work.)
- Never underestimate the difficulty of turning a 'test bed' standard exhibit into a fully finished one that will stand up to long-term use. In the world of interactive exhibits, it is easy to get an idea; it is less easy to develop it to the stage where it can be tried out with a controlled audience; and it is very difficult to implement it as a rugged, well-engineered exhibit that looks good and will survive



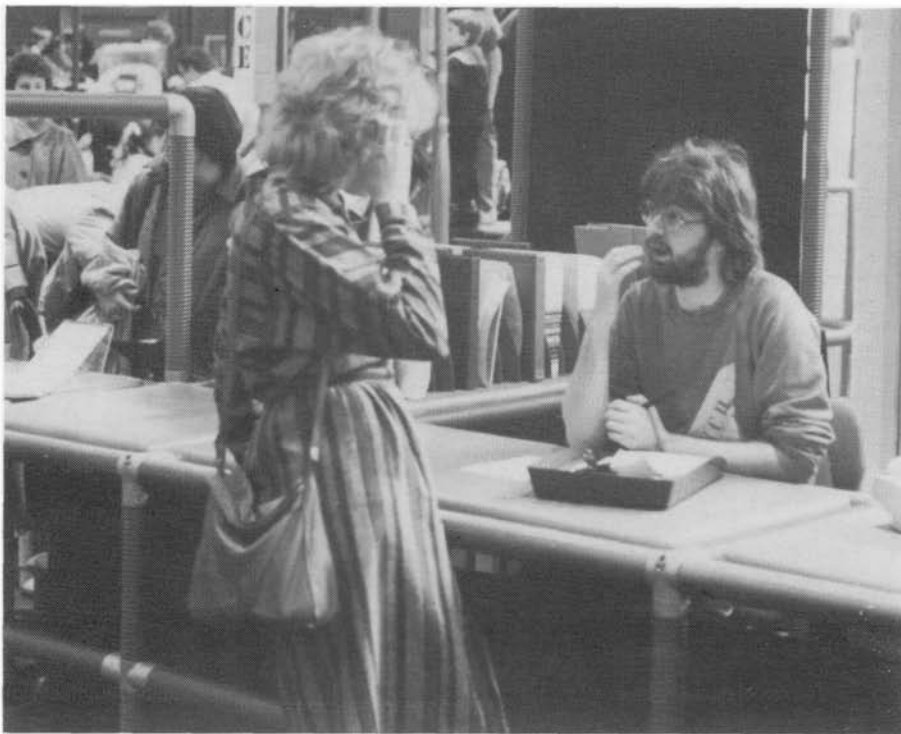
A dilemma which could face a project less well funded than Launch Pad: whether to choose several low cost exhibits such as the bridge building exercise (top) or a few spectacular exhibits such as the large whisper dish which draw the crowds.

long-term punishment from literally millions of 'unskilled operators'.

- Agree at the outset on the 'exhibit style' you want, and make sure from the start that your resources (human and otherwise) are realistically matched to the task you have set yourself.

How many visitors?

Within a few days of opening Launch Pad, the general pattern of its use by visitors became apparent. With 65 exhibits (eventually there will be a few more) the exhibition is full when there are 300-500 people in it. A time/ticketing system is employed to prevent the number of people in Launch Pad from exceeding this maximum. The criteria for the exhibition being 'full' is that: a) every exhibit is fully in use, and b) most exhibits have one or two people waiting to use them. (This



Launch Pad has experimented with a ticketing system to control entry without queuing. Visitors looked round the main museum first, returning at the time printed on the ticket.

limited waiting probably has advantages; while waiting to use an exhibit, people have a chance to watch others using it and to reflect on what they see. But too much queuing for exhibits quickly leads to problems.)

Early indications are that visitors stay about one hour in Launch Pad on average (though a small proportion may stay much longer – three to four hours or more – and some return several times during their Museum visit). This compares with an average length of visit to the Science Museum as a whole of one and a half to two and a half hours. Up to 2500 visitors can come to Launch Pad in an eight hour day, or a total of 800,000 in a year. In practice, of course, the exhibition is not fully occupied at all times so the overall figure will be correspondingly reduced.