RAL

DESIGN & DISCOVERY

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RUTHERFORD APPLETON LABORATORY

SCIENCE AND ENGINEERING RESEARCH COUNCIL

STARLINK

Introduction

Modern astronomical measurement techniques produce large amounts of data in a form which requires processing by a computer before they can be understood. Because of this, a Panel was set up in 1978 by the Science Research Council to determine the computing needs of UK astronomers in the 80s. It recommended the installation of a nationwide network of data analysis computers.

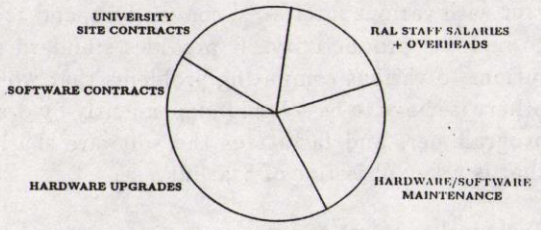
This was the basis for the **Starlink Project** which installed 6 VAX computer systems at major astronomical sites around the country in 1980.

The primary objectives of the Project are to:

- Provide and coordinate data reduction and analysis facilities for UK astronomers.
- Encourage software sharing and standardisation to prevent unnecessary duplication of programming effort.

Organisation

Starlink is funded by the Astronomy & Planetary Science Board of the SERC and is managed from the Rutherford Appleton Laboratory (RAL). Its budget is £2 million a year, split as follows:



There are 22 Starlink sites devoted to astronomers, together with a central management computer. They are grouped into 9 areas, each with its own management committee. The project has 40 staff, 14 of whom are at RAL while the others work on contract at University and Polytechnic sites. Each site and its users are looked after by a site manager and, in addition, there are Starlink programmers at several sites.

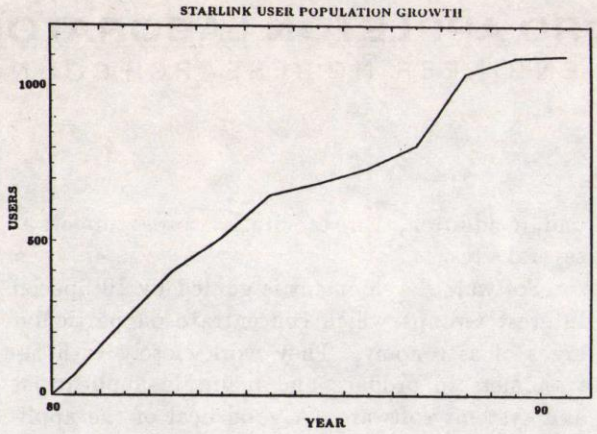
Software development is guided by 10 Special Interest Groups which concentrate on particular areas of astronomy. They work closely with astronomers to produce and maintain applications and systems software. A good deal of the applications software is written and supported by the astronomers themselves.

Sites and Users

The locations of the Starlink sites are listed below, together with the size of their user population:

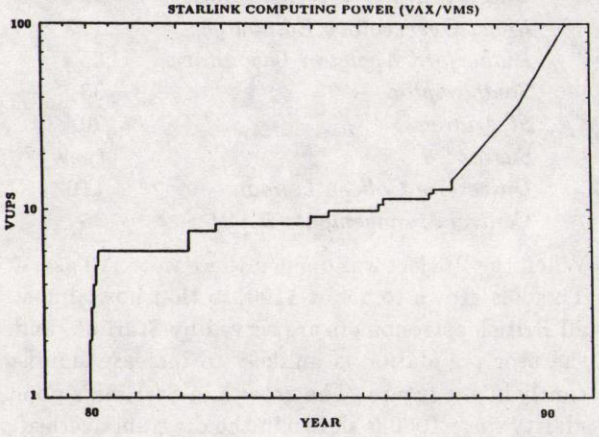
Armagh	15
Belfast	24
Birmingham	42
Cambridge/RGO	179
Cardiff	31
Durham	65
Hatfield	(new)
Imperial College	37
Jodrell Bank	66
Keele	10
Kent	(new)
Leicester	67
Manchester	34
Oxford	69
Preston	13
Queen Mary & Westfield College	39
Royal Observatory Edinburgh	127
Rutherford Appleton Laboratory	35
Southampton	33
St Andrews	20
Sussex	(new)
University College London	116
Central Management (RAL)	35

When the Project was opened there were 110 users. This has grown to about 1100, so that now almost all British astronomers are served by Starlink, and the user population is unlikely to increase significantly in the future. The growth in Starlink's popularity since 1980 is shown in the diagram overleaf.



Hardware

The original hardware comprised 6 VAX 11/780 computers with the usual disk and tape units, plus high resolution colour image display equipment. Since then, the Project has added VMS based computers (VAX 11/750s, MicroVAXes, VAXstations) and UNIX based computers (DECstations, SUN workstations) at its expanding network of sites, each of which now consists of a "cluster" of small, low-cost machines rather than a single expensive large computer. The sites are linked together by the JANET network. The diagram below shows how the computing power (measured in VAX Units of Performance) provided to users by the Project has increased since 1980. The recent large increase in power reflects the rapid advance of computer technology which has enabled Starlink, within the funds available, to provide astronomers with a much better service than in the past. This improved service makes better use of astronomers' time and the available data.



Software

The Starlink Software Collection is a library of software which has been built up and developed over the last ten years. There are about 80 software items in the library, of which about 20 are data reduction and analysis packages which cover the following fields:

- General purpose.
- Specific wavelengths *(X-ray, radio, etc).*
- Specific instruments *(IUE, IRAS, etc).*
- Astrometry.
- Photometry.
- Polarimetry.
- Spectroscopy.
- Statistics and database management.

The core of the Collection is a standard set of programs and data files which are installed at every Starlink site. There is also a set of optional items, and another set which is installed only on a central machine. Software is distributed over the computer network connecting the sites. This enables each Starlink site to maintain its copy of the Collection in an up-to-date form, which makes it easy for users to move between sites.

The Collection continues to grow rapidly in size and there are about 60 software releases a year, of which about 10 introduce new items and 50 update existing ones. Currently it has about 2 million lines of source code which represents many hundreds of programmer-years of effort.

Starlink is developing a "software environment" called ADAM. This provides the user and programmer with various interfaces, conventions, and tools to increase productivity. It provides standard solutions to various computing problems that would otherwise have to be solved independently by every programmer, and facilitates the software sharing that is a key objective of Starlink.

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