Telecommunications

Artemis

The satellite environmental test programme was continued and completed in 1999. The pre-shipment review was held and the test programme was declared complete. Artemis, currently stored in its transport container at ESTEC, is ready to be shipped to the launch site. In parallel with the satellite testing, the ground segment was built up and the operational procedures established and verified.

It was planned to launch Artemis in February 2000 on the maiden flight of the Japanese H2A vehicle. Unfortunately, NASDA had an H2 launch failure in November and this has delayed the ground test programme for the new generation of the launcher. The Artemis launch date has been delayed accordingly, with NASDA predicting that the first H2A launch that could carry Artemis will not take place before February 2001.

The test programme using the SILEX optical data-relay terminal on Spot-4 was continued, albeit at a low level because the partner terminal on Artemis is still on the ground. SILEX’s performance remains nominal, with all parameters stable.

ARTES - Advanced Research in Telecommunications

Element 1 - Preliminary Studies and Investigations

Element 1 is the basic telecommunications study area through which new programmes are identified. A new phase for this element extending its duration until 2005 was approved early in 1999, and nearly all ESA Member States have since subscribed to this extension. To focus the Element 1 activities, a new strategy for ESA’s telecommunications programmes has been generated and approved by the Joint Board for Communications Programmes (JCB).

Element 3 - Multimedia Programmes

Element 3 is designed to assist European industry in its efforts to become a global player in the multimedia satellite market. The activities are co-funded with industry, the level of co-funding depending upon the nature of the particular companies involved. Activities are carried out along three lines:
- Line 1 – Applications
- Line 2 – Development of satcom system elements
- Line 3 – Pioneering of novel systems.

Line 1 is dedicated to promoting and running activities in partnership with industry and operators to enable the early roll-out of satellite-based broadband multimedia applications. Three Invitations to Tender (ITTs) were issued in 1999 covering initiatives in the fields of high-speed Internet, tele-education/tele-health, and broadband mobile pilot services. As a result, six new contracts have been placed with European and Canadian industry, bringing to fourteen the number of activities running within the framework of Line 1.

The various projects focus on different aspects of multimedia service development and integration, ranging from satcom infrastructure hardware elements, to service management and content provision. All projects include a pilot utilisation phase performed in close cooperation with user groups, with the aim of verifying the impacts of the proposed applications in the real operational scenarios. Strong emphasis is given in these undertakings to the ability to produce ventures able to survive commercially, or at least with convincing potential to become self-sustaining in the short term, after completion of the contractual activities with ESA.
Line 2 is aimed at supporting industry in the development of items for upcoming satellite multimedia systems, and several activities started in 1998 were continued during the year. Based on the responses to a Call for Ideas in 1998, four ITTs were issued in 1999. All four resulted in new activities being kicked off with industry, the majority being ground-segment related. A further Call for Ideas was issued in 1999 for Line 1 and 2 activities, and more than 50 proposals were received. These proposals have been grouped together to form the basis for ITTs in 2000.

Line 3 addresses supporting industry in meeting the revolutionary challenges at system level in providing multimedia services via satellite. Work was initiated in 1999 in support of three major initiatives being undertaken by European industry: Skybridge, Euroskyway and WEB (WEST Early Bird). The ESA Ministerial Council in May approved a significant enlargement of these activities, with an envelope of 280 M€, which will lead to engineering models or prototypes of all critical elements of these systems.

Element 4 - Telecommunications Partnership Programme
This ARTES element has now been running for seven years and continues to be a useful vehicle for research and development and demonstration of European activities with clear applications potential. Early in 1999, the JCB agreed to an extension of the element until 2005.

Element 4 was the first ESA initiative in co-funding. Its pioneering role has since been further developed in other applications areas, and co-funding is becoming increasingly popular in national and international projects. The largest contributor to this programme in 1999 was the United Kingdom, with the overall programme subscriptions envelope having reached 65 M€.

Element 5 - Advanced Systems and Telecommunications Equipment (ASTE)
ASTE is the Agency’s main programme for preparatory research and development in satellite communications and navigation. It addresses the early stages of development of new and promising technologies, once specific opportunities have been identified. Through ASTE, ESA sponsors the development of these new technologies to a point where the private sector can start to become directly involved and participate in the funding. Fourteen States have participated in the second phase, which began in 1997 and remains open for commitments until June 2000.

The third phase covers the period 2000 – 2005 and has been approved with an envelope of 200 M€. A workshop was held at ESTEC in September at which the ASTE Programme in general and Workplan 2000 in particular were presented to 140 industry and Delegation representatives. Subsequent to the Workshop, the JCB and the Agency’s Industrial Policy Committee (IPC) approved Workplan 2000, which contains more than 50 industrial activities, for which ITTs will be issued starting in January 2000. The first subscriptions had already been received by year’s end, and more are expected in the course of 2000.

An outstanding track record of success has been built up over the years. Many of the approximately 200 studies and developments undertaken so far within ASTE are on the verge of becoming commercial products or services, ready for the World market. ASTE ensures Europe’s future presence as a major player in the satellite communications and navigation markets, with European companies at the forefront of each wave of new technology.

Element 12 - Little LEO Messaging System
At the end of the year, after a period of extensive testing, ESA accepted the Little LEO Messaging System (LLMS) from the prime contractor SAIT Systems (B). This handover completed the main development contract for this Low Earth Orbit (LEO) messaging system and was a first step towards developing a commercial mailbox service. In an extension of the
contract, it is anticipated that before mid-2000 work directed towards tailoring the system for an Internet environment, and which will produce over 100 user terminals, will be completed.

As a complement to the technical activities, an agreement was signed in December that makes the satellite payload available to a SAIT subsidiary at a first step in starting commercial operations. User testing was started even before the final acceptance milestone, including the fitting with terminals of several small boats that crossed the South Atlantic in November and December, and more recently the equipping of an expedition to the Antarctic.

The GNSS-1 / EGNOS Programme

The GNSS-1 Programme is developing the European Geostationary Navigation Overlay System – Advanced Operational Capability (EGNOS-AOC), to improve the performance of the GPS and GLONASS satellite navigation systems for all modes of transport within the European region. EGNOS will provide a primary means of navigation for civil aviation for all phases of flight, from en-route updating to category-1 landings. The Programme is being implemented in co-operation with EuroControl and major European air-traffic management service providers: AENA (E), DNA (F), DFS (D), ENAV (I), NATS (UK), NAV-EP (P) and SwissControl (CH).

EGNOS is also intended as an accurate and reliable source of position, velocity and time information for maritime- and road-traffic management systems, and for the accurate synchronisation of wide-area communications networks.

After successfully completing the GNSS-1 Initial Phase with the Preliminary Design Review (PDR) in November 1998, the GNSS-1 Implementation Phase was officially approved by all Programme participants in December, and the EGNOS AOC Implementation contract was signed in June 1999 with Alcatel Space Industries (F) leading a European industrial consortium.

In December 1999, the ESA Programme Board for Navigation approved a major evolution of the EGNOS programmatic baseline taking into account the introduction of the Artemis navigation transponder, the latest updates in international standards defined by ICAO for aviation, as well as technical improvements at EGNOS ground-segment level.

The EGNOS System Test Bed Version 1 (ESTB-V1), due for completion in January 2000, is based on the Euridis system developed by CNES, the SatRef control centre provided by the Norwegian Mapping Authority upgraded with EGNOS algorithms, and the Mediterranean Test Bed (MTB) system provided by ENAV. It provides real-time broadcasting of prototype EGNOS signals over the Inmarsat III AORE, and in the future IOR and Artemis satellites, which can be used to perform EGNOS trials and demonstrations over the European region.

EGNOS AOC implementation is proceeding towards its Critical Design Review in June 2001, and should be completed with an Operational Readiness Review in December 2003.

GNSS-2 / GalileoSat

The most important events in 1999 were the approval of the GalileoSat Programme by the Ministerial Council in May, and the agreement on the Galileo Resolution by the European
Union Transport Council in June. These decisions have laid the foundations for Europe's engagement in building its own infrastructure for global navigation via satellite.

ARTES Element 9 proved to be most effective for all of the preparatory studies and hardware developments. Through the GNSS-2 Comparative System Study (November 1998 – December 1999), a baseline had been identified for the European Galileo initiative. A MEO constellation, possibly complemented with a small number of GEO satellites, will most effectively meet the Galileo performance requirements and will also guarantee the desired inter-operability with the US GPS system. Besides completing many details on the technical characteristics, such as signal structures, the study provided a first insight into the architecture of the rather complex ground control segment and its operations. The industrial study team also submitted its cost estimates for the Galileo space and related ground segment and elaborated a design and development plan aiming at in-orbit validation during 2004/2005 and full operations from 2008 onwards.

Work on the design of the GNSS-2 Signal Validation Facility began in mid-year. This mixed hardware/simulation facility will provide a comprehensive test-bed for the optimisation of the Galileo signals. The development of the highly accurate H-maser clock now also includes the electronics package. The first flight model will serve as a reference clock in the Columbus ACES experiment. Other hardware development items include the satellite transmit antenna, power amplifiers and output multiplexers.

In December, the GalileoSat System Definition Study was kicked-off, with some 40 European companies elaborating the architecture of the Galileo space and related ground segment. They are required to submit their proposal for the development and implementation of the Galileo system by end-2000. These activities are being pursued in parallel with the complementary studies by the European Commission.

**ESA Communications Satellites in Orbit**

Two European Communications Satellites ECS-4 and ECS-5, launched by ESA in 1987 and 1988 respectively, continued to be controlled during 1999 on behalf of Eutelsat by ESOC from its Redu (B) ground station. Between them, ECS-4 and ECS-5 still have six operational payload channels, which continue to be used for Euteltracs transport communications, television transmission, news gathering and telephony. Eutelsat has confirmed its acceptance of the ESA offer to continue operations on its behalf until at least the end of 2001.

The Maritime European Communications Satellite Marecs-B2, which has now completed its 15th year in orbit, is also controlled by ESOC from Redu (B) and Villafranca (E). Its capacity has been leased to Nuovo Telespazio (I), which in turn subleases it to Fugro, a civil-engineering company, for position determination and other services. The current leasing arrangement expires at the end of 1999 and alternative arrangements are being explored for this useful resource to continue to be put to good use.

Nuovo Telespazio is also leasing the capacity of ESA’s European Mobile Services (EMS) payload, embarked on the Italsat-2 spacecraft, for the provision of L-band mobile services in Europe.