SPACE

SYSTEMS SYNOPSIS

CHRISTIAN ROVSING
INTERNATIONAL A/S

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Systems Synopsis

A MEMBER OF THE CHRISTIAN ROVSING GROUP OF COMPANIES

PREFACE

This document gives a brief introduction to the activities of the Christian Rovsing Group of companies and a synopsis of the systems services provided by Christian Rovsing International A/S.

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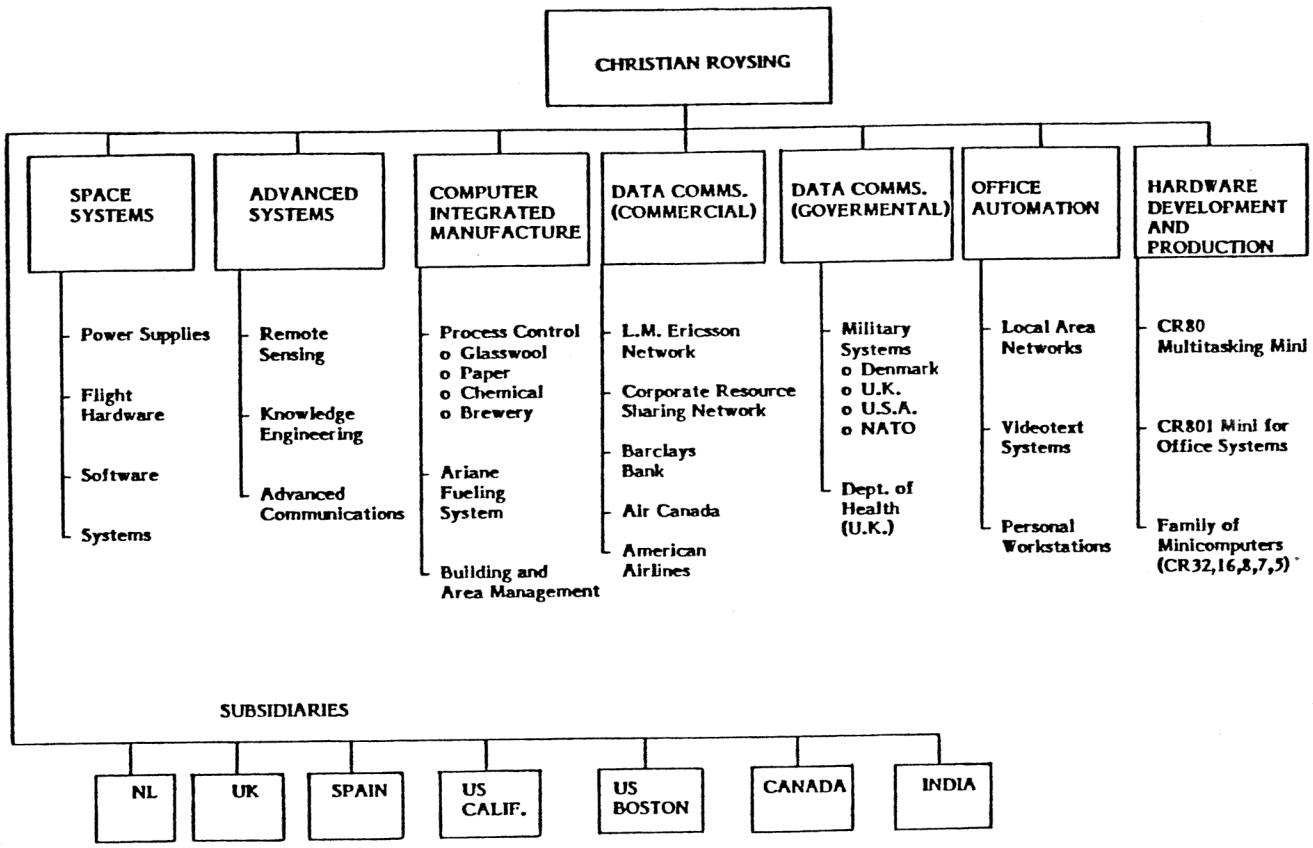
(Please quote D/84/6(1) when refering to this document.)

Contents:

1. THE CHRISTIAN ROVSING GROUP

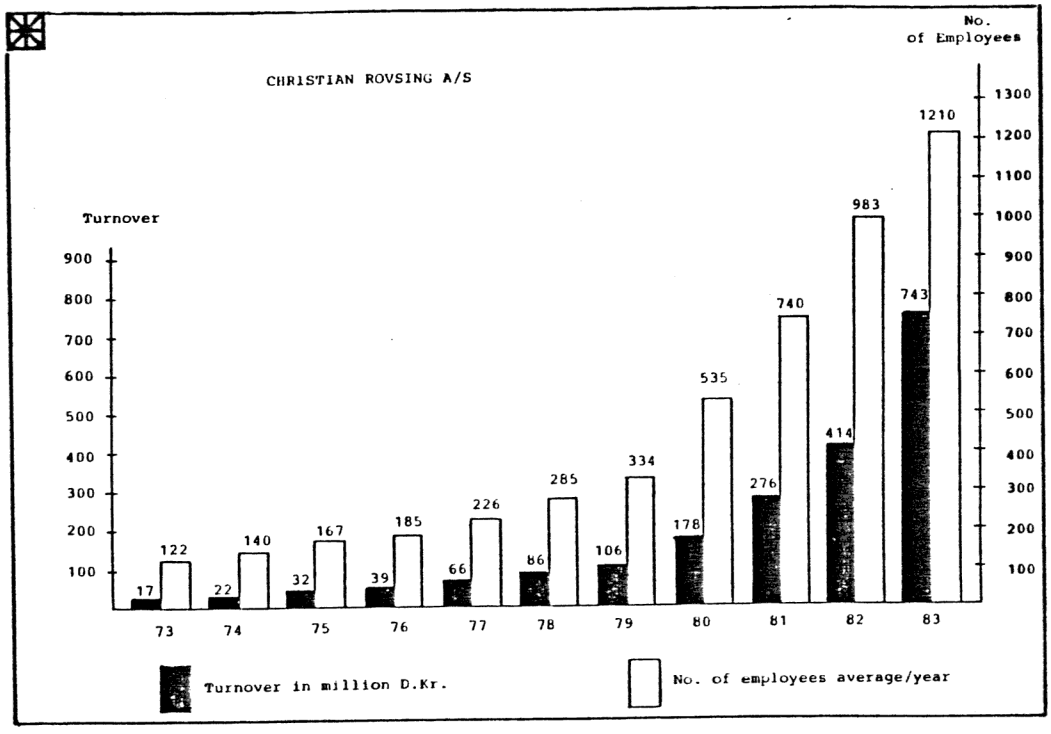
The Christian Rovsing Company was formed in 1963 to provide software consultancy services in the Copenhagen area of Denmark.

Today the Company has over 1,200 employees, a turnover of some US $70M and supplies over 70% of its services on the international market. A diagram showing current areas of activity is given below:



Christian Rovsing International A/S is a wholly owned subsidiary of the Christian Rovsing Company and, in particular, has responsibility for space systems, the development of advanced systems and consultancy services on an international basis across the whole range of company services.

The company growth over the past ten years in terms of number of employees and turnover is shown below:



2. SPACE SYSTEMS SYNOPSIS

2.1. Introduction

Since the early seventies, the Christian Rovsing Group has been actively involved in many of the major European space programmes. The participation has been on a number of different levels and has included study activities, software development and space hardware design and manufacture. The Group's headquarters are located in Copenhagen where ESA approved clean room facilities for the manufacture and integration of flight hardware are available, but a large amount of work has been undertaken at customer premises.

A synopsis of the Group's space systems activities is included in the following sections. It is organized in the areas:

- o Ground Station Activities
- o Communication Satellite Programmes
- o Scientific Satellite Programmes
- o Transportation Programmes
- o Technology Studies
- o Consultancy
- o Miscellaneous

2.2. Ground Station Activities

MARECS (1978-1982)	o Participation at the European Space Research and Technology Centre (ESTEC) in the design, development and implementation of the ESA Payload Test Laboratory (PTL) in Spain. The PTL was used in the comprehensive testing of the MARECS-A satellite transponders immediately after launch, and is being used on a daily basis to monitor the satellite's performance.
ECS (1980-1983)	o Delivery of software for the ESA Test and Monitoring Station (TMS 1) of Redu, Belgium. The station carries out the commissioning and daily monitoring of the ECS range of satellites.
SPOT (1978-1981)	o Phase B study to define ground station Archiving and Dissemination subsystems
LASS (ERS-1 and 2) (1978-1979)	o Phase A study to define Ground Segment requirements.

METEOSAT
(1975-1981)

- o Ground station Image-Data Handling System delivered to the European Space Operations Centre (ESOC) for handling the Meteosat images in the following areas:

  - Pre-processing
  - Rectification
  - Archiving

- o Image-Data Handling System delivered to Centre d'Etudes Meteorologie Spatiale (CEMS) in Lannion, France for archiving of satellite data, in particular from Meteosat.

- o METEOSAT ground computer system software definition, as members of GROUP ONE software consortium.

2.3. Communication Satellite Programmes

OTS
(1973-1978)

- o Member of Phase B study team.
- o Design, development and production of Priority Select and Interface Unit.
- o Electrical Ground Support Equipment for TT&C subsystem.
- o EMC studies.

MAROTS (ECS)
(1977-1983)

- o Payload Ground Support Equipment.
- o Design, development and production of:
  - Priority Select and Interface Unit
  - DC/DC Power Converter.
- o Automatic Test Equipment

H SAT
(1977)

- o Member of Phase A study team.

NORDSAT
(1977)

- o Member of Phase A study team.

TELECOM-1
(1979-1982)

- o Design, development and production of:
  - Priority Select and Interface Unit
  - DC/DC Power Converter
- o Automatic Test Equipment.

L-SAT
(1980)

- o Member of Phase B study team for Power subsystem and, in particular: AC-Power to Essential and Auxilliary Loads.

2.4. Scientific Satellite Programmes

HEOS-A2
(1972)

- o Study contract to evaluate three different attitude determination methods.

COS-B
(1974-1976)

- o Development of software packages for the Multi-Satellite Support System (MSSS).

GEOS
(1971-1974)

- o Development of Attitude and Orbit Control (AOC) electronics.
- o Special Test Equipment for AOC electronics.
- o EMC studies.

VIKING
(1980-1982)

- o Supply of DC/DC Power Converters.

2.5. Transportation Programmes

ARIANE
(1974-Present)

- o Development and production of Servo-amplifiers for Guidance Control System.
- o Automatic Test Equipment.
- o EGSE - Ground Adaptor communication link between the Onboard Computer and ground checkout computer.
- o Checkout Software for ARIANE Operations Control Centre in Kourou, French Guiana.
- o Control system for automatic fueling and execution of launch sequences.

SPICE
(1980-1981)
- Checkout Software (SPICE - Spacelab Payload Integration and Coordination in Europe).

2.6. Technology Studies

POWER CONDITIONING
(1971-Present)
- Satellite Power System Optimization - the implementation of computer programmes for the optimization of power systems in satellites.
- Power Converter Modelling.
- AC Power Distribution in satellites - the study of a low power AC-Bus system for use on board satellites.

GENERAL SATELLITE ELECTRONICS
(1971-Present)
- Electromagnetic Cleanliness in Satellites.
- Fault tolerant Computing for Onboard Spacecraft Applications.
- Radiation Protection and Hardening of Satellite Electronics.

SATELLITE DATA ACQUISITION
(1976-1978)
- Frame Synchronization - analysis of the performance of optimum and sub-optimum methods of frame synchronization of satellite data.
- Bit Synchronization - analysis of methods for bit synchronization of satellite data and the parameters which affect performance.
- High Density Digital Tape Recording Techniques.

REMOTE SENSING IMAGE-DATA HANDLING
(1978-1983)
- Future Ground stations - analysis of critical areas of processing due to very high data rates typical of future satellites.
- Survey of Technology Available for Very High Speed Data Recording and Handling of Very Large Data Archives.
- End-to-end Trade-off Analysis of a Data Dissemination System (participation as subcontractor)
- Precision Pre-processing of Remote Sensing Data.

- o SAR Processing - analysis and development of algorithms for Look Summation and Post Processing.
- o Operational Aspects of SAR Data Acquisition and Processing.

LANGUAGES
(1983-Present) o Study on the use of High Order Languages in the production of onboard computer software.

2.7. Consultancy

Development of Satellite Ground Checkout Software.

IN COOPERATION WITH ESA

(1973-Present) o Development of Checkout Software for Overall Checkout Equipment (OCOE) based on Honeywell, CTL and VAX computers. The software has been developed for test of the following satellites:

- COS-B
- OTS
- ISEE-B
- MAROTS
- EXOSAT
- IRAS
- MARECS
- ECS
- ISPM
- FOC
- GIOTTO
- HIPPARCOS

IN COOPERATION WITH INDUSTRY

(1974-1984) o ERNO/ESA-SPICE

Participation in the development of the following software for SPACELAB:

- Ground Checkout Software
- ECOS and SCOS Onboard Software
- Follow-up activities at NASA.

(1979-1980) o LABEN

Development of OCOE software packages for SIRIO 2.

(1981-1983) o DORNIER SYSTEM

Development of user software for Ground Checkout of the ISPM and FOC satellites.

(1981-1984) o BRITISH AEROSPACE DYNAMICS GROUP

Development of all EGSE basic software for OLYMPUS as a joint venture with BAe.

(1983-Present) o FOKKER/DORNIER SYSTEM

Development of checkout software for the ERS-1 Payload.

2.8. Miscellaneous

ONBOARD COMPUTER

(1972-1975) o Design and development of Direct Memory Access (DMA) modules.

o Study of Fault tolerant Computing for Onboard spacecraft applications.

(1983-Present) o Participation at LABEN in the development of a general satellite On-Board Data Handling Test Equipment.

APSEF

(1971-1973) o Design and manufacture of the Automatic Power System Evaluation Facility at ESTEC. (Computer controlled station for testing prototype and engineering models of satellite power systems).