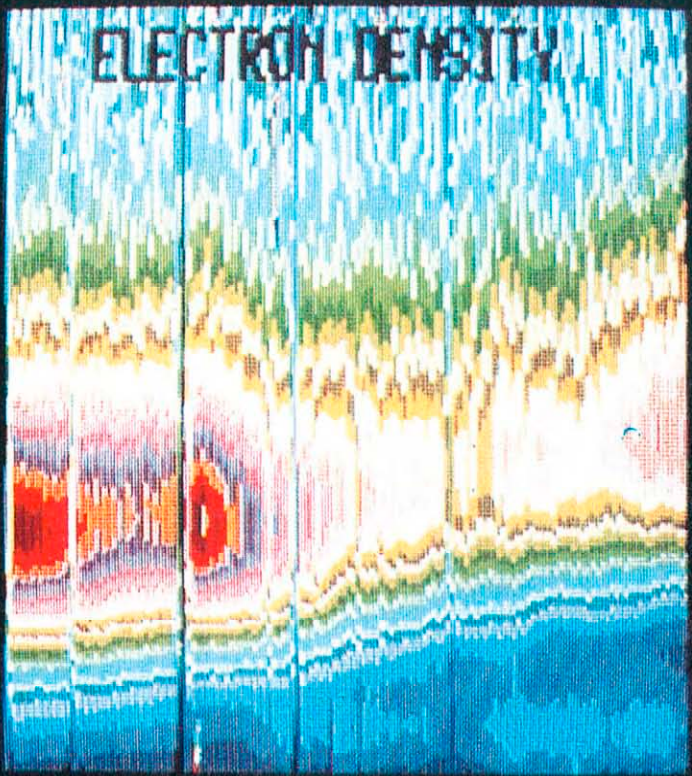


CECHAS

EISCAT 1981-8-20

ALTITUDE <120 TO 800 KM>



TIME (1545 TO 2115 UT)

# E I S C A T

EUROPEAN INCOHERENT SCATTER SCIENTIFIC ASSOCIATION

**ANNUAL REPORT 1981**

S-98127 KIRUNA, SWEDEN, PHONE (0980) 18740

Frontpiece: Electron Densities from the first EISCAT observations on August 20.  
Colour contours produced at CEPHAG, Grenoble.



HM King Carl Gustav with Tor Hagfors and Sir Granville Beynon at the EISCAT inauguration ceremony.

## CONTENTS

Introduction	2
The First Results	4
Transmitters	8
Antennas	9
Receivers	10
ADCs and Correlators	11
Computers and Data Handling	12
UHF Common Programme	14
Diary of Observations	17
Reports Published	19
Council and Committees	20
Meetings in 1981	21
Balance Sheet	22
Investment and Operating Costs	24

# INTRODUCTION

The past few annual reports have become increasingly apologetic for the substantial and unexpected delays encountered due to the late delivery of crucial parts of the equipment. In the present report there is, at long last, little need for apologies because the EISCAT facilities have now been put to useful scientific observations at a rate which may be unprecedented in similar observatories. We have been able to show to all those who participated in the observations or who partook in the analysis of the data obtained, that EISCAT can produce interesting and excellent data of a sophistication unequalled elsewhere.

After continuing transmitter problems during the spring, it finally became possible to operate the transmitter at reduced power during April. In June the first unmistakable incoherent scatter echoes were obtained.

On August 26 the official inauguration of the observatory took place simultaneously at the three sites, at Kiruna in the presence of HM King Carl Gustaf of Sweden, and at all three sites in the presence of dignitaries from the member countries. The King officially started the observations by depressing a button and data taking was initiated simultaneously at the three receivers allowing live data to be displayed. The occasion was blessed by the rare occurrence of fair weather at all three sites and by the fortune of having all three stations work simultaneously for the first time, allowing real time data to be displayed.

The remaining months of 1981 saw a frantic activity to make observations in various types of common programme modes as well as in support of GEOS, of several rocket campaigns, optical observations, the Energy Budget Campaign and ionospheric modification experiments. Although the equipment is still far from working to specifications it has already been possible to extract meaningful and interesting scientific results. Details will be given below.

During 1981 it was decided to enter into a data analysis and

data distribution contract which will remove much of the routine work from the tasks of the EISCAT staff and make the staff more available for developing new observing programmes and data analysis schemes. It was also decided to replace the present KGI-EISCAT headquarters computer system by a new and much more sophisticated computer, ND 500. Because of the lack of satisfactory accommodation for visiting scientists in Tromsø, construction of an eight bedroom building was started at Ramfjordmoen. Completion is expected early next year.

The year 1981 has, therefore, been very eventful. It is with considerable satisfaction that, in this last annual report during my tenure as director of EISCAT, it is possible to point to scientific returns on the investment which has been so generously made by the Associates.

Tor Hagfors  
Director

# THE FIRST RESULTS

In the period immediately before the inauguration we ran the transmitter with a 500  $\mu$ s pulse and with the antenna pointed in a fixed direction along the geomagnetic field line at F-region heights. At the remote receiving sites in Kiruna and Sodankylä the antenna beams were scanned to fixed positions in the E-region, and the F-region and to one position above the F-region. This mode was an approximation to Common Programme One (CP1).

The first of these runs was recorded and distributed to the Associates for independent analysis in order to make certain that the EISCAT routine analysis programs would conform to the results of

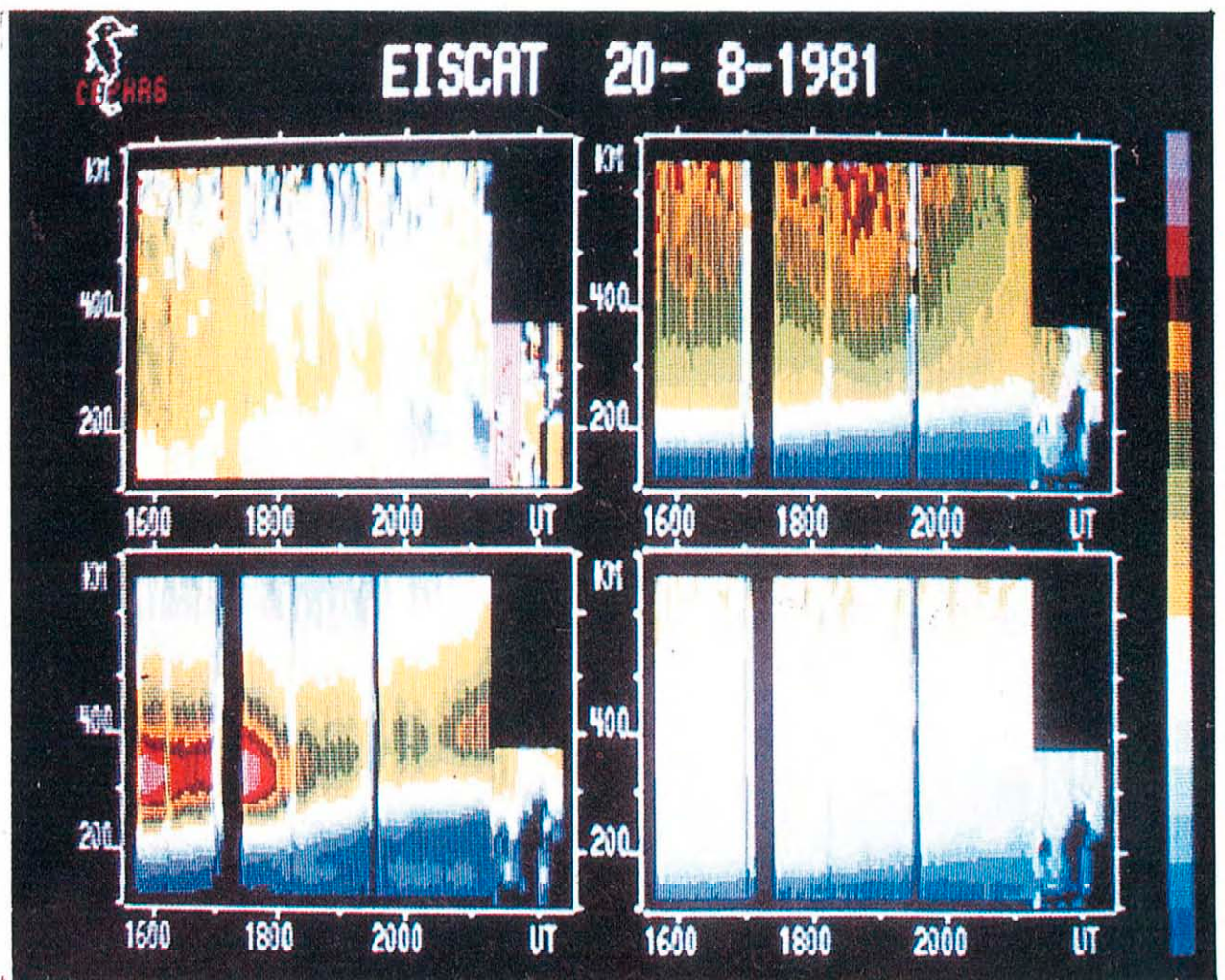


Figure 1: Results from the first EISCAT observations on August 20, showing on the left plasma velocity and electron density and on the right electron temperature and ion temperature. Colour contours produced at CEPHAG, Grenoble.

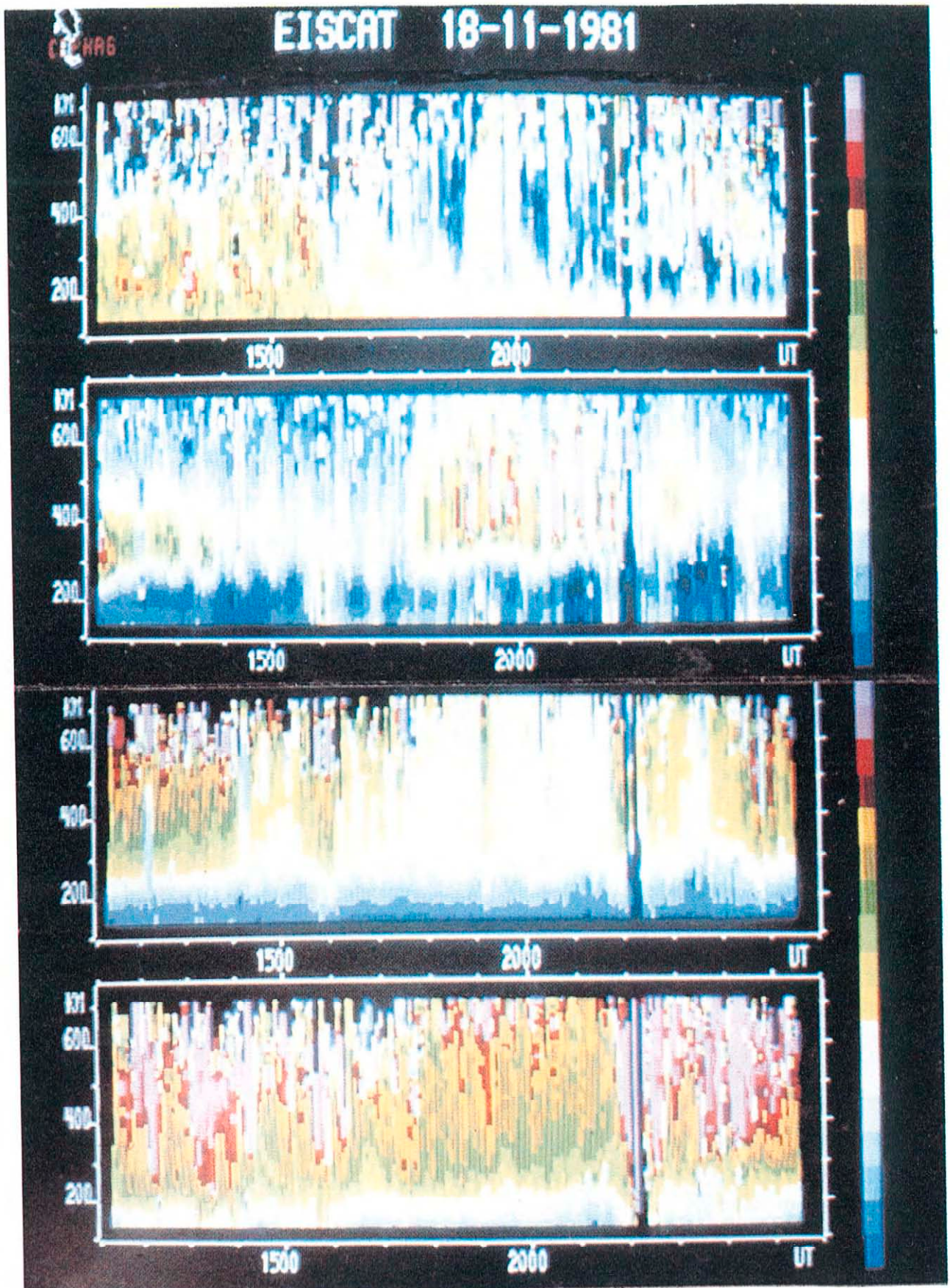


Figure 2: Results from EISCAT observations on November 18, showing plasma velocity, electron density, electron temperature and ion temperature. Colour contours produced at CEPHAG, Grenoble.

the analysis programs of the Associates.

The CEPHAG group at the University of Grenoble has been particularly active in interpreting the EISCAT data. Some examples of their analysis results are shown in Figure 1 and 2. The presence of neutral air gravity waves, the effects of precipitating particles on temperature and density as well as compositional changes with time have been derived from such data.

A second type of common program (CP0) was devised in order to provide data to be used in conjunction with GEOS observations. In this program a 360  $\mu$ s pulse was transmitted at one frequency and a 60  $\mu$ s pulse at another frequency with the transmitter antenna stationary along the geomagnetic field lines. The long pulse was to provide temperature, density and velocity data at F-region heights and the 60  $\mu$ s pulse to provide electron density profiles in the E-region. The remote sites were programmed to intersect the transmitter beam at a fixed height in the F-region, the idea being to provide the best possible time resolution measurements of electric fields.

The originally planned Common Programme Three (CP3), which involves scanning the transmitter beam normal to L shells with the remote antenna beams intersecting at a constant height in the F-layer, has been developed and run in several steps. The first version involved three positions, the second version 11 positions and the last version 16 positions in the north-south direction.

During the latter part of November and during December the pressure by the Associates to conduct special programme runs became irresistible. Special runs were made in support of Dynamics Explorer passes, Petrel rocket launches, Energy Budget Campaign rockets, optical observations from Kiruna and Spitzbergen as well as in support of the MPG heating experiment. The first naturally excited plasma lines were also observed.

Because of the short time which has elapsed since these experiments it is too early to discuss the scientific significance of the results. An exception may be the heating experiment where the real time displays have given some significant results.

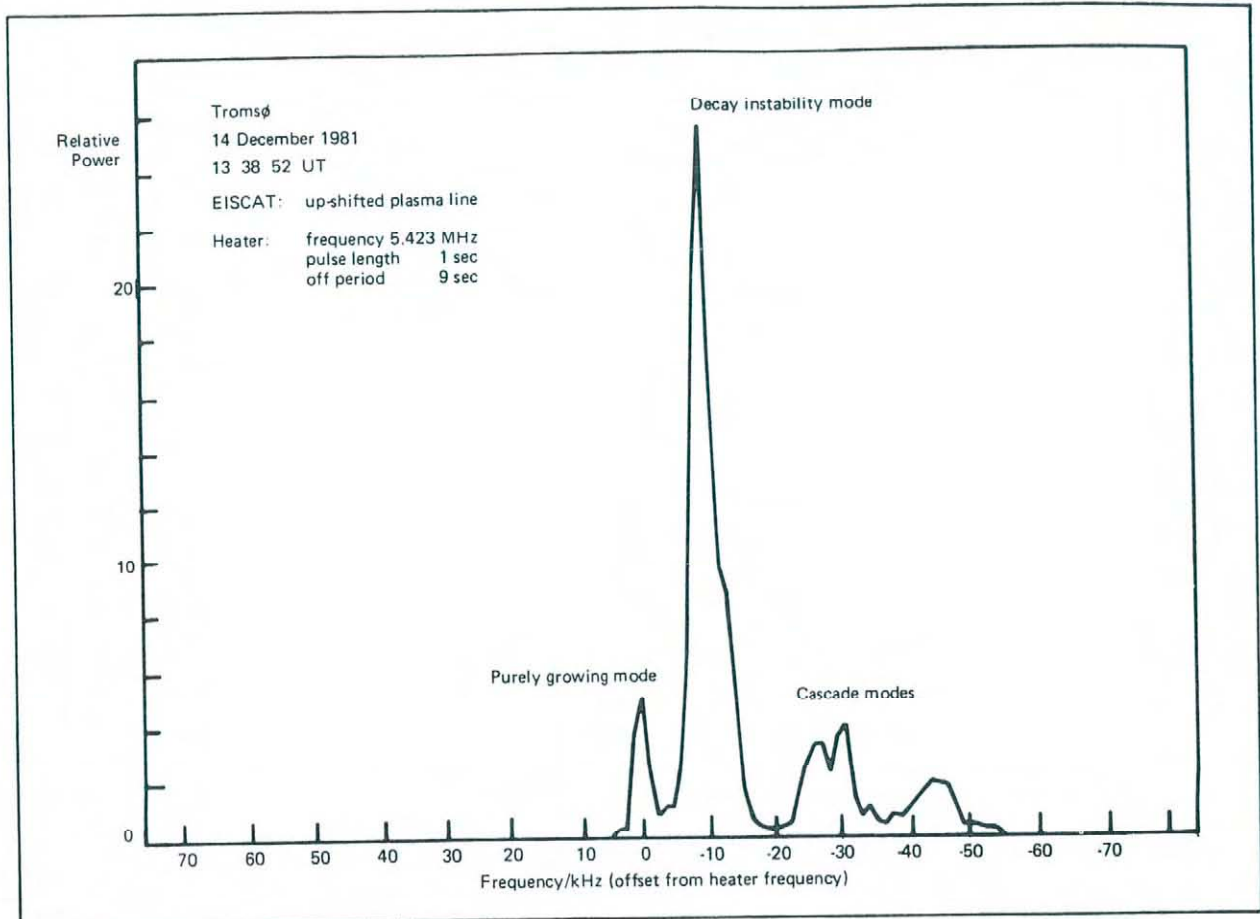


Figure 3: Up-shifted plasma line observed at EISCAT during operation of the heater at 5.423 MHz on December 14.

As has been shown elsewhere the presence of a strong heating wave in the ionosphere excites various types of plasma waves, some of which are associated with density fluctuations which can be detected by an incoherent scatter radar. The most peculiar result in the EISCAT observations is the transient nature of the excitation of these plasma waves. There is a strong transient often corresponding to 500 000 K equivalent noise temperature at the time of turn-on of the heater, but the plasma oscillations decay to a very low level in the course of a few hundred milliseconds in spite of the heater remaining on at the same power level. Observations in Arecibo have shown an initial transient, but also a substantial component of plasma oscillations throughout the duration of the heating pulse. The EISCAT observations, therefore, behave substantially differently. The spectral distribution during an integration period which encompasses the heater turn-on is shown in Figure 3. All the “classical” features show up. In particular the cascade spectrum show up as

lines at the appropriate positions. In similar observations at Arecibo they usually merge into a broad single feature often referred to as “the broad bump”.

This latter observation as well as many of the other ones have already provided many puzzles which, when solved, may shed new light both on ionospheric physics and plasma physics.

## TRANSMITTERS

It was at the end of April that — for the first time — the UHF transmitter was capable of working briefly at full specified peak and average power. However, because the transmitter did not work to the correct specifications no on-site acceptance test could be completed, and the manufacturer’s team left Tromsø.

EISCAT personnel were allowed to use the transmitter at reduced power but operation of the transmitter proved to be very problematic, even at the low power level of 600 kW. It was particularly annoying that the firing of the crow-bar caused components in the modulator to be damaged and often created transients in the digital equipment which either stopped the transmitter or produced absurd results. A serious leak in the cooling pump could not be fixed and led to such losses of coolant that it added substantially to operating expenses.

Following the inauguration, Mr Tallmadge from SRI International spent some time diagnosing the deficiencies in the transmitter. His report suggested a large number of modifications which were accepted by Aydin. Many of the components needed have long delivery time and it now looks as if the modifications and the final acceptance tests can only take place during the early part of 1982. In the meantime work has progressed very slowly with the VHF transmitter. The VHF tubes have not yet been tested under power in the transmitter. The VHF transmitter in-plant acceptance tests, projected in the previous annual report for the summer of 1981, have slipped by one year since then.

# ANTENNAS

As EISCAT started observations in the latter half of 1981 the UHF antennas were for the first time applied under fully realistic operational conditions in tristatic programmes. As a whole the antennas behaved satisfactorily, with only minor faults to report. For example, there is a recurrent problem, experienced occasionally at all sites, of high-speed fuses blowing in the control circuit of the antenna motors. The problem is of concern because the components are expensive and represent a significant cost throughout the year.

At the transmitter site a water cooling system has been installed to protect the centre connectors of the two rotary joints and to absorb the heat which will be dissipated in the duplexer when this is installed in the instrument cabin of the antenna.

During 1981 the VHF antenna at Ramfjordmoen was used for radio star measurements and for some test runs to assess the interference effects from local TV relay stations. From spectral observations we have been able to identify several TV-transmissions between 210 and 220 MHz. These unwanted signals will hardly affect ion line measurements, but may be detrimental for observations of the lower plasma lines. Filters have been installed to limit the effect of this interference.

As the VHF transmitter remained at the manufacturer's plant all through the year, we had no possibilities of testing the high power capability of the VHF antenna feed.

The VHF feed is being continuously pressurized by a set of compressors. According to the operating instructions the compressors should be returned to the manufacturer in Germany for service after 1500 hours of operation. To EISCAT the prescribed procedure appears both expensive and unwieldy, but some parts of the compressor equipment have had to be repaired for damage incurred by our exceeding the rated interservice period. We have attempted, without success so far, to acquire the necessary specifications to enable us to seek local assistance for the servicing.

# RECEIVERS

The helium cooled parametric amplifiers used in the UHF system did not behave satisfactorily at all stations. At Sodankylä both channels performed well yielding system temperatures around 40 K. At Kiruna one channel performed adequately, but the other operated for part of the year using a spare up-converter with inferior noise properties, the original converter having been returned for repair. The behaviour improved once the original was re-installed, but temperatures below 60 K were not achieved. At Tromsø both channels failed during the testing of the transmitter, probably due to a malfunction of the receiver protector or inadequate filtering of harmonics in the transmitter output. Throughout the observations made in 1981 the preamplifier at Tromsø was a transistor amplifier with noise temperatures exceeding 250 K.

With growing concern for the meticulous care needed to keep the present preamplifiers operational we are now looking to GaAsFET technology as a replacement. EISCAT received three offers for delivery of one, two or three dual-channel GaAsFET amplifiers. The quoted maximum temperatures ranged from approximately 60 to 100 K. Delivery times were 3-4 months. An alternative procedure would be to assemble the amplifiers ourselves, drawing on the expertise of other observatories. At the end of the year no final decision had been reached as to which option to select.

For the remainder of the receiver chain the Annual Report 1980 listed a set of modifications required for satisfactory performance. With reference to the listed changes the present status is :

- i) improved PIN-diode switches have been installed to isolate the two local oscillators of the 1st mixer;
- ii) as a preliminary measure 3 dB pads have been inserted between the power dividers and the 2nd mixers;
- iii) 50 MHz lowpass filters have been inserted in two receiver channels to prevent the 90 MHz signals from the 2nd local oscillator from feeding through and mixing with the 3rd har-

- monics of the 30 MHz reference signal;
- iv) the improved DC-amplifiers used at Sodankylä have been duplicated and will shortly be delivered to the other sites. The first delivery will include 4 amplifiers for Tromsø and 2 for Kiruna. These amplifiers are equipped with filters suited for ordinary single pulse or multi-pulse operation.

## ADCS AND CORRELATORS

During 1981 there was a slip in the delivery date for the six slow Analogue-Digital Converters (ADCs) in each receiver, but it was promised that they would be available early in 1982. In the meantime only two ADCs were available in each receiver which limited our use of frequency agility. A fault in the RF Exciter of the transmitter also limited our use of frequency agility, and so our early observations have only used two frequencies for the monostatic observations and a third frequency for the remote stations.

One technical problem appeared in the interface between the ADCs and the buffer memory of the correlator. If ever two channels of the receiver were sampled at the same micro-second there was a risk of an “overflow” condition. By staggering the sampling on the different channels this risk was reduced, but it is hoped that the basic problem will be solved soon.

At the beginning of 1981 the correlator itself posed a challenge to EISCAT. On the one hand, it was a very fast and very flexible device which gave EISCAT the ability to produce a large number of auto-correlation functions from different pulse schemes in real time, something that no other incoherent scatter facility had ever been able to do. On the other hand, in performance the correlator was very sensitive, and often the output was corrupted. The correlator was also difficult to program at a low level.

Changes were made in the circuitry of the correlator and these have succeeded in making the correlator more — but not entirely — reliable. Thus, at the end of 1981, the Tromsø and Sodankylä correlators operated for several months without serious failure. At

Kiruna, however, there was a total breakdown of the correlator in December and when it was repaired by the engineers from Nordlysobservatoriet, another fault was uncovered which had been undetected since October.

It was clearly important that EISCAT staff should be able to detect, diagnose and correct faults in the correlator as soon as possible, with the same expertise as the engineers who built the device. As a first step, in April Hans-Jørgen Alker held a very successful course at Tromsø for staff from all three sites. As a result the staff feel far more confident in using the correlator. To do this a number of ready-made programs are available, prepared by Terrance Ho of MPI, Lindau. In addition programs have been prepared by Régis Gras at CEPHAG, Grenoble. While there are a number of scientists and programmers who can make effective use of these existing programs, very few people at present can write a totally new program, which will be necessary if EISCAT is to make full use of this instrument.

Mention must also be made of a prototype correlator of an entirely new type developed by Tapani Äijänen at Sodankylä using charge-coupled devices (CCDs). This has already been used successfully to observe the artificially excited plasma lines.

## **COMPUTERS AND DATA-HANDLING**

For over two years it had been clear that when EISCAT was in full operation a major problem would be the volume of raw data that would have to be archived, indexed and reduced to physical parameters which would then be distributed to the six associates.

Two problems were identified:-

### **i) Computing Equipment**

The Nord-10 computer was too slow to allow EISCAT Headquarters to analyse the data, and moreover EISCAT had access to this computer for only 50% of the time. Using the fastest programs available and integrating the raw data over a period of 3 minutes it would need about 48 hours of computing time to

analyse the 48 hours of raw data anticipated each week. Analysis of each pre-integration period of 10 seconds would be out of the question. It was clear that a much faster computer was necessary with better input and output devices.

Fortunately there were plans for expansion of the building that serves the Kiruna Geophysical Institute (KGI) and EISCAT, and the available budget included funds for new computing equipment. With this in mind, KGI and EISCAT considered several alternatives which would increase the speed of the existing equipment. These included the AP120 fast processor from Floating Point Systems, which could be “fed” by the Nord-10, and the Nord-500 from Norsk Data which could be fed by the Nord-100. Norsk Data offered a package including a new Nord-100, a Nord-500 and two large discs (150 Mbyte and 75 Mbyte), and at the end of the year it was agreed to purchase this package in equal partnership with KGI. An advantage of the Nord-500 is that it is well-suited for multi-user operation and so promises to be very convenient for the computing needs of visiting scientists.

In the meantime, the actual work of rebuilding at KGI/EISCAT had affected the computing facilities and the Nord-10 was not available for a large part of 1981. 1982 therefore promises a sudden change from very little computing power at EISCAT Headquarters to a 50% share in a system which should meet EISCAT’s needs for several years.

ii) **Data-Handling**

The second problem concerned the actual copying of reduced tapes for distribution to all six countries, and the archiving of the data so that scientists in the associate countries could obtain raw data with the original pre-integration time of 10 seconds.

To do this job efficiently, a data centre would need sufficient tape stations to produce 6 copies in parallel, and a large enough data-base for the archiving and answering of requests to be carried out efficiently at small overhead cost. EISCAT was not equipped to do this. In addition it was likely that a large data

centre could produce visual summaries of the common programme parameters to distribute to scientists in the associate countries.

In the spring of 1981 a bid for tender was sent to 11 data centres in the six countries. Four of these submitted detailed proposals and after further discussions the Directorate recommended that a contract for data-handling should be awarded to the Space Centre Toulouse.

The contract is being negotiated in two stages. In the first stage Toulouse will take responsibility for indexing, copying and distributing tapes of reduced parameters, and for indexing and archiving raw data in order to answer requests from accredited scientists. A draft contract for this stage was agreed in December and a final version should be signed early in 1982. The second stage will cover the visualisation of the reduced data in microfiche form.

## UHF COMMON PROGRAMME

It is intended that EISCAT should devote 24 hours a week to observations of a "Common Programme" and the results will be distributed to scientists working in the six member countries. At UHF four common programmes have been defined:-

### **a) Common Programme Zero**

CP 0 is a very simple programme designed to give continuous measurements of electron density, electron and ion temperatures and electric fields in the F-region.

All three antennas are fixed: the Tromsø beam set parallel to the magnetic field line and the remote antennas pointing to a fixed height. Two pulses are transmitted. A short pulse is used to give a power profile which can be converted into an electron density profile with height resolution of  $\sim 10$  km. A longer pulse gives profiles of electron density, electron and ion temperatures and plasma velocity with height resolution of  $\sim 50$  km. The longer pulse also provides

an echo for the remote stations which observe a common scattering volume at a height of 300 km.

### **b) Common Programme One**

CP 1 is similar to CP 0 but includes extensive measurements in the E-region.

The Tromsø beam is again set parallel to the field line but the remote antennas scan up and down so that they can measure plasma velocity at a number of heights.

In 1981 full frequency agility was not available and so CP-1, a simplified version of CP 1, was run. In this programme a single long pulse was transmitted. This gave profiles of electron density, electron and ion temperature and plasma velocity over the height range 200-800 km with height resolution of  $\sim 75$  km. The remote antennas made measurements at 110, 120, 130, 140, 300 and 700 km.

When full frequency agility is available, the full version of CP 1 will be used. This will include a multipulse sequence of five short pulses to make measurements in the E-region with good height resolution, a medium length pulse for measurements in the F-region and a long pulse to provide echoes for the remote antennas. The remote antennas will scan in a double cycle, each half lasting 6 minutes. In the first half observations will be made at 95, 107, 130 and 225 km, while in the second it is planned to observe at 100, 115, 150 and 300 km.

### **c) Common Programme Two**

In CP 2 the Tromsø beam points in sequence in three different directions so that it is possible to distinguish time- and space-variations, as for example in observations of atmospheric gravity waves.

A simple form of this programme has already been run as CP-2. The three antennas move in a cycle of 6 minutes pointing to the vertices of a right-angled triangle at a height of 300 km. The same pulse scheme is used as in CP 0.

When the transmitter is operating at full power and when full frequency agility is available, the pulse scheme will be changed to that used in CP 1. At the same time the remote antennas will observe at 110 km as well as 300 km.

#### **d) Common Programme Three**

CP 3 is designed to make ionospheric measurements over a wide range of L values. This will serve several purposes.

Some scientists see CP 3 as a way of studying the polar cap, and for these only measurements north of Tromsø are important. Others wish to study the penetration of magnetospheric electric fields to mid-latitudes, and for these it is best to measure at a few points over a wide latitude range, completing the scan in the shortest possible time. Yet others are more interested in defining the various boundaries that can be identified at different latitudes; because these boundaries are often quite sharp this work requires closely-spaced points and the scan time is necessarily longer. Finally, there are scientists who wish to relate CP 3 to ground-based or satellite measurements.

In answer to these various — and conflicting — demands two versions of CP 3 have been run.

CP-3(Simple) was developed for collaboration with GEOS. The aim was a latitude scan passing through the GEOS field line with a cycle time of 6 minutes. The mode used was very similar to CP-2 with three pointing directions in the Tromsø meridian at elevations of 62°, 77° and 92°.

The full version of CP 3 was developed for collaboration with MITHRAS and follows a 16-position trajectory which runs perpendicular to the L-shells between latitudes 74.25° N and 64.25° N. The cycle time is 30 minutes which is rather long but it is argued that EISCAT is not designed to make observations over a wide geographical area with high time resolution. It may be better to use STARE and SABRE data to observe rapid changes in electric fields at different latitudes, while using EISCAT to make the density, temperature and composition measurements which cannot be rivalled.

# DIARY OF OBSERVATIONS 1981

The first clear echoes from the ionosphere were received at all sites during June, and the first continuous set of observations were made on August 20. Common Programme observations began on September 16 and the first Special Programme was run on October 25. During the 13 week period from September 16 to December 17 Common Programme observations were made for a total of 312 hours. Special Programme observations accounted for a total of 90 hours of which France used 17 hours, Germany 44 hours, Norway 2 hours and the United Kingdom 27 hours.

Table 1 : Common Programme Observations

Date	Start (UT)	Stop (UT)	Mode
81 09 16/17	0902	0715	CP-1
81 09 23/24	0930	0800	CP-1
81 09 30/01	1130	0900	CP-1
81 10 02	0825	1055	CP-1
81 10 06/08	2200	0900	CP-1
81 10 14/15	1415	0900	CP-1
81 10 21/22	0910	0900	CP 0
81 10 25/26	1630	0900	CP 0
81 11 04/05	0930	0900	CP 0
81 11 11	0900	1450	CP 0
81 11 18/19	0900	0900	CP 0
81 11 25/26	0900	0840	CP-2
81 11 29/30	1000	1000	CP-3 (Simple)
81 12 08/09	1500	2020	CP-3 (Extended)
81 12 15/16	1500	1940	CP-3 (Simple)

**Table 2 : Special Programme Observations**

Date	Start (UT)	Stop (UT)	Programme	Country
81 10 25	1850	1940	POLAR	Norway
81 11 19	1835	2000	EN-BUD	Germany
81 11 23	1710	2330	STAGE	Germany
81 11 26	0050	0130	EN-BUD	Germany
81 11 26	1625	2300	STAGE	Germany
81 12 01	1530	1620	PETREL	UK
81 12 01/02	1700	0140	STAGE	Germany
81 12 02	0800	1315	MITHRAS	France
81 12 03/04	1700	0130	STAGE	Germany
81 12 05	1110	1650	MITHRAS	France
81 12 06	1445	1650	PLH	Germany/France
81 12 07	1000	1730	SPITS	UK
81 12 07	1730	1900	LANCS	UK
81 12 08	0900	1400	PLH	Germany/France
81 12 09	1645	1845	PETREL	UK
81 12 09	2040	2300	EN-BUD	Germany
81 12 10	1200	1500	PLH	Germany/France
81 12 11	1250	1420	PLH	Germany/France
81 12 14	0910	1200	SPITS	UK
81 12 14	1230	1400	PLH	Germany/France
81 12 16	1345	1445	PETREL	UK
81 12 17	0800	1000	SPITS	UK
81 12 17	1100	1230	PLH	Germany/France
81 12 17	1500	1700	LANCS	UK
81 12 17	1715	2300	SPITS	UK

**Code:**

- POLAR : Polar 6 rocket campaign
- EN-BUD : Energy-Budget campaign
- STAGE : Comparison with STARE and GEOS
- PETREL : Petrel rocket campaign
- MITHRAS : Simultaneous observations at Chatanika, Millstone Hill and EISCAT
- PLH : Plasma line measurements during operation of the heater
- SPITS : Comparison with Fabry-Perot observations from Spitzbergen
- LANCS : Measurements of F-region irregularities (Lancaster University)

# EISCAT REPORTS PUBLISHED IN 1981

Terrance Ho and Hans-Jørgen Aker: EISCAT Technical Note 81/24  
Scientific programming of the EISCAT digital correlator (Revised).

Terrance Ho: EISCAT Technical Note 81/25  
Programs Corrsim, Corrttest: System for program development and software simulation of EISCAT digital correlator. User's manual.

Terrance Ho: EISCAT Technical Note 81/26  
Instruction manual for EISCAT digital correlator (Revised).

Terrance Ho: EISCAT Technical Note 81/27  
Standard subroutines and programs for EISCAT digital correlator.

Terrance Ho: EISCAT Technical Note 81/28  
Pocket manual for programming the EISCAT digital correlator.

Kristen Folkestad: EISCAT Technical Note 81/29  
Lectures for EISCAT personnel, Volume II.

Markku Lehtinen and Anna-Liisa Turunen: EISCAT Technical Note 81/30  
EISCAT UHF antenna direction calibration.

Kristen Folkestad: EISCAT Technical Note 81/31  
Use of EISCAT radar as a supplement to rocket measurements.

Tauno Turunen, Tarmo Mustonen and Phil Williams: EISCAT Technical Note 81/32  
EISCAT UHF receivers: report and recommendations.

Phil Williams: EISCAT Technical Note 81/33  
Polarisers in the EISCAT system.

Phil Williams (Editor): EISCAT Meetings 81/6  
Proceedings EISCAT Annual Review Meeting.  
Alta, Norway, 6-10 April 1981.

# MEMBERSHIP OF COUNCIL AND COMMITTEES

## AT 31st DECEMBER 1981

	FRANCE	FINLAND	FEDERAL REPUBLIC OF GERMANY	NORWAY	SWEDEN	UNITED KINGDOM
COUNCIL	M. Blanc M. Petit J-C Ribes	O. Ranta A. Siivola	W.I. Axford G. Haerendel G. Preiss	O. Holt A. Omholt	B. Hultqvist M.O. Ottosson	H.H. Atkinson W.J.G. Beynon H. Rishbeth
SAC	D. Alcayde P. Bauer	J. Oksman	J.A. Fejer H. Kohl	O. Holt	S. Westerlund	H. Rishbeth T.B. Jones
AFC	J. Mirabel A. Schwerer	O. Ranta	M. Meinecke G. Preiss	L. Westgaard	M.O. Ottosson	G. Rowe J.D. Willcock

### HEADQUARTERS SENIOR STAFF AT 31 DECEMBER 1981

Director	—	T. Hagfors
Associate Director	—	K. Folkestad
Associate Director	—	P.J.S. Williams*
Business Manager	—	Position vacant

\*on secondment from SERC



EISCAT Headquarters Staff at Kiruna.

## EISCAT MEETINGS

### COUNCIL

16th meeting, Munich, 28-29 April 1981

17th meeting, Kiruna, 27 August 1981

18th meeting, Paris, 5-6 November 1981

### SCIENTIFIC ADVISORY COMMITTEE

19th meeting, Lindau, 27-28 January 1981

20th meeting, Slough, 20-21 May 1981

21st meeting, Kiruna, 27-28 August 1981

### ADMINISTRATIVE AND FINANCE COMMITTEE

16th meeting, Hamburg, 12-13 March 1981

17th meeting, Hamburg, 24-25 September 1981

### EISCAT ANNUAL REVIEW MEETING

5th meeting, Alta, 6-10 April 1981

### EISCAT User's Introductory Course

Kiruna, 23 March--3 April 1981

### EISCAT Programmers meeting

Kiruna, 7-9 October 1981

# BALANCE SHEET

## Assets

<b>FIXED ASSETS</b>	At Dec. 31, 1980	Additions	Depreci- ation	At Dec. 31, 1981
Buildings	1.4			1.4
Transmitters	23.4	1.0		24.4
UHF-antenna	23.9		1.3	22.6
VHF-antenna	28.5	0.6	1.5	27.6
Receivers	0.4			0.4
Computers etc.	3.5	0.1	0.1	3.5
Other	1.1	0.3	0.3	1.1
<b>Total</b>	<b>82.3</b>	<b>2.0</b>	<b>3.2</b>	<b>81.1</b>
<b>CONTRIBUTIONS</b>				
Pool uncalled	3.0			1.5
<b>CURRENT ASSETS</b>				
Debtors	0.4			0.4
Prepayments and accrued income	0.1			0.1
Cash and Ordinary Bank Accounts	5.9			7.2
Special Accounts	1.7			2.3
<b>Total Current Assets</b>	<b>8.2</b>			<b>10.1</b>
<b>GRAND TOTAL</b>	<b>93.5</b>			<b>92.7</b>

### Notes on the Balance Sheet:

1. Remaining commitments due to main contracts: Transmitters, MSEK 3.3  
VHF-antenna, MSEK 0.3
2. In Kind expenditure by Nordic Associates is only included to the extent that fixed assets have been formally handed over as contributions to EISCAT.

# AT 31 DECEMBER 1981

Liabilities

MSEK

## CAPITAL

Contributions

Pool

Capital Operating

In Kind

Depreciations

Total Capital

## RESERVES

Pool

Capital Operating

Total Reserves

Pool Contributions uncalled

Special Accounts

## LIABILITIES

Provisions

Other Liabilities

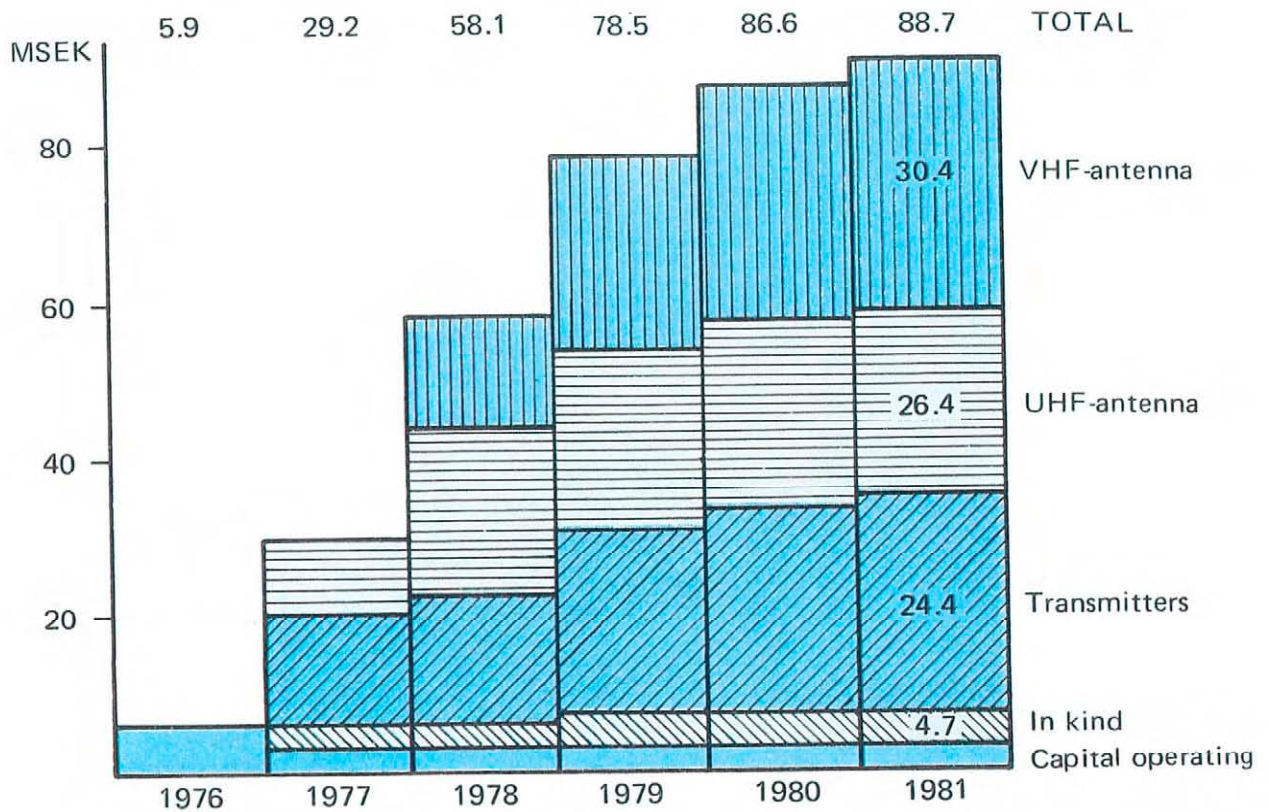
Total Liabilities

## GRAND TOTAL

	At Dec. 31, 1980	At Dec. 31, 1981
	79.5	81.1
	2.4	2.8
	4.7	4.7
	86.7	88.7
	4.4	7.6
	82.3	81.1
	4.8	5.5
	0.7	1.2
	5.5	6.7
	3.0	1.5
	1.7	2.3
	0.5	0.7
	0.4	0.4
	0.9	1.1
	93.5	92.7

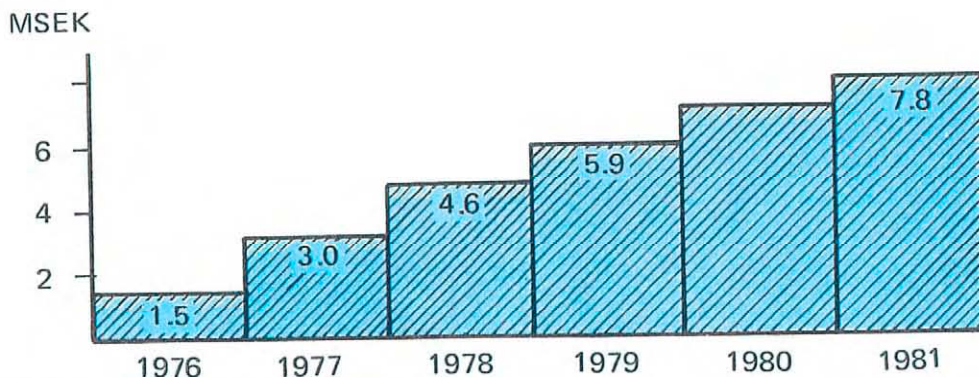
# CAPITAL INVESTMENTS

The capital investments amounted to 88.7 MSEK at the end of 1981 the cumulative cash flow of the capital investments has been as follows:



# OPERATING COSTS

The operating costs increased to 7.8 MSEK in 1981 but are not yet up to the level for full operations. The annual costs has had the following progress:



Figures quoted are current values at the time of expenditure.

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