THE SEVENTIES – SETTING THE STAGE FOR ADVANCED ANTENNA DEVELOPMENT AND ELECTROMAGNETICS RESEARCH IN SOUTH AFRICA

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THE SEVENTIES – SETTING THE SCENE FOR GROWTH

About 1968:	The Rocket Research Institute of the CSIR sends engineers and scientists overseas to study radar and missiles.
1970:	The first anechoic chamber in South Africa built at NIDR with HP 8410 vector network analyser operating to 12.4 GHz.
1970 – 1974:	Dirk Baker leaves Rhodes University to do a PhD in antennas and EM Theory under Prof John D Kraus at the Ohio State University (OSU).
1972 – 1973:	NIDR sends John Cloete and Ad Sparrius for MEng studies in USA. John Cloete spends 6 months at Scientific Atlanta. Bob van der Neut spends a sabbatical in Europe working on antennas.
1972:	Jan Malherbe at U of Stellenbosch acquires an HP8410 vector network analyser and starts research programme into filters and components.
1975:	Critical mass of engineers assembled at NIDR. Collaborative projects with universities begin.
1975 on:	The push to higher frequencies, excellent measurement facilities and exciting projects attract young and innovative engineers.
1978 – 1979:	Derek McNamara goes to OSU to study GTD and on his return leads computational electromagnetics efforts at NIDR.

EXPANSION OF FREQUENCY RANGE

1970: Up to 12.4 GHz **1975:** Up to 18 GHz
1980: Up to 40 GHz **1983:** Up to 100 GHz

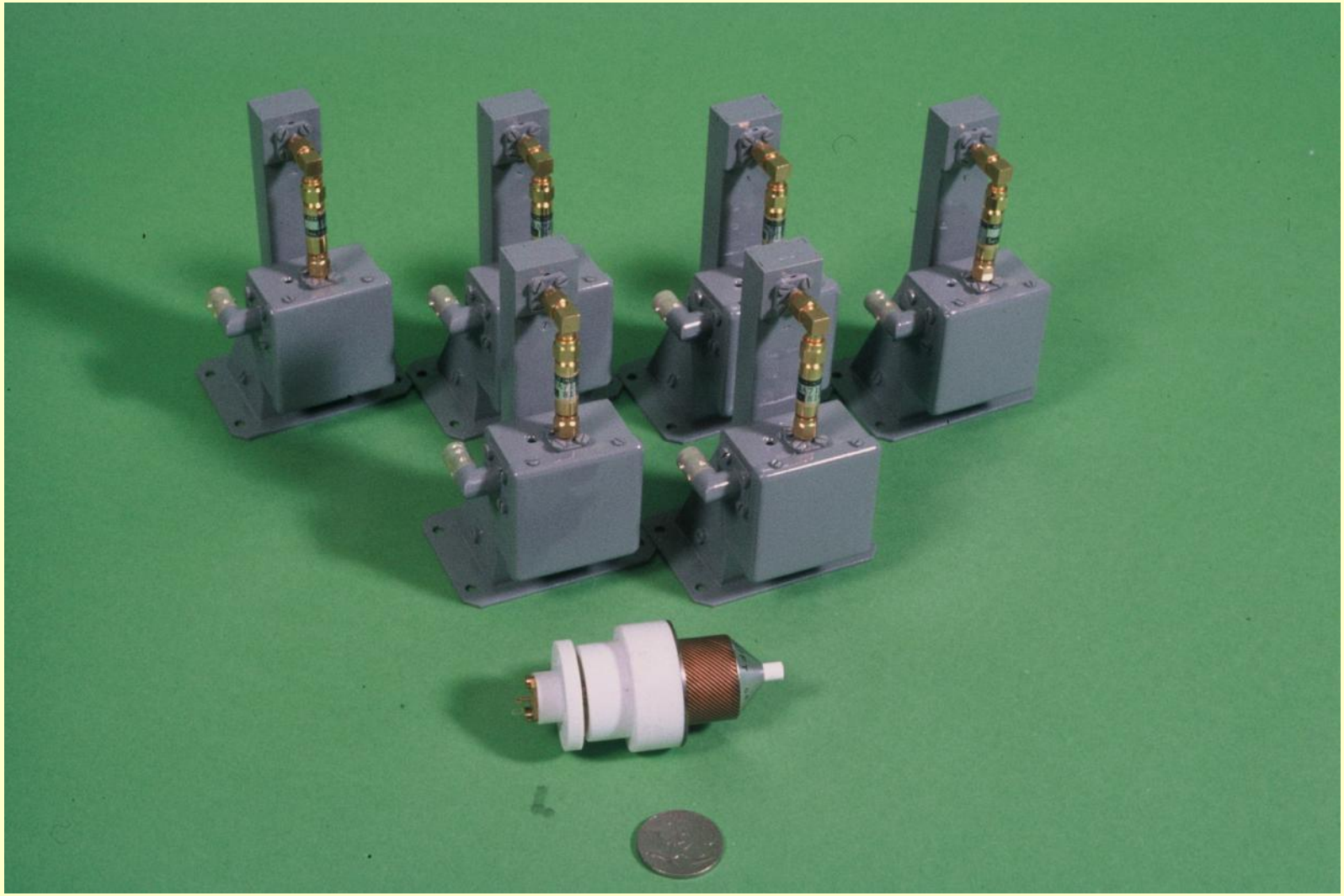
The automated vector network analysers revolusionised measurements in the 1970s, a far cry from the manual measurements of only 10 years earlier.

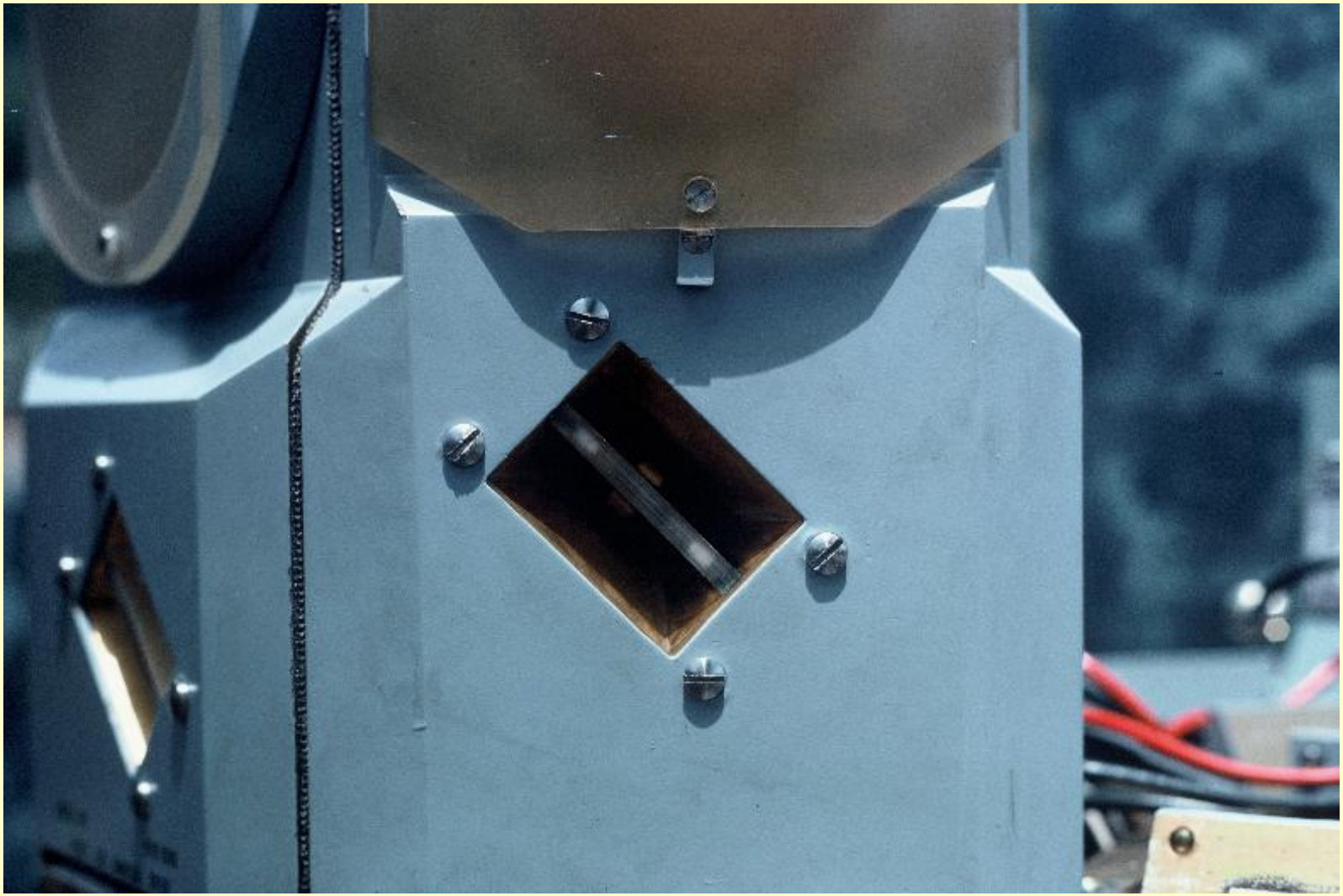
SYSTEM LEVEL DEVELOPMENTS

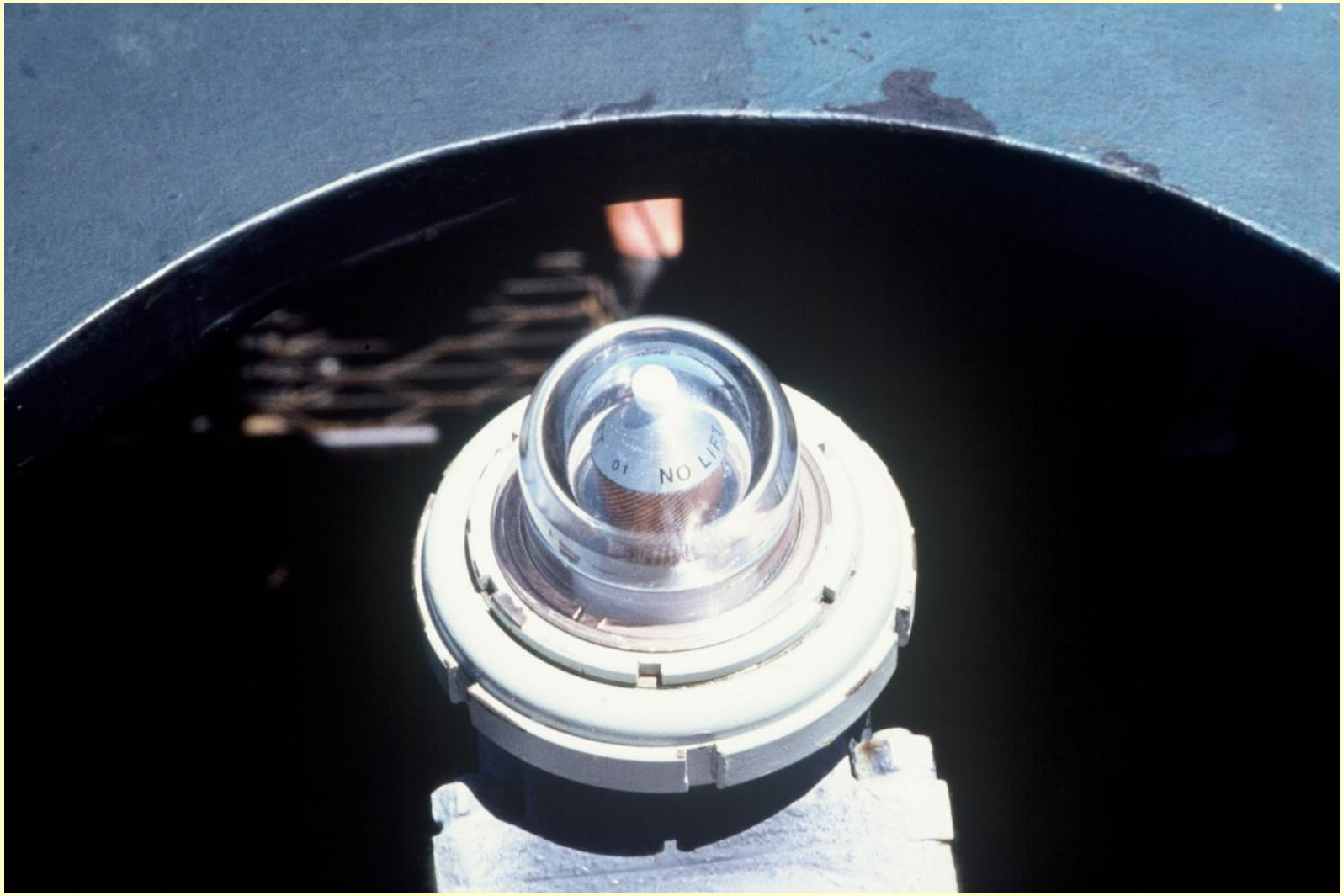
The 1970s was a time of exciting projects not only at component level but also at system level. Extensive programmes began at NIDR addressing:

- Missile guidance – TV, Radar, IR
- Radars – tracking, pulse compression and mmWave
- EW – Radar Warning Receivers, ELINT

Most of this work was classified and remains unpublished. A small sample of antenna related developments appears in the Proceedings of the First SAIEE Symposium on Antennas and Propagation, Pretoria, 16-18 May 1983.



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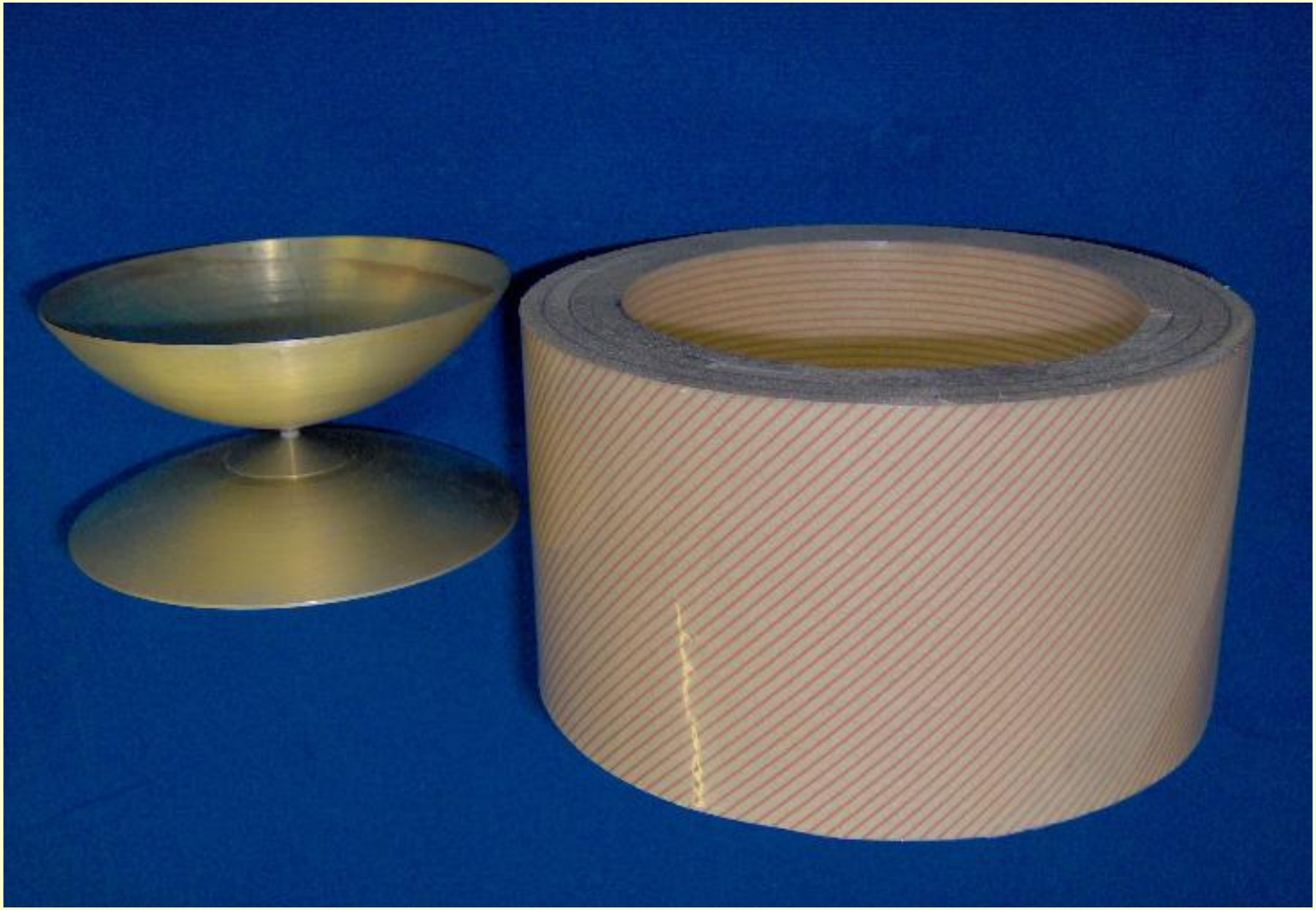
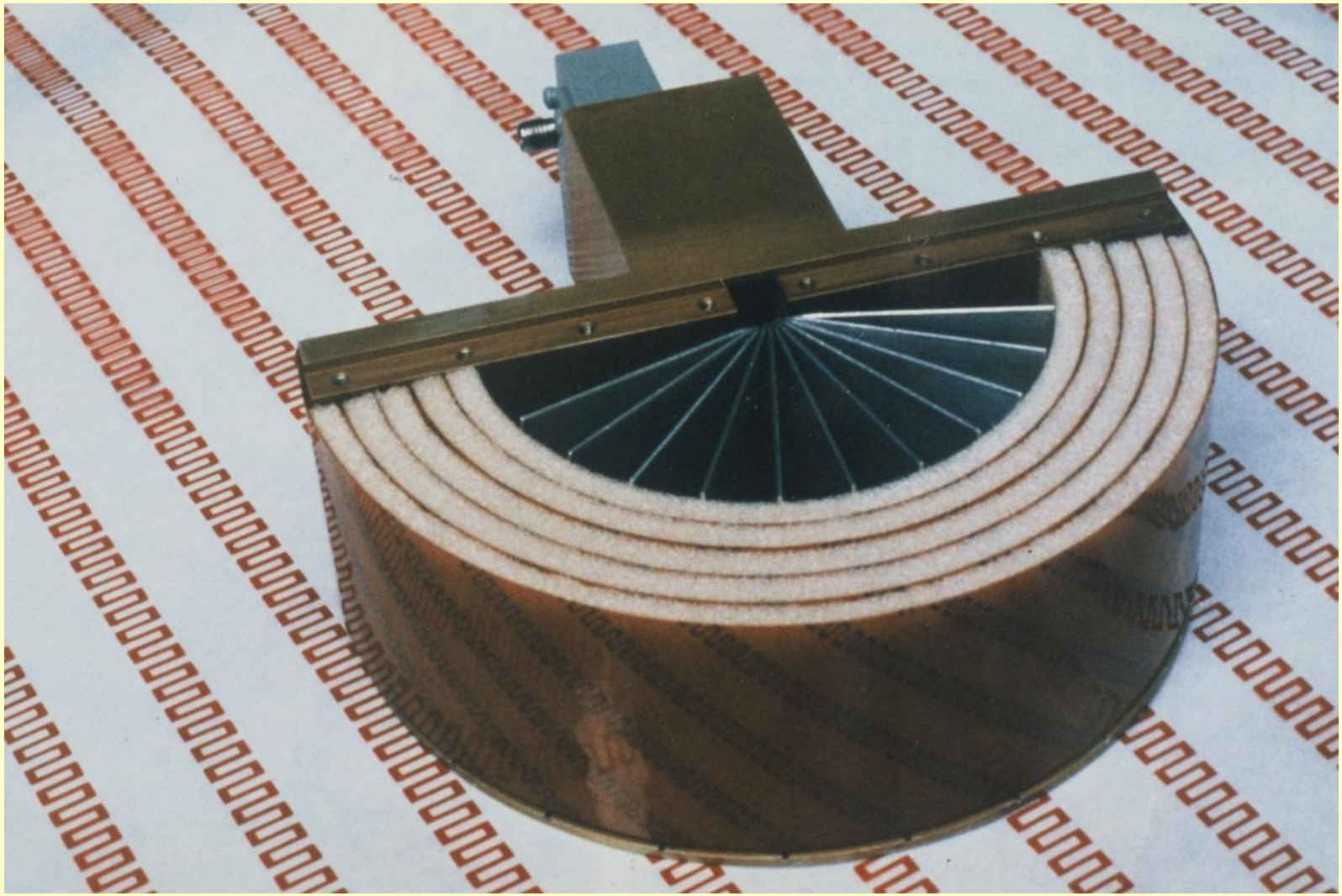
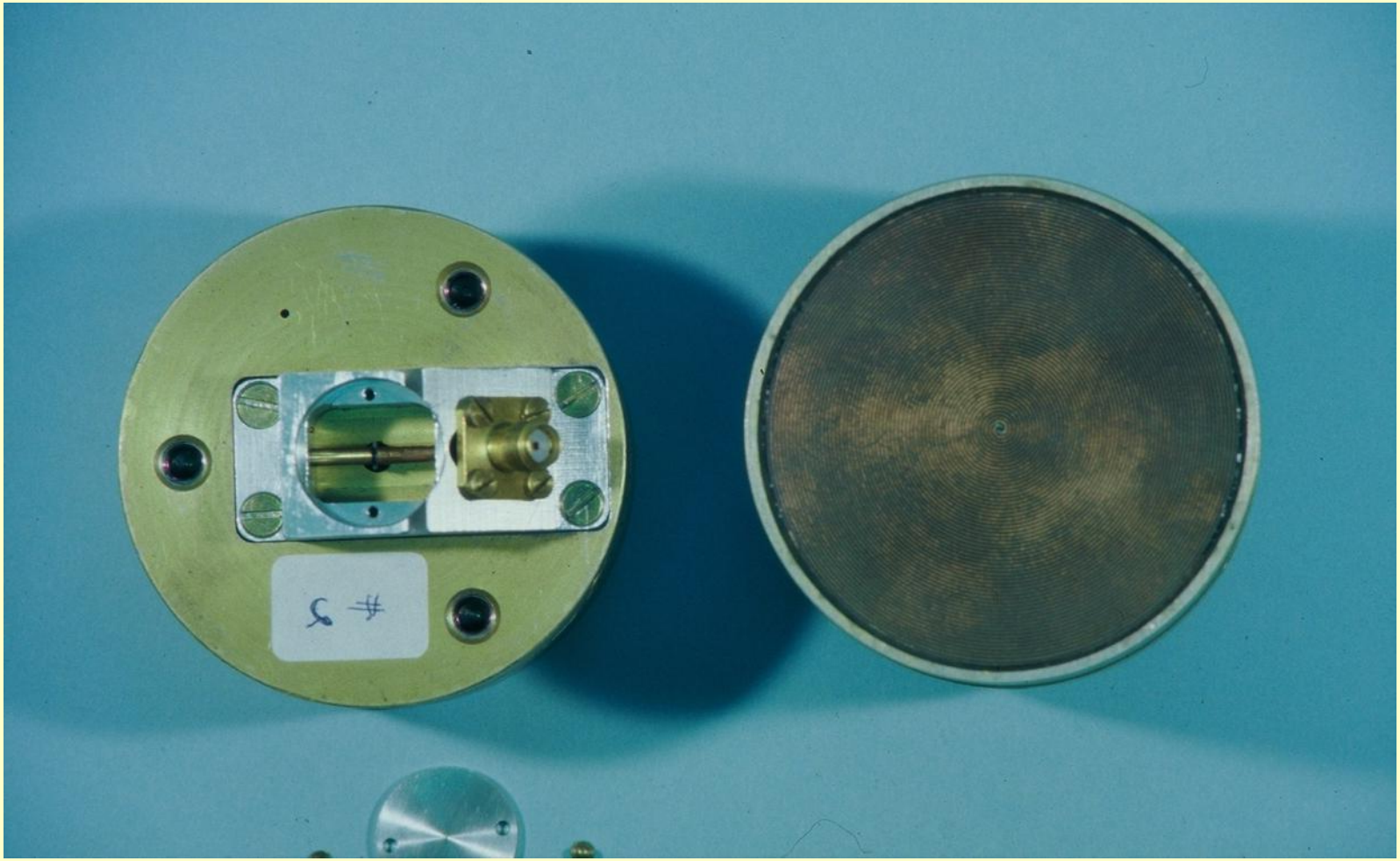
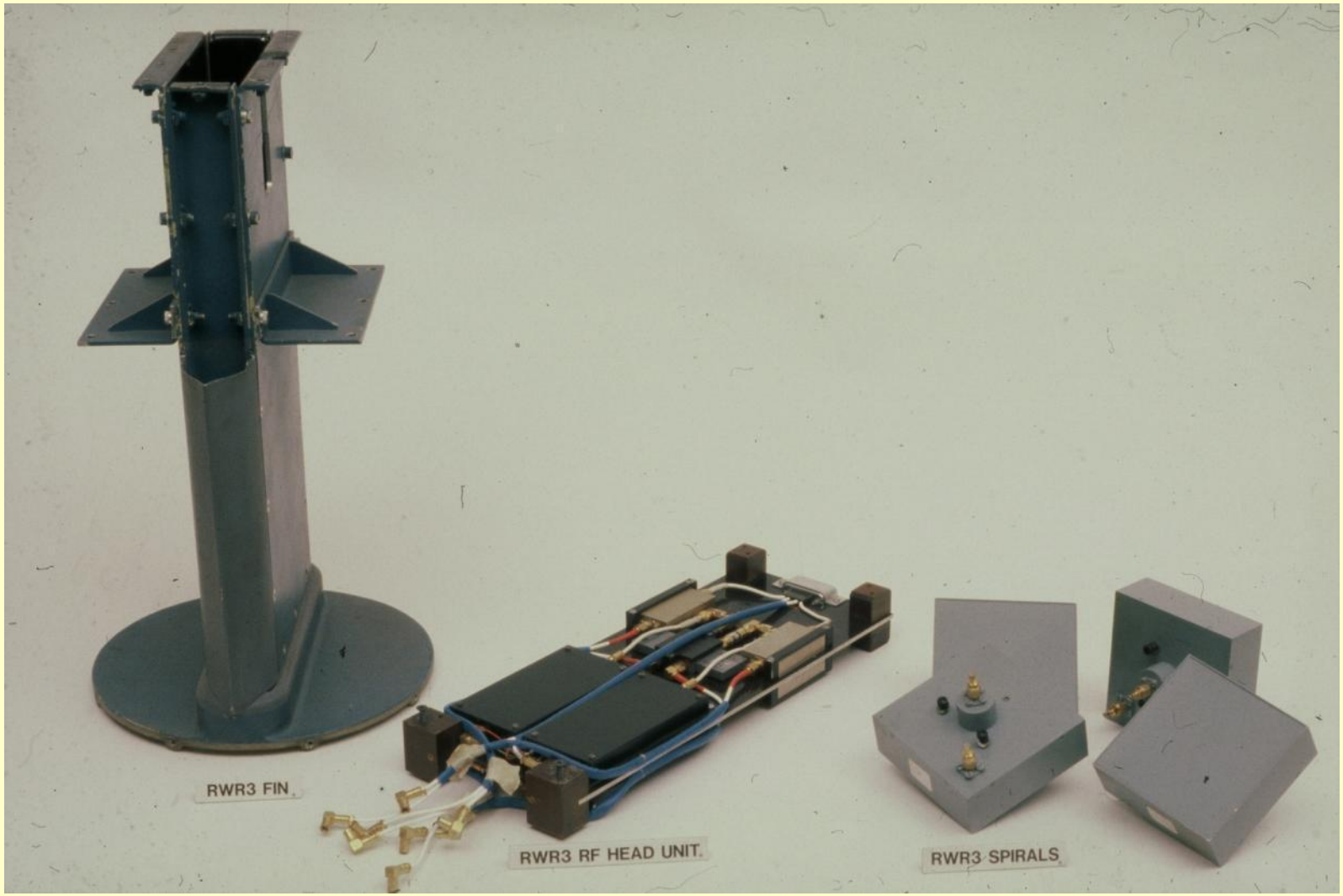
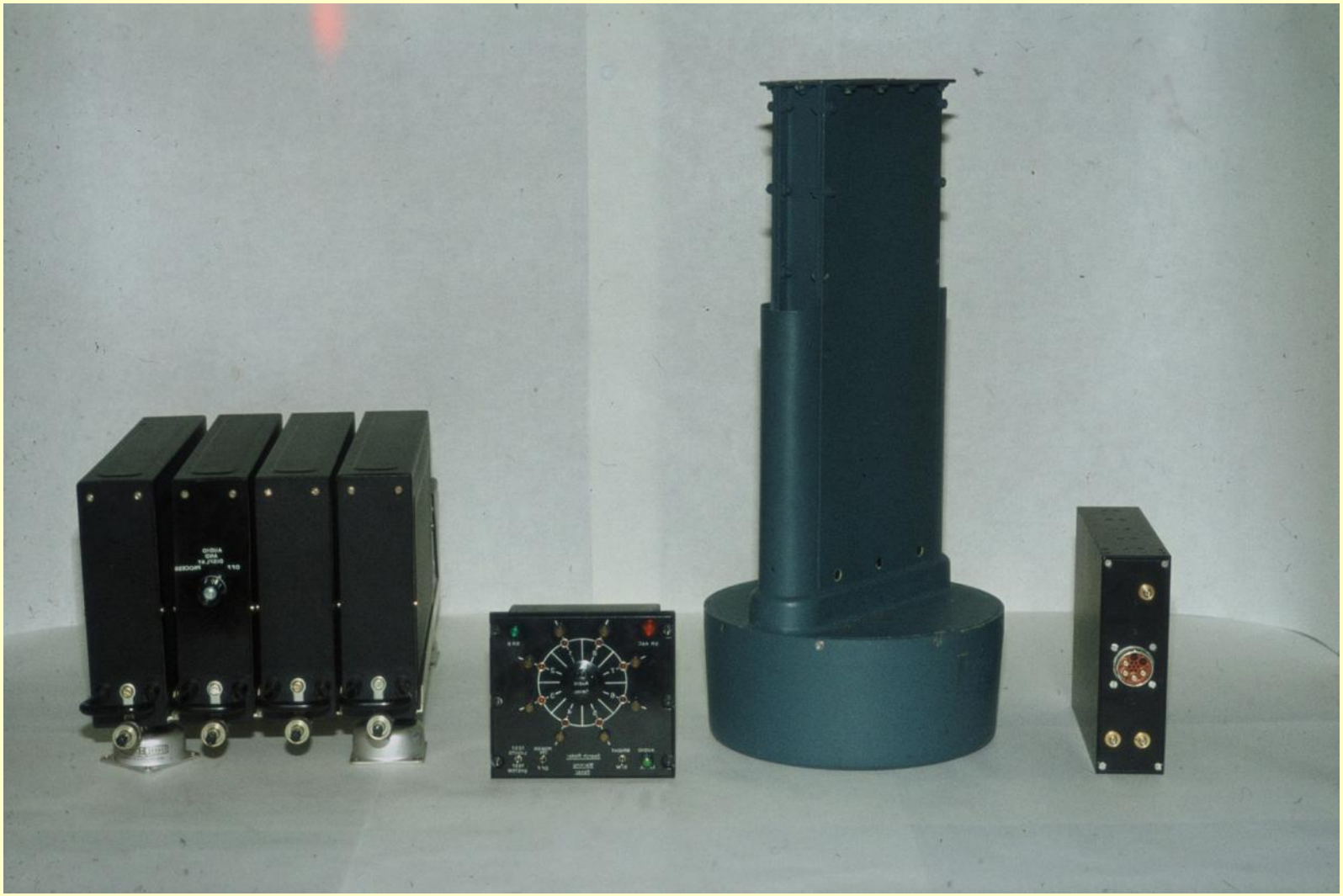





#5


RWR2 DISCONE IN RADOME


RWR3 FIN
RWR3 RF HEAD UNIT.
RWR3 SPIRALS



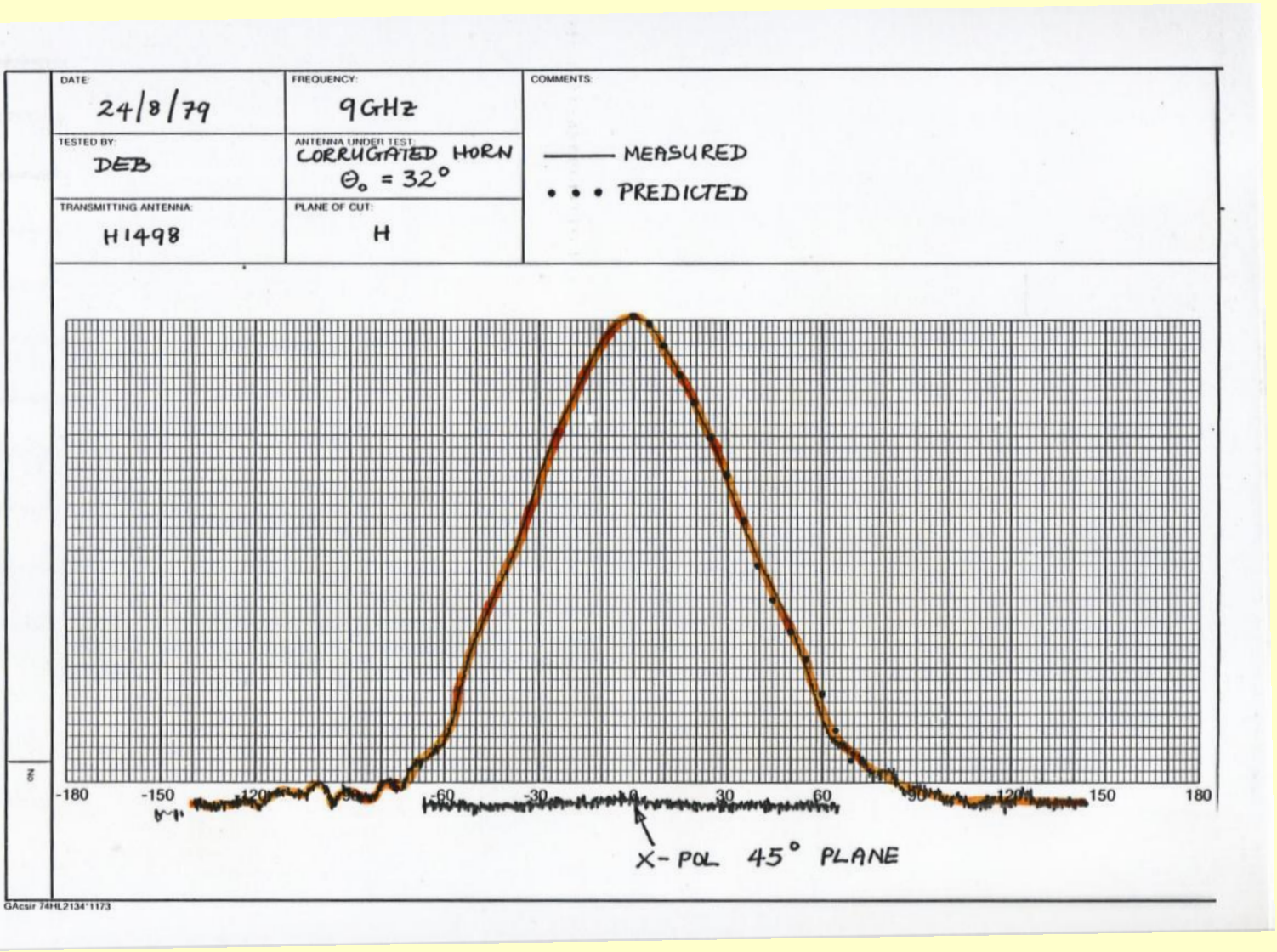
COMPUTATIONAL ELECTROMAGNETICS

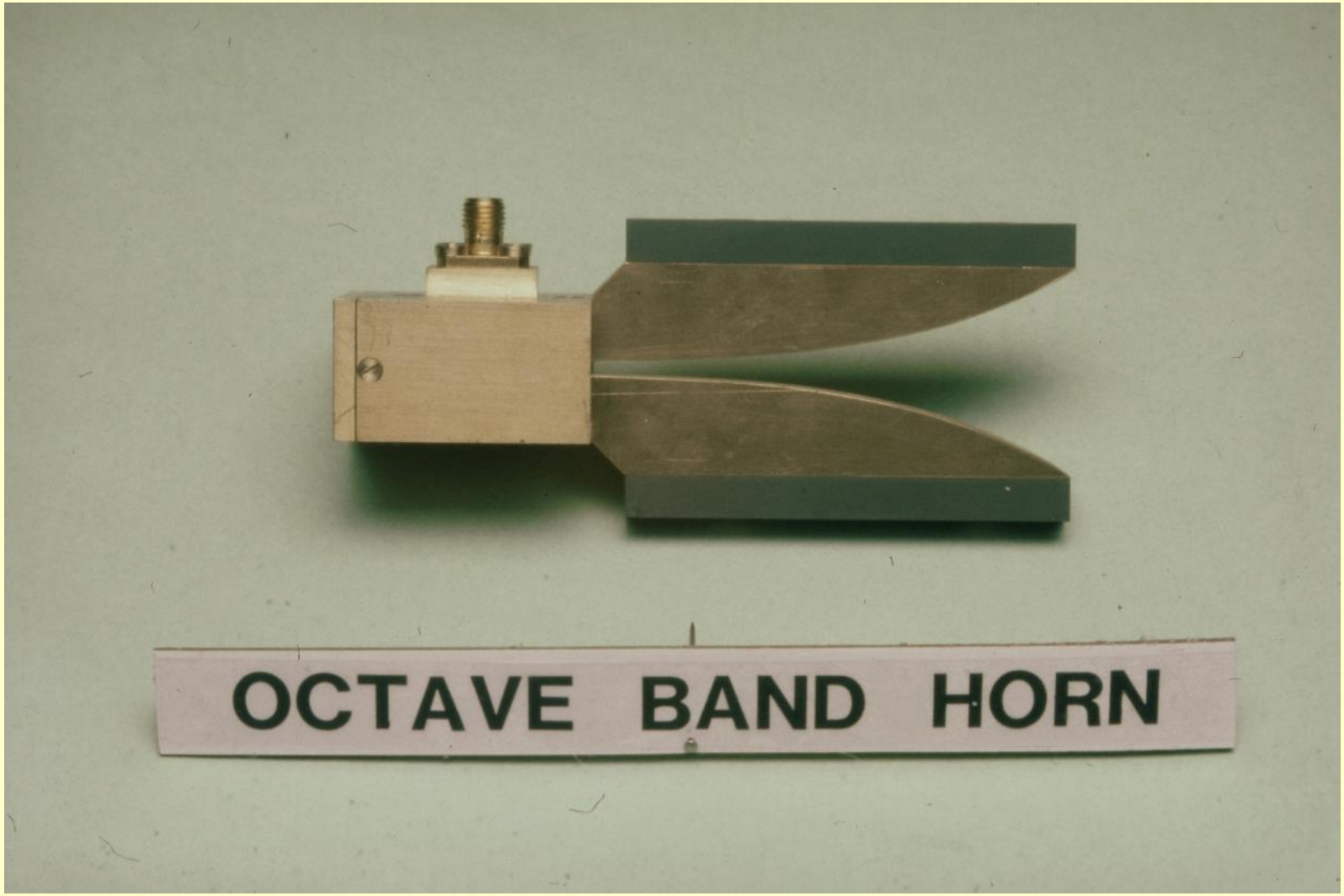
1972/73: At NITR Duncan Baker evaluates HF LPDA antennas using computer based analytical techniques. Spurious feed line resonances found by examining input impedance.

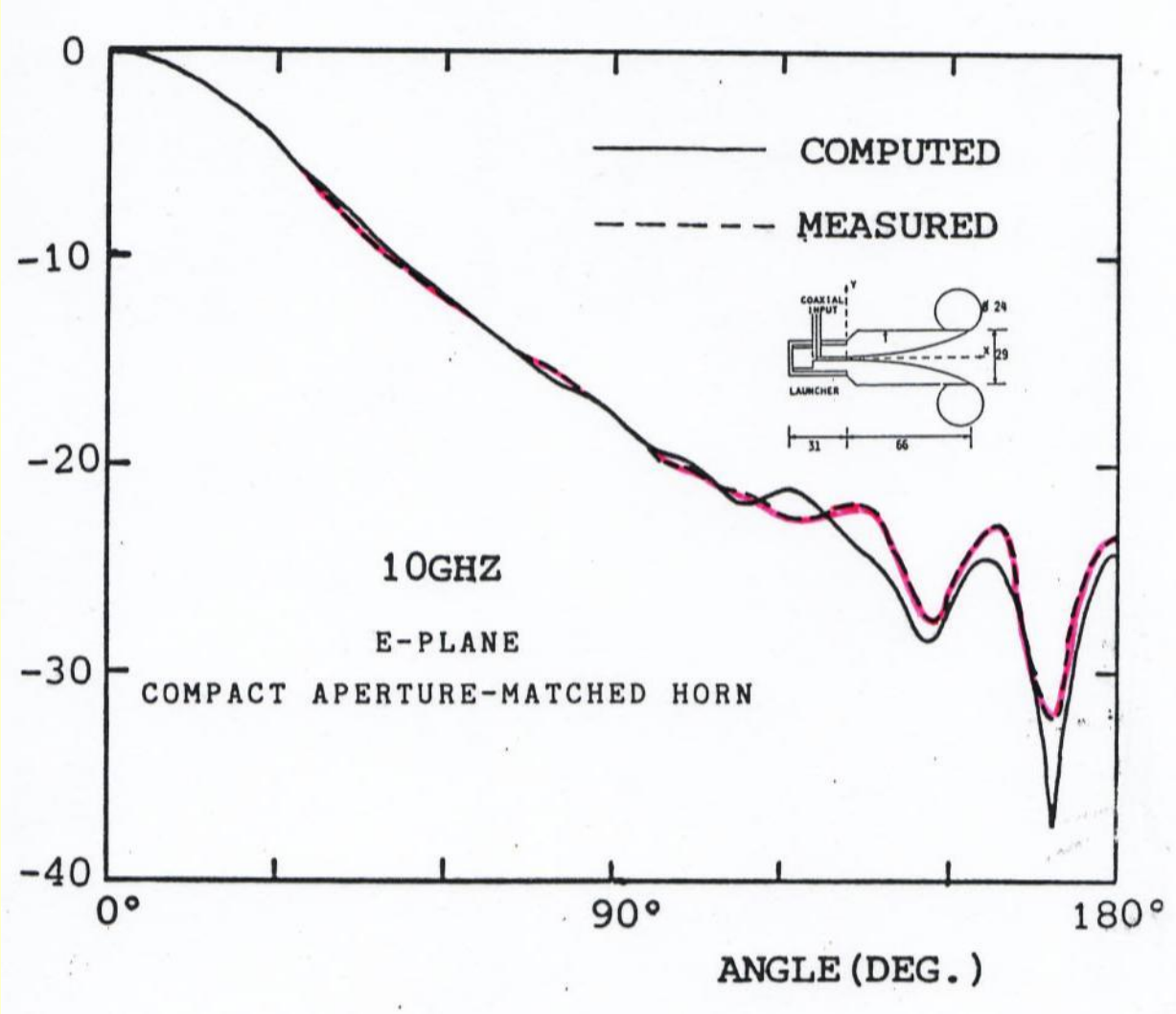
From 1978: Concerted effort in EM codes at NIAST (formerly NIDR), CSIR under Derek McNamara

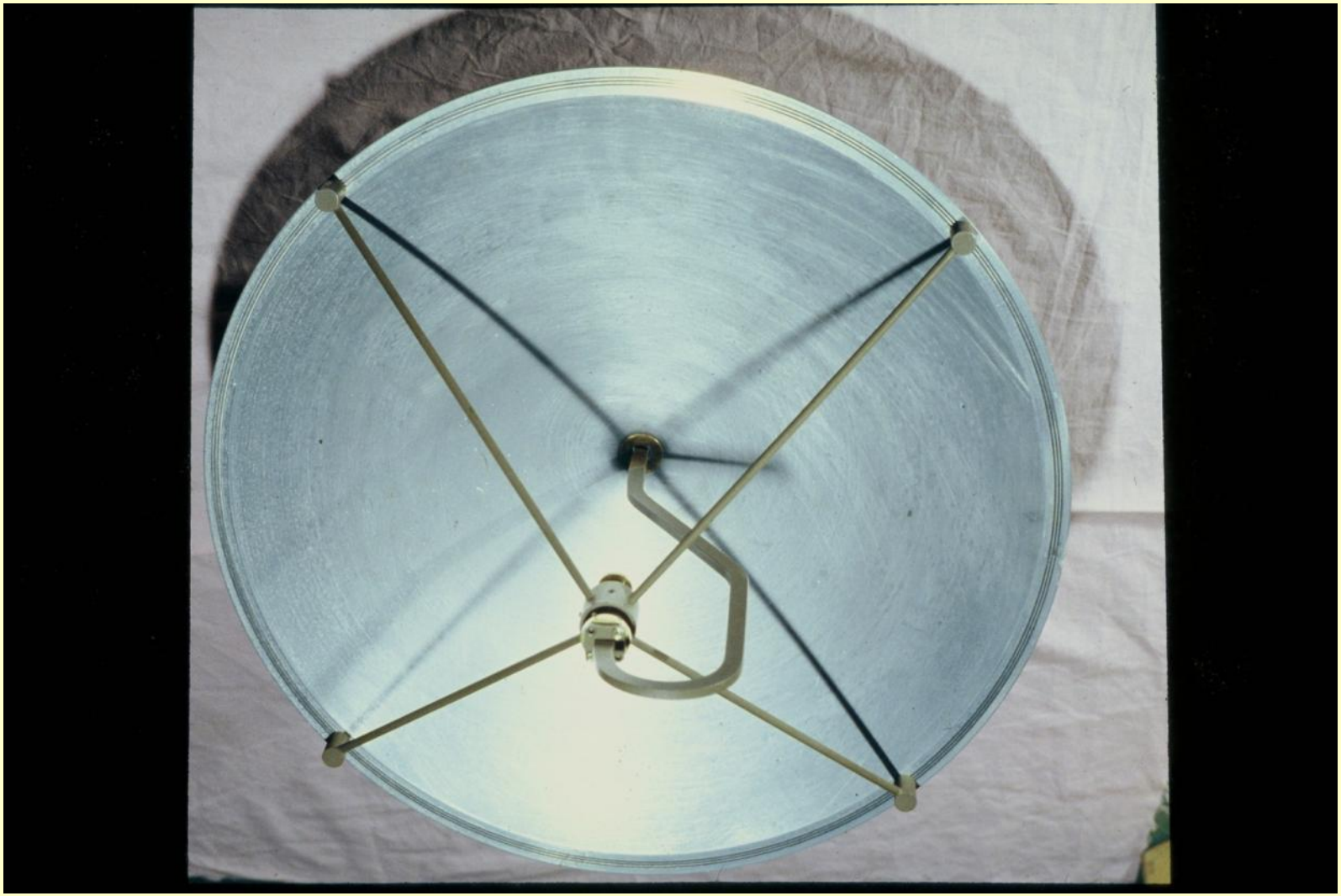
- GTD codes for antennas on aircraft and structures
- Physical optics/GTD codes for reflector analysis
- Relatively simple numerical analysis (at least it seems so now) and integration of aperture fields (horn antennas)
- Moment method analysis of thin wire antennas using NEC 2 (also at NITR) and Richmond's codes
- General purpose finite element codes

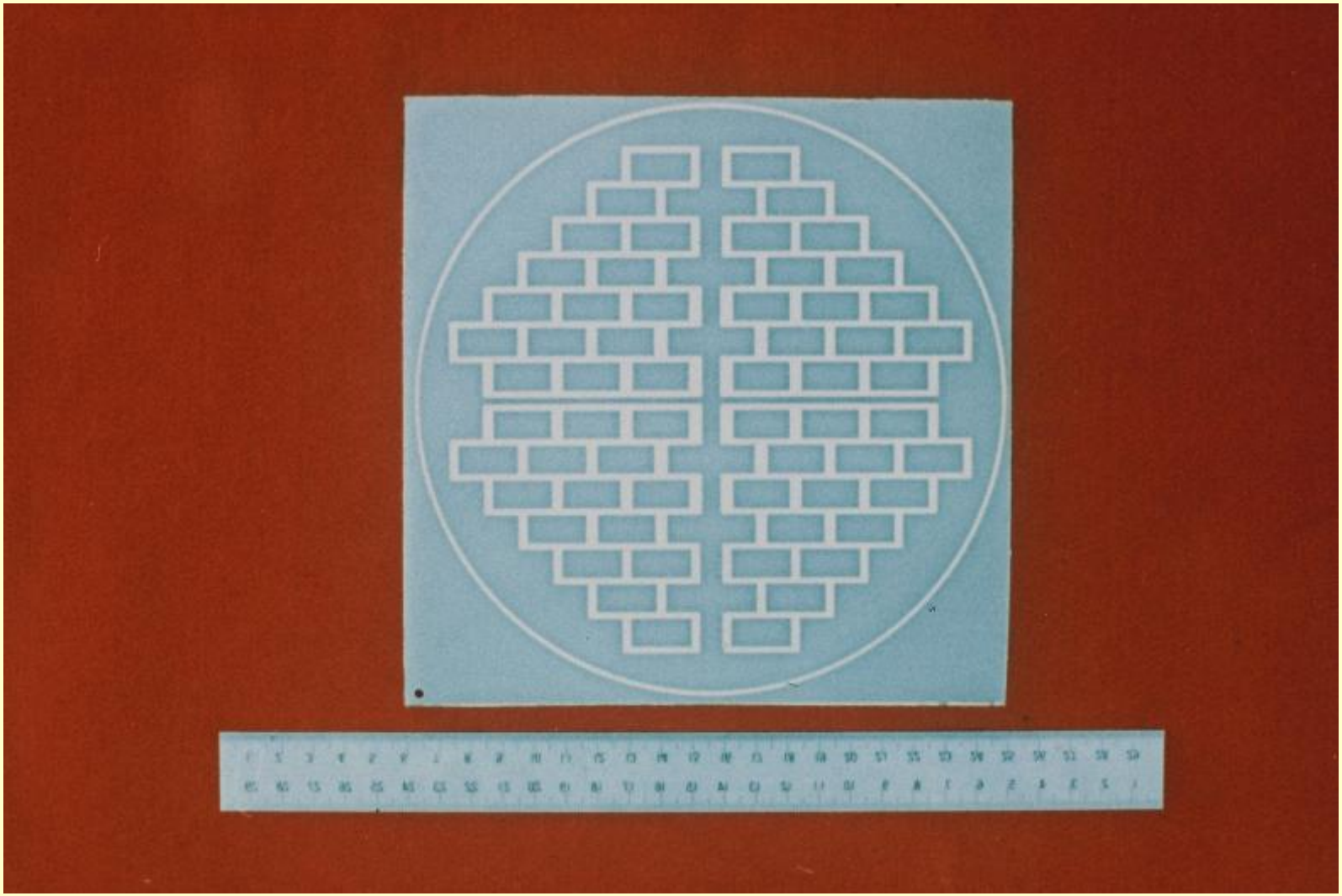

CORRUGATED CONICAL HORN


DATE:
24/8/79
FREQUENCY:
9GHz
COMMENTS:
TESTED BY:
DEB
ANTENNA UNDER TEST:
CORRUGATED HORN
$\theta_0 = 32°$
MEASURED
PREDICTED
TRANSMITTING ANTENNA:
H1498
PLANE OF CUT:
H
-180
-150
-120
-90
-60
-30
0
30
60
90
120
150
180
X-POL 45° PLANE
GAcsir 74HL2134*1173

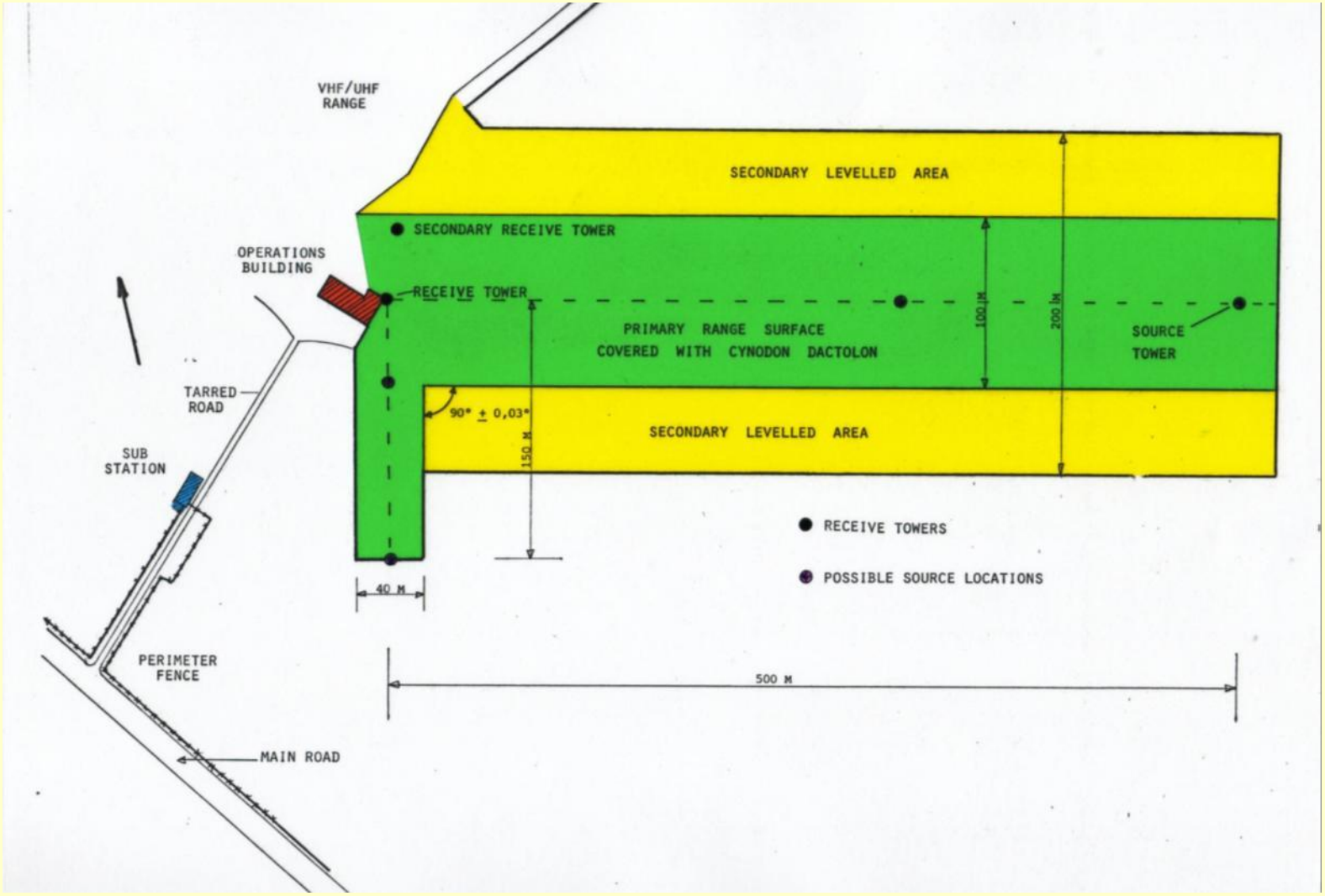

OCTAVE BAND HORN

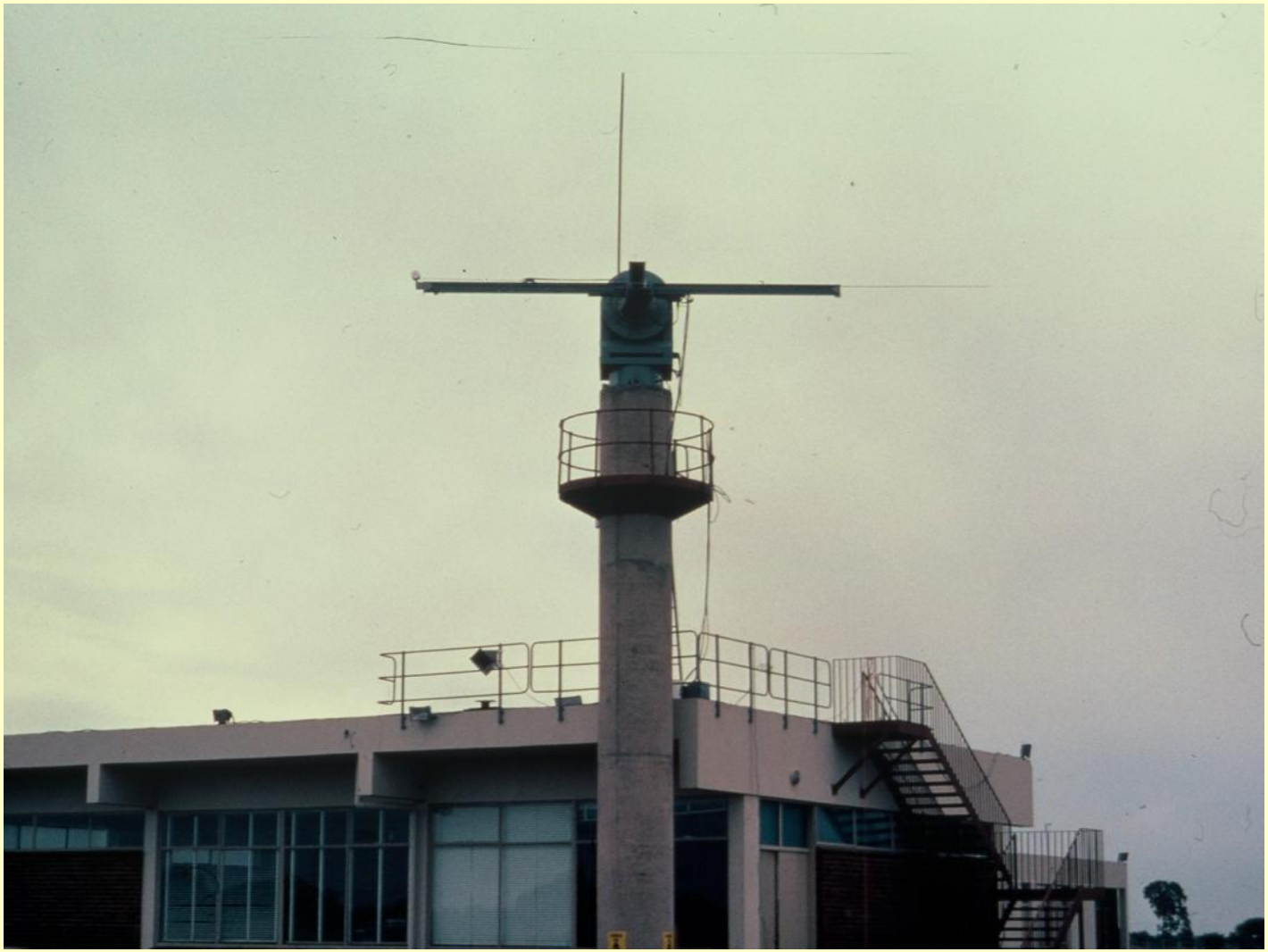

0
-10
-20
-30
-40
0°
90°
180°
ANGLE (DEG.)
COMPUTED
MEASURED
10GHZ
E-PLANE
COMPACT APERTURE-MATCHED HORN
COAXIAL INPUT
LAUNCHER
24
29
31
66





The need to measure antennas larger than 5 m drove the requirement for a world-class outdoor test range.





MIGRATION FROM NIAST

Late70s & 80s: Experienced people moved to industry: Abel van der Merwe (ESD, Sysdel), John Howard (ESD), Garth Milne (Kentron, US), Denis Milton(Kentron), Johan Pretorius and Dirk Baker (EMLab) and others.

1980s: Experienced engineers began moving from NIAST to the Universities of Pretoria and Stellenbosch (Ad Sparrius, John Cloete, Derek McNamara, Johan Joubert, David Davidson and others). This resulted in academic programmes where the practical and theoretical aspects of antennas and electromagnetics were emphasised. Teaching and research activities were further enhanced by more overseas PhDs (Callie Pistorius, Barend Taute, Howard Reader).

Throughout this time a core of experienced engineers remained at CSIR to carry on the work started in the seventies (Bob van der Neut, Francois Anderson, Louis Botha, Barend Taute, amongst others).

Many of you in the audience know and have been influenced by these people.

SOME CONCLUDING OBERVATIONS

The seventies and early eighties were exciting times where practical antenna design and development dominated and many antennas were successfully developed without the benefit of modern computational tools.

The advances in numerical techniques and their widespread application have made it possible to design far more complex antennas and antenna systems than were possible in the seventies.

We have seen the growth of antenna technology from the design and manufacture of isolated antenna elements to complex antenna systems where interactions between the antenna and its environment dominate performance.

Much has been achieved and antenna technology in South Africa is on a par with the best in the world. However, we should remember those earlier events which picked up speed some 35 years ago and set the scene for where we are today.

Those were extraordinary and wonderful times to be a young engineer – many of us here today are privileged to have been part of it.

JOHN D KRAUS

28 June 1910 – 18 July 2004

To my professor, mentor, fellow engineer and friend.

Thank you for showing me the value of empirical and observational research and hands-on innovation.