



15-17 AUGUST 2022
FÅRÖ

Nordic HF Conference

Fårö Kursgård, Fårö

Programme



THE NATIONAL COMMITTEE
FOR RADIO SCIENCE
THE ROYAL SWEDISH ACADEMY OF SCIENCES



It is a great pleasure to again welcome all participants to HF 22, the 13th Nordic Conference on HF Communications. With this conference, we celebrate the 13th consecutive event.

In retrospective, both the conferences and the technology reflected in the papers, presentations and exhibitions have changed markedly during the three decades that have passed since 1986.

With a bit more than 20 years in the HF-business I have had the pleasure to experience a vast change in HF systems technology during these years, from morse code operation and binary FSK to wideband HF and IP integration. Although the commercial use of HF has declined over this time the usage in my field of work, the military usage, has prevailed and even increased. The need for secure communications in a contested electromagnetic environment has become very apparent and HF-communications is an important capability in this aspect.

The unique features of HF: the robustness, the resilience and the ability to work without the dependency on other infrastructure have shown its value in crisis situations. These features together with the continuous strive to make HF a communication asset seamlessly integrated into our information systems make a bright future for HF. The 90s gave us the serial tone modem, the standardized ARQ protocols, the years from 2000 we saw the IP integration picking up speed, in the past 5-10 years we have experienced the move towards wideband HF. It is certainly interesting what will be behind the next corner for HF. Nordic HF is one of the forums where we have a chance to look around the next corner.

Like previous conferences HF 22 promises to be a success with many interesting presentations of new developments and equipment. The aim of the conference is also to provide a meeting-place for discussions among colleagues on the interesting and stimulating field of HF communications. HF 22 is planned to provide ample time for contacts and informal meetings among the participants. We strongly encourage all to take advantage of these opportunities to meet old as well as new colleagues and friends - informal networks of personal relations are indeed important factors in the advancement of HF technology!

As before, the conference takes place at the Training Camp on Fårö north of Gotland in the Baltic Sea. We trust that the unique surroundings, pleasant climate and the company of old and new friends at the conference will, once again, help to create a friendly atmosphere and a memorable week for the participants and their families.

As usual, the topics of the papers submitted to the current conference show a great diversity, ranging from theoretical analysis to "hands-on" practical experiences. The current conference has a very varied composition covering a lot of the HF aspects. I am very pleased to see that we manage to maintain diversity in the origins of the papers. There are authors from industry, government agencies, university and the user community. This is an important factor for the valuable information exchange at the conference. HF 22 is, as usual, an international conference with English as the official language. The programme offers a substantial number of papers divided into a total of eight sessions, covering most aspects of HF.

The Committees wish to express their sincere thanks to:

Union Radio-Scientifique Internationale (URSI), Swedish National Committee of URSI (SNRV), Nordic Radio Society foundation (NRS), Swedish Defence Materiel Administration (FMV), Combitech AB and others that have provided valuable assistance in the HF 22 organisation.

Finally, we are also deeply indebted to all authors and presenters who have provided the core substance of the conference.

Rickard Berg
Editor
Chairman of the HF 22 Programme Committee

SNRV - Swedish National Committee of URSI

SNRV was founded in 1931 as the Swedish National Committee of the International Union of Radio Science (URSI). There are corresponding committees in the other Nordic countries.

SNRV has 20 full members and in addition 2 honorary and about 120 co-opted members. The objective of SNRV is to encourage and promote education, research and development in the radio field. The SNRV is organised in sections in the same way as the URSI Commissions:

- A Electromagnetic Metrology
- F Wave Propagation and Remote Sensing
- B Fields and Waves
- G Ionospheric Radio and Propagation
- C Radiocommunication Systems and Signal processing
- H Waves in Plasmas
- D Electronics and Photonics
- J Radio Astronomy
- E Electromagnetic Environment and Interference
- K Electromagnetics in Biology and Medicine

SNRV and URSI are also in charge of arranging national and international conferences to spread scientific results and to make the radio scientific field a subject of debate.

NRS - Nordic Radio Society

The Nordic Radio Society is a foundation co-operating with SNRV to contribute to the development and increase of the radio technical competence by arranging or initiating various activities within the radio field. Its short form NRS was taken when arranging and sponsoring the Nordic Radio Symposium in 1986 in Saltsjöbaden, Sweden. Six other Nordic Radio Symposia followed: 1989 (Saltsjöbaden), 1992 (Aalborg, Denmark), 1995 (Saltsjöbaden), 1998 (Saltsjöbaden), 2001 (Nynäshamn), and 2004 (Oulu, Finland).

NRS has been active in the arrangement of the Nordic HF conferences at Fårö every 3rd year since 1992.

NRS has also held a number of Seminars on special radio themes for a limited number of participants. Moreover, also Evening Meetings with invited guest on radio topics.

NRS is thus a forum for contacts and exchange of information between experts, scientists, technicians and people engaged in development. The Nordic Radio Society works for the exchange of knowledge between different technical disciplines and between universities and the radio industry.

The members of NRS represent SNRV, radio industry, consultants, defence and universities see: www.nrs.se.

Mats Nilson
Chairman NRS



RECEPTION DESK

The HF 22 reception is open 15:00 – 22:00 on Sunday and 07:30 – 17:00 on Monday to Wednesday.

MEALS

All meals are served in the restaurant building.

Morning and afternoon coffee/tea is served in the exhibition area (for family members in the pub). For excursions, family members may make a lunch package at breakfast.

Breakfast	07:00 – 09:30	
Coffee/tea	09:45 – 10:15	
Lunch	11:30 – 13:00	
Coffee/tea	15:00 – 15:30	
Dinner	17:00 – 18:30	On Tuesday the conference dinner will begin at 19:00. “Dricka” (Gotland drinks) will be served from 18:00.

Food preferences have been sent to the restaurant manager. Vegetarian food will be available; the Bavarian buffet will have beef, pork and lamb sausages. As a safety measure, you may approach the reception or a hostess to check that issue.

INTERNET ACCESS

E-mail and browsing facilities are available over the free wireless network. No password is required.

DOCUMENTATION

Proceedings of HF 22 is provided as a paperback volume and on CD. Proceedings on CD from earlier conferences is available for purchase. A few weeks after the conference a CD with all conference proceedings will be available for purchase on the web site. There will be “print on demand” facilities at the venue. Our website will list titles and authors of all papers for Internet search and access to the topics.

AMATEUR RADIO STATION

SL1HF is situated behind Lambgiftet lodge. Station managers are Karl-Arne Markström, SM0AOM and Olov Carlsson, SM7EXE. Please log all QSOs accurately and write the SL1HF QSL card for every QSO. Cards are provided in the radio shack.

EXTENDED STAY AND FAMILY ACCOMMODATION

The camp office is ready to receive your payment for extra accommodation; please pay not later than Monday afternoon.

COVID-19 PRECAUTIONS

Unfortunately, the pandemic is not entirely over. All participants are therefore requested to still observe any relevant precautions in order to limit the possible spread of the disease. Should you become ill during the conference, please contact the camp staff who can assist with contacting local medical facilities.

TIMINGS

General timings including social activities are on the next page with the conference programme on subsequent pages.

SUNDAY

17:00 – 22:00 Bavarian buffet, sponsored by Rohde & Schwarz.

19:00 – 24:00 The pub is open.

MONDAY

07:30 Morning music (Täby Spa Octet)

07:45 Please gather on the parade grounds for the flag ceremony and official conference opening.

08:00 The flag is raised.

15:30 – 17:00 Sightseeing tour on Fårö; buses leave from the garage yard.

19:00 HF 22 concert in Fårö Church (short walk from the camp). Frey Franzén from Gotland on violin and Polina Pohzha, Ukrainian pianist, singer and composer who came to Gotland in spring 2022.

20:00 Exhibitors' party in the exhibition area

19:00 – 24:00 The pub is open.

TUESDAY

15:30 – 18:00 Foxhunt (Amateur Radio Direction Finding); please assemble in the auditorium.

18:00 “Dricka” (Gotland drinks) served just outside the restaurant and pub area.

19:00 Conference dinner. In a convenient break we will have a concert by Gotland band De Lyttas Kapell led by Johan Seige and prize award for the foxhunt.

19:00 – 24:00 The pub is open.

N.B. Swedish alcohol rules state that the “Dricka” must not enter the restaurant and pub area including the terraces. And wines etc must not exit that area.

WEDNESDAY

13:45 Bus shuttle leaves for Visby airport (ETA 15:00) and ferry terminal (ETA 15:30). Other transportation can be arranged by your own initiatives – plenty of private cars will leave after lunch.

EXHIBITORS (at printing deadline)

Promarine Ltd

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SESSION PROGRAMME AND CONTENTS

Monday 08:00 – 10:00

EMC AND MONITORING		Jürgen Escher	Page
Ben A. Witvliet	Ambient outdoor electromagnetic noise measurements in the conflicting perspective of spectrum planners and spectrum users		1.1
Lars Weberg	Green power for HF in the field – A possibility?		1.2
Anders Svensson and Leif Johansson	SDR for strategic COMINT applications		1.3
Johan Lundqvist	A MUSIC subspace algorithm applied to a legacy 3-channel Watson-Watt short wave DF system		1.4

Monday 10:30 – 12:00

LINK ESTABLISHMENT		Danie van Wyk	Page
Alfons Sailer, Jürgen Escher and Yehuda Eder	Direct sampling HF radio for next generation link setup “staring ALE”		2.1
Steve Kille	Not using ALE for frequency selection		2.2
Rickard Berg, Kennert Andersson and Håkan Bergzén	Can staring ALE become a game changer in HF military broadcast		2.3

Monday 13:30 – 15:00

TRIALS, PERFORMANCE AND USER SCENARIOS		Rolf Gustavsson	Page
Karl-Arne Markström	A generalised approach for performance evaluation of HF systems		3.1
Jean-Yves Bernier, Bertrand Ravera and Catherine Lamy-Bergot	HF-XL airborne trials over the Atlantic		3.2
William M. Batts, William N. Furman and John W. Nieto	A comparison of wideband high frequency data link protocol performance		3.3

Tuesday 08:00 – 10:00**Page****EQUIPMENT****Harald Wickenhäuser**

Arnie Johansen	An alternative approach to HF receiver architectures	4.1
Nathalie Haziza and Jean-Yves Bernier	HF Red-Pitaya-based experimentation platform	4.2
Karl-Arne Markström	Rise and fall of a major HF supplier – Standard Radio & Telefon AB	4.3

Tuesday 10:30 – 12:00**SYSTEMS AND TECHNIQUES****Sue Trinder****Page**

Germano Capela and Eduardo Bolas	Systems engineering challenges for future NATO HF capability deployment	5.1
Jens Zander	Multi-band channel aggregation in meshed wideband HF radio networks – Implementation aspects	5.2
Jouni Salmi	Multihop functionality in cognitive networked HF system	5.3

Tuesday 13:30 – 15:00**PROPAGATION****Olov Carlsson****Page**

Ben A. Witvliet	Near Vertical Incidence Skywave – The propagation mechanism, the impact of antenna, backscatter and solar flares	6.1
Christopher Jeffery	Development of a new HF tool that tracks covariance information for propagation studies through disturbed ionospheres	6.2
William N. Furman, Richard Buckley and Ryan Seeber	Application of machine learning techniques to HF propagation prediction and deployment considerations in tactical HF radios	6.3

Wednesday 08:00 – 10:00**Page****MODULATION AND CODING****Jens Zander**

Brandon T. Hunt, David B. Haab, Thomas Cameron Sego, Tom V. Holschuh, Hussein Moradi and Behrouz Farhang- Boroujeny	Evaluation and comparison of a new robust waveform against direct sequence spread spectrum for HF	7.1
Mark Jorgenson	Robust HF waveforms: Maintaining communications in challenging conditions	7.2
John W. Nieto, William N. Furman and William M. Batts	A comparison of published waveform design techniques used for reliable HF communications	7.3
Danie van Wyk, Riekert Jansen van Vuuren, Louis van der Westhuizen and Paul Zietsman	Performance of WB-RDL with 4G-ALE (WALE) for wideband HF radio systems	7.4

Wednesday 10:30 – 12:00**ANTENNAS****Karl-Arne Markström****Page**

Harald Wickenhäuser	Vertical antennas, an “old hat”?	8.1
Sambhav Malhotra and Jens Zander	Portable/rapid deployment HF antennas for multi-band channel aggregation systems	8.2

LIST OF AUTHORS

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William M. Batts	L3Harris Technologies, USA	3.3, 7.3
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SPONSORS (at printing deadline)

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Welcome dinner, Umbrellas



www.elbitsystems.com

Conference Banquet



www.combitech.se

Conference bags



www.amtelecommunication.se

Pens



www.comrod.com



www.novatorsolutions.com

Concert during banquet



www.w5solutions.com



www.l3harris.com

Conference Proceedings printing

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