

Barry J. Shelley, N1VXY
Publisher

Becky R. Schoenfeld, W1BXY
Editorial Director

Jen Glifort, KC1KNL
Senior Editor

Caroline Kenney
Meghan Reilly
Leanna Zwiebel
Assistant Editors

Bart Jahnke, W9JJ
Radiosport & Field Services
Manager

Rick Lindquist, N1RL
Happenings

Bob Allison, WB1GCM
Product Review Lab Testing

Steve Ford, WB8IMY
Mark J. Wilson, K1RO
Al Brogdon, W1AB
Bernie McClenny, W3UR
H. Ward Silver, N0AX
Paul Wade, W1GHZ
Jon Jones, N0JK
Rick Palm, K1CE
Joel R. Hallas, W1ZR
Barry Shackelford, W6YE
Kai Siwiak, KE4PT
Bruce Draper, AA5B
Contributing Editors

Michelle Bloom, WB1ENT
Production Supervisor

Jodi Morin, KA1JPA
Assistant Production Supervisor

Maty Weinberg, KB1EIB
Production Coordinator

David Pingree, N1NAS
Senior Technical Illustrator

Janet Rocco, W1JLR
Advertising Sales Manager

Bob Inderbitzen, NQ1R
Product Development Manager

Yvette Vinci, KC1AIM
Marketing and Sales Manager

Steve Ewald, WV1X
Field Organization Supervisor

Eric Casey, KC2ERC
Convention and Event Coordinator

- 9 Second Century**
Ham Radio Lives in You
- 30 Build a DSP Audio Filter**
Steve Allen, KZ4TN
- 34 Exploring Radio Mathematics**
Dave Casler, KE0OG
- 38 Military Mast Problems and Solutions**
Bob Dixon, W8ERD
- 42 Product Review**
Mark Wilson, K1RO
R Finder B1 Dual-Band DMR/FM Transceiver with Android Smartphone; Koolertron Dual-Channel DDS Signal Generator; Dr.Duino Pioneer Edition Arduino Project Kit
- 57 Mini DXpeditions on a Cruise with MARCO**
Jay Garlitz, AA4FL
- 60 The State of Ham Radio in Japan**
Ryota "Roy" Motobayashi, AC6IM
- 63 Science Fair Adventures in Ham Radio**
Roy Gross, KM6EOO
- 66 The QSO Today Virtual Ham Expo**
Bob Inderbitzen, NQ1R
- 68 ARRL Seeks Nominations for the 2020 Bill Leonard Award**
- 75 Frequency Measuring Test — November 2020**
Ward Silver, N0AX
- 76 The 2020 ARRL 10-Meter Contest**
- 76 The December 2020 ARRL Rookie Roundup — CW**
- 77 The 2020 ARRL 160-Meter Contest**
- 88 A Look Back — January 1971**



Columns

At the Foundation	77
Celebrating Our Legacy.....	95
Classic Radio.....	93
Contest Corral	74
Correspondence.....	24
The Doctor is In	53
Eclectic Technology	41
Happenings	69
Hints & Hacks	55
How's DX?	78
Member Spotlight	13
Public Service.....	72
The World Above 50 MHz.....	80
Up Front.....	20
100, 50, and 25 Years Ago.....	96

Digital and Mobile Editions

ARRL members can access the digital edition via a link at www.arrl.org/qst, download our iOS app from the iTunes Store, and download our Android app from the Google Play Store.



Departments

Amateur Radio Band Chart	82
ARRL Section Managers.....	16
Certificate of Code Proficiency Recipients	86
Feedback	56
Convention and Hamfest Calendar.....	85
Field Organization Reports.....	73
Guide to ARRL Member Benefits	14
Ham Ads.....	124
Index of Advertisers.....	126
Officers, Division Directors, and Staff.....	15
QST Cover Plaque Award.....	33
Strays.....	94
Silent Keys.....	97
Special Event Stations.....	83
This Month in QEX	79
W1AW Qualifying Runs	86
W1AW Schedule.....	87
W1AW's QSL File	28

Write for QST

www.arrl.org/qst-author-guide
email: qst@arrl.org



Our Cover

As the weather grows colder and hams prepare for winter, many find themselves dreaming of the perfect DX experience — whether that means taking their gear and some friends on a DXpedition to a far-off place or finally managing to log that rare entity from home. Spark your DX dreams by reading about “Mini DXpeditions on a Cruise with MARCO,” by Jay Garlitz, AA4FL, on page 57 of this issue. [Jay Garlitz, AA4FL, photo]

QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, Inc., 225 Main St., Newington, CT 06111-1400, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices.

POSTMASTER: Send address changes to: QST, 225 Main St., Newington, CT 06111-1400, USA. Canada Post: Publications Mail Agreement #90-0901437. Canada returns to be sent to IMEX Global Solutions, 1501 Morse Ave., Elk Grove Village, IL 60007.

US & Possessions: Membership in the ARRL, including a 1-year subscription to QST, is available to individuals at \$49. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of \$25. Life Membership, including a subscription to QST is available at \$1,225.* Membership includes \$21 per year for subscription to QST. Membership and QST cannot be separated. Libraries and institutions, \$49 per year. Single copies \$6.95.

International

To compensate for additional postage for mailing outside the US, the following rates apply:

Canada: Membership in the ARRL, including a 1-year subscription to QST, \$62, payable in US funds. Life Membership, including a subscription to QST is available at \$1,550.* Libraries and institutions, \$62 per year.

All Other Countries: Membership in the ARRL, including a 1-year subscription to QST, \$76, payable in US funds. Life Membership, including a subscription to QST, is available at \$1,900.* Libraries and institutions, \$76 per year.

Membership without QST is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for \$10 per year.

Foreign remittances should be by international postal or express money order or bank draft negotiable in the US and for an equivalent amount in US funds.

Membership in the ARRL, including a 1-year subscription to Digital QST only, is available to Canadian and International members at \$49.

Copyright © 2020 by the American Radio Relay League Inc. Title registered at the US Patent Office. International copyright secured. All rights reserved. Quedan reservados todos los derechos. Printed in the USA.

QST®, DXCC®, VUCC®, DX Century Club®, ARES®, Amateur Radio Emergency Service®, Logbook of The World®, LoTW®, and ARRL, the national association for Amateur Radio® are registered trademarks of the American Radio Relay League, Inc.

The ARRL and QST in no way warrant the products described or reviewed herein.

QST is available to blind and physically handicapped individuals from the Library of Congress, National Library Service for the Blind and Physically Handicapped. Call 1-800-424-8567 or go to www.loc.gov/nls/.

Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421.

*Payment arrangements available. Please write for details.

In order to ensure prompt delivery, we ask that you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department at circulation@arrl.org or **860-594-0200** immediately. Thank you for your assistance.

Reprints and permissions:
permission@arrl.org

Details of our Online Privacy Policy can be found at www.arrl.org/online-privacy-policy.

Telephone: **860-594-0200**
Fax: **860-594-0259**