

**Howard E. Michel, WB2ITX**  
Publisher

**Steve Ford, WB8IMY**  
Editor

**Becky R. Schoenfeld, W1BXY**  
Managing Editor

**Jen Giffort, KC1KNL**  
**Caroline Kenney**  
**Allison McLellan**  
Assistant Editors

**Bart Jahnke, W9JJ**  
Radiosport & Field Services  
Manager

**Rick Lindquist, WW1ME**  
*Happenings*

**Bob Allison, WB1GCM**  
*Product Review Lab Testing*

**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

**Sue Fagan, KB1OKW**  
Graphic Design Supervisor

**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

**Diane Szlachetka, KB1OKV**  
Advertising Graphics Designer

**Steve Ewald, WV1X**  
Field Organization Supervisor

**Eric Casey, KC2ERC**  
Convention and Event Coordinator

**9** **Second Century**  
Embracing Change in the Shack

**30** **Recreate or Modify PCB Layouts with Open-Source Software**  
Dr. Erich S. Heinzle, VK5HSE

**36** **Build a Digital Voice Keyer Using Readily Available Software**  
Jim Kauffman, W4IU

**38** **Optimizing Propagation on 630 and 2200 Meters**  
Robert S. Logan, NZ5A

**44** **Product Review**  
**Mark Wilson, K1RO**  
QRP Labs QCX CW Transceiver Kit;  
NEX-GEN XD4 Portable Spot II; HeckKits LC  
Meter Kit; PCBgogo Prototype Printed  
Circuit Boards



**62** **DXpedition to Historic  
Tabarca Island**  
Eliodor Tanislav, YO3AAS

**65** **A Pilgrimage to Mount Athos**  
Peter P. Vekinis, LX1QF/KH6VP/SV0GV

**68** **Team Exuberance Energizes Young Hams**  
Allison McLellan

**71** **Airborne Antenna Inspection**  
James Hull, KK4EOU

**72** **The 2019 ARRL National Convention at Dayton Hamvention®**  
Allison McLellan

**85** **The Hiram Percy Maxim 150th Birthday Celebration  
Operating Event**

**86** **2019 ARRL International DX CW Contest Results**  
Charlie Carroll, K1XX

**88** **2019 ARRL RTTY Roundup Results**  
Jeff Stai, WK6I

**90** **The 2019 ARRL International EME Competition**

**90** **The 2019 ARRL September VHF Contest**

**91** **The 2019 ARRL 10 GHz and Up Contest**

## Columns

Classic Radio.....	82
Close Up.....	59
Contest Corral.....	84
Correspondence.....	24
The Doctor is In.....	56
Eclectic Technology.....	58
Happenings.....	76
Hints & Hacks.....	60
How's DX?.....	92
Member Spotlight.....	13
Public Service.....	80
Social Media Snapshot.....	28
Up Front.....	20
The World Above 50 MHz.....	94
100, 50, and 25 Years Ago.....	102

## Digital and Mobile Editions

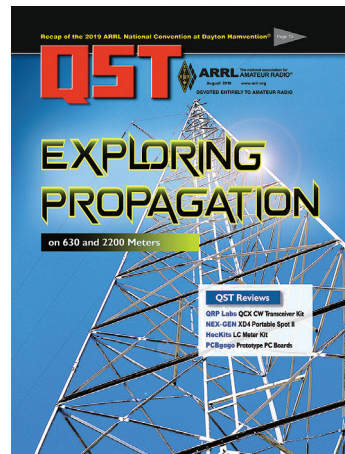
ARRL members can access the digital edition via a link at [www.arrl.org/qst](http://www.arrl.org/qst), download our iOS app from the iTunes Store, and download our Android app from the Google Play Store.

## Departments

Amateur Radio Band Chart.....	101
ARRL Member Benefits.....	14
ARRL Section Managers.....	16
Certificate of Code Proficiency Recipients.....	98
Convention and Hamfest Calendar.....	99
Feedback.....	61
Field Organization Reports.....	102
Ham Ads.....	140
Index of Advertisers.....	142, 143
New Products.....	57
Officers, Division Directors, and Staff.....	15
QuickStats.....	130
Silent Keys.....	103
Special Event Stations.....	96
Strays.....	83, 97, 100
This Month in QEX.....	35
W1AW Qualifying Runs.....	98
W1AW Schedule.....	91

## Interested in Writing for QST?

[www.arrl.org/qst-author-guide](http://www.arrl.org/qst-author-guide)  
email: [qst@arrl.org](mailto:qst@arrl.org)



## Our Cover

Robert S. Logan, NZ5A, studied signals from nondirectional beacon antennas (NDBs), like this one in Australia, to find out how to improve his own station's performance on two of Amateur Radio's newest bands. Learn more in his article, "Optimizing Propagation on 630 and 2200 Meters," on page 38 of this issue. [Australian Air Services, 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 © 2019 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/](http://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](mailto:circulation@arrl.org) or 860-594-0200 immediately. Thank you for your assistance.

Reprints and permissions:

[permission@arrl.org](mailto:permission@arrl.org)

Details of our Online Privacy Policy

can be found at

[www.arrl.org/online-privacy-policy](http://www.arrl.org/online-privacy-policy).

Telephone: 860-594-0200

Fax: 860-594-0259