

David A. Minster, NA2AA
Publisher

Becky R. Schoenfeld, W1BXY
Editorial Director

Jen Glifort, KC1KNL
Senior Editor

Caroline Kenney
Leanna Zwiebel
Assistant Editors

Bart Jahnke, W9JJ
Radiosport & Regulatory
Affairs Manager

Rick Lindquist, WW1ME
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
Dave Casler, KE0OG
Paul Wade, W1GHZ
Jon Jones, N0JK
Rick Palm, K1CE
Joel R. Hallas, W1ZR
Barry Shackelford, W6YE
Kai Siwiak, KE4PT
Bruce Draper, AA5B
Phil Salas, AD5X
John Stanley, K4ERO
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 Manage

Steve Ewald, WV1X
Field Organization Supervisor

9 **Second Century**
Out of the Darkness, Into the Light

30 **Using WSJT-X to Graph Radio Frequency Stability**
Michael Foerster, W0IH

33 **A Simple, Adaptable AGC Circuit for the Simple High-Frequency Communications Receiver**
James Forkin, WA3TFS

36 **The Tin-Can Tower Vertical**
Hiroki Kato, AH6CY

38 **Product Review**
Mark Wilson, K1RO
Lab599 Discovery TX-500 160 – 6 Meter Portable Transceiver; BridgeCom Systems SkyBridge Plus Dual-Band Digital Hotspot; Intuitive Circuits DTMF-8 Decoder Board



55 **Ham Radio Creates a Planet-Sized Space Weather Sensor Network**
Kristina Collins, KD8OXT; David Kazdan, AD8Y, and Nathaniel A. Frissell, W2NAF

59 **Tips for Earning Nine-Band DXCC**
Christian Bravo, W4ALF

62 **Anatomy of a Special Event Station**
Chris Brady, N3CB

72 **2021 ARRL International DX CW Contest Results**
Mark Beckwith, N5OT

74 **2021 ARRL RTTY Roundup Results**
Jeff Stai, WK6I

76 **The 2021 ARRL September VHF Contest**

76 **The 2021 ARRL 10 GHz and Up Contest**

78 **The 2021 ARRL International EME Competition**

87 **A Look Back — October 1971**

Columns

Ask Dave	50
Celebrating Our Legacy.....	95
Classic Radio.....	93
Contest Corral	71
Correspondence.....	24
Eclectic Technology	54
Happenings	65
Hints & Hacks	52
How's DX?	77
Member Spotlight	13
Public Service.....	69
The World Above 50 MHz.....	79
Up Front.....	20
100, 50, and 25 Years Ago.....	96

Departments

ARRL Section Managers.....	16
Certificate of Code Proficiency Recipients.....	83
Convention and Hamfest Calendar.....	84
Field Organization Reports.....	70
Guide to ARRL Member Benefits	14
Ham Ads	124
Index of Advertisers.....	126, 127
Life Members	85
Officers, Division Directors, and Staff.....	15
QST Cover Plaque Award.....	35
Silent Keys.....	97
Special Event Stations.....	81
This Month in QEX	82
Volunteer Monitor Program Report.....	85
W1AW Qualifying Runs	83
W1AW Schedule.....	86
W1AW's QSL File	28



Our Cover

Hiroki Kato's, AH6CY, coffee-can vertical antenna isn't the only example of ham ingenuity you'll find in this issue, though it might be the most inventive! In this month's technical section, Michael Foerster, W0IH, shows you how to use *WSJT-X* to check your frequency calibration, and James Forkin, WA3TFS, revisits his May 2020 *QST* receiver project to add an AGC circuit. [Hiroki Kato, AH6CY, photo]

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.

Write for QST

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



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

Copyright © 2021 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.

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**