

SCIENTIFIC AMERICAN PRESENTS

EXTREME ENGINEERING

Volume 10, Number 4, Winter 1999

CONTENTS

8 ENGINEERING AT THE EDGE OF THE POSSIBLE

For millennia, engineers have pushed the limits of human ingenuity. Here are some of their all-time greatest achievements.

The Big, The Small

14 MIGHTY MONOLITH

John J. Kosowatz

China builds the world's largest dam.

24 SOME ASSEMBLY REQUIRED

Sasha Nemecek

How to fabricate things atom by atom.

28 BUILDING GARGANTUAN SOFTWARE

Eva Freeman

4,000 programmers do Windows 2000.

32 LIFE IN SPACE

Tim Beardsley

The biggest space station takes shape.

34 A SMALL WORLD

David Voss

Labs-on-chips become reality.

38 BRINGING BACK THE BARRIER

Marguerite Holloway


Louisiana rebuilds its vast wetlands.

ABOUT THE COVER: The Citicorp Center, New York City (915 ft). Photograph by Norman McGrath.

Scientific American Presents (ISSN 1048-0943), Volume 10, Number 4, Winter 1999, published quarterly by Scientific American, Inc., 415 Madison Avenue, New York, NY 10017-1111. Copyright © 1999 by Scientific American, Inc. All rights reserved. No part of this issue may be reproduced by any mechanical, photographic or electronic process, or in the form of a phonographic recording, nor may it be stored in a retrieval system, transmitted or otherwise copied for public or private use without written permission of the publisher. Periodicals Publication Rate. Postage paid at New York, N.Y., and at additional mailing offices. Canadian BN No. 127387652RT; QST No. Q1015332537. Subscription rates: one year \$19.80 (outside U.S. \$23.80). To purchase additional quantities: 1 to 9 copies: U.S. \$6.95 each plus \$2.00 per copy for postage and handling (outside U.S. \$5.00 P&H); 10 to 49 copies: U.S. \$6.25 each, postpaid; 50 copies or more: U.S. \$5.55 each, postpaid. Send payment to Scientific American, Dept. SAQ, 415 Madison Avenue, New York, NY 10017-1111. Postmaster: Send address changes to Scientific American Presents, Box 5063, Harlan, IA 51593. Subscription inquiries: U.S. and Canada (800) 333-1199; other (515) 247-7631. Copyright 1999 Scientific American, Inc.

PHOTOGRAPH BY IAN LAMBOT





The Bank of China Tower,
Hong Kong (1,209 ft)

The Powerful, The Strong, The Fast

- 42** SEVEN WONDERS OF MODERN ASTRONOMY
George Musser
The most amazing telescopes and how they work.
- 50** A BRIDGE TO A COMPOSITE FUTURE
Jessa Netting
Can a bridge made of glass and carbon support four lanes of traffic?
- 52** SUBTERRANEAN SPEED RECORD
Sasha Nemecek
CERN builds the biggest—and fastest—particle accelerator ever.
- 56** BLITZING BITS
W. Wayt Gibbs
Supercomputers aim for petaflops—a quadrillion floating-point operations per second.
- 62** HARDER THAN ROCKET SCIENCE
Ken Howard
The story of one NASA engineer's decades-long quest to fly at Mach 20.
-

The Tall, The Deep, The Long

- 66** THE SKY'S THE LIMIT
Alden M. Hayashi
Superskyscrapers stretch toward new heights. How high can they go?
- 73** TO THE BOTTOM OF THE SEA
José M. Roesset
The oil industry may soon build offshore platforms in more than a mile of water.
- 78** DESIGNER GENOMES
Karen Hopkin
Unraveling the human genome is nothing; scientists say it is now possible to design novel life-forms.
- 82** BRIDGING BORDERS IN SCANDINAVIA
Peter Lundhus
A new bridge, tunnel and artificial island will soon link Denmark and Sweden.
-
- 90** THE GREATEST PROJECTS NEVER BUILT
An essay by Mark Alpert
- 94** THE HUBRIS OF EXTREME ENGINEERING
An essay by Henry Petroski