HISTORY OF UNDERSEA TELECOMMUNICATIONS TECHNOLOGY

Dr. Ronald J. Rapp and Ms. Marsha A. Spalding
Tyco Telecommunications (US) Inc.

In this paper we review the history and the evolution of the technologies enabling the design, manufacture, installation, operation and maintenance of undersea telecommunication cables deployed around the globe. We highlight pivotal historical events, and also focus on developments in cable transmission media and characteristics, materials for robust handling and optimal subsea performance, and advancements in ships, cable handling equipment, and marine tools used to deploy and maintain these systems.

We trace this evolution from the first telegraph cables installed in Europe in the 1840s-1850s; to the first transatlantic cables installed in the 1850s-1860s carrying 2 to 8 words per minute; through TAT-1, installed in 1956, which carried 36 voice circuits. The breakthrough of fiberoptics in transmission signal technology led to the first transoceanic optical undersea cable in 1988, TAT-8, which carried 0.5 Gb/s, the equivalent of 8000 voice channels. The technological development of optical amplification, which enabled a signal rate-independent transmission medium, was implemented in the mid-1990s, first in TPC-5 across the Pacific and later in TAT-12/13, across the Atlantic. These were the first fiber optic cable systems employing Erbium Doped Fiber Amplifiers (EDFA); they operated at 5 Gb/s with two STM-64 channels on each fiber pair. Further technological advancements allowed the application of Dense Wave-Division Multiplexing (DWDM), a transmission technique initially implemented in shorter terrestrial fiberoptic systems, to be deployed over the long distances required for undersea telecommunications. These multichannel systems utilize many closely-spaced wavelengths transmitted and amplified on a single optical fiber, increasing capacities by 100-fold, allowing for multi-Terabit capacity systems.

We describe how technical challenges have evolved and have been managed on ultra-long haul systems. We also discuss the evolution of marine tools used to deploy and maintain undersea systems. Finally, we describe how these undersea telecommunication technologies have been adapted to initiatives in scientific observation, oil and gas platform connectively, and harbor security.

978-1-4244-2620-1/08/$25.00 ©2008 IEEE