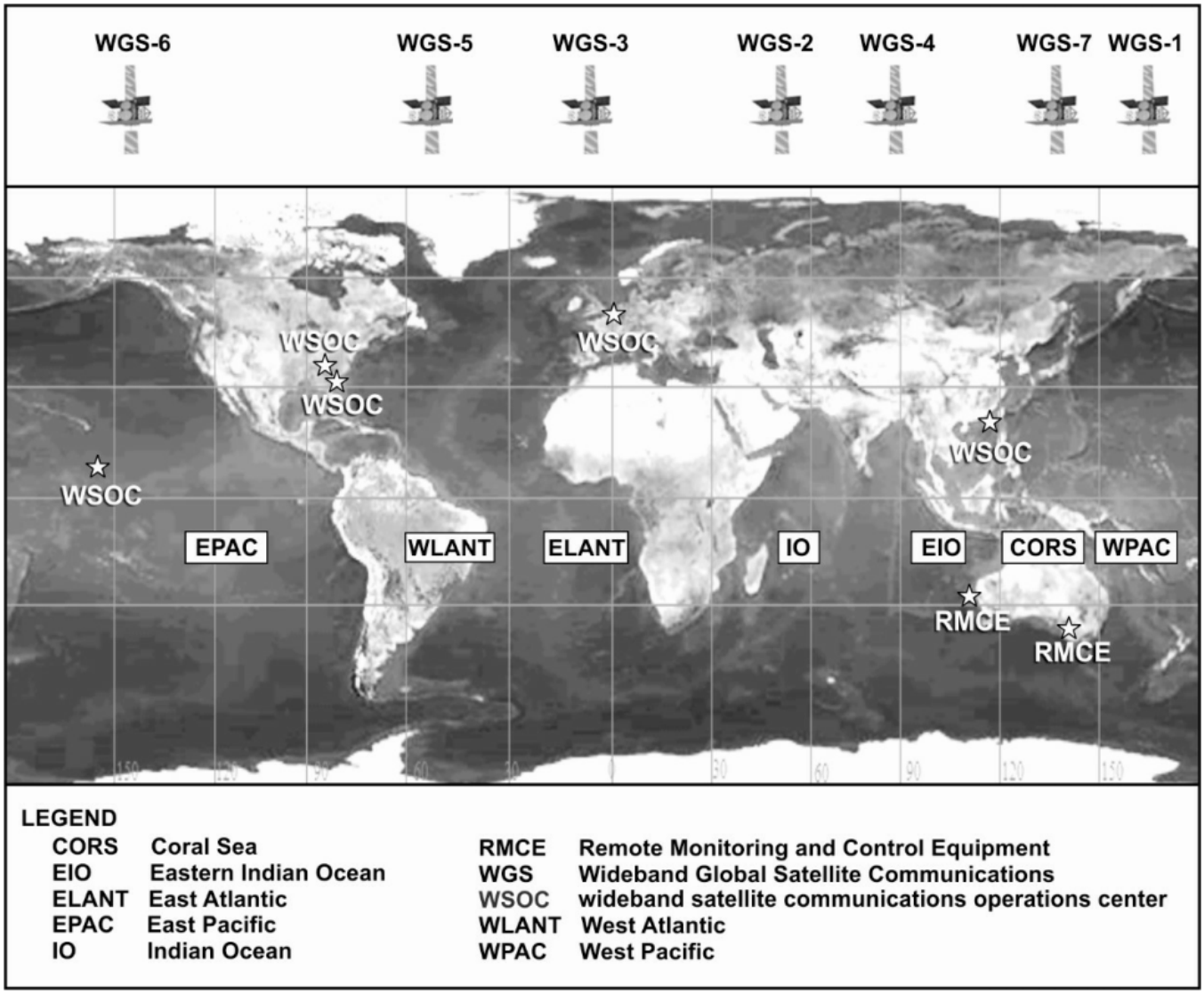
Today's era for long-range HF communications is the result of recent advances in radio and Digital Signal Processing (DSP) technology. HF radio is no longer limited to those slow traditional 9,600 bps data rates mentioned above. Modernized PSK systems can deliver rates up to 240,000 bps on a 48 kHz wide channel, allowing the same levels of data transmission speeds, quality and security of a narrow-band SATCOM system - particularly useful for more robust communications in hostile environments. These WBHF waveforms - a "very wide" PSK aggregate indeed, preceded by a pilot tone - can be easily identified on a wide-band sonagram: see page 25. Typical bandwidths are 12, 24 and 48 kHz. Most of these communication systems are military. The Australian Defence Force recently transmitted high-quality still images and video via internet protocol (IP) over a state-of-the art wideband PSK HF radio link between the RAAF base at Townsville and the RAAF base at Wagga! See *https://news.defence.gov.au/media/media-releases/australian-defence-force-trials-new-data-transfer-technology* for details.

With the rise of Communist China, and the Russian Federation trying to resume superpower status in the 21st century, we're now witnessing the Second Global Cold War. SATCOM is increasingly vulnerable from jamming, and from potential total failure as a result of attacks on spacecraft or through the use of anti-satellite surface-to-air missiles.



NATO wideband global military SATCOM coverage areas

While uplink jamming (UJ) - i.e. corrupting the signal transmitted from a ground station to the satellite - is able to degrade the satellite's signal for all of its users, downlink jamming (DJ) has a localized effect since it blocks transmissions from the satellite to certain terrestrial receivers only. Logically, UJ requires a much more powerful signal in order to reach the satellite's transponders. The point is that today, powerful SATCOM jamming tools are increasingly inexpensive ... A pretty interesting summary of Chinese and Russian activities in this field, entitled "Challenges to Security in Space", can be found at *www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Space_Threat_V14_020119_sm.pdf* .

NATO is significantly dependent on SATCOM for the planning and execution of operations. Members and partner forces are suffering from a disruption of SATCOM, particularly along the alliance's eastern flank where Russian armed forces continue to conduct electronic warfare. By consequence, there is a widespread comeback of HF in local and global communications. Says C4ISRNET on 22 September 2020, in a paper titled "The military renaissance in high frequency communications" at *www.c4isrnet.com/battlefield-tech/it-networks/2020/09/22/the-military-renaissance-in-high-frequency-communications*: "In an online presentation to the Association of Old Crows on 6 August 2020, Paul Denisowski, product management engineer at Rohde & Schwarz North America, described how communications satellites are vulnerable to antisatellite systems as well as ground-, air- and space-based 'kill vehicles'. China, Russia and the USA have all carried out anti-satellite (ASAT) tests, and many other countries are developing ASAT capabilities."

2.8 Equipment

We could write another volume the size of the book in hand to tell you stories about our experience with radio monitoring equipment during the past five decades. Furthermore, we could tell you what we use now and advise you to buy exactly the same configuration and you would be satisfied with it. Really? Apart from the fact that equipment manufacturers would certainly not like us to proceed in this way - because every manufacturer is convinced that just his gear is the best available - your needs will be at least slightly different from ours. While one user of the book in hand sits in his "radio shack" and reads fascinating digital data messages, the next one sails around the world on his yacht and relies on us for the latest radiofax and radiotelex schedules in order to get his selected wave height prognosis chart. The third one is the chief of the monitoring service of a major country who is overequipped with the most expensive gear available on the professional market, but as he does not know how to operate it the results are miserable ...

According to the situation report above, the most interesting modes today are digital data transmissions, with an increasing tendency towards sophisticated synchronous systems. Next comes SSB and radiofax, and finally CW, which is virtually extinct among professional radio services. Therefore, a modern allround monitoring station is composed of the following elements:

- Antenna. The quality of the antenna system is of immense importance for the signal strength. The ideal case is a rotable logarithmic-periodic antenna, which is thus used in many professional plants. At the opposite end of the quality scale is the active antenna of only 1 or 2 m length with an amplifier which will most probably produce its own spurious signals in the HF range. This can be only a patched-up solution, compared with e.g. a 10 or 20 m longwire antenna which should be installed as high as possible. The best semi-professional solution is an array of several dipole and/or longwire antennas, arranged in different directions and connected to an antenna switch for quick selection of the best one for the station monitored.