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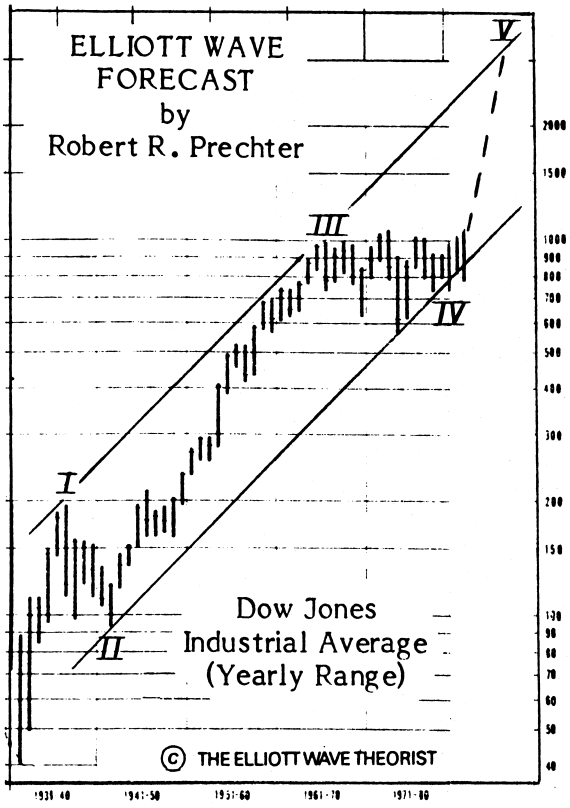
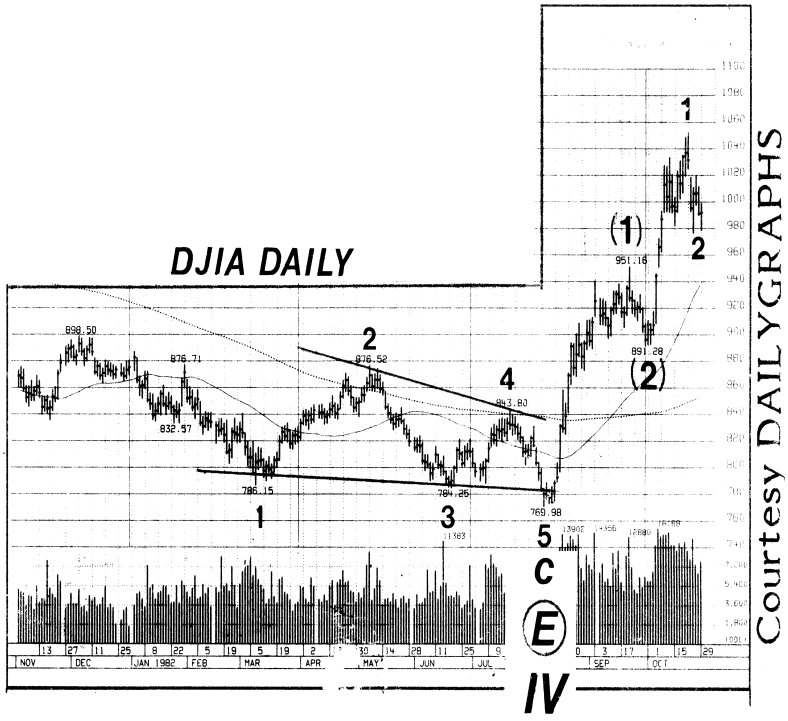
WHEN IT'S DONE

In 1982, I was negative two years old. Ronald Reagan was president. The Information Revolution was just beginning, and the United States had finally emerged from the '70s stagflation and was about to launch into the greatest bull market since the Roaring Twenties. By the mid-'80s, society was awash in positive social mood. Taxes were falling, there was a newfound respect for business, and the public craved upbeat social icons such as Madonna and Michael Jackson. Clearly, the go-go '80s and the era of Reaganomics was a great time to be alive.

Despite the boom years that were to come, the sentiment at the 1980/1982 lows was negative. The bottoming process in social mood included wild fluctuations in financial markets that bankrupted many people. One of the most infamous of these was the 1980 crash in gold prices, which was incorrectly blamed on Paul Volcker's raising of interest rates rather than on the lofty prices to which the bulls had bid up the metal. Inflation and bond yields were still elevated, yet they were no longer accelerating as they had in the years following the collapse of Bretton Woods. This changing environment exacerbated the effects of an ongoing real estate slump: Housing sales fell 50% from the highs set in 1978, leaving many crushed under 18% mortgage rates but without the accelerating inflation of the previous decade to support their monthly payments.[1] Pundits called for the end of the US dollar as the de facto world currency, and bestselling books prepared people for economic collapse.[2] The years 1980 and 1981 saw back-to-back recessions. The degree of economic and social anguish in the early 1980s was substantial.





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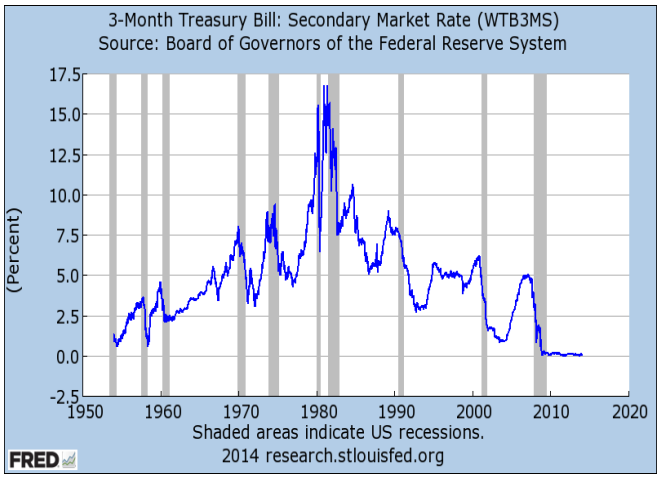
In the midst of the public's despair, the October 6, 1982 issue of Robert Prechter's *The Elliott Wave Theorist* (EWT) boldly went against consensus opinion by confirming the start of a bull market of historic proportions. As shown on page 1, the subsequent November issue of EWT contained a chart demonstrating that Cycle wave IV had ended and that Cycle wave V was in its early stages:

> "Make no mistake about it. The next few years will be profitable beyond your wildest imagination. Make sure you make it while the making is good. Then be prepared to lock it up safely for the bad years which are sure to follow." -Robert Prechter, November 1982



Of course, even among those who subscribed to EWT, few took the plunge to buy stocks in 1982. Perhaps the largest impediment for investors was the double-digit rates of interest still in effect following the summer phase of the Kondratieff cycle (K-cycle), which had ended in 1980. Why take on market risk when you could earn such high rates in risk-free Treasury bills or FDIC insured savings accounts? In this fashion, the K-cycle is proficient at trapping investors in the wrong assets: Cash is always most attractive at market lows before stocks soar, and most unattractive at market highs before stocks collapse. This effect is especially strong near the peak of the Kondratieff-cycle autumn when cash yields essentially nothing, nearly ensuring that investors will embrace the greatest risk right before the winter phase and its attendant depression. The chart at right clearly illustrates the effect of the K-cycle on interest rates, which peaked with the 1980s low in equities and declined for the next 32 years.

By 1986, the bull market in stocks was well underway. By then the upward trend was becoming increasingly obvious. The reputation of the hard money crowd—the heroes of the '70s—was tested as the metals continued their slide into what would ultimately become a multi-decade bear market. Paper-money advocates had already suffered, as the erosion of the US dollar and the repeated recessions of the '70s and early '80s had disproved the Keynesian idea that inflation was benevolent or containable. In contrast, the Elliott Wave Principle (EWP) provided the *correct* theoretical framework from which to make an accurate forecast.

Rise of Thinking Machines

The bull market of the '80s was not just in equities. During this time, the computer era was just taking off. To the same extent that the Industrial Revolution transformed goods production, computers were about to revolutionize the way people work and share information.

Although computers had been around for a while, in the '60s and early '70s they were prohibitively expensive. Only large corporations, the military and scientific institutions could afford them. Because they were so costly and required a large staff to maintain, usually only one mainframe was available at any given enterprise. The main system would then be time-shared by multiple personnel via lightweight terminals—a far cry from the modern culture of personal devices that we now enjoy. And despite the high prices, even by the '80s the most powerful *supercomputers* would pale in comparison with modern tablets! In 1986, the roughly $50 million (adjusted for inflation)[3] Cray-2 from Cray Research replaced the Cray X-MP as the most powerful computer in the world. Its performance—at a record 1.9 GFLOPS—would not be surpassed until 1990. Today, *an iPad 2 is comparably powerful* and costs only $600.[4]

Cray-2 Supercomputer, 1986

The word "supercomputer" is somewhat of a misnomer. These giant machines are actually much better understood as networks of small computers working together. Therefore, while it is true that they can handle certain tasks much faster than normal computers, they can do so only for problems that can be broken down into parts that can be worked on simultaneously. Since the iPad 2 has a similar overall throughput but with fewer processors, it has fewer limitations. In this respect, it is even more powerful than the Cray-2.

One fascinating aspect of the Cray-2 is that the components were designed in three dimensions. This compact design enabled faster communication between each microchip. Specifically, groups of processors were placed onto normal circuit boards, but then these boards were stacked tightly together and directly connected. Since conventional air-cooling could not effectively dissipate heat in such firmly packed circuitry, the boards were immersed in a tank of Fluorinert, a coolant fluid that insulates electronics.[5] (If you've ever seen the movie *The Abyss*—James Cameron's 1989 science fiction thriller about deep sea divers who discover an alien craft—then you may recall a brief mention of Fluorinert: Actor Ed Harris "inhales" oxygenated Fluorinert when testing an experimental liquid breathing system. Amazingly, this scene was inspired by real research into liquid breathing, which is still going on.)[6]

The behemoth supercomputers of the '80s are captivating, but the big key to the technology revolution was undoubtedly the personal computer. That the modern PC architecture even exists is almost an accident of history. In 1981, IBM was in a rush to mass-produce a micro-computer before competitors overtook the market. Consequently, it dispensed with its usual protocol of monolithic design and developed the PC as a "Lego-like" device with standard and interchangeable parts. This design, first introduced with the IBM 5150, turned out to be a boon for consumers and for the future of the PC but also a major factor in IBM's decline. Because anyone could manufacture the individual parts, the PC quickly became commoditized. Specialization and economies of scale created an environment of rapidly falling prices and improving quality. Ultimately, this trend increased the accessibility of powerful computing beyond that of just the largest corporations and governments and into the hands of nearly everyone.

Saturn V rocket, Johnson Space Center

The Birth of EWAVES

The dual success of both computing and Elliott wave analysis was clearly evident by the mid-'80s. It was during this time that David Register, a statistician and computer programmer, sparked the idea of connecting EWP and computing, forming the genesis of the EWAVES project. Register studied physics and mathematics at North Carolina State and acquired a master's degree in statistics in 1974. This background led him to a job as an assistant scientist with Lockheed Corporation at the Johnson Space Center in Houston. He eventually settled into developing information systems for NASA's on-board flight recording equipment. There, he was ultimately promoted to principal scientist—the highest technical level at Lockheed.

Shortly afterward, Register learned of a newly created group at Lockheed specializing in artificial intelligence (AI). The field of AI was so new at the time that Lockheed could not find anyone with the necessary skills to hire externally. Their only choice was to train scientists in-house. With help from the Defense Advanced Research Projects Agency (DARPA), Register and his colleagues spent the next year studying the field of AI and the AI-associated programming language LISP, which at the time was (and arguably still is) the most powerful computer language available.

As a hobby, Register dabbled in the markets and pursued a side-interest in technical analysis. Like many who chase an interest in the markets, he discovered a lot of conjecture and interesting tidbits from his readings but found nothing that could provide a truly comprehensive model of market behavior. All this changed with his reading of Frost and Prechter's *Elliott Wave Principle* and EWT's market call of 1982. In Register's words:

> "Wow. This was a real eye opener! All the skills in pattern recognition, statistics and artificial intelligence that I had acquired were suddenly connected and applicable to a real-world financial problem. After going through the Lockheed management for approval I sent an unsolicited proposal to Robert Prechter of Elliott Wave International."

Two weeks later, Register found himself on a plane to meet Prechter and to express his interest in developing a computer algorithm that could perform the kind of pattern recognition required to discern Elliott wave forms. After much excited discussion, the two signed a contract in 1986 to begin the development of EWAVES, which would become the first non-governmental project at Lockheed and likely the first application of AI to financial markets. During development, every three weeks Register would travel to Georgia to spend a day sitting beside Prechter as Prechter worked. Register watched and asked questions about Elliott waves as Prechter applied them in his own real-time analysis. Then Register would relay his findings to the development team in Houston. It took several years to cover all the patterns and formalize the core aspects of machine-based wave analysis.

One of the most difficult problems the team faced was designing logic to emulate the non-written aspects of Elliott wave analysis that are natural and intuitive to humans. Unlike human analysts, computers have no intuition, they do not learn by experience (yet), and they know only what programmers tell them. They also operate with a degree of literalness and explicitness that perhaps only an accountant could appreciate. As a result, Prechter and Register had to specify EWP to an unprecedented extent. This is

not to say that EWAVES completed an ultimate specification of EWP, but rather that EWAVES, *as a particular implementation* of EWP, required more specificity for computer implementation than had been furnished for EWP in the past. Consequently, the careful specificity of EWP that emerged from the development process has never been documented outside of EWAVES.

XKCD, Issue #568

Building Version 1.0

The project met with initial success. In just a few years, an alpha version of EWAVES was ready—and counting. EWAVES, however, ran into a severe problem: Computers at the time were simply not powerful enough to handle the workload it demanded. Short-cuts were tested, but none yielded the results that EWAVES would have been capable of given more processing power. Even today, we regularly run EWAVES tests that take weeks to complete, and these are on modern computers that are approximately *1,000 times more powerful* than the PCs of the ’80s. Such tests would have never been possible in the past. Therefore, EWAVES was placed on the backburner for a long time. It was viewed as a project with a lot of potential but, unfortunately, without any immediate utility.

It wasn’t until quite recently that the EWAVES project was revived. In my own life, I had an early fascination with technology, which ultimately led me to attend MIT and then to join Microsoft. My burgeoning side interest in finance crystallized during the 2008 crash, so I left Microsoft to help co-found an algorithmic hedge fund with a focus on high-frequency trading. A cruel twist of fate occurred when I succumbed to a severe form of a little-known but exceedingly common condition known as Chronic Myofascial Pain (CMP). Yet in what must have been destiny, I ended up returning home in the interest of my recovery, which in turn led me to join my father’s company. EWAVES seemed a perfect fit for my experience, and since that time I have been committed to taking charge of streamlining the old code and restoring the project’s momentum.

It took many months to get the core parts of EWAVES running in a stable fashion on modern 64-bit machines. During this time, our team began work on a trading module, testing how we might use the EWAVES analysis to produce actionable market recommendations. We dubbed our first release as version 1.0 (despite its beta status) because the next major version we have begun developing (version 2.0) is a complete rewrite from the ground up. This rewrite has two purposes: (1) to be able to leverage modern programming languages and tools and (2) to reexamine every decision made by the original Lockheed programmers. Many of the changes made during 2.0 development are being backported into the original program so that we can test them individually. Therefore, we expect many 1.X upgrades to accrue benefits to our Flash performance in the near future. Eventually, all of these incremental improvements will culminate with the release of EWAVES 2.0.

When will the next EWAVES upgrade be ready? I don’t know yet, because it’s a research project, not an implementation with an established set of specifications. What I can say, however, is that each new version will be an improvement over the last. The only deadline we can offer is the infamous software industry expression, “When it’s done.” And even then, being “done” is a rather intangible concept when applied to projects like this, because even after we release version 2.0 we will no doubt immediately begin improvements in a 2.X line. Software is never done. Regardless, when each improvement is finalized, we will report on it in *EWAVES Flash*.

Signal Review

Since all trading methodologies are necessarily probabilistic, one of the most important elements for successful trading is knowing when a signal is *wrong*. The job of analysis is to provide a statistical edge, whereas the goal of trading strategy is to realize this edge over time. Since there are no guarantees with any one particular signal, risk control is a key component to any trading methodology.

One of the benefits of Elliott wave analysis is that it defines objective price points to tell you when a signal is invalidated. Consider the following bearish EWAVES count for silver on October 11, 2013:

Figure 1

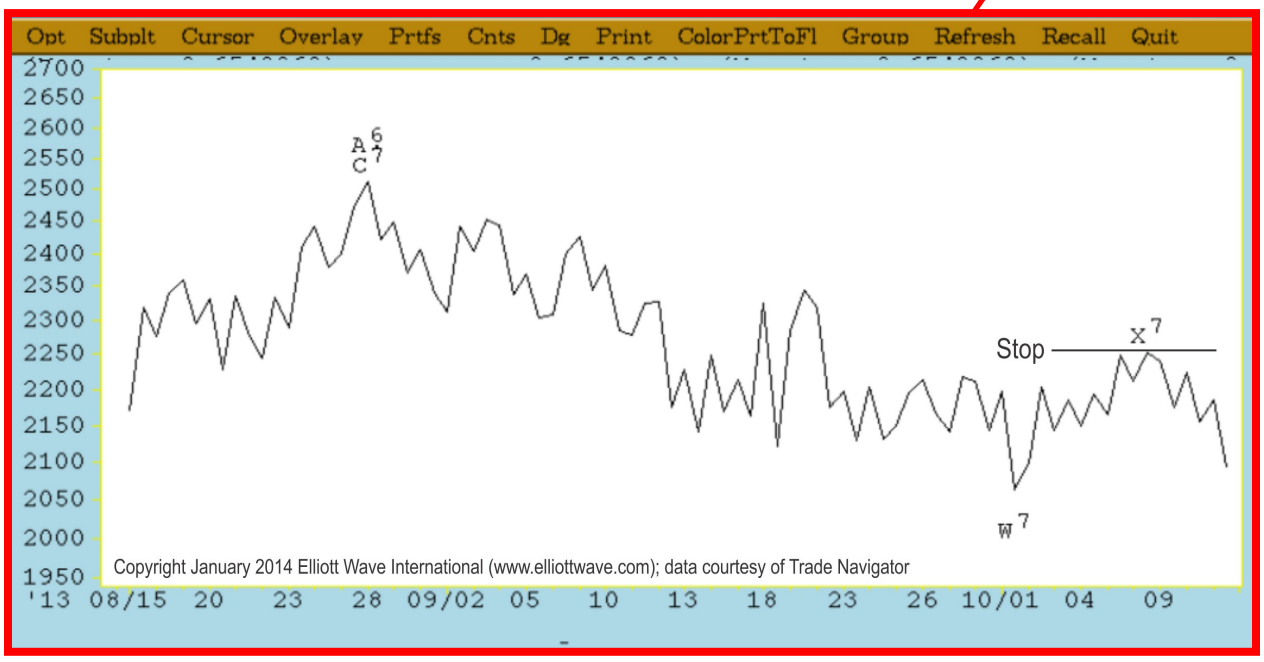


Figure 2

The long term count in Figure 1 showed that silver was likely still in the midst of an impulse to the downside (wave 3^3). The short term count was also bearish, showing that a Y^7 was expected to take out the W^7 low as part of a double zigzag pattern. This short term count called for a tight stop at 22.53, which would immediately invalidate the labeling at X^7. This recommendation lost 4.5% when 22.53 was exceeded.

By knowing when a signal is invalidated, EWAVES allows for a trading strategy that uses wave structure to signal times to take immediate protective action. This protection, combined with proper money-management techniques (such as purposefully under-leveraging), in the long run provide the necessary mix to realize the statistical edge that comes from using high probability wave counts.

Some final thoughts

Although the primary focus of this issue is to provide a condensed history of the EWAVES project, there are also some exciting things happening currently that deserve mention. For EWAVES 1.X/2.0, we are revisiting some important elements at the very base of the counting engine; since they are foundational to the program, any advances in this area will potentially have a significant impact. We are also working on improving our strategy module. Although these enhancements are not easy to implement, the next version will be worth the effort.

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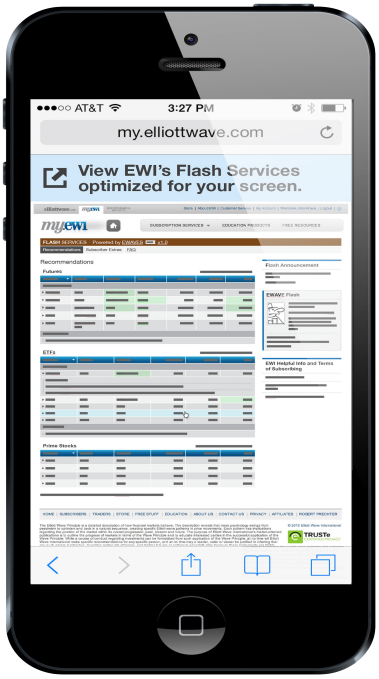

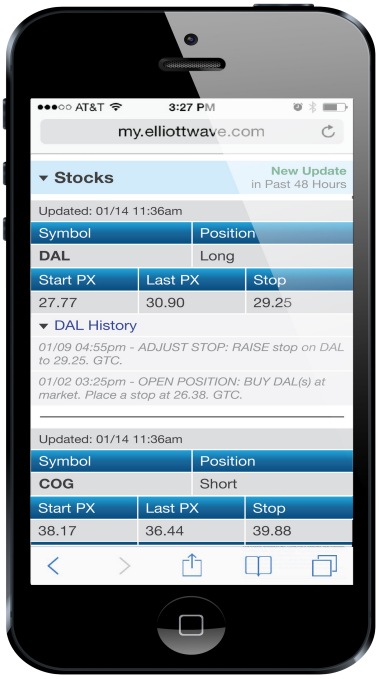

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