

---

## *The Birth of the Supersonic Naval Ordnance Research Track*

By Elizabeth Babcock, Director

As the supersonic naval ordnance research track (SNORT) celebrates the 50<sup>th</sup> anniversary of the track's first test — a "TIM Go-Devil, 800 f.p.s." sled run on November 18, 1953 — this article provides a brief look at the events surrounding SNORT's birth.

### China Lake's First Tracks

Instrumented track tests began early at the Naval Ordnance Test Station, with its earliest track (two rails 1,500 feet in length) opening for business in 1945 on K-2 Range.

Another early NOTS track was the heavily used facility at B-4, constructed in 1946 and allowing test sleds to move down a 2.76-mile standard-gauge two-rail track at speeds of up to 605 miles an hour. Although the track was not long or precise enough to suit many NOTS range peo-

ple and their customers, it was useful for numerous early Sidewinder tests and for other simulations where a smooth ride was unnecessary.

The Station and other installations with test ranges were also scrambling to develop high-speed tracks that would allow the nation's rapidly evolving rocket and aircraft components to experience the physical phenomena associated with transonic and supersonic speeds. Although these high speeds could be simulated in wind tunnels, a choking effect frequently spoiled attempts to simulate flight conditions through the transonic range (600-800 miles per hour). Both the Air Force and the National Advisory Committee for Aeronautics (NACA, forerunner of NASA) were working on new supersonic tunnels to avoid this phenomenon, but most such facilities did not begin operation until the mid-1950s.

(continued on page 7)

*The Birth of the Supersonic Naval Ordnance Research Track* (continued from page 4)**The Birth of SNORT**

The birth of SNORT can be dated from November 1947, when after study of various track lengths and configurations (even one proposal for a circular track), NOTS sent the Navy's Bureau of Ordnance a plan for construction of an aptly named Long Track, described as stretching as far as 25 miles into the desert and accommodating captive testing at accelerations to speeds extending into the supersonic. In February 1948 the Bureau authorized the Station to begin a feasibility study for a more affordable high-speed three-rail track 11 miles in length.

It would take many studies and a lot of red tape before the first shovelful of dirt for SNORT construction would be turned. The Department of Defense Research and Development Board (RDB), which needed to authorize the track before it could be built, had to decide which of a dizzying variety of track proposals to endorse. An Ad Hoc Group on Track-Type Testing Facilities, chaired by John K. Northrop, president of Northrop Aircraft, Inc. and designer of pioneering tracks for Edwards Air Force Base, began surveying existing and planned tracks.

While NOTS awaited RDB approval, local authorities went ahead with site selection and planning, settling on a flat area a mile and a half north of Inyokern Road and approximately midway between the China Lake administrative area and the village of Inyokern. Not only did the site have suitable terrain and a convenient, noninterfering location relative to the aircraft ranges, but it was also relatively free of earthquake faults, an important feature, since even a mild tremor could conceivably knock the track out of alignment.

While the Aviation Ordnance and Test Department began planning and acquiring the track's instrumentation and test carriages, design responsibility for both the track and its facilities went to the Underwater Ordnance Department (UOD) at NOTS Pasadena under the leadership of James H. Jennison, head of UOD's Development Engineering Division, who had designed NOTS' Variable-Angle Launcher at Morris Dam.

Jennison, Carl H. Heilbron, and others on the design staff studied many types of track configurations in various combinations involving between two

and four rails. Eventually the designers agreed that three identical rails placed at the same level would be the most versatile configuration, since the tracks could be spaced horizontally in such a way that three different two-track widths would be possible.

**Inhouse Funding and Outside Support**

With funding from higher sources still not forthcoming, NOTS Technical Director Dr. L.T.E. Thompson authorized Local Project 583, "Exploratory Studies for Project SNORT," thus putting the planned track in direct competition with Sidewinder and several other local projects for the discretionary funding that was ordinarily reserved for research endeavors.

In July 1949 the Northrop group recommended that SNORT be built, with the caveat that NOTS work more closely with the installations already possessing tracks. Following those findings, Rear Admiral Walter G. Schindler, BuOrd's Assistant Chief for Research, signed a November 30, 1949, charter of a new coordinating group, the Bureau of Ordnance Committee on Aeroballistics (BOCA), which was given responsibility for the assignment, coordination, and technical direction of all BuOrd aeroballistics research programs, both in-house and under contract.

By that time the Station's management team was getting discouraged about SNORT's lack of progress toward construction. In a long discussion in the January 1950 Research Board meeting, Thompson agreed with the track's critics that expensive facilities should not be built at NOTS unless an immediate need for them could be demonstrated, but he argued persuasively that SNORT was such a facility.

"The SNORT track was sold by L. T. E. Thompson to be another type of aerodynamic research tool, a sort of wind tunnel," Dr. Ivar Highberg, then head of the Ballistics Division's Exterior Ballistics Branch, later explained. "We in the Ballistics Division said it would never be used for that purpose and were trying to get a replacement for the 1,500-foot track on K Range, the terminal ballistics track." Thompson convinced Highberg to support the SNORT project.

(continued on page 8)

## *The Birth of the Supersonic Naval Ordnance Research Track* (continued from page 7)

In return, Thompson agreed to throw his weight behind the idea of constructing the proposed 3,000-foot G-4 track for terminal ballistics work.

### **More Studies and Homework**

Just as the SNORT project seemed to be gathering momentum toward construction, outside authorities once again put on the brakes. On June 15, 1950, Air Force General Joseph T. McNarney, chairman of the National Defense Management Committee, requested that all construction funds for SNORT be held up until the RDB had a chance to determine that the best available information had been used in the track's design. In an ironic coincidence, just two days later Congress authorized SNORT's eagerly awaited \$5.5-million funding.

Station managers, knowing McNarney's reputation for toughness, approached the latest holdup with trepidation, but they needn't have worried. The McNarney Committee, swayed by the advice of the Northrop group, recommended construction of the new track at NOTS, with the proviso that funds should be obligated only after China Lake showed that the design of the track incorporated "the best experience obtained from the operation of existing tracks."

Fortunately, NOTS was already learning from existing tracks. China Lake track personnel also witnessed several tests on the 2,000-foot track at Edwards Air Force Base, visited Edwards' new 10,000-ft. track to see the rail-alignment process, and got Air Force officials to agree that test runs could be made at Edwards. Visits to the Northrop Aircraft plant had allowed the China Lakers to discuss track design and witness a track vehicle under construction. The Station also learned from a just-completed 3,500-foot launching track at Holloman Air Force Base in New Mexico.

That homework paid off in October when McNarney received the stipulated RDB memorandum assuring him that "the Department of the Navy is utilizing the best experience available from the operation of existing tracks in the design of the Naval Ordnance Test Station Track." On October 26 Congress appropriated a \$950,000 first increment to cover SNORT's initial study, contracts, and contingency items. In November, as promised, McNarney released his restriction on the track's funding. The last impediment to construction seemed to have been removed.

### **Changes in Project Scope**

By mid-December Jennison and his 20-person design group in Pasadena finished the track's first schematic drawings and sent them to the Bureau. Since immediate construction of the full 11 miles of three-rail track appeared to be economically infeasible, the plan was to complete the track's first 6 miles within 2 years, with the entire 11 miles to be finished within 3 to 4 years. The track would have two rails at standard railway gauge for the full 11 miles, with a third rail extending part of the way to provide a narrower gauge.

By the end of spring 1951, eight NOTS sled runs had occurred on the Edwards track, and 31 runs had been made on the Station's own B-4 track. By summer Jennison and his design team had worked out the major concepts of SNORT's design, and Project Engineering Inc. had completed design studies. That July Jennison accepted a challenging new job as head of the Station's Design and Production (D&P) Department. Since his responsibilities in connection with the track design also continued, the entire SNORT design staff transferred into D&P with him.

Then in October Congress appropriated \$4.55 million, the final installment in the \$5.5 million NOTS had estimated the track would cost. On October 24 Cdr. S. K. Wilson, NOTS Public Works Officer, began advertising contracts for the track headquarters area and the first 4.84 miles of the track. When Jennison, Heilbron, and other members of the SNORT planning group opened the bids in late November, they were shocked to discover that the lowest bid for the first two increments was for more money than was available for the entire project.

The group quickly decided that the best course would be to scale back to 4.47 miles of track, a plan that the D&P staff believed would give "the barest minimum in track facilities ... the best that can be had under the circumstances." The designers also raised the minimum zero-stress temperature for the rails to 70 degrees Fahrenheit, largely because no contractor would bid on the job at the originally stipulated 30-degree minimum. The NOTS Research Board agreed — and urged Commander Wilson "to proceed with construction of the track immediately, before prices go any higher."

(continued on page 9)

## *The Birth of the Supersonic Naval Ordnance Research Track* (continued from page 8)

### Construction Decisions

Construction of SNORT began on January 14, 1952. The grand plans for the Long Track had been scaled back considerably. The track would be only 4.1 miles long and would have just two standard-gauge rails for its entire length. But even this truncated version would still be the longest precision two-rail track in the country.

The contractor, J. A. McNeil Corporation, scraped off a long north-south gash in the desert, and workmen began pouring two hefty reinforced-concrete beams running under SNORT's entire length with a horizontal slab joining the two beams. In cross-section the joined beams and slab formed an H-shaped structure resistant to both horizontal and vertical stresses. This entire structure was buried in a compacted earthwork base.

The standard heavy crane rail selected for SNORT was laid in 50-foot lengths in order to minimize the number of joints required. To help maintain the precise track alignment necessary for controlled testing conditions, the rail ends were milled square and joined with dowel-pin connections set so that the adjoining rail ends would touch only when rail temperature reached 70 degrees.

Laying the rail was exacting work, with alignment tolerances of three to six hundredths of an inch necessary over the entire length of the track. A suitable vehicle would be able to streak down the track at a velocity of 3,500 feet per second, accelerating at rates of up to 150 g. For the track to be useful, it would need to stay in precise alignment. To develop accurate benchmarks and monuments close to the track, surveyors from the U.S. Coast and Geodetic Survey established a 12-mile-long baseline 300 feet west of the track. Surveyors could then make accurate measurements of rail alignment and horizontal, vertical, or rotational adjustments could be made to the rail.

The carriages thundering down the track would almost inevitably use most of SNORT's length, and efficient braking systems were mandatory if the test items were to be recovered. For this reason, the new track incorporated provisions for three braking systems — water brakes, sand brakes, and a third type using retro-rockets.

As track construction made rapid progress, SNORT's designers concentrated on test-sled design, which they considered fully as important as

that of the track itself. The stress caused by the force of the sled hurtling down the track needed to be balanced by corresponding elastic strains in the sled's shoes and axles. Observation of sled shoes on the B-4 track had shown that most of the wear came from heating and vaporization of a thin layer on the shoe surface. The runners of the new sleds were ingeniously designed so that at top operating speeds, shoes would run on a cushion of vapor from their own evaporation. The test-vehicle designers considered many types of propulsion, eventually selecting solid- or liquid-fuel rocket power as the only practical method for producing the high accelerations required. To minimize vibrations, the team also designed low resonant frequencies into both track and carriages.

To the relief of the test conductors, the minimum test operations that began with that first November 1953 tests showed by early February 1954 that test vehicles could operate at the hoped-for speeds and that the water brake would stop the vehicles as planned. A test series of the Falcon fuze, run during the last half of the month, was the first single-rail use of the new track. With all instrumentation operating as designed, SNORT was at last ready for its grand opening.

### Grand Opening

On the last Saturday in March 1954 nearly 1,300 community members lined up to watch the first public demonstration of SNORT, the main event in a program celebrating the fourth birthday of the Test Department.

This first public run proved so popular that SNORT demonstrations became regular features of Armed Forces Day celebrations for many years thereafter. Station management discovered that a demonstration of SNORT could be used as an impressive, reliable, and yet relatively inexpensive symbol of China Lake test activities.

More to the point for the testing community, the Navy's desert facility at last had a high-speed track that could fill the gap between static testing of wind-tunnel models and free-flight testing of full-scale rockets and missiles.

The track is still in use to this day, with SNORT's versatility accommodating runs of low or high speeds and short or long durations. Projects taking advantage of SNORT's capabilities over the years have ranged from aircrew ejection systems to live ordnance components to movie special effects.