

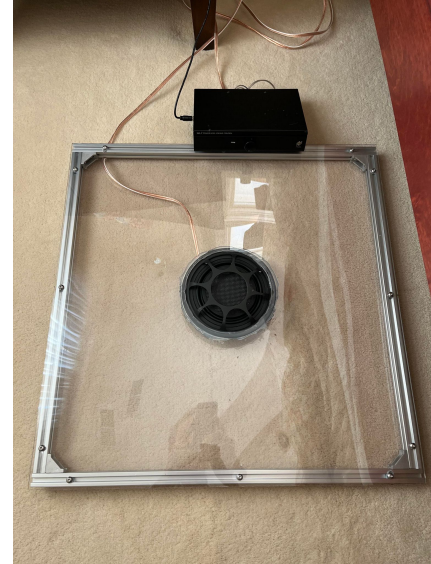
# Dormisan Cumulo Vibrotactile Sleep System

## THE DISCOVERY

In neonatal intensive care units, clinicians observed that newborns with neonatal abstinence syndrome were calmer when positioned near the unit's milk refrigerator. The cause was traced to low-frequency vibrations from the compressor reaching the infants through the floor and nearby surfaces.

Researchers tested a mattress delivering controlled stochastic vibrotactile stimulation (SVS) on 26 opioid-exposed newborns and found a 35% reduction in movement activity ( $p < 0.001$ ), fewer tachycardic episodes, and stable vital signs (Zuzarte et al., PLoS ONE, 2017).

In 2025, a multicenter randomized controlled trial independently validated SVS, with 80% of parents and 60% of clinicians reporting that the SVS mattress calmed subjects (Singh et al., Pediatric Research).



Phase 1 prototype. Plexiglass emitter assembly coupled to the SVS generator housing.

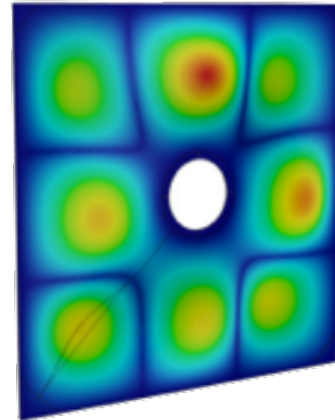
## THE OPPORTUNITY

Dormisan LLC recognized this potential. If SVS could calm the most distressed newborns, it could improve sleep in the general population. They engaged Grinalds Solutions to turn this clinical discovery into a consumer product.

## PHASE 1: PROVING THE TECHNOLOGY

The first task was building a prototype to validate SVS delivery through a consumer mattress.

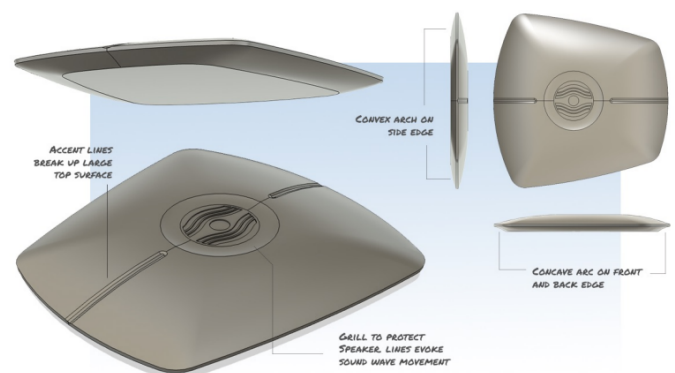
- Custom SVS generator PCB with TI DSP-enabled smart amplifier
- Stochastic stimulation signal shaping in the 30-60 Hz band
- Plexiglass emitter coupling energy directionally into mattress
- FEA validation of modal displacement at target frequencies



Phase 1 prototype. Excitation zones

## EARLY RESULTS

Initial testing with third-party sleep trackers showed the prototype increased heart rate variability by up to 20% in target demographics. This is a key biomarker for autonomic regulation and restorative sleep. The technology was validated. We moved on to Phase 2.



Phase 2 industrial design. Integrated emitter, sensors, and processing in a consumer-ready disc.

# Building the Product

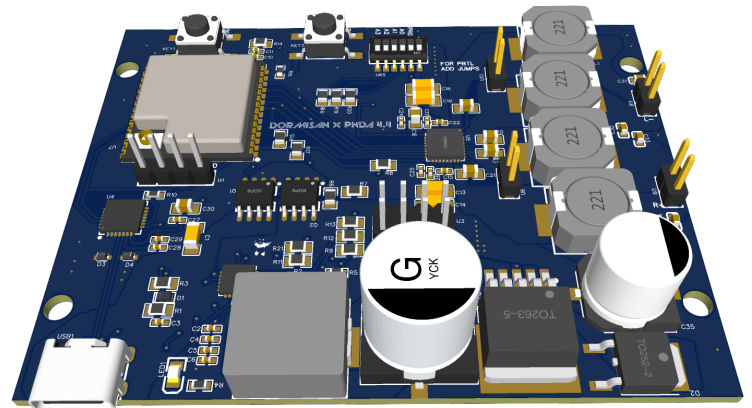
## PHASE 2: PRODUCTIZATION

With the core SVS technology validated, the program shifted from proof of concept to consumer product. Every element was redesigned for production.

- Thin disc enclosure with concealed motor grill
- Integrated motherboard with DSP, sensors, BLE, and charging
- iOS app for session control and per-mattress calibration
- Custom actuator with rib structures for energy coupling

## TECHNICAL ARCHITECTURE

- Real-time stochastic waveform synthesis on TI DSP amplifier
- Accelerometer, barometric, motion, and temperature sensors
- Firmware sensor fusion with denoising and cross-compensation
- Predictive detection for apnea, restless leg, stress, pain
- Calibration across foam, spring, and hybrid mattress types



Phase 2 motherboard. Rechargeable platform with onboard DSP, sensor array, and BLE.

## OUTCOME

Dormisan now has a production-ready platform covered by a provisional patent. The company is raising funding for a consumer launch in late 2026.

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Phase 2 Product enclosure using TPU plastic to house the exciter, DSP engine, and power supply

## WHAT THIS DEMONSTRATES

- Taking a clinical observation from published research through to a production-ready consumer product
- Custom mechanical, electrical, and software engineering across two product generations
- Real-time embedded DSP for therapeutic waveform generation with measurable physiological outcomes
- Full product lifecycle from provisional patent through prototype validation to scale-up readiness

## REFERENCES

1. Zuzarte I, et al. "Vibrotactile stimulation: A non-pharmacological intervention for opioid-exposed newborns." *PLoS ONE*, 12(4), 2017. PMC5398650
2. Singh R, et al. "Efficacy of stochastic vibro-tactile stimulation for newborns at risk of neonatal opioid withdrawal syndrome." *Pediatric Research*, 2026. PMID: 40410582