

White Paper- Pioneering Intelligent Transportation Systems with Seating Machines™

**“The people who are crazy enough to think they can change the world are the ones who do.”
Steve Jobs.**



**SENSEat™ Seat Cushion
Driver Monitoring System.**



**SMARTag™ Seatbelt
Passenger Carpool
Monitoring.**



**Noviation™ Seat Cushion
Pilot Monitoring System.**



**MKL™ Seat Cushion
Covert Polygraph.**

Why We live in a 24-hour society with long periods of sedentary sitting in air and road vehicles. Insufficient sleep, odd hours and/or prolonged sitting promote driver and pilot fatigue and drowsiness, leading to grim crash statistics. Drivers and passengers are stuck in traffic jams leading to some illegal use of high occupancy vehicles (HOV) fast lanes.

It all leads to an unfulfilled transportation market needs and hunger for innovative solutions. Therefore, NOVAAlert develops “Seating Machines™” - embedded in-seats non-contact sensing and big data AI/Machine-learning for pioneering ITS (Intelligent Transportation Systems).

Calls for solutions

- The EU mandated driver monitoring starting 2024, US will soon follow.
- The US Air Force published request to industry for cockpit sensors to alert for potential degraded pilot health.
- Governments are seeking effective fast lane carpool solutions to enforce compliance by cheat-proof passenger counting.

Differentiated NOVAAlert solutions Flagship Seating Machines™ technologies - quantum-leap vehicular smart transportation biometric monitoring platforms. Our secret sauce invisible multiparameter sensing and self-calibrating with computational intelligence of adaptive AI/Machine learning, pending patents.

The common thread is NOVAAlert's proven IP innovations of real-time, cloud connected, non-contact (through-clothing) physiological, psychophysiological, postural and behavioral monitoring embedded in seat cushions and seat-belts, with dual civilian and military/security-related use.

- SENSEat™ - sensing seat cushions as DMS (Driver Monitoring Systems): Smart non-contact sensing seat to help reduce road casualties by actionable monitoring early signs of fatigue, drowsiness, intoxication and ill-health. Incorporates alerting and arousing “virtual rumble strips” and post-crash human factors “black box” records. Complements camera inattention solutions, overcomes their failure to identify driver asleep with open eyes.
- Noviation™- sensing seat cushions PMS (Pilot Monitoring Systems): Smart sensing seat to help aviation safety by actionable monitoring of early signs of fatigue, unscheduled sleep, ill-health and unconsciousness. Incorporates human factors post-crash “black box” records.
- HOVi SMARTag™ sensing seatbelts tags for cost-effective cheat-proof enforcement of passenger counting in fast-lane carpool; identify forgotten child in car; help reduce congestions and pollution.
- MKL™ In-vehicle, cloud-based remote, contact-free ambulatory covert polygraph investigation.

Mission Collaborate in developing, testing and licensing semi-custom intelligent vehicular system platforms applicable in emerging smart transportation human factors monitoring, with dual use in civilian and military/security markets. Solutions designed to monitor the physiology and behavior of drivers, pilots and passengers.

NOVAAlert Traction Founded in 2021, NOVAAlert IVS Ltd. is the latest of the ATLAS biomedical engineering companies founded by Dan Atlas since 1977 - all globally known for pioneering achievements in monitoring of physiology, psychophysiology, behavior and fitness to perform of drivers and pilots.

Over 300 former successful projects include: Smart sensing G-LOC helmets for the Israel Airforce; Non-contact pilot vitals sensing seat for Israel Aerospace Industries; Non-contact smart monitoring beds; US/Israel covert homeland security polygraph seats; Wearable and steering-embedded driver alertness systems delivered Autoliv, Fiat, Daimler and US FRWA.

About NOVAAlert IVS Ltd., startup founded by Dan Atlas in 2021, is the latest of his serially-created 3 biomedical engineering R&D companies (Atlas Researches, Atlas Engineering and ATLASense Biomed) with several other pilot project initiative companies since 1977. The combined reputation record includes over 300 pioneering projects and innovative industry “firsts”. NOVAAlert leverages its predecessors' cutting-edge technology achievements. See White paper in www.novalert.com.

Business model Pursuing collaborations for excellence in pioneering industry “firsts” monitoring innovations in civilian & military aviation & space, automotive safety and security. Offer potential partners a production and marketing license opportunity for significant future commercialization in emerging smart transportation.

Operations As bioengineering micro-business, NOVAAlert creates additional outside jobs and partnerships without any employees. As a solopreneur, Dan orchestrates an ad-hoc a pool of top-talent

service providers and consultants, privately funding all operations: Research, design & development. Drawings & documentations. Printed circuit layout. Materials & equipment. Industrial design. Prototyping & validation tests. Patent applications. Business handouts. Note: Presently 92% of all businesses in the US are micro-businesses (1-9 employees). Nearly third of the US micro-businesses were created since 2020.

Team Advisory: Three globally-recognized professors of human factors, artificial intelligence and sleep. Service providers: Industrial & board design; software & algorithms; prototyping laboratory.

Background of Founder/CEO (Dan Atlas) 5th decade of progressive accomplishments of biomedical engineering: Company founding and managing, pioneering monitoring technologies, inventions, license grants, and management of over 300 projects. Formerly an electronics project engineer in the US, contributing to military aviation and aerospace; senior engineer in Israel - defense, microelectronics and seismology. See LINKEDIN <https://www.linkedin.com/in/dan-atlas-0a1280b4/>

Contact Dan Atlas Founder/CEO NOVALert IVS Ltd. info@novalert.com atlasres@gmail.com
<https://www.novalert.com/> https://finder.startupnationcentral.org/company_page/novalert
P.O.B. 271 Hod Hasharon 45102, Israel. Mobile +972-50-7795686

Annexes

NOVALert's key technological differentiation

1. Reliably sensing tiny physiological and behavioral signals emerged in vibrational motion artifacts, operating in harsh or noisy environments.
2. Seat technology sensors are augmented by sensing environmental vibrations and high energy impact, documenting a "virtual black box", generating local and communicated alerts as well as activating arousing vibrators as "virtual rumble strips".
3. Continuous, real-time monitoring and analyzing multiparameter data of seated persons with contact-free (through clothing) non-obtrusive seat cushion and seatbelt technologies.
4. Use of low-cost sensing elements enabled by continuous software-driven self-calibration against aging and temperature drift, redundant sensory backup with continuous self-test.
5. Broad use-cases in civilian and military automotive and aviation, security applications, carpools.

Traction

- ✓ Founder, entrepreneur, Dan Atlas, <https://www.linkedin.com/in/dan-atlas-0a1280b4/> recognized electronics and biomedical engineering expert likely to having conceived, invented, designed and developed the largest variety of physiological, behavioral, medical diagnostics and therapeutic monitoring devices in Israel, in addition to wellness, security, automotive and aviation monitors.
- ✓ Recognized veteran pioneering team expertise in biomedical engineering, electronics, human factors and AI analytics.
- ✓ Over 300 successful ATLAS companies' projects since 1977 including pioneering record in medical therapy, diagnostic and fitness devices, smart non-contact covert sensing polygraph seats delivered to Israel & US homeland security agencies, smart non-contact beds.
- ✓ Over \$US1.2M R&D funded in relevant technology POC projects by Dan Atlas, Israel, EU and US Governments, licensees, and OEMs.
- ✓ Pilots' smart sensing helmets to IAF.
- ✓ Pilots' vitals monitoring seats to Israel Aerospace Industries.
- ✓ Predicate wearable DMS technologies to Fiat, Daimler, and USFRA.
- ✓ Steering-wheel embedded sensing to Autoliv.

Driver Monitoring	
Current problems	Our SENSEat™ Solution
<p>Underserved human factors monitoring is characterized by lack of continuous, real-time, reliable identification of fatigue, drowsiness, or sudden incapacitating health event. Additionally, following an inevitable crash the human factors leading to the crash are not documented and clear, resulting in inaccurate statistics.</p> <p>Driver monitoring exhibits the inadequacy of camera-based solutions that may fail to identify a driver asleep with open eyes. The camera-based solutions are exceedingly effective in telling a driver that s/he is caught in the act of unlawful act of phone texting or dialing, drinking, smoking and other inattentive behavior.</p>	<p>Bio-signal monitoring sensors are embedded in a seat cushion (SENSEat™). Invisible, low-power, low-cost comprehensive sensing of fatigue, sleepiness and vital signs. NOVALert Driver Monitoring System is designed to identify early signs of fatigue, drowsiness and or sudden incapacitating health event. The analytics software is to confirm a potential performance decrement or total incapacitation by embedded seat vibration for a PVT (Psychomotor Vigilance Test). Such vibrations serve both to measure reaction time and offer virtual rumble strips arousing and sustaining. Upon an inevitable crash, a virtual “Black Box” will offer a record of pre- and post-crash human factors records to help understand the cause of the crash.</p> <ul style="list-style-type: none"> ▪ Designed to complement the inadequacy of camera-based solutions that may fail to identify a driver asleep with open eyes. ▪ Designed to meet or exceed the EU 2024 mandated DMS requirements.
Pilots Monitoring	
Current problems	Our Noviation™ Solution
<p>Underserved human factors monitoring is characterized by lack of continuous, real-time, reliable identification of fatigue, drowsiness, or sudden incapacitating health event. Additionally, following an inevitable crash the human factors leading to the crash are not documented and clear, resulting in inaccurate statistics.</p> <p>Driver monitoring exhibits the inadequacy of camera-based solutions that may fail to identify a driver asleep with open eyes. The camera-based solutions are exceedingly effective in telling a driver that s/he is caught in the act of unlawful act of phone texting or dialing, drinking, smoking and other inattentive behavior.</p>	<p>Bio-signal monitoring sensors are embedded in a seat cushion. Invisible, low-power, low-cost comprehensive sensing of fatigue, unscheduled sleep and vital signs. NOVIATION™ (NOVALert Aviation) is designed to identify early signs of fatigue, drowsiness and or sudden incapacitating health event. Brief periods of inattention of a flying pilot are not a problem when an attentive non-flying pilot is in the cockpit. The flying pilot monitoring is critical to intended plan of the commercial aircraft industry to enable a single pilot in cabin, provided s/he is monitored.</p> <p>The analytics software is to confirm a potential performance decrement or total incapacitation by embedded seat vibration for a PVT (Psychomotor Vigilance Test). Such vibrations serve both to measure reaction time and sense possible loss of consciousness by failure to respond. Upon an inevitable crash, a virtual “Black Box” will offer a record of pre- and post-crash human factors records to help understand the cause of the crash.</p> <p>In addition, the cushion can be adapted to the back of G-suits, becoming operational upon sitting.</p> <p>The Noviation™ pilot monitoring is designed to enable a safe single flying pilot in cockpit with a non-flying pilot taking a nap.</p>



HOV (High Occupancy Vehicles)	
The problems	Our 'HOVi SMARTag'™ Solution
<p>The carpools reinforcement is subject to attempts of cheating. Specifically, placing mannequins or animals for counting as passengers to observing police that must keep a safe distance, or to expensive road cameras, both easily fooled as well as fail altogether due to weather conditions.</p> <p>While fines are imposed upon caught cheaters, there are no reliable technologies to catch them safely and effectively. Police force is spread too thin to cover vast roads. They cannot tell a person from a dummy from a distance, and fast lanes are not convenient for police stakeout. Another issue is police safety- in the US a stopped driver may have and use a gun.</p> <p>The installing of cameras along the highway lanes is very costly. The cameras are prone to vandalism and may well fail to distinguish a dummy from a person at any speed. Sunshades, rain, snow- may each block the view of the passengers.</p>	<p>Bio-signal monitoring sensors are embedded in a seatbelt tag. Low-power, low-cost comprehensive sensing and communicating passenger's unique Bluetooth Low Energy ID and vital signs. HOVi™ is designed to identify a cheater: A tag placed on a dummy, or more than a single tag placed on the seatbelt.</p>

SENSeat™ Design

The mechanical design was tested to withstand and successfully operate with various adults with weights up to 100Kg. The signals monitored were the heart blood pressure pulse wave and the respiration effort. The design consists of a sturdy sensor plate hosting and protection the multiple sensors. The seat and back plates are encased in foam and outer fabric.

The patent pending concepts for design-for-reliability additionally incorporate sensors' redundancy and parameter multiplicity. It means a) that if continuous self-test identifies sensor's fault, there will be at least another sensor to still deliver the required signals. Provisions are electronically made to calibrate sensors for aging and thermal drifts, thus enabling the use of low-cost sensors. It also means that each sensor is designed to produce more than a single parameter.

The sensors are not directly touching the body. They work through clothing and of course, the upholstery.

The MARK I design is capable of alerting for vital signs - heart and respiration rates - above or below preset thresholds, postural early signs of fatigue and drowsiness including yawning and driving under the influence of drugs and alcohol (unstable steering).

The designed psychomotor vigilance tests (PVT) are performed by seat vibration and required response, thereupon enabling the comparison of baseline to current reaction time as well as identifying lack of response (possible sign of severe health issue or loss of consciousness).

The software analytics are additionally specified to record a running loop “Black Box” to enable post-analysis of human factors in an inevitable crash, itself sensed by as high energy by a environmental vibrations reference sensor that additionally is required to enable retrieval of the small physiological signals from vibrational noise. Connected “Black box” is essential for real-time first responders information of operator(s)' condition.

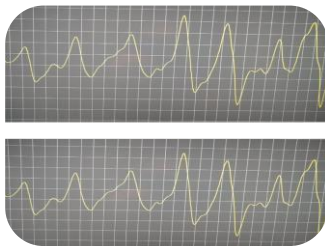
The MARK II design includes experimental non-contact sensor for cardiac ECG and muscle EMG to enable additional physiological and psychophysiological monitoring capabilities.

The core digital engine selected for standalone as well as for in-vehicle interface in an NVIDIA SOM (System-on-Module). It opens broad future capabilities, including add-on inattention cameras.

‘HOVi SMARTag’™ Seatbelt Tag Design

The seatbelt’s clip-on tag contains low-energy Bluetooth to transmit passenger’s ID to driver’s smartphone/gateway. The patent pending concept for cheat-proofing is inherent in non-contact monitoring of vital signs. Specifically, a dummy (no vital signs), multiple tags (synchronized vital signs), or a strapped animal.

A side benefit is identifying a child left in a parked car.



Cheater 1
Placed 2+ tags on the same seatbelt (identical vitals)



Cheater 2
Clicked seatbelt for with no person, or a mannequin – no vital signs.



Cheater 3
Strapped a dog in – non-human vitals.

EU COMISSION QUOTES

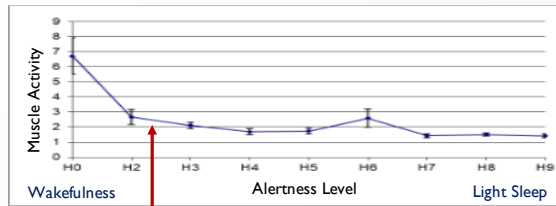
A. Proposed (DMS) solution is an original solution that combines multiple non-invasive sensors to measure a driver's health condition and awake status to provide an early alert to prevent accidents. The solution outperforms the existing ones and has the potential to disrupt the market.

B. The innovation itself is unique, I did not find any similar approaches to the driver monitoring system, that would be based on the sensors embedded in the driver's seat.

C. The car industry is looking for such kind of advanced DMS solution. Moreover, it appears to be fully in line with the EU Regulations to be put in place in 2024 in the field of car safety.

D. The innovation has the potential to scale up the company as it can replace the existing solutions in a growing market.

Annex 2 - The Scientific Basis of NOVAAlert Alertness Monitoring



Early detection of drowsiness

NOVAAlert's Brock University (Canada) scientific muscle tonus validation tests by Prof. Robert Ogilvie and Core Martin confirmed Dan Atlas' theory:

- One falls asleep only following muscle activity relaxation, muscle activity keeps us awake. In above, Muscle activity illustrate a strong relationship with brain changes (Alertness level). Tested both chin EMG and wrist EMG, show similar significant decreases in muscle activity across the sleep onset period (H0=wakefulness, H9= true light sleep stage).
- NOVAAlert's vibrations contingent on sensed muscle fatigue were found to be highly effective for 60 to 75 minutes in postponing the effects of increased sleepiness and increased likelihood of experiencing microsleeps. This is consistent with the intended use of the device as an early warning system.

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Annex 3 - Autoliv & NOVAAlert Smart Wheel Tests

Data collection

- Data collection
 - Relevant vehicle data
 - Speed, lane position, SW angle, pedals etc.
 - Video based gaze direction, eyelid opening, head pos
 - KSS value every 5 minute
 - EEG, EOG and EMG
 - Video recordings (road scenery and cabin)
- In total 43 drivers have completed 3 drives each
- Procedure: Each driver drove three times during one day (day, evening and night). Trip duration 80-90 minutes

*On-road tests were conducted with governmental approval (N2007-E32579) and ethical approval by Regional ethics approval board (SPH 14-07-13A-05)



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