A Critical Examination of Alleged Terrestrial Sommerfeld-Goubau "WiPoW Comms" System

I. Introduction: A Critical Inquiry into an Alleged Decade-Old Terrestrial System

A. Context of the Investigation

This report undertakes a critical examination of assertions surrounding an alleged terrestrial communication and power system, purportedly utilizing Sommerfeld-Goubau (S-G) technology and referred to as "WiPoW comms." Claims suggest this system has been operational for nearly a decade. The investigation is prompted by a request to professionally challenge the claims, counter-claims, instances of missing claims, and any lack of evidence associated with this system, with a particular focus on information attributed to the webpage https://thedailydialectics.com/sommerfeld-goubau/wipow-comms.

B. Methodological Constraint: The Inaccessible Primary Source

A significant and immediate challenge in this investigation is the consistent inaccessibility of the specified webpage and other related pages hosted on the thedailydialectics.com domain.1 This persistent unavailability prevents any direct verification, analysis, or refutation of the content as it might be presented on the site itself. Consequently, this report must, by necessity, rely on information from secondary sources, predominantly a public internet forum discussion 5, which purports to quote or summarize claims originating from thedailydialectics.com. This reliance on second-hand accounts introduces a considerable limitation and forms a substantive point of critique regarding the fundamental verifiability of the original assertions. The inability to access and scrutinize the primary source material is a critical deficiency for any claim demanding scientific or technical credibility.

C. Report Objective and Scope

The principal objective of this report is to critically evaluate the scientific and technical veracity of the claims attributed to thedailydialectics.com. This involves a thorough scrutiny of any cited supporting evidence, or its notable absence, and an assessment of the overall plausibility of the alleged terrestrial system. The scope of this examination encompasses:

- The established scientific principles of Sommerfeld-Goubau lines versus their alleged novel applications.
- Claims regarding deployment by major technology corporations, particularly on existing power line infrastructure.
- The purported use of Terahertz (THz) frequencies for combined power and data transmission within this system.
- The alleged capability to wirelessly power nano-scale machines, specifically Microelectromechanical Systems (MEMS).
- An analysis of patents cited or alluded to as foundational evidence.
- A review of potential health and safety implications that such a system, if real, would entail.

- An emphasis on the lack of credible, verifiable evidence supporting the overarching narrative.

D. Emerging Theme: The "Conspiracy of Plain Sight" Fallacy

The narrative concerning this alleged system, as inferred from the available secondary source 5, appears to suggest the existence of a technologically advanced, large-scale network operating covertly, yet paradoxically utilizing public infrastructure such as power lines. This narrative construct often aligns with a conspiratorial trope where complex, clandestine operations are claimed to be conducted "in plain sight," supposedly shielded by public ignorance, disbelief, or the sheer audacity of the endeavor. This report will address the immense practical and logistical difficulties inherent in maintaining the secrecy of such a widespread and physically manifested technological deployment.

The combination of extraordinary claims—such as Google and Facebook deploying THz Sommerfeld-Goubau lines on public power grids for a decade to power MEMS [5]—with the persistent inaccessibility of the primary source making these claims [1] immediately raises concerns characteristic of unsubstantiated theories. Legitimate, groundbreaking technology, particularly if deployed on a societal scale for nearly a decade, would invariably generate a substantial and traceable public and scientific footprint. Such a footprint would include regulatory filings with governmental bodies, numerous patents clearly detailing these specific large-scale applications (not just tangential component technologies), mainstream news reports, articles in reputable industry publications, and observable modifications to public infrastructure. The conspicuous absence of this kind of verifiable, multi-source evidence, especially when the primary proponent's platform is itself unavailable, strongly suggests that the claims lack a credible foundation. This pattern is frequently observed in the dissemination of pseudoscientific concepts or conspiracy-minded narratives, where the lack of evidence is often reframed as proof of concealment rather than a deficiency in the claim itself.

II. The Sommerfeld-Goubau Line: Established Science and Practical Realities

A. Fundamental Principles

A Sommerfeld-Goubau line, commonly referred to as a G-line, is a type of transmission line specifically designed to guide electromagnetic surface waves. It typically consists of a single cylindrical conductor, which may be bare or, more commonly, coated with a thin layer of dielectric material.6 This dielectric coating serves to slow the propagation velocity of the electromagnetic wave along the conductor to a speed less than that of light in free space. This reduction in phase velocity causes the electromagnetic fields to become bound to the surface of the wire, effectively guiding the wave along its length.6 The underlying physics connects the Zenneck wave, the radial cylindrical surface wave, and the Sommerfeld-Goubau (or axial cylindrical surface) wave, showing them to be different perspectives on the same fundamental phenomenon of surface wave propagation.7

To launch a surface wave onto a G-line or to extract energy from it, specialized coupling structures are required. These are often conical metallic horns, referred to as "launchers" or "catchers." The narrow end of the horn is typically connected to a conventional transmission line, such as a coaxial cable (e.g., to its shield, with the G-line wire passing through an aperture at the cone's apex), facilitating the transition from a transverse electromagnetic (TEM) mode in the cable to the transverse magnetic (TM-like) surface wave mode on the G-line.[6] The efficiency of these launchers is critical for the overall performance of a G-line system.

B. Validated Applications

The G-line was historically developed and utilized as a low-loss alternative to other transmission lines, such as coaxial cables or twin-lead lines, particularly at UHF (Ultra High Frequency) and lower microwave frequencies. At these frequencies, conventional cables can exhibit significant attenuation over extended distances (e.g., tens of meters), rendering them impractical for applications like antenna feedlines.6 G-lines offered a solution with lower signal loss for such scenarios.

Beyond antenna feeds, G-lines have found applications in scientific research and specialized measurement systems. For instance, they are employed in test stands designed to measure the impedance characteristics of components for particle accelerators. In such setups, the transverse electric field profile of the surface wave on the G-line can mimic that of a charged particle beam, allowing for impedance measurements outside the operational accelerator environment.[8] More recent research has explored the development of planar Goubau lines (PGLs), where the G-line structure is fabricated on a dielectric substrate. These PGLs are being investigated for their potential as low-loss waveguides in integrated circuits and systems operating at very high frequencies, including the terahertz (THz) band.[9]

C. Inherent Limitations and Practical Challenges

Despite their advantages in specific contexts, Sommerfeld-Goubau lines are subject to several inherent limitations and practical challenges that restrict their broader applicability:

- **Attenuation:** While G-lines can offer lower attenuation than coaxial cables at certain high frequencies, they are not lossless. Energy is inevitably lost due to the finite conductivity of the wire (conductor losses) and any imperfections or losses within the dielectric coating (dielectric losses). These losses generally tend to increase with operating frequency.[6] Even for THz waveguiding on bare metal wires, which can be considered a variant of the Sommerfeld surface wave concept, material properties, surface roughness, and dispersion remain significant challenges, although attenuation can be low due to the small effective surface area interacting with the wave.[11]

- **Bend Sensitivity:** G-lines are highly sensitive to physical bends. Sharp bends or curves in the wire can cause the surface wave to radiate energy away from the line, leading to significant signal loss and potential interference.[6] Consequently, practical G-line installations must maintain large bend radii, which can be a substantial constraint for deployment along existing infrastructure that may involve numerous turns and non-linear paths.
- **Launcher/Coupler Efficiency and Complexity:** Efficiently coupling electromagnetic energy onto and off the G-line is a critical design challenge. The launchers and catchers must be carefully designed and matched to the G-line and the connecting transmission lines. Achieving high coupling efficiency, especially over broad bandwidths or at very high frequencies (like THz), can be complex and may require intricate structures.[8]
- **Environmental Susceptibility:** As an open waveguide structure, the G-line's propagating surface wave extends into the space surrounding the wire. This makes it susceptible to environmental factors. Precipitation (rain, snow, ice), accumulation of debris or contaminants on the line, and the proximity of other conductive or dielectric objects can alter the G-line's electromagnetic characteristics, increase losses, and potentially disrupt wave propagation. This susceptibility is a known characteristic of open waveguide systems and would be particularly problematic for long-distance, outdoor deployments.
- **Power Handling for Transmission:** While some research has explored G-lines for wireless power transfer, these investigations are typically at modest power levels and for short distances. For example, one study reported on microwave power transfer at 1.36 GHz with a DC rectification efficiency of approximately 12.7% when the input power was 15 dBm (milliwatts), intended for niche applications like emergency power for cable cars.[10] Another demonstrated an RF-to-RF efficiency of 35% to a single receiver at a distance of 0.5 meters for a 233 MHz signal.[12] These examples are proof-of-concept studies and are vastly different in scale, power level, and operational context from the requirements of a widespread, terrestrial power distribution system.

The established applications of G-lines are predominantly as specialized solutions for specific engineering problems, such as low-loss UHF antenna feeds or controlled laboratory environments for scientific measurements. Extrapolating these known uses and characteristics to a ubiquitous, power-grid-integrated, terahertz-frequency communication and power delivery system represents a monumental leap. Such a system would need to overcome the inherent limitations related to bend sensitivity, environmental factors, frequency-dependent losses, and the complexities of efficient, robust coupling on an unprecedented scale. Current engineering realities and the documented performance of G-lines do not support the feasibility of such a grand-scale deployment as alleged. The transition from well-understood, niche applications to a global terrestrial system operating under vastly more demanding conditions is not substantiated by the existing body of scientific and engineering literature on Sommerfeld-Goubau lines.

III. Deconstructing the Claims Attributed to "thedailydialectics.com"

The narrative attributed to thedailydialectics.com, primarily disseminated through secondary accounts like the one found in an internet forum discussion [5], posits a complex and far-reaching terrestrial system. This section will systematically deconstruct the principal claims, challenging them based on established scientific principles, engineering practicalities, and the available evidence.

A. Alleged Deployment on Power Line Infrastructure by Google/Facebook
A central assertion is that "The sommerfeld goubau launchers have been being placed on power lines via google," with similar implications made for Facebook's involvement.5 This claim faces several critical challenges:

- **Challenge 1: Lack of Verifiable Public Evidence:** There is a profound absence of credible, independent, or verifiable public evidence to substantiate the claim of a decade-long, large-scale deployment of Sommerfeld-Goubau launchers on public power line infrastructure by these major technology corporations. Such a massive undertaking would typically generate a substantial trail of public records, including but not limited to: official press releases from the involved companies (Google, Facebook) or utility providers, regulatory filings with energy and communications authorities, numerous scientific publications detailing the technology and its deployment, widespread photographic or video evidence from independent observers, and reports in reputable technical journals or mainstream media. The primary source making these specific allegations remains inaccessible [1], further undermining the claim's credibility.
- Challenge 2: Technical Unsuitability of Conventional Power Grids for S-G Waveguiding at THz:
  Existing electrical power transmission and distribution networks are designed for the efficient transport of electrical energy at low frequencies (typically 50 Hz or 60 Hz). Their physical and electrical characteristics are fundamentally unsuited for guiding high-frequency surface waves as required by Sommerfeld-Goubau lines, especially at terahertz frequencies.
  - **Multi-conductor and Discontinuous Nature:** Power lines are typically

multi-conductor systems (e.g., three-phase conductors, neutral wires, grounding wires), often unshielded, and characterized by numerous physical and electrical discontinuities. These include insulators, transformers, substations, junctions, support towers, and variations in conductor sag and height.[6] In contrast, efficient Sommerfeld-Goubau wave propagation requires a single, relatively uniform conductor with minimal discontinuities and carefully controlled impedance characteristics.

- **Hostile Electromagnetic Environment:** The presence of multiple conductors, grounding structures, varying clearances to ground and other objects, and the inherent "dirty" radio frequency (RF) environment around power lines (due to corona discharge, arcing at insulators, etc.) would severely disrupt, scatter, or prevent the stable propagation of a well-defined S-G surface wave. This would be particularly acute at THz frequencies, where wavelengths are very short and thus more sensitive to physical imperfections and the surrounding environment.
- **Specialized THz Waveguides vs. Power Lines:** Research into guiding THz waves often involves highly optimized structures like planar Goubau lines fabricated on specialized substrates or carefully prepared bare metal wires in controlled laboratory environments.[9] Even for these tailored THz waveguides, challenges such as high losses (dielectric, ohmic, radiation) and parasitic effects are significant concerns.[9] Standard power line conductors, with their rough surfaces, exposure to weathering, contamination, and complex surrounding metallic structures, are vastly different from these optimized laboratory setups. Retrofitting existing power lines to function as efficient, long-range THz G-lines would necessitate massive, highly visible modifications to "clean up" the electromagnetic environment, ensure proper wave confinement, and mitigate losses—or it would require the system to operate based on entirely unknown physical principles. The assertion that *existing* power lines are being used "as is" for such a purpose is technically unsound.

The narrative appears to conflate the general physical principle that electromagnetic waves can propagate along conductive structures with the highly specific and demanding requirements for efficient, low-loss Sommerfeld-Goubau surface waveguiding. The fundamental design and operational purpose of power grids are antithetical to their use as high-performance THz waveguides.

Table 1: Sommerfeld-Goubau Lines – Reality vs. Allegation

Feature	Established S-G Characteristics (Supported by)	Alleged "thedailydialectics.com" System Characteristics (Derived from)
Conductor Type	Typically single, often dielectric-coated wire; specialized planar structures for THz.	Existing, multi-conductor, bare power lines.
Operating Frequency	Primarily UHF and microwave; research into THz for planar/bare wire guides.	"Terahertz microwave frequency."
Typical Application	Low-loss antenna feedlines (UHF/microwave); scientific research; specialized test stands; short-range, low-power WPT research.	Ubiquitous, long-range power and data transmission on a continental scale.
Max Practical Distance for Efficient Transmission	Tens to hundreds of meters for UHF/microwave antenna feeds; centimeters to meters for WPT research; THz guiding research focuses on short, optimized paths.	Implied continental or widespread coverage ("terrestrial system").
Power Handling Capacity	Antenna feeds: signal levels. WPT research: milliwatts to a few watts over short distances.	Sufficient to "tirelessly power devices," including MEMS, implying significant power levels over vast areas.
Infrastructure Requirement	Carefully engineered single line with launchers/catchers; minimal bends and discontinuities; controlled environment for optimal performance.	Existing power grid infrastructure with "launchers" allegedly added.
Bend Sensitivity	High; sharp bends cause radiation loss, requiring large bend radii.	Deployed on existing power lines which inherently have numerous bends, sags, and angles.

Environmental Susceptibility	High for open structures; affected by weather, debris, proximity to objects.	Deployed in exposed, outdoor environments on power lines.

This table starkly illustrates the chasm between the scientifically established characteristics and limitations of Sommerfeld-Goubau lines and the extraordinary capabilities attributed to them in the narrative. The alleged system consistently demands performance metrics and operational conditions that are far beyond, or directly contradictory to, what is known and validated for G-line technology.

B. Terahertz (THz) Frequencies for Long-Range Power and Data Transmission

The claim that the system utilizes "terahertz microwave frequency" 5 for widespread, long-range power and data transmission via power lines introduces further significant technical challenges:

- **Challenge 1: Severe Atmospheric Absorption:** Terahertz radiation, typically defined as electromagnetic waves in the frequency range of 0.1 to 10 THz, is known to be strongly absorbed by components of the Earth's atmosphere, most notably water vapor.[13] This absorption significantly attenuates THz signals, limiting their practical unguided transmission range in air to tens of meters, or even less at specific resonant absorption frequencies.[13] While a Goubau line is a guided wave structure, the surface wave it carries still has fields extending into the surrounding air. Over long distances typical of power line networks, any radiation leakage (due to imperfections, bends, or couplers) or interaction of the wave's evanescent fields with the atmosphere would still be subject to these substantial absorption losses. This inherent property of THz propagation makes it an exceedingly poor choice for long-distance transmission in an open, atmospheric environment.
- **Challenge 2: Signal Integrity and Power Efficiency Over Power Lines:** Maintaining the integrity of data signals and achieving high power transfer efficiency for THz waves propagated over many kilometers of existing power lines (which, as established, are not designed as THz waveguides) presents an extraordinary technical hurdle.
    - **Losses:** Conductor losses (due to the skin effect) and any dielectric losses (if a coating were hypothetically added or if insulators interact with the fields) generally increase with frequency. While specialized bare metal wires can guide THz waves with potentially low attenuation under ideal conditions [11], practical power line conductors have rough surfaces, are subject to corrosion and contamination, and are exposed to weathering. These factors would introduce significant scattering and absorption losses for THz waves, severely degrading propagation efficiency.

    - **Dispersion:** Over long transmission paths, dispersion effects would become highly significant for broadband THz signals. Dispersion causes different frequency components of a pulse to travel at slightly different velocities, leading to pulse spreading and distortion, which would corrupt data signals and reduce the effective bandwidth of the communication channel.[11]
- **Challenge 3: Lack of Suitable THz Power Source and Launching Technology for Grid-Scale Applications:** While sources capable of generating THz radiation exist, including gyrotrons, backward wave oscillators, and quantum cascade lasers [13], the technologies for generating and efficiently launching the immense THz power levels that would be required for meaningful power distribution across a power grid via G-lines—and doing so reliably and continuously for a purported decade of operation—are beyond current, widely established, and deployed technological capabilities. Commercially available THz sources, such as those in the 0.3–1.0 THz range [13], are typically designed for applications like spectroscopy, short-range imaging, or scientific research, and operate at power levels many orders of magnitude below what would be needed for grid-scale power delivery.

The selection of THz frequencies for a pervasive, power-line-based system appears technically counterintuitive, given the well-documented challenges associated with THz propagation and power generation at scale. This choice suggests either a fundamental misunderstanding of THz physics and engineering by the proponents of the claim or an intentional invocation of "THz" for its exotic, "high-technology" connotation, rather than for any practical advantage in the alleged application. The known benefits of THz radiation, such as its large available bandwidth for high-data-rate communications or its unique interactions with materials for spectroscopy, are typically exploited in applications where its significant drawbacks (e.g., limited range, atmospheric absorption, power generation challenges) can be effectively managed or are less critical, such as short-range point-to-point links, secure communications, or non-destructive material characterization. Using THz for long-distance power and data transmission on an inherently unsuitable medium like existing power lines is incongruous with its known physical properties and current technological capabilities.

C. Wireless Powering of Ubiquitous Nano-Machines (MEMS)
A particularly striking claim is that the alleged Sommerfeld-Goubau system is used to power "NANO Machines, aka Microelectromechanical systems (MEMS)" and that the "development in goubau systems has been spearheaded most entirely due to its ability power MEMs".5 The narrative further suggests that "THz waves can penetrate the skin easily" and "The wave can be received via an antenna only a few micrometers thick," facilitating this MEMS powering.5 These assertions are highly problematic when compared to established MEMS technology

and the physics of wireless power transfer.

- Challenge 1: Discrepancy with Known MEMS Powering Methods:
  Current and developmental methods for powering MEMS devices are typically localized and designed for the very low power requirements (microwatts to milliwatts) of these miniature systems. Established approaches include:
  - **Energy Harvesting:** Piezoelectric, electrostatic, and electromagnetic vibration energy harvesters that convert ambient mechanical energy into electrical power.[14]
  - **Direct Powering:** Integrated batteries, or direct wiring for applications where feasible.
  - Research into piezoelectric thin films for MEMS emphasizes their advantages in miniaturization and low power consumption.[14] Studies on enhancing electrostatic MEMS converters detail efforts to boost output power to a few milliwatts.[15] The notion of broadcasting THz power over a vast power-line-based G-line grid to energize countless, randomly located, and potentially mobile MEMS devices is a radical departure from these targeted, localized, and low-power solutions.
- Challenge 2: Extreme Challenges in Efficiency and Targeting of Power Delivery:
  The practicalities of efficiently and selectively delivering meaningful amounts of THz power from a macro-scale power line G-line to micro- or nano-scale MEMS receivers, which could be embedded within various objects or even biological tissues, are immense.
  - **Power Budget and Path Losses:** The inverse square law for unguided radiation and significant path losses (absorption, scattering, coupling inefficiencies) for guided waves over long, non-ideal paths would mean that an enormous amount of power would need to be transmitted from the G-line to ensure even microwatts reach distant MEMS devices. This implies incredibly high field strengths near the G-line or extraordinarily efficient and highly directive miniature receiving antennas and power conversion circuits within the MEMS, none of which are described or credibly proposed.
  - **Skin Penetration and Tissue Interaction:** The claim that "THz waves can penetrate the skin easily" [5] is a simplification. While THz radiation is non-ionizing and can penetrate biological tissues to some extent, more so than visible or infrared light but less than X-rays [13], this penetration is not lossless. Water, a primary constituent of biological tissue, is a strong absorber of THz radiation. Significant absorption and scattering would occur as THz waves pass through tissue, limiting the effective penetration depth and attenuating the power available to any embedded MEMS. "Some distance" of penetration [13] does not equate to efficient power delivery to deeply embedded

or arbitrarily located devices.

- Challenge 3: Antenna Size, Efficiency, and Complexity at THz for MEMS:
While an antenna with physical dimensions in the micrometer range is indeed plausible for operation at THz frequencies (where wavelengths range from 3 mm down to 30 µm 13), its efficiency, bandwidth, and radiation pattern would be critically dependent on its specific design, materials, integration with the MEMS circuitry, and the electromagnetic properties of its immediate surroundings (e.g., within a biological tissue or other material). The simplistic statement that a micrometer-thick antenna can receive the wave 5 overlooks these crucial engineering complexities. Furthermore, such an antenna would need to be coupled to rectification and power management circuitry within the MEMS, all operating efficiently at THz frequencies, which is a non-trivial design challenge.

The assertion regarding MEMS powering appears to be a speculative and exaggerated extension of legitimate research areas, such as THz interactions with biological materials and the development of G-line-like structures for specialized applications. The narrative seems to misinterpret or misapply findings from these fields. For example, the reference to Anthony Treizebré's work [5] on THz BioMEMS, which in the provided quote clearly discusses the use of THz for "spectroscopy" to "probe the low binding energy between molecules" and achieve "sub-micrometer spatial resolution" for analytical purposes, is seemingly twisted to imply a focus on *powering* MEMS ubiquitously. Treizebré's described work is about using THz radiation as a sensing and analysis tool in conjunction with MEMS devices, not as a primary power source broadcast over a wide area. This misattribution is a critical flaw in the argument linking G-line development primarily to MEMS powering. The leap from THz spectroscopy in BioMEMS to a global MEMS powering network via power lines is unsupported and technically implausible.

D. Misinterpretation and Misapplication of Patents and Technical Roles

The narrative attempts to bolster its credibility by referencing patents and the work of specific inventors, notably Karthik Yogeeswaran, and linking them to Google and Meta Platforms (Facebook). However, a closer examination reveals that these references are often decontextualized or misinterpreted.

- **Claim** [5]**:** Karthik Yogeeswaran is presented as a key figure, an inventor for both Google and Facebook (now Meta) patents related to Sommerfeld-Goubau launchers and line-of-sight receivers. His work is alleged to involve "propagation of electromagnetic radiation from power lines" for Goubau launchers, directly linking this to the powering of MEMS.
- Challenge 1 (Analysis of Karthik Yogeeswaran's Patents):
A review of patents listing Karthik Yogeeswaran as an inventor, with Meta

Platforms, Inc. or Google LLC as assignees, reveals a focus different from the claims.

- Patents such as 11750242 and 11374618 (assignee: Meta Platforms, Inc.) describe systems for a "Surface wave based wireless connection to an electronic device".[16] The abstracts detail the use of a "two-dimensional conductive surface" of a *surface waveguide*, which is treated to enhance its surface reactance. Electromagnetic waves are coupled to this surface and then to an electronic device using mode converters.[16] This technology appears geared towards localized wireless communication or power transfer for consumer electronics, components within a device, or short-range inter-device links, rather than deployment on continental-scale power line infrastructure for widespread power distribution or MEMS activation.
- There is no explicit mention in the provided abstracts of these Meta patents of Sommerfeld-Goubau lines being deployed *on power lines*, the use of THz frequencies for such an application, or the specific purpose of powering ubiquitous MEMS in the manner alleged.
- A patent assigned to Google LLC, with Karthik Yogeeswaran as an inventor, relates to "coating a segment of fiber optic cable".[17] This is clearly related to fiber optic technology and does not substantiate claims about S-G launchers on power lines.
- While the secondary source [5] asserts that Yogeeswaran's work involves "propagation of electromagnetic radiation from power lines, the system in which goubau launchers operate," the publicly available abstracts of his patents do not support this specific interpretation in the context of a decade-old, large-scale, THz S-G system for power and MEMS.
- It is important to note that full-text analysis of Meta patents 11374618 [18] and 11750242 [20] was hindered by inaccessible links during the research phase. However, the detailed abstracts available from other sources [16] provide a strong indication of their scope and intended applications, which do not align with the grander claims.

* Challenge 2 (Analysis of Facebook Patent US8949250B1):
  The internet forum discussion 5 links Facebook's purported involvement in Sommerfeld-Goubau technology via a URL (http://www.thedailydialectics.com/SommerfeldGoubau/Facebook), which is inaccessible.4 The discussion then refers to "investigating the patent technology shared in this thread." While no specific patent number is directly cited in 5 for Facebook's alleged S-G work, US Patent 8,949,250 B1 is often brought up in online discussions related to these broader claims.
  - However, US Patent 8,949,250 B1, assigned to Facebook, Inc., is titled

"Generating recommended search queries on online social networks".[22] An examination of its title, and by extension its likely content (given that direct access via patents.google.com was also marked as inaccessible [23]), indicates that this patent pertains to software algorithms for social networking, search query recommendations, and user interface functionalities.
  - There is no discernible connection between the subject matter of this patent (social media search algorithms) and the claimed hardware technologies of Sommerfeld-Goubau lines, wireless power transmission, surface waves on power lines, or THz systems. Other Facebook patents generally revolve around social networking, data processing, advertising, and virtual/augmented reality [24], not large-scale power infrastructure.
- Challenge 3 (Pattern of Misleading Connections):
  The narrative presented in the secondary source 5 attempts to construct a cohesive picture of a coordinated, large-scale Sommerfeld-Goubau deployment by weaving together disparate patents and distinct areas of research. For example, Karthik Yogeeswaran's patents on surface wave guides for electronic devices are linked to alleged power line deployments, and Anthony Treizebré's research on THz spectroscopy for BioMEMS is misrepresented as being about MEMS powering. These connections are speculative, lack direct evidentiary support within the cited materials themselves (when critically examined), and demonstrate a pattern of misapplication.

This strategic citation of legitimate patents and recognized researchers, but in a manner that decontextualizes or misrepresents their actual work, is a common tactic in the promotion of fringe theories or unsubstantiated claims. It attempts to lend an unwarranted air of authority and credibility by associating the narrative with established names and institutions, even when the core work of those entities does not support the specific, often extraordinary, claims being made. A careful examination of the actual scope and content of these patents, as undertaken here, reveals the flaws in these purported connections.

Table 2: Analysis of Key Patents Mentioned or Inferred in Relation to Claims

Patent Number (or inferred)	Assignee	Key Inventor(s) Mentioned	Official Title / Abstract Summary (from)	Interpreted Actual Scope & Technology	Relevance to "thedailydialectics.com" Claims (as per) &

					Justification for Challenge
11750242	Meta Platforms, Inc.	Karthik Yogeeswaran, Apoorva Sharma	"Surface wave based wireless connection to an electronic device." Involves a surface waveguide with a treated 2D conductive surface and mode converters to couple EM waves to an electronic device. [17]	Localized wireless communication/power for electronic devices (e.g., within a device, short-range).	**Alleged Relevance:** Evidence of Meta's S-G technology. **Challenge:** No mention of power line deployment, THz for this purpose, long-range transmission, or MEMS powering. Technology is for localized device-level applications.
11374618	Meta Platforms, Inc.	Karthik Yogeeswaran, Apoorva Sharma	"Surface waveguide with a two-dimensional conductive surface surrounded by a conductive wall." Similar to 11750242, focusing on guiding EM waves on a treated 2D surface for connection to an electronic	Localized wireless communication/power for electronic devices.	**Alleged Relevance:** Evidence of Meta's S-G technology. **Challenge:** Same as for 11750242; scope is device-centric, not infrastructure-scale.

			device. [16]		
Patent for "coating a segment of fiber optic cable" [17]	Google LLC	Karthik Yogeeswaran, et al.	Method involving coating fiber optic cable, forming a coil, deforming it. [17]	Fiber optic cable manufacturing or deployment technology.	**Alleged Relevance:** Implied connection to Google's S-G work via Yogeeswaran. **Challenge:** Clearly relates to fiber optics, not Sommerfeld-Goubau lines on power lines or THz wireless power. Irrelevant to core claims.
US 8,949,250 B1 (inferred)	Facebook, Inc.	[22]	"Generating recommended search queries on online social networks." [22]	Software algorithms for social media search functionality and user experience.	**Alleged Relevance:** Linked via inaccessible thedailydialectics URL [4] implying Facebook's involvement in S-G hardware. **Challenge:** Patent subject matter is entirely unrelated to S-G lines, wireless power, THz, or physical

					infrastructure. This is a clear misattribution if this patent is the one implied.

This table highlights the significant disconnect between the actual technical scope of the cited or inferred patents and how they are portrayed within the narrative supporting the alleged terrestrial system. The patents largely describe localized device-level technologies or unrelated software functionalities, not the claimed widespread infrastructure.

E. Claims of Invasiveness and Secrecy

The narrative also incorporates claims about the system's invasive nature and its operation in secrecy 5: "The ability for google to send and receive data from the power lines is an invasive tactic being that you will statistically be around one the majority of time. The fact that the system can Tirelessly power devices would at least have semblance of positive attributes if it weren't a secret."

- Challenge 1: Implausibility of Secrecy for Pervasive, Decade-Old Infrastructure: The assertion that a novel, pervasive technology deployed by major global corporations (Google, Facebook) on public utility infrastructure (power lines), involving the installation of physical "launchers" and possessing significant societal impacts (data collection, power delivery), could be kept entirely secret for nearly a decade is exceptionally implausible.
  - Maintaining such secrecy would necessitate the collusion, silence, or unwitting cooperation of a vast number of individuals and organizations. This would include employees within the alleged deploying companies, personnel at utility companies across potentially multiple countries, manufacturers of the specialized hardware, installation and maintenance crews, and regulatory bodies overseeing energy and communications. The probability of no credible leaks, whistleblowers, or accidental public disclosures over a ten-year period from such a diverse group is vanishingly small.
  - Furthermore, such extensive physical infrastructure modifications or additions ("launchers on power lines") would likely be observable and detectable by independent researchers, engineers, journalists, or even technologically inclined members of the public. The global amateur radio community, for instance, is often adept at detecting unusual electromagnetic signals. The complete absence of any such independent reports, photographic evidence, or reverse-engineered findings over a decade strains credulity.

- Challenge 2: "Invasiveness" Claim Premised on Unproven Technical Capability: The claim of "invasiveness" due to data collection from power lines is predicated on the system's alleged technical capability to perform this function ubiquitously and effectively. As demonstrated in previous sections, the technical feasibility of using existing power lines as efficient, long-range THz Sommerfeld-Goubau waveguides for robust data transmission is highly questionable. If the fundamental technical capability itself lacks substantiation, then the consequent claim of "invasiveness" based on that capability is similarly weakened.

The "secrecy" argument often functions as a convenient way to explain the lack of concrete, verifiable evidence for an extraordinary claim. In such narratives, the absence of proof is not seen as a fatal flaw in the claim's credibility but rather as a testament to the effectiveness of the alleged concealment. However, when the claimed system involves widespread physical infrastructure and the participation of major public corporations, the burden of proof for such secrecy becomes immense. The notion that such a technologically advanced and societally impactful system could remain completely invisible to the entire independent technical community, regulatory bodies, and the general public for a decade is arguably a more extraordinary claim than the purported technology itself.

IV. Health, Safety, and Environmental Impact: The Unaddressed THz Question

Any technology that involves the widespread emission of electromagnetic radiation, particularly a novel system alleged to have been operating pervasively for a decade, necessitates a thorough consideration of potential health, safety, and environmental impacts. The claims surrounding the Sommerfeld-Goubau THz system [5] notably lack any discussion of these critical aspects.

A. Review of Terahertz (THz) Radiation Bioeffects
Terahertz (THz) radiation, occupying the electromagnetic spectrum between microwaves and far-infrared light (typically 0.1 THz to 10 THz), has distinct interaction properties with biological matter.

- **Non-Ionizing Nature:** THz radiation is non-ionizing.[13] This means that individual THz photons do not carry sufficient energy to directly break chemical bonds or eject electrons from atoms (ionize them) in the way that X-rays or gamma rays do. Consequently, the types of direct DNA damage associated with ionizing radiation are not the primary concern with THz exposure.
- **Thermal Effects:** The most well-established biological effect of THz radiation is heating.[28] This occurs because water molecules, which are abundant in biological

tissues, strongly absorb THz waves. This absorption of energy leads to an increase in tissue temperature. The extent of heating depends on factors such as the power density of the THz radiation, exposure duration, frequency, and the water content of the specific tissue.

- **Potential Non-Thermal Effects:** Research into potential non-thermal effects of THz radiation is an active and evolving field. Some studies suggest that THz waves, even at energy levels not causing significant bulk heating, might be able to modulate biological or neurological functions, or induce changes in DNA dynamics (like local breaks of hydrogen bonds) and gene expression.[13] However, these findings are often from specific experimental conditions, and there is not yet a broad scientific consensus on the general relevance or mechanisms of specific non-thermal hazards at typical environmental exposure levels. The biological significance and dose-response relationships for such effects are still under investigation. [28] emphasizes that "there is still quite limited knowledge about safe limits of THz exposure" and calls for systematic study of various exposure modes.
- **Tissue Damage Thresholds:** Experimental studies have been conducted to determine tissue-damage thresholds for THz radiation. For example, one study reported an ED50 (Effective Dose for 50% of subjects) for tissue damage to be 7.16 W/cm^2 for short (2-second) exposures to broadband THz (0.1-1.0 THz).[29] It is crucial to understand that this is an acute damage threshold, not a guideline for safe chronic or public exposure, which would be set at much lower levels.

B. International Safety Guidelines (ICNIRP, IEEE)

Several international bodies are responsible for developing guidelines to protect against adverse health effects from exposure to electromagnetic fields (EMF), including those in the THz range.

- **ICNIRP and IEEE:** The International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE) are key organizations that issue such guidelines based on comprehensive reviews of the available scientific literature.[29]
- **Frequency Coverage and Extrapolation:** ICNIRP, for example, provides RF EMF guidelines covering frequencies up to 300 GHz (0.3 THz).[30] The THz band extends significantly beyond this. Historically, due to a relative scarcity of direct experimental data on bioeffects specifically within the entire THz range, safety standards for THz frequencies have often been developed by extrapolating from data available for adjacent spectral regions, namely microwaves (lower frequencies) and infrared radiation (higher frequencies).[28]
- **Acknowledged Knowledge Gaps:** ICNIRP itself acknowledges the existence of

"gaps in knowledge" relevant to its RF guidelines, including aspects such as the relationship between RF EMF exposure and heat-induced pain, and the precise quantification of core temperature rise from whole-body exposure across a wide frequency range.[30] These gaps are particularly relevant when considering the higher end of the RF spectrum and the lower end of the THz spectrum.

- **Complexity of THz Standards:** Defining unified safety standards for the THz region is further complicated because the THz frequency band (0.1 THz to 10 THz) straddles areas traditionally covered by two different safety standard philosophies: radiofrequency (RF) radiation safety standards (typically for frequencies up to 0.3 THz), which are often based on preventing excessive heating or psychophysical effects like pain perception, and laser safety standards (which often apply from 0.3 THz upwards), which are frequently based on preventing acute tissue damage (e.g., ED50 values).[29]

C. Challenge: Lack of Apparent Consideration of Health Risks for a Ubiquitous System

If a terrestrial system based on THz Sommerfeld-Goubau lines, capable of delivering significant power and data via public power line infrastructure, has indeed been operational for nearly a decade as claimed 5, it would imply the potential for widespread, chronic public exposure to THz radiation at levels sufficient for the system's alleged functions.

- The narrative surrounding this system provides no indication whatsoever that any health risk assessment has been conducted, that mitigation strategies have been implemented, or that any adherence to existing (or developing) safety guidelines for THz exposure has been considered.
- Given the "secret" nature alleged for the system, it would imply a deliberate circumvention of public health scrutiny and regulatory oversight concerning EMF exposure, which is a serious charge.
- The invocation of THz radiation's ability to "penetrate skin easily" [5] for the purpose of powering MEMS, without any corresponding discussion of the safety limits or potential biological consequences of such penetration at the necessary power levels, highlights a selective and potentially irresponsible presentation of scientific properties. If the THz radiation is potent enough to power devices through biological tissue, its potential for unintended biological interactions at those power densities, especially under conditions of chronic and widespread exposure, must be rigorously assessed and managed. The complete silence on this critical aspect within the claims is a major deficiency.

The development and deployment of any new technology emitting electromagnetic radiation, especially one intended for ubiquitous use, must be accompanied by transparent and thorough safety evaluations. The absence of any such consideration in the narrative of the alleged THz system further undermines its credibility and raises serious questions about the proponents' understanding or regard for public health.

Table 3: Terahertz (THz) Radiation – Key Properties and Safety Overview

Property/Aspect	Known Characteristics / Current Understanding (Supported by)	Relevant Safety Guideline Body & Status (e.g.)	Implication for Alleged System (Based on claims in)
Frequency Range	0.1 THz to 10 THz (or up to 30 THz by some definitions).	ICNIRP, IEEE. Guidelines exist, but THz often involves extrapolation from adjacent bands.	The alleged system operates within this range, where specific long-term exposure guidelines are still maturing.
Atmospheric Attenuation	Strong absorption by atmospheric gases, especially water vapor; limits unguided range to tens of meters.	Not directly a safety guideline issue, but a propagation constraint.	Challenges claims of long-range atmospheric or leaky guided wave transmission for power/data.
Material Penetration (e.g., skin, clothing)	Can penetrate some distance through dielectric materials and body tissues; non-ionizing. Penetration depth is frequency and material dependent.	Safety guidelines consider surface and internal energy deposition.	"Skin penetration" for MEMS powering [5] implies tissue exposure; safety of chronic exposure at necessary power levels is unaddressed.
Ionizing/Non-ionizing	Non-ionizing.	Basis for different biological interaction mechanisms compared to X-rays.	Primary concern is not direct ionization damage, but thermal and potential non-thermal effects.
Primary Biological Interaction Mechanism	Heating due to absorption by water. Active research into non-thermal effects	Guidelines primarily based on preventing excessive heating and established	If system delivers power, thermal effects are a definite concern. Potential

	(e.g., on cell functions, gene expression).	adverse effects.	non-thermal effects from chronic exposure are unknown and unaddressed.
Key Safety Standard Bodies	ICNIRP, IEEE.	ICNIRP guidelines cover RF up to 300 GHz; acknowledge knowledge gaps. IEEE standards also exist. THz region often involves extrapolation and straddles RF/laser standard philosophies.	A "secret" decade-old deployment would have bypassed all standard safety assessment and regulatory processes.
Current Status of Safety Knowledge	"Limited knowledge about safe limits of THz exposure"; "current THz standards have been defined using extrapolated estimates"; ongoing research needed.	Standards are conservative but evolve with research.	Alleging a widespread THz-emitting system operates without addressing these known uncertainties is highly problematic.

This table underscores the complexities and existing uncertainties surrounding THz radiation bioeffects and safety standards. The claim of a decade-long, widespread, and secret THz-emitting system operating without any apparent consideration for these critical safety aspects is a significant red flag.

V. Contrasting with Legitimate Wireless Power and Communication Technologies

To further assess the plausibility of the alleged Sommerfeld-Goubau "WiPoW comms" system, it is instructive to compare its purported characteristics with those of established and emerging legitimate wireless power transfer (WPT) and wireless communication technologies. This comparison reveals stark discrepancies.

A. Established Wireless Power Transfer (WPT) Methods
The field of WPT encompasses several distinct technologies, each with its own principles, capabilities, and limitations:

- **Magnetic Resonance Coupling:** This technique enables wireless power transfer over mid-ranges (typically up to a few meters) by using two or more magnetically coupled resonators tuned to the same resonant frequency. Energy is exchanged efficiently via oscillating magnetic fields in the near-field. Commercial examples exist (e.g., based on WiTricity's work), and research has been conducted at institutions like Cornell University, demonstrating capabilities such as powering a 40W light bulb over shorter distances.[32] Some research claims efficiencies like 80% over 10 feet using this method.[32] These systems are generally designed for charging specific devices (e.g., consumer electronics, medical implants, electric vehicles) within a defined proximity, not for broad, grid-scale power distribution. This technology is explicitly non-radiative in nature.[32]

- **Inductive Coupling:** This is a very short-range WPT method (typically centimeters) based on Faraday's law of induction. It is widely used in applications like Qi wireless chargers for mobile phones and RFID tags. Efficiency is high at close range but drops rapidly with distance.
- **Microwave Power Transmission (Radiative):** This method uses directional antennas to transmit power via microwave beams over longer distances. It has been explored for concepts like space-based solar power, where solar energy collected in orbit would be beamed to Earth.[32] However, it faces significant challenges related to conversion efficiency, the need for large transmitting and receiving antennas (rectennas), precise beam pointing, and public concerns about safety and environmental impact due to the radiative nature of the power transfer.[32]
- **Sommerfeld-Goubau Lines for WPT (Research Scale):** As previously discussed, there is research into using G-lines for WPT. However, these studies are typically conducted at microwave frequencies (e.g., 233 MHz, 1.36 GHz), demonstrate power transfer over very short distances (e.g., 0.5 meters), and achieve modest RF-to-DC or RF-to-RF efficiencies (e.g., 12-35%).[10] These are laboratory-scale investigations or proofs-of-concept for highly specialized, niche applications (like emergency power for a cable car [10]), not designs for widespread, high-power energy distribution.

B. Established Wireless Communication Methods

Modern society relies on a diverse array of well-understood wireless communication technologies:

- **Cellular Networks:** Systems like 3G, 4G LTE, and 5G provide mobile voice and data services over wide geographical areas using networks of base stations and licensed frequency spectrum.
- **Wi-Fi (IEEE 802.11 standards):** Provides short to medium-range wireless local area networking (WLAN) in unlicensed spectrum bands.

- **Bluetooth:** Enables short-range communication between devices, primarily for peripherals and personal area networks.
- **Satellite Communications:** Uses geostationary or low Earth orbit (LEO) satellites to provide communication services over vast distances, including remote areas.
- **Fiber Optics:** While a wired technology, it is the backbone for much of the global communication network, offering extremely high bandwidth and low loss.
- **Microwave Links:** Point-to-point or point-to-multipoint radio links using directional antennas, often for backhaul or fixed wireless access.

These established communication technologies are characterized by decades of public research and development, international standardization processes (e.g., by ITU, 3GPP, IEEE), transparent regulatory frameworks for spectrum allocation and equipment certification, and largely visible and documented infrastructure. None of these widely deployed systems utilize Sommerfeld-Goubau lines on public power grids operating at THz frequencies for their core functionality.

C. Highlighting the Discrepancy

The alleged Sommerfeld-Goubau "WiPoW comms" system, with its extraordinary purported capabilities—decade-long secret operation, THz frequencies propagated on existing power lines, simultaneous long-range power delivery and data transmission, and the ability to power ubiquitous MEMS 5—stands in stark and irreconcilable contrast to the known characteristics, limitations, and evolutionary development paths of all legitimate WPT and wireless communication technologies.

Established technologies progress through stages of theoretical conception, peer-reviewed research, experimental validation, prototype development, standardization, regulatory approval, and incremental or disruptive market introduction. This entire process is typically accompanied by extensive public documentation, patent filings that clearly articulate the intended large-scale application, and open scientific discourse. The narrative of thedailydialectics.com bypasses all these recognized stages of technological maturation. It presents a fully formed, highly advanced, and globally impactful system as having appeared and operated secretly for years, without leaving the expected trail of scientific, industrial, and regulatory evidence. This attempt to posit a "missing link" or a "suppressed technology" that operates far beyond the frontiers of established science, without providing the necessary foundational research or evolutionary evidence that would invariably accompany such a revolutionary leap, is a defining characteristic of unsubstantiated technological claims. The vast, unexplained chasm between current, well-understood technologies and the fantastical assertions made for the alleged Sommerfeld-Goubau system renders these claims scientifically and technically untenable.

VI. Conclusion: An Evidence-Based Assessment of the "thedailydialectics.com" Narrative

This report has undertaken a rigorous, evidence-based examination of the claims attributed to thedailydialectics.com concerning an alleged decade-old terrestrial Sommerfeld-Goubau system operating at terahertz frequencies on public power line infrastructure for ubiquitous power and data transmission, including the powering of MEMS devices. The analysis reveals a profound lack of credible support for these assertions.

A. Recapitulation of Key Challenges

The claims face a multitude of insurmountable challenges from scientific, engineering, and evidentiary perspectives:

- **Lack of Verifiable Evidence for Deployment:** There is no credible, independent, or publicly verifiable evidence confirming the existence or deployment of such a system by any entity, let alone major corporations like Google or Facebook, on public power lines or any other infrastructure.
- **Technical Implausibility of Using Power Lines as THz S-G Waveguides:** Existing power line infrastructure is fundamentally unsuited for the efficient, long-range propagation of THz surface waves as per Sommerfeld-Goubau principles due to its multi-conductor nature, numerous discontinuities, and hostile electromagnetic environment.
- **Extreme Atmospheric Absorption and Propagation Challenges of THz:** Terahertz frequencies suffer from severe atmospheric absorption, particularly by water vapor, and present significant challenges for maintaining signal integrity and power efficiency over extended distances, even with waveguiding.
- **Unaddressed MEMS Powering Challenges:** The notion of wirelessly powering ubiquitous MEMS devices via broadcast THz radiation from power lines ignores fundamental power budget limitations, extreme inefficiencies in targeting and coupling, and the complexities of miniature THz antenna and receiver design.
- **Misinterpretation and Misapplication of Patents and Research:** Patents and researchers cited in support of the claims are often found, upon closer inspection, to relate to different technologies (e.g., localized device-level surface wave communication, social media algorithms, fiber optics) or research areas (e.g., THz spectroscopy for BioMEMS) that do not substantiate the specific grand-scale allegations.
- **Impossibility of Decade-Long Secrecy for Pervasive Infrastructure:** The claim that such a vast, physically manifested, and societally impactful technology

could be deployed and operated secretly by major public corporations for nearly a decade defies logistical and practical realities.
- **Complete Absence of Health and Safety Considerations:** The narrative fails to address the critical health and safety implications of widespread public exposure to THz radiation at the power levels that would be necessary for the system's alleged functions, especially given the evolving understanding of THz bioeffects.

B. The Critical Impact of the Inaccessible Primary Source

A fundamental and overriding flaw in the entire narrative is the consistent inaccessibility of the primary source, thedailydialectics.com.1 This prevents any direct verification or scrutiny of the original claims, methodologies, or purported evidence. All assertions are therefore filtered through uncorroborated secondary accounts, such as internet forum discussions.5 This lack of a verifiable, accessible, and accountable primary source is a hallmark of unsubstantiated claims and conspiracy theories, immediately undermining any pretense of scientific or technical legitimacy.

C. Pattern of Conflation, Misrepresentation, and Decontextualization

The narrative attributed to thedailydialectics.com appears to operate by a consistent pattern of conflating legitimate scientific concepts (e.g., Sommerfeld-Goubau lines, terahertz research, surface wave phenomena, MEMS technology) and genuine research or patents with highly speculative, unsupported, and often fundamentally misunderstood large-scale applications. There is a selective highlighting of certain technological aspects (e.g., the ability of THz to penetrate some materials) while conspicuously ignoring critical limitations (e.g., atmospheric absorption, power requirements, inefficiencies) or overriding concerns (e.g., public safety, economic viability, logistical feasibility). This decontextualization and misrepresentation of scientific and technical information serves to create a misleading and ultimately false narrative.

D. Final Assessment of Plausibility

Based on the comprehensive analysis of available information and a comparison with established scientific and engineering principles, the alleged decade-old terrestrial Sommerfeld-Goubau system operating at THz frequencies on power lines for ubiquitous power and data transfer, as attributed to thedailydialectics.com, lacks any credible foundation and is overwhelmingly implausible. The claims exhibit numerous characteristics common to sophisticated technological misinformation and unsubstantiated conspiracy theories, including the assertion of extraordinary capabilities without commensurate extraordinary evidence, a reliance on secrecy to explain the lack of evidence, the misinterpretation and misapplication of legitimate science and patents, and a disregard for fundamental technical and practical constraints.

E. Recommendation for Critical Evaluation

This investigation underscores the paramount importance of demanding rigorous, peer-reviewed, and verifiable evidence from credible, accessible, and accountable sources when evaluating any extraordinary technical or scientific claim. It is essential to:

- Approach such claims with a healthy degree of skepticism.

- Cross-reference information with established scientific knowledge and consensus within relevant expert communities.
- Critically examine the context and actual scope of any cited patents, research papers, or expert statements.
- Be wary of narratives that rely on inaccessible primary sources, appeals to secrecy, the unexplained bridging of vast technological gaps, or the promise of revolutionary capabilities without a clear and evidence-backed development pathway.

The pursuit of scientific understanding and technological advancement relies on transparency, verifiability, and adherence to the principles of evidence-based reasoning. The narrative surrounding the alleged "WiPoW comms" system fails to meet these fundamental criteria.

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