

**FOURTEENTH INTERNATIONAL  
HYDRAIL CONFERENCE**  
Hamburg, Germany — June 19-21, 2019

**THE HYDRAIL TRANSITION**

**Economic and Historical Basis**

Presented by Stan Thompson, Co-Founder  
**THE MOORESVILLE HYDRAIL INITIATIVE**



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Mooreville/South Iredell Chamber of Commerce &  
The Mooreville Rotary Club



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**THE MOORESVILLE HYDRAIL INITIATIVE: WHO WE ARE**



**Jason W. Hoyle**, Research Analyst, The Energy Center, App State.

With hosts, produces the annual International Hydrail Conferences. Created the [hydrail.appstate.edu](http://hydrail.appstate.edu) international web site

**Bill Thunberg**, former Mooreville Mayor; former Chamber Chairman, now Exec. Dir., Lake Norman Regional Transportation Commission.

Bill is the Hydrail Initiative's "Chief Information Officer"

**Stan Thompson**, retired strategic planner and environmental and transportation futurist, BellSouth Telecommunications (now AT&T), 12-year columnist on history and economics, *The Mooreville Tribune*. Coined "hydrail" in 2003

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**WHAT'S HYDRAIL ?**

**Hydrail** is the latest general class of railway traction technology.

It's **wireless** electric traction, where lithium ion batteries power the traction motors, capture stopping energy for re-acceleration and—for long range operation—are **kept continuously charged** by fuel cells using onboard compressed gaseous hydrogen.

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### THE HYDRAIL TRANSITION:

**FROM:** DIESEL AND OVERHEAD ELECTRIC



**TO:** WIRELESS HYDROGEN FUEL CELL / BATTERY ELECTRIC



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### WHAT'S DRIVING THE HYDRAIL TRANSITION

**FROM DIESEL:**

- international commitments to **climate change** protection
- growing understanding of **health** implications
- **urban** noise and smell
- **onboard** noise levels

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### WHAT'S DRIVING THE HYDRAIL TRANSITION

**FROM CATENARY:**

- skyrocketing **fixed plant** cost
- interactions with **buried infrastructure**
- **public pushback** against aerial plant
- growing awareness of **shock** hazards

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**MAJOR CATENARY CapEx COST DRIVERS**

- **copper**; new (and replaced when stolen)
- corrosion/interaction with **buried infrastructure**
- raising/designing **bridge/tunnel clearance**
- incremental cost of **bridge approaches**
- incremental cost of **power infrastructure**
- Rough approximation: **\$6-12M/mile of track** 7

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- There are about **233,000** miles of track in the USA's rail network...
- At **\$10 million/mile** (if there were enough copper in Earth's crust to electrify it), the cost would be a quadrillion or so.
- A **million-dollar hydrail fueling station** for the whole line costs only as much as **530 feet of track electrification**.



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**CATENARY EXPENSE DRIVERS**

- fixed plant maintenance ~ **\$150K/mile/year**
- power purchase during **peak rate** hours
- labor/materials replacement due to **theft**
- revenue loss during **power interruptions**
- incremental cost of power **distribution plant**

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MANCHESTER GUARDIAN — 6 JUNE, 2011

Business / Network Rail

Network Rail losing millions from copper thefts

Copper theft from railway lines is so rife the rail operator has had to take on new staff, as well as pay compensation for delays



Network Rail workers in Sheffield repair and replace stolen copper wiring. Photographer: Christopher Thomond for the Guardian

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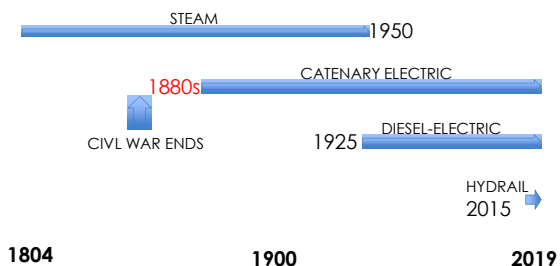
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Railway Traction — Historic Timeline



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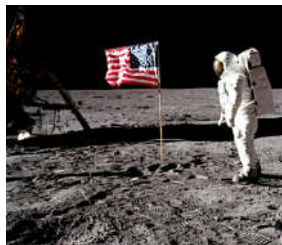
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HYDRAIL IS "ROCKET SCIENCE"...

...1969 ROCKET SCIENCE!



50 YEARS AGO, FUEL CELLS POWERED THE APOLLO MOON SHOTS...

...YET TODAY THE USA IS STILL PLANNING NEW INFRASTRUCTURE INVESTMENT IN A TECHNOLOGY ALMOST DATING BACK TO THE CIVIL WAR!

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How old *is* catenary railway electrification ?

When it debuted,

- **Jefferson Davis** was writing his Civil War history.
- **Ulysses S. Grant** was basking in retirement.
- **Brahms, Verdi and Puccini** were writing music.
- **Queen Victoria** still had 22 years to reign.
- The **Wounded Knee** massacre had *not happened*.
- **Custer's last stand** was only three years earlier.
- **AZ, NM, OK and UT** were **not yet states**.



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**HYDRAIL'S HISTORY IN AMERICA**

- circa 2000: Dr. Arnold Miller invents FC mining loco
- circa 2002: Congress funds H2 loco for Dep't of Defense
- 2003: Mooresville proposes passenger hydrail to US DOT
- 2004: "Mooresville Hydrail Initiative" in Int'l Journal of H2
- 2005: First *International Hydrail Conference* (Charlotte)
- 2008: First (still the only) full-scale hydrail loco: HH 1205



- 2009: After George W. Bush left office, HH 1205 was moth-balled and eventually parted-out.

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**HYDRAIL'S EUROPEAN HISTORY (highlights)**

- 1998: Atomic Energy of Canada (Dr. Alistair Miller): "rail and marine = **easiest** transport applications for H2"
- 1998: Germany's Dr. Holger Busche "North German **wind turbines** should power trains **via hydrogen**."
- 2005: First Hydrail Conference: US, CA, JP, DK (Charlotte)
- 2013: At 8<sup>th</sup> Hydrail Conference in Toronto, Hydrogenics & Alstom Transport conceive **Coradia iLint** hydrail train
- 2014: Alstom announces sale of **40 iLints** in Germany



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### HYDRAIL'S HISTORY IN ASIA (highlights)

- circa 2000: East Japan Railways, gov't vie to be first
- 2005: Mooresville proposes hydrail cooperation to China
- 2007: South Korea presents at 3<sup>rd</sup> Hydrail Conference
- 2013: SW Jiaotong U. presents "Blue Sky" at 8IHC Toronto
- 2013: China hosts Mooresville in Shanghai at convention
- 2015,16: China hydrail factories: Qingdao and Tangshan



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### MOOREVILLE'S HYDRAIL CHINA CONNECTION:



CHAIRMAN MAO\* (CENTER) AND ME...  
 \*Prof. MAO Zong Qiang, of China's national hydrogen organization  
 (8 years after I wrote him to recommend hydrail cooperation)

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### HYDRAIL TODAY - 20 Countries have active projects

- **Austria:** Zillertal = first narrow-gauge hydrail
- **Canada:** Ontario's Metrolinx system
- **China:** two factories in Qindao and Tangshan
- **Czech Republic:** building switch engines
- **France:** Alstom of Paris=1<sup>st</sup> manufacturer
- **Germany:** Factory in Salzgitter
- **India:** Indian Railways in-house plant (ICF)
- **Italy:** first hydrail-related PhD at U. Pisa
- **Japan:** RTRI testing prototype (wireless Olympics?)
- **Korea:** presented their project in Rome last month
- **Latvia:** joint with Czech Republic
- **Malasia:** Sarawak
- **Mexico:** Maya environmental tourism line
- **Netherlands:** X all diesels at home; NL Aruba has "wind-trams"
- **Poland:** hydrail freight with H2 from coal
- **South Africa:** platinum mine locomotives
- **Switzerland:** Stadler building Zillertalbahn
- **Taiwan:** park-sized train was world's first hydrail to carry people
- **UK:** announced factory in Cheshire; 1<sup>st</sup> 100
- **USA:** US DOE's H2@Rail@with US DOT/FRA (kick-off in March, 2019)

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**HYDRAIL ROLLING STOCK MANUFACTURERS**  
 EXSITING AND ANNOUNCED

- Alstom (HQ in Paris; plant in Salzgitter, Germany)\*
- China Railway Rolling-stock Corporation\*
- East Japan Railways
- Integral Coach Factory (Indian Railways)
- Korean Railways
- Siemens (Germany and global)
- Porterbrook-Ballard (UK)
- VivaRail (UK) \*now in production!

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How a small-town Chamber of Commerce got in the “world-changing” business...

**Statesville Record and Landmark**  
 Iredell-born hydrail concept goes international

Groups: US getting left behind on transportation technology

Alstom-TSI/iredeill.com, Jan 15, 2017, 4x1.1



Don Thompson (right) shakes the first hydrail in 2014 with German leader...  
 Member of Transport and Digital Infrastructure Advisory International...  
 2014. Photo: Don Thompson

- air quality sanctions
- DOT, EPA connections
- no Mecklenburg tax funds
- nobody believed in hydrail
- **2005:** invited the world to 1-IHC
- email; to China
- **2006:** 2-IHC convened in Denmark
- “Easier to fix the world than CLT”
- crowd-sourcing hydrail know-how
- **2007:** triggered first hydrail PhD

- 2013** — the tipping point!
- Hydrogenics meets Alstom
- **Mooreville coaches China**
- 2017** = 12<sup>th</sup> IHC; **13<sup>th</sup> in Rome in 2018!**

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**Hydrogen Fuel Cell Railways: THE MORAL IMPERATIVE**

GETTING HYDRAIL INTO THE PUBLIC CONVERSATION **QUICKLY** MATTERS BECAUSE **IT'S LITERALLY A MATTER OF LIFE AND DEATH.**

Fine particulates from diesel train exhaust are inhaled continually by crew, passengers, station workers and residents near tracks...



They pass through the alveoli in the lungs, enter the bloodstream and eventually accumulate in the pericardium, causing illness and eventual death. **The most exposed people probably live in the last areas likely to get hydrail relief; that's why getting the first hydrail transitions deployed quickly is urgent**—it also drives **timing of the last.**

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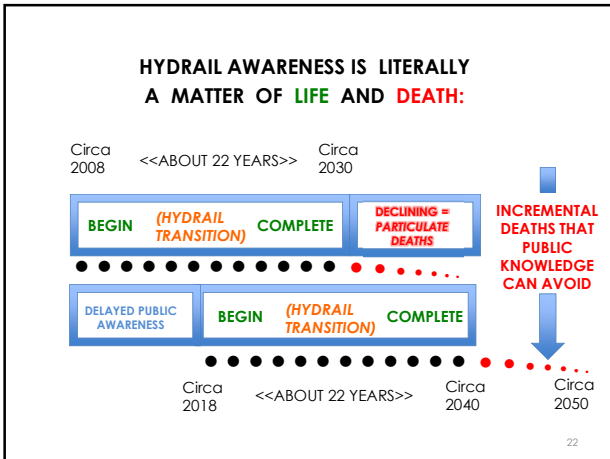
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Visit the world hydrail web site at  
Appalachian State University (UNC Boone)

<http://www.hydrail.appstate/conferences>

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call or text: **704 458-9410**

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