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# Simplicity and Fleet Electrics

# Getting Around the Cost Problem

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## Abstract

For electric cars to replace fuel burners they must have intrinsic advantages beyond those seen today and cost significantly less to operate, but 125 years of evolution has made the ICE car hard to beat. A modular battery electric "ridek" composed of "ridon" and "modek" exchangeable modules offers many economies, conveniences and a business plan that cannot be matched by conventional cars. It bears the successful advantages of a mutation, matched by reproducibility. A score of the projected advantages of this new species of electric vehicle are presented herewith and it is tempting to conjecture that more will manifest themselves. It is intriguing to note that a vehicle that readily comes apart (like NASCAR racers) has several features that enhance its overall safety over that of conventional cars.

Electric cars have arrived but the enthusiasm for them so strongly expressed at EVS meetings may be misplaced because ICE cars work so well and are much cheaper. It seems likely that unless the cost problem can be solved it will be paramount among the various factors that determine what we drive. So long as we attempt to re-engine the conventional car, leaving its infrastructure essentially unchanged, it is difficult to imagine electric vehicles supplanting our old friends, because enthusiasm alone is not enough.[1]

The two attributes of an electric drive are mechanical simplicity and durability. For a fleet of cars it makes economic sense for the running gear and body to be ***separate modules***. The availability of rented motive modules able to carry a variety of customizable body modules (Fig. 4) presents a totally new choice for the fleet owner but also for the private motorist. Both modules can be manufactured locally in entrepreneurial shops.

This modularity concept leads to an interesting business plan based on the prolonged service life, greatly reduced depreciation, increased utilization, etc., of the motive module, all of which result in substantial savings for the motoring public. Furthermore, the marketing advantages that the established auto companies now enjoy become disadvantages when a competitor, who needs none of them, adopts this new business plan

The unibody construction of the modern car saves weight and improves rigidity over the body-on-chassis construction that used to be the way cars were built, so it might seem rather drastic to divide a car into two exchangeable modules. However, the engineering problems that must be solved to do this are insignificant when compared with the benefits accruing from the much more flexible business plan that exchangeable modularity allows.

The inaccessibility of the modern automobile contrasts with the full access to the

motive module when the body module lifts off. This makes updating and the incorporation of new technologies in the motive module easy. Module exchange can be made in a few minutes without waiting. It can be accomplished in a variety of ways; the simplest needs only four jacks that retract into the ground.

Figure 1: Modular vehicle with body lifted off

Figure 2: Ridek III modular vehicle with powered steps and sliding door to maximize user friendliness

A **ridek** vehicle is composed of a **modek** (short for motorized deck) and a **ridon** (*ride-on*) that rides upon it.[2] These modules are quickly exchangeable with other like modules joined across a *standardized interface*. It was not initially clear what all the benefits of quick-change ridek modularity might be. This is born out by the patent underlying ridek (*Modular Vehicle Construction and Transportation System)*[3] conceived primarily as a means for facilitating battery exchange without disturbing the battery or its connections, rather than for its economic value. Fourteen years after that patent was applied for, the economic value of ridek modularity now seems destined to change the auto industry.

Figure 3: Ridek showing cage construction of the ridon

Figure 4: Versatility of ridons

Significantly, the greatest single expense of operating a car, according to *Consumer Reports*[4] is depreciation and the average life of a car is only about twelve years. But the depreciation isn't linear; it is most rapid during the 3-5 year warranty period because many owners like the comfort of a warranty and fear major out-of-warranty expenses. Consequently, the rate of depreciation during a car's early years is exaggerated. However, a modek doesn't need a warranty and it should have a life expectancy of 30 years or more[a]—corresponding to that of an electric trolley bus—and, because only its wheels show beneath the ridon it carries, its age is not apparent. This long amortization period greatly

[a] "—20-year life expectancy of the chassis" this and the next footnote are quoted from a GM AUTOnomy Press Release in 2006.

reduces its rate of depreciation and invites fleet ownership of the modek modules.

Without a ridon aboard, the standardized modek offers matchless accessibility for maintenance by fleet personnel. This is why the modek does not need a warranty and, unlike a non-modular vehicle, it is readily updateable when new technology demands. Technicians are easily trained and the risk of electrocution (a worry with most electric cars) is virtually zero.

Changing a modek at an exchange station for one that is fully charged and serviced takes only minutes. Because the delay is negligible, there is no need for a courtesy car, even if it is "free." (The customer must somehow pay for the car even though it may not be directly charged under warranty service.) The nuisance of leaving the ridon and its contents behind is avoided. The tradesman who might be unable to work because the tools of his trade are in his van that is being serviced would not be inconvenienced if they were in his ridon brought to a modek exchange station.

Unlike modeks, ridons would tend to be privately owned and might not last longer than cars, but they should cost much less because they have no suspension, motor, transmission or battery. Development costs for new models would be minor—a considerable economic advantage over conventional cars.[b] The manufacture of ridons in local shops offers great scope for customization, another strong buyer incentive. This reaches far beyond a choice of seats and styling because modeks can carry ridon modules serving as pickup trucks, sedans, vans, and roadsters—the term *convertible* takes on a different meaning! Instead of conventional cars serving as taxis, ridek taxi design allows for great improvement, as illustrated by Ridek III, the third road worthy ridek prototype.[5]

The engineering is straightforward and already demonstrated in Rideks I, II, and III. In 2000, the lead author received a US patent for a quick-change modular vehicle.[2] Interestingly, General Motors applied for a similar patent in 2003 but that was denied because of "the teachings of Dower."[6] GM built a full-scale futuristic model called *AUTOnomy* and a full-size working car called *Hy-Wire* that was never road legal, perhaps because a precedent for a drive-by-wire car had not been established.[7] *Fly-by-wire* systems rather than hydraulic systems of flight control have become standard in large passenger aircraft since they were first used in the Airbus A320 in 1988 and in Boeing's 777. Somehow, mechanical systems strike people as being intrinsically safer and questions were raised about the fly-by-wire system in an Air France A330-200 that mysteriously crashed into the Atlantic in May 2008. Fortunately, retrieval of the aircraft's "black box" two years later has restored confidence because it showed that the crash resulted from a malfunctioning airspeed indicator, already scheduled for replacement, that caused the aircraft to stall and rendered the pilots unable take the elementary corrective action that every pilot learns *ab initio.*

Dower's patent described *mechanical systems* for steering and brakes because he felt they would be viewed as intrinsically safer although he realized that the safety of electrical systems can be improved without limit.[3] His three ridek prototypes showed that automatic coupling of the mechanical controls from the ridon to the executing mechanisms in the modek could be simple and safe, like the automatic latches that hold those modules together. When jacks deploy to lift a ridon from a modek, four sturdy spring latches automatically release, allowing the ridon to clear the modek, which can then move away to be replaced by another that is fully serviced. As the ridon descends upon a modek, metal cones align with mating receptacles and a large square knob facing upward from the modek mates with a square receptacle under the ridon to link the steering. The brake pedal has an arm that presses a horizontal plate on the modek to engage the brakes. The jacks could retract into the ground at a fixed site but, for demonstrations of the five-minute modek exchange in the field, a hoisting mechanism on a tilt-bed trailer lifts the modek (Fig. 1).[5]

Let us enumerate the advantages of ridek modularity:

1) The projected life of the modek (the more expensive module of the ridek) is about 30 years.
2) The private automobile reduces to the cheaper private ridon because the long-lived modek would normally be leased.

The modek's simple motor and transmission, matchless accessibility and its standardization to fit various ridons favor local

[b] "Millions of chassis—which GM calls 'skateboards'—could be manufactured to achieve economies of scale…Small satellite assembly plants could make unique bodies for both emerging and established markets."

entrepreneurial manufacture because large automated assembly-line manufacture is un-necessary. Indeed, small-plant manufacture is entirely feasible because of the simplicity of both the modek and the ridon designs.

So we have:

3) More good jobs.
4) Wide distribution of maintenance skills.
5) Simplified training of maintenance crew personnel.
6) Low maintenance costs.
7) Customization of ridons.
8) Updatability of modeks.
9) Reduced obsolescence
10) Increased versatility (with different ridons).
11) Minimal or zero dealer and warranty costs.
12) Reduced idle time (for modeks returned to pool when not needed).

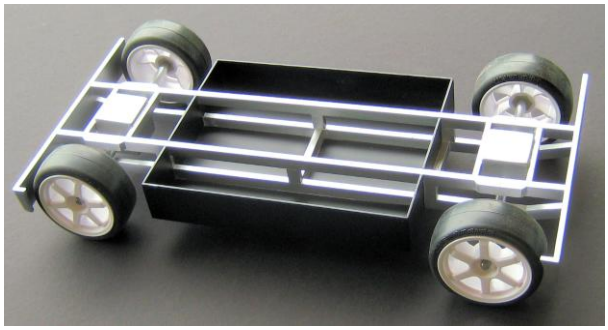


Figure 4: The central battery box in the modek is open until the floor of the ridon comes down and forms a lid to give *great rigidity to the ridek combination*

Although Rideks I, II, and III have shown that quick-change modularity is practical and gives plenty of room for batteries placed low and well away from passengers, the chassis design of the modek does not well lend itself to conventional automobile design. After several years, a simple design presented itself. It was a box made of strong but lightweight carbon fiber honeycomb panels like those used for the floor in large passenger aircraft. The floor of the ridon becomes the lid of the modek box. That floor offers strong resistance to the impact of a "T-boning" car and, 18 inches above the road, it seats the driver and passengers above the point of impact, well separated from modek's batteries below them. The value of this is emphasized by a fire occurring in a Chevrolet *Volt* three weeks after a crash test.[8] The battery in the *Volt* lies between the front seats and beneath the rear seats. Contrast this with the ridek where the *batteries and all high voltages* are confined to the modek and robustly separated from the ridon module.

Hence we have:

13) Simple, quick and inexpensive battery swapping by means of modek exchange which leaves the battery and its connections undisturbed.
14) Complete protective separation of batteries from passengers.
15) Substantially reduced overall operating costs.
16) Minimal model-change expenses.
17) Modeks could keep account of various charges such as for road use (where and when), to replace gasoline tax, and the buying and selling of electricity at public charging points.
18) Increased Safety.
19) Maximal battery electric range.
20) Complete flexibility of battery types.

## Conclusion

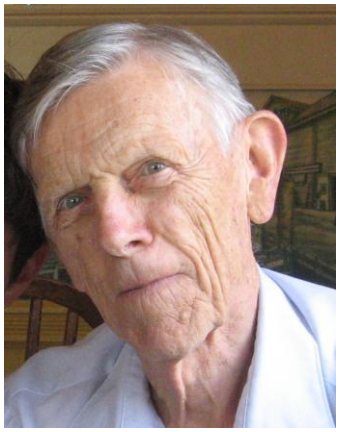
Modularizing the automobile into two separate economic units—a ridon coach, and a modek mule—enormously expands its competitive opportunities by creating a new species of vehicle, the ridek, that saves money and increases convenience in ways that are not possible for a conventional car.

## References


1. WHITE J. B. *Eyes on the Road.* Wall Street Journal, Feb. 9, 2012, p. D2.
2. DOWER, GORDON E. *A Better Plan for a Better Place for electric cars,* Point Roberts: The Ridek Corporation, 2009.
3. DOWER, GORDON E. *Modular Vehicle Construction and Transportation System.US Patent* 6,059,058, 2000.
4. ConsumerReports.org, April 2008. *Owner Costs Drop Over Time.*
5. www.ridek.com

6. PAPE. *Vehicle Body Interchangeability US Patent* 2003/0094318&9, 2003.
7. Wikipedia.org/wiki/steering "As of 2007 there are no production cars available that rely solely on steer-by-wire technology… [which] would require new legislation in most countries."
8. BUNKLEY, NICK. *Batteries in Electric Cars Examined After Chevy Volt Fire.* New York Times, Nov. 11, 2011.

## Authors



Gordon Dower MD FACC is a retired scientist with many publications including 7 patents awarded or pending, 6 related to transportation. The one not related is for the EASI lead system, widely used in heart monitoring and in the Space Shuttle. It funds the development of Ridek modularity (ridek.com), currently focused on the work described herein.

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